

VOLUME 2

I Street Bridge Replacement Project



Final Environmental Impact Report/ Environmental Assessment with Finding of No Significant Impact

Sacramento and Yolo Counties

Federal Project No.: BRLS 5002(164)

Prepared by the
City of Sacramento and the
State of California Department of Transportation

The environmental review, consultation, and any other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by Caltrans pursuant to 23 U.S.C. 327 and the Memorandum of Understanding dated December 23, 2016 and executed by FHWA and Caltrans.



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Volume 2 Appendices

Appendix A	Section 4(f) De Minimis Determination and Section 6(f) Assessment
Appendix B	Title VI Policy Statement
Appendix C	Summary of Relocation Benefits
Appendix D	Avoidance, Minimization, and/or Mitigation Summary
Appendix E	Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis
Appendix F	Sub-Area Travel Forecasting Model Development and Validation
Appendix G	Agency Letters and Consultations
Appendix H	List of Technical Studies
Appendix I	Public Comments and Responses

Appendix A

**Section 4(f) De Minimis Determination and
Section 6(f) Assessment**

Appendix A Section 4(f) De Minimis Determination and Section 6(f) Assessment

A.1 Introduction

This document contains the Section 4(f) evaluation for the I Street Bridge Replacement project. This evaluation will be circulated as part of the EIR/EA to satisfy the requirements of Section 4(f) of the U.S. Department of Transportation (U.S. DOT) Act of 1966.

The environmental review, consultation, and any other action required in accordance with applicable federal laws for this project is being, or has been, carried-out by the California Department of Transportation (Caltrans) under its assumption of responsibility pursuant to 23 United States Code (USC) 327.

Section 4(f) of the Department of Transportation Act of 1966, codified in federal law at 49 USC 303, declares that “it is the policy of the United States government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.”

Section 4(f) specifies that the Secretary [of Transportation] may approve a transportation program or project ... requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land of a historic site of national, state, or local significance (as determined by the federal, state, or local officials having jurisdiction over the park, area, refuge, or site) only if:

- there is no prudent and feasible alternative to using that land, and
- the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use.

As defined in 23 Code of Federal Regulations (CFR) Section 774.17,¹ resources subject to Section 4(f) consideration include publicly owned lands that are considered part of a public park; a recreational area of national, state, or local significance; a wildlife or waterfowl refuge; or a historic site of national, state, or local significance, whether publicly or privately owned.

Section 4(f) further requires consultation with the Department of the Interior and, as appropriate, the involved offices of the Department of Agriculture and the Department of Housing and Urban Development in developing transportation projects and programs that use lands protected by Section 4(f). If historic sites are involved, then coordination with the State Historic Preservation Officer (SHPO) is also needed.

¹ 49 USC Section 303 is the code (law) passed by the U.S. Congress in 1966 that serves as the basis for U.S. DOT to develop the rules for implementing the law which is defined in 23 CFR 774.17.

This document also assesses the project against the requirements of Section 6(f)(3) of the Land and Water Conservation Fund Act (LWCF Act) (16 USC Section 4601-4), which contains provisions to protect federal investments in park and recreational resources and the quality of those assisted resources.

A.2 Description of Proposed Project

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, proposes to construct a new bridge over the Sacramento River to replace the vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient bridges (i.e., approach structures). The new connection also would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

The build alternatives under consideration are one bridge alignment for the new bridge over the Sacramento River and two alternatives for portions of the roadway design in Sacramento.

- City of Sacramento Railyards Boulevard/Jibboom Street/Bercut Drive Intersection
 - Alternative 1—Signalized Intersection at Jibboom Street and Bercut Drive
 - Alternative 2—Roundabout Intersection at Jibboom Street and Bercut Drive
- No-Build (No-Project) Alternative

The proposed project would be located in Sacramento and Yolo Counties, over the Sacramento River and between the cities of Sacramento and West Sacramento. The project site is approximately 1,000 feet north of the existing I Street Bridge (Figures 1-1 and 1-2 of the EIR/EA). The total length of the project would be approximately 0.42 mile along C Street and Railyards Boulevard. The purpose of the project is to construct a new public crossing of the Sacramento River north of the Union Pacific Railroad (UPRR)-owned I Street Bridge from C Street in West Sacramento to Railyards Boulevard in Sacramento in order to remove a series of functionally obsolete or structurally deficient bridges, consistent with the adopted findings of the Sacramento River Crossings Alternatives Study for Bridge Location 2 in the North Market Area.

The project is subject to state and federal environmental review requirements because of use of federal Highway Bridge Program (HBP) funds from the Federal Highway Administration (FHWA). Accordingly, project documentation is being prepared in compliance with both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The City of Sacramento is the lead agency under CEQA, with the City of West Sacramento as a responsible agency, and Caltrans is the lead agency under NEPA. The FHWA's other responsibilities for environmental review, consultation, and any other action required in accordance with applicable federal laws for this project will be carried out by Caltrans under its assumption of responsibility pursuant to 23 USC 327.

This project is included in the Sacramento Area Council of Governments 2035 *Metropolitan Transportation Plan/Sustainable Communities Strategy*.

A.3 Section 4(f) Properties

A.3.1 Study Area

Two study area limits were used as part of the identification of Section 4(f) properties. Parks and recreational areas were evaluated using a different study area than that used for the cultural resources analysis because the evaluation of cultural resources as defined in Section 106 requires identification of an Area of Potential Effects (APE). Accordingly, the study area for the Section 4(f) analysis comprises the two study areas described below, which may or may not overlap.

A.3.1.1 Study Area for Historic Properties

The study area for historic sites is the APE developed for this project in accordance with 36 CFR 800.4(a)(1), plus the boundary of the Old Sacramento State Historic Park. The APE is the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties or archaeological sites. Old Sacramento State Historic Park, a California Historic Landmark, is outside of the APE but is being addressed in this document as an historic property as well as a recreational area.

A.3.1.2 Study Area for Public Parks and Recreational Areas

The study area for public parks and recreation areas is a 0.5 mile buffer around the project site. The study area is shown in Figure 1 (Attachment A). There are no wildlife refuges in the study area; therefore, refuges are not discussed further.

A.3.2 Description of Section 4(f) Properties

A.3.2.1 Historic Properties

Table 1 provides a list of historic and cultural resources within the study area for historic properties that have been considered as potential Section 4(f) properties.

In accordance with the requirements of Section 4(f) and Section 106 of the National Historic Preservation Act, Caltrans consulted with the SHPO regarding determinations of eligibility for three properties identified in the APE and shown below in Table 1. Caltrans received concurrence with its determination of eligibility in a letter from the SHPO dated February 7, 2017. In addition, a fourth historic property that was not included in the project APE is considered a Section 4(f) property, Old Sacramento State Historic Park. As shown in Table 1, these four properties are eligible for, presumed eligible for, or listed on the National Register of Historic Places (NRHP). Three of the sites are considered Section 4(f) resources. The value of the Pioneer Flour Mill Wharf site is not in its preservation in place, but rather in the data it contains. Therefore it is not protected by the provisions of Section 4(f).

Table 1. Historic Properties Listed or Eligible for the NRHP

Name	Address	NRHP Eligibility	Section 4(f) Resource?
I Street Bridge (P-34-002349)	I Street/State Route (SR) 16	Listed in the NRHP in 1982	Yes
Sacramento River East Levee (P-34-00490)	Sacramento	Found eligible for listing	Yes
Pioneer Flour Mill Wharf	Sacramento	Presumed eligible for listing for the purposes of the project	No
Old Sacramento State Historic Park	Sacramento	Found eligible for listing	Yes

A.3.2.2 Public Parks and Recreation Areas

Table 2 provides a list of the parks, recreational facilities, and other public spaces with recreational use within the study area that have been considered as potential Section 4(f) properties. These properties are shown in Figure 1 (Attachment A) using the map identification numbers in Table 2.

In accordance with the coordination requirements of Section 4(f), letters were sent to each of the jurisdictions along the study area requesting feedback and confirmation on the locations, primary purpose, and attributes of the parks and recreational areas within their respective jurisdictions.

Table 2. Potential Section 4(f) Properties (Parks and Recreation Areas)

Map ID	Name	Description	Approximate Distance from Project Footprint	Section 4(f) Resource?
City of West Sacramento				
1	Elkhorn Plaza	Size: 5.2 acres Features: One backstop, half soccer field, picnic area with BBQs, horseshoe pits, and play structure. Agency with Jurisdiction: City of West Sacramento	0.6 mile	Yes
2	Heritage Green (proposed)	Size: 0.75 acres Features: Future park site with lawn space, picnic area, play structure, and community garden. Agency with Jurisdiction: City of West Sacramento	0.2 mile	Yes
3	Raley Field	Size: Approximately 14.3 acres Features: Triple-A Baseball field for the Sacramento River Cats minor league baseball team. Also a venue for concerts, community events, and private events. Agency with Jurisdiction: Privately owned	0.45 mile	No
4	Washington Plaza (proposed)	Size: 0.38 acres Features: Future park site with urban plaza, interactive water feature, picnic area, and game tables. Agency with Jurisdiction: City of West Sacramento	0.2 mile	Yes

Map ID	Name	Description	Approximate Distance from Project Footprint	Section 4(f) Resource?
5	Crossings Yard (proposed)	Size: 0.69 acres Features: Future park site with lawn space, picnic area, and play structure. Agency with Jurisdiction: City of West Sacramento	Adjacent	Yes
6	Governor's Residence State Park	Size: Approximately 38.25 acres Features: Future regional park, with 11–12 acres potentially dedicated to the Governor's Residence and the remaining 31–33 acres dedicated to state park land, with waterfront access. Agency with Jurisdiction: City of West Sacramento	0.3 mile	Yes
7	Broderick Boat Ramp	Size: Approximately 8.87 acres Features: Boat ramp and launching dock, parking for trailers, restroom facilities. Agency with Jurisdiction: City of West Sacramento	Adjacent	Yes
8	Off-Leash Dog Park (proposed)	Size: Approximately 1.5 acres Features: Future off-leash dog park with access to Broderick Boat Ramp. Agency with Jurisdiction: City of West Sacramento	Adjacent	Yes
9	River Walk Park	Size: 7.5 acres Features: Riverfront park that contains a paved trail along the west bank of the Sacramento River. Picnic areas are located between the trail and the river. Along the trail itself are many educational signs that talk about the settlement of Sacramento, as well as the natural habitat of the river. Agency with Jurisdiction: City of West Sacramento	Adjacent	Yes
10	Riverfront Park (proposed)	Size: 0.71 acres Features: Future riverfront park with half basketball court, children's play area, and picnic areas. Agency with Jurisdiction: City of West Sacramento	Adjacent	Yes
11	River Walk Park (proposed)	Size: TBD Features: Proposed extension of existing River Walk Park. Agency with Jurisdiction: City of West Sacramento	Adjacent	Yes
12	Access Corridor (proposed)	Size: 0.75 acres Features: Future promenade with fitness stations and public seating. Agency with Jurisdiction: City of West Sacramento	0.3 miles	Yes
13	River Walk Park (proposed)	Size: TBD Features: Proposed extension of existing River Walk Park. Agency with Jurisdiction: City of West Sacramento	1 mile	Yes
City of Sacramento				
14	Tiscornia Park	Size: Approximately 14.36 acres Features: River access at the confluence of the Sacramento and American Rivers, beach, picnic and BBQ areas, parking, restroom facilities. Agency with Jurisdiction: City of Sacramento	0.4 miles	Yes
15	Sacramento River Parkway Trail	Size: 9.3 miles Features: Consists of two disconnected segments. The north segment in the project area starts at Jiboom Street Bridge in Tiscornia Park and connects to the American River Parkway Trail. Agency with Jurisdiction: City of Sacramento	Adjacent	Yes

Map ID	Name	Description	Approximate Distance from Project Footprint	Section 4(f) Resource?
16	Robert T. Matsui Waterfront Park	Size: 6.5 acres (Phase I) Features: Public area that contains paved bike path (Sacramento River Bike Trail) adjacent to the west bank of the Sacramento River. Second phase of development will include shade structure, and picnic and BBQ areas. Agency with Jurisdiction: City of Sacramento	Adjacent	Yes
17	Sacramento River Parkway (Central Area)	Size: Approximately 11.52 acres Features: Parkway along the east bank of the Sacramento River between Discovery Park and the Pocket Area of Sacramento. Contains the paved Sacramento River Parkway Trail and provides connection to the American River Bike Trail. Agency with Jurisdiction: City of Sacramento	Adjacent	Yes
18	Riverfront Park (proposed)	Size: Approximately 0.04 acres Features: Future linear park consisting of passive and active uses, with riparian planting, river access, and small gathering spaces. Agency with Jurisdiction: City of Sacramento	Adjacent	Yes
19	Old Sacramento State Historic Park	Size: Approximately 6.2 acres Features: Sacramento Railroad Museum and other historic buildings, picnic areas, and walking tours through Old Sacramento. Agency with Jurisdiction: California Department of Parks and Recreation	Adjacent	Yes
20	Sacramento River Parkway (Future)	Size: Approximately 16 miles Features: Proposed extension of existing Sacramento River Parkway that would require many public right-of-way acquisitions. Agency with Jurisdiction: City of Sacramento	Adjacent	Yes
21	Crocker Park	Size: Approximately 3.62 acres Features: Picnic area adjacent to Crocker Art Museum. Agency with Jurisdiction: City of Sacramento	0.4 mile	Yes
22	Central Shops Plazas (proposed)	Size: Approximately 12.53 acres Features: Future urban plazas that will connect the Central Shops buildings of the Railyards site. Agency with Jurisdiction: City of Sacramento	0.6 mile	Yes
23	Depot Park (proposed)	Size: Approximately 1.49 acres Features: Planned park that will serve as entry way to "Depot" District of the Sacramento Railyards Agency with Jurisdiction: City of Sacramento	0.1 mile	Yes
24	Vista Park (proposed)	Size: Approximately 10.54 acres Features: Planned park that would contain a playing field and amphitheater. Agency with Jurisdiction: City of Sacramento	0.15 mile	Yes
25	Stanford Walk (proposed)	Size: Approximately 0.77 acre Features: Future urban linear plaza intended for pedestrians and bicyclists. Will connect Vista Park to the Central Shops District. Agency with Jurisdiction: City of Sacramento	0.2 mile	Yes

Map ID	Name	Description	Approximate Distance from Project Footprint	Section 4(f) Resource?
26	Neighborhood Parks (proposed)	Size: Approximately 2.88 acres Features: Five open space areas for active and passive community activities including play structures, gardens, and gathering spaces. Agency with Jurisdiction: City of Sacramento	0.3 mile	Yes
27	Saint Rose of Lima Park	Size: 0.51 acre Features: Public square with benches, a stage, and seasonal ice rink. Agency with Jurisdiction: City of Sacramento	0.3 mile	Yes
28	Leland Stanford Mansion State Historic Park	Size: 0.6 acre Features: Historic mansion and gardens. A museum with daily tours. Agency with Jurisdiction: California Department of Parks and Recreation	0.5 mile	Yes
29	Caesar Chavez Plaza	Size: 3.05 acres Features: Café, fountain, picnic area, stage, seasonal events including farmers market and summer concerts Agency with Jurisdiction: City of Sacramento	0.3 mile	Yes
30	Capitol Park	Size: Approximately 36 acres Features: California State Capitol, gardens, memorial, walking paths, seating, guided daily tours. Agency with Jurisdiction: California Department of Parks and Recreation	0.5 mile	Yes
31	Zapata Park	Size: 0.95 acre Features: Neighborhood park with play structure and basketball court. Master Plan includes community garden. Agency with Jurisdiction: City of Sacramento	0.45 mile	Yes
32	J. Neely Johnson Park	Size: 0.96 acre Features: Community garden Agency with Jurisdiction: City of Sacramento	0.5 mile	Yes

A.3.3 Section 4(f) De Minimis Determination

Section 6009(a) of the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users amended Section 4(f) legislation at 23 USC 138 and 49 USC 303 to simplify the processing and approval of projects that have only *de minimis* impacts on lands protected by Section 4(f). This revision provides that once U.S. DOT determines that a transportation use of Section 4(f) property, after consideration of any impact avoidance, minimization, and mitigation or enhancement measures, results in a *de minimis* impact on that property, an analysis of avoidance alternatives is not required and the Section 4(f) evaluation process is complete. FHWA’s final rule on Section 4(f) *de minimis* findings is codified in 23 CFR 774.3 and CFR 774.17.

Responsibility for compliance with Section 4(f) has been assigned to Caltrans pursuant to 23 USC 326 and 327, including determinations and approval of Section 4(f) evaluations, as well as coordination with those agencies that have jurisdiction over a Section 4(f) resource that may be affected by a project action.

Table 3 summarizes the use determination for the recreational resources in the study area, including proposed parks. There are no differences in acquisition impacts proposed as part of the City of Sacramento roadway design alternatives. Areas of permanent acquisition are shown in Figure 2 (Attachment A). The remainder of the resources are discussed in Section A.3.4, *Other Resources Evaluated Relative to the Requirements of Section 4(f)*.

Table 3. Section 4(f) Parks and Recreation Properties Use Determination Summary

Map ID	Name	Use?	Constructive Use?	Temporary Occupancy?	Explanation
City of West Sacramento					
1	Elkhorn Plaza	No	No	No	0.6 mile away from project footprint, no potential for impact.
2	Heritage Green (proposed)	No	No	No	0.2 mile away from project footprint, no potential for impact.
3	Raley Field	No	No	No	0.45 mile away from project footprint, no potential for impact.
4	Washington Plaza (proposed)	No	No	No	0.2 mile away from project footprint, no potential for impact.
5	Crossings Yard (proposed)	No	No	No	0.69 mile away from project footprint, no potential for impact.
6	Governor's Residence State Park (proposed)	No	No	No	0.3 mile away from project footprint, no potential for impact.
7	Broderick Boat Ramp	Yes	No	No	Permanently incorporate 0.135 acre of the park.
8	Off-Leash Dog Park (proposed)	No	No	No	Adjacent to project footprint, but no temporary occupancy or acquisitions required.
9	River Walk Park	No	No	No	Adjacent to project footprint, but no temporary occupancy or acquisitions required.
10	Riverfront Park (proposed)	No	No	No	Adjacent to project footprint, but no temporary occupancy or acquisitions required.
11	River Walk Park (proposed)	No	No	No	City of West Sacramento will coordinate design and construction of the two projects. No acquisition of land would occur.
12	Access Corridor (proposed)	No	No	No	0.3 mile away from project footprint, no potential for impact.
13	River Walk Park (proposed)	No	No	No	1 mile away from the project footprint, no potential for impact.
City of Sacramento					
14	Tiscornia Park	No	No	No	0.4 mile away from project footprint, no potential for impact.
15	Sacramento River Parkway Trail	No	No	Yes	Project would require temporary rerouting and detour of trail for approximately 2 years.
16	Robert T. Matsui Waterfront Park	No	No	No	Adjacent to project footprint, but no construction staging or acquisitions required.
17	Sacramento River Parkway (Central Area)	Yes	No	No	Permanently incorporate 2.155 acres of the park.

Map ID	Name	Use?	Constructive Use?	Temporary Occupancy?	Explanation
18	Riverfront Park (proposed)	No	No	No	City of Sacramento will coordinate design and construction of the two projects. No acquisition of land would occur.
19	Old Sacramento State Historic Park	No	No	Yes	Temporary occupancy at back of property when existing I Street Bridge approach ramp structures are decommissioned.
20	Sacramento River Parkway (future)	No	No	No	Adjacent to project footprint, but no construction staging or acquisitions required.
21	Crocker Park	No	No	No	0.5 mile away from project footprint, no potential for impact.
22	Central Shops Plaza (proposed)	No	No	No	0.6 mile away from project footprint, no potential for impact.
23	Depot Park (proposed)	No	No	No	0.15 mile away from project footprint, no potential for impact.
24	Vista Park (proposed)	No	No	No	0.15 mile away from project footprint, no potential for impact.
25	Stanford Walk (proposed)	No	No	No	0.2 mile away from project footprint, no potential for impact.
26	Neighborhood Parks (proposed)	No	No	No	0.5 mile away from project footprint, no potential for impact.
27	Saint Rose of Lima Park	No	No	No	0.2 mile away from project footprint, no potential for impact.
28	Leland Stanford Mansion State Historic Park	No	No	No	0.4 mile away from project footprint, no potential for impact.
29	Caesar Chavez Plaza	No	No	No	0.3 mile away from project footprint, no potential for impact.
30	Capitol Park	No	No	No	0.5 mile away from project footprint, no potential for impact.
31	Zapata Park	No	No	No	0.45 mile away from project footprint, no potential for impact.
32	J. Neely Johnson Park	No	No	No	0.5 mile away from project footprint, no potential for impact.

As Table 3 demonstrates, the proposed project would result in a Section 4(f) use of two recreational resources: Broderick Boat Ramp and the Sacramento River Parkway (Central Area). The project would also result in a temporary occupancy of the Sacramento River Parkway Trail and Old Sacramento State Historic Park. The temporary occupancy of Old Sacramento State Historic Park is discussed in Section A.3.4.1, *Historic Properties*. The boat ramp, parkway, and trail are discussed further below.

A.3.3.1 Broderick Boat Ramp

Broderick Boat Ramp is a public park that primarily provides boating access to both the Sacramento and American Rivers. Boats of many sizes may be launched from the boat ramp. It is located on the west bank of the Sacramento River at 103 4th Street. It contains a boat ramp and launching dock, parking for trailers, and restroom facilities. The park is approximately 8.87 acres. The majority of the park is undeveloped and does not contain any public facilities or structures. There is no entrance fee to the park.

Impacts on Broderick Boat Ramp

A permanent incorporation of 0.135 acre from the resource would be necessary, which is approximately 1.2 percent of the entire park. The portion of the park that would be acquired is along the southern boundary of the park near B Street along a levee road. This section of the park contains trees and grassy areas, but no park facilities or active recreation areas. The boat ramp, parking lot, and restrooms are all located on the northern portion of the property. Visitors would not experience any loss of access or use of active recreational or parking facilities after construction of the proposed project.

De Minimis Determination for Broderick Boat Ramp

Although a use of 0.135 acre of the park would occur, the impact would be minor. In terms of recreational value, the affected area of this park does not contain developed recreational facilities. Access to the park, public facilities, and boat ramp would all be maintained. The transportation use of the Section 4(f) resource, together with any impact avoidance, minimization, and mitigation or enhancement measures incorporated into the project, would not adversely affect the activities, features, and attributes that qualify the resource for protection under Section 4(f) and would qualify as a *de minimis* impact.

Measures to Minimize Harm for Broderick Boat Ramp

Measures necessary to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures) are considered prior to determining an impact to be *de minimis*. The project includes the following elements to reduce impacts on the Broderick Boat Ramp. Additional minimization measures may be added in coordination with the City of West Sacramento Parks and Recreation Department.

- Maintain safe access to Broderick Boat Ramp at all times.
- Ensure that construction equipment in the Broderick Boat Ramp park and other potential impediments to recreation is equipped with required safety markings (e.g., lights).
- Coordinate construction activities with the City of West Sacramento Department of Parks and Recreation at least 10 days in advance of start of construction and regularly while construction activities are ongoing in the Broderick Boat Ramp park.
- Post written notices in the Broderick Boat Ramp park regarding construction activities.
- Restore any areas within the Broderick Boat Ramp park disturbed by construction activities to preconstruction or better conditions.
- Compensate for loss of 0.135 acre of parkland. In accordance with Section 5404 of the California Public Park Preservation Act, the loss of acreage at the Broderick Boat Ramp park will be compensated for by either providing new acreage at a suitable location or improving the unacquired portion of the parkland and facilities. The project proponents will work with the City of West Sacramento to identify sites that are considered suitable as replacement land or to identify appropriate park improvements following the steps listed below.
 - Conduct a fair-market value assessment of the value of the land being acquired.

- Coordinate with the City of West Sacramento regarding compensation and appropriate enhancement measures.

Coordination for Broderick Boat Ramp

Prior to making Section 4(f) approvals, coordination with the City of West Sacramento Department of Parks and Recreation is required regarding activities, features, and attributes that qualify Broderick Boat Ramp as a Section 4(f) resource. Caltrans requested of the City of West Sacramento Department of Parks and Recreation concurrence on the *de minimis* finding under Section 4(f) after an opportunity for public review and comment concerning the effects of the project occurred. Both the concurrence request and affirmative agency response are included in Attachment B.

Conclusion for Broderick Boat Ramp

Conversion of a minor portion of the Broderick Boat Ramp into a transportation use would not adversely affect the activities, features, and attributes that qualify this park for protection under Section 4(f). Accordingly, the project would have a *de minimis* impact on Broderick Boat Ramp.

A.3.3.2 Sacramento River Parkway Trail

The Sacramento River Parkway Trail is a recreational land use primarily used by bicyclists, joggers, and pedestrians accessing various parts of Sacramento. It is made up of two disconnected segments. The north segment is along the eastern bank of the Sacramento River, and starts at the northern end of Jibboom Street in Tiscornia Park and ends in Old Sacramento in the south, passing under the existing I Street Bridge. Portions of the trail are paved, and portions are considered off road. All portions are designated for recreational use. On Front Street in Old Sacramento, pedestrians and bicyclists traverse a cobblestone and gravel street. The trail starts again in Miller Park, outside of the study area. Parking for the Sacramento River Parkway Trail is available at its northern end at Tiscornia Park.

There are no developed facilities that are a part of the trail. Rather, the trail passes through various parks that contain facilities, such as Tiscornia Park, the Sacramento River Parkway, Old Sacramento State Historic Park, and Miller Park.

Use of Sacramento River Parkway Trail

No permanent acquisition or easement would be required for the project. However, construction of the project would close the trail in the area between Matsui Waterfront Park and Old Sacramento and would necessitate a temporary detour. As described below, the temporary use of Sacramento River Parkway Trail during the construction period would satisfy the requirements of 23 CFR Section 774.13(d) for a “minimal” temporary occupancy.

- **The duration of the occupancy must be temporary (i.e., less than the time needed for construction of the project), and there should be no change in ownership of the land.**

The Sacramento River Parkway Trail along Jibboom Street passes directly under the existing I Street Bridge, and continues north under the location of the proposed new bridge.

Consequently, the trail would require temporary rerouting during construction. The detour would be in place for approximately 2 years and would ensure uninterrupted use of the trail. The total project construction schedule is approximately 30 months. Given that the length of occupancy would be 6 months less than the total construction period and no changes in ownership would take place, the occupancy is considered temporary.

- **The scope of work must be minor (i.e., both the nature and magnitude of changes to the Section 4[f] resource are minimal).**

Construction activities would require a temporary rerouting of the trail. A detour (described below) would be provided for the closed section of trail to ensure safety of pedestrians and cyclists during construction. The detour would be in place for approximately 2 years, and would be approximately 0.2 mile longer than the existing route. Once constructed, the trail would be returned to pre-construction conditions. The trail would remain accessible throughout the construction period and would be restored after approximately 24 months.

- **There are no anticipated permanent adverse physical impacts, and there will be no interference with the activities or purpose of the resource, on either a temporary or permanent basis.**

No permanent physical impacts on the trail are proposed as part of the project. The trail would continue to function in its current purpose. During construction of the project, a portion of the northern segment of the trail would be rerouted. To the south of Railyards Boulevard the detour would follow the temporary Jibboom Street alignment. To the north of Railyards Boulevard cyclists and pedestrians would then continue following a detour north along Bercut Drive to Richards Boulevard, where they could then connect back to the Parkway on the west side of Interstate 5 (I-5). Uninterrupted use of the trail would be maintained throughout the construction period. The existing trail passes through a busy area of Sacramento that includes various developed areas and busy intersections, and is near major freeway. A temporary rerouting of the trail would not adversely impact pedestrians and bicyclists using the trail.

- **The land being used must be fully restored (i.e., the resource must be returned to a condition that is at least as good as that which existed prior to the project).**

Following construction, all equipment and construction debris would be removed from the site. The affected portion of the trail would again be located within the Sacramento River Parkway, in as good or better than current conditions and on its original alignment with the addition of the new connections to Railyards Boulevard that the proposed project would provide.

- **There must be documented agreement of the appropriate officials having jurisdiction over the resource regarding the foregoing requirements.**

Prior to making Section 4(f) approvals, coordination with the City of Sacramento Department of Parks and Recreation, the agency having jurisdiction over this resource, is required in order to obtain concurrence on the temporary occupancy finding. After an opportunity for public review and comment concerning the effects of the project occurred, Caltrans requested concurrence on the temporary occupancy finding from the City of Sacramento Department of Parks and Recreation. Both the concurrence request and affirmative agency response are included in Attachment B.

Measures to Minimize Harm for Sacramento River Parkway Trail

The following measures to minimize harm will be incorporated into the project to reduce the effects of the temporary occupancy.

- Provide advance notice regarding project-related construction activities at Sacramento River Parkway Trail. At least 10 days advance notice will be provided regarding trail closure and detour at all trailheads and parking lots at Tiscornia Park and Matsui Waterfront Park.
- Coordinate construction activities with the City of Sacramento Department of Parks and Recreation so that trail users can be informed of construction activities.

Conclusion for Sacramento River Parkway Trail

Implementation of the project would not require a Section 4(f) use of the Sacramento River Parkway Trail because it would not require permanent closure of the trail. The temporary occupancy of the Sacramento River Parkway Trail meets the criteria outlined in 23 CFR 774.13(d); therefore, the temporary occupancy would not constitute a use under Section 4(f).

A.3.3.3 Sacramento River Parkway (Central Area)

The Sacramento River Parkway plan area is located along the east bank of the Sacramento River within the city limits. It is approximately 17 miles long and 820 acres in area (City of Sacramento 1997). The Sacramento River Parkway Plan has the primary objective of preserving riparian habitat while providing public access to recreational opportunities along the Parkway. It is envisioned as a recreational resource that links with the American River Parkway, and eventually connecting with the Laguna Area. Part of the Parkway Plan includes acquiring more public access to areas that are currently blocked to the public.

The Sacramento River Parkway Central Area, where the project would be located, is between Jibboom Street and Old Sacramento. The Parkway contains a strip of land adjacent to the river, and the paved Sacramento River Parkway Trail, which provides connection to the American River Bike Trail. This portion of the Sacramento River Parkway is primarily used by pedestrians. It provides riverfront views and other forms of passive recreation. The Central Area of the parkway does not contain developed public facilities other than the Sacramento River Parkway Trail, which is analyzed as a separate resource above.

Use of Sacramento River Parkway (Central Area)

The project would require acquisition of 2.155 acres from the Sacramento River Parkway. The same amount would be necessary for either of the two City of Sacramento roadway design alternatives. The area that would be acquired is a strip of land on the eastern portion of the parkway's Central Area, adjacent to I-5 and away from the riverbank. Acquiring 2.155 acres constitutes a loss of 0.26 percent (total) of the Sacramento River Parkway. Such acquisition constitutes permanent incorporation of land from a Section 4(f) resource into a transportation use. This acquisition would be a minimal impact because there are no developed facilities or other resources in this portion of the parkway. The Sacramento River Parkway Trail would be temporarily rerouted away from this area, and is discussed as a separate resource. The

construction period is anticipated to last approximately 2 years. Impacts on recreation during construction would be minimized by maintaining access to the Parkway at all times, including the Sacramento River Parkway Trail via a detour. Construction equipment in the Parkway during construction activities and other potential impediments to recreation would be equipped with required safety markings (e.g., lights).

De Minimis Determination for Sacramento River Parkway (Central Area)

Although a use of 2.155 acre of the Sacramento River Parkway would occur, the impact would be minor and would qualify as a *de minimis* impact. In terms of recreational value, this area does not include any recreational areas or features other than the Sacramento River Parkway Trail, which is analyzed as a separate resource in Section A.3.3.2. The rest of this portion of the parkway is mainly open space used for passive recreation. After construction, pedestrian use of this area for walking and river views would be restored.

Measures to Minimize Harm for Sacramento River Parkway (Central Area)

Measures necessary to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures) are considered prior to determining an impact to be *de minimis*. The project includes the following elements to reduce impacts.

- Maintain safe access to the Sacramento River Parkway Trail at all times.
- Ensure that project construction equipment in the Sacramento River Parkway, and other potential impediments to recreation, is equipped with required safety markings (e.g., lights).
- Coordinate construction activities with the City of Sacramento Department of Parks and Recreation at least 10 days in advance of start of construction and regularly while construction activities are ongoing in the Parkway.
- Post written notices in the Sacramento River Parkway regarding construction activities.
- Return construction staging or any areas within the Sacramento River Parkway disturbed by construction activities to preconstruction or better conditions.

Additional minimization measures may be added in coordination with the City of Sacramento Department of Parks and Recreation.

Coordination for Sacramento River Parkway (Central Area)

Prior to making Section 4(f) approvals, coordination with the City of Sacramento Department of Parks and Recreation is required regarding activities, features, and attributes that qualify Sacramento River Parkway (Central Area) as a Section 4(f) resource. Caltrans requested of the City of Sacramento Department of Parks and Recreation concurrence on the *de minimis* finding under Section 4(f) after an opportunity for public review and comment concerning the effects of the project occurred. Both the concurrence request and affirmative agency response are included in Attachment B.

Conclusion for Sacramento River Parkway (Central Area)

The transportation use of Sacramento River Parkway Trail, together with measures to minimize harm incorporated into the project, would not adversely affect the activities, features, and attributes that qualify this park for protection under Section 4(f). Accordingly, the project would have a *de minimis* impact on Sacramento River Parkway Trail. As stated above, this acquisition would constitute 0.26 percent of the entire parkway, a minor area. This portion of the parkway does not contain any developed public facilities, other than the Sacramento River Parkway Trail, which is analyzed separately. Once construction is complete, pedestrians would be able to access this portion of the parkway. Furthermore, the portion of the parkway that would be acquired is a strip of land adjacent to I-5, not the riverfront.

A.3.4 Other Resources Evaluated Relative to the Requirements of Section 4(f)

This section discusses parks, recreational facilities, wildlife refuges, and historic properties found within or next to the project area that do not trigger Section 4(f) protection because either: 1) they are not publicly owned, 2) they are not open to the public, 3) they are not eligible historic properties, 4) the project would not permanently use the property and would not hinder the preservation of the property, or 5) the proximity impacts would not result in constructive use.

A.3.4.1 Historic Properties

Based on the analysis conducted as part of the Section 106 of the National Historic Preservation Act, three historic properties qualified as Section 4(f) resources. Two of these properties, I Street Bridge and Sacramento River East Levee, are within the project APE and are described in Table 4, below. No adverse effects under Section 106 were identified for these properties. SHPO's concurrence with the No Adverse Effect determination is included in Appendix G of this Final EIR/EA. Old Sacramento State Historic Park is not within the project APE but is within the Section 4(f) study limits. Old Sacramento State Historic Park is also included in Table 4 and described below.

As shown in Table 4, no use of any cultural resources protected by the provisions of Section 4(f) would occur.

Table 4. Section 4(f) Historic Property Use Determination Summary

Name	Use?	Constructive Use?	Temporary Occupancy?	Explanation
I Street Bridge (P-34-002349)	No	No	No	No physical destruction of the bridge would occur and, therefore, no adverse effect under Section 106.
Sacramento River East Levee (P-34-00490)	No	No	No	No adverse effect finding under Section 106. No land or portion of the resource would be permanently incorporated or temporarily occupied. Proximity impacts to the resource would not be of a severity such that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired.
Old Sacramento State Historic Park	No	No	Yes	Temporary occupancy at back of property when existing I Street Bridge approach ramp structures are decommissioned.

The proposed project would not adversely affect the activities, features, or attributes that qualify these historic resources for protection under Section 4(f); therefore, no use of historic properties would result from the project. The temporary occupancy of Old Sacramento State Historic Park is discussed below.

Old Sacramento State Historic Park

Old Sacramento State Historic Park is a public park and a historic part of the City of Sacramento located along the east bank of the Sacramento River, between Tower Bridge and I Street Bridge. The park area is a California Historic Landmark and is eligible for listing in the NRHP. The park contains many historic buildings, as well as the Sacramento Railroad Museum. It is accessible via the Capitol Mall/Lincoln Highway and J Street. There are two public parking garages as well as on-street parking along most of the streets in Old Sacramento. This state park is popular in the region and is frequented by both locals and tourists. Pedestrians shop, dine, and sightsee throughout the park, and there are views of and access to the Sacramento River. The park is also a popular location for school field trips and holiday events, such as parades and other gatherings, which typically draw large crowds to the park. Public facilities are prominent throughout the park, including public restrooms, drinking fountains, and benches.

Old Sacramento State Historic Park is not located within the architectural APE of the project. However, it is a California Historic Landmark eligible for listing in the NRHP and a public recreational resource; therefore, the park is included within the Section 4(f) study area. Within the jurisdiction of the state park is a parking lot just east of the Sacramento Railroad museum. This lot is located under the location where the existing I Street Bridge approach structures would be decommissioned.

Temporary Occupancy of Old Sacramento State Historic Park

As described below, the temporary use of Old Sacramento State Historic Park during the construction period would satisfy the requirements of 23 CFR Section 771.135(p)(7) for a “minimal” temporary occupancy. Construction activities in the park would last approximately 4 months. The portion of the park that would be affected is the parking area under the approaches

to the existing I Street Bridge. Parking would be maintained throughout the construction period, as would access to the state park. Recreational activities would not be impeded during construction.

- **The duration of the occupancy must be temporary (i.e., less than the time needed for construction of the project), and there should be no change in ownership of the land.**

Construction activities at the park, primarily demolition of the bridge approaches, would last approximately 4 months. The total construction period for the project would be 30 months. No permanent acquisition or easement would be required, so no change in ownership is proposed.

- **The scope of work must be minor (i.e., both the nature and magnitude of changes to the Section 4[f] resource are minimal).**

Demolition of the bridge approaches would result in minor impacts on this resource. Demolition activities would require temporary closure of a small portion of the parking lot for safety purposes. As such, there would be no active recreational uses allowed in the area of demolition during the duration of the work.

- **There are no anticipated permanent adverse physical impacts, and there will be no interference with the activities or purpose of the resource, on either a temporary or permanent basis.**

The portion of the Old Sacramento State Historic Park underneath and around the existing I Street Bridge approach structures contains parking for cars, buses, and RVs, pedestrian walkways, and some vegetation. Parking would remain available in the two public parking garages at the park entrances and on streets throughout the park. Safe access to Old Sacramento State Historic Park and the Sacramento Railroad Museum, including the parking garages, would also be maintained during the demolition period.

- **The land being used must be fully restored (i.e., the resource must be returned to a condition that is at least as good as that which existed prior to the project).**

Following removal of the bridge approach structures, the site would be returned to a condition as good as or better than current conditions. All equipment and construction debris would be removed from the site.

- **There must be documented agreement of the appropriate officials having jurisdiction over the resource regarding the foregoing requirements.**

Prior to making Section 4(f) approvals, coordination with the California Department of Parks and Recreation, the agency having jurisdiction over this resource, is required in order to obtain concurrence on the temporary occupancy finding. After an opportunity for public review and comment concerning the effects of the project occurred, Caltrans requested concurrence on the temporary occupancy finding from the California Department of Parks and Recreation. The concurrence request and affirmative response is included in Attachment B.

Measures to Minimize Harm for Old Sacramento State Historic Park

- Provide advance notice regarding project-related construction activities at Old Sacramento State Historic Park. At least 10 days advance notice will be provided regarding construction activity near the parking lots at Old Sacramento State Historic Park.
- Coordinate construction activities with the California Department of Parks and Recreation, so that the agency can inform users regarding construction activities.

Conclusion for Old Sacramento Historic Park

Implementation of the project would not constitute a Section 4(f) use of the Old Sacramento State Historic Park because it would not require acquisition of permanent right-of-way (ROW) from the park. The portion of the park that would be affected is currently used for parking, not recreational activities. There are two parking garages as well as on-street parking that would be available as alternative parking areas during the 4 months that project construction activities would occur in the parking area. Park activities and facilities would not be affected during construction. Access to the park, museum, riverfront, and other public recreational facilities would be fully available during construction. The temporary occupancy of the Old Sacramento Historic Park meets the criteria outlined in 23 CFR 774.13(d); therefore, the project would not constitute as a use under Section 4(f).

A.3.4.2 Parks and Recreational Areas

City of West Sacramento

Three public parks (Elkhorn Plaza, Raley Field and River Walk Park) are located within the study area in the city of West Sacramento but would not be affected by the proposed project.

Elkhorn Plaza is located within the study area, approximately 0.6 mile west of the project boundary. Access to Elkhorn Plaza is through Sacramento Avenue and Elkhorn Plaza.

Raley Field is located within the study area, approximately 0.45 mile west of the project boundary. Access to Raley Field is through 5th Street, the Tower Bridge Gateway, and Ballpark Drive. Parking for Raley Field is located between 5th Street and South River Road.

River Walk Park is located along the west bank of the Sacramento River between the Tower Bridge and existing I Street Bridge. The park has views of the Sacramento River, Old Sacramento, and the Sacramento Skyline. There are picnic areas, as well as an area for special events available for rent. There is also a restroom facility.

No ROW would be acquired from these parks and recreational areas and no temporary construction easement would be required for staging or other construction activities. Visitors would not experience any loss of access or use of recreational or parking facilities. Therefore, there would be no use of these properties under Section 4(f). No further study is required.

River Walk Park-Proposed Extension

A proposed extension of the Sacramento River Walk Park is described in the City of West Sacramento Parks Master Plan (2003).

Development of these parcels has not yet occurred. The extensions of the River Walk north and south of the existing River Walk Park are not yet constructed, and a temporary construction easement would not be required for staging or other construction activities associated with the proposed project. The City of West Sacramento, as both one of the project proponents and the agency with jurisdiction over this resource, will assist with coordination of the design and construction of the two projects. Therefore there will be no acquisition of land from this proposed resource.

Other City of West Sacramento Proposed Parks

Other proposed parks are identified in Figure 1 (Attachment A) and described in Table 2 above. These parks are not yet constructed. There would be no direct use and temporary construction easements would not be required for staging or other construction activities. Therefore, there would be no use of these properties under Section 4(f). No further study is required.

City of Sacramento

Downtown Sacramento Parks

Crocker Park, Leland Stanford Mansion State Historic Park, Capitol Park, Saint Rose of Lima Square, Caesar Chavez Park, J. Neely Johnson Park, and Zapata Park are all located in downtown Sacramento. These parks are accessible via local streets and are far enough away from the project boundary that access to these parks would not be affected. No ROW would be acquired from any of these parks on a permanent basis, and temporary construction easements would not be required for staging or other construction activities. These parks are far enough away from the project boundary that visitors would not have views of construction equipment, nor would they experience temporary construction-related noise effects. There would not be any loss of access or use of recreational or parking facilities. Therefore, there would be no use of these properties under Section 4(f). No further study is required.

Tiscornia Park

Tiscornia Park is located north of the project at the confluence of the Sacramento and American Rivers. It contains beach and river access and picnic areas. This park is accessible from Jibboom Street. No ROW would be acquired from this park on a permanent basis, and a temporary construction easement would not be required for staging or other construction activities. Visitors may have intermittent and temporary views of construction equipment and may also experience temporary construction-related noise effects, but they would not experience any loss of access or use of recreational or parking facilities.

Proposed Riverfront Park

A proposed public Riverfront Park is part of the planned Sacramento Railyards development. The Sacramento Railyards Specific Plan (City of Sacramento 2016) identifies Open Space areas that are intended to create a framework for linking the different districts within the Railyards development. The portion of the proposed Riverfront Park along the riverfront between Tiscornia Park and Old Sacramento would contain a segment of the Sacramento River Parkway (Central Area). It would primarily consist of passive open space, and no developed facilities are currently planned. Another portion of the park along and just east of the riverfront would surround a river-adjacent mixed-use residential/hotel with green and park-like public space. The parks within the Sacramento Railyards would be privately developed, but under jurisdiction of the City of Sacramento. They would also be maintained by the City of Sacramento (Rich pers. comm.).

This park is not yet constructed. As currently designed, the proposed project would not require either temporary construction easements or permanent ROW acquisition in the park; therefore, there would be no use of this property under Section 4(f). No further study is required.

Other City of Sacramento Proposed Parks

Other proposed parks include other parcels identified in the Sacramento Railyards Specific Plan as open space (shown in Figure 1 [Attachment A]). These parks are not yet constructed. There would be no direct use and temporary construction easements would not be required for staging or other construction activities. Therefore, there would be no use of these properties under Section 4(f). No further study is required.

A.4 Section 6(f) Assessment

Section 6(f)(3) of the LWCF Act (16 USC Section 4601-4) contains provisions to protect federal investments in park and recreational resources and the quality of those assisted resources. The law recognizes the likelihood that changes in land use or development may make park use of some areas purchased with LWCF funds obsolete over time, particularly in rapidly changing urban areas, and provides for conversion to other use pursuant to certain specific conditions.

Section 6(f)(3): No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing comprehensive statewide outdoor recreation plan and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.

This requirement applies to all parks and other sites that have been the subject of LWCF grants of any type and includes acquisition of park land and development or rehabilitation of park facilities.

A review of the LWCF listing of grants for Sacramento and Yolo Counties revealed that several grants have been allotted to the Sacramento River Parkway (project numbers BG-34-321 and SL-

34-001) and one grant has been allotted to the Sacramento River Parkway Trail (project number 06-00679). Further consultation with the California Department of Parks and Recreation confirmed that LWCF funds were used to construct the Sacramento River Parkway Trail in the vicinity of the project (Attachment B). The trail would be temporarily rerouted during construction, and the detour would be in place for approximately 2 years. However, the trail would remain in use during construction, and would be reestablished in its original location to a condition as good as or better than current conditions. Therefore, there would be no conversion of any LWCF-funded recreational areas to a non-recreational use, and protection under Section 6(f) would not apply.

A.5 References Cited

A.5.1 Printed References

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Federal Highway Administration (FHWA). 2012. *Section 4(f) Policy Paper*. Available:
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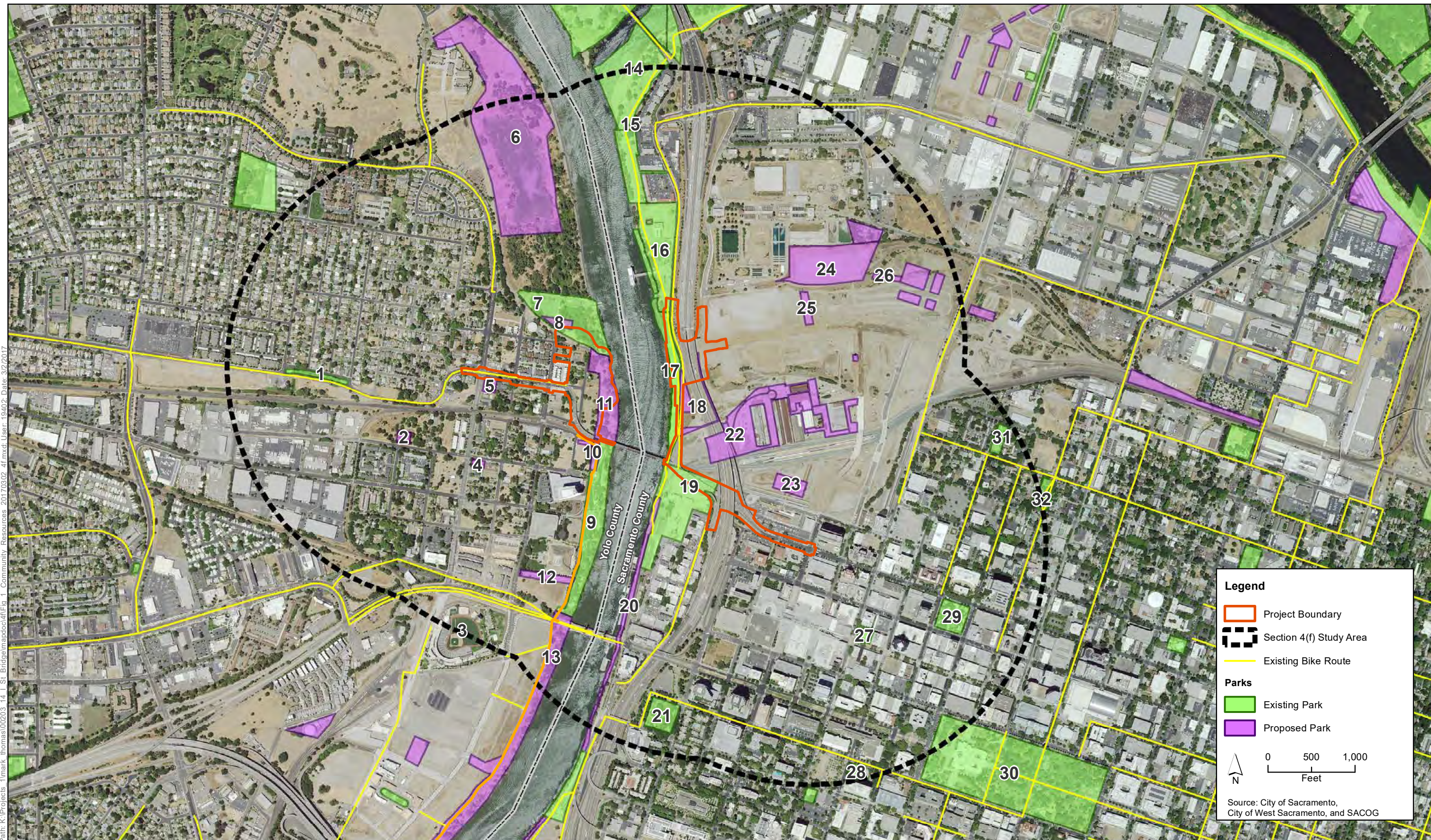
ICF International. 2016. *Archaeological Survey Report for the I Street Bridge Replacement Project, City of Sacramento, Sacramento County and City of West Sacramento, Yolo County, California*. November 2016.

A.5.2 Personal References

Rich, Richard. City of Sacramento. Project Manager, Railyards Project Entitlements and Environmental Review. September 8, 2016—Phone conversation with Lindsay Christensen, ICF International.

Attachment A
Figures

Path: K:\Projects\1\mark_thomas\0203_14_1_1_St_Bridgelmapdoc\4\Fig_1_Community_Resources_20170302_41.mxd; User: 19402; Date: 3/2/2017



Legend

- Project Boundary
- Section 4(f) Study Area
- Existing Bike Route

Parks

- Existing Park
- Proposed Park

0 500 1,000 Feet

Source: City of Sacramento, City of West Sacramento, and SACOG

Figure 1
Section 4(f) Study Area

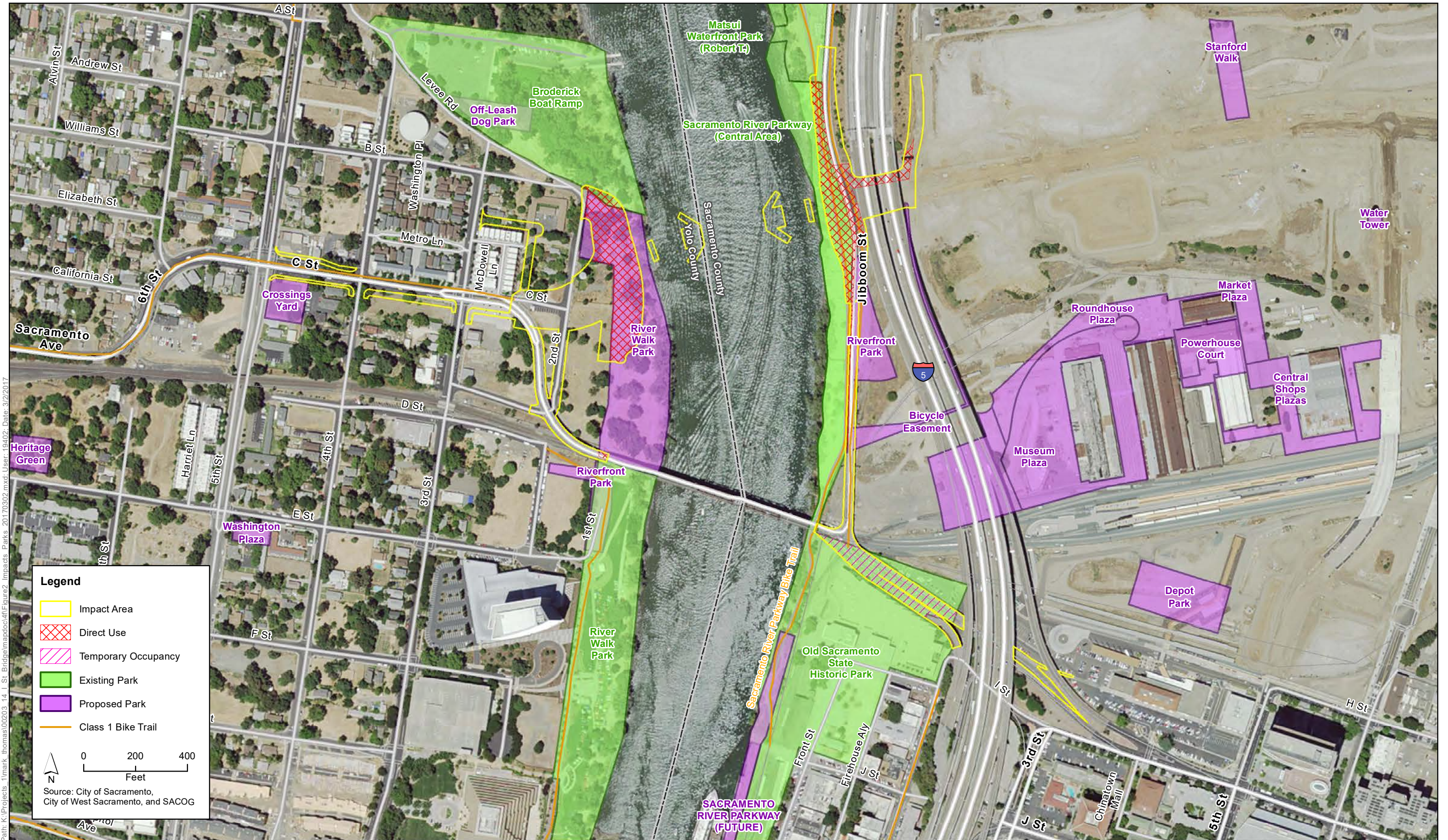


Figure 2
Proposed Project Impacts to Parks

Attachment B
Correspondence

Section 4(f) Correspondence

DEPARTMENT OF TRANSPORTATION**DISTRICT 3**

703 B STREET
MARYSVILLE, CA 95901
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*Making Conservation
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March 6, 2018

Cindy Tuttle
Parks and Recreation Director
City of West Sacramento
1110 West Capitol Avenue
West Sacramento, CA 95691

Dear Ms. Tuttle:

The purpose of this letter is to request concurrence that the activities, features, or attributes are not adversely affected for the Broderick Boat Ramp after any avoidance, minimization, or mitigation measures have been applied. This request stems from the need to meet compliance under the Section 4(f) regulation which protects publicly-owned parks. Caltrans intends to make a de minimis finding upon your concurrence.

The City of Sacramento, in cooperation with the City of West Sacramento and the California Department of Transportation (Caltrans), proposes to construct a new bridge on a new alignment over the Sacramento River to replace the existing I Street Bridge.

A "use" under Section 4(f) occurs because the proposed project will acquire right-of-way (approximately 0.135-acre) from the park. This portion to be acquired is along the southern boundary of the park near B Street, along a levee road. This section of the park contains trees and grassy areas, but no park facilities or active recreation areas. The boat ramp, parking lot, and restrooms are all located on the norther portion of the property. Visitors will not experience any access restrictions, or loss of recreational activities or parking facilities after construction of the I Street Bridge Project.

The enclosed Appendix A, which is a part of the circulated Draft EIR/EA, demonstrates how Section 4(f) criteria is applied, explains the "use" that occurs to the Broderick Boat Ramp, and the reasons why de minimis is an appropriate approval under Section 4(f).

The public was afforded an opportunity to review and comment on the Draft EIR/EA during the public circulation period of September 28, 2017 thru November 12, 2017. At the end of the 45-day review period, the public did not comment on the "use" of the Broderick Boat Ramp.

One of the last steps to satisfy Section 4(f) requirements is to have the official with jurisdiction over the Section 4(f) property concur in writing that the project will not adversely affect the activities, features, or attributes that qualify the property for protection under Section 4(f).

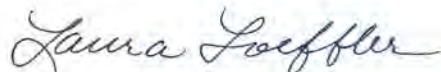
Ms. Tuttle
March 6, 2018
Page 2

Receipt of written concurrence from the City of West Sacramento, Department of Parks and Recreation enables Caltrans to approve the *de minimis* finding for the Broderick Boat Ramp in accordance with the requirements of Section 4(f).

Please indicate your concurrence with the findings described in the enclosed Appendix A by signing and returning this letter to Laura Loeffler, Environmental Branch Chief, Department of Transportation, Environmental Planning, 703 B Street, Marysville, CA 95901, email laura.loeffler@dot.ca.gov.

If you have any questions, please contact me at (530) 741-4592.

Sincerely,

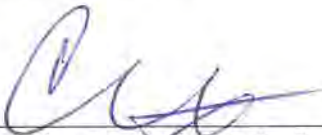


Laura Loeffler
Branch Chief, North Region Environmental Planning M-1
Caltrans, District 3 Marysville

Enclosure

(1) Appendix A. Section 4(f) De Minimis Determination and Section 6(f) Assessment

c: Jesse Gothan, City of Sacramento
Jason McCoy, City of West Sacramento
Claire Bromund, ICF



/signature line for Cindy Tuttle, Parks and Recreation Director

3/13/18
Date

DEPARTMENT OF TRANSPORTATION**DISTRICT 3**

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April 9, 2018

Mr. Raymond Constantino
Senior Planner
City of Sacramento
Department of Youth, Parks, and Community Enrichment
915 I Street, 3rd Floor
Sacramento, CA 95814

Dear Mr. Constantino:

The purpose of this letter is to request concurrence for the temporary occupancy of the Sacramento River Parkway Trail, and concurrence that the activities, features, or attributes are not adversely affected for a de minimis determination for the Sacramento River Parkway (Central Area), both owned by the City of Sacramento, Department of Youth, Parks and Community Enrichment.

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, proposes to construct a new bridge on a new alignment over the Sacramento River to replace the existing I Street Bridge.

As part of the federal environmental process under NEPA, Caltrans prepared documentation in accordance to the Section 4(f) regulation. The enclosed Appendix A, which is a part of the circulated Draft EIR/EA, demonstrates how Section 4(f) criteria applies and explains how the criteria is met for temporary occupancy and de minimis. This Section 4(f) analysis, as Appendix A to Draft EIR/EA, was circulated for public review from September 28, 2017 to November 12, 2017. At the end of the 45-day public review period, the public did not submit any comments that pertain to Section 4(f).

Sacramento River Parkway Trail

Construction of the proposed project would close the Sacramento River Parkway Trail in the area between Matsui Waterfront Park and Old Sacramento and would necessitate a temporary detour. As described in more detail in Appendix A, the temporary occupancy of Sacramento River Parkway Trail during the construction period meets the criteria of 23 CFR Section 774.13(d) for temporary occupancy. As specified in the regulation, temporary occupancy of a property does not constitute "use" of a Section 4(f) resource when the following conditions are satisfied.

Mr. Constantino
April 9, 2018
Page 2

- The duration of the occupancy must be temporary (i.e., less than the time needed for construction of the project), and there should be no change in ownership of the land.
- The scope of work must be minor (i.e., both the nature and magnitude of changes to the Section 4(f) resource are minimal).
- There are no anticipated permanent adverse physical impacts, and there would be no interference with the activities or purpose of the resource, on either a temporary or a permanent basis.
- The land being used must be fully restored (i.e., the resource must be returned to a condition which is at least as good as that which existed prior to the project).
- There must be documented agreement of the appropriate officials having jurisdiction over the resource regarding the foregoing requirements.

Sacramento River Parkway (Central Area)

The proposed project would acquire 2.1-acres from the Sacramento River Parkway. The area that would be acquired is a strip of land on the eastern portion of the parkway's Central Area, adjacent to I-5 and away from the riverbank. Acquiring 2.1-acres constitutes a loss of 0.26 percent (total) of the Sacramento River Parkway. The area to be acquired does not have any park facilities, attributes, or parkway features. The Sacramento River Parkway Trail would be temporarily rerouted away from this area. Construction is anticipated to last approximately 2 years. Access to the parkway will be maintained throughout the construction period, and a detour will be provided for continued access the Sacramento River Parkway Trail. Construction equipment will be equipped with the required safety markings (e.g. lights) and staged in the parkway in a manner that will not impede access to recreational activities. Additional details, as well as measures to minimize harm, are provided in the enclosed Appendix A.

One of the last steps to satisfy Section 4(f) requirements is to have the official with jurisdiction over the Section 4(f) property concur in writing that the criteria can be met for temporary occupancy for the Sacramento River Parkway Trail.

In addition, written concurrence that the project will not adversely affect the activities, features, or attributes for a de minimis determination for the Sacramento River Parkway (Central Area).

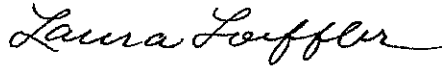
Receipt of written concurrence from the City of Sacramento, Department of Youth, Park and Community Enrichment enables Caltrans to approve the de minimis finding and the temporary occupancy in accordance with the requirements of Section 4(f).

Please indicate your concurrence with the findings described in the enclosed Appendix A by signing below and returning this letter to Laura Loeffler, Environmental Branch Chief,

Mr. Constantino
April 9, 2018
Page 3

If you have any questions, please contact me at (530) 741-4592.

Sincerely,



Laura Loeffler
Branch Chief, North Region Environmental Planning M-1
Caltrans, District 3 Marysville

Enclosure

(1) Appendix A. Section 4(f) De Minimis Determination and Section 6(f) Assessment

c: Jesse Gothan, City of Sacramento
Jason McCoy, City of West Sacramento
Claire Bromund, ICF Consultant



4/26/18

/signature line for Raymond Constantino
Senior Planner

Date

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April 9, 2018

Ty Smith
Museum Director
California State Railroad Museum
California Department of Park and Recreation
P.O. Box 942896
Sacramento, CA 94296

Dear Mr. Smith:

The purpose of this letter is to request concurrence for the temporary occupancy of the Old Sacramento State Historic Park owned by the California Department of Parks and Recreation (California State Parks). This request stems from the requirement to comply with the Section 4(f) of the U.S. Department of Transportation Act that protects publicly-owned parks and historic properties eligible for the National Register.

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, proposes to construct a new bridge on a new alignment over the Sacramento River to replace the existing I Street Bridge.

As part of the federal environmental process under NEPA, Caltrans prepared documentation in accordance to the Section 4(f) regulation. The enclosed Appendix A, which is a part of the circulated Draft EIR/EA, demonstrates how Section 4(f) criteria applies and explains how the criteria is met for temporary occupancy. This Section 4(f) analysis, as Appendix A to Draft EIR/EA, was circulated for public review from September 28, 2017 to November 12, 2017. At the end of the 45-day public review period, the public did not submit any comments that pertain to Section 4(f).

Construction activities in Old Sacramento would last approximately 4 months. No permanent acquisition or easement would be required, so no change in ownership is proposed. The portion of Old Sacramento that would be affected is the parking area under the approach structures to the existing I Street Bridge. Demolition of the bridge approach structures would require temporary closure of a small portion of the parking lot for safety purposes. Parking would be maintained throughout the construction period, as would access to Old Sacramento. Recreational activities would not be impeded during construction.

As described in the enclosure, the temporary occupancy of the Old Sacramento State Historic Park during the construction period meets the requirements of 23 CFR Section 774.13(d) for

Mr. Smith
April 9, 2018
Page 2

temporary occupancy. As specified in the regulation, temporary occupancy of a property does not constitute "use" of a Section 4(f) resource when the following conditions are satisfied.

- The duration of the occupancy must be temporary (i.e., less than the time needed for construction of the project), and there should be no change in ownership of the land.
- The scope of work must be minor (i.e., both the nature and magnitude of changes to the Section 4[f] resource are minimal).
- There are no anticipated permanent adverse physical impacts, and there would be no interference with the activities or purpose of the resource, on either a temporary or a permanent basis.
- The land being used must be fully restored (i.e., the resource must be returned to a condition which is at least as good as that which existed prior to the project).
- There must be documented agreement of the appropriate officials having jurisdiction over the resource regarding the foregoing requirements.

One of the last steps to satisfy Section 4(f) requirement is to have the official with jurisdiction over the Section 4(f) property concur in writing that the conditions listed above can be met for temporary occupancy.

Written concurrence from the California State Parks is necessary for the temporary occupancy of the Old Sacramento State Historic Park.

Please indicate your concurrence by signing below and returning this letter to Laura Loeffler, Environmental Branch Chief, Department of Transportation, Environmental Planning, 703 B Street, Marysville, CA 95901, email laura.loeffler@dot.ca.gov.

If you have any questions, please contact me at (530) 741-4592.

Sincerely,



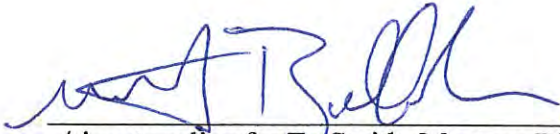
Laura Loeffler
Caltrans, Division of Environmental

Enclosures

(1) Appendix A. Section 4(f) De Minimis Determination and Section 6(f) Assessment

Mr. Smith
April 9, 2018
Page 3

- c: Jesse Gothan, Project Engineer, City of Sacramento
- Jason McCoy, Senior Project Planner, City of West Sacramento
- Claire Bromund, ICF Consultant



7/26/18

/signature line for ~~Ty Smith, Museum Director~~ MATTHEW BELLAH Date
California State Railroad Museum PARKS DISTRICT SUPERINTENDENT

Section 6(f) Correspondence

From: Bee, Natalie@Parks <Natalie.Bee@parks.ca.gov>
Sent: Wednesday, July 08, 2015 1:16 PM
To: Christensen, Lindsay
Subject: RE: Sacramento I Street Bridge Replacement project
Attachments: Scanned from OGALS Xerox.pdf

Hi Lindsay,

I've attached the map for the Sacramento River Trail that was funded through LWCF from Old Sac to Discovery, project number 06-00679. Is the City looking to replace the I Street bridge using the existing footprint or is an additional bridge being installed that would impact the current trail?

Natalie Bee

Associate Park and Recreation Specialist
California State Parks
Office of Grants and Local Services
1416 9th Street, Rm 918
Sacramento, CA 94296-0001

(916) 651-0564 *phone*
(916) 653-6511 *fax*



From: Christensen, Lindsay [<mailto:Lindsay.Christensen@icfi.com>]
Sent: Wednesday, July 08, 2015 12:34 PM
To: Bee, Natalie@Parks
Subject: Sacramento I Street Bridge Replacement project

Hi Natalie,

Per our phone conversation, I'm looking to see if any LWCF grants were used in the project area for the I Street Bridge Replacement Project. I am attaching a draft figure that shows where potential park impacts could occur. Any information you can provide would be very helpful.

Thank you so much!

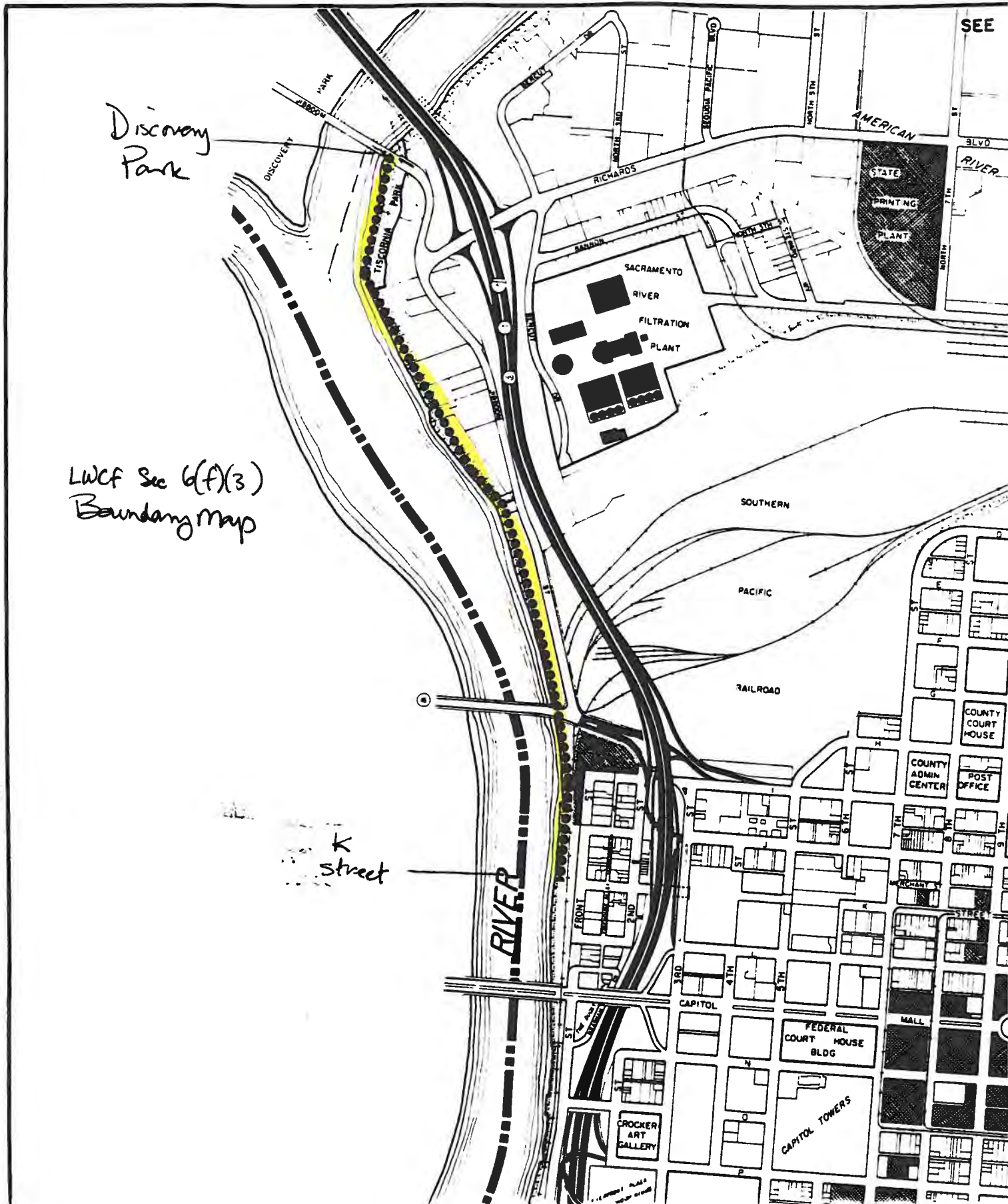
LINDSAY CHRISTENSEN | Project Coordinator, Environment & Planning
Division | 916.231.7614 | lindsay.christensen@icfi.com | icfi.com

ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814 | 916.737.3000



Please consider the environment before printing this e-mail.

SACRAMENTO RIVER BIKE TRAIL



Discovery Park

LWCF Sec 6(f)(3)
Boundary map

K Street

SEE

Appendix B
Title VI Policy Statement

Appendix B Title VI Policy Statement

DEPARTMENT OF TRANSPORTATION
OFFICE OF THE DIRECTOR
P.O. BOX 942873, MS-49
SACRAMENTO, CA 94273-0001
PHONE (916) 654-6130
FAX (916) 653-5776
TTY 711
www.dot.ca.gov



*Making Conservation
a California Way of Life.*

April 2018

NON-DISCRIMINATION POLICY STATEMENT

The California Department of Transportation, under Title VI of the Civil Rights Act of 1964, ensures *"No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance."*

Related federal statutes and state law further those protections to include sex, disability, religion, sexual orientation, and age.

For information or guidance on how to file a complaint, please visit the following web page:
http://www.dot.ca.gov/hq/bep/title_vi/t6_violated.htm.

To obtain this information in an alternate format such as Braille or in a language other than English, please contact the California Department of Transportation, Office of Business and Economic Opportunity, 1823 14th Street, MS-79, Sacramento, CA 95811. Telephone (916) 324-8379, TTY 711, email Title.VI@dot.ca.gov, or visit the website www.dot.ca.gov.

A handwritten signature in blue ink, appearing to read "Laurie Berman".

LAURIE BERMAN
Director

*"Provide a safe, sustainable, integrated and efficient transportation system
to enhance California's economy and livability"*

Appendix C

Summary of Relocation Benefits

Appendix C Summary of Relocation Benefits

C.1 California Department of Transportation Relocation Assistance Program

C.1.1 Declaration of Policy

“The purpose of this title is to establish a *uniform policy for fair and equitable treatment* of persons displaced as a result of federal and federally assisted programs in order that such persons *shall not suffer disproportionate injuries* as a result of programs designed for the benefit of the public as a whole.”

The Fifth Amendment to the U.S. Constitution states, “No Person shall...be deprived of life, liberty, or property, without due process of law, nor shall private property be taken for public use without just compensation.” The Uniform Act sets forth in statute the due process that must be followed in Real Property acquisitions involving federal funds. Supplementing the Uniform Act is the government-wide single rule for all agencies to follow, set forth in 49 Code of Federal Regulations (CFR) Part 24. Displaced individuals, families, businesses, farms, and nonprofit organizations may be eligible for relocation advisory services and payments, as discussed below.

C.1.2 Fair Housing

The Fair Housing Law (Title VIII of the Civil Rights Act of 1968) sets forth the policy of the United States to provide, within constitutional limitations, for fair housing. This act, and as amended, makes discriminatory practices in the purchase and rental of most residential units illegal. Whenever possible, minority persons shall be given reasonable opportunities to relocate to any available housing regardless of neighborhood, as long as the replacement dwellings are decent, safe, and sanitary and are within their financial means. This policy, however, does not require Caltrans to provide a person a larger payment than is necessary to enable a person to relocate to a comparable replacement dwelling.

Any persons to be displaced will be assigned to a relocation advisor, who will work closely with each displacee in order to see that all payments and benefits are fully utilized and that all regulations are observed, thereby avoiding the possibility of displacees jeopardizing or forfeiting any of their benefits or payments. At the time of the initiation of negotiations (usually the first written offer to purchase), owner-occupants are given a detailed explanation of the state’s relocation services. Tenant occupants of properties to be acquired are contacted soon after the initiation of negotiations and also are given a detailed explanation of the Caltrans Relocation Assistance Program. To avoid loss of possible benefits, no individual, family, business, farm, or nonprofit organization should commit to purchase or rent a replacement property without first contacting a Caltrans relocation advisor.

C.1.3 Relocation Assistance Advisory Services

In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, Caltrans will provide relocation advisory assistance to any person, business, farm, or nonprofit organization displaced as a result of the acquisition of real property for public use, so long as they are legally present in the United States. Caltrans will assist eligible displacees in obtaining comparable replacement housing by providing current and continuing information on the availability and prices of both houses for sale and rental units that are “decent, safe, and sanitary.” Nonresidential displacees will receive information on comparable properties for lease or purchase (for business, farm, and nonprofit organization relocation services, see below).

Residential replacement dwellings will be in a location generally not less desirable than the displacement neighborhood at prices or rents within the financial ability of the individuals and families displaced, and reasonably accessible to their places of employment. Before any displacement occurs, comparable replacement dwellings will be offered to displacees that are open to all persons regardless of race, color, religion, sex, national origin, and consistent with the requirements of Title VIII of the Civil Rights Act of 1968. This assistance will also include the supplying of information concerning federal and state assisted housing programs and any other known services being offered by public and private agencies in the area.

Persons who are eligible for relocation payments and who are legally occupying the property required for the project will not be asked to move without first being given at least 90 days written notice. Residential occupants eligible for relocation payment(s) will not be required to move unless at least one comparable “decent, safe, and sanitary” replacement dwelling, available on the market, is offered to them by Caltrans.

C.1.3.1 Residential Relocation Payments

The Relocation Assistance Program will help eligible residential occupants by paying certain costs and expenses. These costs are limited to those necessary for or incidental to the purchase or rental of a replacement dwelling and actual reasonable moving expenses to a new location within 50 miles of the displacement property. Any actual moving costs in excess of the 50 miles are the responsibility of the displacee. The Residential Relocation Assistance Program can be summarized as follows:

Moving Costs

Any displaced person, who lawfully occupied the acquired property, regardless of the length of occupancy in the property acquired, will be eligible for reimbursement of moving costs. Displacees will receive either the actual reasonable costs involved in moving themselves and personal property up to a maximum of 50 miles, or a fixed payment based on a fixed moving cost schedule. Lawful occupants who move into the displacement property after the initiation of negotiations must wait until Caltrans obtains control of the property in order to be eligible for relocation payments.

Purchase Differential

In addition to moving and related expense payments, fully eligible homeowners may be entitled to payments for increased costs of replacement housing.

Homeowners who have owned and occupied their property for 90 days or more prior to the date of the initiation of negotiations (usually the first written offer to purchase the property), may qualify to receive a price differential payment and may qualify to receive reimbursement for certain nonrecurring costs incidental to the purchase of the replacement property. An interest differential payment is also available if the interest rate for the loan on the replacement dwelling is higher than the loan rate on the displacement dwelling, subject to certain limitations on reimbursement based upon the replacement property interest rate.

Rent Differential

Tenants and certain owner-occupants (based on length of ownership) who have occupied the property to be acquired by Caltrans prior to the date of the initiation of negotiations may qualify to receive a rent differential payment. This payment is made when Caltrans determines that the cost to rent a comparable “decent, safe, and sanitary” replacement dwelling will be more than the present rent of the displacement dwelling. As an alternative, the tenant may qualify for a down payment benefit designed to assist in the purchase of a replacement property and the payment of certain costs incidental to the purchase, subject to certain limitations noted under the *Down Payment* section below.

To receive any relocation benefits, the displaced person must buy or rent and occupy a “decent, safe and sanitary” replacement dwelling within one year from the date Caltrans takes legal possession of the property, or from the date the displacee vacates the displacement property, whichever is later.

Down Payment

The down payment option has been designed to aid owner-occupants of less than 90 days and tenants in legal occupancy prior to Caltrans’ initiation of negotiations. The one-year eligibility period in which to purchase and occupy a “decent, safe and sanitary” replacement dwelling will apply.

Last Resort Housing

Federal regulations (49 CFR 24) contain the policy and procedure for implementing the Last Resort Housing Program on Federal-aid projects. Last Resort Housing benefits are, except for the amounts of payments and the methods in making them, the same as those benefits for standard residential relocation as explained above. Last Resort Housing has been designed primarily to cover situations where a displacee cannot be relocated because of lack of available comparable replacement housing, or when the anticipated replacement housing payments exceed the limits of the standard relocation procedure, because either the displacee lacks the financial ability or other valid circumstances.

After the initiation of negotiations, Caltrans will within a reasonable length of time, personally contact the displacees to gather important information, including the following:

- Number of people to be displaced.
- Specific arrangements needed to accommodate any family member(s) with special needs.
- Financial ability to relocate into comparable replacement dwelling which will adequately house all members of the family.
- Preferences in area of relocation.
- Location of employment or school.

C.1.4 Nonresidential Relocation Assistance

The Nonresidential Relocation Assistance Program provides assistance to businesses, farms and nonprofit organizations in locating suitable replacement property, and reimbursement for certain costs involved in relocation. The Relocation Advisory Assistance Program will provide current lists of properties offered for sale or rent, suitable for a particular business's specific relocation needs. The types of payments available to eligible businesses, farms, and nonprofit organizations are: searching and moving expenses, and possibly reestablishment expenses; or a fixed in lieu payment instead of any moving, searching and reestablishment expenses. The payment types can be summarized as follows:

C.1.4.1 Moving Expenses

Moving expenses may include the following actual, reasonable costs:

- The moving of inventory, machinery, equipment and similar business-related property, including: dismantling, disconnecting, crating, packing, loading, insuring, transporting, unloading, unpacking, and reconnecting of personal property. Items acquired in the right-of-way contract may not be moved under the Relocation Assistance Program. If the displacee buys an Item Pertaining to the Realty back at salvage value, the cost to move that item is borne by the displacee.
- Loss of tangible personal property provides payment for actual, direct loss of personal property that the owner is permitted not to move.
- Expenses related to searching for a new business site, up to \$2,500, for reasonable expenses actually incurred.

C.1.4.2 Reestablishment Expenses

Reestablishment expenses related to the operation of the business at the new location, up to \$25,000 for reasonable expenses actually incurred.

C.1.4.3 Fixed In Lieu Payment

A fixed payment in lieu of moving, searching, and reestablishment payments may be available to businesses that meet certain eligibility requirements. This payment is an amount equal to half the average annual net earnings for the last two taxable years prior to the relocation and may not be less than \$1,000 nor more than \$40,000.

C.1.5 Additional Information

Reimbursement for moving costs and replacement housing payments are not considered income for the purpose of the Internal Revenue Code of 1954, or for the purpose of determining the extent of eligibility of a displacee for assistance under the Social Security Act, or any other law, *except* for any federal law providing local “Section 8” Housing Programs.

Any person, business, farm or nonprofit organization that has been refused a relocation payment by the Caltrans relocation advisor or believes that the payment(s) offered by the agency are inadequate may appeal for a special hearing of the complaint. No legal assistance is required. Information about the appeal procedure is available from the relocation advisor.

California law allows for the payment for lost goodwill that arises from the displacement for a public project. A list of ineligible expenses can be obtained from Caltrans’ Division of Right of Way and Land Surveys. California’s law and the federal regulations covering relocation assistance provide that no payment shall be duplicated by other payments being made by the displacing agency.

More information regarding Caltrans’ Division of Right of Way’s Relocation Assistance Program can be found on the internet at <http://www.dot.ca.gov/hq/row/rap/index.htm>.

Avoidance, Minimization and/or Mitigation Summary

Appendix D Avoidance, Minimization and/or Mitigation Summary

This appendix was updated for the Final EIR/EA to be consistent with the measures, and any changes to them, in Chapters 2 and 3. Changes since the Draft EIR/EA are not indicated in the contents of this appendix.

D.1 Land Use

D.1.1 Avoidance, Minimization and/or Mitigation Measures

No measures are necessary.

D.1.2 CEQA Mitigation Measures

Restore Sacramento River Parkway Trail after Construction

In the event that any inadvertent damage occurs to the Sacramento River Parkway Trail, the area affected will be restored to the condition that existed prior to construction activities or better.

Provide Advance Notification of Sacramento River Parkway Trail Closures

The City of Sacramento will provide advance notification of the Sacramento River Parkway Trail closure on its websites and trailheads. Notices will include trail closure dates, approximate duration, and a description of the detour available during closure.

D.2 Growth

D.2.1 Avoidance , Minimization and/or Mitigation Measures

No measures are necessary.

D.2.2 CEQA Mitigation Measures

No measures are necessary.

D.3 Community Impacts

D.3.1 Avoidance and Minimization Measures

Prepare a Transportation Management Plan

Prior to construction, the project proponent will prepare a Transportation Management Plan (TMP). Implementation of a TMP would minimize disruptions to traffic and to emergency services during construction and ensure that construction would not create major delays. A TMP is a program of activities for alleviating or minimizing work-related traffic delays by applying traditional traffic handling practices as well as innovative strategies. A TMP program includes public awareness campaigns, motorist information, demand management, incident management, system management, construction methods and staging, and alternate route planning. TMP strategies also strive to reduce the overall duration of work activities where appropriate. Typical components of a TMP can include measures such as implementation of staging, traffic handling, and detour plans; restricting construction work to certain days and/or hours to minimize impacts on traffic and pedestrians; coordination with other construction projects to avoid conflicts; and the use of portable changeable message signs to inform the public of construction activities.

Implementation of the measures in the TMP would reduce the temporary access and circulation impacts of the project that would be caused by potentially lengthy construction delays. In addition to the measures described above, the TMP will include the following measures.

- Any emergency service agency whose ability to respond to incidents will be affected by any lane closure must be notified prior to that closure.
- Work will be coordinated with the local busing system (including school buses and public systems) to minimize impacts on their bus schedules.

The project proponent will provide information to residents and businesses before and during project work that may represent a negative impact on commerce and travel surrounding the zone of construction.

D.3.2 Mitigation Measures

Construct Mid-block East West Road

Construct a new east/west access road south of C Street, just south of the Washington Firehouse property, to restore on-street parking, emergency access, and circulation to parcels currently served by 2nd Street, and prevent creation of a cul-de-sac inconsistent with West Sacramento's Standard Specifications. The roadway will restore circulation that will be impaired or unusable due to bridge impacts on the parking lot and the adjacency of the new location of the southeast corner of 3rd and C Street to the driveway or curb cut into the Washington Firehouse parking. The roadway will be consistent with the 2nd Street reconfiguration shown in Figure 2.81 and Figure 2.85 of *Washington Realized* (City of West Sacramento 2015). Implementation of this

measure will occur concurrent with project construction and will require acquisition of rights-of-way from four parcels in West Sacramento, as listed in Table 2.3-3 below.

Table 2.3-3. Mid-block East West Road Parcel Acquisitions

Assessor's Parcel Number	Description	Proposed Acquisitions (acres)
010-371-007	Vacant – City of West Sacramento	0.091
010-371-008	Vacant – City of West Sacramento	0.221
010-371-009	Vacant – City of West Sacramento	0.044
010-372-002	Vacant waterfront – City of West Sacramento	0.191

Source: Mark Thomas and Company 2018.

The new access road will provide access to private parcels between 3rd Street and the Sacramento River and will accommodate pedestrian and bicycle use as well as provide limited vehicular access within the same street space. It will be designed to enhance and visually communicate the shared nature of the street. It may be a “Stubbed” access street connected to 3rd Street, then terminating in a hammer head or parking lot. Or it may be a “Connecting” access street connected to the existing 2nd Street and 3rd Street. The new access road will be a minimum of 60 feet wide with a 20-foot right-of-way for vehicles and a 20-foot “no structure” zone on each side which may accommodate semi-private uses or parking.

D.3.3 CEQA Mitigation Measures

No measures are necessary.

D.4 Utilities/Emergency Services

D.4.1 Avoidance and Minimization Measures

Provide Advance Notice to Utility Service Providers

The project proponent will provide advance notification and coordinate with utility service providers prior to and during construction to avoid or minimize potential service disruptions.

Prepare a Transportation Management Plan

Please refer to the discussion of this measure in Section D.3.1.

Construct Mid-block East West Road

Please refer to the discussion of this measure in Section D.3.2.

D.4.2 CEQA Mitigation Measures

No measures are necessary.

D.5 Traffic and Transportation/Pedestrian and Bicycle Facilities

D.5.1 Avoidance, Minimization and/or Mitigation Measures

Prepare a Transportation Management Plan

Please refer to the discussion of this measure in Section D.3.1.

Construct Mid-block East West Road

Please refer to the discussion of this measure in Section D.3.2.

Implement Roadway and Freeway Improvements

5th Street/E Street, West Sacramento – Under 2040 conditions, construct westbound and eastbound left-turn lanes with at least 75 feet of storage. Install a traffic signal when warranted, due to increases in peak-hour volumes or to accommodate the planned streetcar. Implementation of this measure would result in the following.

2040 operations after mitigation = LOS C or better.

This mitigation would increase crossing lengths for pedestrians and bicyclists, which would increase their exposure time to vehicles.

5th Street/F Street, West Sacramento – Under 2040 conditions, construct westbound and eastbound left-turn lanes with at least 75 feet of storage. Install a traffic signal when warranted, which was previously identified as mitigation for the Raley's Landing project. Implementation of this measure would result in the following.

2040 operations after mitigation = LOS C or better.

This mitigation would increase crossing lengths for pedestrians and bicyclists, which would increase their exposure time to vehicles.

5th Street/Tower Bridge Gateway, West Sacramento – Implement the planned modification of the 5th Street/West Capitol Avenue intersection, which would eliminate the vehicle connection to West Capitol Avenue. The proximity of this intersection to 5th Street/Tower Bridge Gateway creates inefficient signal operations at 5th Street/Tower Bridge Gateway and 3rd Street/Tower Bridge Gateway. Implementation of this measure would result in the following.

2020 operations after mitigation = LOS D or better based on 2040 conditions that reflect this configuration with higher peak hour volumes.

North 7th Street/B Street, Sacramento – Under 2020 conditions, widen North 7th Street to four lanes through the intersection. This capacity expansion is part of the *Sacramento Railyards Specific Plan Update*. Implementation of this measure would result in the following.

2020 operations after modification = LOS B in the a.m. peak hour.

Modifications that require construction of additional lanes would increase crossing length for pedestrians and bicyclists, which would increase their exposure time to vehicles.

Bercut Drive/Richards Boulevard, Sacramento – Under 2040 conditions, extend the southbound right-turn lane to provide 200 feet of storage. Implementation of this measure would result in the following.

2040 operations after modification = LOS F (72 seconds of delay) in the p.m. peak hour.

This modification may take away on-street parking spots.

North 3rd Street/Richards Boulevard, Sacramento – Under 2040 conditions, operation of this intersection is constrained by the downstream intersection of I-5 northbound ramps/Richards Boulevard and Bercut Drive/Richards Boulevard. Providing additional capacity for motorists heading northbound onto I-5 would improve operations along the corridor, including at North 3rd Street/Richard Boulevard. This could be addressed by providing a second right-turn lane from Richards Boulevard westbound onto I-5 northbound through converting a westbound through lane to a through-right shared lane. This modification is consistent with the I-5/Richards Boulevard Interchange Project Study Report improvement alternatives but would require ramp modifications that are subject to Caltrans approval and may create a more hazardous conflict zone between bicyclists and vehicles. Implementation of this measure would result in the following.

2040 operations after mitigation = LOS F (104 seconds of delay) in the p.m. peak hour.

North 12th Street/North B Street, Sacramento – Under 2040 conditions, the vehicle traffic operations at this intersection are constrained by multimodal modifications planned for the intersection to better accommodate bicycle and pedestrian travel through the intersection, including a cycle track, bulb outs, and vehicle turn-movement restrictions. These modifications are consistent with the *Sacramento 2035 General Plan* for this area, where bicycle and pedestrian travel have high priorities. Physical mitigation to reduce vehicle delays would require taking space away from bicycles and pedestrians or from adjacent property to accommodate more vehicle lanes, which may not be feasible.

I-5 Southbound Weaving Segment between Garden Highway and Richards Boulevard – Modify ramp meter signal timings at the Garden Highway and West El Camino Avenue southbound I-5 on-ramps to reduce a.m. peak-hour flows onto the mainline such that mainline flows in the weaving segment are no higher than under 2020 no build conditions. Implementation of this measure would result in the following.

2020 operations after mitigation = a.m. peak hour LOS F (maximum service volume = 2,185)

Changing the ramp meter timing could cause queues to lengthen at the on-ramps, potentially affecting upstream arterial traffic operations on Garden Highway and West El Camino Avenue.

D.5.2 CEQA Mitigation Measures

Prepare a Transportation Management Plan

Please refer to the discussion of this measure in Section D.3.1.

Construct Mid-block East West Road

Please refer to the discussion of this measure in Section D.3.2.

Implement Roadway and Freeway Improvements

Please refer to the discussion of this measure in Section D.5.1.

D.6 Visual/Aesthetics

D.6.1 Avoidance and Minimization Measures

Work with Stakeholders to Determine Bridge Aesthetics

The project proponent will conduct a focused outreach effort and will conduct a public meeting or charrette session with public stakeholders to develop an aesthetic design approach to aid in reducing the visual impact of the proposed bridge. This measure will allow concerned viewers to contribute to creating a bridge that is visually appealing to the general public, while balancing the need for increased circulation access at this location. Affected stakeholders will be able to provide input on the preferred architectural style and coloring of the proposed bridge.

Implement Project Landscaping

The project proponent will install landscaping where space and safety considerations allow. This will improve the visual quality of the project corridor by improving corridor aesthetics and helping to reduce the apparent scale of new and reconfigured intersections, in addition to replacing some of the vegetation lost through construction. Prior to approval of the roadway design, the City of Sacramento and /or City of West Sacramento project landscape architect will review project designs to ensure that the following elements are implemented in the project landscaping plan.

- Design and implement low-impact development (LID) measures that disperse and reduce runoff by using such features as vegetated buffer strips/medians between paved areas that

catch and infiltrate runoff. In addition, pervious paving will be evaluated for use in the proposed project to improve infiltration and to reduce the amount of surface runoff from entering waterways and the storm water system. LID measures will not be used where infiltration could result in adverse environmental effects. LID measures, such as cobbled swales and aggregate mulching, can be used as an aesthetic design element to create an attractive view while reducing water use.

- Require construction contractors to incorporate native grass and wildflower seed to standard seed mixes, which may be non-native, for erosion control measures that will be applied to all exposed slopes. Wildflowers will provide seasonal interest to areas where trees and shrubs are removed and grasslands are disturbed. Only wildflower and grass species that are native will be incorporated into the seed mix, and under no circumstances will any invasive grass or wildflower plant species be used as any component in any erosion control measures. Species will be chosen that are indigenous to the area and for their appropriateness to the surrounding habitat. For example, upland grass and wildflower species will be chosen for drier, upland areas, and wetter species will be chosen for areas that will receive more moisture. If not appropriate to the surrounding habitat, wildflowers should not be included in the seed mix.
- Require the species list to include trees, shrubs, and an herbaceous understory of varying heights, as well as both evergreen and deciduous types. Plant variety will increase the effectiveness of the roadside planting areas by providing multiple layers, seasonality, diverse habitat, and reduced susceptibility to disease. Evergreen groundcovers or low-growing plants, such as *Ceanothus* spp., should be used in areas where taller vegetation would potentially cause driving hazards by obscuring site distances. Species used will be native and indigenous to the project area and California. Native plant species can be used to create attractive spaces, high in aesthetic quality, that are not only drought-tolerant but also attract more wildlife than traditional landscape plant palettes. Use of native species promotes a visual character of California that is being lost through development and reliance on non-native ornamental plant species.
- Use vegetative accents and screening to reduce the perceived scale and mass of the built features, while accentuating the design treatments that will be applied to built features. Special attention should be paid to plant choices near residences to ensure that species chosen are of an appropriate height, and rely on evergreen species to provide year-round light screening from nuisance light, if applicable.
- Under no circumstances will any invasive plant species be used at any location.
- Plant vegetation within the first 6 months following project completion.
- Implement an irrigation and maintenance program during the plant establishment period and carried on, as needed, to ensure plant survival. However, design of the landscaping plan will try to maximize the use of planting zones that are water efficient. The design also may incorporate aesthetic features, such as cobbling swales or shallow detention areas, which can reduce or eliminate the need for irrigation in certain areas.
- If an irrigation system is required, use a smart watering system in areas that are irrigated to evaluate the existing site conditions and plant material against weather conditions to avoid overwatering of such areas. To avoid undue water flows, manage the irrigation system in

such a manner that any broken spray heads, pipes, or other components are fixed within 1-2 days, or the zone or system will be shut down until it can be repaired.

Apply Minimum Lighting Standards

All artificial outdoor lighting and overhead street lighting is to be limited to safety and security requirements and the minimum required for driver safety. Lighting will be designed using Illuminating Engineering Society's design guidelines and in compliance with International Dark-Sky Association-approved fixtures. All lighting will be designed to have minimum impact on the surrounding environment and will use downcast, cut-off type fixtures that are shielded and direct the light only toward objects requiring illumination. Therefore, lights will be installed at the lowest allowable height and cast low-angle illumination while minimizing incidental light spill onto adjacent properties or open spaces, or backscatter into the nighttime sky. The lowest allowable wattage will be used for all lighted areas, and the amount of nighttime lights needed to light an area will be minimized to the highest degree possible. Light fixtures will have non-glare finishes that will not cause reflective daytime glare. Lighting will be designed for energy efficiency, with daylight sensors or timers with an on/off program. Lights will provide good color rendering with natural light qualities, with the minimum intensity feasible for security, safety, and personnel access. Lighting, including light color rendering and fixture types, will be designed to be aesthetically pleasing.

LED lighting will avoid the use of blue-rich white light lamps and use a correlated color temperature that is no higher than 3,000 Kelvin, consistent with the International Dark-Sky Association's Fixture Seal of Approval Program (International Dark-Sky Association 2010a, 2010b, 2015). In addition, LED lights will use shielding to ensure that nuisance glare and that light spill does not affect sensitive residential viewers.

Lights along pathways and bridge safety lighting will use shielding to minimize offsite light spill and glare, and will be screened and directed away from adjacent uses to the highest degree possible. The amount of nighttime lights used along pathways will be minimized to the highest degree possible to ensure that spaces are not unnecessarily over-lit. For example, the amount of light can be reduced by limiting the amount of ornamental light posts to higher use areas and by using bollard lighting on travel way portions of pathways.

Technologies to reduce light pollution evolve over time; design measures that are currently available may help but may not be the most effective means of controlling light pollution once the project is designed. Therefore, all design measures used to reduce light pollution will use the technologies available at the time of project design to allow for the highest potential reduction in light pollution.

D.6.2 Mitigation Measures

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D.16.2.

D.6.3 CEQA Mitigation Measures

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D.16.1.

Work with Stakeholders to Determine Bridge Aesthetics

Please refer to the discussion of this measure in Section D.6.1.

Implement Project Landscaping

Please refer to the discussion of this measure in Section D.6.1.

Apply Minimum Lighting Standards

Please refer to the discussion of this measure in Section D.6.1.

D.7 Cultural Resources

D.7.1 Avoidance and Minimization Measures

Conduct Mandatory Cultural Resources Awareness Training for Construction Personnel

Before any ground-disturbing work occurs in the project area, a qualified archaeologist will be retained to conduct mandatory contractor/worker cultural resources awareness training for construction personnel. The awareness training will be provided to all construction personnel (contractors and subcontractors), to brief them on the need to avoid effects on cultural resources adjacent to and within construction areas and the penalties for not complying with applicable state and federal laws and permit requirements.

D.7.2 Mitigation Measures

Develop Interpretative Display for the I Street Bridge

The project proponent will develop an interpretive display and erect the display in Old Sacramento at a site within clear view of the I Street Bridge. The display will focus on the removal of vehicular uses from the I Street Bridge, to interpret for future generations the vehicular uses of the bridge. The project proponents will also assemble a freestanding interpretive panel that documents the history of the joint railroad-automobile use of the I Street Bridge, emphasizing the non-rail uses. Details on the implementation on the interpretive display will be coordinated through Caltrans in consultation with SHPO.

Establish an Environmental Sensitive Area for Resource CA-SAC-658H

An Environmentally Sensitive Area (ESA) will be established to ensure that resource CA-SAC-658H is not affected during project implementation. Prior to construction, the construction contractor will install high-visibility orange construction fencing and/or flagging, as appropriate, along the perimeter of the area of direct impact (ADI) located within the APE to restrict access to the portion of CA-SAC-658H outside the ADI. Prior to installation of the ESA fencing, the Environmentally Sensitive Area Action Plan will be reviewed as a stipulation of the project-specific PA prepared for the project.

Implement a Programmatic Agreement for the Project

A project-specific PA between Caltrans, the City of Sacramento and the SHPO was developed for the project. The project-specific PA assures fulfillment of the NHPA requirements of Section 106 and ensures proper evaluation and treatment of any previously unknown archaeological resources uncovered during ground-disturbing construction activities. Additionally, the project-specific PA establishes responsibilities for the treatment of historic properties, the implementation of mitigation measures, and ongoing consultation efforts with Native American groups.

The project-specific PA includes development of a plan for archaeological test trenching within the APE on the West Sacramento side of the river, since this area has a high archaeological sensitivity for both historic-period and prehistoric material. A plan will be prepared for this work similar to a Caltrans Extended Phase I (XPI) Plan. Excavations will be conducted prior to construction, and will aid in the identification of unknown subsurface archaeological deposits that may be present within the APE. The project-specific PA also includes an Environmentally Sensitive Area Action Plan, as discussed above, for CA-SAC-658H. As part of the project-specific PA, a Cultural Resources Management Plan (CRMP) was prepared to Caltrans, City of Sacramento, and City of West Sacramento standards. The CRMP designates procedures for treatment of previously unidentified cultural resources encountered during test trenching or construction, including steps for the mitigation of resources that are determined eligible for the NRHP.

The CRMP specifies that a qualified archaeologist and a Native American monitor will be retained to monitor all initial ground disturbing activities (e.g., vegetation removal, grading, excavation, bridge construction). The purpose of the monitoring is to ensure that measures identified in the environmental document are properly implemented to avoid and minimize effects to cultural resources and to ensure that the project complies with all applicable permit requirements and agency conditions of approval. Conditions for monitoring and project reporting are specified in the CRMP.

The project-specific PA is included in Appendix G.

Implement Avoidance and Notification Procedures for Cultural Resources Discovered during Construction

It is Caltrans' and the City of Sacramento's policy to avoid cultural resources whenever possible. If cultural materials are discovered during construction, all earthmoving activity within and around the immediate discovery area will be diverted until a qualified archaeologist can assess the nature and significance of the find. All reasonable measures will be implemented to avoid, minimize, or mitigate further harm to the resource. If appropriate, the project proponent will notify Indian tribes or Native American groups that may attach religious or cultural significance to the affected resource.

If human remains are discovered, State Health and Safety Code Section 7050.5 states that further disturbances and activities shall cease in any area or nearby area suspected to overlie remains, and the county coroner shall be contacted. Pursuant to PRC Section 5097.98, if the remains are thought to be Native American, the coroner will notify the NAHC, which will then notify the Most Likely Descendent (MLD). The project proponent will work with the MLD to avoid the remains and, if avoidance is not feasible, to determine the respectful treatment of the remains. Further provisions of PRC Section 5097.98 are to be followed as applicable.

D.7.3 CEQA Mitigation Measures

Conduct Mandatory Cultural Resources Awareness Training for Construction Personnel

Please refer to the discussion of this measure in Section D.7.1.

Develop Interpretative Display for the I Street Bridge

Please refer to the discussion of this measure in Section D.7.2.

Establish an Environmental Sensitive Area for Resource CA-SAC-658H

Please refer to the discussion of this measure in Section D.7.2.

Implement a Programmatic Agreement for the Project

Please refer to the discussion of this measure in Section D.7.2.

Implement Avoidance and Notification Procedures for Cultural Resources Discovered during Construction

Please refer to the discussion of this measure in Section D.7.2.

D.8 Hydrology and Floodplain

D.8.1 Avoidance and Minimization Measures

No measures are necessary.

D.8.2 CEQA Mitigation Measures

No measures are necessary.

D.9 Water Quality

D.9.1 Avoidance and Minimization Measures

Implement Measures to Protect Water Quality during Construction

Compliance with regulatory permits and municipality programmatic requirements is anticipated during all construction field activities, including project staging and storage area usage. As a result, no water quality impacts are anticipated for the duration of the project. In support of this effort, the project is expected to be regulated under the CGP, Order No. 2009-0009-DWQ, and all associated adopted amendments. The CGP is applicable for all construction projects where operations, such as clearing, grubbing, grading and excavation, disturbs 1 acre or more of land. Compliance with the CGP requires the project proponent/construction contractor to prepare a SWPPP. The SWPPP includes conditions for final stabilization of the project area, including staging areas, which will require review and approval by the RWQCB prior to acceptance of the project's Notice of Termination. Implementation of the SWPPP begins when construction operations start and continues until the project is complete, field activities have finished, and the Notice of Termination is approved.

The approved SWPPP includes (and is not limited to) the following elements.

- **Project Description** – The Project description includes maps and other information related to construction activities and potential sources of pollutants.
- **Minimum Construction Control Measures** – These measures may include limiting construction access routes, stabilizing areas denuded by construction, and using sediment controls and filtration.
- **Erosion and Sediment Control** – The SWPPP is required to contain a description of soil stabilization practices, control measures to prevent a net increase in sediment load in storm water, controls to reduce tracking sediment onto roads, and controls to reduce wind erosion.
- **Non-Storm Water Management** – The SWPPP includes provisions to reduce and control discharges other than storm water.

- Post-Construction Storm Water Management – The SWPPP includes a list of storm water control measures that provide ongoing (permanent) protection for water resources.
- Waste Management and Disposal – The SWPPP includes a waste management section, including, for example, equipment maintenance waste, used oil, and batteries. All waste must be disposed of as required by state and federal law.
- Maintenance, Inspection, and Repair – The SWPPP requires an ongoing program to ensure that all controls are in place and operating as designed.
- Monitoring – This provision requires documented inspections of the control measures.
- Reports – The contractor will prepare an annual report on the construction project and submit this report on July 15 each year. This report will be submitted to the State Water Board on the Storm Water Multiple Application and Report Tracking System website.
- Training – The SWPPP provides documentation on the training and qualifications of the designated Qualified SWPPP Developer and Qualified SWPPP Practitioner. Trained personnel must perform inspections, maintenance, and repair of construction site BMPs.
- Construction Site Monitoring Program – The SWPPP includes a Construction Site Monitoring Program detailing the procedures and methods related to the visual monitoring and sampling and analysis plans for non-visible pollutants, sediment and turbidity, and pH and bioassessment.

The following minimum BMPs would be necessary for the project to comply with the CGP.

- Soil stabilization
 - Hydroseeding
 - Geotextiles, mats, plastic covers, and erosion control blankets
 - Hydraulic mulch
- Sediment control
 - Fiber rolls
 - Silt fence
 - Sediment trap
 - Gravel bag berm
 - Check dams
 - Storm drain inlet protection
- Tracking control practices
 - Temporary construction entrance
- Non-storm water controls
 - Dewatering operations

- Material and equipment use over water
- Clear water diversion
- Temporary stream crossing
- Potable water/irrigation
- Water management and materials pollution control
 - Concrete waste management
 - Hazardous waste management and contaminated soil management

The project proponent and construction contractor are required to follow the conditions and provisions stipulated in the applicable water quality permits and associated water quality/storm water programmatic documents. With that understanding, at this time, no additional measures are anticipated. However, changes to project field variables during construction, including implementation of minimization and avoidance measures related to permit compliance, could result in additional measures being required and implemented.

Implement Measures to Protect Water Quality during Project Operation and Maintenance

The project design will incorporate Construction General Permit SWPPP post-construction measures, site design measures, LID measures, and other permanent erosion control elements found in Sacramento Stormwater Quality Partnership's SQIP, the City of West Sacramento's SWMP, and Caltrans' MS4 program guidance documents. The NPDES MS4 permits contains provisions to reduce, to the maximum extent practicable, pollutant loadings from the facility once construction is complete. Thus, design features or BMPs would be developed and incorporated into the project design and operations prior to project construction. These measures would reduce the suspended particulate loads, and thus pollutants associated with the particles, from entering waterways. Under the Sacramento County MS4 Permit, storm water mitigation measures are required to be incorporated into project design plans for Planning Priority Projects. These include development projects or land-disturbing activity that results in the creation, addition, or replacement of 5,000 square feet or more of impervious surface area on an already developed site. Traditional permittees, such as City of West Sacramento, are required to comply with Section E of the Statewide Phase II MS4 Permit, which specifies requirements for site design measures¹, LID design standards, alternative post-construction stormwater management program, and operations and management requirements for post construction stormwater management. Additionally, an operation and maintenance program would be implemented for permanent control measures.

Low-impact development measures are proposed to reduce the rate of runoff, filter pollutants, and allow infiltration into the ground. The proposed measures would address peak-flow attenuation impacts and can include structural measures, such as detention, underground storage,

¹ Site design measures are implemented to reduce site runoff. Examples of these measures include stream setbacks and buffers, soil quality improvement and maintenance, tree planting and preservation, rooftop and impervious area disconnection, porous pavement, green roofs, vegetated swales, and rain barrels and cisterns.

and non-structural measures, through the modification of proposed treatment BMPs to accommodate flow and volume control.

Caltrans-approved treatment BMPs/low-impact development measures that have been studied and verified to remove targeted design constituents and provide general pollutant removal include the following.

- Biofiltration systems
- Infiltration devices
- Detention devices
- Dry weather flow diversion
- Gross solids removal devices (GSRDs)
- Media filters
- Multi-chamber treatment train
- Wet basins

The project proponent would be responsible for maintaining the treatment BMPs discussed above. The Maintenance Stormwater Coordinator would be involved in the design review of any permanent storm water treatment BMPs and would need to approve any such devices at the end of the plans, specifications, and estimate phase. The Caltrans Maintenance Unit would be able to provide guidance on the following project-related issues to ensure that BMPs function as needed.

- Drainage patterns (particularly known areas of flooding and debris)
- Stability of slopes and roadbed (help to determine whether the Project can be built and maintained economically)
- Possible material borrow or spoil sites
- Concerns of the local residents
- Existing and potential erosion problems
- Facilities within the right-of-way that will affect design
- Special problems such as deer crossings and endangered species
- Whether facilities are safe to maintain
- Known environmentally sensitive areas
- Frequency of traction sand use and estimate of sand quantity applied annually

BMPs will address soil stabilization, sediment control, wind-erosion control, non-storm water management, vehicle tracking control, and waste management practices and will be based on the best available technology. Implementation of these measures will ensure that storm water runoff would reduce or avoid permanent impacts on water quality. Because project proponent and the construction contractor must comply with conditions stipulated in the MS4 permit for the project,

and an operation and maintenance program would be implemented for permanent control measures, no additional measures are required during operation and maintenance.

D.9.2 CEQA Mitigation Measures

No measures are necessary.

D.10 Geology/Soils/Seismic/Topography

D.10.1 Avoidance and Minimization Measures

No measures are necessary.

D.10.2 CEQA Mitigation Measures

No measures are necessary.

D.11 Paleontology

D.11.1 Avoidance and Minimization Measures

Educate Construction Personnel in Recognizing Fossil Material

All construction personnel will receive training provided by a qualified professional paleontologist experienced in teaching non-specialists to ensure that construction personnel can recognize fossil materials in the event that any are discovered during construction.

Stop Work if Substantial Fossil Remains Are Encountered during Construction

If substantial fossil remains (particularly vertebrate remains) are discovered during earth-disturbing activities, activities will stop immediately until a State-registered professional geologist or qualified professional paleontologist can assess the nature and importance of the find and a qualified professional paleontologist can recommend appropriate treatment. Treatment may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection, and may include preparation of a report for publication describing the finds. The project proponent will ensure that recommendations regarding treatment and reporting are implemented.

D.11.2 CEQA Mitigation Measures

Educate Construction Personnel in Recognizing Fossil Material

Please refer to the discussion of this measure in Section D11.1.

Stop Work if Substantial Fossil Remains Are Encountered during Construction

Please refer to the discussion of this measure in Section D11.1.

D.12 Hazardous Waste/Materials

D.12.1 Avoidance and Minimization Measures

Conduct Phase II Site Assessments

The project proponent will conduct a Phase II assessment within the proposed acquisition area of the parcels described below.

- APNs 010-371-005 and 010-371-006 to assess the site for possible soil/groundwater contamination.
- Existing Caltrans right-of-way and C Street Site Y for previous ADL impacts and metals within the depth of construction as metals could potentially originate from historical Capitol Plating operations.
- APNs 001-019-017, 001-210-018, and 002-010-023 to evaluate the site's potential for metals, TPH, and PCB impacts for all construction activities that will result in soil excavation within the proposed right-of-way adjacent to Jibboom Street at these parcels. Based on the findings of the Phase II investigation, a soils management plan and health and safety plan may be necessary.

The Phase II assessment will include sampling and laboratory analysis to confirm the presence of hazardous materials and may include the following.

- Surficial soil and water samples
- Testing of underground storage tanks
- Subsurface soil borings
- Groundwater monitoring well installation, sampling, and analysis (may be appropriate on neighboring properties as well to determine the presence of contamination)
- Asbestos, lead, and other regulated material testing

Conduct a Detailed Review of Existing Records

To determine the site history for APN 010-482-011, the project proponent will conduct a detailed review of existing records at Yolo County Environmental Health Services and the Central Valley RWQCB and conduct an owner/tenant interview, if possible. If additional information is not available, the project proponent will conduct a Phase II assessment within the proposed acquisition area.

Develop and Implement Plans to Address Worker Health and Safety

The project proponent will develop and implement the necessary plans and measures required by Caltrans and federal and state regulations, including a health and safety plan, BMPs, and/or an injury and illness prevention plan. The plans will be prepared and implemented to address worker safety when working with potentially hazardous materials, including potential ACMs, LCPs, lead or chromium in traffic stripes, ADL, and other construction-related materials within the right-of-way during any soil-disturbing activity.

Conduct Sampling, Testing, Removal, Storage, Transportation, and Disposal of Yellow/White Traffic Striping

As required by Caltrans' standard special provisions, the construction contractor will sample and test yellow/white traffic striping scheduled for removal to determine whether lead or chromium is present. All aspects of the project associated with removal, storage, transportation, and disposal will be in strict accordance with appropriate regulations of the California Health and Safety Code. The stripes will be disposed of at a Class 1 disposal facility. The responsibility of implementing this measure will be outlined in the contract between the project proponent and the construction contractor. Implementing this measure will minimize potential effects from these hazardous materials.

Perform Soil Testing and Appropriately Dispose of Soils Contaminated with ADL

The project proponent will conduct soil testing for ADL contamination in the project area along C Street, 2nd Street, and at the bridge approach/viaduct leading from C Street in West Sacramento; and within the proposed project limits in Sacramento at the bridge approach/viaduct leading from I Street, and along Jibboom Street and Bercut Drive.

Soils in the project limits identified as having hazardous levels of ADL will be disposed of or reused according to federal and state regulations. Soils within the right-of-way that contain hazardous waste concentrations of ADL may be reused under the authority of variances issued by DTSC. These variances include stockpiling, transporting, and reusing soils with concentrations of lead below maximum allowable levels in the project right-of-way. Stockpiling, transporting, and reusing of soil will also be conducted following Caltrans' standard special provisions.

Develop a Lead and Asbestos Abatement Plan

For the structures proposed to be removed or renovated as part of the project, a hazardous materials survey will be conducted prior to demolition or significant renovation. If lead or asbestos is found in these structures, an abatement plan will be developed prior to removal or renovation. The abatement plan will provide for a California-certified asbestos consultant and California Department of Health Services–certified lead project designer to prepare hazardous materials specifications for abatement of the ACM and LCP. This specification should be the basis for selecting qualified contractors to perform the proposed asbestos and lead abatement work. The project proponent will retain a California-licensed asbestos abatement contractor to perform the abatement of any asbestos-containing construction materials and LCP deemed potentially hazardous. Abatement of hazardous building materials will be completed prior to any work on these structures.

Comply with the Land Use Covenant for the Northern Shops and Sacramento Station Study Areas

The land use covenant (LUC) outlines approved land use and provisions for soil, soil vapor, and groundwater management. These provisions include the Northern Shops study area and Sacramento Station study area sites. The project proponent will comply with the provisions of the LUC, including the following.

1. No activities that will disturb the soil shall be allowed on the property without a soil management plan (SMP) approved in writing by the Department of Toxic Substances Control (DTSC).
2. Any soil brought to the surface shall be managed in compliance with all applicable provisions of state and federal law and a SMP approved in writing by DTSC.
3. No groundwater will be extracted, except as approved of in advance in writing by DTSC in a groundwater management plan.
4. Vapor intrusion mitigation management is required for enclosed structures or buildings.

Comply with the Land Use Covenant or Guidance Documents for the Manufactured Gas Plant Study Area

If soil remedy is complete and soils are certified prior to construction in the Manufactured Gas Plant study area, the project proponent will comply with the resulting LUC and/or guidance documents. If site characterization is not complete, the project proponent will conduct a Phase II assessment within the depth and area of construction improvements.

D.12.2 CEQA Mitigation Measures

No measures are necessary.

D.13 Air Quality

D.13.1 Avoidance and Minimization Measures

Develop a Lead and Asbestos Abatement Plan

Please refer to the discussion of this measure in Section D.12.1.

D.13.2 CEQA Mitigation Measures

Implement Control Measures for Construction Emissions of Fugitive Dust

Caltrans' Standard Specification Section 14, "Environmental Stewardship" addresses the construction contractor's responsibility on many items of concern, such as air pollution; protection of lakes, streams, reservoirs, and other waterbodies; use of pesticides; safety; sanitation; convenience for the public; and damage or injury to any person or property as a result of any construction operation. Section 14-9.02 includes specifications relating to air pollution control for work performed under a contract, including compliance with air pollution control rules, regulations, ordinances, and statutes provided in Government Code Section 11017 (Public Contract Code Section 10231). Section 14-9.03 is directed at controlling dust. Caltrans' Standard Specifications are incorporated into all Caltrans' construction contracts.

Sacramento Metro Air Quality Management District

Additional measures to control dust in Sacramento County will be borrowed from SMAQMD's recommended list of dust control measures and implemented to the extent practicable when the measures have not already been incorporated in, and do not conflict with, the requirements of Caltrans' Standard Specifications, special provisions, the NPDES permit, the Biological Opinions, the CWA Section 404 permit, CWA Section 401 Certification, and other permits issued for the project. The following measures are taken from SMAQMD's (2016) CEQA Guide and represent their basic control measures for fugitive dust.

- Water all exposed surfaces two times daily. Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas, and access roads.
- Cover or maintain at least two feet of free board space on haul trucks transporting soil, sand, or other loose material on the site. Any haul trucks that would be traveling along freeways or major roadways should be covered.
- Use wet power vacuum street sweepers to remove any visible trackout mud or dirt onto adjacent public roads at least once a day. Use of dry power sweeping is prohibited.
- Limit vehicle speeds on unpaved roads to 15 mph.
- All roadways, driveways, sidewalks, parking lots to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.

Yolo Solano Air Quality Management District

Additional measures to control dust in Yolo County will be borrowed from YSAQMD's recommended list of dust control measures and implemented to the extent practicable when the measures have not already been incorporated in, and do not conflict with, the requirements of Caltrans' Standard Specifications, special provisions, the NPDES permit, the Biological Opinions, the CWA Section 404 permit, CWA Section 401 Certification, and other permits issued for the project. The following measures are taken from YSAQMD's Construction Dust Mitigation Measures (Yolo Solano Air Quality Management District 2007).

- Water all active construction sites at least twice daily. Frequency should be based on the type of operation, soil, and wind exposure.
- Haul trucks shall maintain at least 2 feet of freeboard.
- Cover all trucks hauling dirt, sand, or loose materials.
- Apply non-toxic binders (e.g., latex acrylic copolymer) to exposed areas after cut and fill operations and hydroseed area.
- Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least four consecutive days).
- Plant tree windbreaks on the windward perimeter of construction projects if adjacent to open land.
- Plant vegetative ground cover in disturbed areas as soon as possible.
- Cover inactive storage piles.
- Sweep streets if visible soil material is carried out from the construction site.
- Treat accesses to a distance of 100 feet from the paved road with a 6- to 12-inch layer of wood chips or mulch.
- Treat accesses to a distance of 100 feet from the paved road with a 6-inch layer of gravel.

Sacramento Railyards Specific Plan

Construction activity within the *Sacramento Railyards Specific Plan* area will comply with the mitigation measures contained in the adopted *Mitigation Monitoring Plan* for the Railyards development (City of Sacramento 2016). Wet suppression and wind speed reduction are the two most common methods used to control open dust sources at construction sites because a source of water and material for wind barriers tend to be readily available on a construction site.

Implement SMAQMD's Recommended Construction GHG BMPs

The City will implement the following SMAQMD's recommended GHG reduction measures, to the extent feasible.

- Improve fuel efficiency from construction equipment:
 - Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to no more than 3 minutes (5 minute limit is required by the state airborne

toxics control measure [Title 13, sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the site.

- Maintain all construction equipment in proper working condition according to manufacturer’s specifications. The equipment must be checked by a certified mechanic and determined to be running in proper condition before it is operated.
- Train equipment operators in proper use of equipment.
- Use the proper size of equipment for the job.
- Use equipment with new technologies (repowered engines, electric drive trains).
- Perform on-site material hauling with trucks equipped with on-road engines (if determined to be less emissive than the off-road engines).
- Use alternative fuels for generators at construction sites such as propane or solar, or use electrical power.
- Use an ARB-approved low carbon fuel for construction equipment. (NOx emissions from the use of low carbon fuel must be reviewed and increases mitigated.)
- Encourage and provide carpools, shuttle vans, transit passes and/or secure bicycle parking for construction worker commutes.
- Reduce electricity use in the construction office by using compact fluorescent bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones.
- Recycle or salvage non-hazardous construction and demolition debris (goal of at least 75 percent by weight).
- Use locally sourced or recycled materials for construction materials (goal of at least 20 percent based on costs for building materials, and based on volume for roadway, parking lot, sidewalk and curb materials). Wood products utilized should be certified through a sustainable forestry program.
- Minimize the amount of concrete for paved surfaces or utilize a low carbon concrete option.
- Produce concrete on-site if determined to be less emissive than transporting ready mix.
- Use SmartWay certified trucks for deliveries and equipment transport.
- Develop a plan to efficiently use water for adequate dust control.

D.14 Noise

D.14.1 Avoidance and Minimization Measures

Measures to Minimize Noise Effects from Construction

Standard Caltrans procedures include implementation of the following measures to minimize the temporary noise effects from construction.

- All equipment will have sound-control devices that are no less effective than those provided on the original equipment. No equipment will have an unmuffled exhaust.
- The construction contractor will implement appropriate additional noise measures, including changing the location of stationary construction equipment, turning off idling equipment, rescheduling construction activity, notifying adjacent residents in advance of construction work, and installing acoustic barriers around stationary construction noise sources.

D.14.2 CEQA Mitigation Measures

Build Pavement Surface Designed to Reduce Tire-Pavement Noise

Provide a “quieter pavement” surface on C Street that is designed to reduce noise from the tire-pavement interface. Pavement surfaces such as Open-Graded Asphalt Concrete have been shown to be effective at reducing vehicle noise emissions by 3 dB or more. Once the noise-reducing surface is installed, post-construction noise level testing shall be done at locations in line with building façade locations to determine compliance with City exterior noise limits.

Ensure Building Compliance with City Noise Limits for Interior Spaces

This measure will only be implemented if measured noise level at a residential building façade exceeds 70 Ldn after implementation of quieter pavement. To comply with City noise standards for interior spaces, the Project Proponent shall ensure that building assemblies (composite of window, wall and door assemblies as applicable) provide a composite Outdoor-Indoor Transmission Class (OITC) rating of 29 as a minimum value, in residential facades facing C Street. Since closed windows are implicit in the OITC rating, buildings are required to include ventilation or air-conditioning system to provide adequate ventilation to interior spaces. The composite attenuation from building assemblies rated at OITC 29 or higher is expected to ensure compliance with the 45 Ldn City standard for interior spaces. Documentation of OITC performance of existing buildings may be available in architectural documents. However, in some cases, an acoustical consultant may be retained to determine performance of building assemblies, if architectural plans are not available. Where building assemblies do not meet an OITC value of 29, window, wall and door assemblies will be evaluated and replaced as appropriate. The sound-insulation performance of buildings facing the C Street segment of the project shall be documented in a supplemental report.

Use Noise-Reducing Construction Practices

To the extent feasible, construction contractors will control noise from construction activity such that noise does not exceed applicable noise ordinance standards specified by the City of West Sacramento. Measures that can be implemented to control noise include:

- Locate noise-generating equipment as far away as practical from residences and other noise-sensitive uses.
- Equip all construction equipment with standard noise attenuation devices such as mufflers to reduce noise and equip all internal combustion engines with intake and exhaust silencers in accordance with manufacturer's standard specifications.
- Establish equipment and material haul routes that avoid residential uses to the extent practical, limit hauling to the hours between 7:00 a.m. and 10:00 p.m., and specify maximum acceptable speeds for each route.
- Use electrically powered equipment in place of equipment with internal combustion engines where practical, where electric equipment is readily available, and where this equipment accomplishes project work as effectively and efficiently as equipment powered with internal combustion engines.
- Restrict the use of audible warning devices such as bells, whistles, and horns to those situations that are required by law for safety purposes.
- Provide noise-reducing enclosure around stationary noise-generating equipment.
- Provide temporary construction noise barriers between active construction sites that are in close proximity to residential and other noise-sensitive uses. Temporary barriers can be constructed or created with parked truck trailers, soil piles, or material stock piles.
- Route haul trucks away from residential areas where practical.

The construction contractor will develop a construction noise control plan which identifies specific feasible noise control measures that will be employed and the extent to which the measure will be able to control noise to specific noise ordinance limits. The plan will identify areas where it not considered feasible to comply with applicable noise ordinance limits. The noise control plan will be submitted to and approved by the project proponent before any noise-generating activity begins.

Use Vibration-Reducing Construction Practices

The construction contractor will, to the extent feasible, maintain the following minimum distances between vibration-generating construction activity and nearby buildings:

Impact pile driving – 200 feet
Sonic pile driving – 125 feet
Vibratory roller – 75 feet

For cases where this is not feasible, the resident or property owner will be notified in writing prior to construction activity that construction may occur within these distances of their building.

The project proponent will inspect the potentially affected buildings prior to construction to inventory existing cracks in paint, plaster, concrete, and other building elements. The project proponent will retain a qualified acoustical consultant or engineering firm to conduct vibration monitoring at potentially affected buildings to measure the actual vibration levels during construction and to keep vibration at those buildings below 0.1 in/sec where feasible. Following completion of construction, the City will conduct a second inspection to inventory changes in existing cracks and new cracks or damage, if any that occurred as a result of construction-induced vibration. If new damage is found, then the City will promptly arrange to have the damaged repaired, or will reimburse the property owner for appropriate repairs.

In addition, if construction activity is required within 100 feet of residences or other vibration-sensitive buildings, a designated complaint coordinator will be responsible for handling and responding to any complaints received during such periods of construction. A reporting program will be required that documents complaints received, actions taken, and the effectiveness of these actions in resolving disputes.

D.15 Energy

D.15.1 Avoidance and Minimization Measures

No measures are necessary.

D.15.2 CEQA Mitigation Measures

No measures are necessary.

D.16 Natural Communities

D.16.1 Avoidance and Minimization Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

The project proponent and/or their contractor will install orange construction fencing between the construction area and adjacent sensitive biological resource areas. Sensitive biological resources that occur adjacent to the construction area that could be directly affected by the project include natural communities of special concern; special-status wildlife habitats for valley elderberry longhorn beetle; nest sites of Swainson's hawk, purple martin, or other migratory birds; roosting bats; and protected trees to be avoided.

Barrier fencing around sensitive areas will be installed as one of the first orders of work and prior to equipment staging. Before construction begins, the construction contractor will work

with the project engineer and a resource specialist to identify the locations for the orange construction fencing, and will place stakes around the sensitive resource sites to indicate these locations. The protected areas will be designated as environmentally sensitive areas and clearly identified on the construction plans and described in the specifications. To minimize the potential for snakes and other ground-dwelling animals from being caught in the orange construction fencing, the fencing will be placed with at least a 1-foot gap between the ground and the bottom of the orange construction fencing. The exception to this condition is where construction barrier fencing overlaps with erosion control fencing and must be secured to prevent sediment runoff. Barrier fencing will be installed before construction activities are initiated, maintained throughout the construction period, and removed after completion of construction.

Conduct Environmental Awareness Training for Construction Employees

The project proponent will retain a qualified biologist to conduct environmental awareness training for construction crews before project implementation. The awareness training will be provided to all construction personnel and will brief them on the need to avoid effects on sensitive biological resources (e.g., native trees, natural communities of special concern, and special-status species habitats in and adjacent to the construction area). The education program will include a brief review of the special-status species with the potential to occur in the BSA (including their life history and habitat requirements, and photographs of the species). The training will identify the portions of the BSA in which the species may occur, as well as their legal status and protection. The program also will cover the restrictions and guidelines that must be followed by all construction personnel to reduce or avoid effects on these species during project implementation. This will include the steps to be taken if a sensitive species is found within the construction area (i.e., notifying the crew foreman, who will call a designated biologist). In addition, construction employees will be educated about the importance of controlling and preventing the spread of invasive plant infestations. An environmental awareness handout that describes and illustrates sensitive resources to be avoided during project construction and identifies all relevant permit conditions will be provided to each crew member. The crew foreman will be responsible for ensuring that crew members adhere to the guidelines and restrictions. Education programs will be conducted for appropriate new personnel as they are brought on the job during the construction period.

Conduct Periodic Biological Monitoring

The project proponent will retain a qualified biological monitor for the project who will visit the site a minimum of once per week to ensure that fencing around environmentally sensitive areas is intact and that activities are being conducted in accordance with the agreed upon project schedule and agency conditions of approval. The monitor will provide the project proponent with a monitoring log for each site visit.

Certain activities will require a biological monitor to be present for the duration of the activity or during the initial disturbance of an area to ensure that impacts on special-status species are avoided. The activities that require specific monitoring are identified in Sections 2.17, 2.18, 2.19, and 2.20.

D.16.2 Mitigation Measures

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

The project proponent will compensate for the permanent loss of up to 1.44 acres of riparian forest. In addition, any unavoidable loss of riparian forest in the temporary work area will be mitigated. The project proponent will implement onsite and, if necessary, offsite compensation measures and/or purchase mitigation bank credits to compensate for losses of cottonwood riparian forest on the waterside slope of the existing levees, including riparian forest supporting SRA cover habitat (as described in Section 2.20, “Threatened and Endangered Species,” portions of the cottonwood riparian forest in the BSA also provide SRA cover habitat for fish). Onsite compensation will be used to the maximum extent practicable. Compliance with the USACE levee vegetation policy (U.S. Army Corps of Engineers 2014), the Urban Levee Design Criteria (California Department of Water Resources 2012), or other engineering constraints may limit the ability to achieve full onsite compensation. Therefore, offsite compensation and/or purchase of mitigation bank credits may be needed to achieve no net loss of existing in-kind riparian and SRA cover habitat values. Each of these options is discussed below.

- 1. Onsite and/or Offsite Restoration and/or Enhancement along the Sacramento River.** Riparian habitat restoration and/or enhancement onsite or offsite should occur in the same year construction is completed. For onsite or offsite replacement plantings, the project proponent will prepare a mitigation planting plan, including a species list and number of each species, planting locations, and maintenance requirements. Plantings will consist of cuttings taken from local plants or plants grown from local material. Planted species for the mitigation plantings will be similar to those removed from the project area and will include native species, such as Fremont cottonwood, valley oak, black walnut, Oregon ash, boxelder, and black willow. The final planting plan will be developed based on results of the arborist survey for species to be removed (see additional discussion below). All plantings will be fitted with exclusion cages or other suitable protection from herbivory. Plantings will be irrigated for up to 3 years or until established. Plantings will be monitored annually for 3 years or as required in the project permits. If 75 percent of the plants survive at the end of the monitoring period, the revegetation will be considered successful. If the survival criterion is not met at the end of the monitoring period, planting and monitoring will be repeated after mortality causes have been identified and corrected.
- 2. Mitigation Bank Credit Purchase.** If this option is chosen, the project proponent will provide written evidence to the resource agencies that compensation has been established through the purchase of mitigation credits. The amount to be paid will be the fee that is in effect at the time the fee is paid. The mitigation will be approved by CDFW and may be modified during the permitting process. Mitigation can be in the form of creation and/or preservation credits. If mitigation is in the form of restoration/creation credits, the mitigation will be at a minimum ratio of 1:1 (1 acre of restored or created riparian habitat for each acre of riparian habitat removed). If mitigation is in the form of preservation credits, the mitigation will be at a minimum ratio of 2:1 (2 acres of preserved riparian habitat for each acre of riparian habitat removed). The final compensation ratio will be approved by CDFW in order to result in no net loss of riparian habitat. The project proponent will purchase riparian habitat credits from an approved mitigation bank near the project, such as the

Cosumnes Floodplain Mitigation Bank, Fremont Landing Conservation Bank, or Elsie Gridley Mitigation Bank. Replacement riparian forest habitat will include trees species that would support nesting Swainson's hawk (i.e., oak, cottonwood) and will occur within the range of nesting Swainson's hawk within the Sacramento Valley.

To provide a more accurate estimate of tree loss, an arborist survey will be conducted upon completion of 90 percent design plans for the project. In addition to a description of the tree, the arborist survey report will include the precise location of the trunk and size of the dripline for all trees whose trunk or canopy overlap with the project footprint. Riparian forest compensation will be consistent with the requirements of the City of West Sacramento and City of Sacramento tree ordinances to ensure compensation for losses of individual protected trees.

In addition to mitigating for the loss of riparian forest habitat, specific measures will be included to satisfy National Marine Fisheries Service requirements and compensate for the loss of SRA cover (area and linear feet). However, the acreage will not be duplicated, such that the acreage of riparian forest habitat restored for SRA cover mitigation will apply toward riparian forest habitat mitigation requirements. SRA cover mitigation will include the following riparian replacement requirements.

- Replace the 890 linear feet and 0.44 acre of affected SRA cover vegetation (see Section 2.19.3.1, "Loss of Shaded Riverine Aquatic Cover") at a 3:1 replacement ratio (i.e., 3 linear feet replaced for every 1 foot affected and 3 acres replaced for every acre affected) by planting native riparian trees in temporary impact areas and along existing onsite or offsite unshaded banks along the Sacramento River.
- Plant native riparian trees onsite to the maximum extent practicable, followed by planting on adjacent reaches of the Sacramento River to minimize the need for purchasing offsite mitigation bank credits.
- Plant riparian trees that are intended to provide SRA cover along the water's edge at summer low flows up to the OHWM and at sufficient densities to provide shade along at least 85 percent of the bank's length when the trees reach maturity. This will ensure that riparian plantings intended for SRA cover mitigation will contribute to instream SRA cover when they are inundated during winter/spring flows and overhead cover (shade) during summer flows when they approach maturity.
- Monitor and evaluate the revegetation success of riparian plantings intended for SRA cover mitigation as described above.
- If mitigation for SRA cover is in the form of offsite mitigation bank credits, credits will need to be purchased from an approved mitigation bank within the approved service area for the project that provides riparian forest floodplain conservation credits as off-site compensation for impacts on state- and federally listed fish species, designated critical habitat, and essential fish habitat for Pacific salmon.

Compensate for Loss of Protected Trees not in Riparian Habitat

Within 1 year prior to construction, the project proponent will have a certified arborist conduct a preconstruction inventory of all heritage trees to be removed within the areas defined as ruderal

woodland and landscaped land cover types. The inventory will include the location, species, and diameter of all trunks; approximate height and canopy diameter; and approximate age, in support of a tree permit for removal of the heritage trees. All conditions of the tree permit will be implemented.

The project proponent will mitigate the loss of protected trees using one or a combination of the two following options.

- Because it is unlikely that adequate space will be available in the project area for tree planting after construction, pay an in-lieu fee to the City of West Sacramento, which would be used to purchase and plant trees elsewhere in West Sacramento. Replacement trees will be required at a ratio of 1:1 (i.e., 1-inch diameter of replacement tree planted for every 1-inch diameter of tree removed). Replacement trees will be of the same species, except for the replacement of tree of heaven and black locust, which are invasive species and will be replaced with native tree species. Mitigation will be subject to approval by the City's tree administrator and will take into account species affected, replacement species, location, health and vigor, habitat value, and other factors to determine fair compensation for tree loss. Replacement trees will be monitored annually for 3 years to document vigor and survival. If any of the replacement trees die within 3 years of the initial planting, the project proponent will plant additional replacement trees and monitor them until all trees survive for a minimum of 3 years after planting.
- If feasible, plant replacement trees at or near the location of the tree removal, following the same replacement ratio, species, monitoring, and tree survival requirements described for the option above.

D.16.3 CEQA Mitigation Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D16.1.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D16.1.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D16.1.

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D16.2.

Compensate for Loss of Protected Trees not in Riparian Habitat

Please refer to the discussion of this measure in Section D16.2.

D.17 Wetlands and Other Waters

D.17.1 Avoidance and Minimization Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D.16.1.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D.16.1.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D.16.1.

Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

The project proponent and/or their construction contractor will comply with all construction site BMPs specified in the *Water Quality Assessment Report* prepared for the project (ICF International 2016b) and the final SWPPP that will be developed for the project, as well as any other permit conditions to minimize introduction of construction-related contaminants and mobilization of sediment in the Sacramento River and the riparian forest/shrub wetland near the construction area. Broadly, these BMPs will address soil stabilization, sediment control, wind erosion control, vehicle tracking control, non-storm water management, and waste management practices. The BMPs will be based on the best conventional and best available technology.

The proposed project is subject to storm water quality regulations established under the NPDES, described in Section 402 of the federal CWA. In California, the NPDES program requires that any construction activity disturbing 1 or more acres comply with the statewide General Permit, as authorized by the State Water Board. The General Permit requires elimination or minimization of non-storm water discharges from construction sites and development and implementation of a SWPPP for the site. The primary elements of the SWPPP include the following.

- Description of site characteristics—including runoff and streamflow characteristics and soil erosion hazard—and construction procedures
- Guidelines for proper application of erosion and sediment control BMPs
- Description of measures to prevent and control toxic materials spills
- Description of construction site housekeeping practices

In addition to these primary elements, the SWPPP specifies that the extent of soil and vegetative disturbance would be minimized by control fencing or other means and that the extent of soil disturbed at any given time would be minimized. The SWPPP must be retained at the construction site.

The BMPs will be selected to achieve maximum sediment removal and represent the best available technology that is economically achievable; they are subject to review and approval by the project proponent. The project proponent will perform routine inspections of the construction area to verify that the BMPs are properly implemented and maintained. The project proponent will notify contractors immediately of a noncompliance issue and will require compliance.

The BMPs will include, but are not limited to, the following.

- All earthwork or foundation activities involving wetlands or the intermittent vegetated stream will occur in the dry season (between May 1 and October 31). All in-water work within the Sacramento River will be conducted between May 1 and November 30 to minimize or avoid potential impacts on sensitive life stages (migration, spawning, egg and embryo incubation, and rearing) of special-status fish species.
- Equipment used in and around drainages and wetlands will be in good working order and free of dripping or leaking engine fluids. All vehicle maintenance will be performed at least 300 feet from all streams. Any necessary equipment washing will be carried out where the water cannot flow into drainages or wetlands.
- Develop a hazardous material spill prevention control and countermeasure plan before construction begins. The plan will include strict onsite handling rules to keep construction and maintenance materials from entering the river, including procedures related to refueling, operating, storing, and staging construction equipment and to preventing and responding to spills. The plan also will identify the parties responsible for monitoring a spill response. During construction, any spills will be cleaned up immediately according to the spill prevention control and countermeasure plan. The project proponent will review and approve the contractors' spill prevention control and countermeasure plan before allowing construction to begin.
- Prohibit the following types of materials from being rinsed or washed into the streets, shoulder areas, or gutters: concrete, solvents and adhesives, thinners, paints, fuels, sawdust, dirt, gasoline, asphalt and concrete saw slurry, and heavily chlorinated water.
- Take any surplus concrete rubble, asphalt, or other rubble from construction to a local landfill.
- Prepare and implement an erosion and sediment control plan for the proposed project that will include the following provisions and protocols. The SWPPP for the project will detail the applications and type of measures and the allowable exposure of unprotected soils.
 - Discharge from dewatering operations, if needed, and runoff from disturbed areas will be made to conform to the water quality requirements of the waste discharge permit issued by the RWQCB.

- Apply temporary erosion control measures, such as sandbagged silt fences, throughout construction of the proposed project and remove them after the working area is stabilized or as directed by the engineer. Soil exposure will be minimized through use of temporary BMPs, groundcover, and stabilization measures. Exposed dust-producing surfaces will be sprinkled daily, if necessary, until wet; this measure will be controlled to avoid producing runoff. Paved roads will be swept daily following construction activities.
- The contractor will conduct periodic maintenance of erosion and sediment control measures.
- Plant an appropriate seed mix of native species on disturbed areas upon completion of construction.
- Cover or apply nontoxic soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more) that could contribute sediment to waterways.
- Enclose and cover exposed stockpiles of dirt or other loose, granular construction materials that could contribute sediment to waterways. Material stockpiles will be located in non-traffic areas only. Side slopes will not be steeper than 2:1. All stockpile areas will be surrounded by a filter fabric fence and interceptor dike.
- Contain soil and filter runoff from disturbed areas by berms, vegetated filters, silt fencing, straw wattle, plastic sheeting, catch basins, or other means necessary to prevent the escape of sediment from the disturbed area.
- Use other temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) to control erosion from disturbed areas as necessary.
- Avoid earth or organic material from being deposited or placed where it may be directly carried into the channel.

The project proponent also will obtain a 401 Water Quality Certification from the Central Valley RWQCB, which may contain additional BMPs and water quality measures to ensure the protection of water quality.

D.17.2 Mitigation Measures

Compensate for Loss of Perennial Stream

The project proponent will comply with any regulatory requirements determined as part of the state (Section 401 Water Quality Certification or WDRs, LSAA) and federal (Section 404 and Section 10 permits) processes for the work that would occur in the Sacramento River. The project proponent will compensate for the permanent fill of up to 1.85 acre of other waters of the United States in the Sacramento River by purchasing mitigation bank credits, which can be in the form of preservation and/or creation credits using the following minimum ratios.

- A minimum of 2:1 (2 acres of mitigation for each acre filled), for a total of up to 3.7 acres, if credits are for preservation of habitat; or

- A minimum of 1:1 (1 acre of mitigation for each acre filled), for a total of up to 1.85 acre, if credits are for creation of habitat.

The actual compensation ratios will be determined through coordination with the Central Valley RWQCB and USACE as part of the permitting process. The project proponent will compensate for permanent loss of perennial stream by implementing one or a combination of the following options.

- Purchase credits for created riparian stream channel at a USACE- approved mitigation bank with a service area that encompasses the project area, such as the Cosumnes Floodplain Mitigation Bank, Fremont Landing Conservation Bank, or Elsie Gridley Mitigation Bank. The project proponent will provide written evidence to the resource agencies that compensation has been established through the purchase of mitigation credits.
- Compensate out-of-kind for loss of perennial stream by implementing compensatory mitigation for cottonwood riparian forest impacts described in Section 2.16, “Natural Communities” (*Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest [including SRA Cover]*). The acreage restored or created to compensate for loss of perennial stream will be added to the acreage restored or created for loss of riparian habitat.

D.17.3 CEQA Mitigation Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D.16.1.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D.16.1.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D.16.1.

Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

Please refer to the discussion of this measure in Section D.16.1.

Compensate for Loss of Perennial Stream

Please refer to the discussion of this measure in Section D.16.2.

D.18 Plant Species

D.18.1 Avoidance and Minimization Measures

No measures are necessary.

D.18.2 CEQA Mitigation Measures

No measures are necessary.

D.19 Animal Species

D.19.1 Avoidance and Minimization Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D.16.1.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D.16.1.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D.16.1.

Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

Please refer to the discussion of this measure in Section D.17.1.

Conduct Preconstruction Surveys for Western Pond Turtle and Allow Turtles to Leave Work Area Unharmed

To avoid potential injury to or mortality of western pond turtles, the project proponent will retain a qualified biologist to conduct a preconstruction survey for western pond turtles immediately prior to construction activities (including vegetation removal) along the banks of the Sacramento River. The biologist will survey the aquatic habitat, river banks, and adjacent riparian and ruderal habitat within the construction area immediately prior to disturbance.

If a western pond turtle is found within the immediate work area during the preconstruction survey or during project activities, work shall cease in the area until the turtle is able to move out of the work area on its own. Information about the location of turtles seen during the

preconstruction survey will be included in the environmental awareness training (*Conduct Environmental Awareness Training for Construction Employees*) and provided directly to the construction crew working in that area to ensure that areas where turtles were observed are inspected each day prior to the start of work to ensure that no turtles are present.

If a western pond turtle nest is discovered during the preconstruction survey or during project construction, the project proponent will coordinate with CDFW to determine whether additional avoidance measures (e.g., no-disturbance buffer or monitoring) is prudent.

Conduct Preconstruction Surveys for Nesting Migratory Birds, Including Special-Status Birds, and Establish Protective Buffers

The project proponent will retain a qualified wildlife biologist to conduct nesting surveys before the start of construction. These nesting surveys will be conducted in conjunction with the Swainson's hawk nesting surveys (see *Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction* in Section 2.20) and will include a minimum of three separate surveys to look for active nests of migratory birds, including raptors. Surveys will include a search of all trees and shrubs, ruderal areas, and grassland vegetation that provide suitable nesting habitat within 50 feet of disturbance. In addition, a 0.25-mile area from the river will be surveyed for nesting raptors in order to identify raptors that might be affected by pile driving. Surveys should occur during the height of the breeding season (March 1 to June 1), with one survey occurring in each of the 2 consecutive months within this peak period and the final survey occurring within 1 week of the start of construction. If no active nests are detected during these surveys, no additional measures are required.

If an active nest is found in the survey area, a no-disturbance buffer will be established to avoid disturbance or destruction of the nest site until the end of the breeding season (September 15) or until after a qualified wildlife biologist determines that the young have fledged and moved out of the construction area (this date varies by species). The extent of these buffers will be determined by the biologist in coordination with CDFW and will depend on the level of noise or construction disturbance taking place, line-of-sight between the nest and the disturbance, ambient levels of noise and other non-project disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Conduct Tree Removal during Non-Sensitive Periods for Wildlife

The project proponent will remove or trim trees during the non-breeding season for tree-nesting migratory birds and raptors, and prior to periods when bats would be hibernating (generally between September 15 and October 31). If tree removal cannot be confined to this period, the project proponent will retain a qualified wildlife biologist with knowledge of the wildlife species that could occur in the project area to conduct the appropriate preconstruction surveys and establish no-disturbance buffers for sensitive wildlife species as described under measures for Swainson's hawk (see *Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction* in Section 2.20), nesting birds, and roosting bats. Implementation of the following measures will avoid and minimize impacts on purple martins, as well as other nesting birds and bats that use the approach structures.

Avoid and Minimize Impacts on Purple Martins during Construction Activities

No construction activity that results in ground disturbance, modification of the I Street Bridge approach structure, loud noises, and/or vibrations will be conducted within 100 feet of the edge of the purple martin colony during the purple martin nesting season (March 15 to August 15). In addition, no construction-related vehicles or machinery shall be operated or stored beneath the colony during this period or until a qualified biologist determines that the purple martins have completed nesting and are no longer occupying the structure.

Avoid and Minimize Impacts on Nesting Birds and Roosting Bats from Demolition of Approach Structures

Because all four of the approach structures that are associated with the I Street Bridge are used by nesting birds (including purple martin) and roosting bats, the removal of these structures will take place outside of the breeding season for migratory birds and bats, and will be conducted in the following manner to avoid and minimize direct harm and temporary disturbance to nesting birds and roosting bats.

Timing of Approach Structure Demolition

To avoid and minimize potential impacts on purple martins and bats, the approach structures will not be removed or be altered until after the new I Street Bridge and associated replacement habitat on the bridge and/or elsewhere is in place and available for use by birds and bats for at least one overlapping nesting/maternal season, which generally would be from March 15 to September 15. Exclusion activities will be initiated between September 15 and October 31 to avoid affecting nesting purple martins and other birds, and to avoid affecting maternal and hibernating bat roosts. The exact date of beginning exclusion will be determined based on the results of preconstruction surveys that will be conducted in mid- to late August to document the status of bird nests and bat roosts. Active nests will be periodically monitored until it is verified that they are no longer being used. The non-volant (non-flying) period for most young bats is between April and the beginning of September (Johnston et al. 2004:26).

To avoid and minimize potential noise impacts on migratory birds nesting adjacent to project demolition activities, all demolition activities resulting in loud noise will be conducted outside of the nesting season, which is generally September 15 to February 1, to the extent feasible.

Approach Structure Exclusion Measures

The following exclusion measures will be implemented before demolition of the approach structures and will be approved by the project proponent and CDFW prior to implementation.

The vent holes and expansions joints on the approach structures will be altered to exclude birds and bats from using them prior to initiating demolition activities. After it has been confirmed that purple martins or other birds are no longer nesting in the vent holes, one-way doors will be installed on the vent holes to allow any wildlife (e.g., birds and bats) that may be occupying the hollow box-girders on the existing approach structure to exit and not re-enter. After the one-way

doors have been in place for 48 hours, they will be removed and the vent holes will be sealed off to prevent any wildlife from re-entering prior to demolition.

One-way door devices also will be installed along the expansion joints to allow bats to exit but not re-enter. These one-way door devices will be designed such that they do not contain netting or wire mesh that bats could become entangled in. Once installed, a qualified biologist will observe the one-way door devices at locations confirmed to have contained bats to verify that bats are exiting the structures and being excluded. The one-way doors will remain in place for 48 hours, after which they will be inspected for remaining bats. Once each expansion joint is confirmed to be unoccupied, they will be sealed close with an expanding foam sealant to prevent bats from reoccupying the approach structures.

Implementation of the following measures will partially compensate for the loss of purple martin habitat and the long-term effects on the Sacramento area population.

Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

To avoid and minimize potential impacts on pallid bat, western red bat, and non-special-status bat species from the removal of trees and buildings, the project proponent will implement the following actions.

Preconstruction Surveys

Within 2 weeks prior to tree trimming or removal and any building demolition (e.g., homes, sheds, other outbuildings), a qualified biologist will examine trees to be removed or trimmed and buildings planned for demolition for suitable bat roosting habitat. High-quality habitat features (e.g., large tree cavities, basal hollows, loose or peeling bark, larger snags, abandoned buildings, attics) will be identified, and the area around these features searched for bats and bat sign (e.g., guano, culled insect parts, staining). Riparian woodland and stands of mature broadleaf trees will be considered potential habitat for solitary foliage-roosting bat species.

If suitable roosting habitat and/or bat sign is detected, biologists will conduct an evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of 2 nights. Full-spectrum acoustic detectors will be used during emergence surveys to assist in species identification. If site security allows, detectors should be set to record bat calls for the duration of each night. All emergence and monitoring surveys will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologist will analyze the bat call data using appropriate software and prepare a report that will be submitted to the project proponent and CDFW.

Timing of Tree Removal and Building Demolition

Trees and buildings planned for removal and demolition will have exclusion devices installed between September 15 and October 31 to avoid affecting maternal and hibernating bat roosts. The exact timing of removal and demolition will be determined based on preconstruction surveys of trees and buildings.

Protective Measures

Protective measures may be necessary if it is determined that bats are using buildings or trees in the BSA as roost sites, or if sensitive bats species are detected during acoustic monitoring. The following measures will be implemented when roosts are found within trees or buildings planned for removal according to the timing discussed above. Specific measures will be approved by the project proponent and CDFW prior to excluding bats from occupied roosts.

- Exclusion from buildings or bridge structures will not take place until temporary or permanent replacement roosting habitat is available.
- Exclusion from roosts will take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators, and will take place during weather and temperature conditions conducive to bat activity.
- Biologists experienced with bats and bat evictions will carry out or oversee the exclusion tasks and will monitor tree trimming and removal, and buildings if they are determined to be occupied.
- Trees that provide suitable roost habitat will be removed in pieces, rather than felling the entire tree and should be done late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators, and will take place during warm weather conditions conducive to bat activity.
- Structural changes may be made to a known roost proposed for removal, to create conditions in the roost that are undesirable to roosting bats and encourage the bats to leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change). Structural changes to the roost will be authorized by CDFW and will be performed during the appropriate exclusion timing (listed above) to avoid harming bats.
- Non-injurious harassment at the roost site, such as ultrasound deterrents or other sensory irritants, may be used to encourage bats to leave on their own.
- One-way door devices will be used where appropriate to allow bats to leave the roost but not to return.
- Prior to building demolition and/or tree removal/trimming and after other eviction efforts have been attempted, any confirmed roost site will be gently shaken or repeatedly struck with a heavy implement such as a sledge hammer or an axe. Several minutes should pass before beginning demolition work, felling trees, or trimming limbs to allow bats time to arouse and leave the roost. A biological monitor will search downed vegetation for dead and injured bats. The presence of dead or injured bats will be reported to CDFW. Injured bats will be transported to the nearest CDFW-permitted wildlife rehabilitation facility.

Conduct All In-Water Construction Activities between May 1 and November 30 and during Daylight Hours Only

The project proponent will conduct all in-water construction work and pile driving (in-water and shore-based within 250 feet of the Sacramento River), installation of cofferdams, removal of temporary sheet piles, and placement of rock revetment between May 1 and November 30 to

avoid or minimize causing disturbance and injury to, or mortality of, special-status fish species in the affected reaches of the Sacramento River. In addition, in-water work will be conducted during daylight hours only to provide fish in the affected reaches of the Sacramento River with an extended quiet period during nighttime hours for feeding and unobstructed passage.

Limiting in-water construction to the May 1–November 30 period would achieve several goals.

- In-water construction activities with the potential to generate harmful levels of underwater noise (e.g., driving piles with an impact hammer) would avoid the primary migration periods of adults and juveniles of special-status fish species.
- The length of the in-water construction period would be maximized, thereby limiting the number of construction seasons that in-water construction would be needed and the number of year classes of fish species that potentially would be exposed to in-water construction effects.

Implement Measures to Minimize Exceedance of Interim Threshold Sound Levels during Pile Driving

The project proponent will require the contractor to implement the following measures, developed in coordination with project design engineers, to minimize the exposure of listed fish species to potentially harmful underwater sounds.

- If feasible, the contractor will vibrate all piles to the maximum depth possible before using an impact hammer.
- No more than 20 piles will be driven per day, and pile driving with an impact hammer will occur on no more than 75 individual days total during construction.
- During impact driving, the contractor will limit the number of strikes per day to the minimum necessary to complete the work and will limit the total number of hammer strikes to 16,000 strikes per day (i.e., 800 hammer strikes per pile, per day) for piles for the bridge piers and temporary trestles, and 20,000 strikes per day (i.e., 1,000 hammer strikes per pile, per day) for the piles for the bridge fender system.
- The smallest pile driver and minimum force necessary will be used to complete the work.
- During impact driving, the project proponent will require the contractor to use a bubble curtain or similar device, if feasible, to minimize the extent to which the interim peak and cumulative SEL thresholds are exceeded.
- No pile driving activity will occur at night, thereby providing fish with an extended quiet period during nighttime hours on days pile driving is being conducted for feeding and unobstructed passage.

Implement Cofferdam Restrictions

The following restrictions will be implemented during installation of the cofferdams and cofferdam dewatering.

- The extent of cofferdam footprints will be limited to the minimum necessary to support construction activities.
- Sheet piles used for cofferdams will be installed and removed using a vibratory pile driver.
- Cofferdams will be installed and removed only during the proposed in-water work window (between May 1 and November 30).
- Cofferdams will not be left in place over winter where they could be overtopped by winter/spring flows and when juveniles of listed species are most likely to be present in the construction area.
- All pumps used during dewatering of cofferdams will be screened according to CDFW and NMFS guidelines for screens.
- Cofferdam dewatering and fish rescue/relocation from within cofferdams will commence immediately following cofferdam closure.

Prevent the Spread or Introduction of Aquatic Invasive Species

The project proponent or its contractors will implement the following actions to prevent the potential spread or introduction of AIS associated with the operation of barges and other in-water construction activities. Species of concern related to the operation of barges and other equipment in the lower Sacramento River include invasive mussels (e.g., quagga mussels [*Dreissena bugensis*] and zebra mussels [*Dreissena polymorpha*]) and aquatic plants (e.g., Brazilian waterweed [*Egeria densa*] and hydrilla [*Hydrilla verticillata*]) (California Department of Fish and Game 2008).

- The project proponent or its contractors will coordinate with the CDFW's Invasive Species Program to ensure that the appropriate BMPs are implemented to prevent the spread or introduction of AIS.
- Educate construction supervisors and managers about the importance of controlling and preventing the spread of AIS.
- Train vessel and equipment operators and maintenance personnel in the recognition and proper prevention, treatment, and disposal of AIS.
- If feasible, prior to departure of vessels from their place of origin and before in-water construction equipment is allowed to operate within the waters of the Sacramento River, thoroughly inspect and remove and dispose of all dirt, mud, plant matter, and animals from all surfaces that are submerged or may become submerged, or places where water can be held and transferred to the surrounding water.

Minimize or Avoid Temporary Construction Lighting and Permanent Bridge Lighting from Directly Radiating on Water Surfaces of the Sacramento River

The project proponent will minimize or avoid the effects of nighttime lighting on special-status fish species by implementing the following actions.

Temporary Construction Lighting

- Avoiding construction activities at night, to the maximum extent practicable.
- Using the minimal amount of lighting necessary to safely and effectively illuminate the work areas.
- Shielding and focusing lights on work areas and away from the water surface of the Sacramento River, to the maximum extent practicable.

Permanent Bridge Lighting

- Minimizing nighttime lighting of the bridge structure for aesthetic purposes.
- Using the minimal amount of lighting necessary to safely and effectively illuminate vehicular, bicycle, and pedestrian areas on the bridge.
- Shielding and focusing lights on vehicular, bicycle, and pedestrian areas and away from the water surface of the Sacramento River, to the maximum extent practicable.

D.19.2 Mitigation Measures

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D.16.2.

Compensate for Loss of Perennial Stream

Please refer to the discussion of this measure in Section D.17.2.

Conduct Staff Training

The City of Sacramento will work with a wildlife biologist with knowledge of the life history, behavior, and habitat requirements of purple martin to conduct a training session for City project managers (i.e., project managers from the Public Works department) to inform staff of the biology, habitat requirements, regulatory status, and legal protection of purple martin as well as the mitigation requirements under CEQA and NEPA for the colonies in the City of Sacramento. The training will allow City staff to be informed for other City projects that could affect purple martins. The training session will occur prior to the demolition of the I Street Bridge approach structure.

Enhance Existing Colony Entrance Holes

To improve nesting success at other existing colonies within the City of Sacramento, nest guards will be installed in at least 50 nest entrance holes (unless there are fewer than 50 holes without guards already installed) across colony locations in the City used by martins in the previous 3 years. The nest guards will consist of 1/2-inch wire mesh installed along the interior edge of the previously used vent holes and will extend at least 1 inch above the floor of the structure

chamber. Nest guards will be installed prior to the demolition of the I Street Bridge approach structure and outside of the nesting season (i.e., installation could generally occur between September 15 and February 1).

Create Purple Martin Replacement Habitat

Purple martin nesting habitat that will be lost due to demolition of the I Street Bridge approach structure will be mitigated in part with replacement habitat. Replacement habitat will consist of at least 10 large (e.g., 4-foot tall) nest boxes placed at least 20 feet above the ground at the same location as the existing approach structure. An initial set of nest boxes will be installed prior to the 2019 nesting season to determine if they are used by purple martins. The initial nest boxes will be strapped to the approach structure support columns. Nest box design, construction, and installation will be coordinated with a biologist with extensive experience with the nesting needs of the Sacramento region population of purple martins.

Nest boxes will be monitored in all years leading up to the demolition of the approach structure to determine their use by purple martins in order to make modifications to the design, location, and/or number of boxes to encourage and continue to support purple martins at the I Street colony location.

The final design and at least the minimum number of replacement boxes will be in place and overlap temporally with the approach structure for at least one season prior to demolition and removal of the approach structure. Prior to the demolition of the approach structure, the nest boxes may be removed (outside of the nesting season) to accommodate demolition activities but will be re-installed in advance of the subsequent nesting season on permanent poles within the same location as the approach structure.

Landscaping near the nesting habitat will be designed to not disrupt the flight access within 120 feet of replacement nesting habitat (i.e., will not physically or visually obstruct the space around the nesting habitat). Small to medium non-fruit-bearing trees will be incorporate into the landscaping plans. Where possible, pine trees (*Pinus* spp.) also will be incorporated into landscaping plans to provide a permanent source of nesting material for purple martins. If feasible, some mowed or cut vegetation along the West Sacramento levee in the BSA (see BSA limits shown on EIR/EA Figure 2.16-1) will be left in place between March 15 and May 15 to allow purple martins to use this material for nesting.

Prepare and Implement a Monitoring and Management Plan for the I Street Bridge Purple Martin Colony Replacement Habitat

The project proponent will develop and implement a monitoring and management plan for the I Street Bridge purple martin colony replacement habitat prior to the construction of the proposed project. The monitoring portion of the plan will be implemented at least one nesting season prior to the demolition of the existing approach structure near the I Street Bridge. At a minimum, the plan will include the following actions and requirements.

- Monitor annually the use of replacement habitat by purple martins at the I Street Bridge colony location over a minimum 10-year period with at least 7 of the years occurring after

the completion of the new bridge and the demolition of the existing approach structure that provides nesting habitat for purple martins. The monitoring period may be extended if it is found that (1) purple martins are not using the replacement habitat; or (2) the replacement habitat is not functioning as intended and repairs are made, or additional replacement habitat is created.

- Monitor annually the other colonies in the Sacramento region to provide context for how the I Street Bridge colony is doing relative to the remaining population. Colonies will be monitored over the same period as the I Street Bridge colony.
- Annual monitoring will include up to 6 visits to each colony starting in March and ending in approximately June. Reproductive monitoring at colonies will be conducted using a pole mounted camera. Reproductive monitoring will occur during the latter part of the annual colony monitoring (approximately 3 of the total visits to a colony). At a minimum, the following information will be recorded.
 - Number of nesting pairs
 - Documentation of which vent holes and/or nest boxes are used
 - Documentation of use of perching structures
 - Effectiveness of landscaped areas and semi-natural areas (vegetated levee) in providing nesting materials
 - Observations of predation or presence of known predators
 - Changes in habitat in and around the colony
- Monitoring and management will be conducted by a wildlife biologist with knowledge of the life history, behavior, and habitat requirements of purple martin and with demonstrated prior experience in monitoring purple martin colonies.
- The monitoring and management plan will include adaptive management measures to correct problems with I Street Bridge Project replacement habitat, make other habitat improvements, and/or implement management recommendations within or adjacent to the BSA, or at other city of Sacramento colony locations where the City has existing rights to make modifications, in an attempt to boost nesting success. These measures may include but would not be limited to the following.
 - A commitment to replacing poor-functioning or damaged free-standing purple martin nesting and/or perching habitat such that there is no net loss in the amount of created habitat.
 - A process for making and implementing recommendations on the management of vegetation around colonies within the city of Sacramento.

The Director of the City of Sacramento Department of Public Works, or his or her designee, will be responsible on a continuing basis for the implementation of the mitigation measures relating to purple martin impacts, replacement habitat and the replacement habitat management plan. The Director will determine the manner in which mitigation shall proceed, and the resources, including staff commitment and consultants, that will be utilized in the effort.

Replace Bat Roosting Habitat Lost from Demolition of Approach Structures

Bat roosting habitat will be incorporated into the new bridge and, if necessary, additional free-standing roosting habitat (e.g., bat houses) will be created and installed within or adjacent to the BSA. At a minimum ratio of 1:1, 1,132 linear feet of roosting habitat will be created to compensate for the loss of bat roosting habitat associated with the approach structures. Bat replacement habitat will consist of crevice habitat built into the new bridge. Bat replacement habitat will be designed generally following the guidelines in *California Bat Mitigation Techniques, Solutions, and Effectiveness* (Johnston et al. 2004), which provides a review of mitigation options for bats in relation to Caltrans projects. Final plans for bat habitat replacement will be approved by the project proponent and CDFW.

Monitor Bat Replacement Habitat

The project proponent will be responsible for monitoring replacement bat habitat over a 5-year period for a minimum of 3 years (e.g., years 2, 3, and 5) to determine whether bats are using the habitat, determine whether the habitat is functioning as intended, and identify any corrective actions that need to be made to the habitat to improve its use by bats. Bat use will be documented through a combination of visual observation (bats and bat sign), which could be conducted during the day where roosting bats are visible or at night during an emergence survey. Acoustic recordings will be used in combination with emergence surveys to attempt to identify the species of bat(s) using the replacement habitat. The locations and amount of occupied habitat will be recorded. Recommendations for corrective actions will be presented to the project proponent and CDFW for approval. Annual monitoring reports will be sent to the project proponent and CDFW.

Develop and Implement a Hydroacoustic Monitoring Plan

The project proponent and/or its construction contractor will develop and implement a hydroacoustic monitoring plan. The monitoring plan will be submitted to the resource agencies (CDFW, NMFS, and USFWS) for approval at least 60 days before the start of project activities. The plan will include the following requirements.

- The project proponent and/or its construction contractor will monitor underwater noise levels during all impact pile driving activities on land and in water to ensure that that peak and cumulative SELs do not exceed estimated values (Table 2.19-8).
- The monitoring plan will describe the methods and equipment that will be used to document the extent of underwater sounds produced by pile driving, including the number, location, distances, and depths of the hydrophones and associated monitoring equipment.
- The monitoring plan will include a reporting schedule for daily summaries of the hydroacoustic monitoring results and for more comprehensive reports to be provided to the resource agencies on a monthly basis during the pile driving season.
- The daily reports will include the number of piles installed per day; the number of strikes per pile; the interval between strikes; the peak SPL, SEL, and RMS per strike; and the accumulated SEL per day at each monitoring station.

- The project proponent or its contractors will ensure that a qualified fish biologist is on site during impact pile driving to document any occurrences of stressed, injured, or dead fish. If stressed, injured, or dead fish are observed during pile driving, the project proponent and/or its construction contractor will reduce the number of strikes per day to ensure that fish are no longer showing signs of stress, injury, or mortality.

Monitor Turbidity in the Sacramento River

The project proponent will require the construction contractor to monitor turbidity levels in the Sacramento River during in-water construction activities (e.g., pile driving, extraction of temporary sheet piles used for cofferdams, placement of RSP). Turbidity will be measured using standard techniques upstream and downstream of the construction area to determine whether changes in ambient turbidity levels exceed 20 percent, the threshold derived from the Sacramento and San Joaquin Rivers Basins Plan (Central Valley Regional Water Quality Control Board 2011). If it is determined that turbidity levels exceed the 20-percent threshold, then the project proponent and/or its contractors will adjust work to ensure that turbidity levels do not exceed the 20-percent threshold.

Prepare and Implement a Fish Rescue and Relocation Plan

The project proponent and/or its construction contractor will develop and implement a fish rescue and relocation plan to recover any fish trapped in cofferdams. The fish rescue and relocation plan will be submitted to the resource agencies (CDFW, NMFS, and USFWS) for approval at least 60 days before initiating activities to install cofferdams. At a minimum, the plan will include the following.

- A requirement that fish rescue and relocation activities will commence immediately after cofferdam closure and that dewatering has sufficiently lowered water levels inside cofferdams to make it feasible to rescue fish.
- A description of the methods and equipment proposed to collect, transfer, and release all fish trapped within cofferdams. Capture methods may include seining, dip netting, and/or electrofishing as approved by CDFW, NMFS, and USFWS. The precise methods and equipment to be used will be developed cooperatively by CDFW, NMFS, USFWS, and the project proponent and/or contractor.
- A requirement that only CDFW-, NMFS-, and USFWS-approved fish biologists will conduct the fish rescue and relocation.
- A requirement that fish biologists will contact CDFW, NMFS, and USFWS immediately if any listed species are found dead or injured.
- A requirement that a fish rescue and relocation report be prepared and submitted to CDFW, NMFS, and USFWS within 5 business days following completion of the fish relocation. Data will be provided in tabular form and at a minimum will include the species and number rescued and relocated, approximate size of each fish (or alternatively, approximate size range if large number of individuals are encountered), date and time of their capture, and general condition of all live fish (e.g., good—active with no injuries; fair—reduced activity with some superficial injuries; poor—difficulty swimming/orienting with major injuries). For dead fish,

additional data will include fork length and description of injuries and/or possible cause of mortality if it can be determined.

D.19.3 CEQA Mitigation Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D.16.2.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D.16.2.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D.16.2.

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D.16.2.

Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

Please refer to the discussion of this measure in Section D.17.1.

Compensate for Loss of Perennial Stream

Please refer to the discussion of this measure in Section D.17.2.

Conduct Preconstruction Surveys for Western Pond Turtle and Allow Turtles to Leave Work Area Unharmed

Please refer to the discussion of this measure in Section D.19.1.

Conduct Preconstruction Surveys for Nesting Migratory Birds, Including Special-Status Birds, and Establish Protective Buffers

Please refer to the discussion of this measure in Section D.19.1.

Conduct Tree Removal during Non-Sensitive Periods for Wildlife

Please refer to the discussion of this measure in Section D.19.1.

Avoid and Minimize Impacts on Purple Martins during Construction Activities

Please refer to the discussion of this measure in Section D.19.1.

Avoid and Minimize Impacts on Nesting Birds and Roosting Bats from Demolition of Approach Structures

Please refer to the discussion of this measure in Section D.19.1.

Conduct Staff Training

Please refer to the discussion of this measure in Section D.19.2.

Enhance Existing Colony Entrance Holes

Please refer to the discussion of this measure in Section D.19.2.

Create Purple Martin Replacement Habitat

Please refer to the discussion of this measure in Section D.19.2.

Prepare and Implement a Monitoring and Management Plan for the I Street Bridge Purple Martin Colony Replacement Habitat

Please refer to the discussion of this measure in Section D.19.2.

Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

Please refer to the discussion of this measure in Section D.19.1.

Replace Bat Roosting Habitat Lost from Demolition of Approach Structures

Please refer to the discussion of this measure in Section D.19.2.

Monitor Bat Replacement Habitat

Please refer to the discussion of this measure in Section D.19.2.

Conduct All In-Water Construction Activities between May 1 and November 30 and during Daylight Hours Only

Please refer to the discussion of this measure in Section D.19.1.

Implement Measures to Minimize Exceedance of Interim Threshold Sound Levels during Pile Driving

Please refer to the discussion of this measure in Section D.19.1.

Develop and Implement a Hydroacoustic Monitoring Plan

Please refer to the discussion of this measure in Section D.19.2.

Monitor Turbidity in the Sacramento River

Please refer to the discussion of this measure in Section D.19.2.

Implement Cofferdam Restrictions

Please refer to the discussion of this measure in Section D.19.1.

Prepare and Implement a Fish Rescue and Relocation Plan

Please refer to the discussion of this measure in Section D.19.2.

Prevent the Spread or Introduction of Aquatic Invasive Species

Please refer to the discussion of this measure in Section D.19.1.

Minimize or Avoid Temporary Construction Lighting and Permanent Bridge Lighting from Directly Radiating on Water Surfaces of the Sacramento River

Please refer to the discussion of this measure in Section D.19.1.

D.20 Threatened & Endangered Species

D.20.1 Avoidance and Minimization Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D.16.1.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D.16.1.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D.16.1.

Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

Please refer to the discussion of this measure in Section D.17.1.

Avoid and Minimize Impacts on Valley Elderberry Longhorn Beetle

The following measures will be implemented prior to and during construction to ensure that the proposed project does not adversely affect elderberry shrubs adjacent to the project footprint.

- Contractors will be briefed on the need to avoid damaging the elderberry shrubs and the possible penalties for not complying with these requirements. Crews also will be educated on the status of the VELB and the need to protect its habitat.
- All elderberry shrubs that are outside of the permanent project footprint or that can be avoided will be identified on construction drawings, with notes indicating that they are sensitive resources to be avoided.
- Orange construction barrier fencing will be placed at a minimum of 20 feet from each shrub's dripline [fencing around shrub 6 (construction will be within 20 feet) will be placed as far out from the dripline as possible]. No construction activities will be permitted within the buffer zone other than those activities necessary to erect the fencing. *As specified in the Conservation Guidelines for the Valley Elderberry Longhorn Beetle (Guidelines) (U.S. Fish and Wildlife Service 1999), signs will be posted every 50 feet (at a minimum) along the perimeter of the buffer area fencing. The signs will contain the following information: This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment.* The signs should be clearly readable from a distance of 20 feet and must be maintained for the duration of construction.
- Buffer area fences around the shrubs will be inspected weekly by a biological monitor during ground-disturbing activities and monthly after ground-disturbing activities until project construction is complete or until the fences are removed, as approved by the biological monitor. The biological monitor will be responsible for ensuring that the contractor maintains the buffer area fences around elderberry shrubs throughout construction. Biological inspection reports will be provided to USFWS and the project proponent.

Implementation of the following measures will ensure that construction activities avoid or minimize potential impacts on Swainson's hawk within and adjacent to the limits of disturbance associated with project construction.

Conduct Tree Removal during Non-Sensitive Periods for Wildlife

The project proponent will remove or trim trees during the non-breeding season for tree-nesting migratory birds and raptors, and prior to periods when bats would be hibernating (generally between September 15 and October 31). If tree removal cannot be confined to this period, the project proponent will retain a qualified wildlife biologist with knowledge of the wildlife species that could occur in the project area to conduct the appropriate preconstruction surveys and establish no-disturbance buffers for sensitive wildlife species as described under measures for Swainson's hawk, nesting birds, and roosting bats.

Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction

The project proponent will retain a wildlife biologist experienced in surveying for Swainson's hawk to conduct surveys for the species in the spring/summer prior to construction. The surveys will be conducted within the limits of disturbance and in a buffer area up to 0.25 mile from the limits of disturbance. The size of the buffer area surveyed will be based on the type of habitat present and the line-of-sight from the construction area to surrounding suitable breeding habitat. Surveys will follow the methods in *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee 2000). A minimum of six surveys will be conducted according to these methods. If a variance of the survey distance or number of surveys is necessary, the project proponent will coordinate with CDFW regarding appropriate survey methods based on proposed construction activities. Surveys generally will be conducted from February to July. Survey methods and results will be reported to the project proponent and CDFW.

Monitor Active Swainson's Hawk Nests during Pile Driving and Other Construction Activities

Active Swainson's hawk and white-tailed kite nests within 600 feet of the BSA will be monitored during pile driving and other construction activities. Monitoring will be conducted by a wildlife biologist with experience in monitoring Swainson's hawk and white-tailed kite nests. The monitor will document the location of active nests, coordinate with the project proponent and CDFW, and record all observations in a daily monitoring log. The monitor will have the authority to temporarily stop work if activities are disrupting nesting behavior to the point of resulting in potential take (i.e., eggs and young chicks still in nests and adults appear agitated and could potentially abandon the nest). The monitor will work closely with the contractor, the project proponent, and CDFW to develop plans for minimizing disturbance, such as modifying or delaying certain construction activities.

A minimum non-disturbance buffer of 600 feet (radius) will be established around all active Swainson's hawk and white-tailed kite nests. No entry of any kind related to construction will be allowed within this buffer while the nest is active, unless approved by CDFW through issuance of an Incidental Take Permit or through consultation during project construction. The buffer size may be modified based on site-specific conditions, including line-of-sight, topography, type of disturbance, existing ambient noise and disturbance levels, and other relevant factors. Entry into the buffer for construction activities will be granted when the biological monitor determines that the young have fledged and are capable of independent survival or that the nest has failed and the nest site is no longer active. All buffer adjustments will be approved by CDFW.

Conduct All In-Water Construction Activities between May 1 and November 30 and during Daylight Hours Only

Please refer to the discussion of this measure in Section D.19.1.

Implement Measures to Minimize Exceedance of Interim Threshold Sound Levels during Pile Driving

Please refer to the discussion of this measure in Section D.19.1.

Develop and Implement a Hydroacoustic Monitoring Plan

Please refer to the discussion of this measure in Section D.19.2.

Monitor Turbidity in the Sacramento River

Please refer to the discussion of this measure in Section D.19.2.

Implement Cofferdam Restrictions

Please refer to the discussion of this measure in Section D.19.1.

Prepare and Implement a Fish Rescue and Relocation Plan

Please refer to the discussion of this measure in Section D.19.2.

Prevent the Spread or Introduction of Aquatic Invasive Species

Please refer to the discussion of this measure in Section D.19.1.

Minimize or Avoid Temporary Construction Lighting and Permanent Bridge Lighting from Directly Radiating on Water Surfaces of the Sacramento River

Please refer to the discussion of this measure in Section D.19.1.

D.20.2 Mitigation Measures

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D.16.2.

Compensate for Loss of Perennial Stream

Please refer to the discussion of this measure in Section D.17.2.

Transplant Elderberry Shrubs That Cannot Be Avoided

Elderberry shrubs that cannot be avoided will be transplanted to a USFWS-approved conservation area in accordance with the Guidelines (U.S. Fish and Wildlife Service 1999). Transplanting will occur during the plant's dormant phase (approximately November through the first 2 weeks of February, after they have lost their leaves). A qualified specialist familiar with

elderberry shrub transplantation procedures will supervise the transplanting. The location of the conservation area transplantation site will be approved by USFWS before removal of the shrubs.

Compensate for Impacts on Valley Elderberry Longhorn Beetle Habitat

Before construction begins, the project proponent will compensate for direct impacts (including transplanting) on all elderberry stems measuring 1 inch or more at ground level (i.e., habitat for VELB) that are located within 20 feet of proposed construction activities. Compensation will include planting replacement elderberry seedlings or cuttings and associated native plantings in a USFWS-approved conservation area, at a ratio between 1:1 and 8:1 (ratio = new plantings to affected stems), depending on the diameter of the stem at ground level, the presence or absence of exit holes, and whether the shrub is located in riparian habitat (U.S. Fish and Wildlife Service 1999).

Mitigation credits for VELB will be purchased at a USFWS-approved mitigation bank. The exact amount and location of compensatory mitigation will be based on consultation with USFWS.

Table 3-18 summarizes the compensation required for direct effects on up to five elderberry shrubs (shrubs 1, 2, 3, 5, and 7) that provide VELB habitat. Based on stem counts listed in Table 3-18 for these five shrubs and in accordance with the Guidelines, 34 elderberry seedlings and 34 associated native plants will be planted in a USFWS-approved conservation area. This compensation may be reduced if some of the shrubs occurring within temporary impact areas (shrubs 1, 2, 3, and 7) can be avoided once more detailed plans are available.

Table 3-18. Required Compensation for Directly Affected Elderberry Shrubs

Habitat	Stem Diameter	Number of Stems	Exit Holes?	Seedling Ratio	Native Plant Ratio	Total Seedling	Total Native Plants
Riparian	Stems >1" to <3"	0	No	2:1	1:1	0	0
	Stems >1" to <3"	0	Yes	4:1	2:1	0	0
	Stems >3" to <5"	0	No	3:1	1:1	0	0
	Stems >3" to <5"	0	Yes	6:1	2:1	0	0
	Stems >5"	1	No	4:1	1:1	4	4
	Stems >5"	0	Yes	8:1	2:1	0	0
Nonriparian	Stems >1" to <3"	22	No	1:1	1:1	22	22
	Stems >1" to <3"	0	Yes	2:1	2:1	0	0
	Stems >3" to <5"	1	No	2:1	1:1	2	2
	Stems >3" to <5"	0	Yes	4:1	2:1	0	0
	Stems >5"	2	No	3:1	1:1	6	6
	Stems >5"	0	Yes	6:1	2:1	0	0
Total		26				34	34

Purchase Channel Enhancement Credits for Impacts on Critical Habitat

Permanent impacts on critical habitat (bank and substrate below the OHWM and water column habitat), totaling 3.11 acres (up to 80,449 square feet [1.85 acre] from the new bridge piers and RSP and up to 55,000 square feet [1.26 acre] from bridge shading of aquatic habitat) will be mitigated at a 3:1 ratio. The project proponent proposes to mitigate the permanent loss of critical habitat through purchase of 9.33 acres of mitigation credits at a NMFS-approved anadromous fish conservation bank.

Compensate for Permanent Loss of Shallow Water Habitat for Delta Smelt

As a result of FESA consultation for effects on listed species, the USFWS identified mitigation for permanent impacts on 0.036 acre of shallow water habitat for delta smelt through the purchase of mitigation bank credits at a 3:1 ratio. The project proponent will compensate for the permanent loss of shallow water habitat through the purchase of 0.108 acre of mitigation credit at a USFWS-approved mitigation bank, such as Liberty Island Conservation Bank.

Implement Reasonable and Prudent Measures and Terms and Conditions of USFWS Biological Opinion for Delta Smelt and VELB

As a result of FESA consultation for effects on listed species, the USFWS determined the following reasonable and prudent measures necessary and appropriate to minimize the effect of the action area on delta smelt and VELB. The project proponent will be responsible for the implementation and compliance with these measures in accordance with the terms and conditions listed in the Biological Opinion issued for the project.

1. Minimize adverse effects to the delta smelt and VELB and their habitats in the action area by implementing the proposed project, including the conservation measures as described with the following terms and conditions.
2. Minimize adverse effects to the delta smelt and its critical habitat to the fullest extent practicable.

The terms and conditions described in the Biological Opinion are non-discretionary, and the project proponent must comply with them in order to implement the above reasonable and prudent measures (50 CFR 402.14).

Implement Reasonable and Prudent Measures and Terms and Conditions of NMFS Biological Opinion for Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CV steelhead, and the southern DPS of North American green sturgeon

As a result of FESA consultation for effects on listed species, NMFS identified the measures listed below as non-discretionary, stating they must be undertaken by the project proponent, following the terms and conditions listed in the Biological Opinion, so that they become binding conditions of any contracts or permits.

1. Measures shall be taken to minimize sedimentation events and turbidity plumes.
2. Measures shall be taken to reduce the potential sound impacts.

3. Measures shall be taken to revegetate temporarily impacted areas below and above the OHWM with native plants and shrubs.
4. The project proponent shall monitor and report on the amount or extent of incidental take.

The terms and conditions described in the Biological Opinion are non-discretionary, and the project proponent must comply with them in order to implement the above reasonable and prudent measures (50 CFR 402.14).

D.20.3 CEQA Mitigation Measures

Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

Please refer to the discussion of this measure in Section D.16.1.

Conduct Environmental Awareness Training for Construction Employees

Please refer to the discussion of this measure in Section D.16.1.

Conduct Periodic Biological Monitoring

Please refer to the discussion of this measure in Section D.16.1.

Compensate for Temporary Effects on and Permanent Loss of Cottonwood Riparian Forest (including SRA Cover)

Please refer to the discussion of this measure in Section D.16.2.

Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

Please refer to the discussion of this measure in Section D.17.1.

Compensate for Loss of Perennial Stream

Please refer to the discussion of this measure in Section D.17.2.

Avoid and Minimize Impacts on Valley Elderberry Longhorn Beetle

Please refer to the discussion of this measure in Section D.20.1.

Transplant Elderberry Shrubs That Cannot Be Avoided

Please refer to the discussion of this measure in Section D.20.2.

Compensate for Impacts on Valley Elderberry Longhorn Beetle Habitat

Please refer to the discussion of this measure in Section D.20.2.

Conduct Tree Removal during Non-Sensitive Periods for Wildlife

Please refer to the discussion of this measure in Section D.20.1.

Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction

Please refer to the discussion of this measure in Section D.20.1.

Monitor Active Swainson's Hawk Nests during Pile Driving and Other Construction Activities

Please refer to the discussion of this measure in Section D.20.1.

Conduct All In-Water Construction Activities between May 1 and November 30 and during Daylight Hours Only

Please refer to the discussion of this measure in Section D.19.1.

Implement Measures to Minimize Exceedance of Interim Threshold Sound Levels during Pile Driving

Please refer to the discussion of this measure in Section D.19.1.

Develop and Implement a Hydroacoustic Monitoring Plan

Please refer to the discussion of this measure in Section D.19.2.

Monitor Turbidity in the Sacramento River

Please refer to the discussion of this measure in Section D.19.2.

Implement Cofferdam Restrictions

Please refer to the discussion of this measure in Section D.19.1.

Prepare and Implement a Fish Rescue and Relocation Plan

Please refer to the discussion of this measure in Section D.19.2.

Prevent the Spread or Introduction of Aquatic Invasive Species

Please refer to the discussion of this measure in Section D.19.1.

Minimize or Avoid Temporary Construction Lighting and Permanent Bridge Lighting from Directly Radiating on Water Surfaces of the Sacramento River

Please refer to the discussion of this measure in Section D.19.1.

Purchase Channel Enhancement Credits for Impacts on Critical Habitat

Please refer to the discussion of this measure in Section D.20.2.

D.21 Invasive Species

D.21.1 Avoidance and Minimization Measures

Avoid the Introduction and Spread of Invasive Plants

The project proponent or their contractor will be responsible for avoiding the introduction of new invasive plants and the spread of invasive plants previously documented in the study area. Accordingly, the following measures will be implemented during construction.

- Educate construction supervisors and managers on weed identification and the importance of controlling and preventing the spread of invasive weeds.
- Dispose of invasive species material removed during project construction offsite at an appropriate disposal facility to avoid the spread of invasive plants into natural areas.
- Minimize surface disturbance to the greatest extent feasible to complete the work.
- Use weed-free imported erosion-control materials (or rice straw in upland areas).
- Use locally grown native plant stock and native or naturalized (noninvasive) grass seed during revegetation.
- If feasible, remove trees of heaven located in and adjacent to the temporary impact area on the east side of 2nd Street in the City of West Sacramento.

D.21.2 CEQA Mitigation Measures

Avoid the Introduction and Spread of Invasive Plants

Please refer to the discussion of this measure in Section D.21.1.

Appendix E

**Incomplete or Unavailable Information for
Project-Specific MSAT Health Impacts Analysis**

Appendix E Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

The following is from the FHWA memorandum *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA - Appendix C* (Federal Highway Administration 2012).

CEQ Provisions Covering Incomplete or Unavailable Information (40 CFR 1502.22)

Sec. 1502.22 INCOMPLETE OR UNAVAILABLE INFORMATION

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

- (a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.
- (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:
 1. a statement that such information is incomplete or unavailable;
 2. a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
 3. a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and
 4. the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.
- (c) The amended regulation will be applicable to all environmental impact statements for which a Notice to Intent (40 CFR 1508.22) is published in the Federal Register on or after May 27, 1986. For environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation.

Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather

than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The U.S. Environmental Protection Agency (EPA) is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is “a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects” (EPA, <http://www.epa.gov/iris/>). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA’s Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are; cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, <http://pubs.healtheffects.org/view.php?id=282>) or in the future as vehicle emissions substantially decrease (HEI, <http://pubs.healtheffects.org/view.php?id=306>).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (<http://pubs.healtheffects.org/view.php?id=282>). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA (<http://www.epa.gov/risk/basicinformation.htm#g>) and the HEI (<http://pubs.healtheffects.org/getfile.php?u=395>) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an “acceptable” level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA’s approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

Due to the limitations cited, a discussion such as the example provided in this Appendix (reflecting any local and project-specific circumstances), should be included regarding incomplete or unavailable information in accordance with Council on Environmental Quality (CEQ) regulations [40 CFR 1502.22(b)]. The FHWA Headquarters and Resource Center staff Victoria Martinez (787) 766-5600 X231, Bruce Bender (202) 366-2851, and Michael Claggett (505) 820-2047, are available to provide guidance and technical assistance and support.

Source:

Federal Highway Administration. 2012. *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA*. Appendix C. December 6. Available at: <http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/ajintguidmem.cfm>. Accessed: May 24, 2016.

Appendix F
**Sub-Area Travel Forecasting Model
Development and Validation**

TECHNICAL MEMORANDUM

Date: May 28, 2014

To: Zach Siviglia & Rob Himes – Mark Thomas & Company

From: Kwasi Donkor & Ronald T. Milam – Fehr & Peers

Subject: **I Street Bridge Replacement Over The Sacramento River Project - Sub-Area Travel Forecasting Model Development and Validation**

*RS14-3220***INTRODUCTION**

Fehr & Peers has developed a sub-area travel forecasting model for the I Street Bridge Replacement Project using a modified version of the regional SACMET model. The original model was based on network and socioeconomic inputs from the SACOG Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). Over time, the model has undergone a variety of refinements and modifications to improve its level of detail and sensitivity for the following projects.

- City of Sacramento General Plan
- American River Crossing Study
- Entertainment and Sports Complex EIR
- Downtown/Riverfront Streetcar Plan
- McKinley Village

For the I Street Bridge Replacement Project, more refinements were necessary, especially in West Sacramento, where the network and traffic analysis zone (TAZ) system had limited detail. Once the refinements were completed, the sub-area model was validated within the overall I Street Bridge Replacement project study area.

Model validation describes a model's performance relative to how well its output matches observed conditions in the base year and how well it responds to input variable changes. Static validation tests are used to statistically measure the model's ability to replicate observed conditions while dynamic

validation tests are used to measure whether the model responds in the correction direction and magnitude when input variables are changed.

SUBAREA MODEL REFINEMENTS

Key modifications that are a part of the I Street Bridge Replacement Project sub-area model are listed below:

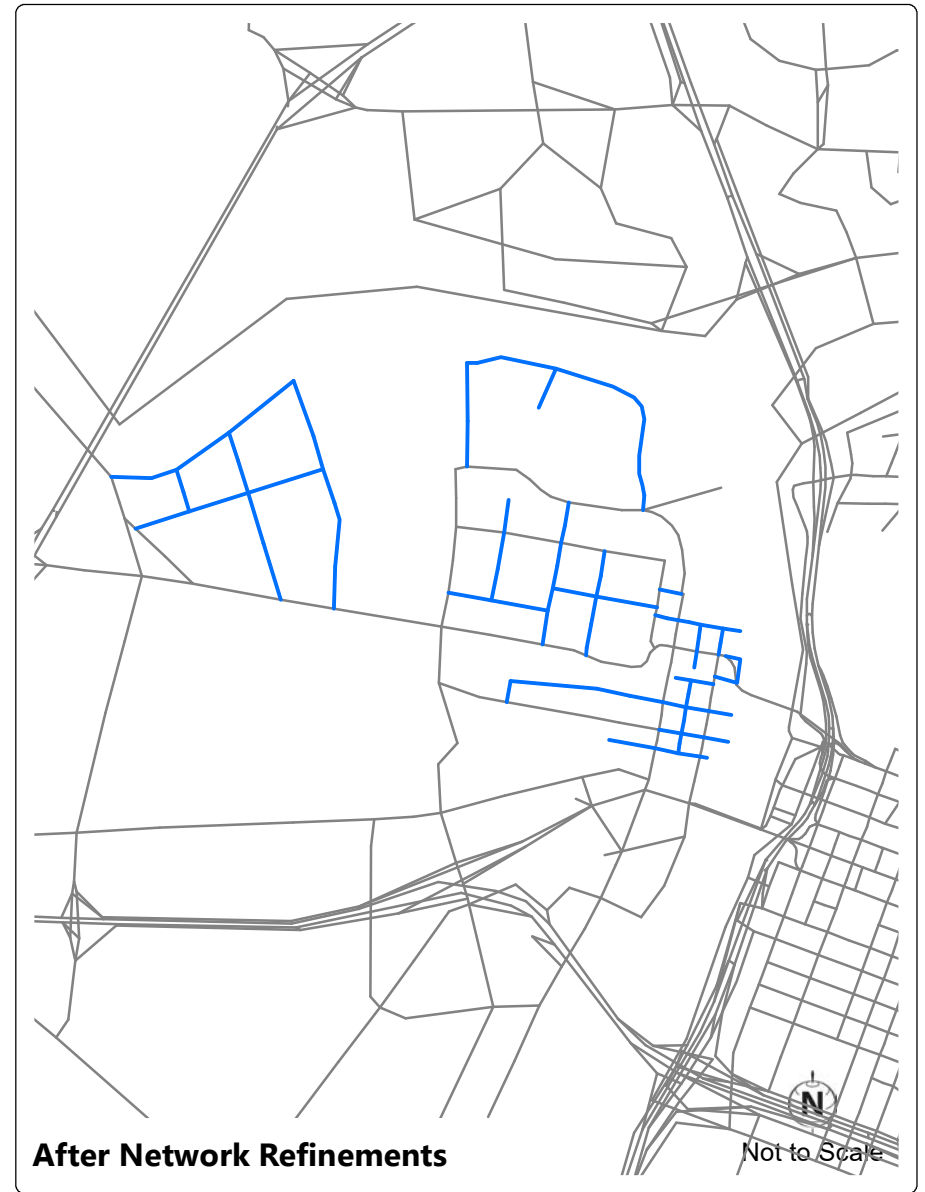
- Updated the base year roadway network to include greater detail within areas of the City of Sacramento and City of West Sacramento, and corrected inconsistencies between model inputs and field observations related to roadway network speeds and capacity. Figure 1 shows the detailed model network refinements.
- Updated the future year roadway network to reflect base year changes and include more detail for planned roadways.
- Added new traffic analysis zones (TAZs) in the study area to increase the level of detail and improve the loading of traffic from TAZs onto the transportation network. Figure 2 shows the added TAZ refinements.

VALIDATION

The *2010 California Regional Transportation Plan Guidelines*, published by the California Transportation Commission, contain the following guidance, criteria, and thresholds for model validation.

General

- Agencies that use metropolitan planning organization (MPO) models for purposes other than regional planning should ensure that the model provides the appropriate scale and sensitivity for applications at a sub-regional level such as corridor, sub-area, or local planning studies. Below the regional level, model refinements are likely necessary to ensure the model meets the validation targets established in these guidelines and is appropriately sensitive to smaller scale changes associated with sub-regional studies.





Static Validation

- *At least 75 percent of the roadway links for which counts are available should be within the maximum desirable deviation, which ranges from approximately 15 to 60 percent depending on total volume (the larger the volume, the less deviation is permitted).*
- *A correlation coefficient of at least 0.88* - The correlation coefficient estimates the overall level of accuracy between observed traffic counts and the estimated traffic volumes from the model. This coefficient ranges from 0 to 1.0, where 1.0 indicates that the model perfectly fits the data.
- *The percent root mean square error (RMSE) below 40%* - The RMSE is the square root of the model volume minus the actual count squared, divided by the number of counts. It is a measure similar to standard deviation in that it assesses the accuracy of the model.

Dynamic Validation

- Dynamic validation can include the following model sensitivity tests, as appropriate given the type of regional model and alternatives under evaluation (*for purposes of this study, the first two tests were performed*).
 - Add lanes to a link
 - Delete a link
 - Add a link
 - Change link speeds
 - Change link capacities

In addition to the static test criteria above, the subarea model volume-to-count ratio was measured against a desired maximum threshold of no more than a 10 percent deviation.

General Performance

As described above and shown in Figures 1 and 2, the sub-area model received refinements to its network and TAZ system. These changes were made in direct response to the need for the model to include sufficient detail to forecast traffic volume changes in response to a local bridge modification.

Static Validation

The static validation of the subarea model was tested for 87 individual roadway segments and 12 freeway segments in the project study area under daily conditions. Under normal circumstances, the base year model volumes would be compared to base year traffic counts. The model's base year is 2008 and a complete set of traffic counts is not available for 2008. Further, the 2008/09 recession caused a substantial reduction in employment within the model area that has not yet fully recovered. A comparison of 2012 traffic counts conducted for more than 250 roadway segments throughout the City of Sacramento revealed that overall traffic counts were about 8 percent less than the counts for these same locations in 2007. As such, this model validation relied on traffic counts from 2012-2014. Because current employment levels have not yet reached 2008 levels in many areas, the model's base year traffic volume forecasts are expected to slightly overestimate the 2012-2014 traffic counts. Table 1 presents the static validation results produced using the modified subarea model.

TABLE 1 – FINAL RESULTS OF DAILY MODEL VALIDATION		
Validation Item	Criterion of Acceptance	Model Results
Model Wide Volume-to-Count Ratio	Within \pm 10%	+7%
% of Links Within Deviation Allowance	At Least 75%	70%
Correlation Coefficient	At Least 88%	97%
RMSE	40% or less	25%
Green shading denotes the model results pass the applicable test.		
Source: Fehr & Peers, 2013.		

In general, the sub-area model generated traffic volume estimates that closely matched roadway and freeway volumes with overall volumes being slightly higher than counts as expected. The sub-area model performed well passing 3 of the 4 static tests and improving on results compared to the original off-the-shelf model. The largest differences occurred on low volume roadways and on select segments in downtown Sacramento where the grid street pattern makes it difficult for a model to perfectly match localized travel patterns with multiple path choices.

Dynamic Validation

For this sub-area model, the dynamic validation tests focused on roadway network changes given the proposed project to add a new bridge crossing over the Sacramento River. Previous dynamic tests for other projects have confirmed that the SACMET model generally responds in the correct direction and magnitude when making land use and network changes. So, the specific dynamic validation tests for this sub-area model focused on what happens when the I Street Bridge is eliminated or the number of lanes for the I Street Bridge is increased. Table 2 summarizes the dynamic validation results for the roadway network changes.

TABLE 2 – DYNAMIC VALIDATION: CHANGE IN ROADWAY NETWORK (DAILY DEMAND)				
Roadway Change	Before Change		After Change	
	Changed Link Volume	Screenline Volume (1)	Changed Link Volume	Screenline Volume (1)
Delete the I Street Bridge links	16,173	221,505	0	216,653
Add one lane in each direction to the I Street Bridge	16,173	221,505	17,460	221,922
Note: (1) Screenline includes the I Street Bridge, Tower Bridge, and Pioneer Bridge (US 50) Source: Fehr & Peers, 2014.				

The results in Table 2 reveal that the model output responds in the correct direction and magnitude given the input changes. When an important link such as a bridge is eliminated, trips must shift to other bridges but often experience much higher delays due to capacity constraints. The results show the trips shifted to Tower Bridge and US 50 (proportional to their relative capacities) and that total trips across the screenline declined slightly due to the higher overall travel delays. The SACMET model contains a feedback mechanism between trip assignment and trip distribution that can influence trip destinations and mode choice such that a major capacity constraint can result in less overall vehicle trips. Likewise, when lanes are added to the I Street Bridge, the model accounts for the opposite pattern where not only do traffic volumes increase on the I Street Bridge, but the capacity expansion reduces travel times enough that additional trips are induced.

Fehr & Peers also prepared preliminary traffic volume forecasts used to evaluate potential alignments for the new I Street Bridge prior to the model validation. River crossings at both Railyards Boulevard and Camille Lane were modeled using the 2035 version of the SACMET model. The results of the analysis (shown in Table 3) were consistent with the dynamic validation results and serve as another reasonableness check of the model.

TABLE 3 – PRELIMINARY ANALYSIS RESULTS: BRIDGE ALIGNMENT ALTERNATIVES (DAILY DEMAND)				
Roadway Change	Before Change		After Change	
	Changed Link Volume	Screenline Volume (1)	Changed Link Volume	Screenline Volume (1)
New 2-lane Bridge Crossing at Railyards Boulevard	0	314,521	35,851	319,635
Add one lane in each direction (for a total of 4 lanes) to the Railyards Boulevard Bridge	35,851	319,635	48,637	328,201
New 2-lane Bridge Crossing at Camille Lane	0	314,521	32,489	318,169
Add one lane in each direction (for a total of 4 lanes) to the Camille Lane Bridge	32,489	318,169	44,611	325,376
Note: (1) Screenline includes the new I Street Bridge alignments, Tower Bridge, Pioneer Bridge (US 50), and the Broadway Bridge Source: Fehr & Peers, 2014.				

Appendix G

Agency Letters and Consultation

Index

Notice of Preparation

Letters Received in Response to Notice of Preparation

Species Lists

U.S. Fish and Wildlife Service Biological Opinion

National Marine Fisheries Service Biological Opinion

Native American Consultation

State Historic Preservation Office Consultation

Section 106 Finding of Effects and Project-specific Programmatic Agreement

Air Quality Conformity Documentation

Notice of Preparation

DATE: September 22, 2014

TO: Interested Persons

FROM: Dana Mahaffey, Associate Planner
Community Development Department

RE: **NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND SCOPING MEETING FOR THE I STREET BRIDGE REPLACEMENT PROJECT: A NEW BRIDGE OVER THE SACRAMENTO RIVER (IDENTIFIED BY THE U.S. COAST GUARD AS THE "C STREET BRIDGE")**

COMMENT PERIOD

September 22, 2014 to October 21, 2014

INTRODUCTION

The City of Sacramento ("City") is the Lead Agency for preparation of an Environmental Impact Report (EIR) for the proposed I Street Bridge Replacement over the Sacramento River (Project). The EIR will evaluate potential significant environmental effects of the project. Written comments regarding the issues that should be covered in the EIR, including potential alternatives to the Project and the scope of the analysis, are invited. The EIR for the Project is being prepared in compliance with the California Environmental Quality Act (CEQA). The Project is subject to state as well as federal environmental review requirements, and project documentation will be prepared in compliance with both CEQA and the National Environmental Policy Act (NEPA). The City of West Sacramento, co-sponsor of the project, is a Responsible Agency under CEQA. The California Department of Transportation (Caltrans) is the NEPA lead agency and anticipates preparation of an Environmental Assessment. In addition, the Federal Highway Administration's responsibilities for environmental review, consultation, and any other action required in accordance with applicable Federal laws for this Project will be carried out by Caltrans as assigned under Moving Ahead for Progress in the 21st Century (MAP-21) (23 United States Code [USC] 327), effective on October 1, 2012.

Under CEQA, upon deciding to prepare an EIR, the City of Sacramento as lead agency must issue a Notice of Preparation (NOP) to inform trustee, the public, and responsible agencies of that decision. The purpose of the NOP is to provide information describing the Project and its potential environmental effects to those who may wish to comment regarding the scope and content of the information to be included in the EIR. Agencies should comment on such information as it relates to their statutory responsibilities in connection with the Project.

The project description, location, and environmental issue areas that may be affected by development of the proposed project are set forth below. The EIR will evaluate the project-specific and cumulative

impacts, identify mitigation measures that may be feasible to lessen or avoid such impacts, and identify alternatives to the proposed project.

SUBMITTING COMMENTS

Comments and suggestions as to the appropriate scope of analysis in the EIR are invited from all interested parties. Written comments or questions concerning the EIR for the proposed project should be directed to the environmental project manager at the following address by October 21, 2014. Please include the contact person's full name and address in order for staff to respond appropriately:

Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department
300 Richards Blvd., Third Floor, Sacramento, CA 95811
Telephone: (916) 808-2762
E-mail: DMahaffey@cityofsacramento.org

SCOPING MEETING

A public scoping meeting will be held on Thursday, October 9th, 2014 from 3:30 p.m. to 6:30 p.m. at the following location:

**Stanford Gallery
111 I Street
in Old Sacramento**

Responsible agencies and members of the public are invited to attend and provide input on the scope of the EIR. The scoping meeting will be conducted in an open house format. Written comments regarding relevant issues may be submitted at the meeting.

PROJECT LOCATION/SETTING

The Project is located in both the City of Sacramento and the City of West Sacramento and crosses the Sacramento River. The location is shown on the attached figure. The project area is approximately bounded by the I Street Bridge, the intersection of C Street with 3rd Street in West Sacramento, the intersection of Bercut Drive with Railyards Boulevard (under construction) in the Railyards planned development, Jibboom Street, and the I Street/I-5 onramp near 3rd Street in Sacramento.

PROJECT DESCRIPTION

The proposed I Street Bridge Replacement Project would be constructed north of the existing I Street Bridge as shown in the attached location map. The Project would include the construction of a new bridge across the Sacramento River between the Sacramento Railyards and the West Sacramento Washington planned developments. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento. The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at

Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. The levee maintenance road in West Sacramento will intersect at grade with the new crossing.

The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished.

The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered under separate CEQA/NEPA review.

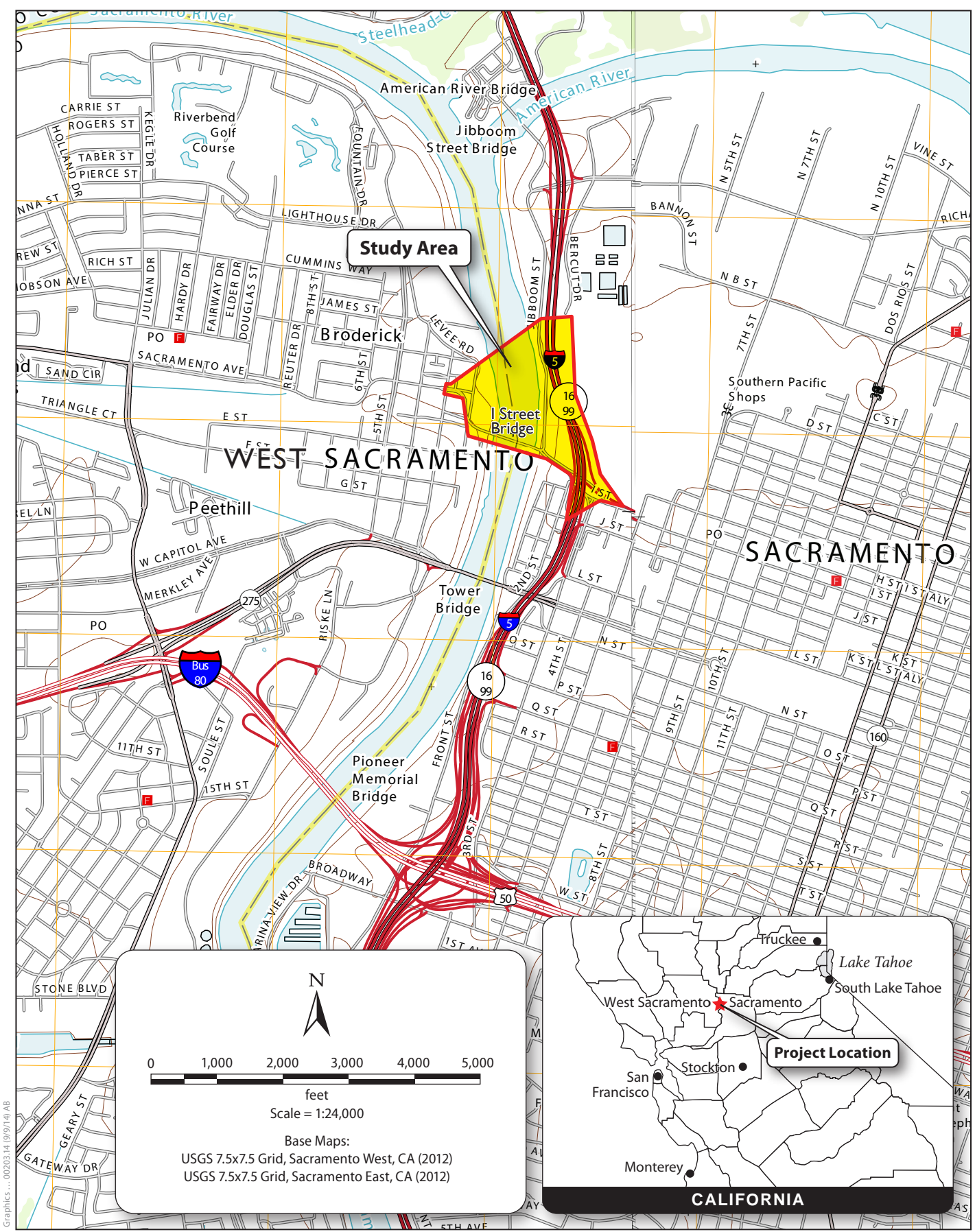
Additional information and materials relating to the proposed project are available on the City's website at <http://portal.cityofsacramento.org/Public-Works/Engineering-Services/Projects/Current-Projects/I-Street-Bridge-Replacement>.

ENVIRONMENTAL EFFECTS AND SCOPE OF THE EIR

The EIR will analyze potentially significant impacts that could result from construction and operation of the Project. Pursuant to section 15063(a) of CEQA Guidelines, an Initial Study has not been prepared for the Project. The EIR will evaluate the full range of environmental issues contemplated for consideration under CEQA and the CEQA Guidelines. The environmental factors that the City has determined would potentially be affected by the Project include:

- Transportation/Traffic
- Cultural Resources
- Hazards & Hazardous Materials
- Biological Resources
- Greenhouse Gas Emissions
- Hydrology/Water Quality
- Land Use/Planning
- Aesthetics
- Noise
- Recreation

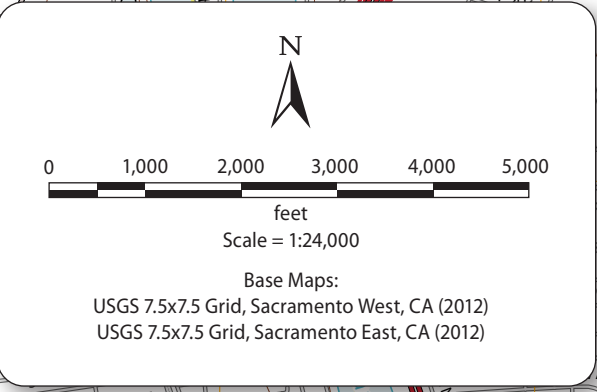
The EIR will identify and evaluate alternatives to the proposed project.



Study Area

WEST SACRAMENTO

SACRAMENTO



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Location Map

Letters Received in Response to Notice of Preparation



Edmund G. Brown Jr.
Governor

STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit



Ken Alex
Director

Notice of Preparation

September 22, 2014

To: Reviewing Agencies

Re: I Street Bridge Replacement Project: A New Bridge Over the Sacramento River
SCH# 2014092069

Attached for your review and comment is the Notice of Preparation (NOP) for the I Street Bridge Replacement Project: A New Bridge Over the Sacramento River draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Dana Mahaffey
City of Sacramento
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

**Document Details Report
State Clearinghouse Data Base**

SCH# 2014092069
Project Title I Street Bridge Replacement Project: A New Bridge Over the Sacramento River
Lead Agency Sacramento, City of

Type NOP Notice of Preparation
Description The project would include the construction of a new bridge across the Sacramento River between the Sacramento Railyards and the West Sacramento Washington planned developments. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Blvd. in Sacramento and would include a moveable center span to allow passage for watercraft. The existing I Street Bridge would continue to be used by the railroad. The existing Sacramento would be demolished.

Lead Agency Contact

Name Dana Mahaffey
Agency City of Sacramento
Phone (916) 264-5011 **Fax**
email
Address 300 Richards Blvd., 3rd Floor
City Sacramento **State** CA **Zip** 95811

Project Location

County Sacramento, Yolo
City Sacramento, West Sacramento
Region
Cross Streets C Street, West Sacramento
Lat / Long 38° 35' 11" N / 121° 30' 21" W
Parcel No. Various
Township 9N **Range** 4E **Section** **Base**

Proximity to:

Highways I-5, I-80
Airports
Railways UPRR
Waterways Sacramento & American Rivers
Schools Elkhorn ES, Wayne Geri...
Land Use West Sacramento: Recreation/Parks, Waterfront
Sacramento: American River Parkway, Heavy Industrial

Project Issues Aesthetic/Visual; Air Quality; Archaeologic-Historic; Biological Resources; Flood Plain/Flooding; Geologic/Seismic; Noise; Public Services; Recreation/Parks; Soil Erosion/Compaction/Grading; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Wetland/Riparian; Landuse; Cumulative Effects

Reviewing Agencies Resources Agency; Department of Boating and Waterways; Central Valley Flood Protection Board; Office of Historic Preservation; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 2; Native American Heritage Commission; Public Utilities Commission; State Lands Commission; California Highway Patrol; Caltrans, District 3 S; Air Resources Board; Transportation Projects; Regional Water Quality Control Bd., Region 5 (Sacramento)

Date Received 09/22/2014 **Start of Review** 09/22/2014 **End of Review** 10/21/2014

NOP Distribution List

County: Sacramento & Yolo

SCH# 201405069

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Environmental Document Coordinator
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- RWQCB 3
Central Coast Region (3)
- RWQCB 4
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- RWQCB 5F
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- RWQCB 6
Lahontan Region (6)
- RWQCB 6V
Lahontan Region (6)
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- RWQCB 8
Santa Ana Region (8)
- RWQCB 9
San Diego Region (9)

- Other _____
- _____
- _____
- _____
Conservancy

From: john@goldengatesalmon.org [<mailto:john@goldengatesalmon.org>]

Sent: Monday, October 06, 2014 11:14 AM

To: Ciara Zanze

Subject: [FWD: I Street Bridge Replacement Project - Environmental Scoping Meeting Thursday October 9]

Hi Ciara

The email below was forwarded to me. I don't know if this email will reach the intended targets but any discussion of rebuilding any bridge over the Sacramento River should take into account the damage that night lighting of the river below can have on ESA-listed salmon as well as other fish. Here's a link to a piece I wrote on the issue <http://www.redding.com/opinion/john-mcmanus-lights-on-the-river-kill-salmon>

Attached is a document with a more detailed discussion of the problems associated with lights illuminating the Sacramento River at night. I would hope these concerns will be proactively addressed as the planning for the replacement structure proceeds. Thanks.

John McManus
Executive Director
Golden Gate Salmon Association
650-218-8650

DRAFT

D.6. Project: Eliminate or reduce lighting at in-river structures.

Relevant Stressor Reduction Target: To reduce predation on juvenile salmon.

Action: This project proposes to reduce night-time predation in the vicinity of man-made structures in the rivers and Delta (e.g., fish screens, bridges, docks, marinas) by eliminating or altering lighting methods and equipment.

Expected Outcome: Reduced predation, increased fish survival, increased fish production.

Background: Artificial night-time lighting at structures near water is believed to have adverse impacts on juvenile salmon by altering fish behavior and making the fish more prone to predation. For example, in 1984, the U.S. Fish and Wildlife Service and the California Department of Fish and Game (DFG) requested that the U.S. Bureau of Reclamation turn off large sodium vapor lights on top of the Red Bluff Diversion Dam on the Sacramento River to reduce the opportunities for Sacramento pikeminnow predation on juvenile salmon passing the dam (Vogel and Smith 1984), a measure that was ultimately believed to be beneficial for salmon (Vogel *et al.* 1988). More recently DFG identified a potentially severe problem with lighting on the Sundial pedestrian bridge (Figures D.6.1 and D.6.2) over the Sacramento River in Redding:

Assessment of the impacts from light sources along the Sacramento River which lead to increased predation on juvenile salmonids is also needed. The most upstream issue is the Sundial Bridge in Redding which uses numerous flood lights which illuminate the Sacramento River all night long every night of the year. Approximately 80% of the winter-run Chinook salmon population in the state spawn upstream of the bridge and the out-migrating juveniles must pass through the lighted portion of the river below the bridge and face predators. Studies in Washington State have found lighted portions of streams have significantly higher predation rates on juvenile fish. Downstream of the Sundial Bridge from Redding to the bay, there are several other light sources ranging from highway bridges to lighted water intake structures. These should all be evaluated and recommendation should be developed to fix identified problems (DFG 2011).

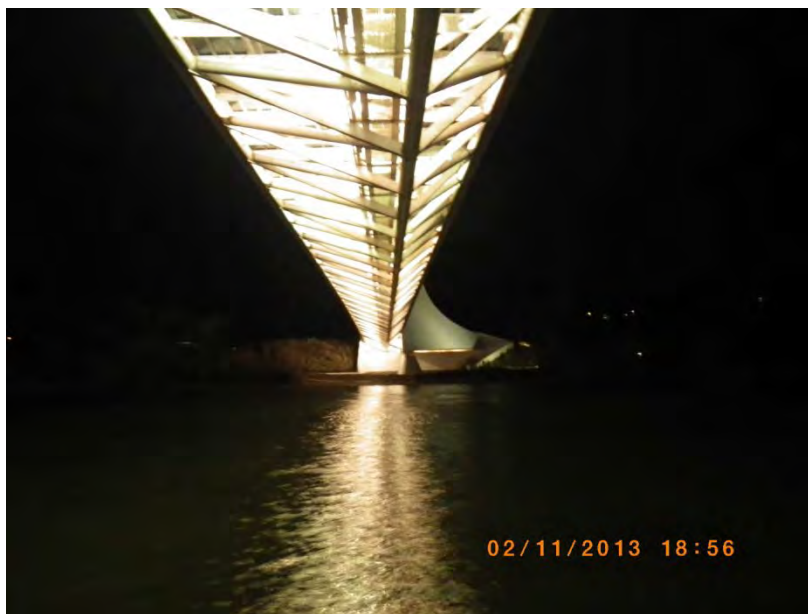
The primary purpose of the Sundial Bridge is aesthetics. The massive array of lights shining directly down on the river all night posed significant risks to fry and juvenile salmon. At night, the structure was likely causing mortality of young fish, including threatened and endangered species. Fortunately, in mid 2013 the city of Redding, working with the California Department of Fish and Wildlife, greatly reduced the lights to the point where they are believed to no longer pose a significant threat to salmon.

The Sacramento River between Redding and the Delta has dozens of structures over or immediately adjacent to the river illuminated at night which may disrupt the downstream migration of juvenile salmon and make the fish more susceptible to predation. The cumulative impact on rearing or migrating salmon from the upper rivers to the Delta could be enormous.

Predators are known to take advantage of lighting on bridges in the Pacific Northwest to prey on migrating salmonids (Nightingale and Simenstad 2002). The USFWS found that lighting on a bridge over the Cedar River in Washington state was having a severe adverse impact to migrating sockeye fry which was largely eliminated by adding shielding over the lights directing light away from the river (Washington DOT 2001). This problem may be particularly severe in the Sacramento River and its tributaries because of relatively clear-water conditions. Those structures having a federal nexus and creating adverse impacts on salmon caused by nighttime lighting may constitute “take” of federally listed species under the Endangered Species Act.



Figure D.6.1. Before photos of the Sundial pedestrian bridge over the Sacramento River in Redding at night. Photo credit: Eric Cassano.





After shot of the Sundial bridge showing reduced lighting

Longcore and Rich (2010) identified several options for addressing light pollution and its impacts on the environment:

- 1) Determination if the need for lighting is actually needed,
- 2) Direct the light toward where it is needed and eliminate light escaping in other directions,
- 3) Reduce excess intensity of lighting to more-appropriate levels,
- 4) Reduce the duration of night-time lighting and,
- 5) Eliminate full spectrum light and use other wavelengths less disruptive to the ecosystem.

Opportunities and Challenges: This project proposes to eliminate or reduce night-time lighting at structures over or adjacent to the Sacramento River and its tributaries to reduce predation on juvenile salmon. Many structures possess night-time lighting that could likely be simply turned off due to a lack of real need. Some structures possessing night-time lighting for security purposes could be altered to provide motion sensor activation. Many structures could probably be altered by directing the lighting away from shining directly down into the river, shielding the fixtures, using less-disruptive wavelengths or lower-intensity lighting.

This project will require an initial study identifying structures lit at night and the relative risks to salmonids. The outcome of that study would lead to implementation of a program to eliminate or reduce impacts of night-time lighting on salmon.

Cost or Difficulty: The estimated cost for an initial study to identify structures posing risks to salmon from night-time lighting is \$150,000. Owners of facilities lit up at night near water are

initially unlikely to be willing to turn off their lights at night, physically alter the lighting, or change the methods of lighting; associated costs and security will be of concern. Opposition from owners of night-time lit structures will require education on the need for change in lighting methods or equipment. In some instances, lighting changes may result in cost savings due to lower power consumption. The cost for implementation of remedial actions to eliminate or reduce night-time illumination is unknown until after the initial survey is completed.

Certainty: High probability of reducing night-time predation near man-made structures in the rivers and Delta.

References:

California Department of Fish and Game. 2011. Draft Conservation Strategy for Restoration of the Sacramento – San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions. July 2011. 336 p.

Longcore, T. and C. Rich. 2010. Light pollution and ecosystems. Available online at: http://www.actionbioscience.org/environment/longcore_rich.html

Nightingale, B. and C. Simenstad. 2002. Artificial night-lighting effects on salmon and other fishes in the Northwest. Ecological consequences of artificial night lighting: conference abstracts. February 23 – 24, 2002. Los Angeles, CA.

Vogel, D.A., K.R. Marine, and J.G. Smith. 1988. Fish passage action program for Red Bluff Diversion Dam. Final Report on Fishery Investigations. U.S. Fish and Wildlife Service Report No. FR1/FAO-88-19. Fisheries Assistance Office, U.S. Fish and Wildlife Service. October 1988. 77 p.

Vogel, D.A. and J.G. Smith. 1984. Fish passage action program for Red Bluff Diversion Dam. Annual progress report. USFWS Report No. FR1/FAO-85-4. Fisheries Assistance Office, U.S. Fish and Wildlife Service. December 1984. 72 p. plus appendices.

Washington State Department of Transportation. 2001. Cedar River salmon saved by shielding light fixtures. Signals maintenance shapes salmon solution. Northwest Region, Bulletin 01-12. March 23, 2001.

From: jesales@surewest.net [<mailto:jesales@surewest.net>]
Sent: Wednesday, October 08, 2014 11:38 AM
To: Tom Buford; Dana Mahaffey
Subject: Fwd: IDA Statement on Nobel Prize for Physics

As noted below -

IDA recommends a correlated color temperature (CCT) of 3000 Kelvin or less for white LED lighting systems. ... see statement attached.

This would be a good standard to include in lighting portions of the zoning code or even better the Outdoor Lighting section of our zoning code (like Citrus Heights).

See IDAs - [Blue Rich White Light Paper](#) ---

- <http://www.darksky.org/assets/documents/Reports/IDA-Blue-Rich-Light-White-Paper.pdf>

[Seeing Blue](#) ----

<http://www.darksky.org/assets/documents/SeeingBlue.pdf>

[Blue Light Threatens Animals and Humans](#) ---

- http://www.darksky.org/assets/documents/PR/2009/PR_Blue_White_Light.pdf

A compromise that would be the upper limit could be a correlated color temperature (CCT) of 3000 Kelvin.

An incandescent lamp is normally rated at a CCT of 2700 Kelvin and nearly all LED lamps in Home Depot/Lowe's etc. are 2700K.

As noted below "energy-efficient nature of LEDs encourages the use of excessive amounts of light", this is an issue that must be addressed.

Close to home dimming and other lighting controls have been pioneered by the California Lighting Technology Center at UC Davis. <http://cltc.ucdavis.edu>

Directors Michael Siminovitch and Konstantinos (Kosta) Papamichael have been at the forefront of dimming and concern about blue light.

Please have a look around the CLTC web site and see some of the projects they have been doing at Davis and other campuses.

Regards

Jack Sales



OPEN HOUSE COMMENT CARD

Please share your thoughts, comments, or questions about the project or potential environmental effects

First input of hard copy regarding
light on the river and impact on salmon
"light on the River kills salmon"
I present 6 different cases of
light and predation of salmon

Name Jack Sales
email jesales@surewest.net
phone 916-726-7405

You may submit your comments to staff tonight or directly to Ciara Zanze at czanze@aimconsultingco.com or fax (916) 442-1186.

Submission #
Subject: Puntledge River

Puntledge River 5th. St. Bridge, Courtenay B.C., Poster - used as display and introduction

Comments, Notes, Internet locations (URLs)

Experimental Attempts to Reduce Predation by Harbor Seals on Out-Migrating Juvenile Salmonids
H.Yurk, A.W.Trits American Fisheries Society 129: 1360-1366, 2000

Evaluation of an Electric Barrier as a Deterrent on the Puntledge River (Draft) (Selected pages
referencing "lighting")

Prepared by Pacific Salmon Commission, Vancouver B.C. Canada December 2008

Scan of printed content provided by Jack Sales follows.

Puntledge River

5th. St. Bridge, Courtenay, B.C.

The Puntledge River was historically one of the largest producers of chinook salmon in British Columbia. However, by 1995, only 208 chinook salmon returned.

At one time harbor seals congregated under artificial lights to eat juvenile salmonids as they migrated downstream, turning the lights off reduced predation.



Harbor seals *Phoca vitulina* in the Puntledge River regularly position themselves side by side, ventral side up, in the upstream shadow of two bridges near the light-shadow boundary. The seals swim against the river current and hold their position in the water. Minimal movements of their hind flippers cause no apparent disturbance to the surface waters. This feeding strategy allows the seals to form an almost continuous barrier so they can intercept smolts that drift downstream near the surface. The seals are assisted in their feeding efforts by the bridge and sports lights that illuminate the water surface. It was estimated that harbor seals consumed an average of 140,000 chum salmon fry and 13,000 coho salmon smolts per night in 1994.

The Puntledge River was historically one of the largest producers of chinook salmon in British Columbia. However, by 1995, only 208 chinook salmon returned to spawn (Trites at al. 1996).

Reference - *Experimental Attempts to Reduce Predation by Harbor Seals on Out-Migrating Juvenile Salmonids*, H. YURK & A. W. TRITES, 2000

----- Puntledge River Comments -----

Experimental Attempts to Reduce Predation by Harbor Seals on Out-Migrating Juvenile Salmonids, H. Yurk, A. W. Trites, 2000

NOTE Discussion of lighting and the failure to recognize lighting as the root cause.

URL = <http://www.zoology.ubc.ca/~consort/pdfs/YurkTrites2000-sealpredation.pdf>

URL = <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=69621>

URL = <http://www.tandfonline.com/doi/abs/10.1577/1548-8659%282000%29129%3C1360%3AEATRPB%3E2.0.CO%3B2#preview>

Evaluation of an Electric Barrier as a Seal Deterrent on the Puntledge River (Draft) December 2008

Pages 1, 12, 13, 18

URL = http://www.nwd-wc.usace.army.mil/tmt/documents/FPOM/2010/2010_FPOM_MEET/2010_MAR/Seal Fence Report_Dec8_1.pdf

Follow up comments required to show full context.

More?

Experimental Attempts to Reduce Predation by Harbor Seals on Out-Migrating Juvenile Salmonids

H. YURK*

Marine Mammal Research Unit, Fisheries Centre, University of British Columbia,
6248 Biological Sciences Road, Vancouver, British Columbia, Canada V6T 1Z4, and
Vancouver Aquarium Marine Science Centre,
Post Office Box 3232, Vancouver, British Columbia, Canada V6B 3X8

A. W. TRITES

Marine Mammal Research Unit, Fisheries Centre, University of British Columbia,
6248 Biological Sciences Road, Vancouver, British Columbia, Canada V6T 1Z4

Abstract.—During spring, harbor seals *Phoca vitulina* feed at night under two bridges spanning the Puntledge River in Courtenay, British Columbia, Canada. Positioned parallel to one another, ventral side up, the seals form a feeding line across the river to intercept thousands of out-migrating salmonid smolts. During a 4-week observation period in the spring of 1996, we attempted to disrupt the seals' feeding patterns by (a) deploying a mechanical feeding barrier (cork line), (b) altering the lighting conditions (lights on a bridge were turned off), and (c) installing an acoustic harassment device. We found acoustic harassment to be the most effective feeding deterrent. Of the other two deterrents, turning off the bridge lights was more effective than deploying a cork line, which had little effect. Acoustic harassment devices appear to be the most effective, non-lethal means for protecting juvenile salmonids from harbor seal predation in portions of the Puntledge River.

Natural predators that prey upon both out-migrating and returning anadromous fish can detrimentally affect the survival of depressed fish populations (Bigg et al. 1990; Fraker 1994; Olesiuk et al. 1995). In the northeast Pacific, seals and sea lions are commonly observed feeding on returning adult Pacific salmon *Oncorhynchus* spp. in rivers and estuaries during summer and fall (Spalding 1964; Olesiuk et al. 1990). Seals also intercept out-migrating smolts in spring and early summer (Olesiuk et al. 1995). Among the better-studied seal-salmon interactions are those in the Puntledge River on Vancouver Island, British Columbia (Bigg et al. 1990; Olesiuk et al. 1995; Trites et al. 1996; Figure 1).

Harbor seals *Phoca vitulina* in the Puntledge River regularly position themselves side by side, ventral side up, in the upstream shadow of two bridges near the light-shadow boundary. The seals

swim against the river current and hold their position in the water. Minimal movements of their hind flippers cause no apparent disturbance to the surface waters. This feeding strategy allows the seals to form an almost continuous barrier so they can intercept smolts that drift downstream near the surface. Apparently, the seals are assisted in their feeding efforts by the bridge lights that illuminate the water surface.

One way to enhance the survival of salmonids is to disrupt the feeding patterns of their predators. Techniques vary, but include making the smolts foul-asting, creating a mechanical barrier that prevents seals from entering estuaries or river systems, and installing optic or acoustic harassment devices (AHD) to hinder the seals from feeding in particular areas (Gearin et al. 1986; Mate and Harvey 1987; Pfeifer 1989).

The AHDs are generally considered to be effective in deterring seals and sea lions from preying on fish in certain areas. The widespread use of these devices by aquaculture operators, who use them to deter seals and sea lions from entering netpens, attests to this claim. The AHDs have also deterred a large number of California sea lions *Zalophus californianus* from preying on returning winter steelhead *Oncorhynchus mykiss* in the Chittenden Locks, Seattle, Washington (Fox et al. 1996). However, at aquaculture sites and at the Chittenden Locks, some pinnipeds appear to become acclimated to AHD sounds and may have to be physically removed (Fox et al. 1996).

The goal of our study was to disrupt the feeding patterns of harbor seals feeding on smolts in the Puntledge River. During an observation period in April and May 1996, we evaluated three methods: installation of a mechanical feeding barrier, alteration of artificial light on the river, and deployment of an AHD.

* Corresponding author: yurk@zoology.ubc.ca
Received November 29, 1999; accepted June 5, 2000

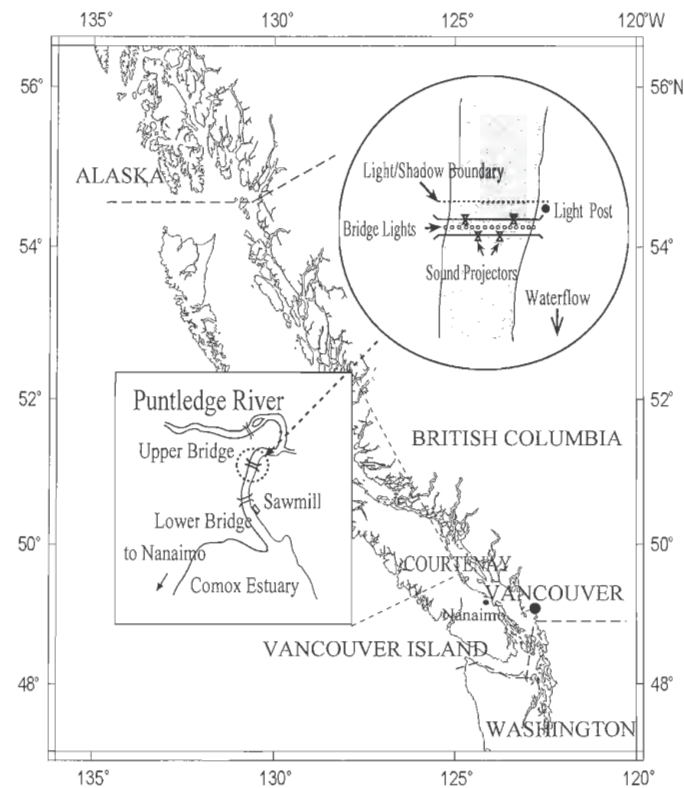


FIGURE 1.—Geographic area and detail map showing placement of sound projectors at the upper bridge on the Puntledge River, Courtenay, British Columbia.

Study Site and Background

The Puntledge River flows out of the north end of Comox Lake and continues through the city of Courtenay until it reaches Comox Harbor and the Strait of Georgia (Figure 1). Chinook salmon *O. tshawytscha*, pink salmon *O. gorbuscha*, coho salmon *O. kisutch*, and steelhead are raised at the

Puntledge River Hatchery and return to spawn in the Puntledge River system. The Puntledge River was historically one of the largest producers of chinook salmon in British Columbia. However, by 1995, only 208 chinook salmon returned to spawn (Trites et al. 1996).

Salmon smolts migrate out of the Puntledge River-

er from March to May (C. Beggs, Puntledge River Hatchery, personal communication). Each year, the migration period begins with pink salmon smolts in March and April, followed by smolts of chum salmon *O. keta* during April and the first half of May. These are followed by coho salmon smolts at the beginning of May and chinook salmon smolts during the second half of May. The outmigrating smolts are of both wild and hatchery origin. The hatchery annually releases 3,000,000–6,000,000 chum salmon, 150,000–400,000 coho salmon, and around 1,000,000 pink salmon. However, in the year of our study (1996), pink salmon smolts were released directly into the estuary, thereby reducing the number of smolts in the river.

Approximately 200 harbor seals (increasing to 700 during the fall) haul out on log booms in the estuary of the Puntledge River year round (Bigg et al. 1990; Jurk et al. 1997; Figure 1). A considerably smaller number of harbor seals enter the river to feed on salmon smolts during the spring (Olesiuk et al. 1995). Visual scans of the river show that the seals feed in two primary areas: under the upper bridge (5th Street) and under the lower bridge (17th Street; Figure 1).

Seals entered the river at around dusk; the majority arrived later in the evening when a clearly defined light-shadow boundary formed under the two bridges (Olesiuk et al. 1995). Illumination of the water at the upper bridge was produced by 14 lights hanging over the center line of the bridge above the roadway (Figure 1). Depending on the height of the river, which was tidally influenced, the lights produced a relatively distinct, straight light-shadow line on the water surface 8–12 m both upstream and downstream of the upper bridge (Figure 1). The lower bridge did not have a row of center lights and, therefore, did not have a similar light-shadow boundary.

Methods

We tested three methods of seal deterrence to determine whether any prevented the seals from feeding at the upper bridge, their primary feeding site. The first treatment at the upper bridge involved the temporary installation of a mechanical feeding barrier. We strung a 60-m rope that had cork floats spaced 1 m apart across the river beneath the bridge. Though we tried to place the rope along the shadow line, changes in tidal movements and river currents often caused it to move a few meters downstream (Figure 1). Therefore, we had to adjust the cork line several times during the experiment. For the second treatment, we extin-

guished all of the upper bridge lights for four nights (Figure 1). For the third treatment, we used two different AHDs: (1) the "Seal-Scarer," produced by Airmar Technology (New Hampshire), which was used in seven of the eight experiments, and (2) the "MK3 Seal Scrammer," produced by Ferranti Thompson, Ltd. (Dorset, UK), which was only used once as we did not receive it in time to conduct a thorough test of its effectiveness.

The Airmar Seal-Scarer device consisted of a control unit and four sound projectors that were each attached by 30 m of cable. The AHD was configured to produce broadband signals that pitched at 27 kHz and had a maximum source intensity at 10 kHz (194 decibels [dB], referenced to 1 Pa/V at 1 m from the sound source). The four sound projectors or transducers were suspended 40 cm below the water surface by ropes attached to floats. Attached to the bottom of each projector was a lead weight to ensure that the projectors remained upright and steady in the river current. The Airmar device was set to reach full intensity 1 min after being turned on. It then continuously alternated a 2-s sound burst through each of the transducers. The MK3 "Seal Scrammer" consisted of a control unit with one hydrophone-like transducer. It produced sounds ranging from 10 to 40 kHz and had a peak intensity at 27 kHz (195 dB).

The experiments were conducted by two observers in one 4-d period (two cork line treatments and two control nontreatments) and two 10-d periods (lights out, acoustic harassment, and control) during the nights of 22–26 April, 30 April–10 May, and 15–25 May 1996. We chose this study design after considering peak migration periods of smolts and the time that observers were available. Observations started each night at 2100 hours and ended at 0300 hours, for a total of 161 h of observation over 23 d. Treatment (experiment) and nontreatment (control) nights were randomly selected throughout the observation period. The number of treatments during each observation period could not be kept constant because of a few nights of extreme rainy weather; bridge lights could not be turned off because of public safety concerns. In all, two experiments involved the mechanical feeding barrier (cork line), four experiments involved decreased illumination, and eight experiments involved an AHD. The total number of nontreatment (control) nights was nine.

The observers counted harbor seals every 30 min from the upper bridge decks with a red-filtered, 10⁶-candlepower spotlight to illuminate the river. Observers also counted seals at the lower

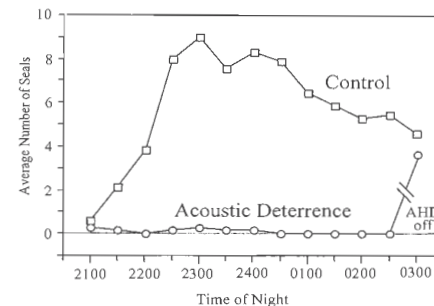


FIGURE 2.—Average number of seals present at the upper bridge on the Puntledge River, Courtenay, British Columbia, during count sessions on seven control nights and seven experimental nights when the Airmar acoustic harassment device was deployed. Note that the Airmar device was turned off at 0235 hours each experimental night.

bridge to determine whether the deterrents forced the animals to relocate. The maximum number of observations per night was 13 (Figure 2) at the upper bridge and 12 at the lower bridge. The seals were repeatedly counted by the two observers for a 5-min period; the highest number was retained as the best estimate of the number of animals present (counts by the two observers rarely differed). This procedure reduced the probability of underestimating the number of seals present.

We used a two-sample *t*-test to compare the mean number of seals present when the AHD device was deployed with the mean number present when no deterrent was used. The average number of seals present was calculated for each night of observation and treated as a single observation. Means of the nightly average number of seals were then calculated and compared for seven control nights and seven experimental nights.

Results and Discussion

On the control nights, when no deterrents were used, an average of 8 seals (range, 1–26) fed at the upper bridge. In contrast, we observed only 1 seal on average at the lower bridge (range, 0–8). During their nightly feeding routine, most seals appeared at the upper bridge 1.0–1.5 h after nightfall (between 2030 and 22:30 hours; Figure 2), and the majority appeared to stay until 0300 hours. The mean number of seals at the upper bridge rose from one at 2100 hours to nine at 2300 hours, dropping to an average of five by 0300 hours (Figure 2).

Seals started to appear downriver from the lower bridge earlier in the evening than at the upper bridge, but did not stay there long.

The presence of seals near the bridges did not always mean they were feeding. For example, a lack of head movement and absence of fish in the water column indicated that no feeding took place on the night of 23 April and that only sporadic feeding occurred on the night of 22 April. Feeding behavior also changed over the course of the study. From 24 April to 9 May, the seals stationed themselves at the water surface near the upstream shadow line and, with their ventral sides up, "gulped" the salmon fry (mainly chum salmon) that drifted downstream. After 15 May, the animals stayed further back in the bridge's shadow and more actively pursued their prey (mainly coho salmon smolts).

Olesiuk et al. (1995) estimated that harbor seals consumed an average of 140,000 chum salmon fry and 13,000 coho salmon smolts per night in 1994. We did not remeasure the feeding rates because we were concerned that illuminating the animals with a red spotlight for long stretches of time might affect their behavior and confound our experiment. In contrast to Olesiuk et al. (1995), we observed a behavioral response to the red light: the seals often moved away and seemed sensitive near the light-shadow line of the spotlight. Our procedure of continuous counts during a 5-min period paid special attention to the possibility of animals avoiding the spotlight.

Tidal heights and freshwater flow influenced

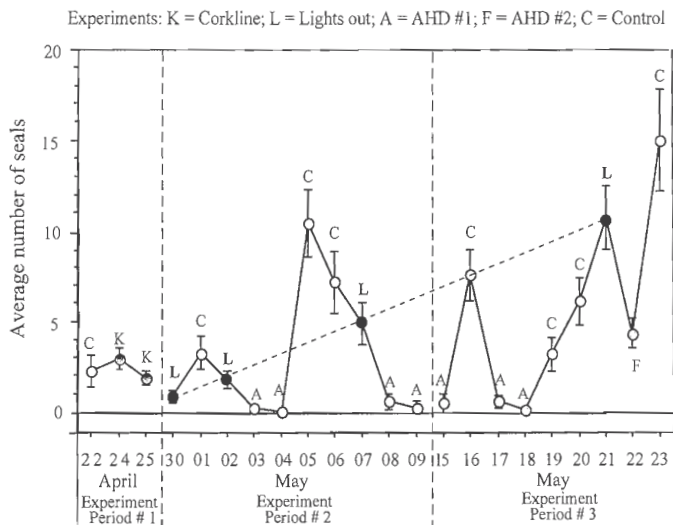


FIGURE 3.—Average number of seals present at the upper bridge on the Puntledge River, Courtenay, British Columbia, on each observation night. Seals were counted every 30 min, for a total number of 13 counts/night (bars = \pm SE). Letter symbols indicate the type of treatment applied.

feeding activities at the upper bridge. During extreme low tides, the water depth was below 1.5 m. Our observations found that the seals did not attempt to feed until the tide raised the river to almost 2 m. Tidal heights were estimated by comparing hydrographic charts of the river with tidal heights published in regional tide tables. However, our estimates neither took into account the amount of runoff from the lake nor the effects of variable rainfall. During the first 2 weeks of observations in 1996, rainfall exceeded the annual average and caused the Puntledge River to flow faster and at a higher level than normal. This seemed to affect feeding; we did not observe seals feeding on nights of extreme rainfall.

Spot checks along the river away from the bridges revealed a number of seals feeding in areas illuminated by other light sources. For example, we observed as many as seven seals feeding in a stretch of river that was lit by halogen lights from

a ballpark at Lewis Park (upstream of upper bridge). In addition, halogen lights used by a sawmill (below the lower bridge) illuminated another area frequented by feeding seals.

Treatment 1: Cork Line

At the upper bridge, we deployed the cork line on two nights for an average of 3 h each night (Figure 3). Within 1 h of setting the cork line on the first night, the number of seals feeding at the lower bridge increased from one to four. As the night progressed, the number of seals at the lower bridge steadily dropped and more seals began appearing next to the cork line at the upper bridge. On the following night, we deployed and retrieved the cork line twice. The animals were not at either bridge during the first deployment and did not seem to be disturbed by the second deployment. A drop in the number of seals toward the end of the second deployment suggested a mild response

TABLE 1.—Number of harbor seals counted at the upper bridge on 7 control nights and 7 nights when the acoustic harassment device (AHD) was deployed. The means (standard deviations) for the control and AHD nights were 7.57 (2.96) and 0.36 (0.20), respectively.

Night	Control	AHD
1	3.31	0.23
2	10.46	0.08
3	7.23	0.62
4	7.62	0.31
5	3.23	0.54
6	6.15	0.62
7	15.00	0.15

to the deterrent. However, the seals that remained appeared to engage in some form of play with the cork line. We concluded that though the cork line had a short-term initial effect on the seals, the animals were quick to habituate to it. We did not attempt any further trials with the cork line after these two nights of testing.

Treatment 2: Lights Out

Fewer seals were observed feeding the first night we turned off the lights at the upper bridge compared with adjacent control nights when the lights were left on (Figure 3). However, on subsequent experimental nights, we noted a progressive increase in the number of seals feeding in the residual light (closed circles in Figure 3; $F_{1,3} = 17.5$, $P = 0.05$). By the end of four experimental nights, numbers appeared to reach and even exceed those observed during comparable control nights (Figure 3). Although we do not know whether the reduced light affected their feeding efficiency, the results of this experiment suggest that the seals learned to compensate for the reduced lighting by making effective use of the residual city lighting. Therefore, we concluded that, though the "lights-out" treatment was initially effective as a deterrent, the seals eventually habituated to the lighting change.

Treatment 3: Acoustical Deterrence

Significantly fewer seals fed at the upper bridge on the seven nights we deployed the Airmar device compared with seven control nights when no deterrent was used ($t_{12} = 4.60$, $P = 0.001$; Figures 2, 3, Table 1). A mean of 0.4 animals was present during the acoustical tests (range, 0–1) compared with a mean of 8 animals on control nights (range, 0–26). On most experimental nights, no seals fed within a 50-m radius of the bridge.

The first two nights we deployed the Airmar device at the upper bridge, significantly more seals

appeared at the lower bridge than were previously counted on control nights and during the lights-out experiment. On subsequent experimental nights, the numbers dropped steadily at the lower bridge until no seals were observed feeding there. We presume this drop in numbers at the lower bridge reflected poor feeding conditions at this location.

Conclusions

Our results show that AHDs were the most effective of the three methods tested to deter seals from feeding on salmon smolts in the Puntledge River. Extinguishing the bridge lights was the second most effective deterrent, followed by the cork line, which had little, if any, effect. The upper bridge appeared to be the preferred feeding site for the harbor seals, as lighting and river topography at this bridge are probably ideal for optimal foraging success. Given that it is doubtful that all incandescent light sources around this bridge can be extinguished, acoustic deterrence could be used to control predation during the months of April and May.

The AHDs are effective within a limited range, but cannot prevent seals from entering the river or from moving or feeding in other areas of the river. The seals only have to swim with their heads out of the water to avoid the underwater noise. By installing AHDs at the Chittenden Locks in Seattle, Washington, the number of sea lions feeding on returning steelhead decreased over the course of 2 years (Fox et al. 1996). Similarly, AHDs could be effective for deterring seals in the Puntledge River and other salmon-producing streams until better measures to protect salmonids are implemented. However, acoustic deterrence can probably only be used as a temporary predation-control mechanism because pinnipeds have a strong ability to learn and adapt to sounds (Fraker 1994). For example, changes in the abundance and availability of prey may lead to motivational changes in pinniped behavior (from avoiding AHDs to ignoring them). Therefore, the effectiveness of the AHDs in the Puntledge River should be tested again during spring out-migrations and, possibly, during fall returns. Hopefully, the Department of Fisheries and Oceans, which is responsible for protecting salmon and seals in Canada, will undertake the necessary steps to continue testing the effectiveness of AHDs.

Acknowledgments

We thank our field assistant, Christy Wilson, for the many hours she spent in darkness and pouring

rain watching and counting seals. Also, we are grateful to Graeme Ellis and George Horonowitsch of the Pacific Biological Station, Department of Fisheries and Oceans (DFO), for their relentless efforts to provide the necessary equipment and logistics to plan and execute this study. We would also like to thank Steven Christensen from Airmar Technology, Ltd., and John Ace-Hopkins from Ferranti-Thompson, Ltd., for lending us their AHDs; and Harry Genoe, Chris Beggs, and the staff of the Puntledge River Hatchery for providing boats, technical assistance, and manpower during the study, as well as the City of Courtenay for helping us turn on and off the bridge lights. Furthermore, we would like to thank the Institute of Ocean Sciences, DFO, for providing hydrographic charts of the river. We also thank John Ford for his advice on the design of the study and for allowing us to use his laboratory at the Vancouver Aquarium Marine Science Centre to analyze data. A.W.T. was supported in part by the North Pacific Marine Science Foundation through the North Pacific Universities Marine Mammal Research Consortium. Finally, we would like to thank Jim Boutilier and the Department of Fisheries and Oceans for providing the funds to conduct this study, and Lance Barrett-Lennard, David Rosen, Bruce Wright, and two anonymous reviewers for their comments on earlier drafts of this manuscript.

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**Evaluation of an Electric Barrier as a Seal Deterrent
on the Puntledge River**

Prepared For

Pacific Salmon Commission
Southern Boundary Restoration & Enhancement Fund Committee
600 - 1155 Robson Street
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December 2008

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4. RESULTS

4.1 Baseline Observations

Following observations and assessments conducted in the 1990s on seal predation on outmigrating fry and smolts (Olesiuk et al. 1995), it was strongly recommended that shielding of the lights at the 5th and 17th Street bridges should be evaluated as a mitigative measure to deter seals from foraging beneath them. Predation on outmigrants was determined to be a relatively localized behaviour. With assistance from the City of Courtenay, modifications to the lights on the 5th Street bridge were finally completed in the fall of 2007. This included turning off every second light on the bridge truss above the road, and erecting a shield around the remaining lights to prevent light from spilling beyond the bridge deck and into the river, significantly reducing the light shadow used by foraging seals.

Observations of seal foraging behaviour were collected by Puntledge Hatchery personnel during the months of April and May 2008 (before the arrays began operating and during their operation) at 5 main areas of the Puntledge / Courtenay River: Condensory Road bridge, Lewis Park tennis courts, 5th Street bridge, Central Builders, and the 17th Street bridge using night vision equipment (see Figure 1). Observations were conducted between dusk and dawn and during favourable tides (when seals typically enter the river for foraging at the 5th Street bridge). The 2008 observations are compared to 2007 observations collected during the same months and illustrated in Figure 4.

It appears that the light shields were effective in reducing the number of seals feeding under the 5th Street bridge. For the period prior to the start of the electric fence trial on April 27, the maximum number of seals observed on any given monitoring event was 4 in 2008 compared to 9 in 2007 and 10 in 2006. The average number of seals observed during this period was 5.2 in 2006, 3.7 in 2007 and 0.7 in 2008. It was noted that the light shields appeared to have eliminated the distinct shadow line where seals have congregated to feed on outmigrating juveniles in past years. Seals may have been displaced to other well lit areas of the river to feed such as the tennis courts (upstream) or the area adjacent Central Builders (downstream). A comparison of 2007 and 2008 observations at the Lewis Park Tennis Courts provides limited information due to the disproportion in sampling effort between the 2 years (Figure 5). No observations were collected at the Central Builders site downstream of the 5th Street bridge in 2007 for comparison. These comparisons do not take into account other variables that may have influenced seal activity such as tide level and river discharge.

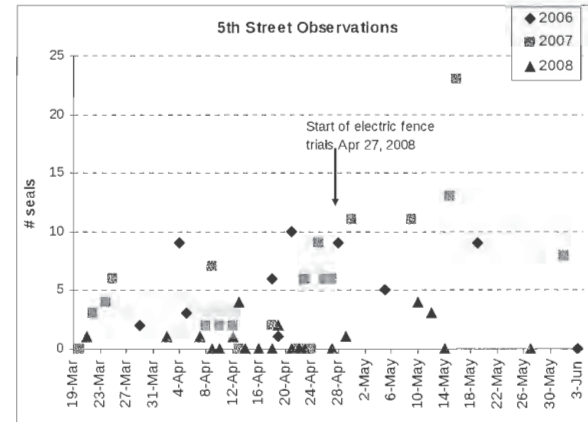


Figure 4. Observations of seals in the Courtenay River at the 5th Street bridge between April and June before lights were shielded (2006-2007) and after (2008). Commencement of the 2008 electric deterrent trials is noted. Trials in 2007 were conducted on April 12-13 and April 23-25

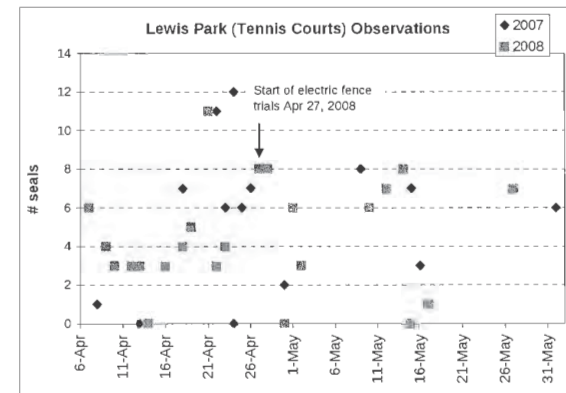


Figure 5. Observations of seals in the Courtenay River at the Lewis Park Tennis Courts (upstream of the 5th Street bridge), between April and June before lights were shielded (2007) and after (2008). Commencement of the 2008 electric deterrent trials is noted. Trials in 2007 were conducted on April 12-13 and April 23-25.

Pulse width settings greater than 3 msec appeared to cause physiological stress in the seals that were exposed to this electric field, leading the project team to recommend an upper threshold of 3 msec for future trials.

The effectiveness of the barrier was dependent on the strength of the field provided by the pulse width parameter, but may also have been dependent on the environmental conditions during which the array was operated. As the river depth over the array increased due to tidal inundation and increased discharge, the electric field weakened at the surface, potentially creating openings in the electric barrier that seals would quickly learn and habituate to. (data pending from SR).

While the barrier may be considered effective at deterring the upstream movement of a large proportion of seals that approached it, it was noted that even at the highest electrical field strengths tested some seals continued to challenge the array exposing themselves to significant physiological stress and potentially harmful levels. The commencement of trials at the lowest pulse width setting (1 msec) and ramping up gradually to higher levels (4-5 msec) has been criticized by Dr Jennifer Hurley, who has considerable experience with captive sea lions, as essentially training seals to tolerate the electrical stimulus, and charge through the array at levels that may be harmful. However, the gradual ramping up of field strength was necessary to determine the upper threshold for invoking an acceptable behavioural response in seals.

Based on the DIDSON images and shoreline observations there was no apparent effect of the electrical field on juvenile salmon migration behaviour at the levels tested. Conversely, upstream migrating adults appeared to have been obstructed at levels that were considered effective at deterring seals. The delay and/or obstruction of 11 of 14 adult salmon targets in DIDSON imagery recorded on May 18 lead to the conclusion that operation of the electric deterrent at a setting that affects the upstream passage of seals (3msec) adversely affects the migratory behaviour of adult salmon. Therefore, with respect to the second objective, the current technology may only be useful at reducing seal predation on juvenile salmon smolts and fry in localized foraging areas and preventing naive seals from accessing feeding areas further upstream during a brief operating window (late April to mid May). Even during this period, there remains the potential that operation of an electric barrier in the Courtenay River to reduce predation on outmigrating juvenile salmonids will overlap with migrating adults (late steelhead migrants and early summer chinook migrants).

→ The displacement of seals from the 5th Street bridge area to other foraging areas downstream continues to be an issue where lighting provides the distinctive shadow that seals utilize to their advantage such as the Central Builders parking lot downstream of the 5th Street bridge and the 17th Street bridge. Periodic observations at these two locations identified between 8 and 24 seals. Light shielding at the 5th Street bridge installed in 2007 appears to have significantly reduced the number seals foraging at this location. Efforts to design similar solutions in other well lit sections of the river should be explored with the City of Courtenay, Ministry of Transportation and other riverside property owners as this treatment seems to have a positive effect at reducing the number of seals from these areas.

Submission #1
Subject: Ecological Light Pollution General

Ecological Consequences of Artificial Night Lighting By Catherine Rich, Travis Longcore is now at the Sacramento Public Library under Call Number 577.272 E19 2006

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CONCEPTS & THEORY
The influence of artificial light on stream and riparian ecosystems: questions, challenges, and perspectives
Elizabeth K. Perkin, Franz Hölker, John S. Richardson, Jon P. Sadler, Christian Wolter, and Klement Tockner 2011. The influence of artificial light on stream and riparian ecosystems: questions, challenges, and perspectives. *Ecosphere* 2:art122
<http://www.esajournals.org/doi/pdf/10.1890/ES11-00241.1>

Bright lights, big city: influences of ecological light pollution on reciprocal stream-riparian invertebrate fluxes.
<http://www.ncbi.nlm.nih.gov/pubmed/24147405>

Cloud Coverage Acts as an Amplifier for Ecological Light Pollution in Urban Ecosystems
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<http://www.darksky.org/light-pollution-topics/the-environment>
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REVIEWS REVIEWS REVIEWS

Ecological light pollution

Travis Longcore and Catherine Rich

Ecologists have long studied the critical role of natural light in regulating species interactions, but, with limited exceptions, have not investigated the consequences of artificial night lighting. In the past century, the extent and intensity of artificial night lighting has increased such that it has substantial effects on the biology and ecology of species in the wild. We distinguish "astronomical light pollution", which obscures the view of the night sky, from "ecological light pollution", which alters natural light regimes in terrestrial and aquatic ecosystems. Some of the catastrophic consequences of light for certain taxonomic groups are well known, such as the deaths of migratory birds around tall lighted structures, and those of hatchling sea turtles disoriented by lights on their natal beaches. The more subtle influences of artificial night lighting on the behavior and community ecology of species are less well recognized, and constitute a new focus for research in ecology and a pressing conservation challenge.

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As diurnal creatures, humans have long sought methods to illuminate the night. In pre-industrial times, artificial light was generated by burning various materials, including wood, oil, and even dried fish. While these methods of lighting certainly influenced animal behavior and ecology locally, such effects were limited. The relatively recent invention and rapid proliferation of electric lights, however, have transformed the nighttime environment over substantial portions of the Earth's surface.

Ecologists have not entirely ignored the potential disruption of ecological systems by artificial night lighting. Several authors have written reviews of the potential effects on ecosystems or taxonomic groups, published in the "gray" literature (Health Council of the Netherlands 2000; Hill 1990), conference proceedings (Outen 2002; Schmiedel 2001), and journal articles (Frank 1988; Verheijen 1985; Salmon 2003). This review attempts to integrate the literature on the topic, and draws on a conference organized by the authors in 2002 titled *Ecological Consequences of Artificial Night Lighting*. We identify the roles that artificial night lighting plays in changing eco-

logical interactions across taxa, as opposed to reviewing these effects by taxonomic group. We first discuss the scale and extent of ecological light pollution and its relationship to astronomical light pollution, as well as the measurement of light for ecological research. We then address the recorded and potential influences of artificial night lighting within the nested hierarchy of behavioral and population ecology, community ecology, and ecosystem ecology. While this hierarchy is somewhat artificial and certainly mutable, it illustrates the breadth of potential consequences of ecological light pollution. The important effects of light on the physiology of organisms (see Health Council of the Netherlands 2000) are not discussed here.

■ Astronomical and ecological light pollution: scale and extent

The term "light pollution" has been in use for a number of years, but in most circumstances refers to the degradation of human views of the night sky. We want to clarify that this is "astronomical light pollution", where stars and other celestial bodies are washed out by light that is either directed or reflected upward. This is a broad-scale phenomenon, with hundreds of thousands of light sources cumulatively contributing to increased nighttime illumination of the sky; the light reflected back from the sky is called "sky glow" (Figure 1). We describe artificial light that alters the natural patterns of light and dark in ecosystems as "ecological light pollution". Verheijen (1985) proposed the term "photopollution" to mean "artificial light having adverse effects on wildlife". Because photopollution literally means "light pollution" and because light pollution is so widely understood today to describe the degradation of the view of the night sky and the human experience of the night, we believe that a more descriptive term is now necessary. Ecological light pollution includes direct glare, chronically increased illumina-

In a nutshell:

- Ecological light pollution includes chronic or periodically increased illumination, unexpected changes in illumination, and direct glare
- Animals can experience increased orientation or disorientation from additional illumination and are attracted to or repulsed by glare, which affects foraging, reproduction, communication, and other critical behaviors
- Artificial light disrupts interspecific interactions evolved in natural patterns of light and dark, with serious implications for community ecology

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Figure 1. Diagram of ecological and astronomical light pollution.

tion, and temporary, unexpected fluctuations in lighting. Sources of ecological light pollution include sky glow, lighted buildings and towers, streetlights, fishing boats, security lights, lights on vehicles, flares on offshore oil platforms, and even lights on undersea research vessels, all of which can disrupt ecosystems to varying degrees. The phenomenon therefore involves potential effects across a range of spatial and temporal scales.

The extent of ecological light pollution is global (Elvidge *et al.* 1997; Figure 2). The first atlas of artificial night sky brightness illustrates that astronomical light pollution extends to every inhabited continent (Cinzano *et al.* 2001). Cinzano *et al.* (2001) calculate that only 40% of Americans live where it becomes sufficiently dark at night for the human eye to make a complete transition from cone to rod vision and that 18.7% of the terrestrial surface of the Earth is exposed to night sky brightness that is polluted by astronomical standards. Ecosystems may be affected by these levels of illumination and lights that do not contribute to sky glow may still have ecological consequences, ensuring that ecological light pollution afflicts an even greater proportion of the Earth. Lighted fishing fleets, offshore oil platforms, and cruise ships bring the disruption of artificial night lighting to the world's oceans.

The tropics may be especially sensitive to alterations in natural diel (ie over a 24-hour period) patterns of light and dark because of the year-round constancy of daily cycles (Gliwicz 1999). A shortened or brighter night is more likely to affect tropical species adapted to diel patterns with minimal seasonal variation than extratropical species adapted to substantial seasonal variation. Of course, temperate and polar zone species active only during a portion of the year would be excluded from this gen-

eralization. Species in temperate zones will also be susceptible to disruptions if they depend on seasonal day length cues to trigger critical behaviors.

■ Measurements and units

Measurement of ecological light pollution often involves determination of illumination at a given place. Illumination is the amount of light incident per unit area – not the only measurement relevant to ecological light pollution, but the most common. Light varies in intensity (the number of photons per unit area) and spectral content (expressed by wavelength). Ideally, ecologists should measure illumination in photons per square meter per second with associated measurements of the wavelengths of light present. More often, illumination is measured in lux (or footcandles, the non-SI unit), which expresses the brightness of light as perceived by the human eye. The lux measurement places more emphasis on wavelengths of light that the human eye detects best and less on those that humans perceive poorly. Because other organisms perceive light differently – including wavelengths not visible to humans – future research on ecological light pollution should identify these responses and measure light accordingly. For example, Gal *et al.* (1999) calculated the response curve of mysid shrimp to light and reported illumination in lux adjusted for the spectral sensitivity of the species.

Ecologists are faced with a practical difficulty when communicating information about light conditions. Lux is the standard used by nearly all lighting designers, lighting engineers, and environmental regulators; communication with them requires reporting in this unit. Yet the use of lux ignores biologically relevant information. High-pressure sodium lights, for instance, will attract moths because of the presence of ultraviolet wavelengths, while low-pressure sodium lights of the same intensity, but not producing ultraviolet light, will not (Rydell 1992). Nevertheless, we use lux here, both because of the need to communicate with applied professionals, and because of its current and past widespread usage. As this research field develops, however, measurements of radiation and spectrum relevant to the organisms in question should be used, even though lux will probably continue to be the preferred unit for communication with professionals in other disciplines.

Ecologists also measure aspects of the light environment other than absolute illumination levels. A sudden change in illumination is disruptive for some species (Buchanan 1993), so percent change in illumination, rate, or similar measures may be relevant. Ecologists may also measure luminance (ie brightness) of light sources that are visible to organisms.

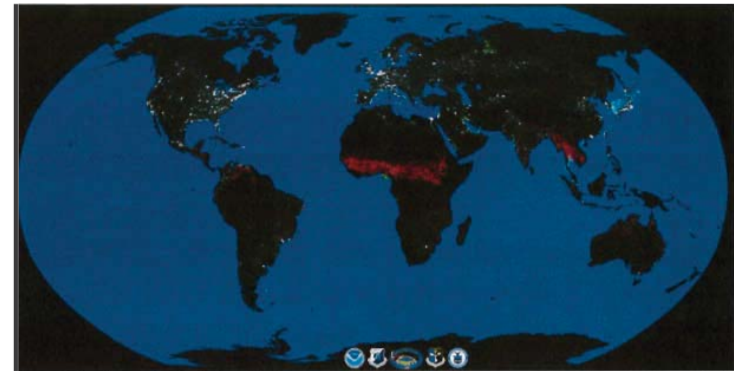


Figure 2. Distribution of artificial lights visible from space. Produced using cloud-free portions of low-light imaging data acquired by the US Air Force Defense Meteorological Satellite Program Operational Linescan System. Four types of lights are identified: (1) human settlements – cities, towns, and villages (white), (2) fires – defined as ephemeral lights on land (red), (3) gas flares (green), and (4) heavily lit fishing boats (blue). See Elvidge *et al.* (2001) for details. Image, data processing, and descriptive text by the National Oceanic and Atmospheric Administration's National Geophysical Data Center.

■ Behavioral and population ecology

Ecological light pollution has demonstrable effects on the behavioral and population ecology of organisms in natural settings. As a whole, these effects derive from changes in orientation, disorientation, or misorientation, and attraction or repulsion from the altered light environment, which in turn may affect foraging, reproduction, migration, and communication.

Orientation/disorientation and attraction/repulsion

Orientation and disorientation are responses to ambient illumination (ie the amount of light incident on objects in an environment). In contrast, attraction and repulsion occur in response to the light sources themselves and are therefore responses to luminance or the brightness of the source of light (Health Council of the Netherlands 2000).

Increased illumination may extend diurnal or crepuscular behaviors into the nighttime environment by improving an animal's ability to orient itself. Many usually diurnal birds (Hill 1990) and reptiles (Schwartz and Henderson 1991), for example, forage under artificial lights. This has been termed the "night light niche" for reptiles and seems beneficial for those species that can exploit it, but not for their prey (Schwartz and Henderson 1991).

In addition to foraging, orientation under artificial illumination may induce other behaviors, such as territorial singing in birds (Bergen and Abs 1997). For the northern mockingbird (*Mimus polyglottos*), males sing at night before mating, but once mated only sing at night in artificially

lighted areas (Derrickson 1988) or during the full moon. The effect of these light-induced behaviors on fitness is unknown.

Constant artificial night lighting may also disorient organisms accustomed to navigating in a dark environment. The best-known example of this is the disorientation of hatchling sea turtles emerging from nests on sandy beaches. Under normal circumstances, hatchlings move away from low, dark silhouettes (historically, those of dune vegetation), allowing them to crawl quickly to the ocean. With beachfront lighting, the silhouettes that would have cued movement are no longer perceived, resulting in disorientation (Salmon *et al.* 1995). Lighting also affects the egg-laying behavior of female sea turtles. (For reviews of effects on sea turtles, see Salmon 2003 and Witherington 1997).

Changes in light level may disrupt orientation in nocturnal animals. The range of anatomical adaptations to allow night vision is broad (Park 1940), and rapid increases in light can blind animals. For frogs, a quick increase in illumination causes a reduction in visual capability from which the recovery time may be minutes to hours (Buchanan 1993). After becoming adjusted to a light, frogs may be attracted to it as well (Joeger and Hallman 1973; Figure 3).

Birds can be disoriented and entrapped by lights at night (Ogden 1996). Once a bird is within a lighted zone at night, it may become "trapped" and will not leave the lighted area. Large numbers of nocturnally migrating birds are therefore affected when meteorological conditions bring them close to lights, for instance, during inclement weather or late at night when they tend to fly lower.



Figure 3. Attraction of frogs to a candle set out on a small raft. Illustration by Charles Copeland of an experiment in northern Maine or Canada described by William J Long (1901). Twelve or fifteen bullfrogs (*Rana caesbeiana*) climbed on to the small raft before it flipped over.

Within the sphere of lights, birds may collide with each other or a structure, become exhausted, or be taken by predators. Birds that are waylaid by buildings in urban areas at night often die in collisions with windows as they try to escape during the day. Artificial lighting has attracted birds to smokestacks, lighthouses (Squires and Hanson 1918), broadcast towers (Ogden 1996), boats (Dick and Donaldson 1978), greenhouses, oil platforms (Wiese et al. 2001), and other structures at night, resulting in direct mortality, and thus interfering with migration routes.

Many groups of insects, of which moths are one well-known example (Frank 1988), are attracted to lights. Other taxa showing the same attraction include lacewings, beetles, bugs, caddisflies, crane flies, midges, hoverflies, wasps, and bush crickets (Eisenbeis and Hassel 2000; Kolligs 2000; Figure 4). Attraction depends on the spectrum of light – insect collectors use ultraviolet light because of its attractive qualities – and the characteristics of other lights in the vicinity.



Figure 4. Thousands of mayflies carpet the ground around a security light at Millecoquins Point in Naubinway on the Upper Peninsula of Michigan.

Nonflying arthropods vary in their reaction to lights. Some nocturnal spiders are negatively phototactic (ie repelled by light), whereas others will exploit light if available (Nakamura and Yamashita 1997). Some insects are always positively phototactic as an adaptive behavior and others always photonegative (Summers 1997). In arthropods, these responses may also be influenced by the frequent correlations between light, humidity, and temperature.

Natural resource managers can exploit the responses of animals to lights. Lights are sometimes used to attract fish to ladders, allowing them to bypass dams and power plants (Haynes et al. 1984). Similarly, lights can attract larval fish to coral reefs (Munday et al. 1998). In the terrestrial realm, dispersing mountain lions avoid lighted areas to such a degree that Beier (1995) suggests installing lights to deter them from entering habitats dead-ending in areas where humans live.

Reproduction

Reproductive behaviors may be altered by artificial night lighting. Female *Physalaemus pustulosus* frogs, for example, are less selective about mate choice when light levels are increased, presumably preferring to mate quickly and avoid the increased predation risk of mating activity (Rand et al. 1997). Night lighting may also inhibit amphibian movement to and from breeding areas by stimulating phototactic behavior. Bryant Buchanan (pers comm) reports that frogs in an experimental enclosure stopped mating activity during night football games, when lights from a nearby stadium increased sky glow. Mating choruses resumed only when the enclosure was covered to shield the frogs from the light.

In birds, some evidence suggests that artificial night lighting affects the choice of nest site. De Molenaar et al.



Figure 5. Crowned hornbill (*Tockus alboterminatus*) hawking insects at a light at the Kibale Forest National Park, Uganda.

(2000) investigated the effects of roadway lighting on black-tailed godwits (*Limosa l. limosa*) in wet grassland habitats. Breeding densities of godwits were recorded over 2 years, comparing lighted and unlighted conditions near a roadway and near light poles installed in a wet grassland away from the road influence. When all other habitat factors were taken into account, the density of nests was slightly but statistically lower up to 300 m away from the lighting at roadway and control sites. The researchers also noted that birds nesting earlier in the year chose sites farther away from the lighting, while those nesting later filled in sites closer to the lights.

Communication

Visual communication within and between species may be influenced by artificial night lighting. Some species use light to communicate, and are therefore especially susceptible to disruption.

Female glow-worms attract males up to 45 m away with bioluminescent flashes; the presence of artificial lighting reduces the visibility of these communications. Similarly, the complex visual communication system of fireflies could be impaired by stray light (Lloyd 1994).

Artificial night lighting could also alter communication patterns as a secondary effect. Coyotes (*Canis latrans*) group howl and group yip-howling more during the new moon, when it is darkest. Communication is necessary either to reduce trespassing from other packs, or to assemble packs to hunt larger prey during dark conditions (Bender et al. 1996). Sky glow could increase ambient illumination to eliminate this pattern in affected areas.

Because of the central role of vision in orientation and behavior of most animals, it is not surprising that artificial lighting alters behavior. This causes an immediate conservation concern for some species, while for other species the influence may seem to be positive. Such "positive" effects, however, may have negative consequences within the context of community ecology.

Community ecology

The behaviors exhibited by individual animals in response to ambient illumination (orientation, disorientation) and to luminance (attraction, repulsion) influence community interactions, of which competition and predation are examples.

Competition

Artificial night lighting could disrupt the interactions of groups of species that show resource partitioning across illumination gradients. For example, in natural commu-

nities, some foraging times are partitioned among species that prefer different levels of lighting. The squirrel treefrog (*Hyla squirella*) is able to orient and forage at lighting levels as low as 10^3 lux and under natural conditions typically will stop foraging at illuminations above 10^3 lux (Buchanan 1998). The western toad (*Bufo boreas*) forages only at illuminations between 10^1 and 10^3 lux, while the tailed frog (*Ascaphus truei*) forages only during the darkest part of the night at below 10^3 lux (Hailman 1984). While these three species are not necessarily sympatric (ie inhabiting the same area), and differ in other niche dimensions, they illustrate the division of the light gradient by foragers.

Many bat species are attracted to insects that congregate around light sources (Frank 1988). Although it may seem that this is a positive effect, the increased food concentration benefits only those species that exploit light sources and could therefore result in altered community structure. Faster-flying species of bats congregate around lights to feed on insects, but other, slower-flying species avoid lights (Blake et al. 1994; Rydell and Baagøe 1996).

Changes in competitive communities occur as diurnal species move into the "night light niche" (Schwartz and Henderson 1991). This concept, as originally described, applies to reptiles, but easily extends to other taxa, such as spiders (Frank pers comm) and birds (Hill 1990; Figure 5).

Predation

Although it may seem beneficial for diurnal species to be able to forage longer under artificial lights, any gains from increased activity time can be offset by increased predation risk (Gotthard 2000). The balance between gains from extended foraging time and risk of increased preda-

tion is a central topic for research on small mammals, reptiles, and birds (Kotler 1984; Lima 1998). Small rodents forage less at high illumination levels (Lima 1998), a tendency also exhibited by some lagomorphs (Gilbert and Boutin 1991), marsupials (Laferrier 1997), snakes (Klauber 1939), bats (Rydell 1992), fish (Gibson 1978), aquatic invertebrates (Moore et al. 2000), and other taxa.

Unexpected changes in light conditions may disrupt predator-prey relationships. Gliwicz (1986, 1999) describes high predation by fish on zooplankton during nights when the full moon rose hours after sunset. Zooplankton had migrated to the surface to forage under cover of darkness, only to be illuminated by the rising moon and subjected to intense predation. This "lunar light trap" (Gliwicz 1986) illustrates a natural occurrence, but unexpected illumination from human sources could disrupt predator-prey interactions in a similar manner, often to the benefit of the predator.

Available research shows that artificial night lighting disrupts predator-prey relationships, which is consistent with the documented importance of natural light regimes in mediating such interactions. In one example, harbor seals (*Phoca vitulina*) congregated under artificial lights to eat juvenile salmonids as they migrated downstream, turning the lights off reduced predation levels (Yurk and Triess 2000). Nighttime illumination at urban crow roosts was higher than at control sites, presumably because this helps the crows avoid predation from owls (Gorenzel and Salmon 1995). Desert rodents reduced foraging activity when exposed to the light of a single camp lantern (Kotler 1984). Frank (1988) reviews predation by bats, birds, skunks, toads, and spiders on moths attracted to artificial lights. Mercury vapor lights, in particular, disrupt the interaction between bats and tympanate moths by interfering with moth detection of ultrasonic chirps used by bats in echolocation, leaving moths unable to take their normal evasive action (Svensson and Rydell 1998).

From these examples, it follows that community structure will be altered where light affects interspecific interactions. A "perpetual full moon" from artificial lights will favor light-tolerant species and exclude others. If the darkest natural conditions never occur, those species that maximize foraging during the new moon could eventually be compromised, at risk of failing to meet monthly energy budgets. The resulting community structure would be simplified, and these changes could in turn affect ecosystem characteristics.

■ Ecosystem effects

The cumulative effects of behavioral changes induced by artificial night lighting on competition and predation have the potential to disrupt key ecosystem functions. The spillover effects from ecological light pollution on aquatic invertebrates illustrates this point. Many aquatic invertebrates, such as zooplankton, move up and down within the water column during a 24-hour period, in a

behavior known as "diel vertical migration". Diel vertical migration presumably results from a need to avoid predation during lighted conditions, so many zooplankton forage near water surfaces only during dark conditions (Gliwicz 1986). Light dimmer than that of a half moon ($<10^1$ lux) is sufficient to influence the vertical distribution of some aquatic invertebrates, and indeed patterns of diel vertical migration change with the lunar cycle (Dodson 1990).

Moore et al. (2000) documented the effect of artificial light on the diel migration of the zooplankton *Daphnia* in the wild. Artificial illumination decreased the magnitude of diel migrations, both in the range of vertical movement and the number of individuals migrating. The researchers hypothesize that this disruption of diel vertical migration may have substantial detrimental effects on ecosystem health. With fewer zooplankton migrating to the surface to graze, algae populations may increase. Such algal blooms would then have a series of adverse effects on water quality (Moore et al. 2000).

The reverberating effects of community changes caused by artificial night lighting could influence other ecosystem functions. Although the outcomes are not yet predictable, and redundancy will buffer changes, indications are that light-influenced ecosystems will suffer from important changes attributable to artificial light alone and in combination with other disturbances. Even remote areas may be exposed to increased illumination from sky glow, but the most noticeable effects will occur in those areas where lights are close to natural habitats. This may be in wilderness where summer getaways are built, along the expanding front of suburbanization, near the wetlands and estuaries that are often the last open spaces in cities, or on the open ocean, where cruise ships, squid boats, and oil derricks light the night.

■ Conclusions

Our understanding of the full range of ecological consequences of artificial night lighting is still limited, and the field holds many opportunities for basic and applied research. Studies of natural populations are necessary to investigate hypotheses generated in the laboratory, evidence of lunar cycles in wild populations, and natural history observations. If current trends continue, the influence of stray light on ecosystems will expand in geographic scope and intensity. Today, 20% of the area of the coterminous US lies within 125 m of a road (Ritters and Wickham 2003). Lights follow roads, and the proportion of ecosystems uninfluenced by altered light regimes is decreasing. We believe that many ecologists have neglected to consider artificial night lighting as a relevant environmental factor, while conservationists have certainly neglected to include the nighttime environment in reserve and corridor design.

Successful investigation of ecological light pollution will require collaboration with physical scientists and

engineers to improve equipment to measure light characteristics at ecologically relevant levels under diverse field conditions. Researchers should give special consideration to the tropics, where the constancy of day-night lighting patterns has probably resulted in narrow niche breadths relative to illumination. Aquatic ecosystems deserve increased attention as well, because despite the central importance of light to freshwater and marine ecology, consideration of artificial lighting has so far been limited. Research on the effects of artificial night lighting will enhance understanding of urban ecosystems – the two National Science Foundation (NSF) urban Long Term Ecological Research sites are ideal locations for such efforts.

Careful research focusing on artificial night lighting will probably reveal it to be a powerful force structuring local communities by disrupting competition and predator-prey interactions. Researchers will face the challenge of disentangling the confounding and cumulative effects of other facets of human disturbance with which artificial night lighting will often be correlated, such as roads, urban development, noise, exotic species, animal harvest, and resource extraction. To do so, measurements of light disturbance should be included routinely as part of environmental monitoring protocols, such as the NSF's National Ecological Observatory Network (NEON). Future research is likely to reveal artificial night lighting to be an important, independent, and cumulative factor in the disruption of natural ecosystems, and a major challenge for their preservation.

Ecologists have studied diel and lunar patterns in the behavior of organisms for the greater part of a century (see Park 1940 and references therein), and the deaths of birds from lights for nearly as long (Squires and Hanson 1918). Humans have now so altered the natural patterns of light and dark that these new conditions must be afforded a more central role in research on species and ecosystems beyond the instances that leave carcasses on the ground.

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LIGHTS OUT! FOR NATURE

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Humans have radically transformed the physical characteristics of the nighttime hours in ways that would have been unimaginable only a hundred years ago (Figure 1, Longcore and Rich 2004). The cost of industrial development, affluence, and mass consumption has been the loss of natural patterns of darkness over vast expanses of the Earth's surface, both on land and at sea (Cinzano et al. 2001).

Those concerned with the nighttime environment, whether scientists or advocates, regulators or lighting manufacturers, in the private or public sector, together face the challenge of restoring the night sky and natural patterns of light and dark in a global economy. We are motivated by an affinity for the night sky (Mizon 2002), respect for our natural heritage, concern for our own health (Stevens and Rea 2001, Pauley 2004), and a desire to protect the night for the other living beings with which we share the planet.

Astronomers were the first to express concern about the widespread proliferation of artificial night lighting, and they rightfully raised the alarm about the degradation of the night sky (Riegel 1973). Concern about the effects of artificial lighting on wildlife and plants has been a relatively recent phenomenon (Verheijen 1985, Uppgren 1996, Outen 1998). This is not to say that scientists were not interested in the effects of light on other species. Naturalist William Beebe was fascinated with the ability of ultraviolet lights to attract juvenile fish, as documented in a sketch from an expedition in 1935 (Figure 2). But Beebe's observations were not motivated by concern that lights had widespread ecological consequences.

A substantial and growing body of research on the ecological effects of artificial night lighting is now available (see Rich and Longcore 2006). New scientific articles that extend this knowledge are being published at a steady rate (e.g., Oro et al. 2005, Baker and Richardson 2006, Miller 2006). Sufficient information is now available to devise policies to mitigate and avoid the range of profound, adverse consequences on other



Figure 1. The view of Los Angeles from the Mount Wilson Observatory showing the extent of night lighting.



Figure 2. William Beebe shows the attractive effect of different light types on fish on an expedition to Bermuda in 1935. Reprinted from the *Bulletin*, published by the former New York Zoological Society, now known as the Wildlife Conservation Society.

species caused by artificial light at night.

Urban planners and open space managers can incorporate this knowledge to better protect nature at night. Here we provide examples of three general types of impacts on wildlife: direct mortality, altered reproductive behaviors, and disrupted interactions between species. These examples give an indication of the breadth of this problem and of the opportunities for solutions.

Lights that kill

Anyone with a porch light knows that lights can kill. Many insects are attracted to their deaths at lights; in Germany alone, the estimate of total insect deaths at streetlights in a summer is 100 billion (Eisenbeis 2006).

Migratory birds are attracted to the lights on tall towers when weather conditions are adverse. In North America, an estimated 4–5 million birds are killed per year in collisions with towers, their guy wires, and each other. Most of these are Neotropical migrants, birds that migrate to Central and South America, which are already under severe population stress (Banks 1979, Shire et al. 2000, Longcore et al. 2007). Based on past patterns, we have calculated that two species of federal conservation concern, blackpoll warbler and bay-breasted warbler, suffer losses of over 100,000 individuals each year (Longcore et al. 2007). Over 10,000 individuals of an additional 20 species of conservation concern are killed annually. A change in lighting type would probably eliminate up to 80% of this mortality (Gehring and Kerlinger 2007), and the U.S. Federal Communications Commission is considering such a change based on expert testimony from us, other groups, and the U.S. Fish and Wildlife Service.

Although they are not afforded the same attention as birds, the mortality of insects can be significant. In a study along a forested stream, a single streetlight installed on the bank attracted and killed as many caddisflies as emerged from the stream along an entire 200 meter stretch (Scheibe 1999). This process is described by Professor Gerhard Eisenbeis as the “vacuum cleaner effect,” vividly evoking the image of lights sucking insects out of the surrounding habitat (Eisenbeis 2006).

Beachfront lighting and sky glow threaten the survival of hatchling sea turtles and affect the nest site choice of female turtles (Witherington 1992, Salmon et al. 2000).

Hatchlings are disoriented by lights and fail to make their dash to the ocean and out to sea. This problem was identified first in the 1960s (MacFarlane 1963) and many programs have been put in place to control beachfront lighting (Salmon 2006).

Interference with reproduction

Even when lights do not kill wildlife, they can interrupt important behaviors such as those associated with reproduction. For example, stray light can wash out the visual messages between male and female fireflies (Lloyd 2006).

In a recently published article, two Canadian researchers investigated the effects of intermittent light on the reproductive behavior of northern green frogs (Baker and Richardson 2006). They counted the number of calls by males to attract mates under natural ambient darkness and under the light of a flashlight shined on them. This simulates the effects of a security light on a motion detector or the flash of lights from a passing car. The results show a significant 44% decrease in the number of calls and a 675% increase in the number of moves made by individuals (Baker and Richardson 2006).

Under different circumstances, extra light causes species to expend energy calling at night. In another recent article, current and historic singing records for American robins were used to show that males sing well before dawn only in those locations with high light levels (Miller 2006). Subsequent research on European robins concluded that daytime noise is a more important predictor of nighttime singing, although locations where birds sang at night were on average brighter than areas where birds did not sing at night (Fuller et al. 2007). Our analysis of the data reported by Fuller et al. (2007) suggests a threshold effect where increased illumination allows nocturnal singing in noisy locations; no birds sang at night at any of the darkest 20% of locations, even if the location was noisy during the day.

The effects of lighting can extend to the ocean. Seabirds are attracted to and incinerated at flares at oil platforms, migratory birds are killed running into cruise ships, and lighted squid boats each shine 30,000 Watts into the ocean (Montevecchi 2006). But even sky glow at the level of the full moon could easily disrupt the tightly synchronized spawning of corals. Under normal lunar cycles the release of coral larvae, also known as *planula*, always follows the new moon, presumably to reduce predation on these larvae. This synchronization breaks down in experiments where corals are subjected to perpetual full moon illumination (Jokiel et al. 1985).

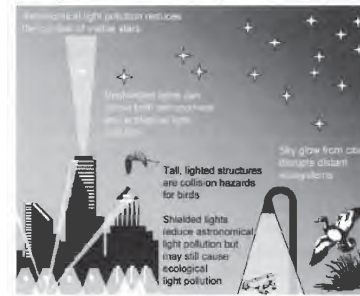


Figure 3. Ecological and astronomical light pollution is caused by lights at night. Figure reprinted from Longcore and Rich (2004).

Predators, prey, and night lights

Lights at night also disrupt ecological interactions. Predator-prey interactions are particularly vulnerable to influence by lighting. In general, additional light benefits the predator, except when the prey are found in groups where individuals warn each other of predators, such as flocks of birds and schools of fish (Longcore and Rich 2004). But examples of lights increasing nocturnal predation are many.

In a study of European storm-petrel nests in caves on an island off the coast of Spain, the birds in the cave illuminated by city lights were killed far more often by gulls than those in the cave facing away from the city (Oro et al. 2005). In addition, bird survival decreased after completion of a major lighting project in the city, declining significantly in the years that followed (Oro et al. 2005). In a separate study of black-vented shearwaters, another seabird, nesting birds were predated far more in the light of the full moon than the dark of the new moon, again by gulls (Keitt et al. 2004).

Young salmon, known as salmon fry, migrate from the streams where they hatch to the ocean. They migrate en masse at night, cued by illumination levels, and this timing is designed to reduce predation. Researchers in the Pacific Northwest documented harbor seals positioning themselves under lights on a bridge to locate and capture the outmigrating fry (Yurk and Trites 2000). When they turned off the lights, predation levels declined at first but then increased as the seals relocated under other lights from the town. They were found eating salmon fry under the lights of a ball field, a sawmill, and other urban glow (Yurk and Trites 2000).

A recent study from Florida showed alteration in the foraging behavior of beach mice under night lighting (Bird et al. 2004). Some species of these small rodents are federally endangered and they are an important part of the coastal dune ecosystem. The research found that beach mice reduced the proportion of bait stations they visited closer to lights. In addition, this pattern was found for both low-pressure sodium vapor lights, which are generally considered to have fewer environmental impacts because they are less attractive to insects, and for yellow "bug lights," which are also promoted as being turtle-friendly and mandated for this reason (Bird et al. 2004). In this example, we see that lights that reduce impacts for one species are not necessarily benign for others.

Nature needs the night

Our question, from this ecological perspective, is whether the international community is up to the challenge of restoring the night. The geographic scope is great, extending throughout the world from urban lights, roadway lights, tower lighting, light-induced fisheries, offshore oil production, and many other sources (Longcore and Rich 2004).

The range of species is also great, extending across all major taxonomic groups and habitats. Any species that evolved with natural patterns of light and dark is potentially susceptible to adverse effects of artificial lighting. Direct glare, sky glow, and steady and intermittent lights from urban to rural environments, both on land and at sea, all alter the nighttime environment, causing both ecological and astronomical light pollution (Longcore and Rich 2004).

Unfortunately, there is no one-size-fits-all solution to mitigate the effects of artificial night lighting on nature. Some species are sensitive to yellow light, others to blue.

As we have seen, turtle-friendly lights still disrupt foraging of endangered beach mice (Bird et al. 2004). Attraction of migratory birds to tall towers can be reduced by using flashing lights (Gauthreaux and Belser 2006), while flashing lights in other contexts would be detrimental. Effective solutions will be place- and habitat-specific, such as a road in Florida where lights that attract turtles were replaced by LED lights embedded in the pavement (Figure 4, Salmon 2006).

Our message is simple. Nature needs the night. Substantial progress has been made in understanding the many effects of light on other species and indeed on humans as well. We hope that readers will put this knowledge to work — as researchers, as advocates, as regulators, and as informed citizens.

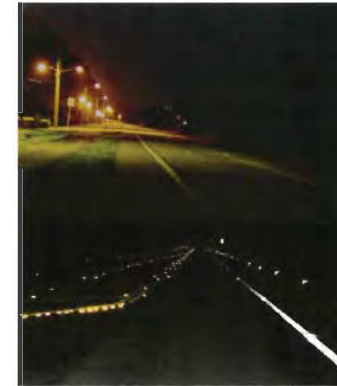


Figure 4. An example of embedded roadway lighting from Boca Raton, Florida. In the top view, the streetlights are visible from the sea turtle nesting beach, while the embedded lights in the lower view are not visible from the beach (Bertolotti and Salmon 2005). Figure reprinted from "Protecting Sea Turtles from Artificial Night Lighting at Florida's Oceanic Beaches" by Michael Salmon. Found in *Ecological Consequences of Artificial Night Lighting* by Catherine Rich and Travis Longcore, eds. Copyright © 2006 Island Press. Reproduced by permission of Island Press, Washington, D.C.

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The influence of artificial light on stream and riparian ecosystems: questions, challenges, and perspectives

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Abstract. Artificial light at night is gaining attention for its potential to alter ecosystems. Although terrestrial ecologists have observed that artificial light at night may disrupt migrations, feeding, and other important ecological functions, we know comparatively little about the role artificial light might play in disrupting freshwater and riparian ecosystems. We identify and discuss four future research domains that artificial light may influence in freshwater and associated terrestrial ecosystems, with an emphasis on running waters: (1) dispersal, (2) population genetics and evolution, (3) ecosystem functioning, and (4) potential interactions with other stressors. We suggest that future experimental and modeling studies should focus on the effects of different spectral emissions by different light sources on freshwater organisms, the spatial and temporal scale over which artificial light acts, and the magnitude of change in light at night across the landscape relative to the distribution of running and standing waters. Improved knowledge about the effects of artificial light on freshwater ecosystems will inform policy decisions about changes to artificial light spectral emissions and distributions.

Key words: aquatic invertebrates; artificial illumination; ecosystems; fish; multiple stressors; riparian; streams; urbanization.

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INTRODUCTION

Human activities influence and have modified the majority of the Earth's ecosystems (Vitousek et al. 1997). Freshwater ecosystems are especially affected, both because they accumulate and integrate the effects of activities within their

catchments, and because they have always been preferred sites for human activities (Ricciardi and Rasmussen 1998, Dudgeon et al. 2006, Balian et al. 2008).

The effects of chemical pollution (Likens et al. 1996), alteration to natural flows (Poff et al. 1997) and nutrient cycles (Turner and Rabalais 1991),

invasive species (Ricciardi and Rasmussen 1998), increasing urbanization (Morely and Karr 2004), and loss of riparian margins (Sweeney et al. 2004) on freshwater ecosystems have influenced policy decisions for the past 40–50 years (e.g., the USA Environmental Protection Agency's Clean Water Act of 1972). In contrast, the influence of artificial lighting as a human-induced impact affecting freshwater systems has only been recognized in the past 10 years or so (Moore et al. 2000, Longcore and Rich 2004, Moore et al. 2006, Nightingale et al. 2006), and there are still many gaps in empirical knowledge. This is despite the fact that the use of artificial lighting is now widespread and has increased over the past century (Holden 1992). While Cinzano et al. (2001) reported that approximately 67% of Americans and 20% of people world-wide now live in locations where Milky Way is no longer visible due to interference from artificial light sources, the wider effects of artificial light on other organisms and on ecosystems are poorly quantified. While many studies have focused on the control of natural light on biorhythms (Bishop 1969, Grau et al. 1981), few have looked at the potential of artificial light as a disrupter of these rhythms (Moore et al. 2000). This is surprising as approximately 30% of vertebrates and 60% of invertebrates are nocturnal (Hölker et al. 2010a) and could, therefore, be highly influenced by the presence of artificial light.

Longcore and Rich (2004) and Navara and Nelson (2007) presented broad reviews of artificial light and summarized a range of evidence, yet over two thirds of their examples relate to terrestrial organisms. Both Moore et al. (2006) and Nightingale et al. (2006) identified some effects of artificial light on lakes and fish, but in general, freshwater ecosystems are poorly represented in the current literature. An initial search of Web of Science (13 October 2011) of peer-reviewed literature using various terms relating to human alterations and ecosystems revealed a noticeable lack of research on artificial light and freshwater systems, especially when compared to other common pressures to which these systems are subjected (Table 1). This is despite freshwaters having high biodiversity and being disproportionately affected by species loss. Globally, freshwaters are inhabited by more than 125,000 known species, and even though freshwaters

Table 1. Number of references returned on a Web of Science search (13 October 2011) for various human impacts and ecosystem type terms.

Human impact term	Ecosystem term			
	River	Lake	Wetland	Riparian
"Artificial light"	7	8	0	1
"Light pollution"	4	4	0	0
"Environmental flows"	90	14	9	24
"Climate change"	241	213	64	41

Notes: Terms were searched for in the category of "Topic," with lemmatization option off. "Ecology" was added as term to all searches to limit results to ecologically relevant papers.

cover only about 0.8% of the Earth's surface, they are home to about 9.5% of all animal species, and one-third of all vertebrates (Balian et al. 2008). Nevertheless, there have been some seminal contributions to our understanding, for example in the use of artificial lights to: (1) increase fish growth rates in hatcheries (Boeuf and Le Bail 1999), (2) understand how it influences zooplankton movements (Moore et al. 2000), and (3) guide fish around dangerous in-stream structures (Johnson et al. 2005).

Here, we attempt to redress the balance in available literature to date by focusing on freshwater, and in particular streams with their associated riparian margins, defined as areas that are "transitional semiterrestrial areas regularly influenced by fresh water, usually extending from the edges of water bodies to the edges of upland communities" (Naiman et al. 2005:2). We give special attention to adult aquatic insects, as they represent a key in the exchange of nutrients between stream and riparian systems (Richardson et al. 2010).

Our goal is to illustrate how artificial light influences species interactions and processes in stream and riparian ecosystems, and to stimulate research in an area that we consider of major importance for their future conservation and management. Ecologists have only recently started to acknowledge the alteration of the night-scape as a major concern in conservation policy and freshwaters are no exception (Rich and Longcore 2006, Hölker et al. 2010a).

RESEARCH DOMAINS

We begin by presenting four major research domains relating to the ways artificial light can

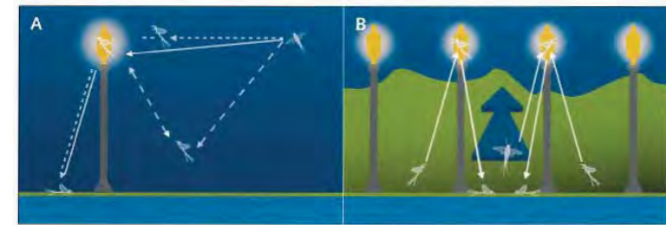


Fig. 1. Eisenbeis (2006:281–304) proposes three different ways for artificial lights to trap flying insects. Two are shown here: fixation (dashed line), captivity (dotted line), and directly lethal (solid line) effects (A) and the crash barrier effect (B). Fixated insects do not suffer mortality directly from artificial light, but are stunned by it and are easy targets for predators or fail to engage in basic behaviors, such as reproduction. Captive insects fly to the light and circle around it endlessly until they die of exhaustion or are consumed by predators. The crash barrier effect is the result of a row of lights (like those lining a street) preventing the dispersal of insects through their attractive properties.

act on stream and riparian ecosystems, through altering: dispersal, population genetics and evolution, ecosystem functioning, and interactions with other common stressors; and then outline a range of key research questions which need addressing.

Dispersal

There is evidence that artificial lights located near streams change the behavior of adult aquatic insects as they disperse through the terrestrial environment. Eisenbeis (2006) proposes three different ways for artificial lights to trap flying insects (Fig. 1). The first is through fixation or captivity effects (Fig. 1A). Here insects located near lights fly directly to them and are killed immediately, or they circle close to the light and are unable to leave eventually dying from exhaustion, predation, or heat. The lights may also induce settling behavior that incapacitates the insects, rendering them easy targets for predators. The second mechanism is the crash barrier effect (Fig. 1B), where insect dispersal and migration are impeded by running into a "barrier" of lights, such as a row of street lights. The final mechanism is termed the vacuum cleaner effect, whereby insects from a large area are attracted to a nearby light source. However, these are only hypotheses and carefully designed

experiments are needed to determine how much of an effect these mechanisms actually play in disrupting aquatic insect dispersal.

Studies comparing different trapping techniques provide evidence for the vacuum cleaner effect. These studies illustrate that light traps differentially capture certain insects (e.g., Trichoptera) more readily than other kinds of traps (e.g., Collier and Smith 1998). While the height of streetlights is designed to maximize safety for car drivers, lights that are used along walking and bike paths, as well as those used for decorative purposes could be adjusted to attract fewer insects, if we can predict which heights have the highest concentrations of insects based on landscape features and insect species. Svensson (1974) found that light traps at 11 and 50 m height captured fewer trichopterans than those at 1 m due to the propensity of several species to fly low to the ground, suggesting that higher lights might trap fewer insects than lower lights, but this has yet to be generalized across taxa and habitats.

Overall, research on insect dispersal, especially adult aquatic insect dispersal, is extremely limited. Part of this lack is that it is very difficult to rigorously study insect dispersal. Stable isotope and elemental markers are potentially valuable tools, as is the increasing use of genetic

analysis (Smock 2007); however, capturing insects in substantial numbers generally requires the use of light or pheromone traps. While these methods are adequate for most studies of aquatic insect dispersal, light traps cannot be used in studies of artificial light as they obviously create a confounding factor. In addition, while population genetic analyses hold promise for longer-term studies and determining if populations adapt to artificial light, they are not really useful as a tool for short-term dispersal studies.

It is also unclear how much the dispersal of adult aquatic insects matters for the population dynamics of these organisms. Masters et al. (2007) found that the recovery of the benthos from acidification is not limited by adult dispersal. Furthermore, Bunn and Hughes (1997) calculated that it is likely that populations of *Tasiogma* spp. (Trichoptera) in a reach are maintained through the reproduction of only 3–12 females per generation. It is not obvious how much of an effect land use changes have on adult aquatic insect dispersal (Petersen et al. 2004); however, studying the effects of artificial light on insect dispersal will likely further this field.

Clearly, we need to come up with new and innovative ways to study aquatic insect dispersal. One possibility is to use Malaise traps to capture individuals marked with fluorescent dyes or stable isotope tracers (Macneale et al. 2005). Conducting more basic studies of aquatic insect dispersal will help those studying the effects of artificial light to develop hypotheses (e.g., the effect of light height, light distances from streams) more effectively.

Aquatic insects are not the only stream organisms that may have their dispersal interrupted by the addition of artificial lights. It is well established that the migration of Pacific salmon species (*Oncorhynchus* spp.) can be slowed or stopped by the presence of artificial lights (Nightingale et al. 2006). Furthermore, exposure to constant light can decrease smoltification and increase the deterioration in body condition associated with smoltification in chinook salmon (*O. tshawytscha*) (Hoffnagle and Fivizzani 1998). This might be due to the synchronization of downstream migration with the new moon; however, it is possible that the lunar timing of downstream migration is stock-dependent (Hoffnagle and Fivizzani 1998). It is

likely that any species that uses lunar cycles to cue migration or dispersal will be disrupted by the addition of artificial lights (see *Key Research Questions*; Fig. 2).

Population genetics and evolution

To our knowledge, no one has yet experimentally investigated the possibility that artificial light can act as an evolutionary force in freshwater or riparian species. However, its potential to influence evolution has received attention from Moore et al. (2006) and Nightingale et al. (2006).

Artificial light at night could reduce effective population sizes through the direct loss of individuals, reproductive failure, or changes to sex ratios. The direct mortality of individuals is probably most likely in the case of aquatic insects; either through the attraction of the adults to lights (Scheibe 2003, Eisenbeis 2006), or increased predation through improved predator vision. However, mid-trophic fish species could also suffer higher rates of predation under artificial light (see: *Ecosystem functioning: Food webs*). Reproductive failure could be due to the inability to locate suitable mates, as in the case of several amphibian species (Longcore and Rich 2004). Aquatic insects are again likely to suffer

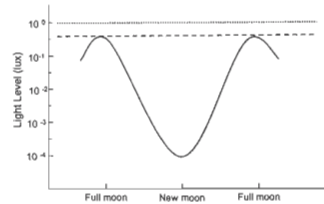


Fig. 2. Sky glow eliminates monthly variation in light levels. The solid line shows the natural light provided by a full moon in a temperate region. The dashed line is the light level measured in the center of Berlin on a clear night and is roughly equivalent to a full moon, while the dotted line is the light level in the center of Berlin on a cloudy night and is roughly four times greater (Kyba et al. 2011). The y-axis is logarithmic.

from changes to sex ratios, as there are often biases in light trap catches, depending on the species (Waringer 1989).

Reduction in effective population sizes will lead to less genetic diversity and possibly genetic drift; leaving a population with insufficient variation to adapt to future stressors, and therefore is a major concern for species conservation (Lande and Barrowclough 1987). If some populations are eliminated, it could result in reduced gene flow across the range of some species, with the potential to lead to the diversification of populations and potentially even speciation.

There is already some evidence that other environmental stressors alter genotype frequencies in a population. Populations of a common aquatic insect (*Chironomus riparius*) that were exposed to a chemical stressor (tributyltin) in a laboratory study had increased rates of larval mortality and reduced genetic variation (Nowak et al. 2009). This result was especially significant because the changes were seen in neutral markers, not in response genes, and therefore represent a true reduction in effective population size. Conversely, mosquitoes living on an arid slope showed increasing diversity (due to higher rates of recombination and mutation) as a result of exposure to greater environmental stress, such as increased temperatures and solar radiation, than those living on a humid slope of the same valley (Nevo 2001). Furthermore, females from the arid slope showed an increased tendency to mate with males that were also from the arid slope, potentially leading to sympatric speciation between the two groups (Nevo 2001). While it might be difficult to forecast which species will have increased or decreased genetic diversity, artificial light could also change the frequency of heritable behaviors that could influence the evolution of organisms.

Mating and reproductive behaviors in freshwater species are likely to be influenced by artificial light (Moore et al. 2006, Nightingale et al. 2006). Sexual selection for traits that are visually stimulating could increase or decrease with exposure to artificial light, depending on the spectral qualities of the light and species' visual sensitivities. For instance, cichlid fishes undergo strong sexual selection that favors brightly colored individuals and has driven speciation

events in populations in clear water that allows plenty of light (Seehausen et al. 1997). The effects of artificial light on sexual selection could be especially interesting and unpredictable, given the common use of high pressure sodium lamps, which have a very limited emission spectra and could prevent females from recognizing male color patterns (Fig. 3). This has taken place in Lake Victoria, where turbidity from eutrophication reduces the spectral range of light entering the water to wavelengths that are similar to the emission spectra of high pressure sodium lamps, and reduces female selectivity based on color (Seehausen et al. 1997). Similarly, guppy habitat specialization has been driven by a combination of diverse ambient light conditions, predation, and sexual selection (Endler 1992). The introduction of artificial light to these streams could lead to the visual homogenization of these environments, which could lead to reduced speciation as well as increasing susceptibility to predation.

Other behaviors that could be influenced by artificial light that are potentially important to evolution are feeding behaviors. Some spiders are more likely to build their webs in close proximity to artificial light to take advantage of the increased densities of insects found at lights (Heiling 1999). If there is a genetic basis for this behavior, then the presence of artificial light could very well contribute to the evolution of this species. Ultimately, any behavior that could be altered by artificial light and is under genetic control could allow artificial light to change the evolution of a species exhibiting such a behavior.

It is also important to consider the effect of artificial light in combination with species interactions in driving rapid evolutionary change, which could lead to altered ecological dynamics, e.g., different guppy phenotypes result in altered ecosystem structure and function (Schoener 2011). To test if artificial light causes rapid evolution of exposed organisms, researchers could hatch diapausing copepod eggs that were laid before artificial light became widespread. The feeding and diel vertical migration (DVM) behavior of pre-lighting and modern copepods could then be compared (Hairston et al. 1995). To determine what percentage of the behavioral change is really due to evolution, and not some other ecological factor, genetic techniques should be used to identify genes that are likely respon-

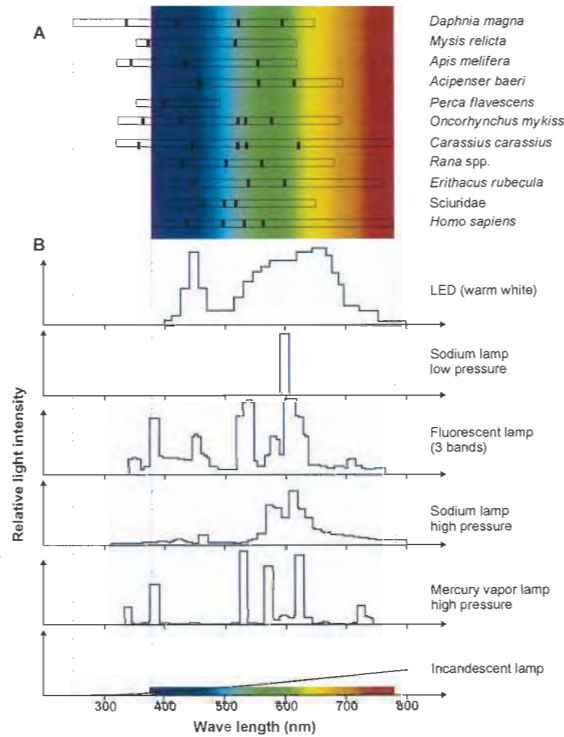


Fig. 3. The light sensitivities of various animals are displayed against a background of wavelengths that humans perceive as visible light (A). The black ovals represent the peak sensitivities for each organism; note that some organisms have sensitivities in the UV range. The dashed vertical lines designate the limits of the UV (10–400 nm) and human-visible light (390–750 nm) (Menzel and Blakers 1976, Smith and Macagno 1980, Lythgoe 1984, Loew and Wahl 1991, Fratzler et al. 1994, Hawryshyn and Hárosi 1994, Vorobyev and Osorio 1998, Gal et al. 1999, Wiltshko and Wiltshko 1999, Sillmann and Dahlin 2004). The wavelengths of light emitted from various artificial light sources (B) are highly variable, with some emitting light over a broad spectrum and others having only a few narrow peaks.

sible for the observed behavior and then tested to ensure that they are responsive to altered light conditions and change organism behavior (Hairton et al. 2005, Fussmann et al. 2007). Furthermore, it will be beneficial to establish if any of these rapid evolutionary changes results in genetic isolation, and eventually, speciation (Hendry et al. 2007).

Ecosystem functioning

As previously addressed by Moore et al. (2000), Longcore and Rich (2004), and Moore et al. (2006), we expect that modified lighting regimes will lead to a range of whole freshwater ecosystem changes and also influence the linkages between freshwater and riparian ecosystems. Of particular interest is how artificial light could alter the exchange of organic matter between stream and riparian systems. Artificial light could influence ecosystems in ways that might be unexpected from single species studies, e.g., by changing species interactions, especially predator-prey interactions, and therefore have important conservation implications (Wooten et al. 1996).

Primary production.—Primary production is a key ecosystem process controlled by light. To our knowledge, only one study has found evidence that riparian vegetation could be influenced by the presence of artificial light at night (Cathey and Campbell 1975). Their work illustrated that trees and shrubs exposed to streetlamps, particularly incandescent or high pressure sodium luminaires, may have longer growing periods, earlier leaf-out and later leaf fall times than those in darker environments (Cathey and Campbell 1975). This may have a range of bottom-up effects. For example, earlier leaf-out could cause earlier inputs of terrestrial insects (that use riparian vegetation as habitat) to freshwater systems, but only if terrestrial insects are able to use this new habitat resource. Later leaf fall could result in a mismatch of resources and consumers, as detritivorous aquatic invertebrate taxa might have evolved to match the timing of the allochthonous inputs of leaves with critical life stages (Hershey and Lamberti 1998:169–199). However, substantial changes in leaf-out/fall and growth are unlikely unless artificial lights are present with warmer temperatures that allow for a longer growing season (Cathey and Camp-

bell 1975). While this situation is currently unlikely in temperate climates, global temperatures are projected to increase by 0.6–6.4°C in the next 90 years, with greater warming in northern temperate regions (IPCC 2007), which would increase the chances that artificial light might influence riparian vegetation. The effects of increased temperatures and light could be studied in urban areas that not only have increased levels of artificial light, but also artificially high temperatures due to the heat island effect (Oke 1973).

Food webs.—Light is an important cue for both predator avoidance and feeding in freshwater systems. Aquatic invertebrates in lotic systems drift at light levels below 10⁻³ lux (at 400–535 nm) to avoid predation by fish (Bishop 1969). However, Atlantic salmon have been shown to change foraging strategies below light levels of 10⁻¹ lux, moving to areas of slow-moving water that, while not as rich in prey, allow more time for identification of prey items and night-time foraging (Metcalf et al. 1997). Light adaptations are also evident in lentic environments, where zooplankton engage in DVM in the water column to feed on phytoplankton during the night when they are less visible to predators (Young and Watt 1996). Moore et al. (2000) were able to detect a decrease in the amplitude of DVM in *Daphnia retrocurva* as a result of artificial light from a nearby city, by monitoring the vertical migration inside darkened versus clear enclosures. Light intensity also had a significant influence on the ability of vendace (*Coregonus albula*) to feed on *Daphnia magna*, with declining efficiency down to a threshold of 0.05 lux (Ohlberger et al. 2008). On the other hand, a decrease in feeding movements to avoid artificial light has been observed in vendace (Schmidt et al. 2009). These studies suggest that artificial light can result in altered food webs in lentic systems, leading to increased algal biomass as zooplankton spend less time in the upper euphotic water column feeding on algae (Moore et al. 2000, Moore et al. 2006). Lotic systems could see higher relative abundances of armored grazers, such as glososomatid caddisflies or snails, as invertebrates with less physical protection, such as mayflies, are eliminated through heavy predation (McNeely et al. 2007). In this case, there would eventually be a reduced number of

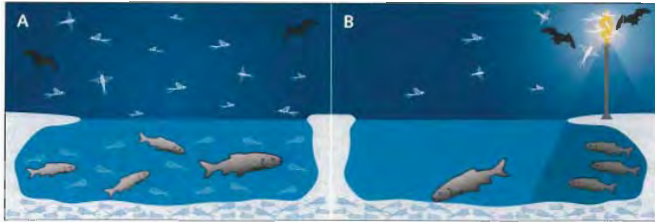


Fig. 4. A schematic of a stream ecosystem under natural nighttime conditions (A), and the same system under the influence of artificial light (B). Note the predicted shifts as light is introduced from A to B in the positions of small fishes seeking cover, suppression of streaminvertebrate drift, adult insects attracted to lights, and bats shifting their foraging efforts near the lights. Refer to *Ecosystem functioning: Food webs* in the text for details.

invertebrates available to fish predators, but if there are adequate numbers of protected invertebrate grazers, they would likely control lotic algal standing biomass.

We expect that artificial light at night not only influences freshwater food webs (Fig. 4), but also the exchange of materials between stream and riparian environments (Richardson et al. 2010; Fig. 5), which can be mediated by predators (Baxter et al. 2004). Accordingly, one key question here is how artificial light changes predator-prey relationships. Some species might be able to exploit artificial light to extend foraging opportunities, at least in the short-term (Moore et al. 2006, Nightingale et al. 2006). One example of this is the spiders who build their webs near light sources (Heiling 1999). However, foraging benefits, if they exist, may be short-lived due to resulting reductions in prey populations (Beier 2006). This will probably depend on the trophic structure of specific food webs, as apex predators will benefit more than mid-trophic species that have to avoid predation themselves.

Patterns of invertebrate drift and fish feeding are both likely to change under the influence of artificial light (Moore et al. 2006, Nightingale et al. 2006). If fish are able to feed much more efficiently on drifting insects, it could result in a decrease of emerging aquatic insects. However, light is known to depress drift rates (Bishop 1969); if fish are more active under artificial lights but prey is less available, fish could suffer from

increased energetic demands. Conversely, the number of terrestrial invertebrates entering the stream and available for fish to prey on could also change. Under natural conditions, terrestrial insects are an important allochthonous resource for fish (Fig. 4A). Kawaguchi and Nakano (2001) found that terrestrial insects contribute about 50% of the total annual prey consumption of salmonids in some Japanese streams, while about 84% of the consumption in a cyprinid (*Alburnus alburnus*) in a German lake comes from terrestrial sources (Mehner et al. 2005). In the presence of artificial light near a waterbody, terrestrial insects could become an even more important food source for fish. On the other hand, juvenile and other vulnerable fish might retreat to overhangs and reduce foraging efforts in order to avoid predation (Nightingale et al. 2006; Fig. 4B).

While adult aquatic insect flight in a dark riparian forest might normally be restricted to areas immediately adjacent to streams (Petersen et al. 1999), insects may cluster around artificial lights located in floodplains (Figs. 1, 5). Many aquatic insects emerge at night (Tobias 1967, Jackson 1988, Pinder et al. 1993), and are therefore vulnerable to attraction to artificial lighting while in their adult phase. We hypothesize that as the distance of an artificial light source from a water body increases, the proportion of freshwater carbon transferred to the terrestrial ecosystem increases relative to a riparian system that does not have lights, as

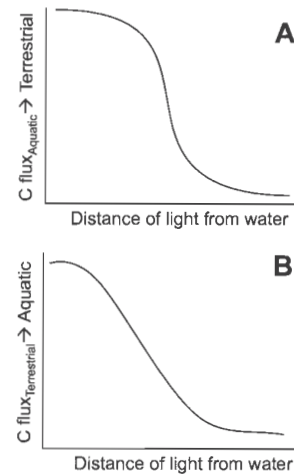


Fig. 5. Theoretical changes in carbon flux from freshwater to terrestrial systems, in the form of insects. Aquatic insects will be attracted to lights very near aquatic bodies in high densities, while lights that are farther away will increase the inland dispersal of aquatic insects, up to some threshold (A). Similarly, there will be higher inputs of terrestrial insects to the aquatic system when lights are close to the aquatic environment but these inputs will decrease quickly as the light location moves inland (B).

aquatic insects are attracted further into the terrestrial system (Fig. 5A). Preliminary support for this hypothesis comes from Kovats et al. (1996) who found adult caddisflies 5 km inland when using light traps. Conversely, we predict the amount of terrestrial carbon contributed to a freshwater system through terrestrial invertebrates will decrease as the distance of an artificial light source to a water body increases. For instance, a light situated on a dock will draw terrestrial insects to the water body, while lights from a road running parallel and several hun-

dred meters away from a water body will draw terrestrial insects away from the water (Fig. 5B). This will create areas that are highly dense in resources for insectivorous organisms, while creating other areas that are depauperate. Outcomes of this process may be an increase in competitive interactions between insectivores (Rydell 2006) and also an increased transfer of freshwater resources to terrestrial consumers.

Interaction with other stressors

There is a growing concern about how environmental stressors might interact with each other, and in fact, an entire issue of the journal *Freshwater Biology* (see Ormerod et al. 2010) was dedicated to this topic. However, the specific ways that artificial light might interact with other common urban stressors have not yet been described in the peer-reviewed literature. As artificial light most frequently occurs in urbanized areas, its effects may be confounded with other urban stressors, making it impossible to determine how much a role artificial light has played in declines in biodiversity and ecosystem functioning. Artificial light may already play a major role in changing organism behavior and ecosystem functioning. However, to fully understand its importance, we must elucidate how it interacts with other stressors in freshwater and riparian ecosystems. Does light pollution act synergistically with other stressors to increase the stress experienced by organisms, or does it potentially lessen the effect of some stressors? How artificial light interacts with other stressors will help prioritize what areas are most important to protect. Dudgeon et al. (2006) enumerated the five major threat categories to freshwater ecosystems as overexploitation, water pollution, habitat degradation, species invasion, and flow modification. Of course, another major threat to freshwater ecosystems is climate change. Artificial light has the potential to interact with all of these threats. By conducting carefully designed studies to understand the interaction between artificial lighting and the threats mentioned in Dudgeon et al. (2006), we will be able to develop a model for when artificial light is likely to do the most harm and be carefully controlled, or conversely, when it could be used as a mitigating factor for some other stressor.

In this section, we explain the ways artificial

light could combine with changes to temperature regimes, increased chemical pollution and urban development, altered flow regimes, and increased nutrient concentrations. We also describe how the effects of artificial light might be masked by the presence of other stressors and may not become apparent until the other stressors are removed.

One potential concern is for light to interact with other common urban stressors, such as temperature and pollution, to interfere with migration and dispersal. For example, some fish have been shown to become disoriented when swimming near lights (Tabor et al. 2004, Nightingale et al. 2006), which they are more likely to encounter when traversing urban areas that also contain other stressors. In the absence of light, migratory fish, such as salmonids, travel quickly through large rivers (Økland et al. 2001) that are more likely to have sub-optimal temperatures or increased pollutants, but the disorientation caused by urban lights could increase the time these fish spend in polluted environments and, as a result, increase their risk of mortality (McCormick et al. 1998).

The interaction of artificial light and other urban stressors could also alter patterns of the dispersal of riparian obligates, such as adult aquatic insects. For instance, the presence of culverts has been shown to reduce the upstream flight of adult caddisflies (Blakely et al. 2006). These culverts are usually installed to allow roads to pass over small streams, leading to a high probability of street lighting being associated with culverts. The street lighting would most likely run perpendicular to the stream (Fig. 6), leading the insects farther away from the stream. We hypothesize that this will lead to decreased dispersal and gene flow, and potentially the elimination of up-stream populations; however, it is possible that these lights could draw the insects over to a neighboring small watershed and, as a result, enhance genetic exchange. Similarly, Málnás et al. (2011) found that a bridge reduced the upstream flight of the mayfly *Palingenia longicauda* on a river in Hungary. At least part of the disruption was caused by polarized light reflecting off the surface of the bridge, which enticed gravid females to oviposit there (Horváth et al. 2009, Málnás et al. 2011).

The construction of dams has led to altered

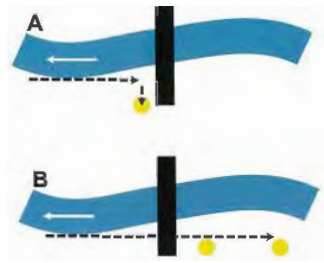


Fig. 6. Artificial lights located near culverts intersecting streams may strengthen their disruption of aquatic insect upstream flight (A) or mediate it (B), depending on their location. The white arrow represents the direction of streamflow, the dashed line is the flight path of the aquatic insects, the yellow circles are lights and the black line is a culvert.

flow regimes, often with a dampening of pre-dam high flows. These high flows can serve as a signal to cue migration or spawning events (McCormick et al. 1998, Bunn and Arthington 2002). Normally, light is also a strong *Zeitgeber* for these behaviors (Grau et al. 1981, Greenstreet 1992), but where artificial lighting and flow alterations occur, there could be a complete loss of external cues for these behaviors. This could lead to asynchronous migration and spawning events, and ultimately result in lower population sizes.

While flow modifications are largely a concern of stream environments, increasing loads of nitrogen and phosphorus pollution is a common problem across all freshwater systems (Carpenter et al. 1998). Areas with increased nutrient loading that are also exposed to artificial light at night could be at an increased risk for algal blooms, largely as a result of night-time light altering the behavior of grazing macroinvertebrates (Moore et al. 2000, Moore et al. 2006). Other common pollutants in freshwater ecosystems could also interact with artificial light, most resulting in further reductions of biodiversity. However, bright artificial light could mitigate effects of pollutants that degrade under light

Table 2. Key research questions in each research domain.

Key research question	Research domain			
	Dispersal	Evolution	Ecosystem functioning	Interactions with other stressors
Spectral qualities	How do different spectra change an organism's attraction to light? How do different spectra change hormone production?	Are there changes in sexual selection as a result of specific spectra entering the environment?	Is primary production changed? Does the spectrum of artificial light fall within visual predators or prey or both?	Is the light spectra reaching aquatic organisms altered by pollution?
Spatial & temporal scales	Patterns of light across the landscape: does it create traps or barriers? What time of day do species move, does the presence of artificial lights change this?	How quickly does adaptation to/selection from artificial light happen? Are entire populations affected or only fractions of some populations?	Are there refuges available? Is daytime behavior altered? Are there energetic costs?	Is light present year-round or seasonally? What effects might this have on spawning? What is the distribution across watersheds? Specifically, how does artificial light overlap with other stressors?
Magnitude of change in brightness	Is sky glow or direct glare a bigger problem?	Is sky glow or direct glare a bigger problem?	Is sky glow or direct glare a bigger problem? Are there thresholds of effective light levels?	Is sky glow or direct glare a bigger problem? Are there thresholds of effective light levels? Is there an increase in light brightness due to reductions in riparian vegetation (as a result of anthropogenic activities)? Are the light levels high enough to photodegrade chemicals?

exposure.

In restoration efforts, common urban stressors might act in concert to hide the negative effects of artificial light. For instance, water quality was the limiting factor in fish survival and reproduction in a central European river system. However, after decades of efforts to improve water quality, hydromorphological degradation then emerged as the main obstacle to further ecological improvement and freshwater diversity (Borchardt et al. 2005, European Commission 2007). Improving degraded habitats became important once pollutants and oxygen stress had been eliminated; similarly, after degraded habitats have been improved artificial lights could prevent a restoration site from achieving full functionality. This is important to consider as freshwater and riparian ecosystems that have undergone successful restoration often become attractive places for recreation (Woolsey et al. 2007). As recreational uses of these areas increase, user groups might call for the installa-

tion of artificial lights, particularly along biking and running paths in temperate zones with long periods of dark during winter months.

KEY RESEARCH QUESTIONS

We have identified three main general questions facing researchers in artificial light that deserve more attention. These include understanding how different spectral qualities of various sources of artificial light, spatial and temporal scales over which artificial light acts, and the magnitude of changes in light influence organisms and ecosystems (Table 2).

Diverse organisms have sensitivities in different parts of the light spectrum, and various artificial lighting sources emit very distinctive wavelengths of light (Fig. 3). Therefore, different light sources (e.g., high pressure sodium, metal halide) with distinct color spectra are expected to elicit unique responses from different organisms (Fig. 3; Moore et al. 2006). Recently, the European

Eco-Design Directive has enacted a step-by-step plan to phase out particularly energy-intensive lighting products (e.g., high-pressure mercury lamps, the European Parliament and the Council of the European Union 2009). Thus, many countries and the EU have launched a number of programs to adopt efficient lighting systems with a focus on LEDs as a promising energy-efficient lighting technique. There is some evidence that LEDs will attract fewer insects than previous bulb types (Eisenbeis and Eick 2011), but this needs to be more rigorously tested, as the light levels and luminaire construction in this study varied in addition to bulb type. Further, it is completely unknown how other freshwater organisms might respond to different wavelengths, although some fish (e.g., *Acipenser baeri* and *Oncorhynchus mykiss*) have peak sensitivities that correspond to peak emissions from LEDs (Hawryshyn and Hárosi 1994, Sillman and Dahlin 2004; Fig. 3).

The spatial and temporal scalar influence of artificial light is also an area that requires elucidation. Scheibe (2003) showed that one street light located near a stream can attract caddisflies hatching from several hundred meters of stream, but it is unclear how applicable his results are for different habitat and ecosystem types, or what the impact of multiple light sources might be. At larger spatial scales, it is clear that the sky glow created by the cumulative lights of a large city can influence natural areas 10s and even 100s of kilometers away (Albers and Duriscoe 2001, Kyba et al. 2011). For example, Moore et al. (2000) found that artificial light from 16 km away was strong enough to alter the DVM of *Daphnia*. We need to know if wide-spread use of artificial lights near freshwater and riparian habitats will contribute to the decline or disappearance of sensitive species, lead to localized decreases close to bright light sources, or even be beneficial for other species. Even if sky glow does not cause extinctions, it could very likely alter food web structure either by changing predators' ability to detect prey or prey behavior (Moore et al. 2006). Another question that needs to be answered is if light-sensitive species are able to re-colonize areas when lights are removed. Mapping the occurrence of artificial light across landscapes will allow us to make better predictions about the

likelihood of specific habitats being recolonized.

While the results of Scheibe (2003) and Moore et al. (2000) suggest that artificial light can influence organisms over a relatively large spatial area, we do not know the temporal scale of this influence. Does exposure to artificial light during the night alter the behavior of organisms during the day? Perhaps some organisms have life stages that are particularly vulnerable to exposure to artificial light, but are not sensitive during the rest of their lives. These species might be able to take advantage of dark refuges for sensitive life stages and then live in artificially lit areas at other times. If populations are negatively affected by artificial light, are they able to recover quickly once artificial light is removed from their habitat? This largely depends on whether artificial light alters the genetic structure of populations. Furthermore, spatial analysis is needed to determine the overlap of artificial lights and freshwater bodies. As noted in the introduction, freshwater environments are preferred sites for human activities, which will often lead to an increase of artificial lights. We expect to find the greatest amount of lighting in already damaged urban areas, but we also need to determine if vacation homes and highways introduce a meaningful amount of light to more natural areas.

The magnitude of changes in light also needs to be better understood. While direct glare is the most conspicuous form of light pollution, sky glow is a much more wide-spread phenomenon that is likely to influence animal behavior (Longcore and Rich 2004, Moore et al. 2006, Nightingale et al. 2006). Sky glow can increase ambient light levels hundreds of kilometers away from the cities from which it emanates. This is the case in several ecologically important U.S. National Parks (Everglades, Channel Islands, and Joshua Tree), which have night skies that are substantially brighter than natural due to sky glow from nearby cities (Albers and Duriscoe 2001). One potential problem of increased light from sky glow is that it reduces or eliminates the natural monthly variation in night-time light that arises from the lunar cycle (Longcore and Rich 2004, Kyba et al. 2011; Fig. 2). If the general increase in ambient light caused by sky glow can alter behavior and harm ecosystems, then managing artificial light becomes a much more pressing

conservation concern. However, it will be very difficult to study the effects of sky glow on ecosystems, as there are very few places left in North America and Europe that do not have elevated levels of sky glow to use as control sites (Cinzano et al. 2001). Furthermore, once researchers have located a promising location, how do they mimic an increase in sky glow that would normally be produced by a city of 500,000+ inhabitants that is 50 km away? While researchers may be able to introduce direct glare by introducing a few lights to an ecosystem, those interested in understanding the influence of sky glow may have to introduce artificial darkness to an already lit area, as Moore et al. (2000) did.

CONCLUSION

How artificial light at night might influence stream and riparian ecosystems is a relatively unexplored topic, with many possibilities for relevant research. Even though the experimental knowledge of the ecological impacts of artificial light at night is still developing, governments are creating legislation to regulate it, mostly to reduce energy costs and decrease greenhouse gas emissions (Hölker et al. 2010b). Reducing energy consumption is a desirable goal, but if it is achieved solely through changing lighting fixtures and not necessarily reducing lighting, and without knowing how different aspects of artificial light (e.g., intensity and spectral qualities) influence ecosystems, this legislation could have unintended and even negative impacts on ecosystems. We also expect that governments will not be able to regulate artificial light everywhere, but by understanding its potential consequences, we can better prepare for or mitigate them.

Carefully designed experiments are needed to determine the exact effects of artificial light on ecosystems and over what spatial and temporal scales they act. From a management perspective, it is highly important to consider and incorporate the mitigation of potential ecological impacts and losses of biodiversity and ecosystem services into new lighting concepts (Rich and Longcore 2006, Hölker et al. 2010a, b). While there are many challenges to overcome in pursuing this research, the potential for new breakthroughs in under-

standing ecosystems and their functioning is high and should motivate researchers to innovate new techniques.

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Cloud Coverage Acts as an Amplifier for Ecological Light Pollution in Urban Ecosystems

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Abstract

The diurnal cycle of light and dark is one of the strongest environmental factors for life on Earth. Many species in both terrestrial and aquatic ecosystems use the level of ambient light to regulate their metabolism, growth, and behavior. The sky glow caused by artificial lighting from urban areas disrupts this natural cycle, and has been shown to impact the behavior of organisms, even many kilometers away from the light sources. It could be hypothesized that factors that increase the luminance of the sky amplify the degree of this “ecological light pollution”. We show that cloud coverage dramatically amplifies the sky luminance, by a factor of 10.1 for one location inside of Berlin and by a factor of 2.8 at 32 km from the city center. We also show that inside of the city overcast nights are brighter than clear rural moonlit nights, by a factor of 4.1. These results have important implications for chronobiological and chronocological studies in urban areas, where this amplification effect has previously not been considered.

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Introduction

The ambient light level is one of the strongest factors driving animal behavior and chronobiology, evidenced by the dramatic split of most species into diurnal or nocturnal activity. It is therefore unsurprising that changes in ambient nighttime lighting result in behavioral and physiological changes for many nocturnal species [1], whether in terrestrial [2–4], marine [5], or freshwater [6–8] habitats.

With the exception of life in the deep oceans and underground, all life on Earth has evolved to live in an environment of cycles of light and dark, with a substantial proportion of the global biodiversity being nocturnal (30% of all vertebrates and >60% of all invertebrates [9]). Most organisms, humans included, have evolved molecular circadian clocks which are set by natural day/night cycles. Until the invention of artificial light, this meant that many behavioral and physiological traits were determined by the motions of the sun, the moon, the stars, and the weather (e.g. [10–12]).

The first lighting technology was fire, which was used expressly to modify animal behavior: fire allowed human activity to continue past sundown and frightened away human predators. Small scale urban lighting began with gas lamps, but the nighttime environment drastically changed with the widespread deployment of electric lighting in the last century. Since then, the rapid global increase of artificial light has fundamentally transformed night-escapes, both in terms of quantity, increasing several percent each year, and in quality (color spectra) [13].

Light pollution, which causes the “light dome” dome of sky glow over urban areas, is an unintended result of this electric lighting, and because of it approximately 10% of the world’s

population, and more than 40% of the US population, no longer view the night sky with dark adapted vision [14]. In addition to emptying the night sky of stars, it has been suggested this unwanted light may be damaging to our health [15–18], although this hypothesis is debated [19].

For any given individual species, the impact of artificial light may be neutral, beneficial (e.g. increased foraging), or detrimental (e.g. collisions with lighted structures [20]). In either of the latter cases this may disrupt predator-prey relationships and ecosystem functions [21,22]. Thus, light pollution can also be considered an important driver behind the erosion of ecosystem services (e.g. pollination of plants by moths or bats, loss of biodiversity, and changes to food webs [9]). Aesthetic values, such as the visibility of the Milky Way, could be also considered a vulnerable cultural ecosystem service [23]. While the fact that artificial light affects animal behavior has been recorded since Aristotle, recognition of the potential danger posed to entire social-ecological systems by urban lighting is relatively recent [13,24].

Sky glow occurs when light escaping upwards from a city is scattered back to the ground, through interactions with atmospheric components. On clear nights with extremely good visibility, urban sky glow is caused by the scattering of light by molecules (Rayleigh scattering), Rayleigh scattering affects blue light much more strongly than red, and is responsible for making the sky blue and the sunset red. The glow of distant cities is red for the same reason [25].

Atmospheric visibility is generally reduced due to the presence of aerosols, small particles or droplets suspended in the air that can come from natural (e.g. dust, sea salt) or artificial (e.g. soot) sources. Aerosols can impact light pollution in several ways. First, higher aerosol concentrations should amplify the sky glow

(particularly on cloud free nights), as aerosols increase the chance that light is scattered back to Earth. Second, if the aerosols are absorbing in the visible band (which is typical in the case of smog), they could reduce the extent to which environmental changes (e.g. snow, or as we shall see, cloud cover) amplify light pollution, as multiply scattered light would have increased chances of absorption. Third, in the case of very short visibility, the probability of light propagating to the city limits will be reduced, and thus the horizontal extent of the sky glow outside of the city should be reduced.

Clouds are effectively thick collections of aerosols (small water droplets) that almost non-absorbing at visible wavelengths. This makes clouds very reflective [26,27], and therefore we expect them to amplify sky glow. In the case of optically thick clouds, if we consider only the upward and downward propagation of light (as in the so-called two-stream approximation), then, to first order, the cloud bottom can be thought of as a two-sided, white (Lambertian) boundary, which diffusely reflects sun, moon, or city light back towards the hemisphere from which it came. While this analogy is clearly an oversimplification (e.g. one can usually see quite well outdoors in the daytime even under thick clouds), it is useful for gaining a "feel" for how clouds interact with light pollution. In the particular case of an observer under optically thick clouds and inside of a large city (where the cloud bottom is much closer to the observer than is the edge of the city), the model of the cloud bottom as a Lambertian surface is probably a reasonably good approximation.

This redirection of light back towards the ground gives rise to the effect shown in Figure 1, that while in pristine environments clouds appear as dark objects on the star filled sky, in cities clouds appear as bright objects on a dark background, nearly devoid of stars. While this phenomena has been qualitatively observed by many people, we believe that this work represents the first systematic and quantitative study of this effect presented in the scientific literature. The reasons a similar study by [28] did not observe this effect are considered in the discussion section. Measurements of the increase of light due to cloud coverage were shown in [29] and in a poster by Posch, Hollau, Kerschbaum, and Bleha presented at the Cancer and Rhythm conference, Graz Austria, 2004, but in both cases only for single nights.



Figure 1. Photograph showing the amplification effect that clouds have on the sky glow. Inside of cities clouds appear as bright objects on a dark sky. In natural environments, clouds look more like the tower in the photo: dark silhouettes against a star-lit sky. Photo: C. Cyba. doi:10.1371/journal.pone.0017307.g001

While an atmospheric model of clouds as white surfaces and "Rayleigh scattering only" skies is sufficient to qualitatively discuss the results of this paper, we should note that quantitative modeling of light pollution requires much more attention to detail. For an observer on the ground, the radiance of the sky observed in any given direction depends upon a host of variables, including the wavelength of the light in question, the makeup of the atmosphere, the distribution of city lights on the ground, the topography of the city, and the observer's position within it. In the next two paragraphs we point to more detailed references, which together describe each of the components needed to fully characterize the sky glow produced by a city.

The scattering and absorption of light in the atmosphere is of central importance to climate science, and has thus been described in detail elsewhere (see e.g. [27,30]). Modeling the interaction of light pollution with clouds requires understanding of the optical properties of the cloud, in particular the cloud optical thickness (a description of the probability that light interacts with water droplets in the cloud), the single scatter albedo (the propensity of photons to be scattered rather than absorbed), and the asymmetry parameter (the relative proportion of photons that are scattered forward rather than backward) [27]. A detailed discussion of cloud reflectance can be seen in e.g. [26].

In most cases, atmospheric scientists focus discussion on the interaction of sunlight with the atmosphere. Light pollution, however, is very different from sunlight in that the angular distribution of upward traveling light depends strongly on position, and the spectral distribution depends very strongly on local factors (i.e. what types of lamps are in common use). An evaluation of the combined luminance of all of the sources of light a single city is given in [31], a comprehensive review of the spectrum of different lamp types is given in [32], and discussion of the geometry of light pollution, and sky maps showing the sky radiance caused by single or multiple lamps is given in [33].

Historically, light pollution research and advocacy has been undertaken by astronomers, who justifiably have little interest in cloudy nights. In the first serious model of light pollution [34], only the case of clear skies was considered, and with some exceptions (e.g. [33]), models and measurements generally consider only cloud-free conditions [14,35–38].

We expect the presence of clouds to significantly brighten urban skies, and to amplify the degree of ecological light pollution. We aim to show that in studying the impact of sky glow on ecology, health, or interruption of circadian rhythm, it is essential that cloud coverage be taken into account. In performing our analysis, we also expect to show that the level of light pollution in Berlin is ecologically relevant (meeting or exceeding the light levels produced by the moon), and finally that the total light produced by Berlin decreases as the night progresses.

Materials and Methods

The main goal of this paper is to measure how cloud coverage affects sky brightness in an urban environment. This measurement is referred to as the "cloud analysis". In order to allow for comparisons to the sky brightness typical of natural environments, we also study how the elevation of the moon above the horizon affects sky brightness. This is called the "moon analysis".

Our night sky brightness data were taken using the "Sky Quality Meter" (SQM) produced by Unihedron (Grimbsy, Canada), shown in Figure 2. The SQM measures luminance (surface brightness) for a patch of the sky, in units of magnitudes per square arc second (mag/arcsec²). The photosensitive element of the meter is a silicon photodiode (TAOS TSL237S light-to-frequency

converter), which responds to light with wavelengths in the range of 320 to 1050 nm, with a peak at about 680 nm. The photodiode is covered by a HOYA CM-500 filter, which reduces the wavelength response to 320 to 720 nm, in order to provide better agreement with the wavelength response of human night vision. The response of the SQM contains an internal temperature sensor which is used by the SQM software to provide compensation (i.e. the results reported by the SQM should have no temperature dependence over the range -25 to 70 degrees Celsius).

Unihedron produces several different models of the SQM, which are differentiated by their method of data readout and by their field-of-view (FOV). The SQM is available as a hand-held device with a digital display, or as a continuous measurement device using either a USB or Ethernet connection. We made use of Ethernet enabled SQMs, as Ethernet allows longer cable runs than USB. The field-of-view is determined by the presence (SQM-LE) or absence (SQM-E) of a focusing lens, which reduces the FOV from a wide angle to a small patch of the sky. The half-width at half-maximum has been measured to be 4° and 10° for the SQM-E and SQM-LE respectively [39]. For the measurements reported in this paper, we made use of one SQM-LE and two SQM-E devices.

The SQM reports the sky brightness in units of magnitudes per square arcsecond (mag/arcsec²), a logarithmic unit in use by the astronomy community. The scale is defined so that an increase of 5 in mag/arcsec² corresponds to a factor of 100 decrease in luminance. It is possible to approximately convert mag/arcsec² into nit (cd/m²) using the formula: $cd/m^2 = 9.0 \times 10^{-8} \times 10^{0.4x}$, where x is the luminance in mag/arcsec². (This equation was provided to us by Unihedron, and originates from the webpage of Paul Schlyter: www.ajarnhimlen.se/comp/radfaq.htm) This conversion, however, contains an implicit assumption about the wavelength distribution of star light, which we can neither assume to be the same as light pollution, nor the same for both clear and

cloudy conditions. A general conversion from mag/arcsec² to lux is not possible, as converting luminance measurements to illuminance measurements requires making an assumption about the angular distribution of the sky brightness intensity, which we expect to change in the presence of clouds. The SQMs have a quoted systematic uncertainty of ~10% (0.10 mag/arcsec²).

The Ethernet enabled SQMs were installed at three locations: our measurement tower at the Institute for Space Sciences at the Freie Universität (52.4577°N, 13.3107°E), at the Leibniz-Institut für Freshwater Ecology and Inland Fisheries (52.4487°N, 13.6513°E), and on an island of the Spree river outside of the city (52.3681°N, 13.8049°E). The locations are approximately 10, 18, and 32 km from the center of Berlin, and can be classified as urban, suburb, and rural respectively. In order to protect the devices from rain and snow, the SQMs were installed in a protective housing produced by Unihedron. The housing consists of a short length of 3" PVC pipe fitted on the top and bottom with 3" PVC endcaps. The bottom endcap has a hole drilled in it to allow for entry of cables and to allow moisture to escape, and the top endcap has a hole to allow a window for observations. This window is covered with a glass top which is glued to the surface of the endcap. The attenuation of the glass cover has been measured to be 0.11 mag/arcsec² [40], and to correct for this effect we subtract this amount from the readings reported by the device. The internal web server of the SQM-LE produces enough heat to quickly melt snow and evaporate water from the glass surface.

The data were read out from the SQMs using a custom developed Perl script, partially based on sample code provided by the manufacturer. The devices were polled approximately once per second, and whenever the readout value changed, the time and sky brightness measurement were recorded to a file. These values were then averaged by our analysis program to create a minute-by-minute dataset. Despite the logarithmic scale, we directly averaged the measurements in mag/arcsec², as we expect measurement differences at very short time scales are more likely to be due to the device electronics rather than a physical change in the sky brightness.

Our cloud coverage figures were taken from synoptic measurements at a manned weather station (Berlin-Dahlem, World Meteorological Index 10381) located adjacent to our measurement location at the Freie Universität. The SYNOP data were retrieved from the OGIMET website, <http://www.ogimet.com>. In synoptic observations cloud coverage is reported in "oktas", which represent the fraction of the sky obscured by cloud in eighth's. Zero oktas corresponds to a cloud-free sky, while eight oktas corresponds to completely overcast conditions. The synop data were reported hourly, so the maximum time difference between any sky brightness measurement and the most recent cloud observation was 30 minutes. Berlin has several synop stations, and we have verified that using cloud data from a different station (e.g. closer to the rural site) has only a minor impact on the results. Because we are most interested in what is happening at the urban location we used the data from the adjacent weather station.

In natural ecosystems, the moon is the highest source of light at night. The relationship between the intensity of moonlight (both direct and scattered) and the moon's position parameters (distance from Earth, phase, elevation above the horizon, and time of year) is computationally very complex (see e.g. the simulation presented in [28]). We eliminated the need to compensate for moonlighting in the cloud analysis by simply considering only moonless nights. To do this, it was necessary to calculate the position of the moon for each data point. This was accomplished using the "Astro:Coord:ECI" and "Astro:Coord:ECI:Moon" open source Perl scripts (v0.033), which were developed by Thomas R. Wyant, and



Figure 2. Photograph showing the Sky Quality Meter installed in its protective housing (SQM-LU left), along with an expanded view (SQM-LE right). The housing at left is shown with the two included hose clamps that allow easy attachment to a stake or pole. The USB version (left) requires only one cable, but at the cost of shorter cable runs and the internal heating provided by the Ethernet version (right). doi:10.1371/journal.pone.0017307.g002

are freely distributed by the Comprehensive Perl Archive Network (<http://search.cpan.org/~wyant/Astro-satpass-0.033/>). The algorithm is based upon calculations in [41], and has a quoted moon position uncertainty of 10 seconds of arc in latitude.

The moon positioning algorithm was initialized using the longitude, latitude, and elevation (91 m) of the measurement tower at the Freie Universität. The moon position was calculated at the 30 second mark of each minute, matching the median time of our sky brightness measurements. We define our data to be "moonless" when the moon's true position (i.e. ignoring any effects of refraction in the atmosphere) is 2° or more below the horizon.

The sky brightness data for the cloud analysis were taken during the period from April 22 to September 21, 2010, using wide field-of-view SQM-Es at our urban and rural measurement stations (10 and 32 km from the city center, respectively). Within this time span the data from six nights were rejected due to failures in the data acquisition chain (e.g. from a power interruption). The summer air in Berlin is relatively clean, and visibilities of 30–40 km were typical during this study. Because we expected the total amount of light produced by the city to decrease as the night progressed (from decreased auto, residential, and advertising lighting), we only considered data taken during the same time window each night. This considerably restricts the size of our dataset, but reduces the possibility of introducing systematic bias or larger variation into the observed sky glow.

The optimal duration of the data taking window depends upon the analysis that one wishes to pursue. For the cloud analysis our goal was to include as many different cloud coverage values as possible, getting a "snapshot" of the sky brightness at the same time as the cloud coverage measurement was taken, and for a variety of weather conditions, was more important than sampling unchanging skies over several hours. The large size of weather systems means that overcast or clear conditions often persist for several days, and for this reason we wished to use data from as many nights as possible. Due to the extremely short duration of the night at the time of the summer solstice in Berlin, this restricted us to using only data taken between 12:45 am and 1:15 am local time (UTC+2, Central European Summer Time). Berlin is near the center of its time zone, so the moment of "true" local midnight occurred during this half-hour period for each night in our dataset.

In the case of our moon analysis we were less concerned with including as many individual nights as possible. Instead, we preferred to use a longer time interval each night, which allowed

the moon to move through a substantial range of elevation above the horizon each night. For this reason we only used data taken at least three weeks away from the summer solstice (i.e. April 22–May 30, and July 13–September 21). This allowed us to use a wider time window than that used in the cloud analysis, from 12:00 am to 2:00 am. To avoid the possible influence of clouds, we only included data for which the cloud coverage in the two synop reports nearest to the sky brightness measurement was 0 or 1 oktas.

The computer reading out the data at the Freie Universität has access to an Internet connection, which allowed timing to be maintained to better than second accuracy throughout the data taking period. The computer collecting data at the remote location, however, was located in a non-climate controlled container, and experienced clock drift. This computer's time was periodically corrected manually, at intervals ranging from 5 to 38 days. When these corrections were made, the total drift since the last correction was noted. This allowed us to remove the linear portion of the clock drift in software, and pass the corrected data to our analysis program after the data was collected. Over the entire period of data taking, the average clock drift was +12.9 seconds/day, and we do not expect that the maximum deviation from true time at any period in our dataset was more than 5 minutes.

Results

The sky brightness values recorded on three representative nights (clear, partly cloudy, and overcast) at our three measurement locations are shown in Figure 3. In all weather conditions, the rural site was darkest (largest value of mag/arcsec²) and the urban site was brightest. The plot at left shows the data for the clear (0–1 oktas) night of June 4–5, 2010, during which the half full moon rose at 1:21 am. The middle plot shows data for May 20–21, which was partly cloudy (3–4 oktas) until 3 am, when the sky cleared (to 1 okta). The right hand plot shows the data for May 13–14, which was overcast (8 oktas) the entire evening. A dotted line is drawn in the right hand panel to show the portion of the data from that night that contributes to the cloud analysis.

At midnight on the clear night in the left hand frame of Figure 3, the sky brightness at the rural site was on average about 1.85 mag/arcsec² darker than the urban site (2.4 mcd/m² compared to 0.43 mcd/m², ~1/5 the luminance), while on the overcast night it was 3.15 mag/arcsec² darker (26 mcd/m² compared to 1.4 mcd/m², ~1/20 the luminance). It is immediately apparent from these plots that the sky glow exhibits a strong

urban→rural gradient, and that clouds have a very significant impact on urban sky brightness. Note that the suburban data were taken with a narrow FOV SQM-LE, which we found tends to record darker values for clear and partly cloudy conditions. We included the suburban data in Figure 3 to emphasize the urban→rural transition, but we do not use the data from that location in our cloud or moon analysis.

While we would in principle prefer to have equivalent statistics for each level of cloudiness, in practice we must make use of the conditions that nature provides. Table 1 shows the number of nights in the dataset for which each degree of cloudiness was observed at 1 am. The table also shows the effective number of nights available for the cloud analysis. Fractional values occur because of occasional data loss, and because of nights during which the moon rose or set during the 30 minute analysis period. Clear or overcast conditions occurred much more frequently than partly cloudy (2–6 oktas) skies.

Our results for the cloud analysis using the full dataset are shown in the left panel of Figure 4, and numerically in Table 2. In the figure, the upper set of points represent the data at the rural location, while the lower set were taken inside of the city. For each value of cloudiness (in oktas) the median sky brightness observed is shown with a horizontal line. The variation in the observed data is shown by the thick and thin lines, which cover the ±1 and 2σ bands (containing ~68% and 95% of the observed data, respectively). The large separation between the distributions for clear and cloudy conditions at the urban site refutes the null hypothesis (i.e. that clouds do not amplify urban sky glow) with certainty.

We found that on the clearest nights around the time of the solstice, the sky at the rural location doesn't appear to get quite as dark as it might on an equivalent night in the spring or fall. As is shown in Figure 5, on these nights the ʹ shaped pattern of the sky darkening and then brightening doesn't include the typical broad plateau. However, due to both our narrow time window of 15 minutes around 1:00 am, the large number of clear nights, and the marked difference between the urban and rural measurements, the impact of this effect is a minor increase in the spread of the data for the darkest nights. As a test, we tried selecting data within 15 minutes of 1:08 am (which is a better approximation of local midnight), and found that this had a negligible impact.

The results of the moon analysis are shown in the right hand panel of Figure 4. The data are grouped in bins of 5° of moon elevation above the horizon, and the bars show the ±1 and 2σ bands, as in the plot at left. Negative values of elevation indicate that the moon was below the horizon, and are shown in individual bins as a consistency demonstration.

As discussed in the Materials and Methods section, the analysis uses only a small portion of the data from each night because the

total amount of light produced by the city is expected to change as the night progresses. We tested this hypothesis by selecting a small number of nights with completely overcast skies. In order to guarantee overcast skies, data were only included if the cloudiness was 8 oktas in both of the adjacent hourly synop reports. Figure 6 shows how the sky glow over the Freie Universität changed during nights between April 26 and May 15. The left hand plot shows the data in mag/arcsec², the right hand plot shows the same data on a linear scale, using the approximate conversion to cd/m² (nit). Over the course of the night the sky brightness decreased from 15.95 to 16.55 mag/arcsec², a decrease in luminance of approximately 40%.

The data on which these results are based is provided in supplemental File S1. The table's contents are: the date, time of observation in "hours after midnight" in the GMT+1 time zone (i.e. +0.5 is 12:30:00 am, and -0.0083 is 11:59:30 pm), the sky brightness value observed at the urban and rural sites (in mag/arcsec²), the cloud coverage from the most recent SYNOP report in oktas, the difference in oktas between the two adjacent SYNOP reports, the cloud base (an integer code number as per the SYNOP specifications, see e.g. <http://weather.unisys.com/wsp/Appendices/Formats/SYNOP.html>), the visibility (in meters), and finally the elevation (in degrees), illuminated fraction, and distance (in km) of the moon.

Discussion

Using two SQMs, we studied changes in the sky brightness of Berlin in a rural and urban location over a period of 152 calendar days. The degree to which Berlin's skies are polluted by light can be demonstrated by comparing the sky brightness measured here with that measured in a more natural setting. In a recent study of sky brightness at the Zschiegen Landscape Protection Area in Hungary (an International Dark-Sky Park), the darkest measurements obtained on clear moonless nights using an SQM were 21.5–21.6 mag/arcsec² [38]. The very darkest observations for clear moonless nights in Berlin were ~21.2 mag/arcsec² at our rural location and ~19.3 mag/arcsec² at our urban location, a luminance greater by 38% and 690%, respectively. Typical nights at both locations, however, were far brighter even than this.

The left hand plot of Figure 4 demonstrates the significant degree with which clouds amplify the impact of light pollution. The data show a strong dependence on the cloudiness level, with very rapid brightening as the sky becomes fully overcast. The measured sky brightness for fully overcast skies at our urban measuring station was 16.5 mag/arcsec², a luminance approximately 10600% brighter than that observed for dark nights at the dark-sky park in Hungary.

We can see that this sky brightening is ecologically relevant by comparing the brightness at the urban station to the brightness observed on moonlit, cloud free nights at our rural station. The two panels of Figure 4 show that regardless of weather conditions, the night sky of Berlin is almost always as bright as that naturally experienced during a high elevation summer moon. (Although it should be kept in mind that the SQM-E effectively measures the integral amount of light incident on a plane parallel to the ground. The angular distributions of sky glow and direct moonlight, and therefore an organism's visual experience of the environment under the two, are very different.) This means that for light avoiding organisms that moderate their behavior in the presence of moonlight, for example zooplankton in a lake system [42], the light pollution from Berlin is expected to be a considerable stressor. It has been previously shown, in lake food webs, that light mediated diurnal vertical migrations of zooplankton may be

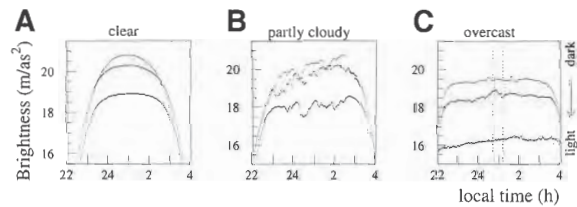


Figure 3. Examples of the sky brightness (in mag/arcsec²) observed for different cloud conditions and at different locations. The minute by minute data for individual clear (A, June 4–5), partly cloudy (B, May 20–21), and overcast (C, May 13–14) nights at each of our rural (red), suburban (blue), and urban (black) measurement stations is shown. Larger values of mag/arcsec² indicate darker skies. The unit is logarithmic, with a 2.5 increase in mag/arcsec² corresponding to a sky that is ~10 times as dark. The dotted lines in the plot at right show the time window used in the cloud analysis.

doi:10.1371/journal.pone.0017307.g003

Table 1. Frequency of cloud coverage conditions over the course of data taking.

Okta	0	1	2	3	4	5	6	7	8
Total Nights	21.5	26.5	7	12.5	7	13	10	23	26
Moonless Nights	11.9	10.6	3	7	0	5	6	9.2	13.6

For each value of cloud coverage (0 is clear, 8 is overcast), the number of nights in the observation period is shown along with the effective number of nights that the moon was at least 2° below the horizon between 12:45 and 1:15 am. Fractional values occur due to occasional data loss due to power outages, and to nights during which the moon rose.

doi:10.1371/journal.pone.0017307.t001

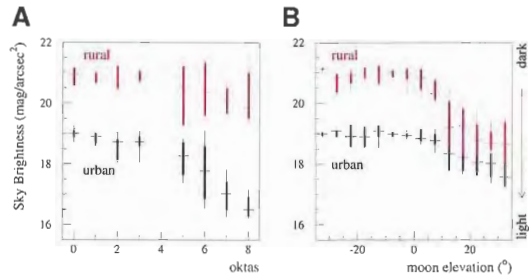


Figure 4. Profile histograms of the sky brightness data. Panel A shows the sky brightness observed as a function of cloud coverage. The bars show the ± 1 and 2σ spread of the data. Panel B shows the sky brightness as a function of moon elevation for clear (0–1 okta) nights. Larger values of mag/arcsec² indicate darker nights. doi:10.1371/journal.pone.0017307.g004

suppressed, decreasing the grazing pressure on phytoplankton [7,43].

The amplification of sky glow by clouds surely amplifies this stressor, since we observed that the sky glow typical on overcast nights within Berlin was 4.1 times as bright as that observed outside the city on clear nights with a high elevation moon. In pristine ecosystems at a similar latitude to Berlin, a sky glow brighter than 19 mag/arcsec² is likely only experienced for several hours on a few nights each summer, namely on cloud free nights when the moon happens to be high in the sky. This “worst case scenario” for some zooplankton species in their natural environment represents almost the most favorable conditions they can ever face in the urban waterways of Berlin. While it can be expected that some species will be genetically capable of adapting their behavior, physiology, growth, and reproduction to live in or take advantage of unnaturally lit environments, other species will not, and at least some light-sensitive species and genotypes will be lost in the long term [9].

The “error bars” shown in Figure 4 are not uncertainties, but rather represent the spread of the observed data. For the data in the cloud analysis there are three sources of variation. First, during a single night, changes in the local cloud coverage (i.e. the positions of clear and cloudy patches of the sky relative to the SQM) lead to changes in the measured sky brightness, in part due to the angular response of the SQM. This was shown in Figure 3. While only data taken within 15 minutes of the synoptical

observation we considered, in some cases the cloud coverage changes during this time. Second, “oktas” are a relatively crudely spaced measure, and are determined by human observers, each of whom might have a slightly different idea of where the cutoff lies between, say, 3–4 oktas. Third, from night to night the baseline value for a given number of oktas is expected to be different, due to differences in the environmental conditions: cloud type (i.e. the cloud height, optical thickness, single scatter albedo, and asymmetry parameter), surface albedo, visibility, and atmospheric aerosol content. It is this second source of variation that gives rise to some of the “lopsided” distributions, where the upward and downward lengths of the 1 or 2 σ bars differ considerably in length. For example, the large upward tail on the rural 8 okta measurement in Figure 4 is due to a night with exceptionally low clouds (100–200 meter ceiling). Finally, in the case of the rural data, the cloud condition at the rural site may be slightly different than at the urban site, where the synoptical observation was made.

We believe the largest source of the night to night variation, and the reason for the steep increase in brightness with cloud level at 4–5 oktas, is changes in cloud type and thickness. Scattering from aerosols is strongly forward peaked, so while light may be deflected as it propagates through a thin cloud it is not particularly likely to be scattered back towards the ground. Thick clouds on the other hand, are expected to be very efficient at scattering light back down to ground level, as the photons must undergo many scattering events before leaving the cloud top. The hypothesis that

Table 2. Amplification factor of clouds.

Okta	0	1	2	3	4	5	6	7	8
Rural (mag/arcsec ²)	21.0	20.8	20.7	20.9	/	20.5	20.4	20.1	19.9
Urban (mag/arcsec ²)	19.0	18.9	18.7	18.7	/	18.3	17.8	17.0	16.5
Rural amplification	1	1.2	1.3	1.1	/	1.5	1.7	2.3	2.8
Urban amplification	1	1.1	1.3	1.3	/	2.0	3.1	6.1	10.1

For each value of cloud coverage (0 is clear, 8 is overcast), the median observed sky brightness over the course of data taking is shown in mag/arcsec². These data were used to calculate a sky brightness amplification factor for each level of cloudiness (relative to clear skies). Under clear conditions urban skies were 6.1 times brighter than at the rural site. doi:10.1371/journal.pone.0017307.t002

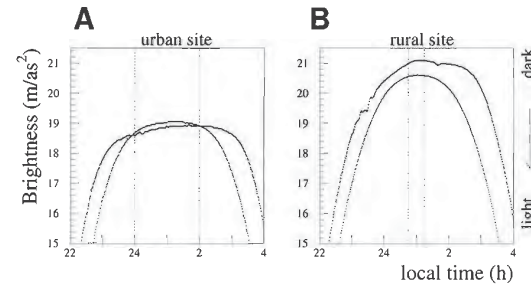


Figure 5. Nights are dramatically shorter around the time of the summer solstice. The minute by minute sky brightness data (in mag/arcsec²) for the night of June 16–17 (red) is compared to July 20–21 (black) at our urban (A), and rural (B) locations. In the left plot the dotted lines indicate the time window used in the moon analysis, and in the right plot the time window used in the cloud analysis. Due to the shortening days we reject data taken within three weeks of the summer solstice from our moon analysis. The curve for July 20–21 at the rural site appears lopsided because the moon set shortly before 1am. doi:10.1371/journal.pone.0017307.g005

the night to night variation is due to changes in cloud type could be easily tested by repeating this experiment in a location that has access to continuous LIDAR measurement of cloud properties.

We have demonstrated that in Berlin, and presumably in urban areas in general, cloud coverage has a strong amplification effect on light pollution. Due to this amplification, the luminance of the night sky in Berlin is 10.1 times brighter on overcast nights than on clear moonless nights, and 4.1 times brighter than that observed at our rural location on the brightest clear nights with a high elevation moon. Since many organisms are known to modify their behavior in the presence of moonlight, and because of the high frequency of overcast conditions, the cloud amplification effect has strong implications for the ecology of urban areas. The influence of cities extends over large areas: at 32 km from the city center the

impact of clouds was still to brighten (by a factor of 2.8), rather than to darken, the night sky.

In contrast to the results reported here, a similar study undertaken in Hong Kong as part of a Master's thesis did not find a dependence of the night sky brightness on cloud coverage [28]. Although there were several methodological differences between that study and the present work, we believe that the primary reason for the different conclusions is that the studies were taken under completely different environmental conditions. The horizontal visibility measured by the synop station in Hong Kong was typically between 4 and 12 km. This is far shorter than that reported in Berlin, which was in almost all cases >10 km. A second important difference is that the data presented in [28] are for a site 15–20 km away from Hong Kong itself, a very large

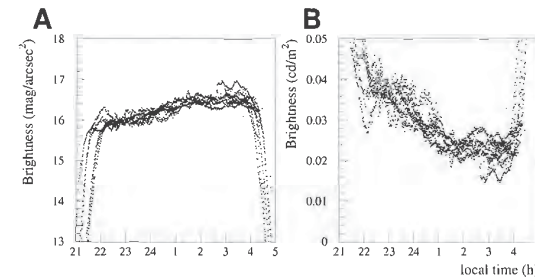


Figure 6. The sky brightness measured at the urban location is shown against local time for overcast skies in the April 26 - May 15 period. Data were included if the cloudiness was reported as 8 oktas in both the hourly report before and after the data was taken. Panel A shows the minute-by-minute data in the usual logarithmic scale (mag/arcsec²), panel B shows the same data on a linear scale, using the approximate conversion to cd/m². The data shown were taken during the nights of April 26, May 2–3, May 6–7, May 9–10, May 11, and May 13–15, 2010. doi:10.1371/journal.pone.0017307.g006

distance compared to the typical visibility. It may be that an examination of the data taken within Hong Kong itself would reveal a stronger relationship between cloud coverage and sky brightness. We agree with the suggestion in [44], that duplication of this study in other cities could help to elucidate the interaction between visibility, aerosols, clouds, and sky brightness, particularly if the site has access to LIDAR data.

The recent development of convenient sky brightness meters (both the Sky Quality Meter and the International Year of Astronomy Lightmeter) has made the continuous monitoring of ecological light pollution simple. The long term deployment of these devices by light pollution researchers in cities and dark sky parks, and by ecologists and physiologists in their research environments, will allow for both a quantitative understanding of the difference in night lighting across social-ecological systems, and for systematic, high precision, ground based tracking of year-to-year changes in sky brightness.

The well known map of world light pollution [14] includes by necessity only data from clear nights. Our analysis indicates that it is very important that biological conclusions based upon those results (e.g. [16]) consider the potential role that weather plays in enhancing the brightness of urban areas. Additionally, researchers performing *in situ* experiments in or near urban areas in which the presence or absence of the moon is known to affect the result (e.g. insect catches, [4,45]) should be aware that clouds and aerosols may play a larger role than the moon in determining ambient lighting.

It may be the case that the regional frequency of overcast nights is more important than population density in determining the

threat posed to urban ecosystems by light pollution. By extending this analysis to include cities and towns of varying size, different regions, rural areas, and dark sky parks, we could test if this is the case. The development of a global dataset of continuous measurements from sky brightness meters would allow for rigorous evaluation of the results of [14], would provide strong constraints for verifying light pollution models, and would be beneficial to ecologists and light pollution researchers everywhere. We encourage anyone interested in participating in such a measurement to contact us.

Supporting Information

File S1
(TXT)

Acknowledgments

We would like to thank Unihedron for their technical and software support.

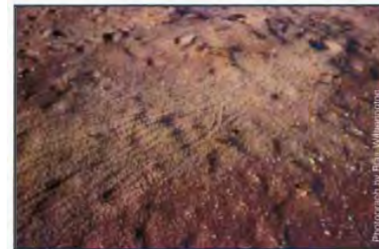
Author Contributions

Conceived and designed the experiments: CCMK TR FH JF. Performed the experiments: CCMK FH TR. Analyzed the data: CCMK. Contributed reagents/materials/analysis tools: CCMK. Wrote the paper: CCMK FH JF TR.

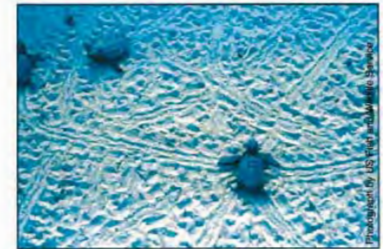
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IDA Practical Guide



Turtle trails that go straight to the ocean, as they should.



Turtles that are confused by light pollution (shown above with their erratic trails), are unable to find their way to the ocean.

Topic : *Effects of Artificial Light at Night on Wildlife*

FROM THE BEGINNING OF EXISTENCE, humans have controlled their immediate environment, building shelters to keep out the elements and fires to banish the darkness. As civilizations continue to develop, humans are able to affect dizzying change on habitats in all corners of the globe. Though agreeable to us, many of the comforts of advanced society are devastating to the creatures that share the earth. A growing body of data suggests that artificial night lighting has negative and deadly effects on a wide range of creatures, including amphibians, birds, mammals, insects, and even plants.

Humans have evolved as diurnal animals, biased toward the daytime and dependant on visual cues, so illumination of our nightscapes seems comfortable and necessary. All animals, including humans, depend on a regular interval of daylight and darkness for proper functioning of behavioral, reproductive and immune systems. Many of these animals need the natural night to survive. For thousands of species, the natural dark night of the evolutionary past is an integral component of their continued existence.

Artificial night lighting harms species directly by triggering unnatural periods of attraction or repulsion that lead to disruptions in reproductive cycles, by fixation, by

disorientation, or by interfering with feeding and sustenance. Light pollution has been shown to disorient migratory birds and hatchling turtles, disrupt mating and reproductive behavior in fireflies and frogs, and interfere with communication in species from glowworms to coyotes. Disturbances such as degradation of habitat, creation of artificial and dangerous habitat, and energy waste that may lead to climate change can all be linked to excessive artificial night lighting. Research biologists are warning that the negative synergy of such combinations can result in a cascade effect, with disastrous results for entire ecosystems around the world.

Climate characteristics vary from one year to the next; it is not uncommon to experience cool summers, dry springs, and slow falls. A season's photoperiod is the only consistent factor in the natural environment. Therefore, many species of plants and animals rely on the length of the day to indicate the proper season for mating, molting, and other life cycle activities. This photoperiodic sensitivity is often so acute that many species can detect discrepancies in natural light as short as one minute. Reproduction cycles are most often disrupted when artificial light at night interferes with species' natural detection systems. Tees have been known to bud prematurely; some flowers cease blooming. Artificial light also can cause animals such as squirrels and robins to mate out of season. Changes in plant and animal reproductive activity can create difficulty in finding food and increase chances of starvation.

Diurnal—active during daylight
Photoperiod—duration of sunlight as determined by season (photoperiodic—internal clock governed by how long the day is)
Phototaxis—movement in response to light
Predation—predatory behavior in animal relationships



Pine Barrens tree frog

Photograph by Alexei Pucek

There is evidence that the use of high and low pressure sodium light in ecologically sensitive areas such as wetlands, woods, and coastal areas has less impact on habitat and life cycle behavior than use of other kinds of light. The relatively monochromatic wavelength emitted by the yellow tinted sodium vapor lights attracts fewer insects and can be more easily filtered to minimize negative effects.

Insects, frogs, toads, and salamanders have demonstrated both physical and behavioral disruptions as a result of artificial night lighting. A majority of frog and toad species are nocturnal and, because they must remain close to a water source, are less able to compensate for changes in the environment by relocating.

Like other amphibians, salamanders are currently suffering population declines around the world. Many species of pond-breeding salamanders show strong site fidelity to their home ponds, and studies to date have shown that artificial illumination can disrupt salamanders' ability to return to home ponds to breed.

Artificial light at night contributes to lack of food (starvation) by interfering with predator/prey relationships. For instance, moths and other night-flying insects are attracted to lights. This involuntary phototaxis leads to their easy capture. Their incessant gravitation toward artificial points of light not only makes them vulnerable as prey and subjects them to increased predation, but disrupts the normal nocturnal patterns of predator species by creating an artificial feed concentration around points of light. For some species of predators, such as bats or birds that are not repelled by light, this disruption means a change in the concentration and location of their feed, which can lead to imbalances in predator/prey ratio. For species repelled by light, such as horseshoe bats, long eared bats, and mouse eared bats, feed becomes scarcer and difficult to procure, as many insects swarm around lights, leaving fewer to be caught as they fly free. The decreasing amount of available food due to

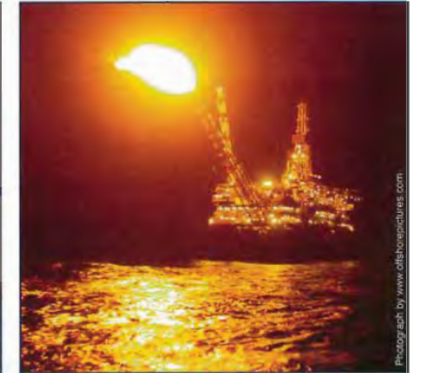


Insects are attracted to the white light of floodlights.

Photograph by Alexei Pucek



Visible for miles, squid boat lights unnaturally attract species of fish and migratory birds.



Relentless lights are common on offshore oil platforms.

Photograph by www.offshoreonlines.com

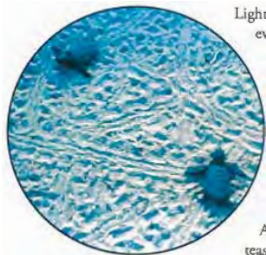
Upon discovering the magnitude of fatal bird collisions, some cities are initiating mitigation procedures. The Lights Out Toronto campaign, established in 2006 in Toronto, Canada calls for residents to turn out any unnecessary lights for the protection of migratory birds. In addition, the city has issued bird friendly development guidelines for all new buildings, which include the control of unnecessary artificial light. In September 2008, Boston, MA, USA began a two-month initiative to conserve electricity by shutting off lights at 34 city skyscrapers. A stated purpose of this project was the protection of migrating birds. Chicago, IL and New York, NY USA also participate in a "Lights Out" during migration season.

a combination of habitat loss and life cycle disruption is causing many bat populations, such as Europe's horseshoe bat, to become threatened or endangered.

Since the eyes of nocturnal animals are specially evolved for foraging in low-light conditions, small changes in illumination can compromise strategies and profoundly alter their relationship with prey species. Even fish are affected by artificial light. Some species of fish, normally exposed only to natural light sources such as phosphorescence, can be temporarily blinded and left vulnerable by artificial light. Artificial light also inhibits normal anti-predation behavior such as schooling, and can affect migration patterns in species such as salmon and sockeye fry.

As awareness of the danger of artificial light to sea turtles grows, an increasing number of communities are restricting coastal illumination. Countries all over the world have passed ordinances that control the amount and type of light used in coastal environments. As the list grows, hatchling sea turtles are starting to be able to find the sea without the help of human volunteers to guide them. Learn more about local and regional action by visiting www.seaturtle.org.

Offshore, brightly lit oil and gas platforms and squid vessels that attract prey and affect numerous species of fish with lights pose both primary and secondary hazards to marine birds. The illumination and heat of offshore hydrocarbon platforms and squid fishing vessels also encourage algae growth, attracting fish and invertebrates. Marine birds are then killed around squid vessels by swallowing hooked prey or by feather contamination in oil-fouled water at hydrocarbon platforms. Marine birds that feed on bioluminescent prey may be particularly sensitive to light source attraction, many threatened and endangered species at great risk from artificial ocean lighting. Many species are susceptible to fixation—also known as "capture"—on artificial lights at sea; exhausted birds will circle for hours or days until they fall into the sea. Off eastern Canada in 1998, tens of thousands of seabirds were observed circling the newly operational Hibernia platform, fixated by an unrelenting point of illumination.



Light fixation is a constant bird hazard that continues to kill thousands of birds in urban areas every year. Hundreds of terrestrial bird species fly and migrate under cover of night. While the mechanisms for birds' attraction to artificial night lighting are not well understood, its hazards to birds have been well documented. During the 1960s, it is estimated that over a million birds a year were killed in collisions with lighted television towers in the United States. Since that time, the number and height of communication towers has increased exponentially. Skyscrapers and other urban buildings also threaten birds, posing collision, fixation, and disorientation hazards.

Light and Sea Turtles

Artificial light at night is devastating sea turtle populations around the world for several reasons. Studies in Florida have shown that loggerhead, leatherback, and green turtle females choose the darkest beaches for their nest sites and will not nest at beaches lit by mercury vapor lights. On beaches subject to indirect light trespass, turtles will avoid the more brightly lit areas in preference to the dark. Nests are, therefore, more concentrated in the dwindling dark spaces, causing more hatchlings to succumb to predators and other site-specific hazards.

However, the most deadly problem facing these internationally protected sea turtles is disorientation from excessive and carelessly placed light. Many types of coastal illumination, including street, residential, and business lighting, confuses newly emerged hatchlings, which instinctively orient to the brightest light source. For thousands of years, this source was the reflection of moon and starlight on the sea. The turtles' natural programming allowed them to reach the water safely. Today, development along coastlines can cause hatchlings to head inland instead toward artificial lights, where they die of exhaustion, dehydration, predation, and road traffic. Each year, Florida alone loses hundreds of thousands of hatchlings.

Inappropriate artificial night lighting disrupts physiological as well as environmental functions. Hormone production in vertebrates, for example, is regulated by the circadian rhythm. Studies in humans and rats show a correlation between exposure to even low levels of illumination during normally dark hours and depressed levels of melatonin (a hormone produced in the retina), resulting in an increased risk of accelerated growth in breast cancer tumors. The effect of artificial night lighting on melatonin and other hormonal systems has yet to be studied in the wild, a study made more difficult by the scarcity of natural dark night conditions in most Western ecosystems.

While the wide range of potential damage caused by artificial light at night is still being discovered, steps to reset the natural balance between light and darkness are already being taken. To help preserve wildlife and minimize damage to ecosystems, start by following the steps listed in the Practical Actions to the right. A list of resources to increase knowledge of these topics and links to information on local and regional action groups can be found at the end of this practical guide.

Practical Actions:

- Turn off unnecessary lights around your house and yard.** Use timers and sensors to help put light only where and when it is needed.
- Use fully shielded fixtures to direct the light ONLY WHERE NECESSARY FOR COMFORT AND SAFETY.**
- See red:** Use red filters on house and street lights. Red lights emitting a low wavelength generally have less of an impact on wildlife. Sea turtles and other coastal creatures, as well as amphibians and many species of insects, react especially well to red light—by hardly reacting at all.
- ...or yellow:** Yellow lights such as high pressure sodium (HPS) or low pressure sodium (LPS) lamps attract fewer insects and moths (think of your typical yellow front porch bug light). If light is required, advocate for their use in environmentally sensitive areas such as coastal regions or forest preserves.
- Get educated:** field guides and nature walks will help identify vulnerable species in your area.
- Raise awareness:** Most people are blind to the impact artificial light has on wildlife. A presentation to a social club or activist group could increase interest and win supporters.
- Ask that any further development in your community include a report on ecological issues of light pollution in their environmental impact statement.**

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Related Practical Guides and Web Links:

Blair E. Witherington and R. Erik Martin. "Artificial Lighting and Sea Turtle Hatchling Behavior." *Florida Marine Research Institute Technical Reports*. TR-2 (1996)—http://research.myrfw.com/features/view_article.asp?id=2156

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FLAP—Fatal Light Awareness Program—<http://www.flap.org>

FWC—Florida Fish and Wildlife Conservation Commission—http://www.myfwc.com/WILDLIFEHABITATS/Seaturtle_Lighting.htm
seaturtle.org—<http://www.seaturtle.org>

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THE ENVIRONMENT

"When we add light to the environment, that has the potential to disrupt habitat, just like running a bulldozer over the landscape can." — Chad Moore National Park Service



Light pollution is a threat to the environment

For billions of years, all life has relied on Earth's predictable rhythm of day and night. It's encoded in the DNA of all plants and animals. Humans have radically disrupted this cycle by lighting up the night.

Plants and animals depend on Earth's daily cycle of light and dark rhythm to govern life-sustaining behaviors such as reproduction, nourishment, sleep and protection from predators.

Scientific evidence suggests that artificial light at night has negative and deadly effects on many creatures including amphibians, birds, mammals, insects and plants.

Artificial lights disrupt the world's ecosystems

Nocturnal mammals sleep during the day and are active at night. Light pollution radically alters their nighttime environment by turning night into day.



Credit: [Michael Newton](#)



Credit: [Chris Parfitt](#)

According to research scientist Christopher Kyba, for nocturnal animals, "the introduction of artificial light probably represents

<http://www.darksky.org/light-pollution-topics/the-environment>

the most drastic change human beings have made to their environment."

"Predators use light to hunt, and prey species use darkness as cover," Kyba explains "Near cities, cloudy skies are now hundreds, or even thousands of times brighter than they were 200 years ago. We are only beginning to learn what a drastic effect this has had on nocturnal ecology."

Glare from artificial lights can also impact wetland habitats — home to amphibians such as frogs and toads, whose nighttime croaking is part of the breeding ritual. Artificial lights disrupt this nocturnal activity, interfering with reproduction and reducing populations.

Artificial Lights Can Lead Baby Sea turtles to their Demise

Sea turtles live in the ocean but hatch at night on the beach. Hatchlings find the sea by detecting the bright horizon over the ocean. Artificial lights draw them away from the ocean. In Florida alone, millions of hatchlings die this way every year.



Glare from artificial lights can also impact wetland habitats — home to amphibians such as frogs and toads, whose nighttime croaking is part of the breeding ritual. Artificial lights disrupt this nocturnal activity, interfering with reproduction and reducing populations.

Migratory birds depend on cues from properly timed seasonal schedules. Artificial lights can cause them to migrate too early or too late and miss ideal climate conditions for nesting, foraging and other behaviors.

Artificial Lights have Devastating Effects on Many Bird Species



Birds that migrate or hunt at night navigate by moonlight and starlight. Artificial light can cause them to wander off course and toward the dangerous nighttime landscapes of cities. Every year millions of birds die colliding with needlessly illuminated buildings and towers.

Migratory birds depend on cues from properly timed seasonal schedules. Artificial lights can cause them to migrate too early or too late and miss ideal climate conditions for nesting, foraging and other behaviors.



<http://www.darksky.org/light-pollution-topics/the-environment>

Ecosystems: Everything is Connected

Many insects are drawn to light, but artificial lights can create a fatal attraction. Declining insect populations negatively impact all species that rely on insects for food or pollination. Some predators exploit this attraction to their advantage, affecting food webs in unanticipated ways.



Resources

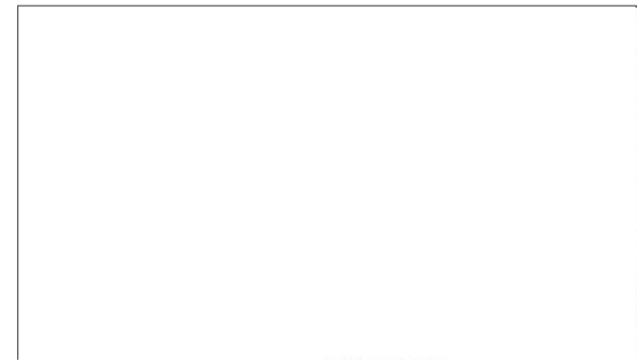
- [IDA Light Pollution & Wildlife brochure](#)
- [IDA Light Pollution & Wildlife Practical guide](#)
- [Audubon Bird-Safe Building Guidelines](#)
- [Wildlife Research](#)

For Kids

[Nighttime Activity Book](#)

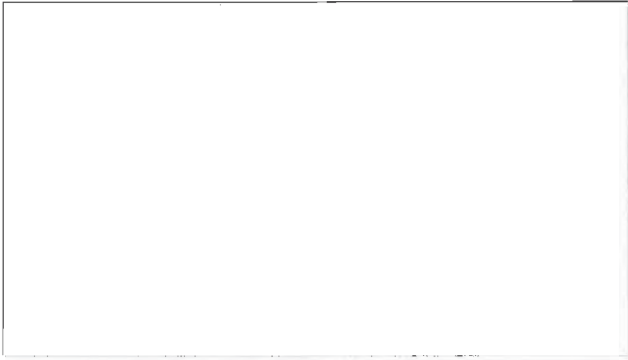
Videos

Dark Ranger, Kevin Poe, explains how light pollution affects baby sea turtles and provides ways in which we can help them successfully make their journey from the shore to the ocean.

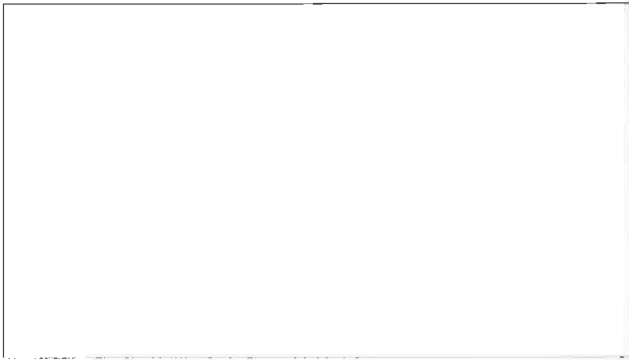


Learn in one minute what you can do to protect birds.

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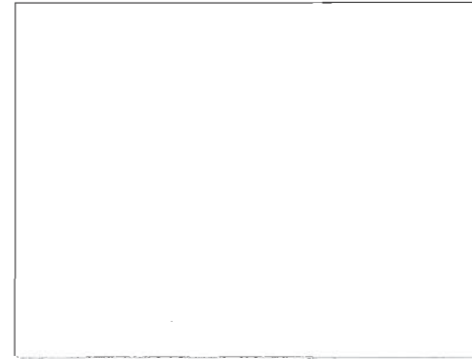


Learn in one minute what you can do to protect wildlife



Watch this video from the Sea Turtle Conservancy on the effect of light pollution on sea turtles.

<http://www.darksky.org/light-pollution-topics/the-environment>



Watch this Science in Seconds video to learn how light pollution negatively affect all types of wildlife.

Recent News Items on Light Pollution & the Environment

'Lights Out' seeks to stem bird carnage caused by city skylines (Washington Post)

Lights Out Baltimore, an organization that started in 2008, scours the streets in the predawn hours to collect birds — dead or stunned — that have collided with windows in the city's corporate canyons. [Read more.](#)

Light pollution 'affects bats' tropical seed dispersal' (BBC News)

Light pollution could affect the regeneration of tropical rainforests because it disrupts the behavior of seed dispersing bats, a study suggests. [Read more.](#)

Birds Killed By Skyscrapers: An Oddly Life-Affirming Photo Essay (FastCompany)

Nine years ago, artist Lynne Parks got into birdwatching. The Baltimore-based artist, who has suffered from cancer since childhood, found something life-affirming in the birds' energy. [Read more.](#)

Artificial lighting and noise alter biorhythms of birds (Science Daily)

Noise from traffic and artificial night lighting cause birds in the city center to become active up to five hours earlier in the morning than birds in more natural areas. [Read more.](#)

Night light pollution affect songbirds' mating life, research suggests (Science Daily)

<http://www.darksky.org/light-pollution-topics/the-environment>

In today's increasingly urbanized world, the lights in many places are always on, and according to a new study, that's having a real impact on the mating life of forest-breeding songbirds. [Read more.](#)

Light at night, melatonin and bird behavior (Science Daily)

Low light levels, similar to those found in urban areas at night, can have a significant effect on melatonin production in birds at night. This suggests that melatonin could be mediating changes in bird behavior at night. [Read more.](#)

Submission # ___
Subject Cedar River Predation

Cedar River Rention, WA Poster - used as display and introduction

The Effect of Light Intensity on Predation of Sockeye Salmon Fry By Cottids in the Cedar River
Roger Tabor, Gayle Brown, Aaron Hird and Stephen Hager, April 2001

Saving Salmon On The Cedar River - derived from Washington State Department of Transportation Bulletin
March 23, 2001 No. 01-12

Signals Maintenance Shapes Salmon Solution - Washington State Department of Transportation Bulletin March
23, 2001 No. 01-12

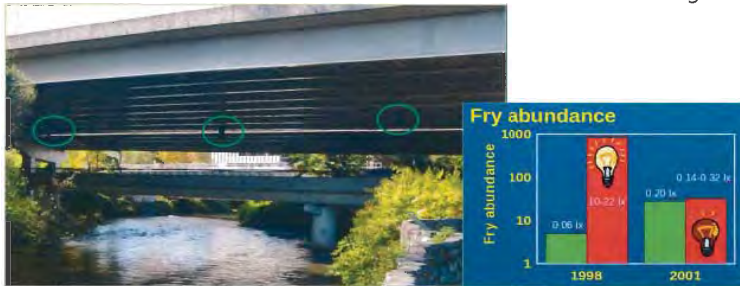
The Effect of Light Intensity on Sockeye Salmon Fry Migratory Behavior and Predation by Cottids in the
Cedar River, Washington
R. Tabor, G. Brown, V. Luiting, North American Journal of Fisheries Management 24:128-145, 2004

The Effect of Light Intensity on Predation of Sockeye Salmon Fry By Prickly Sculpin and Torrent Sculpin
Roger Tabor, Gayle Brown, Victoria Luiting, May 1998

Cedar River Renton, WA

The Cedar River is where the largest run of sockeye salmon in the lower 48 states begins.

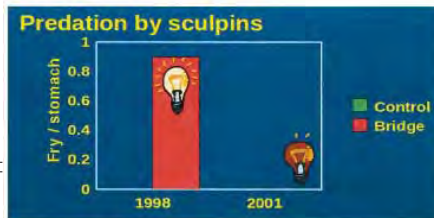
That is, it was before lighting was installed on the Cedar River Trail where it crosses the river below the I-405 bridge.



Light is basically a big stop sign. Sockeye like to migrate at night in the fastest part of the river channel and move to low velocity waters along riverbanks and river bottoms during the day. This way they avoid becoming the prey of fully-grown trout and sculpin, which like to forage at night. But the lights above the trail made the sockeye fry think it was daylight.

The result of shielding the lighting in 1998

The 2000 run was one of the biggest in recent memory, but the year before that was one of the worst, according to Roger Tabor, a fishery biologist with the U.S. Fish and Wildlife Service.



Ref. 1. The Effect of Light Intensity on Sockeye Salmon Fry Migratory Behavior and Predation by Cottids in the Cedar River, Washington, Taabor, Brown, Luiting, 2004
2. Effects of Artificial Lighting on Juvenile Salmonids: A Review of Research in the Lake Washington Basin, Roger Tabor, Mark Celedonia, USFWS, Gayle Brown, USGS

THE EFFECT OF LIGHT INTENSITY ON PREDATION OF SOCKEYE SALMON FRY BY COTTIDS IN THE CEDAR RIVER

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April 2001

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ABSTRACT

In the Cedar River, we examined the relationship between light intensity level and migratory behavior of sockeye salmon fry (*Oncorhynchus nerka*) and predation by cottids. Additionally, light intensity readings were taken to document the location of high artificial light intensity levels and determine what atmospheric conditions affect those light levels. The effect of light intensity on sockeye salmon fry was examined with two methods: 1) comparison of lighted and non-lighted areas in the City of Renton; and, 2) experimental trials with standardized amounts of light added to the river.

Within the lower 2.9 kilometers of the Cedar River, there were several locations with high light intensity levels. Most were next to street bridges. The highest light readings recorded were at the I-405 Bridge and the Renton Library. In the lower Cedar River, artificial lighting appeared to come from two major sources: direct lighting and reflected lighting off of the clouds. At locations with minimal direct lighting, the highest light intensity levels occurred on overcast nights due to reflected light. The lowest levels occurred during clear, moonless nights. As far upstream as river kilometer 9.8, we recorded readings during overcast nights that were higher than during a clear night with a full moon.

Experimental trials were done at two locations away from any lights, Lion's Club Park and Elliot Park. Two trials were done at the Lion's Club Park, both following a release of hatchery sockeye salmon fry. Most trials at Elliot Park were conducted below a sockeye salmon spawning channel. At the Lion's Club Park, light intensity treatments were done in two habitat types, gravel shore and rip-rap shore.

At all City of Renton sites examined, the abundance of sockeye salmon fry was substantially higher at sites with high light intensity levels than at nearby sites with low light. Correspondingly, most predation of fry by cottids was observed in the bright light areas. Higher predation rates were observed along the shoreline as well as in the mid-channel area. In relation to other sampling conducted by the U.S. Fish and Wildlife Service, the I-405 Bridge lighted area was the only location we have ever seen any significant predation of fry by cottids in a mid-channel area of a riffle in the Cedar River.

In the experimental trials, we found that the abundance of fry and predation by cottids was related to light intensity levels. In one bright light treatment, we were able to slow the migratory behavior of over 550 sockeye salmon fry within an 8-meter (m) shoreline section. At the Lion's Club Park, gravel shores had five times as many fry as rip-rap shores for a given light intensity level. Gravel shores had a larger low-velocity area than did rip-rap shores. In two experimental trials, we also examined the abundance of fry shortly after the lights were turned off. In all lighted experimental units, the number of fry declined dramatically after the lights were turned off, however, in control units (no light added), the number of fry remained about the same or actually increased slightly. In the experimental trials, we also monitored the abundance of juvenile chinook salmon

(*O. tshawytscha*). Small numbers of chinook were observed. No relationship between chinook salmon abundance and light intensity was detected. In conclusion, our results indicated that any estimation of predation loss needs to assess the light intensity level, as well as fry abundance and shoreline and mid-channel habitat.

TABLE OF CONTENTS

	<u>Page</u>
Abstract	ii
List of Figures	v
Introduction	1
Study Site	1
Methods	1
Results	4
Discussion	8
Acknowledgments	11
References	12

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1 Map of lower Cedar River and location of study sites	14
2 Fry abundance and predation rates (fry/stomach) for three Cedar River sites in Renton, Washington	15
3 Sockeye salmon fry abundance (log scale) at three light intensity levels while lights were on and then turned off for two experimental trials in the Cedar River	16
4 Sockeye salmon fry abundance and cottid predation of fry at three light intensity levels and two habitat types from March 31, 1999 experimental trial at Lion's Club Park (Rkm 18.3) on the Cedar River	17
5 Sockeye salmon fry abundance and cottid predation of fry at four light intensity levels and two habitat types from April 5, 1999 experimental trial at Lion's Club Park (Rkm 18.3) on the Cedar River	18
6 Sockeye salmon fry abundance and cottid predation of fry at three light intensity levels and three channel types from April 7, 1999 experimental trial at Elliot Park (Rkm 7.4) on the Cedar River	19
7 Sockeye salmon fry abundance (log scale) and cottid predation of fry at three light intensity levels from five nights at the Elliot Park side channel (just below the spawning channel)	20
8 Chinook salmon fry abundance at Lion's Club Park and Elliot Park at various light intensity levels	21
9 Light intensity readings (lumens/ft ² ; log scale) during an overcast night (solid line, solid squares) and a clear, moonless night (dashed line, open circles) from the lower 2.9 kilometers of the Cedar River	22
10 Light intensity readings (+/- range, vertical line) at three Cedar River locations that have little or no direct artificial lighting	23

INTRODUCTION

After emerging from their redds, most sockeye salmon (*Oncorhynchus nerka*) fry immediately emigrate downstream to a lake environment where they reside for the next year. They reduce their vulnerability to predators by emigrating at night. Results of recent lab experiments indicated that increased light appears to slow or stop emigration of sockeye salmon fry which makes them more vulnerable to capture by predators (Tabor et al. 1998a). The Lake Washington sockeye salmon occur within a large urban area. In some river sections that sockeye salmon fry must migrate through, artificial lighting is present. As part of the mitigation for the recent flood control project, light intensity levels were reduced or proposed to be reduced in some areas of the lower Cedar River to reduce predation. Although reduced lighting appears to benefit sockeye salmon fry, little work has been done to quantify its effect on predation in a field situation. Most earlier work was done under laboratory conditions and results can be difficult to apply to field conditions. In 1998 and 1999, we attempted to quantify the effects of increased light under field conditions in the Cedar River. In 2000, we also took light intensity readings in the lower Cedar River to identify areas with high artificial light levels.

STUDY SITE

The Cedar River is the main tributary for the Lake Washington basin. The lower 35.1 kilometers are accessible to anadromous salmonids. Landsburg Dam (Figure 1), a water diversion structure, prevents fish from migrating further upstream. The Cedar River is the major spawning area for a large population of sockeye salmon. Runs in excess of 300,000 fish have occurred in some years.

The lower 3 kilometers of the Cedar River occurs within a large flood plain that was the historical Black River flood plain and Lake Washington delta. Presently, the area is the City of Renton (Figure 1) and has numerous artificial light sources due to urban and residential development. Upstream of river kilometer (Rkm) 3, the river is confined in a relatively narrow canyon with some residential development but substantially less artificial light than the Renton area.

METHODS

We examined the effect of light intensity on sockeye salmon fry with two methods: 1) comparison of lighted and non-lighted areas in the City of Renton; and, 2) experimental trials with standardized amounts of light added to the river. Additionally, we took light intensity readings in the lower Cedar River to document light levels. All light intensity measurements were made with an International Light Inc. model IL1400A radiometer/photometer. Light intensity was measured as lumens/ft².

PREDATION AND SALMONID FRY BEHAVIOR

Renton City lights

Four sites were selected in Renton; 1) I-405 Bridge (Rkm 2.7), 2) Renton Library (Rkm 2.5) Williams Avenue Bridge (Rkm 2.0), and South Boeing Bridge (Rkm 1.2). Each had a high light intensity area and a nearby area with similar habitat and substantially lower light intensity levels. Two sites were done in 1998 and the other two were done in 1999. Fry abundance was estimated at each site except the South Boeing Bridge. In 1998, we used a small 2.5-m long by 1-m high beach seine to compare fry abundance. Fry at the 1999 sites were counted by slowly moving along the shoreline using a flashlight. To be consistent between treatments, we only counted fry within the beam of the flashlight. We assumed that the counting had a minimal effect on fry abundance because it was done within a short period of time, approximately 1 minute per shoreline section. Sockeye salmon fry as well as chinook salmon fry (*O. tshawytscha*) were counted. The two species could be easily distinguished based on parr marks and relative size. Chinook salmon fry were considerably larger than sockeye salmon fry. Light intensity measurements (lumens/ft²) were taken at the surface of the water in the middle of the area sampled. At three of the four sites, cottids were collected for stomach analysis to compare predation rates. Fish were collected with backpack electrofishing equipment. Cottids were collected along the shoreline and/or in the mid-channel area. Cottids along the shoreline were collected visually with the aid of dip nets. Cottids in the mid-channel area were collected passively with the aid of block nets. After capture, cottids were identified to species and total length (TL) was measured. Afterwards, their stomachs were flushed and salmonid fry were counted. We sampled cottids that were > 49 millimeters (mm) TL. Smaller cottids rarely consume sockeye salmon fry. We assumed that cottids had captured fry in the same general area that they were captured. A Mann-Whitney *U* test was used to compare differences in predation rates between a lighted site and the control site. Data were log-transformed because the data was multiplicative rather than additive (Zar 1984).

Experimental Trials

Experimental trials were done at two sites in 1999, the Lion's Club Park at Rkm 18.3 and the Elliot Park at Rkm 7.4 (Figure 1). Sites were divided into shoreline sections that had uniform habitat. Two experimental trials were conducted at the Lion's Club Park along a 112-m shoreline section. The upper 56 m had a rip-rap shoreline while the lower 56 m was a gravel shoreline. Both trials were conducted on a night when hatchery sockeye salmon fry were released upstream at Rkm 21.7. On March 31, 1999, 135,000 fry were released, and on April 5, 1999, 57,000 fry were released. The other site at the Elliot Park consisted of three 40-m shoreline sections: 1) main channel, 2) braided channel; and, 3) side channel at the outlet to the spawning channel. Within each section, three experimental light intensity levels were tested. The main channel and braided channel section were only done once due to the low numbers of fry. The side channel was done five times because good numbers of fry were migrating through this section during the study period. Most of the fry in this section were probably migrants from a nearby spawning channel.

Each shoreline section was divided into 8-m long units. Lights were only added to every other unit to insure light from one experimental unit did not affect another one. Treatments were randomly assigned within each shoreline section. Two lights were used for each experimental unit. Lights were mounted at the top of a 2-m pole, placed 1 m from both edges of each unit, and lights were directed towards the middle of the unit. An individual light system consisted of a 60-watt light bulb, a deflector to focus the light, and a dimmer switch to control the light intensity. We used five light intensity levels: 1) control (no lights): 0.0006-0.010; 2) dim: 0.015-0.025; 3) low: 0.045-0.055; 4) medium: 0.10-0.14; and, 5) bright: 1.0-1.4 lumens/ft².

Light intensity measurements were taken at the surface, 2 meters from shore. Generally three measurements were taken, one in the middle and one each from just inside of the upstream and downstream edges. The middle of each experimental unit was the brightest and the upstream and downstream edges were the dimmest. Light intensity was slowly attenuated across the river channel. Lights were turned on shortly after dusk and adjusted to get the appropriate light intensity. Fry were counted with a flashlight, similar to the City of Renton sites. For some experimental trials, we turned off the lights and recounted the number of fry 20 minutes later.

In most experimental trials, we used backpack electrofishing equipment to collect cottids to determine the predation rate. After capture, cottid stomachs were flushed and the number of ingested fry was counted. Fry were categorized as freshly ingested or well digested. Only counts of freshly ingested fry were used. We assumed that freshly ingested fry were consumed during the experiment and well digested fry were consumed the prior night or sometime before the experiment. Since we started the experiments shortly after sunset and cottids are primarily nocturnal, we felt this was a valid assumption.

Differences in fry abundance were tested with a two-way analysis of variance (ANOVA) without replication. A Mann-Whitney *U* test (two samples) or a Kruskal-Wallis test (more than two samples) was used to compare differences in predation rates. Data were log-transformed because the data was multiplicative rather than additive (Zar 1984).

LIGHT INTENSITY READINGS

Readings of light intensity in the lower Cedar River were done under three scenarios: 1) overcast skies; 2) clear skies, no moon; and, 3) clear skies, full moon. Light readings were taken every 50 m from Rkm 0.9 to 2.9. Below Rkm 0.9 access to the river was limited in many areas. However, additional readings were done at Rkm 0.0, 0.2, 0.3, and 0.7. We also included one site at Rkm 9.8. Additional readings were also taken at major light sources to determine peak light levels. For safety reasons, light readings were taken close to the river bank, approximately 1-5 m from shore. In most locations, the mid-river light reading would be lower than readings taken close to shore because the light source is located on the river bank. At some locations, such as I-405 Bridge and Renton Library, light sources span the entire channel width. At a few sites, we took light readings on the opposite bank from the light source. All readings were taken at the surface of the water. Most readings were taken from the right bank except between the Renton Library (Rkm 2.5) and Houser Way Bridge (Rkm 2.6), where the right bank was difficult to access.

RESULTS

SOCKEYE SALMON FRY

Renton City Lights

Fry abundance. At all three sites examined, the abundance of sockeye salmon fry was substantially higher at sites with high light intensity levels than at a nearby site with low light (Figure 2). This was particularly apparent at the I-405 site where large numbers of fry were present under the bridge but 180 m upstream we were unable to collect a single fry. Both sites had a large amount of shallow, low velocity water where numerous fry could reside. In contrast, few sockeye salmon fry were observed at the Renton Library. Light levels were lower and there was little shallow, low velocity water along the shoreline. However, all sockeye salmon fry observed were present in the lighted area (Figure 2). The Williams Bridge site was counted on two nights, both having similar results. Most fry were nearest the bridge where the light intensity levels were the highest. At 35 m from the bridge, light levels were greatly reduced (0.012 lumens/ft²) and only a couple of fry were observed (Figure 2).

Predation. At both the I-405 Bridge and Renton Library, little predation was observed in control areas with little light, while relatively high predation rates were observed in lighted areas (Figure 2). Fifty-three percent of the cottids in the mid-channel area of the lighted I-405 site had consumed fry (0.9 fry/stomach), while no predation occurred at the control. Predation rates were significantly higher in the lighted area (Mann-Whitney *U* test = 58.5; *P* = 0.002). Preliminary sampling was also done on February 23, 1998, at the I-405 Bridge (the control was not sampled). From 15 cottids collected, a total of 18 sockeye salmon fry were present in the stomach samples (1.2 fry/stomach). At the Renton Library site, cottids were sampled at both the shoreline and mid-channel areas on the same night (March 18, 1999). In the control, no predation was observed in the shoreline area and 1 sockeye salmon fry was observed out of 18 stomach samples from the mid-channel. In the lighted shoreline area, 33% of the cottids had consumed fry (0.6 fry/stomach) but no predation was observed in the lighted mid-channel area (Figure 2). Predation rates were significantly higher in the shoreline of the lighted area than the control area (Mann-Whitney *U* test = 63; *P* = 0.03). Of the cottids (> 49 mm TL) collected at both sites, 95% were coastrange sculpin (*Cottus aleuticus*) and 5% were torrent sculpin (*C. rhotheus*). Predation was observed in both cottid species.

At the South Boeing Bridge site (including control), we collected 105 cottids but only three were > 49 mm TL. No fry was observed in their stomachs. We also flushed the stomachs of four cottids that were 45-49 mm TL. Of these, one torrent sculpin (47 mm TL) that was collected at the bridge had consumed a sockeye salmon fry. No predation was observed at the control site. Light intensity at the South Boeing Bridge was 0.28 lumens/ft² and 0.12 lumens/ft² at the control.

Experimental Trials

Fry abundance. At Lion's Club Park on March 31 (Figure 3) and April 5, few sockeye salmon fry were observed in all units for the first 45 to 60 minutes. However, within the next 20 minutes the number of fry increased dramatically. For example, in the bright-light experimental unit, the number of fry changed from 27 at 2025 hours, to 577 at 2045 hours. The increase in the number of fry was due to the large number of hatchery fish that had been released earlier that evening. The fry were released at Rkm 21.7 at approximately 2008 hours (90 minutes after sunset). Experimental units with higher light levels had significantly more fry in both experimental trials (ANOVA; March 31, $P = 0.02$; April 5, $P = 0.005$; Figures 4,5). Within each light intensity level, higher numbers of fry occurred in the gravel shore than the rip-rap shore (ANOVA; March 31, $P = 0.04$; April 5, $P = 0.03$; Figures 4,5). On average, gravel shores had five times as many fry as rip-rap shores for a given light intensity level.

Overall, fry abundance results at Elliot Park followed similar patterns as at Lion's Club Park. On April 7, low numbers of fry were observed in every experimental unit. However, the highest numbers of fry occurred in the units with the highest light levels for each channel type (Figure 6). Analysis of variance revealed a significant difference ($P = 0.003$) in fry abundance between light intensity levels. Fry abundance was done on four additional dates in the side channel, however, on May 3, the light system for the medium-light experimental unit malfunctioned, thus we were unable to get a count for that experimental unit (Figure 7). Between the five dates that the side channel was sampled, the abundance of fry varied greatly. Most fry were probably migrants from the spawning channel. Peak outmigration appeared to be around May 3. Analysis of variance revealed a significant difference ($P < 0.001$) in fry abundance between light intensity levels. The highest number of fry was always in the medium light unit (Figure 7). On every date, the dim light unit had more fry than the control unit.

In two experimental trials, we also examined the abundance of fry shortly after the lights were turned off. In all lighted experimental units, the number of fry declined dramatically after the lights were turned off (Figure 3). In control units (no light added), the number of fry remained about the same or actually increased slightly (Figure 3).

Predation. In general, predation rates of cottids showed the same trend as fry abundance. The highest predation rates recorded were from experimental units with increased light. This trend was particularly noticeable during the March 31 trial at the Lion's Club Park. No predation was detected in the control units. In contrast, large numbers of fry were found in the stomach samples of cottids collected from the bright-light experimental unit (Figure 4). Three torrent sculpin were collected from this unit with 10 or more fry in their stomachs. The maximum number of sockeye salmon fry consumed by an individual fish was 13 (92 mm TL, torrent sculpin). Differences in predation rates were marginally significant (Kruskal-Wallis test = 5.7, $P = 0.058$) between experimental units but not significant between medium and bright experimental units (Mann-Whitney U test = 3.5, $P = 0.23$). Predation rates in both lighted rip-rap experimental units were

lower than in units with gravel shores. Differences were significant between the two bright experimental units (Mann-Whitney U test = 8.0, $P = 0.03$) but not the medium light experimental unit (Mann-Whitney U test = 3.5, $P = 0.66$).

Predation rates on April 5 were low for all experimental units. Only three out of 42 cottids had consumed sockeye salmon fry. No differences between treatments were detected. However, four of the five fry consumed were from the medium-light experimental units and no predation was observed in the control units (Figure 5).

On April 5, one riffle sculpin (89 mm TL; *C. gulosus*) was collected with 14 yolk-sac sockeye salmon fry. Because these fish were yolk-sac fry, we assumed these were not migrating fish but instead they probably were captured in the substrate. Additionally, many were well-digested and thus were not consumed on the night of our experiment. None of these fry were included in our estimate of predation. Some sculpins such as reticulate sculpin (*C. perplexus*), have been shown to be able to move into the substrate to consume recently-hatched salmonid fry (Phillips and Claire 1966). Additionally, we have collected several riffle sculpin that consumed yolk-sac fry in another location of the Cedar River (R. Tabor, unpublished data).

During the April 7 experimental trial, few predators were collected along the shore in the main channel and braided channel. However, 23 cottids were collected in the side channel. The only experimental unit to have any predation of fry was the medium-light unit. In addition to April 7, side channel predators were sampled two other times. In each trial, the highest predation rates were observed in the medium-light unit; however, there was no significant differences detected between the light intensity levels.

At Lion's Club Park, torrent sculpin made up 91% of the cottids captured, while riffle sculpin made 8% and shorthead sculpin 1% (*C. confusus*). No coastrange sculpin were observed at this site. In the side channel at Elliot Park, 50% of the cottids were torrent sculpin, 26% coastrange sculpin and 24% riffle sculpin.

In addition to cottids, we also collected a few salmonids. The number and species collected included five juvenile coho salmon (*O. kisutch*; range, 74-112 mm FL), eight unidentified trout (range 76-103 mm FL), one cutthroat trout (*O. clarki*; 160 mm FL), and one rainbow trout (*O. mykiss*; 146 mm FL). Almost all were collected at the Lion's Club Park site. The only salmonids observed to have freshly-ingested fry in their stomachs were three juvenile coho salmon. One juvenile coho salmon (109 mm FL) was collected with five freshly ingested sockeye salmon fry. The fish was captured in the bright experimental unit on March 31, 1999. The other two juvenile coho salmon had one fry each in their stomachs. These fish were collected from experimental units with dim and low light intensity levels. Therefore, salmonid predation rates show the same general trend as with cottids but because the sample sizes are small it is difficult to say anything conclusive. Additionally, salmonids are far more mobile than cottids and thus there is a greater chance that they may have consumed their prey at a different location. However, most of the salmonids collected were small and thus, may have a small home range.

CHINOOK SALMON FRY

Small numbers of chinook salmon fry were also observed along the shoreline. There was no apparent pattern between different light intensity levels (Figure 8). In some cases, chinook salmon were more abundant in treatments with little or no light. For example, at the I-405 bridge site, we collected 3.4 chinook salmon/seine in the control area but only 0.3 chinook salmon/seine in the lighted area. Only one chinook salmon was seen from all the cottid stomachs examined. The cottid was a ruffle sculpin (95 mm TL) captured in the bright section at the Lion's Club Park during the March 31 experiment.

LIGHT INTENSITY READINGS

Most high light intensity sites were next to street bridges (Figure 9). The Renton Library and a Boeing building at Rkm 1.6 also had high light readings. The highest light readings were at the I-405 Bridge and the Renton Library. Some light sources are typically shut off during the night. The Renton Library closes at 2100 hours. Peak light levels changed from 1.90 to 0.05 lumens/ft². Many of the lights along the Cedar River Trail are turned off at 2300 hours. Most of our readings were taken while the lights were still on.

Near strong light sources, such as street lights near bridges, light intensity levels did not appear to vary greatly between different sky conditions because the artificial lights were far more intense than other lighting sources such as the moon. However, away from these lights, light intensity levels appear to vary greatly depending on cloud cover and the moon. For example, at locations close to the City of Renton, overcast nights had higher light readings than during a full moon. Reflected light off of the clouds from nearby urban areas appears to be the main light source during overcast nights. The lowest readings were during a clear, moonless night.

We examined past readings of light intensity at Rkm 0.3. In addition to readings taken in 2000, readings were also taken in 1997 and 1999. The highest light intensity readings were recorded on overcast nights (Figure 10). Light readings as high as 0.040 lumens/ft² were recorded on an overcast night, whereas during clear, moonless nights readings ranged from 0.003-0.005 lumens/ft². Even at upstream locations, reflected light appears to be a major source of lighting. At Rkm 9.8, we detected little or no light on a clear, moonless night, on a full moon night light intensity was 0.008, and on an overcast night it was 0.012 lumens/ft² (Figure 10). Upstream of Rkm 10, we did not take any light readings, but we expect that the amount of reflected light would be substantially less due to the lower amount of urban development. In this area, the highest light intensity readings would probably occur during nights with a full moon.

Light intensity readings at Rkm 0.3 were quite variable between overcast nights (Figure 10). Most likely, the thickness of the clouds and the level of the clouds influence to amount of light that is reflected. On March 27, 2000, the clouds appeared to be very thick and low. Light intensity levels on that night were the highest that we have observed.

DISCUSSION

SOCKEYE SALMON FRY BEHAVIOR

Results for field observations in Renton and field experiments corroborated results from earlier lab experiments. Increasing light intensity levels have a profound effect on the behavior of sockeye salmon fry. Fry appear to move out of the thalweg and move to low velocity water where they are vulnerable to predators such as cottids. Even small increases in light intensity levels appeared to affect fry behavior. For example, at the Elliot Park side channel we observed differences in fry abundance consistently between the control (0.010 lumens/ft²) and the dim light experiment unit (0.020 lumens/ft²). Our results suggest that any reductions in light level can be beneficial and the impact of lighting should be considered for any future development project.

We were surprised by the large number (> 550 fry) of sockeye salmon fry that were present within the bright-light experimental unit (sand/gravel shoreline) during the March 31 experiment. Approximately 120,000 fry were released on that date. Assuming a similar per kilometer survival rate as hatchery releases from Landsburg Dam (Seiler and Kishimoto 1997), we estimate that 110,000 fry moved past our experimental site (assumes that the number of wild fry was minimal). Therefore, we were able to delay 0.5% of the release group within a 8 m shoreline section with two small lights. This suggests that several large lights spread out over a long section of shoreline and across the channel with sand/gravel substrate and a low sloping bank could have a strong effect on the behavior and survival of the entire run of out-migrating fry. McDonald (1960) was able to experimentally stop the nightly movement of sockeye salmon fry with artificial lighting of 3.0 lumens/ft², however, other levels of light intensity levels were not tested. Our bright-light experimental unit was 1.0 - 1.4 lumens/ft².

Experiments at the Lion's Club Park demonstrated that habitat can have an important effect on the number of sockeye salmon fry attracted to the lights. The effect was probably due in part to the amount of low velocity habitat as well as to substrate size. Light causes sockeye salmon fry to move to low velocity areas. The rip-rap banks were steeper and had a narrower area of low velocity water than did the gravel shoreline. Differences in substrate size between the two habitat types may also have resulted in differences in predator abundance, which could influence the number of sockeye salmon fry. Typically, the number of large cottids is higher in larger substrates than smaller substrates (Tabor et al. 1999b). Other predators such as rainbow trout were probably higher near the rip-rap. The presence of predators has also been shown to increase the downstream movement of sockeye salmon fry (Ginetz and Larkin 1976; Tabor et al. 1998a) and brown trout fry (*S. trutta*; Gaudin and Caillere 1985; Bardonnnet and Heland 1994).

In all of our experimental trials, we only examined the abundance and predation of fry along the shoreline. Results indicate that lights cause fry to delay their migration and move to the shoreline to an area of low velocity. Another area of low velocity water is typically very close to the substrate across the entire channel. Results from the I-405 bridge site suggest that fry move to the shore as well as move to the substrate in mid-channel areas. The I-405 bridge site has strong lights all the way across the channel. Although, we have never directly observed sockeye salmon

fry close to the substrate in the mid-channel, we did observe much higher predation rates than in similar areas with little or no light. Following 1998 and 1999 hatchery releases, we sampled a total of 10 mid-channel sites with little or no light. Out of 109 cottid stomachs examined, only one salmonid fry was seen. At the I-405 bridge site, a total of 33 fry were observed from 33 cottid stomach samples.

The use of the mid-channel substrates in lighted areas by sockeye salmon fry may be more common in areas with boulders and cobble than areas with smaller substrates. Larger substrates will create a more roughened river channel and have low velocity locations for sockeye salmon fry. Unfortunately these same sites will probably have a higher abundance of cottids > 49 mm TL. At South Boeing Bridge, the substrate was mostly small gravel and few cottids > 49 mm TL were collected and those that were > 49 mm TL were much smaller than those from the I-405 bridge which had some cobble and large gravel. Little predation was documented at the South Boeing Bridge. In the Cedar River, the number of cottids > 49 mm TL was shown to be related to the substrate size (Tabor et al. 1998b).

An important factor that probably affects the impact of artificial lighting is streamflow. The survival of hatchery sockeye salmon fry has been shown to be profoundly affected by streamflow conditions (Seiler and Kishimoto 1997). At lower flows, fry migration time is increased (Seiler and Kishimoto 1996) and they become more vulnerable to predators (Tabor et al. 1998). Fry typically migrate in the thalweg or the fastest part of the channel. During low streamflow conditions, mid-channel velocities are reduced and fry will move through a lighted area slower and thus they may be more likely to be influenced by light. In fact, at streamflow levels over 1,500 cubic feet per second (cfs), approximately 10% of the sockeye salmon fry will migrate during the day (Seiler and Kishimoto 1997). Streamflow levels at Renton for the March 31 and April 5 experiments were 800 and 670 cfs, respectively (USGS, unpublished data). Base streamflow levels are 375 cfs during the fry outmigration period. Thus, we would predict that at lower streamflows more fry would be delayed in our experimental units.

Turbidity will have a large effect on light intensity levels in the water column. Light will not penetrate as well during turbid conditions. Turbidity is often related to streamflow, particularly after rain events. Fry may migrate faster during turbid conditions and visual predators such as trout will have reduced foraging success (Barrett et al. 1992; Vinyard and Yuan 1996).

PREDATION

The size of the experimental units (8 m shoreline length) appeared to work well for detecting differences in fry abundance, but it may have been too small for estimating predation rates. We were able to detect differences between lighted areas and control areas but we were often unable to detect differences between light intensity levels. Few or no predators were collected in some experimental units. Also, the diets of cottids can vary between individual fish. Even when fry are abundant, many cottids will not consume them. Each site will have a variety of other prey types such as aquatic insects or oligochaetes. Also, many of the male cottids may be guarding egg nests and probably will not be actively searching for prey. In most areas, a 20-30 m shoreline would

probably be adequate to collect enough cottids to get an accurate estimate of predation. Additionally, our experiments only lasted for a few hours. Had we extended the experiments over the entire night we may have seen more predation and thus better able to detect differences between treatments. Similarly, for City of Renton light comparisons, large numbers of cottids may be needed to detect differences between light levels.

Based on earlier lab experiments, increased light levels have a profound effect on the behavior of sockeye salmon fry (Tabor et al. 1998a), however, the effect on predator behavior is not well understood. In the Cedar River, cottids appear to exhibit a functional response due to an increase in the abundance of fry but we did not observe any type of numerical response. However, our experiments were done over a short period of time and a numerical response may take several days or weeks. In Lake Iliamna, cottids exhibited a strong numerical response in relation to the abundance of sockeye salmon eggs but cottid movements to the spawning sites takes place over a period of three weeks (Foote and Brown 1998). Therefore, cottids may exhibit a numerical response to an increase in fry availability near permanent light structures. However, there are several alternative prey types in the Cedar River and cottids may not show a strong numerical response such as in Lake Iliamna, which is an oligotrophic system and alternative prey may be limited. Additionally, cottids may naturally avoid lighted areas because they may become more vulnerable to predators. Movement into lighted areas may be a tradeoff for cottids and thus they must balance increased predation risk with increased prey availability.

Cottids are generally considered nocturnal fish; they appear to hide during the day and move out from cover at night to feed. The distance they move away from their daytime cover and the relationship to light levels is not known. If they only move a short distance on a given night then the only cottids that can take advantage of the increase in fry abundance are those that have nearby cover. The number of cottids > 49 mm TL increases as the substrate size is increased (Tabor et al. 1998b). Therefore, in sand or gravel areas where fry may be abundant, cottids may have low abundance.

CHINOOK SALMON FRY

Like sockeye salmon, many chinook salmon out-migrate to the lake as fry (D. Seiler, WDFW, unpublished data), however, while sockeye salmon fry typically use the river channel only as a migratory corridor, chinook salmon fry and juveniles may inhabit the shoreline habitat for an extended period of time (R. Peters, U.S. Fish and Wildlife Service, unpublished data). Chinook salmon may avoid lighted areas while they are inhabiting the shoreline but may become more vulnerable to predation as they move downstream through lighted areas. Nevertheless, given the low number of chinook salmon fry observed, it is problematic to make any conclusions concerning the effect of lights on chinook salmon. Further work directed at chinook salmon is needed to reach any conclusions.

LIGHT INTENSITY READINGS

The location with the most potential for predation appeared to be the area between the I-405

Bridge and the Renton Library. The highest light levels were recorded in this area. There was also good pool habitat where fry could be consumed by large trout as well as cottids. Additionally, the mid-channel substrate is composed of cobble and gravel which was inhabited by cottids > 49 mm TL. Downstream of the Renton Library between Rkm 2.5 and 0.9 there was little pool habitat and the mid-channel substrate was predominantly gravel. Cottids may be abundant but few are > 49 mm TL.

In the lower Cedar River, artificial lighting appears to come from two major sources; direct lighting and reflected lighting off of the clouds. Direct lighting is intense lighting that occurs in a relatively small area and occurs every night and usually all night. Whereas, reflected light is not very intense but spread out over a much larger area and varies greatly with the weather. Direct lighting probably have strong localized effects on sockeye salmon fry and reflected lighting probably has weak effects over a large area. Which has more overall effect of sockeye salmon fry is difficult to assess. However, reducing direct lighting is much easier to address than reducing reflected light. Direct lighting can be turned off, redirected, or perhaps shielded (such as by trees). Reducing reflected light would be a much larger and far more difficult management objective.

ACKNOWLEDGMENTS

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Saving Salmon On The Cedar River

Signals Maintenance Shapes Salmon Solution
Washington State Department of Transportation
Northwest Region, March 23, 2001 BULLETIN No. 01-12

They hung on the light fixtures above the Cedar River Trail southwest of downtown Renton like black rubber lampshades. Users of the trail, which crosses above the river and under I-405, may wonder about the purpose of the pieces of rubber matting. The simple answer is that they are what they appear to be - black rubber lampshades. The more complex answer is in the river below. What does this have to do with WSDOT? Find out below.

The Cedar River is where the largest run of sockeye salmon in the lower 48 states begins. Each year between January and June, several million salmon fry migrate from their spawning grounds east of Maple Valley to Lake Washington. The 2000 run was one of the biggest in recent memory to Roger Tabor, a fishery biologist with the U.S. Fish and Wildlife Service. Tabor has been working with federal, state, local and tribal governments to determine the reason for the decline in the sockeye run. His research brought him to the Cedar River underneath I-405, where he noticed a problem. The light that WSDOT installed to help keep trail users safe posed a threat to the sockeye salmon fry.

"Light is basically a big stop sign," Tabor said. Sockeye like to migrate a night in the fast part of the river channel and move to low velocity waters along riverbanks and river bottoms during the day. This way they avoid becoming the prey of fully-grown trout and sculpin, which like to forage at night. But the lights above the trail make the sockeye fry think it was daylight.

"We were doing a great job of lighting the stream and an inadequate job of lighting the walkway," said Northwest Region Signals Superintendent Kurt Schleichert.

The end result was that thousands of sockeye moved to shallow areas along the riverbank, making them easy prey for trout and sculpin looking for a late-night snack. Tabor estimated the lighting on the river resulted in several thousand salmon fry being eaten at this location in each spring migration period.

Word of the problem reached Gary Davis, a biologist at Northwest Region headquarters in Shoreline who has been working to coordinate WSDOT's salmon recovery efforts with other agencies in King, Pierce, and Snohomish counties. Davis said the agency wanted to help in whatever way it could.

Schleichert, Tabor, Davis and a representative from the city of Renton visited the site last June. It was immediately obvious that the lighting system wouldn't work as it was set up - too much light was shining on the river. One solution, a complete retrofit of the lighting system, wasn't feasible. Schleichert estimates the retrofit would have cost in excess of \$100,000, mainly because it would have required drilling holes in the concrete pathway above the environmentally-sensitive river.

Another solution, at the extreme opposite end of the cost spectrum, beckoned to Schleichert as he examined the light fixtures above the pathway. Why not equip the fixtures with some kind of shield so the light would shine down on the path, but

Northwest Region

Washington State Department of Transportation

March 23, 2001

BULLETIN

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not on the river? Schleichert set South Signal Supervisor John Merryman to work on the task. Merryman enlisted the help of Rich Loucks, a Traffic Signal Technician 3 and Mark Wolff a Traffic Signal Technician 2, who fabricated shields out of rubber matting. The shield had to be custom made for each fixture, because the lights were mounted in different locations in reference to the walkway and the river. Loucks and Wolff installed six shields in late January and two more just this week for a total cost of less than \$100!

After the first six shields were mounted, it was necessary to see if they were doing the job for which they were designed. In early February Tabor and Loucks measured light levels on the river in the area of the trail light fixtures. The results were dramatic. Light readings showed that levels were similar to other nearby areas of the Cedar River that have no direct lighting.

The next evaluation was to see if the reduction of light led to a reduction in salmon fry on the riverbank. Again, the results were remarkable. In late February, Tabor and others counted salmon fry along the shoreline. In one location they counted only 23 fry where there had been more than 1000 in 1998. The 2001 and 1998 counts were conducted under similar conditions and on similar dates and time of the day. Tabor said the shields that WSDOT mounted on the light fixtures likely made the difference.

The Northwest Region is committed to being a responsible environmental partner. Our effort to reduce lighting along the Cedar River is a small, but important example of this commitment. Sockeye salmon is not an endangered or even threatened species, but as the challenges posed by the Endangered Species Act loom, solutions like the one used on the Cedar River will become more common and more necessary.

By - Greg Phipps

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SIGNALS MAINTENANCE SHAPES SALMON SOLUTION

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Washington State Department of Transportation



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(Continued on Page 2)

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"The fry moved through the bridge quickly and were not delayed by the lights," he said. "Fry counts along the shore are usually related to the light intensity level."

The Northwest Region is committed to being a responsible environmental partner. Oureffort to reduce lighting along the Cedar River is a small, but important example of this commitment. Sockeye salmon is not an endangered or even threatened species, but as the challenges posed by the Endangered Species Act loom, solutions like the one used on the Cedar River will become more common and more necessary.



—Greg Phipps

BUILDING TRUST 2001

On Monday, March 12, the Northwest Region hosted an all-day session with the staff from northwest regional offices of the Washington State Department of Ecology and the Washington State Department of Fish and Wildlife. Dubbed "Building Trust 2001", the meetings presented major 2001 construction projects with potential substantial erosion control and storm water issues. The strategic objective of this meeting was to jointly develop approaches to best address environmental issues that may emerge during the delivery of 2001 construction program. This gathering was in line with the region's business plan to deliver its products and services in such a way that it acts and is recognized as a responsible environmental partner.

WSDOT provided an overview of 32 projects and their unique challenges to the agencies. The meeting was also an opportunity for the department to listen to resource agencies' concerns about WSDOT projects and erosion control issues. Project offices and field staff heard firsthand management commitment to environmental compliance.

The session was a big hit with the two resource agencies. Reprinted below are excerpts from rave reviews they sent to Regional Administrator John Okamoto:

- John—The joint meeting between our staffs went very well I thought. Thank you for hosting it and all the work your crew put into the preparations. Our biologists were impressed with the discussion and really appreciated the heads up on each districts work plan. Please express my gratitude to Dave (Dye) and the rest of your staff for creating a very productive session. We are already looking forward to a follow up this fall.
Bob Everett, Regional Director, WSDFW
- Thanks to you and DOT for hosting the gathering, John. And thanks to Dave (Dye) and Lorena (Eng) for setting the stage for a very open, inviting and positive meeting. Our staff appreciated the chance to meet with so many of your

(Continued on Page 3)

The Effect of Light Intensity on Sockeye Salmon Fry Migratory Behavior and Predation by Cottids in the Cedar River, Washington

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Abstract.—We examined the relationship between light intensity, migratory behavior of sockeye salmon *Oncorhynchus nerka* fry, and predation by cottids *Cottus* spp. We tested the hypothesis that above-natural intensities of nighttime light would increase cottid predation of sockeye salmon fry. In circular tank experiments under controlled laboratory conditions, we tested the ability of cottids to prey on sockeye salmon fry under six different light intensities using minimal water circulation to separate the effect of the migratory behavior of fry from the ability of cottids to capture them. We found that cottids preyed most effectively in complete darkness, whereas the lowest predation occurred at the brightest light intensity. We next tested the predation ability of cottids at four light intensities in a pair of artificial streams to simulate more natural conditions. In experiments without cottids, the majority of fry passed quickly through the artificial streams under complete darkness, but as light intensity was increased, fewer fry emigrated and did so at a slower rate. With cottids present and increased light intensity, even fewer fry emigrated but they did so at a faster rate than did those in the stream without cottids. We determined that cottids probably consumed about 5% of the sockeye salmon fry under complete darkness and ate about 45% of the fry at the brightest light intensity tested. In experimental field trials, the shoreline abundance of fry and predation by cottids increased as light intensities increased. Using two small lights within an 8-m shoreline section on the Cedar River, Washington, we delayed as many as 550 sockeye salmon fry and observed predation of as many as 7.6 fry/cottid. At the end of the experiment, we turned the lights off and noted that the shoreline abundance of fry declined dramatically. At two locations on the Cedar River lit by city lights, the abundance of sockeye salmon fry and predation by cottids was substantially greater than at nearby sites with low light. Also, we demonstrated at one site that reducing light intensity substantially reduced predation on sockeye salmon fry. Overall, we conclude that increased light intensity appears to slow or stop out-migration of fry, making them more vulnerable to capture by predators such as cottids.

After emerging from their redds, most sockeye salmon *Oncorhynchus nerka* fry immediately emigrate downstream at night to a lake environment, where they reside for the next year. However, during this brief (usually one or two nights) out-mi-

gration period, predation by other fishes can be an important source of mortality (Foerster 1968; Beauchamp 1995). Fry presumably reduce their vulnerability to predators by emigrating at night and selecting areas of the river channel with the fastest current velocities (McDonald 1960). The downstream migration of sockeye salmon fry is closely related to light intensity (McDonald 1960). The nightly downstream migration is initiated after the light intensity is less than 0.1 lx. Therefore, increased light intensity from artificial lighting may alter the migration patterns of sockeye salmon fry and change their vulnerability to predation.

The few studies that have examined predation

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on juvenile salmonids under different light intensities have had variable results. Ginetz and Larkin (1976) found that predation of sockeye salmon fry by rainbow trout *O. mykiss* in artificial streams increased as light intensity was increased under low light conditions (<0.1 lx); at high light intensities (0.5–3.0 lx), however, predation decreased as the light intensity was increased. Predation of chum salmon *O. keta* fry by staghorn sculpin *Leptocottus armatus* increased with increased light intensity at night but decreased with increased light intensity during the day (Mace 1983). Patten (1971) found that predation on coho salmon *O. kisutch* fry was greater on moonlit nights than on moonless nights; their results may have been biased, however, by differences in water temperature between treatments. In contrast, Petersen and Gadomski (1994) found that predation on chinook salmon *O. tshawytscha* smolts by northern pikeminnow *Pychocheilus oregonensis* increased as light intensity decreased from 215 to 0.01 lx.

With increased urbanization and development of the Pacific Northwest, the amount of artificial lighting has increased on many streams. The effects of artificial lighting on salmonid populations is poorly understood. In Washington, the Lake Washington sockeye salmon are found within a large urban area. The major spawning tributary to Lake Washington is the Cedar River, some sections of which are exposed to artificial lighting and also present migration routes for sockeye salmon fry. In recent years, sockeye salmon production has declined in the Cedar River; increased predation on migrating sockeye salmon fry as a result of increased nighttime lighting may be one factor in the decline of the Cedar River sockeye salmon population.

The objective of this study was to determine the effect of light intensity on the migratory behavior of sockeye salmon fry and on the predation of fry by cottids *Cottus* spp. in the Cedar River.

Study Site

The Cedar River, the main tributary for the Lake Washington basin (Figure 1), is the major spawning area for sockeye salmon. The lower 35.1 km are accessible to anadromous salmonids. Landsburg Dam, a water-diversion structure, prevents fish from migrating farther upstream. The lower 3 km of the Cedar River flows through a large, heavily urbanized floodplain. This river section is within the City of Renton, Washington, and has numerous sources of artificial light from urban and residen-

tial development. Upstream of river kilometer (rkm) 3, the river valley has some residential development but artificial light is substantially less than in the Renton area. Historically, the Cedar River did not flow into Lake Washington but flowed south as part of the Duwamish River. In 1917, however, the Cedar River was diverted into Lake Washington and a ship canal was constructed to connect the lake to Puget Sound. The historical abundance of sockeye salmon in the Cedar River is poorly understood, although the current sockeye salmon population in the Cedar River appears to be derived principally from introductions between 1937 and 1945 of fry from Baker Lake, Washington (Hendry et al. 1996).

Lake Washington, a large monomictic lake with a total surface area of 9,495 ha and a mean depth of 33 m, sits within a large urban area that includes both Seattle and Renton. More than 78% of the shoreline is given over to residential land use. The lake supports a large run of sockeye salmon. Some years have seen adult returns in excess of 350,000 fish, with most of the adult fish spawning in the Cedar River.

After emerging from the gravel, sockeye salmon fry immediately migrate downstream to Lake Washington, where they reside for the next year. They migrate primarily at night but some daytime migration can occur, particularly during high-flow events with increased turbidity (Seiler and Kishimoto 1997; Hensleigh and Hendry 1998). Fry generally take one or two nights to reach the lake (Seiler and Kishimoto 1997). In the Cedar River, sockeye salmon fry are vulnerable to predation from rainbow trout (both resident and steelhead; Beauchamp 1995), cutthroat trout *O. clarki*, juvenile coho salmon, and four cottid species: coast-range sculpin *Cottus aleuticus*, prickly sculpin *C. asper*, riffle sculpin *C. gulosus*, and torrent sculpin *C. rhotheus* (Tabor et al. 1998).

Prickly sculpin is the largest cottid in Lake Washington and the Cedar River, reaching more than 225 mm total length (TL). Prickly sculpin that prey on sockeye salmon fry in the Cedar River are generally 50–150 mm TL (R. Tabor, unpublished data). Larger prickly sculpin mostly consume larger prey such as lamprey (adults and ammocoetes) *Lampetra* spp., adult longfin smelt *Spirinchus thalichthys*, other cottids, and signal crayfish *Pacifastacus leniusculus*. Found in quiet areas of the lower 5 km of the Cedar River, prickly sculpin are also the dominant cottid in the benthic areas of Lake Washington (Eggers et al. 1978).

Torrent sculpin and riffle sculpin are widespread

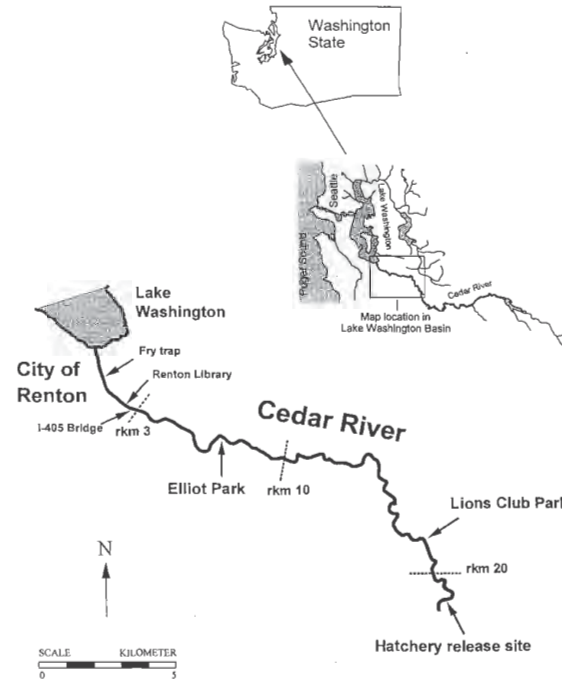


FIGURE 1.—Map of the lower Cedar River, showing the two experimental field trial sites (Lions Club Park and Elliot Park) and the two Renton city light sites (Renton Library and I-405 bridge). The locations of the release site for hatchery sockeye salmon fry and the fry enumeration trap are also shown. rkm = river kilometer.

in the Cedar River, inhabiting the lower 55 km of the river and several small tributaries. Coastrange sculpin occur primarily in the lower 21 km of the river. Torrent sculpin as large as 150 mm TL have been found in the Cedar River. Because of their high abundance and relatively high predation rates, torrent sculpin appear to be the most important cottid predator of sockeye salmon fry in the Cedar River (Tabor, unpublished data). Sizes of riffle sculpin and coastrange sculpin in the Cedar River are generally similar, both reaching approximately 120 mm TL. Riffle sculpin are typically found in

low-velocity areas along the shore of the Cedar River. Coastrange sculpin are usually found in riffles; however, large individuals are often found in pools.

Methods

To determine the effect of light intensity on the migratory behavior of sockeye salmon fry and on the predation of fry by cottids, we conducted several laboratory experiments and field studies (Table 1). We also measured light intensity at sites along the Cedar River to document the amount of

TABLE 1.—List of various study components used to examine the relationship between light intensity and sockeye salmon fry migratory behavior and predation by cottids. All field studies were conducted on the Cedar River. The cottid species of the field studies are listed in order of abundance; river km is distance from the mouth of the river.

Study component	River km	Dates	Cottid species
Laboratory experiments			
Circular tank experiments		May 1997	Prickly and torrent sculpin
Artificial stream experiments		May, Jun 1997	Prickly sculpin
Field Studies			
Experimental field trials			
Lions Club Park	18.3	Mar, Apr 1999	Torrent and riffle sculpin
Elliot Park	7.4	Apr, May, Jun 1999	Torrent, coastrange, and riffle sculpin
Renton city lights			
Renton Library	2.4	Mar 1999, Feb 2001	Coastrange sculpin
I-405 bridge	2.7	Feb 1998, Feb 2001	Coastrange and torrent sculpin
Light intensity readings			
City of Renton	0.0–2.9	Mar, Oct 2000	
Non-lighted areas	0.5–13.2	Feb, Apr 2001	

artificial lighting present and to assess how much the moon and cloudy nights affect light intensity levels. We used cottids to test the effect of increased light intensity on predation of sockeye salmon fry because cottids readily adapt to laboratory conditions, are abundant, and are important predators of sockeye salmon fry in the Cedar River (Tabor et al. 1998). Prickly sculpin and torrent sculpin were used in the laboratory experiments; torrent sculpin, coastrange sculpin, and riffle sculpin were collected at the field study sites.

Laboratory Experiments

We took a dual experimental approach to determine whether cottids prey more effectively at the light intensities generated by standard artificial light sources. Because cottids and sockeye salmon fry may alter their behavior in relation to light intensity, the sensory abilities of one to detect the other may be differentially affected by light intensity. We first tested predation of cottids in the simplistic environment of circular hatchery tanks with minimal water flow, to allow us to separate the effect of the changes in fry migratory behavior that might occur under different light intensities from the ability of cottids to prey on them. To assess the effect of light intensity on sockeye salmon fry behavior, we performed a second experiment, using artificial streams under more natural conditions that allowed fry to migrate downstream. The sockeye fry released upstream in these trials could behave more naturally in this environment than in a hatchery tank in relation to the light intensities used in our treatments; that is, they could migrate quickly through the artificial stream

or delay their passage by stationing in eddies or burying in the gravel substrate.

During May–June 1997, we conducted experiments at the Western Fisheries Research Center, U.S. Geological Survey, Seattle, Washington. Prickly sculpin (74–103 mm TL) and torrent sculpin (74–98 mm TL) collected from the Cedar River and Lake Washington by electrofishing were transported to the laboratory, where they were maintained in circular holding tanks in size-sorted (small: 70–79 mm TL; medium: 80–89 mm TL; and large sculpin: 90–99 mm TL) and species-specific groups. The sizes of cottids collected are representative of those that commonly consume sockeye salmon fry in the Cedar River (Tabor, unpublished data). Sockeye salmon fry were obtained periodically from the Washington Department of Fish and Wildlife fry enumeration trap located near the mouth of the Cedar River. The mean fork length (FL) of the fry was 28.4 mm ($N = 90$; SE, 0.18; range, 26–34 mm FL). The fry were presumably both migration- and predator-experienced. After transport to the laboratory, the fry too were held in circular holding tanks. Fry were fed commercial fry food daily throughout the experimental period. Most fry were used in experiments within 5 d after they were collected; however, some fry used in the last experiments were held as long as 14 d. Sculpin were fed available salmonid fry before the experiment.

The light intensities used in the experiments represent the range of values observed during field measurements in the lower Cedar River. All light intensity measurements were made with an International Light, Inc., model IL1400A radiometer/

photometer. The light source consisted of one or two strings of small ornamental lights (small, clear, holiday tree lights) taped to the underside of the lids of the tanks and the artificial streams and suspended directly above the water. Each light string was connected to an outlet box and a dimmer switch. Predation trials in both experiments were run during daylight hours. Testing environments were covered with layers of black sheeting to exclude all light except that produced by our artificial light source.

Circular tank experiments.—The tank experiments were conducted in three 1.2-m-diameter circular tanks. Water depth was maintained at 30 cm and water temperature was approximately 12°C. We tested six light intensities (0.00, 0.03, 0.06, 0.11, 1.08, and 10.8 lx) during the predation experiments. For each trial, we randomly selected one of these treatment light intensities. We carefully adjusted the lights to maintain that intensity in each of the three replicate test tanks before each experimental trial. In each trial we used single-species groups of 20 sculpin (three large, nine medium, and eight small fish randomly sampled from the size-sorted holding tanks) and 100 fry. We performed six replicate trials for each light intensity with both prickly sculpin and torrent sculpin. The fry were given 15 min to adjust to the experimental setup before the sculpin were added. Two black Plexiglas shelves within each tank served as a refuge/hiding place for the sculpin during the experiments. After addition of the sculpin, each trial lasted 40 min. Trial starting times were staggered for the three test tanks to allow sufficient time for recovery of all fish with a small aquarium net and flashlight. Predation was determined as the number of sockeye salmon fry lost during a trial. Results of the light intensity experiment were analyzed with one-way analysis of variance (ANOVA) tests and post hoc Tukey's Honestly Significant Difference (HSD) tests.

Prickly and torrent sculpin were used on alternate days to allow adequate digestion time between trials. The stomach contents of three replicate groups of cottids from both the 0.00 and 10.8 lx light intensities ($N = 60$ for each light treatment and cottid species combination) were removed by gastric lavage to confirm consumption of fry, determine the percent of sculpin that consumed fry, and confirm the absence of previously consumed fry. Light et al. (1983) found gastric lavage was 100% effective for removing stomach contents of slimy sculpin *C. cognatus*.

Artificial stream experiments.—Sockeye salmon

fry migration/behavior experiments were done in two identical artificial streams containing natural river gravel substrate. Each stream was 9 m long by 1.5 m wide and was contained within a fiberglass trough. We used only a 3-m section of each stream to allow enough space downstream to set up a fish trap for collecting the fry. Each experimental section consisted of a 2.5-m-long pool and a short riffle section. The riffles had a 2% gradient and a water depth of 18 cm. The maximum depth of each pool was approximately 75 cm. Surface velocities ranged from 0.37 m/s near the inflow to 0.12 m/s at the outflow. Near the bottom of each pool the water velocity was negligible. The light intensity was measured approximately 10 cm below the surface of the water in both streams. For the predator trials, 20 prickly sculpin (mean, 86.5 mm TL; range, 75–99 mm TL) were placed in each artificial stream, where they remained throughout the duration of the experiment. We performed trials once every 2–3 d to allow the sculpin enough time to digest fry from the previous trial.

At the start of each trial, 125 fry were transferred from the laboratory, where they had been held in low light intensity, and were released at the upstream end of each experimental section. Trials started immediately with the addition of fry, and the fry traps were checked with a flashlight at 20 min and after 2, 4, and 6 h. Any fry caught in the fry trap were removed with a small aquarium net and counted. After 6 h, all lights were turned off and the fry were given 12–16 h (overnight) to migrate through the streams to the trap. Again, any fry in the trap were removed and a final count was made. We did not try to collect any fry possibly remaining in the artificial streams because preliminary work had indicated the fry were extremely difficult to locate and capture. In nonpredator trials, the number of fry not accounted for by the beginning of the next trial was added to the number of fry released (125) at the start of that next trial. Consequently, the results are presented as a cumulative percentage of the total fry in each stream that migrated downstream to the fry trap within the trial periods. In the predator trials, we assumed that the fry not accounted for were all consumed by sculpin. Because few fry migrated overnight in the predator trials when the streams were darkened, this appears to be a valid assumption.

The artificial stream trials were conducted in two parts. No predators were used in the first part, in which two replicates of each of three light intensities (0.00, 1.08, and 5.40 lx) were tested. In the second part, predators were present in one

stream and absent in the other, and four light intensities were tested (0.00, 0.22, 1.08, and 5.4 lx). Two replicates of each level were tested except that time constraints allowed only one trial at 0.22 lx. On each trial date, the same randomly selected light intensity treatment was used in both the predator and nonpredator artificial stream.

Field Studies

Experimental field trials.—We performed experimental field trials at two sites on the Cedar River, the Lions Club Park at rkm 18.3 and the Elliott Park at rkm 7.4 (Figure 1). The Lions Park site, with a 112-m shoreline section, had two distinct habitat types: The upper 56 m had a riprap shoreline (steep sloping banks), whereas the lower 56 m had a gravel shoreline with gradually sloping banks. The Lions Club Park was the site of two experimental trials, both conducted on nights when hatchery sockeye salmon fry had been released upstream at rkm 21.7. On March 31, 1999, 135,000 fry were released at approximately 2015 hours and on April 5, 1999, 57,000 fry were released at approximately 2115 hours. Most of the fry appeared to reach the fry trap at rkm 1.2 between 2300 and 0000 hours on March 31 and between 0000 and 0100 hours on April 6 (D. Seiler, Washington Department of Fish and Wildlife, unpublished data).

The other site, at Elliott Park, consisted of a side channel immediately downstream from the outlet of a spawning channel. We sampled the side channel five times from April 7 to June 14, 1999, during the fry out-migration period. Fry observed at this site most likely originated from the spawning channel, because no hatchery fry were released during these dates. The Elliott Park site consisted of one 40-m-long sand/gravel shoreline section.

Shoreline sections at both sites were divided into 8-m-long units. Lights were added only to every other unit to ensure that light from one experimental unit did not affect the adjacent units. Treatments were randomly assigned within the alternate shoreline sections. Two lights were used for each experimental unit, each mounted at the top of 2-m-tall poles that were placed at the far ends of each unit; there, the lights were directed toward the middle of the unit. Each light was set up as an individual light system consisting of a 60-W light bulb, a deflector to focus the light, and a dimmer switch to control the light intensity. We used different combinations of five light intensities: (1) control (no lights), 0.01–0.11 lx; (2) dim, 0.16–0.27 lx; (3) low, 0.48–0.59 lx; (4) medium, 1.08–1.51 lx; and (5) bright, 10.80–15.10 lx. Light

intensity was measured at the surface of the water, 2 m from shore. Generally, we took three measurements, one in the middle and one each from just inside the upstream and downstream edges. The middle of each experimental unit was the brightest, and the upstream and downstream edges were the dimmest; moreover, light intensity attenuated across the river channel. We turned on the lights shortly after dusk and adjusted their settings to get the appropriate light intensity.

Experiments lasted 2–3 h. At both sites, sockeye salmon fry abundance was estimated by counting fry along the shoreline. Fry were counted by an observer using a flashlight, who slowly walked along the shoreline in a systematic pattern to ensure that the area out to 2 m from shore was completely covered. To be consistent between treatments, we counted only fry within the beam of the flashlight. Preliminary observations indicated that fry were in shallow water and close to the surface of the water, tended to hold their position facing into the current, and did not move appreciably. Thus, fry could be easily counted and fish counts between different shoreline types (gravel shore and rip-rap) could be compared. In subsequent electrofishing after the experimental trials, we found no evidence that sockeye salmon fry were hidden within the riprap. We assumed that the counting had a minimal effect on fry abundance because it took only a short time, approximately 1 min per shoreline section. Fry were counted every 15 min at the Lions Club Park. At Elliott Park, we only did two counts, one shortly after the experiment was started and another at the end of the experiment. For some experimental trials, we recounted the number of fry present 20 min after the lights had been turned off.

After the lights had been turned off, we used backpack electrofishing equipment to collect cottids along the shoreline to determine the level of predation. We assumed there was little movement of sculpin between sections because of the relatively short duration of each experiment (approximately 2 h) and the 8-m gap between sections. We also considered it unlikely that a sculpin from one section could flee into another section because there was a gap between sections and because we sampled in an upstream direction, from the downstream end to the upstream end. Stunned fish were collected with the aid of dip nets and a spot light. After capture, cottids were identified as to species and measured for total length. Cottids of 50 mm TL or larger were anesthetized and their stomach contents were removed by gastric lavage. Because

small cottids rarely consume sockeye salmon fry (Tabor, unpublished data), we did not check the contents of their stomachs. Ingested fry were counted and categorized as freshly ingested or well digested. Only counts of freshly ingested fry were used in the analyses. We assumed that freshly ingested fry were consumed during the experiment, whereas well-digested fry had been consumed the previous night or sometime before the experiment. Because we started the experiments shortly after sunset and because cottids are primarily nocturnal and sockeye salmon fry migrate primarily at night, we deem this a valid assumption.

We tested differences in fry abundance with a two-way ANOVA without replication. Data were log-transformed because the data were multiplicative rather than additive (Zar 1984). The two factors paired for testing were light intensity and habitat type for the Lions Club Park data and light intensity and date for the Elliott Park data. Several cottids did not consume any fry, meaning that the predation data were not normally distributed; therefore, we used nonparametric procedures to compare predation, a Mann-Whitney *U*-test (two samples) or a Kruskal-Wallis test (more than two samples).

Renton city lights.—Two sites were selected in Renton, the Renton Library and the I-405 bridge (Figure 1), as having an area of high light intensity and a nearby area with similar habitat and substantially lower light intensity. Abundance of sockeye salmon fry and predation of fry by cottids were monitored on nights when hatchery sockeye salmon fry were released so we could ensure that a large number of fry were available. The Renton Library sits 5 m above the Cedar River, spanning the entire width of the river and covering a 28-m-long section of the river. We compared the findings for a 22-m-long river section under the library, where no artificial lights were present, with those for a 22-m-long river section 3 m downstream of the library and characterized by several artificial lights spanning the width of the river. The library site was sampled once in 1999 and once in 2001. The I-405 bridge had several lights under the bridge to illuminate a walkway that spans the river. The control site for this location was 180 m upstream from the bridge, where no direct lighting was present. Both sites were 20 m long. Sampling was conducted once in 1998 and again in 2001. Sampling in 2001 was conducted after artificial lights had been shielded and light intensities along the river had been substantially reduced from 9.7–21.5 lx in 1998 to 0.14–0.32 lx in 2001. In the

TABLE 2.—River conditions and the number of emigrating sockeye salmon fry on three dates used to examine the difference in predation of sockeye salmon fry by cottids before and after lights at the I-405 bridge were shielded. Streamflow and water temperature data were taken by U.S. Geological Survey at rkm 2.2. Fry abundance estimates were obtained from fry trap data (D. Seiler, Washington Department of Fish and Wildlife, unpublished data). The fry trap was located at rkm 1.6 (from the mouth of the river). Catch efficiency of the fry trap on the dates listed ranged from 9.6% to 10.2%.

Date	Fry abundance		Streamflow (m ³ /s)	Temperature (°C)
	Sample night	Prior night		
Feb 23, 1998	296,800	318,000	16.7	7.3
Feb 25, 1998	537,900	434,000	18.6	7.2
Feb 21, 2001	684,000	557,000	10.0	7.7

2001 sampling, streamflow was lower, water temperature was slightly higher, and fry abundance was greater than during the 1998 sample (Table 2). Therefore, predation in 2001 was expected to be as high or higher than during sample dates in 1998. Sockeye salmon fry abundance at all sites was estimated by counting fry along the shoreline, similar to the experimental field trials. Light intensity was measured at the surface of the water in the middle of the area sampled.

At both sites, cottids were collected with backpack electrofishing equipment and analyzed for stomach content to compare the extents of predation of fry. At Renton Library, cottids were sampled along the shoreline and were collected visually with the aid of dip nets and a spot light. At the I-405 bridge site, cottids were collected in the mid-channel area because few cottids were present along the shore of the control site. Stunned cottids in the mid-channel area were collected passively with the aid of block nets. After capture, cottids were identified to species and TL was measured. Afterwards, their stomach contents were removed by gastric lavage and consumed sockeye salmon fry were counted. We assumed that cottids had consumed fry in the same general area where we captured them. We included counts of all sockeye salmon fry ingested because the artificial lighting was consistent from night to night. A Mann-Whitney *U*-test was used to compare differences in predation between the lighted site and the control site.

Light intensity readings.—In 2000 we assessed the artificial lighting along the lower 3 km of the Cedar River, taking light readings every 50 m over rkm 0.9–2.9. Below rkm 0.9, access to the river was limited in many areas, so additional readings were only made at rkm 0.0, 0.2, 0.3, and 0.7. All

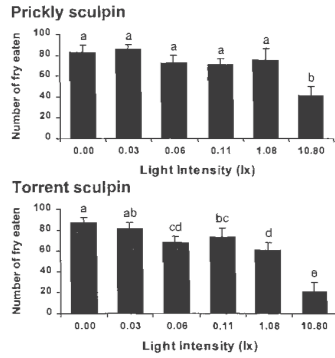


FIGURE 2.—Number of sockeye salmon fry eaten (\pm SD) by prickly sculpin and torrent sculpin in 40-min trials in circular tanks at different light intensities. Each bar is the mean of six trials. Groups of bars with different letters are significantly different (ANOVA and Tukey's HSD; $P < 0.05$).

readings were taken close to the riverbank, approximately 1–5 m from shore, and at the surface of the water. At major light sources, we took an additional reading to determine the maximum light intensity. Besides identifying sources of direct lighting, we also measured light intensity in other natural lighting conditions—(1) overcast skies; (2) clear skies, no moon; and (3) clear skies, full moon—at five locations without artificial lighting: rkm 0.5, 3.1, 6.9, 9.8, and 13.2.

Results

Laboratory Experiments

Prickly sculpin and torrent sculpin displayed similar amounts of predation with respect to increasing light intensity in tank experiments. Both species captured more fry under low light conditions than under the highest light intensity (Figure 2). Prickly sculpin captured a mean of 82.3 fry ($SD = 7.4$) at 0.00 lx compared with a mean of 41.5 fry ($SD = 8.7$) at 10.80 lx. Torrent sculpin captured a mean of 86.8 fry ($SD = 5.3$) at 0.00 lx and a mean of 21.3 fry ($SD = 8.3$) at 10.80 lx. A separate one-way ANOVA was performed on untransformed data of number of fry eaten for the two sculpin species. The ANOVA tests indicated significant differences among the six light intensities

tested for both prickly sculpin ($P < 0.001$) and torrent sculpin ($P < 0.001$). Results from a post hoc Tukey's HSD test for prickly sculpin showed significantly less fry consumption at the highest light intensity but no difference among the other five light levels (Figure 2). Torrent sculpin indicated more differences among the six light intensities although, as with prickly sculpin, predation at the highest light intensity differed from that at the other five. The other five levels showed significant differences between treatments ($P < 0.05$), but there was no consistent trend from the lowest intensity to the highest one. In general, however, the number of fry eaten by torrent sculpin decreased as the light intensity increased.

Gastric lavage of three replicate trials of 20 sculpins each (total, 60 sculpin per species) from the trials at 0.00 and 10.80 lx verified that both prickly sculpin and torrent sculpin consumed more sockeye salmon fry at the lowest light intensity than at the highest light intensity. Ninety-five percent of the prickly sculpin had consumed at least one fry at 0.00 lx, whereas only 87% consumed fry at 10.80 lx. Thirty-eight percent of the prickly sculpin had consumed more than four fry at 0.00 lx, but only 5% had consumed more than four fry at 10.80 lx. The maximum number consumed by a prickly sculpin was nine fry (0.00 lx). Ninety-two percent of the torrent sculpin had consumed at least one fry at 0.00 lx, but only 68% had consumed fry at 10.80 lx. Fifty-two percent of the torrent sculpin had consumed more than four fry at 0.00 lx, whereas only 7% had consumed more than four fry at 10.80 lx. The maximum number of fry consumed by a torrent sculpin was 12 fry (0.00 lx).

We also verified that 2 d was sufficient time for digestion of previously consumed fry (and therefore, resumption of predatory motivation) in these experiments because only freshly consumed fry were recovered in the gastric lavage contents.

Artificial Stream Experiments

The first set of experimental trials, conducted with no predators present, indicated that sockeye salmon fry migrated through the stream at a faster rate under complete darkness (0.00 lx) than in the other two light intensities (1.08 and 5.4 lx). Under complete darkness, 74% ($SD = 4.5\%$) of the fry migrated downstream within the first 20 min of the trials, and an additional 25% migrated downstream over the course of the next 24 h. Results were similar for the two treatments with light present but differed from those with light absent. In the 1.08 and 5.40 lx trials, 32% ($SD = 8.6\%$) and 34%

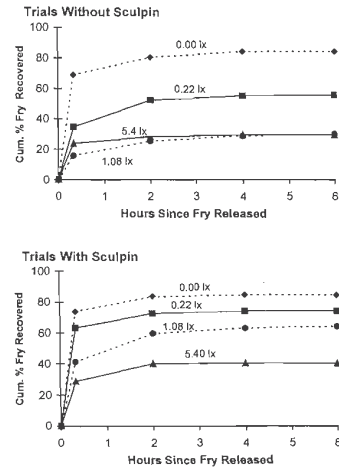


FIGURE 3.—Cumulative percent of total sockeye salmon fry recovered after release in artificial streams under four different light intensities. Each line is the mean of two trials, except that only one trial was conducted for the 0.22-lx experiment. The top and bottom panels show the results for trials when fry emigrated in the absence or in the presence of prickly sculpin, respectively.

($SD = 7.8\%$), respectively, of the fry migrated downstream within the first 20 min, and an additional 52% and 56%, respectively, migrated downstream within the next 24 h.

The second set of experimental trials was conducted with sculpin present in one stream and not in the other. These predation plus out-migration trials showed several strong patterns, even with only two trials completed at each of four light levels (Figure 3). First, as in the earlier trials, fry readily emigrated through the artificial streams under complete darkness but increasingly delayed passage as the light increased. Second, fry emigrated faster in all nondark trials when sculpin were present. Third, and most crucial, a greater proportion of fry were never recovered in the stream trials with sculpin present and the proportion missing was related directly to the light intensity (Table 3). Even though fry migrated more quickly with sculpin present than when the pred-

TABLE 3.—Percentage of sockeye salmon fry not recovered from outmigration trials in the artificial streams in the presence or absence of prickly sculpin under different light intensities. Estimates of the percent eaten were derived by subtracting the mean percent fry not recovered from the trials with no sculpin (mean = 10.0%) from each mean of percent fry not recovered with sculpin present.

Light level (lx)	Percent fry not recovered (SD)		Estimated percent eaten	Number of trials
	Sculpin absent	Sculpin present		
0.00	8.1 (2.2)	15.2 (2.3)	5.2	2
0.22	13.4	38.4	28.4	1
1.08	10.0 (1.7)	34.0 (6.2)	24.0	2
5.40	8.5 (1.5)	55.2 (13.6)	45.2	2

ators were absent, the fry were apparently more vulnerable to predation with increasing light intensity. At the most intense light tested (5.4 lx), subtracting the average number of fry unaccounted for in all trials with no sculpin present (10%) indicates that about 45% of the fry in the trial were probably consumed by sculpin. At 0.22 lx, about 28% of the fry became prey, and only about 5% were likely prey to the sculpin in the dark trials. Finally, our results consistently showed that fry not recovered in the first 2 h of a trial including sculpin were never recovered.

Field Studies

Experimental field trials.—At Lions Club Park on March 31 and April 5, 1999, few sockeye salmon fry were observed in all units for the first 45 min to 1 h. Within the next 20 min, however, the number of fry increased dramatically. For example, in the brightest light experimental unit, the number of fry changed from 27 at 2025 hours to 577 at 2045 hours. This increase in the number of fry most probably resulted from the large number of hatchery fish released earlier that evening. Experimental units with greater light intensities had significantly more fry in both experimental trials (ANOVA; March 31, $P = 0.02$; April 5, $P = 0.005$; Figure 4). Moreover, within each light intensity trial, more fry were found in the gravel shore than on the riprap shore (ANOVA; March 31, $P = 0.04$; April 5, $P = 0.03$; Figure 4). On average, gravel shores had 5 times as many fry as riprap shores for a given light intensity.

Overall, fry abundance results at the Elliot Park side channel followed patterns similar to those at Lions Club Park. Fry counts were conducted on five dates; on May 3, 1999, however, the light system for the medium-light experimental unit

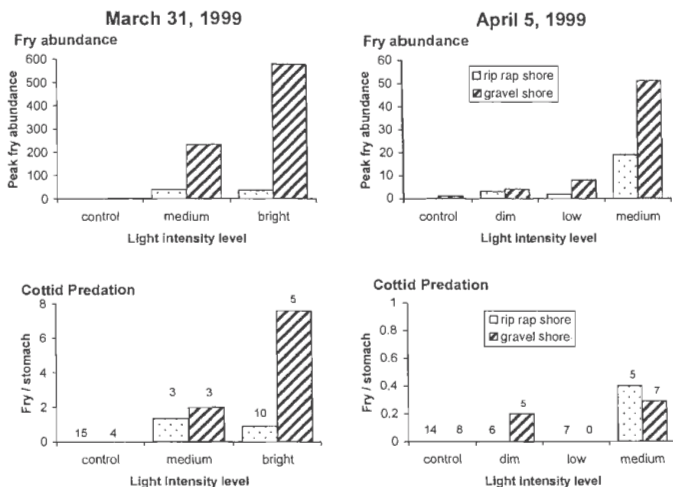


FIGURE 4.—Sockeye salmon fry abundance and cottid predation of fry at various light intensities and two habitat types from two experimental trials at Lions Club Park (rkm 18.3) on the Cedar River in 1999. Numbers above the bars indicate the number of cottid stomachs examined. Only freshly ingested sockeye salmon fry were counted as indicators of recent ingestion.

malfunctioned, and we were unable to get a fry count for that part of the experiment (Figure 5). The abundance of fry in the side channel varied greatly on the five dates sampled and most probably consisted of migrants from the spawning channel. Peak out-migration appeared to occur around May 3. An ANOVA revealed a significant difference ($P < 0.001$) in fry abundance between light intensity values and between sampling dates ($P < 0.001$). The most fry were always in the medium-light unit, the dim-light unit always had the second most numerous fry, and the control unit always had the least (Figure 5).

In two experimental trials, we also examined the abundance of fry shortly after the lights were turned off. In all the lighted experimental units, the number of fry decreased dramatically after the lights were turned off (Figure 6). In control units (no light added), the number of fry decreased slightly or actually increased. The lighted shoreline sections averaged a 93% reduction in fry

abundance at Lions Club Park and a 88% reduction at Elliot Park.

In general, predation of fry by cottids showed the same trend as fry abundance. The most predation took place in experimental units with increased light. This trend was particularly noticeable during the March 31, 1999, trial at the Lions Club Park. Whereas no predation was detected in the control units, large numbers of fry were found in the stomach samples of cottids collected from the bright-light experimental unit (Figure 4). Three torrent sculpin collected from this unit had 10 or more fry in their stomachs. The maximum number of sockeye salmon fry consumed by an individual fish was 13 (92 mm TL, torrent sculpin). Differences in predation were marginally significant (Kruskal-Wallis test = 5.7, $P = 0.058$) between experimental units but were not significant between medium and bright experimental units (Mann-Whitney U -test = 3.5, $P = 0.23$). Predation in both of the lighted riprap experimental units

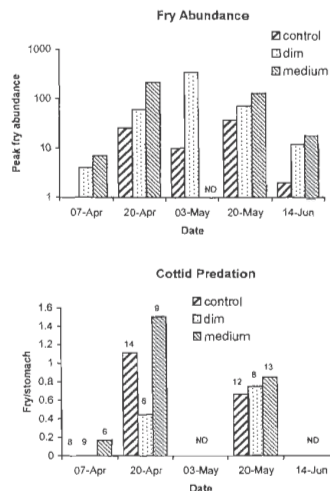


FIGURE 5.—Abundance of sockeye salmon fry (log scale) and extent of cottid predation of fry at three light intensity values on five nights in 1999 at the Elliot Park side channel (just below a spawning channel). Numbers above the bars indicate the number of cottid stomachs examined. Only freshly ingested sockeye salmon fry were counted as indicators of recent ingestion. ND = no data.

was less than in units with gravel shores; these differences were significant between the two bright experimental units (Mann-Whitney U -test = 8.0, $P = 0.03$) but not in the medium-light experimental unit (Mann-Whitney U -test = 3.5, $P = 0.66$).

Predation of fry on April 5, 1999, was low for all experimental units. Only 3 of the 42 cottids analyzed had consumed sockeye salmon fry. Although we detected no differences between treatments, four of the five fry consumed were from the medium-light experimental units and no predation was observed in the control units (Figure 4).

Cottids were collected on three occasions at the Elliot Park side channel. In each trial, the most predation was observed in the medium-light unit

(Figure 5); however, no significant differences between the light intensity units were detected.

At Lions Club Park, torrent sculpin made up 92% of the cottids captured, riffle sculpin 8%. At the Elliot Park side channel, 50% of the cottids were torrent sculpin, 26% were coastrange sculpin, and 24% were riffle sculpin. Predation was observed in all cottid species present at both sites.

Renton city lights.—At both locations examined, the abundance of sockeye salmon fry along the shoreline was substantially greater at sites with high light intensity than at a nearby site with low light (Figures 7 and 8). Additionally, little predation was observed in control areas with low light intensity, whereas relatively high predation was observed in lighted areas. At the Renton Library, predation on both sample dates was significantly higher in the lighted area than in the control area (Mann-Whitney U -tests: March 18, 1999, $U = 63$, $P = 0.03$; February 21, 2001, $U = 247$, $P = 0.002$). Combined, 53% of the cottids in the lighted area had consumed sockeye salmon fry, whereas only 3% had in the control site. All of the cottids collected at the library location were coastrange sculpin.

At the lighted I-405 site on February 25, 1998, 53% of the cottids had consumed fry (0.9 fry/stomach), but no predation had occurred at the control site. Predation was significantly greater in the lighted area (Mann-Whitney U -test = 58.5; $P = 0.002$) than in the control area. Preliminary sampling was also done at the I-405 bridge on February 23, 1998 (the control site was not sampled). From 15 cottids collected, a total of 18 sockeye salmon fry was found in the stomach samples (1.2 fry/stomach). Shielding lights under the I-405 bridge greatly reduced light intensities in the river, consequently greatly decreasing the shoreline abundance of fry and the predation of fry. In 2001, in contrast to the sampling in 1998, the number of fry at the bridge was similar to the number at the control site (Figure 8). We sampled 22 cottids from the I-405 bridge site and 14 cottids from the control site and observed no predation at either site. Predation of fry was significantly less at the I-405 bridge site when the lights shielded than on two dates in 1998 when the lights were shining directly on the river (Mann-Whitney U -test = 319; $P < 0.001$). Of all the cottids collected at the bridge and control site, 96% were coastrange sculpin and 4% were torrent sculpin; both species were observed to have ingested sockeye salmon fry.

Light intensity readings.—Surveys of the lower 3 km of the Cedar River indicated that most of

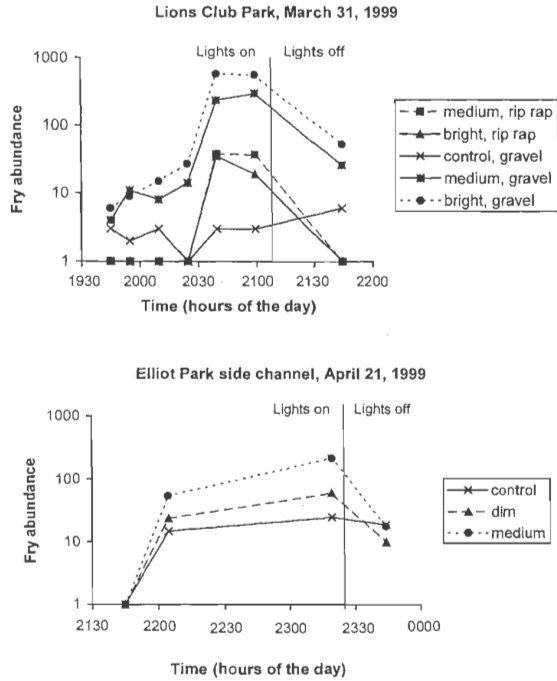


FIGURE 6.—Abundance of sockeye salmon fry (log scale) at three light intensity values in two experimental trials in the Cedar River, 1999, in which artificial lights that were on at dusk were later turned off. Vertical lines indicate when the lights were turned off. The March 31 trial was done at two habitat types, riprap and gravel shore. No fry were seen in the control riprap unit, so that site is not plotted on the graph.

this area has light intensity values (>0.2 lx) exceeding natural amounts (0.0 lx). Within the lower Cedar River, nine locations had light intensity greater than 1.1 lx. At six of these sites, the light was from street lights at bridges; at the other three, the light was associated with a building adjacent to the river. The highest light readings recorded were at the I-405 bridge (21.5 lx) and the Renton Library site (20.4 lx). Between rkm 0.9 and 2.9, the median light intensity level was 0.37 lx on a clear, moonless night but 0.94 lx on a cloudy night.

Light readings of areas with no direct lighting in the lower 13 km of the Cedar River indicated that light reflected off clouds was greatest near the mouth of the river and gradually decreased at upstream locations (Figure 9). Light intensities on cloudy nights in the lower 9 km of the river exceeded those on a clear night with a full moon. As expected, light intensity readings during clear skies were similar between locations. Observations from a plane at night suggest that most of the reflected light comes from the City of Renton

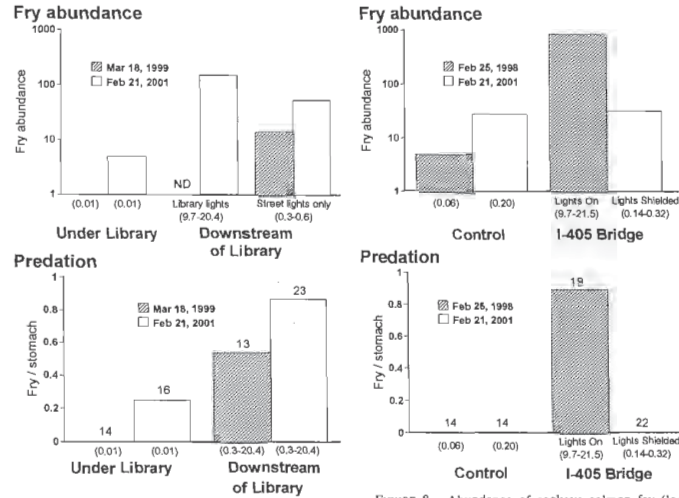


FIGURE 7.—Abundance of sockeye salmon fry (log scale) and extent of predation of fry by cottids at the Renton Library, City of Renton, Washington. The library lights were on for approximately 3 h after sunset and then turned off, whereas the street lights remained on all night. The abundance of fry was the number along a 20-m shoreline section at each site. Light intensities (in lux) are indicated in parentheses. In 1998, the lights under the I-405 bridge shone directly on the river; in 2001, the lights were shielded so that they shone primarily on a walkway and not on the river. The control site was located 180 m upstream of the bridge. The number of cottids examined for fry consumption is given above each bar. ND = no data.

and from a large industrial area just south of Renton. Upstream of the City of Renton, no significant lighting sources were apparent that would increase the amount of reflected light along the river during cloudy nights.

Discussion

Fry Behavior

Increasing light intensity appeared to affect greatly the behavior of sockeye salmon fry. Sockeye salmon fry usually emigrate at night, when light levels are less than 0.1 lx, and select areas of the river channel that have the fastest current velocities (McDonald 1960). Our experimental field trials demonstrated that if fry encounter lighted areas, many will hold their position in low-

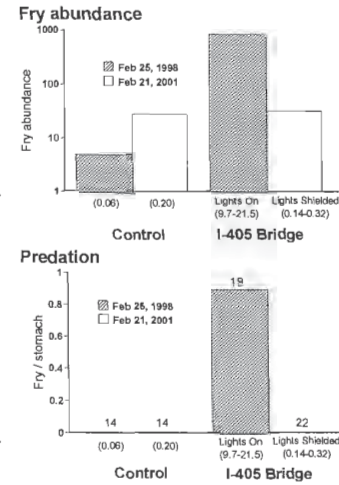


FIGURE 8.—Abundance of sockeye salmon fry (log scale) and predation of fry by cottids at two Cedar River sites with various light intensity values near the I-405 bridge, City of Renton, Washington. The abundance of fry was the number counted along a 20-m shoreline section at each site. Light intensities (in lux) are indicated in parentheses. In 1998, the lights under the I-405 bridge shone directly on the river; in 2001, the lights were shielded so that they shone primarily on a walkway and not on the river. The control site was located 180 m upstream of the bridge. The number of cottids examined for fry consumption is given above each bar.

velocity water and delay their migration. McDonald (1960) also observed that sockeye salmon fry stopped swimming downstream when they encountered a light. Shoreline observations in the Cedar River indicated that fry were in shallow water close to the surface of the water and tended to hold their position facing into the current without moving appreciably. Our behavioral observations at lighted areas were similar to daytime observations of Hartman et al. (1962), who found that sockeye salmon fry accumulate and hold along the stream edges and invariably remain in the top 0.15 m of the water. Hensleigh and Hendry (1998) experimentally found that most fry moved down-

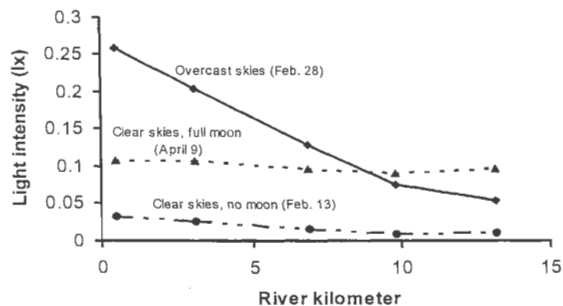


FIGURE 9.—Nighttime light intensities at five locations on the lower Cedar River as determined in 2001 under three different scenarios. Light readings were taken close to the surface of the water at locations with no direct lighting. The dates on which the light readings were taken are indicated in parentheses.

stream in the dark but tended to hold their positions or move slightly upstream in the light.

As shown by counts of fry along the shoreline of the Cedar River, the abundance of sockeye salmon fry that were delayed appeared to be positively related to the light intensity. Even small increases in light intensity seemed to affect fry behavior. At Elliot Park, for example, we consistently observed differences in fry abundance between the control (0.11 lx) and the dim-light experimental unit (0.22 lx). In the Cedar River, other variables such as total number of nightly migrants, water velocities, shoreline type, substrate type, streamflow, and turbidity will probably also influence the number of fry delayed. If these other variables could be held constant the number of fry delayed will probably be closely related to light intensity values.

We were surprised by the large number (>550 fry) of sockeye salmon fry present within the bright-light experimental unit (sand and gravel shoreline) during the March 31, 1999, experiment. Approximately 120,000 fry had been released on that date. Assuming a similar per kilometer survival rate as those in hatchery releases from Landsburg Dam (Seiler and Kishimoto 1997) and if the number of wild fry was minimal, we estimate that 110,000 hatchery fry moved past our experimental site. Therefore, we were able to delay 0.5% of the release group within an 8-m-long shoreline section with two small lights. Near the shoreline, the light intensity level was 11–15 lx, but in the middle of the channel, where most fry would be, we would expect the light intensity to be only 0.1 lx. This

suggests that several large lights spread out over a long section of shoreline and across the river channel could strongly affect the behavior of migrating fry.

The duration of delay for an individual sockeye salmon fry is unclear. We assumed that once a fry is delayed in a lighted area, it may be delayed for a considerable period of time. At the I-405 bridge site (before the lights were shielded), we routinely observed large numbers of fry at different hours of the night, from shortly after dusk to shortly before dawn. Although there may have been some level of turnover of individuals, we think it reasonable that many were delayed for several hours. Because fry only take one or two nights to reach Lake Washington, a delay of a few hours may markedly increase their risk to predation. McDonald (1960) was able to completely stop the nightly movement of sockeye salmon fry with artificial lighting (30 lx) that was kept on all night. In other experimental trials, McDonald (1960) turned the lights off at different times of the night and observed that immediately afterwards the migration of fry commenced. In our experimental field trials, the fry appeared to resume their migration shortly after the lights were turned off. Further experiments are needed to determine how long fry are delayed.

In addition to increased shoreline abundance of sockeye salmon fry, increased light intensity may also cause fry to move into low-velocity areas along the bottom of the river channel. Once fry encounter artificial lighting, they reverse their di-

rection and face upstream into the current (McDonald 1960); they will either stay in fixed position above the substrate or seek cover in the substrate. Given the high current velocities in the Cedar River, the only locations where fry could easily maintain their position in the current would be along the shore or on the bottom of the river channel. We were able to directly estimate the number of fry along the shoreline but not the number of fry along the bottom of the river channel. However, we were able to measure this number indirectly by examining predation by cottids in the midchannel area of a riffle at the I-405 site. Because of the high incidence of predation at this lighted site, we believe many sockeye salmon sought cover in the substrate and became vulnerable to predation by cottids. In all, we found 33 fry in 33 cottid stomach samples. Under similar conditions at a nearby control site, as well as at nine other sites further upstream with little lighting, only one salmonid fry was found in the stomachs of 109 cottids examined (Tabor, unpublished data). Similarly, in 2001, after the lights at the I-405 site were shielded, we observed no predation.

Predation of Fry

Under natural nighttime light intensity, sockeye salmon fry and cottids are probably spatially segregated because the fry occupy areas of faster water velocity (McDonald 1960), whereas cottids stay in close contact with the substrate and thus occupy areas with substantially slower water velocities. By selecting fast-flowing water areas, fry are able to move quickly downstream and reduce the likelihood of encounter with predators (Ginetz and Larkin 1976). Increased light causes fry to delay migration and to move to low-velocity water, where one would expect more frequent rates of encounter with cottids. Other research on predation of fry by cottids in the Cedar River has indicated that predation occurs primarily in low-velocity habitats such as pools and side channels (Tabor et al. 1998). Also, predation rates appear to be negatively related to streamflow. In addition, investigators have found that survival of juvenile salmonids is positively related to streamflow, which is probably related to reduced amounts of predation (Cada et al. 1997; Seiler and Kishimoto 1997).

Predation of fry by cottids appeared to be closely related to fry density at all field sites. As light intensity increased, the shoreline density of fry increased and subsequently the amount of predation increased. Cottids appeared to exhibit some

type of functional response related to an increase in the abundance of fry. Because we conducted a variety of different field studies, it would be difficult to determine the exact type of functional response. Cottids may have a lesser ability to consume fry as light intensity increases, as demonstrated in the circular tank experiments, but the number of fry available to them at brighter light intensities will be substantially higher and thus overall predation should be greater, as was observed at field sites. Woodsworth (1982; prickly sculpin and sockeye salmon fry), Mace (1983; staghorn sculpin and chum salmon fry), and Jones (1986; prickly sculpin and chum salmon fry) studied the functional response of cottids feeding on salmonid fry. They all found that the functional response appeared to reach an asymptote at intermediate prey densities and then increase again at high prey densities. This may explain why we did not detect any differences in predation at Elliot Park. Jones (1986) also described a gorging behavior by prickly sculpin at high prey densities, wherein they would consume substantially more fry than the expected maximum ration. This may be similar to what we observed at high-light conditions at Lions Club Park, where fry were abundant and torrent sculpin of 90, 92, and 102 mm TL consumed 10, 13, and 12 fry, respectively.

Based on results from the artificial stream experiments and the Cedar River, increased light intensities greatly affect the behavior of sockeye salmon fry; however, the effect on predator behavior is not well understood. In field experiments, cottids appeared to exhibit a functional response in relation to an increase in the abundance of fry but did not exhibit any type of aggregative response (Sutherland 1996). However, our experiments were done over a short time and an aggregative response may take several days or weeks. In Lake Iliamna, Alaska, cottids exhibited a strong aggregative response in relation to the abundance of sockeye salmon eggs, but cottid movements to the salmon spawning sites took place over 3 weeks (Foote and Brown 1998). Therefore, cottids may exhibit an aggregative response to an increase in fry availability near permanent light structures. However, several alternative prey types exist in the Cedar River and cottids may not show a strong aggregative response such as that seen in Lake Iliamna, which is an oligotrophic system and perhaps limited in alternative prey. Jones (1986), in experimental studies with prickly sculpin, found that the abundance of alternative prey (amphipods and isopods) appeared to have almost as much

influence as the abundance of the principal prey (chum salmon fry). In addition, cottids themselves may naturally avoid lighted areas because they too may become more vulnerable to predators. Movement into lighted areas may be a tradeoff for cottids, such that they have to balance increased risk of predation with increased prey availability.

Besides cottids, sockeye salmon fry in the Cedar River are also vulnerable to predation by salmonids, including rainbow trout (Beauchamp 1995), cutthroat trout, and juvenile coho salmon (Tabor et al. 1998). How increased light intensity affects predation of fry by salmonids is unclear. We used cottids for our laboratory experiments and field studies because they are an abundant predator in the Cedar River, are easy to collect, adjust readily to laboratory conditions, and are not as mobile as salmonids. Because salmonid predators are primarily visual predators, the effect of light intensity may be more pronounced when salmonids are present. Unlike cottids, salmonids may forage more effectively at higher light intensities. Predation of sockeye salmon fry by rainbow trout in artificial streams increased with increasing light intensity at intensities of less than 0.1 lx (Ginetz and Larkin 1976). Alternatively, salmonids are typically nocturnal during this time of the year (Riehle and Griffith 1993; Contor and Griffith 1995) and thus may avoid lighted areas. Additional field sampling needs to be undertaken to understand how increased light intensity would change the predation rate of fry by salmonid predators.

Tank and artificial stream experiments produced contrasting results. Tank experiments indicated that predation of sockeye salmon fry increased as light intensities decreased, whereas artificial stream experiments indicated the opposite. The reason for this large discrepancy is probably differences in current velocities. The artificial stream experiments were done in a flow-through system with strong current velocities (midchannel surface velocities ranging from 0.37 to 0.12 m/s), which created a fast-water refuge from cottids. In contrast, the tank experiments were done with little flow and no opportunity for the fry to emigrate downstream. In the tank experiments, predator and prey both occupied the same habitat and the reduction in predation with increased lighting probably reflects both the foraging ability of the sculpin and the ability of the fry to avoid them. The circular tank experiment made clear that both prickly sculpin and torrent sculpin can be highly effective predators in complete or near-complete darkness and that increased ambient light does not neces-

sarily enhance their ability to prey on sockeye salmon fry. Hockstra and Janssen (1985) demonstrated that blinded mottled sculpin *C. bairdi* were able to feed on mobile prey just by using their lateral line system.

In contrast to our results, Ginetz and Larkin (1976) found that predation of sockeye salmon fry by rainbow trout in artificial streams decreased as light intensity increased from 0.5 to 3.0 lx. Discrepancies between their experiments and this study are probably attributable to the predators used, the current velocities, and the size of the artificial stream. Ginetz and Larkin (1976) used a 0.6-m-wide experimental stream and rainbow trout, a highly mobile predator. Our experimental stream was 1.5 m wide and the predator we used was prickly sculpin, a substantially less mobile species. The current velocities used by Ginetz and Larkin were 0.12 m/s, which means there was probably no location where rainbow trout could not forage effectively. McDonald (1960) found that most sockeye salmon fry migrate in current velocities greater than 0.65 m/s, which may be too high for rainbow trout and other predators to forage effectively. Other researchers have also conducted light experiments with juvenile salmonids in which there is little or no current velocity (Patten 1971; Mace 1983; Petersen and Gadomski 1994). Their results may not apply to emigrating fish in natural situations if high current velocities are available. In those controlled experiments, predators usually had easy access to prey and the experiments may not have adequately simulated natural conditions, where high current velocities are available that create a fast-water refuge. In our artificial stream, current velocities were probably high enough to create such a refuge from prickly sculpin.

The size of the experimental field units (8 m shoreline length) appeared to work well for detecting differences in fry abundance but may have been too small for estimating predation rates. We could detect differences in predation between lighted areas and control areas at Lions Club Park, but we were often unable to detect differences in results between different light intensities. In some experimental units few predators were collected. Also, the diets of cottids can vary between individual fish; even when fry are abundant, many cottids will not consume them, and each site will include a variety of other prey types such as aquatic insects or oligochaetes. If many of the male cottids are guarding egg nests, they may not be actively searching for prey. In mottled sculpin, the

male may spend 8 weeks fanning and protecting eggs and young (Downhower and Brown 1980). In most areas, a 20–30 m shoreline would probably be adequate to collect enough cottids to get an accurate estimate of predation. Additionally, had we extended the experiments—which lasted for only a few hours—over the entire night we may have seen more predation and thus been better able to detect differences between treatments.

Experiments at the Lions Club Park demonstrated that shoreline habitat type can have an important effect on the number of sockeye salmon fry delayed in their emigration and the subsequent predation that ensues. This effect was probably in large part attributable to water velocities as well as substrate type. Light caused sockeye salmon fry to move to low-velocity areas. The riprap banks were steeper and had a narrower area of low-velocity water than did the gravel shoreline. The two habitat types may also have had differences in predator abundance, which could influence the number of sockeye salmon fry. The results of our laboratory experiments and other studies (Ginetz and Larkin 1976; Gaudin and Caillere 1985; Bar-donnet and Heland 1994) have demonstrated that the presence of predators increases the downstream movement of salmonid fry. Typically, large cottids are more numerous in larger substrates such as riprap than in smaller substrates (Tabor et al. 1998). The abundance of other predators such as rainbow trout may also be greater near a riprap bank (Lister et al. 1995).

The substrate type across the channel width may also have an important effect on predation in a lighted area. Larger substrates will create a rougher river channel and may have more abundant low-velocity locations for sockeye salmon fry. However, these same sites will probably also have more large cottids. In riffles of the Cedar River, the abundance of cottids larger than 50 mm TL was greatest in areas with large substrates such as cobble (Tabor et al. 1998). At the I-405 bridge site, the substrate consisted primarily of cobble and large gravel; there we were able to collect several cottids larger than 50 mm TL. At another lighted bridge site in the Cedar River, however, the substrate was mostly small gravel, and few cottids larger than 50 mm TL were collected; thus, the overall predation at that site was probably minimal (Tabor, unpublished data).

Management Implications

In the lower Cedar River, nighttime lighting appears to come from three major sources: direct

artificial lighting, the moon, and reflected lighting off of clouds. Direct lighting is intense lighting that occurs in a relatively small area every night and usually all night. In contrast, reflected light and moonlight are not very intense but they are spread over a much larger area and vary greatly with the weather and moon phase. Direct lighting probably has strong localized effects on sockeye salmon fry, whereas reflected lighting and moonlight probably have weak effects over a large area. Which of these has more overall effect on sockeye salmon fry is difficult to assess. However, it is much easier to reduce direct lighting than to address reducing reflected light. Direct lighting can be turned off, redirected, or shielded. Reducing reflected light would be a much larger and far more difficult management objective.

Overall, our results suggest that reductions in light intensity can be beneficial for emigrating sockeye salmon fry and that the impact of lighting should be considered for any future development project. For example, by reducing the lighting at the I-405 bridge site, we substantially reduced predation on sockeye salmon fry. Attempting to keep light values below 0.1 lx appears to be a prudent management goal.

Acknowledgments

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THE EFFECT OF LIGHT INTENSITY ON PREDATION OF SOCKEYE SALMON FRY BY PRICKLY SCULPIN AND TORRENT SCULPIN

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Abstract

Recent dramatic declines in sockeye salmon (*Oncorhynchus nerka*) in Lake Washington, WA, have caused considerable alarm among concerned managers, scientists and citizens. Many factors may be involved, however, one possibility is that the increasing incidence of residential and commercial nighttime lighting along the lower portions of the Cedar River, the major sockeye producing tributary of Lake Washington, has led to substantially increased predation on emigrating fry by nocturnal predators. Freshwater sculpins are a major predator of sockeye salmon fry and are also the most abundant predator in the Cedar River. Previous research has shown that sculpin predation on salmon fry is greater under high levels of natural nighttime light (i.e., under moonlight). We tested the hypothesis that above-natural nighttime light levels further increase sculpin predation of sockeye salmon fry.

Light may differentially affect behavior of both sockeye fry and sculpin. Thus, we first tested the ability of sculpin to prey on sockeye fry under six light levels (0.0-1.0 lm/ft²) in laboratory tanks with minimal water circulation to separate the effect of the migratory behavior of the fry from the ability of sculpin to capture them. The two species of sculpin most abundant in the lower portions of the Cedar River, *Cottus asper* and *C. rhotheus*, were each tested separately in groups of 20 by exposing them to 100 sockeye fry for 40 min. This experiment showed that both species preyed effectively on sockeye fry but surprisingly, that they preyed most effectively in complete darkness, capturing an average of 82 and 87% for *C. asper* and *C. rhotheus*, respectively (N = 6 trials each). As light level was increased, predation rate declined for both species with least predation occurring at the highest light level (42 and 21% for *C. asper* and *C. rhotheus*, respectively). Additional trials at 1.0 lumens/ft² with one of the species, *C. rhotheus*, given shorter, longer, and the same duration trials as used in the first experiment, showed that similar numbers of fry were captured regardless of trial duration. This suggested that reduced predation with increased light was likely due to enhanced ability of the fry to detect and avoid sculpin, rather than increased inhibition of sculpin predatory behavior.

We next tested the predation ability of sculpin at four light levels (0.0-0.5 lumens/ft²) in a pair of artificial streams which simulated more natural conditions. One contained no sculpin and the other *C. asper*. In this environment, fry were released at the upstream end of the streams and successful emigrants were recovered in a trap in the downstream end during the next six hours. Fry were recovered in the trap and counted after 20 minutes, and at 2, 4, and 6 hours. Trials without sculpin showed results consistent with other studies, i.e., the majority of fry passed quickly through the streams under complete darkness but fewer fry emigrated and at a slower rate as light level was increased. The trials with sculpin showed that with increased light even fewer fry emigrated but they did so at a faster rate than did fry in the stream without sculpin. The difference between trials with sculpin and those without indicated that sculpin probably preyed on about 5% under complete darkness and about 45% at the highest light level tested.

Taken together, our results show that sculpin can capture sockeye fry even in complete darkness. They also indicate that under conditions where fry can behave naturally and sculpin are camouflaged against natural substrate, increased light, especially that above natural levels, appears to slow or stop emigration of fry which makes them more vulnerable to capture by sculpin. Existing conditions in the lower Cedar River may mitigate some sculpin predation under higher than natural nighttime light levels. However, artificial lighting should not be ignored as a factor contributing to increased predation by sculpin and other aquatic predators.

Table of Contents

	<u>Page</u>
Abstract	ii
List of Tables	iv
List of Figures	iv
Introduction	1
Experimental Design and Methods	2
Results	4
Discussion	7
Acknowledgments	10
References	10

List of Tables

<u>Table</u>		<u>Page</u>
1	Percentage of sockeye salmon fry not recovered from emigration trials in the artificial streams in the presence or absence of prickly sculpin under different light intensities	12

List of Figures

<u>Figure</u>		<u>Page</u>
1	Number of sockeye salmon fry eaten by prickly sculpin and torrent sculpin in 40 min trials in circular tanks at different light intensities	13
2	Frequency of occurrence (percent) of the number of sockeye salmon fry consumed by prickly sculpin and torrent sculpin in circular tanks at two light intensity levels	14
3	Mean number of sockeye salmon fry eaten by torrent sculpin in circular tank trails of different duration	15
4	Mean number and percent of sockeye salmon fry eaten by prickly sculpin in circular tanks trials of two densities of fry	15
5	Cumulative percent of total sockeye salmon fry recovered after release in the artificial streams for three light intensity levels, May 24-29, 1997	16
6	Cumulative percent of total sockeye salmon fry recovered after release in the artificial streams, June 4-23, 1997	16

Introduction

The few studies that have examined predation rates on juvenile salmonids under varying light intensities have generally shown that within the natural range of light intensities occurring at night (e.g., from overcast, moonless nights to clear, moonlit nights), predation increases with increasing light (Patten 1971; Ginetz and Larkin 1976; Mace 1983). This has led to the speculation that with the increasing occurrence of high intensity artificial nighttime lighting near waterways through which juvenile salmonids migrate, predation may increase substantially beyond natural levels. Sockeye salmon, *Oncorhynchus nerka*, production has declined dramatically in the Cedar River, Washington, in recent years coincidentally with increased use of residential and industrial lighting. Concerned managers and scientists have considered that increased predation on migrating sockeye fry due to this increased nighttime lighting may be one of numerous possible factors in the decline of Cedar River sockeye salmon.

Field studies have shown that four sculpin species of the genus *Cottus* are the most abundant piscivores in the Cedar River, and also are frequently captured with sockeye salmon fry in their stomachs (Tabor and Chan 1996a, b). Increased light intensity would presumably allow sculpin to better see sockeye salmon fry. However, the sensory mechanism by which cottids are able to effectively capture sockeye salmon fry is not well understood. The importance of vision in locating prey for cottids is not known. Patten (1971) and Mace (1983) speculated that increased predation rates with increased light intensities were due to increased visual acuity of sculpin. The lateral line system and olfaction also appear to be important for cottids to locate their prey. Hoekstra and Janssen (1985) found that blinded mottled sculpin (*C. bairdi*) primarily used their lateral line system to feed on a variety of motile prey. Cottids also appear to use olfaction to detect immobile prey such as salmon eggs (Dittman et al. in press).

Besides the foraging ability of sculpin, changes in light intensity may also alter the behavior of sockeye salmon fry. Increased light intensity may cause sockeye salmon fry to migrate slower and be closer to the bottom and thus become more vulnerable to predation. McDonald (1960) found that the downstream migration of sockeye salmon fry was closely related to light intensity. The nightly downstream migration was initiated after light intensity was < 0.01 lumens/ft². This migration was almost completely stopped with the addition of artificial lights (3 lumens/ft²).

The objective of our study was to determine the effect of light intensity on predation of sockeye salmon fry by two species of sculpin in the Cedar River, prickly sculpin, *Cottus asper*, and torrent sculpin, *C. rhotheus* (Tabor and Chan 1996a). Because sculpins and sockeye fry may alter their behavior in relation to light intensity, and the sensory abilities of one to detect the other may be differentially affected by light intensity, we took a dual experimental approach to answer the question of whether sculpins prey more effectively at light levels generated by standard artificial light sources. We first tested predation rates of sculpin in circular hatchery tanks with minimal water flow to separate the effect of changes in the migratory behavior of fry from the ability of sculpin to prey on them. To assess the effect of light intensity on sockeye

salmon fry behavior, a second experiment was done in artificial streams under more natural conditions which allowed fry to migrate downstream.

Experimental Design and Methods

During May-June 1997, experiments were conducted at the Northwest Biological Science Center, U.S. Geological Survey. Prickly and torrent sculpin were collected from the Cedar River and Lake Washington by electrofishing and transported to the lab, where they were kept in circular holding tanks. Lengths ranged from 74-103 mm TL for prickly sculpin and from 74-98 mm TL for torrent sculpin. Sockeye salmon fry were obtained periodically from the Washington Department of Fish and Wildlife fry enumeration trap located near the mouth of the Cedar River. Fry were presumably both migration- and predator-experienced. Fry were transported back to the lab where they were also held in circular holding tanks. After collection, a subset of 30 fish from each batch of fry was measured for average total length. Fry were fed commercial fry food daily throughout the experimental period. Sculpin were fed available salmonid fry prior to the experiment. Sculpin were divided into three size classes: large (90-99 mm TL), medium (80-89 mm), and small (70-79 mm).

Light intensity levels used in the experiments represent a range of levels observed from field measurements in the lower Cedar River. All light intensity measurements were made with an International Light Inc. model IL1400A radiometer/photometer. Light intensity was measured as lumens/ft². The light source consisted of one or two strings of small ornamental lights (small clear Christmas tree lights) taped to the underside of lids for the tanks and artificial streams. Lights were suspended directly above the water. Each light string was connected to an outlet box and a dimmer switch. Predation trials in both experiments were run during daylight hours. Testing environments were covered with layers of black sheeting to exclude all light except that produced by our artificial light source.

Circular tank experiments.-- Because both sculpins and sockeye fry may alter their behavior in relation to light intensity, we took a dual experimental approach to better understand the change in behavior of both predator and prey. We first tested predation rates of sculpins in circular hatchery tanks with minimal water flow. The purpose of this experiment was to separate the effect of changes in the migratory behavior of fry in relation to light from the ability and motivation of sculpins to prey on them. The second set of experiments was done in artificial streams to simulate natural conditions. The sockeye fry released upstream in each trial could behave more naturally in this environment in relation to our treatment light levels, i.e., they could migrate quickly through the artificial stream or they could delay their passage by stationing in eddies or burying in the gravel substrate. We compared the number of fry recovered at timed intervals from a trap in the downstream end of each of two artificial streams which were identical except that one stream contained sculpin and one did not.

The tank experiments were conducted in 1.2 m-diameter circular tanks. Water depth averaged 30 cm. Throughout the study, water temperature in the tanks was maintained at approximately 12°C. We tested six light intensities (0.000, 0.003, 0.006, 0.010, 0.100, 1.000 lumens/ft²) during the predation experiments. Prior to each experimental trial, the light level was randomly selected and measured in each of the three replicate tanks. Three large, nine medium, and eight small sculpin were randomly selected for each predation trial from holding bins of each size class. We used single-species groups of 20 sculpin and 100 fry in each trial. Six replicates for each light intensity level were done for both prickly sculpin and torrent sculpin. The fry were given 15 minutes to adjust to the experimental setup prior to the addition of the sculpin. The sculpin were provided with two black Plexiglas shelves within each tank to serve as a refuge/hiding place during the experiments. Upon addition of the sculpin, each trial lasted 40 minutes. The addition and removal of both fry and sculpin were staggered to facilitate collection of all fish with a small aquarium net and flashlight. The predation rate was determined as the number of sockeye salmon fry lost during the experiment. Prickly and torrent sculpin were utilized on alternate days in order to allow adequate digestion time between trials. The stomach contents of three replicate groups of sculpins from both the 0.000 and 1.000 lumen/ft² light intensities were removed by gastric lavage in order to establish whether predation rates differed with sculpin size and to confirm digestion of previously consumed fry. Results of the light intensity experiment were analyzed with one-way analysis of variance (ANOVA) tests and post-hoc Tukey's Honestly Significant Difference (HSD) tests.

Six additional experimental trials were done to determine if more time is necessary for sculpin to 'settle down' and initiate predatory behavior at the highest level of light intensity (1.0 lumens/ft²). These trials were only done with torrent sculpin. Two replicates of 20-, 40-, and 60-minute trials were conducted. Three other experimental trials were conducted to determine if additional fry would be consumed if 200 fry were added instead of 100 fry. In these trials we used prickly sculpin and the lowest light intensity level (0.000 lumens/ft²).

Artificial stream experiments.-- Sockeye salmon fry migration/behavior experiments were done in two identical artificial streams. Each stream is 9 m long by 1.5 m wide and contained within a fiberglass trough. We only used a 3 m section of each stream in order to allow enough space downstream for a fish trap to collect the fry. Each experimental section consisted of a 2.5 m long pool and a short riffle section. Riffles had a 2% gradient with a water depth of 18 cm. The maximum depth of each pool was approximately 75 cm. Surface velocities ranged from 0.37 m/s near the inflow to 0.12 m/s at the outflow. Near the bottom of each pool the water velocity was negligible. The light level was measured approximately 10 cm below the surface of the water in both streams. One hundred and twenty five fry were released at the upstream end of each experimental section and allowed to move downstream. The fry traps were checked with a flashlight at 20 minutes, and at 2, 4, and 6 hours; the fry were then removed with a small aquarium net and counted. After six hours, all lights were turned off and the fry given 12-16 hours (over night) to migrate through the streams to the trap. We did not collect the remaining fry. Preliminary work indicated that the fry were extremely difficult to capture in the artificial streams. In non-predator trials, the number of fry not accounted for by the beginning of the next trial was added to the number of fry released (125) at the start of the next trial. Consequently, the

results are presented as a cumulative percent of the total fry in each stream which migrated downstream to the fry trap within the trial periods. In the predator trials, we assumed that the fry not accounted for were all consumed by sculpin. Because very few fry migrated overnight in the predator trials when the streams were darkened, this appeared to be a valid assumption. For the predator trials, twenty prickly sculpin were placed in the artificial stream. These sculpin remained in the stream throughout the duration of the experiment. Trials occurred once every 2-3 days to allow the sculpin enough time to digest fry from the previous trial.

The artificial stream trials were conducted in two parts. The first part occurred with no predators present. Two replicates of three light intensities (0.000, 0.100, and 0.500 lumens/ft²) each were tested. In the second part, predators were present in one stream and absent in the other. Two replicates of four light intensities (0.000, 0.020, 0.100, and 0.500 lumens/ft²) each were tested. We were unable to evaluate additional light levels due to time and fry supply limitations.

Results

Circular tank experiments.-- Prickly sculpin and torrent sculpin displayed similar predation abilities with respect to increasing experimental light intensity. Both species captured greater mean numbers of fry under low light conditions than under the highest light level (Figure 1). Prickly sculpin captured a mean of 82.3 fry (SD = 7.4) at 0.000 lumens/ft², whereas they captured a mean of 41.5 fry (SD = 8.7) at 1.0 lumens/ft². Torrent sculpin captured a mean of 86.8 fry (SD = 5.3) at 0.000 lumens/ft² and a mean of 21.3 fry (SD = 8.3) at 1.0 lumens/ft². A separate one-way ANOVA was performed on untransformed data of number of fry eaten for the two sculpin species. The ANOVA indicated a significant difference among the six light levels for both species. The results from a post-hoc Tukey HSD test for prickly sculpin showed no difference in fry consumption among light levels 1-5 but substantially and significantly lower fry consumption at 6, the highest light level, compared to the other five (Figure 1). The same test for the torrent sculpin indicated more differences among the six light levels. As with the prickly sculpin, treatments 1-5 all differed from 6. In addition, all non-adjacent means differed significantly from each other ($p < 0.05$). Adjacent means did not differ significantly (e.g., 1&2, 2&4, 4&3, 3&5). Overall, it is clear from this experiment that sculpin of both species can be highly effective predators in complete or near complete darkness and increased ambient light does not necessarily enhance their ability to prey on sockeye fry.

Comparison of counts of fry found in stomach samples and those determined from the number of fry missing from live fry counts indicated there was usually some small error in our counts. Only one of the 12 counts were in agreement. However, 10 of the 12 counts compared were within two fry of each other. One count was off by three fry and the other was off by six fry. The error in the counts would probably be due to: 1) miscounting the number of fry that are added or recovered from the tanks; 2) overlooking fry at the end of each trial; and/or 3) gastric flushing was < 100% and some fry remained in the stomachs. Nine of the twelve trials had more

fry found in the stomach samples than was determined from live fry counts, which would indicate that one or two extra fry were often used in each trial. This seems reasonable because sockeye salmon fry are quite small. However, the error associated with our counting was quite small and we don't believe it affected the results.

Gastric flushing of three replicate trials of 20 sculpins each (total, 60 sculpin per species) from the 0.000 and 1.000 lumens/ft² trials verified that both prickly sculpin and torrent sculpin consumed more sockeye salmon fry at the lowest light intensity than at the highest light intensity. Ninety-five percent of the prickly sculpin had consumed at least one fry at 0.000 lumens/ft², while 87% consumed fry at 1.000 lumens/ft² (Figure 2). Thirty-eight percent of the prickly sculpin had consumed more than 4 fry at 0.000 lumens/ft², whereas only 5% had consumed more than 4 fry at 1.000 lumens/ft². The maximum number consumed by a prickly sculpin was 9 fry (0.000 lumens/ft²). Ninety-two percent of the torrent sculpin had consumed at least one fry at 0.000 lumens/ft², while only 68% consumed fry at 1.000 lumens/ft² (Figure 2). Fifty-two percent of the torrent sculpin had consumed more than 4 fry at 0.000 lumens/ft², whereas only 7% had consumed more than 4 fry at 1.000 lumens/ft². The maximum number consumed by a torrent sculpin was 12 fry (0.000 lumens/ft²).

At the highest light intensity, 1.000 lumens/ft², large prickly sculpin (N = 9) consumed a mean of 3.1 fry (SD = 1.8) while medium (N = 27) and small (N = 24) prickly sculpin consumed a mean of 1.9 fry (SD = 1.4) and 1.6 fry (SD = 0.9), respectively. In contrast, fry consumption was more evenly distributed among the prickly sculpin size classes in complete darkness. Both large and medium prickly sculpin consumed similar numbers of fry, 4.3 fry (SD = 2.4) for large prickly sculpin and 4.7 fry (SD = 2.4) for mediums. Small prickly sculpin consumed a mean of 2.9 fry (SD = 1.9) at the lowest light intensity.

Differences in size seemed to have less effect on the predation rate of torrent sculpin at the highest light intensity, 1.0 lumens/ft². Large torrent sculpin consumed a mean of 1.8 fry (SD = 1.5) while the medium and small torrent sculpin consumed a mean of 1.3 fry (SD = 1.6) and 1.3 fry (SD = 1.1), respectively. Consumption of fry by torrent sculpin was also more evenly distributed among the size classes at the lowest light intensity. Large torrent sculpin consumed a mean of 4.2 fry (SD = 2.9) while medium and small torrents consumed a mean of 5.4 fry (SD = 2.9) and 3.6 fry (SD = 2.5), respectively.

An experiment with different groups of torrent sculpin given either 20, 40, or 60 minutes (1.0 lumens/ft²) to prey on 100 fry indicated most predation occurs in the first 20 minutes (Figure 3). A similar and low number of fry were captured in all trials regardless of duration, suggesting that sculpin quickly captured vulnerable fry and then were unable to catch the others. This result, and our observations of the willingness of sculpin to attack fry even under brightly lit conditions, indicate that fry are better able to avoid sculpin with increased light. Results also indicate that sculpin need little time to 'settle down' and initiate predatory behavior.

An additional experiment to look at predation rates of prickly sculpin given 200 fry (0.000 lumens/ft²) indicated they were capable of consuming an excess of 100 fry. An average

of 123.3 fry (SD = 12.9; Figure 4) were consumed for the three trials. Sixty-two percent of the fry were consumed, whereas in earlier trials of the same sculpin species and light intensity, 82% of the fry were consumed. In earlier trials that had few remaining fry, there may have been a depletion effect. When fry numbers are reduced to just a few individuals, sculpin may have difficulty locating and capturing fry. Differences between some light intensity levels may be difficult to detect if 100 fry and 20 sculpin are used.

Artificial stream experiments.-- The first set of experimental trials was conducted without any predators present. Two replicates of three light intensity levels each were done. Sockeye salmon fry migrated through the stream at faster rate under complete darkness (0.000 lumens/ft²) than at the other two light intensity levels (0.100 and 0.500 lumens/ft²). Under complete darkness, 74% (SD = 4.5%) of the fry migrated downstream within the first twenty minutes of the trials, while only an additional 25% migrated downstream over the course of the next 24 hours (Figure 5). In contrast, under the greatest light intensity, 34% (SD = 7.8%) of the fry migrated downstream within the first twenty minutes while an additional 52% migrated downstream over the course of the next 24 hours. Trials conducted at the intermediate light intensity of 0.100 lumens/ft² provided results similar to those at 0.500 lumens/ft². During the first twenty minutes, 32% (SD = 8.6%) of the fry migrated downstream while an additional 56% migrated downstream over the course of the next 24 hours.

The second set of experimental trials was conducted with sculpin present in one stream and not in the other. Predation/emigration trials showed several strong patterns even with only two trials completed at each of four light levels (Figure 6). First, similarly to earlier trials, fry readily emigrated through the artificial streams under complete darkness but increasingly delayed passage as light level increased. Second, a greater proportion of the fry emigrated faster through the stream in all non-dark trials when sculpin were present. Third, and most crucial, a greater proportion of fry were never recovered in the stream trials with sculpin and this proportion related directly to light level (Table 1). At the highest light level tested (0.5 lumens/ft²), an average of 55% fry were not accounted for. If the average number of fry unaccounted for in all trials without sculpin (10%) is subtracted from this value, then about 45% of the fry were likely preyed upon by sculpin. At 0.020 lumens/ft², the light level approximating that along the urbanized sections of the Cedar River, about 28% of the fry became prey. Only about 5% were likely prey to the sculpin in the dark trials. Our results consistently indicated that fry not recovered in the first two hours of a trial with sculpin were never recovered.

Discussion

Results of the tank experiments indicated that prickly sculpin and torrent sculpin were able to forage effectively in complete darkness. Thus sculpin must use some other sensory mechanism besides vision. Most likely sculpin used their lateral line system to detect the movements of fry. Hoekstra and Janssen (1985) demonstrated that mottled sculpin (*C. bairdi*) were able to feed on mobile prey with just their lateral line system. Night snorkeling observations of sculpin in the Cedar River, also indicated that sculpin seem to react to movements of fry. In Elliot spawning channel and Cavanaugh Pond, fry were often quite numerous yet sculpin did not appear to pursue fry if they were motionless. However, when the fry were startled by the light and darted away, sculpin would become very active and strike at moving fry.

Differences in predation between light intensity levels of the tank experiment may not reflect changes in the foraging ability of sculpin but rather the ability of fry to avoid them. At higher light levels, fry may have been better able to see approaching sculpin and more effective in avoiding them. Additionally, fry may also have formed schools at higher light intensity levels and thus sculpin may have had more difficulty in pinpointing individual fry to consume. Schooling has been shown to be related to light for several freshwater species (Emery 1973).

In the tank experiments, we were unable to detect differences between most light levels. However, this may have been due to a depletion effect. As fry numbers are reduced to just a few individuals, the behavior of fry and sculpin can be altered. Locating prey at low densities may be difficult for sculpin. Additional trials done with 200 fry instead of 100, indicated 20 prickly sculpin were able to consume an excess of 100 fry. A prey to predator ratio of 10:1 would probably have been better than the 5:1 ratio we used. Differences between some light intensity levels may be difficult to detect if a 5:1 ratio is used. In designing the experiments, we underestimated the capabilities of the sculpin to prey on sockeye salmon fry. Ideally prey need to be replaced as they are consumed so the density does not change (Petersen and Gadomski 1996). However, we felt this was impractical in our experiment. We had hoped that at least 40-50% of the fry would be remaining at the end of each trial. We were better able to detect differences between light levels in torrent sculpin trials, possibly because torrent sculpin consumption rates were lower than prickly sculpin. Thus, the density of fry did not change as dramatically as in the prickly sculpin trials.

Overall consumption rates of fry by torrent sculpin were lower than prickly sculpin. The smaller mean size of the torrent sculpin probably best explains the differences. If increasing light does enhance the ability of sockeye fry to escape predation by the sculpin as we suggested above, then smaller body size correlated with reduced swimming ability would explain the reduced consumption by torrent sculpin. Torrent sculpin may also be more behaviorally inhibited at the higher light levels than prickly sculpin and take more time to adjust and 'settle down'. However, our experiment with different groups of torrent sculpin given either 20, 40, or 60 minutes to prey on 100 fry showed that there was no increase in fry consumed beyond the 20-

minute trial length. Thus, torrent sculpin appeared to adjust quickly to the tank conditions. The relative ability of torrent and prickly sculpin to prey on salmonids is unknown. However, torrent sculpin predation rates did appear to be lower than that of prickly sculpin at the highest light intensity level (1.000 lumens/ft²). For example, only 68% of the torrent sculpin consumed any fry, whereas 87% of the prickly sculpin consumed fry at that light level. Both are capable of consuming large numbers of sockeye salmon fry in some situations (Tabor and Chan 1996a,b). Northcote (1954) found that both species are highly piscivorous at sizes > 70 mm TL. Differences in the consumption of salmonids may have more to do with habitat selection and prey availability than differences between the species. Prickly sculpin do, however, grow to a much larger size than torrent sculpin. The maximum size observed in the Lake Washington system is 239 mm TL for prickly sculpin and 155 mm TL for torrent sculpin. However, large prickly sculpin rarely consume salmonids, instead they usually prey on benthic fishes and crayfish (Tabor and Chan 1996a,b).

Earlier research on the effects of light intensity on sculpin predation (Patten 1971; Mace 1983) was conducted under different conditions than our study and thus the results are difficult to apply to our research. The authors speculated that increased predation rates with increased light intensities were due to increased visual acuity of sculpin. Both studies were conducted in flow-through systems and the fry were not allowed to outmigrate. Additionally, both studies were done with different salmonid prey (chum salmon, *O. keta*, and coho salmon, *O. kisutch*, fry) and the study of Mace (1983) focused on predation by staghorn sculpin. These predators and prey may behave differently than the fish that we used. Sockeye salmon fry and different salmon species may behave differently under varying light conditions (Ali 1959).

Experiments of Patten (1971) and Mace (1983) were also done in field enclosures and, because of large variations in environmental conditions, their work may have had biased results. First, the results of Patten (1971) confounded potential effects of light intensity with water temperature. Results showed greater predation on coho salmon fry during moonlit nights compared to moonless nights but the former trials occurred at higher water temperatures (8.5 vs 5.5 C) and this alone may have accounted for the increased predation observed during brighter nights. In addition, changes in spawning behavior of torrent sculpin could also have biased the results. Experiments of Mace (1983) were done in an estuary. Throughout the experiments, the tidal level changed, which caused changes in water depth, flow, and possibly turbidity.

Although increased light intensities did not improve the foraging ability of sculpin, it did have a pronounced effect on the movement of sockeye salmon fry. Sockeye fry moved through experimental streams at a faster rate under complete darkness than under bright lights. Increased ambient light appears to inhibit the migratory movement of the fry. McDonald (1960) found that the nightly movement of sockeye salmon fry was not initiated until light intensity was <0.01 lumens/ft². The author was able to experimentally stop the nightly movement with artificial lighting of 3.0 lumens/ft². Other levels of light intensity levels were not tested. Fraser et al. (1994) found that the movement of Atlantic salmon fry (*Salmo salar*) away from their redds did not differ between 0.0 and 0.7 lumens/ft². However, at 2.0 lumens/ft², movements were significantly reduced. In our experiments, we were able to detect differences as low as 0.020 lumens/ft².

The presence of sculpin also appeared to influence the movement of sockeye salmon fry. A greater proportion of the fry emigrated faster through the stream in all non-dark trials when sculpin were present. This result has also been reported in another experimental study of sockeye salmon fry with rainbow trout predators (*O. mykiss*; Ginetz & Larkin 1976). Increased downstream movement due to the presence of predators has also been found in brown trout fry (*S. trutta*; Gaudin and Caillere 1985; Bardonnnet and Heland 1994).

We used sculpins for our experiments because they are an abundant predator in the Cedar River, they are easy to collect, and they adjust readily to laboratory conditions. Other predators of sockeye salmon fry in the Cedar River include cutthroat trout (*O. clarki*), rainbow trout (including juvenile steelhead), juvenile coho salmon (Tabor and Chan 1996a), and potentially some species of birds. These predators are primarily visual predators and thus the effect of light intensity may be more pronounced when these predators are present. Unlike sculpin, they may forage more effectively at higher light intensity levels.

The importance of increased light intensity on sockeye salmon fry survival in the lower Cedar River is unclear. The greatest nighttime light intensity levels occur in the lower four kilometers, as the river flows through the city of Renton. Light intensity levels as high as 1.45 lumens/ft² have been recorded in this stretch of river. However, most light intensity levels appear to be between 0.010 and 0.020 lumens/ft². Under current conditions in the lower 3 km, the only area where predators appear to be abundant is along the shoreline. The substrate of most of the lower 3 km is gravel which appears to support few sculpin that are large enough to consume sockeye salmon fry. Further upstream, where large gravel and cobble are present, larger sculpin are substantially more abundant. Additionally, most of this river stretch is riffle (high velocity) type habitat with few areas of low-velocity habitat (side channels and pools). Most predation of fry appears to occur in low-velocity areas. Increased light intensity levels may cause fry to be delayed and move to areas of lower water velocities where they are more vulnerable to predators. This may be particularly important during periods of low discharge. A recently proposed flood control project in the lower Cedar River would reduce velocities in much of the lower 1.5 kilometers. Under these conditions, artificial lighting may be more of a factor in fry survival. However, because predation of sockeye salmon fry is also influenced by other factors, such as discharge, depth, and habitat complexity, it will be difficult to ascertain the overall importance of increased light intensity. It does appear that reducing artificial light would benefit sockeye salmon. Of course, any reduction of lighting must be balanced with safety and other concerns.

Acknowledgments

We thank Liz Warman and Paul Crane of The Boeing Company for financial support of this study. We also thank John Lombard, King Co. Dept. of Natural Resources for financial support and encouragement, and Dave Seiler, Washington Dept. of Fish and Wildlife, for permission to obtain sockeye fry from the Cedar River fry trap. Tim Eichler, Paul Lorenz and Chuck Ridley, WDFW, helped collect and transfer fry to us from the fry trap. Steve Hager, U.S. Fish and Wildlife Service, assisted with the field collection of sculpin. Brian Footen, Muckleshoot Indian Tribe, assisted with the gastric flushing. Bob Wunderlich, U.S. Fish and Wildlife Service, reviewed an earlier draft of this report.

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- Tabor, R.A. and J. Chan. 1996b. Predation on sockeye salmon fry by piscivorous fishes in the lower Cedar River and southern Lake Washington. Miscellaneous report. U.S. Fish and Wildlife Service, Western Washington Fishery Resource Office, Olympia, Washington.

Table 1. Percentage of sockeye salmon fry not recovered from emigration trials in the artificial streams in the presence or absence of prickly sculpin under different light intensities.

Light Level (lumens/ft ²)	Percent Fry Not Recovered (SD)		Estimated % Eaten *	N Trials
	Sculpin Absent	Sculpin Present		
0.00	8.1 (2.2)	15.2 (2.3)	5.2	2
0.02	13.4 (--)	38.4 (--)	28.4	1
0.10	10.0 (1.7)	34.0 (6.2)	24.0	2
0.50	8.5 (1.5)	55.2 (13.6)	45.2	2

* Note: Estimate derived by subtracting the mean percent fry not recovered from the trials with no sculpin (mean = 10.0%) from each mean of percent fry not recovered with sculpin present.

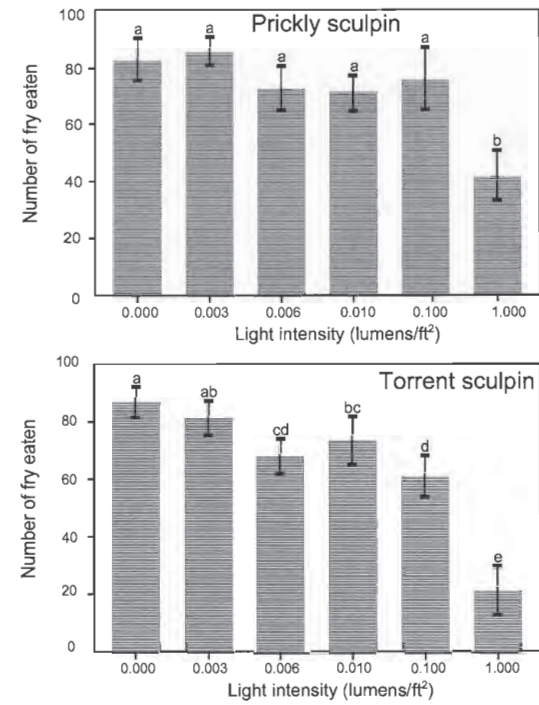


Figure 1. Number of sockeye salmon fry eaten by prickly sculpin and torrent sculpin in 40 min trials in circular tanks at different light intensities. Each bar is the mean of 6 trials. Error bars represent the standard deviation. Groups of bars with different letters are significantly different (ANOVA and Tukey HSD: P<0.05).

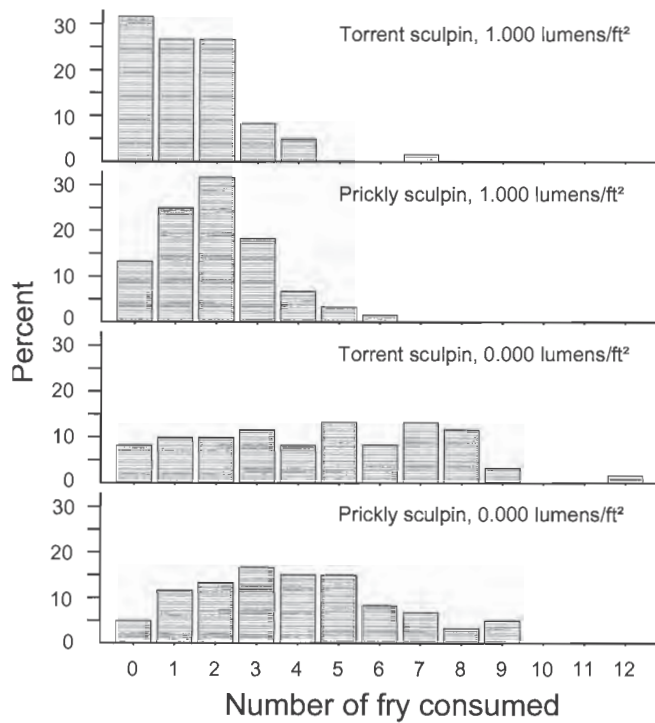


Figure 2. Frequency of occurrence (percent) of the number of sockeye salmon fry consumed by prickly sculpin and torrent sculpin in circular tanks at two light intensity levels. Numbers for each graph are based on a total of 60 sculpin from three replicates (20 sculpin each).

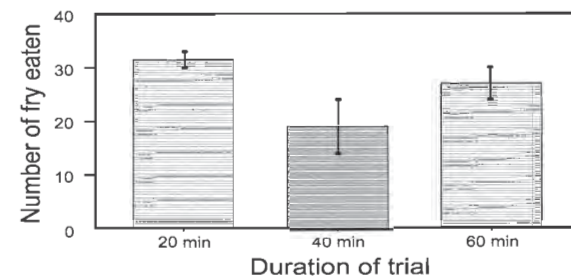


Figure 3. Mean number of sockeye salmon fry eaten by torrent sculpin in circular tank trials of different duration. Numbers are based on two replicates. Trials were all done with 100 fry and 20 sculpin; light intensity was 1.000 lumens/ft². Error bars represent the range of observations.

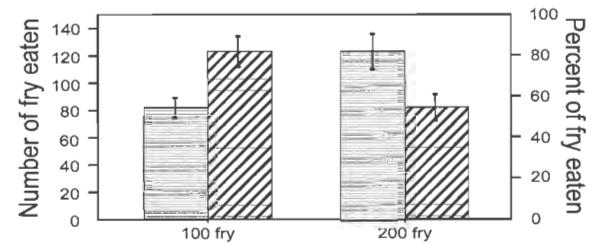


Figure 4. Mean number (shaded bars) and percent (hashed bars) of sockeye salmon fry eaten by prickly sculpin in circular tank trials of two densities of fry. Numbers for 100 fry density are based on six replicates and 200 fry density are based on three replicates. Trials were all done with 20 sculpin and light intensity of 0.000 lumens/ft². Error bars represent the standard deviation.

Submission # _____
 Subject Lake Washington, Poster - used as display and introduction

Effects of Artificial Lighting on Juvenile Salmonids A Review of Research in the Lake Washingtonian Basin
 Roger Tabor, Mark Celedonia, USFWS, Gayle Brown, USGS (PDF of Power Point) Oregon AFS Meeting October, 2010

Chinook Salmon Smolt Behavior in Lake Washington and the Ship Canal: 2004-2008 Acoustic Tracking Studies
 Roger Tabor, Mark Celedonia, USFWS Power Point Slide 1 and Slide 31

Movement and Habitat Use of Chinook Salmon Smolts in the Lake Washington Ship Canal 2007-2008 Acoustic Tracking Studies May 2011
 Roger Tabor, Mark Celedonia, et al USFWS (Selected pages referencing "lighting")

Movement and Habitat Use of Chinook Salmon Smolts, Northern Pikeminnow, and Smallmouth Bass Near the SR 520 Bridge 2008 Acoustic Tracking Study December 2011
 Roger Tabor, Mark Celedonia, et al USFWS (Selected pages referencing "lighting")

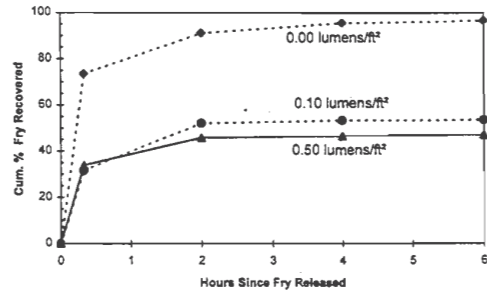


Figure 5. Cumulative percent of total sockeye salmon fry recovered after release in the artificial streams for three light intensity levels (lumens/ft²), May 24-29, 1997. Each line is the mean of two trials. All trials were done in the absence of predators.

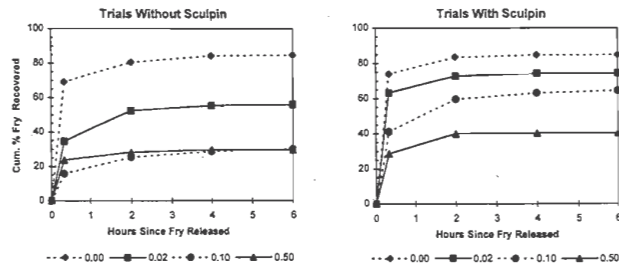


Figure 6. Cumulative percent of total sockeye salmon fry recovered after release in the artificial streams, June 4-23, 1997. Each line is the mean of 2 trials. The left and right panels show the results for trials when fry emigrated in the absence or presence of prickly sculpin, respectively. Trials were conducted at 4 light intensities shown below each panel in lumens/ft².

Lake Washington

Lake Washington is a rearing area and migratory path for salmon runs that include Cedar and Sammamish Rivers, Kelsey, Bear Creek, Issaquah, Ebright, and Pipers Creeks. All these runs must also funnel through the Ballard Locks.

Acoustic tracking has been used extensively in research on these salmon runs. *While not the primary focus, these studies have shown conclusively that light on the waterway slows or stops outward migration of juvenal salmon, thus increasing predation.*

"Light is basically a big stop sign" Roger Tabor USFWS

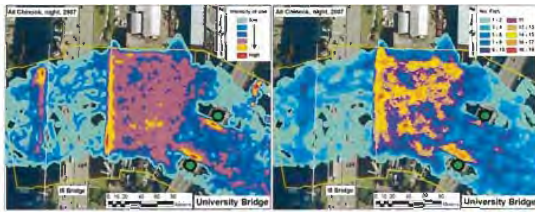


FIGURE 47. Distribution of tagged Chinook salmon at night at the University Bridge study site, June-July, 2007. Density plot (left) shows intensity of fish use for all tracked fish (weighted by time), and spatial frequency distribution (right) shows number of fish tracked by area. The white lines parallel to the I-5 bridge show the location of the light/shadow edge created by artificial lighting on the I-5 bridge deck (see Figure 48). Light levels were 1.6-2.0 lx (measured at 3 points) within 1 m of this line on the light side, and were 0.2-0.5 lx (measured at 6 points) in the shadow area between the lines. Green circles show approximate locations of lights beneath the University Bridge (see Figure 50).



FIGURE 48. Artificial lighting on the I-5 bridge deck spanning the Lake Washington Ship Canal (looking north).



FIGURE 50. Artificial lighting under the University Bridge. Lighting is directed down onto the water surface. Light on the north bridge support structure is pictured. Light on the south support structure is similar. These lights correspond with green circles in Figure 47.



Effects of Artificial Lighting on Juvenile Salmonids: A Review of Research in the Lake Washington Basin

Roger Tabor, Mark Celedonia, USFWS
Gayle Brown, USGS (Fisheries and Oceans Canada)

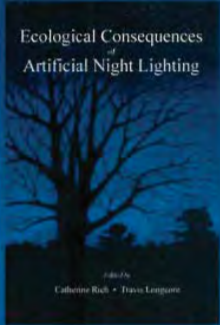
Uses of Artificial Lighting

- Kona's Manta Rays
- Lake Tanganyika's clupeid fishery

Ref. 1. Movement and Habitat Use of Juvenile Chinook Salmon Smolts in the Lake Washington Ship Canal: 2007-2008 Acoustic Tracking Studies Celedonia, M. T., Z. Li, S. Sanders, R. Tabor, S. Damm, D. Lantz, and B. Price, 2011
2. Effects of Artificial Lighting on Juvenile Salmonids: A Review of Research in the Lake Washington Basin, Roger Tabor, Mark Celedonia, USFWS, Gayle Brown, USGS

Artificial Lighting

Ecological Consequences
of
Artificial Night Lighting



Lake Washington Basin



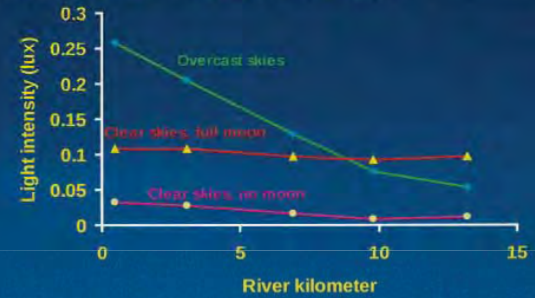
Pacific Northwest



Light Sources

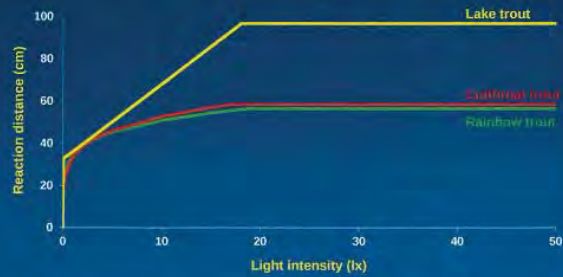
Office: 600 lux
Sunlight: 50,000 lux

A) No direct artificial lighting – Cedar River



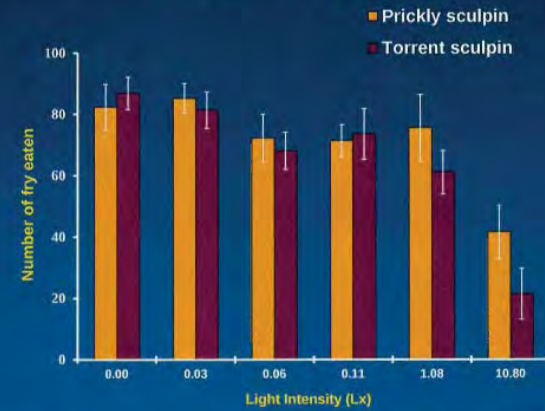
B) Direct artificial lighting: 0.2 – 60 lux

Prey Detection of Piscivorous Salmonids



Mazur and Beauchamp, 2003. Visual prey detection among species of piscivorous salmonids. Environmental Biology of Fishes 67:397-405.

Tank Experiments

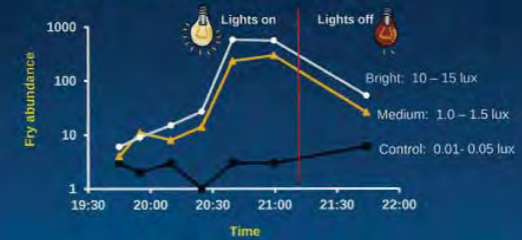


Cedar River Sockeye salmon fry and Sculpin Study

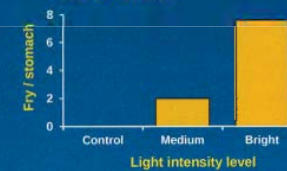
- Sockeye salmon fry
 - Migrate at night
 - One or two nights to reach the lake
 - Select mid-channel areas with high velocities
- Sculpin
 - Predator of sockeye fry
 - Abundant
 - Easy to work with in lab
 - Sedentary



Cedar River field experiment - March 1999



Cottid Predation



I-405 Bridge Walkway



I-405 Bridge Walkway

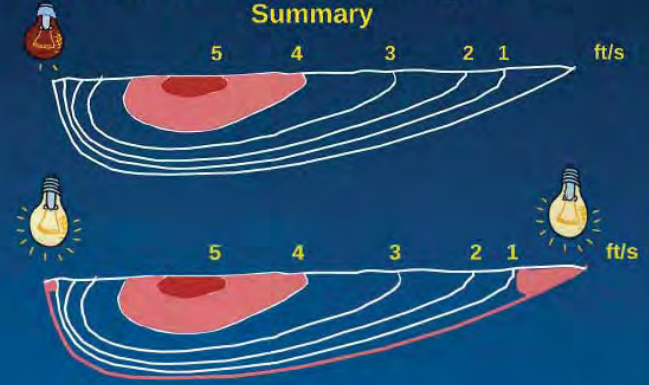
Fry abundance



Predation by sculpins

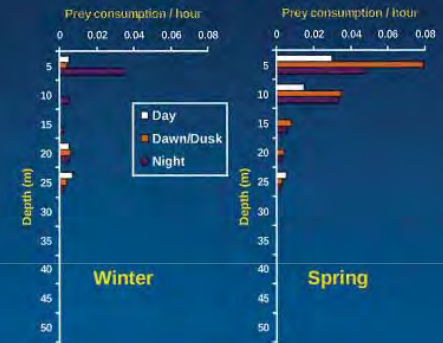


Sockeye salmon fry migration Summary



Tabor, Brown, and Luiting. 2004. The effect of light on sockeye fry migratory behavior and cottid predation. North American Journal of Fisheries Management 24:128-145.

Cutthroat Trout - Lake Washington Visual Foraging Model



Mazur and Beauchamp. 2006. Linking piscivory to fish distributions with a visual foraging model. Journal of Fish Biology 69:151-175.

Cedar River/Lake Washington Juvenile Chinook Salmon

- Juveniles rear in Cedar River or Lake Washington
- Inhabit shallow shoreline areas from January to May



Chinook Salmon Smolts

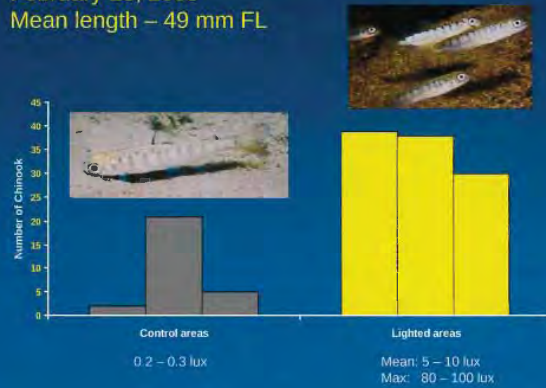
- Outmigrate from Lake Washington and through Ship Canal in May-July
- Migrate along shoreline



Artificial Lighting Experiment

February 23, 2005

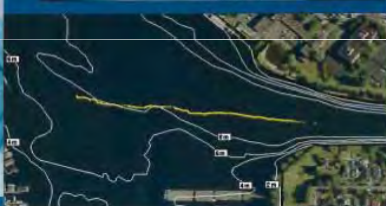
Mean length – 49 mm FL



Fine-scale Acoustic Tracking - HTI

Simplified System Schematic

≥ 4 hydrophones



SR 520 Bridge – west end

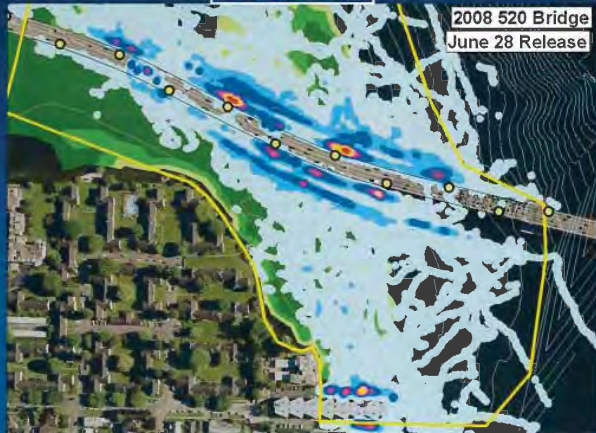


I-5 / University Bridges – Ship Canal

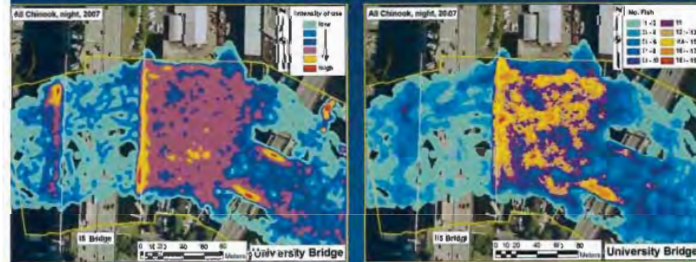


SR 520 Bridge – west end - June 26th release group

0.2-0.9 lux ambient
2.1-20.0 lux near lights



I-5 / University Bridges – Ship Canal
June-July 2007



0.2-0.5 lux in shadow
1.6-2.0 lux along light edge

Ballard Locks 2007-2008



0.0-0.2 lux ambient
3-32 lux in heavy Chinook areas

Celedonia et al. Draft report. Movement and habitat use of Chinook salmon smolts at the SR 520 Bridge.

Celedonia et al. Draft report. Movement and habitat use of Chinook salmon smolts in the Ship Canal.

Potential Predators



Great blue heron



Cutthroat trout



Northern pikeminnow



Western grebe











Smallmouth bass

Conclusions

- Nighttime lighting can have a strong effect on fish behavior and may increase their vulnerability to predation
- Light is an important element of predator - prey relationships
- Assessments on the effects of lighting need to examine the behavior of both predator and prey under natural conditions
- Environmental assessments need to include the effects of artificial lighting

Acknowledgements

-  Seattle Public Utilities – SPU
-  US Army Corps of Engineers – COE
-  City of Renton
-  Washington Department of Fish and Wildlife – WDFW
-  King County
-  University of Washington – UW
-  Washington State Department of Transportation – WSDOT
-  Hydroacoustic Technology Inc. – HTI
-  U.S. Geological Survey - USGS
-  USFWS Employees

Chinook Salmon Smolt Behavior in Lake Washington and the Ship Canal: 2004-2008 Acoustic Tracking Studies



Mark T. Celedonia & Roger A. Tabor

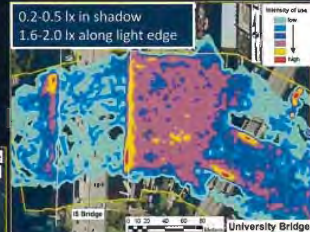


U.S. Fish & Wildlife Service
Washington Fish & Wildlife Office
510 Desmond DR., SE
Lacey, WA 98503

Slide 1

Holding (not actively migrating) Chinook Salmon smolts are attracted to artificial light at night

- Neither Smallmouth Bass nor Northern Pike minnow showed an affinity for artificial light
- Other predators? (Cutthroat Trout)
- How do these behaviors affect predation rate?



Slide 31



U.S. Fish and Wildlife Service

Movement and Habitat Use of Chinook Salmon Smolts, Northern Pikeminnow, and Smallmouth Bass Near the SR 520 Bridge

2008 Acoustic Tracking Study

December 2011 By Mark T. Celedonia, Roger A. Tabor,
Steve Damm, Daniel W. Lantz, Terence M. Lee,
Zhuozhuo Li, Benjamin E. Price, William Gale,
Kenneth Ostrand

U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Lacey, Washington



Funded by the Washington State Department of Transportation

MOVEMENT AND HABITAT USE OF CHINOOK SALMON SMOLTS,
NORTHERN PIKEMINNOW, AND SMALLMOUTH BASS NEAR THE
SR 520 BRIDGE

2008 ACOUSTIC TRACKING STUDY

by

Mark T. Celedonia, Roger A. Tabor, Scott Sanders, Steve Damm, Daniel W. Lantz,
Terence M. Lee, Zhuozhuo Li, and Benjamin E. Price

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December 2011

EXECUTIVE SUMMARY

This study continued and extended research performed in 2007 by the Washington State Department of Transportation (WSDOT) and the U.S. Fish and Wildlife Service (USFWS) to evaluate influence of the SR 520 bridge (the bridge) on behavior and habitat use of Chinook salmon *Oncorhynchus tshawytscha* smolts and piscivorous fish. Results obtained in 2007 suggested that the bridge was having some influence on migration, movement, and habitat use of Chinook salmon, and that at least one potential predator - smallmouth bass *Micropterus dolomieu* - often used the bridge as selected habitat. Further study was needed due to high variability in Chinook salmon behavior, uncertainty with regard to important causal factors, and low sample sizes of predators (namely northern pikeminnow *Ptychocheilus oregonensis*). Results will help guide design and construction of the new bridge to minimize impacts to Chinook salmon.

The primary objectives of the 2008 study were to: 1) increase the sample size of Chinook salmon used for evaluating migrational delay at the bridge; 2) evaluate interannual variability in fish behavior relative to the bridge; 3) collect additional ancillary data to help understand observed fish behavior patterns; 4) increase sample sizes of tagged northern pikeminnow and smallmouth bass; and, 5) explore potential predation consequences of the bridge on Chinook salmon. In order to meet these objectives, the 2008 study largely replicated the 2007 acoustic tracking study design. Components added for 2008 included: 1) Chinook salmon smoltification (gill Na⁺, K⁺ ATPase) sampling; 2) zooplankton sampling; 3) predator abundance and diet sampling.

Four groups of 27-53 tagged Chinook salmon smolts were released between June 12 and July 10, 2008, and 75-85% of tagged fish were tracked at the study site. Overarching patterns in Chinook salmon smolt behavior were similar to those observed in 2007. Behaviors were generally similar within release groups and varied considerably between release groups. The first three release groups primarily exhibited holding behaviors at and near the study site. The fourth release group represented a unique case: most fish (93%) actively migrated through the site in one of two schools.

As in 2007, fish response to the bridge was at least partially dependent upon whether fish were actively migrating or holding. Behaviors of actively migrating fish were similar in both years, although few independent observations were obtained in 2008 (n=11). Combining both years (n=57), 35% of actively migrating smolts showed minimal or no response to the bridge, 42% paralleled the bridge before passing underneath, and 23% paralleled the bridge and milled near the bridge before passing underneath. Median delay was 63 seconds (range 6 seconds to 19 minutes) for paralleling fish, and 22 minutes (range 3-46 minutes) for paralleling and milling fish.

The bridge appeared to attract some Chinook salmon that exhibited a holding behavior. Holding fish spent 2 hours to 11 days on and near the study site, and median 51% of this time was spent on-site. When on-site, fish most commonly selected for areas near the bridge (within 20 m of the bridge edge) and the condo on the south side of the site. Of secondary importance were areas directly beneath the bridge and areas with moderately dense to dense vegetation not

near the bridge. During the day, fish selected more offshore areas when near the bridge (5-7 m bottom depth) or condo (7-8 m bottom depth) than when they were not near either structure (2-5 m bottom depth). Similar observations were made in 2007. Data suggested that the bridge may provide a source of nearby cover and thus function as a corridor to deeper water where there is a better foraging base and occasionally more favorable water temperatures.

At night, Chinook salmon were attracted to areas where street lamps on the bridge cast light into the water. A reevaluation of 2007 data found that it occurred then also. Bridge lighting thus appears at least partially responsible for the nighttime selection of near bridge areas by Chinook salmon. Neither smallmouth bass nor northern pikeminnow appeared particularly attracted to the lights. Other studies suggest that predation rate may be higher in lighted areas even if predators on the whole do not select for these areas. Any potentially negative consequences to Chinook salmon might be minimized by reducing the intensity of light reaching the water surface.

We tagged 21 northern pikeminnow and 10 smallmouth bass at the study site, and obtained extensive tracking results on 8 northern pikeminnow and 7 smallmouth bass. Results for both species were similar in 2007 and 2008; therefore, data were combined to provide more robust analyses. This yielded sample sizes of 15 northern pikeminnow and 19 smallmouth bass (> 240 mm FL).

Northern pikeminnow were primarily concentrated at 4-6 m depth during all diel periods. Moderately dense vegetation, which occurs at 4-6 m depth, was the most commonly used habitat type. The small pier at the Madison Point Condominiums was used extensively. During each diel period, less than 50% of northern pikeminnow showed positive selection for the bridge or areas near the bridge. Overall, we did not document a strong affinity for the bridge. Instead, the bridge was generally used in proportion to its availability.

Smallmouth bass showed a strong affinity for overwater structures, including the bridge. Smallmouth bass were often closely associated with bridge columns. At dawn, they often moved into sparse vegetation and the offshore edge of vegetation. These movements are probably indicative of foraging activity. Additionally, they occasionally used dense and moderately dense vegetation, primarily at dusk and night. In both years, smallmouth bass were primarily concentrated in water 4-8 m deep during all diel periods.

We set a series of gill nets at five locations (the bridge, two sites north of the bridge, and two sites south of the bridge) on a weekly basis during the study period to determine the relative abundance and diet of northern pikeminnow and smallmouth bass. We collected a total of 135 northern pikeminnow and found no evidence that northern pikeminnow were congregated at the SR 520 bridge in comparison to four nearby sites. Additionally, there was no evidence to suggest that juvenile salmonids were preyed upon at a higher rate by northern pikeminnow near the bridge. Juvenile salmonids (Chinook salmon and unidentified salmonids) made up 35% of the overall diet of all sites combined. One important observation was the prevalence of river lamprey *Lampetra ayresi* in the diet of northern pikeminnow. Previous studies of northern pikeminnow in Lake Washington have rarely found river lamprey in their diet.

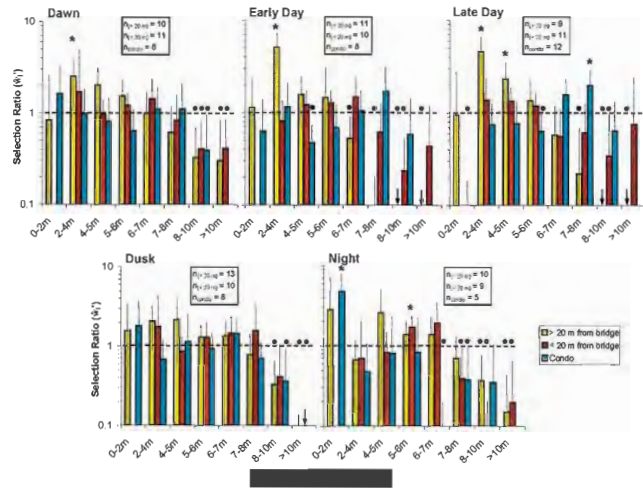


FIGURE 25. Diel bottom depth selection (\hat{w}_i , selection ratio; log scale) of Chinook salmon released on June 12, 2008. Selection is for the entire water column and not for the position of the fish within the water column. Depth selection was determined for three distinct areas: 1) directly beneath bridge and within 20 m of the bridge edge; 2) > 20 m from bridge edge; and, 3) within 20 m of the edge of the Lakeshore West Condominiums. Error bars represent Bonferroni-adjusted 90% confidence intervals. Error bars indicate if selection for (>1) or against (<1) a water column depth occurred. An asterisk (*) denotes selection for a depth and a circle (o) denotes selection against. Each area contained all depth categories, except minimum depth near bridge was 2-4 m and maximum depth near the condo was 8-10 m.

At night, areas where fish spent a greater proportion of time near the bridge coincided with locations of street lights on the bridge (Figure 28). This suggested that fish were attracted to areas with artificial lighting. Street lights appeared to attract fish in two general areas. The strongest area of attraction was directly adjacent to a street light on the same side of the bridge as the light. Most street lights had high concentrations of fish use near them (Figure 28). A weaker yet still apparent association was observed in 2007 (Figure 29). High concentration areas were on the same side of the bridge as the light. Areas on the opposite side of the bridge from the light usually did not show elevated fish usage. A weaker area of fish attraction appeared as a line of elevated fish usage running parallel with the bridge approximately 15-27 m from both the northern and southern edges. This appeared in both the June 12 and June 26 releases (Figure 28). This may be caused by lights on the opposite side of the bridge. The distance from the bridge where these lines occurred may correspond with the bridge shadow created by lights on

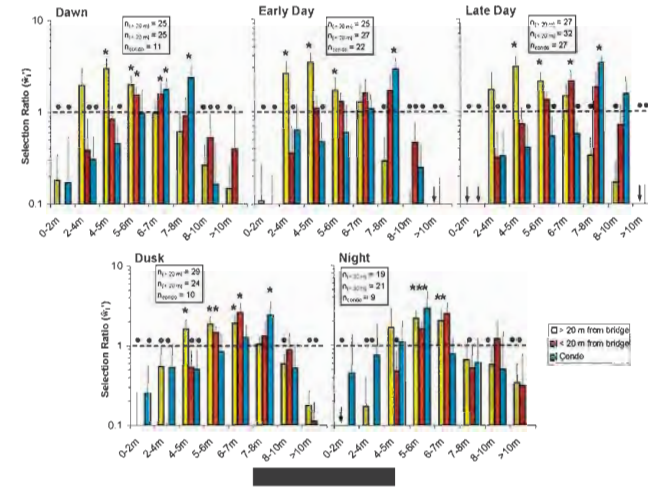


FIGURE 26. Diel bottom depth selection (\hat{w}_i , selection ratio; log scale) of Chinook salmon released on June 26, 2008. Selection is for the entire water column and not for the position of the fish within the water column. Depth selection was determined for three distinct areas: 1) directly beneath bridge and within 20 m of the bridge edge; 2) > 20 m from bridge edge; and, 3) within 20 m of the edge of the Lakeshore West Condominiums. Error bars represent Bonferroni-adjusted 90% confidence intervals. Error bars indicate if selection for (>1) or against (<1) a water column depth occurred. An asterisk (*) denotes selection for a depth and a circle (o) denotes selection against. Each area contained all depth categories, except minimum depth near bridge was 2-4 m and maximum depth near the condo was 8-10 m.

the opposite side of the bridge. That is, lights on the north side of the bridge were about 14.5 m from the southern edge of the bridge. Therefore, the shadow cast by the bridge would lie not only directly beneath the bridge, but would also be cast some distance from the bridge. We did not measure light levels in any of these areas.

Washington and the LWSC. Water clarity was generally lower in the LWSC than along the western shore of Lake Washington during the study period. Turbidity and light intensity can substantially alter juvenile fish habitat use patterns (Gregory 1993; Miner and Stein 1996; Abrahams and Kattenfeld 1997; Reeb 2002). In general, predation risk declines in turbid conditions allowing prey species to abandon anti-predator behaviors. For example, in clear water small bluegill remain in shallow areas when predators are present, but spend substantial proportions of time (> 80%) in deepwater habitat under turbid conditions (Miner and Stein 1996). Similarly, Gregory (1993) observed that juvenile Chinook salmon concentrated in one part of a test arena under clear conditions, but that fish distributed more evenly throughout the arena under turbid conditions. Higher water clarity in Lake Washington may force Chinook salmon closer to shore, and diminished clarity in the LWSC may allow fish to utilize open water areas during the day and take advantage of presumably better foraging opportunities as well as lower, more favorable water temperatures.

In both years of the SR 520 bridge studies, holding Chinook salmon smolts showed significant selection for and/or considerable use of the SR 520 bridge edge and the condo edge, and selected for deeper water when near these structures than when they were away from the structures. Chinook salmon and other salmonids have also been observed at high densities along outside edges of overwater structures in Puget Sound (Toft et al. 2007). In 2007, we hypothesized that during the day holding Chinook salmon have a positive selection for deep waters near the bridge, which may be related to access to preferred foraging locations and/or cooler, more favorable water temperatures. This hypothesis can also be extended to the condo. Specifically, the bridge, the condo, and other overwater structures extending into deeper littoral and pelagic zones may provide a source of cover or refuge from open water predators, thus allowing juvenile Chinook salmon to access areas that they would otherwise avoid.

The depths selected by smolts near the 520 bridge and the condo corresponded with elevated *Daphnia* abundance. Zooplankton typically avoid nearshore areas and are instead found in greatest abundance farther from shore (Wetzel 1975; Hall et al. 1979; Naud and Magnan 1988; Werner and Hall 1988; Tabor and Wurtsbaugh 1991; Diehl and Eklöv 1995). The width of the nearshore zone of low abundance depends on elevation of the horizon, position of the sun, and differential light levels nearshore compared with offshore (Wetzel 1975). In 2008, our zooplankton sampling at the SR 520 study site showed zooplankton mass substantially higher at areas where the bottom depth was ≥ 7 m than at areas with bottom depths ≤ 5 m, suggesting that the zone of low abundance extended from the shoreline to 5-7 m bottom depth. Chinook salmon smolts selected for depths within the zone of low zooplankton abundance when not near the bridge or condo during the day: daytime depth selection of Chinook salmon smolts was highest for 2-5 m and typically quite low for depths > 7 m when not near the bridge or condo. When at the bridge edge, however, daytime depth selections were typically highest for 5-7 m - the transitional area between low and high *Daphnia* abundance - and deeper depths consistently showed higher selection ratios when fish were near the bridge than when they were not (condo excluded). When at the condo edge, daytime depth selections were highest for 7-8 m depth.

birds, and other fishes (Woodhead 1966). Artificial lighting may allow juvenile Chinook salmon to feed actively at night. Commonly, small zooplanktivorous fishes feed heavily at dawn and dusk and do not feed much at night (Hall et al. 1979; Wurtsbaugh and Li 1985). However, they may feed throughout the night during full moon conditions (Gliwicz 1986). Artificial lighting generally reduces the abundance of *Daphnia* in surface waters (Moore et al. 2000); however, other components of the zooplankton community such as larval fishes (Gregory and Powles 1985) may be more abundant and vulnerable to predation by juvenile Chinook salmon.

Lighted areas may allow zooplanktivorous fishes an opportunity to forage throughout the night but their increased abundance may attract their predators (Nightingale et al. 2006). Even if piscivorous fishes are not attracted to lighted areas, the predation rate by piscivorous fishes that inhabit the lighted area may be dramatically higher than that in other areas (Tabor et al. 2004a). Research at petroleum platforms has shown that artificial lighting allows fish to feed on zooplankton that have concentrated in the light field; however, they may be more vulnerable to large piscivorous fishes (Stanley and Wilson 1997; Keenan et al. 2003). In Lake Tanganyika in Africa, fishermen use lights to attract zooplanktivorous fishes, which in turn attract large piscivorous fishes (Coulter 1990). In Lake Washington, we have observed great blue herons and western grebes feeding around lights but no information is available on their nighttime diet. Piscivorous fishes may also be attracted to lighted areas due to an aggregation of small fishes like juvenile Chinook salmon. Cutthroat trout appear to feed heavily at night in Lake Washington because of reflected artificial lighting from surrounding urbanized areas (Mazur and Beauchamp 2006). Obviously artificial lighting on the bridge is important for safety concerns; however, lighting should be designed to minimize the amount of light that reaches the water surface.

Gill ATPase sampling suggested that the physiological smoltification process was dampened or muted in our study fish. This may explain the predominance of holding behaviors observed: lacking sufficient physiological cues, fish may be more prone to holding than actively migrating seaward. However, ATPase activity may not be a good predictor of predisposal to migrate seaward. Seaward movement can occur without elevated ATPase activity (Ewing et al. 1980a; Tiffan et al. 2000), and, conversely, slow moving fish can have high levels of ATPase activity (Tiffan et al. 2000). Nonetheless, the general suppression of ATPase activity in our study fish was curious because ATPase should peak at some point during the outmigration season. ATPase suppression can be associated with adverse or stressful conditions, such as elevated water temperatures (Marine and Cech 2004), low levels of food abundance (Ewing et al. 1980b), high levels of suspended sediment (Shrimpton et al. 2007), and high rearing densities (Strange et al. 1978). Shrimpton et al. (1994) found ATPase activity suppressed in hatchery-reared coho salmon and speculated that stressful hatchery rearing conditions may have been to blame. Release from the hatchery environment can stimulate smoltification (McCormick et al. 2003) assuming release occurs within the environmental smolt window.

Northern pikeminnow

Results of 2008 northern pikeminnow tracking appeared to be similar to 2007 results. Both depth selection and habitat use of northern pikeminnow appeared to be similar between years. In both years they were primarily concentrated in 4-6 m depth interval during all diel periods. At

Although northern pikeminnow did not strongly use the bridge structure, several used the Madison Point Condominium pier. Within our study area, there were four overwater structures from a small pier (Edgewater Apartments) in shallow water to the large bridge structure. The Edgewater Apartment pier was probably in too shallow of water to attract northern pikeminnow. The Madison Point Condominium pier is a narrow pier but extends out into the water depths (4-5 m) preferred by northern pikeminnow. It is unclear why they would prefer this small pier over the two larger structures (Lakeshore West Condominiums and SR 520 bridge). The Madison Point pier may enable pikeminnow to observe approaching prey (i.e., juvenile Chinook salmon) from a variety of directions and still provide overwater cover from their predators such as piscivorous birds. Also, vegetation under the pier may be denser and more preferred by northern pikeminnow. Perhaps this site attracts northern pikeminnow because of some other type of forage. Northern pikeminnow often consume plant material and dead animal remains (Tabor et al. 1993; Petersen et al. 1994; Shively et al. 1996; Tabor et al. 2004b). If condominium residents regularly discard fish or shellfish remains at this pier or another source of plant or animal material is present, northern pikeminnow may congregate here.

Substrate selection by northern pikeminnow was markedly different between day and night. Differences may reflect their foraging strategies and prey availability. Northern pikeminnow are opportunistic predators with a wide range of prey types. During the day they may attempt to prey on diurnally-active prey (e.g., juvenile salmonids, threespine stickleback, and other littoral fishes) near macrophyte beds where silt substrates predominate. At night, they may attempt to prey on nocturnally-active prey such as sculpin and crayfish which are often more abundant in areas with larger substrates (Mueller 2002; Tabor et al. 1998).

Northern pikeminnow showed a slight attraction to street lights on the SR 520 bridge. Because juvenile Chinook salmon congregate near the lights, pikeminnow may in turn be attracted to the increased density of potential prey. Northern pikeminnow actually appear to prey more effectively on juvenile salmonids at extremely low light levels than at high light levels (Petersen and Gadomski 1994). However, the increased density of juvenile salmonids could result in higher predation rates by northern pikeminnow. Similarly, sockeye salmon fry are more vulnerable to sculpin predation at street lights because of the increase in density of fry even though sculpin are more effective at preying on fry at extremely low light levels (Tabor et al. 2004a).

Smallmouth bass

In 2008, we were able to track an additional eight large smallmouth bass. In general, results of these fish appeared to be similar to 2007 smallmouth bass tracking results. Combined, they showed a strong affinity for overwater structures. In both years, they were primarily concentrated in 4-8 m depth interval during all diel periods. At dawn, they often moved into sparse vegetation and the offshore edge of vegetation. Additionally, they occasionally used dense and moderately-dense vegetation, primarily at dusk and at night.

Unlike northern pikeminnow, we were able to effectively track most tagged smallmouth bass. Smallmouth bass usually have a defined home range (Kraai et al. 1991; Ridgway and Shuter 1996; Hodgson et al. 1998; Cole and Moring 1997) and may not be as mobile as northern

At dawn and dusk, some smallmouth bass made forays along the shore or into deeper waters. These movements may have been movements to actively search for prey. Piscivores, such as smallmouth bass, are well adapted to feed in dim light and are often more active during crepuscular periods because they have the greatest advantage over prey species. Results of two smallmouth bass implanted with depth tags at the SR 520 bridge site showed crepuscular activity patterns (Celedonia et al. 2008a). In the Columbia River, smallmouth bass show a crepuscular feeding pattern, but it is not pronounced (Vigg et al. 1991). An extended period of morning feeding has also been observed. Emery (1973) also found peak feeding was at dawn and dusk and they fed opportunistically during the daytime. In the Snake River, smallmouth bass were most active in the early morning (Munther 1970). In laboratory experiments, Reynolds and Casterlin (1976) also found smallmouth bass displayed a crepuscular activity pattern.

Most smallmouth bass did not appear to be active at night. Other studies have also found they are inactive at night and rest on the bottom near some type of cover such as large woody debris (Munther 1970; Emery 1973). During our snorkeling in Lake Washington and the LWSC, we often encountered smallmouth bass that were motionless and appeared to be resting on the bottom (R. Tabor, unpublished data). Our tagged smallmouth bass were mostly inactive at night, however there were some exceptions. Nighttime activity may be related to artificial lighting or moonlight. Some of the night-active smallmouth bass in Portage Bay and at a site near the Seattle Tennis Club in Lake Washington were near artificial lighting (Celedonia et al. 2008b). In laboratory experiments, Reynolds and Casterlin (1976) found smallmouth bass were often active at night. Largemouth bass, which have similar crepuscular activity patterns (Reynolds and Casterlin 1976), can feed at night especially under full moon light conditions (McMahon and Holanov 1995).

Restricted movement at night by smallmouth bass is most likely indicative of resting behavior; whereas restricted movement throughout the day may be related to either resting behavior, typical behavior of an ambush predator, or related to spawning activity. During the spring, male smallmouth bass often are guarding a nest and have a small home range during this period (Savitz et al. 1993) and foraging activity is presumably reduced. Of the adult smallmouth bass we tagged at the study site, all appeared to move over a relatively large area during the day and did not appear to be nest guarding. Spawning activity occurs in the spring and our tracking may have been conducted after spawning season was over. Also, adult smallmouth bass collected at the study site were collected with gill nets, which selects for more active fish and probably not for nest guarding males.

Relative abundance and diet of piscivorous fishes at the SR 520 bridge site

We found no evidence that northern pikeminnow were congregated at the SR 520 bridge in comparison to four other nearby sites. Northern pikeminnow have been shown to congregate around dams (Beamesderfer and Reiman 1991) and at the outlets of hatchery facilities (Collis et al. 1995); however, this is likely due to prey availability and not the structure itself. The use of overwater structures by northern pikeminnow in lakes has not been well documented. Acoustic tracking of northern pikeminnow at SR 520 bridge indicated they occasionally use overwater structures; however, they most frequently used a small pier near shore instead of the SR 520 bridge. Exactly why they preferred this small structure is unclear.

The diet composition of northern pikeminnow at the SR 520 bridge site consisted of juvenile salmonids, river lamprey, threespine stickleback, longfin smelt, and crayfish. They did not appear to be feeding on juvenile salmonids to a larger degree than at other sites. Northern pikeminnow are considered opportunity predators that will eat a wide variety of food including plant material (Tabor et al. 1993; Shively et al. 1996) and dead fish (Petersen et al. 1994) and will quickly switch to other prey items as it becomes abundant (Collis et al. 1995; Shively et al. 1996). The diet composition of northern pikeminnow at the SR 520 bridge is probably a reflection of prey abundance and availability. There was no evidence to support the hypothesis that juvenile salmonids are more vulnerable to northern pikeminnow predation due to the bridge structure. Similarly, Ward et al. (1994) found no difference in the frequency of occurrence of juvenile salmonids in northern pikeminnow diets between developed and undeveloped areas of the lower Willamette River.

Juvenile salmonids made up a substantial portion of the diet of northern pikeminnow at all of our five sites in the central-west part of the lake. All of the identifiable salmonids were Chinook salmon. Previous studies of northern pikeminnow in Lake Washington have found Chinook salmon is a rare prey item in their diet (Olney 1975; Brocksmith 1999; Beauchamp et al. 2007a). The other studies usually had small sample sizes in June and their sampling was spread out over the entire lake and thus they could have missed this predation event. If predation of Chinook salmon is strongly concentrated in the central-west part of the lake and little sampling occurred in this area, the overall predation levels on juvenile salmonids may be underestimated by these other studies.

One important finding of our diet analysis was the prevalence of river lamprey in the diet of northern pikeminnow. In previous sampling of northern pikeminnow in Lake Washington by Olney (1975), Brocksmith (1999), Beauchamp et al. (2004) and Beauchamp et al. (2007a), river lamprey was not mentioned as an important prey item. Olney (1975) only states that a few Pacific lamprey *Entosphenus tridentatus* were consumed and does not mention river lamprey. Brocksmith (1999) found lamprey in 3 of 124 gut samples but does not mention which species was present. Beauchamp et al. (2004) and Beauchamp et al. (2007a) did not mention lamprey; instead they found northern pikeminnow preyed on longfin smelt, threespine stickleback, salmonids, yellow perch, and sculpin. These other studies conducted sampling throughout the year and across the entire lake. In our study, we intensively sampled one area of the lake over a short time period. River lamprey may congregate in this area to prey on juvenile salmonids and are in turn preyed on by northern pikeminnow. Because river lamprey was only observed in northern pikeminnow, river lamprey may be particularly vulnerable to piscivorous fishes at night. Northern pikeminnow appear to be able to forage under lower light conditions than the other species (Petersen and Gadomski 1994).

The ecology and abundance of river lamprey in Lake Washington is poorly understood. Typically, river lamprey are anadromous, spending about 5 years in freshwater as ammocoetes and then migrating to estuarine and marine environments to feed on fish and then return to freshwater as adults to spawn and die (McPhail 2007). In Lake Washington, they appear to be able to complete their life history in freshwater. Other landlocked populations have been documented in British Columbia lakes (McPhail 2007). Currently river lamprey is listed as a

support columns; and, 5) decrease the overall number of support columns. Two options (Options A and L) would raise portions of the bridge higher than current elevations. It is unclear how the third design option (Option K) would affect bridge height in the study site area.

Based on our acoustic tracking studies and other studies of migrating Chinook salmon (Kemp 2005; Tabor et al. 2006; Celedonia et al. 2008b; R. Tabor, USFWS, unpublished data), actively migrating Chinook salmon smolts attempt to avoid passing beneath overwater structures. Upon encountering structures such as docks and piers, fish generally move into deeper water and either pass beneath the structure or swim around the perimeter of the structure. Once beyond the structure, fish generally move back into shallower water. Some factors that appear to influence behaviors are structure width, height of structure above the water surface, light conditions beneath the structure, degree of contrast at the light/shadow edge, type and size of adjacent structures, and macrophyte distribution. These are anecdotal observations, however, and more rigorous study is needed to better understand how size, shape, and other parameters of overwater structures influence salmonid behavior. Elevating the bridge above the surface of the water may allow more ambient light beneath the bridge and may thus diminish any influence the bridge shadow has on migrating Chinook salmon. However, a wider bridge may counteract this. It is uncertain how these two factors (bridge width and height of bridge above the surface) would interact to influence behaviors of actively migrating Chinook salmon behaviors.

Given the complexity and uncertainty of factors influencing holding Chinook salmon's use of the bridge, we cannot infer with much certainty the influence of the new bridge design on holding Chinook salmon. Specific features that may influence attraction of Chinook salmon smolts to the current bridge during the day may include one or more of the following: 1) shading under and near the bridge; 2) structural complexity provided by the bridge (i.e., the bridge columns); and, 3) the presence of macrophytes near and/or under the bridge. Elevating the new bridge may diminish the bridge shadow's darkness and the degree of contrast at the light-dark edge, and may thus diminish the attractiveness of shadow as cover as well as allow more dense growth of macrophytes beneath the bridge. The greater width of the new bridge may, however, offset these effects as a wider bridge would allow less ambient light underneath thereby darkening the shadow. Tagged Chinook salmon smolts usually selected for the bridge edge. Thus, a wider bridge would have no influence on these fish. However, we did observe occasional selection for a small area directly beneath the bridge where the bridge was elevated above the surface of the water. A wider bridge that is elevated throughout the study area may thus increase under-bridge area used by Chinook salmon. Fewer and more widely spaced bridge columns may diminish any role the columns serve in providing cover to holding Chinook salmon smolts. The new bridge alignment moves the new bridge slightly north of the current location which will change the proportion of water column depths spanned. For example, the current bridge spans a large proportion of 4-6 m deep water relative to other depths. The proposed bridge alignment will diminish this proportion and will increase the proportion spanning 6-8 m depth. When Chinook salmon were near the bridge, depths of 6-8 m had the highest selection ratios in 2007 and in the later 2008 releases. The proposed bridge would increase the availability of near bridge habitat at these depths. Although it is difficult at best to predict how these changes in bridge design and alignment will interact to influence holding Chinook salmon during the day, we believe that patterns in holding Chinook salmon habitat use near and under the bridge will most likely either be similar to those observed at the current bridge or that selection



U.S. Fish and Wildlife Service

Movement and Habitat Use of Chinook Salmon Smolts in the Lake Washington Ship Canal

2007-2008 Acoustic Tracking Studies

May 2011 By Mark T. Celedonia, Zhuozhuo Li, Scott T. Sanders, Roger A. Tabor, Steve Damm, Daniel W. Lantz and Benjamin E. Price

U.S. Fish & Wildlife Service
Washington Fish & Wildlife Office
Lacey, Washington



Seattle
Public
Utilities



Funded by Seattle Public Utilities (City of Seattle),
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District

LWSC Chinook Salmon Acoustic Tracking, 2007-2008
FINAL REPORT

May 2011

More than fifty percent of the tagged fish also used south Lake Union, often for more than 24 hours.

In general, tagged Chinook salmon in the LWSC distributed broadly throughout areas with bottom depths ≥ 4 m, although shallower areas were used on occasion. Seasonal and inter-annual shifts in spatial distribution appeared to be related to diel period, water temperature, and water clarity. Overwater structures may have also influenced spatial distribution in some cases. We found little evidence of strong shoreline orientation in the LWSC, although extensive shoreline development throughout the LWSC may have obscured the natural tendencies of the fish. This contrasts with findings in Lake Washington where fish remain relatively close to shore in areas with bottom depths of 1-6 m during the day. Lower abundance of some Chinook salmon predator species in the LWSC may contribute to the shift in horizontal spatial distribution of Chinook salmon here.

Tagged Chinook salmon smolts often used the edges of overwater and in-water structures where water depth was greater than 6 m. This was observed primarily at the University Bridge and South Lake Union sites. In general, Chinook salmon milled throughout a zone that started at the structure edge and extended outward 20 m. These findings were similar to those observed in studies at the State Route (SR) 520 bridge and a nearby overwater condo in Lake Washington (Celedonia et al. 2008a; Celedonia et al. 2009). It is possible juvenile Chinook salmon use structure edges to be near cover. This behavior has important management implications in that use of these areas puts Chinook salmon in close contact with known smallmouth bass *Micropterus dolomieu* habitat. However, the extent to which these behaviors result in increased predation requires further study. Nonetheless, resource managers and policy makers should consider this in the design, modification, and permitting of over- and in-water structures in the LWSC where bottom depths are 6 m and deeper.

At the University Bridge site, fish migration behavior was strongly influenced by the University Bridge. Many tagged fish responded by milling along the eastern edge of the bridge and in nearby areas prior to passing beneath the bridge. Similar behaviors were observed at the SR 520 bridge (Celedonia et al. 2008a; Celedonia et al. 2009). Few if any fish responded to the presence of the I-5 bridge, presumably because it is much higher than the University Bridge and has no in-water structure. The milling behaviors at the University Bridge put fish in prolonged contact with edges of in-water structures that were frequented by smallmouth bass (Tabor et al. 2010). This may increase predation on Chinook salmon smolts. In one cases, data showed predation upon a tagged Chinook salmon in this area.

At night, tagged Chinook salmon frequented areas with artificial lighting and spent prolonged periods in these areas. Similar observations were made along the SR 520 bridge (Celedonia et al. 2009). Relatively dim light levels (1.6-2.0 lx) attracted tagged Chinook salmon. Other studies suggest that predation rates by piscivorous fishes may be higher in lighted areas even if predators on the whole do not select for these areas. Any potentially negative consequences to Chinook salmon might be minimized by reducing the intensity of light reaching the water surface.

Influence of artificial lights on nighttime movement and habitat use

We observed influences of artificial lighting on nighttime movement and habitat use of tagged Chinook salmon at three study sites: University Bridge, South Lake Union, and the Ballard Locks. This study was not intended to provide a thorough evaluation of artificial lighting. However, upon observing in our tracking data indicators that artificial lighting may have influenced tagged Chinook salmon habitat use, we conducted follow-up site visits to provide at least a minimal level of verification. We identified sources of artificial lighting and/or measured light levels near the water surface. These light surveys were not intended to be rigorous: we did not attempt to locate and measure every source of artificial light. Light intensity levels were measured at the water surface with an Extech Instruments light meter to the nearest 0.1 lx.

At the Ballard Locks, areas of the site that were intensively used by tagged Chinook salmon at night were often associated with artificial light (Figures 44 and 45). These included areas at the large lock approach/entrance along the north pier wall, the area immediately to the north of this pier wall, at the small lock approach/entrance along the north pier wall, as well as two other localized areas (Figure 44). Light levels in these areas were generally greater than 10 lx, although one point was measured as low as 0.3 lx (Figure 45). Ambient light levels measured at 11 points throughout the site were generally 0.0 lx (7 points), and was as high as 0.2 lx (3 points). Interestingly, some areas with elevated light levels were not associated with greater use by tagged Chinook salmon. For example, light levels along a line running parallel to and 15 m from the small lock pier wall were generally 3-10 lx (Figure 45). However, we did not observe any elevated use by tagged Chinook salmon in this area. This may have been due to the proximity of this area to higher light levels closer to the pier wall.

At the South Lake Union site, we observed several instances of tagged Chinook salmon spending prolonged periods near known artificial lights at night (Figure 46). Light levels were measured at only two known sources, and were 2.3-6.0 lx about 1 m above the surface of the water. Ambient light levels measured along the shoreline were 0.5-0.7 lx. Artificial light sources were on structures in areas where the water was relatively deep (> 6 m). There were numerous other areas near overwater structures in deep water where some tagged Chinook salmon spent prolonged periods at night. It is uncertain if there was artificial lighting in these areas. A more rigorous light survey is needed to verify all artificial lights sources and the light level at these sources.



FIGURE 44. Areas of moderate to high intensity use by tagged Chinook salmon at night at the Ballard Locks, June-July, 2007 (left) and 2008 (right). Areas of higher use that were associated with artificial lighting are outlined in black. See Figure 45 for light level measurements in these areas.



FIGURE 45. Light level readings (lx) in selected areas of the Ballard Locks study site. Selected areas used more intensively by tagged Chinook salmon are outlined in black. See Figure 38 for distribution of tagged Chinook salmon usage intensity. Ambient light level was generally 0.0 lx, although in some areas was as high as 0.2 lx.

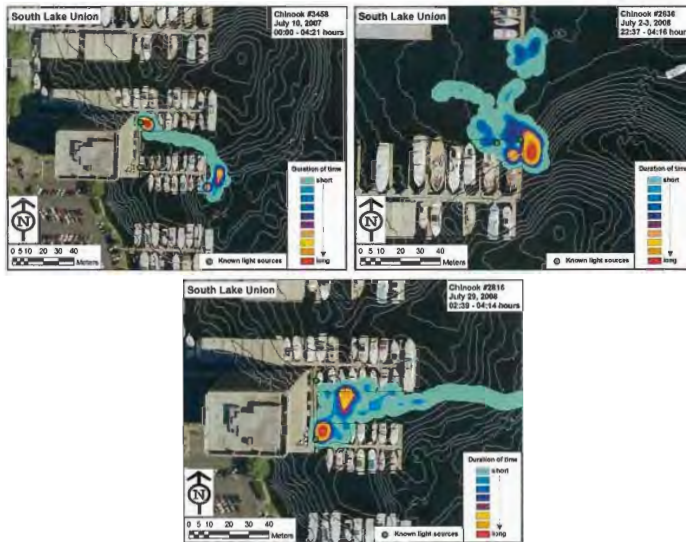


FIGURE 46. Three examples of tagged Chinook salmon use of artificially lit areas at night at the South Lake Union site: Chinook #3458 (upper left), #2636 (upper right), and #2816 (bottom). Sources of known artificial light are shown. Other sources of artificial light may have also been present. Light levels at the two sources in the upper left and bottom images measured about 1 m above the water surface were 6.0 lx (north source) and 2.3 lx (south source). Ambient levels measured along the shoreline were 0.5-0.7 lx. Light levels at the sources in the upper right image were not measured.

At the University Bridge site, there was a notable response of tagged Chinook salmon to artificial lighting on the I-5 bridge deck and the light/shadow edge this lighting created in the water (Figures 47, 48, and 49). Light levels were 1.6-2.0 lx (measured at 3 points) within 1 m of the edge on the light side, and were 0.2-0.5 lx (measured at 6 points) in the shadow area between the lines. Many fish milled along the light/shadow edge on the eastern side of the I-5 bridge and milled between this edge and the University Bridge. These areas were highlighted on both spatial frequency distribution maps (suggesting that many fish spent time milling in this area) and density plots (suggesting that many fish spent prolonged periods here relative to other parts of the site) (Figure 47). Movement pathways of many fish also showed extensive north-south

milling along this edge (e.g., Figure 49). Many of these fish also milled in the area between the edge and the University Bridge, often interspersing periods of milling along the light/shadow edge with periods milling between the bridges. There was a marked reduction in activity in the shadow zone beneath and adjacent to the I-5 bridge. This was evident on both density plots and spatial distribution maps (Figure 47). Tracks of tagged fish suggested that many fish either did not enter the shadow area or moved quickly through without spending much time. Movement pathways of some fish suggested that this light/shadow edge influenced their movement. For example, when Chinook salmon #3168 encountered the western light/shadow edge from the east, it twice changed its pathway and moved away from the edge before crossing the edge on its third encounter (Figure 49).

Also at the University Bridge site, we observed areas of high tagged fish use in the mid-channel area adjacent to the University Bridge support structures (Figure 47). These areas were associated with artificial lighting beneath the bridge attached to the support structures (Figures 47 and 50), presumably as a boating navigational aid. We did not measure light levels here.

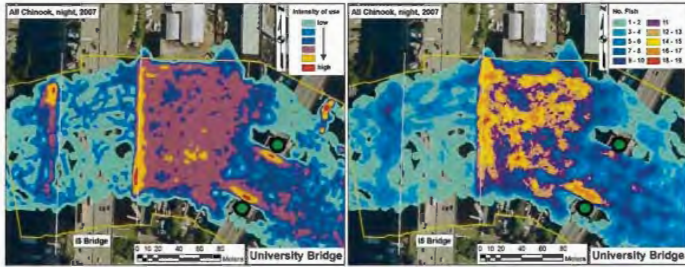


FIGURE 47. Distribution of tagged Chinook salmon at night at the University Bridge study site, June-July, 2007. Density plot (left) shows intensity of fish use for all tracked fish (weighted by time), and spatial frequency distribution (right) shows number of fish tracked by area. The white lines parallel to the I-5 bridge show the location of the light/shadow edge created by artificial lighting on the I-5 bridge deck (see Figure 48). Light levels were 1.6-2.0 lx (measured at 3 points) within 1 m of this line on the light side, and were 0.2-0.5 lx (measured at 6 points) in the shadow area between the lines. Green circles show approximate locations of lights beneath the University Bridge (see Figure 50).



FIGURE 48. Artificial lighting on the I-5 bridge deck spanning the Lake Washington Ship Canal (looking north).



FIGURE 49. Four examples of tagged Chinook salmon behavior near the light/shadow edge created by artificial lighting on the I-5 bridge deck: Chinook #3168 (upper left), #2688 (upper right), #2918 (bottom left), and #3142 (bottom right). The white lines parallel to the I-5 bridge indicate the light/shadow edge created by artificial lighting on the I-5 bridge deck. Light levels were 1.6-2.0 lx (measured at 3 points) within 1 m of this line on the light side, and were 0.2-0.5 lx (measured at 6 points) in the shadow area between the lines. The color scale indicates the time sequence of each track. The blue circle shows the starting point of the fish in each image.



FIGURE 50. Artificial lighting under the University Bridge. Lighting is directed down onto the water surface. Light on the north bridge support structure is pictured. Light on the south support structure is similar. These lights correspond with green circles in Figure 47.

Submission #2
Subject: Sundial Bridge - CDFG - GGSA

- ✓ Ecosystem Restoration Program Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta, Sacramento Valley and San Joaquin Valley Regions, CDFW, USFWS and NMFS, May 2014
<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=87585>
- ✓ Potential Effects of Artificial Light from the Sundial Bridge on Juvenile Chinook Salmon Migratory Behavior and Predation by Predatory Fishes in the Sacramento River, Redding, Shasta County By Andrew Jensen, August 6, 2012
URL = none at this time
- ✓ State wildlife officials say Sundial Bridge lighting may be hurting salmon, by Damon Arthur, Feb 21, 2013
Record Searchlight [redding.com](http://www.redding.com)
URL = <http://www.redding.com/news/state-wildlife-officials-say-sundial-bridge-may>
- ✓ Lights on the river kill salmon, by John McManus, May 5, 2013 The Record Searchlight Redding Ca. [redding.com](http://www.redding.com)
URL = <http://www.redding.com/opinion/john-mcmanus-lights-on-the-river-kill-salmon>
- ✓ Golden Gate Salmon Association, Golden Gate Salmon Rebuilding Plan, Project B.6 Eliminate or Reduce Lighting at In-River Structures, Dec 2013
URL = http://www.ggsalmon.org/salmonplan/GGSA_Salmon_Plan.pdf

Ecosystem Restoration Program

Conservation Strategy for Restoration

of the

Sacramento-San Joaquin Delta, Sacramento Valley and San Joaquin Valley Regions



May 2014



Additionally, assessment of the impacts from light sources along the Sacramento River which lead to increased predation on juvenile salmonids is also needed. A notable example is the Sundial Bridge in Redding, which uses numerous floodlights that illuminate the Sacramento River all night, year round. Approximately 80 percent of the winter-run Chinook salmon population in the state spawn upstream of the bridge and the out-migrating juveniles must pass through the lighted portion of the river below the bridge and face predators. Studies in Washington State have found lighted portions of streams have significantly higher predation rates on juvenile fish. Downstream of the Sundial Bridge, there are several other light sources ranging from highway bridges to lighted water intake structures. These should all be evaluated and recommendations should be developed to fix identified problems.

Conservation actions will include coordination of protection, enhancement, and restoration of occupied and historic Central Valley salmon habitats with other federal, state, and regional programs. These efforts will include implementation of measures in the restoration plan for the AFRP, the Central Valley Salmon and Steelhead Recovery Plan and applicable CDFW management measures; appropriate operation of hatcheries such that natural populations are not threatened; management of fish passage to reduce predation on juveniles and increase their survival; improved export flows to improve conditions for upstream migration of adults; and operation of physical barriers consistent with achieving recovery goals.

Steelhead. Steelhead (*O. mykiss*) depend on essentially all habitats of the Sacramento River system: the main channel for migrating between the ocean and upstream spawning and rearing areas and the tributaries for spawning and rearing. The construction of low elevation dams on major tributaries of the Sacramento River has denied steelhead access to most of their historical spawning and rearing habitats in upstream areas. See full write-up in Delta species section.

Conservation actions will include coordination of protection, enhancement, and restoration of occupied and historic Central Valley steelhead habitats with other federal, state, and regional programs; implementation of measures in the restoration plan for the AFRP, the Central Valley Salmon and Steelhead Recovery Plan and applicable CDFW management measures; and the minimization of flow fluctuations to reduce or avoid stranding of juveniles.

Green and White Sturgeon. Sturgeons are native anadromous fish that inhabit both salt water and freshwater and tolerate a wide range of salinity concentrations. Spawning occurs in larger rivers upstream of the Delta. White sturgeon rear in the Sacramento-San Joaquin estuary and spawn in the Sacramento and San Joaquin rivers and their major tributaries. Green sturgeon (*Acipenser medirostris*) are an at-risk species native to the Sacramento River, yet little is known about the habitat needs of this species and its response to restoration. The ERP funded research to conduct telemetric, physiological, reproductive, and genetic studies to provide State and Federal agencies such as the ERP Implementing Agencies with information on the size of the population and its critical habitat within the Sacramento-San Joaquin watershed. This



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Potential Effects of Artificial Light from the Sundial Bridge on Juvenile Chinook Salmon Migratory Behavior and Predation by Predatory Fishes in the Sacramento River, Redding, Shasta County

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August 6, 2012

This white paper is being prepared in response to the concern within the Department regarding the artificial night lighting on the Sundial Bridge (Bridge), and the potential effects the lighting may have on juvenile Chinook salmon (*Oncorhynchus tshawytscha*) migration and rates of predation. The purpose of this white paper is to provide a brief overview of the key aspects of the Bridge, outline some of the potential effects artificial night lighting may have on biological organisms (with an emphasis on salmonids), highlight some of the research that has been performed to assess impacts of artificial light, provide some avoidance and minimization measures, highlight the need for future research, and to provide a starting point for future discussions between the resource agencies and the City of Redding.

The Bridge, designed by renowned Spanish architect Santiago Calatrava, is a cantilever spar cable-stayed bridge for bicycle and pedestrian access that spans the Sacramento River in Redding, Shasta County, California. The Bridge is suspended by steel cables from a single 217-foot tall pylon and spans more than 700 feet across the river without touching the water, which was a design criterion to help protect the salmon spawning areas in the vicinity of the Bridge. The Bridge is 23 feet wide and weighs more than three million pounds (Saflex 2009). The construction on the Bridge began in 1999 was completed in 2004, officially opening on July 4, 2004.

Calatrava's design called for a pedestrian walkway of nonskid glass that at night would be illuminated from underneath by 210 lights, creating an ethereal effect (Via 2004). At night, the laminated glass deck is illuminated from underneath with 1/3 of the lights pointing downstream, 1/3 facing upstream, and the remaining 1/3 facing up towards the Bridge deck (Saflex 2009). The result is that from dusk to dawn the Bridge and the Sacramento River in the vicinity of the Bridge are illuminated (Attachment 1). While the Bridge is undoubtedly an architectural masterpiece, a local icon, a major tourist attraction, and has been designed to be environmentally sensitive in many ways, the night time lighting of the Bridge and Sacramento River may be causing detrimental effects to salmon populations that spawn and rear upstream and in the vicinity of the Bridge.

Natural light plays a fundamental role in the biology of organisms. It is important to consider whether artificial illumination outside of the normal circadian cycle affects organisms (Rondorf et al. 2010). Artificial light has the potential to disrupt the biology of many species (Royal Commission 2009). Rich and Longcore (2006) concluded that artificial night lighting may alter the spatial distribution, diel movements, demography, and overwintering success of some freshwater organisms. Light is one of the most potent agents interacting with our biological systems. Biological responses to light include phototropism and stimulation of hormone production, including the fine tuning of cyclical changes. The intensity, spectral quality, duration and periodicity of exposure to light affect the biochemistry, physiology, and behavior of organisms. Wherever artificial light floods into the natural world there is a potential for some aspect of life and its biological rhythms such as migration, reproduction, and feeding, to be affected (Royal Commission 2009). Artificial lighting that is present on over-water structures may disorient migrating juvenile salmonids, compromise their ability to avoid nocturnal predators, and affect the photosynthesis of aquatic vegetation (Rondorf et al. 2010).

The issue of potential biological impacts from artificial lighting of the Bridge was acknowledged and addressed during the environmental review and approval process (City of Redding 2000). Pursuant to the California Environmental Quality Act (CEQA) and the CEQA Guidelines, mitigation measures were identified and included in the *Mitigation Monitoring Program for the Pedestrian Bridge at Turtle Bay, Redding, California, Addendum to the Mitigated Negative Declaration (Use Permit 43-97, SCH 1995023013)*. Specifically, *Biological Resources BR-9 – Fisheries Impacts Due to Lighting of Surface Waters*, states that "Artificial flood lighting along surface waters is known to attract fry and juvenile salmonids, and other predator fish species." Mitigation measure *BR-9m*, states "No direct lighting onto the river shall occur at either approach or from the bridge." The City of Redding Community Services Department is responsible for monitoring and implementing the above mitigation measure.

Due to the complex nature of light in water, fish have evolved well-developed and highly specialized eyes (Rondorf et al. 2010). The *Oncorhynchus spp.* eye contains a large number of rods and cones, showing that it is adapted for vision in both bright and dim light (Brett and Ali 1958). When light levels change abruptly, the eye has to adapt quickly in order to distinguish objects in the background (Dowling 1967). When the introduced light is bright, the eye will not respond to a dim light, which it may have detected under lower light conditions (Simenstad et al. 1999), making it difficult for juvenile salmon to visually detect predators in the areas beyond the brightly lit area.

Scientific research on the effects of artificial lighting on salmonid populations has been limited, thus the overall impacts of such lighting is poorly understood. However, the studies that have been conducted to address this issue, have illustrated results which indicate that increased light intensity appears to slow or stop out-migrating salmon fry, and increase feeding patterns, making them more vulnerable to predation (McDonald 1960; Patten 1971; Ginetz and Larkin 1976; Tabor et al. 2004). Salmonid fry presumably reduce their vulnerability to predators by emigrating at night and selecting areas of the river channel with the fastest current velocities (McDonald 1960). Juvenile salmonids feed primarily on drifting invertebrates during sunrise and dusk, but do not feed during complete darkness (Brett and Groot 1963; Fraser et al. 1997). Therefore the presence of artificial lighting and illumination of the water may facilitate juvenile salmonid feeding, which in turn may increase their vulnerability to predation at night (Rondorf et al. 2010). Ginetz and Larkin (1976) found that predation of sockeye salmon (*Oncorhynchus nerka*) fry by rainbow trout increased as light intensity increased in the artificial streams they used during their research. According to Skykeepers (2008), research shows that artificial light on newly hatched salmon causes vision problems and reduced survival rates. In addition, nighttime lighting of the Bridge presents a possible predator trap for juvenile salmonids migrating downstream from spawning and rearing areas above the Bridge. Celedonia et al. (2011) found that at night, Chinook salmon were attracted to areas where street lamps on a bridge cast light into the water, increasing their risk to predation, and that any negative consequences to Chinook salmon might be minimized by reducing the intensity of light reaching the water surface. Tabor et al. (2004) found that in the Cedar River in Washington, predation of migrating sockeye salmon fry increased as a result of

artificial nighttime lighting, and that the lighting may be one of the factors in the overall decline of the Cedar River sockeye salmon population. With no predators present, the sockeye fry migrated through the river at a faster rate under complete darkness (0.001 Lux) than in the other two light intensities assessed (1.08 and 5.4 Lux).

On June 14, 2012, I performed light measurements at several locations under and around the Bridge, as well as in an adjacent parking lot, using an EXTECH Light Meter (Model LT300). All measurements were taken in Lux, an International System of Units unit of illuminance and luminous emittance. One Lux is equal to one lumen per square meter (Wikipedia 2012). In addition, I took light measurements under the Cypress Road Bridge as a comparison of a bridge spanning the river that has artificial lighting associated with it. The Cypress Road Bridge is located a couple of miles downstream of the Sundial Bridge. Skies were clear and there was no moon visible during the collection of light intensities.

For reference, a moonless clear night sky would result in surface illumination levels of 0.002 lux, a full moon on a clear night would result in 0.27 lux, family living room lights result in 50 lux, and a dark overcast day would be 100 lux (Wikipedia 2012).

Below are the results I obtained:

- Location #1: Located directly under the Sundial Bridge on the south side of the Bridge, taken at the edge of water of the Sacramento River.
 - Time: 10:12 P.M.
 - Result: 25.55 lux
- Location #2: Located approximately 100-feet downstream of the Sundial Bridge on the south side of the Sacramento River, at the water's edge.
 - Time: 10:22 P.M.
 - Result: 1.34 lux
- Location #3: Located approximately 400-feet downstream of the Sundial Bridge on the south side of the Sacramento River. Minimal artificial lighting present, although a minor amount filtering through the trees from the Turtle Bay Museum.
 - Time: 10:31 P.M.
 - Result: 0.01 lux
- Location #4: Located in the Sundial Bridge Parking Lot, in close proximity to a street light, however, not directly beneath it.
 - Time: 10:38 P.M.
 - Result: 6.95 lux
- Location #5: Located in the Turtle Bay Parking Lot directly under a street lamp.
 - Time: 10:45 P.M.
 - Result: 19.56 lux
- Location #6: Located under the Cypress Road Bridge, approximately 2 miles downstream of the Sundial Bridge, taken near the water's edge on the west side of the river. The Cypress Bridge has some artificial lighting shining down into the river; however the lighting appeared much less intense than the Sundial Bridge lighting.
 - Time: 10:55 P.M.
 - Result at downstream side of bridge: 3.47 lux
 - Result at upstream side of bridge: 7.14 lux

In the Sacramento River and tributaries such as Clear Creek, studies have been conducted to assess the seasonal, spatial and diel distribution patterns of juvenile Chinook salmon, M. Brown, U.S. Fish and Wildlife Service (personal communication April 16, 2012; Gaines and Martin 2002). The U.S. Fish and Wildlife Service has been assessing the diurnal timing of juvenile Chinook out-migration in Clear Creek, with 14 trials/studies conducted about every other week from December 2011 through June 2012, and have found that 80% of the fish caught in the rotary-screw trap (RST) entered the RST in a five hour block of time from 1800 to 2300. During this same time period, sunset times ranged from 1645 on December 1, 2011 to 2034 on June 30, 2012 (Calendar-365). The peak of the migration took place from 2000 to 2100. Similar results were observed in two trials that took place in May and June 2011, M. Brown (personal communication April 16, 2012; July 5, 2012). On the Mainstem Sacramento River, Gaines and Martin (2002) found that relative abundance of Chinook salmon fry and pre-smolt/smolt (all runs combined) captured by RST's below Red Bluff Diversion Dam was significantly greater during nocturnal periods. They found that the same results held true for all sizes of rainbow trout (*Oncorhynchus mykiss*) combined, a potential predator species of the juvenile Chinook. Based on these studies, it appears most juvenile Chinook are out-migrating under the cover of darkness, thus artificial lighting could delay or inhibit out-migration and increase predation. McDonald (1960) was able to completely stop the nightly movement of sockeye salmon fry with artificial lighting kept on all night at levels of 30 lux. Tabor et al. (2004) found that if sockeye salmon fry encountered lighted areas, many held their position in low-velocity water, and the migration was delayed. They also found that the fry resumed their migration shortly after the lights were turned off.

Tabor et al. assessed several sources of artificial lighting, including laboratory experiments that included artificial streams, experimental field trials consisting of constructed artificial lighting, and existing sites, such as the Renton Library and the I-405 bridge. Both the library and the bridge span the entire width of the Cedar River, and both structures have several sources of artificial light that illuminate the river, similar to the current conditions of the Sundial Bridge. In addition, sampling was conducted in 1998 and again in 2001 after artificial lights had been shielded and light intensities along the river had been substantially reduced from 9.7-21.5 lux (1998) to 0.14-0.32 lux (2001). Overall, the results from Tabor et al. (2004) suggest that reductions in light intensity can be beneficial for emigrating juvenile salmonids and that the impact of lighting should be considered for any future or existing projects.

Chinook salmon populations in the main-stem Sacramento River have fluctuated greatly in the last decade. Table 1 provides a summary of Chinook salmon run sizes in the main-stem Sacramento River from 2000 through 2011. Currently, three separate Chinook runs migrate to, spawn, and reside as juveniles in the Redding area, both above and below the Bridge. The three runs (known by their timing as they pass San Francisco) are late-fall, winter and fall-run. Winter-Run Chinook salmon are currently only found in the Sacramento River near Redding, and the majority of the population spawns above the Bridge. Winter-Run are currently federally and state listed as Endangered, which makes them the intense focus of fisheries and water agencies, at both a state and federal level, since their juvenile and adult numbers determine harvest regulations for both sport and commercial fishers, as well as guiding agricultural and urban water use transfer limitations, D. Killam (personal communication June 29, 2012). Chinook salmon in this area typically rear for up to a year near the location where they emerged from their redd. They then migrate to the ocean, and return to the same area as adults in 2 to 5 years (typically in 3 years). Understanding this "life history" is important because if the lights from the bridge were impacting juvenile salmon survival, the effects would typically not be apparent until 3 years after juvenile downstream migration occurs, once the juveniles return to the Redding area as adults to spawn. An example of this is if the Bridge lights were first turned on in mid-2004 then the juveniles from 2003 would not have been impacted and would have returned in 2006. The juveniles from 2004 however could have been impacted, but they would have returned in 2007. For purposes of this discussion, populations of adult Chinook salmon from mid-2007 to the present day could have reduced numbers as a result of lighting impacts at the Sundial Bridge.

Table 1. Adult populations of Chinook salmon runs in the main-stem Sacramento River for years 2000 to 2011, (from Princeton to Keswick Dam). Grey area indicates populations whose juveniles could not have been impacted by Sundial Bridge lighting.

Year	Total Main-stem Sac River Population			% Spawning above Sundial Brg.		
	Late-fall	Winter	Fall-Run	Late-fall	Winter	Fall-Run
2000	8702	1,350	96,688	0%	6%	6%
2001	19276	8,224	75,168	26%	35%	7%
2002	36004	7,441	65,690	27%	49%	9%
2003	5532	8,218	89,229	58%	66%	6%
2004	8884	7,869	43,604	84%	16%	10%
2005	10603	15,839	57,012	47%	52%	27%
2006	10175	17,290	55,468	35%	35%	14%
2007	15340	2,541	17,061	57%	52%	20%
2008	3979	2,830	24,743	48%	51%	1%
2009	3424	4,537	5,827	73%	16%	25%
2010	4365	1,596	16,372	72%	48%	16%
2011	3725	824	11,592	73%	6%	34%

As shown in Table 1 above, in 2004, when the Bridge was completed the population was 7,869. In 2005 and 2006 the population topped out at 15,839 and 17,290, respectively. In 2007, three years after the Bridge was completed and night lighting first occurred in this section of river, which is the typical return interval for Chinook

salmon (2004 Year Class), the population had declined to 2,541 fish. In 2008 and 2009, the years in which the 2005 and 2006 year class fish would be expected to return, the populations were 2,830 and 4,537, respectively.

The causes of the population declines since 2007 can be many, and no one cause is likely solely responsible for the declines. However, with the correlation of timing between the completion of the Bridge and the corresponding declines in returning adults, and the fact that research has demonstrated artificial light has a detrimental effect on emigrating juvenile salmonids, this issue warrants further discussion to find possible solutions to avoid and minimize future impacts. Such measures may include changing the position of specific lights to face up rather than out and down towards the river, install shields on some of the lights, turn off some of the lights if not needed, change the type of light used, etc. In addition, it may be deemed necessary to conduct some site specific studies in the vicinity of the Bridge, to help determine the level of biological response occurring due to the nighttime illumination from the Bridge.

In summary, Department staff will propose to meet with other resource agencies such as NOAA Fisheries and the U.S. Fish and Wildlife Service to discuss these issues, determine an appropriate course of action, and outline potential minimization measures that could be implemented to reduce potential impacts from the artificial lighting of the Bridge. Additional meetings should then be conducted with the City of Redding to agree on an appropriate approach. As stated above, The City of Redding is responsible for implementation of the *Mitigation Monitoring Program – Pedestrian Bridge at Turtle Bay*, specifically mitigation measure *BR-9 – Fisheries Impacts Due to Lighting of Surface Waters*. Tabor et al. (2004) states that when attempting to reduce artificial light, efforts should be made to keep levels below 0.1 lux as a prudent management goal. The recommendations of The Royal Commission (2009) regarding artificial lighting, state that artificial light should only be used at times when the benefits are needed, and that lighting standards should require the provision of light at an intensity no greater than the minimum necessary to deliver the intended benefits. In addition, the light should be directed at only those areas which are intended to be illuminated. Therefore, taking this type of approach, we should be able to develop some criteria for lighting that would provide the necessary level of safety for pedestrians using the bridge during the nighttime hours, lighting of the Bridge for its incredible architecture, while providing a necessary level of protection for migrating juvenile Chinook salmon, as well as the overall aquatic ecosystem in the vicinity of the Bridge.

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Attachment 1 – Photos of Sundial Bridge



Photo 1. Sundial Bridge under construction.



Photo 2. Sundial Bridge information sign showing hours of operation.



Photo 3. View of the Sundial Bridge from downstream.



Photo 4 – Sundial Bridge lit up at dusk, with lights pointing down towards the Sacramento River, in a downstream direction.



Photo 5. Nighttime lighting of the Sundial Bridge, resulting in illumination of the Sacramento River across its entire width.



Photo 6. Nighttime lighting of the Sundial Bridge with significant illumination of the Sacramento River.



Photo 7. View of the Sundial Bridge under-deck lights, with one facing down towards the river and one facing up towards the bridge deck.



Photo 8. Looking down into the Sacramento River from the Sundial Bridge at 7:12 P.M., into approximately 5-8 feet of water, with a dead adult Chinook salmon visible on the bottom. It was completely dark outside when the photo was taken, thus the illumination of the river bottom is solely from the lights on the bridge.

State wildlife officials say Sundial Bridge lighting may be hurting salmon

BY: Damon Arthur

POSTED: 10:00 PM, Feb 21, 2013

TAG: [local \(/topic/local\)](#) | [sacramento river \(/topic/sacramento+river\)](#) | [kurt starman \(/topic/kurt+starman\)](#)

Redding's Sundial Bridge may be bringing about the demise of endangered winter-run Chinook salmon.

Since the bridge opened to walkers and bicycle riders in 2004, the number of winter-run Chinook salmon returning to spawn in the Sacramento River has plummeted from over 15,000 fish in 2005 to 824 in 2011.

The lights under the pedestrian bridge may be one of the reasons why the number of salmon is declining, according to the state Department of Fish and Wildlife, which is studying the effects of the bridge lights.

"Intense levels of artificial light slow or stop juvenile migration of salmon" on their annual trek to the Pacific Ocean, said Andrew Jensen, a DFW staff environmental scientist.

And when the young fish stop in the water under the lights, larger fish, such as rainbow trout, are there to eat them, Jensen said. Other bridges over the Sacramento River in Redding also may have lighting underneath that is disrupting fish migration, he said.

The DFW and the city of Redding have been working together to test different light levels under the Sundial Bridge, he said. Light levels under the bridge deck this week were less than half of what they were before the testing began.

Redding City Manager Kurt Starman said the city is interested in working with the DFW on finding out whether the lights are hurting fish. But whether the lights were harming young salmon was still a "supposition" and further studies were needed, he said.

"I'm not aware of any conclusions or facts to support that," Starman said of the DFW's concerns.

Years before the bridge was built, environmental impact reports noted that light from the bridge shining on the water would hurt fish.

John Oldham, the city's environmental compliance officer, said because of the lighting concern, lamps under the bridge were pointed up to avoid light shining directly on the water.

Some of the lights may have inadvertently been pushed down or slipped down over the years, Oldham said.

There were 240 lights installed under the bridge and they were aimed into the air, said Bob Morrison Jr., the engineer who supervised construction on the bridge.

"There are no lights that shine down on the water," Morrison said. He said the fish may be seeing the light that is pointing into the air.

In an August 2012 report Jensen wrote on the bridge lighting. From dusk to dawn, one third of the lights were pointed up, another third were pointed upstream and another third were pointed downstream, the report says.

The light is apparently reflecting off the translucent panels on the bridge deck and back toward the water, Jensen said.

That light could be influencing how the young salmon migrate to the ocean. About 60 percent of the winter-run salmon, listed as an endangered species under California and federal law, spawn upstream of the Sundial Bridge.

After the salmon eggs hatch in the river and the young salmon swim to the ocean they are preyed upon by larger fish, Jensen said. He said the juvenile salmon migrate at night. But when they encounter bright light on the water it stops them at the light. The light also attracts bugs the young salmon like to feed on, Jensen said. But again, when the juveniles stop to feed on the bugs, the bigger fish can prey on them, he said.

Jensen said he found other scientific studies that back up the DFW's claim that the lights could be hurting young salmon.

In June, the DFW took nighttime measurements of the lighting under the bridge at the water's edge and found it at 25.55 lux, a measurement of illumination per square meter. One hundred feet downstream, the light was 1.34 lux. Light levels near a lamp in the Sundial Bridge parking lot measured 6.95 lux, according to Jensen's report.

City officials have turned down the light under the bridge and it's currently about 11 lux, he said. To help the fish, the lighting level on the water may need to be reduced a level ranging from 1.5 to 3 lux, he said.

Turning down or turning off some of the lights may not be the only solution, Jensen said. The city could place shields over the lights or use shade cloth, or even a different type of light, he said.

Jensen said the DFW is interested in working with the city to solve the problem because of the Sundial Bridge's popularity and because the lighting is part of the bridge's appeal.

Lights on the river kill salmon

By John McManus

Staff Reports

Sunday, May 5, 2013

This may not sound intuitive, but many brightly lit bridges, docks and marinas along the Sacramento River are causing the deaths of untold numbers of young salmon. Some of these structures, like bridges, have to be lit so drivers can see the roadway, but there's no need to light up the water below. Reducing the lights' brightness, or redirecting them so they don't light up the water, is all that's needed.

Here's the problem. Baby salmon get eaten by most fish bigger than they are. Survival is tough. The baby salmon have pretty good eyesight, but their eyes work in either day or night mode, not both at the same time. They eat during the day and when they travel, they do it at night to minimize detection. When they swim under lit bridges at night, their eyes shift from night to daytime mode. So does their behavior. They slow down and start thinking about food. This is when they become very vulnerable to bigger fish lurking in the shadows.

Scientists have been able to bring migrating baby salmon to a stop by turning on the lights. Officials knew this would be a problem with Redding's Sundial Bridge. When Redding got a permit to build the bridge, one of the conditions said, "No direct lighting onto the river shall occur at either approach or from the bridge." Somehow this got overlooked when the bridge was built. Some lights underneath the bridge were pointed down and lit the river. Recently the city of Redding has been responsive to the problem and has taken steps to fix it, which salmon advocates very much appreciate. But the problem persists at other bridges, marinas, docks and water-intake structures up and down the river.

Among the baby salmon being gobbled up due to lights on the water are some on the federal endangered species list, including winter-run salmon. This creates a big problem for fishing communities on the coast and elsewhere that are seeing their fishing seasons restricted, at great loss, to avoid contact with winter-run fish. Water diverters in the Delta also face restrictions in an effort to protect the winter run.

Experts have pointed to a possible correlation between a recent steep decline in winter-run salmon and the Sundial Bridge's lights.

Before the effects of the bridge's lights on salmon kicked in, winter-run returns hit a high of over 17,000 in 2006. Once the effect of the lights was felt, winter-run salmon numbers dropped to 2,541 fish. They haven't recovered since. Others have pointed to a steep increase in Delta water diversion as a more likely cause of the winter-run decline, and multiple factors can't be ruled out.

Easy steps can be taken to make bridges and other structures more salmon friendly.

Changing the position of specific lights to face up rather than toward the river, installing shields, turning lights off when they're not needed, and changing the type of light used are a few.

Losing winter run, or any juvenile salmon, due to misdirected lighting is something that should be addressed because the fix is so simple. Those of us downstream who rely on salmon for a living are most appreciative of any steps taken in this direction.

John McManus is the executive director of the Golden Gate Salmon Association.



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Project B.6 Eliminate or Reduce Lighting at In-River Structures

Bright lights shining into the water at night from bridges and other structures in the Sacramento River and its tributaries create a significant predation hazard for salmon fry and smolts. These fish tend to move at night when they can avoid predators. When they encounter bright lights they become disoriented and are easy predator prey.

One of the prominent problem bridges was the Sundial foot bridge which crosses the Sacramento River in Redding. Lowering the very bright lights on the bridge was taken up as a project by the regional office of the California Department of Fish and Wildlife. The City of Redding cooperated and the intensity of the lights has been lowered significantly. They have also been redirected away from the water. The next step will be the installation of lower intensity LED lights which will lower the level more plus save electricity. The City and CDFW are also working to reduce lights on other nearby bridges. This project is near complete and will save thousands of smolts.



The two pictures on the left show the bridge before the lights were lowered and the picture on the right shows it after they were lowered.

Photos by Andrew Jensen, California Dept. of Fish and Wildlife

[More Detail](#)





Welcome to the Golden Gate Salmon Rebuilding Plan



Submission #__
Subject: Columbia River Crossing: Biological Assessment
CRC Biological Assessment - June 2010 - Section 6 (1 of 2) Page 6-48 and 6-49
http://www.columbiarivercrossing.org/FileLibrary/Biological_Assessment_Opinion/CRC_BA_12_Section_6_1of2.pdf

1 6.1.4.1 General Effects of Artificial Lighting on Fish

2 Artificial light sources associated with overwater structures or construction activities may attract
3 fish. Because salmon rely on vision for capturing prey, the artificial lights may improve both
4 prey detection and predator avoidance (Tabor et al. 1998, as cited in Carrasquero 2001). During a
5 study of the Columbia River at Bonneville Pool, Collis et al. (1995) observed that juvenile
6 salmon were attracted to work lights directed at the water surface. In Lake Washington, juvenile
7 Chinook have been observed congregating at night near streetlights on the SR 520 bridge
8 (Celedonia et al. 2008). Tabor et al. (2004) observed sockeye fry in the Cedar River, noting that
9 they were significantly more abundant under city street lights than at nearby sites that were not
10 illuminated. Light levels as low as 0.22 lux (0.020 foot candle) appeared to influence fry
11 behavior. In one location, turning off the streetlights resulted in a significant decrease in the
12 number of sockeye fry present.

13 Artificial lights can create sharp boundaries between dark and light areas under water. This, in
14 turn, may cause juvenile fish to become disoriented or avoid crossing the light-dark interface, as
15 outlined in detail in Section 6.1.3.1. Williams and Thom (2001) noted that artificial lighting on
16 docks may change nighttime movement patterns in juvenile salmon. Numerous other studies
17 (Fields 1966, Prinslow et al. 1979, Weitkamp 1982, Ratte and Salo 1985, Pentec 1997, Taylor
18 and Willey 1997, and Johnson et al. 1998; as cited in Southard et al. 2007) corroborate these
19 findings, noting behavioral changes in juvenile salmon in response to artificial lighting.
20 McDonald (1960, as cited in Tabor et al. 2004) found that sockeye fry will stop swimming
21 downstream upon encountering artificial lighting, and was able to completely stop nightly
22 migration of sockeye salmon fry with artificial lighting kept on all night at 30 lux (2.8 foot
23 candles). A USFWS (1998) literature review noted that sockeye fry moved through experimental
24 streams more quickly in complete darkness than under bright lights (Tabor et al. 1998). Increased
25 light appeared to inhibit migration of sockeye fry, with significant effects to migration when
26 light levels reached 2.0 lumens/ft² (2.0 foot candles). A later study (Tabor et al. 2004)
27 corroborated the finding that fewer sockeye moved through illuminated artificial streams than in
28 darkness, and those that did move, moved more slowly. In this study, light intensity levels from
29 1.08 to 5.40 lux (0.1 to 0.5 foot candle) appeared to inhibit migration. The same study noted that
30 the delay in outmigration in sockeye fry increased their vulnerability to predation.

31 Another USFWS study (Tabor and Piaskowski 2001) observed juvenile Chinook in nearshore
32 habitat in Lake Washington, noting that individuals became active when light levels reached
33 0.08 to 0.21 foot candle and were scarce in the study area when light levels were between
34 2.2 to 6.5 foot candles. A review of the impact of ferry terminals on juvenile migration in Puget
35 Sound (Simenstad and Nightingale 1999) cites Ali (1958, 1960, and 1962) as stating that light is
36 tremendously important for numerous life functions of chum, coho, sockeye, and pink salmon,
37 noting that feeding, minimum prey capture, and schooling are dependent on light levels lower
38 than 10⁻⁴ foot candles (similar to a clear, moonless night) and that maximum prey capture for
39 chum and pink fry occurs when the light level is 1.0 foot candle (similar to light levels at dawn
40 and dusk).

41 Artificial light sources may provide an advantage to predators such as smallmouth bass,
42 largemouth bass, northern pikeminnow, and salmonids. Rainbow trout predation on sockeye fry
43 in artificial streams increased with increased lighting at levels of less than 1.1 lux (Ginetz and
44 Larkin 1976, as cited in Tabor et al. 2004). Northern pikeminnow are attracted to areas where
45 juvenile salmonids congregate, such as hatchery release sites and dams (Collis et al. 1995;

1 Beamesderfer and Rieman 1991). If light sources attract congregations of juvenile salmonids,
2 this could cause an increase in predation by northern pikeminnow. Celedonia et al. (2008) found
3 that smallmouth bass may feed at night in the vicinity of artificial light or under moonlight.
4 Largemouth bass have been shown to forage efficiently at light levels ranging from low-intensity
5 daylight to full moonlight, with less foraging at light levels equivalent to a starlit, moonless night
6 (McMahon and Holanov 1995).

7 Tabor et al. (2004) observed the effect of light intensity on cottid predation of sockeye fry in
8 artificial streams, noting that cottids consumed 45 percent of the fry under intense illumination
9 (5.4 lux or 0.50 foot candle), 28 percent under dim light (0.22 lux or 0.020 foot candle), and
10 5 percent in complete darkness (0 lux or 0 foot candle). The study also observed that fewer fry
11 emigrated in illuminated streams and did so at a faster rate when predators were present than in
12 lighted streams where predators were not present, indicating that the presence of predators may
13 inhibit migration in some individuals. In a field study in the Cedar River, Washington, Tabor et
14 al. (2004) further noted that the number of shoreline fry and rates of predation by cottids
15 increased with an increase in light levels. At one site, shielding the lights to levels of
16 0.1 to 0.32 lux (0.013 to 0.030 foot candle) substantially reduced predation.

17 The literature is not in complete agreement about light levels that are likely to impede migration
18 or increase predation on juvenile fish. However, data from Tabor et al. (2004) may present a
19 worst-case scenario. That is, light levels as low as 0.22 lux (0.20 foot candle) may delay
20 migration or increase predation on juvenile salmonids.

21 **6.1.4.2 Effects of Lighting on Fish in the CRC Action Area**

22 The project will install both temporary and permanent lighting.

23 **Temporary Lighting**

24 Temporary overwater lighting sources will include the cofferdams, barges, work
25 platforms/bridges, oscillator platforms, and tower cranes. Figure 6-17, Figure 6-18, and Figure
26 6-19 show the locations and sequencing of temporary structures requiring artificial lighting in the
27 work area. Temporary lighting will not be uniform over all of the in-water construction years.
28 During the Columbia River in-water construction period, temporary lighting will be limited to
29 the first three pier complexes during the first year, expand to all six in the second, and taper off
30 to three or fewer during the last 2 years (Figure 6-17). In North Portland Harbor, temporary
31 lighting will be distributed more or less evenly over the first 2 years of the in-water construction
32 periods with illumination-producing structures concentrated in the last in-water construction year
33 (Figure 6-18). Temporary lighting will be distributed evenly across the Columbia River in-water
34 demolition period (Figure 6-19).

35 The barges and temporary in-water structures will cast light at the water surface during
36 construction and demolition in the Columbia River and North Portland Harbor. At this stage in
37 the project design, the intensity of light likely to be cast on the water surface is not known.
38 However, to the extent practicable, the project will implement conservation measures that
39 minimize the effects of lighting on fish. Measures may include using directional lighting with
40 shielded luminaires to control glare and to direct light onto work areas instead of surface waters.



October 9, 2014

Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department
300 Richards Blvd, Third Floor
Sacramento CA 95811
DMahaffey@cityofsacramento.org

RE: I Street Bridge Replacement Project (SAC201401517)

Ms. Mahaffey,

The Sacramento Metropolitan Air Quality Management District (The District) thanks the City of Sacramento for the opportunity to comment on the proposed project to replace the I Street Bridge with a multi-modal facility. The District is required by law to "represent the citizens of the Sacramento district in influencing the decisions of other public and private agencies whose actions may have an adverse impact on air quality within the Sacramento district."¹ We offer our comments in that spirit.

Construction Emissions

Construction of the project may result in significant emissions of criteria pollutants and precursors of primary concern. These emissions should be discussed, quantified, and disclosed in the manner described in Chapter 3 of the District's "CEQA Guide to Air Quality Assessment."² Should the project exceed District thresholds, we recommend that construction mitigation be adopted as part of the mitigation monitoring and reporting plan (Attachment).

With respect to greenhouse gas emissions generated from the construction of the project, these emissions should be discussed, quantified, and disclosed in the manner described in Chapter 6 of the District's "CEQA Guide to Air Quality Assessment." Per the guidance, the District recommends that GHG emissions be minimized during the construction phase utilizing the District's "Guidance for Construction GHG Emissions Reductions."³

¹ California Health and Safety Code §40961

² <http://www.airquality.org/ceqa/ceqaguideupdate.shtml>

³ <http://www.airquality.org/ceqa/ceqaguideupdate/Ch6ConstructionMitMeasures.pdf>

Consistency with existing Air Quality Management Plan

A portion of the project is located within the Railyards Specific Plan, which has construction mitigation and an operational air quality mitigation plan. All activity within the Railyards Specific Plan must be consistent with this mitigation, including paying the per acre fee on all land disturbed and the emission reduction requirements outlined in the mitigation monitoring and reporting plan.

Greenhouse Gas Emissions

Operation of the project may result in an increase in Greenhouse Gas emissions. These emissions should be discussed, quantified, and disclosed in the manner described in Chapter 6 of the District's "CEQA Guide to Air Quality Assessment." The proponents should also discuss the project's consistency with existing Greenhouse Gas reduction plans, such as the Metropolitan Transportation Plan/Sustainable Communities Strategy, the California Air Resources Board Scoping Plan and the City of Sacramento Climate Action Plan.

General comments

To summarize, the District requests that the City consider construction and operational emissions, and ensure compliance with the Railyards Specific Plan mitigation monitoring and reporting plan.

The SMAQMD thanks the City of Sacramento for the opportunity to comment on this project. If you have additional questions or require further assistance, please contact me at pphilley@airquality.org or (916) 874-4882.

Sincerely,



Paul Philley, AICP
Associate Air Quality Planner/Analyst
Sacramento Metropolitan Air Quality Management District
777 12th Street, 3rd Floor
Sacramento, CA 95814

Attachment: Construction Mitigation

Basic Construction Emission Control Practices

BASIC CONSTRUCTION EMISSION CONTROL PRACTICES

The following practices are considered feasible for controlling fugitive dust from a construction site. Control of fugitive dust is required by District Rule 403 and enforced by District staff.

- **Water all exposed surfaces two times daily. Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas, and access roads.**
- **Cover or maintain at least two feet of free board space on haul trucks transporting soil, sand, or other loose material on the site. Any haul trucks that would be traveling along freeways or major roadways should be covered.**
- **Use wet power vacuum street sweepers to remove any visible trackout mud or dirt onto adjacent public roads at least once a day. Use of dry power sweeping is prohibited.**
- **Limit vehicle speeds on unpaved roads to 15 miles per hour (mph).**
- **All roadways, driveways, sidewalks, parking lots to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.**

The following practices describe exhaust emission control from diesel powered fleets working at a construction site. California regulations limit idling from both on-road and off-road diesel powered equipment. The California Air Resources Board enforces the idling limitations.

- **Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes [required by California Code of Regulations, Title 13, sections 2449(d)(3) and 2485]. Provide clear signage that posts this requirement for workers at the entrances to the site.**

Although not required by local or state regulation, many construction companies have equipment inspection and maintenance programs to ensure work and fuel efficiencies.

- **Maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified mechanic and determine to be running in proper condition before it is operated.**

Lead agencies may add these emission control practices as Conditions of Approval (COA) or include in a Mitigation Monitoring and Reporting Program (MMRP).

ENHANCED EXHAUST CONTROL PRACTICES

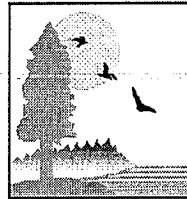
1. The project representative shall submit to the lead agency and District a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 horsepower, that will be used an aggregate of 40 or more hours during any portion of the construction project.
 - The inventory shall include the horsepower rating, engine model year, and projected hours of use for each piece of equipment.
 - The project representative shall provide the anticipated construction timeline including start date, and name and phone number of the project manager and on-site foreman.
 - This information shall be submitted at least 4 business days prior to the use of subject heavy-duty off-road equipment.
 - The District's [Equipment List](#) Form can be used to submit this information.
 - The inventory shall be updated and submitted monthly throughout the duration of the project, except that an inventory shall not be required for any 30-day period in which no construction activity occurs.
2. The project representative shall provide a plan for approval by the lead agency and District demonstrating that the heavy-duty off-road vehicles (50 horsepower or more) to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project wide fleet-average 20% NO_x reduction and 45% particulate reduction compared to the most recent California Air Resources Board (ARB) fleet average.
 - This plan shall be submitted in conjunction with the equipment inventory.
 - Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and/or other options as they become available.
 - The District's [Construction Mitigation Calculator](#) can be used to identify an equipment fleet that achieves this reduction.
3. The project representative shall ensure that emissions from all off-road diesel powered equipment used on the project site do not exceed 40% opacity for more than three minutes in any one hour.
 - Any equipment found to exceed 40 percent opacity (or Ringelmann 2.0) shall be repaired immediately.

Enhanced Exhaust Control Practices

- **Non-compliant equipment will be documented and a summary provided to the lead agency and District monthly.**
 - **A visual survey of all in-operation equipment shall be made at least weekly.**
 - **A monthly summary of the visual survey results shall be submitted throughout the duration of the project, except that the monthly summary shall not be required for any 30-day period in which no construction activity occurs. The monthly summary shall include the quantity and type of vehicles surveyed as well as the dates of each survey.**
- 4. The District and/or other officials may conduct periodic site inspections to determine compliance. Nothing in this mitigation shall supercede other District, state or federal rules or regulations.**

CALIFORNIA STATE LANDS COMMISSION

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Sacramento, CA 95825-8202



Established in 1938

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October 16, 2014

File Ref: SCH # 2014092069

Dana Mahaffey
City of Sacramento
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

**Subject: Notice of Preparation (NOP) for an Environmental Impact Report (EIR)
for the I Street Bridge Replacement Project, Sacramento and Yolo
County**

Dear Ms. Mahaffey:

The California State Lands Commission (CSLC) staff has reviewed the subject NOP for an EIR for the I Street Bridge Replacement Project (Project), which is being prepared by the city of Sacramento (City). The City, as a California public agency proposing to carry out the Project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The CSLC is a trustee agency for projects that could directly or indirectly affect sovereign lands and their accompanying Public Trust resources or uses. Additionally, because the Project involves work on sovereign lands, the CSLC will act as a responsible agency. CSLC staff requests that City consult with us on preparation of the Draft EIR as required by CEQA section 21153, subdivision (a), and the State CEQA Guidelines section 15086, subdivisions (a)(1) and (a)(2).

CSLC Jurisdiction and Public Trust Lands

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of

all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

After reviewing the information contained in the NOP, CSLC staff has determined the Project will be located along areas of the natural bed of the Sacramento River on State-owned sovereign land under the jurisdiction of the CSLC. Therefore, a lease from the CSLC will be required for the City to implement the Project on sovereign lands; please contact Wendy Hall (see contact information below) for further information about the extent of the CSLC's sovereign ownership and leasing requirements.

These comments are made without prejudice to any future assertion of State ownership or public rights, should circumstances change, or should additional information become available. This letter is not intended, nor should it be construed as a waiver or limitation of any right, title, or interest of the State of California in any lands under its jurisdiction.

Project Description

The City is proposing a new I Street Bridge to be constructed just north of the existing I Street Bridge, to fulfill improved access for waterfront uses and circulation between the cities of Sacramento and West Sacramento. The Project area is located in both the city of Sacramento and the city of West Sacramento, and the new bridge will cross the Sacramento River between the Sacramento Railyards and the West Sacramento Washington planned developments.

In 2011, the cities completed the Sacramento River Crossings Alternatives Study, which identified the purpose and need for new bridge crossings. The study concluded that a North Market crossing was needed to replace the I Street Bridge. The I Street Bridge is 100 years old, the lanes are too narrow to serve buses, there are no bicycle lanes, and sidewalks are too narrow to meet accessibility standards. The Project is expected to meet the objectives and needs of both cities as follows:

- Improve mobility for motorists, bicyclists and pedestrians;
- Promote economic development; and
- Provide improved access to the Sacramento River waterfront.

From the Project Description, CSLC staff understands that the Project would include the following components:

- A new bridge connecting C Street in West Sacramento to Railyards Boulevard in Sacramento for vehicle, bicycle, and pedestrian crossing;
- A moveable center span to allow passage of watercraft;
- New signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard, and the extension of C Street from the intersection of 3rd Street to the proposed bridge;

- Continuance of the existing I Street Bridge for railroad use only, with discontinuance of vehicle and pedestrian access; and
- Demolition of existing roadway approach structures for the I Street Bridge for Jibboom Street, I Street, and J Street in Sacramento, and C Street in West Sacramento.

Environmental Review

CSLC staff requests that the city consider the following comments when preparing the Draft EIR.

General Comments

1. Project Description: A thorough and complete Project Description should be included in the Draft EIR in order to facilitate meaningful environmental review of potential impacts, mitigation measures, and alternatives. In particular, provide a thorough description with illustrations of all proposed work below the mean high tide line, including:
 - Construction of bridge support structures, dewatering and containment structures, dredging operations, water quality BMPs, construction methodology, and topographic construction plans drawn to scale;
 - A visual simulation of the new bridge as viewed from southbound Interstate 5 just north of the bridge location;
 - A description of interrupted recreation access to the Sacramento River and adjacent bike trails;
 - A description of any levee construction work and potential disruption of utility services and easement access;
 - A description of impacts to watercraft navigation and commerce during bridge construction;
 - A restoration plan to mitigate impacts for aquatic and terrestrial habitats and species; and
 - A construction schedule with description of proposed construction equipment, exterior lighting, and locations of staging areas.

Thorough descriptions will facilitate CSLC staff's determination of the extent and locations of its leasing jurisdiction, make for a more robust analysis of the work that may be performed, and minimize the potential for subsequent environmental analysis to be required.

Biological Resources

2. The Draft EIR should disclose and analyze all potentially significant effects on sensitive species and habitats in and around the Project area, including special-status wildlife, fish, and plants, and if appropriate, identify feasible mitigation

measures to reduce those impacts. The City should conduct queries of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDDB) and U.S. Fish and Wildlife Service's (USFWS) Special Status Species Database to identify any special-status plant or wildlife species that may occur in the Project area. The Draft EIR should also include a discussion of consultation with the CDFW, USFWS, and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS), including any recommended mitigation measures and potentially required permits identified by these agencies. In particular, provide a thorough description of all construction activities with potential to:

- Cause entrapment of fish species through in-channel construction area dewatering and containment activities;
- Adversely affect riverbank vegetation;
- Import or contribute to the spread of non-native invasive species (see below); and/or
- Impede fish passage.

One of the major stressors in California waterways is introduced species. Therefore, the Draft EIR should consider the Project's potential to encourage the establishment or proliferation of aquatic invasive species (AIS) such as the quagga mussel, or other nonindigenous, invasive species including aquatic and terrestrial plants. For example, construction boats and barges brought in from long stays at distant projects may transport new species to the Project area via hull biofouling, wherein marine and aquatic organisms attach to and accumulate on the hull and other submerged parts of a vessel. If the analysis in the Draft EIR finds potentially significant AIS impacts, possible mitigation could include contracting vessels and barges from nearby, or requiring contractors to perform a certain degree of hull-cleaning. The CDFW's Invasive Species Program could assist with this analysis as well as with the development of appropriate mitigation (information at www.dfg.ca.gov/invasives/).

In addition, in light of the recent decline of native pelagic organisms and in order to protect at-risk fish species, the Draft EIR should examine if any elements of the Project (e.g., changes in bankside vegetative cover) would favor non-native fisheries within the Sacramento River and its tributaries.

3. Construction/Pile Driving Noise: The Draft EIR should also evaluate potential adverse noise and vibration impacts on fish and birds from construction, restoration activities in the water and on the levees, and for land-side supporting structures. In particular, pile driving activities are known to cause barotrauma to fish when underwater sound pressure level thresholds are exceeded. Mitigation measures could include species-specific work windows, use of vibratory rather than impact hammers, or deployment of noise curtains, as may be recommended by CDFW, USFWS, and NMFS. Again, staff recommends early consultation with these agencies to minimize the impacts of the Project on sensitive species.

Climate Change

4. Greenhouse Gases: A greenhouse gas (GHG) emissions analysis consistent with the California Global Warming Solutions Act (Assembly Bill [AB] 32) and required by the State CEQA Guidelines should be included in the Draft EIR. This analysis should identify a threshold for significance for GHG emissions, calculate the level of GHGs that will be emitted as a result of construction of all parts of the Project, determine the significance of the impacts of those emissions, and, if impacts are significant, identify mitigation measures that would reduce them to the extent feasible. For the proposed Project, a myriad of diesel fueled equipment and vehicles are likely required for bridge construction and demolition of existing structures. A comprehensive inventory of all GHG emission source equipment should be developed with estimated levels of produced emissions. Early consultation with the Sacramento Metropolitan Air Quality Management District is recommended for development of a GHG threshold of significance and incorporation of mitigation measures to reduce emissions.

Sea Level Rise: The Draft EIR should discuss the Project as it relates to climate change and sea level rise. This discussion should include both the potential effects of an incremental increase in the ordinary low and high water marks resulting from rising seas as well as a discussion of potential seasonal river flow changes resulting from changes in Sierra snowmelt patterns. If applicable, the Draft EIR should disclose what design elements will be included for the in-channel support structures to ensure they will not impede flows or reduce in-channel capacity for flood control under this future scenario.

Cultural Resources

5. Submerged Resources: The Draft EIR should evaluate potential impacts to submerged cultural resources in the Project area. The CSLC maintains a shipwrecks database that can assist with this analysis. CSLC staff requests that the City contact Assistant Chief Counsel Pam Griggs (see contact information below) to obtain shipwrecks data from the database and CSLC records for the Project site. The database includes known and potential vessels located on the State's tide and submerged lands; however, the locations of many shipwrecks remain unknown. Please note that any submerged archaeological site or submerged historic resource that has remained in State waters for more than 50 years is presumed to be significant. Because of this possibility, please add a mitigation measure requiring that in the event cultural resources are discovered during any construction activities, Project personnel shall halt all activities in the immediate area and notify a qualified archaeologist to determine the appropriate course of action.

Title to Resources: The Draft EIR should also mention that the title to all abandoned shipwrecks and archaeological sites on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC. CSLC staff requests that the city consult with Assistant Chief Counsel Pam Griggs (see contact information below), should these resources on State lands be discovered during construction of the proposed Project.

Hydrology and Water Quality

6. Hydrology and Flood Protection: Construction of bridge support structures within the active channel will result in a new alteration to channel flows and sedimentation processes. The Draft EIR should provide an analysis of how in-channel support structures are designed to minimize these impacts and any impacts that have potential to occur. Bridge support structures also have potential to reduce channel volume flood control capacity and cause additional stress on levee systems. The City should consider a bridge design with minimum structural volume necessary for support structures within the levees to achieve Project objectives. Early consultation with Sacramento Area Flood Control Association is recommended for bridge design and mitigation measures to reduce impacts on channel volume flood control capacity and levee systems.
7. Mercury/Methylmercury: The Project study area includes the Sacramento River. For those portions of the project involving in-water work, CSLC staff requests that the Draft EIR include sediment quality testing and avoidance and minimization measures prior to dredging to reduce potential release of mercury and other toxins into the aquatic environment.

On April 22, 2010, the Central Valley Regional Water Quality Control Board (CVRWQCB) identified the CSLC as both a State agency that manages open water areas in the Sacramento-San Joaquin Delta Estuary and a nonpoint source discharger of methylmercury (Resolution No. R5-2010-0043), because subsurface lands under the CSLC's jurisdiction are impacted by mercury from legacy mining activities dating back to California's Gold Rush. Pursuant to a CVRWQCB Total Maximum Daily Load (TMDL), the CVRWQCB is requiring the CSLC to fund studies to identify potential methylmercury control methods in the Delta and to participate in an Exposure Reduction Program. The goal of the studies is to evaluate existing control methods and evaluate options to reduce methylmercury in open waters under jurisdiction of the CSLC. Any action taken that may result in mercury or methylmercury suspension within the Sacramento-San Joaquin Delta Estuary may affect the CSLC's efforts to comply with the CVRWQCB TMDL.

Aesthetics

8. Aesthetics: The new bridge will have a substantial new visual presence within the river channel and to adjacent Sacramento and West Sacramento land uses. In particular, southbound Interstate 5 just south of the American River confluence provides a significant gateway view to downtown Sacramento, the Sacramento River, and West Sacramento, where the new bridge will have a prominent visual presence. As such, the architectural style of the bridge is critically important and should attempt to serve as a future landmark of City identity. Architectural elements, such as visual design, color, scale, orientation, and glare will need to be carefully selected to minimize scenic impacts. The City should prepare a visual simulation of the new bridge from sensitive scenic locations where viewsheds will be impacted, such as the adjacent Interstate 5, to select a location of least visual impact.

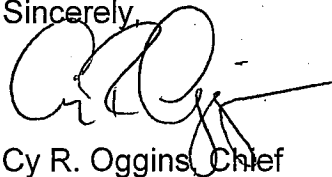
Mandatory Findings of Significance

9. Cumulative Impacts: The Draft EIR should consider whether the combined impacts of other current and future projects in the Project vicinity have potential to result in cumulatively considerable impacts on Sacramento River public trust resources, such as recreation public access, watercraft navigation, waterfront uses, natural resources, public commerce, open space, restoration activities, etc. Other projects in the vicinity could include the new downtown arena, Sacramento Railyards projects, and other current and probable future projects in West Sacramento.

Thank you for the opportunity to comment on the NOP for the Project. As a trustee and responsible agency, the CSLC requests that you consult with us on this Project and keep us advised of changes to the Project description and all other important developments. Please send additional information on the Project to the CSLC staff listed below as the EIR is being prepared.

Please refer questions concerning environmental review to Jason Ramos, Senior Environmental Scientist, at (916) 574-1814 or via e-mail at jason.ramos@slc.ca.gov. For questions concerning archaeological or cultural resources under CSLC jurisdiction, please contact Assistant Chief Counsel Pam Griggs at (916) 574-1854 or via email at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Wendy Hall, Public Land Management Specialist, at (916) 574-0994, or via email at wendy.hall@slc.ca.gov.

Sincerely,



Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
LMD, W. Hall
DEPM, J. Ramos
Legal, P. Griggs

From: [Jesse Gothan](#)
To: [Dana Mahaffey](#); [Bromund, Claire](#); [Rob Himes](#); [Zach Siviglia](#); [Ciara Zanze \(czanze@aimconsultingco.com\)](#); [Gladys Cornell](#)
Cc: [Luken, Mike](#)
Subject: FW: Comments on I Street Bridge Replacement Project Scoping Meeting
Date: Friday, October 17, 2014 9:01:33 AM

This NOP comment just arrived. -Jesse

From: timcastleman@gmail.com [mailto:timcastleman@gmail.com] **On Behalf Of** Practical Cycle Tim
Sent: Friday, October 17, 2014 8:54 AM
To: Steve Hansen; Jim Brown; James E. Houpt; Jesse Gothan
Subject: Comments on I Street Bridge Replacement Project Scoping Meeting

I attended the October 9 event for a short time and was pleased to see the plan includes a bike trail to go under the new roadway to retain the continuous bike path to and from Old Sacramento.

It is important that bikes are not forced to a stop to cross the new roadway.

In view of the vision for a connected "Loop" defined in the 2003 Riverfront Master Plan, planning MUST include the connection through Old Sacramento to Tower Bridge. I was disappointed to see that the City still has NO PLAN for improvements to the bike trail through Old Sacramento.

This vital segment of the [Sacramento River Parkway](#) on the waterfront between the Tower bridge and the I Street railroad bridge would connect Sacramento and the Bay Area via the [Great California Delta Trail](#). This "gap" also blocks riders from connecting to the [American River Parkway](#) and denies access to the Historic Riverfront Area for those with disabilities.

To ensure these problems are addressed we are asking the City of Sacramento to include improvements to the bike path from the Tower bridge to the I street railroad bridge, including a safe railroad crossing at J Street, a widened and leveled path, with a smooth surface and room for all users, as part of the Old Sacramento Infrastructure (Riverfront Boardwalk) project and the I Street Bridge Replacement project.

Please use this email as my public comment instead of the brief note on the postcard I returned.

Thank you,

Tim Castleman
Practical Cycle



Central Valley Regional Water Quality Control Board

17 October 2014

Dana Mahaffey
City of Sacramento
300 Richards Blvd, 3rd Floor
Sacramento, CA 95811

CERTIFIED MAIL
7014 1200 0000 7154 3045

COMMENTS TO NOTICE OF PREPARATION FOR THE DRAFT ENVIRONMENTAL IMPACT REPORT, I STREET BRIDGE REPLACEMENT PROJECT: A NEW BRIDGE OVER THE SACRAMENTO RIVER PROJECT, SCH NO. 2014092069, SACRAMENTO & YOLO COUNTIES

Pursuant to the State Clearinghouse's 22 September 2014 request, the Central Valley Regional Water Quality Control Board (Central Valley Water Board) has reviewed the *Notice of Preparation for the Draft Environmental Impact Report* for the I Street Bridge Replacement Project: A New Bridge over the Sacramento River Project, located in Sacramento & Yolo Counties.

Our agency is delegated with the responsibility of protecting the quality of surface and groundwaters of the state; therefore our comments will address concerns surrounding those issues.

Construction Storm Water General Permit

Dischargers whose project disturb one or more acres of soil or where projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Storm Water Discharges Associated with Construction Activities (Construction General Permit), Construction General Permit Order No. 2009-009-DWQ. Construction activity subject to this permit includes clearing, grading, grubbing, disturbances to the ground, such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP).

For more information on the Construction General Permit, visit the State Water Resources Control Board website at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml.

Clean Water Act Section 401 Permit – Water Quality Certification

If an USACOE permit (e.g., Non-Reporting Nationwide Permit, Nationwide Permit, Letter of Permission, Individual Permit, Regional General Permit, Programmatic General Permit), or any other federal permit (e.g., Section 9 from the United States Coast Guard), is required for this project due to the disturbance of waters of the United States (such as streams and wetlands), then a Water Quality Certification must be obtained from the Central Valley Water Board prior to initiation of project activities. There are no waivers for 401 Water Quality Certifications.

Waste Discharge Requirements

If USACOE determines that only non-jurisdictional waters of the State (i.e., “non-federal” waters of the State) are present in the proposed project area, the proposed project will require a Waste Discharge Requirement (WDR) permit to be issued by Central Valley Water Board. Under the California Porter-Cologne Water Quality Control Act, discharges to all waters of the State, including all wetlands and other waters of the State including, but not limited to, isolated wetlands, are subject to State regulation.

For more information on the Water Quality Certification and WDR processes, visit the Central Valley Water Board website at:

http://www.waterboards.ca.gov/centralvalley/help/business_help/permit2.shtml.

Regulatory Compliance for Commercially Irrigated Agriculture

If the property will be used for commercial irrigated agricultural, the discharger will be required to obtain regulatory coverage under the Irrigated Lands Regulatory Program.

There are two options to comply:

1. **Obtain Coverage Under a Coalition Group.** Join the local Coalition Group that supports land owners with the implementation of the Irrigated Lands Regulatory Program. The Coalition Group conducts water quality monitoring and reporting to the Central Valley Water Board on behalf of its growers. The Coalition Groups charge an annual membership fee, which varies by Coalition Group. To find the Coalition Group in your area, visit the Central Valley Water Board’s website at: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/app_approval/index.shtml; or contact water board staff at (916) 464-4611 or via email at IrrLands@waterboards.ca.gov.
2. **Obtain Coverage Under the General Waste Discharge Requirements for Individual Growers, General Order R5-2013-0100.** Dischargers not participating in a third-party group (Coalition) are regulated individually. Depending on the specific site conditions, growers may be required to monitor runoff from their property, install monitoring wells, and submit a notice of intent, farm plan, and other action plans regarding their actions to comply with their General Order. Yearly costs would include State administrative fees (for example, annual fees for farm sizes from 10-100 acres are currently \$1,084 + \$6.70/Acre); the cost to prepare annual monitoring reports; and water quality monitoring costs. To enroll as an Individual Discharger under the Irrigated Lands Regulatory

Program, call the Central Valley Water Board phone line at (916) 464-4611 or e-mail board staff at IrrLands@waterboards.ca.gov.

Low or Limited Threat General NPDES Permit

If the proposed project includes construction dewatering and it is necessary to discharge the groundwater to waters of the United States, the proposed project will require coverage under a National Pollutant Discharge Elimination System (NPDES) permit. Dewatering discharges are typically considered a low or limited threat to water quality and may be covered under the General Order for *Dewatering and Other Low Threat Discharges to Surface Waters* (Low Threat General Order) or the General Order for *Limited Threat Discharges of Treated/Untreated Groundwater from Cleanup Sites, Wastewater from Superchlorination Projects, and Other Limited Threat Wastewaters to Surface Water* (Limited Threat General Order). A complete application must be submitted to the Central Valley Water Board to obtain coverage under these General NPDES permits.

For more information regarding the Low Threat General Order and the application process, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0074.pdf

For more information regarding the Limited Threat General Order and the application process, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0073.pdf

If you have questions regarding these comments, please contact me at (916) 464-4684 or tcleak@waterboards.ca.gov.



Trevor Cleak
Environmental Scientist

cc: State Clearinghouse Unit, Governor's Office of Planning and Research, Sacramento



October 21, 2014

Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department
300 Richards Blvd., Third Floor, Sacramento, CA 95811
DMahaffey@cityofsacramento.org

Subject: Notice of Preparation of an Environmental Impact Report for the I Street Bridge Replacement Project

Dear Ms. Mahaffey,

The Sacramento Municipal Utility District (SMUD) appreciates the opportunity to provide comments on the Notice of Preparation (NOP) of an Environmental Impact Report for the I Street Bridge Replacement Project. SMUD is the primary energy provider for Sacramento County and the proposed project location. SMUD's vision is to empower our customers with solutions and options that increase energy efficiency, protect the environment, reduce global warming, and lower the cost to serve our region. As a Responsible Agency, SMUD aims to ensure that the proposed project limits the potential for significant environmental effects on SMUD facilities, employees, and customers.


It is our desire that the I Street Bridge Replacement Project will acknowledge any project impacts related to the following:

- Overhead and or underground transmission and distribution line easements
- Electrical load needs/ requirements
- Energy Efficiency
- Utility line routing
- Climate Change

SMUD would like to be involved in discussing these issues as early as possible. We aim to be partners in the efficient and sustainable delivery of the proposed project. Please ensure that the information included in this response is conveyed to the project planners and the appropriate project proponents.

Environmental leadership is a core value of SMUD and we look forward to collaborating with you on this project. Again, we appreciate the opportunity to provide input on the NOP. If you have any questions regarding this letter, please contact Rob Ferrera, SMUD Environmental Specialist at (916) 732-6676.

Sincerely,

A handwritten signature in black ink, appearing to read 'Rob Ferrera', with a long horizontal line extending to the right.

Rob Ferrera
Environmental Specialist
Environmental Management
Legislative & Regulatory Affairs
Sacramento Municipal Utility District

Cc: Pat Durham
Beth Tincher
Steve Johns
Joseph Schofield



10/21/2014

VIA EMAIL

Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department
300 Richards Blvd., Third Floor
Sacramento, CA 95811

RE: Notice of Preparation of an Environmental Impact Report for the proposed I Street Bridge Replacement Project

Dear Ms. Mahaffey:

WALKSacramento has reviewed the Notice of Preparation of an Environmental Impact Report for the I Street Bridge Replacement Project. We offer the following comments on the scope of the EIR.

Walking provides many benefits to individuals and the public, among which are improved physical health and mobility. Walking, instead of driving, between Sacramento and West Sacramento can help people attain the minimum-recommended physical activity of thirty minutes of moderate exercise per day, and it can reduce the demand for vehicle crossings on the proposed bridge replacement and the existing and new roadways connecting to the bridge.

In order to fully evaluate the impacts of the proposed bridge replacement on pedestrians, the EIR should consider changes to pedestrian mobility and safety that occur due to construction and operation of the bridge. Mobility evaluation could include pedestrian travel time between the 3rd Street/C Street intersection in West Sacramento and the 2nd Street/I Street intersection in Sacramento. Because the bridge landing point on the Sacramento side changes considerably with the new bridge, travel times to several destinations could also be calculated to evaluate overall mobility. Safety of pedestrians on sidewalks should be considered if there is mixing of pedestrians and bicyclists. Pedestrian safety should also be considered in respect to changes to new or additional intersection and road crossings required to complete walking trips. Wider roadways with longer crossing times, greater crossing distances and less frequent crossing opportunities can put pedestrians at greater risk to vehicle collisions.

WALKSacramento is working to support increased physical activity such as walking and bicycling in local neighborhoods as well as helping to create community environments that support walking and bicycling. The benefits include improved physical fitness, less motor vehicle traffic congestion, better air quality, and a stronger sense of cohesion and safety in local neighborhoods.

Thank you for your consideration of these comments and recommendations. If you have questions or need additional information, please contact me at (916) 446-9255 or cholm@walksacramento.org.

Sincerely,

Chris Holm
Project Analyst



October 21, 2014

Ms. Dana Mahaffey, Associate Planner
City of Sacramento
Community Development Department
300 Richards Boulevard 3rd Floor
Sacramento, CA 95811

**Re: RESPONSE TO NOTICE OF PREPARATION OF AN ENVIRONMENTAL
IMPACT REPORT FOR THE I-STREET BRIDGE REPLACEMENT PROJECT:
A NEW BRIDGE OVER THE SACRAMENTO RIVER (IDENTIFIED BY THE
U.S. COAST GUARD AS THE "C STREET BRIDGE") SCH # 2014092069**

Dear Ms. Mahaffey:

Thank you for the Notice of Preparation ("NOP") of an Environmental Impact Report ("EIR") for the I-Street Bridge Replacement Project: a new bridge over the Sacramento River (identified by the U.S. Coast Guard as the "C-Street Bridge") ("Project").

The proposed project, as described in the NOP, has the potential to impact the West Sacramento Project – West Sacramento's flood risk reduction plans to achieve the state-mandated 200-year level of flood protection. These potential impacts include, but are not necessarily limited to: geology & soils; hydrology & water quality; and recreation. As your Project moves forward, we request the project design and EIR consider both the impacts to the existing levee and the future flood risk reduction improvements. More specifically, we request your Project incorporate levee improvements, or be compatible with the future levee improvements.

Thank you for the opportunity to review and comment on the NOP. We appreciate the Project's purpose and beneficial impact it will have for both cities. If you have any questions about our comments, please contact me at (916) 617-4850 or via e-mail at gregf@CityofWestSacramento.org.

Sincerely,

A handwritten signature in black ink, appearing to read "A. Fabun", is written over a light blue background.

Greg Fabun
Flood Protection Manager

cc: Mike Luken, Transportation Manager, City of West Sacramento
Denix Anbiah, Director of Public Works, City of West Sacramento



October 21, 2014

Dana Mahaffey, Associate Planner
City of Sacramento, Community Development Department
Environmental Planning Services
300 Richards Boulevard, Third Floor
Sacramento, CA 95811-0218
DMahaffey@cityofsacramento.org

Subject: Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the I Street Bridge Replacement Project

Dear Ms. Mahaffey:

Thank you for the opportunity to comment on the subject NOP. We greatly appreciate that the Cities of Sacramento and West Sacramento are planning to build a new low-level, neighborhood friendly bridge across the Sacramento River. The new bridge will help address the critical lack of convenient and safe crossings of the river for bicyclists and allow many more people to use bicycles for trips to jobs, shopping, entertainment, or the Sacramento Valley Station. We believe the bicycle facilities on the bridge should be designed for the large proportion of the population (~60%) that is interested in bicycling but concerned about interacting with high speeds or volumes of vehicle traffic (Mekuria et al. 2012).

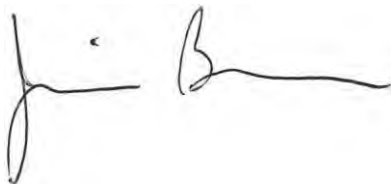
To assist the City of Sacramento in achieving the goals of its Climate Action Plan, every project should make it possible for its residents, employees, and visitors to safely and conveniently take more trips by bicycle. The proposed project will cause a significant adverse effect on the environment if it will not adequately provide access by bicycle for the majority of our population. Therefore the project must be designed and constructed to be friendly for bicyclists of all ages and abilities:

- Either the bridge must be designed for not more than 30 mph vehicle traffic or, if vehicle speed limit is intended to be greater, vehicle lanes must be separated from bicycle lanes (e.g. with buffers that are painted and delineated with flexible bollards)
- Vehicle parking should not be placed alongside the bicycle lanes to prevent the hazard of car doors being opened in front of bicyclists (if vehicle parking is designed on the bridge and/or its approaches, ensure the combined width of parking lane and bicycle lane is at least 14 ft)
- Traffic control devices should be installed at the intersections of the bridge with Jibboom Street in Sacramento and at 2nd St in West Sacramento to ensure vehicle speeds do not exceed 30 mph
- Convenient connections between the bicycle lanes across the bridge and the river front bicycle paths must be provided on both sides of the river.

SABA works to ensure that bicycling is safe, convenient, and desirable for everyday transportation. Bicycling is the healthiest, cleanest, cheapest, quietest, most energy efficient, and least congesting form of transportation.

Thank you for considering our comments.

Sincerely,

A handwritten signature in black ink, appearing to read "Jim Brown". The signature is written in a cursive style with a large initial "J" and a long horizontal stroke extending to the right.

Jim Brown
Executive Director

CC: Paul Philley, SMAQMD (pphilley@airquality.org)
Ed Cox, City of Sacramento Alternative Modes Coordinator (ecox@cityofsacramento.org)

Species Lists



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To:

March 25, 2019

Consultation Code: 08ESMF00-2017-SLI-0452

Event Code: 08ESMF00-2019-E-04740

Project Name: I Street Bridge Replacement

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

Project Summary

Consultation Code: 08ESMF00-2017-SLI-0452

Event Code: 08ESMF00-2019-E-04740

Project Name: I Street Bridge Replacement

Project Type: BRIDGE CONSTRUCTION / MAINTENANCE

Project Description: Construct a new public crossing of the Sacramento River north of the Union Pacific Railroad-owned I Street Bridge and south of Richards Boulevard.

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/38.58725979190753N121.50605787333976W>



Counties: Sacramento, CA | Yolo, CA

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Least Bell's Vireo <i>Vireo bellii pusillus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5945	Endangered

Reptiles

NAME	STATUS
Giant Garter Snake <i>Thamnophis gigas</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog <i>Rana draytonii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander <i>Ambystoma californiense</i> Population: U.S.A. (Central CA DPS) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle <i>Desmocerus californicus dimorphus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp <i>Branchinecta lynchi</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp <i>Lepidurus packardii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i>	Final

NAME

STATUS

<https://ecos.fws.gov/ecp/species/321#crithab>



United States Department of the Interior



FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
Phone: (916) 930-5603 Fax: (916) 930-5654
http://kim_squires@fws.gov

In Reply Refer To:

March 25, 2019

Consultation Code: 08FBDT00-2017-SLI-0041

Event Code: 08FBDT00-2019-E-00342

Project Name: I Street Bridge Replacement

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08FBDT00-2017-SLI-0041

Event Code: 08FBDT00-2019-E-00342

Project Name: I Street Bridge Replacement

Project Type: BRIDGE CONSTRUCTION / MAINTENANCE

Project Description: Construct a new public crossing of the Sacramento River north of the Union Pacific Railroad-owned I Street Bridge and south of Richards Boulevard.

Project Location:

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Counties: Sacramento, CA | Yolo, CA

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See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
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Birds

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NAME	STATUS
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Amphibians

NAME	STATUS
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California Tiger Salamander <i>Ambystoma californiense</i> Population: U.S.A. (Central CA DPS) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle <i>Desmocerus californicus dimorphus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp <i>Branchinecta lynchi</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp <i>Lepidurus packardii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> https://ecos.fws.gov/ecp/species/321#crithab	Final

Sorvari, Tina

From: NMFSWCRCA Specieslist - NOAA Service Account
<nmfswcrca.specieslist+canned.response@noaa.gov>
Sent: Monday, March 25, 2019 1:40 PM
To: Sorvari, Tina
Subject: Re: Federal Highway Administration – California Division, Sacramento I Street Bridge
BRLS 5002 (164) City of Sacramento

Receipt of this message confirms that NMFS has received your email to nmfswcrca.specieslist@noaa.gov. If you are a federal agency (or representative) and have followed the steps outlined on the California Species List Tools web page (http://www.westcoast.fisheries.noaa.gov/maps_data/california_species_list_tools.html), you have generated an official Endangered Species Act species list.

Messages sent to this email address are not responded to directly. For project specific questions, please contact your local NMFS office.

Northern California/Klamath (Arcata) 707-822-7201

North-Central Coast (Santa Rosa) 707-387-0737

Southern California (Long Beach) 562-980-4000

California Central Valley (Sacramento) 916-930-3600

Sorvari, Tina

From: Sorvari, Tina
Sent: Monday, March 25, 2019 1:40 PM
To: 'nmfswcrca.specieslist@noaa.gov'
Subject: Federal Highway Administration – California Division, Sacramento I Street Bridge BRLS 5002 (164) City of Sacramento

Hello- I am requesting an ESA species list. Please see below. Thank you.

Federal Agency: Federal Highway Administration – California Division
Federal Agency Address: 650 Capitol Mall, Suite 4-100, Sacramento, CA 95814
4708
Non-Federal Agency Representative: California Department of Transportation
Non-Federal Agency Representative Address: 703 B Street, Marysville, CA
95901
Project Name: City of Sacramento - various infrastructure projects: BRLS
5002(164)
Point-of-Contact Tina Sorvari – ICF 916-231-9738 tina.sorvari@icf.com

Quad Name **Sacramento West**

Quad Number **38121-E5**

ESA Anadromous Fish

SONCC Coho ESU (T) -

CCC Coho ESU (E) -

CC Chinook Salmon ESU (T) -

CVSR Chinook Salmon ESU (T) - **X**

SRWR Chinook Salmon ESU (E) - **X**

NC Steelhead DPS (T) -

CCC Steelhead DPS (T) -

SCCC Steelhead DPS (T) -

SC Steelhead DPS (E) -

CCV Steelhead DPS (T) - **X**

Eulachon (T) -

sDPS Green Sturgeon (T) - **X**

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -

CCC Coho Critical Habitat -

CC Chinook Salmon Critical Habitat -

CVSR Chinook Salmon Critical Habitat - **X**

SRWR Chinook Salmon Critical Habitat - **X**

NC Steelhead Critical Habitat -

CCC Steelhead Critical Habitat -

SCCC Steelhead Critical Habitat -

SC Steelhead Critical Habitat -

CCV Steelhead Critical Habitat - **X**

Eulachon Critical Habitat -

sDPS Green Sturgeon Critical Habitat - **X**

ESA Marine Invertebrates

Range Black Abalone (E) -

Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -

Olive Ridley Sea Turtle (T/E) -

Leatherback Sea Turtle (E) -

North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -

Fin Whale (E) -

Humpback Whale (E) -

Southern Resident Killer Whale (E) -

North Pacific Right Whale (E) -

Sei Whale (E) -

Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -

Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -

Chinook Salmon EFH - **X**

Groundfish EFH - **X**

Coastal Pelagics EFH -

Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds

See list at left and consult the NMFS Long Beach office
562-980-4000

MMPA Cetaceans -

MMPA Pinnipeds -

Quad Name **Sacramento East**

Quad Number **38121-E4**

ESA Anadromous Fish

SONCC Coho ESU (T) -

CCC Coho ESU (E) -

CC Chinook Salmon ESU (T) -

CVSR Chinook Salmon ESU (T) - **X**

SRWR Chinook Salmon ESU (E) - **X**

NC Steelhead DPS (T) -

CCC Steelhead DPS (T) -

SCCC Steelhead DPS (T) -

SC Steelhead DPS (E) -

CCV Steelhead DPS (T) - **X**

Eulachon (T) -

sDPS Green Sturgeon (T) - **X**

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -

CCC Coho Critical Habitat -

CC Chinook Salmon Critical Habitat -

CVSR Chinook Salmon Critical Habitat - **X**

SRWR Chinook Salmon Critical Habitat -

NC Steelhead Critical Habitat -

CCC Steelhead Critical Habitat -

SCCC Steelhead Critical Habitat -

SC Steelhead Critical Habitat -

CCV Steelhead Critical Habitat - **X**

Eulachon Critical Habitat -

sDPS Green Sturgeon Critical Habitat - **X**

ESA Marine Invertebrates

Range Black Abalone (E) -

Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -

Olive Ridley Sea Turtle (T/E) -

Leatherback Sea Turtle (E) -

North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -

- Fin Whale (E) -
- Humpback Whale (E) -
- Southern Resident Killer Whale (E) -
- North Pacific Right Whale (E) -
- Sei Whale (E) -
- Sperm Whale (E) -

ESA Pinnipeds

- Guadalupe Fur Seal (T) -
- Steller Sea Lion Critical Habitat -

Essential Fish Habitat

- Coho EFH -
- Chinook Salmon EFH - **X**
- Groundfish EFH - **X**
- Coastal Pelagics EFH -
- Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds

See list at left and consult the NMFS Long Beach office
562-980-4000

- MMPA Cetaceans -
- MMPA Pinnipeds -

U.S. Fish and Wildlife Service Biological Opinion



United States Department of the Interior



FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In reply refer to:
08FBDT00-2016-F-0227

Ms. Laura Loeffler, Branch Chief
North Region Environmental Planning M-1
California Department of Transportation, District 3
703 B Street
Marysville, CA 95901

JUN 15 2017

Subject: Formal Consultation on the I Street Bridge Replacement Project, Sacramento County, California (Fed ID# BRLS-5002 (164))

Dear Ms. Loeffler:

This letter is in response to the California Department of Transportation's (Caltrans) August 4, 2016, request to initiate formal consultation with the U.S. Fish and Wildlife Service (Service) on the I Street Bridge Replacement Project between the cities of Sacramento and West Sacramento, Sacramento and Yolo Counties, California. Caltrans determined that the proposed project may affect and is likely to adversely affect the threatened federally threatened delta smelt (*Hypomesus transpacificus*) and its critical habitat and the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Caltrans' request was received by the Service on August 9, 2016. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

Fixing America's Surface Transportation Act (FAST Act) was signed into law on December 4, 2015. Providing funding from 2016 to 2020, the FAST Act includes provisions to promote streamlined and accelerated project delivery. Caltrans is approved to participate in the FAST Act project delivery program through the National Environmental Policy Act (NEPA) Assignment Memorandum of Understanding (MOU). The MOU allows Caltrans to assume the Federal Highway Administration's (FHWA) responsibilities under NEPA as well as FHWA's consultation and coordination responsibilities under Federal environmental laws for most highway projects in California. Caltrans is exercising this authority as the Federal nexus for section 7 consultation on this project.

In reviewing this project, the Service has relied upon (1) the biological assessment enclosed with the initiation letter (Caltrans 2016); (2) emails between the Service and Caltrans; and (3) other information available to the Service.

The Service has reviewed the proposed project and its effects to the delta smelt's designated critical habitat. In designating critical habitat for the delta smelt, the Service identified the following Primary Constituent Elements essential to the conservation of the species and how the project may or may not affect each Primary Constituent Element. Primary Constituent Element 1 is physical habitat for spawning. Effects to the spawning substrate are not expected to occur. Primary Constituent Element 2 is suitable water quality for all life stages. During the proposed project water in the action area may be affected through the creation of small sediment plumes (i.e., turbidity) during the pile driving above critical habitat and may be exposed to contaminants. The sediment plumes are temporary in nature and typically dissipate within the same day of activity. The sediment plumes are discountable in relation to the size of the Delta and temporary, and would not be expected to affect the overall water quality of the Delta ecosystem. Primary Constituent Element 3 is river flow. The proposed project will not affect river flow within critical habitat. Primary Constituent Element 4 is salinity for rearing and the project will not affect salinity. Based on the above analysis, the Service has determined that the proposed project is not likely to adversely affect the delta smelt's designated critical habitat.

Consultation History

August 9, 2016	The Service received the Caltrans request for consultation and biological assessment.
November 2016	The Service exchanged emails with Caltrans regarding project effects.
January 10, 2017	The Service received an email from Caltrans regarding changes to the project description.
May 8, 2017	The Service received the Caltrans request for consultation on the geotechnical work to inform the design of the I Street Bridge. Prior communications with Caltrans indicated Caltrans preference for issuing bridge replacement biological opinion prior to geotechnical work even if it results in reinitiation due to changes in project description.
June 5, 2017	The Service received information regarding a project change and confirmation of impacts and proposed compensatory mitigation.

BIOLOGICAL OPINION

Description of the Proposed Action

The City of Sacramento (Applicant), in cooperation with the City of West Sacramento and Caltrans, proposes to construct a new bridge over the Sacramento River to replace the vehicle crossing that is current accommodated by the existing I Street bridge in order to remove a series of functionally obsolete or structurally deficient bridges (i.e. approach structures). The proposed bridge will be located approximately 1,000 feet to the north of the existing bridge connecting C Street in West Sacramento with Railyards Boulevard in Sacramento. The 860-foot-long bridge,

consisting of two vehicle lanes, on-street Class II bike lanes, and sidewalks along both sides will be located north of the existing I Street Bridge. The proposed bridge will be a five-span bridge with an approximately 330-foot-long movable center span. The proposed project will install an abutment on each bank of the river and four piers across the river to support the five-span bridge. From west to east, these support structures are referred to as Abutment 1, Pier 2, Pier 3, Pier 4, Pier 5, and Abutment 6.

Construction is expected to require 30 consecutive months beginning in Spring 2018 and ending in Summer 2020. Construction is expected to require two years of in-water construction limited to the period of May 1 to November 30 during these years. Construction is expected to require excavation, dewatering, grubbing/land clearing, earthmoving, grading, compaction, paving, auguring, pile driving, and demolition activities. Construction is expected to require a variety of heavy equipment including excavators, crawler tractors, scrapers, front end loaders, dump trucks, graders, drill rigs, impact and vibratory pile drivers, compactors, water trucks, air compressors, generators, forklifts, trenchers, pavers, hoe rams, barges, tug boats, cranes, and concrete trucks.

New Bridge Construction

The total bridge length will be approximately 860 feet long, consisting of a 270-foot-long approach span from the west connected to a movable 330-foot-span in the center connect to a 200-foot-long approach span from the east. The approach span from the west will cross Abutment 1 and Piers 2 and 3 and the approach span from the east will cross Abutment 6 and Piers 4 and 5. Abutments 1 and 6 will be constructed on the banks of the river, and Piers 2 and 5 will be placed within the river approximately around the existing bank toe of slope.

The abutments will consist of approximately 50 piles per abutment that are driven or cast-in-drill-hole (CIDH) to a depth of approximately 70 feet below original ground elevation. Piers 2 and 5 will consist of 50 driven or CIDH piles per pier that are approximately 70 feet below the original ground elevation. The piles will be either precast concrete or steel and the Applicant will drive these piles using an impact hammer. Piers 3 and 4 will consist of four large diameter cast-in-steel-shell piles per pier. Each pier will be 9 feet in diameter, extending approximately 140 feet below the original ground elevation and will be driven with a vibratory hammer and/or a hydraulic oscillator/rotator system. Installation of these piers will also require driving 8 temporary steel "spud" piles to a depth of 40 feet for anchoring barges used for project activities. It is anticipated that rock slope protection will be installed around the bridge abutments and piers within the water to control erosion.

Installation of a Fender Protection System

The Applicant will install a fender protection system around Piers 3 and 4 to protect the piers from errant watercrafts that are navigating along the river. The fender system will consist of 30 driven concrete or wooden piles around each pier. These piles will be driven to a depth of approximately 30 feet below the original ground elevation.

Temporary Trestles and Cofferdams

The Applicant will install temporary trestles and cofferdams to construct Piers 2, 3, 4, and 5. The Applicant will construct the trestles during the first construction season using temporary piles within the river. The platform atop each trestle will include approximately 80 driven steel piles. The piles will be either 16-inch diameter or 16-inch H piles driven with an impact hammer. Once installed, the temporary trestle piles will remain in the river throughout the duration of construction. The Applicant will remove these piles in the second construction season following completion of construction.

The Applicant will construct temporary cofferdams to dewater the area to allow construction of Piers 2 and 5. The cofferdams will consist of approximately 180 sheet piles driven to a depth of 25 feet below original ground elevation using a vibratory hammer. The Applicant will remove the sheet piles comprising the cofferdams following completion of construction using a vibratory hammer.

Demolition of Approach Spans to Existing Bridge

Following completion of the connection of Railyards Boulevard and C Street to the proposed bridge, the Applicant will remove the four existing approach structures to the existing bridge. These bridges will be demolished and the foundations would be removed to a depth of 3 feet below original ground elevation. Encroachment permits from Caltrans and Union Pacific Railroad will be needed to complete removal of these bridges. The existing bridge is owned and operated by Union Pacific Railroad and will continue to be used by trains following construction of the new bridge.

Roadway, Bikeway, and Levee Modifications

The Applicant proposes to improve roadway access along C Street and Railyards Boulevard to the proposed bridge location. The Applicant will purchase property in the area to accommodate these improvements. These improvements include wider lanes and enhancements to bicycle and pedestrian access. The Applicant will also demolish roadways leading to the existing I Street Bridge.

The Applicant will reconstruct the existing Class I Sacramento River Parkway Bikeway along Jibboom Street approximately 500 feet to the north and 300 feet to the south of Railyards Boulevard. The Applicant will construct retaining walls along the path to account for the vertical elevation difference between Jibboom Street and a path underneath the proposed bridge.

The Applicant will improve the existing levee along the West Sacramento side of the river. The existing levee does not meet current standards required by Title 23 of the California Code of Regulations. The Applicant will reconstruct the levee cross-section approximately 300 feet to the north and south of the proposed C Street alignment. The levee improvements will include a slurry cutoff wall extending to a depth of 110 feet below original ground elevation. The Applicant will also construct access roads from the new roadway to the top of the improved levee

section to maintain access to the levee. The proposed grading for the levee will require relocation of an existing water tower located along 2nd street. This new levee maintenance road will also serve as a future extension to the Class I River Walk Park bikeway.

Staging and Storage during Construction

The Applicant will use two staging areas to store materials and equipment during construction, such as pipe materials, precast manholes and drop inlets, steel girders, piles, and rebar, along with construction equipment when not in use. One area will be located south of Railyards Boulevard under Interstate 5 in Sacramento. The other area will be located in West Sacramento west of the landward site of the levee and south of the new bridge location. The Applicant will use the staging areas throughout the duration of construction and return the areas to their pre-project conditions at the completion of the project.

General Conservation Measures

Measure 1: Install Barrier Fencing between the Construction Area and Sensitive Biological Resources

The Applicant will install orange construction barrier fencing around sensitive areas as one of the first orders of work and prior to equipment staging. Before construction begins, the Applicant will work with the project engineer and a resource specialist to identify the locations for the barrier fencing and place stakes around sensitive sites to indicate these locations. The protected areas will be designated as environmentally sensitive areas and clearly identified on the construction plans and described in the specifications. To minimize the potential for snakes and other ground-dwelling animals from being caught in the barrier fencing, the fencing will be placed with at least a 1-foot gap between the ground and the bottom of the barrier fencing. The exception to this condition is where barrier fencing overlaps with erosion control fencing and must be secured to prevent sediment runoff. Barrier fencing will be installed before construction activities are initiated, maintained throughout the construction period, and removed after completion of construction.

Measure 2: Conduct Environmental Awareness Training for Construction Employees

The Applicant will retain a qualified biologist to conduct environmental awareness training for construction crews before project implementation. The awareness training will be provided to all construction personnel and would brief them on the need to avoid effects on sensitive biological resources (e.g., native trees, natural communities of special concern, and special-status species habitats in and adjacent to the construction area). The education program will include a brief review of the special-status species with the potential to occur in Caltrans' biological study area (BSA) (including their life history, habitat requirements, and photographs of the species). The training will identify the portions of the BSA in which the species may occur, as well as their legal status and protection.

The program also will cover the restrictions and guidelines that would be followed by all construction personnel to reduce or avoid effects on these species during project implementation. This will include the steps to be taken if a sensitive species is found within the construction area (i.e., notifying the crew foreman, who would call a qualified biological monitor). In addition, construction employees will be educated about the importance of controlling and preventing the spread of invasive plant infestations. An environmental awareness handout that describes and illustrates sensitive resources to be avoided during project construction and identifies all relevant permit conditions would be provided to each crew member. The crew foreman would be responsible for ensuring that crew members adhere to the guidelines and restrictions. Education programs would be conducted for appropriate new personnel as they are brought on the job during the construction period.

Measure 3: Conduct Periodic Biological Monitoring

The Applicant will retain a qualified biological monitor for the project who will visit the site a minimum of once per week to ensure that fencing around environmentally sensitive areas is intact and that activities are being conducted in accordance with the agreed upon project schedule and agency conditions of approval. The monitor will provide the Applicant with a monitoring log for each site visit.

Conservation Measures for the Valley Elderberry Longhorn Beetle

Measure 4: Avoid and Minimize Impacts on Valley Elderberry Longhorn Beetle

The following will be implemented prior to and during construction to ensure effects to valley elderberry longhorn beetles are minimized:

- Consistent with Measure 2, contractors will be briefed on the need to avoid damaging the elderberry plants and the possible penalties for not complying with these requirements. Crews also will be educated on the status of the valley elderberry longhorn beetle and the need to protect its habitat.
- All elderberry shrubs that are outside of the permanent project footprint or that can be avoided will be identified on construction drawings, with notes indicating that they are sensitive resources to be avoided.
- Consistent with Measure 1, orange construction barrier fencing will be placed at a minimum of 20 feet from each shrub's dripline or as far out from the dripline as possible. No construction activities will be permitted within the buffer zone other than those activities necessary to erect the fencing. As specified in the Conservation Guidelines for the Valley Elderberry Longhorn Beetle (Guidelines) (Service 1999), signs will be posted every 50 feet (at a minimum) along the perimeter of the buffer area fencing. The signs will contain the following information: This area is habitat of the Valley Elderberry Longhorn Beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to

prosecution, fines, and imprisonment. The signs should be clearly readable from a distance of 20 feet and must be maintained for the duration of construction.

- Consistent with Measure 3, buffer area fences around the shrubs will be inspected weekly by a biological monitor during ground-disturbing activities and monthly after ground-disturbing activities until project construction is complete or until the fences are removed, as approved by the biological monitor. The biological monitor will check that the contractor is maintaining the buffer area fences around elderberry shrubs throughout construction. Biological inspection reports would be provided to the Service and the Applicant.

Measure 5: Transplant Elderberry Shrubs That Cannot Be Avoided

Elderberry shrubs that cannot be avoided would be transplanted to a Service-approved conservation area in accordance with the Guidelines. Transplanting will occur during the plant's dormant phase (approximately November through the first 2 weeks of February, after they have lost their leaves). A qualified biologist that is familiar with elderberry shrub transplantation procedures will supervise the transplanting. The location of the conservation area transplantation site will be approved by the Service before removal of the shrubs.

Measure 6: Compensate for Impacts on Valley Elderberry Longhorn Beetle

Before construction begins, the project proponent will compensate for direct impacts (including transplanting) on all elderberry stems measuring 1 inch or more at ground level (i.e., habitat for the valley elderberry longhorn beetle) that are located within 20 feet of proposed construction activities. Compensation will include planting replacement elderberry seedlings or cuttings and associated native plantings in a Service-approved conservation area, at a ratio between 1:1 and 8:1 (ratio = new plantings to affected stems), depending on the diameter of the stem at ground level, the presence or absence of exit holes, and whether the shrub is located in riparian habitat (Service 1999).

Mitigation credits for impacts to valley elderberry longhorn beetle habitat would be purchased at a Service-approved mitigation bank. There are three mitigation banks listed on the Service website that sell valley elderberry longhorn beetle credits and have service areas that overlap the project area. These banks are: French Camp Conservation Bank, Laguna Creek Conservation Bank, and River Ranch Conservation Bank. The Applicant would plant 34 elderberry seedlings and 34 associated native plants in a Service-approved conservation area.

Conservation Measures for the Delta Smelt

Measure 7: Conduct All In-Water Construction Activities between May 1 and November 30 and during Daylight Hours Only

The Applicant will conduct all in-water construction work and pile driving (in-water and shore-based within 250 feet of the Sacramento River), installation of cofferdams, removal of temporary

sheet piles, and placement of rock revetment between May 1 and November 30 to avoid or minimize causing disturbance and injury to, or mortality of, special-status fish species in the affected reaches of the Sacramento River. In addition, in-water work will be conducted during daylight hours only to provide fish in the affected reaches of the Sacramento River with an extended quiet period during nighttime hours for feeding and unobstructed passage.

Measure 8: Implement Measures to Minimize Exceedance of Interim Threshold Sound Levels during Pile Driving

The Applicant will require the contractor to implement the following measures, developed in coordination with project design engineers, to minimize the exposure of listed fish species to potentially harmful underwater sounds:

- The contractor will vibrate all piles to the maximum depth possible before using an impact hammer.
- No more than 20 piles will be driven per day, and pile driving with an impact hammer will occur on no more than 75 individual days total during construction.
- During impact driving, the contractor will limit the number of strikes per day to the minimum necessary to complete the work and would limit the total number of hammer strikes to 16,000 strikes per day (i.e., 800 hammer strikes per pile, per day) for piles for the bridge piers and temporary trestles, and 20,000 strikes per day (i.e., 1,000 hammer strikes per pile, per day) for the piles for the bridge fender system. The smallest pile driver and minimum force necessary will be used to complete the work.
- During impact driving, the Applicant will require the contractor to use a bubble curtain or similar device to minimize the extent to which the interim peak and cumulative Sound Exposure Level (SEL) thresholds are exceeded.
- No pile driving activity will occur at night, thereby providing fish with an extended quiet period during nighttime hours on days pile driving is being conducted for feeding and unobstructed passage.

Measure 9: Develop and Implement a Hydroacoustic Monitoring Plan

The Applicant and/or their construction contractor will develop and implement a hydroacoustic monitoring plan. The monitoring plan will be submitted to the resource agencies (California Department of Fish and Wildlife [CDFW], National Marine Fisheries Service [NMFS], and the Service) for approval at least 60 days before the start of project activities. The plan will include the following requirements:

- The Applicant and/or its construction contractor will monitor underwater noise levels during all impact pile driving activities on land and in water to ensure that peak and

cumulative SELs do not exceed estimated values in Table 4-4 of the biological assessment.

- The monitoring plan will describe the methods and equipment that would be used to document the extent of underwater sounds produced by pile driving, including the number, location, distances, and depths of the hydrophones and associated monitoring equipment. The monitoring plan will include a reporting schedule for daily summaries of the hydroacoustic monitoring results and for more comprehensive reports to be provided to the resource agencies on a monthly basis during the pile driving season. The daily reports will include the number of piles installed per day; the number of strikes per pile; the interval between strikes; the peak sound pressure level (SPL) and accumulated SEL per strike; and the accumulated SEL per day at each monitoring station.
- The Applicant or its contractors will ensure that a qualified fish biologist is on site during impact pile driving to document any occurrences of stressed, injured, or dead fish. If stressed, injured, or dead fish are observed during pile driving, the Applicant and/or its construction contractor will reduce the number of strikes per day to ensure that fish are no longer showing signs of stress, injury, or mortality.

Measure 10: Protect Water Quality and Prevent Erosion and Sedimentation in Drainages and Wetlands

The Applicants and/or their construction contractor would comply with all construction site Best Management Practices (BMPs) specified in the Water Quality Assessment Report prepared for the project (ICF 2015) and the final Storm Water Pollution Prevention Plan (SWPPP) that would be developed for the project, as well as any other permit conditions to minimize introduction of construction-related contaminants and mobilization of sediment in the Sacramento River and the riparian forest/shrub wetland. Broadly, these BMPs would address soil stabilization, sediment control, wind erosion control, vehicle tracking control, non-storm water management, and waste management practices. The BMPs will be based on the best conventional and best available technology. Refer to the biological assessment for further details for Measure 10.

Measure 11: Monitor Turbidity in the Sacramento River

The Applicant will require the construction contractor to monitor turbidity levels in the Sacramento River during in-water construction activities (e.g., pile driving, extraction of temporary sheet piles used for cofferdams, placement of rock slope protection [RSP])). Turbidity will be measured using standard techniques upstream and downstream of the construction area to determine whether changes in ambient turbidity levels exceed 20%, the threshold derived from the Sacramento and San Joaquin Rivers Basins Plan (Central Valley Regional Water Quality Control Board 2011). If it is determined that turbidity levels exceed the 20% threshold, then the Applicant and/or its contractors would adjust work to ensure that turbidity levels do not exceed the 20% threshold.

Measure 12: Implement Cofferdam Restrictions

The following restrictions will be implemented during installation of the cofferdams and cofferdam dewatering:

- The extent of cofferdam footprints will be limited to the minimum necessary to support construction activities.
- Sheet piles used for cofferdams will be installed and removed using a vibratory pile driver.
- Cofferdams will be installed and removed only during the proposed in-water work window (between May 1 and November 30).
- Cofferdams will not be left in place over winter where they could be overtopped by winter/spring flows and when listed species are most likely to be present in the construction area.
- All pumps used during dewatering of cofferdams will be screened according to CDFW and NMFS guidelines for screens. Cofferdam dewatering and fish rescue/relocation from within cofferdams will commence immediately following cofferdam closure.

Measure 13: Prepare and Implement a Fish Rescue and Relocation Plan

The Applicant and/or their construction contractor will develop and implement a fish rescue and relocation plan to recover any fish trapped in cofferdams. The fish rescue and relocation plan would be submitted to the resource agencies (CDFW, NMFS, and the Service) for approval at least 60 days before initiating activities to install cofferdams. At a minimum, the plan will include the following:

- A requirement that fish rescue and relocation activities will commence immediately after cofferdam closure and that dewatering has sufficiently lowered water levels inside cofferdams to make it feasible to rescue fish.
- A description of the methods and equipment proposed to collect, transfer, and release all fish trapped within cofferdams. Capture methods may include seining, dip netting, and/or electrofishing as approved by CDFW, NMFS, and the Service. The precise methods and equipment to be used would be developed cooperatively by CDFW, NMFS, the Service, and the Applicant and/or contractor.
- A requirement that only CDFW-, NMFS-, and Service-approved fish biologists will conduct the fish rescue and relocation.

- A requirement that fish biologists will contact CDFW, NMFS, and the Service immediately if any listed species are found dead or injured.
- A requirement that a fish rescue and relocation report be prepared and submitted to CDFW, NMFS, and the Service within 5 business days following completion of the fish relocation. Data will be provided in tabular form and at a minimum will include the species and number rescued and relocated, approximate size of each fish (or alternatively, approximate size range if large number of individuals are encountered), date and time of their capture, and general condition of all live fish (e.g., good–active with no injuries; fair–reduced activity with some superficial injuries; poor–difficulty swimming/orienting with major injuries). For dead fish, additional data will include fork length and description of injuries and/or possible cause of mortality if it can be determined.

Measure 14: Prevent the Spread or Introduction of Aquatic Invasive Species

The Applicant or their contractors will implement the following actions to prevent the potential spread or introduction of aquatic invasive species (AIS) associated with the operation of barges and other in-water construction activities. Species of concern related to the operation of barges and other equipment in the lower Sacramento River include invasive mussels (e.g., quagga mussels [*Dreissena bugensis*] and zebra mussels [*Dreissena polymorpha*]) and aquatic plants (e.g., Brazilian waterweed [*Egeria densa*] and hydrilla [*Hydrilla verticillata*]) (California Department of Fish and Game 2008).

The Applicant or their contractors will coordinate with the CDFW's Invasive Species Program to ensure that the appropriate BMPs are implemented to prevent the spread or introduction of AIS. Educate construction supervisors and managers about the importance of controlling and preventing the spread of AIS. Train vessel and equipment operators and maintenance personnel in the recognition and proper prevention, treatment, and disposal of AIS.

To the extent feasible, prior to departure of vessels from their place of origin and before in-water construction equipment is allowed to operate within the waters of the Sacramento River, the Applicant or their contractors will thoroughly inspect and remove and dispose of all dirt, mud, plant matter, and animals from all surfaces that are submerged or may become submerged, or places where water can be held and transferred to the surrounding water.

Measure 15: Minimize or Avoid Temporary Construction Lighting and Permanent Bridge Lighting from Directly Radiating on Water Surfaces of the Sacramento River

The Applicant will minimize or avoid the effects of nighttime lighting on special-status fish species by implementing the following actions:

Temporary Construction Lighting

- Avoiding construction activities at night, to the maximum extent practicable.
- Using the minimal amount of lighting necessary to safely and effectively illuminate the

work areas.

- Shielding and focusing lights on work areas and away from the water surface of the Sacramento River, to the maximum extent practicable.

Permanent Bridge Lighting

- Minimizing nighttime lighting of the bridge structure for aesthetic purposes.
- Using the minimal amount of lighting necessary to safely and effectively illuminate vehicular, bicycle, and pedestrian areas on the bridge.
- Shielding and focusing lights on vehicular, bicycle, and pedestrian areas and away from the water surface of the Sacramento River, to the maximum extent practicable.

Measure 16: Compensate for Permanent Loss of Shallow Water Habitat for Delta Smelt

Permanent impacts on shallow water habitat for delta smelt, totaling 0.036 acre, will be mitigated at a 3:1 ratio. The Applicant proposes to compensate for the permanent loss of shallow water habitat through the purchase of 0.108 acre of mitigation credits at a Service-approved mitigation bank, such as the Liberty Island Conservation Bank, to offset the project's impact.

Action Area

The Action area is defined in 50 CFR § 402.02, as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” For the proposed project, the Service considers the action area to include the approximately 42-acre BSA described in the biological assessment and portions of the Sacramento River that may be affected by elevated turbidity, sediment deposition, and underwater noise generated by in- and near-water construction activities.

Because pile driving effects are anticipated to extend beyond water quality effects (with BMPs in place), the action area includes areas both upstream and downstream from pile driving activity where pile driving noise may have a physical or behavioral effect on delta smelt. Based on the analysis, in the biological assessment, of sound expected to be generated by pile driving the action area for this project also includes the entire width of the Sacramento River channel 7,400 feet upstream and 7,600 feet downstream of the proposed bridge crossing (i.e., from approximately River Mile 58 to approximately River Mile 61) extending out 2,000 feet beyond the straight line.

Analytical Framework for the Jeopardy Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. “Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and

recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal action, and any cumulative effects, on the rangewide survival and recovery of the listed species. It relies on four components: (1) the Status of the Species, which describes the rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

Status of the Species

Delta Smelt

Legal Status

The Service proposed to list the delta smelt as threatened with proposed critical habitat on October 3, 1991 (Service 1991). The Service listed the delta smelt as threatened on March 5, 1993 (Service 1993), and designated critical habitat for the species on December 19, 1994 (Service 1994). The delta smelt was one of eight fish species addressed in the *Recovery Plan for the Sacramento–San Joaquin Delta Native Fishes* (Service 1996), which is currently under revision. A 5-year status review of the delta smelt was completed on March 31, 2004 (Service 2004). The 2004 review concluded that delta smelt remained a threatened species. A subsequent 5-year status review recommended uplisting delta smelt from threatened to endangered (Service 2010a). A 12-month finding on a petition to reclassify the delta smelt as an endangered species was completed on April 7, 2010 (Service 2010b). After reviewing all available scientific and commercial information, the Service determined that re-classifying the delta smelt from a threatened to an endangered species was warranted but precluded by other higher priority listing actions (Service 2010c). The Service annually reviews the status and uplisting recommendation for delta smelt during its Candidate Notice of Review (CNOR) process. Each year, the CNOR has recommended the uplisting from threatened to endangered. Electronic copies of these documents are available at http://ecos.fws.gov/docs/five_year_review/doc3570.pdf and <http://www.gpo.gov/fdsys/pkg/FR-2013-11-22/pdf/2013-27391.pdf> (Service 2010a; Service 2010b).

Description and Life Cycle

The delta smelt is a small fish of the family Osmeridae. It is endemic to the San Francisco Bay-Delta where it primarily occupies open-water habitats in Suisun Bay and marsh and the Sacramento-San Joaquin Delta. The delta smelt is primarily an annual species, meaning that it completes its life cycle in one year which typically occurs from April to the following April,

within a 1-2 month buffer. In captivity delta smelt can survive to spawn at two years of age (Lindberg *et al.* 2013), but this appears to be rare in the wild (Bennett 2005). Very few individuals reach lengths over 3.5 inches (90 millimeters [mm]).

Population Numbers

Currently, the spawning stock of delta smelt appears to be at its second lowest abundance on record, the lowest having been recorded during WY 2016 (Table 1). The 2016 Fall Mid water Trawl (FMWT) Index was 8, the second lowest value on record. The California Department of Fish and Wildlife's (CDFW) Spring Kodiak Trawl (SKT) monitors the adult spawning stock of delta smelt and serves as an indication for the relative number and distribution of spawners in the system. The Service has calculated an absolute abundance estimate¹ for adult spawners in water year 2017 using January and February SKT data. This absolute abundance estimate is also the second lowest on record (Table 1). The population size of adult delta smelt January-February (2017) was estimated to be between 22,000 and 92,000 fish with a point estimate of 47,786. The January-February (2016) point estimates were the lowest values since 2002 and suggested delta smelt experienced increased mortality during extreme drought conditions occurring during 2013-2015. While 2017 estimates likely represent an increase in recruitment and survival from the prior year, the continued low parental stock of delta smelt relative to historical numbers suggest the population will continue to be vulnerable to stochastic events and operational changes that may occur in response until successive years of increased population growth result in a substantial increase of abundance.

Table 1. Three indicators of adult delta smelt status for water years 2002-2017. Column 2 is the CDFW Fall Mid water Trawl Index by water year (i.e., the indices for calendar years 2001-2016). Column 3 is the CDFW Spring Kodiak Trawl Index. Column 4 is an estimate of adult delta smelt abundance during January and February that the Service calculates from the Spring Kodiak Trawl Survey.

Water Year	FMWT Index (unitless)	SKT Index (unitless)	Jan-Feb SKT abundance estimate (thousands of fish)
2002	603	N/A	739.8
2003	139	N/A	634
2004	210	99.7	654.5
2005	74	52.9	477.8
2006	26	18.2	186.8
2007	41	32.5	292
2008	28	24.1	325.3
2009	23	43.8	365.9
2010	17	27.4	169.4
2011	29	18.8	290.8

¹ The Service completed a new adult delta smelt abundance estimation procedure based on CDFW's SKT data for January and February (see Table 1). This procedure has recently been updated from that used in 2016. While these estimates likely represent a minimum population size due to the method's reliance on survey data, this is our current best estimate of population size.

2012	343	130.2	772.3
2013	42	20.4	212.5
2014	18	30.1	207.6
2015	9	13.8	139.3
2016	7	1.8	16.2
2017	8	3.8	47.8

In addition to the abundance estimates, the CDFW conducts four fish surveys from which it develops indices of delta smelt's relative abundance (Figures 3-1 and 3-2). Each survey has variable and unquantified capture efficiency, and in each, the frequency of zero catches of delta smelt is very high, largely due to the species' rarity (*e.g.*, Latour 2015; Polansky *et al.* in review). The [summer] Towntnet Survey (TNS) is the longest running indicator of delta smelt relative abundance; it has been conducted since 1959. Although this survey was designed to index the relative abundance of metamorphosing juvenile striped bass (*Morone saxatilis*) (Turner and Chadwick 1972), delta smelt have been collected incidentally; most of the delta smelt captured are age-0 and about 20-40 mm in length (Miller 2000). The FMWT is the second longest running indicator of delta smelt relative abundance; it has been conducted since 1967. This survey was also designed to index the relative abundance of age-0 striped bass (Stevens 1977), but as with the TNS, delta smelt are collected incidentally (Stevens and Miller 1983). Most of the delta smelt captured by the FMWT are age-0 "subadults" and are about 50-70 mm in length (Sweetnam 1999). The 20-mm Survey is the third longest running indicator of delta smelt relative abundance; it has been conducted since 1995. This survey was designed to monitor the distribution of late larval or metamorphosing juvenile delta smelt to assess their distribution and risk of entrainment into the large water export diversions of the Central Valley Project (CVP) and State Water Project (SWP) (Dege and Brown 2004). As its name suggests, most of the delta smelt collected by the 20-mm Survey are about 10-30 mm in length, with a peak catch of fish just under 20 mm (Kimmerer 2008). The newest indicator of delta smelt relative abundance is the SKT, which has been conducted since 2002. This survey was designed to monitor the distribution of pre-spawn and spawning adult delta smelt to assess their distribution and risk of entrainment. Most of the delta smelt captured in the SKT are 60-80 mm in length (Bennett 2005).

The TNS and FMWT abundance indices for delta smelt have documented the species' long-term decline, while the newer 20-mm and SKT abundance indices have generally confirmed the recent portions of the trends implied by the older surveys (Figures 3-1 and 3-2). During the period of record, juvenile delta smelt relative abundance has declined from peak levels observed during the latter 1970s (Figure 3-1), while subadult relative abundance was at its highest in 1970 and again in 1980 (Figure 3-2). Juvenile and subadult abundance indices both declined rapidly during the early 1980s, increased somewhat during the 1990s, and then collapsed in the early 2000s. Since 2005, the TNS and the FMWT have produced indices that reflect less year to year variation than their 20-mm and SKT analogs, but overall, the trends in both sets of indices are similar. During the past decade, each index has frequently reached new record low levels. The TNS index was 0.0 in 2015 and 2016, and the 2015 FMWT index and subsequent 2016 SKT index were record lows (about one half of one percent of the relative abundance recorded in 1970-1971).

The abundance of adult delta smelt may have exceeded twenty million in 1980-1981 (Rose *et al.* 2013b). This may sound like a large number – and it is compared to the contemporary estimates listed in Table 1. However, decades of monitoring by CDFW has shown that the delta smelt has usually not been very abundant when compared to other pelagic (meaning offshore-oriented or open-water) fishes (Figure 4). In the TNS, delta smelt catches have usually been lower than age-0 striped bass, and in recent years, also lower than gobies and threadfin shad. In the FMWT, delta smelt catches have been persistently lower than at least five other species. Research and monitoring in shallower habitats like Suisun Marsh (Moyle 1986; Matern *et al.* 2002), Delta

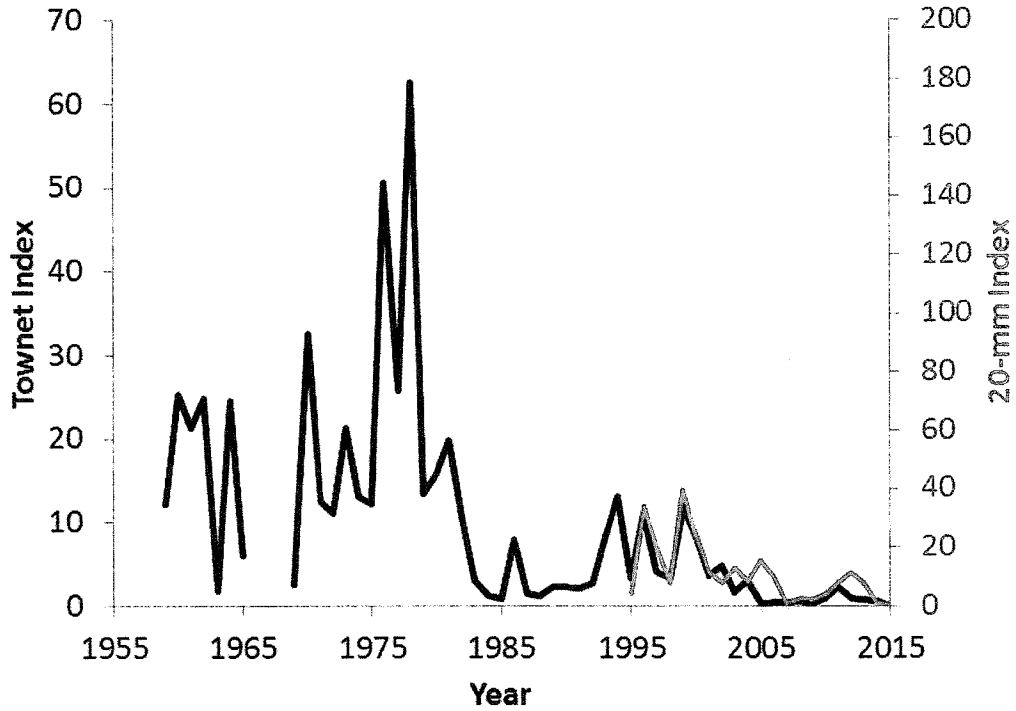


Figure 3-1. Time series of the California Department of Fish and Wildlife’s Summer Townet Survey (black line; primary y-axis) and 20-mm Survey (gray line; secondary y-axis) abundance indices for delta smelt.

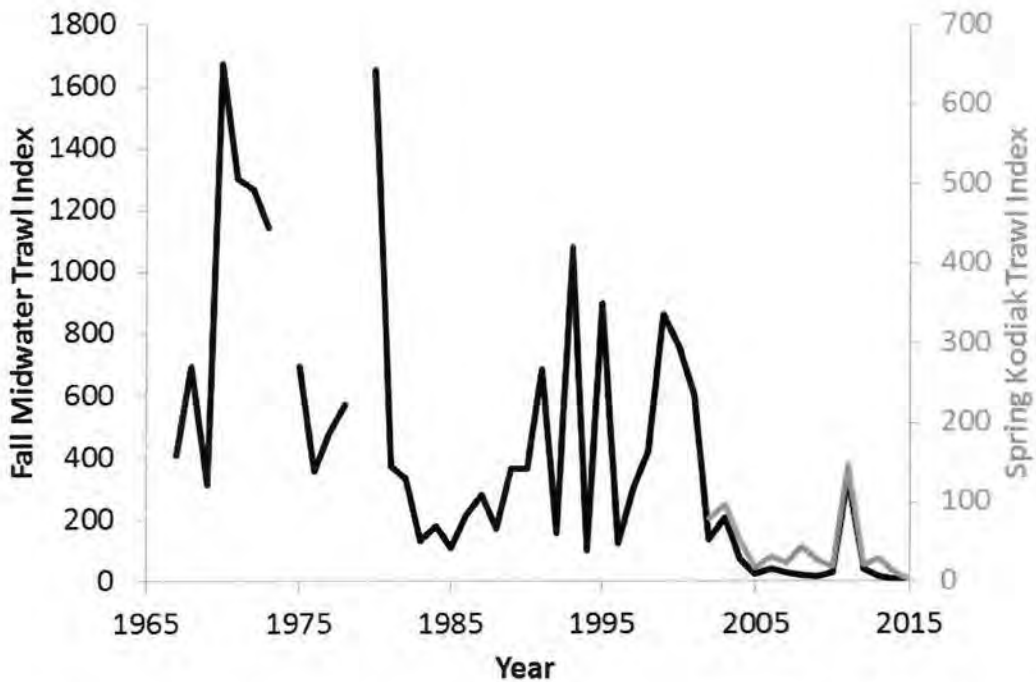


Figure 3-2. Time series of the California Department of Fish and Wildlife’s Fall Midwater Trawl (black line; primary y-axis) and Spring Kodiak Trawl (gray line; secondary y-axis) abundance indices for delta smelt.

beaches (Nobriga *et al.* 2005), and small tidal marshes in the upper estuary (Gewant and Bollens 2012) have reported even lower relative abundances of delta smelt. In each of the studies cited, the catches of delta smelt represented less than one percent of the total fish catch and there were usually more than a dozen more abundant fish species.

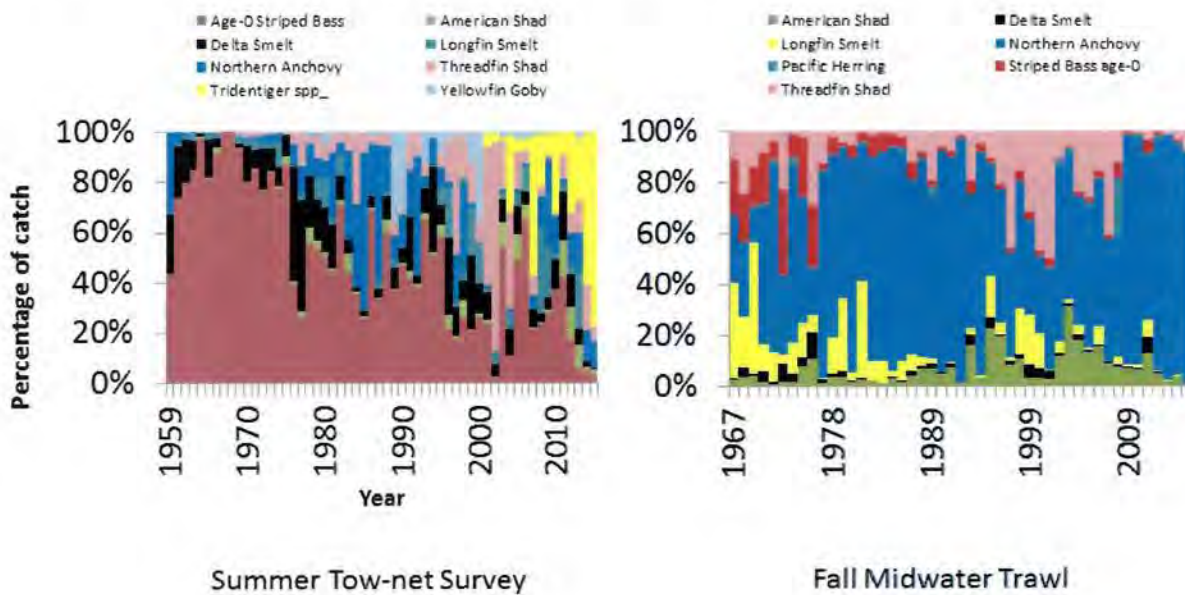


Figure 4. Fractional compositions of the eight most frequently collected fish species in the California Department of Fish and Wildlife's Summer Tow-net Survey (1959-2015), and the seven most frequently collected fish species in the Fall Midwater Trawl (1967-2015).

The long-term rarity of the delta smelt has had a consequence for understanding the reasons for their population decline, which generates uncertainty about how resource managers should intervene. Some pelagic fishes have shown long-term relationships between Delta inflow, Delta outflow, or X2 and their abundance or survival (Stevens and Miller 1983; Jassby *et al.* 1995; Kimmerer 2002a; Kimmerer *et al.* 2009). There does seem to be some difference in the likelihood of whether the delta smelt population will increase or decrease in abundance from one year to the next based on hydrology (Figure 5), but there has never been any predictable relationship linking freshwater flow conditions to the relative abundance of delta smelt (Stevens and Miller 1983; Jassby *et al.* 1995; Kimmerer 2002a; Kimmerer *et al.* 2009). Recently, several teams of researchers have built several varieties of conceptual (IEP 2015) and mathematical (Thomson *et al.* 2010; Maunder and Deriso 2011; Miller *et al.* 2012; Rose *et al.* 2013a) life cycle models for the delta smelt that attempt to describe the reasons the population has declined. Some of these models have been able to recreate the trend observed in abundance indices very well (Figure 6), but they have all done so using different approaches and different variables to do so. Collectively, these modeling efforts have been helpful in that they generally support water temperature and changes in the estuary's food web as 'universally supported' factors affecting delta smelt. However, they have also come to very different conclusions about the conservation value of more readily manageable factors like water project operations.

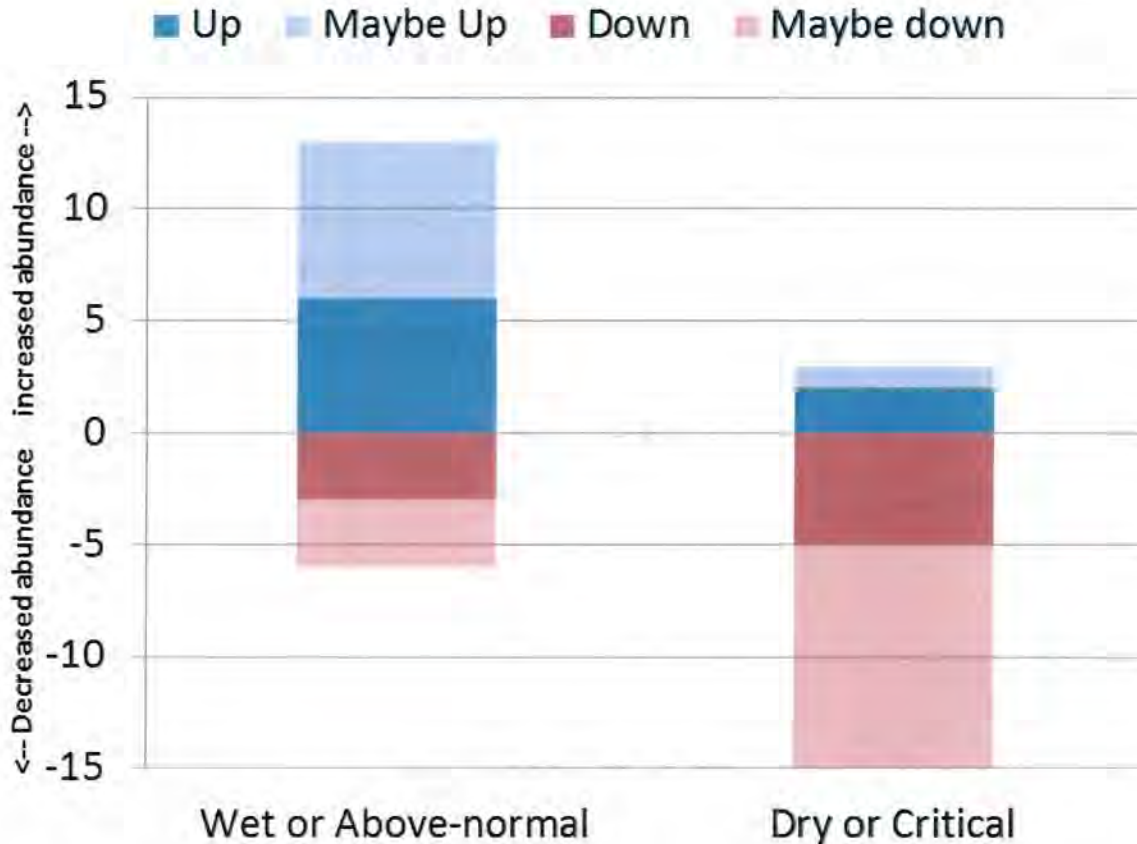


Figure 5. Frequencies of delta smelt population increases or decreases (red colored portions of each bar occurring below zero) based on the California Department of Fish and Wildlife’s Fall Midwater Trawl Survey, 1967-2015. A population increase reflects an increase in relative abundance over the prior year’s index and a population decrease reflects a decrease in relative abundance compared to the prior year’s index. The Service performed bootstrap resampling on each year’s catch per tow to generate a mean catch per tow with 95 percent confidence intervals. This resulted in four possible outcomes: (1) a statistically significant increase in relative abundance from one year to the next in which the confidence intervals of the two years did not overlap (“Up”; solid blue bar segments), (2) a statistically non-significant increase in relative abundance from one year to the next in which the confidence intervals of the two years overlapped (“Maybe Up”; lighter blue bar segments), (3) a statistically significant decrease in relative abundance from one year to the next in which the confidence intervals of the two years did not overlap (“Down”; solid red bar segments), or (4) a statistically non-significant decrease in relative abundance from one year to the next in which the confidence intervals of the two years overlapped (“Maybe Down”; lighter red bar segments). The counts in each of the four categories were combined by Sacramento Valley Water Year Types except that below-normal years were not plotted. The frequencies of population decline were converted into a negative number so that population increases would count up from the zero line on the y-axis and population decreases would count down from the zero line.

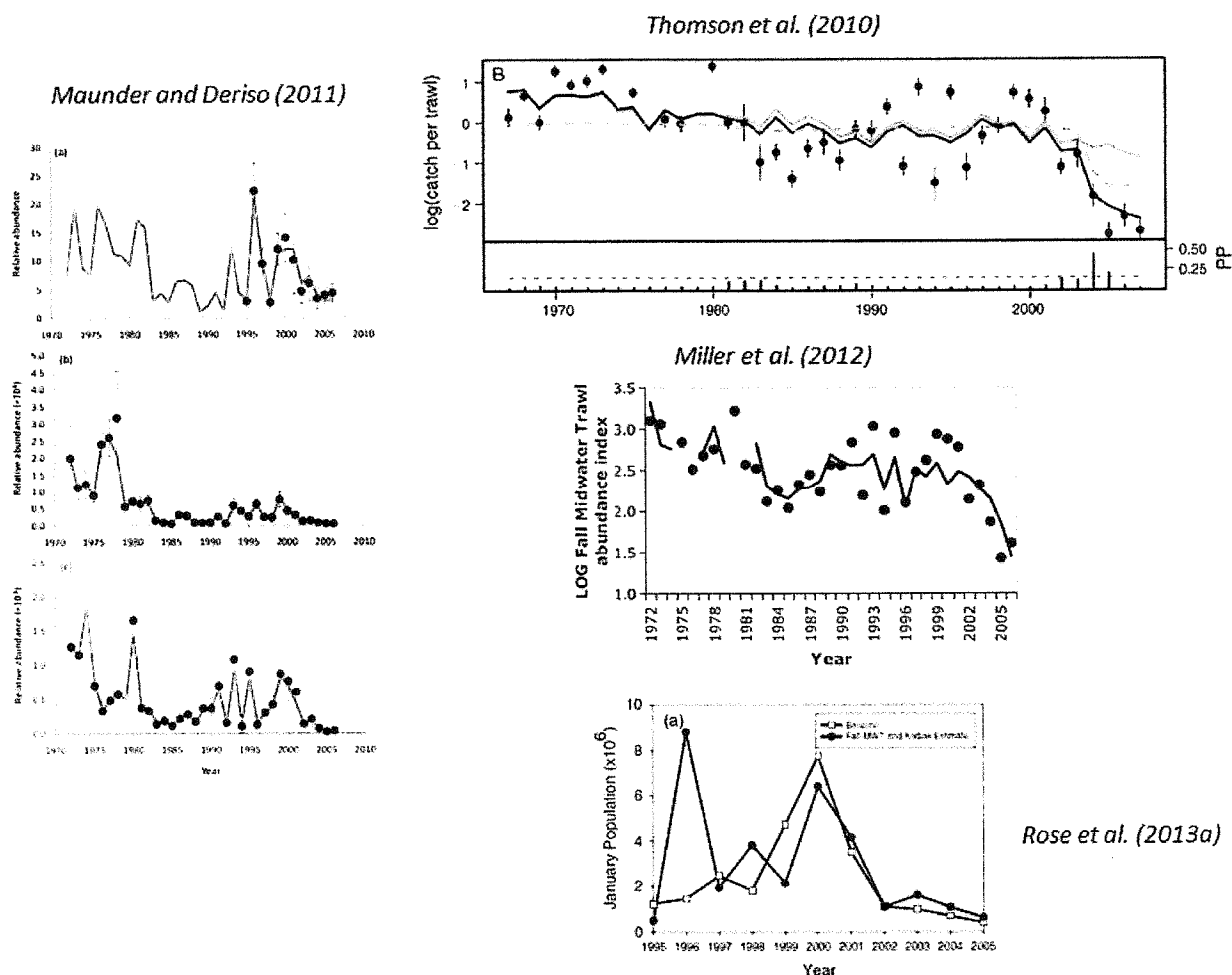


Figure 6. Examples of recent published model fits to time series of delta smelt relative abundance data. The source of each is referenced above or alongside each time series. In each plot, observed catches are depicted as black dots and model predictions of the data as gray or black lines. Model predictions from Rose *et al.* (2013a) are a black line with open symbols. In Maunder and Deriso (2011), the three panels represent the 20-mm Survey, Summer Tow-net Survey, and Fall Midwater Trawl (FMWT) Survey from top to bottom, respectively. The other three studies are fit to estimates of adult delta smelt relative abundance (FMWT catch in Thomson *et al.* 2010 and the FMWT index in Miller *et al.* 2012) or absolute abundance (Rose *et al.* 2013a). See each study for further details on Methods, Results, and the authors’ interpretations of their Results.

Habitat and Distribution

Because the delta smelt only lives in one part of one comprehensively monitored estuary, its general distribution is well understood (Moyle *et al.* 1992; Bennett 2005; Hobbs *et al.* 2006; 2007; Feyrer *et al.* 2007; Nobriga *et al.* 2008; Kimmerer *et al.* 2009; Merz *et al.* 2011; Murphy and Hamilton 2013; Sommer and Mejia 2013). There are both location-based (*e.g.*, Sacramento River around Decker Island) and conditions-based (low-salinity zone) habitats that delta smelt permanently occupy. There are habitats that delta smelt occupy seasonally (*e.g.*, for spawning), and there are habitats that delta smelt occupy transiently, which we define here as occasional

seasonal use. These include distribution extremes from which delta smelt are not collected every year or even in most years.

Most delta smelt complete their entire life cycle within or immediately upstream of the estuary's low-salinity zone. The low-salinity zone is frequently defined as waters with a salinity range of about 0.5 to 6 parts per thousand (ppt) (Kimmerer 2004). The 0.5 to 6 ppt and similar salinity ranges reported by different authors were chosen based on analyses of historical peaks in phytoplankton and zooplankton abundance, but recent physiological and molecular biological research has indicated that the salinities that typify the low-salinity zone are also optimal for delta smelt (Komoroske *et al.* 2016). The low-salinity zone is a dynamic habitat with size and location that respond rapidly to changes in tidal and river flows. The U.S. Environmental Protection Agency (EPA) recently finished a comprehensive set of maps that show how the low-salinity zone changes in size and shape when freshwater flows change the location of X2 (EPA 2012). This document can be found at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/cmnt081712/karen_schwinn.pdf.

The low-salinity zone expands and moves downstream when river flows into the estuary are high, placing low-salinity water over a larger and more diverse set of nominal habitat types than occurs under low flow conditions. During periods of low outflow, the low-salinity zone contracts and moves upstream. Due to its historical importance as a fish nursery habitat, there is a long research history into the physics and biology of the San Francisco Estuary's low-salinity zone (Kimmerer 2004).

The ecological function of the low-salinity zone also varies depending mainly on freshwater flow (Jassby *et al.* 1995; Kimmerer 2002b; Kimmerer 2004). Low outflow can decrease the capacity of the low-salinity zone and adjacent habitats to support the production of delta smelt by reducing habitat diversity and concentrating the fish with their predators and competitors (Service 1993; 1994). During the past four decades, the low-salinity zone ecosystem has undergone substantial changes in turbidity (Schoellhamer 2011) and food web function (Winder and Jassby 2011) that cannot be undone by increasing Delta outflow. These habitat changes, which extend into parts of the Delta where water is fresher than 0.5 ppt, have also decreased the ability of the low-salinity zone and adjacent habitats to support the production of delta smelt (Thomson *et al.* 2010; Rose *et al.* 2013b; IEP 2015).

Delta smelt have been observed as far west as San Francisco Bay, as far north as Knight's Landing on the Sacramento River, as far east as Woodbridge on the Mokelumne River and Stockton on the Calaveras River, and as far south as Mossdale on the San Joaquin River (Figure 7). This distribution represents a range of salinity from essentially zero ppt up to about 20 ppt, which represents a salinity range well beyond definitions of the low-salinity zone or mixing zone near a salinity of 2 ppt emphasized in the critical habitat rule (Service 1994). It is also well beyond the geographic extent of the critical habitat rule (described below). However, most delta smelt that have been collected in the extensively surveyed San Francisco Estuary have been collected from locations within the bounds defined in the critical habitat rule. In addition, all habitats known to be occupied year-round by delta smelt occur within the bounds defined in the critical habitat rule.



Figure 7. Delta smelt range map. Waterways colored in purple depict the delta smelt distribution described by Merz *et al.* (2011). The Service has used newer information to expand the transient range of delta smelt further up the Napa and Sacramento rivers than indicated by Merz *et al.* (2011). The red polygon depicts the designated critical habitat for the delta smelt.

Delta smelt permanently occupy the Cache Slough ‘complex’ including Liberty Island and the adjacent reach of the Sacramento Deepwater Shipping Channel (Sommer and Mejia 2013),

Cache Slough to its confluence with the Sacramento River and the Sacramento River from that confluence downstream to Chipps Island, Honker Bay, and the eastern part of Montezuma Slough (Figure 8). The reasons delta smelt are believed to permanently occupy this part of the estuary are the presence of fresh- to low-salinity water year around that is comparatively turbid and of a tolerable water temperature year around. These appropriate water quality conditions overlap an underwater landscape featuring variation in depth, tidal current velocities, edge habitats, and food production (Sweetnam 1999; Nobriga *et al.* 2008; Feyrer *et al.* 2011; Murphy and Hamilton 2013; Hammock *et al.* 2015; Bever *et al.* 2016). Field observations are increasingly being supported by laboratory research that explains how delta smelt respond physiologically to variation in salinity, turbidity, water temperature, and other aspects of their habitat that can vary with changes in climate, freshwater flow and estuarine bathymetry (Hasenbein *et al.* 2014, 2016; Komoroske *et al.* 2014, 2016).

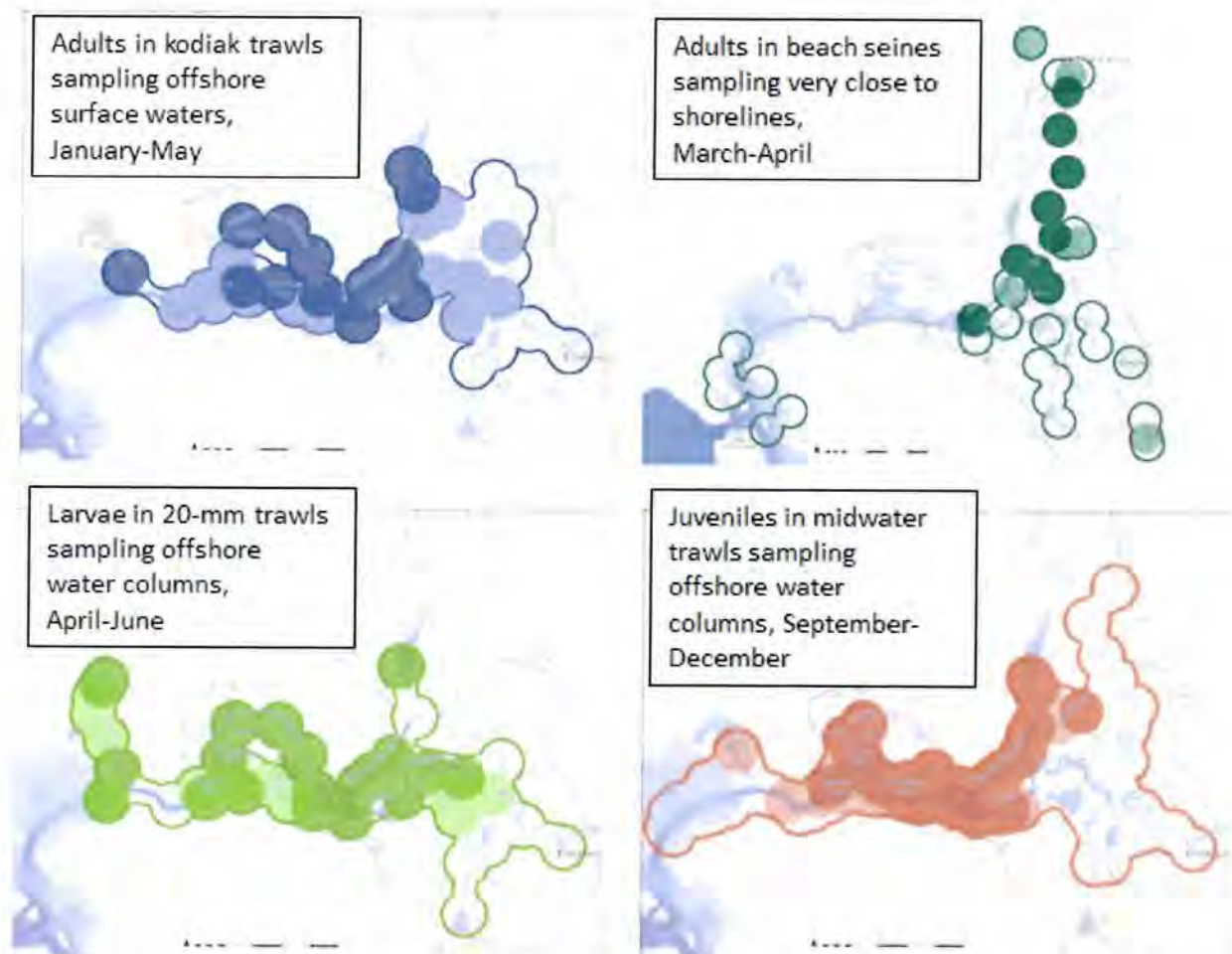


Figure 8. Maps of multi-year average distributions of delta smelt collected in four monitoring programs. The sampling regions covered by each survey are outlined. The areas with dark shading surround sampling stations in which 90 percent of the delta smelt collections occurred, the areas with light shading surround sampling stations in which the next 9 percent of delta smelt collections occurred. Source: Murphy and Hamilton (2013).

Each year, the distribution of delta smelt seasonally expands when adults disperse in response to winter flow increases that also coincide with seasonal increases in turbidity and decreases in water temperature (Figure 8). The annual range expansion of adult delta smelt extends up the Sacramento River to about Garcia Bend in the Pocket neighborhood of Sacramento, up the San Joaquin River from Antioch to areas near Stockton, up the lower Mokelumne River system, and west throughout Suisun Bay and marsh. Some delta smelt seasonally and transiently occupy Old and Middle rivers in the south Delta each year, but face a high risk of entrainment when they do (Grimaldo *et al.* 2009).

The distribution of delta smelt occasionally expands beyond this area (Figure 7). For instance, during high outflow winters, adult delta smelt also disperse west into San Pablo Bay and up into the Napa River (Hobbs *et al.* 2007). Similarly, delta smelt have occasionally been reported from the Sacramento River north of Garcia Bend up to Knights Landing (*e.g.*, Merz *et al.* 2011; Vincik and Julienne 2012).

The expanded adult distribution initially affects the distribution of the next generation because delta smelt eggs are adhesive and not believed to be highly mobile once they are spawned. The distribution of larvae reflects a combination of where spawning occurred and freshwater flow conditions when the eggs hatched. Variation in Delta outflow affects the spatial distribution of the delta smelt population for most of its life. The ecological condition of the estuary's low-salinity zone has historically been indexed using a statistic called X2, a local name for the geographic location of 2 ppt salinity near the bottom of the water column (Jassby *et al.* 1995). During spring, larval delta smelt have centers of distribution in freshwater, typically 20-40 km upstream of X2 (Dege and Brown 2004). By July, as water temperatures in the Delta reach annual peaks, post-larval and juvenile delta smelt have centers of distribution very close to X2 (Dege and Brown 2004), but the fish are broadly distributed around that peak (Sweetnam 1999; Nobriga *et al.* 2008). During the fall, subadult delta smelt still have a center of distribution near X2 (Sommer *et al.* 2011), and remain broadly distributed around that peak (Feyrer *et al.* 2007; 2011). During the winter, maturing adult delta smelt disperse in connection with winter storms following the spread of turbid fresh water (Grimaldo *et al.* 2009; Sommer *et al.* 2011; Murphy and Hamilton 2013). After an initial dispersal, recent analyses suggest the delta smelt population's distribution no longer responds strongly to variation in Delta outflow (Polansky *et al.* in review), though some individuals continue to move around in response to flow changes associated with storms (Leo Polansky, unpublished analysis of Early Warning Survey data set).

Food

At all life stages, numerous small crustaceans, especially a group called calanoid copepods, make up most of the delta smelt diet (Nobriga 2002; Slater and Baxter 2014). Small crustaceans are ubiquitously distributed throughout the estuary, but which prey species are present at particular times and locations has changed dramatically over time (Winder and Jassby 2011; Kratina *et al.* 2014). This has likely affected delta smelt feeding success, particularly during Central California's warm summers.

Reproductive Strategy

The reproductive behavior of delta smelt is only known from captive specimens spawned in artificial environments and most of the information has never been published. Spawning likely occurs mainly at night with several males attending a female that broadcasts her eggs onto bottom substrate (Bennett 2005). Although preferred spawning substrate is unknown, spawning habits of delta smelt's closest relative, the Surf smelt (*Hypomesus pretiosus*), as well as unpublished experimental trials, suggest that sand may be the preferred substrate (Bennett 2005; Sommer and Mejia 2013). Hatching success peaks at temperatures of 15-16°C (59-61°F) and decreases at cooler and warmer temperatures. Hatching success nears zero percent as water temperatures exceed 20°C (68°F) (Bennett 2005). Water temperatures suitable for spawning occur most frequently during the months of March-May, but ripe female delta smelt have been observed as early as January and larvae have been collected as late as July. Delta smelt spawn in the estuary and have one spawning season for each generation, which makes the timing and duration of the spawning season important every year. As stated above, delta smelt are believed to spawn on sandy substrates in fresh and possibly low-salinity water (Bennett 2005). Therefore, freshwater flow affects how much of the estuary is available for delta smelt to spawn (Hobbs *et al.* 2007).

Delta smelt can start spawning when water temperatures reach about 10°C (50°F) and can continue until temperatures reach about 20°C (Bennett 2005). The ideal spawning condition occurs when water temperatures remain cool throughout the spring (*e.g.*, March-May). Few delta smelt ≤ 55 mm in length are sexually mature and 50% of delta smelt reach sexual maturity at 60 to 65 mm in length (Rose *et al.* 2013b). Thus, if water temperatures raise much above 10°C in the winter, the "spawning season" can start before most individuals are mature enough to actually spawn. If temperatures continue to warm rapidly toward 20°C in early spring, that can end the spawning season with only a small fraction of 'adult' fish having had an opportunity to spawn. Delta smelt were initially believed to spawn only once before dying (Moyle *et al.* 1992). It has since been confirmed that like many other ecologically similar forage fishes (Winemiller and Rose 1992) individual delta smelt can spawn more than once if water temperatures remain suitable for a long enough time, and if the adults find enough food to support the production of another batch of eggs (Lindberg *et al.* 2013; Kurobe *et al.* 2016). As a result, the longer water temperatures remain cool, the more fish have time to mature and the more times individual fish can spawn.

Although adult delta smelt can spawn more than once, mortality is high during the spawning season and most adults die by May (Polansky *et al.* in review). The egg stage averages about 10 days before the embryos hatch into larvae. The larval stage averages about 30 days. Metamorphosing "post-larvae" appear in monitoring surveys from April into July of most years. By July, most delta smelt have reached the juvenile life stage. Delta smelt collected during the fall are called "subadults", a stage which lasts until the following winter when fish disperse toward spawning habitats. This winter dispersal usually precedes sexual maturity (Sommer *et al.* 2011).

Recovery and Management

Following Moyle *et al.* (1992), the Service (1993) indicated that SWP and CVP exports were the primary factors contributing to the decline of delta smelt due to entrainment of larvae and juveniles and the effects of low flow on the location and function of the estuary mixing zone (now called the low-salinity zone). In addition, prolonged drought during 1987-1992, in-Delta water diversions, reduction in food supplies by nonindigenous aquatic species -specifically overbite clam and nonnative copepods, and toxicity due to agricultural and industrial chemicals were also factors considered to be threatening the delta smelt. In the Formal Endangered Species Act Consultation on the Proposed Coordinated Long-Term Operations of the State Water Project and Central Valley Project (2008 Service BiOp), the Service's Reasonable and Prudent Alternative required protection of all life stages from entrainment and augmentation of Delta outflow during the fall of Wet or Above-Normal years as classified by the State of California (Service 2008). The expansion of entrainment protection for delta smelt in the 2008 Service BiOp was in response to large increases in juvenile and adult salvage in the early 2000s (Kimmerer 2008). The fall X2 requirement was in response to increased fall exports that had resulted in greatly reduced variability in Delta outflow during the fall months (Feyrer *et al.* 2011).

The Service's (2010c) recommendation to uplist delta smelt from threatened to endangered included reservoir operations and water diversions upstream of the estuary as mechanisms interacting with exports to restrict the low-salinity zone and concentrate delta smelt with competing fish species. In addition, Brazilian waterweed (*Egeria densa*) and increasing water transparency were considered new detrimental habitat changes. Predation was considered a low-level threat linked to increasing waterweed abundance and increasing water transparency. Additional threats considered potentially significant by the Service in 2010 were entrainment into power plant diversions, contaminants, and reproductive problems that can stem from small population sizes. Conservation recommendations included: establish Delta outflows proportionate to unimpaired flows to set outflow targets as fractions of runoff in the Central Valley watersheds; minimize reverse flows in Old and Middle rivers; and, establish a genetic management plan with the goals of minimizing the loss of genetic diversity and limiting risk of extinction caused by unpredictable catastrophic events. The Service (2012b) recently added climate change to the list of threats to the delta smelt.

Continued protection of the delta smelt from excessive entrainment, improving the estuary's flow regime, suppression of nonnative species, increasing zooplankton abundance, and improving water quality are among the actions needed to recover the delta smelt.

Climate Change

Climate projections for the San Francisco Bay-Delta and its watershed indicate that temperature and precipitation changes will diminish snowpack in the Sierra-Nevada, changing the availability of natural water supplies (Knowles and Cayan 2002; Dettinger 2005). Warming may result in more precipitation falling as rain which will mean less water stored in spring snowpacks. This would increase the frequency of rain-on-snow events and increase winter runoff with an

associated decrease in runoff for the remainder of the year (Hayhoe *et al.* 2004). Overall, these and other storm track changes may lead to increased frequency of flood and drought cycles during the 21st century (Dettinger *et al.* 2015). Thus far, the 21st century has been substantially drier than the 20th century (Figure 9).

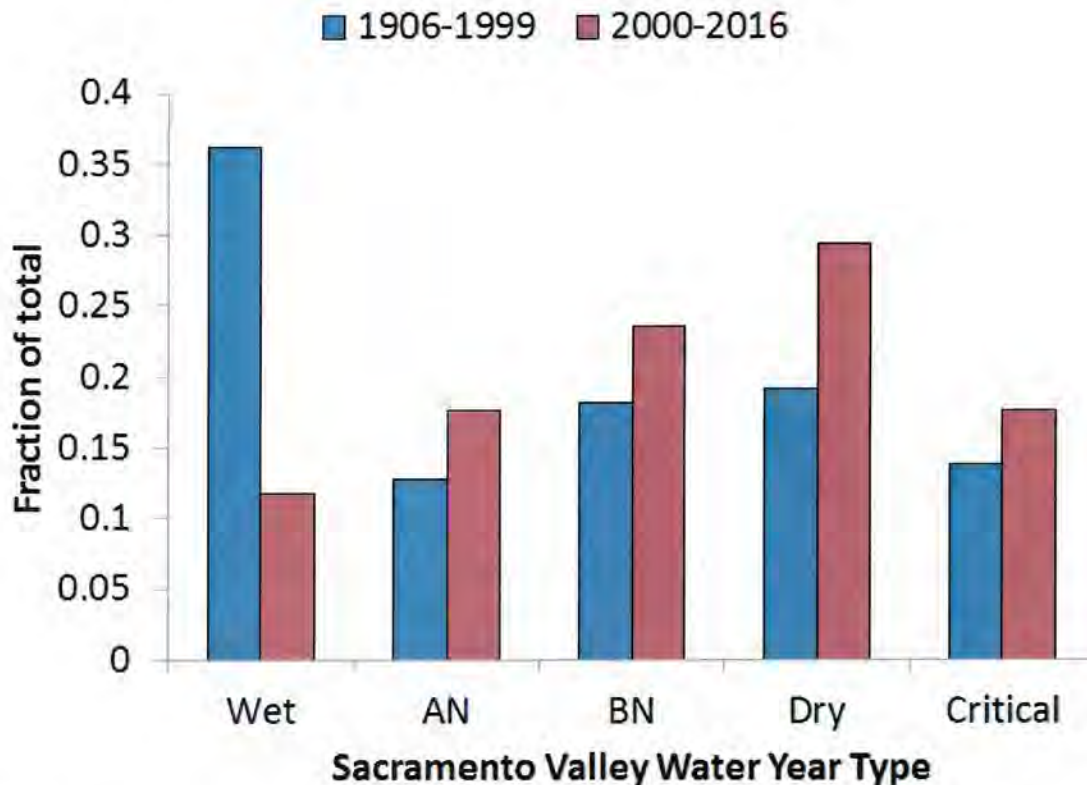


Figure 9. Frequency distribution of Sacramento Valley Water Year Types for: blue= 1906-1999 and red= 2000-2016.

Sea level rise is also anticipated as a consequence of a warming global climate and if it is not mitigated, sea level rise will likely influence saltwater intrusion into the Bay-Delta. Salinity within the northern San Francisco Bay is projected to rise by 4.5 ppt by the end of the century (Cloern *et al.* 2011). Elevated salinity could push X2 farther up the estuary if outflows were not increased to compensate. Fall X2 mean values are projected to increase by about 7 km to the area near the City of Antioch approximately 90 km from the Golden Gate Bridge by 2100 (Brown *et al.* 2013). This projected change in the location of X2 in the fall is expected to decrease suitable physical habitat if current levees and channel structures are maintained.

Central California's warm summers are already a source of energetic stress for delta smelt and warm springs already severely compress the duration of their spawning season (Rose *et al.* 2013a, b). Central California's climate is anticipated to get warmer (Dettinger 2005). We expect warmer estuary temperatures to present a significant conservation challenge for delta smelt. Mean annual water temperatures within the Delta are expected to increase steadily during the second half of this century (Cloern *et al.* 2011). Warmer water temperatures could further reduce

delta smelt spawning opportunities, decrease juvenile growth during the warmest months, and increase mortality via several food web pathways including: increased vulnerability to predators, increased vulnerability to toxins, and decreased capacity for delta smelt to successfully compete in an estuary that is energetically more optimal for warm water-tolerant fishes.

Recent research into the ecological effects of warming water temperatures suggests that delta smelt, depending on location, may be forced to spawn an average of ten to twenty-five days earlier in the season (Brown *et al.* 2013). The number of high mortality days (cumulative number of days of daily average water temperature $>25^{\circ}\text{C}$ (77°F)) is expected to increase (Brown *et al.* 2013). The number of physiologically stressful days (cumulative number of days of daily average water temperature $>20^{\circ}\text{C}$ (68°F)) is expected to be stable or decrease partly because many stressful days will become high mortality days. Thus, current modeling indicates that delta smelt will likely face a shorter maturation window and reduced habitat availability due to increased water temperatures. A shorter maturation window will likely have effects on reproduction (Brown *et al.* 2013). Growth rates have been shown to slow as water temperatures increase above 20°C (68°F), requiring delta smelt to consume more food to reach growth rates that are normal at lower water temperatures (Rose *et al.* 2013a). Delta smelt are smaller, on average, than in the past (Sweetnam 1999; Bennett 2005) and expected temperature increases due to climate change will likely slow growth rates further.

In summary, the delta smelt is currently at the southern limit of the inland distribution of the family Osmeridae along the Pacific coast of North America. Thus, increased temperatures associated with climate change may present a significant conservation challenge if they result in a Bay-Delta that is outside of the delta smelt's competitive limits. For the time being however, water temperatures are cool enough in the delta smelt's range for the species to complete its life cycle.

Summary of the Status of Delta Smelt

The relative abundance of delta smelt has reached very low numbers (Table 1) for a small forage fish in an ecosystem the size of the San Francisco Estuary. The recent record-low relative abundance reflects decades of habitat change, marginalization by non-native species that prey on and out-compete delta smelt, and remarkably dry hydrology occurring over recent years. The anticipated effects of climate change on the San Francisco Estuary and watershed such as warmer water temperatures, greater salinity intrusion, and the potential for frequent extreme drought, which has been experienced for the 21st century thus far (Figure 9) indicate challenges to delta smelt survival will increase. However, a rebound in relative abundance during the very wet and cool conditions during 2011 and again in 2017, indicate that delta smelt has retained some population resilience in years of increased spring outflows from the Delta (IEP 2015).

Valley Elderberry Longhorn Beetle

For the most recent comprehensive assessment of the range-wide status of the beetle, please refer to the Withdrawal of the Proposed Rule To Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife (Service 2014). Threats discussed in the withdrawal continue to act on the beetle, with loss of habitat being the most significant effect. While there continue to be losses of beetle habitat throughout its range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the beetle.

Environmental Baseline

Delta Smelt

The action area is located within the northern part of the range for the delta smelt. The delta smelt occur in the action area as they move into upper reaches of the system in the winter and spawn in this fresh water environment in the spring (IEP 2015). During the summer, the majority of the fish are expected to migrate downstream, towards the low salinity zone or the Cache Slough complex. The habitat conditions within the Delta and Sacramento River are variable by season and year, influencing delta smelt abundance and presence in the system.

The project occurs within the range of delta smelt and delta smelt are found year around within the project area in one part of their life stage or another. Currently, the delta smelt is experiencing the lowest abundance on record. The 2016 FMWT index of delta smelt abundance was 8. Following record low abundance indices from survey data in 2015, delta smelt survey results in water year 2016 continued to decline and exhibit record low abundance. The 2017 SKT index is 3.8 a modest increase from the record low 1.8 in 2016. The SKT monitors the adult spawning stock of delta smelt. The Service has recently begun the Enhanced Delta Smelt Monitoring Program to estimate abundance of delta smelt.

Valley Elderberry Longhorn Beetle

The project site is within the range of the valley elderberry longhorn beetle and the nearest record of the species is approximately 0.5 mile north of the project site along the west bank of the Sacramento River (CDFW 2015a). The Applicant has conducted surveys of the project site for elderberry bushes, the host plant of the valley elderberry longhorn beetle. The Applicant identified a total of seven elderberry bushes on the project site, with five on the West Sacramento side of the project site and two on the Sacramento side of the project site. The elderberry bushes ranged from 6 to 26 feet in height. Exits holes were not identified at the time of the survey but all bushes contained one or more stems equal to or greater than 1 inch diameter at ground level for a total of 42 stems that provide suitable habitat for the valley elderberry longhorn beetle.

Effects of the Action

Delta Smelt

Impacts on most delta smelt migrating adults and all spawning and egg incubation would be avoided by limiting any in-channel construction to the season when these sensitive life stages are considered to be absent or in very low densities (between May 1-November 30 for each construction year). However, some adults and juvenile delta smelt would be subject to potential harassment, injury, or mortality during work activities occurring in or near the stream channel. Most juveniles would be expected to move upstream or downstream of the immediate project area in response to disturbance. Displacement could affect survival by increasing the exposure of juveniles to predators and possibly increasing competition with other juveniles, especially if suitable rearing habitat is limited or not readily available. Although juveniles are capable of actively moving away from disturbances, some juveniles may seek cover in active work areas, where they may be injured or killed by exposure to harmful levels of suspended sediment or other factors. Implementation of the conservation measures would minimize these effects but not eliminate them.

Pile Driving Hydroacoustics

Delta smelt may be subjected to harassment and injury from the generation of noise and underwater sound pressure levels due to installation of new piles and their associated equipment. Barotraumas are pathologies in fish linked to the exposure to drastic changes in pressure which include hemorrhage and rupture of internal organs either immediately or a few days after exposure. Fish with swimbladders are susceptible to tissue damage from impulsive sounds. When pressure waves strike a gas-filled swimbladder, vibration occurs with expansion and contraction of the organ. If the amplitude of the vibration is high, the swimbladder can press against and strain adjacent organs. This compression can cause obvious injury in the form of ruptured capillaries, internal bleeding and destruction of highly vascular organs (Gaspin 1975; Hastings and Popper 2005). Elevated noise levels can cause sublethal injuries affecting survival and fitness. Similarly, if injury does not occur, noise may modify fish behaviors that may make them more susceptible to predation. Fish suffering damage to hearing organs may suffer equilibrium problems, and may have a reduced ability to detect predators and prey. Other types of sub-lethal injuries can place the fish at increased risk of predation and disease. Adverse effects on survival and fitness can occur even in the absence of overt injury. Exposure to elevated noise levels can cause a temporary shift in hearing sensitivity (referred to as a temporary threshold shift), decreasing sensory capability for periods lasting from hours to days (Turnpenny *et al.* 1994; Hastings *et al.* 1996).

The Fisheries Hydroacoustic Working Group, an interagency working group that includes the Service, has established interim criteria for evaluating underwater noise impacts from pile driving on fish. These criteria are defined in the document entitled "Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities" dated June 12, 2008 (Fisheries Hydroacoustic Working Group 2008). This agreement identifies a peak sound pressure level of 206 decibels (dB) and an accumulated SEL of 187 dB as thresholds for injury to fish less than 2

grams. Although there has been no formal agreement on a “behavioral” threshold, the Service and NMFS use 150 dB root mean square (RMS) as the threshold for adverse behavioral effects. Distances to the aforementioned injury and behavioral thresholds were modeled using NMFS’ Underwater Noise Calculation Spreadsheet for pile driving, using sound source levels derived from literature and the NMFS-recommended underwater attenuation rate of 4.5 dB per doubling of distance (NMFS 2009).

16-inch Diameter Steel or Square Precast Concrete Piles Installation for Abutments 1 and 6

The Applicant will install a total of 100 (50 per abutment) 16-inch diameter steel or square precast concrete piles proposed for supporting Abutments 1 and 6 using an impact hammer. When steel or concrete piles are used in conjunction with an impact hammer, high sound levels are likely to be generated during construction. Noise generated by impact pile driving is impulsive in nature. Impulsive noises have short duration and consist of a broad range of frequencies. Impulsive waveforms are characterized by a rapid pressure rise time (the time in milliseconds it takes the wave form to rise from 10 percent to 90 percent of its highest peak) that occurs within the first few milliseconds followed by rapid fluctuation (under-pressure and over-pressure) about the ambient pressure.

The Applicant estimates that driving the 16-inch diameter steel or concrete piles would require approximately 16,000 strikes per day to drive and test each pile (20 piles per day at 800 strikes per pile). The Applicant will drive these piles on land and there would be no opportunities to attenuate noise levels. Without the use of sound attenuation techniques, the distance at which the pile driving noise for 16-inch steel attenuates to below the threshold level (150 dB RMS) for behavioral effects is approximately 5,200 feet and approximately 3,825 feet for concrete piles. The distance at which the pile driving noise for 16-inch steel attenuates to below the sublethal/injury threshold (183-187 dB cumulative SEL) is approximately 824 feet and approximately 1,305 feet for concrete piles.

16-inch Diameter Steel or Square Precast Concrete Piles Installation for Piers 2 and 5

The Applicant will install the 100 16-inch diameter steel or square precast concrete piles proposed for supporting Piers 2 and 5 in dewatered cofferdams using an impact hammer. The Applicant estimates that driving the 16-inch diameter steel or concrete piles would require approximately 16,000 strikes per day to drive and test each pile (20 piles per day at 800 strikes per pile). The Applicant will drive these piles within dewatered cofferdams and there would be no opportunity to attenuate noise levels. Without the use of sound attenuation techniques, the distance at which the pile driving noise for 16-inch steel attenuates to below the threshold level (150 dB RMS) for behavioral effects is approximately 4,459 feet and approximately 824 feet for concrete piles. The distance at which the pile driving noise for 16-inch steel attenuates to below the sublethal/injury threshold (183-187 dB sound equivalency level cumulative) is approximately 824 feet and approximately 177 feet for concrete piles.

108-inch Diameter Steel Casing Installation for Piers 3 and 4

The Applicant will install 8 108-inch steel casings proposed for supporting Piers 3 and 4 using a vibratory pile driver and/or hydraulic-driven oscillator/rotator system. This installation method would not generate high levels of underwater noise.

16-inch Diameter Concrete Pile Installation for Bridge Fender System

The Applicant will install the 60 16-inch diameter concrete piles proposed for supporting the bridge fender system using an impact hammer. The Applicant estimates that driving the 16-inch diameter steel or concrete piles would require approximately 20,000 strikes per day to drive and test each pile (20 piles per day at 1,000 strikes per pile). The Applicant will install a bubble curtain to attenuate noise levels. Without the use of sound attenuation techniques, the distance at which the pile driving noise for 16-inch concrete piles attenuates to below the threshold level (150 dB RMS) for behavioral effects is approximately 1,775 feet. The distance at which the pile driving noise for 16-inch steel or concrete piles attenuates to below the sublethal/injury threshold (183-187 dB sound equivalency level cumulative) is approximately 384 feet. With the use of a bubble curtain to attenuate the noise these distances are reduced to 823 and 177 feet, respectively.

16-inch Diameter Steel Piles for Barge Installation

The Applicant will install the 8 temporary 16-inch diameter steel piles proposed for supporting barge installation using an impact hammer. The Applicant estimates that driving the 16-inch diameter steel or concrete piles would require approximately 6,400 strikes per day to drive and test each pile (8 piles per day at 800 strikes per pile). The Applicant will install a bubble curtain to attenuate noise levels. Without the use of sound attenuation techniques, the distance at which the pile driving noise for 16-inch steel piles attenuates to below the threshold level (150 dB RMS) for behavioral effects is approximately 9,610 feet. The distance at which the pile driving noise for 16-inch steel or concrete piles attenuates to below the sublethal/injury threshold (183-187 dB sound equivalency level cumulative) is approximately 1,775 feet. With the use of a bubble curtain to attenuate the noise these distances are reduced to 4,459 and 823 feet, respectively.

16-inch Diameter Steel or H Piles for Temporary Trestle Installation

The Applicant will install the 160 temporary 16-inch diameter steel piles proposed for supporting barge installation using an impact hammer. The Applicant estimates that driving the 16-inch diameter steel or H piles would require approximately 16,000 strikes per day to drive and test each pile for a total of up to (20 piles per day at 800 strikes per pile). The Applicant will install a bubble curtain to attenuate noise levels. Without the use of sound attenuation techniques, the distance at which the pile driving noise for 16-inch steel piles attenuates to below the threshold level (150 dB RMS) for behavioral effects is approximately 9,610 feet and approximately 3281 feet for H piles. The distance at which the pile driving noise for 16-inch steel piles attenuates to below the sublethal/injury threshold (183-187 dB sound equivalency level cumulative) is

approximately 1,775 feet and approximately 705 feet for H piles. With the use of a bubble curtain to attenuate the noise these distances are reduced to 4,459 and 823 feet, respectively for the 16-inch steel piles and 1,522 and 328 feet, respectively for H piles.

Sheet Piles for Temporary Cofferdam Installation

The Applicant will install the 180 sheet piles proposed to construct a temporary cofferdam using a vibratory hammer. This installation method would not generate high levels of underwater noise.

Pile driving activities will not be continuous but would start and stop during the course of each day of pile driving (including cessation of pile driving activities at night), providing opportunities for delta smelt to continue with their movements and feeding without substantial delays. For pile types that require driving with an impact hammer, the Applicant will first drive each pile as deeply as possible using a vibratory hammer to minimize underwater sound. In addition, general construction noise may act to disperse fish away from the construction area before impact driving is initiated.

Based on the area of disturbance and timing of pile driving operations, we anticipate some disturbance to the movement and feeding of delta smelt in the area. The calculated distance at which the 150 dB RMS threshold for behavioral effects would be exceeded is up to 9,610 feet away from the project site during pile driving for installation of the temporary trestles and supporting barge installation, without accounting for attenuation of sound energy using bubble curtains as proposed by the Applicant. However, the Sacramento River has river channel bends and the straight line distance of open water is 5,400 feet upstream and 5,600 feet downstream of the proposed bridge crossing. These distances are considerably shorter than the 9,610 feet at which the 150 dB RMS threshold for behavioral effects would be exceeded. Consequently, Caltrans has estimated that after accounting for diffraction and attenuation because of the physical geography of the river the 150 dB RMS threshold for behavioral effects would be exceeded only within 7,400 feet upstream and 7,600 feet downstream of the project site.

Mobilization of Sediment from Construction Activities

Construction activities are expected to generate small sediment plumes which will increase turbidity in the action area. Exposure to excessive suspended sediment concentrations could lead to physiological stresses such as clogged gills, eroded gill and epithelial tissue, impaired foraging activity and feeding success, and altered movement and migration patterns of juvenile and adult fish (Clarke and Wilber 2000; Newcombe and Jensen 1996; Newcombe and MacDonald 1991). Exposure of fish to elevated suspended sediment concentrations could result in behavioral avoidance and exclusion from otherwise suitable habitat, disrupt movement and migration patterns, reduce feeding rates and growth, result in sublethal and lethal physiological stress, habitat degradation or delayed hatching; and, under serve circumstances, could result in mortality (Newcombe and Jensen 1996; Clarke and Wilber 2000). The response of fish to suspended sediments varies among species and lifestages as a function of suspended particle size, particle shape, water velocities, suspended sediment concentrations, water temperature, depressed dissolved oxygen concentrations, contaminants, and exposure duration (O'Connor 1991; Sherk

Jr. 1971; Newcombe and Jensen 1996). Short-duration exposure to elevated suspended sediment concentration associated could result in sublethal effects; however, potential exposure and dosage of suspended sediment concentrations drops exponentially from the source of the plume.

While adult delta smelt already live in an environment with high background levels of turbidity and increased turbidity generally correlates with higher abundance of delta smelt (Feyrer *et al.* 2007; Nobriga *et al.* 2008), it is possible that excessive sedimentation may exceed turbidity levels ideal for delta smelt. If adult delta smelt were present within the plume, the behavioral avoidance response of this lifestage is expected to substantially reduce or eliminate the risk of lethal or sublethal exposure the farther they are from the plume source. However, turbidity would be minimized by implementing Conservation Measure 10 and monitoring turbidity throughout in-water construction.

Exposure to Contaminants

Disturbance and resuspension of river bottom sediments during in-water construction pose a risk to delta smelt because of potential increases in the exposure to contaminated sediments. Sand, silt, and gravel characterize bottom substrate in the action area. Non-soluble contaminants with a tendency to adsorb to sediments (as opposed to soluble contaminants which have the tendency to be readily diluted in water) can accumulate in the substrate over time. Non-soluble contaminants that are known to be present in the Sacramento River include polychlorinated biphenyls (PCBs), mercury, pesticides and insecticides (i.e., dieldrin, chlorodane, DDT), and other unknown toxicities (State Water Resources Control Board 2011). Resuspension of sediments with adsorbed metals during in-water construction potentially may lead to degradation of water quality and food resources in the action area. In addition, resuspended particulate material may be transported to other locations in the Sacramento River as a result of transport by river currents, thus leading to potential degradation of water quality and food resources in the action area. Although delta smelt may be present in the action area during May and June, restricting in-water construction to May 1–November 30 will reduce the exposure of delta smelt to contaminants because delta smelt occur less frequently than other months, or not at all, during this time of year.

In-water construction would be limited to pile driving, installation and removal of sheet piles for cofferdams, and rock slope protection placement. In addition, in-water construction would be limited to daylight hours each day. Thus, disturbance of channel substrate and the potential for increased contaminants would be temporary and localized. Assuming that mobilization of sediment is also an indication of contaminant mobilization, the proposed in-water construction methods and construction BMPs should minimize the increase in contaminants in the river.

Contaminant Spills

Construction activities that occur in or near the Sacramento River channel may result in the discharge of contaminants that are potentially lethal to fish, including delta smelt. The operation of heavy equipment, cranes, pile drivers, drilling rigs, tug boats, and other construction equipment during bridge construction may result in spills and leakage of fuel, lubricants, hydraulic fluids, and coolants. Other sources of potential contamination include asphalt, wet

concrete, and other materials that may come into direct contact with surface water during construction activities.

The potential magnitude of biological effects resulting from contaminants depends on a number of factors, including the proximity of spills to the river; the type, volume, concentration, and solubility of the contaminant; and the timing and duration of the spill or release of the contaminant into the water column. Contaminants can affect survival, growth, and reproductive success of fish and other aquatic organisms. The level of effect depends on the species, life stage sensitivity, duration of exposure, condition or health of exposed individuals, and the physical and chemical properties of the water (e.g., temperature, pH, dissolved oxygen, and other factors). Implementation of Conservation Measure 10 will minimize the risk of contaminant spills and potential effects of contaminant spills on fish, including delta smelt, and other aquatic organisms.

Water Quality

The proposed project could involve the storage, use, or discharge of toxic and other harmful substances near streams and other water-bodies that could result in contamination of these waterbodies and potentially affect fish and other aquatic organisms. Potential impacts range from avoidance of the project site to mortality, which could occur through exposure to lethal concentrations of contaminants or exposure to non-lethal levels that cause physiological stress and increased susceptibility to other sources of mortality (e.g., predation and disease). Project activities that could result in the accidental or unintentional runoff or discharge of toxic materials and other harmful substances to streams include the following:

- Potential accidental spill of petroleum products
- Operation of vehicles and equipment in or adjacent to stream channels or drainages
- Storage of pavement, petroleum products, concrete, and other construction materials
- Discharge of water from construction areas
- Disturbance and mobilization of contaminants with adsorbed metals

The operation of heavy equipment, cranes, vibratory and/or impact hammer rigs, and other construction equipment in or near the river can result in accidental spills and leakage of fuel, lubricants, hydraulic fluids, and coolants. In addition, re-suspension of sediments with adsorbed metals during in-water construction potentially could lead to localized degradation of water quality and food resources. Re-suspended particulate material also could be transported to downstream locations as a result of transport by flow, thus leading to potential degradation of water quality and food resources beyond the immediate construction area. Potential water quality effects that would expose delta smelt to hazardous contaminants would be minimized and avoided by implementation of the conservation measures including the BMPs and a spill prevention plan.

Fish Entrapment in Cofferdams

The Applicant will require temporary dewatering using cofferdams to construct piers 2 and 5 for the new bridge. The potential exists for entrapment and mortality of delta smelt following closure

and dewatering of the cofferdam. The proposed timing of cofferdam installation (May) would potentially overlap adult and juvenile occurrence in the river. Implementation of Conservation Measures 12 and 13 will potentially minimize the risk of mortality for delta smelt potentially stranded during cofferdam installation, closure, and dewatering.

Increase in Direct Lighting on the Sacramento River

Temporary lighting of work areas to facilitate nighttime construction, especially at construction sites adjacent to or over the Sacramento River, may result in increased nighttime light intensity on the water surface of the Sacramento River. Increases in direct lighting of the Sacramento River at night may affect the migratory behavior of fish; alter behavior of animals that prey on fish (e.g., piscivorous birds, mammals, and fish) in adjacent and affected habitats; or make juvenile fish more visible to predators, thereby leading to increased mortality of fish through increased predation (Tabor *et al.* 2001). Implementation of Conservation Measure 15 would minimize the potential for effects of lighting on fish, including delta smelt, by requiring shielding and focusing of temporary lights on work areas to avoid and minimize the amount of nighttime lighting that directly radiates on to the Sacramento River, to the extent practicable.

Introduction of Aquatic Invasive Species

During construction, the operation of barges and other in-water equipment originating from regions or areas outside the project area could result in the introduction and spread of aquatic invasive species, including the Asian overbite clam (*Corbula amurensis*), quagga mussel (*Dreissena bugensis*), zebra mussel (*Dreissena polymorpha*), hydrilla (*Hydrilla verticillata*), and Brazilian elodea (*Egeria densa*) (California Department of Fish and Game 2008). The Applicant will minimize this impact by implementing Conservation Measure 14.

Temporary and Permanent Loss of Aquatic Habitat

The proposed project components include the placement of 0.095 acres of temporary and 0.36 acre of permanent fill (bridge piers and rock slope protection) below the OHWM and would result in the shading of 1.26 acres of aquatic habitat. The Applicant has proposed to minimize the loss of permanent fill in shallow water habitat by purchasing 0.108 delta smelt credits at a Service-approved conservation bank but not the shading from the new bridge.

Valley Elderberry Longhorn Beetle

Project construction will adversely affect all 7 elderberry shrubs in the project area with at least one stem one inch or greater in diameter at ground level. Compensation for the loss of 42 stems measuring one inch or greater diameter at ground level would require plantings of 34 elderberry cuttings/seedlings and 34 associated riparian species. Any valley elderberry longhorn beetle larvae occupying the shrub could be killed when a shrub is removed; however, exit holes were not observed during surveys conducted the Applicant. The effects to the beetle are small and discrete, relative to the range of the species, and although the loss of habitat would contribute to the overall reduction of habitat within the range of the valley elderberry longhorn beetle, the

conservation measures would contribute to the long-term preservation and management of beetle habitat. The proposed project will contribute to the conservation of the valley elderberry longhorn beetle by preserving habitat at a conservation bank that would manage large contiguous sections of habitat for the benefit of the species.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed project are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of specific projects that might affect listed species or its critical habitat in the action area that are currently under review by State, county, or local authorities.

Conclusion

After reviewing the current status of the delta smelt and valley elderberry longhorn beetle, the environmental baseline for the action area; the effects of the proposed project and the cumulative effects, it is the Service's biological opinion that the I Street Bridge Replacement Project, as proposed, is not likely to jeopardize the continued existence of the delta smelt or valley elderberry longhorn beetle. This is based on: (1) the implementation of conservation measures to minimize adverse effects on listed species; (2) the low likelihood that the delta smelt would be in the action area during in-water construction activities; and (3) the capability of the delta smelt to continue to utilize the project area following construction.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed animals by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this *Incidental Take Statement*.

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this *Incidental Take Statement*. If Caltrans (1) fails to assume and implement

the *Terms and Conditions* or (2) fails to adhere to the *Terms and Conditions* of the *Incidental Take Statement* through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans must report the progress of the action and its impact on the species to the Service as specified in the *Incidental Take Statement* [50 CFR §402.14(i)(3)].

Amount or Extent of Take

The Service anticipates that all delta smelt juveniles and adults within 7,400 feet upstream and 7,600 feet downstream from the point of pile driving within the project area would be subject to harassment through effects resulting from construction activities. Incidental take in the form of harassment is expected to occur from construction and pile driving. Caltrans has proposed avoidance and minimization measures to reduce adverse effects and therefore take in the form of harassment is anticipated to be low. Incidental take in the form of injury or mortality is anticipated to occur through pile driving-related hydroacoustic effects and stranding behind cofferdams; however, the Service anticipates that take of adult delta smelt through injury or mortality would be low based on the proposed timing of in-water work when delta smelt are least likely to be in the action area and the proposed conservation measures. Upon implementation of the following reasonable and prudent measures, incidental take of delta smelt resulting from the project in the form of harassment, harm, injury, and mortality within the action area would become exempt from the prohibitions described under Section 9 of the Act.

The Service expects that incidental take of the valley elderberry longhorn beetle would be difficult to detect or quantify because the life cycle of the beetle and its small body size make the finding of a dead specimen unlikely, losses may be masked by seasonal fluctuations in numbers or other causes and the species occurs in habitat that makes them difficult to detect. It is not possible to make an accurate estimate of the number of valley elderberry longhorn beetles that would be harassed, harmed, injured, or killed during construction activities. In instances when take is difficult to detect, the Service may estimate take in numbers of individuals per number of elderberry stems one inch or greater in diameter lost or degraded as a result of the action. Therefore, the Service estimates that all valley elderberry longhorn beetles inhabiting the 42 stems of one inch or greater in the 7 identified shrubs may be harassed, harmed, injured, or killed, as a result of the proposed action. Upon implementation of the following reasonable and prudent measures, incidental take of the valley elderberry longhorn beetle would be exempted from prohibitions of take under Section 9 of the Act.

Effect of the Take

In the accompanying biological opinion, the Service determines that this level of take is not likely to result in jeopardy to the valley elderberry longhorn beetle or the delta smelt.

Reasonable and Prudent Measure

The Service has determined that the following reasonable and prudent measures are necessary and appropriate to minimize the effect of the action on the delta smelt and valley elderberry

longhorn beetle. Caltrans will be responsible for the implementation and compliance with these measures:

1. Minimize adverse effects to the delta smelt and valley elderberry longhorn beetle and their habitats in the action area by implementing the proposed project, including the conservation measures as described, with the following terms and conditions.
2. Minimize adverse effects to the delta and its critical habitat to fullest extent practicable.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, Caltrans must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following *Terms and Conditions* implement *Reasonable and Prudent Measure* one (1):
 - a. Caltrans shall include language in their contracts that expressly requires contractors and subcontractors to work within the boundaries of the project footprint identified in this BO, including staging and access.
 - b. If requested, before, during, or upon completion of groundbreaking and construction activities, Caltrans shall allow access by Service personnel into the project footprint to inspect the project and its activities.
 - c. At least 30 days prior to the onset of any construction-related activities, Caltrans shall submit to the Service, for approval, the name(s) and credentials of biological monitors it requests to conduct activities specified for this project. Information included in a request for authorization must include, at a minimum: (1) relevant education; (2) relevant training on species identification, survey techniques, handling individuals of different age classes, and handling of different life stages by a permitted biologist or recognized species expert authorized for such activities by the Service; (3) a summary of field experience conducting requested activities (to include project/research information and actual experience with the species); (4) a summary of biological opinions and/or informal consultations under which they were authorized to work with the listed species and at what level (such as construction monitoring versus handling), this should also include the names and qualifications of persons under which the work was supervised as well as the amount of work experience on the actual project including detail on whether the species was encountered or not; and (5) a list of Federal Recovery Permits [10(a)1(A)] if any, held or under which individuals are authorized to work with the species (to include permit number, authorized activities, and name of permit holder).

No project activities shall begin until the Caltrans has received written Service approval for biologists to conduct specified activities.

2. The following *Terms and Conditions* implement *Reasonable and Prudent Measure* two (2):
 - a. The Applicant and/or Caltrans shall use a Service-approved delta smelt conservation bank if using off-site compensation, as proposed in the biological assessment, to minimize adverse effects to delta smelt and its critical habitat.

Reporting Requirements

In order to monitor whether the amount or extent of incidental take anticipated from implementation of the project is approached or exceeded, Caltrans shall adhere to the following reporting requirements. Should this anticipated amount or extent of incidental take be exceeded, Caltrans must reinitiate formal consultation as per 50 CFR 402.16.

1. Notification of living, injured, or dead listed species will be made to the Assistant Field Supervisor of the Endangered Species Division at the San Francisco Bay Delta Fish and Wildlife Office. When an injured or dead individual of the listed species is found, Caltrans shall follow the steps outlined in the following *Disposition of Individuals Taken* section.
2. Sightings of any listed or sensitive animal species should be reported to the Service and CNDDDB (<https://www.wildlife.ca.gov/Data/CNDDDB/Submitting-Data>).
3. Construction compliance reports will be addressed to the Assistant Field Supervisor of the Endangered Species Division at the San Francisco Bay Delta Fish and Wildlife Office.
4. Caltrans shall submit post-construction compliance reports prepared by the Service-approved biologist to the Service within 60 calendar days following completion of each construction season or within 60 calendar days of any break in construction activity lasting more than 60 calendar days. This report shall detail (1) dates that relevant project activities occurred; (2) pertinent information concerning the success of the project in implementing avoidance and minimization measures; (3) an explanation of failure to meet such measures, if any; (4) known project effects on the delta smelt and valley elderberry longhorn beetle; (5) occurrences of incidental take of any listed species; (6) documentation of employee environmental education; and (7) other pertinent information.

Disposition of Individuals Taken

Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as the Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it, and the bag containing the specimen frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen. The Service contact person is the Assistant Field Supervisor of the Endangered Species Division at the San Francisco Bay Delta Fish and Wildlife Office.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. Caltrans should consider participating in the planning for a regional habitat conservation plan for the delta smelt, valley elderberry longhorn beetle, other listed species, and sensitive species.
2. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the delta smelt and giant garter snake. Such banking systems also could be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate. Particular emphasis should be on the preservation of habitat along roadways in association with wildlife crossings.
3. The Service appreciates Caltrans' proposals to use native plants as part of their restoration plans and right of way seed mix. The Service encourages Caltrans to incorporate native milkweed species into their restoration seed mixes. The Service encourages Caltrans to implement a roadside management program that is compatible with the monarch's life cycle. Compatible maintenance would exclude the use of herbicides/pesticides as well as limiting mowing to one swath closest to the shoulder, outside the butterfly's peak activity and milkweed blooming period.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION-CLOSING STATEMENT

This concludes formal consultation on the I Street Bridge Replacement Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion, including work outside of the described project footprint, including vehicle parking, staging, lay down areas, and access roads; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this biological opinion, including use of rodenticides or herbicides, relocation of utilities, and use of vehicle parking, staging, lay down areas, and access roads; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any additional take will not

be exempt from the prohibitions of section 9 of the Act, pending reinitiation.

Please address any questions or concerns regarding this response to Kim Squires, Section Division Chief, at Kim_Squires@fws.gov. Please refer to Service file number 08FBDT00-2016-F-0227 in any future correspondence regarding this project.

Sincerely,

A handwritten signature in black ink, appearing to read "Kaylee Allen". The signature is fluid and cursive, with a large initial "K" and a long, sweeping underline.

Kaylee Allen
Field Supervisor

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National Marine Fisheries Service Biological Opinion



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS No: WCR-2018-9970

JUN 25 2018

Ms. Sue Bauer
Branch Chief
North Region Environmental Planning M-1
District 3
California Department of Transportation
703 B Street
Marysville, California 95907

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations for the Sacramento River I Street Bridge Replacement Project in Sacramento and Yolo Counties (03-3F090)

Dear Ms. Bauer:

Thank you for your letter of August 8, 2016, and biological assessment (BA), requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Sacramento River I Street Bridge Replacement Project (Project) in Sacramento and Yolo counties.

This biological opinion (BO) is based on the final BA for the Sacramento River I Street Bridge Replacement Project in Sacramento and Yolo counties. Based on the best available scientific and commercial information, the BO concludes that the Project is not likely to jeopardize the continued existence of the Federally listed threatened California Central Valley steelhead (*Oncorhynchus mykiss*), Central Valley spring-run Chinook Salmon (*Oncorhynchus tshawytscha*), Sacramento River winter-run Chinook Salmon (*Oncorhynchus tshawytscha*), or the Southern distinct population segment of North American green sturgeon (*Acipenser medirostris*) and is not likely to destroy or adversely modify their designated critical habitats. NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the Project.

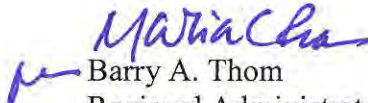
This letter also transmits NMFS's review of potential effects of the Project on essential fish habitat (EFH) for Pacific Coast Salmon, designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. The analysis concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the action area. The EFH consultation concludes with conservation recommendations.



The California Department of Transportation (Caltrans) has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed written response to NMFS within 30 days of receipt of these conservation recommendations, and 10 days in advance of any action, that includes a description of measures adopted by Caltrans for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR § 600.920(j)). If unable to complete a final response within 30 days, Caltrans should provide an interim written response within 30 days before submitting its final response. In the case of a response that is inconsistent with our recommendations, Caltrans must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the I Street Bridge Repair Project and the measures needed to avoid, minimize, or mitigate (also referred to as compensate by NMFS) such effects.

Please contact LTJG Caroline Wilkinson at the California Central Valley Office of NMFS at (916) 930-3731 or via email at caroline.wilkinson@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,


Barry A. Thom
Regional Administrator

Enclosure

cc: To the file: 151422-WCR2017-SA00319



UNITED STATES DEPARTMENT OF COMMERCE
 National Oceanic and Atmospheric Administration
 NATIONAL MARINE FISHERIES SERVICE
 West Coast Region
 650 Capitol Mall, Suite 5-100
 Sacramento, California 95814-4700

**Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Magnuson-Stevens
 Fishery Conservation and Management Act (MSA) Essential Fish Habitat (EFH)
 Consultation, and Fish and Wildlife Coordination Act Recommendations**

Sacramento River I Street Bridge Replacement Project in Sacramento and Yolo Counties
 Project Number 03-3F090

NMFS Consultation Number: WCR-2018-9970

Action Agency: California Department of Transportation (Caltrans)

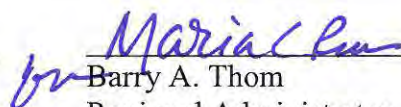
Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Sacramento River winter-run Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	Endangered	Yes	No	Yes	No
Central Valley spring-run Chinook salmon (<i>O. tshawytscha</i>)	Threatened	Yes	No	Yes	No
California Central Valley steelhead (<i>O. mykiss</i>)	Threatened	Yes	No	Yes	No
Southern distinct population segment of North American green sturgeon (<i>Acipenser medirostris</i>)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:


 Barry A. Thom
 Regional Administrator

Date:

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TABLE OF CONTENTS

1. INTRODUCTION	4
1.1 Background	4
1.2 Consultation History.....	4
1.3 Proposed Federal Action	5
1.3.1 Construction of New Bridge.....	5
1.3.2 Roadway, Bikeway, and Levee Modifications	7
1.3.3 Over-water Construction Site Access	9
1.3.4 In-water Construction Activities.....	9
1.3.5 Avoidance and Minimization Measures	10
1.3.6 Mitigation Banking.....	16
2. ENDANGERED SPECIES ACT:	16
2.1 Analytical Approach.....	16
2.1.1 Conservation Banking in the Context of the ESA Environmental Baseline	17
2.2 Rangewide Status of the Species and Critical Habitat.....	18
2.2.1 Sacramento River Winter-run Chinook Salmon.....	20
2.2.2 Central Valley Spring-run Chinook salmon	24
2.2.3 California Central Valley steelhead.....	27
2.2.4 Southern DPS of North American Green Sturgeon	30
2.2.5 Global Climate Change.....	36
2.3 Action Area	36
2.4 Environmental Baseline	37
2.4.1 Mitigation Banking and Environmental Baseline.....	37
2.4.2 Status of Listed Species in the Action Area	38
2.4.3 Status of Critical Habitat in the Action Area.....	45
2.5 Effects of the Action.....	48
2.5.1 Effects of the Proposed Action to Listed Fish Species.....	48
2.5.2 Effects of the Proposed Action to Critical Habitat	56
2.5.3 Mitigation /Conservation Bank Credit Purchases.....	57
2.6 Cumulative Effects	58
2.6.1 Water Diversions	58
2.6.2 Increased Urbanization	58
2.6.3 Rock Revetment and Levee Repair Projects	59
2.7 Integration and Synthesis	59
2.8 Conclusion.....	63
2.9 Incidental Take Statement	63
2.9.1 Amount or Extent of Take	63
2.9.2 Effect of the Take	66
2.9.3 Reasonable and Prudent Measures	66
2.9.4 Terms and Conditions.....	67
2.10 Conservation Recommendations.....	68
2.11 Reinitiation of Consultation	69
3. MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE	69

3.1	Essential Fish Habitat Affected by the Project.....	69
3.2	Adverse Effects on Essential Fish Habitat	70
3.3	Essential Fish Habitat Conservation Recommendations	70
3.4	Statutory Response Requirement	71
3.5	Supplemental Consultation.....	71
4.	FISH AND WILDLIFE COORDINATION ACT	71
5.	DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION	
	REVIEW	72
5.1	Utility.....	72
5.2	Integrity	72
5.3	Objectivity	72
6.	REFERENCES.....	73

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (BO) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.).

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System <https://pcts.nmfs.noaa.gov>. A complete record of this consultation is on file at NMFS California Central Valley Office.

1.2 Consultation History

- On August 28, 2015, NMFS issued a species list to California Department of Transportation (Caltrans).
- On November 17, 2015, LTJG Sean Luis participated in a site visit to the proposed I Street Bridge site.
- On August 8, 2016, the NMFS West Coast Region – California Central Valley Office (CCVO) received a consultation initiation request and Biological Assessment (BA) from Caltrans for the I Street Bridge Replacement Project (Project). This Project is a cooperation between Caltrans and the Cities of Sacramento and West Sacramento, California.
- On January 10, 2017, NMFS CCVO received an email update from Caltrans that less rock slope protection (RSP) would be required than initially expected, thus reducing the permanent impacts for this Project.
- On April 4, 2017, NMFS requested more information about the use and movement of the barge in the waterway during times outside of the in-water work window.

- On June 5, 2017, NMFS received via email a memorandum dated May 19, 2017, with updated information about the use of the barge, a further update to the amount of RSP to be used, and a document that addressed errata in the original BA.
- On May 22, 2018, the consultation was initiated based on Caltrans' timeline.

1.3 Proposed Federal Action

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). “Interrelated actions” are those that are part of a larger action and depend on the larger action for their justification. “Interdependent actions” are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No interrelated actions or interdependent actions were identified.

Under the MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

Under the FWCA, an action occurs whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license” (16 USC 662(a)).

NMFS recognizes that Caltrans has assumed the Federal Highway Administration's (FHWA) responsibilities under Federal environmental laws for ESA section 7 consultation on this project as allowed by a Memorandum of Understanding (NEPA Assignment) with the FHWA effective December 23, 2016.

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, propose to replace the existing I Street Bridge between the cities of Sacramento and West Sacramento, California with a new bridge. The Project will replace the existing functionally obsolete and structurally deficient bridge, and replace it with a larger, safer bridge approximately 1,000 feet north of the existing bridge. The existing bridge will be left in place to remain in use as a railroad bridge. Work on this project is expected to begin in spring 2019 and complete construction by mid-summer 2021. In-water work will be conducted over two seasons from May 1 through November 30. The new bridge will consist of two vehicle lanes, on-street Class II bike lanes, and sidewalks along both sides. The proposed bridge will be approximately 860 feet long, composed of five spans, with an approximately 330-foot long movable center span to meet United States Coast Guard (USCG) requirements.

1.3.1 Construction of New Bridge

The new bridge will consist of two fixed-span approach structures that tie into the Sacramento and West Sacramento banks of the river. The two fixed-span approaches will be 72 feet wide and approximately 200 feet and 270 feet in length on the Sacramento and West Sacramento banks, respectively. The center span of the bridge will consist of a movable span that meets USCG requirements. The movable span will be approximately 330 feet in length. The bridge soffit elevation will be set 3 feet above the 200-year water surface elevation to comply with the Central

Valley Flood Protection Board (CVFPB) freeboard requirements. Each of the fixed-span approaches will consist of two spans. Each approach structure will consist of an abutment on the bank of the river, a center pier within the river located around the existing bank toe of slope, and the another set of piers that also supports the movable center span. The movable center span will provide a 278-foot clear channel opening centered near the middle of the river. The moveable span will likely be a vertical lift bridge that will raise the center span to a minimum vertical clearance of 59 feet over the maximum river elevation of 31 feet.

Due to the existing soil conditions, the bridge will be constructed on deep pile foundations. Table 1 summarizes the type and size of piles that will be used during construction of the new bridge, and the depth to which the piles will be installed. The abutments for the fixed-span approach structures at the river bank will consist of approximately 50 piles per abutment that are driven or cast-in-drill-hole (CIDH), to a depth of approximately 70 feet below the original ground elevation. The center piers for the two fixed-span approach structures (located approximately at the bank toe of slope in the river, below the Ordinary High Water Mark (OHWM)) will consist of 50 driven or CIDH piles per pier that are approximately 70 feet below the original ground elevation. If driven piles are selected for either the abutments or piers, the piles will be precast concrete or steel. The foundations for the movable span will consist of four large-diameter cast-in-steel-shell (CISS) piles per pier. Each pile will be 108 inches in diameter, extending approximately 140 feet below the original ground elevation, and will be driven with a vibratory hammer and/or with a hydraulic oscillator/rotator system.

Table 1. Piles Proposed to Construct I Street Bridge

Pile Location	Pile Diameter/ Type	Total Number of Piles to be Installed	Depth of Installation below ordinary ground elevation (feet)	Temporary or Permanent Installation
Abutments 1 and 6	16-in diameter steel	100	70	Permanent
	16-in square precast concrete (alternative to 16-in diameter steel)			
Piers 2 and 5	16-in diameter steel	100	70	Permanent
	16-in square precast concrete (alternative to 16-in diameter steel)			
Piers 3 and 4	108-in steel casings	8	140	Permanent
Bridge Fender System	16-in diameter concrete	60	30	Permanent
Temporary trestle	16-in diameter steel	160	70	Temporary
	16-in H pile (alternative to 16-in diameter steel pile above)			
Spud piles	16-in diameter steel	8	40	Temporary
Cofferdams	Sheet piles	180	25	Temporary

The proposed Project would include the placement of temporary and permanent fill (bridge piers and RSP) below the OHWM and would result in the temporary and permanent loss of aquatic habitat area and volume, rearing and migration habitat for anadromous fish. A total of up to 0.07 acre of permanent impacts on perennial stream and anadromous fish habitat in the Sacramento River would result from the following bridge components and RSP to be placed below the OHWM. The two fixed-span approach structures for the new bridge would be constructed on center piers (Piers 2 and 5) with foundations each consisting of 50 driven or CIDH piles. The

piles would be covered by pile caps. The footprint for Piers 2 and 5 on the river bottom would total 2,500 square feet (0.06 acre). The movable span section of the bridge would be constructed on a foundation of four 108-inch diameter CISS piles in the riverbed. The CISS piles, consisting of hollow steel shells, would be driven into the channel bottom using drivers and cranes on the temporary trestle or mounted on barges to temporarily place the steel shells at the desired location for each pile. Once the steel shells are in place, the soil inside the shell would be drilled out, and concrete would be poured into the dewatered hollow shells. The piles would be covered by pile caps. The footprint for Piers 3 and 4 on the river bottom would total 464 square feet (0.001 acre). A bridge fender system would be constructed around the movable span piers that would include approximately 30 driven piles around each pier. The footprint of the bridge fender system on the river bottom would total 85 square feet (0.002 acre). RSP (1/4-ton, Method B) would be installed along 120 linear feet of shoreline (approximately 60 linear feet on City of Sacramento shoreline and 60 linear feet on City of West Sacramento shoreline). This would include covering approximately 300 square feet (0.007 acre) of the bank below the OHWM on the City of Sacramento shoreline. A total of up to 37 cubic yards of RSP would be placed below the OHWM and a total of up to 574 cubic yards of RSP would be placed above the OHWM.

Overall, a total of 0.07 acres of critical habitat below the OHWM will be lost to hardscape by the repair of the levee and the placement of bridge piers and RSP. An additional 1.26 acres will be affected by shade created by the new bridge structure. A total of 1.44 acres of cottonwood riparian habitat will be permanently lost to hardscape by the levee and bridge structures, 0.44 of which is below the OHWM.

The new bridge will include a fender system around the moveable span piers to protect the piers from watercraft in the river. The fender system will consist of approximately 30 driven concrete piles around each of the movable span piers (Table 1). The piles will be driven to a depth of about 30 feet below the river bottom.

Construction of the new bridge foundations and approach structures will require the use of temporary work trestles. The trestles will be constructed during the first construction season using temporary piles within the river. Each trestle will include approximately 80 driven steel piles. Either 16-inch diameter hollow piles or 16-inch H piles (Table 1).

1.3.2 Roadway, Bikeway, and Levee Modifications

The new bridge alignment will require several roadway modifications. In Sacramento, Railyards Boulevard will be extended west onto the new bridge over the Sacramento River. East of Bercut Drive, Railyards Boulevard will consist of two westbound lanes and one eastbound lane. Between Jibboom Street and Bercut Drive, Railyards Boulevard will consist of two westbound lanes and three eastbound lanes. The intersection of Railyards Boulevard with Jibboom Street and Bercut Drive will consist of either a signalized intersection or a roundabout with two lanes in each direction. West of the Jibboom Street intersection, Railyards Boulevard will consist of one lane in each direction.

Bercut Drive will be modified from Railyards Boulevard north approximately 500 feet. Bercut Drive will have two northbound lanes at the Railyards Boulevard intersection, tapering down to

one northbound and one southbound lane at the northern project limits. Any improvements to Bercut Drive south of Railyards Boulevard are not part of this Project.

Improvements to Jibboom Street will extend 550 feet north of Railyards Boulevard. Jibboom Street will consist of one travel lane in each direction, on-street Class II bike lanes, a sidewalk along the west side of the roadway, and retaining walls of various heights along both sides of the road. Improvements to or extension of Jibboom Street south of Railyards Boulevard are not part of this Project.

This Project includes raising the roadway profile for Railyards Boulevard to approximately 6 feet higher than the original ground elevation at the Jibboom Street intersection. The profile adjustment will satisfy the Central Valley Flood Protection Board requirements to provide 3 feet of clearance between the 200-year floodwater surface elevation and the bridge soffit, or low chord of the bridge.

In West Sacramento, modifications to the alignment of C Street will cut off access to four residential parcels and one multifamily parcel located along 2nd Street north of C Street. The new alignment will connect to C Street approximately 150 feet east of the 3rd Street intersection and continue north approximately 300 feet. The new alignment will then make a 90-degree left turn and connect to 3rd Street approximately 300 feet north of C Street. The new alignment will require right-of-way acquisition from seven individual parcels and removal of three structures, two individual residences and one apartment building.

Between the bridge touchdown location along C Street in West Sacramento and the 4th Street/C Street intersection, the roadway will consist of one westbound travel lane, two eastbound travel lanes, a center left-turn lane, on-street Class II bike lanes, on-street parking along the north side of the roadway, and sidewalks along both sides of the roadway. As the roadway through this section currently consist of the proposed number of travel lanes, the widening to occur in this area will support the Class II bike lanes and wider sidewalks.

Along C Street between 4th Street and 5th Street, the roadway will consist of one travel lane in each direction, left-turn lanes, on-street Class II bike lanes, and sidewalks along both sides of the road. All of the improvements through this section will be accommodated within the existing roadway limits.

Reconstruction of the existing Class I bikeway, the Sacramento River Parkway, along Jibboom Street, will occur approximately 500 feet north and 300 feet south of Railyards Boulevard. Grade-separation of the path under the proposed bridge structure will accommodate a continuous off-street Class I path along this section. Cyclists and pedestrians approaching Railyards Boulevard in either direction will have the option to continue along the path under the new bridge, avoiding the need to cross the roadway. Cyclists and pedestrians traveling along the path will have the option to connect to Railyards Boulevard and cross over the new bridge into West Sacramento or turn east into Sacramento. Due to the limited horizontal clearance between the Sacramento River and the Interstate 5 (I-5) viaduct structure, retaining walls will be constructed along the path to account for the vertical elevation difference between Jibboom Street and that pat that will continue under the new bridge. Retaining walls will be 16 feet or less in height.

In West Sacramento, improvements to the levee will occur 300 feet north and 300 feet south of the proposed C Street alignment in order to bring the levee into current standards required by Title 23 of the California Code of Regulations. Modifications will require 3:1 side slopes on both the landside and waterside of the levee and a 20-foot wide crown at the top of the levee. Levee improvements will also include a slurry cutoff wall, which will extend to a depth of 110 feet below the original ground elevation. The proposed roadway profile will cross over the levee at approximately 6 feet higher than the original ground elevation. To maintain access to the levee for inspection and maintenance, access roads will be constructed from the new roadway to the top of the improved levee section. The proposed grading for the levee will require relocation of a water tower located along 2nd Street just north of the proposed C Street alignment. Relocation of the water tower will be approximately 43 feet to the northwest of the existing location.

The proposed levee maintenance road will serve as the future Class I River Walk Park Trail extension in West Sacramento. Similar to the trail improvements proposed above for Sacramento, grade-separation of the trail will occur under the proposed bridge structure. Cyclists and pedestrians approaching C Street in either direction will have the option to continue along the trail under the new structure, avoiding the need to cross the roadway. Cyclists and pedestrians who are traveling along the trail also will have the option to connect to C Street to cross over the proposed bridge into Sacramento or head west on C Street.

1.3.3 Over-water Construction Site Access

This Project will require the usage of temporary trestles and barges in order to provide contractor access to the river portion of the Project area. Trestles and barges will provide staging areas for construction materials, a working platform for cranes, and general construction support. The temporary trestles will consist of 160 16-inch diameter steel piles or 16-inch H-piles that will be driven into place with an impact hammer. A temporary work platform will be built around the steel piles. The platform will be removed at the end of the first construction season, but the piles will remain in place for the duration of the entire Project.

Barges will also be used to provide access to the Project location. Each barge will be anchored to the river bottom with four 16-inch diameter steel spud piles that will be driven into place with an impact hammer. Up to two barges will be anchored in the river at one time. Barges will be repositioned in the channel throughout construction only as needed to complete the work. The barges will be removed after the completion of bridge construction.

1.3.4 In-water Construction Activities

In-water construction activities consist of construction activities that occur below the OHWM. In-water work will occur only within the period of May 1 to November 30 during each of the construction seasons. The work window will allow most of the in-water construction work to be completed during the first construction season. Other construction activities above the OHWM may continue to occur outside of the in-water work window.

In-water construction activities will include the following:

- Installation and removal of 160 steel piles with a vibratory hammer and an impact hammer for the temporary falsework platforms (trestles). The piles will be embedded approximately 70 feet below the original ground elevation, based on preliminary engineering and site analysis.
- Installation and removal of eight steel spud piles with an impact hammer for anchoring barges. The piles will be embedded approximately 40 feet into the substrate, based on preliminary engineering and site analysis.
- Installation of steel sheet piles with a vibratory driver for temporary cofferdams.
- Installation of 100 steel piles for piers 2 and 5 with an impact hammer for the new bridge (although work will occur within dewatered cofferdams, underwater sound will propagate beyond the dewatered cofferdams). The piles will be embedded approximately 70 feet into the substrate, based on preliminary engineering and site analysis.
- Installation of eight 108-inch-diameter steel casings for piers 3 and 4 with a vibratory hammer and/or hydraulic oscillator/rotator system for the new bridge. The piles will be embedded approximately 140 feet into the substrate, based on preliminary engineering and site analysis.
- Installation of 30 concrete piles with an impact hammer for the new bridge fender system. The piles will be embedded approximately 30 feet into the substrate, based on preliminary engineering and site analysis.
- Installation of RSP along the shorelines of Sacramento and West Sacramento to prevent erosion. Approximately 120 linear feet of shoreline will be lined with rock, 60 linear feet on each city's shoreline. A total of up to 37 cubic yards of RSP will be placed below the OHWM.

1.3.5 Avoidance and Minimization Measures

- Bubble curtains will be installed around piles during impact driving and proofing operations to dampen underwater sound shockwaves.
- The construction contractor will conduct several dry or dead blows with the hammer initially to frighten fish away from the pile before the pile is driven or proofed with an impact pile driver. Implementation of several dry or dead blows with the hammer to initially frighten fish away is being proposed because the use of a cushioning block or similar feature would result in more strikes being needed to drive the piles, thereby resulting in a greater chance of exceeding the cumulative sound exposure levels (SELs) without significantly reducing peak SELs.
- Install orange construction fencing between the construction area and adjacent sensitive biological resources
 - The Project proponent and/or their contractor will install orange construction fencing between the construction area and adjacent sensitive biological resource areas including protected trees to be avoided.
- Conduct environmental awareness training for construction employees
 - A qualified biologist will conduct the training, which will inform the construction crews on the need to avoid effects to listed anadromous fish

species and their habitats, identify where these species and habitats are most likely to occur, and cover the reporting protocol, restrictions, and guidelines that must be followed to reduce or avoid effects to species and habitats during the Project.

- Conduct periodic biological monitoring
 - A qualified biological monitor will visit the site a minimum of once per week to ensure the fencing has remained in place and that activities are being conducted in accordance with the agreed upon Project schedule and agency conditions of approval.
 - Certain construction activities will require a biological monitor for the duration of the activity or during the initial disturbance of an area. These activities include impact pile driving, turbidity monitoring, and fish capture and relocation.
- Conduct all in-water construction activities between May 1 and November 30 and during daylight hours only
 - All in-water construction work, including pile driving (in-water and on shore within 250 feet of the Sacramento River), installation of cofferdams, removal of temporary sheet piles, and placement of RSP will occur within the in-water work window.
 - In-water work will only occur during daylight to allow fish to use nighttime hours for feeding and unobstructed passage.
- Implement measures to minimize sound levels during pile driving
 - The contractor will vibrate all piles to the maximum depth possible before using an impact hammer.
 - No more than 20 piles will be driven per day.
 - Pile driving will occur on no more than 75 total days during construction.
 - For the piles for the bridge piers and for temporary trestle piles, the number of strikes per day will be limited to 16,000 (i.e. 800 hammer strikes per pile, per day).
 - For the bridge fender piles, the number of strikes per day will be limited to 20,000 (i.e. 1,000 hammer strikes per pile per day).
 - The smallest pile driver and minimum force necessary will be used to complete the work.
 - Sound attenuation devices such as a bubble curtain or similar will be used in order to minimize the extent to which the interim peak and cumulative SEL thresholds are exceeded.
 - No pile driving will occur at night.
- Develop and implement a hydroacoustic monitoring plan. The plan will be submitted to NMFS and other resource agencies for approval at least 60 days before the start of project activities. The plan will include the following requirements:
 - The project proponent and/or the contractor will monitor underwater noise levels during all impact pile driving activities on land and in water to ensure the peak and cumulative SELs do not exceed estimated values.
 - The monitoring plan will describe the methods and equipment that will be used to document the extent of underwater sounds produced by pile driving, including the

- number, location, distances, and depths of hydrophones and associated monitoring equipment.
- The monitoring plan will include a reporting schedule for daily summaries of the hydroacoustic monitoring results and for more comprehensive reports to be provided to the resource agencies on a monthly basis during the pile-driving season.
 - The daily reports will include the number of piles installed per day; the number of strikes per pile; the interval between strikes; the peak Sound Pressure Level, SEL, and RMS per strike; and the accumulated SEL per day at each monitoring station.
 - The Project proponent or its contractors will ensure that a qualified fish biologist is on site during impact pile driving to document any occurrences of stressed, injured, or dead fish. If stressed, injured, or dead fish are observed during pile driving, the Project proponent and/or its construction contractor will reduce the number of strikes per day to ensure that fish are no longer showing signs of stress, injury, or mortality.
 - Protect water quality and prevent erosion and sedimentation in drainages and wetlands by producing a storm water pollution prevention plan (SWPPP) and using best management practices (BMPs). BMPs will include:
 - All earthwork or foundation activities involving wetlands or the intermittent vegetated stream will occur in the dry season (between May 1 and October 31). All in-water work within the Sacramento River will be conducted between May 1 and November 30 to minimize or avoid potential impacts on sensitive life stages (migration and rearing) of listed fish species.
 - Equipment used in and around drainages and wetlands will be in good working order and free of dripping or leaking engine fluids. All vehicle maintenance will be performed at least 300 feet from all streams. Any necessary equipment washing will be carried out where the water cannot flow into drainages or wetlands.
 - Develop a hazardous material spill prevention control and countermeasure plan before construction begins. The plan will include strict onsite handling rules to keep construction and maintenance materials from entering the river, including procedures related to refueling, operating, storing, and staging construction equipment and to preventing and responding to spills. The plan also will identify the parties responsible for monitoring a spill response. During construction, any spills will be cleaned up immediately according to the spill prevention control and countermeasure plan. The Project proponent will review and approve the contractors' spill prevention control and countermeasure plan before allowing construction to begin.
 - Prohibit the following types of materials from being rinsed or washed into the streets, shoulder areas, or gutters: concrete, solvents and adhesives, thinners, paints, fuels, sawdust, dirt, gasoline, asphalt and concrete saw slurry, and heavily chlorinated water.
 - Take any surplus concrete rubble, asphalt, or other rubble from construction to a local landfill.
 - Prepare and implement an erosion and sediment control plan for the proposed Project that will include the following provisions and protocols. The SWPPP for

- the Project will detail the applications and type of measures and the allowable exposure of unprotected soils.
- Discharge from dewatering operations, if needed, and runoff from disturbed areas will be made to conform to the water quality requirements of the waste discharge permit issued by the Recreational Water Quality Criteria.
 - Apply temporary erosion control measures, such as sandbagged silt fences, throughout construction of the proposed Project and remove them after the working area is stabilized or as directed by the engineer. Soil exposure will be minimized through use of temporary BMPs, groundcover, and stabilization measures. Exposed dust-producing surfaces will be sprinkled daily, if necessary, until wet. This measure will be controlled to avoid producing runoff. Paved roads will be swept daily following construction activities.
 - The contractor will conduct periodic maintenance of erosion and sediment control measures.
 - Plant an appropriate seed mix of native species on disturbed areas upon completion of construction.
 - Cover or apply nontoxic soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more) that could contribute sediment to waterways.
 - Enclose and cover exposed stockpiles of dirt or other loose, granular construction materials that could contribute sediment to waterways. Material stockpiles will be located in non-traffic areas only. Side slopes will not be steeper than 2:1. A filter fabric fence and interceptor dike will surround all stockpile areas.
 - Contain soil and filter runoff from disturbed areas by berms, vegetated filters, silt fencing, straw wattle, plastic sheeting, catch basins, or other means necessary to prevent the escape of sediment from the disturbed area.
 - Use other temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) to control erosion from disturbed areas as necessary.
 - Avoid earth or organic material from being deposited or placed where it may be directly carried into the channel.
 - Monitor turbidity in the Sacramento River
 - The Project proponent will require the construction contractor to monitor turbidity levels in the Sacramento River during in-water construction activities (e.g., pile driving, extraction of temporary sheet piles used for cofferdams, placement of RSP). Turbidity will be measured using standard techniques upstream and downstream of the construction area to determine whether changes in ambient turbidity levels exceed 20%, the threshold derived from the Sacramento and San Joaquin Rivers Basins Plan (Central Valley Regional Water Quality Control Board 2011). If it is determined that turbidity levels exceed the 20% threshold, then the Project proponent and/or its contractors will adjust work to ensure that turbidity levels do not exceed the 20% threshold.
 - Implement cofferdam restrictions
 - The extent of cofferdam footprints will be limited to the minimum necessary to support construction activities.

- Sheet piles used for cofferdams will be installed and removed using a vibratory Opile driver.
- Cofferdams will not be left in place over winter where they could be overtopped by winter/spring flows and when juveniles of listed species are most likely to be present in the construction area.
- All pumps used during dewatering of cofferdams will be screened according to California Department of Fish and Wildlife (CDFW) and NMFS guidelines for screens.
- Cofferdam dewatering and fish rescue/relocation from within cofferdams will commence immediately following cofferdam closure.
- Prepare and implement a fish rescue and relocation plan. The fish rescue and relocation plan will be submitted to the resource agencies [CDFW, NMFS, and U.S. Fish and Wildlife Service (USFWS)] for approval at least 60 days before initiating activities to install cofferdams. At a minimum, the plan will include the following:
 - A requirement that fish rescue and relocation activities will commence immediately after cofferdam closure and that dewatering has sufficiently lowered water levels inside cofferdams to make it feasible to rescue fish.
 - A description of the methods and equipment proposed to collect, transfer, and release all fish trapped within cofferdams. Capture methods may include seining, dip netting, and/or electrofishing as approved by CDFW, NMFS, and USFWS. CDFW, NMFS, USFWS, and the Project proponent and/or contractor will cooperatively develop the precise methods and equipment.
 - A requirement that only CDFW-, NMFS-, and USFWS-approved fish biologists will conduct the fish rescue and relocation.
 - A requirement that fish biologists will contact CDFW, NMFS, and USFWS immediately if any listed species are found dead or injured.
 - A requirement that a fish rescue and relocation report be prepared and submitted to CDFW, NMFS, and USFWS within 5 business days following completion of the fish relocation. Data will be provided in tabular form and at a minimum will include the species and number rescued and relocated, approximate size of each fish (or alternatively, approximate size range if large number of individuals are encountered), date and time of their capture, and general condition of all live fish (e.g., good–active with no injuries; fair–reduced activity with some superficial injuries; poor–difficulty swimming/orienting with major injuries). For dead fish, additional data will include fork length and description of injuries and/or possible cause of mortality if it can be determined.
- Prevent the spread or introduction of aquatic invasive species (AIS) including invasive mussels and aquatic plants and hydrilla. The Project proponent or its contractors will implement the following actions to prevent the potential spread or introduction of AIS associated with barges and other construction activities:
 - The Project proponent or its contractors will coordinate with the CDFW’s Invasive Species Program to ensure that the appropriate BMPs are implemented to prevent the spread or introduction of AIS.
 - Educate construction supervisors and managers about the importance of controlling and preventing the spread of AIS.

- Train vessel and equipment operators and maintenance personnel in the recognition and proper prevention, treatment, and disposal of AIS.
- To the extent feasible, prior to departure of vessels from their place of origin and before in-water construction equipment is allowed to operate within the waters of the Sacramento River, thoroughly inspect and remove and dispose of all dirt, mud, plant matter, and animals from all surfaces that are submerged or may become submerged, or places where water can be held and transferred to the surrounding water.
- Minimize or avoid temporary construction lighting and permanent bridge lighting from directly radiating on water surfaces of the Sacramento River. The effects of nighttime lighting on special-status fish species will be minimized or avoided by implementing the following actions:
 - *Temporary Construction Lighting*
 - Avoiding construction activities at night, to the maximum extent practicable.
 - Using the minimal amount of lighting necessary to safely and effectively illuminate the work areas.
 - Shielding and focusing lights on work areas and away from the water surface of the Sacramento River, to the maximum extent practicable.
 - *Permanent Bridge Lighting*
 - Minimizing nighttime lighting of the bridge structure for aesthetic purposes.
 - Using the minimal amount of lighting necessary to safely and effectively illuminate vehicular, bicycle, and pedestrian areas on the bridge.
 - Shielding and focusing lights on vehicular, bicycle, and pedestrian areas and away from the water surface of the Sacramento River, to the maximum extent practicable.
- Onsite mitigation
 - Disturbed areas will be reseeded with an appropriate seed mix of native species on disturbed areas upon completion of construction.
 - To mitigate for the loss of 1.44 acres of riparian forest, onsite mitigation will be used to the greatest extent practicable. Planted species will be similar to those removed and all plants will be fitted with exclusion cages or other protection from herbivory. Plants will be monitored and irrigated for 3 years or as required in the project permits. If 75 percent of the plants survive at the end of the monitoring period, the re-vegetation will be considered successful. If the survival criterion is not met at the end of the monitoring period, planting and monitoring will be repeated after mortality causes have been identified and corrected.
 - The 0.44 acres of affected shaded riverine aquatic habitat (SRA) below the OHWM will be replaced at a 3:1 ratio by planting native riparian trees in temporary impact areas and along existing onsite or offsite unshaded banks along the Sacramento River.
 - Plant riparian trees that are intended to provide SRA cover along the water's edge at summer low flows up to the OHWM and at sufficient densities to provide shade along at least 85% of the bank's length when the trees reach maturity.

1.3.6 Mitigation Banking

Caltrans plans to mitigate for the impacts of the I Street Bridge Replacement Project by purchasing credits from a NMFS approved mitigation bank at a 3:1 ratio for permanent impacts on critical habitat below the OHWM and in water column habitat, totaling 1.33 acres from the new bridge piers and RSP (0.07 acre) and from the bridge shading of aquatic habitat (1.26 acre). Caltrans proposes to mitigate the permanent loss of critical habitat through the purchase of 3.99 acres of mitigation credits at a NMFS-approved fish conservation bank.

Caltrans will compensate for the permanent fill of 1.85 acres of other waters of the United States in the Sacramento River by purchasing mitigation bank credits at either (1) a minimum of 2:1, for a total of up to 3.7 acres, if credits are for preservation of habitat; or (2) a minimum of 1:1, for a total of 1.85 acres, if the credits are for creation of habitat.

Additionally, Caltrans plans to mitigate for the loss of 1.44 acres of riparian forest by mitigating onsite to the maximum extent practicable. Offsite compensation will be used to achieve no net loss of existing in-kind riparian cover habitat values. Caltrans will compensate for the loss of 1.44 acres of riparian forest by purchasing mitigation bank credits at either (1) a minimum of 2:1, for a total of up to 2.88 acres, if credits are for preservation of habitat; or (2) a minimum of 1:1, for a total of 1.44 acres, if the credits are for creation of habitat.

In addition to the mitigation for the loss of riparian forest habitat, specific measures will be included onsite to compensate for the loss of SRA cover. The 0.44 acres of affected SRA below the OHWM will be mitigated onsite at a 3:1 ratio. However, the acreage will not be duplicated; such that the acreage of riparian forest habitat restored for SRA cover mitigation will apply towards riparian forest habitat mitigation requirements.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions will affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This BO includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a

listed species, which is “to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This BO relies on the definition of "destruction or adverse modification," which “means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (81 FR 7214; February 11, 2016).

The designations of critical habitat for CV spring-run Chinook, CCV steelhead, winter-run Chinook, and sDPS green sturgeon use the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same, regardless of whether the original designation identified PCEs, PBFs, or essential features. In this BO, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an “exposure-response-risk” approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative (RPA) to the proposed action.

2.1.1 Conservation Banking in the Context of the ESA Environmental Baseline

Conservation (or mitigation) banks present a unique situation in terms of how they are used in the context of the Effects Analysis and the Environmental Baseline in ESA section 7 consultations. When NMFS is consulting on a proposed action that includes conservation bank credit purchases, it is likely that physical restoration work at the bank site has already occurred and/or that a section 7 consultation occurred at the time of bank establishment. A traditional interpretation of “environmental baseline” might suggest that the overall ecological benefits of the conservation bank actions belong in the Environmental Baseline. However, under this interpretation, all proposed actions, whether or not they included proposed credit purchases,

would benefit from the environmental 'lift' of the entire conservation bank because it would be factored into the environmental baseline. In addition, where proposed actions did include credit purchases, it would not be possible to attribute their benefits to the proposed action, without double-counting. These consequences undermine the purposes of conservation banks and also do not reflect their unique circumstances. Specifically, conservation banks are established based on the expectation of future credit purchases. In addition, credit purchases as part of a proposed action will also be the subject of a future section 7 consultation.

It is therefore appropriate to treat the beneficial effects of the bank as accruing incrementally at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. Thus, for all projects within the service area of a conservation bank, only the benefits attributable to credits sold are relevant to the environmental baseline. Where a proposed action includes credit purchases, the benefits attributable to those credit purchases are considered effects of the action.

That approach is taken in this BO.

2.2 Rangewide Status of the Species and Critical Habitat

This BO examines the status of each species that will be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. This BO also examines the condition of critical habitat throughout the designated area, evaluates the value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that value for the conservation of the species.

In 2016, NMFS completed a status review of 28 species of Pacific salmon, steelhead and eulachon, including Sacramento River winter-run Chinook salmon (winter-run Chinook), Central Valley spring-run Chinook salmon (CV spring-run Chinook), and California Central Valley (CCV) steelhead, and concluded that the species' status should remain as previously listed (81 FR 33468). The 2016 status reviews for winter-run Chinook, CV spring-run Chinook, and CCV steelhead found that, although the listings should remain unchanged, the status of these populations have suffered in 2014 and 2015 from the unprecedented California drought. An updated status review for sDPS green sturgeon was issued recently, concluding that the status of sDPS green sturgeon should remain as threatened (NMFS 2015).

The descriptions of the status of species and conditions of the designated critical habitats in this BO are a synopsis of the detailed information available on NMFS' West Coast Region website. The following federally listed species ESUs or DPSs and designated critical habitat occur in the action area and may be affected by the proposed action.

Sacramento River winter-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)
Listed as endangered (70 FR 37160, June 28, 2005)

Sacramento River winter-run Chinook salmon designated critical habitat
(58 FR 33212, June 16, 1993)

http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chinook/sacramento_river_winter_run/sacramento_river_winter_run_chinook.html

Central Valley spring-run Chinook salmon ESU (*O. tshawytscha*)
Listed as threatened (70 FR 37160, June 28, 2005)

Central Valley spring-run Chinook salmon designated critical habitat
(70 FR 52488, September 2, 2005)

http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chinook/central_valley_spring_run/central_valley_spring_run_chinook.html

California Central Valley steelhead DPS (*O. mykiss*)
Listed as threatened (71 FR 834, January 5, 2006)

California Central Valley steelhead designated critical habitat
(70 FR 52488, September 2, 2005)

http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/steelhead/california_central_valley/california_central_valley_steelhead.html

Southern DPS of North American green sturgeon (*Acipenser medirostris*)
Listed as threatened (71 FR 17757, April 7, 2006)

Southern DPS of North American green sturgeon designated critical habitat
(74 FR 52300, October 9, 2009)

http://www.westcoast.fisheries.noaa.gov/protected_species/green_sturgeon/green_sturgeon_pg.html

Table 2. ESA listing history.

Species	Scientific Name	Original Final Listing Status	Current Final Listing Status	Critical Habitat Designated
Sacramento River winter-run Chinook salmon ESU	<i>Oncorhynchus tshawytscha</i>	1/4/1994 59 FR 440 Endangered	6/28/2005 70 FR 37160 Endangered	6/16/1993 58 FR 33212
Central Valley spring-run Chinook salmon ESU	<i>Oncorhynchus tshawytscha</i>	9/16/1999 64 FR 50394 Threatened	6/28/2005 70 FR 37160 Threatened	9/2/2005 70 FR 52488
California Central Valley steelhead DPS	<i>Oncorhynchus mykiss</i>	3/19/1998 63 FR 13347 Threatened	1/5/2006 71 FR 834 Threatened	9/2/2005 70 FR 52488
Southern DPS of North American green sturgeon	<i>Acipenser medirostris</i>	4/7/2006 71 FR 17757 Threatened	4/7/2006 71 FR 17757 Threatened	10/9/2009 74 FR 52300

2.2.1 Sacramento River Winter-run Chinook Salmon

2.2.1.1 Summary of Sacramento River Chinook Salmon ESU Viability

There are several criteria (only one is required) that would qualify winter-run Chinook at moderate risk of extinction, and since there is still only one population that spawns downstream of Keswick Dam, that population will be at high risk of extinction in the long-term according to the criteria in Lindley *et al.* (2007). Recent trends in those criteria are: (1) continued low abundance; (2) a negative growth rate over 6 years (2006–2012), which is two complete generations; (3) a significant rate of decline since 2006; and (4) increased risk of catastrophe from oil spills, wildfires, or extended drought (climate change). The most recent 5-year status review (NMFS 2016) on winter-run Chinook concluded that the ESU had increased to a high risk of extinction. In summary, the most recent biological information suggests that the extinction risk for winter-run Chinook has increased from moderate risk to high risk of extinction since 2005, and that several listing factors have contributed to the recent decline, including drought and poor ocean conditions (NMFS 2011b).

2.2.1.2 Critical Habitat: Physical and Biological Features for Sacramento River Winter-run Chinook Salmon

NMFS designated critical habitat for winter-run Chinook on June 16, 1993 (58 FR 33212). Critical habitat was delineated as the Sacramento River from Keswick Dam at RM 302 to Chipps Island, RM 0, at the westward margin of the Sacramento-San Joaquin Delta (Delta), including Kimball Island, Winter Island, and Brown’s Island; all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate

Bridge. In the Sacramento River, critical habitat includes the river water, river bottom, and the adjacent riparian zone.

Critical habitat for winter-run Chinook is defined as specific areas (listed below) that contain the PBFs considered essential to the conservation of the species. This designation includes the river water, river bottom (including those areas and associated gravel used by winter-run Chinook as spawning substrate), and adjacent riparian zone used by fry and juveniles for rearing (June 16, 1993, 58 FR 33212). NMFS limits “adjacent riparian zones” to only those areas above a stream bank that provide cover and shade to the nearshore aquatic areas. Although the bypasses (*e.g.*, Yolo, Sutter, and Colusa) are not currently designated critical habitat for winter-run Chinook, NMFS recognizes that they may be utilized when inundated with Sacramento River flood flows and are important rearing habitats for juvenile winter-run Chinook. Also, juvenile winter-run Chinook may use tributaries of the Sacramento River for non-natal rearing. Critical habitat also includes the estuarine water column and essential foraging habitat and food resources used by winter-run Chinook as part of their juvenile outmigration or adult spawning migration.

The following is the status of the PBFs that are considered to be essential for the conservation of winter-run Chinook (June 16, 1993, 58 FR 33212):

1. Access from the Pacific Ocean to Appropriate Spawning Areas

Adult migration corridors should provide satisfactory water quality, water quantity, water temperature, water velocity, cover, shelter and safe passage conditions in order for adults to reach spawning areas. Adult winter-run Chinook generally migrate to spawning areas during the winter and spring. At that time of year, the migration route is accessible to the appropriate spawning grounds on the upper 60 miles of the Sacramento River, however much of this migratory habitat is degraded and they must pass through a fish ladder at the Anderson-Cottonwood Irrigation District Dam (ACID). In addition, the many flood bypasses are known to strand adults in agricultural drains due to inadequate screening (Vincik and Johnson 2013). Since the primary migration corridors are essential for connecting early rearing habitat with the ocean, even the degraded reaches are considered to have a high intrinsic conservation value to the species.

2. The Availability of Clean Gravel for Spawning Substrate

Suitable spawning habitat for winter-run Chinook exists in the upper 60 miles of the Sacramento River between Keswick Dam and Red Bluff Diversion Dam (RBDD). However, the majority of spawning habitat currently being used occurs in the first 10 miles downstream of Keswick Dam. The available spawning habitat is completely outside the historical range utilized by winter-run Chinook upstream of Keswick Dam. Because Shasta and Keswick dams block gravel recruitment, the U.S. Bureau of Reclamation (Reclamation) annually injects spawning gravel into various areas of the upper Sacramento River. With the supplemented gravel injections, the upper Sacramento River reach continues to support a small naturally-spawning winter-run Chinook population. Even in degraded reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

3. Adequate River Flows for Successful Spawning, Incubation of Eggs, Fry Development and Emergence, and Downstream Transport of Juveniles

An April 5, 1960, Memorandum of Agreement between Reclamation and the CDFW originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. In addition, Reclamation complies with the 1990 flow releases required in State Water Resource Control Board (SWRCB) Water Rights Order (WRO) 90-05 for the protection of Chinook salmon. This order includes a minimum flow release of 3,250 cubic feet per second (cfs) from Keswick Dam from September through February during all water year types, except critically dry. NMFS issued a 2009 BO on the long-term operations of the CV Project and State Water Project (CVP/SWP) that requires a minimum flow release of 3,250 cubic feet per second (cfs) from Keswick Dam from September through February during all water year types (NMFS 2009a).

4. Water Temperatures at 5.8–14.1°C (42.5–57.5°F) for Successful Spawning, Egg Incubation, and Fry Development

Summer flow releases from Shasta Reservoir for agriculture and other consumptive uses drive operations of Shasta and Keswick dam water releases during the period of winter-run Chinook spawning, egg incubation, fry development, and emergence. This pattern, the opposite of the pre-dam hydrograph, benefits winter-run by providing cold water for miles downstream during the hottest part of the year. The extent to which winter-run Chinook habitat needs are met depends on Reclamation's other operational commitments, including those to water contractors, Delta requirements pursuant to State Water Rights Decision 1641 (D-1641), and Shasta Reservoir end of September storage levels required in the NMFS 2009 BO (NMFS 2009a) WRO 90-05 requires Reclamation to operate Shasta, Keswick, and Spring Creek Powerhouse to meet a daily average water temperature of 13.3°C (56°F) at RBDD. They also provide the exception that the water temperature compliance point (TCP) may be modified when the objective cannot be met at RBDD. Based on these requirements, Reclamation models monthly forecasts and determines how far downstream 13.3°C (56°F) can be maintained throughout the winter-run Chinook spawning, egg incubation, and fry development stages.

The TCP changes and moves upstream each year to meet this objective. As the TCP moves upstream, the value of that habitat is degraded by reducing the spawning area in size and imprinting upon the next generation to return further upstream.

5. Habitat and Adequate Prey Free of Contaminants

Water quality conditions have improved since the 1980s due to stricter standards and Environmental Protection Agency (EPA) Superfund site cleanups. No longer are there fish kills in the Sacramento River caused by the heavy metals (*e.g.*, lead, zinc and copper) found in the Spring Creek runoff. However, legacy contaminants such as mercury (and methyl mercury), polychlorinated biphenyls (PCBs), heavy metals and persistent organochlorine pesticides continue to be found in watersheds throughout the CV. In 2010, the EPA, listed the Sacramento River as impaired under the Clean Water Act, section 303(d), due to high levels of pesticides,

herbicides, and heavy metals

(http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml). Although most of these contaminants are at low concentrations in the food chain, they continue to work their way into the base of the food web, particularly when sediments are disturbed and previously entombed compounds are released into the water column.

Adequate prey for juvenile salmon to survive and grow consists of abundant aquatic and terrestrial invertebrates that make up the majority of their diet before entering the ocean. Exposure to these contaminated food sources such as invertebrates may create delayed sublethal effects that reduce fitness and survival (Laetz *et al.* 2009). Contaminants are typically associated with areas of urban development, agriculture, or other anthropogenic activities (*e.g.*, mercury contamination as a result of gold mining or processing). Areas with low human impacts frequently have low contaminant burdens, and therefore lower levels of potentially harmful toxicants in the aquatic system. Freshwater rearing habitat has a high intrinsic conservation value even if the current conditions are significantly degraded from their natural state.

6. Riparian and Floodplain Habitat that Provides for Successful Juvenile Development and Survival

The channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento River system typically have low habitat complexity, low abundance of food organisms, and offer little protection from predators. Juvenile life stages of salmonids are dependent on the natural functioning of this habitat for successful survival and recruitment. Ideal habitat contains natural cover, such as riparian canopy structure, submerged and overhanging large woody material (LWM), aquatic vegetation, large rocks and boulders, side channels, and undercut banks that augment juvenile and adult mobility, survival, and food supply. Riparian recruitment is prevented from becoming established due to the reversed hydrology (*i.e.*, high summer time flows and low winter flows prevent tree seedlings from establishing). However, there are some complex, productive habitats within historical floodplains [*e.g.*, Sacramento River reaches with setback levees (*i.e.*, primarily located upstream of the City of Colusa)] and flood bypasses (*i.e.*, fish in Yolo and Sutter bypasses experience rapid growth and higher survival due to abundant food resources) seasonally available that remain in the system. Nevertheless, the current condition of degraded riparian habitat along the mainstem Sacramento River restricts juvenile growth and survival (Michel 2010, Michel *et al.* 2013).

7. Access Downstream so that Juveniles can Migrate from the Spawning Grounds to San Francisco Bay and the Pacific Ocean

Freshwater emigration corridors should be free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. Migratory corridors are downstream of the Keswick Dam spawning areas and include the mainstem of the Sacramento River to the Delta, as well as non-natal rearing areas near the confluence of some tributary streams.

Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For

successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. Unscreened diversions that entrain juvenile salmonids are prevalent throughout the mainstem Sacramento River and in the Delta. Predators such as striped bass (*Morone saxatilis*) and Sacramento pikeminnow (*Ptychocheilus grandis*) tend to concentrate immediately downstream of diversions, resulting in increased mortality of juvenile Chinook salmon.

Water pumping at the CVP/SWP export facilities in the South Delta at times causes the flow in the river to move back upstream (reverse flow), further disrupting the emigration of juvenile winter-run Chinook by attracting and diverting them to the interior Delta, where they are exposed to increased rates of predation, other stressors in the Delta, and entrainment at pumping stations. NMFS' BO on the long-term operations of the CVP/SWP (NMFS 2009a) sets limits to the strength of reverse flows in the Old and Middle rivers, thereby keeping salmon away from areas of highest mortality. Regardless of the condition, the remaining estuarine areas are of high conservation value because they provide factors that function as rearing habitat and as an area of transition to the ocean environment.

2.2.2 Central Valley Spring-run Chinook salmon

2.2.2.1 Summary of CV Spring-run Chinook salmon DPS Viability

Since the independent populations in Butte, Deer and Mill creeks are the best trend indicators for ESU viability, NMFS can evaluate risk of extinction based on Viable Salmonid Population (VSP) parameters in these watersheds. Lindley *et al.* (2007) indicated that the CV spring-run Chinook populations in the Central Valley had a low risk of extinction in Butte and Deer creeks, according to their population viability analysis (PVA) model and other population viability criteria (*i.e.*, population size, population decline, catastrophic events, and hatchery influence, which correlate with VSP parameters abundance, productivity, spatial structure, and diversity). The Mill Creek population of CV spring-run Chinook was at moderate extinction risk according to the PVA model, but appeared to satisfy the other viability criteria for low-risk status. However, CV spring-run Chinook failed to meet the “representation and redundancy rule” since there are only demonstrably viable populations in one diversity group (northern Sierra Nevada) out of the three diversity groups that historically contained them, or out of the four diversity groups as described in the NMFS Central Valley Salmon and Steelhead Recovery Plan. Over the long term, these three remaining populations are considered vulnerable to catastrophic events, such as volcanic eruptions from Mount Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought is also considered to pose a significant threat to the viability of the CV spring-run Chinook populations in these three watersheds due to their close proximity to each other. One large event could eliminate all three populations.

In the 2011 status review of CV spring-run Chinook, the authors concluded that the ESU status had likely deteriorated on balance since the 2005 status review and the Lindley *et al.* (2007) assessment, with two of the three extant independent populations (Deer and Mill creeks) of CV spring-run Chinook slipping from low or moderate extinction risk to high extinction risk. Additionally, Butte Creek remained at low risk, although it was on the verge of moving towards high risk, due to the rate of population decline. In contrast, CV spring-run Chinook in Battle and

Clear creeks had increased in abundance since 1998, reaching levels of abundance that place these populations at moderate extinction risk. Both of these populations have likely increased at least in part due to extensive habitat restoration. The Southwest Fisheries Science Center concluded in their viability report (Williams *et al.* 2011) that the status of CV spring-run Chinook has probably deteriorated since the 2005 status review and that its extinction risk has increased. The degradation in status of the three formerly low- or moderate-risk independent populations is cause for concern.

In the 2016 status review, NMFS found, with a few exceptions, CV spring-run Chinook salmon populations have increased through 2014 returns since the last status review (2010/2011), which moved the Mill and Deer creek populations from the high extinction risk category to moderate, and Butte Creek remaining in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations continued to show stable or increasing numbers in that period, putting them at moderate risk of extinction based on abundance. Overall, the Southwest Fisheries Science Center concluded in their viability report that the status of CV spring-run Chinook salmon (through 2014) had probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased. However, the 2015 returning fish were extremely low (1,488), with additional pre-spawn mortality reaching record lows. Since the effects of the 2012 to 2015 drought have not been fully realized, NMFS anticipates at least several more years of very low returns, which may result in severe rates of decline (NMFS 2016b).

2.2.2.2 Critical Habitat: Physical and Biological Features for CV Spring-Run Chinook Salmon

Critical habitat was designated for CV spring-run Chinook on September 2, 2005 (70 FR 52488). Critical habitat for CV spring-run Chinook includes stream reaches of the Feather, Yuba and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the OHWM. In areas where the OHWM has not been defined, the lateral extent will be defined by the bankfull elevation which is the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of one to two years on the annual flood series (Bain and Stevenson 1999) (70 FR 52488). Critical habitat for CV spring-run Chinook is defined as specific areas that contain the PBFs essential to the conservation of the species. Following are the inland habitat types used as PBFs for CV spring-run Chinook.

1. Spawning Habitat

Freshwater spawning sites are those with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. Most spawning habitat in the CV for Chinook salmon is located in areas directly downstream of dams containing suitable environmental conditions for spawning and incubation. Spawning habitat for CV spring-run Chinook occurs on the mainstem Sacramento River between RBDD and Keswick Dam and in tributaries such as Mill, Deer, and Butte creeks; as well as the Feather and Yuba rivers, Big Chico, Battle, Antelope, and Clear creeks. However, little spawning activity has been recorded in recent years on the Sacramento River mainstem for CV spring-run Chinook. Even in degraded

reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

2. Freshwater Rearing Habitat

Freshwater rearing sites are those with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile salmonid development; and natural cover such as shade, submerged and overhanging LWM, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system (*e.g.*, the lower Cosumnes River, Sacramento River reaches with setback levees [*i.e.*, primarily located upstream of the City of Colusa]) and flood bypasses (*i.e.*, Yolo and Sutter bypasses). However, the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from piscivorous fish and birds. Freshwater rearing habitat also has a high intrinsic conservation value even if the current conditions are significantly degraded from their natural state. Juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment.

3. Freshwater Migration Corridors

Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that augment juvenile and adult mobility, survival, and food supply. Migratory corridors are downstream of the spawning areas and include the lower mainstems of the Sacramento and San Joaquin rivers and the Delta. These corridors allow the upstream passage of adults and the downstream emigration of juveniles. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For adults, upstream passage through the Delta and much of the Sacramento River is not a problem, yet a number of challenges exist on many tributary streams. For juveniles, unscreened or inadequately screened water diversions throughout their migration corridors and a scarcity of complex in-river cover have degraded this PBF. However, since the primary migration corridors are used by numerous populations and are essential for connecting early rearing habitat with the ocean, even the degraded reaches are considered to have a high intrinsic conservation value to the species.

4. Estuarine Areas

Estuarine areas free of migratory obstructions with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water are included as a PBF. Natural cover such as submerged and overhanging LWM, aquatic vegetation, and side channels are suitable for juvenile and adult foraging.

The remaining estuarine habitat for these species is severely degraded by altered hydrologic regimes, poor water quality, reductions in habitat complexity, and competition for food and space with exotic species. Regardless of the condition, the remaining estuarine areas are of high conservation value because they provide factors that function to provide predator avoidance, as rearing habitat and as an area of transition to the ocean environment.

2.2.3 California Central Valley steelhead

Summary of CCV Steelhead DPS Viability

All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of naturally spawned fish to hatchery produced fish over the past 25 years (Good *et al.* 2005, NMFS 2011a, NMFS 2016a); the long-term abundance trend remains negative. Hatchery production and returns are dominant over natural fish, and one of the four hatcheries is dominated by Eel/Mad River origin steelhead stock. Continued decline in the ratio between naturally-produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin-clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts captured in monitoring studies has steadily increased over the past several years.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show an overall very low abundance, and fluctuating return rates. Lindley *et al.* (2007) developed viability criteria for Central Valley salmonids. Using data through 2005, Lindley *et al.* (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The widespread distribution of wild CCV steelhead in the Central Valley provides the spatial structure necessary for the DPS to survive and avoid localized catastrophes. However, most wild CCV steelhead populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2011a). The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.

The 2016 status review (NMFS 2016a) concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review when the Technical Recovery Team concluded that the DPS was in danger of extinction. Further, there is still a general lack of data on the status of wild populations. There are some encouraging signs, as several hatcheries in the Central Valley have experienced increased returns of steelhead over the last few years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Delta fish facilities, and the percentage of wild fish in those data remains much higher than at Chipps Island. The new video counts at Ward Dam show that Mill Creek likely supports one of the best wild steelhead populations in the Central Valley, though at much reduced levels from the 1950s and 60s. Restoration and dam removal efforts in Clear Creek continue to benefit CCV steelhead. However, the catch of unmarked (wild) steelhead at Chipps Island is still less than 5 percent of the total smolt catch, which indicates that natural production of steelhead throughout the Central Valley remains at very low levels.

2.2.3.1 Critical Habitat: Physical and Biological Features for CCV Steelhead

Critical habitat was designated for CCV steelhead on September 2, 2005 (70 FR 52488). Critical habitat for CCV steelhead includes stream reaches such as those of the Sacramento, Feather, and Yuba rivers, and Deer, Mill, Battle, and Antelope creeks in the Sacramento River basin; the San Joaquin River, including its tributaries, and the waterways of the Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the OHWM. In areas where the OHWM has not been defined, the lateral extent will be defined by the bankfull elevation which is the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series (Bain and Stevenson 1999) (70 FR 52488). Critical habitat for CCV steelhead is defined as specific areas that contain the PBFs and physical habitat elements essential to the conservation of the species. Following are the inland habitat types used as PBFs for CCV steelhead.

1. Freshwater Spawning Habitat

Freshwater spawning sites are those with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. Most of the available spawning habitat for steelhead in the CV is located in areas directly downstream of dams due to inaccessibility to historical spawning areas upstream and the fact that dams are typically built at high gradient locations. These reaches are often impacted by the upstream impoundments, particularly over the summer months, when high temperatures can have adverse effects upon salmonids spawning and rearing downstream of the dams. Even in degraded reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

2. Freshwater Rearing Habitat

Freshwater rearing sites are those with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and survival; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and

overhanging LWM, log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system (*e.g.*, the lower Cosumnes River, Sacramento River reaches with setback levees [*i.e.*, primarily located upstream of the City of Colusa]) and flood bypasses (*i.e.*, Yolo and Sutter bypasses). However, the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators. Freshwater rearing habitat also has a high conservation value even if the current conditions are significantly degraded from their natural state. Juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment.

3. Freshwater Migration Corridors

Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that augment juvenile and adult mobility, survival, and food supply. Migratory corridors are downstream of the spawning areas and include the lower mainstems of the Sacramento and San Joaquin rivers and the Delta. These corridors allow the upstream and downstream passage of adults, and the emigration of smolts. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For this reason, freshwater migration corridors are considered to have a high conservation value even if the migration corridors are significantly degraded compared to their natural state.

4. Estuarine Areas

Estuarine areas free of migratory obstructions with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water are included as a PBF. Natural cover such as submerged and overhanging LWM, aquatic vegetation, and side channels, are suitable for juvenile and adult foraging. Estuarine areas are considered to have a high conservation value as they provide factors which function to provide predator avoidance and as a transitional zone to the ocean environment.

2.2.4 Southern DPS of North American Green Sturgeon

2.2.4.1 Summary of sDPS Green Sturgeon Viability

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2011c). Viability is defined as an independent population having a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year timeframe (McElhany *et al.* 2000). The best available scientific information does not indicate that the extinction risk facing sDPS green sturgeon is negligible over a long-term (~100 year) time horizon; therefore, the sDPS is not believed to be viable. To support this statement, the PVA that was done for sDPS green sturgeon in relation to stranding events (Thomas *et al.* 2013) may provide some insight. While this PVA model made many assumptions that need to be verified as new information becomes available, it was alarming to note that over a 50-year time period the DPS declined under all scenarios where stranding events were recurrent over the lifespan of a green sturgeon.

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley *et al.* (2007), in discussing winter-run Chinook, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2011c).

There is a strong need for additional information about sDPS green sturgeon, especially with regard to a robust abundance estimate, a greater understanding of their biology, and further information about their habitat needs.

2.2.4.2 Southern DPS of North American Green Sturgeon Critical Habitat

Critical habitat was designated for the sDPS green sturgeon on October 9, 2009 (74 FR 52300). A full and exact description of all sDPS green sturgeon critical habitat, including excluded areas, can be found at 50 CFR 226.219. Critical habitat includes the stream channels and waterways in the Delta to the OHWM. Critical habitat also includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, and the Yuba River upstream to Daguerre Dam. Coastal marine areas include waters out to a depth of 60 fathoms, from Monterey Bay in California, to the Strait of Juan de Fuca in Washington. Coastal estuaries designated as critical habitat include San Francisco Bay, Suisun Bay, San Pablo Bay, and the lower Columbia River estuary. Certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay,

Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) are also included as critical habitat for sDPS green sturgeon.

Critical habitat for sDPS green sturgeon includes PBFs within the defined area that are essential to the conservation of the species. PBFs for sDPS green sturgeon have been designated for freshwater riverine systems, estuarine habitats, and nearshore coastal areas. In keeping with the focus on the California CV, we will limit our discussion to freshwater riverine systems and estuarine habitats.

2.2.4.2.1 Freshwater Riverine Systems

1. Food Resources

Abundant food items for larval, juvenile, sub-adult, and adult life stages for sDPS green sturgeon should be present in sufficient amounts to sustain growth, development, and support basic metabolism. Although specific information on food resources for green sturgeon within freshwater riverine systems is lacking, they are presumed to be generalists and opportunists that feed on similar prey as other sturgeons (Israel and Klimley 2008). Seasonally abundant drifting and benthic invertebrates have been shown to be the major food items of shovelnose and pallid sturgeon in the Missouri River (Wanner *et al.* 2007), lake sturgeon in the St. Lawrence River (Nilo *et al.* 2006), and white sturgeon in the lower Columbia River (Muir *et al.* 2000). As sturgeons grow, they begin to feed on oligochaetes, amphipods, smaller fish, and fish eggs as represented in the diets of lake sturgeon (Nilo *et al.* 2006), pallid sturgeon (Gerrity *et al.* 2006), and white sturgeon (Muir *et al.* 2000).

2. Substrate Type or Size

Critical habitat in the freshwater riverine system should include substrate suitable for egg deposition and development, larval development, sub-adults, and adult life stages. For example, spawning is believed to occur over substrates ranging from clean sand to bedrock, with preferences for cobble (Emmett *et al.* 1991, Moyle *et al.* 1995). Eggs are likely to adhere to substrates, or settle into crevices between substrates (Van Eenennaam *et al.* 2001, Deng *et al.* 2002). Larvae exhibited a preference for benthic structure during laboratory studies (Van Eenennaam *et al.* 2001, Deng *et al.* 2002, Kynard *et al.* 2005), and may seek refuge within crevices, but use flat-surfaced substrates for foraging (Nguyen and Crocker 2007).

3. Water Flow

An adequate flow regime is necessary for normal behavior, growth, and survival of all life stages in the upper Sacramento River. Such a flow regime should include stable and sufficient water flow rates in spawning and rearing reaches to maintain water temperatures within the optimal range for egg, larval, and juvenile survival and development (11°C - 19°C or 51.8°F - 66.2°F) (Mayfield and Cech 2004, Van Eenennaam *et al.* 2005, Allen *et al.* 2006). Sufficient flow is also needed to reduce the incidence of fungal infestations of the eggs, and to flush silt and debris from cobble, gravel, and other substrate surfaces to prevent crevices from being filled in and to maintain surfaces for feeding. Successful migration of adult green sturgeon to and from

spawning grounds is also dependent on sufficient water flow. Spawning in the Sacramento River is believed to be triggered by increases in water flow to about 14,000 cfs [average daily water flow during spawning months: 6,900 – 10,800 cfs; (Brown 2007)]. In Oregon's Rogue River, nDPS green sturgeon have been shown to emigrate to sea during the autumn and winter when water temperatures dropped below 10°C (50°F) and flows increased (Erickson *et al.* 2002). On the Klamath River, the fall outmigration of nDPS green sturgeon has been shown to coincide with a significant increase in discharge resulting from the onset of the rainy season (Benson *et al.* 2007). On the Sacramento River, flow regimes are largely dependent on releases from Shasta Dam, thus the operation of this dam could have profound effects upon sDPS green sturgeon habitat.

4. Water Quality

Adequate water quality, including temperature, salinity, oxygen content, and other chemical characteristics are necessary for normal behavior, growth, and viability of all life stages. Suitable water temperatures include: stable water temperatures within spawning reaches, temperatures within 11°C - 17°C (51.8°F – 62.6°F) (optimal range is 14°C - 16°C (57.2°F – 60.8°F)) in spawning reaches for egg incubation (March-August) (Van Eenennaam *et al.* 2005), temperatures below 20°C (68°F) for larval development (Werner *et al.* 2007), and temperatures below 24°C (75.2°F) for juveniles (Mayfield and Cech 2004, Allen *et al.* 2006). Suitable salinity levels range from fresh water [< 3 parts per thousand (ppt)] for larvae and early juveniles to brackish water (10 ppt) for juveniles prior to their transition to salt water. Prolonged exposure to higher salinities may result in decreased growth and activity levels and even mortality (Allen and Cech 2007). Adequate levels of dissolved oxygen (DO) are needed to support oxygen consumption by early life stages, ranging from 61.78 to 76.06 mg O₂ hr⁻¹ kg⁻¹ for juveniles (Allen and Cech 2007). Suitable water quality also includes water with acceptably low levels of contaminants (*i.e.*, pesticides, organochlorines, selenium, elevated levels of heavy metals, *etc.*) that may disrupt normal development of embryonic, larval, and juvenile stages of green sturgeon. Poor water quality can have adverse effects on growth, reproductive development, and reproductive success. Studies on the effects of water contaminants upon green sturgeon are needed; studies performed upon white sturgeon have clearly demonstrated the negative impacts contaminants can have upon white sturgeon biology (Fairey *et al.* 1997, Foster *et al.* 2001a, Foster *et al.* 2001b, Kruse and Scarnecchia 2002, Feist *et al.* 2005). Legacy contaminants such as mercury persist in the watershed and pulses of pesticides have been identified in winter storm discharges throughout the Sacramento River basin, the Central Valley, and the Delta.

5. Migratory Corridor

Safe and unobstructed migratory pathways are necessary for adult green sturgeon to migrate to and from spawning habitats, and for larval and juvenile green sturgeon to migrate downstream from spawning and rearing habitats within freshwater rivers to rearing habitats within the estuaries. Unobstructed passage throughout the Sacramento River up to Keswick Dam (RM 302) is important, because optimal spawning habitats for green sturgeon are believed to be located upstream of the RBDD (RM 242).

6. Depth

Deep pools of ≥ 5 m (16 ft) depth are critical for adult green sturgeon spawning and for summer holding within the Sacramento River. Summer aggregations of green sturgeon are observed in these pools in the upper Sacramento River upstream of Glenn-Colusa Irrigation District (GCID). The significance and purpose of these aggregations are unknown at the present time, but may be a behavioral characteristic of green sturgeon. Adult green sturgeon in the Klamath and Rogue rivers also occupy deep holding pools for extended periods, presumably for feeding, energy conservation, and/or refuge from high water temperatures (Erickson *et al.* 2002, Benson *et al.* 2007). As described above approximately 54 pools with adequate depth have been identified in the Sacramento River upstream of the GCID location.

7. Sediment Quality

Sediment should be of the appropriate quality and characteristics necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of contaminants [*e.g.*, elevated levels of heavy metals such as mercury, copper, zinc, cadmium, and chromium, polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides] that can result in negative effects on any life stage of green sturgeon or their prey. Based on studies of white sturgeon, bioaccumulation of contaminants from feeding on benthic species may negatively affect the growth, reproductive development, and reproductive success of green sturgeon. The Sacramento River and its tributaries have a long history of contaminant exposure from abandoned mines, separation of gold ore from mine tailings using mercury, and agricultural practices with pesticides and fertilizers that result in deposition of these materials in the sediment horizons in the river channel. The San Joaquin River is a source for many of these same contaminants, although pollution and runoff from agriculture are the predominant driving force. Disturbance of these sediment horizons by natural or anthropogenic actions can liberate sequestered contaminants into the river. This is a continuing concern throughout the watershed.

2.2.4.2.2 Estuarine Habitats

1. Food Resources

Abundant food items within estuarine habitats and substrates for juvenile, sub-adult, and adult life stages are required for the proper functioning of this PBF for green sturgeon. Green sturgeon feed primarily on worms, mollusks, and crustaceans (Moyle 2002). Radtke (1966) studied the diet of juvenile sDPS green sturgeon and found their stomach contents to include a mysid shrimp, amphipods, and other unidentified shrimp. These prey species are critical for the rearing, foraging, growth, and development of juvenile, sub-adult, and adult green sturgeon within the bays and estuaries. Currently, the estuary provides these food resources, although annual fluctuations in the population levels of these food resources may diminish the contribution of one group to the diet of green sturgeon relative to another food source.

Invasive species are a concern because they may replace the natural food items consumed by green sturgeon. The Asian overbite clam (*Corbula amurensis*) is one example of a prolific

invasive clam species in the Delta. It has been observed to pass through white sturgeon undigested (Kogut 2008).

2. Water Flow

Within bays and estuaries adjacent to the Sacramento River (*i.e.*, the Delta and the Suisun, San Pablo, and San Francisco Bays), sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds is required. Sufficient flows are needed to attract adult green sturgeon to the Sacramento River from the bay and to initiate the upstream spawning migration into the upper river. The specific quantity of flow required is a topic of ongoing research.

3. Water Quality

Adequate water quality, including temperature, salinity, oxygen content, and other chemical characteristics, is necessary for normal behavior, growth and viability of all life stages. Suitable water temperatures for juvenile green sturgeon should be below 24°C (75°F). At temperatures above 24°C, juvenile green sturgeon exhibit decreased swimming performance (Mayfield and Cech 2004) and increased cellular stress (Allen *et al.* 2006). Suitable salinities in the estuary range from brackish water (10 ppt) to salt water (33 ppt). Juveniles transitioning from brackish to salt water can tolerate prolonged exposure to salt water salinities, but may exhibit decreased growth and activity levels (Allen and Cech 2007), whereas sub-adults and adults tolerate a wide range of salinities (Kelly *et al.* 2007). Sub-adult and adult green sturgeon occupy a wide range of DO levels, but may need a minimum DO level of at least 6.54 mg O₂/l (Kelly *et al.* 2007, Moser and Lindley 2007).

Suitable water quality also includes water free of contaminants (*e.g.*, pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal development of juvenile life stages, or the growth, survival, or reproduction of sub-adult or adult stages. In general, water quality in the Delta and estuary meets these criteria, but local areas of the Delta and downstream bays have been identified as having deficiencies. Discharges of agricultural drain water have also been implicated in local elevations of pesticides and other related agricultural compounds within the Delta and the tributaries and sloughs feeding into the Delta. Discharges from petroleum refineries in Suisun and San Pablo bay have been identified as sources of selenium to the local aquatic ecosystem (Linville *et al.* 2002).

4. Migratory Corridor

Safe and unobstructed migratory pathways are necessary for timely passage of adult, sub-adult, and juvenile fish within the region's different estuarine habitats and between the upstream riverine habitat and the marine habitats. Within the waterways comprising the Delta and bays downstream of the Sacramento River, safe and unobstructed passage is needed for juvenile green sturgeon during the rearing phase of their life cycle. Passage within the bays and the Delta is also critical for adults and sub-adults for feeding and summer holding, as well as to access the Sacramento River for their upstream spawning migrations and to make their outmigration back into the ocean. Within bays and estuaries outside of the Delta and the areas comprised by Suisun,

San Pablo, and San Francisco bays, safe and unobstructed passage is necessary for adult and sub-adult green sturgeon to access feeding areas, holding areas, and thermal refugia, and to ensure passage back out into the ocean. Currently, safe and unobstructed passage has been diminished by human actions in the Delta and bays. The CVP and SWP, responsible for large volumes of water diversions, alter flow patterns in the Delta due to export pumping and create entrainment issues in the Delta at the pumping and fish facilities. Power generation facilities in Suisun Bay create risks of entrainment and thermal barriers through their operations of cooling water diversions and discharges. Installation of seasonal barriers in the South Delta and operations of the radial gates in the Delta Cross Channel facilities alter migration corridors available to green sturgeon. Actions such as the hydraulic dredging of ship channels and operations of large ocean going vessels create additional sources of risk to green sturgeon within the estuary. Commercial shipping traffic can result in the loss of fish, particularly adult fish, through ship and propeller strikes.

5. Water Depth

A diversity of depths is necessary for shelter, foraging, and migration of juvenile, sub-adult, and adult life stages. Sub-adult and adult green sturgeon occupy deep (≥ 5 m) holding pools within bays, estuaries, and freshwater rivers. These deep holding pools may be important for feeding and energy conservation, or may serve as thermal refugia (Benson *et al.* 2007). Tagged adults and sub-adults within the San Francisco Bay estuary primarily occupied waters with depths of less than 10 meters, either swimming near the surface or foraging along the bottom (Kelly *et al.* 2007). In a study of juvenile green sturgeon in the Delta, relatively large numbers of juveniles were captured primarily in shallow waters from 3 – 8 feet deep, indicating juveniles may require shallower depths for rearing and foraging (Radtke 1966).

Currently, there is a diversity of water depths found throughout the San Francisco Bay estuary and Delta waterways. Most of the deeper waters, however, are composed of artificially maintained shipping channels, which do not migrate or fluctuate in response to the hydrology in the estuary in a natural manner. Shallow waters occur throughout the Delta and San Francisco Bay. Extensive “flats” occur in the lower reaches of the Sacramento and San Joaquin river systems as they leave the Delta region and are even more extensive in Suisun and San Pablo bays. In most of the region, variations in water depth in these shallow water areas occur due to natural processes, with only localized navigation channels being dredged (*e.g.*, the Napa River and Petaluma River channels in San Pablo Bay).

6. Sediment Quality

Sediment quality (*i.e.*, chemical characteristics) is necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of contaminants (*e.g.*, elevated levels of selenium, PAHs, and organochlorine pesticides) that can cause negative effects on all life stages of green sturgeon (see description of *sediment quality* for riverine habitats above).

2.2.5 Global Climate Change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the CCV and aquatic habitat at large is climate change. Warmer temperatures associated with climate change reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen *et al.* 2000). Central California has shown trends toward warmer winters since the 1940s (Dettinger *et al.* 2004). Projected warming is expected to affect Central Valley Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if climate warms by 5°C (9°F), it is questionable whether any Central Valley Chinook salmon populations can persist (Williams 2006).

For winter-run Chinook, the embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, so this run is particularly at risk from climate warming. CV Spring-run Chinook adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson *et al.* 2011). CV Spring-run Chinook spawn primarily in the tributaries to the Sacramento River and those tributaries without cold-water refugia (usually input from springs) will be more susceptible to impacts of climate change. Although steelhead will experience similar effects of climate change to Chinook salmon, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile steelhead need to rear in the stream for one to two summers prior to emigrating as smolts. In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 14°C to 19°C (57°F to 66°F). ACID is considered the upriver extent of green sturgeon passage in the Sacramento River. The upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer. Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of green sturgeon, but temperatures at spawning locations lower in the river may be more affected.

In summary, observed and predicted climate change effects are generally detrimental to the species (McClure 2011, Wade *et al.* 2013), so unless offset by improvements in other factors, the status of the species and critical habitat is likely to decline over time. The climate change projections referenced above cover the period between the present and approximately 2100. While there is uncertainty associated with projections, which increases over time, the direction of change is relatively certain (McClure *et al.* 2013).

2.3 Action Area

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is not the same as the Project area because the action area must delineate all areas where federally-listed salmon, steelhead, and green sturgeon may be effected by the implementation of the proposed action.

The Project area is located along the Sacramento River in Sacramento and Yolo counties. The current and proposed I Street Bridges adjoin the cities of Sacramento and West Sacramento in the Sacramento West U.S. Geological Survey (USGS) Quadrangle, Range 4 East Township 9 North. The center of the existing bridge lies approximately at position 38.58627°, -121.50640°. The center of the proposed new bridge will lie approximately 1,000 feet north of the existing bridge approximately at position 38.58928°, -121.50635°.

The bridge crosses a portion of the lower Sacramento River. The action area encompasses 4,325 linear meters (14,190 feet) of the Sacramento River, to include 1,410 meters (4,626 feet) upstream and 2,915 meters (9,564 feet) downstream from the bridge which will effectively stop acoustic propagation. The action area encompasses the full lateral extent of the river. The action area includes the portion of the river determined to likely experience potential adverse effects resulting from the Project, including sedimentation, turbidity, and hydroacoustic impacts. Since the proposed action includes the purchase of mitigation credits from a conservation bank, the Action Area also includes the areas affected by the four conservation or mitigation banks that have service areas relevant to the project. These include the Fremont Landing Conservation Bank, a 100-acre floodplain site along the Sacramento River (Sacramento River Mile 106), Bullock Bend Mitigation Bank, a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80), Cosumnes Floodplain Mitigation Bank, a 493-acre site located at the confluence of the Cosumnes and Mokelumne Rivers in Sacramento County, and the Liberty Island Conservation Bank, a 147.91-acre floodplain site at the lower end of the Yolo Bypass.

2.4 Environmental Baseline

The “environmental baseline” includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The action area encompasses 4,325 linear meters (14,190 feet) of the Sacramento River. The action area includes the portion of the river determined to likely experience potential adverse effects resulting from the project including sedimentation, turbidity, and hydroacoustic impacts.

2.4.1 Mitigation Banking and Environmental Baseline

There are several conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this BO. These banks occur within critical habitat for sDPS green sturgeon, winter-run Chinook, CV spring-run Chinook, and CCV steelhead. These include:

Cosumnes Floodplain Mitigation Bank: Established in September 2009, the Cosumnes Floodplain mitigation bank is a 493-acre site located at the confluence of the Cosumnes and Mokelumne Rivers in Sacramento County. This bank is authorized by NMFS to provide credits for Floodplain Mosaic Wetlands, Floodplain Riparian Habitat, and Shaded Riverine Aquatic

Habitat. There are floodplain mosaic wetlands, floodplain riparian habitat, and shaded riverine aquatic habitat credits available. To date, there have been 17,407.3 of 78,172.4 credits sold and the ecological value (increased rearing habitat for juveniles) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

Fremont Landing Conservation Bank: Established in 2006, the Fremont Landing Conservation Bank is a 100-acre floodplain site along the Sacramento River (Sacramento River Mile 106) and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook, CV spring-run Chinook and CCV steelhead. There are off-channel shaded aquatic habitat credits, riverine shaded aquatic habitat credits and floodplain credits available. To date, there have been 28.2 of 100 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

Bullock Bend Mitigation Bank: Established in 2016, the Bullock Bend Mitigation Bank is a 116.15-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80) and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook, CV spring-run Chinook and CCV steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement and salmonid riparian forest credits available. To date, there have been 56.52 of 116.15 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

Liberty Island Conservation Bank: Established in 2010, the Liberty Island Conservation Bank is a 147.91-acre floodplain site at the lower end of the Yolo Bypass and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook, CV spring-run Chinook, sDPS Green Sturgeon, and CCV steelhead. There are salmonid riparian and salmonid marsh credits available. To date, there have been 139.11 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

2.4.2 Status of Listed Species in the Action Area

The action area functions primarily as rearing habitat and as a migration corridor for winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon. Various life stages of these species may be found within the action area throughout the year. Due to Project timing and location, fish in the action area are expected to be over 2g. This larger size means that they have different susceptibilities to effects from sound caused by pile driving.

Sacramento River winter-run Chinook Salmon

Of the four anadromous fish species addressed in this BO, winter-run Chinook faces the greatest risk of extinction. This is due to a severe reduction in historical spawning habitat in the

Sacramento River watershed. Listed as federally endangered, winter-run Chinook geographical distribution is confined to the mainstem Sacramento River, extending as far north as Keswick Dam. Spawning occurs below Keswick Dam and the mainstem Sacramento River serves as a migratory corridor. Figure 1 includes temporal occurrence and relative abundances for adults and juveniles in the mainstem Sacramento River and at Knights Landing, respectively. The Knights Landing data is indicative of juvenile presence and run timing in the action area, but the adult data is more indicative of upstream presence.

Based on salvage records at the CVP and SWP fish collection facilities, juvenile winter-run Chinook are expected in the action area starting in December. Based on these data, their presence in the action area is expected to peak in March and then rapidly decline from April through June. The majority of winter-run juveniles will enter the action area during February through June. Presence of adult Chinook salmon is interpolated from historical data. Adult winter-run Chinook are expected to enter the action area starting in January, with the majority of adults passing through the action area from February to April. As such, adult winter-run Chinook are not expected to be in the action area during the in-water work window, although juvenile winter-run Chinook may be present during this time.

Based on the temporal presence of winter-run Chinook in the lower Sacramento River, the timing of the Proposed project, and the location of the action area, it is likely that adult and juvenile Sacramento River winter-run Chinook salmon will be using the action area during the in-water work window.

Winter run relative abundance	High				Medium				Low			
a) Adults freshwater												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento River basin ^{a,b}	■	■	■	■	■	■	■				■	■
Upper Sacramento River spawning ^c					■	■	■	■				
b) Juvenile emigration												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento River at Red Bluff ^d	■	■	■				■	■	■	■	■	■
Sacramento River at Knights Landing ^e	■	■	■							■	■	■
Sacramento trawl at Sherwood Harbor ^f	■	■	■	■							■	■
Midwater trawl at Chipps Island ^g	■	■	■	■	■							■

Sources: ^aYoshiyama *et al.* (1998); Moyle (2002); ^bMyers *et al.* (1998) ; ^cWilliams (2006) ; ^dMartin *et al.* (2001); ^eKnights Landing Rotary Screw Trap Data, CDFW (1999-2011); ^{f,g}Delta Juvenile Fish Monitoring Program, USFWS (1995-2012)

Figure 1. The temporal occurrence of adult (a) and juvenile (b) winter-run in the Sacramento River. Darker shades indicate months of greatest relative abundance.

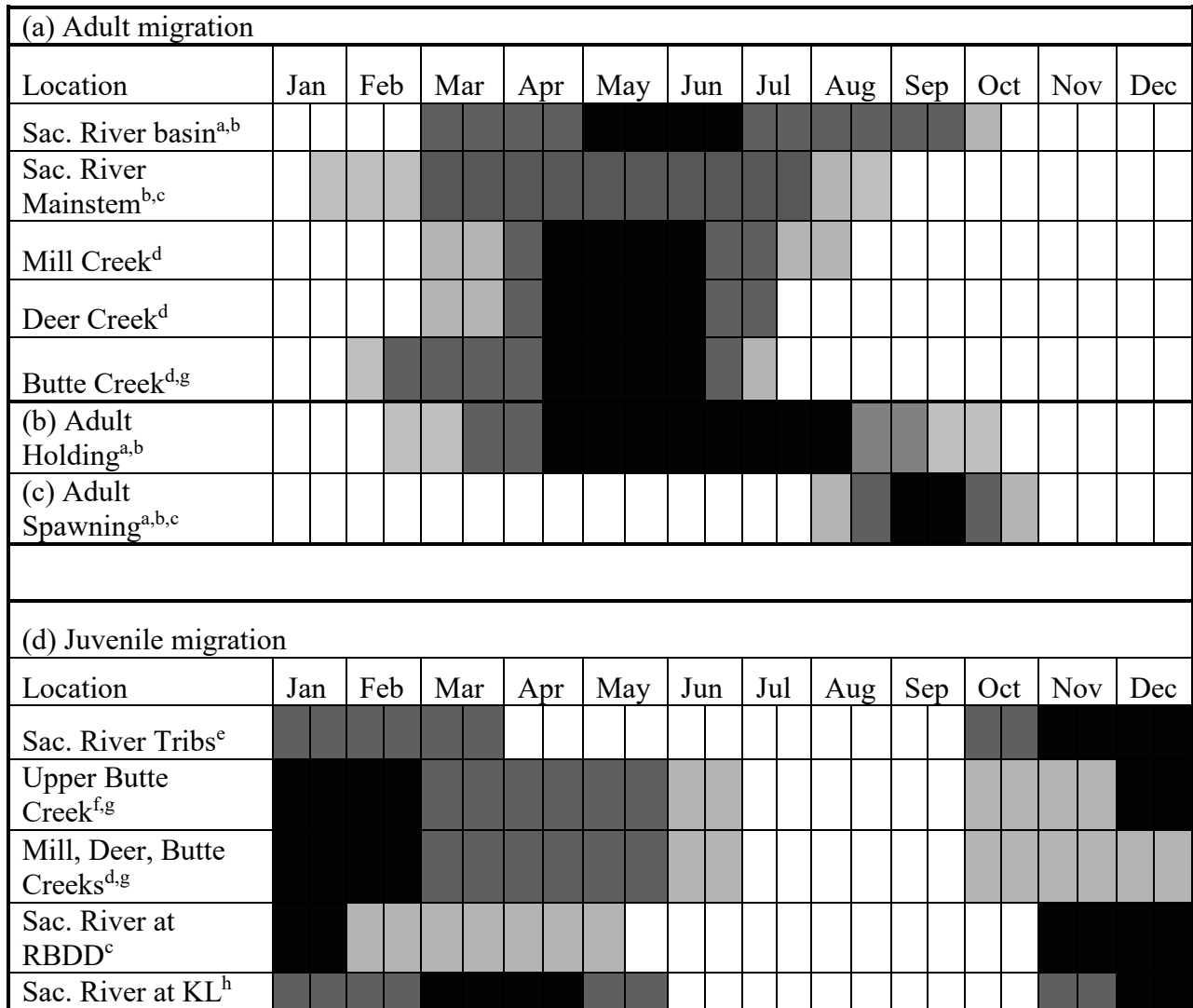
CV spring-run Chinook Salmon

The mainstem of the Sacramento River serves as a primary migratory corridor for both upstream and downstream migration of CV spring-run Chinook, connecting spawning habitat within the Sacramento River basin to the San Francisco Bay estuary and the Pacific Ocean. CV spring-run Chinook share a similar geographical distribution as well as many life history characteristics with CCV steelhead and the PBFs of their critical habitat are concurrently defined (see “*Status of Critical Habitat in the Action Area*” section). Figure 2 includes temporal occurrence and relative abundances for adults and juveniles in the mainstem Sacramento River and at Knights Landing, respectively. Similar to winter-run Chinook, the Knights Landing data are indicative of juvenile presence and run timing in the action area, but the adult data are more indicative of upstream presence.

CVP and SWP salvage records and the northern and Central Delta fish monitoring data indicate that juvenile CV spring-run Chinook first begin to appear in the action area in December and January, but that a significant presence does not occur until March and peaks in April. By May, the salvage of juvenile CV spring-run Chinook declines sharply and essentially ends by the end of June. The data from the northern and central Delta fish monitoring programs indicate that a small proportion of the annual juvenile CV spring-run Chinook emigration occurs in January and is considered to be mainly composed of yearling CV spring-run Chinook juveniles based on their size at date. Adult CV spring-run Chinook are expected to start entering the action area in

approximately January. Low levels of adult migration are expected through early March. The peak of adult spring-run Chinook movement through the action area is expected to occur from April through June with adults continuing to enter the system through the summer.

Based on the temporal presence of CV spring-run Chinook in the lower Sacramento River, the timing of the in-water work associated with the proposed Project, and the location of the action area, it is likely that adult and juvenile CV spring-run Chinook will be using the action area during the proposed in-water work.



Relative Abundance:  = High  = Medium  = Low

Sources: ^aYoshiyama *et al.* (1998); ^bMoyle (2002); ^cMyers *et al.* (1998); ^dLindley *et al.* (2004); ^eCDFG (1998); ^fMcReynolds *et al.* (2007); ^gWard *et al.* (2003); ^hSnider and Titus (2000)

Note: Yearling spring-run Chinook salmon rear in their natal streams through the first summer following their birth. Downstream emigration generally occurs the following fall and winter. Most young-of-the-year spring-run Chinook salmon emigrate during the first spring after they hatch.

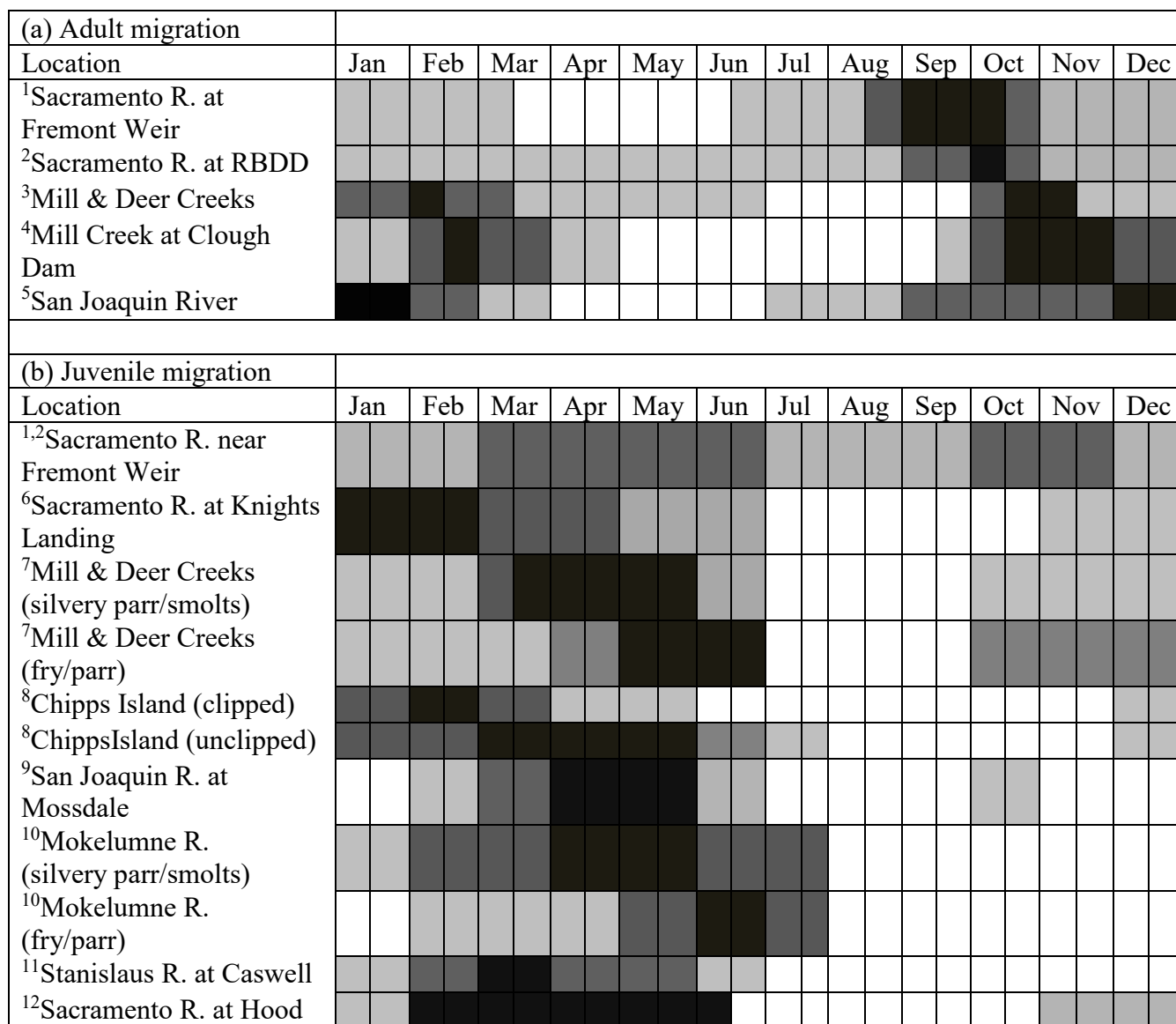
Figure 2. The temporal occurrence of adult (a) and juvenile (b) Central Valley spring-run Chinook salmon in the Sacramento River. Darker shades indicate months of greatest relative abundance.

CCV steelhead

Steelhead are well-distributed throughout the Central Valley below the major rim dams (Good *et al.* 2005, NMFS 2011a, NMFS 2016a). The mainstem of the Sacramento River serves as a primary migratory corridor for both upstream and downstream migration, connecting spawning habitat within the Sacramento River basin to the San Francisco Bay estuary and the Pacific Ocean. All adult CCV steelhead originating in the Sacramento River watershed will have to migrate through the action area in order to reach their spawning grounds and to return to the ocean following spawning. Likewise, all CCV steelhead smolts originating in the Sacramento River watershed will also have to pass through the action area during their emigration to the ocean. The Sacramento River may provide some rearing benefit to emigrating steelhead smolts. Figure 3 includes temporal occurrence and relative abundances for adults and juveniles in the mainstem Sacramento River and at Knights Landing, respectively. Similar to winter-run and CV spring-run Chinook, the Knights Landing data are indicative of juvenile presence and run timing in the action area, but the adult data are more indicative of upstream presence.

CCV steelhead smolts will first start to appear in the action area in November. This is based on the records from the CVP and SWP fish salvage facilities, as well as the fish-monitoring program in the northern and central Delta. Their presence increases through December and January, peaks in February and March, and declines in April. By June, the emigration has essentially ended, with only a small number of fish being salvaged through the summer at the CVP and SWP. Adult steelhead are expected to move through the action area throughout the year with the peak of upriver immigration expected to occur August through November. There is potential exposure to adult steelhead moving back downstream in a post-spawn condition (kelts) through the action area during the February to May period. It is expected that more kelts will be observed earlier in the period (February) due to the timing of spawning in the Sacramento River basin.

Based on the temporal presence of adult and juvenile steelhead in the lower Sacramento River, the timing of the proposed project, and the location of the action area, it is likely that adult steelhead will be using the action area as a migration corridor during construction. Additionally, it is likely that juvenile steelhead may be emigrating through the action area during construction.



Relative Abundance: = High = Medium = Low

Sources: ¹Hallock *et al.* (1957); ²McEwan (2001); ³Harvey (1995); ⁴CDFW unpublished data; ⁵CDFG Steelhead Report Card Data 2007; ⁶NMFS analysis of 1998-2011 CDFW data; ⁷Johnson and Merrick (2012); ⁸NMFS analysis of 1998-2011 USFWS data; ⁹NMFS analysis of 2003-2011 USFWS data; ¹⁰unpublished EBMUD RST data for 2008-2013; ¹¹Oakdale RST data (collected by FishBio) summarized by John Hannon (Reclamation); ¹²Schaffter (1980).

Figure 3. The temporal occurrence of (a) adult and (b) juvenile California Central Valley steelhead at locations in the Central Valley. Darker shades indicate months of greatest relative abundance.

sDPS green sturgeon

The upper mainstem Sacramento River is the only area where consistent annual spawning by sDPS green sturgeon has been confirmed via the presence of eggs and larvae (Poytress *et al.* 2015). The action area is located on the main migratory route for adults moving upstream to spawn, post spawn adults migrating back to the ocean, juvenile outmigrants, and rearing sub-adults. Juvenile green sturgeon from the sDPS are routinely collected at the SWP and CVP salvage facilities throughout the year. Based on the salvage records, green sturgeon may be present during any month of the year, and have been particularly prevalent during July and August. Adult green sturgeon begin to enter the Delta in late February and early March during the initiation of their upstream spawning run. The peak of adult entrance into the Delta appears to occur in late February through early April with fish arriving upstream in April and May. Adults continue to enter the Delta until early summer (June-July) as they move upriver to spawn. It is also possible that some adult green sturgeon will be moving back downstream in April and May through the action area, either as early post spawners or as unsuccessful spawners. Some adult green sturgeon have been observed to rapidly move back downstream following spawning, while others linger in the upper river until the following fall.

2.4.3 Status of Critical Habitat in the Action Area

Sacramento River winter-run Chinook Salmon

Critical habitat for Sacramento River winter-run Chinook occurs in the action area. As defined in the federal register notice designating winter-run Chinook critical habitat, the essential physical and biological habitat features of winter-run Chinook are: (1) migratory corridors for both upstream and downstream migration; (2) clean gravel for spawning; (3) adequate flow conditions for spawning, eggs, and larvae; (4) adequate temperature conditions for spawning, eggs, and larvae; (5) habitat and prey items that are free of contaminants; and (6) rearing habitat for juveniles. The features that occur within the action area are migratory corridors, habitat and prey items, and rearing habitat for juveniles. Each of these features has been degraded from historical conditions. Naturally-occurring floodplain habitat has been largely removed near the action area due to bank revetment and other levee repair actions, limiting habitat value for juvenile rearing. Habitat complexity has been reduced due to revetment activities and removal of vegetation, reducing macroinvertebrate production, shelter from predators, and thermal refugia. The mainstem Sacramento River also contains inorganic nutrients and contaminants from agriculture and industrial practices throughout the Sacramento River watershed. These contaminants can greatly degrade water quality, especially in summer months.

CCV steelhead and CV spring-run Chinook Salmon

The action area includes critical habitat that has been designated for CCV steelhead and CV spring-run Chinook. Critical habitat was designated under the same federal register notice for these two species, as their habitat requirements are very similar. PBFs within the action area for these two species include: (1) freshwater rearing sites, and (2) freshwater migration corridors. Both of these PBFs have been degraded from their historical condition due to human activity on and near the mainstem Sacramento River. Naturally-occurring floodplain habitat has been largely

removed near the action area due to bank revetment and other levee repair actions, limiting habitat value for juvenile rearing. Similarly, habitat complexity has been reduced due to revetment activities and removal of vegetation, reducing macroinvertebrate production, shelter from predators, and thermal refugia.

sDPS Green Sturgeon

Critical habitat for sDPS green sturgeon also occurs in the action area. The PBFs of sDPS green sturgeon critical habitat that are within the action area include (1) food resources, (2) adequate flow regime for all life stages, (3) water quality, (4) migratory corridors, (5) adequate water depth for all life stages, and (6) adequate sediment quality. The mainstem Sacramento River serves primarily as a migration corridor for green sturgeon. Insufficient data exists regarding the dynamics of juvenile rearing in the mainstem Sacramento River, but they are thought to exhibit at least some rearing behavior in the river before entering the Delta. Compared to the salmonid species addressed in this BO, the PBFs of green sturgeon critical habitat within the action area have not been negatively affected to the same degree. Because sub-adult and adult life stages are associated with benthic habitat, water quality and low flow conditions are likely the most deleterious factors influencing green sturgeon critical habitat PBFs. Due to a highly altered flow regime in the Sacramento River watershed and a recent drought event, flows through the action area are often inconsistent in summer months and have been greatly decreased from historical levels. Less is known about the habitat preference and reach-scale spatial orientation of juveniles, though they are most likely affected by these factors as well.

Factors Affecting Listed Species and Critical Habitat in the Action Area

This section will focus on factors that are specific to the action area.

The mainstem Sacramento River has been degraded from its historic condition and many anthropomorphic and naturally occurring factors have led to the decline of anadromous fish in the surrounding lotic ecosystem. Due to the construction of Keswick and Shasta dams, as well as various other dams constructed on Sacramento River tributaries, flows and temperatures through the action area have been altered from their natural and historic regimes. Altered flow regimes can influence migratory cues, water quality (including contaminants, dissolved oxygen, and nutrients for primary productivity), and temperature.

Drought conditions have played a significant role from 2012 through 2016, as flows have decreased and temperatures have increased, leading to unfavorable environmental conditions in the river. This has resulted in direct and indirect impacts to listed fish as well as impacts to critical habitat. Increased temperatures have the potential to disrupt aquatic macroinvertebrate production, leading to declines in food availability in the action area (Ward and Stanford 1982). In addition, due to low flows, high concentrations of inorganic nutrients from agricultural activity may occur in the action area (Paerl *et al.* 2011). For CV spring-run Chinook and CCV steelhead, rearing site and migration corridor PBFs have been partially degraded as a result of flow and temperature alteration due to dam construction. Winter-run Chinook PBFs affected by altered temperatures and flows include: migratory corridors for both upstream and downstream migration; adequate flow conditions; adequate temperature conditions; and rearing habitat for

juveniles. Affected PBFs for green sturgeon include adequate flow regime for all life stages, water quality, and migratory corridors.

The areas surrounding the portion of the Sacramento River that flows through the action area have been heavily urbanized. This has likely increased the amount of contaminant loading in the aquatic ecosystem. Heavy metals, PAHs, petroleum products, plastics, fertilizers, and many other contaminants can enter the river via urban runoff. In particular, the action area is adjacent to the Southern Pacific Railyard site in downtown Sacramento, a “superfund” site designated by the State of California due to excessive contamination of soils and groundwater over a 240-acre area with lead and other contaminants (Lee and Jones-Lee 1994).

Levees have been constructed along the banks of the Sacramento River, substantially reducing the density of riparian vegetation within the action area. Riparian vegetation provides a large host of ecosystem services and its removal has diminished habitat value within the action area. Riparian vegetation plays a key role in the conservation value of rearing habitat for all salmonid life stages. It provides shading to lower stream temperatures; increases the recruitment of LWM into the river, increasing habitat complexity; provides shelter from predators and; enhances the productivity of aquatic macroinvertebrates (Anderson and Sedell 1979, Pusey and Arthington 2003). It has also been shown to directly influence channel morphology and may be directly correlated with improved water quality in aquatic systems (Schlosser and Karr 1981, Dosskey *et al.* 2010).

Importance of the Action Area to the Survival and Recovery of Listed Species

The mainstem Sacramento River contains rearing habitat and a migration corridor for the juvenile life stage of all species addressed in this BO. The action area comprises approximately 14,190 feet linear feet of the river (2.6 RM) which may serve as rearing habitat for juveniles. The lower mainstem Sacramento River totals 302 RM from Keswick Dam to Rio Vista, making the action area approximately 0.8% of the total length of rearing habitat in the river. Although it is a small proportion of the total, the rearing habitat in the action area is important because it is downstream of major tributaries such as the Yuba River and Feather River, providing rearing opportunities for juveniles out-migrating from those systems.

Because it provides passage for all species between the Delta and their spawning habitat upstream, the migration corridor PBF is extremely important for their survival and recovery. Adults of all species returning from the ocean to spawn utilize the Sacramento River mainstem to travel upstream into various areas of the watershed. CCV steelhead and CV spring-run Chinook access a number of spawning reaches upstream of the action area, including the Yuba River, Feather River, and smaller mainstem tributaries such as Battle Creek, Antelope Creek, Cottonwood Creek, and many others. Winter-run Chinook access spawning sites in the mainstem Sacramento River below Keswick Dam; and sDPS green sturgeon access sites in the mainstem Sacramento River below Keswick Dam, in the Feather River, and potentially in the Yuba River. Annual recruitment of each of these species is partially dependent on available passage through the action area as they occupy a large geographical range upstream.

2.5 Effects of the Action

Under the ESA, “effects of the action” means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The proposed action includes activities that may directly or indirectly impact winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon and/or the critical habitat of these species. The following is an analysis of the potential direct and indirect effects to listed fish species and/or their critical habitat that may occur because of implementing the I Street Bridge Replacement Project.

2.5.1 Effects of the Proposed Action to Listed Fish Species

2.5.1.1 Direct Effects

Listed salmonids may be impacted by instream construction activities. Construction-related effects may include debris falling into the active channel, interactions with the construction barge, tools and/or equipment falling into the active channel, or noise generated by displaced rock and sediment and the operation of construction machinery. Adult winter-run Chinook are known to migrate through the action area; juvenile and adult CCV steelhead, sDPS green sturgeon, and CV spring-run Chinook are known to rear in and migrate through the action area. Any of these species/life stages may be present during the scheduled in-water work window and may be negatively affected by construction-related effects. BMPs, avoidance, and minimization techniques will be implemented, minimizing the probability of construction-related effects in the action area.

Salmonid behavioral response to noise and disturbance caused by construction activities may negatively influence fish’s downstream migration. Fish that migrate downstream may be exposed to short-term stress from being displaced from their rearing area and needing to locate a new rearing area. As such, listed salmonids may experience crowding and competition with resident fish for food and habitat, which can lead to reduced growth. Further, listed salmonids may be subject to increased predation risk while they are locating new rearing areas, leading to reduced survival. However, displaced fish will likely relocate to areas downstream that have suitable habitat and low competition; therefore, these potential negative effects are not expected to occur. Since only a small number of listed salmonids are likely to be in the action area and temporarily displaced by the proposed Project, it is not expected to affect the survival chances of individual fish or affect the population based on the size of the area that will be affected and the small number of fish likely to be displaced.

Instream construction activities may cause mortality, or reduced abundance, of benthic aquatic macroinvertebrates within the area where the bridge repairs will occur due to coarse sediment smothering. These effects to aquatic macroinvertebrates will be temporary and rapid recolonization (about 2 weeks to 2 months) is expected (Merz and Chan 2005). Furthermore,

downstream drift is expected to temporarily benefit any downstream, drift-feeding organisms, including juvenile salmonids. The amount of food available for juvenile salmonids and other listed salmonids is therefore expected to return to at least to pre-Project conditions.

Although listed fish may be exposed to construction areas with reduced prey base, listed fish will be able to retreat to adjacent suitable habitat, and food resources will only be temporarily impacted. Therefore, effects of instream construction activities are expected to be minor and are unlikely to result in injury or death.

2.5.1.2 Indirect Effects

2.5.1.2.1 Unintentional Spill of Hazardous Substances

During construction, the potential exists for spills or leakage of toxic substances that could enter the Sacramento River. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, concrete, sealants, and oil).

High concentrations of contaminants can cause direct and indirect effects to fish. Direct effects include mortality from exposure or increased susceptibility to disease that reduces the overall health and survival of the exposed fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. A potential indirect effect of contamination is reduced prey availability; invertebrate prey survival could be reduced following exposure, therefore making food less available for fish. Fish consuming infected prey may also absorb toxins directly. For salmonids, potential direct and indirect effects of reduced water quality during project construction will be addressed by utilization of vegetable-based lubricants and hydraulic fluids in equipment operated in the wet channel, and by implementing the construction site housekeeping measures incorporated in the project SWPPP. These measures include provisions to control erosion and sedimentation, as well as a Spill Prevention and Response Plan to avoid, and if necessary, clean up accidental releases of hazardous materials.

With these best management practices in place, impacts from contaminants are expected to be discountable for listed species.

2.5.1.2.2 Fish Rescue and Relocation

Prior to dewatering the area behind the sheet piles, fish will be captured and relocated from the area to be dewatered. Capture methods may include seining, dip netting, and/or electrofishing. The fish capture/relocation is included in this Project in order to avoid or minimize injury or death to fish due to dewatering. However, the handling of fish rescue itself may cause stress, injury, or death, even though it will be conducted by a qualified fish biologist and done according to a NMFS-approved relocation plan.

2.5.1.2.3 Sediment and Turbidity

Construction activities related to the bridge construction will temporarily disturb soil and riverbed sediments, resulting in the potential for temporary increases in turbidity and suspended sediments in the action area. Turbidity plumes are expected to affect a portion of the channel width and extend up to 600 feet downstream of the site. Construction-related increases in sedimentation and siltation above the background level could potentially affect fish species and their habitat by reducing juvenile survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity. The magnitude of potential effects on fish depends on the timing and extent of sediment loading and flow in the river before, during, and immediately following construction.

High concentrations of suspended sediment can have both direct and indirect effects on salmonids. The severity of these effects depends on the sediment concentration, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat. Juvenile salmonids have been observed to avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler *et al.* 1984). Sigler *et al.* (1984) found that prolonged exposure to turbidities between 25 and 50 nephelometric turbidity units (NTUs) resulted in reduced growth and increased emigration rates of juvenile coho salmon and steelhead compared to controls. These findings are generally attributed to reductions in the ability of salmon to see and capture prey in turbid water (Waters 1995). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Berg and Northcote (1985) observed changes in social and foraging behavior and increased gill flaring (an indicator of stress) in juvenile coho salmon at moderate turbidity (30-60 NTUs). In this study, behavior returned to normal quickly after turbidity was reduced to lower levels (0-20 NTU).

Any increase in turbidity associated with instream work is likely to be brief and occur only near the site, attenuating downstream as suspended sediment settles out of the water column. Temporary spikes in suspended sediment may result in behavioral avoidance of the site by fish; several studies have documented active avoidance of turbid areas by juvenile and adult salmonids (e.g., Sigler *et al.* 1984, Lloyd 1987, Servizi and Martens 1992).

Although less is known about the timing of rearing and migration of sDPS green sturgeon, both adult and juvenile life stages are known to utilize the action area as a migration corridor and may exhibit rearing behavior there as well. Less is known about the specific detrimental physical and physiological effects of sedimentation and turbidity to sturgeon. However, it is thought that high levels of turbidity can generally result in gill fouling, reduced temperature tolerance, reduced swimming capacity and reduced forage capacity in lotic fishes (Wood and Armitage 1997).

Individual fish that encounter increased turbidity or sediment concentrations will likely move away from affected areas into more suitable surrounding habitat. In-water work will only occur

from May 1 to November 30, which will limit the duration of the turbidity effects. Gravel will be washed to reduce the introduction of fine sediments to the stream.

Based on the proposed Project description, sedimentation events and elevation of turbidity associated with construction are expected to be minor and transient in nature. In addition, avoidance and minimization techniques will be implemented in this Project as well as BMPs pertaining to the minimization of sedimentation and turbidity ensuring the turbidity does not exceed the 20% threshold derived from the Sacramento and San Joaquin Rivers Basins Plan. These actions will minimize the extent of adverse effects associated with the proposed action.

2.5.1.2.4 Acoustic Effects

Piles that are driven into river bed substrate propagate sound through the water, which can damage a fish's swim bladder and other organs by causing sudden rapid changes in pressure, rupturing or hemorrhaging tissue in the bladder (Gisiner 1998, Popper et al. 2006). The swim bladder is the primary physiological mechanism that controls a fish's buoyancy. A perforated or hemorrhaged swim bladder has the potential to compromise the ability of a fish to orient itself both horizontally and vertically in the water column. This can result in diminished ability to feed, migrate, and avoid predators. Sensory cells and other internal organ tissue may also be damaged by noise generated during pile driving activities as sound reverberates through a fish's viscera (Gaspin 1975). In addition, morphological changes to the form and structure of auditory organs (sacculus and lagenar maculae) have been observed after intense noise exposure (Hastings 1995). It is important to note that acute injury resulting from acoustic impacts should be scaled based on the mass of a given fish. Juveniles and fry have less inertial resistance to a passing sound wave and are therefore more at risk for non-auditory tissue damage (Popper and Hastings 2009).

Fish can also be injured or killed when exposed to lower sound pressure levels for longer periods of time. Hastings (1995) found death rates of 50 percent and 56 percent for gouramis (*Trichogaster* sp.) when exposed to continuous sounds at 192 dB (re 1 μ Pa) at 400 Hz and 198 dB (re 1 μ Pa) at 150 Hz, respectively, and 25 percent for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB (re 1 μ Pa) at 250 Hz for 2 hours or less. Hastings (1995) also reported that acoustic "stunning," a potentially lethal effect resulting in a physiological shutdown of body functions, immobilized gourami within 8 to 30 minutes of exposure to the aforementioned sounds.

Multiple studies have shown responses in the form of behavioral changes in fish due to human-produced noise (Wardle et al. 2001, Slotte et al. 2004, Popper and Hastings 2009). Instantaneous behavioral responses may range from slight variations, a mild awareness, to a startle response. Fish may also vacate their normally-occupied positions in their habitat for short or long durations. Depending on the behavior that is being disrupted, the direct and indirect negative effects could vary. Behavioral effects could affect juvenile fish more than adults, as there are essential behaviors to their maturation and survival, such as feeding, sheltering, and migration. An example of a significant, direct negative effect would be interruption or alteration of migratory behavior. In the context of the proposed action area, the migratory behavior of juvenile salmonids and green sturgeon may be affected by various pile driving and acoustic impacts. Though pile driving may affect migratory behavior, it is not expected to prevent salmonids and

sturgeon from passing upstream or downstream because pile driving will not be continuous through the day (maximum 16,000 strikes per day), and will not occur at night, when the majority of fish migrate.

The permanent piles for the bridge abutments will be installed on land using an impact hammer. The proposed action includes installation of 100, 16-inch diameter steel or 16-inch precast concrete piles. According to an October 2012 update to the Caltrans hydroacoustic compendium (Caltrans 2012), the installation of 16-inch diameter steel piles with an impact hammer on land will result in single-strike sound levels of 198 dB_{peak} and 183 dB_{root mean square (RMS)} at 10 meters (32.8 feet) from the pile with an estimated sound exposure level (SEL) of 171 dB. According to Caltrans (2012), the installation of 16-inch precast concrete piles with the use of an impact hammer on land will result in single-strike sound levels of 192 dB_{peak} and 181 dB_{RMS} at 10 meters (32.8 feet) from the pile with an estimated SEL of 174 dB. For both the steel and pre-cast concrete piles, the estimated peak sound level (183 dB) is below the interim threshold (206 dB) for fish injury for a single strike. However, cumulative acoustic effects are expected for any situation in which multiple strikes are being made to an object with a single strike peak dB level above the effective quiet threshold of 150 dB.

The piles for the temporary trestle will be installed in water using an impact hammer with attenuation. The proposed action includes installation of 160 piles for the temporary trestle. Piles will either be 16-inch diameter steel or 16-inch H piles. According to Caltrans (2012), the installation of 16-inch diameter steel piles will result in single-strike sound levels of 208 dB_{peak} and 187 dB_{RMS} at 10 meters (32.8 feet) from the pile with an estimated SEL of 176 dB. Use of attenuation, such as a bubble curtain, is assumed to provide a minimum 5 dB of sound reduction for all sound levels. According to Caltrans (2012), the installation of 16-inch H piles will result in single-strike sound levels of 195 dB_{peak} and 180 dB_{RMS} at 10 meters (32.8 feet) from the pile with an estimated SEL of 170 dB. Use of attenuation, such as a bubble curtain, is assumed to provide a minimum 5 dB of sound reduction for all sound levels.

The permanent piles for piers 2 and 5 will be installed inside a de-watered cofferdam using an impact hammer. The proposed action includes installation of 100, 16-inch diameter steel or 16-inch precast concrete piles. The dewatered cofferdams are assumed to provide 5 dB of attenuation, so following Caltrans (2012), the installation of 16-inch diameter steel piles with an impact hammer and 5dB of attenuation will result in single-strike sound levels of 203 dB_{peak} and 182 dB_{RMS} at 10 meters (32.8 feet) from the pile with an estimated SEL of 171 dB. With the use of attenuation, the installation of 16-inch precast concrete piles with the use of an impact hammer behind a de-watered cofferdam will result in single-strike sound levels of 183 dB_{peak} and 171 dB_{RMS} at 10 meters (32.8 feet) from the pile with an estimated SEL of 161 dB. For both the steel and pre-cast concrete piles, the estimated peak sound level is below the interim threshold for fish injury for a single strike. However, cumulative acoustic effects are expected for any situation in which multiple strikes are being made to an object with a single strike peak dB level above the effective quiet threshold of 150 dB.

The permanent piles for the bridge fender system will be installed using an impact hammer that will be operated from a construction barge. The proposed action includes installation of 60, 16-inch precast concrete piles. According to Caltrans (2012), the installation of 16-inch precast

concrete piles with the use of an impact hammer and no attenuation will result in single-strike sound levels of 188 dB_{peak} and 176 dB_{root mean square (RMS)} at 10 meters (32.8 feet) from the pile with an estimated SEL of 166 dB. With the use of attenuation, the maximum single-strike sound level is estimated to be 183 dB_{peak} and 171 dB_{RMS} at 10 meters (32.8 feet) from the pile and an estimated SEL of 161 dB. For both the attenuated and unattenuated scenarios, the estimated peak sound level is below the interim threshold for fish injury for a single strike. However, cumulative acoustic effects are expected for any situation in which multiple strikes are being made to an object with a single strike peak dB level above the effective quiet threshold of 150 dB.

Spud piles to keep the barge in place will be installed in water using an impact hammer either with or without attenuation. The proposed action will use eight, 16-inch diameter steel piles to affix the barge in place. According to Caltrans (2012), the installation of 16-inch diameter steel piles will result in single-strike sound levels of 208 dB_{peak} and 187 dB_{RMS} at 10 meters (32.8 feet) from the pile with an estimated SEL of 176 dB. Use of attenuation, such as a bubble curtain, is assumed to provide a minimum 5 dB of sound reduction for all sound levels.

The permanent piles for piers 3 and 4 will be eight, 108-inch steel casings. The piles for piers 3 and 4 will be installed using either a vibratory hammer or a hydraulic driven oscillator/rotator system. Additionally, the cofferdams will be installed using a vibratory driver. No impact driving will be used for the cofferdams. Neither the vibratory hammer nor a hydraulic driven oscillator/rotator system are expected to cause injury to fish. This is because the injury threshold for fish is higher using these machines because the shape of the sound is different.

NMFS currently uses a dual metric criteria to assess onset of injury for fish exposed to pile driving sounds [Fisheries Hydroacoustic Working Group (FHWG) 2008]. Specifically, this includes a peak level of 206 dB and an accumulated SEL of 187 dB for fish equal to or greater than 2 grams. If either threshold is exceeded, then physical injury is assumed to occur. There is uncertainty as to the behavioral response of fish exposed to high levels of underwater sound produced when driving piles in or near water. Based on the information currently available, and until new data indicate otherwise, NMFS uses a 150 dB RMS threshold for behavioral responses in salmonids and green sturgeon. Though the dB value is the same, the 150 dB RMS threshold for behavioral effects is unrelated to the 150 dB effective quiet threshold.

Distances to the thresholds for acoustic effects under the different construction scenarios are summarized in Table 3.

Avoidance and minimization measures for pile driving include, the seasonal work window which will avoid many sensitive life stages, limiting pile driving to daylight hours to allow migration through the area at night, vibrating piles to the maximum extent possible, the use of a vibratory driver for the cofferdams, the use of a vibratory hammer or hydraulic oscillator/rotator system for the large casings at piers 3 and 4, and the use of attenuation methods such as installing inside a dewatered cofferdam or the use of bubble curtains.

Sound has the ability to injure fish physically by damaging a fish's swim bladder and other organs by causing sudden rapid changes in pressure, rupturing or hemorrhaging tissue in the bladder. Additionally, it can harass fish by instigating behavioral changes. These behavioral

changes can also lead to injury or death, such as fish being scared into higher predation areas. This project will involve impact pile driving with a bubble curtain used as attenuation and vibratory hammers. The calculations above state that there is the potential for the cumulative acoustic effects to exceed the effective quiet threshold allowing for injury or behavioral changes. Based on the acoustic effects analysis (Table 3), peak sound pressures are estimated to be above the thresholds for injury and/or mortality of listed fish within 0 to 14 meters (0 to 45.9 feet) of the pile driving, depending on the size of piles used and the use of sound attenuation techniques. Peak sound pressures are not estimated to be above the threshold for injury and/or mortality of listed fish >14 meters (or 45.9 feet) from the pile driving. Cumulative sound exposure levels are expected to exceed the 187 dB threshold for physical injury for fish greater than 2 grams, from 54 to 541 meters (177 to 1,774.9 feet) of the pile, depending on the size of piles used and the use of sound attenuation techniques (Table 3). Non-injurious behavioral effects are expected to occur from 251 to 2,929 meters (828.4 to 9,609.6 feet) of the pile, depending on the size of pile used and the use of sound attenuation techniques (Table 3). Through avoidance and minimization measures, the effect of sound on listed species will be minimized.

Table 3. Acoustic effects under different construction scenarios.

Pile Location	Pile Type	Driver Type	Installation	Number of Strikes Per Pile	Piles Per Day	Strikes Per Day	Reference Distance (m)	Attenuation (dB)	Peak (dB)	SEL (dB)	RMS (dB)	Distance (m) to Threshold			
												Onset of Physical Injury			Behavior
												Peak dB	Cumulative SEL dB		RMS dB
													Fish >2 g	Fish < 2 g	
206 dB	187 dB	183 dB	150 dB												
Abutments 1 and 6	16-inch diameter steel	Impact	Land	800	20	16000	10	0	198	171	183	3	251	251	1585
	16-inch precast concrete	Impact	Land	800	20	16000	10	0	192	174	181	1	398	398	1166
Temporary Trestle	16-inch diameter steel	Impact	Water	800	20	16000	10	0	208	176	187	14	541	541	2929
	16-inch diameter steel	Impact	Water with attenuation	800	20	16000	10	5	203	171	182	6	251	251	1359
	16-inch H pile	Impact	Water	800	20	16000	10	0	195	170	180	2	215	215	1000
	16-inch H pile	Impact	Water with attenuation	800	20	16000	10	5	190	165	175	1	100	100	464
Piers 2 and 5	16-inch diameter steel	Impact	Inside de-watered cofferdam	800	20	16000	10	5	203	171	182	6	251	251	1359
	16-inch precast concrete	Impact	Inside de-watered cofferdam	800	20	16000	10	5	183	161	171	0	54	54	251
Bridge Fender System	16-inch diameter concrete	Impact	Water	1000	20	20000	10	0	188	166	176	1	117	117	541
	16-inch diameter concrete	Impact	Water with attenuation	1000	20	20000	10	5	183	161	171	0	54	54	251
Spud Piles	16-inch diameter steel	Impact	Water	800	8	6400	10	0	208	176	187	14	541	541	2929
	16-inch diameter steel	Impact	Water with attenuation	800	8	6400	10	5	203	171	182	6	251	251	1359
Piers 3 and 4	108-inch steel casings	Vibratory hammer	Water	NA	2 weeks /pile	NA	Vibratory pile driving not expected to cause injury to fish								
	108-inch steel casings	Hydraulic driven oscillator / rotator	Water	NA	2 weeks /pile	NA	Hydraulic oscillator/rotator systems rotate piles into place and do not generate high underwater noise levels								

2.5.2 Effects of the Proposed Action to Critical Habitat

Critical habitat has been designated in the action area for winter-run Chinook, CV spring-run Chinook, California Central Valley steelhead, and southern DPS of green sturgeon. The PBFs that occur within the action area for winter-run Chinook are: (1) migratory corridors for both upstream and downstream migration, (2) habitat and prey items that are free of contaminants, and (3) riparian habitat for juvenile rearing. The PBFs within the action area for sDPS green sturgeon are: (1) food resources, (2) adequate flow regime for all life stages, (3) water quality, (4) migratory corridors, (5) adequate water depth for all life stages, and (6) adequate sediment quality. The PBFs within the action area for CV spring-run Chinook and CCV steelhead are (1) freshwater rearing sites and (2) freshwater migration corridors.

Migratory corridors for winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon are likely to be negatively affected by the proposed action. The bridge piers and fenders associated with the proposed Action will create a permanent increase to in-river obstructions, but, given the width of the river and that many of the piles are aligned with each other along the trajectory of the river flow, this should not negatively impact the migration corridors in either direction for listed species. There will be a permanent loss of 0.44 acres SRA below the OHWM, and an additional permanent loss of 1 acre of cottonwood riparian habitat above the OHWM that supports critical habitat. Additionally, RSP and bridge pilings will permanently affect 1.33 acres of critical habitat. This loss of critical habitat results in on-site adverse impact to the designated critical habitat of listed species.

Habitat and prey items for winter-run Chinook (PBF 2) may be temporarily affected by contaminants due to the proposed action. Habitat may be contaminated via increased turbidity and sediments in the water column due to pile driving, the construction barge running aground, and the removal of temporary trestle and spud piles. Additionally, water, sediments, and potential prey items may become contaminated from petrochemicals from construction equipment. Contamination is not likely to persist after construction work is complete, so the habitat and prey items will likely not be permanently affected due to the proposed action. Avoidance and mitigation efforts for sedimentation and contamination are discussed in section 1.3.5.

While the proposed action is not likely to affect flow conditions for sDPS green sturgeon (PBF 2) within the action area, the presence of the barge during the in-water work window may temporarily affect localized flow conditions, since the barge will be anchored via piles driven into the corners of the barge.

Food resources for sDPS green sturgeon (PBF 1) may be temporarily affected by contaminants due to the proposed action. Potential prey items may become contaminated from petrochemicals from construction equipment. Contamination is not likely to persist after construction work is complete, so food resources will likely not be permanently affected due to the proposed action. Avoidance and mitigation efforts for sedimentation and contamination are discussed in section 1.3.5.

The proposed action may affect water quality for sDPS green sturgeon (PBF 3). The water may be contaminated via increased turbidity and sediments in the water column due to pile driving, the construction barge running aground, and temporary trestle and spud pile removal. Additionally, the water may become contaminated from petrochemicals from construction equipment. Contamination is not likely to persist after construction work is complete, so the water will likely not be permanently affected due to the proposed action. Avoidance and mitigation efforts for sedimentation and contamination are discussed in section 1.3.5.

Sediment quality for sDPS green sturgeon (PBF 6) may be temporarily affected by contaminants due to the proposed action. Sediments may become contaminated from petrochemicals from construction equipment. Contamination is not likely to persist after construction work is complete, so the habitat and prey items will likely not be permanently affected due to the proposed action. Avoidance and mitigation efforts for contamination are discussed in section 1.3.5.

2.5.3 Mitigation /Conservation Bank Credit Purchases

The proposed action also includes off-site mitigation for permanent impacts to streambed designated critical habitat of ESA listed anadromous salmonids at a ratio of 3:1 for permanent impacts to habitat below the OHWM and in-water column habitat; totaling 1.33 acres from the new bridge piers and RSP, and from the bridge shading of aquatic habitat. Caltrans will additionally compensate for the permanent fill of 1.85 acres of other waters of the United States in the Sacramento River by purchasing mitigation bank credits at either (1) a minimum of 2:1, for a total of up to 3.7 acres, if credits are for preservation of habitat; or (2) a minimum of 1:1, for a total of 1.85 acres, if the credits are for creation of habitat. Caltrans plans to mitigate for the loss of 1.44 acres of riparian forest by mitigating onsite to the maximum extent practicable. Offsite compensation will be used to achieve no net loss of existing in-kind riparian cover habitat values. Caltrans will compensate for the loss of 1.44 acres of riparian forest by purchasing mitigation bank credits at either (1) a minimum of 2:1, for a total of up to 2.88 acres, if credits are for preservation of habitat; or (2) a minimum of 1:1, for a total of 1.44 acres, if the credits are for creation of habitat.

The purchase of mitigation credits will address the loss of ecosystem functions due to the modification of the riverbank and streambed. These credit purchases are ecologically relevant to the impacts and the species affected because the NMFS-approved conservation/mitigation banks that serve the Project area include SRA, riparian forest and floodplain credits with habitat values that are already established and meeting performance standards. In addition, the banks are located in areas that will benefit the ESUs/DPSs affected by the proposed action.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase will be realized because each of the NMFS-approved banks considered in this BO have mechanisms in place to ensure credit values are met over time. Such mechanisms include legally-binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage and maintain the bank and habitat values in perpetuity, performance security

requirements, a remedial action plan, and site inspections by NMFS. In addition, each bank has a detailed credit schedule and credit transactions and credit availability are tracked on the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the U.S. Army Corps of Engineers, with support from the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the FHWA, and NMFS to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas, as well as information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation. RIBITS also contains links to bank establishment documents. The Bullock Bend Mitigation Bank was established June 23, 2016; the Cosumnes Floodplain Mitigation Bank was established August 4, 2008; the Fremont Landing Conservation Bank was established October 19, 2006; and the Liberty Island Conservation Bank was established July 21, 2010.

2.6 Cumulative Effects

“Cumulative effects” are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area’s future environmental conditions caused by global climate change that are properly part of the environmental baseline vs. cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.6.1 Water Diversions

Water diversions for municipal and industrial use are found in action area. Depending on the size, location, and season of operation, any of the diversions that are unscreened may entrain and kill many life stages of aquatic species, including juvenile listed anadromous fish species.

2.6.2 Increased Urbanization

Increases in urbanization and housing developments can affect habitat by altering watershed characteristics, and changing both water use and storm water runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those that are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This, in turn, will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.3 Rock Revetment and Levee Repair Projects

Cumulative effects include non-Federal riprap projects. Depending on the scope of the action, some non-Federal riprap projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of riprap occur within the Sacramento River watershed. The effects of such actions result in continued degradation, simplification and fragmentation of riparian and freshwater habitat.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to listed species and critical habitats as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated critical habitat for the conservation of the species.

In our *Range-wide Status of the Species* section, NMFS summarized the current likelihood of extinction of each of the listed species. We described the factors that have led to the current listing of each species under the ESA and across their ranges. These factors include past and present human activities and climatological trends and ocean conditions that have been identified as influential to the survival and recovery of the listed species. Beyond the continuation of the human activities affecting the species, we also expect that ocean condition cycles and climatic shifts will continue to have both positive and negative effects on the species' ability to survive and recover. The *Environmental Baseline* section reviewed the status of the species and the factors that are affecting their survival and recovery in the action area. The *Effects of the Action* section reviewed the exposure of the species and critical habitat to the proposed action and cumulative effects. NMFS then evaluated the likely responses of individuals, populations, and critical habitat. This *Integration and Synthesis* section will consider all of these factors to determine the proposed action's influence on the likelihood of both the survival and recovery of the listed species, and on the conservation value of designated critical habitats.

In order to estimate the risk to CCV steelhead, CV spring-run Chinook, winter-run Chinook, and green sturgeon as a result of the proposed action, NMFS uses a hierarchical approach. The condition of the ESU or DPS is summarized from the *Status of the Species* section of this BO. We then consider how the status of populations in the action area, as described in the *Environmental Baseline*, is affected by the proposed action. Effects on individuals are summarized, and the consequence of those effects is applied to establish risk to the diversity group, ESU, or DPS.

Status of the Species and Environmental Baseline

There are several criteria that would qualify the winter-run Chinook population at moderate risk of extinction (continued low abundance, a negative growth rate over two complete generations, significant rate of decline since 2006, increased hatchery influence on the population, and increased risk of catastrophe), and because there is still only one population that spawns below Keswick Dam, winter-run Chinook are at a high risk of extinction in the long term. Although many of the PBFs of winter-run Chinook critical habitat are currently degraded and provide limited high quality habitat, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

CV spring-run Chinook remain at moderate risk of extinction based on the evaluation for years 2012 – 2014 (Williams et al. 2016). However, based on the severity of the drought and the low escapements, as well as increased pre-spawn mortality in Butte, Mill, and Deer creeks in 2015, there is concern that these CV spring-run Chinook strongholds will deteriorate into high extinction risk in the coming years based on the population size or rate of decline criteria (NMFS 2016b). Although many of the PBFs of CV spring-run Chinook critical habitat are currently degraded and provide limited high quality habitat, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

The status of the CCV steelhead DPS appears to have remained unchanged since the 2016 status review and the DPS is likely to become endangered within the near future throughout all or a significant portion of its range (NMFS 2016a). Many of the PBFs of CCV steelhead critical habitat are degraded and provide limited high quality habitat. Although the current conditions of CCV steelhead critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento watershed are considered to have high intrinsic value for the conservation of the species, as they are critical to ongoing recovery efforts.

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate (NMFS 2015). Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Factors that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, and presence of contaminants in sediment. Although currently many of the PBFs of sDPS green sturgeon critical habitat are degraded and provide

limited high quality habitat, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

The evidence presented in the *Environmental Baseline* section indicates that past and present activities within the Sacramento River basin have caused significant habitat loss, degradation, and fragmentation. This has significantly reduced the quality and quantity of the remaining PBFs within action area of the Sacramento River for the populations of CCV steelhead, winter and CV spring-run Chinook, and sDPS green sturgeon that utilize this area. Alterations in the flow regimes of the Sacramento River system, removal of riparian vegetation and shallow water habitat, reduced habitat complexity, construction of armored levees for flood protection, and the influx of contaminants from agricultural and urban dischargers have also substantially reduced the functionality of the waterways.

Cumulative Effects

Water diversions, increased urbanization, and continuing rock revetment and levee projects can be reasonably assumed to occur in the future in the action area. The effects of these actions result in the continued degradation, simplification, and fragmentation of the riparian and freshwater habitat. Some of these actions, particularly those which are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Summary of the Effects of the Proposed Action

Fish will be harassed, injured, or killed during completion of the proposed action through various pathways. Direct effects from Project activities could result in physically crushing fish, negative effects through behavioral responses, or prey items killed from sediment or pollutant buildup. Any spills or leaks of toxic substances from construction equipment could cause direct or indirect effects to fish that risk mortality or reduces the overall health and survival of exposed fish. A rescue and relocation plan involves capturing fish and physically handling and relocating them, which risks injury and death. Construction-related increases in sedimentation and siltation above background level could potentially affect fish species and their habitat reducing survival of juveniles or interfering with feeding, migrating, and rearing activities. A large and varied amount of pile driving can create enough sound to damage a fish's internal organs or affect their migration and behavioral responses. Avoidance and mitigation measures, as well as BMPs, have been put in place to decrease any negative effects to listed species.

Critical habitat has been designated in the action area for winter-run Chinook, spring-run Chinook, CCV steelhead, and sDPS green sturgeon. PBFs affected for each species are listed in section 2.5.2. The proposed action will permanently affect an area that already contains degraded PBFs. The migratory corridors and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species. Therefore, the loss of any amount of these PBFs in the action area would negatively affect all of the listed species that utilize the action area.

NMFS Recovery Plan

The NMFS Recovery Plan for salmonids proposes actions to be taken on the Sacramento River to enhance fish passage and habitat. Four of these actions relevant to the proposed action are (1) Restore and maintain riparian and floodplain ecosystems along both banks of the Sacramento River to provide a diversity of habitat types including riparian forest, gravel bars and bare cut banks, shady vegetated banks, side channels, and sheltered wetlands, such as sloughs and oxbow lakes following the guidance of the Sacramento River Conservation Area Handbook. (2) Ensure that riverbank stabilization projects along the Sacramento River utilize biotechnical techniques that restore riparian habitat, rather than solely using the conventional technique of adding riprap. (3) Curtail further development in active Sacramento River floodplains through zoning restrictions, county master plans, and other Federal, State, and county planning and regulatory processes. (4) Implement projects that promote native riparian (e.g., willows) species including eradication projects for nonnative species (e.g., Arundo, tamarisk). The proposed Project reduces the riparian ecosystem by converting critical habitat to hardscape. The levee repair regrades an existing levee and contributes to the continued rip rapping of the riparian habitat along the Sacramento River. This bridge represents new development in active Sacramento River floodplains and removes permanently 1.4 acres of cottonwood riparian habitat.

Summary

According to the most recent status reviews, CV spring-run Chinook, winter-run Chinook, CCV steelhead, and sDPS green sturgeon are at some level or threat or risk of extinction due to past and present activities within the Sacramento River basin that have caused significant habitat loss, degradation, and fragmentation. Cumulative effects like water diversions, increased urbanization, and continuing rock and levee projects will all continue to happen in the action area without necessarily requiring federal permitting. During this proposed Project, fish will be harassed, injured, or killed during completion of the proposed action through various pathways. Direct effects from the Project as well as pollution events, rescue and relocation, turbidity increases, pile driving, and a loss of critical habitat all have the potential to affect fish. Avoidance and mitigation measures, as well as BMPs, have been put in place to decrease any negative effects to listed species.

The proposed construction will temporarily decrease the action area's ability to safely support listed fish at a variety of life stages and will increase the risk of mortality events or behavioral changes. Permanent effects will be seen on 1.44 acres of cottonwood riparian habitat (both above and below the OHWM) and 1.33 acres of critical habitat below the OHWM in the form of RSP and pier piling placement. These valuable areas that support critical habitat will be turned into hardscape. These permanent impacts only represent a small loss in the scope of the available habitat, but the high intrinsic conservation value of the area means this loss will be detrimental for the listed species that use the action area. On and offsite mitigation will attempt to address the loss of ecosystem function due to the modification of the riverbank and streambed (see section 1.3.6). Measures are included in the proposed action to protect fish and designated critical habitat. These measures, in addition to the purchase of mitigation credits, are expected to prevent the negative effects to individuals, populations, and designated critical habitat from reducing appreciably the likelihood of either the survival or recovery of a listed species in the wild by

reducing their numbers, reproduction, or distribution; or appreciably diminishing the value of designated critical habitat for the conservation of the species.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon, or destroy or adversely modify their designated critical habitats.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

NMFS anticipates incidental take of juvenile winter-run Chinook, adult and juvenile CV spring-run Chinook, adult and juvenile CCV steelhead, and subadult sDPS green sturgeon from impacts directly related to sedimentation and turbidity, pile driving and impairment of essential behavior patterns as a result of these activities, potential fish entrainment, and the possibility deleterious materials entering the waterway at the project construction site. The incidental take is expected to be in the form of harm, harassment, or mortality of winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon resulting from the installation and removal of temporary and permanent piles during bridge construction. Incidental take is expected to occur for any in-water work window seasons when of winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon individuals could potentially be in the action area. NMFS cannot, using the best available information, quantify the anticipated incidental take of individual winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon because of the variability and uncertainty associated with the population size of the species, annual variations in the timing of migration, and uncertainties regarding individual

habitat use of the action area. However, it is possible to describe the ecological surrogates for the incidental take.

It is impossible to precisely quantify and track the amount or number of individuals that are expected to be incidentally taken (injure, harm, kill, etc.) per species as a result of the proposed action due to the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of spawning and migration, individual habitat use within the action area, and difficulty in observing injured or dead fish. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the project that are expected to result in incidental take, that are more predictable and/or measurable, with the ability to monitor those surrogates to determine the extent of take that is occurring.

Ecological surrogates are Project elements that are expected to result in take and are somewhat predictable and/or measurable. Ecological surrogates can be monitored to approximate the level of take that occurs. Ecological surrogates for construction effects are described below. Overall, the number of listed fish that may be incidentally taken during activities is expected to be small, due to the proposed work window.

1) Direct Effects

Incidental take is expected to occur from construction-related effects in the form of injury or death of listed species. Additionally, take in the form of harassment is likely to occur as a result of displacement due to construction operations. Disruption of habitat utilization is likely to result in increased predation risk, decreased feeding, and increased competition. The behavioral modifications are expected to result from disruption of habitat use. Fish may become entrained in the new steel piles and may be injured or killed if the piles are dewatered. Two cofferdams are to be dewatered and will remain in place only during construction of the new bridge piers. The dimensions of each cofferdam are 25 feet by 80 feet, or 2,000 square feet. The temporary cofferdams and trestle piles will occupy 0.095 acres of river bottom during construction. This area contains the permanent effects and serves as the ecological surrogate for direct effects because it is where construction or dewatering will directly affect listed species. There is not a stronger ecological surrogate based on the information available at this time. It is not possible to quantify the exact numbers of individuals that may be affected. If Caltrans exceeds the 0.095 acre footprint, the proposed Project will be considered to have exceeded anticipated take levels, thus requiring Caltrans to cease operations and coordinate with NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

2) Rescue and Relocation

The proposed Project involves a fish rescue and relocation plan designed to recover any fish caught in cofferdams. It is impossible to estimate how many fish may need to be relocated from cofferdams. A fish rescue and relocation plan will be used as an ecological surrogate. If this plan is not submitted to the resource agencies for approval at least 60 days prior to initiating activities to install cofferdams, the proposed Project will be considered to have exceeded anticipated take

levels, thus requiring Caltrans to coordinate with NMFS on ways to reduce the amount of take down to anticipated levels.

3) Increased Sedimentation and Turbidity

The analysis of the effects of the proposed Project anticipates that the turbidity levels produced by installation and removal of piles will not exceed 20% over background, the threshold derived from the Sacramento and San Joaquin Rivers Basins Plan. The 20% turbidity level is being used as an ecological surrogate. If turbidity exceeds 20% over background levels, and construction activities fail to halt and adjust work to return to acceptable levels, the proposed Project will be considered to have exceeded anticipated take levels, thus requiring Caltrans to cease operations and coordinate with NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

4) Pile Driving and Acoustic Impacts

The proposed Project effects anticipates installation of all of the steel piles for the new fenders to be driven by vibratory and impact hammers. Pile driving with an impact hammer will occur during daylight hours, but will likely not be continuous throughout the entire working day. The Project will use the piles listed in Table 3. All piles will be driven during the in-water pile driving work window, between May 1 and November 30.

Pile driving with an impact hammer is expected to cause incidental take in the form of injury and mortality to salmonids and sturgeon through exposure to temporary high noise levels or sustained exposure to lower sound levels (> 206 dB peak or 183 or 187 dB SEL) within the water column during the installation of the piles. NMFS will use the area of sound pressure wave impacts extending into the water column from each pile, and the time period for pile driving as a surrogate for number of fish.

Based on the acoustic effects analysis (Table 3), peak sound pressures are estimated to be above the thresholds for injury and/or mortality of listed fish within 0 to 14 meters (0 to 45.9 feet) of the pile driving, depending on the size of piles used and the use of sound attenuation techniques. Peak sound pressures are not estimated to be above the threshold for injury and/or mortality of listed fish >14 meters (or 45.9 feet) from the pile driving. Cumulative sound exposure levels are expected to exceed the 187 threshold for physical injury for fish greater than 2 grams from 54 to 541 meters (177 to 1,774.9 feet) of the pile, depending on the size of piles used and the use of sound attenuation techniques (Table 3). Non-injurious behavioral effects are expected to occur from 251 to 2,929 meters (828.4 to 9,609.6 feet) of the pile, depending on the size of pile used and the use of sound attenuation techniques (Table 3). If Caltrans' monitoring indicates that sound levels greater than 206 dB peak, 187 dB or 183 dB cumulative SEL, or 150 dB RMS extend beyond the distances expected for the pile size and attenuation type, the amount of incidental take would be exceeded. If these ecological surrogates are not met and maintained, the proposed Project will be considered to have exceeded anticipated take levels, thus requiring Caltrans to cease operations and coordinate with NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

5) Loss of Habitat

NMFS anticipates that ESA listed anadromous fish may be harmed as a result of significant habitat impacts that will increase the likelihood of injury and death from habitat modifications at the repair site that reduce the quantity and quality of rearing habitat and by creating habitat conditions that increase the likelihood predation.

It is impossible to precisely quantify and track the amount or number of individuals that are expected to be incidentally harmed as a result of the proposed action due to the varying population size (annually and seasonally), annual variations in the timing of spawning and migration, variation in individual habitat use with the action area, and difficulty in making observations of injured or dead fish. The ecological surrogate for incidental take associated with the action is the permanent loss of 1.33 acres of habitat below the OHWM and the degradation of riparian vegetation where migrating and rearing juveniles of the species exist within the footprint of the proposed action.

Anticipated incidental take will be exceeded if the ecological surrogates described in the sections above are not met, the Action is not implemented as described in the BA prepared for this Action, all conservation measures are not implemented as described in the BA (including successful completion of monitoring and reporting criteria), or the Action is not implemented in compliance with the terms and conditions of this incidental take statement. If these ecological surrogates are not met and maintained, the proposed action will be considered to have exceeded anticipated take levels, thus requiring Caltrans to cease and coordinate with NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

“Reasonable and prudent measures” are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The measures described below are non-discretionary, and must be undertaken by Caltrans so that they become binding conditions of any contracts or permits, as appropriate, for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this incidental take statement. If Caltrans (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor(s) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement [50 CFR§402.14(i)(3)].

1. Measures shall be taken to minimize sedimentation events and turbidity plumes.
2. Measures shall be taken to reduce the potential sound impacts.
3. Measures shall be taken to revegetate temporarily impacted areas below and above the OHWM with native plants and shrubs.
4. Caltrans shall monitor and report on the amount or extent of incidental take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and Caltrans or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

The following terms and conditions implement reasonable and prudent measure 1: Measures shall be taken to minimize sedimentation events and turbidity plumes.

- a) BMPs shall be implemented to prevent sediment incursion into the active channel.
- b) Water discharged into the Sacramento River during construction will be filtered with a filter bag, diverted to a settling tank or infiltration area, and/or treated in a manner to ensure that discharges conform to the water quality requirements of the waste discharge permit.
- c) Turbidity and settleable solids shall be monitored according to water quality permits. If acceptable limits are exceeded, work shall be suspended until acceptable measured levels are achieved.

The following terms and conditions implement reasonable and prudent measure 2: Measures shall be taken to reduce the potential sound impacts.

- a) Noise attenuation methods, such as a bubble curtain, shall be used.
- b) Pile driving shall not be conducted at night when migration is most prevalent.

The following terms and conditions implement reasonable and prudent measure 3: Measures shall be taken to revegetate impacted areas below and above the OHWM with native plants and shrubs.

- a) All mitigation credits shall be purchased from a NMFS approved conservation bank.
- b) All mitigation credits shall be purchased prior to the end of construction.
- c) Documentation of the purchase of mitigation credits shall be sent to NMFS.
- d) Plants placed on-site as a form of mitigation shall be irrigated and maintained for 3 years.
- e) The removal of existing riparian and native vegetation shall be minimized to the maximum extent practicable.

The following terms and conditions implement reasonable and prudent measure 4: Caltrans shall monitor and report on the amount or extent of incidental take.

- a) Caltrans shall provide a report of project activities to NMFS by December 31 of each construction year.

- b) The report shall include project schedules, project completions, and details regarding project implementation for each given year.
- c) This report shall include a summary description of in-water constraint activities, avoidance and minimization measures taken, and any observed take incidents.
- d) Caltrans shall visually monitor the waterway in the action area during operations for any affected fish, including, but not limited to, CV spring-run Chinook, CCV steelhead, winter-run Chinook, and the sDPS green sturgeon. Observation of affected fish shall be reported to NMFS by telephone at (916) 930-3600, by FAX at (916) 930-3629, or at the address given below within 24 hours of the incident. Operations shall be halted immediately until Caltrans coordinates with NMFS to determine the cause of the incident and whether any additional protective measures are necessary to protect listed salmonids and green sturgeon. Any protective measures that are determined necessary to protect listed salmonids and sturgeon shall be implemented as soon as practicable within 72 hours of the incident. Affected fish are defined as:
 - a. Dead or moribund fish at the water surface;
 - b. Showing signs of erratic swimming behavior or other obvious signs of distress;
 - c. Gaping at the water surface; or
 - d. Showing signs of other unusual behavior.

A follow-up written notification shall also be submitted to NMFS which includes the date, time, and location that the carcass or injured specimen was found, a color photograph, the cause of injury or death, if known, and the name and affiliation of the person who found the specimen. Written notification shall be submitted to NMFS at the above address. Any dead specimen(s) shall be placed in a cooler with ice and held for pick up by NMFS personnel or an individual designated by NMFS to do so.

Updates and reports required by these terms and conditions shall be submitted to:

Assistant Regional Administrator
National Marine Fisheries Service
California Central Valley Office
650 Capitol Mall, Suite 5-100
Sacramento California 95814-4607

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

- (1) Caltrans should work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid and sturgeon habitat restoration projects within the Sacramento River Basin.

- (2) Caltrans should use a vibratory hammer whenever possible to avoid acoustic impacts to ESA-listed fish.
- (3) Equipment used for the Project shall be thoroughly inspected off-site for drips or leaks.
- (4) To the extent practicable, equipment shall be serviced with petroleum or other contaminant sources off-site.
- (5) Equipment used for the Project shall be thoroughly cleaned off-site to prevent introduction of contaminants.

2.11 Reinitiation of Consultation

This concludes formal consultation for I Street Bridge Replacement Project.

Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action (50 CFR 402.16).

3. MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by Caltrans and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plan (FMP) developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

EFH designated under the Pacific Coast Salmon FMP may be affected by the proposed action. Additional species that utilize EFH designated under this FMP within the action area include

fall-run/late fall-run Chinook salmon. Habitat Areas of Particular Concern (HAPCs) that may be either directly or indirectly adversely affected include (1) complex channels and floodplain habitats, and (2) thermal refugia.

3.2 Adverse Effects on Essential Fish Habitat

Effects to the HAPCs listed in section 3.1 are discussed in context of effects to critical habitat PBFs as designated under the ESA in section 2.5.2. Effects to ESA-listed critical habitat and EFH HAPCs are appreciably similar; therefore, no additional analyses are conducted. A list of adverse effects to EFH HAPCs is included in this EFH consultation. Affected HAPCs are indicated by number corresponding to the list in section 3.1:

Pile Driving:

- Permanent loss of habitat (1)

Sedimentation and Turbidity:

- Reduced habitat complexity (1)
- Reduced size and connectivity of spawning patches (1)
- Increased scouring (1)
- Degraded water quality (1,2)
- Reduction in aquatic macroinvertebrate production (1)

Contaminants and Pollution-related Effects:

- Degraded water quality (1, 2)
- Reduction in aquatic macroinvertebrate production (1)

De-watering of Piles and/or Attenuation Casing:

- Degraded water quality (1, 2)
- Temporary loss of habitat (1, 2)

Vegetation removal:

- Permanent loss of natural shade cover (2)
- Permanent loss of habitat (1)

3.3 Essential Fish Habitat Conservation Recommendations

The following are EFH conservation recommendations for the proposed Project:

- (1) Caltrans should work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid and sturgeon habitat restoration projects within the Sacramento River Basin. HAPCs that would benefit from implementation of restoration projects include (1) complex channels and floodplain habitats and (2) thermal refugia.

- (2) Caltrans should post interpretive signs within the action area describing the presence of listed fish and/or critical habitat as well as highlighting their ecological and cultural value.

Fully implementing the EFH conservation recommendations above would protect EFH for Pacific coast salmon by avoiding or minimizing the adverse effects described in section 3.2.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, Caltrans must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects [50 CFR 600.920(k)(1)].

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

Caltrans must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations [50 CFR 600.920(l)].

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The

FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The following recommendations apply to the proposed action:

- (1) Caltrans should post interpretive signs within the action area describing the presence of listed fish and/or critical habitat as well as highlighting their ecological and cultural value.

The action agency must give this recommendation equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA.

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion is Caltrans. Other interested users could include City of Sacramento, City of West Sacramento, U.S. Coast Guard, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. Individual copies of this opinion were provided to Caltrans. This opinion will be posted on the Public Consultation Tracking System website (<https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts>). The format and naming adheres to conventional standards for style.

5.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

5.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA

regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

6. REFERENCES

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Native American Consultation

Hoffman, Robin

From: Hoffman, Robin
Sent: Tuesday, April 07, 2015 7:17 AM
To: 'nahc@nahc.ca.gov'
Subject: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project
Attachments: I-St-Bridge_NAHC-request_04072015.pdf

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

I would like to request a Sacred Lands File search and list of Native American contacts for the City of Sacramento's I St. Bridge Replacement Project. The formal request form and APE map is attached. Please let me know if you have any questions.

Thank you,

Robin D. Hoffman, MA, RPA | Senior Consultant – Archaeologist | [916.231.7684](tel:916.231.7684) (w) | [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814

Sacred Lands File & Native American Contacts List Request

NATIVE AMERICAN HERITAGE COMMISSION

1550 Harbor Blvd, Suite 100
West Sacramento, CA 95501
(916) 373-3710
(916) 373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: _____

County: _____

USGS Quadrangle

Name: _____

Township: _____ Range: _____ Section(s): _____

Company/Firm/Agency:

Contact Person: _____

Street Address: _____

City: _____ Zip: _____

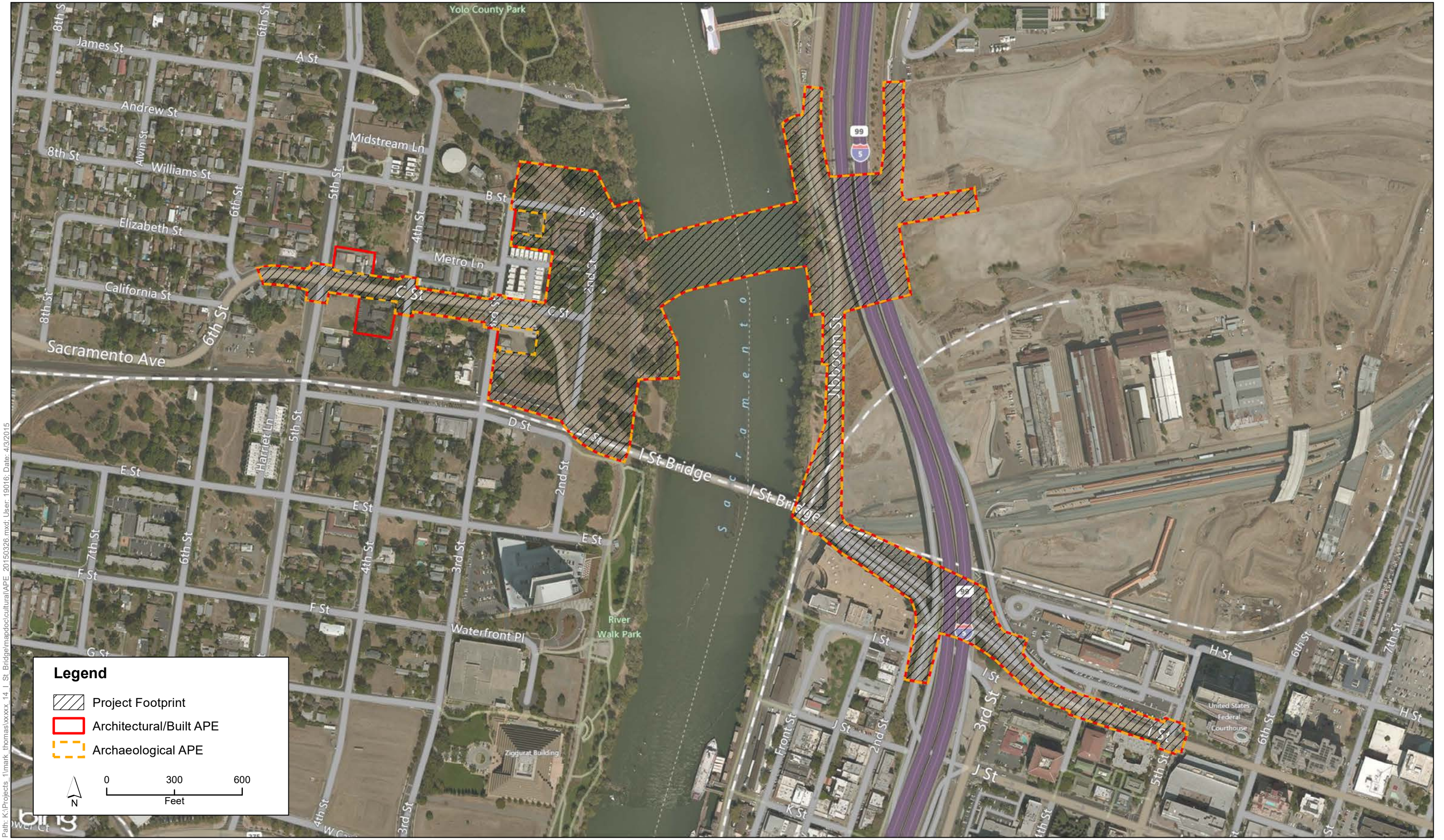
Phone: _____ Extension: _____

Fax: _____

Email: _____

Project Description:

____ Project Location Map is attached



Path: K:\Projects\1\mark_thomas\xxxxx_14_I_Street_Bridge\mapdoc\cultural\APE_20150326.mxd; User: 19016; Date: 4/3/2015



Figure 1
Area of Potential Effects
I Street Bridge

From: [Microsoft Outlook](#)
To: ["Debbie Pilas-Treadway"](#)
Subject: Relayed: FW: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project
Date: Thursday, April 09, 2015 9:18:47 AM
Attachments: [FW SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project.msg](#)

Delivery to these recipients or groups is complete, but no delivery notification was sent by the destination server:
'Debbie Pilas-Treadway' (dpt_nahc@pacbell.net) <mailto:dpt_nahc@pacbell.net>
Subject: FW: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project

From: Hoffman, Robin
To: "[Debbie Pilas-Treadway](#)"
Bcc: [Sorvari, Tina](#); [Havelaar, Christiaan](#)
Subject: FW: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project
Date: Tuesday, April 28, 2015 9:19:00 AM
Attachments: [I-St-Bridge_NAHC-request_04072015.pdf](#)
Importance: High

Ms. Pilas-Treadway,

Could you please confirm that the NAHC is still processing the Sacred Lands File request referred to in the subject line of this email. If so, do you have any estimate on when the request might be completed? For your use, the original request with attached documentation is included as an attachment to this email.

Thank you,
-Robin

From: dpt_nahc@pacbell.net [mailto:dpt_nahc@pacbell.net]
Sent: Thursday, April 09, 2015 9:32 AM
To: Hoffman, Robin
Subject: Re: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project

Thanks Robin, we will start to process your request.

Debbie

On Thursday, April 9, 2015 9:18 AM, "Hoffman, Robin" <Robin.Hoffman@icfi.com> wrote:

Ms. Pilas-Treadway,

I am forwarding you the SLF and contacts request below, with attached documentation, that was sent Tuesday to nahc@nahc.ca.gov. I have yet to receive a receipt of delivery or read receipt, so I would like to confirm that the NAHC received it. If not, could you please process the request at your convenience.

Thank you,

Robin D. Hoffman, MA, RPA | Senior Consultant – Archaeologist | [916.231.7684](tel:916.231.7684) (w) | [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814

From: Hoffman, Robin
Sent: Tuesday, April 07, 2015 7:17 AM
To: 'nahc@nahc.ca.gov'
Subject: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project
Importance: High

I would like to request a Sacred Lands File search and list of Native American

contacts for the City of Sacramento's I St. Bridge Replacement Project. The formal request form and APE map is attached. Please let me know if you have any questions.

Thank you,

Robin D. Hoffman, MA, RPA | Senior Consultant – Archaeologist | [916.231.7684](tel:916.231.7684) (w) | [707.494.3349](tel:707.494.3349) (c)
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Sacred Lands File & Native American Contacts List Request

NATIVE AMERICAN HERITAGE COMMISSION

1550 Harbor Blvd, Suite 100
West Sacramento, CA 95501
(916) 373-3710
(916) 373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: _____

County: _____

USGS Quadrangle

Name: _____

Township: _____ Range: _____ Section(s): _____

Company/Firm/Agency:

Contact Person: _____

Street Address: _____

City: _____ Zip: _____

Phone: _____ Extension: _____

Fax: _____

Email: _____

Project Description:

____ Project Location Map is attached

From: [Microsoft Outlook](#)
To: ["Debbie Pilas-Treadway"](#)
Subject: Relayed: FW: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project
Date: Tuesday, April 28, 2015 9:20:15 AM
Attachments: [FW SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project.msg](#)

Delivery to these recipients or groups is complete, but no delivery notification was sent by the destination server:
'Debbie Pilas-Treadway' (dpt_nahc@pacbell.net) <mailto:dpt_nahc@pacbell.net>
Subject: FW: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project

From: dpt_nahc@pacbell.net
To: [Hoffman, Robin](#)
Subject: Re: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project
Date: Tuesday, April 28, 2015 9:36:24 AM

The letter was typed up yesterday and will be faxed out today. Thanks for the follow up.

Debbie Treadway
Native American Heritage Commission

On Tuesday, April 28, 2015 9:19 AM, "Hoffman, Robin" <Robin.Hoffman@icfi.com> wrote:

Ms. Pilas-Treadway,

Could you please confirm that the NAHC is still processing the Sacred Lands File request referred to in the subject line of this email. If so, do you have any estimate on when the request might be completed? For your use, the original request with attached documentation is included as an attachment to this email.

Thank you,
-Robin

From: dpt_nahc@pacbell.net [mailto:dpt_nahc@pacbell.net]
Sent: Thursday, April 09, 2015 9:32 AM
To: Hoffman, Robin
Subject: Re: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project

Thanks Robin, we will start to process your request.

Debbie

On Thursday, April 9, 2015 9:18 AM, "Hoffman, Robin" <Robin.Hoffman@icfi.com> wrote:

Ms. Pilas-Treadway,

I am forwarding you the SLF and contacts request below, with attached documentation, that was sent Tuesday to nahc@nahc.ca.gov. I have yet to receive a receipt of delivery or read receipt, so I would like to confirm that the NAHC received it. If not, could you please process the request at your convenience.

Thank you,

Robin D. Hoffman, MA, RPA | Senior Consultant – Archaeologist | [916.231.7684](tel:916.231.7684) (w) | [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814

From: Hoffman, Robin

Sent: Tuesday, April 07, 2015 7:17 AM

To: 'nahc@nahc.ca.gov'

Subject: SLF and Contacts Request - City of Sacramento I St. Bridge Replacement Project

Importance: High

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Thank you,

Robin D. Hoffman, MA, RPA | Senior Consultant – Archaeologist | [916.231.7684](tel:916.231.7684) (w) | [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814

STATE OF CALIFORNIA

Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION

1550 Harbor Blvd.
West Sacramento, CA 95691
(916) 373-3710
Fax (916) 373-5471



April 27, 2015

Robin D. Hoffman
ICF International
630 K Street, Ste 400
Sacramento, CA 95814

VIA FAX: 916-737-3030
~~mailto:Karon.Reichardt@dot.ca.gov~~

3 Pages

I Street Bridge Replacement project, Sacramento and Yolo Counties

Mr. Hoffman;

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at (916) 373-3713.

Sincerely,

Debbie Pilas-Treadway
Debbie Pilas-Treadway
Environmental Specialist III

**Native American Contacts
Sacramento and Yolo Counties
April 24, 2015**

Rose Enos
15310 Bancroft Road
Auburn, CA 95603
(530) 878-2378

Maidu
Washoe

Shingle Springs Band of Miwok Indians
Nicholas Fonseca, Chairperson
P.O. Box 1340
Shingle Springs, CA 95682
nfonseca@ssband.org
(530) 676-8010 Office

Miwok
Maidu

(530) 676-8033 Fax

Kesner Flores
P.O. Box 1047
Wheatland, CA 95692
(925) 586-8919

Wintun / Patwin

Shingle Springs Band of Miwok Indians
Daniel Fonseca, Cultural Resource Director
P.O. Box 1340
Shingle Springs, CA 95682
(530) 676-8010 Office

Miwok
Maidu

(530) 676-8033 Fax

April Wallace Moore
19630 Placer Hills Road
Colfax, CA 95713
(530) 637-4279

Nisenan - So Maidu
Konkow
Washoe

T' si-Akim Maidu
Eileen Moon, Vice Chairperson
P.O. Box 1246
Grass Valley, CA 95945
(530) 274-7497

Maidu

Cortina Band of Indians
Charlie Wright, Chairperson
P.O. Box 1630
Williams, CA 95987
(530) 473-3274 Office

Wintun / Patwin

T' si-Akim Maidu
Grayson Coney, Cultural Director
P.O. Box 1316
Colfax, CA 95713
akimmaidu@att.net
(530) 383-7234

Maidu

(530) 473-3301 Fax

Shingle Springs Band of Miwok Indians
Hermo Olanio, Vice Chairperson
P.O. Box 1340
Shingle Springs, CA 95682
holanio@ssband.org
(530) 676-8010 Office

Miwok
Maidu

T' si-Akim Maidu
Don Ryberg, Chairperson
P.O. Box 1246
Grass Valley, CA 95945
(530) 274-7497

Maidu

(530) 676-8033 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed I Street Bridge Replacement project, Sacramento and Yolo Counties

**Native American Contacts
Sacramento and Yolo Counties
April 24, 2015**

United Auburn Indian Community of the Auburn Rancheria
Gene Whitehouse, Chairperson

10720 Indian Hill Road Maidu
Auburn, CA 95603 Miwok

(530) 883-2390 Office

(530) 883-2380 Fax

Yocha Dehe Wintun Nation
Cynthia Clarke, Native Cultural Renewal Committee

P.O. Box 18 Wintun (Patwin)
Brooks, CA 95606

(530) 796-3400 Office

(530) 796-2143 Fax

United Auburn Indian Community of the Auburn Rancheria
Marcos Guerrero, Tribal Preservation Committee

10720 Indian Hill Road Maidu
Auburn, CA 95603 Miwok

mguerrero@auburnrancheria.com

(530) 883-2364 Office

(530) 883-2320 Fax

United Auburn Indian Community of the Auburn Rancheria

Jason Camp, THPO

10720 Indian Hill Road Maidu
Auburn, CA 95603 Miwok

joamp@auburnrancheria.com

(916) 316-3772 Cell

(530) 883-2390

(530) 888-5476 - Fax

Yocha Dehe Wintun Nation

Leland Kinter, Chairperson

P.O. Box 18 Wintun (Patwin)
Brooks, CA 95606

lkinter@yochadehe-nsn.gov

(530) 796-3400

(530) 796-2143 Fax

Yocha Dehe Wintun Nation

Native Cultural Renewal Committee

P.O. Box 18 Wintun (Patwin)
Brooks, CA 95606

(530) 979-6346

(530) 796-3400 - office

(530) 796-2143 Fax

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June 10, 2015

The Honorable Jason Camp
THPO, United Indian Community of the Auburn
Rancheria
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Jason Camp:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

ICF International archaeologist Christiaan Havelaar, Co-Principal Investigator, is a consultant representing the City of Sacramento and will be contacting you to initiate Native American consultation. Mr. Havelaar will be requesting information you may have regarding sites, traditional cultural properties, values, or other cultural resource considerations within the project area so this information may be incorporated into the planning phase of the project.

June 10, 2015

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Your comments and concerns will be important to the City of Sacramento as they move forward with their project. If you have any questions or concerns with the project, please contact Christiaan Havelaar via email (christiaan.havelaar@icfi.com) or at his office (916-737-3000). Mr. Havelaar's mailing address is:

Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

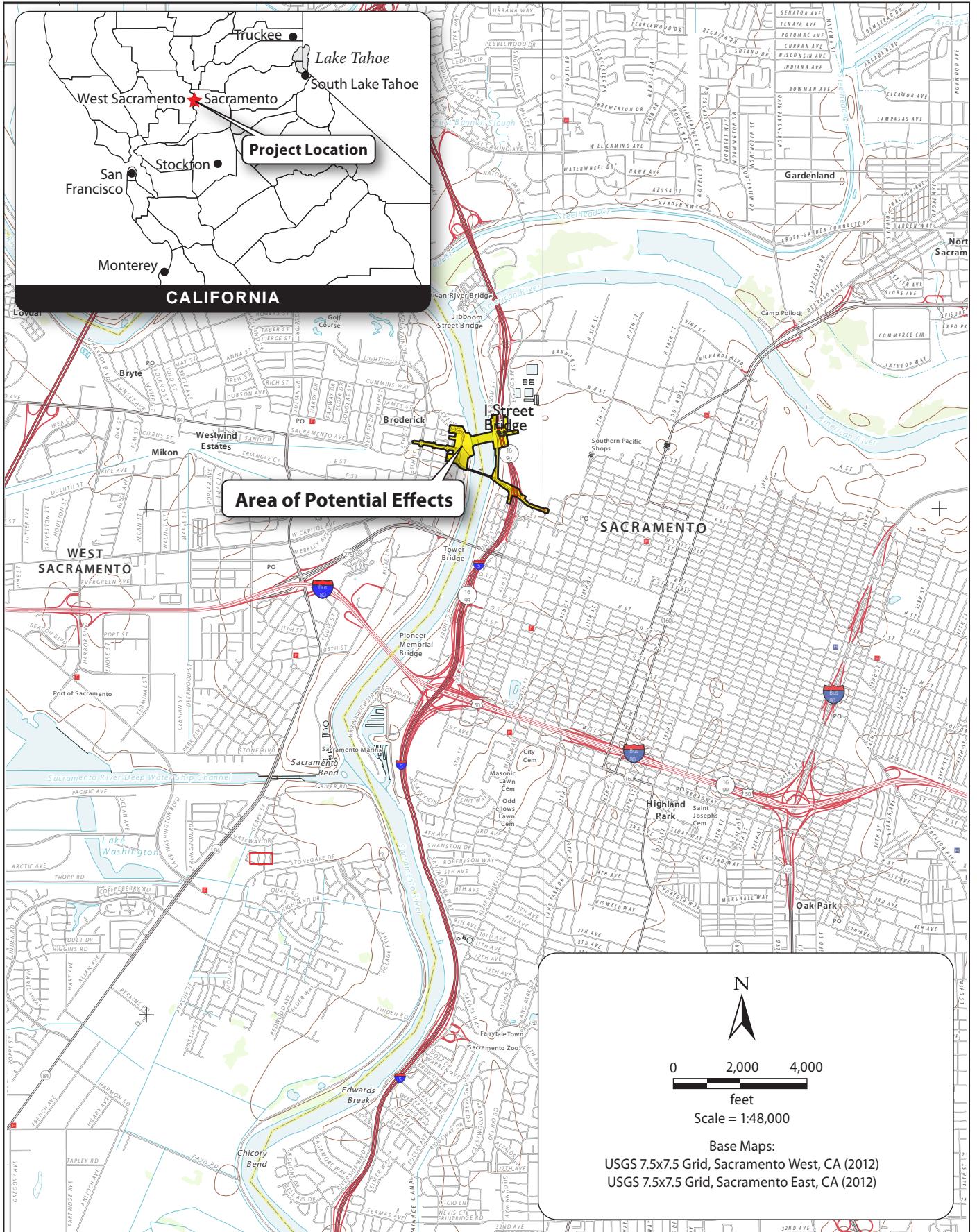
Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Gene Whitehouse, United Indian Community of the Auburn Rancheria
Marcos Guerrero, United Indian Community of the Auburn Rancheria

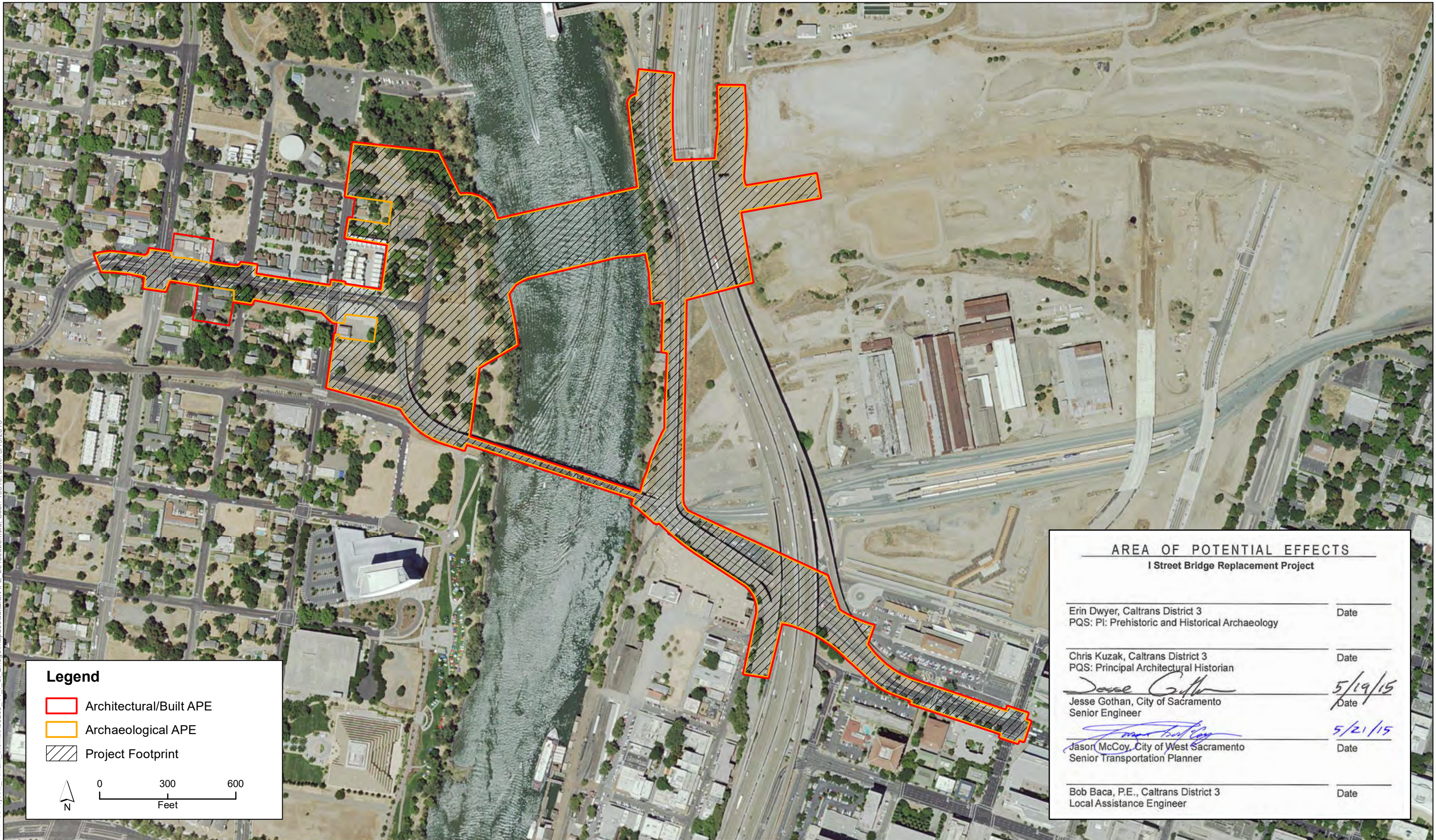


Graphics ... 002033.14 (9/9/14) AB



Figure 1
Project Location Map

Path: K:\Projects_1\mark_thomas\0203_14_I_Street\Bridgemapdoc\cultural\APE_20150326.mxd; User: 190716; Date: 5/19/2015



Legend

- Architectural/Built APE
- Archaeological APE
- Project Footprint

0 300 600
Feet

N

AREA OF POTENTIAL EFFECTS	
I Street Bridge Replacement Project	
Erin Dwyer, Caltrans District 3 PQS: PI: Prehistoric and Historical Archaeology	Date
Chris Kuzak, Caltrans District 3 PQS: Principal Architectural Historian	Date
<i>Jesse Gothan</i> Jesse Gothan, City of Sacramento Senior Engineer	5/19/15 Date
<i>Jason McCoy</i> Jason McCoy, City of West Sacramento Senior Transportation Planner	5/21/15 Date
Bob Baca, P.E., Caltrans District 3 Local Assistance Engineer	Date



**Figure &
Area of Potential Effects
I Street Bridge**

June 10, 2015

The Honorable Cynthia Clarke
Native Cultural Renewal Committee, Yocha Dehe
Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Cynthia Clarke:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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June 10, 2015

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Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

Sincerely,

A handwritten signature in cursive script, appearing to read "Dana Mahaffey".

Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Leland Kinter, Yocha Dehe Wintun Nation

June 10, 2015

The Honorable Grayson Coney
Cultural Director, T'si-Akim Maidu
P.O. Box 1316
Colfax, CA 95713

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Grayson Coney:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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Please consider this letter and preliminary project information as the initiation of Section 106 consultation pursuant to the National Historic Preservation Act and the California Environmental Quality Act.

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

June 10, 2015

Page 2

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Eileen Moon, T'si-Akim Maidu
Don Ryberg, T'si-Akim Maidu

June 10, 2015

The Honorable Rose Enos
15310 Bancroft Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Rose Enos:

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Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,

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Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3

June 10, 2015

The Honorable Kesner Flores
P.O. Box 1047
Wheatland, CA 95692

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Kesner Flores:

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3

June 10, 2015

The Honorable Daniel Fonseca
Cultural Resources Director, Shingle Springs Band
of Miwok Indians
P.O. Box 1340
Shingle Springs, CA 95682

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Daniel Fonseca:

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Nicholas Fonseca, Shingle Springs Band of Miwok Indians
Hermino Olanio, Shingle Springs Band of Miwok Indians

June 10, 2015

The Honorable Nicholas Fonseca
Chairperson, Shingle Springs Band of Miwok
Indians
P.O. Box 1340
Shingle Springs, CA 95682

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Nicholas Fonseca:

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Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

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Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Daniel Fonseca, Shingle Springs Band of Miwok Indians
Heremo Olanio, Shingle Springs Band of Miwok Indians

June 10, 2015

The Honorable Marcos Guerrero
Tribal Preservation Committee, United Indian
Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Marcos Guerrero:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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June 10, 2015

Page 2

Please consider this letter and preliminary project information as the initiation of Section 106 consultation pursuant to the National Historic Preservation Act and the California Environmental Quality Act.

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Your comments and concerns will be important to the City of Sacramento as they move forward with their project. If you have any questions or concerns with the project, please contact Christiaan Havelaar via email (christiaan.havelaar@icfi.com) or at his office (916-737-3000). Mr. Havelaar's mailing address is:

Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Gene Whitehouse, United Indian Community of the Auburn Rancheria
Jason Camp, United Indian Community of the Auburn Rancheria

June 10, 2015

The Honorable Leland Kinter
Chairperson, Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Leland Kinter:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

June 10, 2015

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Native Cultural Renewal Committee, Yocha Dehe Wintun Nation
Cynthia Clarke, Yocha Dehe Wintun Nation

June 10, 2015

The Honorable Eileen Moon
Vice Chairperson, T'si-Akim Maidu
P.O. Box 1246
Grass Valley, CA 95945

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Eileen Moon:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Grayson Coney, T'si-Akim Maidu
Don Ryberg, T'si-Akim Maidu

June 10, 2015

The Honorable April Wallace Moore
19630 Placer Hills Road
Colfax, CA 95713

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable April Wallace Moore:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,

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Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3

June 10, 2015

The Honorable
Native Cultural Renewal Committee, Yocha Dehe
Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Native Cultural Renewal Committee:

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, is proposing to construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento (see attached map). The proposed bridge would include a moveable center span to allow passage for watercraft. Additional roadwork would include new signalized intersections at Jibboom Street and Bercut Drive connecting at Railyards Boulevard and the extension of C Street from the intersection of 3rd Street to the proposed bridge. The River Walk Park in West Sacramento and the Sacramento River Parkway trail in Sacramento, which connects to the American River Bike Trail at Discovery Park, would be extended to the new roadway and pass underneath the abutments of the proposed bridge. In West Sacramento, a portion of the existing levee where the proposed bridge alignment connects to C Street would be reconstructed; the improved levee portion would include a slurry cutoff wall. The existing I Street Bridge would continue to be used by the railroad. Vehicle and pedestrian traffic would be removed. The existing approach structures for Jibboom Street, I Street and J Street in the City of Sacramento and C Street in the City of West Sacramento would be demolished. The proposed bridge crossing could also accommodate future transit options, including a streetcar alignment within the bridge. No such use is proposed as part of this project; any future streetcar expansion would be considered separately.

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Leland Kinter, Yocha Dehe Wintun Nation
Cynthia Clarke, Yocha Dehe Wintun Nation

June 10, 2015

The Honorable Hermo Olanio
Vice Chairperson, Shingle Springs Band of Miwok
Indians
P.O. Box 1340
Shingle Springs, CA 95682

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Hermo Olanio:

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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Sincerely,



Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Daniel Fonseca, Shingle Springs Band of Miwok Indians
Nicholas Fonseca, Shingle Springs Band of Miwok Indians

June 10, 2015

The Honorable Don Ryberg
Chairperson, T'si-Akim Maidu
P.O. Box 1246
Grass Valley, CA 95945

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Don Ryberg:

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630 K Street, Suite 400
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Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Eileen Moon, T'si-Akim Maidu
Grayson Coney, T'si-Akim Maidu

June 10, 2015

The Honorable Gene Whitehouse
Chairperson, United Indian Community of the
Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Gene Whitehouse:

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ICF International
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Sacramento, CA 95814

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Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3
Marcos Guerrero, United Indian Community of the Auburn Rancheria
Jason Camp, United Indian Community of the Auburn Rancheria

June 10, 2015

The Honorable Charlie Wright
Chairperson, Cortina Band of Indians
P.O. Box 1630
Williams, CA 95987

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Charlie Wright:

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Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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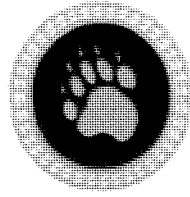
Sincerely,

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Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department

Attachments: Project Location map
Draft Area of Potential Effects map

cc: Erin Dwyer, Caltrans D3



YOCHA DEHE
CULTURAL RESOURCES

June 25th, 2015

Christiaan Havelaar
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

RE: I Street Bridge Replacement Project

Dear Mr. Havelaar:

Thank you for your project notification letter dated June 10, 2015 regarding cultural information on or near the proposed I Street Bridge Replacement Project, Sacramento and West Sacramento, CA. We appreciate your effort to contact us and wish to respond.

The Cultural Resources Department has reviewed the project and concluded that it is within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we have a cultural interest and authority in the proposed project area.

Based on the information provided, the Tribe has concerns that the project could impact undiscovered archaeological deposits. Additionally, Yocha Dehe Wintun Nation requests a site visit to the project area to evaluate our cultural concerns. Furthermore, we wish to initiate consultation with ICF International and the Caltrans District 3. Please provide our Cultural Resources Department with a project timeline, detailed project information and the latest cultural study for the proposed project.

Also, please contact the following individual to coordinate a date and time for the site visit.

Mr. James Sarmento
Cultural Resources Manager
Yocha Dehe Wintun Nation
Office: (530) 723-0452, Email: jsarmento@yochadehe-nsn.gov

Please refer to identification number YD – 06232015-01 in any correspondences concerning this project.

Sincerely,

James Kinter
Tribal Secretary
Tribal Historic Preservation Officer

Yocha Dehe Wintun Nation

PO Box 18 Brooks, California 95606 p) 530.796.3400 f) 530.796.2143 www.yochadehe.org

Cc: Erin Dwyer, Caltrans District 3



SHINGLE SPRINGS RANCHERIA

Shingle Springs Band of Miwok Indians,
Shingle Springs Rancheria
(Verona Tract), California
5281 Honpie Road, Placerville, CA 95667

June 30, 2015

City Of Sacramento
300 Richards Blvd, 3rd floor
Sacramento, CA 95811

Dear Dana Mahaffey

The Most likely Descendant, Daniel Fonseca would like to initiate consultation process with you in regard to the I street bridge replacement located in Sacramento County. Among other things, we would like this consultation to address the cultural and historic resource issues, pursuant to the regulations implementing Section 106 of the National Historic Preservation Act.

Prior to meeting we would like to request any and all completed record searches and or surveys that were done in or around the project area up to and including environmental, archaeological and cultural reports.

Please let this letter serve as a formal request for the Shingle Springs Band of Miwok Indians to be added as a consulting party in identifying any Traditional Cultural Properties (TCPs) that may exist within the project's Area of Potential Effects (APE).

Please contact Kara Perry, Administrative Assistant, (530)488-4049 kperry@ssband.org, or Cynthia Franco, Administrative Assistant, cfranco@ssband.org to schedule a consultation meeting pursuant to Section 106 of the NHPA.

Sincerely,

Daniel Fonseca
Cultural Resources Director
Tribal Historic Preservation Officer (THPO)
Most Likely Descendent (MLD)



MIWOK United Auburn Indian Community
MAIDU of the Auburn Rancheria

Gene Whitehouse
Chairman

John L. Williams
Vice Chairman

Danny Rey
Secretary

Brenda Adams
Treasurer

Calvin Moman
Council Member

August 7, 2015

Christiaan Havelaar
City of Sacramento
630 K Street, Suite 400
Sacramento, CA 95814

Subject: Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Christiaan Havelaar,

Thank you for requesting information regarding the above referenced project. The United Auburn Indian Community (UAIC) of the Auburn Rancheria is comprised of Miwok and Southern Maidu (Nisenan) people whose tribal lands are within Placer County and whose service area includes El Dorado, Nevada, Placer, Sacramento, Sutter, and Yuba counties. The UAIC is concerned about development within its aboriginal territory that has potential to impact the lifeways, cultural sites, and landscapes that may be of sacred or ceremonial significance. We appreciate the opportunity to comment on this and other projects in your jurisdiction.

In order to ascertain whether the project could affect cultural resources that may be of importance to the UAIC, we would like to receive copies of any archaeological reports that are completed for the project. We also request copies of future environmental documents for the proposed project so that we have the opportunity to comment on potential impacts and proposed mitigation measures related to cultural resources. The UAIC would also like the opportunity to have our tribal monitors accompany you during the field survey. The information gathered will provide us with a better understanding of the project and cultural resources on site and is invaluable for consultation purposes.

The UAIC's preservation committee has identified cultural resources in and around your project area, and would like to request a site visit to confirm their locations. Thank you again for taking these matters into consideration, and for involving the UAIC early in the planning process. We look forward to reviewing the documents requested above and consulting on your project. Please contact Marcos Guerrero, Cultural Resources Manager, at (530) 883-2364 or by email at mguerrero@auburnrancheria.com if you have any questions.

Sincerely,

Gene Whitehouse,
Chairman

CC: Marcos Guerrero, CRM

November 4, 2015

The Honorable Jason Camp
THPO, United Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Jason Camp:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

The City invites you to attend an informational meeting on Monday, November 16, 2015 at 10 a.m. in West Sacramento at the public parking lot located at the intersection of 2nd Street and C Street. The purpose of the meeting is to provide you with additional project information and give you the opportunity to share any information you may have regarding sites, traditional cultural properties, values, or other cultural resources considerations associated with the project. So that the meeting can be as productive as possible, by November 11, please share with us any relevant information or materials (e.g., sensitivity maps) you have so that we may better tailor the discussion.

Your comments and concerns will be important to the City as we move forward with the project. ICF International is an environmental consultant representing the City—please contact their archaeologist Robin Hoffman via email at robin.hoffman@icfi.com or telephone at 916-231-7684 with any questions or concerns, or if you are willing to share information prior to the meeting. Mr. Hoffman's mailing address is:

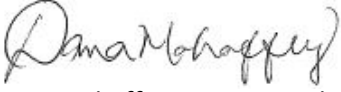
Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Gene Whitehouse, United Indian Community of the Auburn Rancheria
Marcos Guerrero, United Indian Community of the Auburn Rancheria



November 4, 2015

The Honorable Cynthia Clarke
Native Cultural Renewal Committee, Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Cynthia Clarke:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Leland Kinter, Yocha Dehe Wintun Nation



November 4, 2015

The Honorable Grayson Coney
Cultural Director, T'si-Akim Maidu
P.O. Box 1316
Colfax, CA 95713

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Grayson Coney:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Eileen Moon, T'si-Akim Maidu
Don Ryberg, T'si-Akim Maidu

November 4, 2015

The Honorable Rose Enos
15310 Bancroft Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Rose Enos:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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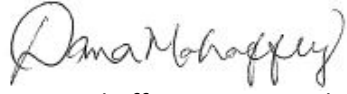
Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey". The signature is written in black ink and is positioned above the printed name.

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento



November 4, 2015

The Honorable Kesner Flores
P.O. Box 1047
Wheatland, CA 95692

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Kesner Flores:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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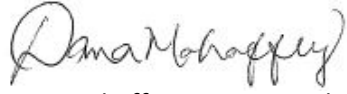
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

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Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento

November 4, 2015

The Honorable Daniel Fonseca
Cultural Resources Director, Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, CA 95682

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Daniel Fonseca:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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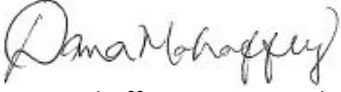
Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Nicholas Fonseca, Shingle Springs Band of Miwok Indians
Hermon Olanio, Shingle Springs Band of Miwok Indians



November 4, 2015

The Honorable Nicholas Fonseca
Chairperson, Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, CA 95682

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Nicholas Fonseca:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

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Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Daniel Fonseca, Shingle Springs Band of Miwok Indians
Hermon Olanio, Shingle Springs Band of Miwok Indians

November 4, 2015

The Honorable Marcos Guerrero
Tribal Preservation Committee, United Indian Community of the
Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Marcos Guerrero:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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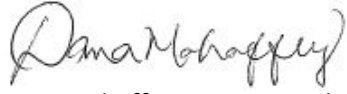
Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Gene Whitehouse, United Indian Community of the Auburn Rancheria
Jason Camp, United Indian Community of the Auburn Rancheria

November 4, 2015

The Honorable Leland Kinter
Chairperson, Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Leland Kinter:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

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Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Native Cultural Renewal Committee, Yocha Dehe Wintun Nation
Cynthia Clarke, Yocha Dehe Wintun Nation

November 4, 2015

The Honorable Eileen Moon
Vice Chairperson, T'si-Akim Maidu
P.O. Box 1246
Grass Valley, CA 95945

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Eileen Moon:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

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Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Grayson Coney, T'si-Akim Maidu
Don Ryberg, T'si-Akim Maidu



November 4, 2015

The Honorable April Wallace Moore
19630 Placer Hills Road
Colfax, CA 95713

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable April Wallace Moore:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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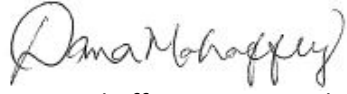
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

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Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento

November 4, 2015

The Honorable Native Cultural Renewal Committee
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Native Cultural Renewal Committee:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Your comments and concerns will be important to the City as we move forward with the project. ICF International is an environmental consultant representing the City—please contact their archaeologist Robin Hoffman via email at robin.hoffman@icfi.com or telephone at 916-231-7684 with any questions or concerns, or if you are willing to share information prior to the meeting. Mr. Hoffman's mailing address is:

Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Leland Kinter, Yocha Dehe Wintun Nation
Cynthia Clarke, Yocha Dehe Wintun Nation



November 4, 2015

The Honorable Hermo Olanio
Vice Chairperson, Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, CA 95682

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Hermo Olanio:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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630 K Street, Suite 400
Sacramento, CA 95814

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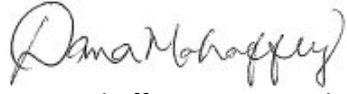
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Daniel Fonseca, Shingle Springs Band of Miwok Indians
Nicholas Fonseca, Shingle Springs Band of Miwok Indians



November 4, 2015

The Honorable Don Ryberg
Chairperson, T'si-Akim Maidu
P.O. Box 1246
Grass Valley, CA 95945

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Don Ryberg:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey". The signature is written in black ink and is positioned above the printed name.

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Eileen Moon, T'si-Akim Maidu
Grayson Coney, T'si-Akim Maidu

November 4, 2015

The Honorable Gene Whitehouse
Chairperson, United Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Gene Whitehouse:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Marcos Guerrero, United Indian Community of the Auburn Rancheria
Jason Camp, United Indian Community of the Auburn Rancheria



November 4, 2015

The Honorable Charlie Wright
Chairperson, Cortina Band of Indians
P.O. Box 1630
Williams, CA 95987

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Charlie Wright:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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ICF International
630 K Street, Suite 400
Sacramento, CA 95814

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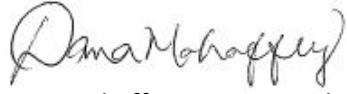
300 Richards Blvd., 3rd Floor
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Help Line: 916-264-5011
CityofSacramento.org/dsd

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento

Hoffman, Robin

From: Hoffman, Robin
Sent: Friday, November 13, 2015 11:21 AM
To: 'mdelgado@yochadehe-nsn.gov'
Subject: City of Sacramento I St. Bridge Replacement Project Meeting
Attachments: I-St-Bridge_Letter_Kinter_11042015.pdf

Marilyn,

It was nice to talk with you. As you requested, the original meeting invitation letter is attached. Please let me know if you have any questions or comments.

-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

November 4, 2015

The Honorable Leland Kinter
Chairperson, Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Invitation to Information Meeting for the I Street Bridge Replacement Project

Dear Honorable Leland Kinter:

As described in our letter to you dated June 10, 2015, the City of Sacramento (City), in cooperation with the City of West Sacramento and Caltrans, is proposing the I Street Bridge Replacement Project, which would construct a new bridge across the Sacramento River. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Boulevard in Sacramento.

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Your comments and concerns will be important to the City as we move forward with the project. ICF International is an environmental consultant representing the City—please contact their archaeologist Robin Hoffman via email at robin.hoffman@icfi.com or telephone at 916-231-7684 with any questions or concerns, or if you are willing to share information prior to the meeting. Mr. Hoffman's mailing address is:

Robin Hoffman
ICF International
630 K Street, Suite 400
Sacramento, CA 95814

If you have questions regarding the content of this letter you can contact me at DMahaffey@cityofsacramento.org or 916-808-2762.

November 4, 2015

Page 2

Sincerely,

A handwritten signature in cursive script that reads "Dana Mahaffey".

Dana Mahaffey, Associate Planner

City of Sacramento Community Development Department

cc: Erin Dwyer, Caltrans D3
Jesse Gothan, City of Sacramento
Native Cultural Renewal Committee, Yocha Dehe Wintun Nation
Cynthia Clarke, Yocha Dehe Wintun Nation

Hoffman, Robin

From: Hoffman, Robin
Sent: Friday, November 13, 2015 11:26 AM
To: Marcos Guerrero (mguerrero@auburnrancheria.com); 'jcamp@auburnrancheria.com'
Subject: Invitation to Information Meeting for the I Street Bridge Replacement Project

This is a follow-up email to the City of Sacramento's (City['s]) November 4, 2015 letter inviting you to attend an informational meeting regarding the City's I Street Bridge Replacement Project. As noted in the letter, the meeting will be held on Monday, November 16, 2015 at 10 a.m. in West Sacramento at the public parking lot located at the intersection of 2nd Street and C Street. The purpose of the meeting is to provide you with additional project information and give you the opportunity to share any information you may have regarding sites, traditional cultural properties, values, or other cultural resources considerations associated with the project.

Could you please let me know if you are planning on attending the meeting and if you have any information or materials (e.g., sensitivity maps) you have and would like to share regarding the project. Also, please let me know if you have any questions or comments.

Thanks again,
-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

Hoffman, Robin

From: Marilyn Delgado <MDelgado@yochadehe-nsn.gov>
Sent: Friday, November 13, 2015 1:27 PM
To: Hoffman, Robin
Cc: Anthony Flores
Subject: RE: City of Sacramento I St. Bridge Replacement Project Meeting

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Robin,

Thank you for sending me the letter. We will have someone at the meeting and will notify you later today who will be in attendance.

Thank you,
Marilyn

Marilyn Delgado
*Director of Cultural Resources
and California Tribal College*

Tewe Kewe Cultural Center
PO Box 18 | Brooks, CA 95606
c 530.723.0444 | p 530.796.3400 | f 530.796.2143
mdelgado@yochadehe-nsn.gov
www.yochadehe.org

From: Hoffman, Robin [mailto:Robin.Hoffman@icfi.com]
Sent: Friday, November 13, 2015 1:23 PM
To: Marilyn Delgado
Subject: City of Sacramento I St. Bridge Replacement Project Meeting

Marilyn,

It was nice to talk with you. As you requested, the original meeting invitation letter is attached. Please let me know if you have any questions or comments.

-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107



MEETING SIGN-IN SHEET

Project: I Street Bridge Replacement Project

Meeting Date: November 16, 2015, 10:00 am

Facilitator: City of Sacramento and ICF

Place/Room: On-site, West Sacramento

Name	Title	Company	Phone	Fax	E-Mail
Tristan Evans	Cultural Resources Admin Assistant	United Auburn Indian Community	916-215-1555		tevans@auburnindian.com
Anthony Flores	Site Protection Manager	Yocha Dehe Wintun Nation	930-723-3477		aflores@yochadehe-nsn.gov
Laraine Bull	Tribal Monitor	Yocha Dehe Wintun Nation	530-723-5891		L.Bull@yochadehe-nsn.gov
DAVID TULLER	Principal Planner	COWS	916-617-4645		dtuller@citywestsacramento.org
Zach Siriglia	Project Manager	Mark Thomas & Company	916-381-9100		zsiriglia@markthomas.com
Megan Johnson	Project Engineer	Mark Thomas & Company	916-381-9100		mjohnson@markthomas.com
JASON MCCOY	SR PLANNER	CITY WEST SAC	916-617-4832		mccoyj@cityofwestsacramento.org
DANA MAHAFFEY	ASSOC PLANNER	CITY OF SAC	808-2762	?	dmahafe@dcityofsacramento.us
Claire Bromund	Project Mgr	ICF	737-3660	737-3630	claire_bromund@icfi.com
Robin Hoffman	Archaeologist	ICF	707-494-3349	—	robin.hoffman@icfi.com
Tina Sorvari	PC/Archaeo	ICF	916-231-9738		tina.sorvari@icfi.com
Jesse GOTHAN	Supervising Engineer	City of Sacto	916-808-6897		jgothan@cityofsacramento.org
Katy Jackson	Com Investment Mgr	City West Sac			



Meeting Notes

Project:	I Street Bridge Replacement Project
Date, Time:	November 16, 2015, 10:00 am
Location:	West Sacramento, on-site (parking area at 2nd Street and C Street)
Attendees:	City of Sacramento: Jesse Gotham (Supervising Engineer, Project Manager), Dana Mahaffey (Associate Planner) City of West Sacramento: Jason McCoy (Senior Transportation Planner), David Tilley (Principal Planner), Katy Jacobson (Senior Program Manager) United Auburn Indian Community (UAIC): Tristan Evans (Cultural Resources Administrative Assistant) Yocha Dehe Wintun Nation (YDWN): Anthony Flores (Site Protection Manager), Laverne Bill (Tribal Monitor) Mark Thomas & Company: Zach Siviglia (Project Manager), Megan Johnson (Project Engineer) ICF International (ICF): Claire Bromund (Project Manager), Robin Hoffman (Project Archaeologist), Tina Sorvari (Project Coordinator/Archaeologist)

- Introductions and sign-in
- Robin Hoffman distributed two exhibits: Area of Potential Effects (APE) map (signed by Caltrans) and project design elements drawing
- Zach Siviglia provided an overview of the project:
 - Purpose/need, funding
 - Community-centered bridge needed, vehicular/pedestrian/cyclist safety currently an issue, must be movable for river boat traffic.
 - Federal funds provided to City of Sacramento. Project also involves a large number of regulatory agencies. Caltrans is the lead federal agency, City of Sacramento is the lead local agency.
 - Described project and alternatives (Alts. 1 and 2 in West Sacramento)
 - Alternative 1 has been eliminated from further consideration because it is not feasible to relocate the levee.
 - Removal of existing approach structures will consist of removing the superstructure, cutting existing piers/supports at ground level, breaking up and removing footings to approximately 3 feet deep, then backfilling the area with soil.

- Abutment areas and new roadway approach area will require ground disturbance/excavation of approximately 3 feet deep to remove existing vegetation and organic material, then excavation of approximately 10-15 feet deep on water side of existing levee for installation of abutment. The existing levee will be slightly cut on water side to allow for gradual slope to new levee profile. In West Sacramento, the levee will be extended west (land side) to comply with levee design standards – fill will be used to extend levee. Slurry wall will be installed in middle of new levee profile at new road location plus approximately 50 feet north and south of new road location. Slurry wall will be in a trench approximately 3-4 feet wide and between 70 and 110 feet deep. Abutments will be constructed with approximately 50 piles driven to depths of approximately 70 feet (W. Sac side) and 80 feet (Sac side).
- Two piers will be installed on both sides of river at existing toe of riverbank/levee.
- Two additional piers will be placed within river channel.
- Current dirt path on water side of existing levee on W. Sac side is approximate location of new bike path.
- Bike lane along C Street will require small amount of excavation (maximum 3 feet) on south side of C Street, then a concrete bike path on top.
- Group walked along W. Sac levee portion of project site.
- Anthony Flores (YDWN) asked if the archaeological survey had been conducted and if an Extended Phase I (XPI) will be conducted.
 - Robin Hoffman replied that the pedestrian survey had been completed and explained what resources (all historic-period) had been identified. Hoffman stated that whether an XPI would be necessary was still being determined by Caltrans.
- Hoffman provided Flores with a set of six maps showing historic Sanborn Maps with the APE overlaid. Hoffman stated that he would provide Flores, Laverne Bill, and Tristan Evans, via email, with the maps in electronic format. Hoffman also said he would share the project cultural resources records search results with Flores, Bill, and Evans.
- Hoffman asked Flores, Bill, and Evans if they had any questions or comments.
 - Evans stated that Marcos Guerrero (UAIC) had asked him to tell Hoffman that UAIC knows of a Traditional Cultural Property (TCP) within or close to the APE on both sides of the river, and that UAIC knows of archaeological sites within or close to the APE on both sides of the river. Evans stated that UAIC requests additional consultation and would like to share information the TCPs and archaeological sites, in addition to discussing potential project effects.
 - Flores stated that YDWN would like additional consultation and would be providing the City of Sacramento with a formal letter regarding the project.
- Claire Bromund asked the group if anyone had any additional questions or comments – to which everyone stated they did not.
- Meeting adjourned.

Hoffman, Robin

From: Hoffman, Robin
Sent: Monday, November 16, 2015 11:58 AM
To: 'Marilyn Delgado'
Subject: RE: City of Sacramento I St. Bridge Replacement Project Meeting

Marilyn,

We just finished our meeting regarding the I St. Bridge Replacement Project. It was great to see Anthony and Laverne again. We are preparing a summary to send out to the attendees, but I cannot make out Laverne's email address from the sign-in sheet. When you have the chance, could you please send me his address so we can include him in the email.

Thank you,
-Robin

From: Marilyn Delgado [mailto:MDelgado@yochadehe-nsn.gov]
Sent: Friday, November 13, 2015 1:27 PM
To: Hoffman, Robin <Robin.Hoffman@icfi.com>
Cc: Anthony Flores <AFlores@yochadehe-nsn.gov>
Subject: RE: City of Sacramento I St. Bridge Replacement Project Meeting
Importance: High

Robin,

Thank you for sending me the letter. We will have someone at the meeting and will notify you later today who will be in attendance.

Thank you,
Marilyn

Marilyn Delgado

*Director of Cultural Resources
and California Tribal College*

Tewe Kewe Cultural Center

PO Box 18 | Brooks, CA 95606
c 530.723.0444 | p 530.796.3400 | f 530.796.2143
mdelgado@yochadehe-nsn.gov
www.yochadehe.org

From: Hoffman, Robin [mailto:Robin.Hoffman@icfi.com]
Sent: Friday, November 13, 2015 1:23 PM
To: Marilyn Delgado
Subject: City of Sacramento I St. Bridge Replacement Project Meeting

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-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

Hoffman, Robin

From: Hoffman, Robin
Sent: Monday, November 16, 2015 4:46 PM
To: 'tevans@auburnrancheria.com'
Cc: Marcos Guerrero (mguerrero@auburnrancheria.com); 'jcamp@auburnrancheria.com'
Subject: I St. Bridge Replacement Project Historic Maps and Records Search Results
Attachments: I-St-Bridge_HistoricMap_Overlays.pdf

Tristan,

It was nice to meet you today and to have the chance to discuss the I St. Bridge Replacement Project. Attached are the historic map overlays I promised you.

Thanks again for taking the time to meet,
-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

Hoffman, Robin

From: Hoffman, Robin
Sent: Monday, November 16, 2015 4:49 PM
To: 'aflores@yochadehe-nsn.gov'; 'lbill@yochadehe-nsn.gov'
Cc: 'Marilyn Delgado'
Subject: I Street Bridge Replacement Project Historic Map Overlays
Attachments: I-St-Bridge_HistoricMap_Overlays.pdf

Anthony and Laverne,

It was nice to see you today and to have the chance to discuss the I St. Bridge Replacement Project. Attached are electronic copies of the historic map overlays I promised you.

Thanks again for taking the time to meet,
-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

Hoffman, Robin

From: Marilyn Delgado <MDelgado@yochadehe-nsn.gov>
Sent: Monday, November 16, 2015 5:03 PM
To: Hoffman, Robin
Subject: RE: City of Sacramento I St. Bridge Replacement Project Meeting

Follow Up Flag: Follow up
Flag Status: Completed

Hi Robin,

I'm just catching up on my emails from today. I see that you got Laverne's email address! I am glad they were there to assist.

Thank you,
Marilyn

Marilyn Delgado

*Director of Cultural Resources
and California Tribal College*

Tewe Kewe Cultural Center

PO Box 18 | Brooks, CA 95606
c 530.723.0444 | p 530.796.3400 | f 530.796.2143
mdelgado@yochadehe-nsn.gov
www.yochadehe.org

From: Hoffman, Robin [mailto:Robin.Hoffman@icfi.com]
Sent: Monday, November 16, 2015 11:58 AM
To: Marilyn Delgado
Subject: RE: City of Sacramento I St. Bridge Replacement Project Meeting

Marilyn,

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Thank you,
-Robin

From: Marilyn Delgado [mailto:MDelgado@yochadehe-nsn.gov]
Sent: Friday, November 13, 2015 1:27 PM
To: Hoffman, Robin <Robin.Hoffman@icfi.com>
Cc: Anthony Flores <AFlores@yochadehe-nsn.gov>
Subject: RE: City of Sacramento I St. Bridge Replacement Project Meeting
Importance: High

Robin,

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Thank you,
Marilyn

Marilyn Delgado

*Director of Cultural Resources
and California Tribal College*

Tewe Kewe Cultural Center

PO Box 18 | Brooks, CA 95606

c 530.723.0444 | p 530.796.3400 | f 530.796.2143

mdelgado@yochadehe-nsn.gov

www.yochadehe.org

From: Hoffman, Robin [<mailto:Robin.Hoffman@icfi.com>]

Sent: Friday, November 13, 2015 1:23 PM

To: Marilyn Delgado

Subject: City of Sacramento I St. Bridge Replacement Project Meeting

Marilyn,

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-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

Hoffman, Robin

From: Bromund, Claire
Sent: Monday, November 16, 2015 4:28 PM
To: aflores@yochadehe-nsn.gov; l.bill@yochadehe-nsn.gov; tevens@auburnrancheria.com; (JGothan@cityofsacramento.org); Dana Mahaffey; Jason McCoy (mccoyj@cityofwestsacramento.org); davidt@cityofwestsacramento.org; katyj@cityofwestsacramento.org; Zach Siviglia; Megan Johnson; Hoffman, Robin; Sorvari, Tina
Cc: Dwyer, Erin T@DOT
Subject: I Street Bridge Replacement Project Info Meeting Sign-in Sheet
Attachments: I-St-Bridge_InfoMtg_signin-11162015.pdf

Attached is the sign-in list for this morning's meeting. Thank you for your participation. Follow-up communications summarizing what was discussed will be sent out separately.

CLAIRE BROMUND | Senior Project Manager | 916.231.9520 (d) | claire.bromund@icfi.com | icfi.com
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814 | 916.737.3000 (o)
Connect with us on [social media](#).



MEETING SIGN-IN SHEET

Project: I Street Bridge Replacement Project

Meeting Date: November 16, 2015, 10:00 am

Facilitator: City of Sacramento and ICF

Place/Room: On-site, West Sacramento

Name	Title	Company	Phone	Fax	E-Mail
Tristan Evans	Cultural Resources Admin Assistant	United Auburn Indian Community	916-215-1555		tevans@auburnindian.com
Anthony Flores	Site Protection Manager	Yocha Dehe Wintun Nation	930-723-3477		aflores@yochadehe-nsn.gov
Laraine Bull	Tribal Monitor	Yocha Dehe Wintun Nation	530-723-5891		L.Bull@yochadehe-nsn.gov
DAVID TULLER	Principal Planner	COWS	916-617-4645		dtuller@citywestsacramento.org
Zach Siriglia	Project Manager	Mark Thomas & Company	916-381-9100		zsiriglia@markthomas.com
Megan Johnson	Project Engineer	Mark Thomas & Company	916-381-9100		mjohnson@markthomas.com
JASON MCCOY	SR PLANNER	CITY WEST SAC	916-617-4832		mccoyj@cityofwestsacramento.org
DANA MAHAFFEY	ASSOC PLANNER	CITY OF SAC	808-2762	?	dmahafe@cityofsacramento.us
Claire Bromund	Project Mgr	ICF	737-3660	737-3630	claire_bromund@icfi.com
Robin Hoffman	Archaeologist	ICF	707-494-3349	—	robin.hoffman@icfi.com
Tina Sorvari	PC/Archaeo	ICF	916-231-9738		tina.sorvari@icfi.com
Jesse GOTHAN	Supervising Engineer	City of Sacto	916-808-6897		jgothan@cityofsacramento.org
Katy Jacobson	Com Investment Mgr	City West Sac			

Hoffman, Robin

From: Bromund, Claire
Sent: Monday, November 16, 2015 4:47 PM
To: Hoffman, Robin
Subject: FW: I Street Bridge Replacement Project Info Meeting Sign-in Sheet

FYI

From: Tristan Evans [mailto:tevens@auburnrancheria.com]
Sent: Monday, November 16, 2015 4:44 PM
To: Bromund, Claire <Claire.Bromund@icfi.com>
Cc: Marcos Guerrero <mguerrero@auburnrancheria.com>; Jason Camp <jcamp@auburnrancheria.com>
Subject: RE: I Street Bridge Replacement Project Info Meeting Sign-in Sheet

Hi Claire,

Thank you for sending this over and for taking the time to meet with UAIC. I know Marcos and Jason look forward to following up with further consultation.

-Tristan

From: Bromund, Claire [<mailto:Claire.Bromund@icfi.com>]
Sent: Monday, November 16, 2015 4:28 PM
To: aflores@yochadehe-nsn.gov; l.bill@yochadehe-nsn.gov; Tristan Evans <tevens@auburnrancheria.com>; (JGothan@cityofsacramento.org) <JGothan@cityofsacramento.org>; Dana Mahaffey <DMahaffey@cityofsacramento.org>; Jason McCoy (mccoyj@cityofwestsacramento.org) <mccoyj@cityofwestsacramento.org>; davidt@cityofwestsacramento.org; katyj@cityofwestsacramento.org; Zach Siviglia <zsiviglia@markthomas.com>; Megan Johnson <mjohnson@markthomas.com>; Hoffman, Robin <Robin.Hoffman@icfi.com>; Sorvari, Tina <Tina.Sorvari@icfi.com>
Cc: Dwyer, Erin T@DOT <erin.dwyer@dot.ca.gov>
Subject: I Street Bridge Replacement Project Info Meeting Sign-in Sheet

Attached is the sign-in list for this morning's meeting. Thank you for your participation. Follow-up communications summarizing what was discussed will be sent out separately.

CLAIRE BROMUND | Senior Project Manager | 916.231.9520 (d) | claire.bromund@icfi.com | icfi.com
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814 | 916.737.3000 (o)
Connect with us on [social media](#).

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Hoffman, Robin

From: Tristan Evans <tevans@auburnrancheria.com>
Sent: Monday, November 16, 2015 5:15 PM
To: Hoffman, Robin
Cc: Marcos Guerrero; Jason Camp
Subject: RE: I St. Bridge Replacement Project Historic Maps and Records Search Results

Follow Up Flag: Follow up
Flag Status: Completed

Hi Robin,

Thank you for taking the time to meet with UAIC. I know Jason and Marcos are looking forward to further consultation on the project, but site visits are always appreciated.

-Tristan

From: Hoffman, Robin [mailto:Robin.Hoffman@icfi.com]
Sent: Monday, November 16, 2015 4:46 PM
To: Tristan Evans <tevans@auburnrancheria.com>
Cc: Marcos Guerrero <mguerrero@auburnrancheria.com>; Jason Camp <jcamp@auburnrancheria.com>
Subject: I St. Bridge Replacement Project Historic Maps and Records Search Results

Tristan,
It was nice to meet you today and to have the chance to discuss the I St. Bridge Replacement Project. Attached are the historic map overlays I promised you.

Thanks again for taking the time to meet,
-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

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Hoffman, Robin

From: Tristan Evans <tevans@auburnrancheria.com>
Sent: Wednesday, November 18, 2015 4:55 PM
To: Hoffman, Robin
Cc: Marcos Guerrero; Jason Camp
Subject: RE: I St. Bridge Replacement Project Historic Maps and Records Search Results

Follow Up Flag: Follow Up
Flag Status: Flagged

Hi Robin,

Thank you for taking the time to meet with UAIC and for sending over those maps. Marcos would like to have a follow-up meeting to discuss the project. Does Monday, November 30 work? If not we can schedule some other dates.

From: Hoffman, Robin [mailto:Robin.Hoffman@icfi.com]
Sent: Monday, November 16, 2015 4:46 PM
To: Tristan Evans <tevans@auburnrancheria.com>
Cc: Marcos Guerrero <mguerrero@auburnrancheria.com>; Jason Camp <jcamp@auburnrancheria.com>
Subject: I St. Bridge Replacement Project Historic Maps and Records Search Results

Tristan,

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Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
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Hoffman, Robin

From: Hoffman, Robin
Sent: Tuesday, November 24, 2015 11:18 AM
To: Marcos Guerrero
Cc: Jason Camp; 'Tristan Evans'
Subject: RE: I St. Bridge Replacement Project Historic Maps and Records Search Results

Marcos,

Yes, let's set up a meeting, though it'll have to be after November 30. Mark Thomas (the engineering company) is putting together some more detailed maps that will be good to have at the meeting and it might take them another week or so to finish them. We, or the City, will get back to you soon to schedule a meeting.

Best,
Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

From: Tristan Evans [<mailto:tevens@auburnrancheria.com>]
Sent: Wednesday, November 18, 2015 4:55 PM
To: Hoffman, Robin <Robin.Hoffman@icfi.com>
Cc: Marcos Guerrero <mguerrero@auburnrancheria.com>; Jason Camp <jcamp@auburnrancheria.com>
Subject: RE: I St. Bridge Replacement Project Historic Maps and Records Search Results

Hi Robin,

Thank you for taking the time to meet with UAIC and for sending over those maps. Marcos would like to have a follow-up meeting to discuss the project. Does Monday, November 30 work? If not we can schedule some other dates.

From: Hoffman, Robin [<mailto:Robin.Hoffman@icfi.com>]
Sent: Monday, November 16, 2015 4:46 PM
To: Tristan Evans <tevens@auburnrancheria.com>
Cc: Marcos Guerrero <mguerrero@auburnrancheria.com>; Jason Camp <jcamp@auburnrancheria.com>
Subject: I St. Bridge Replacement Project Historic Maps and Records Search Results

Tristan,

It was nice to meet you today and to have the chance to discuss the I St. Bridge Replacement Project. Attached are the historic map overlays I promised you.

Thanks again for taking the time to meet,
-Robin

Please note my new contact information below

Robin Hoffman, MA, RPA | Archaeologist | [415.677.7183](tel:415.677.7183) (w) [707.494.3349](tel:707.494.3349) (c)
ICF INTERNATIONAL | 620 Folsom Street, 2nd Floor, San Francisco, CA 94107

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Robinson, Mark

From: Robinson, Mark
Sent: Tuesday, July 19, 2016 10:38 AM
To: 'tevens@auburnrancheria.com'
Cc: 'mguerrero@auburnrancheria.com'; 'jcamp@auburnrancheria.com'
Subject: I Street Bridge

Good Morning:

I am an archaeologist at ICF in Sacramento, following up the work of Robin Hoffman on the I Street Bridge Project.

UAIC has stated that the Band has knowledge of a potential Traditional Cultural Property, as well as archaeological sites, that may be located in the I Street Bridge Project APE.

I would like to request a meeting or phone meeting, with UAIC to discuss these potential resources when the Band and its staff are available.

Please let me know if UAIC has times for a conversation about these potential resources.

Thank you for your time concern; I look forward to consulting with UAIC.

Thank you,
Mark

Mark Robinson | Senior Archaeologist/Project Manager | main 916-737-3000 | direct 916-231-7608
| Mark.Robinson@icfi.com | icfi.com

ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814 USA | 315-559-5435 mobile

Robinson, Mark

From: Marcos Guerrero <mguerrero@auburnrancheria.com>
Sent: Monday, July 25, 2016 6:51 PM
To: Robinson, Mark; Tristan Evans
Cc: Matthew Moore
Subject: RE: I Street Bridge

Hello Mr. Robinson,

Yes, we have a significant amount of information regarding the significance of the project site. Would it be possible for you to set up a meeting sometime the week of August 8?

Melodi will send you our records search rates. Thank you,

Marcos Guerrero, RPA
Cultural Resources Manager
United Auburn Indian Community
Tribal Historic Preservation Department
10720 Indian Hill
Auburn, CA 95603
Direct: 530-883-2364
Cell: 916-300-8792
Fax: 530-883-2390

From: Robinson, Mark [<mailto:Mark.Robinson@icfi.com>]
Sent: Tuesday, July 19, 2016 10:38 AM
To: Tristan Evans
Cc: Marcos Guerrero; Jason Camp
Subject: I Street Bridge

Good Morning:

I am an archaeologist at ICF in Sacramento, following up the work of Robin Hoffman on the I Street Bridge Project.

UAIC has stated that the Band has knowledge of a potential Traditional Cultural Property, as well as archaeological sites, that may be located in the I Street Bridge Project APE.

I would like to request a meeting or phone meeting, with UAIC to discuss these potential resources when the Band and its staff are available.

Please let me know if UAIC has times for a conversation about these potential resources.

Thank you for your time concern; I look forward to consulting with UAIC.

Thank you,
Mark

Mark Robinson | Senior Archaeologist/Project Manager | main 916-737-3000 | direct 916-231-7608
| Mark.Robinson@icfi.com | icfi.com

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City of
SACRAMENTO
Community Development

3 October 2018

The Honorable Gene Whitehouse
Chairman, United Auburn Indian Community
10720 Indian Hill Road
Auburn, CA 95603

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Chairman Whitehouse:

As part of the ongoing consultation for the I Street Bridge Replacement Project under Section 106 of the National Historic Preservation Act, the California Department of Transportation (Caltrans), and the City of Sacramento (City), in cooperation with the City of West Sacramento, are inviting your input on recent documentation prepared for the project.

A Finding of Effect (FOE) document has been prepared and approved by Caltrans District 3 for the project, as has a Cultural Resources Management Plan (CRMP) and Environmentally Sensitive Area Action Plan. These documents, along with a draft of a project-specific Programmatic Agreement (project-specific PA), are being concurrently reviewed by the California Office of Historic Preservation. The entire set of documents is included on the enclosed USB jump drive.

Please provide any comments you may have on the attached documents no later than 30 calendar days from receipt of this letter.

The project-specific PA will be executed by Caltrans and the State Historic Preservation Officer (SHPO), prior to approval of the project. Following Caltrans standard practices, the United Auburn Indian Community (UAIC) will be offered the opportunity to be a concurring party to the project-specific PA.

As part of earlier consultation, the UAIC recommended a geoarchaeological test plan, and archaeological testing and monitoring during all studies, testing, and ground-disturbing work. The plan for the proposed limited archaeological trenching to test for the presence or absence of cultural resources in the West Sacramento portion of the Area of Potential Effects just prior to project construction is described in the project-specific PA. The City will propose that monitors be present during the archaeological testing and during initial ground disturbing construction activities in sensitive areas.

The standard legal practices prescribed in Public Resources Code (PRC 5097.98) that must be followed in the event of the identification of human remains are also described in the project-specific PA, therefore

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

3 October 2018

Page 2

a burial plan will not be needed. If human remains are identified, the City will call the county coroner, consult with the Native American Heritage Commission regarding designation of a Most Likely Descendent if the coroner determines the remains to be Native American, and ensure appropriate treatment of Native American human remains.

If you have any questions or concerns with the project, the content of this letter, or the attached documents, you can contact me at tbuford@cityofsacramento.org or 916-808-7931 or you may contact the project archaeologist, Steve Pappas at Steve.Pappas@icf.com or 916-231-7649.

Sincerely,

A handwritten signature in blue ink, appearing to read 'T. Buford', with a long horizontal flourish extending to the right.

Tom Buford, Principal Planner
City of Sacramento Community Development Department

Enclosure:

Finding of Effect document, with attachments, on USB jump drive

cc, without enclosure:

Lisa Machado, Caltrans D3

Jason McCoy, City of West Sacramento

City of
SACRAMENTO
Community Development

3 October 2018

The Honorable Anthony Roberts
Chairman, Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Chairman Roberts:

As part of the ongoing consultation for the I Street Bridge Replacement Project under Section 106 of the National Historic Preservation Act, the California Department of Transportation (Caltrans), and the City of Sacramento (City), in cooperation with the City of West Sacramento, are inviting your input on recent documentation prepared for the project.

A Finding of Effect (FOE) document has been prepared and approved by Caltrans District 3 for the project, as has a Cultural Resources Management Plan (CRMP) and Environmentally Sensitive Area Action Plan. These documents, along with a draft of a project-specific Programmatic Agreement (project-specific PA), are being concurrently reviewed by the California Office of Historic Preservation. The entire set of documents is included on the enclosed USB jump drive.

Please provide any comments you may have on the attached documents no later than 30 calendar days from receipt of this letter.

The project-specific PA will be executed by Caltrans and the State Historic Preservation Officer (SHPO) prior to approval of the project. Following Caltrans standard practices, the Yocha Dehe Wintun Nation will be offered the opportunity to be a concurring party to the project-specific PA.

The parameters of Extended Phase I excavation efforts are described in the project-specific PA as well as a process for the resolution of any adverse effects on historic properties identified subsequent to project approval. The standard legal practices that must be followed in the event of the identification of human remains are also described in the project-specific PA.

The City remains concerned to protect cultural resources in this area, and your comments and concerns are important to the City and Caltrans as they move forward with the project. If you have any questions or concerns with the project, the content of this letter, or the attached documents, you can contact me

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

3 October 2018

Page 2

at tbuford@cityofsacramento.org or 916-808-7931 or you may contact the project archaeologist, Steve Pappas at Steve.Pappas@icf.com or 916-231-7649.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Tom Buford', with a long horizontal flourish extending to the right.

Tom Buford, Principal Planner
City of Sacramento Community Development Department

Enclosure:

Finding of Effect document, with attachments, on USB jump drive

cc, without enclosure:

Lisa Machado, Caltrans D3

Jason McCoy, City of West Sacramento

From: Marcos Guerrero <mguerrero@auburnrancheria.com>

Sent: Friday, October 26, 2018 8:58 AM

To: Tom Buford <TBuford@cityofsacramento.org>

Cc: Matthew Moore <mmoore@auburnrancheria.com>; Cherilyn Neider <cneider@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>

Subject: I St Bridge Replacement Project

Good Morning Tom,

Are you available to meet on the I St Bridge Replacement Project. Can you send over some dates to schedule the meeting?

In the meantime I have a few questions:

- How come there was no AB52 consultation for the preparation of the CEQA or NEPA documents?
- What is the CEQA document being prepared and has it been certified? MND/EIR?
- What is the NEPA document being prepared and has it been approved? CatEx/EIS?
- UAIC would like copies of the following CEQA documents: MND/EIR and MMRP.
- UAIC would like copies of the following NEPA documents: CatEx/EIS, and ROD.
- Who at Caltrans is the lead on the project for the NEPA and Section 106?
- Is the FOE final or can we still make changes? Is looks signed.
- Is the City conducting Section 106 consultation on behalf of Caltrans or is ICF?
- What is ICF's role?
- Who will be consulting and making edits to the CRMP, ESA AP, and project PA?
- Has SHPO commented on the project? If so, I would like a copy of SHPO's comments.
- When does the 30 comment period end and what time are final comments due?

We are very pleased the City agreed to complete archaeological and geoarchaeological testing, include tribal monitor for all studies, testing, and ground-disturbing work. Thanks you and we look forward to consulting further on this project.

Marcos Guerrero

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From: [Tom Buford](#)
To: [Marcos Guerrero](#)
Cc: [Matthew Moore](#); [Cherilyn Neider](#); [Melodi McAdams](#); ["Lisa Machado"](#); [Bromund, Claire](#); [Zachary Siviglia](#)
Subject: RE: I St Bridge Replacement Project
Date: Friday, October 26, 2018 12:00:18 PM

Marcos:

I've discussed your inquiries with Claire Bromund at ICF. Please see below. I've added Lisa Machado at Caltrans to the email stream:

In the meantime I have a few questions:

- How come there was no AB52 consultation for the preparation of the CEQA or NEPA documents?

AB 52 only applies to CEQA and the project started prior to the effective date of AB 52. The Notice of Preparation of the EIR was released on September 22, 2014. AB 52 does not apply to this project.

- What is the CEQA document being prepared and has it been certified? MND/EIR?
EIR. Not yet certified.

- What is the NEPA document being prepared and has it been approved? CatEx/EIS?
EA. FONSI not yet issued.

- UAIC would like copies of the following CEQA documents: MND/EIR and MMRP.
See project website for Draft EIR/EA circulated in September 2017.
<http://www.cityofsacramento.org/Public-Works/Engineering-Services/Projects/Current-Projects/I-Street-Bridge-Replacement>

- UAIC would like copies of the following NEPA documents: CatEx/EIS, and ROD.
See project website for Draft EIR/EA circulated in September 2017.
<http://www.cityofsacramento.org/Public-Works/Engineering-Services/Projects/Current-Projects/I-Street-Bridge-Replacement>

- Who at Caltrans is the lead on the project for the NEPA and Section 106?
Lisa Machado is the District 3 lead.

- Is the FOE final or can we still make changes? Is looks signed.
The FOE is approved. However, comments received from consulting tribes will be considered.

- Is the City conducting Section 106 consultation on behalf of Caltrans or is ICF?
Caltrans is responsible for Section 106 consultation and is overseeing the City's consultation efforts being done on Caltrans' behalf.

- What is ICF's role?
ICF is the City's environmental consultant.

- Who will be consulting and making edits to the CRMP, ESA AP, and project PA?

SHPO is reviewing the FOE concurrent with the United Auburn Indian Community and Yocha Dehe Wintun Nation. Any comments received from either tribe will be considered.

- Has SHPO commented on the project? If so, I would like a copy of SHPO's comments.

SHPO is reviewing the FOE concurrent with the UAIC and Yocha Dehe Wintun Nation.

- When does the 30 comment period end and what time are final comments due?

Per the letter sent to the UAIC dated October 3, 2018, the 30 day comment period ends 30 days after receipt of the document. Our records indicate the document was delivered to the UAIC on October 5, so the 30 day period will end on November 5.

Please give me a call with any questions or follow up.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

From: Marcos Guerrero <mguerrero@auburnrancheria.com>

Sent: Friday, October 26, 2018 8:58 AM

To: Tom Buford <TBuford@cityofsacramento.org>

Cc: Matthew Moore <mmoore@auburnrancheria.com>; Cherilyn Neider <cneider@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>

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Marcos Guerrero

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YOCHA DEHE
CULTURAL RESOURCES

COMMUNITY DEVELOPMENT
DEPARTMENT

OCT 29 2018

RECEIVED

October 22, 2018

City of Sacramento - Comm. Development
Attn: Tom Buford, Principal Planner
300 Richards Blvd, 3rd Floor
Sacramento, CA 95811

RE: I Street Bridge Replacement Project

Dear Mr. Buford:

Thank you for your project notification letter dated, October 3, 2018, regarding cultural information on or near the proposed I Street Bridge Replacement Project, Sacramento and Yolo Counties. We appreciate your effort to contact us and wish to respond.

The Cultural Resources Department has reviewed the project and concluded that it is within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we have a cultural interest and authority in the proposed project area and would like to initiate a formal consultation with the lead agency. At the time of consultation, please provide our Cultural Resources Department with a project timeline, detailed project information and the latest cultural study for the proposed project.

Please contact the following individual to coordinate a date and time for the consultation meeting:

Kathleen Solorio, CRD Administrative Assistant
Yocha Dehe Wintun Nation
Office: (530) 796-2803
Email: ksolorio@yochadehe-nsn.gov

Please refer to identification number YD - 06232015-01 in any correspondence concerning this project.

Thank you for providing us the opportunity to comment.

Sincerely,

Leland Kinter
Tribal Historic Preservation Officer

Yocha Dehe Wintun Nation

PO Box 18 Brooks, California 95606 p) 530.796.3400 f) 530.796.2143 www.yochadehe.org

From: [Machado, Lisa@DOT](mailto:Machado.Lisa@DOT)
To: [Marcos Guerrero](mailto:Marcos.Guerrero)
Cc: [Schinke, Kendall@DOT](mailto:Schinke.Kendall@DOT); [Bright, Lisa@DOT](mailto:Bright.Lisa@DOT); [Matthew Moore](mailto:Matthew.Moore); [Melodi McAdams](mailto:Melodi.McAdams); [Tom Buford](mailto:Tom.Buford); [Bromund, Claire](mailto:Bromund.Claire); [Bhatal, Thaleena@DOT](mailto:Bhatal.Thaleena@DOT)
Subject: RE: I St Bridge Replacement Project FOE
Date: Tuesday, October 30, 2018 7:36:47 AM

Hello Marcos,

Hopefully I can help to clarify some of the major points. The CEQA document is an EIR and the NEPA document is an EA-FONSI. The combined draft EIR/EA can be found at the following website under the "Environmental Documents" section:

<http://www.cityofsacramento.org/Public-Works/Engineering-Services/Projects/Current-Projects/I-Street-Bridge-Replacement>

Once the project-specific Programmatic Agreement (PA) is signed by the SHPO and the Caltrans DEA Chief, it will be officially executed. The PA will be appended to the final EIR/EA. The PA documents how Caltrans and the City of Sacramento will complete Section 106 for the project in accordance with 36 CFR §§ 800.4(b)(2) and 800.5(a)(3) and Stipulation XII.A of the Caltrans Section 106 PA. The PA allows us to phase the identification and evaluation of potential historic properties in the APE and it allows us to complete the Section 106 process after approval of the final environmental document. As the draft PA itself describes, due to the nature of the project, it was deemed appropriate to phase the Section 106 process with the PA. These kinds of documents are discussed briefly in Exhibit 2.10 of the Caltrans SER:

http://www.dot.ca.gov/ser/vol2/ex_2_10_moa.pdf

Thank you,

Lisa Machado, M.A.

Associate Environmental Planner (Archaeology)
California Department of Transportation, District 3
703 B Street, Marysville, CA 95901
(530) 741-4450
Fax: (530) 741-4457

From: Marcos Guerrero <mguerrero@auburnrancheria.com>
Sent: Monday, October 29, 2018 4:33 PM
To: Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Tom Buford

<TBuford@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>

Subject: RE: I St Bridge Replacement Project FOE

Thanks Lisa,

I will reach out to Tom. I would like any additional clarification you have on the NEPA process. My understanding is the CEQA document will be an MND and the NEPA document will be a CatEx with project specific PA. If you have guidance or literature describing how this all works I would appreciate the chance to learn more about it. Best,
Marcos

From: Machado, Lisa@DOT [<mailto:Lisa.Machado@dot.ca.gov>]

Sent: Monday, October 29, 2018 10:40 AM

To: Marcos Guerrero <mguerrero@auburnrancheria.com>

Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Tom Buford <TBuford@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>

Subject: RE: I St Bridge Replacement Project FOE

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Lisa Machado, M.A.

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(530) 741-4450
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Sent: Friday, October 26, 2018 8:25 AM
To: Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>
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Subject: I St Bridge Replacement Project FOE

Hello Lisa,
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Thank you,
Marcos

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From: [Tom Buford](#)
To: [Kathleen Solorio \(ksolorio@yochadehe-nsn.gov\)](mailto:ksolorio@yochadehe-nsn.gov)
Cc: [Bromund, Claire](#); [Pappas, Steve](#); [Caltrans](#); [Jesse Gothan](#); "[Lisa Machado](#)"; [Zachary Siviglia](#)
Subject: I Street Bridge Replacement Project (YD-06232015-01)
Date: Thursday, November 1, 2018 7:52:44 AM
Attachments: [Yocha Dehe to City 10.22.2018.pdf](#)
[Yocha Dehe re I Street Bridge 10.3.2018.pdf](#)

Ms. Solorio:

We received the attached letter dated October 22, 2018 from Mr. Leland Kinter, Tribal Historic Preservation Officer, in response to our October 3, 2018 letter sent to Yocha Dehe Wintun Nation regarding the I Street Bridge Replacement Project. Mr. Kinter requested that we contact you to coordinate the date and time for a meeting in order to initiate formal consultation. Our October 3rd letter is the latest correspondence with the Yocha Dehe for this project and it requested the Yocha Dehe's review of the most recent cultural documents prepared for the project. Would you please let us know if the Yocha Dehe will be providing comments?

Consultation regarding the I Street Bridge project began in June of 2015 when the City of Sacramento sent a letter to Mr. Leland Kinter, and to the representatives of other area tribes, to initiate consultation under Section 106, in coordination with Caltrans. In a response letter that same month, Mr. James Kinter requested a site visit. In November 2015, invitation letters for an informational site visit were sent. The site visit was held on November 16 and Mr. Anthony Flores and Mr. Laverne Bill were among those who attended.

In October of 2016, the City sent a letter to Mr. Leland Kinter indicating that Extended Phase I (XPI) excavations would be conducted in a limited area in West Sacramento; we then followed up with a second letter in November 2016 explaining that the XPI would not occur as originally scheduled but instead a project-specific programmatic agreement (PA) would be executed to ensure that the XPI would be conducted at an appropriate time in relation to project construction activities. The November 2016 letter also indicated that the Yocha Dehe Wintun Nation would be offered the opportunity to be a concurring party to the PA.

The PA is now written and with our October 3 letter was a USB drive that contained the project's Section 106 Finding of Effect document, the PA, a Cultural Resources Management Plan, and an Environmentally Sensitive Area Action Plan. Caltrans sent the same documents to the California Office of Historic Preservation for concurrent review. The project-specific PA will be executed by Caltrans and the State Historic Preservation Officer prior to approval of the project. In the October 3 letter, we asked that any comments the Yocha Dehe had on the documents be provided within 30 days of receipt of the documents. Our records indicate the letter and documents were received on October 5, so please provide any comments you have by November 5.

We look forward to discussing how best to facilitate coordination with the Yocha Dehe as we implement the requirements of the PA. We value the Yocha Dehe's participation and continued input regarding the I Street Bridge Replacement Project. For your reference, attached to this email are the following items.

- October 22, 2018 letter from Leland Kinter, Yocha Dehe Wintun Nation, Tribal Historic Preservation Officer
- October 3, 2018 letter from Tom Buford, City of Sacramento Community Development Department, Principal Planner

If you have any questions regarding these matters, please let me know. I can be reached via email at tbuford@cityofsacramento.org, and by telephone at (916) 799-1531.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

City of
SACRAMENTO
Community Development

3 October 2018

The Honorable Anthony Roberts
Chairman, Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

03-SAC-0-SAC
PROJ # BRLS 5002(164)
I Street Bridge Replacement

Re: Consultation for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento

Dear Honorable Chairman Roberts:

As part of the ongoing consultation for the I Street Bridge Replacement Project under Section 106 of the National Historic Preservation Act, the California Department of Transportation (Caltrans), and the City of Sacramento (City), in cooperation with the City of West Sacramento, are inviting your input on recent documentation prepared for the project.

A Finding of Effect (FOE) document has been prepared and approved by Caltrans District 3 for the project, as has a Cultural Resources Management Plan (CRMP) and Environmentally Sensitive Area Action Plan. These documents, along with a draft of a project-specific Programmatic Agreement (project-specific PA), are being concurrently reviewed by the California Office of Historic Preservation. The entire set of documents is included on the enclosed USB jump drive.

Please provide any comments you may have on the attached documents no later than 30 calendar days from receipt of this letter.

The project-specific PA will be executed by Caltrans and the State Historic Preservation Officer (SHPO) prior to approval of the project. Following Caltrans standard practices, the Yocha Dehe Wintun Nation will be offered the opportunity to be a concurring party to the project-specific PA.

The parameters of Extended Phase I excavation efforts are described in the project-specific PA as well as a process for the resolution of any adverse effects on historic properties identified subsequent to project approval. The standard legal practices that must be followed in the event of the identification of human remains are also described in the project-specific PA.

The City remains concerned to protect cultural resources in this area, and your comments and concerns are important to the City and Caltrans as they move forward with the project. If you have any questions or concerns with the project, the content of this letter, or the attached documents, you can contact me

300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Help Line: 916-264-5011
CityofSacramento.org/dsd

3 October 2018

Page 2

at tbuford@cityofsacramento.org or 916-808-7931 or you may contact the project archaeologist, Steve Pappas at Steve.Pappas@icf.com or 916-231-7649.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Tom Buford', with a long horizontal flourish extending to the right.

Tom Buford, Principal Planner
City of Sacramento Community Development Department

Enclosure:

Finding of Effect document, with attachments, on USB jump drive

cc, without enclosure:

Lisa Machado, Caltrans D3

Jason McCoy, City of West Sacramento



YOCHA DEHE
CULTURAL RESOURCES

COMMUNITY DEVELOPMENT
DEPARTMENT

OCT 29 2018

RECEIVED

October 22, 2018

City of Sacramento - Comm. Development
Attn: Tom Buford, Principal Planner
300 Richards Blvd, 3rd Floor
Sacramento, CA 95811

RE: I Street Bridge Replacement Project

Dear Mr. Buford:

Thank you for your project notification letter dated, October 3, 2018, regarding cultural information on or near the proposed I Street Bridge Replacement Project, Sacramento and Yolo Counties. We appreciate your effort to contact us and wish to respond.

The Cultural Resources Department has reviewed the project and concluded that it is within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we have a cultural interest and authority in the proposed project area and would like to initiate a formal consultation with the lead agency. At the time of consultation, please provide our Cultural Resources Department with a project timeline, detailed project information and the latest cultural study for the proposed project.

Please contact the following individual to coordinate a date and time for the consultation meeting:

Kathleen Solorio, CRD Administrative Assistant
Yocha Dehe Wintun Nation
Office: (530) 796-2803
Email: ksolorio@yochadehe-nsn.gov

Please refer to identification number YD - 06232015-01 in any correspondence concerning this project.

Thank you for providing us the opportunity to comment.

Sincerely,

Leland Kinter
Tribal Historic Preservation Officer

Yocha Dehe Wintun Nation

PO Box 18 Brooks, California 95606 p) 530.796.3400 f) 530.796.2143 www.yochadehe.org

From: [Marcos Guerrero](#)
To: [Tom Buford](#); [Machado, Lisa@DOT](#)
Cc: [Schinke, Kendall@DOT](#); [Bright, Lisa@DOT](#); [Matthew Moore](#); [Melodi McAdams](#); [Bromund, Claire](#)
Subject: RE: I St Bridge Replacement Project FOE
Date: Thursday, November 15, 2018 1:39:26 PM
Attachments: [RE I Street Bridge Replacement Project APE Map.msg](#)

Hello Tom,

the comments were in reference to the MMs we submitted 11/15/2016. I am glad to see these have been addressed in the PA/CRMP. I think it would be good to walk the APE especially on the Yolo County side to see all of the historic debris in the foot print. I believed the undertaking has a high potential to disturb redeposited and intact archaeological deposits including human remains.

Here are UAIC's comments to the FOE - PA/CRMP:

Additional geoarchaeological and archaeological testing shall be complete and include tribal monitoring. This include any proposed geotechnical work.

My understanding is that the survey and geoarch/XPI testing will be completed after agency approval, access to the properties are granted and USACE 408 permission are given.

For all Phase II proposals and data recovery requirements, UAIC would like discuss all curation and reporting requirements. CalTrans is familiar with this request and it would be better addressed with the Preservation Committee.

CRMP fails to address how TCRs will be identified, evaluated, monitored and reburied. This is especially relevant for sites that are found in a disturbed or redeposited context.

UAIC would like to be included in the development of the prehistoric research design and design of the interpretive panels.

UAIC would like to have its monitors on site for all ground disturbing activities.

UAIC would like to see Native American designed elements used in the final bridge design aesthetics.

UAIC would prefer to have all Native American cultural items and remains respectfully and appropriately reburied.

UAIC would like to be included in the PA amendment process and be included as an invited signatory to the PA.

Ethnography in the CRMP is inaccurate, the entire project area is in Miwok and Nisenan territory. There are limited archaeological data sets because the NAHC and the SLA is confidential, therefore none of the pertinent finds and cemeteries near the project area have not been identified. Broderick is the closest Nisenan Village, it extends throughout the Washington District and the City of West Sacramento is aware of it. We

From: Tom Buford [mailto:TBuford@cityofsacramento.org]
Sent: Thursday, November 15, 2018 12:15 PM
To: Marcos Guerrero <mguerrero@auburnrancheria.com>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Bromund, Claire <Claire.Bromund@icf.com>
Subject: RE: I St Bridge Replacement Project FOE

Marcos:

Thanks for the inquiry.

The Cultural Resources Management Plan that is included as part of the Finding of Effect and Programmatic Agreement, includes a specific provision for burials. As you know, this procedure is regulated by statute, and I believe the provision follows the statutory process and provides adequate protection. If you'd like to discuss it further, however, please let me know.

As for the mitigation measure you mentioned (CUL-1) I spoke with Claire Bromund and we agree this has not been part of this project. We can, of course, discuss this further but I believe the procedures outlined in the Cultural Resources Management Plan will respond to your concerns.

Give me a call with any questions.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

From: Marcos Guerrero <mguerrero@auburnrancheria.com>
Sent: Wednesday, November 14, 2018 8:28 AM
To: Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Tom Buford <TBuford@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>
Subject: RE: I St Bridge Replacement Project FOE

Hello Tom,

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resources with discovery of human remains. These should be separate as we don't want an archaeologist (or qualified cultural resources specialist) evaluating the significance or making recommendations for further evaluation and treatment of human remains. I will let you know if we have any comments on the FOE. The biggest concern with the FOE is how do we deal with the oral and ethnohistorical information, and how will that be used to identify and mitigate for any impacts? Since many of the sites that have been found on the Yolo Co side included human remains, it is my understanding none have been recorded at the NWIC. On recent trail project consultation with the City of West Sacramento, along the I St Bridge, we noted and recorded historic resources on the surface, I am wondering if this information can be included?

Have a good morning,
Marcos Guerrero

From: Machado, Lisa@DOT [<mailto:Lisa.Machado@dot.ca.gov>]

Sent: Monday, October 29, 2018 10:40 AM

To: Marcos Guerrero <mguerrero@auburnrancheria.com>

Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Tom Buford <TBuford@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>

Subject: RE: I St Bridge Replacement Project FOE

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Thank you,

Lisa Machado, M.A.

Associate Environmental Planner (Archaeology)
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To: [Tom Buford](#); [Machado, Lisa@DOT](#)
Cc: [Schinke, Kendall@DOT](#); [Bright, Lisa@DOT](#); [Matthew Moore](#); [Melodi McAdams](#); [Bromund, Claire](#)
Subject: RE: I St Bridge Replacement Project FOE
Date: Thursday, November 15, 2018 1:47:14 PM
Attachments: [RE I Street Bridge Replacement Project APE Map.msg](#)

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This is the first time seeing the Draft CRMP and UAIC would like to request additional consultation. UAIC is unfamiliar with the Colusa Pavement Project.

The research questions do not address the values or significance of this place and resources to the UAIC.

Thank you and we hope to continue this dialog.

Marcos

From: Tom Buford [mailto:TBuford@cityofsacramento.org]
Sent: Thursday, November 15, 2018 12:15 PM
To: Marcos Guerrero <mguerrero@auburnrancheria.com>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Bromund, Claire <Claire.Bromund@icf.com>
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Thank you,

Lisa Machado, M.A.

Associate Environmental Planner (Archaeology)
California Department of Transportation, District 3
703 B Street, Marysville, CA 95901
(530) 741-4450
Fax: (530) 741-4457

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Thank you,

Marcos

11/15/2018 Email Attachment

From: [Marcos Guerrero](#)
To: [Sorvari, Tina](#)
Cc: DMahaffey@cityofsacramento.org; [Jesse Gothan \(JGothan@cityofsacramento.org\)](mailto:JGothan@cityofsacramento.org); ["zsigviglia@markthomas.com"](mailto:zsigviglia@markthomas.com) (zsigviglia@markthomas.com); [Robinson, Mark](#); [Bromund, Claire](#); [Melodi McAdams](#); katyj@cityofwestsacramento.org; [Martinez, Rafael](#); mccoyj@cityofwestsacramento.org; [David W. Tilley](#) (davidt@cityofwestsacramento.org); [Matthew Moore](#); [Erin Dwyer](#); [Melim, Suzanne M@DOT](#)
Subject: RE: I Street Bridge Replacement Project APE Map
Date: Tuesday, November 15, 2016 12:43:05 PM
Attachments: ATT3_Mitigation Measure CUL (4).docx

Dana/Tina,

UAIC has NAHC SLF sites in the project area. Please see the attached map. Unfortunately many of the resource concerns we do know about were all located on the Sacramento County side of the project. The I Street Bridge Replacement project overlaps with a pre-contact lake. There is a concern that the eastern boundary of the project might hit significant burial sites, the southern portion of the project (also on the Sacramento county side) might hit a burial site as well. Given the projects proximity to burial sites on the Eastside I would imagine that there is also overlap on the West Sacramento side. We do not have any cultural surveys or a high level of confidence on the Westside of the I Street Bridge along the area we visited yesterday. Therefore, UAIC recommends a geoarchaeological test plan and archaeological testing, as well as, tribal monitors during all studies, testing and ground disturbing work.

Mark Robinson mentioned a burial plan of action. UAIC agrees and supports this as well as the development of the HPMP and HPTPs if necessary. This includes a tribal monitoring plan and treatment plan.

When the draft PA becomes available UAIC would like to comment on it and THPO Mathew Moore has requested to be an invited signatory to the PA.

Please note for future projects that UAIC charges for all records and literatures searches. If you are interested we could provide one which would provide you with all of the supporting substantial evidence for the purple cultural bubbles. The map also includes boundaries for previously recorded CHRIS/NCIC-NWIC sites.

Attached you will also find the Mitigation Measures that we discussed that UAIC would like included in the DEIR and MMRP. If possible would like them carried over into the DEIS. Let me know if you have any questions?

With respect,

Marcos Guerrero, RPA
Cultural Resources Manager
United Auburn Indian Community
Tribal Historic Preservation Department
10720 Indian Hill Road
Auburn, CA 95603
Direct: 530-883-2364
Cell: 916-300-8792

11/15/2018 Email Attachment

Fax: 530-883-2390

From: Sorvari, Tina [mailto:Tina.Sorvari@icf.com]
Sent: Monday, November 7, 2016 4:25 PM
To: Marcos Guerrero
Cc: Tristan Evans; DMahaffey@cityofsacramento.org; Jesse Gothan (JGothan@cityofsacramento.org); 'zsigviglia@markthomas.com' (zsigviglia@markthomas.com); Robinson, Mark; Bromund, Claire; Melodi McAdams; katyj@cityofwestsacramento.org; Martinez, Rafael; mccoymj@cityofwestsacramento.org; David W. Tilley (davidt@cityofwestsacramento.org); Matthew Moore; Erin Dwyer; Melim, Suzanne M@DOT
Subject: RE: I Street Bridge Replacement Project APE Map

Yes, that'll work. I'll send an invite shortly. Thanks,

TINA SORVARI 916.231.9738

From: Marcos Guerrero [mailto:mguerrero@auburnrancheria.com]
Sent: Monday, November 07, 2016 3:17 PM
To: Sorvari, Tina
Cc: Tristan Evans; DMahaffey@cityofsacramento.org; Jesse Gothan (JGothan@cityofsacramento.org); 'zsigviglia@markthomas.com' (zsigviglia@markthomas.com); Robinson, Mark; Bromund, Claire; Melodi McAdams; katyj@cityofwestsacramento.org; Martinez, Rafael; mccoymj@cityofwestsacramento.org; David W. Tilley (davidt@cityofwestsacramento.org); Matthew Moore; Erin Dwyer; Melim, Suzanne M@DOT
Subject: RE: I Street Bridge Replacement Project APE Map

Hello Tina,

How about Monday November 14th at 1pm?

From: Sorvari, Tina [mailto:Tina.Sorvari@icf.com]
Sent: Monday, November 7, 2016 12:25 PM
To: Marcos Guerrero
Cc: Tristan Evans; DMahaffey@cityofsacramento.org; Jesse Gothan (JGothan@cityofsacramento.org); 'zsigviglia@markthomas.com' (zsigviglia@markthomas.com); Robinson, Mark; Bromund, Claire; Melodi McAdams; katyj@cityofwestsacramento.org; Martinez, Rafael; mccoymj@cityofwestsacramento.org; David W. Tilley (davidt@cityofwestsacramento.org); Matthew Moore; Erin Dwyer; Melim, Suzanne M@DOT
Subject: RE: I Street Bridge Replacement Project APE Map

Hello Marcos,

Do either of the dates/times below work for you? Thanks,

Wed. Nov. 9 – 10:00 AM

Mon. Nov. 14 –any time after noon

TINA SORVARI 916.231.9738

From: Marcos Guerrero [mailto:mguerrero@auburnrancheria.com]
Sent: Monday, October 31, 2016 3:53 PM
To: Sorvari, Tina
Subject: RE: I Street Bridge Replacement Project APE Map

Hello Tina,

11/15/2018 Email Attachment

Do you have any additional proposed times/dates to meet?

mg

From: Sorvari, Tina [<mailto:Tina.Sorvari@icf.com>]

Sent: Friday, October 14, 2016 5:27 PM

To: Marcos Guerrero

Cc: Tristan Evans; DMahaffey@cityofsacramento.org; Jesse Gothan (JGothan@cityofsacramento.org); 'zsiviglia@markthomas.com' (zsiviglia@markthomas.com); Robinson, Mark; Bromund, Claire; Melodi McAdams; katyj@cityofwestsacramento.org; Martinez, Rafael; mccoyj@cityofwestsacramento.org; David W. Tilley (davidt@cityofwestsacramento.org); Matthew Moore; Erin Dwyer; Melim, Suzanne M@DOT

Subject: RE: I Street Bridge Replacement Project APE Map

Hi Marcos,

The City of Sacramento would like to meet with you regarding the I Street Bridge Replacement project so that you can provide information on any resources you are aware of within the project's Area of Potential Effects (APE). At the November 16, 2015 field visit, Tristan Evans indicated that UAIC knows of a potential Traditional Cultural Property (TCP) in or near the APE on both sides of the Sacramento River, as well as an archaeological site in or near the APE also on both sides of the Sacramento River.

Since you're planning to be in West Sacramento for another project site visit on the morning of **Tuesday, October 25**, I'd like to propose a meeting with the City of Sacramento at **9:00 a.m.** nearby. We could meet at the small parking area at the southwest corner of 2nd Street and C Street, which is within the APE for the I Street Bridge project. The cultural reports prepared for the project are not yet approved by the lead agencies so cannot yet be shared. However, during the field meeting, the results of the research done to date will be discussed.

Please respond at your earliest convenience to let us know if this time and day work for you.

Thank you,

TINA SORVARI 916.231.9738

From: Marcos Guerrero [<mailto:mguerrero@auburnrancheria.com>]

Sent: Wednesday, October 12, 2016 9:25 AM

To: Sorvari, Tina; Matthew Moore

Cc: Tristan Evans; DMahaffey@cityofsacramento.org; Jesse Gothan (JGothan@cityofsacramento.org); 'zsiviglia@markthomas.com' (zsiviglia@markthomas.com); Robinson, Mark; Bromund, Claire; Melodi McAdams

Subject: RE: I Street Bridge Replacement Project APE Map

Hello Tina,

The UAIC has known cultural resources in your project area. We would like to set up a time to visit the project area.

Can you send over all cultural resources reports and records search?

Thanks,

mg

11/15/2018 Email Attachment

From: Sorvari, Tina [<mailto:Tina.Sorvari@icf.com>]

Sent: Wednesday, October 12, 2016 9:13 AM

To: Gene Whitehouse

Cc: Marcos Guerrero; Tristan Evans; DMahaffey@cityofsacramento.org; Jesse Gothan (JGothan@cityofsacramento.org); 'zsiviglia@markthomas.com' (zsiviglia@markthomas.com); Robinson, Mark; Bromund, Claire

Subject: I Street Bridge Replacement Project APE Map

Dear Mr. Whitehouse,

In a letter to you from the City of Sacramento dated October 5, 2016, the referenced map was inadvertently left out. Please see the attached for the draft project area of potential effects map.

If you have any questions please contact Dana Mahaffey at DMahaffey@cityofsacramento.org or 916-808-2762 or the project archaeologist, Mark Robinson at Mark.Robinson@icf.com or 916-231-7608.

Thank you.

TINA SORVARI | Project Coordinator | +1.916.231.9738 direct | tina.sorvari@icf.com | icf.com
ICF | 630 K Street, Suite 400, Sacramento, CA 95814 USA | +1.916.834.4722 mobile

Nothing in this e-mail is intended to constitute an electronic signature for purposes of the Electronic Signatures in Global and National Commerce Act (E-Sign Act), 15, U.S.C. §§ 7001 to 7006 or the Uniform Electronic Transactions Act of any state or the federal government unless a specific statement to the contrary is included in this e-mail.

Nothing in this e-mail is intended to constitute an electronic signature for purposes of the Electronic Signatures in Global and National Commerce Act (E-Sign Act), 15, U.S.C. §§ 7001 to 7006 or the Uniform Electronic Transactions Act of any state or the federal government unless a specific statement to the contrary is included in this e-mail.

Nothing in this e-mail is intended to constitute an electronic signature for purposes of the Electronic Signatures in Global and National Commerce Act (E-Sign Act), 15, U.S.C. §§ 7001 to 7006 or the Uniform Electronic Transactions Act of any state or the federal government unless a specific statement to the contrary is included in this e-mail.

Mitigation Measure CUL-1: Avoid Potential Effects on Previously Undiscovered Archaeological Resources.

To minimize the potential for destruction of or damage to previously undiscovered archaeological and Cultural resources and to identify any such resources at the earliest possible time during project-related earthmoving activities, The Project Proponent and its construction contractor(s) will implement the following measures:

1. Paid Native American Monitors from culturally affiliated Native American Tribes will be invited to monitor the vegetation grubbing, stripping, grading, or other ground-disturbing activities in the project area to determine the presence or absence of any cultural resources. Native American Representatives from cultural affiliated Native American Tribes act as a representative of their Tribal government and shall be consulted before any cultural studies or ground-disturbing activities begin.
2. Native American Representatives and Native American Monitors have the authority to identify sites or objects of significance to Native Americans and to request that work be stopped, diverted, or slowed if such sites or objects are identified within the direct impact area; however, only a Native American Representative can recommend appropriate treatment of such sites or objects.
3. A consultant and construction worker cultural resources awareness brochure and training program for all personnel involved in project implementation will be developed in coordination with interested Native American Tribes. The brochure will be distributed and the training will be conducted in coordination with qualified cultural resources specialists and Native American Representatives and Monitors from culturally affiliated Native American Tribes before any stages of project implementation and construction activities begin on the project site. The program will include relevant information regarding sensitive archaeological resources, including applicable regulations, protocols for avoidance, and consequences of violating State laws and regulations. The worker cultural resources awareness program will also describe appropriate avoidance and minimization measures for resources that have the potential to be located on the project site and will outline what to do and whom to contact if any potential archaeological resources or artifacts are encountered. The program will also underscore the requirement for confidentiality and culturally-appropriate treatment of any find of significance to Native Americans and behaviors, consistent with Native American Tribal values.
4. The Project Proponent will include a construction-related inadvertent discovery plan in the construction contractor's contract conditions, which must be finalized and approved

before ground-disturbing construction activities, including excavation or fill, begin. The construction-related inadvertent discovery plan will require the construction contractor to take the following actions if cultural resources such as bone, shell, artifacts, human remains, historic period structural features, architectural elements, bottles, ceramics, bricks, etc. are discovered after ground-disturbing construction activities begin:

- a. If potential archaeological resources cultural resources, articulated, or disarticulated human remains are discovered by Native American Representatives or Monitors from interested Native American Tribes, qualified cultural resources specialists, or other Project personnel during construction activities, work will cease in the immediate vicinity of the find (based on the apparent distribution of cultural resources), whether or not a Native American Monitor from an interested Native American Tribe is present. A qualified cultural resources specialist and Native American Representatives and Monitors from culturally affiliated Native American Tribes will assess the significance of the find and make recommendations for further evaluation and treatment as necessary. These recommendations will be documented in the project record. For any recommendations made by interested Native American Tribes which are not implemented, a justification for why the recommendation was not followed will be provided in the project record.
 - b. No construction activities will occur within 100 feet of an area under a stop work order. The Project Proponent will honor all reasonable requests by a Native American Monitor from interested Native American Tribes to stop work in a specified area for 48 hours, or until Native American Representatives have provided a reasonable path for work to resume, whichever occurs first.
 - c. Following a finding that the discovery represents a potential historical or cultural resource, an archaeologist who meets the Secretary of Interior's Standards for a Professional Archaeologist will delineate the resource according to industry-standard methods, taking into consideration recommendations and findings of Native American Representatives or Monitors from interested Native American Tribes. Recordation of Native American resources will be conducted in a respectful manner consistent with the behaviors identified by the Native American Monitor. The delineation will identify and map the full extent of the site. The site boundary will be recorded using GPS and the site boundary will be flagged to include a 100-foot buffer.
5. Avoidance and preservation in place is the preferred manner of mitigating impacts to a cultural resource and may be accomplished by several means, including:

- a. Planning construction to avoid archaeological sites; incorporating sites within parks, green-space, or other open space; covering archaeological sites; deeding a site to a permanent conservation easement; or other preservation and protection methods agreeable to consulting parties and regulatory authorities with jurisdiction over the activity. Recommendations for avoidance of cultural resources will be reviewed by The Project Proponent, interested Native American Tribes, and the appropriate agencies, in light of factors such as costs, logistics, feasibility, design, technology, and social, cultural, and environmental considerations and the extent to which avoidance is consistent with project objectives. Avoidance and design alternatives may include realignment within the project area to avoid cultural resources, modification of the design to eliminate or reduce impacts to cultural resources, or modification or realignment to avoid highly significant features within a cultural resource. Native American Representatives from interested Native American Tribes will be allowed to review and comment on these analyses and shall have the opportunity to meet with THE PROJECT PROPONENT and its representatives who have technical expertise to identify and recommend feasible avoidance and design alternatives, so that appropriate and feasible avoidance and design alternatives can be identified.

- b. If the resource can be avoided, the construction contractor(s), with paid Native American Monitors from culturally affiliated Native American Tribes present, will install protective fencing outside the site boundary, including a buffer area, before construction restarts. The construction contractor(s) will maintain the protective fencing throughout construction to avoid the site during all remaining phases of construction. The area will be demarcated as an “Environmentally Sensitive Area.” Native American Representatives from interested Native American Tribes and The Project Proponent will also consult to develop measures for long term management of the resource and routine operation and maintenance within culturally sensitive areas that retain resource integrity, including tribal cultural integrity, and including archaeological material, Traditional Cultural Properties, and cultural landscapes, in accordance with state and federal guidance including National Register Bulletin 30 (*Guidelines for Evaluating and Documenting Rural Historic Landscapes*), Bulletin 36 (*Guidelines for Evaluating and Registering Archaeological Properties*), and Bulletin 38 (*Guidelines for Evaluating and Documenting Traditional Cultural Properties*); National Park Service Preservation Brief 36 (*Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*) and using the Advisory Council on Historic Preservation (ACHP) *Native American Traditional Cultural Landscapes Action Plan* for further guidance. Use of temporary and permanent

forms of protective fencing will be determined in consultation with Native American Representatives from interested Native American Tribes.

- c. If preservation in place using appropriate covering or capping is the selected approach, the construction contractor(s) and maintenance personnel will install geotechnical fabric as a protective cover to the surface of the resource and then cap or cover the resource with a layer of local or certified clean soil. A copy of the clean soil certificate will be provided to interested Native American Tribes before a resource is capped or covered. The layer of soil will be thick enough that construction activities will not penetrate the protective cap or otherwise disturb the resource. An archaeologist who meets the Secretary of Interior's Standards for a Professional Archaeologist and a Native American Monitor must be present during installation of any protective cover and capping of a resource. Native American Representatives and Monitors from interested Native American Tribes will also be invited to attend the installation and capping. Both temporary and permanent forms of resource capping will be determined in consultation with interested Native Americans. The limits of the area to be capped will be demarcated in the field by a Native American Monitor in consultation with a The Project Proponent representative and cultural resources specialists.
6. If avoidance is infeasible, a Treatment Plan that identifies how identified properties that have been determined to be eligible for the CRHR or NRHP will be treated under CEQA shall be prepared and implemented in consultation with The Project Proponent and Native American Representatives from culturally affiliated Native American Tribes (if the resources are prehistoric or Native American in nature). In all cases, treatment will be carried out with dignity and respect. Interested Native American Tribes will be consulted on the research approach, methods and whether burial or data recovery or alternate mitigation is culturally-appropriate for the find. Alternative mitigation will be considered for cultural resources instead of burial and archaeological data recovery, curation, testing, and analysis. Work may proceed on other parts of the project site while treatment is being carried out, to the extent it does not interfere with respectful treatment. In the formulation of any Treatment Plan, the following considerations shall be made:
 - a. Concerning scientific handling, testing, or field or laboratory analysis of archaeological sites and materials, The Project Proponent will consult with interested Native American Tribes and USACE to identify an acceptable procedure. The Project Proponent will assume for the purposes of this project that NHPA Section 106 consultation will be approached in a manner consistent with the Advisory Council on Historic Preservation letter dated March 31, 2015, regarding resolution of adverse effects in the Feather River West Levee Project

matter. However, The Project Proponent is not the lead agency for Section 106 compliance. The Project Proponent, as the lead CEQA agency, will not require scientific handling, testing, or field or laboratory analysis, and will consider various types of mitigation including non-traditional approaches to treatment and will recognize the state policy in PRC Section 5097.991 that Native American remains and grave goods shall be repatriated.

- b. The Project Proponent and the MLD will implement the Burial Avoidance and Recovery Plan if human remains or burial objects are observed during construction. If human remains are discovered during any phase of the project, The Project Proponent and the contractors will coordinate with the county coroner and NAHC to make the determinations and perform the management steps prescribed in California Health and Safety Code Section 7050.5 and California PRC Section 5097.98.
 - c. For any treatment and plans, The Project Proponent will assume for the purposes of this project that NHPA Section 106 consultation will be approached in a manner consistent with the ACHP letter dated March 31, 2015, regarding resolution of adverse effects in the Feather River West Levee Project matter. However, The Project Proponent is not the lead agency for Section 106 compliance. The Project Proponent, as the lead CEQA agency, will not require scientific handling, testing, or field or laboratory analysis, and will consider various types of mitigation including non-traditional approaches to treatment and will recognize the state policy in PRC Section 5097.991 that Native American remains and grave goods shall be repatriated.
7. Following completion of major construction activities, The Project Proponent and its consultant, in consultation with Native American Representatives from culturally affiliated Native American Tribes, will prepare a report that documents what, if any, cultural resources or human remains were discovered during project implementation, how impacts to each resource (whether discovered during construction or during inventory and consultation) were avoided or what treatment was instituted, the condition of each resource after project implementation, recommendations for how additional impacts can be avoided, and recommendations for management of each resource. Interested Native American Tribes will be provided reasonable time to review and comment on the draft and draft final confidential report. Any comments made by interested Native American Tribes will be documented in the project record, and recommended revisions will be considered for inclusion in the final reports. For any recommendations made by interested Native American Tribes which are not incorporated into the report, a justification for why the recommendation was not followed will be provided in the report.

- a. Interested Native American Tribes will be provided reasonable time to review and comment on the draft and draft final reports. Any comments made by interested Native American Tribes will be documented in the project record, and recommended revisions will be considered for inclusion in the final reports. For any recommendations made by culturally affiliated Native American Tribes which are not incorporated into the report, a justification for why the recommendation was not followed will be provided in the report. Records of all Native American consultation conducted under CEQA will be confidentially provided to the lead Federal agency responsible for compliance with NEPA and Section 106 of the NHPA.
- b. Should any Native American cultural resources be encountered, resource documentation will take into consideration recommendations and comments made by culturally affiliated Native American Tribes. These comments and recommendations will be documented in the project reports and in the resource records. For any recommendations made by culturally affiliated Native American Tribes which are not adopted by The Project Proponent, a justification for why the recommendation was not followed will be provided in the report.
- c. The Project Proponent or a The Project Proponent representative may request additional information, or notify the appropriate interested Native American Tribe, if they disagree with identification, recommendations or actions made by a Native American Representative or Monitor from an interested Native American Tribe. Similarly a Native American Representative or Monitor from an interested Native American Tribe may notify or request additional information from THE PROJECT PROPONENT if they disagree with identification, recommendations, or actions made by THE PROJECT PROPONENT or one of its representatives.

Timing: During all ground-disturbing construction phases.

Responsibility: The Project Proponent and its construction contractor(s).

Mitigation Measure CUL-2: Avoid Potential Effects on Previously Undiscovered Paleontological Resources.

To minimize the potential for destruction of or damage to potentially unique, scientifically important paleontological resources during project-related earthmoving activities, The Project Proponent and its construction contractor(s) will implement the following measures:

1. Before the start of any project-related earthmoving activities, The Project Proponent shall retain a qualified archaeologist or paleontologist to train all construction personnel involved with earthmoving activities, including the site superintendent, regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and proper notification procedures should fossils be encountered.
2. If paleontological resources are discovered during earthmoving activities, the construction crew shall notify The Project Proponent and shall immediately cease work in the vicinity of the find. The Project Proponent shall retain a qualified paleontologist to evaluate the resource and prepare a recovery plan in accordance with Society of Vertebrate Paleontology guidelines (1996). The recovery plan may include but is not limited to a field survey, construction monitoring, sampling and data recovery procedures, museum storage coordination for any specimen recovered, and a report of findings. Recommendations in the recovery plan that are determined by The Project Proponent to be necessary and feasible shall be implemented before construction activities can resume at the site where the paleontological resources were discovered.

Timing: During all ground-disturbing construction phases.

Responsibility: The Project Proponent and its construction contractor(s).

Mitigation Measure CUL-3: Avoid Potential Effects on Undiscovered Burials.

To minimize the potential for destruction of or damage to undiscovered burials during project-related earthmoving activities, The Project Proponent and its construction contractor(s) will implement the following measures:

1. In accordance with the California Health and Safety Code, if human remains are uncovered during ground-disturbing activities, all ground-disturbing work potentially damaging excavation in the area of the burial and a 150-foot radius shall halt and the County Coroner shall be notified immediately. The coroner is required to examine all discoveries of human remains within 48 hours of receiving notice of a discovery on private or state lands (Health and Safety Code Section 7050.5[b]). If the coroner determines that the remains are those of a Native American, he or she must contact the NAHC by phone within 24 hours of making that determination (Health and Safety Code Section 7050[c]). The NAHC shall designate a Most Likely Descendant for the human remains. After the coroner's findings have been made, an archaeologist meeting the *Secretary of the*

Interior's Professional Standards for Archaeologists and the NAHC-designated Most Likely Descendant shall determine the ultimate treatment and disposition of the remains and take appropriate steps to ensure that additional human interments are not disturbed. The responsibilities of Placer and Nevada County for acting upon notification of a discovery of Native American human remains are identified in PRC Section 5097.9.

2. Native American human remains, associated grave goods, and items associated with Native American human remains that are subject to California PRC Section 5097.98 will not be subjected to scientific analysis, handling, testing or field or laboratory analysis without written consent from the Most Likely Descendant. If human remains are present, treatment shall conform to the requirements of state law under California Health and Safety Code Section 7050.5 and PRC Section 5097.87, unless the discovery occurs on federal land. The Project Proponent agrees to comply with other related state laws, including PRC Section 5097.9.

Timing: During all ground-disturbing construction phases.

Responsibility: The Project Proponent and its construction contractor(s).

Additional mitigation measures for large projects or projects with known burials, and the following mitigation measures for projects in areas where there aren't any known resources include:

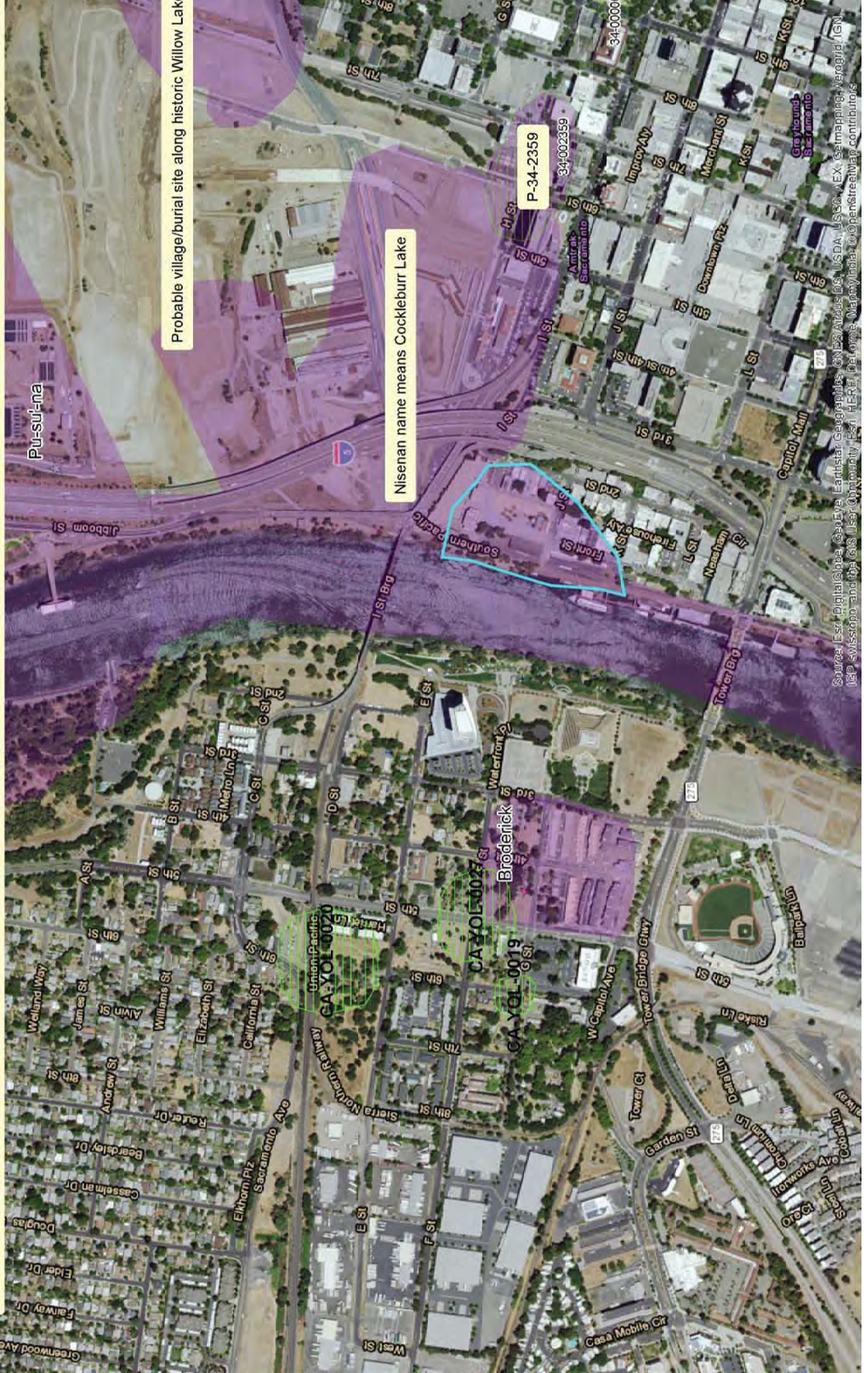
- Develop a standard operating procedure, points of contact, timeline and schedule for the project so all possible damages can be avoided or alternatives and cumulative impacts properly accessed.
- If potential archaeological resources cultural resources, articulated, or disarticulated human remains are discovered by Native American Representatives or Monitors from interested Native American Tribes, qualified cultural resources specialists, or other Project personnel during construction activities, work will cease in the immediate vicinity of the find (based on the apparent distribution of cultural resources), whether or not a Native American Monitor from an interested Native American Tribe is present. A qualified cultural resources specialist and Native American Representatives and Monitors from culturally affiliated Native American Tribes will assess the significance of the find and make recommendations for further evaluation and treatment as necessary. These recommendations will be documented in the project record. For any recommendations made by interested Native American Tribes which are not implemented, a justification for why the recommendation was not followed will be provided in the project record.
- If adverse impacts to tribal cultural resources, unique archeology, or other cultural resources occurs, then consultation with UAIC regarding mitigation contained in the

11/15/2018 Email Attachment

Public Resources Code sections 21084.3(a) and (b) and CEQA Guidelines section 15370 should occur, in order to coordinate for compensation for the impact by replacing or providing substitute resources or environments.

11/15/2018 Email Attachment

Includes Sac-26, SAC-32, 306, 316; Betty Castro's mother (Viola Kahuka Kaola Murray) was born at Pusune (1890). In 1901 the family moved to Verona. Viola's aunt (Iily Spencer) is buried at Pusune



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo and the GIS User Community. Esri, HERE, DeLorme, Mapbox, OpenStreetMap contributors

From: [Tom Buford](#)
To: [Marcos Guerrero](#); [Machado, Lisa@DOT](#)
Cc: [Schinke, Kendall@DOT](#); [Bright, Lisa@DOT](#); [Matthew Moore](#); [Melodi McAdams](#); [Bromund, Claire](#); [Zachary Siviglia](#)
Subject: RE: I St Bridge Replacement Project FOE: Response to Your Email
Date: Friday, November 16, 2018 6:51:42 AM

Marcos:

I received your email of November 15, 2018 regarding the I Street Bridge project , and I've provided our responses to **your questions** below *in italics*, including input from the project team.

The comments were in reference to the MMs we submitted 11/15/2016. I am glad to see these have been addressed in the PA/CRMP. I think it would be good to walk the APE especially on the Yolo County side to see all of the historic debris in the foot print. I believed the undertaking has a high potential to contain buried and intact archaeological deposits including human remains. Additional gearchaeological and archaeological testing shall be complete and include tribal monitoring. This include any proposed geotechnical work.

In response to your comments sent by email on 11/15/2016, the City mailed a letter, dated 11/18/2016, which explained that the plan for the proposed limited archaeological trenching to test for the presence or absence of cultural resources in the West Sacramento portion of the APE just prior to project construction would be described in the project-specific PA. The City will propose that monitors be present during the archaeological testing and during initial ground disturbing construction activities in sensitive areas. We appreciate that you think your comments have been addressed.

During the site visit held on 11/14/2016, when unpaved portions of the project footprint in West Sacramento were walked, you, Matthew Moore, and Danny Rey did not identify or point out locations of any historic debris. If you have new information specific to the I Street Bridge project area, please share it with us so it can be taken into consideration.

My understanding is that the survey and geotech/XPI testing will be complete after agency approval, access to the properties are granted and USACE 408 permission are given.

Pedestrian survey of the entire APE was performed in April 2015. Extended Phase I excavations will occur after agency approval and prior to project construction. Extended Phase I testing in the form of archaeological monitoring of geotechnical borings will also occur prior to construction.

For all Phase II proposals and data recovery requirements, UAIC would like discuss all curation and reporting requirements. CalTrans is familiar with this request and it would be better addressed with the Preservation Committee.

Chapter VI of the CRMP includes a requirement that Phase II evaluation and data recovery documentation be reviewed by PA parties, including the UAIC.

CRMP fails to address how TCRs will be identified, evaluated, monitored and reburied. This is especially relevant for sites that are found in a disturbed or redeposited context.

The CRMP addresses documentation under Section 106 of the National Historic Preservation Act and so does not address tribal cultural resources pursuant to the California Environmental Quality Act (CEQA). The term “tribal cultural resources” was defined in Assembly Bill 52 (AB 52), and applies to CEQA, not Section 106. The I Street Bridge Project started prior to the effective date of AB 52. The Notice of Preparation of the EIR was released on September 22, 2014 so AB 52 does not apply to this project.

UAIC would like to be included in the development of the prehistoric research design and design of the interpretive panels.

The prehistoric research design is described in Chapter IV of the CRMP. If you have specific comments and input, please provide them so they can be considered if preparation and implementation of Phase II evaluation and data recovery documentation becomes necessary. The Phase II Proposal will discuss the results of the XPI testing, and will revisit the research design and methods presented in the CRMP and revise them if needed. The interpretive panel will document the history of the joint railroad-automobile use of the I Street Bridge, emphasizing the non-rail uses. If the UAIC has information relevant to the bridge, we would be happy to receive and consider it. Based on the resources identified during testing, other forms of mitigation may be discussed in the future, if warranted.

UAIC would like to see Native American designed elements used in the final bridge design aesthetics.

We would be happy to receive your ideas for bridge aesthetics so they can be considered by the project architect.

UAIC would prefer to have all Native American cultural items and remains respectfully and appropriately reburied.

Caltrans will ensure that, to the extent permitted by applicable law and regulation, the views of the tribes and the Most Likely Descendant(s) are taken into consideration when decisions are made about the sensitive and dignified treatment and disposition of the Native American human remains and associated items. It is the intent of Caltrans and the City of Sacramento that human remains will not be unnecessarily disturbed and will not be disinterred unless absolutely necessary to protect them from damage or destruction. However, collections, or portions thereof, of archaeological resources identified during testing and ground disturbing activities that are eligible for the NRHP are proposed to be curated as stated in the CRMP. After resources are found, we can discuss this further depending upon the constituents of those resources.

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The UAIC will have opportunity to actively participate in implementation of the project and the PA. The UAIC has been invited to sign the PA as a concurring party per Caltrans standard procedure.

Ethnography in the CRMP is inaccurate the entire project area is in Miwok and Nisenan territory. There are limited archaeological data sets because the NAHC and the SLA is confidential, therefore none of the pertinent finds and cemeteries near the project area have not been identified. Broderick is the closest Nisenan Village, it extends throughout

the Washington District and the City of West Sacramento is aware of it. We would be happy to provide a map and share the knowledge the tribe has about its ancestral villages which may extend into the project area.

The CRMP does acknowledge that lands west of the Sacramento River were utilized by the Nisenan as well. The City would be happy to receive any site-specific information the UAIC has that would benefit the Extended Phase I excavations. In response to prior requests for information, the UAIC has not made the project team aware or shared any information about a village site that may extend into the project area in West Sacramento. If you have new information specific to the I Street Bridge project area, please share it with us so it can be taken into consideration.

This is the first time seeing the Draft CRMP and UAIC would like to request additional consultation. UAIC is unfamiliar with the Colusa Pavement Project.

The CRMP was approved by Caltrans in late August of 2018 and sent to the UAIC in early October with a request for comments within 30 days of receipt. We would be happy to continue consultation with the UAIC as the project continues to move forward. It was in that spirit that the Finding of Effect and PA were sent to the UAIC.

The research questions do not address the values or significance of this place and resources to the UAIC.

Please provide specific information as to the values and significance of this place so that it can be considered in the plans for Extended Phase I excavations and during the implementation of the evaluation procedures described in the CRMP. We wish to incorporate this kind of information in the documents but need more details in order to do so.

Thank you for your continuing input and interest in the project. If you have any questions regarding the information we have provided above, please let me know.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

From: Marcos Guerrero <mguerrero@auburnrancheria.com>

Sent: Thursday, November 15, 2018 1:47 PM

To: Tom Buford <TBuford@cityofsacramento.org>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>

Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Bromund, Claire <Claire.Bromund@icf.com>

Subject: RE: I St Bridge Replacement Project FOE

Hello all,

The comments were in reference to the MMs we submitted 11/15/2016. I am glad to see these have been addressed in the PA/CRMP. I think it would be good to walk the APE especially on the Yolo

County side to see all of the historic debris in the foot print. I believed the undertaking has a high potential to contain buried and intact archaeological deposits including human remains. Additional geoarchaeological and [archaeological](#) testing shall be complete and include tribal monitoring. This include any proposed geotechnical work.

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The research questions do not address the values or significance of this place and resources to the UAIC.

Thank you and we hope to continue this dialog.

Marcos

From: Tom Buford [<mailto:TBuford@cityofsacramento.org>]
Sent: Thursday, November 15, 2018 12:15 PM
To: Marcos Guerrero <mguerrero@auburnrancheria.com>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Bromund, Claire <Claire.Bromund@icf.com>
Subject: RE: I St Bridge Replacement Project FOE

Marcos:

Thanks for the inquiry.

The Cultural Resources Management Plan that is included as part of the Finding of Effect and Programmatic Agreement, includes a specific provision for burials. As you know, this procedure is regulated by statute, and I believe the provision follows the statutory process and provides adequate protection. If you'd like to discuss it further, however, please let me know.

As for the mitigation measure you mentioned (CUL-1) I spoke with Claire Bromund and we agree this has not been part of this project. We can, of course, discuss this further but I believe the procedures outlined in the Cultural Resources Management Plan will respond to your concerns.

Give me a call with any questions.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

From: Marcos Guerrero <mguerrero@auburnrancheria.com>
Sent: Wednesday, November 14, 2018 8:28 AM
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Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Tom Buford <TBuford@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>
Subject: RE: I St Bridge Replacement Project FOE

Hello Tom,

My major concern is at Mitigation Measure CUL-1: Avoid Potential Effects on Previously Undiscovered Archaeological Resources. The language at 4a lumps discovery of archaeological

resources with discovery of human remains. These should be separate as we don't want an archaeologist (or qualified cultural resources specialist) evaluating the significance or making recommendations for further evaluation and treatment of human remains. I will let you know if we have any comments on the FOE. The biggest concern with the FOE is how do we deal with the oral and ethnohistorical information, and how will that be used to identify and mitigate for any impacts? Since many of the sites that have been found on the Yolo Co side included human remains, it is my understanding none have been recorded at the NWIC. On recent trail project consultation with the City of West Sacramento, along the I St Bridge, we noted and recorded historic resources on the surface, I am wondering if this information can be included?

Have a good morning,
Marcos Guerrero

From: Machado, Lisa@DOT [<mailto:Lisa.Machado@dot.ca.gov>]

Sent: Monday, October 29, 2018 10:40 AM

To: Marcos Guerrero <mguerrero@auburnrancheria.com>

Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Tom Buford <TBuford@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>

Subject: RE: I St Bridge Replacement Project FOE

Good morning Marcos,

Lisa Bright forwarded me the email below because I am the Caltrans point of contact for the Section 106 compliance for most Local Assistance projects in District 3. Because the City of Sacramento is the project proponent for the I Street Bridge Replacement, it is best to send any questions or concerns about the documents directly to the City's point of contact. I believe that you have already been in communication with Tom Buford from the City. Because it is the City's project, they are the primary decision makers. As the Section 106 lead, Caltrans will help to facilitate consultation and ensure that it meets the standards of Section 106. Again, if you have comments about the documents, please send them to the City directly. You may include me on that communication if you wish. Please let me know if you have any questions or concerns.

Thank you,

Lisa Machado, M.A.

Associate Environmental Planner (Archaeology)
California Department of Transportation, District 3
703 B Street, Marysville, CA 95901
(530) 741-4450
Fax: (530) 741-4457

From: Marcos Guerrero <mguerrero@auburnrancheria.com>
Sent: Friday, October 26, 2018 8:25 AM
To: Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>
Subject: I St Bridge Replacement Project FOE

Hello Lisa,

Do you know who the point of contact is for the I St Bridge Replacement Project FOE. UAIC would like to consult on the ESA and FOE.

Thank you,
Marcos

Nothing in this e-mail is intended to constitute an electronic signature for purposes of the Electronic Signatures in Global and National Commerce Act (E-Sign Act), 15, U.S.C. §§ 7001 to 7006 or the Uniform Electronic Transactions Act of any state or the federal government unless a specific statement to the contrary is included in this e-mail.

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From: [Marcos Guerrero](#)
To: [Tom Buford](#); [Machado, Lisa@DOT](#)
Cc: [Schinke, Kendall@DOT](#); [Bright, Lisa@DOT](#); [Matthew Moore](#); [Melodi McAdams](#); [Bromund, Claire](#); [Zachary Siviglia](#)
Subject: RE: I St Bridge Replacement Project FOE: Response to Your Email
Date: Tuesday, December 4, 2018 7:07:04 AM
Attachments: [River Walk Trail Extension - Exhibits v2.pdf](#)
[18_0806_West_Sac_River_Walk_Draft_ISMND.PDF](#)

Good morning Tom,

Thank you very much for your detailed comments below. I attached the IS/MND and an exhibit UAIC submitted regarding culturally sensitive areas within the River Walk project area in West Sacramento, Yolo Co. In these areas mixed and redeposited prehistoric and historic were observed. The majority of it appears to be historic. From my experience this often leads to additional finds during construction. However, as you mentioned there are measures in place to complete geo-archeological and an extended phase I survey.

Please see my comments below regarding the City's I St Bridge Replacement Project FOE response to comments.

Best,
Marcos

From: Tom Buford [mailto:TBuford@cityofsacramento.org]
Sent: Friday, November 16, 2018 6:52 AM
To: Marcos Guerrero <mguerrero@auburnrancheria.com>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>
Cc: Schinke, Kendall@DOT <kendall.schinke@dot.ca.gov>; Bright, Lisa@DOT <Lisa.Bright@dot.ca.gov>; Matthew Moore <mmoore@auburnrancheria.com>; Melodi McAdams <mmcadams@auburnrancheria.com>; Bromund, Claire <Claire.Bromund@icf.com>; Zachary Siviglia <zsviglia@markthomas.com>
Subject: RE: I St Bridge Replacement Project FOE: Response to Your Email

Marcos:

I received your email of November 15, 2018 regarding the I Street Bridge project , and I've provided our responses to **your questions** below *in italics*, including input from the project team.

The comments were in reference to the MMs we submitted 11/15/2016. I am glad to see these have been addressed in the PA/CRMP. I think it would be good to walk the APE especially on the Yolo County side to see all of the historic debris in the foot print. I believed the undertaking has a high potential to contain buried and intact archaeological deposits including human remains. Additional geoarchaeological and archaeological testing shall be complete and include tribal monitoring. This include any proposed geotechnical work.

In response to your comments sent by email on 11/15/2016, the City mailed a letter, dated 11/18/2016, which explained that the plan for the proposed limited archaeological trenching

to test for the presence or absence of cultural resources in the West Sacramento portion of the APE just prior to project construction would be described in the project-specific PA. The City will propose that monitors be present during the archaeological testing and during initial ground disturbing construction activities in sensitive areas. We appreciate that you think your comments have been addressed.

During the site visit held on 11/14/2016, when unpaved portions of the project footprint in West Sacramento were walked, you, Matthew Moore, and Danny Rey did not identify or point out locations of any historic debris. If you have new information specific to the I Street Bridge project area, please share it with us so it can be taken into consideration.

See attached exhibit for your future reference.

My understanding is that the survey and geotech/XPI testing will be complete after agency approval, access to the properties are granted and USACE 408 permission are given.

Pedestrian survey of the entire APE was performed in April 2015. Extended Phase I excavations will occur after agency approval and prior to project construction. Extended Phase I testing in the form of archaeological monitoring of geotechnical borings will also occur prior to construction.

Understood.

For all Phase II proposals and data recovery requirements, UAIC would like discuss all curation and reporting requirements. CalTrans is familiar with this request and it would be better addressed with the Preservation Committee.

Chapter VI of the CRMP includes a requirement that Phase II evaluation and data recovery documentation be reviewed by PA parties, including the UAIC.

This is true, but if human remains are discovered then the option will need to be reconsidered. UAIC wishes Caltrans would revisit and update the guidance to include language and guidelines that are respectful and appropriate the Native American Community. I understand this is a much larger topic.

CRMP fails to address how TCRs will be identified, evaluated, monitored and reburied. This is especially relevant for sites that are found in a disturbed or redeposited context.

The CRMP addresses documentation under Section 106 of the National Historic Preservation Act and so does not address tribal cultural resources pursuant to the California Environmental Quality Act (CEQA). The term "tribal cultural resources" was defined in Assembly Bill 52 (AB 52), and applies to CEQA, not Section 106. The I Street Bridge Project started prior to the effective date of AB 52. The Notice of Preparation of the EIR was released on September 22, 2014 so AB 52 does not apply to this project.

Understood thank you for the clarification.

-

UAIC would like to be included in the development of the prehistoric research design and design of the interpretive panels.

The prehistoric research design is described in Chapter IV of the CRMP. If you have specific comments and input, please provide them so they can be considered if preparation and implementation of Phase II evaluation and data recovery documentation becomes necessary. The Phase II Proposal will discuss the results of the XPI testing, and will revisit the research design and methods presented in the CRMP and revise them if needed. The interpretive panel will document the history of the joint railroad-automobile use of the I Street Bridge, emphasizing the non-rail uses. If the UAIC has information relevant to the bridge, we would be happy to receive and consider it. Based on the resources identified during testing, other forms of mitigation may be discussed in the future, if warranted.

UAIC would appreciate if the bridge and interpretive panels included recognition of the Nisenan (South Maidu) and Miwok who continue to inhabit the area. These places were rich fishing villages.

-

UAIC would like to see Native American designed elements used in the final bridge design aesthetics.

We would be happy to receive your ideas for bridge aesthetics so they can be considered by the project architect.

For basket designs it would be best to contact someone like Brian Bibby. He would be familiar with the native designs that would encompass the entire Nisenan/Miwok community that includes tribes like UAIC, Wilton, Shingle Springs, and Ione. UAIC would be happy to host a meeting with your design team.

UAIC would prefer to have all Native American cultural items and remains respectfully and appropriately reburied.

Caltrans will ensure that, to the extent permitted by applicable law and regulation, the views of the tribes and the Most Likely Descendant(s) are taken into consideration when decisions are made about the sensitive and dignified treatment and disposition of the Native American human remains and associated items. It is the intent of Caltrans and the City of Sacramento that human remains will not be unnecessarily disturbed and will not be disinterred unless absolutely necessary to protect them from damage or destruction. However, collections, or portions thereof, of archaeological resources identified during testing and ground disturbing activities that are eligible for the NRHP are proposed to be curated as stated in the CRMP. After resources are found, we can discuss this further depending upon the constituents of those resources.

UAIC would like to be included in the PA amendment process and be included as an invited signatory to the PA.

The UAIC will have opportunity to actively participate in implementation of the project and the PA. The UAIC has been invited to sign the PA as a concurring party per Caltrans standard procedure.

UAIC has request to be an above the line “invited signatory” not a concurring party. UAIC understands that it has been invited to sign the PA as a concurring party.

Ethnography in the CRMP is inaccurate the entire project area is in Miwok and Nisenan territory. There are limited archaeological data sets because the NAHC and the SLA is confidential, therefore none of the pertinent finds and cemeteries near the project area have not been identified. Broderick is the closest Nisenan Village, it extends throughout the Washington District and the City of West Sacramento is aware of it. We would be happy to provide a map and share the knowledge the tribe has about its ancestral villages which may extend into the project area.

The CRMP does acknowledge that lands west of the Sacramento River were utilized by the Nisenan as well. The City would be happy to receive any site-specific information the UAIC has that would benefit the Extended Phase I excavations. In response to prior requests for information, the UAIC has not made the project team aware or shared any information about a village site that may extend into the project area in West Sacramento. If you have new information specific to the I Street Bridge project area, please share it with us so it can be taken into consideration.

There are major villages and cemeteries where an extensive amount of individuals have been removed. These are usually found along the river. The two that PGE and the City has worked are located between 3rd to 6th St and E to G St. Kim Carpenter at FW worked on the sites and may be willing to share the information she has.

This is the first time seeing the Draft CRMP and UAIC would like to request additional consultation. UAIC is unfamiliar with the Colusa Pavement Project.

The CRMP was approved by Caltrans in late August of 2018 and sent to the UAIC in early October with a request for comments within 30 days of receipt. We would be happy to continue consultation with the UAIC as the project continues to move forward. It was in that spirit that the Finding of Effect and PA were sent to the UAIC.

It is not clear why Caltrans approved the CRMP in August 2018 prior to it being sent to October. Please provide a consultation schedule for the CRMP or if is approved final?

The research questions do not address the values or significance of this place and resources to the UAIC.

Please provide specific information as to the values and significance of this place so that it can be considered in the plans for Extended Phase I excavations and during the

implementation of the evaluation procedures described in the CRMP. We wish to incorporate this kind of information in the documents but need more details in order to do so.

In order to provide specific information it would be best to set up a meeting with my staff to discuss the values and significance that are important to the UAIC.

Thank you for your continuing input and interest in the project. If you have any questions regarding the information we have provided above, please let me know.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

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Subject: RE: I St Bridge Replacement Project FOE

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Marcos

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Marcos:

Thanks for the inquiry.

The Cultural Resources Management Plan that is included as part of the Finding of Effect and Programmatic Agreement, includes a specific provision for burials. As you know, this procedure is

regulated by statute, and I believe the provision follows the statutory process and provides adequate protection. If you'd like to discuss it further, however, please let me know.

As for the mitigation measure you mentioned (CUL-1) I spoke with Claire Bromund and we agree this has not been part of this project. We can, of course, discuss this further but I believe the procedures outlined in the Cultural Resources Management Plan will respond to your concerns.

Give me a call with any questions.

Tom

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Environmental Planning Services
(916) 799-1531*

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Hello Tom,

My major concern is at Mitigation Measure CUL-1: Avoid Potential Effects on Previously Undiscovered Archaeological Resources. The language at 4a lumps discovery of archaeological resources with discovery of human remains. These should be separate as we don't want an archaeologist (or qualified cultural resources specialist) evaluating the significance or making recommendations for further evaluation and treatment of human remains. I will let you know if we have any comments on the FOE. The biggest concern with the FOE is how do we deal with the oral and ethnohistorical information, and how will that be used to identify and mitigate for any impacts? Since many of the sites that have been found on the Yolo Co side included human remains, it is my understanding none have been recorded at the NWIC. On recent trail project consultation with the City of West Sacramento, along the I St Bridge, we noted and recorded historic resources on the surface, I am wondering if this information can be included?

Have a good morning,
Marcos Guerrero

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Thank you,

Lisa Machado, M.A.

Associate Environmental Planner (Archaeology)
California Department of Transportation, District 3
703 B Street, Marysville, CA 95901
(530) 741-4450
Fax: (530) 741-4457

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Subject: I St Bridge Replacement Project FOE

Hello Lisa,

Do you know who the point of contact is for the I St Bridge Replacement Project FOE. UAIC would like to consult on the ESA and FOE.

Thank you,

Marcos

- Project Area Limit
 - Area of Direct Impact
 - Parcels
- Linework**
- Trail
 - Fill
 - Sidewalk
 - Curb
 - Gate
 - Retaining Wall
 - Railroad Improvement
 - Striping



V:\2386 River Walk Trail\F3_Protect Features.mxd

Source: ESRI Maps Online; Dokken Engineering 1/24/2018; Created By: briannm

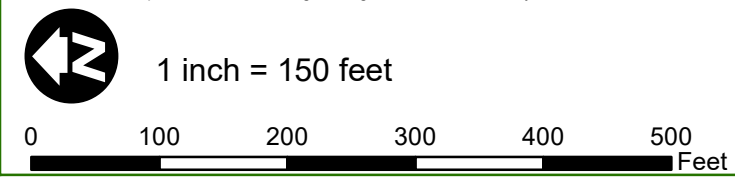


Figure 3
Project Features

River Walk Trail Extension Project
City of West Sacramento, Yolo County, California



YOCHA DEHE
CULTURAL RESOURCES

Section 106 Consultation Meeting between
The City of Sacramento in cooperation with the City of West Sacramento and Caltrans
and
Yocha Dehe Wintun Nation
Regarding the I Street Bridge Replacement Project
YD-06232015-01
Location: City of West Sacramento, Room 238
Start time: 10:00 am
Date: Monday, December 17, 2018

Name	Agency	Email
Lisa Machado	Caltrans	lisa.machado@dot.ca.gov 530-741-4450
Thaleena Bhattal	Caltrans	thaleena.bhattal@dot.ca.gov
DAVID TILLEY	Co WS	David.T@cityofwestsacramento.org
Ron Bess	City of Sacramento	rbess@cityofsacramento.org
Robert Geary	YDWN	rgeary@yochadehe-nsn.org
Jesse Gathan	City of Sacramento	jgathan@cityofsacramento.org
Jason Hickey	Mark Thomas	JHICKEY@MARKTHOMAS.COM
KIRA DAVIS	Mark Thomas	KDavis@MarkThomas.com
Larry Longee	YDWN	llongee@yochadehe-nsn.gov
ISAAC BOSORQUEZ	YDWN	IBOSORQUEZ@YOCIHADHE-NSN.GOV
Stephen Pappas	ICF	steph.pappas@icf.com
Claire Bromund	ICF	claire.bromund@icf.com
Jason McCoy	City of W. SAC.	mccoyj@cityofwestsacramento.org
Lavonne Bill		

From: [Kira Davis](#)
To: llongee@yochadehe-nsn.gov; rgeary@yochadehe-nsn.gov; lbill@yochadehe-nsn.gov; ibojorquez@yochadehe-nsn.gov
Cc: [Jason Hickey](#); [McCoy, Jason](#); ["Jesse Gothan"](#); [Zach Siviglia](#); [Bromund, Claire](#)
Subject: I Street Bridge Replacement - FOE/PA
Date: Monday, December 17, 2018 11:58:54 AM

Hi All,

Below is a link to download the Finding of Effect for the I Street Bridge Replacement Project which includes the Programmatic Agreement.

<https://markthomas.filetransfers.net/downloadPublic/osmludjwufq67ht>

Please let me know if you have any issues downloading the document.

Thanks,

Kira Davis, PE

Project Engineer

(916) 381-9100 front desk

(916) 403-5768 direct

MARK THOMAS

markthomas.com



YOCHA DEHE
CULTURAL RESOURCES

COMMUNITY DEVELOPMENT
DEPARTMENT

JAN 07 2019

RECEIVED

December 20, 2018

City of Sacramento - Community Development
Attn: Tom Buford, Principal Planner
300 Richards Blvd, 3rd Floor
Sacramento, CA 95811

RE: I Street Bridge Replacement Project

Dear Mr. Buford:

Thank you for the consultation meeting on, December 17, 2018, regarding the proposed I Street Bridge Replacement Project, Sacramento and Yolo Counties. We appreciate you taking the time to discuss the project. Based on the information provided during our consultation meeting, the Tribe has concerns that the project could impact known cultural resources and would like to continue consultation on the project.

Yocha Dehe Wintun Nation has reviewed Chapter VI of the CRM Plan and would like to request the following changes be made. Under Field Methods (pg. 211), we would like Tribal Cultural Monitors to be included with the Archaeologist for cultural resources decisions made in the field. Due to the Tribe's opposition to wet screening, under the Rapid Recovery heading (pg. 212), we would like the following statement removed "If the soil is too moist for conventional screening ...placement of RRUs will be determined in the field upon exposure of the deposit." In the section on Cleaning, Labeling and Cataloging (pg. 221), we request that when catalog numbers are assigned to artifacts, the numbers differentiate between discoveries made on the East and West side.

Should you have any questions, please contact the following individual:

Kathleen Solorio, CRD Administrative Assistant
Yocha Dehe Wintun Nation
Office: (530) 796-2803
Email: ksolorio@yochadehe-nsn.gov

Please refer to identification number YD - 06232015-01 in any correspondence concerning this project.

Thank you for providing us the opportunity to comment.

Sincerely,

Leland Kinter
Tribal Historic Preservation Officer

Yocha Dehe Wintun Nation

PO Box 18 Brooks, California 95606 p) 530.796.3400 f) 530.796.2143 www.yochadehe.org

From: [Tom Buford](#)
To: [Melodi McAdams](#); [Matthew Moore](#)
Cc: [Cherilyn Neider](#); [Bromund, Claire](#); [Zachary Siviglia](#)
Subject: I Street Bridge: Discussion of tribal cultural resources
Date: Wednesday, January 9, 2019 12:40:06 PM

Matthew/Melinda:

We received an email from Marcos Guerrero on November 15, 2018 with inquiries regarding the I Street Bridge project. The project team has worked since that time on preparing appropriate responses. I've included them below.

The City's responses to the **questions** are set forth below *in italics*. We have included follow-up emails from UAIC in ().

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City, 1/8/2019: The interpretive panels were incorporated into the project due to the potential effects

of the project on the current I Street Bridge itself. If it is determined that mitigation under Section 106 is required for Native American resources, we can discuss, at a later time, the possibility of incorporation of Native American information into panels.

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been identified. Broderick is the closest Nisenan Village, it extends throughout the Washington District and the City of West Sacramento is aware of it. We would be happy to provide a map and share the knowledge the tribe has about its ancestral villages which may extend into the project area.

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Thank you for your continuing input and interest in the project. If you have any questions regarding the information we have provided above, please let me know.

Tom

Tom Buford, Manager

Environmental Planning Services
(916) 799-1531

From: [Cherilyn Neider](#)
To: [Tom Buford](#); [Melodi McAdams](#); [Matthew Moore](#)
Cc: [Bromund, Claire](#); [Zachary Siviglia](#)
Subject: RE: I Street Bridge: Discussion of tribal cultural resources
Date: Monday, January 14, 2019 11:34:09 AM

Hi Tom,
Thank you for sharing the City's responses. We are planning to review and respond by the end of this week.

Many thanks,
Cherilyn

Cherilyn Neider

Tribal Historic Preservation
United Auburn Indian Community
530.883.2394

From: Tom Buford [mailto:TBuford@cityofsacramento.org]
Sent: Wednesday, January 9, 2019 12:40 PM
To: Melodi McAdams; Matthew Moore
Cc: Cherilyn Neider; Bromund, Claire; Zachary Siviglia
Subject: I Street Bridge: Discussion of tribal cultural resources

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Tom

Tom Buford, Manager

Environmental Planning Services

(916) 799-1531

Nothing in this e-mail is intended to constitute an electronic signature for purposes of the Electronic Signatures in Global and National Commerce Act (E-Sign Act), 15, U.S.C. §§ 7001 to 7006 or the Uniform Electronic Transactions Act of any state or the federal government unless a specific statement to the contrary is included in this e-mail.

From: [Kathleen Solorio](#)
To: [Bromund, Claire](#)
Cc: [Tom Buford](#)
Subject: RE: I Street Bridge Replacement Project – ID # YD-06232015-01
Date: Wednesday, January 30, 2019 9:47:36 AM
Attachments: [image001.png](#)

Thank you, Claire! I have forward the CRMP to the rest of our Site Protection team.

Katie Solorio

CRD Administrative Assistant/GIS Analyst

Yocha Dehe Wintun Nation

PO Box 18 | Brooks, CA 95606

c 530.723.2418 | p 530.796.3400 | f 530.796.2143

ksolorio@yochadehe-nsn.gov

www.yochadehe.org

From: Bromund, Claire [mailto:Claire.Bromund@icf.com]
Sent: Tuesday, January 29, 2019 11:41 AM
To: Leland Kinter; Laverne Bill
Cc: Kathleen Solorio; Machado, Lisa@DOT; Caltrans; Zachary Siviglia; Jesse Gothan; Jason McCoy; 'David Tilley'; Ron Bess; Sorvari, Tina; Tom Buford
Subject: RE: I Street Bridge Replacement Project – ID # YD-06232015-01

Please see the attached files referenced in the email below.

Thank you.

Claire Bromund | Project Director/Project

Manager | 916-231-9520

claire.bromund@icf.com | icf.com

ICF | 630 K Street, Suite 400, Sacramento, CA 95814



From: Tom Buford <TBuford@cityofsacramento.org>
Sent: Tuesday, January 29, 2019 11:38 AM
To: Leland Kinter (lkinter@yochadehe-nsn.gov) <lkinter@yochadehe-nsn.gov>; 'Laverne Bill' <lbill@yochadehe-nsn.gov>
Cc: 'Katie Solorio' <ksolorio@yochadehe-nsn.gov>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>; Caltrans <thaleena.bhattal@dot.ca.gov>; Zachary Siviglia <zsviglia@markthomas.com>; Jesse Gothan <JGothan@cityofsacramento.org>; Jason McCoy <mccoyj@cityofwestsacramento.org>; 'David Tilley' <davidt@cityofwestsacramento.org>; Ron Bess <RBess@cityofsacramento.org>; Bromund, Claire <Claire.Bromund@icf.com>; Sorvari, Tina <Tina.Sorvari@icf.com>
Subject: RE: I Street Bridge Replacement Project – ID # YD-06232015-01

Good morning.

I am re-sending my email from earlier this morning. It bounced back, and I suspect that was because the CRMP attachment was too large to send via the City's email system.

If you receive this, we will, by an alternative method (probably via ICF) make the CRMP available.

Thank you for your patience. Please give me a call (my phone works!) with any questions.

Thanks.

Tom

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

From: Tom Buford
Sent: Tuesday, January 29, 2019 10:11 AM
To: Leland Kinter (lkinter@yochadehe-nsn.gov) <lkinter@yochadehe-nsn.gov>; 'Laverne Bill' <bill@yochadehe-nsn.gov>
Cc: 'Katie Solorio' <ksolorio@yochadehe-nsn.gov>; Machado, Lisa@DOT <Lisa.Machado@dot.ca.gov>; Caltrans <thaleena.bhattal@dot.ca.gov>; 'Zach Siviglia' <zsiviglia@markthomas.com>; 'Jesse Gothan' (JGothan@cityofsacramento.org) <JGothan@cityofsacramento.org>; Jason McCoy (mccoyj@cityofwestsacramento.org) <mccoyj@cityofwestsacramento.org>; 'David Tilley' <davidt@cityofwestsacramento.org>; Ron Bess <RBess@cityofsacramento.org>; 'Bromund, Claire' <Claire.Bromund@icf.com>; Sorvari, Tina <Tina.Sorvari@icf.com>
Subject: I Street Bridge Replacement Project – ID # YD-06232015-01

Dear Mr. Kinter and Mr. Bill,

Following the conference call discussion held with Mr. Laverne Bill on December 19, 2018, and receipt of the attached letter from Mr. Leland Kinter dated December 20, 2018, the CRMP was modified to address the Yocha Dehe Wintun Nation comments as summarized below.

Comment summary: Allow tribal monitors to help determine if items are prehistoric.

Response: Text was added to the 5th paragraph on Page 199 to indicate that the archaeologist will act in consultation with the Native American monitor.

Comment summary: Wet screening of soil samples is considered an unsuitable method. Remove from methods in CRMP.

Response: The second to last sentence in the second paragraph on Page 200 was deleted. The deleted sentence read: "If the soil is too moist for conventional screening, wet screening will be utilized, if necessary." The comment letter included deletion of the last sentence in

that same paragraph, however, that sentence (“The specific number and placement of RRUs will be determined in the field upon exposure of the deposit.”) is not related to the wet screening method so was not deleted.

Comment summary: During curation of artifacts, items from the west side of the river should remain separate and be noted uniquely from items collected on the east side.

Response: Text was added to the second paragraph of Page 202 and the first paragraph of Page 210 to indicate how materials will be organized by the location they were found and that artifacts collected from Yolo County will remain separate from those collected in Sacramento County.

Comment summary: In the discussion of how to address the discovery of human remains, spell out the requirements to contact the coroner and for the coroner to contact the NAHC if the remains are determined to be prehistoric.

Response: The first and third sentences in the last paragraph on Page 215, “Human Remains,” were modified to further describe the requirements contained in the code sections already cited in the document, specifically related to the responsibilities of the coroner when human remains of Native American origin are identified.

The comment letter and revised CRMP, signed by Caltrans, are attached for your reference. We believe the modifications address your comments in full. We look forward to continuing consultation as the project moves forward.

Sincerely,

Tom Buford

*Tom Buford, Manager
Environmental Planning Services
(916) 799-1531*

State Historic Preservation Office Consultation

DEPARTMENT OF TRANSPORTATION

DISTRICT 3
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FAX (530) 741-4457
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TTY 711
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*Serious drought
Help save water!*

December 27, 2016

Julianne Polanco
State Historic Preservation Officer
1725 23rd Street, Suite 100
Sacramento, CA 95816

I Street Bridge Replacement Project
Sacramento and West Sacramento Cities
DEM10L-5002(164)

Re: Section 106 Compliance and Historic Property Survey Report Transmittal for the
I Street Bridge Replacement Project, Sacramento and West Sacramento Cities

Dear Ms. Polanco:

The cities of Sacramento and West Sacramento, in cooperation with the California Department of Transportation (Caltrans), propose to construct a new crossing for vehicular and pedestrian traffic over the Sacramento River that will replace the upper deck of the I Street Bridge, which would no longer carry such traffic. A full project description can be found on page one of the enclosed Historic Property Survey Report (HPSR) and a depiction of the Area of Potential Effect (APE) can be found in Attachment A. Caltrans is initiating consultation for the project with the State Historic Preservation Officer (SHPO) in accordance with the January 2014 *First Amended Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California* (PA).

Enclosed you will find an Historic Property Survey Report (HPSR) for the proposed undertaking with attached Archaeological Survey Report (ASR) and Historical Resources Evaluation Report (HRER). We are consulting with you at the present time under Stipulation VIII.C.6 of the PA, which requires that we seek your concurrence on Caltrans' determinations of eligibility for potential historic properties.

Caltrans is transmitting this as the NEPA lead agency under the provisions of the *Memorandum of Understanding (MOU) between the Federal Highway Administration and the California Department of Transportation Concerning the State of California's Participation in the Surface Transportation Project Delivery 23 USC 327 NEPA Assignment*, which became effective on October 1, 2012. The MOU was signed pursuant to Title 23 USC 327, which allows the Secretary of Transportation to assign, and the State of California to assume, responsibility for FHWA's responsibilities under other Federal environmental laws. As this project is covered by the NEPA Assignment MOU, FHWA has

assigned and Caltrans has assumed FHWA responsibility for environmental review, consultation, and coordination on this project. Please direct all future correspondence on this project to Caltrans.

Consultation and identification efforts for the project revealed one built-environment property within the APE was previously listed in the National Register of Historic Places (NRHP):

- I Street Bridge (listed in 1982, NRHP # 82002233)

Efforts also revealed another built-environment property to be within APE that, after evaluation per the NRHP Criteria, was determined eligible for listing in the National Register:

- Sacramento River East Levee Segment (Map ID 8), originally recorded as P-34-000490, along the east bank of the Sacramento River

Pursuant to Stipulation VIII.C.6 of the PA, Caltrans is requesting your concurrence that the Sacramento River East Levee Segment (P-34-00490) is **individually eligible** for listing in the NRHP. The East Levee Segment possesses associative significance under NRHP Criterion A as a physical representation of the precedent set for flood control management in California between 1850 and 1911, more specifically flood control management policy and development in the Sacramento Valley. Levees, canals, and drainages built within this timeframe are associated with early advances in water management in California that resulted in making settlement and expansion of infrastructure in the region possible. The segment was built to a level that no changes were recommended to it by the California Debris Commission in 1911, when the Commission proposed standardizing and expanding the varied and generally privately operated flood control infrastructure along the Sacramento River. It set the standard for post-1911 efforts to achieve a more unified and standardized approach to levee construction in the Sacramento Valley. As part of the first Reclamation District, RD 1, it is a strong example of the pre-1911 era of flood control measures overseen by local interests. As a result, it is eligible for the NRHP.

Several other built-environment properties were also determined to be within the APE through consultation and identification efforts. They include

- 201 3rd Street, West Sacramento (APN 010-101-005)(Map ID 1)
- 213 3rd Street, West Sacramento (APN 010-101-004)(Map ID 2)
- 212 2nd Street, West Sacramento (APN 010-101-009)(Map ID 3)
- 214 2nd Street, West Sacramento (APN 010-101-010)(Map ID 4)
- 216 2nd Street, West Sacramento (APN 010-101-011)(Map ID 5)
- Washington Water Company Tower at 231 2nd Street, West Sacramento (APN 101-102-010)(Map ID 6)
- Reclamation District 811 Levee Segment (Map ID 7)

Julianne Polanco
December 27, 2016
Page 3 of 3

Pursuant to Stipulation VIII.C.6 of the PA, Caltrans is requesting your concurrence that the above-listed properties are **not eligible** for listing in the NRHP **individually nor as contributors to a potential NRHP eligible district**.

Finally, one archaeological property is located within the APE:

- CA-SAC-658H

The site consists of 518 pilings associated with the Pioneer Flour Mill wharf located along the east bank of the Sacramento River. It also includes a previously unrecorded feature that consists of a raised concrete foundation and loading ramp. The site is located adjacent to, but outside of, the Area of Direct Impact (ADI) for the project. Pursuant to Stipulation VIII.C.3, Caltrans is considering the property eligible for purposes of the project and proposes to protect it by establishing an Environmentally Sensitive Area (ESA) and using exclusionary fencing to avoid impacts.

Due to the portions of the project area not being accessible prior to construction, Caltrans is proposing to prepare a programmatic agreement (PA) specific to this undertaking to ensure that identification and evaluation of archaeological properties within the APE, and any resolution of adverse effects on those properties, is completed. The PA will have as an attachment an Archaeological Resources Management Plan (Management Plan), which will include a detailed protocol for identification, evaluation, and treatment of any adversely affected historic properties, protocols for archaeological monitoring, and evaluation and treatment of any unanticipated discoveries that may be encountered during implementation of the undertaking.

We look forward to receiving your response within 30 days of receipt of this submittal in accordance with Stipulation VIII.C.6.a of the PA. If no response is received within 30 days, Caltrans will move forward with the project upon notification of its intentions to do so via email or other written communication. Please contact Chris Kuzak, District 3 Architectural Historian, at (530) 741-4017 or chris.kuzak@dot.ca.gov, if you have any questions regarding the documentation enclosed with this letter. You may also contact project Archaeologist, Erin Dwyer, at (530) 741-4538 or erin.dwyer@dot.ca.gov.

Sincerely,



Laura Loeffler, Chief
Environmental Management, M1 Branch

Enclosure

cc: Alexandra Bevk, Caltrans HQ CSO

**OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION**

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February 7, 2017

VIA EMAIL

In reply refer to: FHWA_2016_1229_002

Laura Loeffler, Chief
Environmental Management, M1 Branch
Caltrans District 3
703 B Street
Marysville, CA 95901

Subject: Determinations of Eligibility for the Proposed I Street Bridge Replacement Project, Sacramento and West Sacramento, CA

Dear Ms. Loeffler:

Thank you for consulting with me about the subject undertaking in accordance with the January 1, 2014 *First Amended Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California (PA)*.

The cities of Sacramento and West Sacramento, in cooperation with Caltrans, propose to construct a new crossing for vehicular and pedestrian traffic over the Sacramento River that will replace the upper deck of the I Street Bridge, which would no longer carry such traffic. A full project description and the depiction of the area of potential effect (APE) can be found in Attachment A of the HPSR.

Consultation and identification efforts identified the I Street Bridge, a property listed in the National Register of Historic Places (NRHP), within the APE.

Caltrans also determined that the Sacramento River East Levee Segment (P-34-000490), along the east bank of the Sacramento River, is individually eligible under Criterion A as a physical representation of the precedent set for flood control management in California between 1850 and 1911, more specifically flood control management policy and development in the Sacramento Valley. Levees, canals and drainages built within this timeframe are associated with early advances in water management in California that resulted in making settlement and expansion of infrastructure in the region possible. It set the standard for post-1911 efforts to achieve a more unified and standardized approach to levee construction in the Sacramento Valley. As part of the first Reclamation District, RD 1, it is a strong example of the pre-1911 era of flood control measures overseen by local interests.

Caltrans has also determined that the following properties are not eligible for the NRHP:

- 201 3rd Street, West Sacramento, CA
- 213 3rd Street, West Sacramento, CA
- 212 2nd Street, West Sacramento, CA
- 214 2nd Street, West Sacramento, CA
- 216 2nd Street, West Sacramento, CA
- Washington Water Company Tower at 231 2nd Street, West Sacramento, CA
- Reclamation District 811/900 Levee Segment

Based on my review of the submitted documentation I concur with the above determinations.

Finally, pursuant to Stipulation VII.C.3. of the PA, Caltrans is considering CA-SAC-658H to be eligible for the NRHP for the purposes of the project. The site is located adjacent to, but outside of, the Area of Direct Impact for the project. Caltrans proposes to protect the site by establishing an Environmentally Sensitive Area and using exclusionary fencing to avoid impacts.

Due to portions of the project area not being accessible prior to construction, Caltrans is proposing to prepare a programmatic agreement (PPA) specific to this undertaking to ensure that identification and evaluation of archaeological properties within the APE, and any resolution of adverse effects on those properties, is completed. The PPA will have as an attachment an Archaeological Resources Management Plan which will include a detailed protocol for identification, evaluation, and treatment of any adversely affected historic properties, protocols for archaeological monitoring, and evaluation and treatment of any unanticipated discoveries that may be encountered during implementation.

I look forward to working with Caltrans on the preparation of this agreement document.

Thank you for considering historic properties during project planning. If you have any questions, please contact Natalie Lindquist of my staff at (916) 445-7014 with e-mail at natalie.lindquist@parks.ca.gov or Alicia Perez at (916) 445-7020 with e-mail at alicia.perez@parks.ca.gov.

Sincerely,



Julianne Polanco
State Historic Preservation Officer

Section 106 Finding of Effects and Project-specific Programmatic Agreement



**DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION**

Lisa Ann L. Mangat, Director

Julianne Polanco, State Historic Preservation Officer
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October 9, 2018

VIA ELECTRONIC MAIL

Reply in Reference To: FHWA_2016_1229_002

Mr. David Price, Acting Section 106 Coordinator
Department of Transportation
Division of Environmental Analysis
1120 N Street
Sacramento, CA 94274-0001

Subject: Finding of Effect for the I Street Bridge Replacement Project in Sacramento and Yolo Counties, California

Dear Mr. Price:

On September 11, 2018, the Office of Historic Preservation (OHP) received a letter from the California Department of Transportation (Caltrans) continuing consulting with the State Historic Preservation Officer (SHPO) regarding the above referenced undertaking in accordance with the January 1, 2014 *First Amended Programmatic Agreement Among the Federal Highway Administration (FHWA), the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California* (Section 106 PA). Enclosed with Caltrans' letter is a Finding of Effect (FOE), and draft Programmatic Agreement (PA) and attachments.

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, proposes to construct a new bridge over the Sacramento River to replace the vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient bridges (i.e., approach structures). The new connection also would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials (AASHTO), Caltrans, and local agency design standards. A more detailed description of the undertaking can be found on pages 1 through 12 of the FOE.

During earlier consultation, Caltrans' efforts to identify historic properties that may be affected by the undertaking identified two built environment properties that are National Register of Historic Places (NRHP)-eligible or listed in the NRHP: I Street Bridge in Sacramento and West Sacramento, and the Sacramento River East Levee in Sacramento. Efforts also identified one

historic-era archaeological resource, CA-SAC-658H that includes 518 pilings, a raised concrete foundation, and loading ramp associated with the Pioneer Flour Mill, which began operation in 1853. For the purposes of this undertaking only, Caltrans is treating CA-SAC-658H as eligible for listing on the NRHP pursuant to Stipulation VII.C.3 of the Section 106 PA.

Pursuant to Stipulation X.A of the PA, Caltrans has applied the criteria of adverse effect and finds that the undertaking as currently proposed will not adversely affect the I Street Bridge or the Sacramento River East Levee. Caltrans also finds that adverse effects to CA-SAC-658H will be avoided through the establishment of an environmentally sensitive area (ESA). I do not object to Caltrans' assessment of no adverse effects to the I Street Bridge, the Sacramento River East Levee, and CA-SAC-658H.

Due to portions of the area of potential effects (APE) being inaccessible prior to construction, efforts to identify potential subsurface archaeological deposits for this undertaking could not be completed. Caltrans has prepared a draft Programmatic Agreement (PA) and attached Cultural Resources Management Plan (CRMP) for this undertaking to complete the identification, evaluation, assessment of effects, and resolution of adverse effects of historic properties as a result of this undertaking.

Caltrans has invited the Yocha Dehe Wintun Nation and the United Auburn Indian Community of the Auburn Rancheria to be concurring parties to the PA, and provided the tribes the FOE, draft PA and CRMP for review and comment on or around October 4, 2018. Caltrans is seeking SHPO review and comment on the draft PA and CRMP per Stipulation XI of the Section 106 PA. In an email sent to Caltrans staff on October 8, 2018, OHP staff indicated that SHPO review and comment of the draft PA and CRMP would occur after the consulting tribes, had been afforded a reasonable opportunity to review and comment on the documents.

If you require further information, please contact State Historian Natalie Lindquist at 916-445-7014 or at Natalie.Lindquist@parks.ca.gov or Associate State Archaeologist Alicia Perez at 916-445-7020 or at Alicia.Perez@parks.ca.gov.

Sincerely,



Julianne Polanco
State Historic Preservation Officer



Finding of Effect

*I Street Bridge Replacement Project
Sacramento and Yolo Counties
Federal Project No.: BRLS 5002(164)*

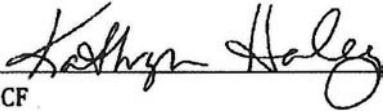
August 2018

**FINDING OF EFFECT FOR THE I STREET BRIDGE REPLACEMENT PROJECT,
CITY OF SACRAMENTO, SACRAMENTO COUNTY, AND
CITY OF WEST SACRAMENTO, YOLO COUNTY, CALIFORNIA
Caltrans District 3, Sacramento and Yolo Counties, Federal-Aid# BRLS 5002(164)**

PREPARED FOR:

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PREPARED BY:



Date: August 17, 2018

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and

Mikesell Historical Consulting
Contact: Steve Mikesell
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REVIEWED BY:



Date: 8/20/18

Chris Kozak
PQS: Principal Architectural Historian
California Department of Transportation, District 3

APPROVED BY:



Date: 8/20/18

Laura Loeffler, Branch Chief
North Region Environmental
Branch M1, Caltrans District 3

August 2018

ICF. 2018. *Finding of Effect for the I Street Bridge Replacement Project, City of Sacramento, Sacramento County, and the City of West Sacramento, Yolo County, California*. August. (00203.14.) Sacramento, CA. Prepared for Mark Thomas Company and the City of Sacramento.

Contents

Finding of Effect	1
Introduction.....	1
Project Description	2
Location.....	2
Purpose and Need.....	2
Project Alternatives	4
No Build (No-Project) Alternative	11
Public Participation.....	12
Community/Scoping Meetings	12
State Historic Preservation Officer	12
Museum and Historical Society Consultation	13
Native American Consultation	14
Description of Historic Properties	17
I Street Bridge	17
Sacramento River East Levee.....	21
CA-SAC-658H.....	26
Application of the Criteria of Adverse Effect.....	27
I Street Bridge	28
Sacramento River East Levee.....	35
CA-SAC-658H.....	41
Unrecorded Archaeological Resources	41
Conclusions and Conditions Proposed	42
References.....	42
Preparers' Qualifications	44

Appendix A Figures

- Figure 1. Vicinity Map
- Figure 2. Proposed Project
- Figure 3. Plan View, Profile, and Elevation
- Figure 4. Location of Geotechnical Borings
- Figure 5. Survey Location Map
- Figure 6. Area of Potential Effects Map

Appendix B Historical Society Correspondence

Appendix C Programmatic Agreement

Tables, Photographs, and Exhibits

Tables

Table 1. Summary of Communications..... 13

Photographs

Photograph 1. General view of I Street Bridge from Old Sacramento. 19

Photograph 2. Aerial view of Sacramento River East Levee between I Street Bridge and gauging station (new bridge location is denoted by arrow and “Levee”). 25

Photograph 3. Showing terminus of bridge on Sacramento County side. The bridge terminates at the end of the truss and the abutment, shown to the right of the walkway near the center of the photograph. 29

Photograph 4. Showing terminus of bridge on Yolo County side. The bridge terminates at the end of the truss, shown near the center of the photograph. The pedestrian stair is a modification, partially attached to the 1911 structure. 30

Photograph 5. Ca. 1911 view of the Sacramento approach to I Street Bridge. Courtesy of the California State Railroad Museum..... 32

Photograph 6. Google Earth aerial view. 32

Photograph 7. I Street Bridge downstream on Sacramento side, showing the view from the proposed location for an interpretive panel. 34

Photograph 8. Showing an interpretive panel already in place near the Tower Bridge, a short distance downstream from the I Street Bridge..... 34

Photograph 9. Sacramento River East Levee at a location south of the proposed new bridge. 35

Photograph 10. Photo simulation of same location, showing new bridge in place. 36

Photograph 11. Showing existing Sacramento River Parkway, Jibboom Street, and Railyards Boulevard. 38

Exhibits

Exhibit 1. Rendering of abutments and realigned Sacramento River Parkway. 37

Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
APE	area of potential effects
APN	Assessor's Parcel Number
BMPs	best management practices
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIDH	cast-in-drilled-hole
CRHR	California Register of Historical Resources
CRMP	Cultural Resources Management Plan
CVFPB	Central Valley Flood Protection Board
ESA	environmentally sensitive area
FNAE	Finding of No Adverse Effect
FNAE-No SC	Finding of No Adverse Effect without Standard Conditions
FOE	Finding of Effect
HBP	Highway Bridge Program
HRER	Historical Resources Evaluation Report
I-5	Interstate-5
MTP/SCS	<i>Metropolitan Transportation Plan/Sustainable Communities Strategy</i>
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
project	I Street Bridge Replacement Project
RD	reclamation district
Section 106 PA	<i>First Amended Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as It Pertains to the Administration of the Federal-Aid Highway Program in California</i>
SHPO	State Historic Preservation Office
Standard Specifications	Caltrans 2015 <i>Standard Specifications</i>
SRFCP	Sacramento River Flood Control Project
TCE	temporary construction easement
UAIC	United Auburn Indian Community of the Auburn Rancheria
UPRR	Union Pacific Railroad
USC	United States Code
USCG	U.S. Coast Guard
XPI	Extended Phase I
YDWN	Yocha Dehe Wintun Nation

Introduction

The City of Sacramento, in cooperation with the City of West Sacramento and the California Department of Transportation (Caltrans), proposes to construct a new bridge over the Sacramento River. The new bridge would replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient bridges (i.e., approach structures). The new connection also would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials (AASHTO), Caltrans, and local agency design standards.

The I Street Bridge Replacement Project (project) is subject to state and federal environmental review requirements because of the use of federal Highway Bridge Program (HBP) funds from the Federal Highway Administration (FHWA). Accordingly, project documentation is being prepared in compliance with both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The City of Sacramento is the lead agency under CEQA, with the City of West Sacramento as a responsible agency, and Caltrans is the lead agency under NEPA. The FHWA's other responsibilities for environmental review, consultation, and any other action required in accordance with applicable federal laws for this project will be carried out by Caltrans under its assumption of responsibility pursuant to 23 United States Code (USC) 327.

Because federal funds will be used to construct the project, the cultural resources studies conducted for this project comply with the terms of the *First Amended Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as It Pertains to the Administration of the Federal-Aid Highway Program in California* (January 2014) (Section 106 PA) for compliance with Section 106 of the National Historic Preservation Act (NHPA).

The purpose of this Finding of Effect (FOE) is to evaluate the proposed project's potential to affect properties listed in or eligible for listing in the National Register of Historic Places (NRHP), or any properties considered historical resources for the purposes of CEQA. The Finding of Effect for any potentially significant buried archaeological resources is not yet known, as resources may still be discovered during implementation of the project. Therefore, a Programmatic Agreement (PA) has been prepared, specifying procedures to resolve any potential adverse effects to those properties.

Two built environment properties located in the project area of potential effects (APE) are NRHP-eligible or listed in the NRHP: the I Street Bridge in Sacramento and West Sacramento, and the Sacramento River East Levee in Sacramento. Detailed description of these resources, potential project effects, and a discussion of the Application of Criteria of Adverse Effect is presented in this report. Based on this analysis, Caltrans and the cities of Sacramento and West Sacramento conclude that the project will not adversely affect either property.

To ensure that the project will not result in adverse effects to cultural resources as the project moves forward into final design, and through construction and completion, conditions are being put in place to protect cultural resources located in the APE. Specifically, these conditions addressed the

two built environment NRHP-eligible/listed NRHP resources. In addition, an Environmentally Sensitive Area (ESA) will be established to protect CA-SAC-658H, an archaeological resource in the area of potential effects (APE). Details are outlined in the Programmatic Agreement (PA) and associated attachments developed for this project. The PA can be found in Appendix C of this report.

Project Description

The City of Sacramento, in cooperation with the City of West Sacramento and Caltrans, proposes to construct a new bridge over the Sacramento River to replace the vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient bridges (i.e., approach structures). The new connection also would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current AASHTO, Caltrans, and local agency design standards.

The I Street Bridge Replacement Project (project) is subject to state and federal environmental review requirements because of the use of federal HBP funds from the FHWA. Accordingly, project documentation is being prepared in compliance with both CEQA and NEPA. The City of Sacramento is the lead agency under CEQA, with the City of West Sacramento as a responsible agency, and Caltrans is the lead agency under NEPA. FHWA's other responsibilities for environmental review, consultation, and any other action required in accordance with applicable federal laws for this project will be carried out by Caltrans under its assumption of responsibility pursuant to 23 USC 327.

This project is included in the Sacramento Area Council of Governments 2016 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS).

Location

The proposed project is located over the Sacramento River between the cities of Sacramento and West Sacramento, approximately 1,000 feet north of the existing I Street Bridge (Figure 1 in Appendix A). The project limits starting within the City of Sacramento consist of Railyards Boulevard from 200 feet east of Bercut Drive on the east, continuing west over the Sacramento River into the City of West Sacramento along C Street, crossing 2nd Street, and terminating approximately 100 feet west of the 5th Street intersection. The project limits also extend along Bercut Drive approximately 500 feet north of Railyards Boulevard, along Jibboom Street 550 feet north of Railyards Boulevard and 300 feet south of Railyards Boulevard, along 3rd Street 50 feet north and south of C Street, along 4th Street 50 feet north and south of C Street, and along 5th Street 50 feet north and south of C Street. The total length of the project is approximately 0.42 mile along C Street and Railyards Boulevard.

Purpose and Need

The proposed project would construct a new bridge over the Sacramento River between the cities of Sacramento and West Sacramento to replace the vehicle crossing that is currently provided by the existing I Street Bridge. Construction of the proposed project has independent utility; the project is not dependent on other projects or improvements to meet the purpose and need.

Termini for the proposed project were developed through an iterative process involving engineering design and traffic operations analysis. Preliminary design concepts were tested with the traffic operations analysis model to evaluate how lane configurations influenced peak-hour conditions.

Purpose

The purpose and objectives of the project are listed below.

- The project should construct a new public crossing of the Sacramento River north of the Union Pacific Railroad (UPRR)-owned I Street Bridge from C Street in the City of West Sacramento to Railyards Boulevard in the City of Sacramento, consistent with the adopted findings of the Sacramento River Crossings Alternatives Study for Bridge Location 2 in the North Market Area.
- The new bridge should meet the requirements of the Neighborhood Friendly Bridge definition that the City of Sacramento City Council adopted by resolution on October 18, 2011.
- In addition to the Neighborhood Friendly Bridge definition, the project should include pedestrian and bicycle facilities in the new public crossing that meet Americans with Disabilities Act (ADA) requirements, and facilitate connections to and from the new crossing and the Sacramento River Parkway and Riverfront Park trails.
- The project would facilitate vehicular and multimodal traffic over the river in order to reduce traffic congestion, improve safety, and remove a number of structurally deficient or functionally obsolete bridges (i.e., approach structures) that have reached the limit of their design life.
- The proposed structure would be a moveable bridge that satisfies the vertical clearance and river navigation requirements of the U.S. Coast Guard (USCG).
- The project design should accommodate future high-quality transit and the addition of a streetcar, which would be a separate, stand-alone project being developed by the cities of West Sacramento and Sacramento.
- The new bridge also is intended to improve the connectivity to, and accessibility of, businesses, recreational areas, and new or redevelopment opportunity sites located in the urban core of Sacramento and West Sacramento, including the Sacramento Railyards and the River District in Sacramento and the Washington District in West Sacramento.

Need

The project is needed for the following reasons.

- The existing I Street Bridge does not fully comply with current design and traffic operation standards due to the following conditions.
 - I Street Bridge limits or restricts traffic capacity and multimodal use. The current bridge width is not sufficient to provide adequate traffic operations, bicycle lanes, or the ability for transit service, including busses, across the bridge.
 - The I Street Bridge and the four associated approach structures are on the eligible bridge list for federal funds for replacement and/or rehabilitation through the HBP. The I Street Bridge has been classified as functionally obsolete, and the existing approach structures have been classified as structurally deficient. The cities of Sacramento and West Sacramento have decided to pursue replacement through the HBP.

- It is necessary to provide access to and between two proposed transit-oriented infill development planning areas on opposite sides of the Sacramento River, Washington District and Sacramento Railyards. To realize the full potential of each of the areas, a pedestrian-friendly, multimodal connection across the river is necessary and is not provided by the current I Street Bridge.
- The I Street Bridge is not in compliance with ADA standards. Standard and continuous sidewalks, and bicycle facilities that encourage walking and bicycling are needed to comply with the ADA and promote the use of alternative modes of travel.

Project Alternatives

This section describes the proposed action and the design alternatives that were developed to meet the identified need through accomplishing the defined purpose(s), while avoiding or minimizing environmental impacts. All aspects of the proposed project would comply with applicable provisions of the Caltrans 2015 *Standard Specifications* (California Department of Transportation 2015) (referred to herein as “Standard Specifications”).

The build alternatives under consideration are one bridge alignment for the new bridge over the Sacramento River and two alternatives for portions of the roadway design in Sacramento.

- City of Sacramento Railyards Boulevard/Jibboom Street/Bercut Drive intersection
 - Alternative 1—Signalized Intersection at Jibboom Street and Bercut Drive
 - Alternative 2—Roundabout Intersection at Jibboom Street and Bercut Drive
- No Build (No-Project) Alternative

The proposed project is located in Sacramento and Yolo Counties, over the Sacramento River and between the cities of Sacramento and West Sacramento, and approximately 1,000 feet north of the existing I Street Bridge (Figure 1). The total length of the project is approximately 0.42 mile (2,200 feet) along C Street and Railyards Boulevard. The purpose of the project is to construct a new public crossing of the Sacramento River north of the UPRR-owned I Street Bridge from C Street in the City of West Sacramento to Railyards Boulevard in the City of Sacramento in order to remove a series of functionally obsolete or structurally deficient bridges (i.e., approach structures), consistent with the adopted findings of the Sacramento River Crossings Alternatives Study for Bridge Location 2 in the North Market Area.

Build Alternatives

One alignment is proposed for the new bridge over the Sacramento River. A new, approximately 860-foot long bridge, consisting of two vehicle lanes, on-street Class II bike lanes, and sidewalks along both sides, is proposed. The bridge would include two fixed-span approach structures, approximately 200 feet and 270 feet in length, that tie into the Sacramento and West Sacramento banks of the river, respectively. The center span of the bridge would be an approximately 330-foot long movable span that meets the USCG requirements. Roadway improvements on Railyards Boulevard in Sacramento and C Street in West Sacramento also are proposed. In Sacramento, two alternatives for portions of the roadway design at the Railyards Boulevard/Jibboom Street/Bercut Drive intersection are being considered. Figure 2 depicts the proposed project and the roadway design alternatives, described below.

- City of Sacramento Railyards Boulevard/Jibboom Street/Bercut Drive intersection
 - Alternative 1—Signalized Intersection at Jibboom Street and Bercut Drive
 - Alternative 2—Roundabout Intersection at Jibboom Street and Bercut Drive

In the City of Sacramento, Alternative 1 consists of signalized intersections at Jibboom Street and Bercut Drive, while Alternative 2 consists of a roundabout between these two intersections. Beyond the Jibboom Street and Bercut Drive intersections, the remaining project elements and limits in the City of Sacramento are similar under both alternatives.

Common Design Features of the Build Alternatives

The proposed project would construct a new bridge over the Sacramento River between Sacramento and West Sacramento to replace the vehicular crossing that is provided by the existing I Street Bridge. The project would facilitate vehicular and multimodal traffic over the river in order to reduce traffic congestion, improve safety, and remove a number of structurally deficient or functionally obsolete bridges (i.e., approach structures) that have reached the limit of their design life. While the existing I Street Bridge over the Sacramento River would remain in-place, the approach structures leading up to the bridge from both directions would be demolished. See Figure 2 for a depiction of the project limits and the approach structures that would be removed.

The Sacramento River is considered to be a navigable waterway of the United States. Under the provisions of the General Bridge Act of 1946, as amended, the USCG must approve proposed location and plans for bridges over navigable waters of the United States prior to commencing construction.

Common design features of the build alternatives are discussed below.

New Bridge Construction and Roadway Modifications

Bridge Construction

The total length of the new bridge would be approximately 860 feet, with up to an 82-foot-wide deck consisting of two vehicle lanes, on-street Class II bike lanes, and sidewalks along both sides of the bridge. The bridge would include two fixed-span approach structures that tie into the Sacramento and West Sacramento banks of the river and are approximately 200 feet and 270 feet in length, respectively (see Figure 3). The center span of the bridge would be a movable span that meets the USCG requirements. The movable span is anticipated to be approximately 330 feet in length. The bridge soffit elevation would be set 3 feet above the 200-year water surface elevation to comply with the Central Valley Flood Protection Board (CVFPB) freeboard requirements.

The two fixed-span approach structures would be up to 82 feet wide, with a superstructure depth (or total bridge thickness) of approximately 6 feet. Each approach structure would be a two-span bridge.

Based on coordination with the USCG, the movable span would provide a 278-foot clear channel opening approximately centered at the middle of the river. As such, a vertical lift span was identified as the appropriate type of movable span. Vertical lift span bridges have a movable span that is lifted vertically to permit passage of boats beneath it. The Tower Bridge over the Sacramento River just downstream of the existing I Street Bridge is an example of a vertical lift span bridge. Like Tower Bridge, the proposed project's bridge would have two towers, one on either side of the lift span. A counterweight would be suspended in each tower, with each counterweight weighing approximately

half of the weight of the span. As the bridge is raised, the counterweights would lower. The vertical lift span would raise the bridge to a minimum vertical clearance of 59 feet over the maximum river elevation of 31 feet (measured to the 29 National Geodetic Vertical Datum [NGVD]).

The truss depth of the movable span would be approximately 40 feet, with 6 feet of the structure being below the bridge deck and 34 feet above the bridge deck. The vertical towers would be approximately 130 feet tall, measured from the bridge soffit elevation. The vertical towers would be approximately 33 feet in thickness and the same width as the bridge deck. The total bridge width on the movable span would be 81 feet.

Due to the existing soil conditions, the bridge would be constructed on deep pile foundations. The abutments for the fixed-span approach structures at the river bank would consist of approximately 50 piles per abutment that are driven or cast-in-drilled-hole (CIDH), to a depth of approximately 70 feet below the original ground elevation. The center piers for the two fixed-span approach structures (located approximately at the bank toe of slope in the river, below the ordinary high water mark) would consist of 50 driven or CIDH piles per pier that are approximately 70 feet below the original ground elevation. If driven piles are selected for either the abutments or piers, the piles would be precast concrete or steel. The foundations for the movable span would consist of four large-diameter cast-in-steel-shell piles per pier. Each pile would be 9 feet in diameter, extending approximately 140 feet below the original ground elevation.

Erosion control measures would be installed around the proposed bridge foundations to prevent future scour at the bridge supports. It is anticipated that rock slope protection would be installed around the bridge abutments and piers within the water to control erosion.

A bridge fender system also is planned around the movable span piers to protect the piers from errant watercrafts that are navigating along the river. The fender system would include approximately 30 driven concrete or wooden piles around each of the movable span piers. The piles would be driven to a depth of approximately 30 feet below the original ground elevation.

Temporary Falsework

Temporary falsework platforms would be required to construct the proposed bridge foundations and approach structures. The platforms would be constructed using temporary piles within the river. In addition, temporary cofferdams would be required to construct the bridge piers within the water. The cofferdams would consist of temporary sheetpiles installed around the individual piers. Dewatering inside the cofferdams would be required.

Roadway Modifications

City of Sacramento

In Sacramento, Bercut Drive would be modified from Railyards Boulevard north approximately 500 feet. Bercut Drive would be designed to have two northbound lanes at the Railyards Boulevard intersection, tapering down to one northbound lane at the northern project limits and one southbound lane. Improvements to Bercut Drive south of Railyards Boulevard are not part of, or needed for, the proposed project and would be constructed if needed as part of a separate future project.

Proposed improvements on Jibboom Street would extend 550 feet north of Railyards Boulevard. The roadway would consist of one travel lane in each direction, on-street Class II bike lanes, sidewalk

along the west side of the roadway, and retaining walls of various heights along both sides of the road. Extension of Jibboom Street south of Railyards Boulevard is not included in, or needed for, the proposed project and would be constructed if needed as part of a separate future project.

The proposed roadway profile for Railyards Boulevard would be approximately 6 feet higher than the original ground elevation at the Jibboom Street intersection. The profile adjustment is needed in order to satisfy the CVFPB requirements to provide 3 feet of clearance between the 200-year-flood water surface elevation and the bridge soffit (low chord of the bridge).

City of West Sacramento

Between the bridge touchdown location along C Street in West Sacramento and the 4th Street/C Street intersection, the roadway would consist of one westbound travel lane, two eastbound travel lanes (the two eastbound travel lanes would taper down to one eastbound lane east of the 3rd Street intersection), a center left-turn lane, on-street Class II bike lanes, on-street parking along the north side of the roadway, and sidewalks along both sides of the roadway. As the roadway through this section currently consists of the proposed number of travel lanes, the widening through this area is primarily needed to support the Class II bike lanes and wider sidewalks.

Along C Street between 4th Street and 5th Street, the roadway would consist of one travel lane in each direction, left-turn lanes, on-street Class II bike lanes, and sidewalks along both sides of the road. All of the improvements through this section would be accommodated within the existing roadway limits.

Residential Access

The new C Street alignment would cut off access to four residential parcels and one multifamily parcel located along 2nd Street, north of C Street. The project would construct a new connection to C Street approximately 150 feet east of the 3rd Street intersection that would continue north approximately 300 feet. The new connection would then make a 90-degree left turn and connect to 3rd Street approximately 300 feet north of C Street. The proposed access would be consistent with the City of West Sacramento's design standards for a public alley, which consists of a 30-foot wide public right of way, supporting a 20-foot travel way, a 5-foot sidewalk, and 5-foot buffer to adjacent parcels. This would require right-of-way acquisition from seven individual parcels and removal of three structures. One structure is located on Assessor's Parcel Number (APN) 010-101-010 and appears to be an individual residence. Another structure is located on APN 010-101-013 and appears to be an apartment building that supports up to one individual apartment. The last structure is located on APN 010-101-004 and appears to be an individual residence.

Class I Bikeway and Levee Modifications and Improvements

City of Sacramento

The existing Class I Sacramento River Parkway trail along Jibboom Street would be reconstructed approximately 500 feet north and 300 feet south of Railyards Boulevard as part of the proposed project. In order to provide a continuous levee maintenance road and off-street Class I path along this section, the path would be grade-separated under the proposed bridge structure. At Railyards Boulevard, maintenance vehicles would have the ability to ingress or egress the path. Cyclists and pedestrians approaching Railyards Boulevard in either direction would have the option to continue along the path under the new structure, avoiding the need to cross the roadway. Cyclists and

pedestrians who are traveling along the path also would have the option to connect to Railyards Boulevard and cross over the proposed bridge into West Sacramento or turn east into Sacramento. Due to the limited horizontal clearance between the river and the Interstate-5 (I-5) viaduct structure, retaining walls would be needed along the path to account for the vertical elevation difference between Jibboom Street and the path that continues under the proposed bridge structure. The maximum retaining wall height along the bike path would be 16 feet.

City of West Sacramento

The proposed project would require improvements to the existing levee along the West Sacramento side of the river, where the proposed bridge alignment would connect to C Street. The existing levee does not meet current standards required by Title 23 of the California Code of Regulations (CCR). Extending approximately 300 feet north and south of the proposed C Street alignment, the levee cross-section would be reconstructed to meet current design standards, which would require 3:1 side slopes on the landside and waterside of the levee, and a 20-foot-wide crown at the top of the levee. The levee improvements also would include a slurry cutoff wall extending to a depth of 110 feet below the original ground elevation (see Figure 2). In addition, the proposed roadway profile would be approximately 6 feet higher than the original ground elevation as it crosses over the levee. In order to maintain access to the levee for inspection and maintenance services, access roads would be constructed from the new roadway to the top of the improved levee section. The proposed grading for the levee would require relocation of the existing water tower that is located along 2nd Street, just north of the proposed C Street alignment. The tower would be relocated to the northwest, approximately 43 feet from its existing location.

The new levee maintenance road also would serve as the future Class I River Walk Park trail extension in West Sacramento. Similar to the trail improvements proposed in Sacramento as part of this project, the trail would be grade-separated under the proposed bridge structure. Cyclists and pedestrians approaching C Street in either direction would have the option to continue along the trail under the new structure, avoiding the need to cross the roadway. Cyclists and pedestrians who are traveling along the trail also would have the option to connect to C Street to cross over the proposed bridge into Sacramento or head west on C Street.

Storm Water Drainage Management

Drainage for the proposed roadway would be conveyed to the existing storm drain system installed within Railyards Boulevard in Sacramento and C Street in West Sacramento. Railyards Boulevard currently drains storm water to the east along the roadway and then into a retention basin south of Railyards Boulevard. C Street drains storm water west along the roadway and then ultimately south beyond the project limits. The proposed project would be designed to ensure that existing storm water conveyance is sufficient, or would increase the capacity of the system to accommodate the project, if necessary.

As is standard with all construction projects, the contractor would be required to install temporary best management practices (BMPs) to control any runoff or erosion from the project site into the surrounding waterways. These temporary BMPs would be installed prior to any construction operations and would be in place for the duration of the contract. Removal of these BMPs would be the final operation, along with project site cleanup.

Structure Demolition and Roadway Modifications

Following completion of the new bridge connections at Railyards Boulevard and C Street, traffic would be diverted to the new bridge, and the four existing approach structures to the I Street Bridge would be removed. Bridge numbers 24C0364L, 24C0364R, 22-0033, and 22C0154 would be demolished; and the foundations would be removed to a depth of 3 feet below the original ground elevation. Encroachment permits from Caltrans and the UPRR would be needed to complete the bridge removal. The existing I Street Bridge is owned and operated by the UPRR and would continue to remain in place and be used by trains following construction of the new bridge.

As part of the removal of the existing approach structures, the project would include modifications to I Street within the City of Sacramento between the southbound I-5 on-ramp and the 5th Street intersection. Modifications would include signing and striping revisions, demolition of existing roadway sections that are no longer required, and removal of bridge abutments and foundations.

Staging, Storage, and Proposed Access during Construction

Two staging areas would be used to store materials and equipment during construction, such as pipe materials, precast manholes and drop inlets, steel girders, piles, and rebar, along with the construction equipment when not in use. One area would be located south of Railyards Boulevard under I-5 in Sacramento; the other area would be located west of the landward side of the levee, south of the new bridge location in West Sacramento. The staging area located along Railyards Boulevard would be accessed via the existing intersection at Jibboom Street. The staging area in West Sacramento would be accessed via the existing 2nd Street connection at 3rd Street, south of C Street. The staging areas would be in use throughout the construction duration; the areas would be returned to their pre-project conditions at the completion of the project.

Utility Relocations

A number of public and private utilities would need to be relocated or adjusted to grade as part of the project, including existing water, sewer, gas, electric, and communication facilities within Jibboom Street, Bercut Drive, C Street, and 2nd Street.

Traffic Management and Detours during Construction

While most of the project would be constructed outside of existing roadways, some areas would require temporary detours or staged construction.

Along Jibboom Street at the proposed Railyards Boulevard intersection, the new roadway profile would be raised approximately 6 feet above the original ground elevation. To maintain access to the existing Jibboom Street viaduct south of Railyards Boulevard during the roadway construction, a temporary access road would be needed. The proposed temporary access road would connect to the existing Jibboom Street viaduct abutment approximately 350 feet south of Railyards Boulevard. The temporary road would then continue under I-5 and connect to the Railyards Boulevard/Bercut Drive intersection. The temporary road would require placement of temporary fill material and a roadway structural section that would be removed after construction of the new bridge. Traffic traveling north along Jibboom Street would continue north along Bercut Drive to access the Richards Boulevard/I-5 interchange.

In order to complete the improvements at Jibboom Street and Railyards Boulevard, Jibboom Street would be closed to traffic approximately 600 feet north of Railyards Boulevard. Traffic traveling south along Jibboom Street to continue over the existing I Street Bridge into West Sacramento would be detoured over to Bercut Drive at Richards Boulevard. Traffic would then use the temporary access road to connect to the Jibboom Street viaduct structure. The temporary access road would be in place for approximately 2 years, after which traffic would use the new roadways and new bridge.

The Sacramento River Parkway trail along Jibboom Street also would require temporary re-routing during construction. The temporary alignment for the trail would follow the temporary Jibboom Street alignment south of Railyards Boulevard. Cyclists and pedestrians would then continue following a detour north along Bercut Drive to Richards Boulevard, where they could then connect back to the Parkway on the west side of I-5. The detour would be in place for approximately 2 years.

During construction, traffic along C Street would be maintained along the existing approach structure until the new bridge is constructed.

Project Construction Sequence

Exploratory Geotechnical Boring

In order to confirm the nature of underground geological conditions and determine the necessary final design details prior to construction, several exploratory geotechnical borings would occur in the project area within the river and on land. Seventeen boring locations are estimated. The estimated depths of the borings are between 30 and 240 feet, with more shallow borings proposed on land and deeper borings (240 feet) proposed at in-water bridge pier locations. Approximately seven of the borings would be in the river levees (five in the west levee and two in the east levee) (see Figure 4 in Appendix A). Geotechnical exploration would likely be authorized by separate permits.

Project Construction

Once the engineering details are final, new bridge and roadway construction would occur, followed by demolition of the four approach structures that connect to the existing I Street Bridge. Once the new bridge and roadways are constructed, traffic would be diverted to the new bridge in order to allow demolition adjacent to the existing bridge. Construction of the project is expected to take approximately 30 months.

Property Acquisition

The project would require temporary construction easements (TCEs) and permanent property acquisitions along C Street, 3rd Street, and 2nd Street within the City of West Sacramento and along Railyards Boulevard, Jibboom Street, Bercut Drive, and I Street within the City of Sacramento.

Along C Street in West Sacramento, TCEs and permanent acquisitions would be required along the south side of the roadway from the intersection of 4th Street to the Sacramento River to accommodate construction of standard shoulders, bike lanes, and sidewalks.

Along 3rd Street and 2nd Street in West Sacramento, TCEs and permanent acquisitions would be needed from the UPRR on the south to just north of the B Street intersections for construction of the proposed roadway and levee improvements.

Along Railyards Boulevard, Jibboom Street, and Bercut Drive in Sacramento, TCEs and permanent acquisition would be needed from the currently state-owned right-of-way for I-5 for construction of the roadway. In addition, TCEs and permanent acquisitions would be needed along Jibboom Street for the proposed temporary detour road and Class I bikeway improvements.

TCEs would be required along the existing I Street connection in Sacramento to facilitate removal of the existing viaduct structures. Due to the limited space available in Old Sacramento, it is anticipated that construction activities would occur by accessing the area from the parking lot at the intermodal station.

Unique Features of Build Alternatives

In the City of Sacramento, two alternatives for portions of the roadway design at the Railyards Boulevard/Jibboom Street/Bercut Drive intersection are being considered. Alternative 1 consists of signalized intersections on Railyards Boulevard at Jibboom Street and Bercut Drive, while Alternative 2 consists of a roundabout between these two intersections. Beyond the Jibboom Street and Bercut Drive intersections, the remaining project elements and limits are similar under both alternatives.

Alternative 1—Signalized Intersection at Jibboom Street and Bercut Drive

Under Alternative 1, Railyards Boulevard would be extended west over the Sacramento River. East of Bercut Drive, Railyards Boulevard would consist of two westbound lanes and one eastbound lane. Between Jibboom Street and Bercut Drive, Railyards Boulevard would consist of two westbound lanes and three eastbound lanes; two eastbound lanes would be trapped into left-turn lanes onto Bercut Drive, and one eastbound lane would continue along Railyards Boulevard. West of Jibboom Street, Railyards Boulevard would consist of one lane in each direction.

Alternative 2—Roundabout Intersection at Jibboom Street and Bercut Drive

Under Alternative 2, Railyards Boulevard would be extended west to the new bridge over the Sacramento River. East of Bercut Drive, Railyards Boulevard would consist of two westbound lanes and one eastbound lane. Between Jibboom Street and Bercut Drive, Railyards Boulevard would consist of a roundabout with two lanes in each direction. One westbound lane would be a trap onto northbound Jibboom Street, and one westbound lane would continue onto the new bridge. One eastbound lane would be trapped into left-turn lanes onto Bercut Drive, and one eastbound lane would continue along Railyards Boulevard. West of Jibboom Street, Railyards Boulevard would consist of one lane in each direction.

No Build (No-Project) Alternative

Under the No Build Alternative, the existing I Street Bridge would remain in use for vehicle, bicycle, and pedestrian access between the cities of Sacramento and West Sacramento. No changes to traffic patterns on I Street or C Street would occur. The four approach structures would remain in place and in use; and there would be no changes to existing roadways, levees, or Class I bikeways.

Improvements and development of transportation infrastructure would continue following the general plans of both cities, the *Sacramento Railyards Specific Plan* (approved November 2016) and the *Washington Specific Plan* (adopted May 1996). The *Sacramento Railyards Specific Plan* (City of Sacramento 2016) identifies the extension of Railyards Boulevard west to a Tee intersection at

Jibboom Street. Railyards Boulevard at Bercut Drive would consist of two westbound lanes and one eastbound lane. The same number of lanes on Railyards Boulevard would extend west to the intersection with Jibboom Street; at this point, the left westbound lane on Railyards Boulevard would become a dedicated left-turn lane onto southbound Jibboom Street, and the right westbound lane would be a dedicated right-turn lane onto northbound Jibboom Street.

In West Sacramento, future changes to C Street would be based on the *Washington Specific Plan* (City of West Sacramento 1996), which identifies 12-foot-wide sidewalks and 7-foot-wide Class II bike lanes along the roadway. The connection to the I Street Bridge would not change.

Public Participation

Community/Scoping Meetings

A community open house for the project was held on June 19, 2014, from 5:30 to 7:30 p.m. at the Stanford Gallery, 111 I Street, Sacramento, California. A public scoping meeting/community workshop for the project was held on October 9, 2014, from 3:30 to 6:30 p.m. at the Stanford Gallery, 111 I Street, Sacramento, California. The purpose of the open house was to share information and receive input from community members on the project.

For both meetings, post cards were mailed to more than 6,000 local residents and businesses; and notification flyers were sent via e-mail to vicinity businesses, community groups, neighborhood associations, and interested individuals.

State Historic Preservation Officer

A meeting with the State Historic Preservation Office (SHPO), Caltrans, and consulting cultural resources specialists was held on February 4, 2016, at the Stanford Gallery, 111 I Street, Sacramento, California in order to present preliminary findings of cultural resources in the area of potential effects (APE) (Figure 6 in Appendix A). The group discussed preliminary cultural resources findings, APE delineation, and proposed treatment for historic properties that may be affected by the project. Resources that were discussed and the results of this consultation follow.

I Street Bridge. Listed in the NRHP in 1982 (National Register #82002233)

All parties agreed that the approach structures to I Street Bridge, which were previously recorded as non-contributing, did not need to be re-recorded and their removal would not result in an adverse effect on I Street Bridge.

Sacramento River East Levee Segment (NRHP-Eligible)

The levee would continue to retain its character-defining features, including location, setting, and alignment. The project would not result in an adverse effect on the levee. Barring any unanticipated discoveries, the SHPO agreed that the project would result in No Adverse Effect and that the FOE would reflect this conclusion. No Memorandum of Agreement would be necessary.

Note: Subsequent to the meeting, due to access restrictions on the west side of the river and the potential for buried deposits, a PA will now be prepared to ensure completion of the identification and evaluation of potential historic properties within the project's APE, and to provide for resolution of any adverse effects on identified historic properties subsequent to approval of the project.

Museum and Historical Society Consultation

On June 8, 2015, ICF sent letters describing the project and requesting any information on potential cultural resources in the APE to the California State Railroad Museum, the Center for California Studies, the Center for Sacramento History, the Sacramento County Historical Society, the West Sacramento Historical Society, the Yolo County Archives and Records Center, the Yolo County Historical Museum, the Yolo County Historical Society, and the Portuguese Historical & Cultural Society. Letters describing the project and requesting any information on potential cultural resources in the APE also were sent to Preservation Sacramento on July 9, 2015, and to the California Department of Parks and Recreation on July 14, 2015. Copies of these letters are included in Appendix B. Follow-up phone calls were made on October 12, 2015. See Table 1 below for a summary of these calls.

Table 1. Summary of Communications

Name/Organization	Telephone	Date Contacted	Summary of Communication
California State Railroad Museum	916-849-0679	10/12/2015	Spoke with the Director, Paul Hammond. He did not have any additional resources to add to those we identified. His comments centered on the eligibility of the levee. Paul said that State Parks identified the stamp in the concrete retaining wall—"Built by S.P. Co 1913-14"—as a character-defining feature of the structure that contributes to the significance of the levee. He viewed subsequent improvements to the wall—even the segment under the boardwalk constructed during redevelopment of Old Sacramento in the late 1960s and early 1970s—as necessary maintenance that does not diminish the historical integrity of the structure.
Center for California Studies	916-278-6906	10/12/2015	Spoke with the Director, Steve Boyler. He did not have any additional resources to add to those we identified. His comments were limited to voicing his support in keeping the existing I-Street Bridge and avoiding impacts on the Transcontinental RR.
Preservation Sacramento	916-202-4815	10/12/2015	Called and left a voice message asking to return my call if there are any questions or concerns regarding this project.
California Department of Parks & Recreation	916-653-4272	10/12/2015	Called California Department of Parks & Recreation Headquarters (1416 9th Street) and spoke to the receptionist, Veronica. She said she would have the Director, Lynn Black, return my call.

Name/Organization	Telephone	Date Contacted	Summary of Communication
California Department of Parks & Recreation	916-445-8836	1/29/2016	Spoke with Dan Osanna, who stated that moving the Washington water tower a few feet would be acceptable. He was not worried about the viewshed from old town Sacramento changing due to removal of vehicular traffic on I Street Bridge. Mr. Osanna said he would consider that a No Adverse Effect. Mr. Osanna mentioned that he had prepared a report in 1993 for the U.S. Army Corps of Engineers as background for the Sacramento Seawall. He also suggested that ICF contact Kyle Wyatt, Historian for the Capitol District & Railroad Museum and provided contact information for Mr. Wyatt.
Kyle Wyatt - California State Historian for Capitol District & Railroad Museum	916-893-3480	1/29/2016	Spoke briefly with Mr. Wyatt, who said he would need to review the APE map to provide comments. Told him that ICF would send the APE map after it went through revisions. The APE map was emailed to Mr. Wyatt on 5/14/2016.
Center for Sacramento History	916-808-7072	10/12/2015	Spoke with the receptionist, who was not sure who would have responded to the letter. The receptionist said that she would have the Director, Marcia Eymann, return the call. No return call was received.
Sacramento County Historical Society	916-572-9858	10/12/2015	Left a voice message. No return call was received.
Portuguese Historical & Cultural Center	916-381-7356	10/12/2015	Phone number no longer in service.
West Sacramento Historical Society	916-374-1849	10/12/2015	Left a voice message. No return call was received.
Yolo County Archives & Records Center	530-666-8010	10/12/2015	Left a voice message. No return call was received.
Yolo County Historical Museum	530-666-1045	10/12/2015	Left a voice message. No return call was received.
Yolo County Historical Society	530-661-2212	10/12/2015	Phone number no longer in service.

Note: Calls were made by ICF archaeologist Robin Hoffman.

Native American Consultation

The California Native American Heritage Commission (NAHC) was contacted on April 7, 2015, to request a search of the sacred lands file and an updated list of Native American contacts for the project area. A response was received from the NAHC on April 28, 2015. Although the search failed to yield information on Native American cultural resources located within or adjacent to the project area, the NAHC provided a list of 16 individuals and organizations in the Native American community that may be able to provide information about cultural resources in the project area (see Attachment E of the PA).

On June 10, 2015, the City of Sacramento sent letters to all 16 representatives, including representatives of the following tribes and individuals.

- Cortina Band of Indians – Charlie Wright
- Shingle Springs Band of Miwok Indians – Daniel Fonseca
- Shingle Springs Band of Miwok Indians – Nicholas Fonseca
- Shingle Springs Band of Miwok Indians – Hermo Olanio
- T’si-Akim Maidu – Don Ryberg
- T’si-Akim Maidu – Grayson Coney
- T’si-Akim Maidu – Kesner Flores
- United Auburn Indian Community of the Auburn Rancheria (UAIC) – Gene Whitehouse
- UAIC – Jason Camp
- UAIC – Marcos Guerrero
- Yocha Dehe Wintun Nation (YDWN) – Leland Kinter
- YDWN – Cynthia Clarke
- YDWN – Native Cultural Renewal Committee
- Unaffiliated individual – Eileen Moon
- Unaffiliated individual – April Wallace Moore

The consultation efforts with the individuals and tribes who responded are summarized as follows.

In a letter to ICF dated June 25, 2015, James Kinter of the YDWN requested a site visit and additional project information. In a letter to the City of Sacramento on June 30, 2015, Daniel Fonseca of the Shingle Springs Band of Miwok Indians, requested completed records searches and cultural resources surveys for the project, in addition to requesting that the Shingle Springs Band of Miwok Indians be included as a consulting party for the identification of any potential Traditional Cultural Properties or Traditional Cultural Landscapes in the APE. On August 7, 2015, Gene Whitehouse of the UAIC requested copies of archaeological reports and future environmental documents for the project, in addition to a site visit to the project to confirm the locations of suspected cultural resources.

On November 4, 2015, the City of Sacramento sent letters to the same 16 Native American representatives to whom the City had sent letters on June 10, 2015. These new letters invited the representatives to attend an onsite informational meeting for the project, where details on project design and construction would be provided, questions taken regarding the project, and any concerns regarding traditional cultural properties or other cultural resources would be addressed. Follow-up phone calls were made to the Native American representatives by ICF archaeologist Robin Hoffman on November 13, 2015. Hoffman inquired whether the representatives would be attending and whether they had any concerns or questions. In cases where the call was not answered, Hoffman left a voicemail.

An onsite information meeting was conducted in the West Sacramento portion of the APE on November 16, 2015. In attendance were representatives from the YDWN, UAIC, City of Sacramento,

City of West Sacramento, ICF, and Mark Thomas & Company. Zach Siviglia, lead project engineer of Mark Thomas & Company, provided detailed descriptions of project funding, purpose, design, and construction to all in attendance, while the group toured the West Sacramento portion of the APE. ICF archaeologist Robin Hoffman provided information on the archaeological studies to date for the project and furnished YDWN and UAIC representatives with maps showing the APE overlain onto historic maps. UAIC representative Tristan Evans informed Hoffman that the UAIC knows of a potential Traditional Cultural Property in or near the APE on both sides of the Sacramento River, as well as an archaeological site in or near the APE on both sides of the Sacramento River, and that the UAIC would like to set up a meeting with the City of Sacramento to discuss these resources. YDWN representative Anthony Flores informed Hoffman that the YDWN would like additional consultation and would be sending a letter to the City of Sacramento stating such. Following the onsite meeting, UAIC representatives and Hoffman exchanged emails regarding scheduling a meeting. No meeting date was set.

On October 5, 2016, the City of Sacramento sent letters to notify the YDWN and UAIC that Extended Phase I (XPI) fieldwork could be conducted in October or November 2016. The letters detailed previous communications and requested comments and concerns, and requested any further information the tribes may have. The City of Sacramento also issued an invitation to UAIC representative Marcos Guerrero for another field meeting on October 14, 2016. A meeting was scheduled and was conducted in the West Sacramento portion of the APE on November 14, 2016. In attendance were representatives from the UAIC, City of Sacramento, City of West Sacramento, ICF, and Mark Thomas & Company. It was subsequently learned that, due to the proximity (within 200 feet) of the proposed excavations to the levee, the XPI cannot be conducted at this time and will instead need to be conducted immediately prior to actual project construction—at which time, the necessary flood control agency permits and stipulations will be in place for the entire project. Mr. Guerrero was informed of this development at the November 14, 2016 meeting.

On November 15, 2016, Mr. Guerrero forwarded an email containing UAIC's map of the area and suggested mitigation measures, including a burial plan. In response, on November 21, 2016, the City of Sacramento sent a letter to Mr. Guerrero. The letter stated that the UAIC will be offered an opportunity to be a concurring partner to the PA and that standard legal practices (Public Resources Code 5097.98) regarding the identification of human remains will be followed and described in the PA; therefore, a burial plan will not be needed. Also on November 21, 2016, a letter was sent to Leland Kinter of the YDWN to inform the tribe why an XPI will not be conducted at this time and that the YDWN will be offered an opportunity to be a concurring partner to the PA. Consultation is ongoing and will continue throughout the life of the project. Native American groups and individuals will be kept apprised of any developments concerning cultural resources. Attachment E of the PA presents documentation of the Native American consultation efforts to date.

Description of Historic Properties

I Street Bridge

Historical Context

Sacramento has since the Gold Rush been at the forefront of railroad and river transportation in the region. The earliest successful modes of transportation between the port at San Francisco and the gold fields in the foothills was by boat on the Sacramento River, with the City of Sacramento being the most important entry point between river traffic and wagons headed to the gold fields. There was an almost immediate cry among Californians for railroad development to ease the burden of carrying goods to the gold fields. The Central Pacific Railroad was organized in Sacramento, and Sacramento was for some time the western terminus of the transcontinental line. This juncture between busy riverboat traffic and emerging railroad traffic established the need for a moveable railroad bridge on the Sacramento River—of which the I Street Bridge was the most important example.¹

The earliest railroad bridge in Sacramento was built by the California Pacific Railroad Company in 1869, about a decade before this early railroad line was taken over by the Central Pacific Railroad. This bridge was important because it linked the Central Pacific tracks going east with the California Pacific tracks to the Bay Area, in what would become the key alignment of the Southern Pacific main line from Oakland to Chicago. This bridge was a timber Howe truss with a 200-foot center swing span and was at nearly the same location as the I Street Bridge. The Central Pacific Railroad built a new timber bridge in 1876 at the same location with a center lift span. The Southern Pacific Railroad, inheritor of nearly all assets of the Central Pacific, built a third bridge at this location in 1894. It too was a timber structure and was double-decked, with railroad tracks on the lower level and a wagon road on top. That 1894 bridge was in use until the I Street Bridge was built in 1911.²

In addition to the interface between riverboat and railroad traffic, the I Street crossing grew into an important crossing for vehicles: wagons in the early years and cars and trucks in later years. As noted, the 1894 bridge at I Street was double-decked and offered vehicular passage between the two counties and the cities of Sacramento and what would become the city of West Sacramento in Yolo County.

The I Street Bridge was designed by John D. Isaacs, consulting engineer for the Southern Pacific Railroad and a major force in railroad engineering in California and the United States. Isaacs was responsible for many innovations in railroading; he was a railroad engineer first and a bridge

¹ There are many sources for the history of riverboat traffic in Sacramento. Important studies of navigation in various eras are discussed in the recent Christopher J. Castenada and Lee Simpson, eds. *River City and Valley Life: An Environmental History of the Sacramento Region*, University of Pittsburgh Press, 2013. An even greater body of literature discusses the railroad history of Sacramento. Especially useful are two recent studies: Richard J. Orsi, *Sunset Limited: The Southern Pacific Railroad and the Development of the American West, 1850–1930*, University of California Press, 2005; and Don L. Hofsommer, *The Southern Pacific, 1901–1985*, Texas A & M Press, 1986.

² The various generations of railroad bridges at this crossing are illustrated and discussed in www.sacramentohistory.org, which links the assets of multiple archives in the Sacramento region.

engineer second. Nonetheless, the general literature on the life of this master engineer highlights the I Street Bridge as his single greatest achievement.³

Isaacs was born in Richmond, Virginia in 1848 and was educated at the University of Virginia. In 1875, he traveled to San Francisco to work for the Southern Pacific Railroad, a job he would hold until his retirement in 1923.⁴ He initially worked as a draftsman in the maintenance of way department (maintaining the track and related structures). He later became the head of maintenance of way in the Pacific Northwest operations of the Southern Pacific. He died in San Francisco in April 1929.⁵

Among railroad engineers, Isaacs had a versatile skill set, specializing in no specific aspect of railroad work but showing a tremendous capacity to handle everything needed to keep a railroad running. He was a key leader in the Southern Pacific Railroad during its period of most explosive growth. Although his legacy is most defined by the development of standardized plans for repetitive structures, he was also a capable designer in dealing with engineering assignments for which a standard plan was not appropriate. Among his many important individual designs, the I Street Bridge is generally held to be the most successful. He also was credited with designing some of the most handsome passenger stations of the Southern Pacific system, including a large Mission Revival building in San Antonio, Texas.

The massive steel fixed and swing spans were built by the American Bridge Company. The Missouri Valley Bridge and Iron Company, working with Southern Pacific crews, built the concrete piers and abutments. The bridge's date of construction is commonly held to be 1911 because that date is cast in steel plates and in the abutments. Owing to delays in building the bridge deck, however, service was delayed until April 1912.

Description

The I Street Bridge is a double-deck steel swing bridge extending from the City of West Sacramento in Yolo County to the City of Sacramento in Sacramento County, California. The bridge features five major spans: two long fixed spans on the Yolo County side; both sides of the swing span; and a fixed span extending from the swing span to the abutment in Sacramento. The configuration of the trusses is that of a Baltimore Petit, with vertical columns in compression, angled members in tension, and angled subtruts. The swing spans continue the Baltimore Petit configuration but feature a polygonal top chord [a true Baltimore Petit has a horizontal top chord]. The swing span is a center-bearing pivot, with a massive concrete center pier that is 54 feet in diameter and 80 feet in height. The two water piers on the Yolo County side and the one water pier on the Sacramento County side are concrete piers taken to bedrock. Since its construction in 1911, the steel structure carried two railroad tracks on the bottom level and two lanes of truck and automobile traffic on the upper level. The approach spans for the automobile level have been rebuilt on several occasions, as highway traffic changed dramatically. The most recent changes on the Sacramento County side date to construction of nearby I-5 in the late 1960s. The boundary of this resource is the double-deck

³ "Half a Century of Constructive Railroad Service: An Appreciation of John D. Isaacs," *Engineering News-Record*, Vol. 84, No. 16, April 15, 1920, pp. 756–8.

⁴ For ease of discussion, the term Southern Pacific Railroad is used to refer to a long list of companies that preceded it and which succeeded it in some cases. It is likely that Isaacs actually began working for the Central Pacific Railroad in 1875. See: Orsi, *Sunset Limited* and Hofsommer, *The Southern Pacific*.

⁵ *Engineering News-Record*, 1929, Vol. 102, p. 775.

structure from abutment to abutment; it excludes any highway approaches on either side of the river and any railroad improvements beyond the abutments.

The bridge is currently owned by the UPRR. The cities of Sacramento and West Sacramento are responsible for maintaining the upper vehicular deck, but the bridge is owned by the railroad.



Photograph 1. General view of I Street Bridge from Old Sacramento.

Since its construction, the I Street Bridge has carried two modes of transportation on the two levels of the truss. The bottom deck has always carried two lanes of rail traffic. The I Street Bridge was built in 1911 in large part to ease a bottleneck caused by the previous bridge, which carried only one track. Each track was allotted 14 feet of horizontal clearance, which dictated the 30-foot width for the bridge. The upper deck, designed for automobiles and trucks, is carried atop the three approach spans and about mid-height on the swing span. The 30-foot width on the upper deck is divided into two 9-foot vehicular lanes and 5-foot sidewalks on either side.

The bridge is carried on two concrete abutments, three fixed span piers, and a giant center pivot pier. The abutments are concrete and directly below the ends of the fixed spans. There are three piers apart from the center pivot, two on the Yolo County side and one on the Sacramento County side. The piers are rectangular with cutwater shapes upstream and downstream. The caisson for the center pier appears to be round but is actually octagonal. It has a 54-inch diameter and supports a center pivot with a 42-inch diameter. The piers for the side spans are said to extend to 55 feet, reaching bedrock; while the center pivot is said to reach to 80 feet. A notable feature of the swing bridge is that it has been controlled by electric motors since it was built. The control house for the bridge is tucked in the space created by the peak above the center pier.

As a general rule, the I Street Bridge retains a very high degree of integrity. If the bridge is defined as extending from one end of the Yolo County fixed spans to the opposing end of the fixed spans in Sacramento County, very little has changed about this bridge. In 1993, the Southern Pacific Railroad replaced the center bearing and at the same time replaced the electric motors, bringing in

alternating current motors to replace the direct current originals.⁶ Beyond the limits of the fixed spans, structural elements related to the bridge have been modified dramatically. The upper deck of the I Street Bridge is almost entire intact within the lengths of the fixed and moveable spans. The vehicular approaches to the upper deck, however, have been modified repeatedly. The original approaches were steep on both sides of the river, and the Yolo County approach featured a sharp bend, which proved to be dangerous. The Sacramento County approaches were further modified in the 1970s when I-5 was constructed not far from the eastern edge of the bridge. This juncture between the bridge and the interstate required construction of a web of on- and off-ramps that connect with the Sacramento County approach to the bridge.

The bridge is defined as extending from abutment to abutment and from the western end of the Yolo County fixed spans to the eastern end of the Sacramento County fixed span. All vehicular approaches beyond these limits are excluded, as are all railroad tracks and structures that extend beyond the stated limits.

Significance

The I Street Bridge was listed in the NRHP in 1981 based on a nomination form prepared by John W. Snyder. The integrity of the bridge is largely unchanged since it was evaluated and listed in the NRHP in 1981 except for its setting. The setting now features significant modern tourist, business, and housing development, while a significant portion of the Sacramento rail yard, present in 1981, when the bridge was nominated, is gone. The I Street Bridge meets NRHP eligibility Criterion A in the area of transportation and Criterion C in the area of engineering. The bridge is significant at the statewide level.

Significance in Transportation History

The 1911 I Street Bridge is the by far the oldest railroad bridge in California that carries a major or trunk line across a major crossing. The Southern Pacific Benicia-Martinez Bridge is still in use and is a notable structure. It was built in 1928 and continues the original California Pacific alignment between Oakland and Sacramento, the same alignment served by the I Street Bridge. While it is much longer than the I Street Bridge, it also was built 17 years after the Sacramento River bridge. There is no extant bridge on the original Atchison Topeka and Santa Fe line into Southern California that is anywhere near as old as the I Street Bridge. The original Santa Fe crossing of the Colorado River was commonly called the Red Rock Bridge. It was built in 1890 but abandoned as a railroad bridge in 1947. The bridge continued as a highway bridge on Route 66 until it was replaced by the Interstate 10 bridge in 1966. The Red Rock Bridge was demolished in 1978.⁷

The I Street Bridge is significant at the state level of significance under Criterion A, in the area of transportation, as the oldest bridge in the state that carries trunk line traffic across a major crossing. From the day it was built, the bridge has carried Southern Pacific's main line freight as well as its major transcontinental passenger service, the service identified today as the Amtrak *California Zephyr*.

⁶ The repair to the center bearing is described in Payne, 2011 and in Terry Koglin, *Moveable Bridge Engineering*, John Wiley & Sons, 2003.

⁷ There is an older bridge now owned by the Burlington Northern Santa Fe line, the 1909 Arizona and California Railway bridge over the Colorado River. The Arizona and California, however, was a short line and does not meet the definition of a main line.

Significance in Engineering

The I Street Bridge holds an important place in the history of swing bridge design, helping to prove that a center pier design could be used for very long and heavy railroad bridges. In his important 1926 study, *Moveable Bridges*, Otis Hovey of the American Bridge Company analyzed the range of moveable bridge types.⁸ Each type—swing span, lift bridges, bascule, and others—was suited to specific types of crossings. And each type had within it various subtypes, built as a method of construction or operation.

Among swing bridges, two subtypes existed at the time the I Street Bridge was built: the center bearing and rim bearing. A swing bridge comprises a center pier in the water with two equal spans, which can pivot to a 90-degree position to allow river traffic to pass through. The only difference between a center bearing and a rim bearing is the manner in which the center pivot is constructed. A center bearing is supported on the bearing when the bridge is in open or closed positions. The rim bearing includes a series of rollers at the rim of the center pivot to support the bridge in an open position.⁹

The rim bearing design was developed by English engineers in the early 19th century specifically for very heavy railroad bridges, based on a belief that the center bearing design would fall apart under the heavy weight of railroad bridges.¹⁰ The standard belief that the rim-bearing design was best for a heavy bridge was especially relevant for the double-deck, double-track design of the I Street Bridge, which at 3,374 tons was the heaviest moveable bridge in the world when it was built. According to Hovey, the engineer for the I Street Bridge, John D. Isaacs initially planned to install a rim bearing pivot: “An attempt was first made to design a rim-bearing turntable to carry this great weight, but the available distance of 8 ft. 4 in. from base of rail to masonry at the center pier was so small that no method of designing a satisfactory distribution system could be designed.” Isaacs chose a center bearing, and the vertical alignment problem was solved. In addition, the center bearing design proved to be remarkably durable and effective; it was in place until the bearing were replaced in 1996.

The I Street Bridge is significant under NRHP Criterion C in the area of engineering. The bridge was among the first very heavy bridges to use a center bearing design. It showed the effectiveness of this design, which was simpler to build and maintain than the rim bearing design, in constructing very heavy moveable bridges, which arguably are among the most difficult types of structures to design, build, and maintain.

Sacramento River East Levee

Historical Context

Historically, much of the Sacramento Valley was marsh and swampland, with seasonal flooding and periodic inundation of normally dry areas. Beginning in the 19th century, flood management and land reclamation projects were undertaken to make the area habitable for larger populations, expand agriculture, and improve navigable waters. The history associated with water resources in California is vast and complex. A large majority of the systems of levees, canals, and drainages that

⁸ Otis Ellis Hovey, *Moveable Bridges*, John Wiley & Sons, 1926.

⁹ Hojjat Adeli, *Historic Bridges: Evaluation, Preservation, and Management*, CRC Press, 2010.

¹⁰ Terry Koglin, *Moveable Bridge Engineering*, John Wiley & Sons, 2003.

provide water conveyance and flood protection today were originally built in the mid- to late 1800s to support mining activities and irrigate agricultural lands. Construction efforts to manage water through reclaiming land and building levees was first undertaken in bits and pieces by individual property owners and organizations, and then ultimately was upgraded and connected with the aid of the state and federal governments.¹¹

The earliest reclamation legislative act was passed by Congress in 1850. Called the Arkansas Act, this legislation was enacted with the intent to grant swamp and overflow land to states under the prerequisite that the land could be “reclaimed” and used for agricultural purposes.¹² The act helped private owners of swamp and overflowed lands obtain funds to reclaim their land by ensuring that “the proceeds from the sale of these lands be applied to the purpose of reclaiming said lands by means of levees and drains.”¹³ This act assisted in funding the initial construction of levees and drainage in California by individual property owners along the Sacramento, American, and Feather Rivers. Five years later, the State of California began encouraging the purchase of swamp and overflowed lands at \$1 per acre. Initially, purchasers were limited to 320 acres of land; over the next several years, amendments increased the limit to 640 acres.

By 1861, the State legislature had enacted the Swamp and Overflowed Land Act, authorized the Swamp Land Commissioners, and initiated the formation of reclamation districts. The act appropriated \$200,000 from the previously established Swamp Land Fund for use at the discretion of the Commission and called for taxation of land to fund reclamation projects.¹⁴ The years from 1861 to 1866 mark the first period of formal organization of reclamation in California.¹⁵ Following a devastating flood in 1862, by 1863, the act was amended; new commissioners were appointed with reduced salaries; and provisions were made to employ engineers to study and initiate efforts to formally design levees and drainage. By 1866, 54 reclamation districts (RDs) had petitioned for establishment. Of these, only 45 were formally organized and active in building levees and drainage structures. These initial RDs were limited to 11 of California’s 58 counties: Marin, Napa, Sacramento, San Joaquin, San Mateo, Solano, Sonoma, Sutter, Tulare, Placer, and Yolo.

The first RD in California, No. 1, encompassed the American Basin, extending from the American River north to the Bear River. Improvements of lands to protect them from flooding and allow reclamation of agricultural lands formally began in 1863. By 1865, 26 miles of levees and 20 miles of drainage canals had been constructed in RD No. 1 (currently RDs 1000 and 1001). The subject levee segment is associated with RD No. 1.

Between the 1860s and early 1900s, efforts were made to standardize the RDs as regulating bodies. In 1866, the Swamp and Overflowed Land Act was amended again, abolishing the Swamp Land Commissioners, discharging their engineers, and transferring the funds allocated through this

¹¹ Karen M. O'Neill, *Rivers by Design: State Power and the Origins of U.S. Flood Control* (Durham N.C.: Duke University Press, 2006), Preface.

¹² Norris Hundley, *The Great Thirst: Californians and Water -a History*, rev. ed. (Berkeley: University of California Press, ©2001), 80.

¹³ Harmon S. Bonte, Bulletin No. 37, *Financial and General Data Pertaining to Irrigation, Reclamation and other Public Districts in California*. Prepared Under the Direction of the California Irrigation and Reclamation Financing and Refinancing Commission (State of California Department of Public Works, Publications of the Division of Water Resources, 1930), pp. 109.

¹⁴ *Ibid.* p. 109.

¹⁵ *Ibid.* p. 115.

legislation to the various counties to construct levees and drainage. The county surveyors were then designated as the engineers for RDs in their respective counties.

In 1868, the California legislature passed the Green Act, which would guide the state flood control policy into the early 1900s. The act enabled purchasers of swamp or overflow land to create a district and construct any type of levee or drainage system on their land. The act also removed restrictions on the amount of acreage individuals or groups could purchase.

By 1880, William Hammond Hall, California's first State Engineer, submitted a report on irrigation and flood control to the state legislature. The report outlined the impact of hydraulic mining on the natural environment and called for creation of centralized water policy and management.¹⁶ During the late 1800s, other individuals and legislators also made efforts to promote the idea of a consolidated statewide water management plan at the state and federal level. However, this idea would not gain any real momentum until the early 1900s. In summary, during this period, individual property owners or RDs built levees. However, these levees were not standardized in design. They were also somewhat sporadically built along rivers. Therefore, in some places they might not be linked together; and if they were linked together, the levees could be different heights and overall dimensions. During a flood, the property with the least stable levee would be flooded. By the early part of the 20th century, over 700 RDs had been organized, often with overlapping boundaries.

In 1911, the U.S. Army Corps of Engineers' California Debris Commission presented its plan to Congress to unify northern California's levees and drainages. The plan, which was prepared between 1909 and 1910, came to be known as the Sacramento River Flood Control Project (SRFCP). It is commonly referred to as "the Jackson Report." Overall, the Jackson Report presented the SRFCP and suggested standardizing and expanding the existing levee system, including raising the height of existing levees, and creating new levees. Additionally, the plan proposed adding weirs and bypass structures to assist in flood control—creating a second river channel that the Sacramento River could overflow into. The report also emphasized enhancing navigation opportunities along the Sacramento and Feather Rivers.

By 1910, "391 miles of such structures were already in existence, but only 74 miles of them were high enough and strong enough to be considered up to necessary standards and grade."¹⁷ In essence, the 74 miles of existing levees that met construction standards as stated in the Jackson Report became the benchmark for levee upgrades moving forward with implementation of the SRFCP. The Sacramento River East Levee segment, which was part of RD No. 1, was one of the levees within the 74 miles of levees that was built up to a level that no changes were proposed as part of the report.

The Jackson Report projected that the levee upgrades and additional enhancements of the existing system would be funded by the state or local landowners. Although no federal legislation resulted from the Jackson Report, California's Governor Hiram Johnson called a special session of the state legislature to pass the California State Flood Control Act, approving the SRFCP. As part of this legislation, "the State Reclamation Board was established to coordinate reclamation, flood control, and navigation projects with the federal government."¹⁸ The passage of the California State Flood Control Act in 1911 marks the origin of a consolidated statewide water management plan, and an

¹⁶ Robert Lloyd Kelley, *Battling the Inland Sea: American Political Culture, Public Policy, and the Sacramento Valley, 1850–1986* (Berkeley: University of California Press, 1989), pp. 191–201–203.

¹⁷ *Ibid.* p. 283.

¹⁸ O'Neill, *Rivers by Design*, p. 115.

organized effort towards standardizing and enhancing the existing levee system that was built between 1850 and 1911.

Until the early half of the 20th century, the federal government had been reluctant to provide states aid for flood control. Six years after the Jackson Report was presented to Congress, and the State of California had begun implementation of the SRFCP, the 1917 Flood Control Act was enacted. The federal legislation provided some funding for SRFCP tasks; however, funding was largely for navigation-related projects. (This federal legislation also helped fund levee improvements along the Mississippi River.)

The 1917 Flood Control Act established the “federal government responsibility to protect lands adjacent to navigable rivers, and it further institutionalized relations between the federal government, contractors, and state and local governments.”¹⁹ Essentially, this legislation marked a shift in national water management; authorizing the federal government to provide states aid for flood control projects. In the decades following, California was able to make strides in enhancing the state’s flood control and water management systems that were initiated by this federal legislation and subsequent aid. By the 1930s, all of the SRFCP weirs were constructed.²⁰ Overall, SRFCP system upgrades and improvements were ongoing throughout the 20th century.

Description

Sacramento River East Levee extends 14.5 miles from the American River to the North Beach Lake Levee, just south of Freeport. The subject segment is earthen and features two basic design types. The south side of the I Street Bridge features a sloped, 10-foot-tall river bank augmented with a 25-foot, board-formed concrete retaining wall built by the Southern Pacific in 1913–14. The first 12 feet of the levee on the north side of the I Street Bridge also consists of a sloped river bank and a concrete retaining wall; but the sloped earthen portion is considerably higher, reaching a height of around 25 feet. The concrete wall in this area is proportionally reduced to approximately 10 feet in height. The segment north of the concrete retaining wall consists of a sloped river bank, with large portions protected by rip-rap. Trees grow intermittently along the earthen river bank on both sides of the bridge. Unlike the RD 900 levee on the west bank of the Sacramento River, this levee lacks the common trapezoidal levee form defined by two inwardly sloping sides capped with a flat crown. Instead, the land side and the crown of the levee segment are at grade with the adjacent land, resulting in a levee with only one sloped side. The levee’s form is a result of numerous efforts by the City of Sacramento to raise the level of the streets and subsequent height of the levee in the area beginning in the early 1860s. The aerial view below shows the location of the levee between the existing I Street Bridge and the location for the proposed replacement structure.

¹⁹ Ibid, p. 126.

²⁰ Mitch Russo, Fact Sheet Sacramento River Flood Control System Weirs and Flood Relief Structures (Sacramento: State of California Department of Water Resources Division of Flood Management, December 2010), accessed October 10, 2016, <http://www.water.ca.gov/newsroom/docs/WeirsReliefStructures.pdf>.



Photograph 2. Aerial view of Sacramento River East Levee between I Street Bridge and gauging station (new bridge location is denoted by arrow and “Levee”).

Significance

The subject segment of the Sacramento River East Levee has an important association with two definitive trends in history at the local level: the First Transcontinental Railroad and water management in California.

Regarding the association with the First Transcontinental Railroad, as indicated above, the levee served as the road bed for the mainline between 1867 and 1879. Most of the road bed and the tracks in the area have been removed, and the small extant portion no longer functions as a mainline. To be eligible for listing in the NRHP or California Register of Historical Resources (CRHR), a segment of the First Transcontinental Railroad must at a minimum retain its original alignment (integrity of location) and be in active use as a mainline. Since most of the rail corridor in the study area is no longer extant, and the portion that is extant functions only as a maintenance spur line for the Old Sacramento Historic District, no segment of the First Transcontinental Railroad in the study area meets the minimum requirement for listing in the NRHP or the CRHR. Consequently, although the levee historically has an association with the First Transcontinental Railroad, this association does not contribute to the levee’s eligibility due to a lack of historic integrity.

The Sacramento River East Levee segment does, however, possess associative significance under NRHP Criterion A and CRHR Criterion 1 as physical representation of the precedent set for flood control management in California between 1850 and 1911. California's earliest reclamation efforts were established between 1850 (Arkansas Act enacted) and 1911 (State Flood Control Act enacted). Levees, canals, and drainages built within this timeframe are associated with early advances in water management in California that resulted in making settlement and expansion of infrastructure in the region possible. These early flood control structures still maintain their original alignment, continue to function as mechanisms of flood control, and serve as part of the existing statewide water management system. As such, these structures are a physical example of the evolution of reclamation in California—including the earliest efforts to build levees, formation of RDs, and development of water management public policy. They are the foundation for all reclamation activities that followed throughout the state after 1911.

The Sacramento River East Levee segment was part of RD No. 1 and was one of the levees that was built up to a level that no changes were proposed as part of the Jackson Report. Consequently, it is an example of one of the levee segments constructed between 1850 and 1911 that set the bar for subsequent levee construction. As such, the Sacramento River East Levee appears eligible for listing in the NRHP under Criterion A and in the CRHR under Criterion 1. The character-defining features associated with this segment of the Sacramento River East Levee are its setting, alignment, and continued function as a flood control mechanism.

In conclusion, the subject segment of the Sacramento River East Levee appears to be individually eligible for listing in the NRHP and the CRHR under Criterion A/1. Additionally, the Sacramento River East Levee segment was evaluated in accordance with Section 15064.5(a) (2)-(3) of the State CEQA Guidelines using the criteria outlined in Section 5024.1 of the California Resources Code, and it appears to be a historical resource for the purposes of CEQA.

CA-SAC-658H

This historic-period archaeological site consists of 518 pilings, a raised concrete foundation, and loading ramp associated with the Pioneer Flour Mill, which began operation in 1853. The pilings are located on the east bank of the Sacramento River from south of the I Street Bridge, northward into the project area (Allan 2002). The concrete foundation and loading ramp are located on the east bank of the Sacramento River and were identified during field survey for the I Street Bridge. The foundation measures 40 x 30 x 2 feet (L x W x H). The ramp is attached to the north end of the foundation, toward the eastern corner, and measures 10 x 18 feet (W x L). No artifacts or additional features associated with CA-SAC-658H are known at this time.

CA-SAC-658H has not been formally evaluated for its potential to be eligible for listing in the NRHP. However, the project has recommended that the resource as a whole be considered NRHP and CRHR eligible for the purposes of this project only.

Application of the Criteria of Adverse Effect

The Criteria of Adverse Effect are given at 36 Code of Federal Regulations (CFR) 800.5 (1):

Criteria of adverse effect. An adverse effect is found when an project may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the project that may occur later in time, be farther removed in distance or be cumulative.

Under the Section 106 PA among Caltrans, the California SHPO, the FHWA, and others, there are two methods of achieving a Finding of No Adverse Effect (FNAE).²¹ In one method, an FNAE may be achieved by adhering to certain "Standard Conditions." The two most common such conditions are consistency with the Secretary of the Interior's Standards for Rehabilitation and establishing an ESA for protection of archaeological properties. For this project, archaeological resources will be protected by establishing an ESA for one known resource in the APE and by implementing a PA and Cultural Resources Management Plan (CRMP) for identification, evaluation, and mitigation of as yet unknown resources that may be discovered in the APE.

Both the PA and its implementation instructions in the Standard Environmental Reference allow for an FNAE without reliance upon Standard Conditions. This provision is explicitly made on page 4 of Exhibit 2.8, "Finding of No Adverse effect: Format and Content."²²

When it is possible to avoid adverse effects to historic properties by placing conditions on the project that are not standard conditions, as described above, or when consulting with Tribal Historic Preservation Officers (THPOs) that have assumed Section 106 responsibilities, it is still possible to have a Finding of No Adverse Effect without Standard Conditions (FNAE-No SC) either because the project design will result in an effect, but the effect is not adverse, or by placing conditions on the project to avoid adverse effect.

With respect to historic properties—the I Street Bridge (NRHP-listed) and the Sacramento River East Levee (NRHP-eligible)—this document makes a FNAE without Standard Conditions (FNAE-No SC). It does so by applying the Criteria of Adverse Effect, including examples of adverse effects, and concludes that the project does not result in an adverse effect on either eligible resource.

The Criteria of Adverse Effect are quoted above. In addition to the Criteria of Adverse Effect, 36 CFR 800.5 (2) includes a series of examples of adverse effects.

²¹ *First Amended Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as It Pertains to the Administration of the Federal-Aid Highway Program in California* (January 2014) (Section 106 PA) for compliance with Section 106 of the NHPA.

²² California Department of Transportation, Standard Environmental Reference, Vol. 2, Exhibit 2.8, "Finding of No Adverse Effect: Format and Content," p. 4.

Examples of adverse effects. Adverse effects on historic properties include, but are not limited to:

- (i) Physical destruction of or damage to all or part of the property;
- (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines;
- (iii) Removal of the property from its historic location;
- (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- (v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
- (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

In the discussion below, the Criteria of Adverse Effect and examples of adverse effects are applied to the two NRHP-listed/eligible resources.

I Street Bridge

The I Street Bridge Replacement Project will affect the NRHP-listed I Street Bridge, but the effect will not be adverse. The project will not diminish the integrity of the resource and will not destroy or adversely affect any qualifying characteristics of the property. Because the project will remove the historical non-rail vehicular use of the bridge, however, the responsible agencies propose to condition an FNAE on development of an interpretive panel to be installed in Old Sacramento to document the vehicular uses of this bridge.

To analyze more closely the nature of the effect of this project on the I Street Bridge, it is useful to discuss in detail each of the seven examples of adverse effects as specified in 36 CFR 800.5(2).

(i) Physical destruction of or damage to all or part of the property

As shown in the "Description of Historic Properties," the NRHP-listed I Street Bridge extends from the Sacramento end of the 1911 fixed span to the opposing end of the fixed span on the West Sacramento side. **Photograph 3** below shows the terminus on the Sacramento side.



Photograph 3. Showing terminus of bridge on Sacramento County side. The bridge terminates at the end of the truss and the abutment, shown to the right of the walkway near the center of the photograph.

Photograph 4 below shows the equivalent terminus on the West Sacramento side of the river.



Photograph 4. Showing terminus of bridge on Yolo County side. The bridge terminates at the end of the truss, shown near the center of the photograph. The pedestrian stair is a modification, partially attached to the 1911 structure.

The approaches east of the Sacramento terminus and west of the West Sacramento terminus were built after 1911 (in 1936 and in 1958, respectively) and are not part of the NRHP-listed property. The project will involve removing the approach spans at both ends of the historic bridge but will not affect any part of the 1911 structure. The project will result in removal of the intrusive pedestrian stair shown in Photograph 3, which is not regarded as a contributing element of the resource.

It is concluded that the project will not result in the “physical destruction of or damage to all or part of the property.”

(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines

The project will not alter any part of the NRHP-listed 1911 bridge.

(iii) Removal of the property from its historic location

The project will not remove any part of the NRHP-listed bridge from its historic location. The bridge, of course, is a moveable structure and rotates several times a day; that manner of relocation will continue in the same manner as had been the case since 1911.

(iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance

When the project is complete, there will be a change of use for this property and the physical setting will be modified, but in neither case will this result in an adverse effect.

In terms of use, it must be acknowledged that the I Street Bridge was built with two decks to accommodate non-rail vehicles on the second level and that use will be discontinued when this project has been completed. It also must be acknowledged that the setting will be modified through removal of the east and west approach spans.

This change in use and removal of approach spans would likely have constituted an adverse effect had those approach spans been part of the original 1911 structures. In actual fact, however, the approaches on both sides of the river have been replaced and reconfigured so dramatically that they bear no resemblance to their original condition. Photograph 5 shows the Sacramento approaches to the I Street Bridge in about 1911. The Sacramento approach was replaced in 1936 with a complex structure that allowed the I Street Bridge to be accessed from I Street as well as from Jibboom Street to the north. The Yolo County side approach was replaced in 1958.

The early approach span, as shown in Photograph 5, was narrow, straight, and fitted with sidewalks with ornate railings. The current condition is shown in Photograph 6, a Google Earth aerial view. It shows the complicated I Street-Jibboom Street connector on the Sacramento County side (to the right in this view) and the great curve in the 1958 approach on the Yolo County side (left in this view).

With reference to use, it should be noted that the significance of the structure in transportation history is defined entirely by its use by the railroads. The bridge carries one of America's busiest trunk lines across a major river crossing. As noted under "Description of Resources," the I Street Bridge is the oldest example in California of a bridge carrying a trunk line over a major crossing. By comparison, the non-rail vehicular use of the bridge is not now and never has been a major factor in the transportation history of the region.

The responsible agencies for the project propose to minimize the impact of the removal of non-rail vehicles through erection of an interpretive display, commemorating the century-plus use of this bridge for non-rail traffic. This display is detailed below, under "Conclusions" and is noted under Measures and Commitments in the attached PA (Appendix C).



Photograph 5. Ca. 1911 view of the Sacramento approach to I Street Bridge. Courtesy of the California State Railroad Museum.



Photograph 6. Google Earth aerial view.

(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features

The overall effect of the project is to remove intrusive visual elements from the setting for the NRHP-listed I Street Bridge. Removal of the intrusive approach spans will open up better sightlines to the NRHP-listed bridge, particularly from the Sacramento side of the river. The overall impact in this regard is beneficial. Consideration was also given to the construction of a new bridge north of the I Street Bridge. As noted in the previous section, the bridge's significance is defined entirely by its use by the railroads. Adding a new bridge north of it will not affect its significance and only enhance views of it for the public.

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance

The project will not result in neglect of the I Street Bridge. The bridge has always been owned by the railroad and will continue to be owned and operated by the railroad.

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance

The I Street Bridge has never been under federal ownership or control.

Conclusions

As shown in the application of examples of adverse effects, there is no aspect of the project that will result directly in an adverse effect. The one project impact that will result in a permanent change to the use of the structure is removal of non-rail vehicles from the bridge. As noted, the bridge was designed to carry non-rail traffic when it was built in 1911, although in a configuration that is much different than what exists today.

The agency officials in charge of the I Street Bridge Replacement Project propose to develop an interpretive display, to be erected in Old Sacramento at a site within clear view of the I Street Bridge. The display will focus on the removal of vehicular uses from the I Street Bridge, to interpret for future generations the vehicular uses of the bridge.

The proposed condition is to assemble a freestanding interpretive panel that documents the history of the joint railroad-automobile use of the I Street Bridge, emphasizing the non-rail uses. It is proposed that the panel be installed at a location along the levee in Old Sacramento in full view of the bridge, similar to the view in **Photograph 7** below.



Photograph 7. I Street Bridge downstream on Sacramento side, showing the view from the proposed location for an interpretive panel.

It is further proposed that the interpretive panel be stylistically consistent with the interpretive panels for the nearby Tower Bridge, located just outside Old Sacramento and in West Sacramento. A view of the panel is shown in **Photograph 8**.



Photograph 8. Showing an interpretive panel already in place near the Tower Bridge, a short distance downstream from the I Street Bridge.

Sacramento River East Levee

The proposed project will affect the Sacramento River East Levee at a single point, where the proposed new bridge will cross the Sacramento River. That general location is shown in the photographs below. **Photograph 9** shows the location under existing conditions, and **Photograph 10** is a photo simulation with the new bridge in place.



Photograph 9. Sacramento River East Levee at a location south of the proposed new bridge.

It will be observed that the levee at this location has a very complex and cluttered setting. The narrow paved pathway at this location is a pedestrian/bicycle path, called the Sacramento River Parkway. The ramp to the right is Jibboom Street as it ramps up to the level of the I Street Bridge. Under the proposed project, Jibboom Street will terminate at Railyards Boulevard, and this on-ramp will be demolished. The elevated roadway to the right is I-5. The screening at this site and the structure behind is a water intake structure for the State of California.

Photograph 10 below shows the levee at the same location with the project completed.



Photograph 10. Photo simulation of same location, showing new bridge in place.

The proposed project will affect the setting for the Sacramento River East Levee but will make minimal changes to the levee itself. The three major changes to the setting for the levee are removal of the Jibboom Street on-ramp; construction of the new bridge; and construction of the Railyards Boulevard approach to the new bridge, passing under I-5. Changes to the levee itself are limited to a restricted area at or near where the new bridge crosses the levee.

To assess whether the proposed project will have an adverse effect, it is useful to analyze the project impacts against the examples of adverse effects, as presented in 36 CFR 800.5.

(i) Physical destruction of or damage to all or part of the property

The project will not destroy or damage the levee. Physical impacts will occur where the roadway meets the bridge abutments. Railyards Boulevard will provide access from the Railyard area of Sacramento and the new bridge.

Physical impacts on the levee fall into three categories: geotechnical borings; abutments for the new bridge; and realignment of Jibboom Street and the bicycle-pedestrian path, called the Sacramento River Parkway. Each category is discussed separately below.

Geotechnical Boring

Project engineers propose sample borings at three locations on the East River Levee: at the bridge crossing and at points about 100 feet north and south of the crossing. Within the levee embankments, hollow-stem auger drilling methods will be used. Hollow-stem auger drilling will be performed using a drag bit and augers with a nominal 6.5-inch outer diameter and 3.25-inch inner diameter to allow collection of soil samples from within the augers during drilling. These geotechnical borings are expected to reach a depth of 30 feet (Figure 5 in Appendix A). Modifications associated with this testing are restricted to the narrow drill bit and are temporary.

Bridge Abutments

The drawing below (**Exhibit 1**) illustrates work that will occur at the point in which the proposed bridge meets the levee. As discussed under the “Description of Historic Properties,” this levee “lacks the common trapezoidal levee form defined by two inwardly sloping sides capped with a flat crown. Instead, the land side and the crown of the levee segment are at grade with the adjacent land, resulting in a levee with only one sloped side.” In that regard, it is difficult to say precisely where the levee begins and ends except on the sloping river side.

As illustrated in the drawing below, the abutments for the bridge will be placed at the crest of the levee on the water side. The actual displacement of levee material will be minimal because the abutment will be placed at the top of the levee.

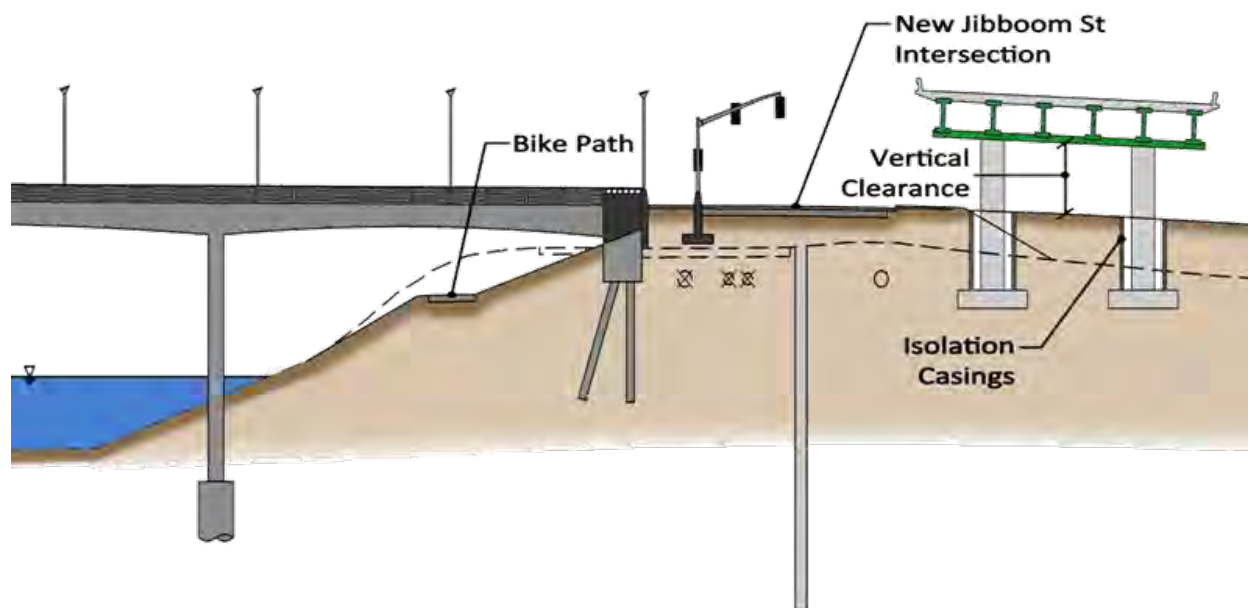


Exhibit 1. Rendering of abutments and realigned Sacramento River Parkway.

Realignment of Jibboom Street, Railyards Boulevard, and the Sacramento River Parkway

As discussed under item (iv) below, the setting for the levee in the vicinity of this project is dominated by transportation features. **Photograph 11** illustrates this setting. This photograph is taken from the levee looking east toward the Sacramento River Parkway in the foreground, Jibboom Street in the middle ground, elevated I-5 in the background, with Railyards Boulevard traffic facing the photographer beneath the interstate.

The project will terminate at Jibboom Street, at the approximate location of the white automobile to the left in **Photograph 11**. Railyards Boulevard will be extended directly toward the photographer. The extension of Railyards Boulevard will pass directly through the current alignment of the Sacramento River Parkway. This necessitates a realignment of the Parkway. As shown in Exhibit 1, the Parkway will be realigned to pass under the first river-side span of the new bridge. This will require building a retaining wall to halt any erosion of the levee. It is estimated that 800 feet of the Parkway will be realigned.



Photograph 11. Showing existing Sacramento River Parkway, Jibboom Street, and Railyards Boulevard.

The physical changes to the material of the levee are very small, particularly when considering the length, width, and height of the resource. The geotechnical testing will involve minor drilling and

removal of a small amount of levee material. The abutments for the proposed bridge require removal of a relatively small amount of levee material and installation of piers for the abutment. Realignment for the Sacramento River Parkway will require removal of more levee material and will slightly modify the river-side contour of the levee.

On balance, however, these modifications to the levee do not diminish the qualities that qualify it for listing in the NRHP. As discussed under “Significance,” the integrity of the levee is restricted to its alignment (location) and function, as well as a marginal integrity of setting. As stated in the report documenting the levee’s eligibility for listing in the NRHP: “In the case of the Sacramento River East Levee segment, the structure is still located in its historic setting, retains its historic alignment, shows evolution of levee construction, and continues to function as a flood control structure. As such the levee appears to retain its integrity of location, design, materials, workmanship, feeling, association, and a sufficient amount of its integrity of setting.”²³

The report acknowledges that the geometry and materials used in the levee have changed a great deal over time. Nowhere is this clearer than at this bridge site, where the proposed bridge will cross the levee. Railyards Boulevard, which serves as the Sacramento approach to the new bridge, traverses the historic Southern Pacific railyard, as its name suggests. In the historic railyard, the grade of the railyard land was repeatedly raised to fill in a historic marsh that was fed by both the American and Sacramento Rivers.²⁴ As stated in the Historical Resources Evaluation Report (HRER): “this levee lacks the common trapezoidal levee form defined by two inwardly sloping sides capped with a flat crown. Instead, the land side and the crown of the levee segment are at grade with the adjacent land, resulting in a levee with only one sloped side. The levee’s form is a result of numerous efforts by the City of Sacramento to raise the level of the streets and subsequent height of the levee in the area beginning in the early 1860s.”

The HRER through which the levee was found to qualify for listing in the NRHP emphasizes its integrity of location, its continuing function as a flood control feature, and a marginal degree of integrity of setting. The minor changes to the river-side profile of the levee for realignment of the Sacramento River Parkway, the introduction of bridge abutments, and the introduction of the new bridge to the setting for the levee do not affect the integrity of location or the continuing function of this flood control feature. The new bridge introduces a transportation element to a setting that is dominated by transportation features, including I-5, Jibboom Street, and Railyards Boulevard. It is concluded that the physical changes to the Sacramento River East Levee are so minor that they do not constitute an adverse effect under this example of an adverse effect.

(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines

The levee will be altered at the bridge crossing, where Railyards Boulevard, which currently terminates at Jibboom Street, will be extended to join the bridge. The levee also will be altered slightly to accommodate the abutment for the new bridge, which primarily will be built inside the

²³ ICF International. 2016. Historical Resources Evaluation Report for the I Street Bridge Replacement Project, California Department of Transportation, District 3, Sacramento and Yolo Counties, California, ICF 00203.14, Sacramento, CA. Prepared for Mark Thomas Company, Sacramento, CA and the California Department of Transportation, District 3, Marysville, CA.

²⁴ That wetlands was called Lake Sutter or, more commonly, China Slough. It is California Historical Landmark No. 594.

levee. The changes to the levee itself will be minimal, although the change to its setting will be greater. The changes to the setting for the levee are discussed under item (iv) below.

(iii) Removal of the property from its historic location

No part of the levee will be moved from its historic location.

(iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance

Under this example and the one that follows, changes to the setting for the levee must be considered. As noted in the description of resources section of this report, the integrity of the Sacramento River East Levee is defined chiefly by its location and function. "In the case of the Sacramento River East Levee segment, the structure is still located in its historic setting, retains its historic alignment, shows evolution of levee construction, and continues to function as a flood control structure. As such of levee appears to retain its integrity of location, design, materials, workmanship, feeling, association, and a sufficient amount of its integrity of setting."

The setting for this levee has been dynamic since the levee was first built in the 1860s. At one point in the 1860s, for example, the levee at this location carried the Central Pacific Railroad's main line. Historic photographs document heavy industrial activity at this location, on the water side and land sides of the levee. That setting was altered most dramatically through construction of vehicular transportation structures, including the Jibboom Street approach to the historic I Street Bridge in the 1930s and most especially through construction of I-5 in the 1960s. The integrity of that setting is difficult to assess because that setting has been changing constantly throughout the history of the levee.

As shown in **Photograph 11** above, the existing setting for the levee is dominated by transportation features, including an elevated I-5, the Jibboom Street on-ramp, and the bicycle path, called the Sacramento River Parkway. The importance of transportation features is even clearer in the photograph below, which was taken at the exact location of the bridge crossing. This picture was taken standing on the levee, looking east toward the Sacramento River Parkway, Jibboom Street, and Railyards Boulevard, which terminates at its juncture with Jibboom Street. It will be observed that Jibboom Street, the Sacramento River Parkway, and Railyards Boulevard have been built up to the height of the levee; and there is no visible distinction between the levee and adjacent roadways at this point.

It is concluded that changes to the setting of the levee do not cause an adverse effect on the levee because the setting is not part of its significance. As noted, the levee has been determined eligible for listing in the NRHP and CRHP because of its Criterion A significance and because it retains integrity of location and function. The setting at this specific location has been so modified in the years since the 1930s (when Jibboom Street was realigned), the 1960s (when I-5 was constructed), and in very recent years (when the Sacramento River Parkway and Railyards Boulevard were built). Those changes continue a long pattern of dominance of the setting by transportation features. Consequently, changes to the setting of the levee do not constitute an adverse effect under Section 106 or a substantial adverse change under CEQA guidelines.

(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features

See discussion under item (iv) above.

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization

The Sacramento River East Levee is of critical importance to the economy and society of Sacramento, to an extent that it has been and almost certainly will be maintained carefully in the future. Nothing about this project would affect the commitment of responsible flood control officials to maintain this crucial piece of infrastructure.

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance

The Sacramento River East Levee has never been owned by the federal government. This project will not change that fact or result in a loss of federal control over this facility.

Conclusions

As shown in the application of examples of adverse effects, no aspect of the project will result directly in an adverse effect the Sacramento East Levee.

CA-SAC-658H

The project will affect CA-SAC-658H, but the effect will not be adverse. Project activities proposed for this resource's location would only occur at the ramp location and would consist of access routes that would result in temporary activities near the site. The project ground-disturbing activities nearest to CA-SAC-658H that would result in permanent impacts would be bike lane construction, approximately 10 feet northeast of the ramp, and removal of the Jibboom Street approach superstructure, approximately 15 feet east of the ramp. The former activity would include ground disturbance to a depth of approximately 15 feet and the latter to a depth of 3 feet. Both of these proposed activities are located outside of the site boundary.

To ensure that the resource is not affected during project implementation, an ESA will be established prior to commencement of construction and will be in place for the duration of project activities in this area. The proposed ESA boundary for this resource is depicted in Figure 6 (APE map) in Appendix A. The complete ESA Action Plan is attached to the PA as Attachment D.

Conclusions

No aspect of the project will result directly in an adverse effect CA-SAC-658H.

Unrecorded Archaeological Resources

Due to the presence of vegetated or paved surfaces, and close proximity of structures (river levees) vital to the health and safety of the surrounding community which could not be breached at this time, the project could not be fully investigated for the presence of archaeological resources prior to the preparation of this FOE and may contain unrecorded archaeological resources. To address this issue, a CRMP was developed which outlines additional archaeological investigations that will take place prior to commencement of construction, as well as archaeological monitoring that will take place during ground-disturbing construction activities. This investigation and monitoring will ensure the identification of any remaining archaeological resources in the project area. In the event

that previously unrecorded archaeological resources are identified as a result of these efforts, the CRMP identifies additional studies which will be required, in consultation with the Caltrans Professional Qualifications Staff, to evaluate and address potential project effects on these resources. The complete CRMP is attached to the PA as Attachment C.

Conclusions

No aspect of the project will result directly in an adverse effect on unrecorded archaeological resources.

Conclusions and Conditions Proposed

As noted earlier in this document, a PA and a CRMP spell out procedures for identification, evaluation, and mitigation of unknown archaeological sites within the APE will be implemented as part of the project. For archaeological resources, an ESA will be established for site CA-SAC-658H, a concrete foundation feature and a series of river pilings located on the east side of the river. The CRMP and the ESA Plan can be found in Appendix C.

In summary, two built environment properties—the I Street Bridge (NRHP Listed) and the Sacramento River East Levee (NRHP Eligible)—are located in the APE. As detailed in this report, Caltrans and the cities of Sacramento and West Sacramento conclude that the project will not adversely affect either property. However, the City of West Sacramento Caltrans have agreed to include conditional measures regarding the bridge and the levee as part of the ESA plan to ensure that neither property will be adversely affected by the project as it moves forward to final design, through construction, and to completion. Conditional measures are detailed in the ESA located in Appendix C of this report. In general, measures include, pre-construction review of final plans, monitoring (if necessary), report on construction regarding bridge demolition and levee work, and all work involved in the creation and implementation of the interpretative panel on the I Street Bridge.

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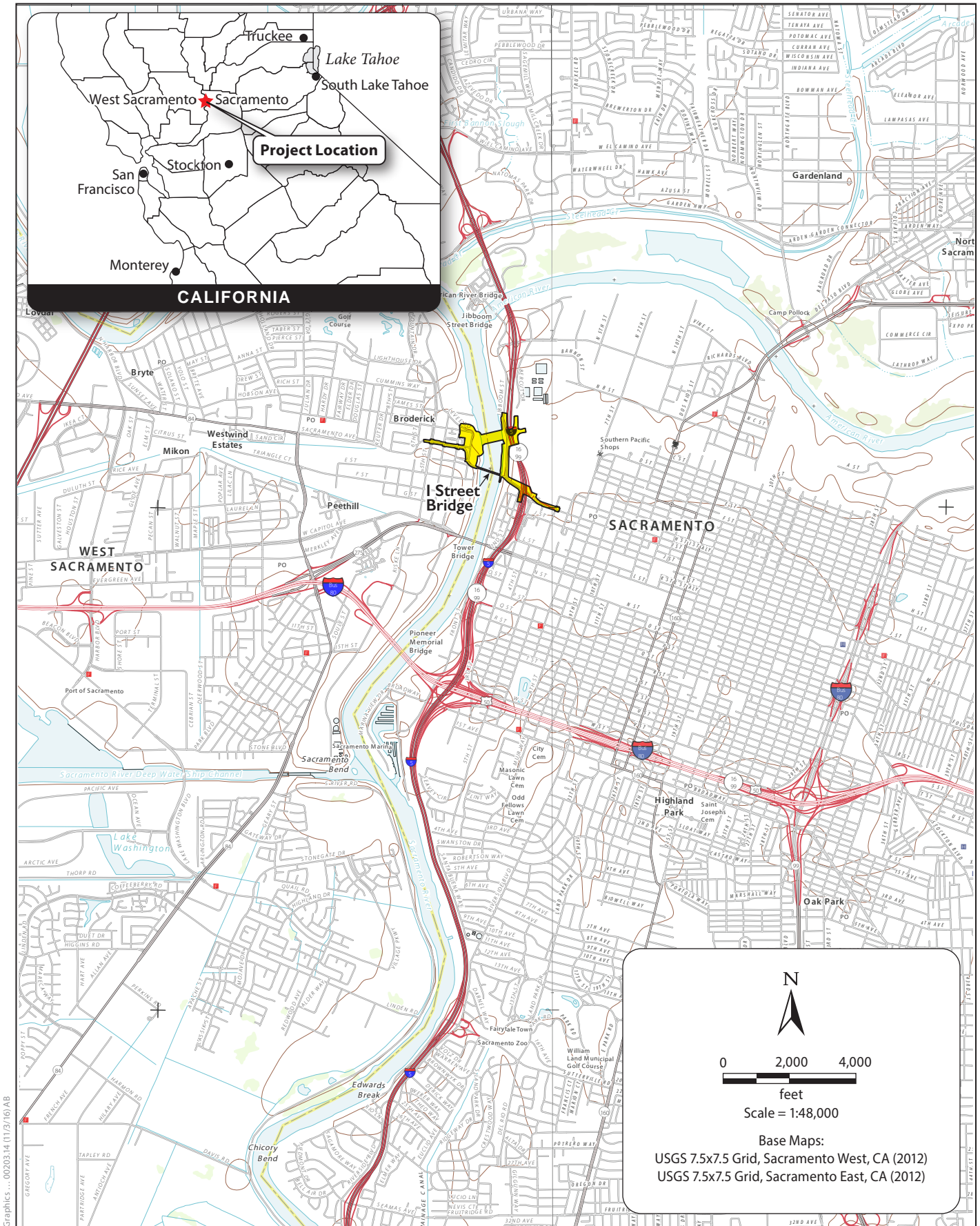
Preparers' Qualifications

Kathryn Haley is an architectural historian with over 14 years of experience in cultural resources management and has worked on a wide variety of projects involving historic research, field inventory, and site assessment conducted for compliance with Section 106, NEPA, and CEQA. With an M.A. in Public History, she meets the Secretary of the Interior's standards for historian and architectural historian. During her career with ICF, Kathryn co-authored and authored several HRER reports for Caltrans. She also has assisted in preparation of Historic Properties Inspection Reports (condition assessments) under the direction of the Naval Facilities Engineering Command in accordance with Section 106 and Section 110 of the NHPA. Moreover, Kathryn has served as project coordinator, historian, and researcher in preparation for NRHP nominations, as well as Historic American Buildings Surveys, Historic American Engineering Records, and Historic American Landscape Survey documents.

Stephen Mikesell has more than 30 years of experience in the historic preservation field. For 10 years, he was the Deputy State Historic Preservation Officer and has worked at Caltrans and with several environmental consulting firms. He also is quite experienced in evaluating historic significance for bridges and railroad properties. He is the author of *Historic Highway Bridges of California*, published in 1990; and completed a book on the Sierra Railway, *The Sierra Railway, Arcadia*, 2015. He also completed a history of the San Francisco-Oakland Bay Bridge, *A Tale of Two Bridges: The San Francisco-Oakland Bay Bridges of 1936 and 2013*, University of Nevada Press, 2017.

Appendix A **Figures**

- Figure 1. Vicinity Map
- Figure 2. Proposed Project
- Figure 3. Plan View, Profile, and Elevation
- Figure 4. Location of Geotechnical Borings Area of Potential Effects Map
- Figure 5. Survey Location Map
- Figure 6. Area of Potential Effects Map

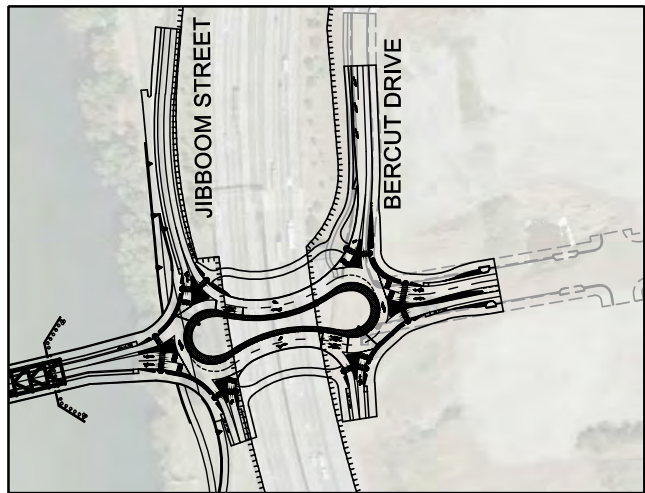
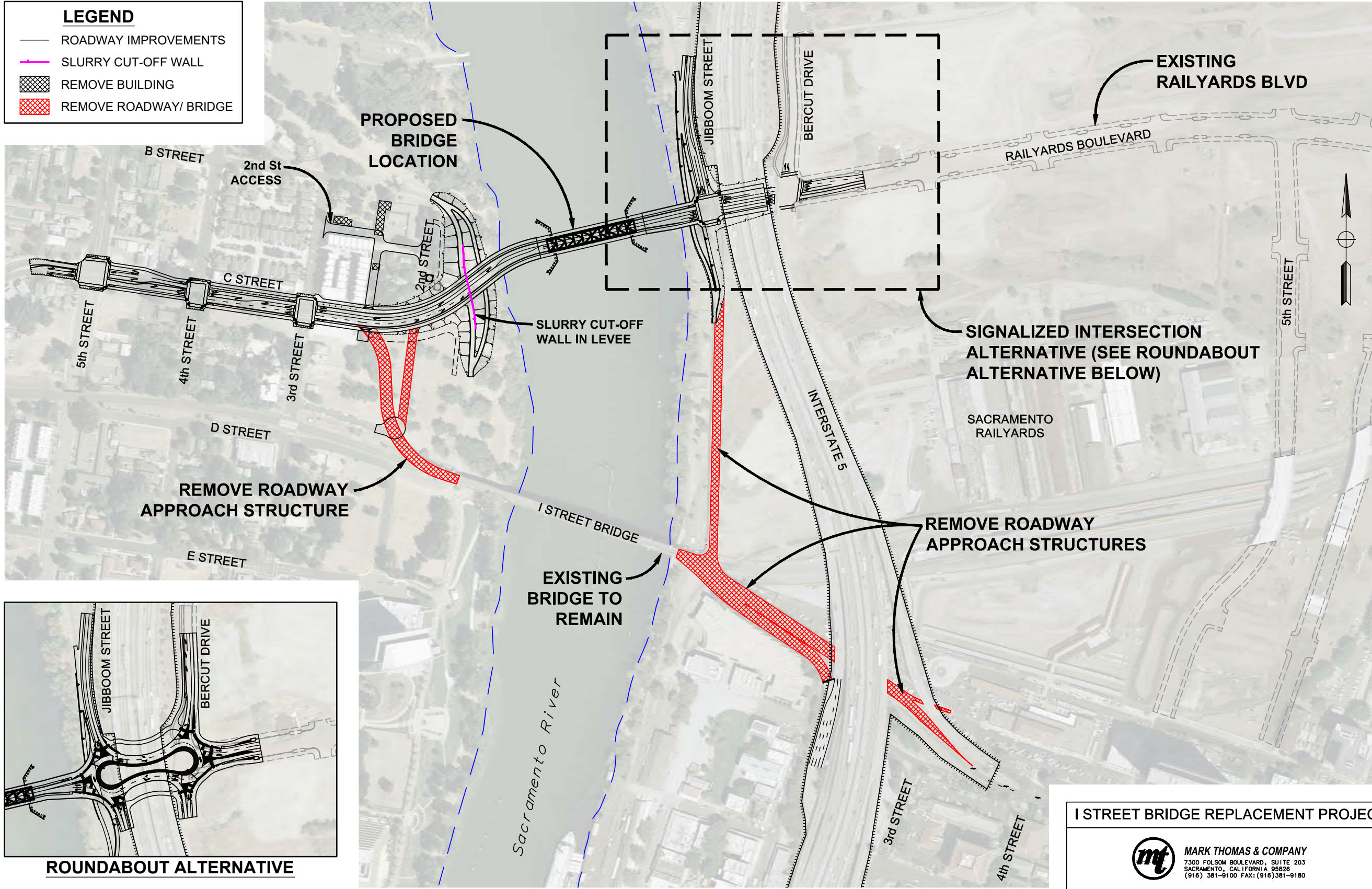


Graphics ... 002033.14 (11/17/16) AB

**Figure 1
Vicinity Map**

LEGEND

- ROADWAY IMPROVEMENTS
- SLURRY CUT-OFF WALL
- ▨ REMOVE BUILDING
- ▨ REMOVE ROADWAY/ BRIDGE



I STREET BRIDGE REPLACEMENT PROJECT



MARK THOMAS & COMPANY
 7300 FOLSOM BOULEVARD, SUITE 203
 SACRAMENTO, CALIFORNIA 95826
 (916) 381-9100 FAX: (916) 381-9180

SCALE: NTS

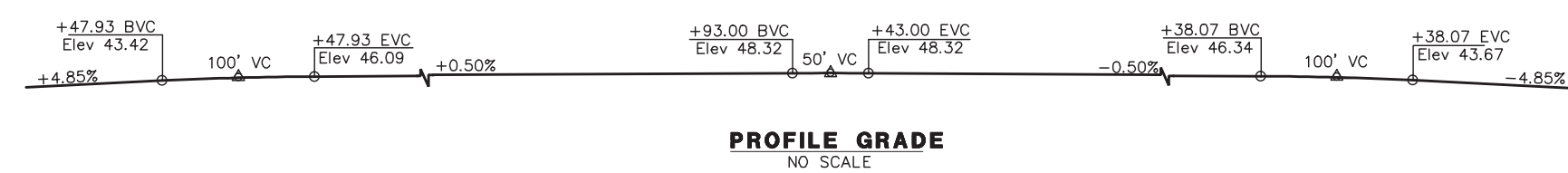
Figure 2
Proposed Project

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT
03	YOL/SAC	"C"/"RY"	N/A

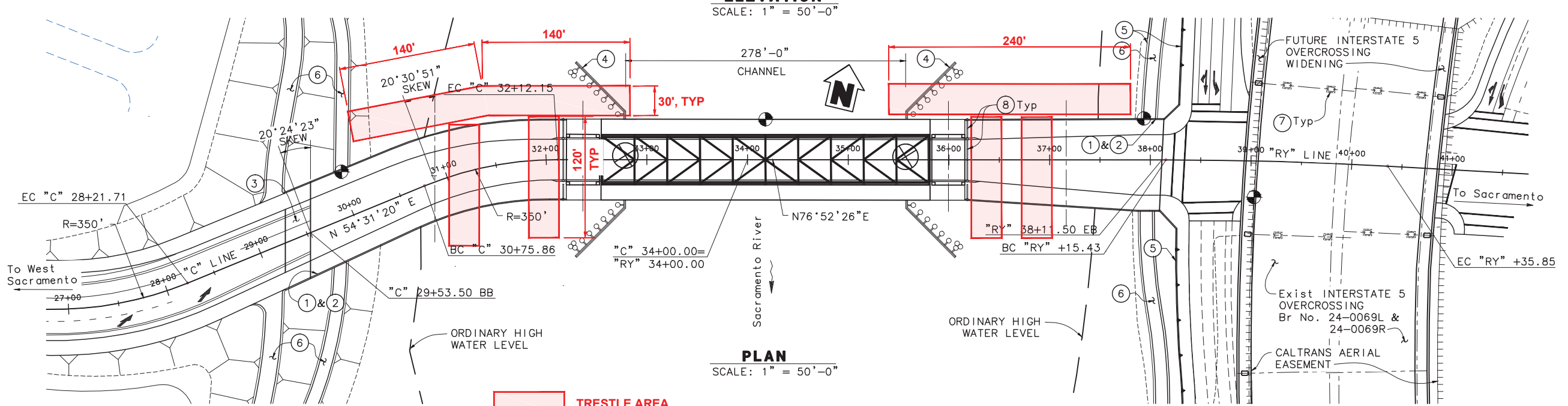
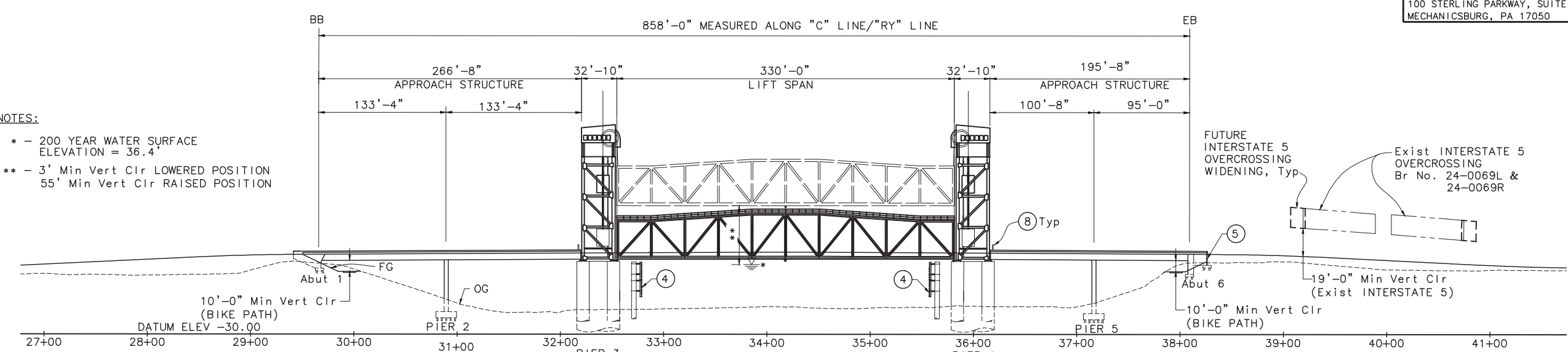
CITY OF SACRAMENTO
DEPARTMENT OF PUBLIC WORKS
915 I STREET, ROOM 2000
SACRAMENTO, CA 95814

MARK THOMAS & COMPANY, INC.
7300 FOLSOM BLVD., SUITE 203
SACRAMENTO, CA 95826

MODJESKI AND MASTERS, INC.
100 STERLING PARKWAY, SUITE 302
MECHANICSBURG, PA 17050



NOTES:
 * - 200 YEAR WATER SURFACE ELEVATION = 36.4'
 ** - 3' Min Vert Clr LOWERED POSITION
 55' Min Vert Clr RAISED POSITION



- LEGEND:
- POINT OF MINIMUM VERTICAL CLEARANCE
 - ⊗ USCG GPS TARGET LOCATION
 - ① PAINT BRIDGE NAME
 - ② PAINT BRIDGE NUMBER
 - ③ APPROACH SLAB
 - ④ FENDER SYSTEM
 - ⑤ RETAINING WALL
 - ⑥ BIKE PATH
 - ⑦ ISOLATION CASING AROUND EXISTING BRIDGE COLUMNS
 - ⑧ TRAFFIC/PEDESTRIAN GATE & WARNING SIGNAL

DESIGNED BY J. HICKEY	DATE 03-20-15	E. FREDRICKSON PROJECT ENGINEER
DRAWN BY J. DOTY	DATE 03-20-15	
CHECKED BY T. PHAM	DATE 03-20-15	
APPROVED E. FREDRICKSON	DATE 03-20-15	

ALTERNATIVE 1

PLANNING STUDY

I STREET BRIDGE (REPLACE)

BRIDGE NO. XXX	UNIT:
SCALE: AS SHOWN	PROJECT NUMBER & PHASE: 03-XXXXXX

CONTRACT NO.: X PROJECT ID: 0000000000

X DESIGN OVERSIGHT
 X SIGN OFF DATE

ADVANCE PLANNING STUDY SHEET (ENGLISH) (REV. 7/16/10)

FILE => I STREET TRESTLE EXHIBIT.DWG

DATE PLOTTED => 10-JUL-15 TIME PLOTTED => 10:41 AM USERNAME => JDOTY

Figure 3
Proposed I Street Bridge: Plan View, Profile, and Elevation



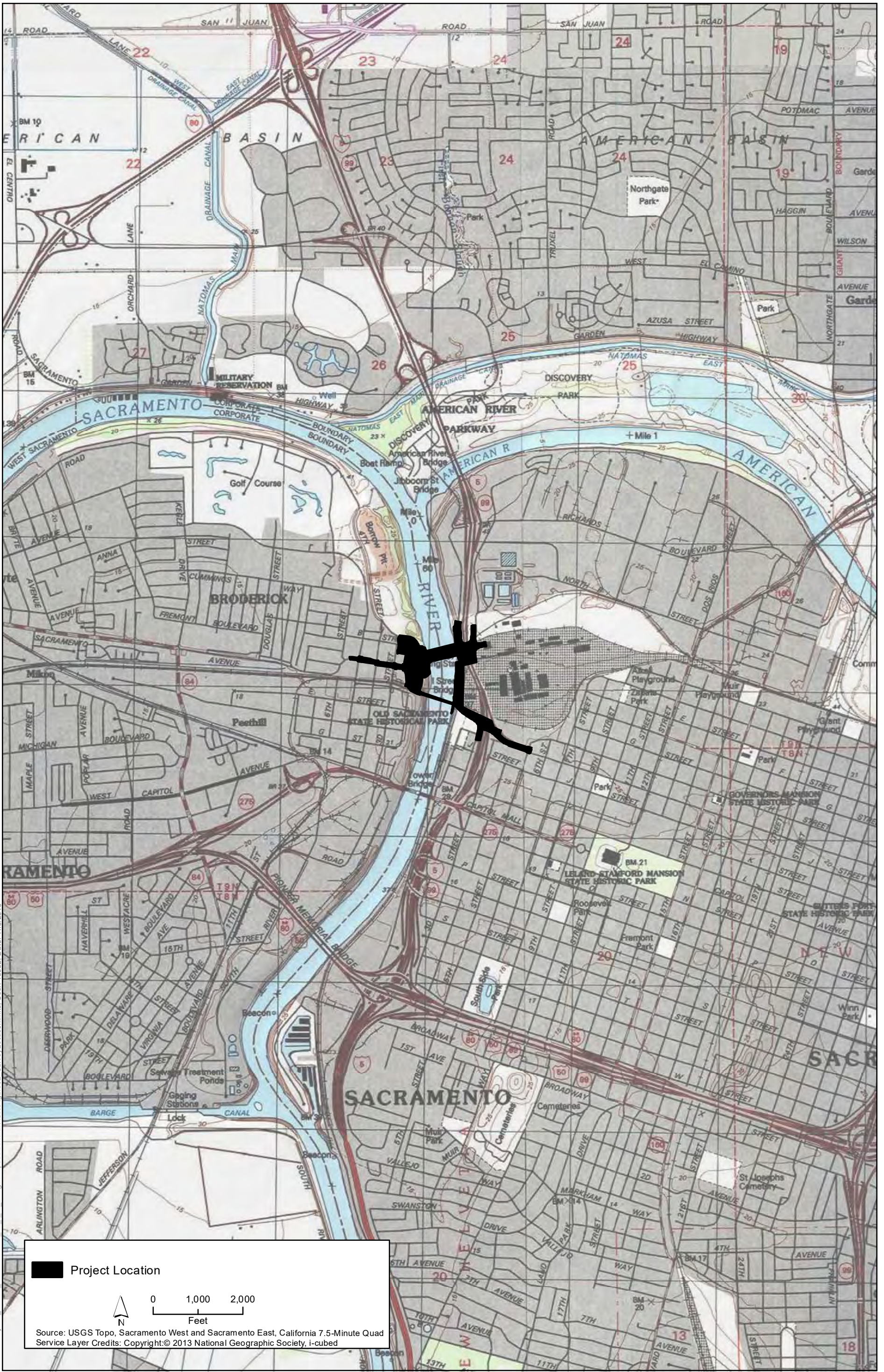
LEGEND

● EB-2 PROPOSED BORING



Source: GEI Consultants, 2016

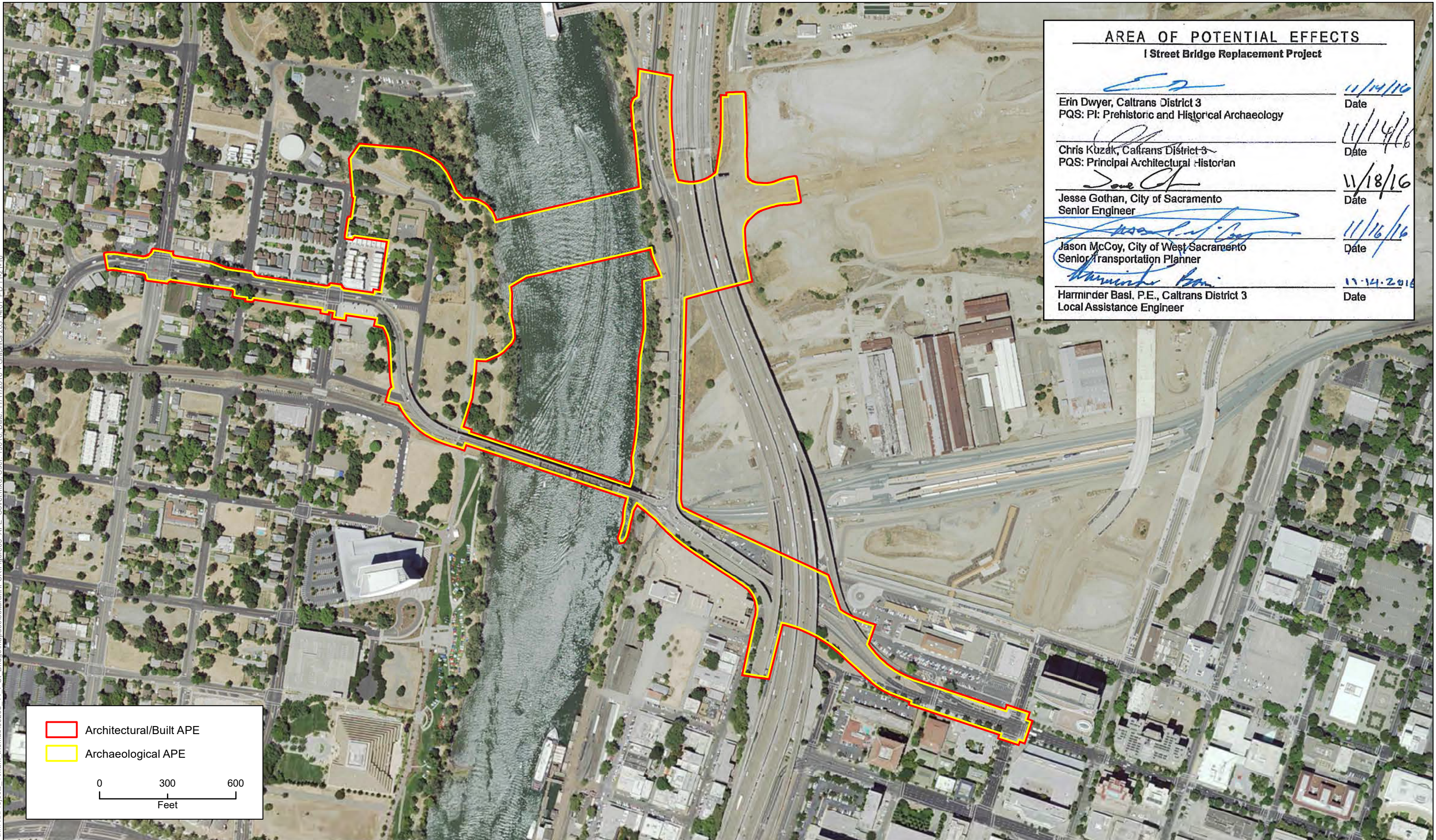
Figure 4
Location of Geotechnical Borings



Path: K:\Projects\1mark\thomas\0203_14_I_Street_Bridge\mapdoc\cultural\ASR\Figure02_SurveyLocation.mxd; User: 19932; Date: 11/3/2016

Figure 5
Survey Location Map
I Street Bridge Replacement Project (Federal-Aid# BRLS 5002(164))
Caltrans District 3, Sacramento and Yolo Counties

Path: K:\Projects\1\mark_thomas\0203_14_I_Street_Bridge\mapdoc\cultural\HPSR\Figure03_APE_Cover.mxd; User: 19016; Date: 11/11/2016 10:14:01 AM; Graphics 203.1401; PD 11-21-16





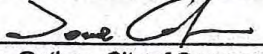

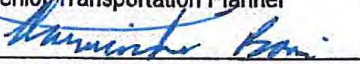
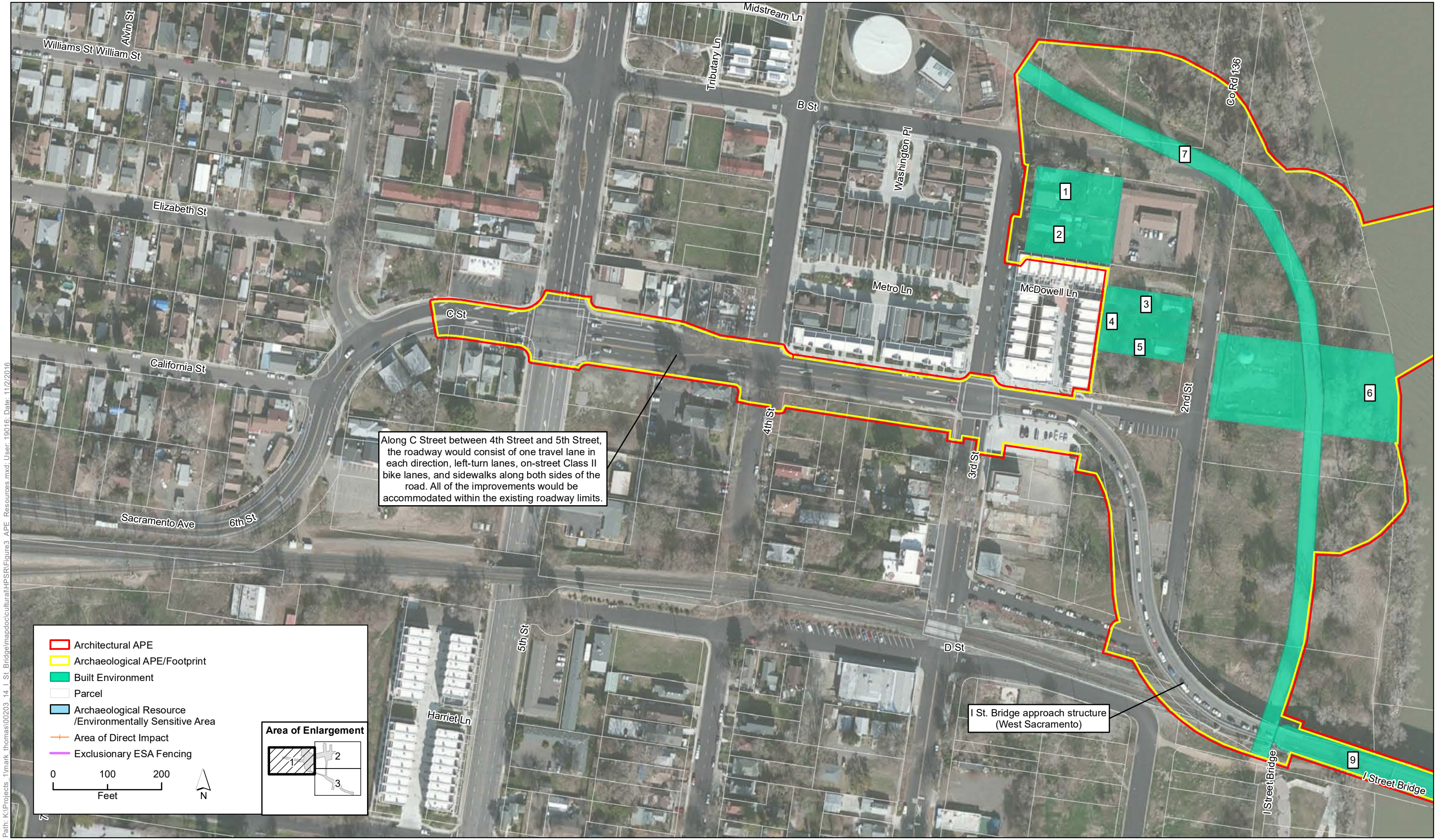
AREA OF POTENTIAL EFFECTS	
I Street Bridge Replacement Project	
 Erin Dwyer, Caltrans District 3 PQS: PI: Prehistoric and Historical Archaeology	11/14/16 Date
 Chris Kuzak, Caltrans District 3 PQS: Principal Architectural Historian	11/14/16 Date
 Jesse Gothan, City of Sacramento Senior Engineer	11/18/16 Date
 Jason McCoy, City of West Sacramento Senior Transportation Planner	11/16/16 Date
 Harminder Basl, P.E., Caltrans District 3 Local Assistance Engineer	11-14-2016 Date

Figure 6
Area of Potential Effects Map
I Street Bridge Replacement Project (Federal-Aid# BRLS 5002(164))
Caltrans District 3, Sacramento and Yolo Counties



Along C Street between 4th Street and 5th Street, the roadway would consist of one travel lane in each direction, left-turn lanes, on-street Class II bike lanes, and sidewalks along both sides of the road. All of the improvements would be accommodated within the existing roadway limits.

I St. Bridge approach structure (West Sacramento)

- ▬ Architectural APE
- ▬ Archaeological APE/Footprint
- ▬ Built Environment
- Parcel
- ▬ Archaeological Resource /Environmentally Sensitive Area
- + Area of Direct Impact
- ▬ Exclusionary ESA Fencing

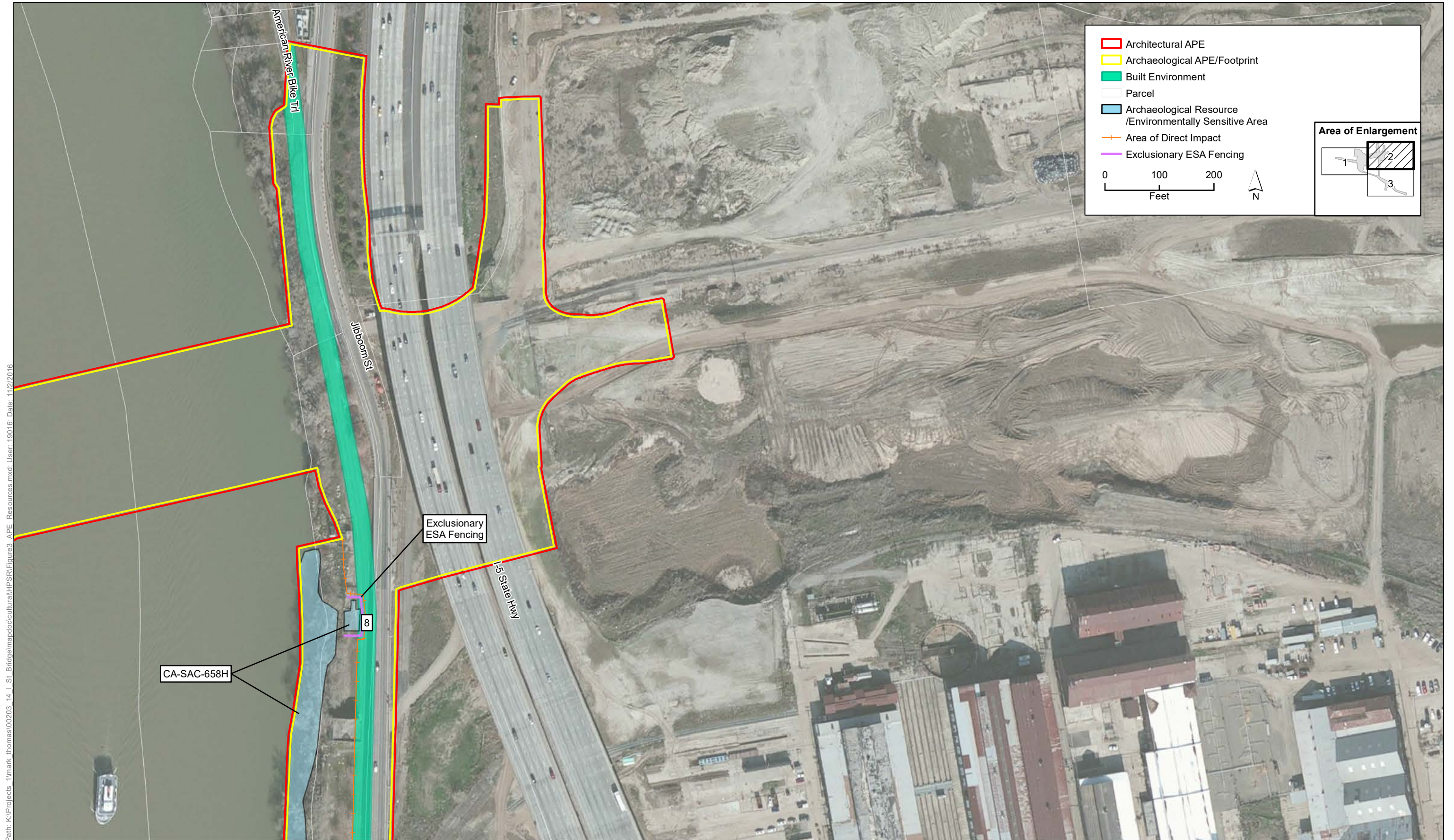
0 100 200
Feet

N

Area of Enlargement

Figure 6 - Sheet 1
Area of Potential Effects Map Detail
I Street Bridge Replacement Project (Federal-Aid# BRLS 5002(164))
Caltrans District 3, Sacramento and Yolo Counties

Path: K:\Projects\1\mark_thomas\0203_14_I_Street_Bridge\mapdoc\cultural\HP\SR\Figure3_APE_Resources.mxd; User: 19016; Date: 11/2/2016



Legend

- Architectural APE
- Archaeological APE/Footprint
- Built Environment
- Parcel
- Archaeological Resource /Environmentally Sensitive Area
- Area of Direct Impact
- Exclusionary ESA Fencing

Area of Enlargement

0 100 200
 Feet

N

1 2 3

CA-SAC-658H

Exclusionary
 ESA Fencing

8

American River Bike Trail

Jibboom St

15 State Hwy

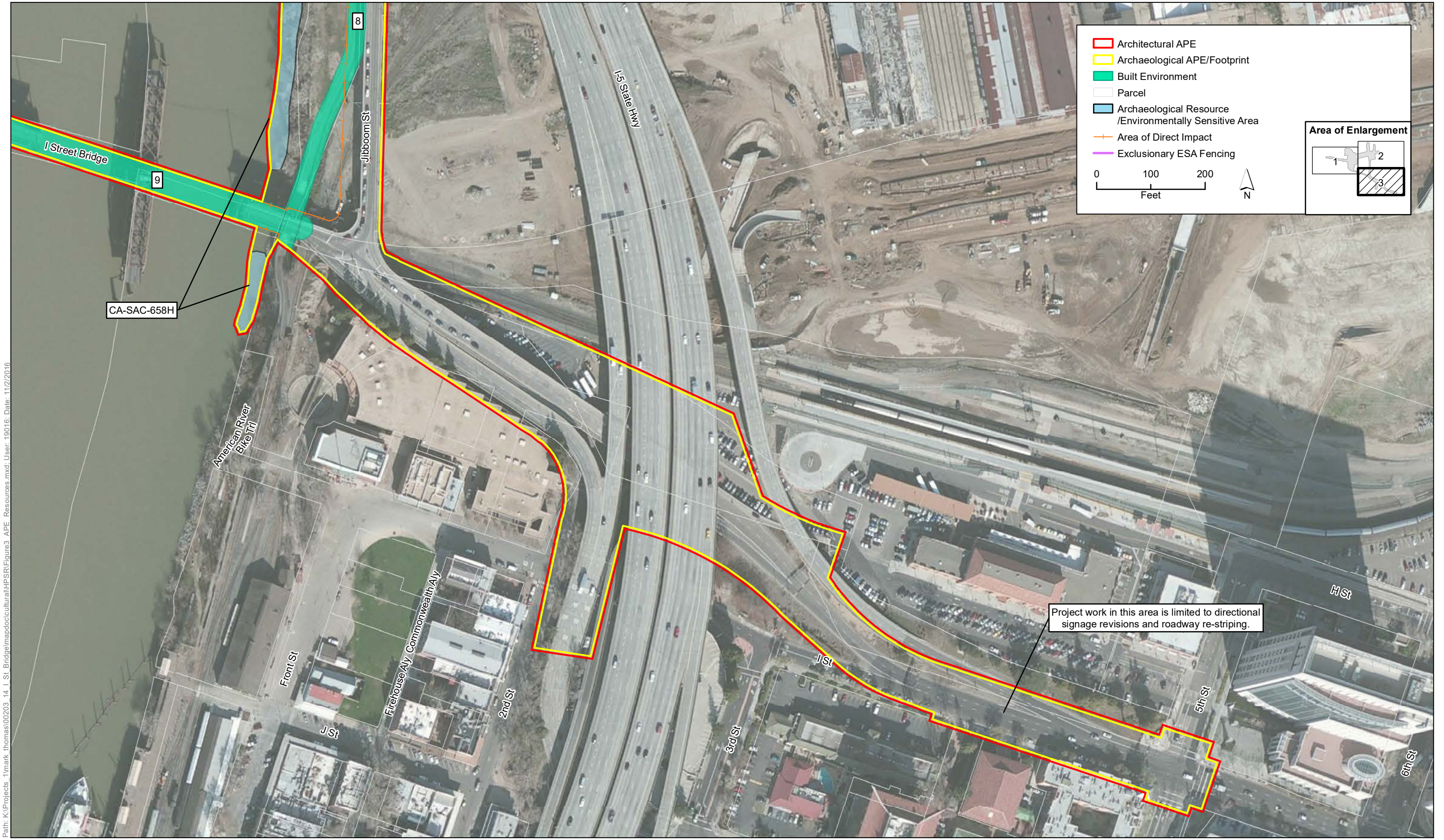


Figure 6 - Sheet 3
Area of Potential Effects Map Detail
I Street Bridge Replacement Project (Federal-Aid# BRLS 5002(164))
Caltrans District 3, Sacramento and Yolo Counties

Appendix B

Historical Society Correspondence



June 8, 2015

California State Railroad Museum
125 I Street
Sacramento, CA 95814

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

As part of our study, we are consulting all regional historical organizations to determine if there are any known historic or cultural resources that may be affected by the proposed project. Your efforts in this process will provide invaluable information for the proper identification and treatment of such resources.

If you have any questions or comments regarding cultural resources in the proposed project area, please feel free to call me at (916) 231-9544 or send an email to me at Monte.Kim@icfi.com. All comments and letters received will be included in the reports generated by this study. Thank you very much for your time regarding our request.

Sincerely,

A handwritten signature in black ink that reads "Monte Kim". The signature is written in a cursive, flowing style.

Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Center for California Studies
6000 J Street
Sacramento, CA 95819

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Sincerely,

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Center for Sacramento History
551 Sequoia Pacific Boulevard
Sacramento, CA 95814

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Portuguese Historical & Cultural Society
P.O. Box 161990
Sacramento, CA 95816

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Sacramento County Historical Society
P.O. Box 160065
Sacramento, CA 95816

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

West Sacramento Historical Society
664 Cummins Way
West Sacramento, CA 95605

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Yolo County Archives & Records Center
226 Buckeye Street
Woodland, CA 95697

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Sincerely,

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Yolo County Historical Museum
512 Gibson Road
Woodland, CA 95695

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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Sincerely,

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Monte Kim, Ph.D.
Architectural Historian



June 8, 2015

Yolo County Historical Society
P.O. Box 1447
Woodland, CA 95776

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

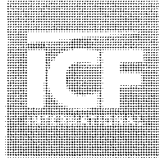
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Sincerely,

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Monte Kim, Ph.D.
Architectural Historian



July 9, 2015

Preservation Sacramento
P.O. Box 162140
Sacramento, CA 95616

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

As part of our study, we are consulting all interested historical organizations to determine if there are any important historic or cultural resources that may be affected by the proposed project. Your efforts in this process will provide invaluable information for the identification and treatment of such resources.

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Sincerely,

A handwritten signature in black ink that reads 'Monte Kim'. The signature is written in a cursive style with a horizontal line above the 'i'.

Monte Kim, Ph.D.
Architectural Historian

Enclosure

Project Vicinity and Location Maps



July 14, 2015

California Department of Parks and Recreation
1416 9th Street
Sacramento, CA 95614

Subject: I Street Bridge Replacement Project

To whom it may concern:

ICF International is conducting a cultural resources study for the City of Sacramento, the City of West Sacramento, and the California Department of Transportation (Caltrans), who are proposing to construct a new bridge over the Sacramento River to replace the existing vehicle crossing that is currently accommodated by the existing I Street Bridge in order to remove a series of functionally obsolete or structurally deficient approach structures. The new connection would reduce future traffic congestion, improve operations and safety, serve multiple modes of transportation, and comply with current American Association of State Highway and Transportation Officials, Caltrans, and local agency design standards.

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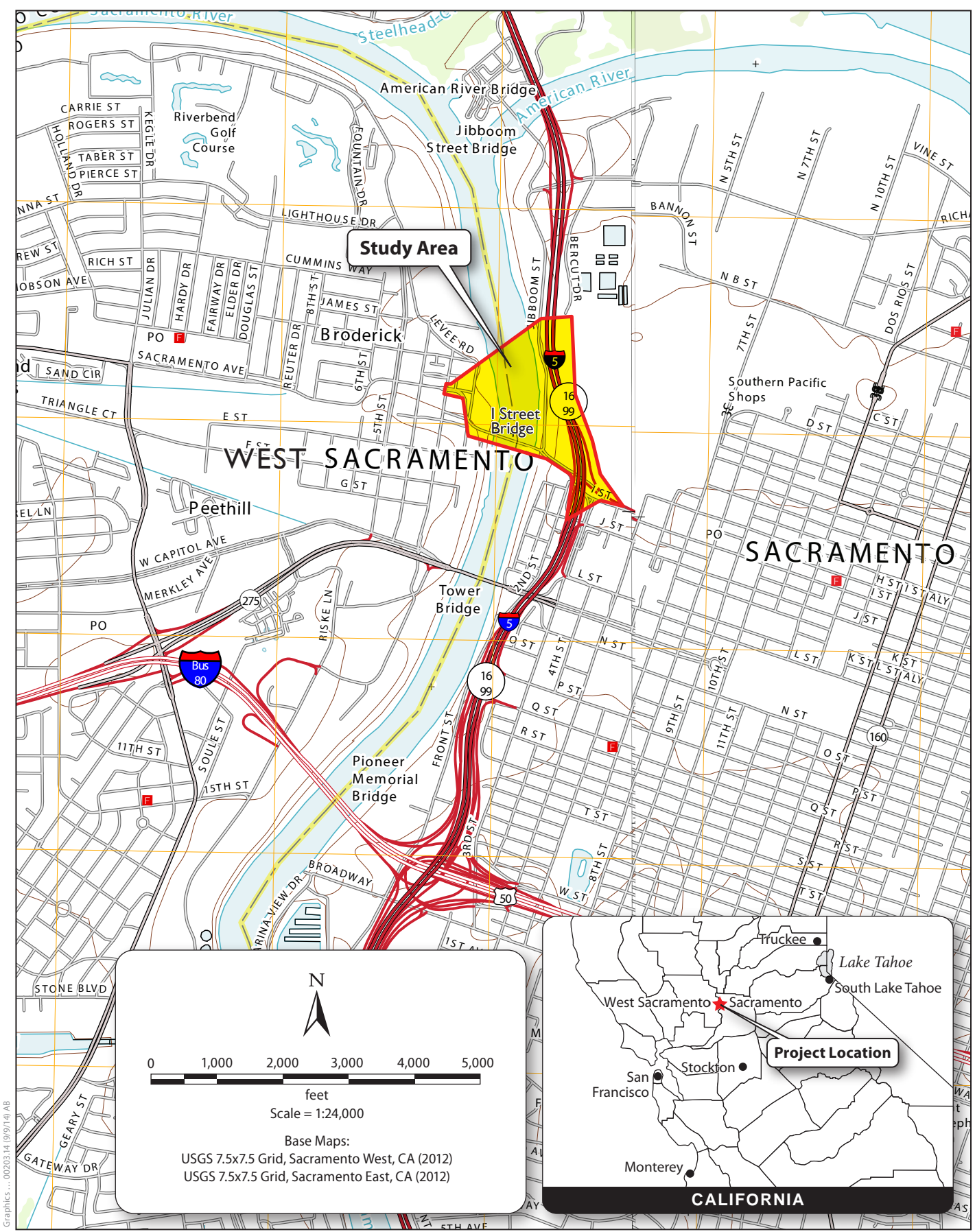
Sincerely,

A handwritten signature in black ink, appearing to read 'Monte Kim'.

MK Monte Kim, Ph.D.
Architectural Historian

Enclosure

Project Vicinity and Location Maps



Graphics ... 002033.14 (9/9/14) AB



Location Map

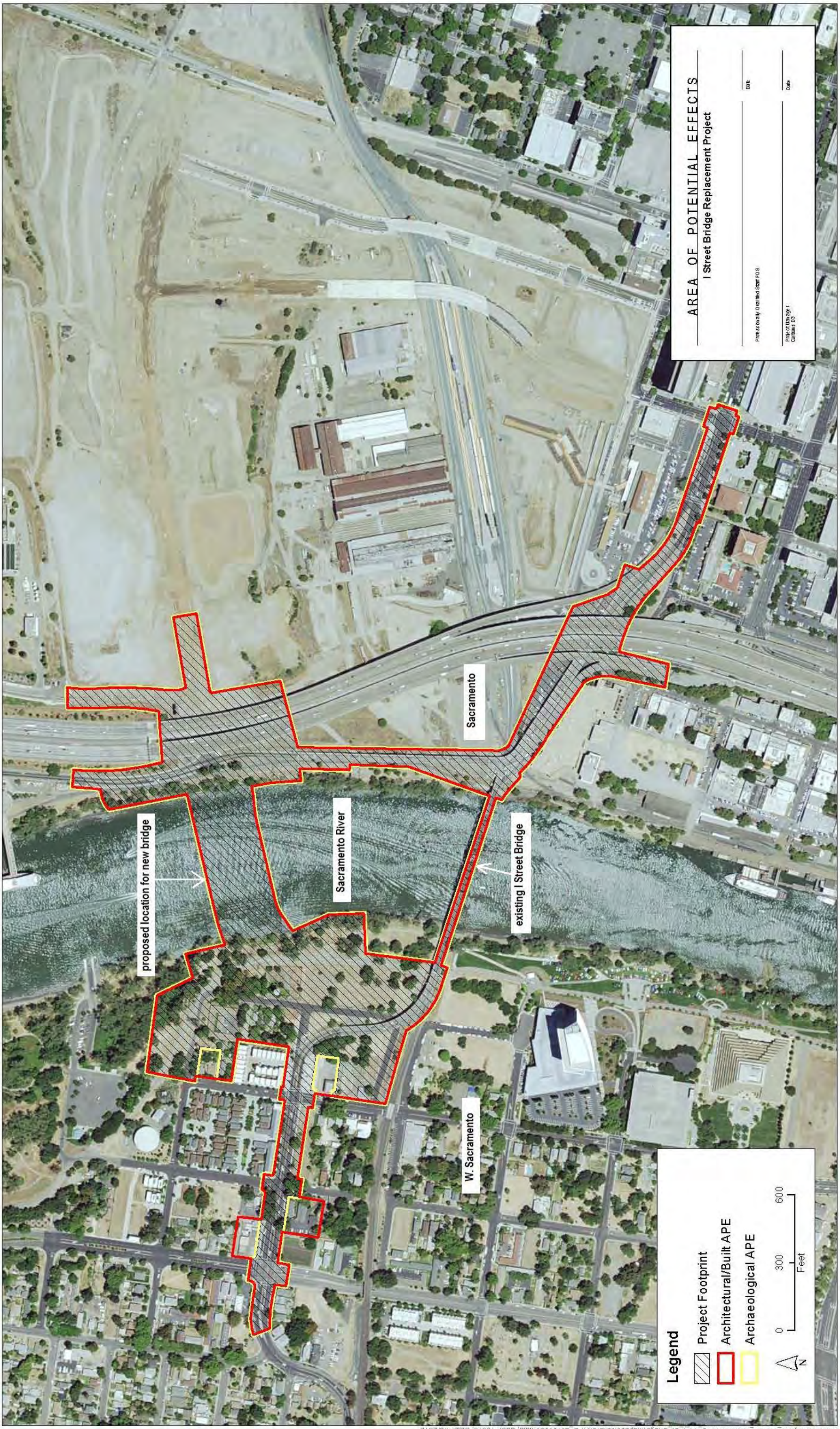


Figure 1
Area of Potential Effects
I Street Bridge

Path: K:\Projects\1001001\1001001_14_I_Street_Bridge\mapdoc\cultural\APE_20150326.mxd; User: 19016; Date: 4/9/2015

From: Haley, Kathryn
To: ["Kyle.wyatt@parks.ca.gov"](mailto:Kyle.wyatt@parks.ca.gov)
Subject: I St. Bridge Project
Date: Saturday, May 14, 2016 12:52:00 PM
Attachments: [Figure03_APE-fs.pdf](#)

Hi Kyle,

As per our conversation several weeks ago, attached please find our revised APE for the I St. Bridge Project. Please review it and let me know if you have any questions about project or known cultural resources in the APE.

All the best,

Katie

KATHRYN HALEY, MA | Senior Associate, Historical Resources | 1.916.231.9527 office | kathryn.haley@icfi.com | icfi.com
ICF INTERNATIONAL | 630 K Street, Suite 400, Sacramento, CA 95814 USA | 1.916.949.9687 mobile
Connect with us on [social media](#).

Appendix C
Programmatic Agreement

PROGRAMMATIC AGREEMENT BETWEEN THE CALIFORNIA DEPARTMENT OF TRANSPORTATION AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING I STREET BRIDGE REPLACEMENT PROJECT SACRAMENTO COUNTY AND YOLO COUNTY, CALIFORNIA

WHEREAS, the Federal Highway Administration (FHWA), has assigned and California Department of Transportation (Caltrans) has assumed FHWA responsibility for environmental review, consultation, and coordination under the provisions of the *Memorandum of Understanding (MOU) between the Federal Highway Administration and the California Department of Transportation Concerning the State of California's Participation in the Project Delivery Program Pursuant to 23 U.S.C. 327*, which became effective on December 23, 2016, and applies to this undertaking; and

WHEREAS, pursuant to the January 2014 *First Amended Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, As It Pertains to the Administration of the Federal-Aid Highway Program in California* (Section 106 PA), Caltrans is deemed to be a federal agency for all highway-aid projects it has assumed, and in that capacity Caltrans has assigned the role of "agency official" to the Caltrans Division of Environmental Analysis (DEA) Chief for the purpose of compliance with 36 Code of Federal Regulations (CFR) Part 800 and is responsible for oversight of District environmental responsibilities. To provide for effective compliance, day to-day responsibilities and coordination of the Section 106 process are further delegated to the DEA Cultural Studies Office (CSO) Chief; and

WHEREAS, Caltrans, the City of Sacramento, and the City of West Sacramento (the Cities), proposes to implement the federally funded I Street Bridge Replacement Project (Undertaking) crossing the Sacramento River between the City of Sacramento in Sacramento County and the City of West Sacramento in Yolo County, which would replace the existing bridge with a new bridge, as described in Attachment A (Project Description); and

WHEREAS, Caltrans has consulted with the State Historic Preservation Officer (SHPO) regarding the Undertaking's potential to affect historic properties, and has decided to prepare a programmatic agreement (PA) pursuant to Stipulation XII.A of the Section 106 PA and 36 CFR Section 800.4(b)(2) and 800.14(b), and will file a copy of this PA with the Advisory Council on Historic Preservation (ACHP) pursuant to Stipulation X.C.4 of the Section 106 PA; and

WHEREAS, the Undertaking's Area of Potential of Effects (APE) as depicted in Attachment B (Project Maps) includes maximum existing or proposed right-of-way for all alternatives under consideration, easements (temporary and permanent), all improved properties subject to temporary or permanent changes in access (ingress and egress), and areas where visual or audible changes could occur outside the required right-of-way; and

2019 MAY - 6 9 59

RECEIVED
CITY CLERK'S OFFICE
CITY OF SACRAMENTO

WHEREAS, Caltrans, in consultation with the SHPO, has determined that the Undertaking will not have an adverse effect on the National Register of Historic Places- (NRHP-) listed I Street Bridge or the NRHP-eligible Sacramento River East Levee; and

WHEREAS, Caltrans, in consultation with the SHPO, finds that the Undertaking's APE has a moderate potential to contain subsurface archaeological deposits which currently cannot be assessed with traditional archaeological survey methods due to access and regulatory constraints at properties in close proximity to the West Sacramento river levee where Extended Phase I testing is proposed, and because of the paved and heavily vegetated surface areas that cannot be adequately assessed with traditional archaeological survey methods.; and

WHEREAS, Caltrans, in consultation with the SHPO and the Cities, has chosen to prepare this PA pursuant to 36 CFR §800.14(b) as the appropriate means to ensure completion of the final identification and evaluation of potential historic properties currently limited by restricted access, and provide for the resolution of any adverse effects on historic properties within the Undertaking's APE subsequent to its approval of the Undertaking; and

WHEREAS, Caltrans District 3 and the Cities have a responsibility to fulfill the terms of this PA and are participating as invited signatories; and

WHEREAS, the Cities, in conjunction with Caltrans, have initiated consultation with the Cortina Band of Indians, the Shingle Springs Band of Miwok Indians, the T'si-Akim Maidu, the United Auburn Indian Community of the Auburn Rancheria, and the Yocha Dehe Wintun Nation, and Eileen Moon and April Wallace Moore, regarding the Undertaking and its potential adverse effect on historic properties; will continue to consult with them and afford them, should they so desire, the opportunity to actively participate in implementation of the Undertaking itself and this PA; and

WHEREAS, Caltrans has invited the United Auburn Indian Community of the Auburn Rancheria and the Yocha Dehe Wintun Nation to sign this PA as concurring parties; and

NOW, THEREFORE, Caltrans and the SHPO agree that upon Caltrans' decision to proceed with the Undertaking, Caltrans shall ensure that the Undertaking is implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties, and further agree that these stipulations shall govern the Undertaking and all of its parts until this PA expires or is terminated.

STIPULATIONS

This PA outlines the phased identification approach required to complete Section 106 compliance for the proposed Undertaking. Caltrans shall ensure that the following stipulations are carried out upon right-of-way acquisition and prior to construction:

I. AREA OF POTENTIAL EFFECTS

- A. The APE for the Undertaking was designed in accordance with Stipulation VIII.A of the Section 106 PA and is depicted in Attachment B (Project Maps) to this PA. The APE comprises the areas required to construct a new bridge over the Sacramento River, both permanent and temporary. The vertical APE includes the depth of grading and excavation needed to construct the bridge structure and remove the old approaches. An Area of Direct Impact (ADI) has been defined by the grading plans based on the maximum extent of ground-disturbing activities.
- B. If modifications to the Undertaking subsequent to the execution of this PA necessitate revision of the APE, District 3 will consult with Caltrans and the SHPO to facilitate mutual agreement on the subject revisions. If Caltrans, District 3, and the SHPO cannot reach such agreement, then the parties to this PA shall resolve the dispute in accordance with Stipulation VIII.C below. If Caltrans, District 3, and the SHPO reach mutual agreement on the proposed revisions, then District 3 will submit a final map of the revisions, consistent with the requirements of Stipulation VIII.A and Attachment 3 of the Section 106 PA no later than thirty (30) days following such agreement. Any additional required identification and evaluation efforts necessitated due to changes to the APE will be undertaken consistent with the requirements of Stipulation VIII.B and VIII.C of the Section 106 PA. Amendment of the APE will not require an amendment to the PA. The revised APE and supporting documentation shall be incorporated into Attachment A to this PA.

II. PHASED IDENTIFICATION AND EVALUATION OF HISTORIC PROPERTIES

- A. Caltrans has chosen, pursuant to Section 106 PA Stipulation XII, to complete the final identification and evaluation of historic properties in the Undertaking's APE subsequent to the agency's approval of the Undertaking.

Caltrans, District 3, and the Cities shall ensure that identification of archaeological sites is conducted pursuant to the *Cultural Resources Management Plan for the I Street Bridge Replacement Project, City of Sacramento and City of West Sacramento, California* (ICF 2018) (CRMP). The CRMP, dated August 2018, is appended to this PA as Attachment C. The CRMP will be used to provide context and guide the identification, evaluation, assessment of effects and treatment to resolve adverse effects to historic properties as a result of construction activities.

1. Due to the lack of surface visibility and potential for subsurface archaeological resources, Extended Phase I testing will take place adjacent to the West Sacramento river levee prior to construction. The testing will occur on properties where both access and permission to conduct the testing is granted by the property owner and regulatory agencies prior to construction. Extended Phase I testing in the form of archaeological monitoring of geotechnical borings will also occur prior to construction. The Extended Phase I Proposal, testing, and reporting will occur in accordance with the CRMP.

2. If no archaeological resources are identified during XPI testing, an XPI Report will be prepared. Caltrans District 3 will circulate the draft XPI Report to the other PA parties who will be afforded 30 days following receipt of the draft report to submit any written comments to District 3. Failure of these parties to respond within this time frame shall not preclude District 3 from authorizing revisions to the draft report, as District 3 may deem appropriate. District 3 will provide the other PA parties with written documentation indicating whether and how the draft report will be modified in accordance with any comments received from the other PA parties. Unless any PA party objects to this documentation in writing to District 3 within 15 days following receipt, District 3 may modify the draft report, as District 3 may deem appropriate. Thereafter, District 3 may issue the Final XPI Report and distribute the document to the PA parties.
3. If archaeological resources are identified as a result of Extended Phase I testing, and those resources can be protected during construction from any project effects by the establishment and effective enforcement of an Environmentally Sensitive Area (ESA), those resources may be considered eligible for the National Register of Historic Places (NRHP) for the purposes of the Undertaking without conducting additional subsurface testing or surface collecting in accordance with Stipulation VIII.C.3 of the Section 106 PA. An ESA Action Plan is appended to this PA as Attachment D.
4. If archaeological resources are identified during the Extended Phase I testing that cannot be protected by establishment of an ESA, Phase II evaluation excavations and data recovery will occur. A draft Phase II Evaluation and Data Recovery Proposal will be prepared. Caltrans District 3 will circulate the draft proposal to the other PA parties who will be afforded 30 days following receipt of the draft proposal to submit any written comments to District 3. Failure of these parties to respond within this time frame shall not preclude District 3 from authorizing revisions to the draft proposal, as District 3 may deem appropriate. District 3 will provide the other PA parties with written documentation indicating whether and how the draft proposal will be modified in accordance with any comments received from the other PA parties. Unless any PA party objects to this documentation in writing to District 3 within 15 days following receipt, District 3 may modify the draft proposal, as District 3 may deem appropriate. Thereafter, District 3 may issue the Final Phase II Evaluation and Data Recovery Proposal and distribute the document to the PA parties. The Phase II Evaluation and Data Recovery Proposal, fieldwork, and report will occur in accordance with the CRMP.
5. Within six months of completion of the Phase II evaluation and data recovery fieldwork, a Phase II Evaluation and Data Recovery Report will be prepared. Caltrans District 3 will circulate the draft report to the other PA parties who will be afforded 30 days following receipt of the draft report to submit any written comments to District 3. Failure of these parties to respond within this time frame shall not preclude District 3 from authorizing revisions to the draft report, as District 3 may deem

appropriate. District 3 will provide the other PA parties with written documentation indicating whether and how the draft report will be modified in accordance with any comments received from the other PA parties. Unless any PA party objects to this documentation in writing to District 3 within 15 days following receipt, District 3 may modify the draft report, as District 3 may deem appropriate. Thereafter, District 3 may issue the Final Phase II Evaluation and Data Recovery Report and distribute the document to the PA parties.

6. For all areas where Extended Phase I testing cannot occur prior to construction, including areas where access is not granted by flood regulatory agencies or areas obscured by pavement or otherwise covered, construction monitoring will occur according to provisions in the CRMP. The evaluations, effects determinations, and potential mitigation for archaeological resources identified during construction will follow the provisions in the CRMP.
 7. The archaeological monitor, in consultation with the District 3 PQS, shall assess the effects of the Undertaking on any properties listed, eligible, or considered eligible for the NRHP within the APE for that stage in accordance with Caltrans policies and guidelines, and as outlined in the CRMP.
 8. Within six months of the completion of project construction, a Final Monitoring Report will be prepared. Caltrans District 3 will circulate the draft report to the other PA parties who will be afforded 30 days following receipt of the draft report to submit any written comments to District 3. Failure of these parties to respond within this time frame shall not preclude District 3 from authorizing revisions to the draft report, as District 3 may deem appropriate. District 3 will provide the other PA parties with written documentation indicating whether and how the draft report will be modified in accordance with any comments received from the other PA parties. Unless any PA party objects to this documentation in writing to District 3 within 15 days following receipt, District 3 may modify the draft report, as District 3 may deem appropriate. Thereafter, District 3 may issue the Final Phase II Evaluation and Data Recovery Report and distribute the document to the PA parties.
- B. Caltrans will not authorize the execution of any Undertaking activity that may affect (36 CFR § 800.16[i]) historic properties in the Undertaking's APE prior to the completion of any appropriate fieldwork defined herein.

III. MEASURES AND COMMITMENTS

- A. The Cities have developed a research design as part of the CRMP for the prehistory of the project area that provides an archaeological context as well as prehistoric and historic-era research themes and questions appropriate to known site types within the valley proper. The research design will serve as guidance for future archaeological investigations in the region.

- B. An ESA Action Plan has been prepared for one archaeological site, and two built environment properties located within the APE that will not be affected by the Undertaking. The ESA Action Plan, included as Attachment D to this PA, includes conditional measures to ensure that the project will not result in adverse effects to historic properties as the project moves forward into final design, and through construction and completion. Measures to protect and avoid these sites, and may be updated as needed during implementation of the Undertaking. If Caltrans determines that revisions to the current ESAs are necessary, which would not adversely affect a historic property, Caltrans shall inform the consulting parties of the revisions and afford them a 15-day opportunity to object. If Caltrans determines that revisions to the current ESAs would adversely affect a historic property that was previously determined to have no adverse effect, Caltrans shall reinitiate consultation with the SHPO and the Tribes regarding additional adverse effects on historic properties. If there are no objections, Caltrans shall move forward with revisions to the ESA Action Plan, which will then be provided to the consulting parties. Amendment of the ESA Action Plan will not require an amendment to the PA.
- C. The Cities, in conjunction with Caltrans, have agreed to prepare an interpretive panel outlining the history and significance of the I Street Bridge. The Cities, in conjunction with Caltrans, also have agreed to submit the design and interpretive material for this panel to the SHPO for comment and approval before finalizing design for the panel. The timeline for preparing the interpretive panel is located in the ESA Action Plan, included as Attachment D.
- D. The Cities shall ensure that any adverse effects of the Undertaking on historic properties are resolved pursuant to the CRMP.
- E. Upon completion of the Final Monitoring Report specified in the CRMP, archaeological materials deemed suitable by the PA parties for curation will be transferred by the Cities to a facility that meets the standards set forth in Curation of Federally Owned and Administered Archeological Collections (36 CFR Section 79).
- F. Any party to this PA may propose to amend the CRMP. Such amendment will not require amendment of this PA.
 - a. Consultation among the PA parties on major amendments to the CRMP will be 30 days in duration, with the option for extensions and subsequent reviews.
 - b. Consultation among the PA parties on amendments related to finds during construction will take no more than 10 business days.

IV. REPORTING REQUIREMENTS AND RELATED REVIEWS

- A. Within 30 days after District 3 and the Cities have determined that all fieldwork required under Stipulation II has been completed, District 3 and the Cities will ensure preparation, and concurrent distribution to the other PA parties for a 30-day review and comment period, a brief letter report that summarizes the field efforts and the preliminary finds that resulted from them. Comments will be shared with SHPO prior to finalization of the

letter report. The finalized letter report will then subsequently be distributed to the PA parties.

- B. Within 12 months after District 3 has determined that all relevant fieldwork required by Stipulation II has been completed, the Cities, in conjunction with District 3, will ensure preparation and subsequent concurrent distribution to the other PA parties, for review and comment, the Final Monitoring Report that documents the results of the final identification and evaluation of historic properties efforts. The other PA parties will be afforded 30 days following receipt of the draft technical report(s) to submit any written comments to District 3. Failure of these parties to respond within this time frame shall not preclude District 3 from authorizing revisions to the draft technical report(s), as District 3 may deem appropriate. District 3 will provide the other PA parties with written documentation indicating whether and how the draft technical report(s) will be modified in accordance with any comments received from the other PA parties. Unless any PA party objects to this documentation in writing to District 3 within 30 days following receipt, District 3 may modify the draft technical report(s), as District 3 may deem appropriate. Thereafter, District 3 may issue the technical report(s) in final form and distribute the document(s) in accordance with paragraph C of this stipulation.
- C. Copies of the final technical report(s) documenting the results of the final identification and evaluation of historic properties efforts will be distributed by Caltrans to the other PA parties and to the North Central Information Center and the Northwest Information Center of the California Historic Resources Information System.

V. NATIVE AMERICAN CONSULTATION

The Cities have consulted with Native American groups and individuals (listed in Attachment E of this PA) identified by the Native American Heritage Commission regarding the proposed Undertaking and its effects on historic properties, will continue to consult with them, and will afford them, should they so desire, the opportunity to participate in implementation of the PA and of the Undertaking. As a result of this consultation, the United Auburn Indian Community of the Auburn Rancheria and the Yocha Dehe Wintun Nation have been invited to concur in this PA. Should any of the remaining parties consulted desire, individually, to participate as a PA party as herein set forth, Caltrans will make an effort to reach a consensus with each such party regarding the manner in which they may participate in implementation of this PA and the Undertaking, and regarding any time frames or other matters that may govern the nature, scope, and frequency of such participation.

VI. TREATMENT OF HUMAN REMAINS OF NATIVE AMERICAN ORIGIN

As legally mandated, human remains and related items discovered during implementation of the terms of this Agreement and the Undertaking will be treated in accordance with the requirements of Health and Safety Code Section 7050.5(b). If pursuant to Health and Safety Code § 7050.5(c), the coroner determines that the human remains are or may be those of a Native American, then the discovery shall be treated in accordance with the provisions of Public Resources Code § 5097.98 (a)(d). The County Coroner shall be contacted if human remains are discovered. The County Coroner shall have two working days to inspect the

remains after receiving notification. During this time, all remains, associated soils, and artifacts shall remain in situ and/or on site, and shall be protected from public viewing. This may include restricting access to the discovery site and the need to hire 24 hour security.

The County Coroner has 24 hours to notify the Native American Heritage Commission (NAHC). The NAHC shall then notify a Most Likely Descendant (MLD), who has 48 hours to make recommendations to the landowner. District 3 shall contact the California SHPO and the Most Likely Descendent(s) within 24 hours of the County Coroner's determination that the remains are Native American in origin. The County shall ensure that the views of the Most Likely Descendent(s), as determined by the California Native American Commission, is taken into consideration when discussions are made about the disposition of Native American human remains and associated objects. The County shall take appropriate measures to protect the discovery site from disturbance during any negotiations. Information concerning the discovery shall not be disclosed to the public pursuant to the specific exemption set forth in California Government Code Section 6254.5(e).

VII. DISCOVERIES AND UNANTICIPATED EFFECTS

If Caltrans, in conjunction with the Cities, determines, after construction of the Undertaking has commenced, that the Undertaking will affect a previously unidentified property that may be eligible for listing in the NRHP, or affect a known historic property in an unanticipated manner, the Cities will address the discovery or unanticipated effect in accordance with the CRMP. Caltrans at its discretion may hereunder assume any discovered property to be eligible for listing in the NRHP in accordance with 36 CFR § 800.13(c).

VIII. ADMINISTRATIVE PROVISIONS

A. STANDARDS

1. **Definitions.** The definitions provided at 36 CFR § 800.16 are applicable throughout this PA.
2. Parties to this agreement are defined as follows:
 - a. **Signatory parties** have the sole authority to execute, amend, or terminate the PA.
 - b. **Invited signatories** have the authority to amend or terminate the PA.
 - c. **Concurring parties** signing the PA do so to acknowledge their agreement or concurrence with the PA, but have no legal authority under the PA to terminate or amend the PA. Concurring with the terms of the PA does not constitute their agreement with the Undertaking.
3. **Professional Qualifications.** The Cities in conjunction with Caltrans will ensure that only individuals meeting the Secretary of the Interior's Professional

Qualification Standards for Archeology and Historic Preservation (48 FR 44738-39) in the relevant field of study carry out or review appropriateness and quality of the actions and products required by Stipulations II, III, IV, and V in this PA. However, nothing in this stipulation may be interpreted to preclude the Cities or any agent or contractor thereof from using the properly supervised services of persons who do not meet the Secretary of the Interior's Professional Qualification Standards.

4. **Documentation Standards.** Written documentation of activities prescribed by Stipulations II, III, IV, and V of this PA shall conform to the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 Federal Register 44716–44740), as well as to applicable standards and guidelines established by the SHPO.
5. **Curation and Curation Standards.** The Cities in conjunction with Caltrans shall ensure that, to the extent permitted under § 5097.98 and § 5097.991 of the California Public Resources Code, the materials and records resulting from the activities prescribed by this PA are curated in accordance with the California Office of Historic Preservation's "Guidance for the Curation of Archaeological Collections" (i.e., 1993 State Curation Guidelines).

B. CONFIDENTIALITY

The PA parties acknowledge that historic properties covered by this PA are subject to the provisions of § 304 of the NHPA and § 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this PA are consistent with said sections.

C. RESOLVING OBJECTIONS

1. Should any party to this PA object at any time in writing to the manner in which the terms of this PA are implemented, to any action carried out or proposed with respect to implementation of the PA (other than the Undertaking itself), or to any documentation prepared in accordance with and subject to the terms of this PA, Caltrans shall immediately notify the other PA parties of the objection, request their comments on the objection within 15 days following receipt of Caltrans' notification, and proceed to consult with the objecting party for no more than 30 days to resolve the objection. Caltrans will honor the request of the other PA parties to participate in the consultation and will take any comments provided by those parties into account.
2. If the objection is resolved during the 30-day consultation period, Caltrans may proceed with the disputed action in accordance with the terms of such resolution.
3. If at the end of the 30-day consultation period, Caltrans determines that the objection cannot be resolved through such consultation, then Caltrans shall forward all documentation relevant to the objection to the ACHP, including Caltrans' proposed

response to the objection, with the expectation that the ACHP will, within 30 days after receipt of such documentation:

- a. Advise Caltrans that the ACHP concurs in Caltrans' proposed response to objection, whereupon Caltrans will respond to the objection accordingly; or
 - b. Provide Caltrans with recommendations, which Caltrans shall take into account in reaching a final decision regarding its response to the objection. The objection shall thereby be resolved; or
 - c. Notify Caltrans that the objection will be referred for comment pursuant to 36 CFR § 800.7(c) and proceed to refer the objection and comment. Caltrans shall take the resulting comments into account in accordance with 36 CFR § 800.7(c) (4) and Section 110(1) of the NHPA. The objection shall thereby be resolved.
4. Should the ACHP not exercise one of the above options within 30 days after receipt of all pertinent documentation, Caltrans may proceed to implement its proposed response. The objection shall thereby be resolved.
 5. Caltrans shall take into account any of the ACHP's recommendations or comments provided in accordance with this stipulation with reference only to the subject of the objection. Caltrans' responsibility to carry out all actions under this PA that are not the subjects of the objection shall remain unchanged.
 6. At any time during implementation of the measures stipulated in this PA, should a member of the public raise an objection in writing pertaining to such implementation to any signatory party to this PA, that signatory party shall immediately notify Caltrans. Caltrans shall immediately notify the other signatory parties in writing of the objection. Any signatory party may choose to comment in writing on the objection to Caltrans. Caltrans shall establish a reasonable time frame for this comment period. Caltrans shall consider the objection, and in reaching its decision, Caltrans will take all comments from the other signatory parties into account. Within 15 days following closure of the comment period, Caltrans will render a decision regarding the objection and respond to the objecting party. Caltrans will promptly notify the other signatory parties of its decision in writing, including a copy of the response to the objecting party. Caltrans' decision regarding resolution of the objection will be final. Following issuance of its final decision, Caltrans may authorize the action subject to dispute hereunder to proceed in accordance with the terms of that decision.
 7. Caltrans shall provide all parties to this PA, and the ACHP, if the ACHP has commented, and any parties that have objected pursuant to section C.3 and C.4 of this stipulation, with a copy of its final written decision regarding any objection addressed pursuant to this stipulation.
 8. Caltrans may authorize any action subject to objection under this stipulation to proceed after the objection has been resolved in accordance with the terms of this stipulation.

D. AMENDMENTS

1. Any signatory party to this PA may propose that this PA be amended, whereupon all signatory parties shall consult for no more than 30 days to consider such amendment. The amendment will be effective on the date a copy signed by all of the original signatories is filed with the ACHP. If the signatories cannot agree to appropriate terms to amend the PA, any signatory may terminate the agreement in accordance with Stipulation VIII.F below.
2. Attachments to this PA may be amended through consultation as prescribed in Stipulation I or Stipulation II, as appropriate, without amending the PA proper.

E. ANNUAL REPORTING

In addition to the documentation and reporting described in Stipulation IV, the Cities shall provide the parties to this agreement an annual update. Such update shall include any scheduling changes proposed, any problems encountered, failures to adopt proposed mitigation measures, and any disputes and objections received in the Cities' efforts to carry out the terms of this PA. The update will be due no later than December 31 of each year, beginning December 31, 2018, and continuing annually thereafter throughout the duration of this PA. The annual update will include a call for requests for an annual meeting amongst PA parties. If PA parties deem it necessary, a meeting will be scheduled in lieu of or in addition to an update report.

F. TERMINATION

1. If this PA is not amended as provided for in Stipulation VII.E, or if either signatory proposes termination of this PA for other reasons, the signatory party proposing termination shall, in writing, notify the other PA parties, explain the reasons for proposing termination, and consult with the other parties for at least 30 days to seek alternatives to termination. Such consultation shall not be required if Caltrans proposes termination because the Undertaking no longer meets the definition set forth in 36 CFR § 800.16(y).
2. Should such consultation result in an agreement on an alternative to termination, the signatory parties shall proceed in accordance with the terms of that agreement.
3. Should such consultation fail, the signatory party proposing termination may terminate this PA by promptly notifying the other PA parties in writing. Termination hereunder shall render this PA without further force or effect.
4. If this PA is terminated hereunder, and if Caltrans determines that the Undertaking will nonetheless proceed, then Caltrans shall comply with the requirements of the Section 106 PA, or request the comments of the ACHP pursuant to 36 CFR § 800.3–800.6.

G. DURATION OF THE PA

The duration of this PA shall be no more than five (5) years following the date of execution by the SHPO and Caltrans, or upon completion of the Undertaking, whichever comes first. If the terms are not satisfactorily fulfilled at that time, Caltrans shall consult with the signatories and concurring parties to extend it or to reconsider its terms. Reconsideration may include continuation of the PA as originally executed, amendment of the PA, or termination. In the event of termination, Caltrans will comply with Stipulations III through XI of the Section 106 PA if it determines that the Undertaking will proceed notwithstanding termination of this PA

H. EFFECTIVE DATE

This PA will take effect on the date that it has been executed by Caltrans and the SHPO.

EXECUTION of this PA by Caltrans and the SHPO, its filing with the ACHP in accordance with 36 CFR § 800.6(b)(1)(iv), and subsequent implementation of its terms, shall evidence, pursuant to 36 CFR § 800.6(c), that this PA is an agreement with the ACHP for purposes of Section 110(1) of the NHPA, and shall further evidence that Caltrans has afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties, and that Caltrans has taken into account the effects of the Undertaking on historic properties.

**PROGRAMMATIC AGREEMENT BETWEEN THE CALIFORNIA
DEPARTMENT OF TRANSPORTATION AND THE CALIFORNIA STATE
HISTORIC PRESERVATION OFFICER REGARDING
I STREET BRIDGE REPLACEMENT PROJECT
SACRAMENTO COUNTY AND YOLO COUNTY, CALIFORNIA**

SIGNATORY PARTIES:

California Department of Transportation

By Philip J. Stolarski

Philip J. Stolarski, Chief
Division of Environmental Analysis

3/22/19

Date

California Office of Historic Preservation

By Julianne Polanco

for Julianne Polanco
State Historic Preservation Officer

3/22/19

Date

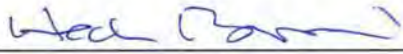
**PROGRAMMATIC AGREEMENT BETWEEN THE CALIFORNIA
DEPARTMENT OF TRANSPORTATION AND THE CALIFORNIA STATE
HISTORIC PRESERVATION OFFICER REGARDING
I STREET BRIDGE REPLACEMENT PROJECT
SACRAMENTO COUNTY AND YOLO COUNTY, CALIFORNIA**

INVITED SIGNATORIES:


California Department of Transportation

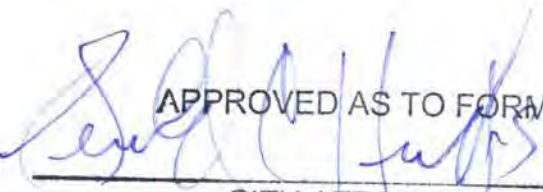
By  4/22/19
Amarjeet Benipal, District Director
District 3, Marysville
Date

City of Sacramento

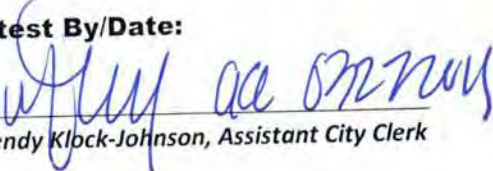
By  3-27-19
Hector Barron, Director of Public Works
Date

City of West Sacramento

By  09/11/19
Denix Anbiah, Director of Public Works
Date


APPROVED AS TO FORM:

CITY ATTORNEY

Attest By/Date:

Wendy Klock-Johnson, Assistant City Clerk

**PROGRAMMATIC AGREEMENT BETWEEN THE CALIFORNIA
DEPARTMENT OF TRANSPORTATION AND THE CALIFORNIA STATE
HISTORIC PRESERVATION OFFICER REGARDING
I STREET BRIDGE REPLACEMENT PROJECT
SACRAMENTO COUNTY AND YOLO COUNTY, CALIFORNIA**

CONCURRING PARTIES:

United Auburn Indian Community of the Auburn Rancheria

By _____
Gene Whitehouse
Chairman

_____ Date

Yocha Dehe Wintun Nation

By _____
Anthony Roberts
Chairman

_____ Date

Air Quality Conformity Documentation

From: [Shengyi Gao](#)
To: [Vaughn, Joseph \(FHWA\)](#); [Alexander Fong](#); [Dave Johnston](#); [David Yang](#); [Douglas Coleman](#); [Heather Phillips](#); [Janice Lam Snyder](#); [Jason Lee](#); [Jerry Barton](#); [John Ungvarsky](#); [Jose Luis Caceres](#); [Karina O'Connor](#); [Born, Kenneth \(FHWA\)](#); [Lucas Sanchez](#); [Mark Loutzenhiser](#); [Matt Jones](#); [Mcneel-Caird](#); [Paul Philley](#); [Renee DeVere-Oki](#); [Rodney Tavitas](#); [Shalanda Christian](#); [Sharon Tang](#); [Sondra Spaethe](#); [Wright Molly](#); [Yu-Shuo Chang](#)
Cc: jgothan@cityofsacramento.org; [Bromund, Claire](#)
Subject: RE: POAQC: City of Sacramento I St Bridge Replacement Project (SAC24683), DUE 6/7/2018
Date: Tuesday, May 29, 2018 2:46:06 PM

Hi all,

The Project Level Conformity Group has determined that the City of Sacramento I St Bridge Replacement Project (SAC24683) is Not a Project of Air Quality Concern (POAQC).

EPA concurred on 05/24/2018 and FHWA concurred on 05/25/2018.

Thanks you everyone!

Shengyi Gao

Sacramento Area Council of Governments

916.340.6239

From: Vaughn, Joseph (FHWA) [mailto:Joseph.Vaughn@dot.gov]
Sent: Friday, May 25, 2018 10:07 AM
To: Shengyi Gao <SGao@sacog.org>; Alexander Fong <alexander.fong@dot.ca.gov>; Dave Johnston <dave.johnston@edcgov.us>; David Yang <DYang@airquality.org>; Douglas Coleman <douglas.coleman@dot.ca.gov>; Heather Phillips <Heather.Phillips@arb.ca.gov>; Janice Lam Snyder <JLam@airquality.org>; Jason Lee <jason.lee@dot.ca.gov>; Jerry Barton <jbarton@edctc.org>; John Ungvarsky <Ungvarsky.John@epa.gov>; Jose Luis Caceres <JCaceres@sacog.org>; Karina O'Connor <oconnor.karina@epa.gov>; Born, Kenneth (FHWA) <kenneth.born@dot.gov>; Lucas Sanchez <lucas.sanchez@dot.ca.gov>; Mark Loutzenhiser <mloutzenhiser@airquality.org>; Matt Jones <mjones@ysaqmd.org>; Mcneel-Caird <lmcneel-caird@pctpa.net>; Paul Philley <PPhilley@airquality.org>; Renee DeVere-Oki <RDeVere-Oki@sacog.org>; Rodney Tavitas <rodney.tavitas@dot.ca.gov>; Shalanda Christian <shalanda_christian@dot.ca.gov>; Sharon Tang <sharon.tang@dot.ca.gov>; Sondra Spaethe <sspaethe@fraqmd.org>; Wright Molly <mwright@airquality.org>; Yu-Shuo Chang <YChang@placer.ca.gov>
Cc: jgothan@cityofsacramento.org
Subject: RE: POAQC: City of Sacramento I St Bridge Replacement Project (SAC24683), DUE 6/7/2018

FHWA concurs that this is not a project of air quality concern.

Joseph Vaughn
Environmental Specialist
FHWA, CA Division
(916) 498-5346

From: Shengyi Gao [<mailto:SGao@sacog.org>]

Sent: Thursday, May 24, 2018 1:20 PM

To: Alexander Fong <alexander.fong@dot.ca.gov>; Dave Johnston <dave.johnston@edcgov.us>; David Yang <DYang@airquality.org>; Douglas Coleman <douglas.coleman@dot.ca.gov>; Heather Phillips <Heather.Phillips@arb.ca.gov>; Janice Lam Snyder <JLam@airquality.org>; Jason Lee <jason.lee@dot.ca.gov>; Jerry Barton <jbarton@edctc.org>; John Ungvarsky <Ungvarsky.John@epa.gov>; Jose Luis Caceres <JCaceres@sacog.org>; Vaughn, Joseph (FHWA) <Joseph.Vaughn@dot.gov>; Karina O'Connor <oconnor.karina@epa.gov>; Born, Kenneth (FHWA) <kenneth.born@dot.gov>; Lucas Sanchez <lucas.sanchez@dot.ca.gov>; Mark Loutzenhiser <mloutzenhiser@airquality.org>; Matt Jones <mjones@ysaqmd.org>; Mcneel-Caird <Imcneel-caird@pctpa.net>; Paul Philley <PPhilley@airquality.org>; Renee DeVere-Oki <RDeVere-Oki@sacog.org>; Rodney Tavitas <rodney.tavitas@dot.ca.gov>; Shalanda Christian <shalanda_christian@dot.ca.gov>; Sharon Tang <sharon.tang@dot.ca.gov>; Sondra Spaethe <sspaethe@fraqmd.org>; Wright Molly <mwright@airquality.org>; Yu-Shuo Chang <YChang@placer.ca.gov>

Cc: jgothan@cityofsacramento.org

Subject: POAQC: City of Sacramento I St Bridge Replacement Project (SAC24683), DUE 6/7/2018

Project Level Conformity Group,

Attached for interagency review is the City of Sacramento I St Bridge Replacement Project (SAC24683) . As part of project level conformity under NEPA, it requires a determination of whether it is a project of air quality concern.

Please confirm that you concur that this is NOT a Project of Air Quality Concern (POAQC). **Please email questions and comments by 5 p.m., Thur., June 7, 2018.**

This project falls under the 23 USC 327 (formerly 6005) federal process. As such, it requires written concurrence by EPA (Karina O'Conner) and FHWA (Joseph Vaughn). Please remember to use "reply all," to make comments to the group. Otherwise, you may also contact the sponsor directly:

Jesse Gothan

City of Sacramento

Tel: (916)808-6897

Email: jgothan@cityofsacramento.org

MTIP ID# (required): SAC24683	
Project Description (clearly describe project): The proposed project would replace the existing I Street Bridge, which connects the Cities of Sacramento and West Sacramento, with a new bridge located approximately 1,000 feet to the north. The existing and proposed bridges include one vehicle travel lane in each direction. The proposed project would facilitate vehicular and multimodal traffic over the river in order to reduce traffic congestion, improve safety, and remove a number of structurally deficient or functionally obsolete bridges that have reached the limit of their design life. The new bridge would consist of two vehicle lanes, on-street Class II bike lanes, and sidewalks along both sides. One alignment is proposed for the new bridge over the Sacramento River, and two alternatives for portions of the roadway in the City of Sacramento are being considered as shown below. Figure 1 shows the regional location and Figure 2 shows the Build Alternatives. <ul style="list-style-type: none"> • City of Sacramento Railyards Boulevard/Jibboom Street/Bercut Drive Intersection <ul style="list-style-type: none"> ○ Alternative 1—Signalized Intersection at Jibboom Street and Bercut Drive ○ Alternative 2—Roundabout Intersection at Jibboom Street and Bercut Drive 	
Type of Project: Roadway Realignment and Intersection signalization projects at individual intersections	County: Sacramento and Yolo Counties
Narrative Location/Route & Post Miles: The proposed project is located over the Sacramento River between Sacramento and West Sacramento, approximately 1,000 feet north of the existing I Street Bridge. The proposed project limits starting within the City of Sacramento consist of Railyards Boulevard from 200 feet east of Bercut Drive on the east, continuing west over the Sacramento River into the City of West Sacramento along C Street, and terminating approximately 100 feet west of the 5 th Street intersection. The proposed project limits also extend along Bercut Drive approximately 500 feet north of Railyards Boulevard, along Jibboom Street 550 feet north of Railyards Boulevard and 300 feet south of Railyards Boulevard, along 3 rd Street 50 feet north and south of C Street, along 4 th Street 50 feet north and south of C Street, and along 5 th Street 50 feet north and south of C Street. The total length of the proposed project is approximately 0.42 miles along C Street and Railyards Boulevard. Federal Project No.: BRLS 5002(164)	
Lead Agency: City of Sacramento	
Contact Person: Jesse Gothan	Email: jgothan@cityofsacramento.org
Phone#: (916) 808-6897	Fax#:
Hot Spot Pollutant of Concern (check one or both) PM2.5 <input checked="" type="checkbox"/> PM10 <input checked="" type="checkbox"/>	
Is this a 6004 or 6005 Federal process? (check one) 6004 <input type="checkbox"/> 6005 <input checked="" type="checkbox"/>	

Federal Action for which Project-Level PM Conformity is Needed <i>(check appropriate box)</i> Categorical Exclusion (NEPA) <input type="checkbox"/> EA or Draft EIS <input checked="" type="checkbox"/> FONSI or Final EIS <input type="checkbox"/>				
Scheduled Date of Federal Action: 7/2018				
Current Programming Dates <i>(as appropriate)</i>				
	PE/Environmental	ENG	ROW	CON
Start	3/2014	8/2018	8/2018	3/2020
End	7/2018	3/2020	3/2020	12/2022
Project Purpose and Need (Summary): The proposed project would construct a new bridge over the Sacramento River between Sacramento and West Sacramento to replace the vehicle crossing that is currently provided by the existing I Street Bridge. Construction of the proposed project has independent utility; the proposed project is not dependent on other projects or improvements to meet the purpose and need.				
Purpose <ul style="list-style-type: none"> • The proposed project should construct a new public crossing of the Sacramento River north of the Union Pacific Railroad-owned I Street Bridge from C Street in the City of West Sacramento to Railyards Boulevard in the City of Sacramento, consistent with the adopted findings of the Sacramento River Crossings Alternatives Study for Bridge Location 2 in the North Market Area. • The new bridge should meet the requirements of the Neighborhood Friendly Bridge definition that the City of Sacramento City Council adopted by resolution on October 18, 2011, which is defined by the following elements. <ul style="list-style-type: none"> ○ A facility whose primary function is local connectivity rather than regional travel and primarily serves short local trips. ○ A bridge which serves all users, including motorists, bicyclists, pedestrians, low energy vehicles, and public transit riders. ○ A bridge with aesthetics and dimensions which are architecturally pleasing and contextually appropriate for the adjacent neighborhoods. ○ A bridge that does not exceed or expand the already-planned capacity of the approach roadways (i.e., no widening of approaches just to accommodate bridge flows). ○ A facility which is designed with a target speed equal to or less than the approach roadways. ○ A bridge which reduces the growth in vehicle miles traveled in the adjacent communities. ○ A bridge that does not connect directly to streets which are primarily residential in character. ○ A bridge that is consistent with the Need and Purpose statement [the adopted Sacramento River Crossings Alternatives Study statement] as articulated. • In addition to the Neighborhood Friendly Bridge definition, the proposed project should include pedestrian and bicycle facilities in the new public crossing that meet Americans with Disabilities Act (ADA) requirements, and facilitate connections to and from the new crossing and the Sacramento River Parkway and Riverfront Park trails. • The proposed project also would need to construct a movable bridge that satisfies the vertical clearance and river navigation requirements of the U.S. Coast Guard (USCG). • The project design feature should not preclude future addition of a streetcar, a separate, stand-alone project being developed by the Cities of West Sacramento and Sacramento. • The new bridge also is intended to improve the connectivity to, and accessibility of, businesses, recreational areas, and new or redevelopment opportunity sites located in the urban core of Sacramento and West Sacramento. 				

Need

- The existing I Street Bridge does not fully comply with current design and traffic operation standards due to the following conditions.
 - I Street Bridge limits or restricts traffic capacity and multimodal use. The current bridge width is not sufficient to provide adequate traffic operations, bicycle lanes, or the ability for transit service across the bridge.
 - The I Street Bridge and the four associated approach structures are on the federal eligible bridge list for federal funds for replacement and/or rehabilitation through the Highway Bridge Program (HBP).
 - The I Street Bridge has been classified as functionally obsolete, and the existing approach structures have been classified as structurally deficient. The Cities of Sacramento and West Sacramento have decided to pursue replacement through the HBP. As adopted by the Sacramento City Council, new crossings of the Sacramento River between the City of Sacramento and City of West Sacramento shall be Neighborhood Friendly. In coordination with staff from the City of West Sacramento and the Sacramento Area Council of Governments (SACOG), the definition for a Neighborhood Friendly Bridge was developed by the City of Sacramento and the Sacramento City Council adopted the definition by resolution in October 2011. The replacement bridge structure is required to be consistent with the Neighborhood Friendly Bridge definition.
- In addition to the Neighborhood Friendly Bridge requirements, lack of ADA compliance, non-standard and non-continuous sidewalks, and lack of bicycle facilities discourage walking and bicycling on the existing I Street Bridge.
- Section 9 of the Rivers and Harbors Act requires any local, state, or federal agency planning to construct a bridge over a navigable waterway to apply for a bridge permit through the USCG. The USCG requires the new bridge to meet or exceed the existing vertical clearance along the river, which is currently set by the US 50 Pioneer Bridge. In order to comply with the Neighborhood Friendly Bridge definition and meet the USCG requirements for navigation clearance, the new bridge will need to be movable.
- The SACOG Metropolitan Transportation Plan/Sustainable Communities Strategy identifies that a proposed streetcar will cross over the new bridge from Sacramento to West Sacramento. While the streetcar will be a separate, stand-alone project, the bridge design must not preclude the future addition of a streetcar.
- Limited connectivity to the riverfront reduces the potential to achieve planned urban development and redevelopment of opportunity sites identified in the adopted plans of Sacramento and West Sacramento.

Surrounding Land Use/Traffic Generators *(Describe effect of traffic generators or diesel traffic. Also, provide a map, preferably aerial photo, including locations of nearby (within 500 ft.) sensitive receptors, such as daycare facilities and schools):*

The existing I Street Bridge primarily serves passenger vehicles traveling between downtown Sacramento and West Sacramento. The bridge connect downtown Sacramento with Interstate 80. Traffic generators are primarily commercial land uses in downtown Sacramento and residences in West Sacramento. Some industrial/warehouse land uses are located near the project area in West Sacramento. These facilities generate truck trips that may use the new bridge. The existing bridge does not have the infrastructure to support large trucks.

Figure 3 shows sensitive receptors within 500 feet from the edge of the road. Residential neighborhoods are located on both sides of C Street in West Sacramento. In Sacramento, the proposed Kaiser Permanente medical center is the only sensitive receptor, as shown in Figure 3.

Opening Year: Build and No-Build LOS – AM 2-Hr, % and # trucks, truck AM 2-Hr of proposed facility:
 (if No Change between Build and No-Build, explain and document why.)

2020	LOS ^a		AADT	AM-2Hr	Truck AADT (%)	TRUCK AM 2Hr, % and #
	East Approach	West Approach				
Build Alternative 1	C	B	25,479	5,507	4,504 (16%)	879; 16%
Build Alternative 2	D	B	25,479	5,507	4,504 (16%)	879; 16%
No-Build	B	F	17,274	3,783	2,681 (18%)	516; 14%

^a LOS is provided for the bridge connection to the roadway network. Note that the connection points change between the Build and No-Build Alternatives. The LOS are provided for broad comparison.

MTP Horizon Year/Design Year: Build and No-Build LOS , AADT, AM 2-Hr, Truck AADT, and % and # trucks for AM 2-Hr of proposed facility:

2040	LOS ^a		AADT	AM-2Hr	Truck AADT	TRUCK AM 2Hr, % and #
	East Approach	West Approach				
Build Alternative 1	C	B	33,310	6,629	5,728 (17%)	941; 14%
Build Alternative 2	D	B	33,310	6,629	5,728 (17%)	941; 14%
No-Build	B	F	25,644	5,275	4,134 (16%)	747; 14%

^a LOS is provided for the bridge connection to the roadway network. Note that the connection points change between the Build and No-Build Alternatives. The LOS are provided for broad comparison.

Only if Facility is an Interchange or Intersection: Opening Year Build and No Build cross-street AADT, % and # trucks, truck AADT):

The proposed facility is not an interchange or intersection project, although 37 intersections were assessed in the Traffic Study. The Project of Air Quality Concern (POAQC) determination focused on the bridge facility. Intersection information can be reviewed in Attachment A from the Traffic Study.

Only if Facility is an Interchange or Intersection: MTP Horizon Year / Design Year Build and No Build cross-street AADT, % and # trucks, truck AADT):

See above.

Describe potential traffic redistribution effects of congestion relief (impact on other facilities):

The new bridge alternative would serve a higher volume of traffic across the bridge than under the no build alternative and the share of non-local traffic would increase. This was part of the reason that only two-lane bridges were considered for the Build Alternatives, as three or four-lane bridges would induce even more regional traffic and would not be compatible with the objective to construct a neighborhood-friendly bridge.

There is an overall increase in demand volume crossing the river between existing conditions and 2020 by about 20 percent. Comparing the No Build to the Build Alternatives, a new I Street Bridge would be able to serve a higher volume than the existing I Street Bridge.

In 2040, there is an overall increase in demand volume crossing the river between existing conditions and 2040 by over 50 percent. Comparing the No Build to the Build Alternatives, a new I Street Bridge would attract a higher volume than the existing I Street Bridge by about 7,500 daily trips.

The existing I Street Bridge has height and width limitation and does not provide adequate traffic operations, bicycle lanes, or the ability for transit to operate over the bridge, while the new bridge includes auto, transit, bicycle, and pedestrian improvement features that will improve connectivity and access across the Sacramento River.

Many changes occur near the study area and throughout the region in land use and roadway network. The most notable changes in the study area are the full build-out of the roadway network in the Railyards area, a new American River bridge crossing connecting Downtown Sacramento to Natomas, and a new Broadway Bridge south of the Tower Bridge connecting Sacramento and West Sacramento. The opening of roadways in the Railyards area will shift some of the existing travel patterns to the new crossings. The increase in demand volume creates queuing that increase delay at nearby intersections, notably 3rd Street / Tower Bridge Gateway. However, as a whole, the proposed project would facilitate movement within the project area. The new bridge is also intended to improve the connectivity to, and accessibility of, businesses, recreational areas, and new or redevelopment opportunity sites located in the urban core of Sacramento and West Sacramento.

Comments/Explanations/Details (*attach additional sheets as necessary*):

The proposed project is located within a nonattainment area for the federal PM_{2.5} standard and a maintenance area for the federal PM₁₀ standard. Therefore, per 40 Code of Federal Regulations (CFR) Part 93 hot-spot analyses are required for POAQC. However, the United States Environmental Protection Agency does not require hot-spot analyses for projects that are not listed in section 93.123(b)(1) as a POAQC. Many projects undergoing Interagency Consultation have relied on loose qualifying criteria of 125,000 average daily trips and/or 10,000 daily diesel truck trips.

The proposed project does not meet the definition of a POAQC as defined by section 93.123(b)(1) because of the following reasons:

- I. The proposed project would facilitate movement within the project area. While there would be increased traffic on local roadways, traffic volumes on the bridge and approaching streets would not exceed the 125,000 average daily trips (project ADT is anticipated at a maximum of 33,310 in 2040) and/or 10,000 diesel truck trips (project truck ADT is anticipated at a maximum of 5,728 in 2040) guidance criteria for a POAQC. In addition, the primary function of the facility is local connectivity rather than regional travel and primarily serves short local trips.
- II. The proposed project does not affect intersections that are at level of service (LOS) D, E, or F with a significant number of diesel vehicles. As discussed above, the bridge approaches do not include a significant number of diesel vehicles, with diesel vehicles comprising 17 to 18% of total ADT and peak hour trips.

The proposed project results in an overall decrease in traffic delays and congestion relief. The table below compares the LOS between the Build and No-Build Alternatives for opening year (2020) and horizon year (2040). The traffic study assessed 37 intersections that would be most affected by the project (See Attachment A from the Traffic Study). The majority of intersection LOS would not change or improve with the proposed project. In addition, the majority of intersections with worsened LOS are in category B. These intersections are not considered to be an air quality concern. When considering LOS categories C, D, E, or F, the proposed project would improve LOS at 27% the intersections while only worsening LOS at 13% of intersections. Note that the percentages below reflect all LOS categories.

Intersection LOS Comparison Between No-Build and Build Alternatives			
Scenario	Steady (%)	Improved (%)	Worsened (%)
Year 2020			
<i>AM</i>	20 (61%)	5 (15%)	8 (24%)
<i>PM</i>	23 (70%)	6 (18%)	4 (12%)
Year 2040			
<i>AM</i>	17 (49%)	13 (37%)	5 (13%)
<i>PM</i>	20 (57%)	8 (23%)	7 (20%)

- III. The proposed project does not include the construction of a new bus or rail terminal that would have a significant number of diesel vehicles congregating at a single location.
- IV. The proposed project does not expand an existing bus or rail terminal that would significantly increase the number of diesel vehicles congregating at a single location.

- V. The proposed project is not in or affecting locations, areas, or categories of sites that are identified in the PM_{2.5} and PM₁₀ applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The proposed project meets the Clean Air Act requirements and 40 CFR 93.116 without any explicit hot-spot analysis. The proposed project would not create a new, or worsen an existing, PM₁₀ or PM_{2.5} violation. The subsequent cumulative 2020 and 2040 analyses also indicates that none of the roadway segments affected by the project would experience a traffic volume that exceeds 125,000 AADT with or without the proposed project. The total truck AADT would be less than 6,000 in 2020 and 2040 which makes up 17-18% of the total AADT. Although the truck percentage reached 18% of the fleet, the truck volume of less than 6,000 is well below what is typically considered to be a POAQC. Moreover, as discussed above, the project would relieve traffic congestion in most of the intersections in the project area and would improve traffic delays. Hence, less idling and running exhaust emissions would be generated.

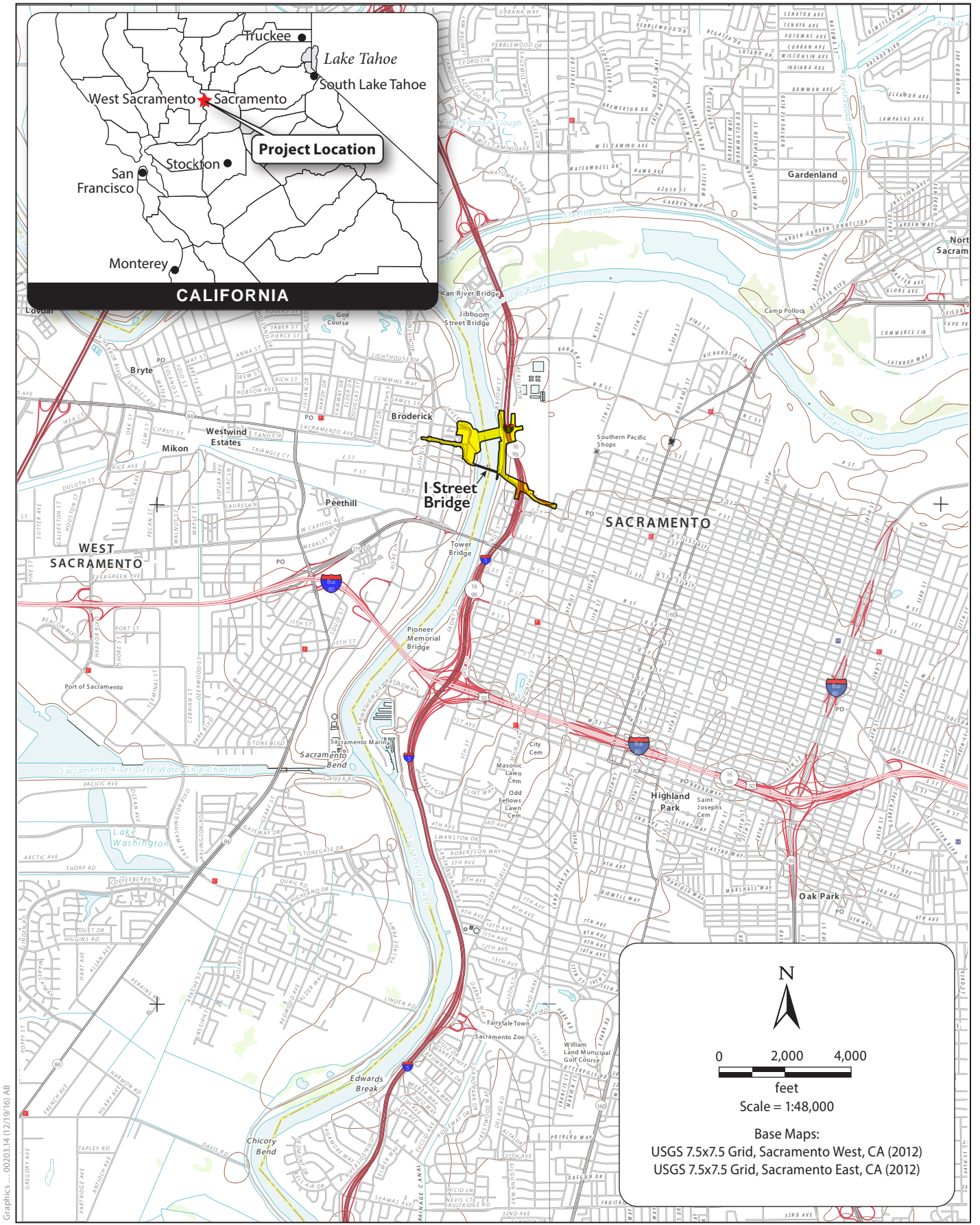
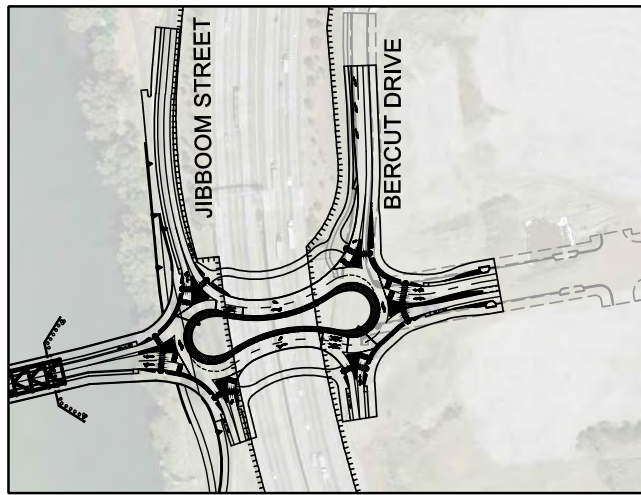
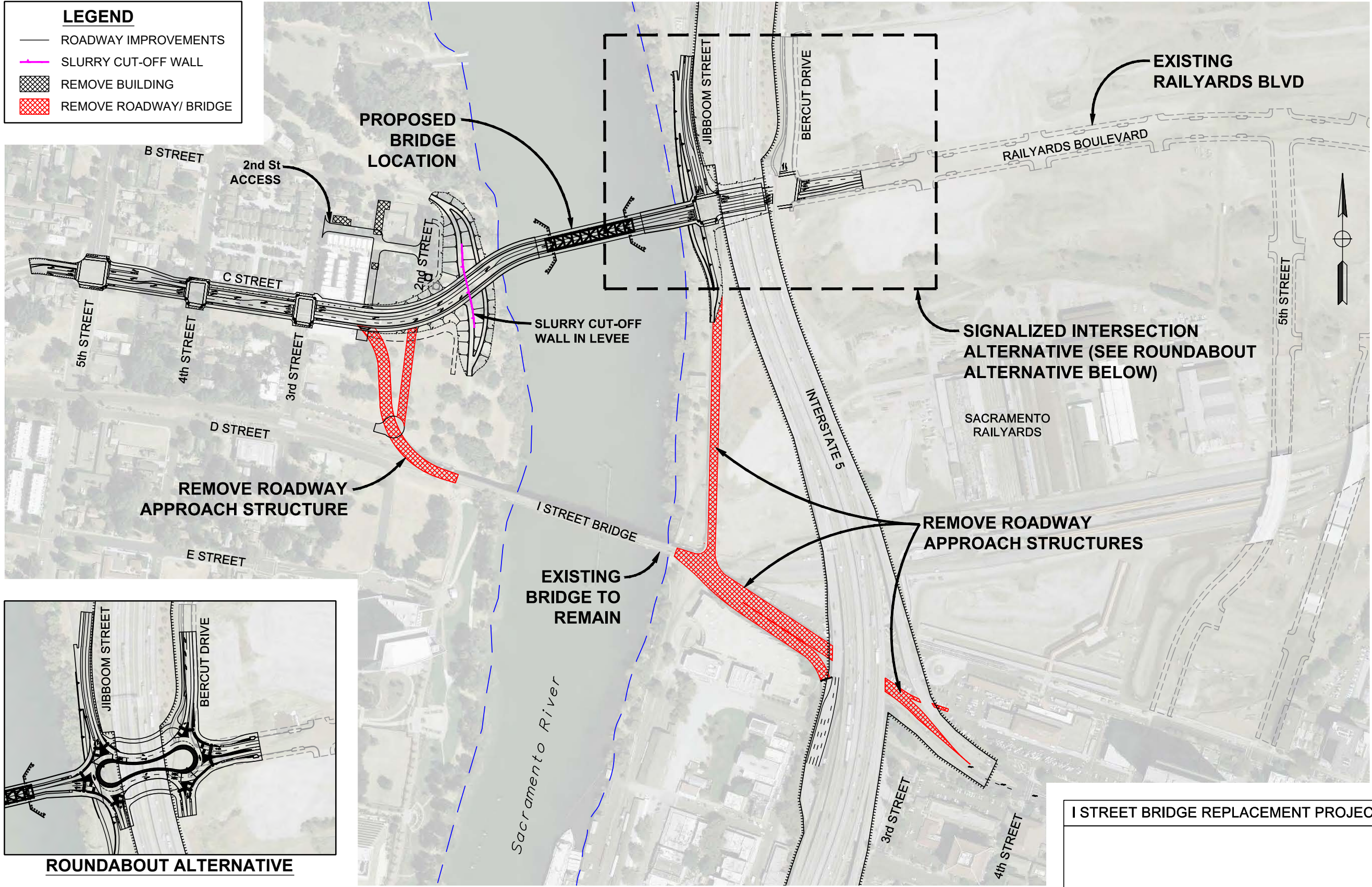


Figure 1
Regional Location

- LEGEND**
- ROADWAY IMPROVEMENTS
 - SLURRY CUT-OFF WALL
 - REMOVE BUILDING
 - REMOVE ROADWAY/ BRIDGE

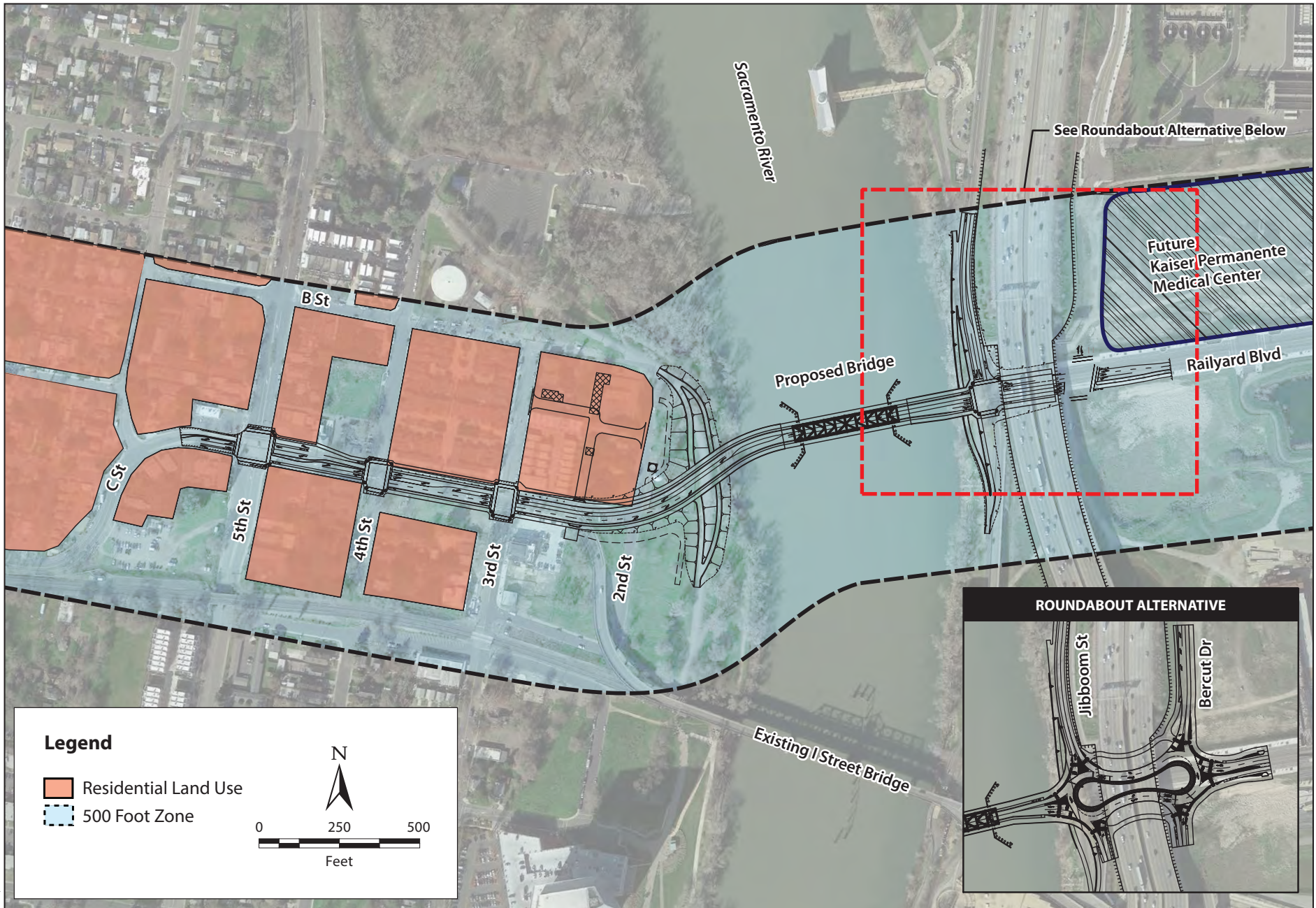


ROUNDBOUT ALTERNATIVE

I STREET BRIDGE REPLACEMENT PROJECT

SCALE: NTS

**Figure 2
Build Alternatives**



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Figure 3
Sensitive Receptors within 500 Feet

I Street Bridge Replacement Project Peak Hour Intersection Operations, Design Year (2040)

Intersection	Traffic Control	LOS/Delay			
		Existing Conditions	2040 No Build	2040 Alternative 1	2040 Alternative 2
1. Jefferson Boulevard/ Sacramento Avenue	Signal	C/23 C/29	E/65* F/95*	E/67* F/88*	
2. 5th Street/ C Street	Signal	B/18 B/20	F/111* F/143*	D/45* C/31*	C/34 C/30*
3. 3rd Street/ C Street	Signal	B/10 B/15	F/101* F/95*	D/48* C/33*	C/31* C/26*
4. 5th Street/ E Street	Side-street stop	A/8 A/7	D/27 D/26	E/37 F/72	
5. 3rd Street/ E Street	Signal	A/7 A/6	B/15 B/17	C/21 C/22	
6. 5th Street/ F Street	Side-street stop	A/9 A/10	D/29 E/46	F/72 F/79	
7. 3rd Street/ F Street	Signal	A/10 A/8	B/15 B/16	B/17 B/20	
8. 5th Street/ West Capitol Avenue	Signal	C/33 C/33	-	-	
9. 5th Street/ Tower Bridge Gateway	Signal	C/34 D/45	D/36 C/34	D/36 C/34	
10. 3rd Street/ Tower Bridge Gateway	Signal	B/15 B/16	C/32 C/32	C/33 C/34	
11. Jibboom Street/ Richards Boulevard	Side-street stop	C/19 B/15	B/12* F/90*	A/10* A/9	
12. I-5 southbound ramps/ Richards Boulevard	Signal	B/19 C/20	F/81* E/58*	E/67* C/31*	
13. I-5 northbound ramps/ Richards Boulevard	Signal	B/14 B/15	D/35* B/14*	C/21* B/17*	
14. Bercut Drive/ Richards Boulevard	Signal	B/12 C/21	D/41* E/65*	C/33* F/83*	
15. North 3rd Street/ Richards Boulevard	Signal	B/18 C/32	C/23* F/139*	B/16* F/145*	
16. North 7th Street/ Richards Boulevard	Signal	C/25 B/20	E/64 D/36	D/46 D/43	
17A. North 12th Street/ Richards Boulevard	Signal	C/32 D/38	E/69* D/40	E/61* E/66	
17B. North 16th Street/ Richards Boulevard	Signal	C/32 D/38	C/34 E/80*	C/33 E/79*	
18. North 7th Street/ North B Street	Signal	B/14 B/17	F/126* F/119*	F/120* F/110*	
19. North 12th Street/ North B Street	Signal	B/15 B/17	F/135* F/138*	F/135* F/153*	
20. North 7th Street/ F Street	Signal	A/9 A/9	B/20 B/13	C/21 C/20*	
21. 8th Street/ F Street	All-way stop	A/6 A/6	A/9 A/8	A/9 A/8*	

Intersection	Traffic Control	LOS/Delay			
		Existing Conditions	2040 No Build	2040 Alternative 1	2040 Alternative 2
22. North 7th Street/ G Street	Signal	A/8 A/7	A/10* A/10*	B/13* B/16*	
23. Jibboom Street/ I Street Bridge	Signal	C/23 F/97*	F/119* F/119*	-	
24. 5th Street/ H Street	Side-street stop (signalized) ⁵	A/9 A/7	D/44* D/50*	D/35* E/61*	
25. 6th Street/ H Street	Signal	A/9 A/8	E/57* E/56*	D/49* E/58*	
26. North 7th Street/ H Street	Signal	B/10 B/11	D/44* C/29*	D/35* C/31*	
27. 8th Street/ H Street	Signal	A/8 A/8	D/44* E/68*	B/20 E/68*	
28. 3rd Street/ J Street	Signal	E/64 F/94*	F/96* F/99*	F/88* E/78*	
29. 5th Street/ I Street	Signal	A/6 B/17	D/50* D/49*	D/52* D/51*	
30. 6th Street/ I Street	Signal	B/12 C/23	C/31* E/61*	C/31* E/66*	
31. 7th Street/ I Street	Signal	A/9 D/38	B/15 D/45*	B/15 D/51*	
32. 3rd Street/ Capitol Mall	Signal	C/24 C/21	C/26* D/39*	C/25* C/35*	
33. Jibboom Street/ Railyards Boulevard	Signal (roundabout) ⁶	-	F/102* F/81*	D/46* C/20*	C/25 A/8*
34. Bercut Drive/ Railyards Boulevard	Signal (roundabout) ⁶	-	F/200* F/310*	F/129* F/141*	F/66 F/115*
35. North 5th Street/ Railyards Boulevard	Signal	-	E/68* F/155*	D/55* F/81*	D/40 F/95*
36. North 7th Street/ Railyards Boulevard	Signal	-	D/41* F/127*	C/27 E/70*	C/26 F/96*
37. North 12th Street/ Railyards Boulevard	Free	-	A/7* A/7*	A/7* A/10*	

Notes:

- ¹ Intersection 17 – North 12th Street/North 16th Street/Richards Boulevard under year 2040 conditions is analyzed as two separate intersections per the planned reconfiguration represented in the River District EIR: Intersection 17A – North 12th Street/Richards Boulevard, and Intersection 17B – North 16th Street/Richards Boulevard.
- ² Level of service (LOS)/delay is reported for the a.m. peak hour (top) and p.m. peak hour (bottom) for each intersection.
- ³ For signalized and all-way stop-controlled intersections, the overall average intersection control delay is reported in seconds per vehicle. For side-street stop-controlled intersections, the average control delay for the worst movement is reported in seconds per vehicle.
- ⁴ LOS in bold and underline font represents an impact. An impact is a change in LOS between no build and build alternative scenarios from acceptable to unacceptable or a worsening of an unacceptable condition.
- ⁵ LOS noted with an asterisk indicates that the percent of demand volume served during the peak hour is less than 95 percent. Delay (and LOS) may be worse than reported.
- ⁶ Traffic control is side-street stop-controlled under existing conditions and signalized in all 2040 scenarios for this noted intersection.
- ⁷ Traffic control is signalized in Alternative 1 and roundabout in Alternative 2 for these noted intersections.
- ⁸ LOS is based on the *Highway Capacity Manual* (Transportation Research Board 2010).

Under the no build scenario, an increase in demand volume at the intersection of Jibboom Street/I Street Bridge causes even more queuing and delay at the surrounding bridge approach intersections than under opening year 2020 conditions. This is due to the limited capacity of the lane configurations and the subsequent inefficiency with the traffic signal operations. The poor operations at Jibboom Street/I Street Bridge create a queue that disrupts upstream traffic flows along C Street and Railyards Boulevard; many study intersections are at LOS F, with average delay per vehicle over 100 seconds in both the a.m. and p.m. peak hour. The intersection of Jefferson Boulevard/Sacramento Avenue worsens to LOS E/F due to increases in demand, especially for conflicting movements.

Under the build scenarios, the local networks are accommodating higher peak-hour volumes. However, the increase in demand generates higher delays for select intersections. In West Sacramento, the westbound left-turn movements at the side-street stop-controlled intersections of 5th Street/E Street and 5th Street/F Street worsen to LOS E/F. A notable improvement occurs at the intersection of 5th Street/Tower Bridge Gateway due to the elimination of the 5th Street/West Capitol Avenue intersection, which increases green time and allows for better signal coordination along 5th Street and Tower Bridge Gateway.

In Sacramento, the intersection of Bercut Drive/Richards Boulevard worsens under the build alternatives in 2040 conditions due to increased bridge traffic from West Sacramento heading onto I-5 northbound. This causes a significant increase in the northbound left-turn volume, which conflicts with other high-volume movements. The split phasing of the northbound and southbound directions contributes to inefficiency in the traffic signal operations. The queues in the westbound through movement also extend into the 3rd Street/Richards Boulevard intersection.

In addition, the intersections of North 7th Street/North B Street and North 12th Street/North B Street operate poorly due to high volumes for conflicting movements, inefficient signal operations caused by the lane configurations, permitted left-turn signal operations, and transit preemption.



U.S. Department
of Transportation
**Federal Highway
Administration**

**Federal Highway Administration
California Division**

650 Capitol Mall, Suite 4-100
Sacramento, CA 95814
(916) 498-5001
(916) 498-5008 (fax)

July 5, 2018

In Reply Refer To:
HDA-CA

Mr. Amarjeet Benipal
District Director,
California Department of Transportation District 3
703 B Street
Marysville, CA 95901

Attention: Jason Lee

SUBJECT: Project Level Conformity Determination for the I Street Bridge Replacement Project
(SACOG ID: SAC24683)

Dear Mr. Benipal:

On June 8, 2018, the California Department of Transportation (Caltrans) submitted to the Federal Highway Administration (FHWA) a complete request for a project level conformity determination for the I Street Bridge Replacement Project. The project is in an area that is designated Non-Attainment or Maintenance for Ozone and Particulate Matter (PM 2.5, PM 10).

The project level conformity analysis submitted by Caltrans indicates that the project-level transportation conformity requirements of 40 CFR Part 93 have been met. The project is included in the Sacramento Area Council of Governments' (SACOG) current Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP), as amended. The design concept and scope of the preferred alternative have not changed significantly from those assumed in the regional emissions analysis.

As required by 40 CFR 93.116 and 93.123, the localized PM analyses are included in the documentation. The analyses demonstrate that the project will not create any new violations of the standards or increase the severity or number of existing violations.

Based on the information provided, FHWA finds that the I Street Bridge Replacement Project conforms with the State Implementation Plan (SIP) in accordance with 40 CFR Part 93.

If you have any questions pertaining to this conformity finding, please contact Joseph Vaughn at (916) 498-5346 or by email at Joseph.Vaughn@dot.gov.

Sincerely,

Tashia J. Clemons
Director, Planning and Environment

Appendix H
List of Technical Studies

Appendix H List of Technical Studies

Copies of the following technical studies are available on the project website at <http://www.cityofsacramento.org/Public-Works/Engineering-Services/Projects/Current-Projects/I-Street-Bridge-Replacement>.

Proposed Project

- Draft Project Report (Mark Thomas & Company 2016)
- Final Project Report (Mark Thomas & Company 2018)

Human Environment

- Community Impact Assessment (ICF International 2016)
- Traffic Technical Data and Calculations (Fehr & Peers 2015)
- Visual Impact Assessment (ICF International 2015)
- Historic Property Survey Report, including Archaeological Survey Report (ICF International 2016), Historical Resources Evaluation Report (ICF International 2016)
- Finding of Effect (ICF 2018)

Physical Environment

- Water Quality Assessment Report (ICF International 2016)
- Scour Analysis (Tetra Tech 2016)
- Preliminary Geotechnical and Foundation Report (GEI Consultants 2014)
- Initial Site Assessment Update (Blackburn Consulting 2016)
- Air Quality Study Report (Terry A. Hayes Associates 2016)
- Noise Study Technical Report (ICF International 2016)

Biological Environment

- Request for Preliminary Jurisdictional Determination (ICF International 2016)
- Natural Environment Study (ICF International 2016)
- Biological Assessment/Essential Fish Habitat Assessment (ICF International 2016)
- Biological Assessment (ICF International 2016)

Appendix I

Public Comments and Responses

Appendix I Public Comments and Responses

I.1 Introduction

This appendix lists the comments received on the Draft EIR/EA, provides copies of the individual comments, and responds in turn to each comment related to environmental issues. Master responses were prepared to address similar comment issues raised by multiple commenters. When an individual comment raises an issue discussed in a master response, the response to that individual comment will cross reference to the appropriate master response (e.g., “see Master Response 1”).

The Master Responses address the following topics.

- Master Response A: Viaduct Removal
- Master Response B: Use of Existing Bridge
- Master Response C: Bridge Architecture
- Master Response D: Purple Martin Mitigation

I.2 Comments Received

During the 45-day public comment period for the Draft EIR/EA (September 28 to November 12, 2017) a total of 38 comment letters/emails and comment cards were received from the entities listed below. Each letter was placed into one of three categories (Agencies, Individuals, and Organizations) and given a unique number, as listed in Table I-1 below.

Table I-1. Comments Received

Comment Letter #	Name of Agency, Individual, or Organization	Date Received
Agencies		
A-1	Sacramento Municipal Utility District, Jamie Cutlip	11/7/2017
A-2	California Department of Fish and Wildlife, Juan Torres	11/9/2017
A-3	California State Lands Commission, Cy R. Oggins	11/13/2017
A-4	State Clearinghouse, Scott Morgan	11/14/2017
Individuals		
I-1	Tim Castleman	10/2/2017
I-2	Tim Castleman	10/5/2017
I-3	Fernando and Ellen Maurizio	10/8/2017
I-4	JoEllen Arnold	10/26/2017
I-5	Kim Fettke	10/26/2017
I-6	Kim Fettke	10/26/2017
I-7	Bill Leddy	10/26/2017
I-8	Susan Martimo	10/26/2017
I-9	Rick Mocerin	10/26/2017

Comment Letter #	Name of Agency, Individual, or Organization	Date Received
I-10	Steve Peterson	10/26/2017
I-11	Russell Rawlings	10/26/2017
I-12	Will Rowe	10/26/2017
I-13	Dan Roy	10/26/2017
I-14	Peter Saucerman	10/26/2017
I-15	Rosanna Southern	10/26/2017
I-16	Chris Tucker	10/26/2017
I-17	Anonymous (1)	10/26/2017
I-18	Anonymous (2)	10/26/2017
I-19	JoEllen Arnold	10/26/2017
I-20	Kim Fettke	10/26/2017
I-21	Heather Johnson	10/26/2017
I-22	Heather Johnson	10/26/2017
I-23	David Krasko	11/8/2017
I-24	Melissa Buckley	11/9/2017
I-25	Susan Greene	11/9/2017
I-26	Gail Ann Overhouse, Gary Bonetti, Sandy Kay Cunha, Michael and Carol Edmonds	11/12/2017
I-27	Mabel Salon	11/12/2017
I-28	Rob Turner	11/12/2017
I-29	Port Telles	11/13/2017
Organizations		
O-1	Powerhouse Science Center, Harry Laswell	10/27/2017
O-2	Sacramento Audubon Society, Larry Hickey	10/31/2017
O-3	Central Valley Bird Club, Audubon California, Yolo Audubon, Chris Conard (CVBC)	11/9/2017
O-4	Environmental Council of Sacramento, Habitat 2020, Rob Burness and Sean Wirth	11/9/2017
O-5	Western Purple Martin Working Group, Stan Kostka	11/13/2017

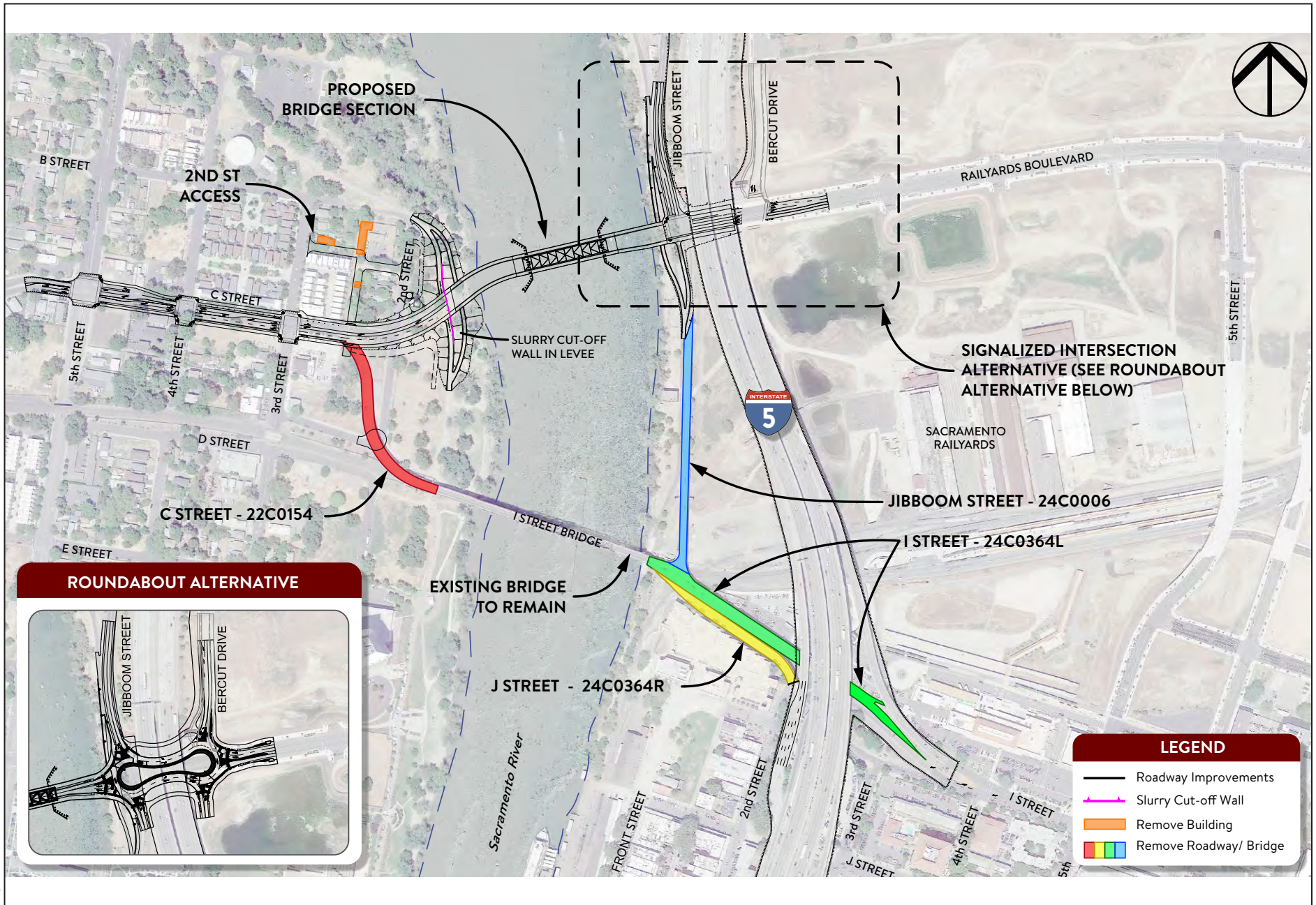
On the following pages are copies of the comments and responses to each. The comment letters are included in the order shown in Table I-1.

I.3 Master Responses

I.3.1 Master Response A: Viaduct Removal

I.3.1.1 Project Objectives

The I Street Bridge Replacement Project is being proposed to accomplish several purposes or objectives. These objectives are listed in EIR/EA Chapter 1, *Project Description*, on page 1-2. Some commenters noted that none of the project objectives are consistent with removing the viaduct structures that connect roadways in both Sacramento and West Sacramento with the upper deck of the existing I Street Bridge. However, one objective listed on EIR/EA page 1-2 is to “remove a number of structurally deficient or functionally obsolete bridges that have reached the limit of their design life.” These structures are shown in red, yellow, green, and blue on Figure I-1 and are also labeled with their bridge identification number. The cities of Sacramento and West Sacramento maintain the viaduct structures located within their limits.



Graphics ... 002033.14 (3/12/18) AB

Figure I-1
I Street Bridge Approach Structures

Once the new bridge over the Sacramento River is constructed the viaduct structures will no longer be necessary because traffic will be routed to the new structure. Also, bridge replacement funds from the Federal Highway Administration and programmed by Caltrans' Local Highway Bridge Program (<http://www.dot.ca.gov/hq/LocalPrograms/hbrr99/hbrr99a.htm>) are being used to construct the new bridge but cannot be used to maintain the existing viaduct structures or existing bridge once motor vehicle traffic is removed.

The existing bridge must remain in place for use as a railroad crossing. Continued use of the top deck for pedestrian and bicycle circulation is being evaluated as a separate project and may include use of small portions of the approach structures; however, demolition of the approach structures is a necessary part of the proposed project. Sacramento riverfront redevelopment in both the City of Sacramento and the City of West Sacramento relies on the removal of the bridge approach viaducts. For example, the City of Sacramento's Railyards Specific Plan Update assumes construction of the new bridge and connection with Railyards Boulevard and removal of vehicular circulation on the existing I Street bridge crossing and demolition of the Jibboom Street connection to the existing I Street approach viaduct system.

1.3.1.2 Alternatives or Mitigation to Retain a Viaduct

Several commenters raised concerns with the removal of the "westbound approach" to the I Street Bridge and refer to that approach structure as having a concrete hollow box-girder portion used by bird and bat species and also as being suitable for future bicycle and pedestrian use. As a point of clarification, the westbound approach to the bridge, the viaduct that connects westbound I Street traffic to the I Street Bridge, is a steel girder bridge (24C0364L). It is likely that commenters actually meant to reference the *eastbound* concrete box-girder viaduct (24C0364R) that connects vehicular traffic traveling either east from the existing I Street Bridge or south from Jibboom Street to the point where vehicular traffic merges with the southbound I-5 J Street off-ramp (exit 519B) and ultimately to the intersection of J Street and 3rd Street in Sacramento.

Some commenters also suggest that the retention of the approach viaducts, specifically the concrete hollow box girder portion of the J Street viaduct (24C0364R), be considered as part of an alternative for the proposed project or as mitigation for the removal of bird and bat habitat. Commenters further propose that retention of the viaduct would also better meet the objectives of the project.

Without motor vehicle traffic, federal transportation funding would no longer be available for maintenance of the viaduct structures and both cities have declining maintenance funding for roadways. Due to the lack of maintenance funding, the City of Sacramento has over \$170 million dollars of roadway maintenance backlog as defined in the most recent (August 2017) pavement condition report. The backlog projection includes new revenue sources from the passage of Senate Bill 1. Absent motor vehicle traffic, federal funds cannot be used to maintain the existing viaduct structures or existing bridge. Demolition of the approach structures is a necessary part of the proposed project for safety and the reduction of long-term maintenance liabilities and is specifically identified as one of the objectives of the project. The creation of an alternative that retains the viaducts would not satisfy the project's objectives and was therefore not proposed and analyzed in the EIR/EA.

The J Street viaduct structure (24C0364R) does not have bicycle or pedestrian facilities, or room to install them, and is not suitable for bicycle or pedestrian use due to it merging with a four-lane I-5 freeway off-ramp that leads to J Street in Sacramento. Combining freeway off-ramp traffic with one-way or two-way bicycle or pedestrian uses is not feasible.

Only the portion of the eastbound J Street viaduct (24C0364R) that connects the bridge system and the I-5 off-ramp is proposed to be removed (see Figure I-1 and EIR/EA Chapter 1). The structure that is used as the freeway off-ramp will remain for that use and will remain under Caltrans' control.

A separate project led by West Sacramento to determine the feasibility of using the upper deck of the existing I Street Bridge as a public facility is currently underway. That separate project may include use of a small portion of the approach structures that connect to the existing I Street Bridge. But, the concrete hollow box girder portion of the J Street viaduct (24C0364R) would not be retained for reuse of the upper deck of the existing bridge. See Master Response B for more information about the potential continued use of the existing bridge.

I.3.2 Master Response B: Use of Existing Bridge

Several comments were received regarding the future use of the existing I Street Bridge structure for recreational and non-motor-vehicle purposes. Separate from the I Street Bridge Replacement Project, the City of West Sacramento was awarded a Caltrans Sustainability Grant to fund completion of a \$225,000 feasibility study to analyze converting the upper deck of the existing I Street Bridge from a vehicle crossing to a bicycle and pedestrian crossing. The project consists of a robust community participation program and the preparation of several technical reports that together comprise the I Street Bridge Deck Conversion for Active Transportation Feasibility Study.

The resulting document consists of four primary elements including Community Participation, Regulatory Compliance, Preliminary Engineering and Project Management. The feasibility study describes in detail research and analysis results that appraise the overall technical and economic feasibility of the project. The study also identifies the successive steps to take toward project implementation. The I Street Bridge Deck Conversion is an important project aimed at maintaining vital connectivity between the Washington neighborhood and Downtown Sacramento.

It is envisioned that this historically significant transportation facility will be designed to integrate with adjacent land use elements to both attract visitors and speak to the history of the I Street Bridge, the two cities, and the railroad that shares it. The I Street Deck Conversion project cannot begin until the completion of the I Street Bridge Replacement Project due to the necessary removal of existing vehicle approach structures at the existing I Street Bridge. These will be removed as part of the I Street Bridge Replacement Project. However, as a result of the deck conversion feasibility study, it may be determined that a small portion of the approach structures that connect to the existing I Street Bridge would be retained. See also Master Response A.

City of West Sacramento staff is working to coordinate both projects in an effort to take advantage of both construction timing and funding opportunities.

I.3.3 Master Response C: Bridge Architecture

To set the stage for future crossings of the Sacramento River, during early planning efforts both cities determined that new bridges over the river must have certain attributes, ultimately adopted as a “Neighborhood Friendly Bridge” definition. Architectural and contextual attributes are included in the definition. As adopted, a neighborhood friendly bridge is one with the following parameters.

A facility whose primary function is local connectivity rather than regional travel and primarily serves short local trips.

A bridge which serves all users, including motorists, bicyclists, pedestrians, low energy vehicles, and public transit riders.

A bridge with aesthetics and dimensions which are architecturally pleasing and contextually appropriate for the adjacent neighborhoods.

A bridge that does not exceed or expand the already-planned capacity of the approach roadways (i.e., no widening of approaches just to accommodate bridge flows).

A facility which is designed with a target speed that is equal to or less than the approach roadways.

A bridge which reduces the growth in vehicle miles traveled in the adjacent communities.

A bridge that does not connect directly to streets which are primarily residential in character.

A bridge that is consistent with the Need and Purpose statement as articulated in the Sacramento River Crossings Alternatives Study Summary Report (February 2011).

Some comments included suggestions and inquiries regarding the architectural design of the new bridge. For the preparation of the EIR/EA, the type, height, length, and width of the new bridge were established based on the Neighborhood Friendly Definition as well as operational, structural and navigational criteria. The EIR/EA includes an assessment of the visual changes that would result from construction of the new bridge over the Sacramento River. However, the final aesthetic details of the bridge design are not the subject of NEPA or CEQA impact analyses.

Following the determination of the effects of construction of a new bridge, the Cities solicited proposals from qualified architects to develop aesthetic design concepts for the new bridge. The process began with the identification of qualified architects that had completed projects of similar scale to the proposed bridge. The Cities solicited both local and international firms to submit their design qualifications. The process the Cities followed to select a bridge architect is described on the City of Sacramento’s website at <http://www.cityofsacramento.org/Public-Works/Engineering-Services/Projects/Current-Projects/I-Street-Bridge-Replacement/Architect-Selection-Process>. The Cities selected an architect with a great vision for the project who will be able to work with all of the various stakeholders to complete the aesthetic design of the bridge.

The final aesthetic design criteria will be developed in cooperation with the bridge architect, but some of the guiding principles will be how the bridge fits within the surrounding setting, and with the overall Sacramento region history, values, and vision.

I.3.4 Master Response D: Purple Martin Mitigation

Several comments were received regarding the use of the concrete hollow box girder viaduct structure by purple martin as nesting habitat. Commenters also noted that the viaduct is used by bat species as well as white-throated swifts. Some commenters noted that the location of the proposed replacement habitat to help mitigate for the removal of the J Street approach viaduct is not suitable and instead proposes the retention of the viaduct for use by nesting purple martin. There is consensus that purple martin are unlikely to use habitat located over the Sacramento River because of afternoon winds that would deter the birds from entering the weep holes that would provide access to the interior of the structure.

As described in Chapter 1 of the EIR/EA and in Master Response A, the *eastbound* concrete hollow box-girder viaduct (24C0364R) is proposed to be removed, along with the other three approach viaduct structures that connect roadways to the upper deck of the existing I Street Bridge, consistent with the purpose and objectives of the project.

The EIR/EA identifies the significant effects of the proposed project on purple martin nesting habitat that would result from the removal of the box girder viaduct. The Draft EIR/EA included several mitigation measures to reduce the effects, including the creation of replacement habitat on the new bridge structure.

Since public circulation of the Draft EIR/EA, the project team met twice with the local purple martin expert mentioned in many comment letters and a representative of the Sacramento Audubon Society to discuss the current status of Sacramento-area purple martin colonies and additional mitigation options suitable for the I Street Bridge colony. It was noted during the discussions that the population of purple martins in the Sacramento region continues to decline and that creation of replacement habitat based on a 2:1 ratio of former numbers of nesting pairs of purple martin was above what was needed. In response to input provided by commenters that it would be unlikely that purple martin would use nest sites located over the Sacramento River, revised mitigation was developed to instead install new nesting habitat that would remain at the same location as the box girder viaduct. Habitat will no longer be created on the new bridge over the Sacramento River. Instead, the habitat removed by the demolition of the viaduct structure will be replaced onsite. A minimum of 10 large nest boxes will be installed. An initial set of wooden nest boxes were put in place under the viaduct in early April 2019 under the guidance of the local expert. Mitigation was also added to the EIR/EA for the enhancement of existing colony entrance holes at other colony locations within the city of Sacramento as well as to train City staff regarding the biology, habitat requirements, regulatory status, and legal protection of purple martin.

The mitigation measures are described starting on pages 2.19-46 of the EIR/EA and include the revised and new measures. As described on page 2.19-46, demolition of the existing viaduct structure would not occur until after all of the proposed replacement habitat is constructed and

available for use by birds for at least one overlapping nesting season. The delay in the demolition was selected because of the uncertainty of the replacement habitat being used by the birds and due to the magnitude of the effect of the project on the purple martin population.

EIR/EA pages 2.19-49 and 2.19-50 also describe mitigation that mandates the development and implementation of a minimum 10-year purple martin monitoring and management plan to assess the success of mitigation at the I Street colony, monitor other colonies in the Sacramento region, and make adjustments and improvements to the I Street replacement habitat. One public comment suggests that the plan include measures in the event that martins do not use the replacement habitat for nesting. To this point the plan measure includes the following language.

- The monitoring and management plan will include adaptive management measures to correct problems with I Street Bridge Project replacement habitat, make other habitat improvements, and/or implement management recommendations within or adjacent to the [biological study area], or at other City of Sacramento colony locations where the City has existing rights to make modifications, in an attempt to boost nesting success. These measures may include but would not be limited to the following.
 - A commitment to replacing poor-functioning or damaged free-standing purple martin nesting and/or perching habitat such that there is no net loss in the amount of created habitat.
 - A process for making and implementing recommendations on the management of vegetation around colonies within the city of Sacramento.

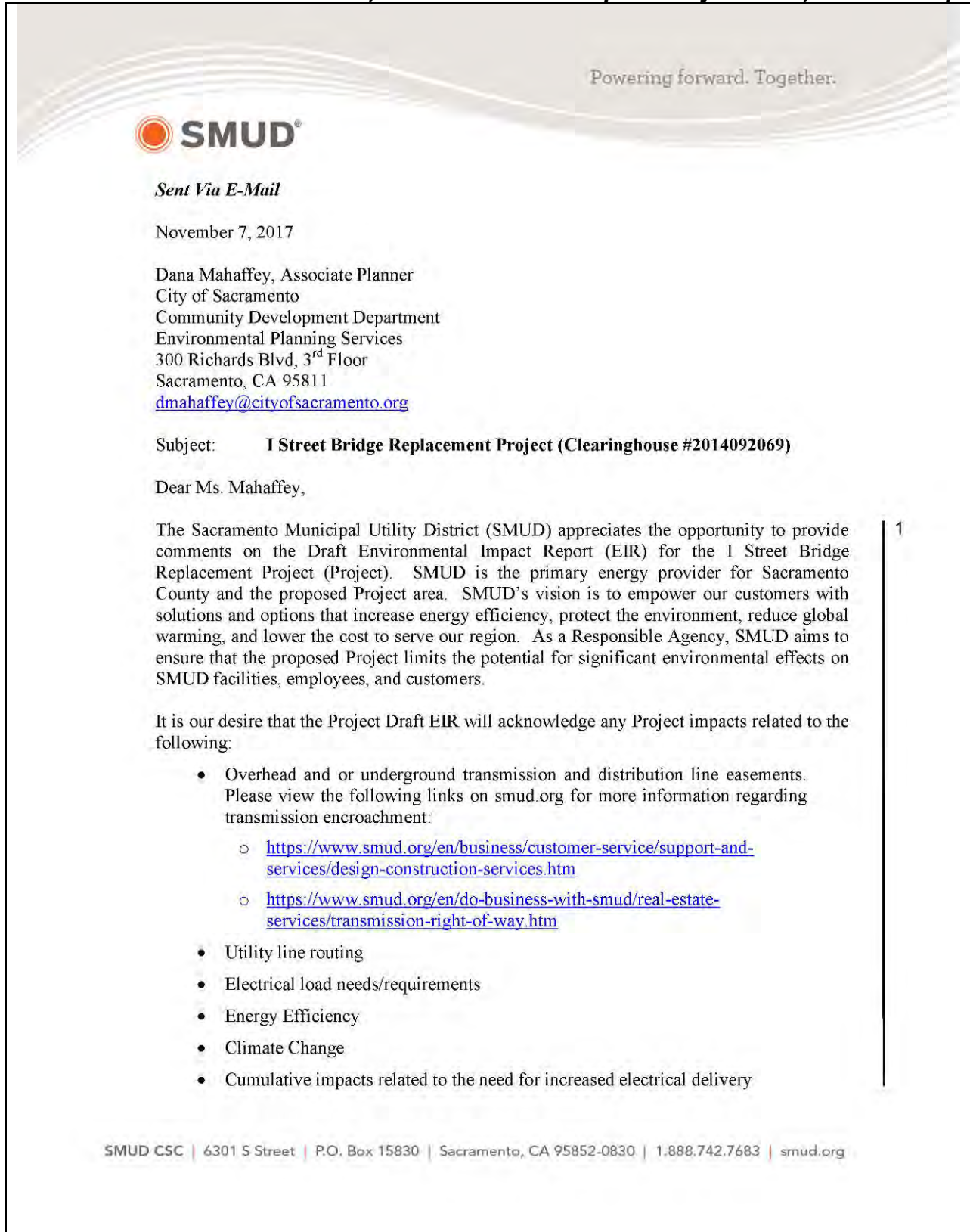
Further, the purple martin monitoring and management plan's 10-year period may be extended if it is found that purple martins are not using the replacement habitat, or the replacement habitat is not functioning as intended.

The revisions to mitigation for purple martin in response to public comment do not change the impact conclusions presented in the EIR/EA. The proposed project would result in a significant impact on the purple martin colony at the I Street Bridge and mitigation measures consistent with the purpose and objectives of the project would not reduce the effect to a less-than-significant level. Therefore, the EIR/EA identifies the impact as unavoidable. However, the significant and unavoidable finding does not override the requirement to implement the identified mitigation, monitor its effectiveness, and implement adaptive management strategies to correct problems and attempt to boost the nesting success of the purple martin population in Sacramento.

I.4 Comments and Responses to Comments

I.4.1 Agencies

Comment Letter A-1, Sacramento Municipal Utility District, Jamie Cutlip



Sent Via E-Mail

November 7, 2017

Dana Mahaffey, Associate Planner
City of Sacramento
Community Development Department
Environmental Planning Services
300 Richards Blvd, 3rd Floor
Sacramento, CA 95811
dmahaffey@cityofsacramento.org

Subject: **I Street Bridge Replacement Project (Clearinghouse #2014092069)**

Dear Ms. Mahaffey,

The Sacramento Municipal Utility District (SMUD) appreciates the opportunity to provide comments on the Draft Environmental Impact Report (EIR) for the I Street Bridge Replacement Project (Project). SMUD is the primary energy provider for Sacramento County and the proposed Project area. SMUD's vision is to empower our customers with solutions and options that increase energy efficiency, protect the environment, reduce global warming, and lower the cost to serve our region. As a Responsible Agency, SMUD aims to ensure that the proposed Project limits the potential for significant environmental effects on SMUD facilities, employees, and customers.

It is our desire that the Project Draft EIR will acknowledge any Project impacts related to the following:

- Overhead and or underground transmission and distribution line easements. Please view the following links on smud.org for more information regarding transmission encroachment:
 - <https://www.smud.org/en/business/customer-service/support-and-services/design-construction-services.htm>
 - <https://www.smud.org/en/do-business-with-smud/real-estate-services/transmission-right-of-way.htm>
- Utility line routing
- Electrical load needs/requirements
- Energy Efficiency
- Climate Change
- Cumulative impacts related to the need for increased electrical delivery

1

SMUD CSC | 6301 S Street | P.O. Box 15830 | Sacramento, CA 95852-0830 | 1.888.742.7683 | smud.org

Comment Letter A-1, Sacramento Municipal Utility District, Jamie Cutlip

Additionally, based on our review of the EIR and our understanding of the proposed Project, SMUD offers the following input for your consideration:

2

1. Energy Delivery (Infrastructure): If electrical service to the proposed bridge will be coming from SMUD's side of the river, then appropriate easements and/or infrastructure to and on the bridge may be necessary.
2. Planning Consideration: If proper clearances from the construction of the new bridge cannot be maintained (please consult with SMUD's new services department for precise clearance requirements), the customer will need to work with SMUD to relocate and/or underground these facilities. This work will be billable to the customer.
3. Transmission Considerations: The following comments pertain to the design and construction requirements around SMUD's distribution right-of-ways. SMUD has existing and/or proposed facilities on or adjacent to the proposed Project Site, including:
 - a. Existing 21kV underground (UG) infrastructure and facilities under Jibboom Street from the I Street Bridge intersection north to Railyards Blvd and beyond. These facilities are not in the elevated section of Jibboom Street but below grade level beneath and on Jibboom Street (when Jibboom reaches grade level);
 - b. Existing 21kV pad-mounted switch (U-11048) and 21kV pad-mounted transformer (TX-00125250) at grade level under the Jibboom and I Street intersection (beneath the elevated roadway). These facilities serve the bridge and surrounding area;
 - c. Existing 21 kV UG and overhead (OH) infrastructure and facilities along the east and west side of Jibboom Street from Railyards Blvd north along the river to and beyond the water treatment intake facility on the Sacramento River. These facilities serve the water treatment plant and surrounding area;
 - d. Existing underground infrastructure and facilities from Jibboom Street east under Interstate along Railyards Blvd;
 - e. Existing 21kV UG infrastructure and facilities just east of the Jibboom and I Street intersection below grade level;
 - f. Existing 21kV pad-mounted switch (U-12572) and 21kV pad-mounted transformer (TX-02011133) just east of the Jibboom and I Street intersection at grade level. These facilities serve Southern Pacific Rail and the surrounding area.

SMUD would like to be involved with discussing the above areas of interest as well as discussing any other potential issues. We aim to be partners in the efficient and sustainable delivery of the proposed Project. Please ensure that the information included in this response is conveyed to the Project planners and the appropriate Project proponents.

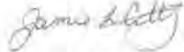
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Comment Letter A-1, Sacramento Municipal Utility District, Jamie Cutlip

Environmental leadership is a core value of SMUD and we look forward to collaborating with you on this Project. Again, we appreciate the opportunity to provide input on this Draft EIR. If you have any questions regarding this letter, please contact SMUD's Environmental Management Specialist, Rob Ferrera, at rob.ferrera@smud.org or 916.732.6676.

3
cont.

Sincerely,



Jamie Cutlip
Regional & Local Government Affairs
Sacramento Municipal Utility District
6301 S Street, Mail Stop A313
Sacramento, CA 95817
jamie.cutlip@smud.org

Cc: Rob Ferrera

(JC/sc)

Response to A-1, Sacramento Municipal Utility District, Jamie Cutlip

Response to Comment A-1-1

This comment includes an introduction and statement that SMUD is a Responsible Agency. The comment requests that the EIR/EA acknowledge potential impacts related to transmission and distribution line easements, utility line routing, electrical load needs/requirements, energy efficiency, climate change, and cumulative impacts related to increased electrical delivery.

As discussed on page 2.4-4 of the EIR/EA, the project proponent will coordinate with utility service providers prior to and during construction to avoid or minimize service interruptions. During this coordination, issues such as transmission line easements, utility line routing, and electrical loading will be addressed to avoid significant and cumulative impacts. It is currently estimated that the proposed bridge will require about 120 kilowatts to open or close and another 20 kilowatts for lighting and the control house's heating, ventilation and air conditioning system. The peak power demand of the bridge would be equivalent to about six residential homes. The project will be designed following current electrical efficiency standards. To minimize energy demand, light-emitting diode (LED) lighting will be used and solar panels will be investigated. Electricity supply could come from either side of the river. Each utility supplier will be contacted during final design of the bridge to confirm the needed supply of power. Potential impacts of the project relating to climate change are discussed starting on page 2.13-14 and page 3-15 of the EIR/EA. No change to the Draft EIR/EA is necessary.

Response to Comment A-1-2

This comment provides a list of considerations related to existing and future electrical service and existing or proposed electrical facilities. As discussed on page 2.4-4 of the EIR/EA, the project proponent will coordinate with utility service providers prior to and during construction to avoid conflicts and minimize any potential service interruptions. No change to the Draft EIR/EA is necessary.

Response to Comment A-1-3

Please see the response to Comment A-1-2.

Comment Letter A-2, California Department of Fish and Wildlife, Juan Torres

From: Torres, Juan@Wildlife [<mailto:Juan.Torres@wildlife.ca.gov>]
Sent: Thursday, November 9, 2017 10:51 AM
To: Jesse Gothan <JGothan@cityofsacramento.org>; Dana Mahaffey <DMahaffey@cityofsacramento.org>
Cc: Sheya, Tanya@Wildlife <Tanya.Sheya@wildlife.ca.gov>; Loeffler, Laura M@DOT <laura.loeffler@dot.ca.gov>
Subject: I STREET BRIDGE REPLACEMENT OVER THE SACRAMENTO RIVER

Dear Mrs. Mahaffey:

The California Department of Fish and Wildlife (Department) reviewed the draft Environmental Impact Report (EIR) for the I Street Bridge Replacement Project (Project). 1

As a trustee for California's fish and wildlife resources, the Department has authority over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (Fish & G. Code, § 1802). The Department may also act as a Responsible Agency (Cal. Code Regs., § 21069) for a project where it has discretionary approval power under the California Endangered Species Act (Fish & G. Code, § 2050 et seq.) and the Lake and Streambed Alteration Program (Fish & G. Code, § 1600 et seq.). The Department also administers the Native Plant Protection Act, Natural Community Conservation Program, and other provisions of the Fish and Game Code that afford protection to California's fish and wildlife resources.

Project Description and alteRnatives

The Project will include construction of a new bridge upstream from the existing I Street Bridge. The new bridge will cross the Sacramento River between the Sacramento Railyards and the West Sacramento Washington planned developments and provide a new bicycle, pedestrian, and automobile crossing. The existing I Street Bridge would continue to be used by the railroad. The approach viaducts to the existing I Street Bridge will be demolished. Two alternatives are discussed in the EIR. Alternative 1 consists of signalized intersections at Jibboom Street and Bercut Drive, while Alternative 2 consists of a roundabout between these two intersections. Beyond the Jibboom Street and Bercut Drive intersections, the remaining project elements and limits in the City of Sacramento are similar under both alternatives.

ENVIRONMENTAL SETTING AND IMPACT ANALYSIS 2

State Threatened, Endangered, Fully Protected and Special Concern Species

Purple Martin (*Progne subis*)

The EIR determined that a significant and unavoidable impact to purple martins would occur as a result of the implementation of the proposed project. As required by section 15126.6 of the CEQA Guidelines, the EIR shall include appropriate range of reasonable and feasible alternatives that would attain most of the basic Project objectives and avoid or minimize significant impacts to the natural resources. The EIR does not include any alternative that would avoid, minimize or mitigate the impacts to purple martin. Thus, the Department requests that the EIR includes alternatives that would avoid impacts to purple martin, such as keeping the existing approach to the I Street Bridge.

Based on the lack of documentation of the use of alternative nesting sites by purple martins in California and the wind patterns in the area, it is very unlikely that the alternative nesting sites provided within the new bridge will be used by this species. In addition to this, no purple martins have been documented to be nesting in similar bridges in the area. The mitigation measures proposed in the EIR are insufficient to mitigate the impacts to these species and it is very likely that if the Project is implemented as described in the EIR, it will result in the extirpation of this purple martin population. 3

Comment Letter A-2, California Department of Fish and Wildlife, Juan Torres

The implementation of a monitoring and management plan described in the EIR for purple martins does not include measures that will be implemented in the event that purple martins do not use the new bridge for nesting. The EIR should include additional mitigation measures to offset impacts to this species. Preserving and managing other existing nesting areas should also be considered as mitigation to offset the impact to this species.

3
cont.

The cumulative impact section fails to disclose the potential impacts to this, and other purple martin populations in the area. The population's levels are so low that additional impacts to other nesting sites could result in the extirpation of purple martins in the valley. The cumulative impacts assessment should include additional analyses of other known projects that could impact purple martin nesting habitat. In addition to this, the cumulative impact assessment should include an analysis regarding the potential cumulative impacts caused by the Railyard project to this population.

4

Central Valley Spring-Run and Sacramento River Winter-Run Chinook Salmon (Oncorhynchus tshawytscha).

5

The EIR disclosed that the Project is likely to adversely affect Central Valley Spring-Run and Winter-Run Chinook Salmon based on temporary effects on water quality (increased turbidity and suspended sediment), rearing and movement habitat (noise and shade), and channel substrates (cofferdams and temporary trestles), as well as, temporary and permanent effects on riparian and shaded riverine aquatic habitat (vegetation removal, bridge and bike path construction). Although the construction window could avoid some impacts to these runs, construction within the Sacramento River could result in the "take," as defined in the Fish and Game Code, section 86, of Central Valley Spring and Winter Run Chinook Salmon; therefore, the Department recommends that an Incidental Take Permit (ITP) is obtained prior to the construction of this project. This would avoid any potential delays in the event that take occurs during construction.

Please note that when acting as a responsible agency, CEQA guidelines section 15096, subdivision (f) requires the Department to consider the CEQA environmental document prepared by the lead agency prior reaching a decision on the project. Addressing the Department's comments and disclosing potential Project impacts on CESA-listed species and any river, lake, or stream, and provide adequate avoidance, minimization, mitigation, monitoring and reporting measures will assist the Department with the consideration of the EIR and reduce potential delays when issuing an ITP and/or an Lake and Streambed Alteration Agreement.

6

The Department appreciates the opportunity to provide comments on the EIR and we hope you will contact us to discuss our concerns, comments, and recommendations in greater detail. If you have any questions, please contact me

Juan Lopez Torres
Senior Environmental Scientist (Specialist)

CALIFORNIA DEPARTMENT OF
FISH and WILDLIFE 
NORTH CENTRAL REGION
HABITAT CONSERVATION PROGRAM
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670
Office: (916) 358-2951
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Juan.Torres@wildlife.ca.gov
www.wildlife.ca.gov

Every Californian should conserve water. Find out how at:



Comment Letter A-2, California Department of Fish and Wildlife, Juan Torres

SaveOurWater.com · Drought.CA.gov

Response to A-2, California Department of Fish and Wildlife, Juan Torres

Response to Comment A-2-1

The comment is introductory, describes the role of the California Department of Fish and Wildlife, and summarizes the project. No response is necessary.

Response to Comment A-2-2

Please see Master Response A.

Response to Comment A-2-3

Please see Master Response D.

Response to Comment A-2-4

The assessment of the contributions of the I Street Bridge Replacement Project to cumulatively considerable impacts is included in EIR/EA Section 2.22. The assessment takes into consideration the effects of the proposed project in combination with the effects of other known projects, including development of the Railyards, to determine the project's contribution to cumulative impacts. The proposed project's impact and contribution to the loss of purple martin nesting habitat results from the removal of nesting habitat (the J Street approach viaduct). The project would not contribute to effects on habitat elsewhere. On page 2.22-9 and 2.22-11, the EIR/EA describes the project's potential contribution to cumulatively considerable impacts on purple martin.

The analysis of the contributions to cumulative impacts of development of the Railyards Specific Plan Area was included in the Railyards Specific Plan Update EIR. A separate analysis of the impacts of the Railyards project does not need to be included in the I Street Bridge Replacement EIR/EA. The Railyards EIR concluded that the impact of Railyards development on purple martin would be significant and unavoidable. The Railyards EIR also assumed the I Street Bridge Replacement Project, including the removal of the approach viaducts, in its cumulative analysis (Railyards Impact 4.3-11). No change to the Draft EIR/EA is necessary.

Response to Comment A-2-5

The commenter's recommendation that an incidental take permit be obtained for potential effects on Central Valley Spring-run and Winter-run Chinook salmon is noted. The EIR/EA has been changed to list the permit in Tables S-1 and 1-1.

Response to Comment A-2-6

The project proponents recognize that the California Department of Fish and Wildlife is a responsible agency under CEQA and understands how the Department may use the project's environmental document as part of future permitting actions. No change to the Draft EIR/EA is necessary.

Comment Letter A-3, California State Lands Commission, Cy R. Oggins

STATE OF CALIFORNIA

EDMUND G. BROWN JR., Governor

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202



Established in 1938

JENNIFER LUCCHESI, Executive Officer
(916) 574-1800 Fax (916) 574-1810
California Relay Service TDD Phone 1-800-735-2929
from Voice Phone 1-800-735-2922

Contact Phone: (916) 574-1890
Contact FAX: (916) 574-1885

November 13, 2017

File Ref: SCH # 2014092069

Dana Mahaffey
City of Sacramento
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811
E-mail: dmahaffey@cityofsacramento.org

**Subject: Draft Environmental Assessment/Environmental Impact Report (EA/EIR)
for the I Street Bridge Replacement Project, Sacramento and Yolo
Counties**

Dear Ms. Mahaffey:

The California State Lands Commission (Commission) staff has reviewed the subject Draft EA/EIR for the I Street Bridge Replacement Project (Project), which is being prepared by the City of Sacramento (City) and the California Department of Transportation (Caltrans). The City, as the public agency proposing to carry out the Project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.), and Caltrans is the lead agency under the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.). The Commission is a trustee agency for projects that could directly or indirectly affect sovereign land and their accompanying Public Trust resources or uses. Additionally, because the Project involves work on sovereign land, the Commission will act as a responsible agency.

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Comment Letter A-3, California State Lands Commission, Cy R. Oggins

Dana Mahaffey

Page 2

November 13, 2017

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1
cont.

Based upon the information provided and a preliminary review of our records, the portion of the Project that crosses the Sacramento River will be located on State sovereign land under the jurisdiction of the Commission. A lease for the use of sovereign land will be required from the Commission for any portion of the Project encroaching on State sovereign land. Please contact Nicholas Lavoie (see contact information below) for further information about the extent of the Commission's sovereign ownership and leasing requirements.

Project Description

2

The City is proposing a new I Street Bridge to be constructed just north of the existing I Street Bridge, to fulfill improved access for waterfront uses and circulation between the cities of Sacramento and West Sacramento. The new bridge will cross the Sacramento River between the Sacramento Railyards and the West Sacramento Washington planned developments. The Project is expected to meet the objectives and needs of both cities as follows:

- Improve mobility for motorists, bicyclists and pedestrians
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From the Project Description, Commission staff understands that the Project would include the following components:

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Comment Letter A-3, California State Lands Commission, Cy R. Oggins

Dana Mahaffey

Page 3

November 13, 2017

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2
cont.

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Environmental Review

Commission staff requests that the City consider the following comments for the EA/EIR.

3

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1. Visual Compatibility of Bridge with River Corridor. Page 2.6-15 identifies that the Project proponent will work with stakeholders to determine bridge aesthetics. Specifically, "affected stakeholders will be able to provide input on the preferred architectural style and coloring of the proposed bridge." The new bridge will have a substantial new visual presence within the river channel and to adjacent Sacramento and West Sacramento land uses. As such, the architectural style and color of the bridge is critically important. Although both sides of the river are surrounded by urban land uses, the bridge scale, architecture, and color must also be compatible with the river and riparian corridor as a natural environment. Bridge color should attempt to balance natural earthtone colors compatible with the river corridor, rather than the bright white finish represented in visual simulations for the new bridge, which is visually disruptive and incompatible with the river corridor visual setting.

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2. Submerged Resources. Please note that any submerged archaeological site or submerged historic resource that has remained in state waters for more than 50 years is presumed to be significant. Because of this possibility, please add a mitigation measure requiring that in the event cultural resources are discovered during any construction activities, Project personnel shall halt all activities in the immediate area and notify a qualified archaeologist to determine the appropriate course of action.

Comment Letter A-3, California State Lands Commission, Cy R. Oggins

Dana Mahaffey

Page 4

November 13, 2017

3. Title to Resources. The EA/EIR should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the state and under the jurisdiction of the California State Lands Commission (Pub. Resources Code, § 6313). Commission staff requests that the City consult with Staff Counsel Jamie Garrett (see contact information below) should any cultural resources on state lands be discovered during construction of the proposed Project.

5

Recreation

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4. Navigation Impediments. The Project involves construction of a new bridge near three other existing bridges (U.S. 50 Bridge, Tower Bridge, and I Street Bridge), in addition to the proposed new Broadway Bridge. The Tower and I Street Bridges include moveable mid-section spans for passage of larger vessels, and these bridges can become an obstacle for navigation of smaller vessels during high flood stage events when the river is at or near full capacity. The new Broadway Bridge is also proposed to include a moveable mid-section span. When heavy watercraft traffic is present on the river (i.e., summer weekends, holidays, prime fishing seasons, etc.), the in-water piers and protective fender structures for these bridges can pose navigation obstacles, resulting in constrained navigation. These in-water structures also accumulate large woody debris, other materials that get caught in the debris piles, and sedimentation, which can be a hazard for navigation and can snag vessel anchors on the river bottom. Periodic maintenance is required to remove accumulated debris and maintain protective structures for the bridge piers (i.e., Tower Bridge Fender Replacement Project Mitigated Negative Declaration).

To the extent feasible, the piers and fender structures for the new bridge should be designed to minimize navigation impacts, and the bridge deck should be elevated to avoid disruption of navigation by smaller vessels during high flood stage events, when the river is at or near full capacity. The Draft EA/EIR does not appear to include an analysis of these potentially significant types of watercraft navigation impacts. An approach to mitigate potential navigation impacts of the I Street Bridge Project could include removal of other existing derelict structures and navigation hazards in the project vicinity. Derelict structures in the Project vicinity could include abandoned pilings, outfall pipelines, piers, floating docks, abandoned vessels, artificial debris, etc. This mitigation approach is feasible given the proposal for a new bridge across the river, retention of the existing bridge, and the cumulative navigation impacts of a fifth bridge within approximately 1 mile of four other existing and planned bridges as noted above. This will also offset the reduction of floodplain volume from the permanent structural encroachment of 1.85 acres for the new bridge within the perennial stream zone of the river. The City is encouraged to provide this analysis in the EA/EIR, identify navigation impacts as potentially significant, and consider a mitigation approach such as the one identified above.

5. Public Access. Promotion of public access to and use of California's navigable waters is a mandate of the California Constitution (art. X, § 4), a condition of statehood in the Act of Admission (9 Stat. 452), and a responsibility of public agencies pursuant to the Public Trust Doctrine. In this case, the Legislature has

7

Comment Letter A-3, California State Lands Commission, Cy R. Oggins

Dana Mahaffey

Page 5

November 13, 2017

provided a process to be followed to facilitate and maintain public access to navigable rivers at bridge sites pursuant to California Streets and Highways Code, section 1809. During the design hearing process, and prior to Commission consideration of approval for a bridge project, the City is required to fully consider, and prepare a report on, the feasibility of providing public access to the Sacramento River for recreational purposes, and determine if such public access will be provided. The report should summarize project impacts and improvements to public access to the river, navigation impacts described above, and existing areas of public access to the river in the Project vicinity. The mitigation approach described above for removal of derelict structures could also serve to enhance public access and navigation within the river pursuant to section 1809. Commission staff encourages the City to include this information in the EA/EIR for conformance with California Streets and Highways Code.

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cont.

Cumulative Impacts

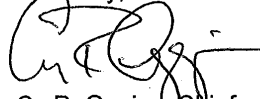
8

6. The EA/EIR should consider the cumulative impacts of other past, present, and probable future projects that could contribute to impacts generated by the Project. Such projects include the Tower Bridge Fender Replacement project, the Southport Sacramento River Early Implementation project, and new Broadway Bridge project.

Thank you for the opportunity to comment on the Draft EA/EIR for the Project. As a trustee and responsible agency, Commission staff requests that you consider our comments prior to certification of the EA/EIR. Please send copies of future Project-related documents, including electronic copies of the Final EIR, Mitigation Monitoring and Reporting Program, Notice of Determination, CEQA Findings, and if applicable, Statement of Overriding Considerations when they become available. Please refer questions concerning environmental review to Jason Ramos, Senior Environmental Scientist, at (916) 574-1814 or via e-mail at Jason.Ramos@slc.ca.gov. For questions concerning archaeological or historic resources under Commission jurisdiction, please contact Staff Counsel Jamie Garrett at (916) 574-0398 or via e-mail at Jamie.Garrett@slc.ca.gov. For questions concerning Commission leasing jurisdiction, please contact Nicholas Lavoie, Regional Land Manager, at (916) 574-0452 or via e-mail at Nicholas.Lavoie@slc.ca.gov.

9

Sincerely,



Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
J. Ramos, Commission
N. Lavoie, Commission
J. Garrett, Commission

Response to A-3, California State Lands Commission, Cy R. Oggins

Response to Comment A-3-1

This comment is introductory and also describes the regulatory jurisdiction of the State Lands Commission. It also notes that a lease of State lands will be necessary as part of project approvals, which is consistent with Tables S-1 and 1-1 of the EIR/EA. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-2

This comment summarizes the elements of the project that could affect State sovereign land. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-3

This comment references the process that will be undertaken to determine the architectural design of the bridge, provides input on the design and suggests that the bridge be visually compatible with the river corridor. Please see Master Response C. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-4

This comment requests the addition of mitigation directing the halting of construction activities if a cultural resource, including a submerged cultural resource, is encountered during construction. The EIR/EA already contains such a measure on pages 2.7-12 and 3-71. Caltrans and City of Sacramento procedures regarding the discovery of cultural materials will be followed. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-5

The State's title to, and the Commissions jurisdiction over resources located on or in the tide and submerged lands of California is acknowledged. This fact does not change the impact analysis presented in the EIR/EA. The project proponents will consult with the State Lands Commission Staff Counsel if cultural resources on State lands are discovered during project construction. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-6

This comment notes the proximity of other existing and proposed bridges to the proposed new I Street Bridge and potential hazards to navigation and indicates that the project could negatively affect watercraft navigation. The U.S. Coast Guard (USCG) is responsible for approving, through issuance of a bridge permit, construction of new bridges that cross navigable waterways. For the proposed project, the USCG reviewed preliminary designs and provided the requirements that the project would be expected to meet in order to provide safe and efficient vessel passage, including for the barges used to transport levee maintenance and repair equipment. The proposed project meets the USCG design requirements, including those for the navigable channel width provided by the bridge, and minimum vertical clearances above 200-year flood water surface elevation for both the closed and open bridge positions.

The analysis of the effects of the project on the floodplain is described in EIR/EA Section 2.8, Hydrology and Floodplain. EIR/EA page 2.8-9 states that the proposed bridge would result in a negligible increase in the peak water surface elevation of 0.02 foot immediately upstream of the

project site for 200-year, 100-year, and 50-year flood events. Therefore, the new bridge would not impact river hydraulics. In addition, as described on page 2.8-11 of the EIR/EA, the proposed deck freeboard clearance meets the requirements of Caltrans and the Central Valley Flood Protection Board and the bridge is designed according to the *FloodSAFE California Urban Levee Design Criteria*.

By being designed to meet the navigational requirements of the USCG, the proposed project would not create or increase navigational hazards, including any hazards caused by derelict structures located in the project vicinity. Routine removal of debris that may get snagged on the bridge would occur on a schedule similar to what is required for the existing I Street and Tower bridges. The removal of existing structures within the Sacramento River is not a requirement for the proposed project. The project would not result in significant impacts on watercraft navigation and no mitigation is necessary. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-7

This comment references California Streets and Highways Code (SHC) and the requirement to consider the feasibility of providing public access to the Sacramento River at the bridge. Compliance with SHC Section 1809 is separate from the provisions of CEQA. The proposed project would not change existing river access in the project area. The project would enhance recreational use of the banks of the river by incorporating bicycle and pedestrian facility connections to existing and planned trail systems. The feasibility of providing access to the Sacramento River from the I Street Bridge will be documented and considered prior to project approval. The City of Sacramento acknowledges the need for the assessment. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-8

The discussion of the cumulative effects of the project starts on EIR/EA page 2.22-1. The cumulative impact section describes the approach to the analysis, the impact assessment, and the cumulative impacts to specific resource areas to which the project may incrementally contribute. No change to the Draft EIR/EA is necessary.

Response to Comment A-3-9

This comment concludes the letter, notes the State Lands Commission's role as a trustee and responsible agency, and requests receipt of future project related documents. No change to the Draft EIR/EA is necessary.

Comment Letter A-4, State Clearinghouse, Scott Morgan



EDMUND G. BROWN JR.
GOVERNOR

STATE OF CALIFORNIA
GOVERNOR'S OFFICE of PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT



KEN ALEX
DIRECTOR

November 14, 2017

Dana Mahaffey
City of Sacramento
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

Subject: I Street Bridge Replacement Project
SCH#: 2014092069

Dear Dana Mahaffey:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on November 13, 2017, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

"A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

1

Comment Letter A-4, State Clearinghouse, Scott Morgan

**Document Details Report
State Clearinghouse Data Base**

SCH# 2014092069
Project Title I Street Bridge Replacement Project
Lead Agency Sacramento, City of

Type EIR Draft EIR

Description The project would include the construction of a new bridge across the Sacramento River between the Sacramento Railyards and the West Sacramento Washington planned developments. The new bridge would provide a new vehicle, bicycle, and pedestrian crossing connecting C Street in West Sacramento to Railyards Blvd. in Sacramento and would include a moveable center span to allow passage for watercraft. The existing I Street Bridge would continue to be used by the railroad. The existing Sacramento would be demolished.

Lead Agency Contact

Name Dana Mahaffey
Agency City of Sacramento
Phone (916) 808-2762 **Fax**
email
Address 300 Richards Blvd., 3rd Floor
City Sacramento **State** CA **Zip** 95811

Project Location

County Sacramento, Yolo
City Sacramento, West Sacramento
Region
Lat / Long 38° 35' 20" N / 121° 30' 24" W
Cross Streets C Street, West Sacramento, Bercut Dr/Railyards Blvd, 3rd St
Parcel No. Various
Township 9N **Range** 4E **Section** **Base** 10

Proximity to:

Highways I-5, I-80
Airports
Railways UPRR
Waterways Sacramento & American Rivers
Schools Elkhorn Will ES
Land Use West Sacramento: Recreation/Parks, Waterfront
 Sacramento: American River Parkway, Heavy Industrial

Project Issues Air Quality; Archaeologic-Historic; Biological Resources; Flood Plain/Flooding; Geologic/Seismic; Noise; Public Services; Recreation/Parks; Soil Erosion/Compaction/Grading; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Wetland/Riparian; Landuse; Cumulative Effects; Aesthetic/Visual; Drainage/Absorption; Economics/Jobs; Population/Housing Balance; Growth Inducing

Reviewing Agencies Resources Agency; Department of Boating and Waterways; Central Valley Flood Protection Board; Department of Fish and Wildlife, Region 2; Office of Historic Preservation; Department of Parks and Recreation; California Highway Patrol; Caltrans, District 3 S; Regional Water Quality Control Bd., Region 5 (Sacramento); Air Resources Board, Transportation Projects; Delta Protection Commission; Delta Stewardship Council; Native American Heritage Commission; Public Utilities Commission; State Lands Commission

Date Received 09/28/2017 **Start of Review** 09/28/2017 **End of Review** 11/13/2017

Note: Blanks in data fields result from insufficient information provided by lead agency.

Comment Letter A-4, State Clearinghouse, Scott Morgan

STATE OF CALIFORNIA

EDMUND G. BROWN JR., Governor

CALIFORNIA STATE LANDS COMMISSION
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November 13, 2017

File Ref: SCH # 2014092069

Governor's Office of Planning & Research

NOV 13 2017

STATE CLEARINGHOUSE

Dana Mahaffey
City of Sacramento
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811
E-mail: dmahaffey@cityofsacramento.org

**Subject: Draft Environmental Assessment/Environmental Impact Report (EA/EIR)
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Comment Letter A-4, State Clearinghouse, Scott Morgan

Dana Mahaffey

Page 2

November 13, 2017

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Comment Letter A-4, State Clearinghouse, Scott Morgan

Dana Mahaffey

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November 13, 2017

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Cultural Resources

2. Submerged Resources. Please note that any submerged archaeological site or submerged historic resource that has remained in state waters for more than 50 years is presumed to be significant. Because of this possibility, please add a mitigation measure requiring that in the event cultural resources are discovered during any construction activities, Project personnel shall halt all activities in the immediate area and notify a qualified archaeologist to determine the appropriate course of action.

Comment Letter A-4, State Clearinghouse, Scott Morgan

Dana Mahaffey

Page 4

November 13, 2017

3. Title to Resources. The EA/EIR should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the state and under the jurisdiction of the California State Lands Commission (Pub. Resources Code, § 6313). Commission staff requests that the City consult with Staff Counsel Jamie Garrett (see contact information below) should any cultural resources on state lands be discovered during construction of the proposed Project.

Recreation

4. Navigation Impediments. The Project involves construction of a new bridge near three other existing bridges (U.S. 50 Bridge, Tower Bridge, and I Street Bridge), in addition to the proposed new Broadway Bridge. The Tower and I Street Bridges include moveable mid-section spans for passage of larger vessels, and these bridges can become an obstacle for navigation of smaller vessels during high flood stage events when the river is at or near full capacity. The new Broadway Bridge is also proposed to include a moveable mid-section span. When heavy watercraft traffic is present on the river (i.e., summer weekends, holidays, prime fishing seasons, etc.), the in-water piers and protective fender structures for these bridges can pose navigation obstacles, resulting in constrained navigation. These in-water structures also accumulate large woody debris, other materials that get caught in the debris piles, and sedimentation, which can be a hazard for navigation and can snag vessel anchors on the river bottom. Periodic maintenance is required to remove accumulated debris and maintain protective structures for the bridge piers (i.e., Tower Bridge Fender Replacement Project Mitigated Negative Declaration).

To the extent feasible, the piers and fender structures for the new bridge should be designed to minimize navigation impacts, and the bridge deck should be elevated to avoid disruption of navigation by smaller vessels during high flood stage events, when the river is at or near full capacity. The Draft EA/EIR does not appear to include an analysis of these potentially significant types of watercraft navigation impacts. An approach to mitigate potential navigation impacts of the I Street Bridge Project could include removal of other existing derelict structures and navigation hazards in the project vicinity. Derelict structures in the Project vicinity could include abandoned pilings, outfall pipelines, piers, floating docks, abandoned vessels, artificial debris, etc. This mitigation approach is feasible given the proposal for a new bridge across the river, retention of the existing bridge, and the cumulative navigation impacts of a fifth bridge within approximately 1 mile of four other existing and planned bridges as noted above. This will also offset the reduction of floodplain volume from the permanent structural encroachment of 1.85 acres for the new bridge within the perennial stream zone of the river. The City is encouraged to provide this analysis in the EA/EIR, identify navigation impacts as potentially significant, and consider a mitigation approach such as the one identified above.

5. Public Access. Promotion of public access to and use of California's navigable waters is a mandate of the California Constitution (art. X, § 4), a condition of statehood in the Act of Admission (9 Stat. 452), and a responsibility of public agencies pursuant to the Public Trust Doctrine. In this case, the Legislature has

Comment Letter A-4, State Clearinghouse, Scott Morgan

Dana Mahaffey

Page 5

November 13, 2017

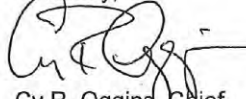
provided a process to be followed to facilitate and maintain public access to navigable rivers at bridge sites pursuant to California Streets and Highways Code, section 1809. During the design hearing process, and prior to Commission consideration of approval for a bridge project, the City is required to fully consider, and prepare a report on, the feasibility of providing public access to the Sacramento River for recreational purposes, and determine if such public access will be provided. The report should summarize project impacts and improvements to public access to the river, navigation impacts described above, and existing areas of public access to the river in the Project vicinity. The mitigation approach described above for removal of derelict structures could also serve to enhance public access and navigation within the river pursuant to section 1809. Commission staff encourages the City to include this information in the EA/EIR for conformance with California Streets and Highways Code.

Cumulative Impacts

6. The EA/EIR should consider the cumulative impacts of other past, present, and probable future projects that could contribute to impacts generated by the Project. Such projects include the Tower Bridge Fender Replacement project, the Southport Sacramento River Early Implementation project, and new Broadway Bridge project.

Thank you for the opportunity to comment on the Draft EA/EIR for the Project. As a trustee and responsible agency, Commission staff requests that you consider our comments prior to certification of the EA/EIR. Please send copies of future Project-related documents, including electronic copies of the Final EIR, Mitigation Monitoring and Reporting Program, Notice of Determination, CEQA Findings, and if applicable, Statement of Overriding Considerations when they become available. Please refer questions concerning environmental review to Jason Ramos, Senior Environmental Scientist, at (916) 574-1814 or via e-mail at Jason.Ramos@slc.ca.gov. For questions concerning archaeological or historic resources under Commission jurisdiction, please contact Staff Counsel Jamie Garrett at (916) 574-0398 or via e-mail at Jamie.Garrett@slc.ca.gov. For questions concerning Commission leasing jurisdiction, please contact Nicholas Lavoie, Regional Land Manager, at (916) 574-0452 or via e-mail at Nicholas.Lavoie@slc.ca.gov.

Sincerely,



Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
J. Ramos, Commission
N. Lavoie, Commission
J. Garrett, Commission

Response to A-4, State Clearinghouse, Scott Morgan

Response to Comment A-4-1

This letter indicates the distribution of the Draft EIR/EA by the State Clearinghouse to the agencies indicated on the Document Details Report. Responses to the California State Lands Commission letter are included with the original copy received on November 13, 2017. See responses to A-3. No change to the Draft EIR/EA is necessary.

I.4.2 Individuals

Comment Letter I-1, Tim Castleman

From: timcastleman@gmail.com [<mailto:timcastleman@gmail.com>] **On Behalf Of** Practical Cycle Tim
Sent: Monday, October 2, 2017 11:00 AM
To: Katie Durham <kdurham@aimconsultingco.com>
Subject: Material Impact on Practical Cycle

Dear Katie,

The planned 24 to 30 month Sacramento River Bike trail closure and detour will have a significant impact on the bike rental aspect of our business operations. Is there any way we can work directly with someone to reduce this harm? | 1

Tim Castleman, President
Practical Cycle LLC
Cell: 916-889-6130

114 J Street
Sacramento, CA 95814
916-706-0077

150 Natoma Station
Folsom, CA 95630
916-351-8330

<http://www.PracticalCycle.com>

Response to I-1, Tim Castleman

Response to Comment I-1-1

This comment indicates that the Sacramento River Bike trail closure would significantly impact the commenter's bicycle rental business and asks to work with someone on this issue. See Response to I-2, below, for more detailed information regarding this issue. No change to the Draft EIR/EA is necessary.

Comment Letter I-2, Tim Castleman



October 5, 2017

To: City of Sacramento, Community Development Department, 300 Richards Boulevard, 3rd Floor, Sacramento, California 95811

Re: I Street Bridge Replacement Project Draft EIR/EA dated September 2017, Sacramento River Bike Trail Closure and Detour

The planned 24 to 30 month Sacramento River Bike trail closure and detour will have a significant material impact to our business. The proposed detour downgrades an extremely popular bike route from a Class 1 separated bike trail to a two lane road that doesn't even have Class 2 bike lanes. Both locals and visitors will be placed into a dangerous uncomfortable situation if this plan proceeds as published.

1

- Rental customers both locally and from all over the world will encounter dangerous uncomfortable traffic conditions.
- Commuters will be diverted from their normal safe route and discouraged from biking to work.
- Motor vehicle operators will react negatively to heavier than expected bike traffic.
- Practical Cycle will have to disclose this to prospective renters and will potentially lose a significant amount of rental revenue.
- Prospective customers will not have a safe place to try the bikes we sell and therefore sales will decline.

Though we are excited to see progress improving our community, this impact on our business is significant enough to inspire consideration of relocating the business.

The detour plan should Maintain Class 1 Bike Trail Level Of Service during the construction period.

As Practical Cycle has an upcoming Building Lease Renewal under consideration now we need details of the plan to achieve this to be provided as soon as possible. If no such plan is forthcoming we need to be notified promptly so that we may plan accordingly. Please do not delay response as Time is of the Essence.

2

Tim Castleman, CEO

CC: Katie Durham-AIM Consulting, DTP % Brooksie Hughes, SABA % Jim Brown

Practical Cycle LLC
114 J Street, Sacramento, CA 95814
(916) 706-0077
www.PracticalCycle.com

Response to I-2, Tim Castleman

Response to Comment I-2-1

This comment expresses an economic concern related to the proposed approximately 2-year temporary detour of the Sacramento River Bike trail during project construction. Page 1-10 of the EIR/EA describes the proposed detour route which includes a temporary alignment for the trail following the temporary Jibboom Street alignment south of Railyards Boulevard. Cyclists and pedestrians would then continue following a detour north along Bercut Drive to Richards Boulevard, where they could then connect back to the Parkway on the west side of I-5.

Subsequent to circulation of the Draft EIR/EA, the detour options were considered further. Page 1-10 of the Draft EIR/EA has been changed to indicate that the temporary re-routing of the Sacramento River Parkway trail (described from south to north) would follow the temporary Jibboom Street alignment to south of Railyards Boulevard. The path would then be temporarily re-routed to pass under I-5, around the I Street Bridge project construction limits at the west end of Railyards Boulevard. Cyclists and pedestrians would then travel north along Jibboom Street and connect back to the trail just south of Matsui Park. The portion of Jibboom Street south of Matsui Park would be closed to vehicular traffic during construction. The revised detour avoids directing pedestrians and cyclists onto Bercut Drive and Richards Boulevard.

Response to Comment I-2-2

This comment is in regard to the timing of a decision to renew a commercial building lease in relation to the proposed project. See the response to Comment I-2-1. No change to the Draft EIR/EA is necessary.

Comment Letter I-3, Fernando and Ellen Maurizio

Fernando and Ellen Maurizio
300 C Street
West Sacramento, CA 95605

Dana Mahaffey, Associate Planner
City of Sacramento Community Development Department
300 Richards Blvd., 3rd Floor, Sacramento, CA 95811

To Dana Mahaffey:

We appreciate the opportunity to comment on the draft Environmental Impact Report and the I Street Bridge Replacement Project in general.

1

We are writing to express our support for Alternative 1 and to make other general comments about traffic and noise reduction related to the project.

We are supportive of the build in general, and supportive of Alternative 1 on the basis of Table 2.5-8 (page 2.5-22) and the traffic patterns predicted under the two alternatives. Based on our understanding, Alternative 1 will provide a more stable traffic pattern with less significant delays (although still more delays and congestion compared to today) near our intersection at 3rd and C Streets in West Sacramento.

Our most significant concern with the project is noise (both during construction and ongoing). We understand permanent noise barriers may not be totally feasible on our block of C Street between 3rd and 4th Streets, as noted in the plan. However, with the sole remediation being quiet asphalt, we are very concerned about the noise level in and around our home in the future.

2

We have two requests related to noise remediation we are asking that you consider in the Environmental Impact Study. Currently, there is no way out of our neighborhood (Metro Place) with a traffic signal other than the one at 3rd and C. There's also currently no dedicated left turn signal (it's a yield only) for residents driving south on 3rd Street who want to turn left (east) onto the I Street Bridge. At rush hour in the afternoon, there is so much northbound traffic coming up C Street waiting to turn right onto the bridge that there is no opportunity to turn left, which means many people, after waiting through multiple green light cycles, just give up and drive into the intersection to cut in. Pretty much every time, everyone honks, every day during rush hour. Given that traffic is likely to increase with the new bridge, we are asking that you include in the overall plans a left turn lane for southbound 3rd Street turning left onto the new bridge. This would help with access to the bridge for residents here and it would also help reduce noise. (Maybe this is something that will be covered in the Transportation Management Plan, so sorry if this is the wrong forum, but we do want to put it out there.)

3

On page 2.22-6, the report describes future increased noise levels expected from increased train traffic. The continuous mid-range noise and vibration from trains going by is loud, but from a resident's perspective, it's easy to get used to. The most disruptive part of living near the tracks is the 4-horn signal (96 to 110 decibels) that trains are required to make each time they cross 3rd Street, day and night. We are asking that you consider including in the overall plan making the area around the 3rd Street crossing a "quiet zone" under the Federal Railroad Administration rules (FRA guide is included as an attachment). This would also mean an offsetting noise reduction in the surrounding area and it would mean a lot to us

4

Comment Letter I-3, Fernando and Ellen Maurizio

as residents, especially given the construction noise we understand would be associated with the project.

4
cont.

We would also like to provide some statements in support of the mitigation measures described in the study and ask that the project continue to focus on them throughout the planning and execution of construction, if it moves forward:

5

- We very much support plans to mitigate the impact to purple martins and other local birds and bats in the planning and ask that no corners are cut during the process that might reduce the likelihood of their successful relocation to a replacement habitat or reduce their habitat further.
- The draft Environmental Impact Report clearly gives a lot of consideration to the noise around the project area, and we would ask that you follow through on the mitigation measures described in the document and also consider new ways to remedy construction and ongoing noise from the project as you continue to develop the plan.

And a minor comment, on page 2.3-9 there's a note indicating that there are "retail, restaurant and other commercial properties" along C Street. Please note, there is also quite a lot of residential property on C Street, which is noted elsewhere in the report.

6

Thank you again for such a thorough study and for the opportunity to comment.

Sincerely,

Fernando and Ellen Maurizio

(sent via email)

Comment Letter I-3, Fernando and Ellen Maurizio

Section I. Pre-Rule Quiet Zones: Qualifying for Automatic Approval (Chart 1A)

1. Identify all the crossings you wish to include as part of the proposed Quiet Zone (QZ).
2. Check whether each crossing qualifies as a pre-rule crossing (horns not sounding on October 9, 1996 and December 18, 2003 because of state/local law or community agreement with the railroads). If all crossings do not qualify as pre-rule crossings, then the proposed quiet zone does not qualify as a Pre-Rule QZ, and you should refer to *Section III. New Quiet Zones*.
3. Determine whether you wish to eliminate any crossings from the proposed QZ. The length of a Pre-Rule QZ may continue unchanged from that which existed on October 9, 1996. If, however, you choose to eliminate a crossing, the QZ must be at least ½ mile in length along the railroad tracks.
4. A QZ may include highway-rail grade crossings on a segment of rail line crossing more than one political jurisdiction, or there may be roads within a particular area that are the responsibility of different entities (State or county roads within a town, for example). If the selected crossings are the responsibility of more than one entity, obtain the cooperation of all relevant jurisdictions.
5. Update the USDOT Grade Crossing Inventory Form to reflect conditions at each public and private crossing; this update should be complete, accurate, and be dated within 6 months prior to the QZ implementation. For instructions on how to complete the update, see the FRA website at <http://www.fra.dot.gov/eLib/details/L02730>.
6. If each public crossing in the proposed QZ is equipped with one or more Supplementary Safety Measures (SSMs) as defined in Appendix A of the Rule, the QZ qualifies for Automatic Approval. To complete the process of creating the QZ, notify the parties listed in rule section 222.43 by December 18, 2004.

Note: Once the QZ has been created, install the required signage by December 18, 2006. (Refer to rule sections 222.25 and 222.35 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 4.5-5 years. (Refer to rule section 222.47 for details.)

7. If every public crossing is not equipped with at least one SSM, then the QZ can automatically qualify by comparing its Quiet Zone Risk Index (QZRI) with the Nationwide Significant Risk Threshold (NSRT). However, these QZs are subject to annual review by the FRA.

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Comment Letter I-3, Fernando and Ellen Maurizio

8. Using the FRA's Quiet Zone Calculator, a web-based tool that can be found at <http://safetydata.fra.dot.gov/quiet/>, determine whether the QZRI of the proposed QZ is less than or equal to the NSRT. If the QZRI is less than or equal to the NSRT, the QZ qualifies for Automatic Approval. Notify the parties listed in rule section 222.43 by December 18, 2004.

Note: Once the quiet zone has been created, install the required signage by December 18, 2006. (Refer to rule sections 222.25 and 222.35 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

9. If the QZRI is greater than the NSRT, use the FRA's Quiet Zone Calculator to check whether it is less than twice the NSRT. If the QZRI is more than twice the NSRT, the QZ cannot qualify for Automatic Approval. For information on how to proceed, see *Section II, Pre-Rule Quiet Zones Not Qualified for Automatic Approval*.
10. If the QZRI is greater than the NSRT, but less than twice the NSRT, determine whether any of the public crossings have experienced a "relevant collision" on or after December 18, 1998. (See rule section 222.9 for the definition of a "relevant collision.") If there have not been any "relevant collisions" at any public crossing since December 18, 1998, the QZ qualifies for Automatic Approval. Notify the parties listed in rule section 222.43.

Note: Once the quiet zone has been created, install the required signage by December 18, 2006. (Refer to rule sections 222.25 and 222.35 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

11. If the QZRI is greater than the NSRT, but less than twice the NSRT, and there has been a "relevant collision" at a public crossing within the proposed QZ, the QZ cannot qualify for Automatic Approval. For information on how to proceed, see *Section II, Pre-Rule Quiet Zones Not Qualified for Automatic Approval*.

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Comment Letter I-3, Fernando and Ellen Maurizio

Section II. Pre-Rule Quiet Zones Not Qualified for Automatic Approval (Chart 1B)

1. Review *Section I, Pre-Rule Quiet Zones: Qualifying for Automatic Approval*, to confirm that the proposed Pre-Rule Quiet Zone does not qualify for Automatic Approval.
2. If each crossing qualifies as a pre-rule crossing (horns not sounding on October 9, 1996 and December 18, 2003 because of state/local law or community agreement with the railroads), send notice of continuation of the quiet zone to all parties by December 18, 2004. (Refer to rule section 222.43 for details.)

Note: If you eliminated any pre-rule crossings to create the proposed Quiet Zone, the Quiet Zone must be at least ½ mile in length along the railroad tracks.

3. Submit to FRA a detailed plan for establishing a quiet zone before December 18, 2006. This plan should include a timetable for the implementation of safety improvements. If you intend to implement ASMs, the plan should include a completed application for FRA approval of their use. If a detailed plan is not been submitted by December 18, 2006, the quiet zone will terminate. (Refer to rule section 222.41 for details.)

Note: Since the proposed quiet zone does not qualify for Automatic Approval, any SSMS and ASMs used must be implemented in accordance with rule section 222.39.¹

Note: For guidance on ASM use, see *Section IV, Creating Quiet Zones using Engineering Alternative Safety Measures (modified SSMS)* and *Section V, Creating Quiet Zones using Non-engineering Alternative Safety Measures*.

Note: Required signage must also be installed by December 18, 2006. (Refer to rule sections 222.25 and 222.35 for details.)

4. Install SSMS and/or traffic control device upgrades as necessary to reduce risk within the proposed quiet zone.
5. If every public crossing in the proposed Quiet Zone is equipped with one or more SSMS as defined in Appendix A of the Rule, you can establish the proposed Quiet Zone through public authority designation by completing the following steps:

¹ Although the requirements for implementation of SSMS and ASMs must be in accord with rule section 222.39, the Pre-Rule Quiet Zone requirements covering minimum length and traffic control devices remain in effect for these crossings.

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Comment Letter I-3, Fernando and Ellen Maurizio

- a. Complete the planned improvements by December 18, 2008,²
- b. Update the USDOT Grade Crossing Inventory Form.
- c. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 4.5-5 years. (Refer to rule section 222.47 for details.)

6. Using the FRA's Quiet Zone Calculator, a web-based tool that can be found at <http://safetydata.fra.dot.gov/quiet/>, determine whether the implementation of SSMS, ASMS, and/or traffic control devices will reduce the QZRI of the proposed Pre-Rule Quiet Zone to the level of risk that would exist if the train horns were still sounded (RIWH). If the QZRI will be less than or equal to the RIWH, you can establish the Quiet Zone through public authority designation by completing the following steps:

- a. Complete the planned improvements by December 18, 2008,²
- b. Update the USDOT Grade Crossing Inventory Form.
- c. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

7. Using the FRA's Quiet Zone Calculator, a web-based tool that can be found at <http://safetydata.fra.dot.gov/quiet/>, determine whether the implementation of SSMS, ASMS, and/or traffic control devices will reduce the QZRI of the proposed Pre-Rule Quiet Zone to the Nationwide Significant Risk Threshold (NSRT). If the QZRI will be less than or equal to the current NSRT, you can establish the Quiet Zone through public authority designation by completing the following steps:

- a. Complete the planned improvements by December 18, 2008.²
- b. Update the USDOT Grade Crossing Inventory Form.

² If the State is involved in the development of Quiet Zones, then the date for completion is extended an additional 3 years.

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Comment Letter I-3, Fernando and Ellen Maurizio

- c. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

Note: Quiet Zones established by comparison to the NSRT are subject to annual FRA review. (Refer to rule section 222.51 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

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Comment Letter I-3, Fernando and Ellen Maurizio

Section III. Creating a New Quiet Zone Using SSMs (Chart 2)

1. Select the crossings to be included in the New Quiet Zone.
2. A Quiet Zone may include highway-rail grade crossings on a segment of rail line crossing more than one political jurisdiction, or there may be roads within a particular area that are the responsibility of different entities (State or county roads within a town, for example). If the selected crossings are the responsibility of more than one entity, obtain the cooperation of all relevant jurisdictions.
3. A New Quiet Zone must be at least ½ mile in length along the railroad tracks.
4. A New Quiet Zone must have, at a minimum, flashing lights and gates in place at each public crossing. These must be equipped with constant warning time devices where reasonably practical, and power out indicators. Any necessary upgrades must be completed before calculating risk for the quiet zone.
5. Are there any private crossings within the proposed Quiet Zone? If any private crossings allow access to the public or provide access to active industrial or commercial sites, you must conduct a diagnostic team review of those crossings. Following the diagnostic review, you must comply with the diagnostic team's recommendations concerning those crossings.
6. Update the USDOT Grade Crossing Inventory Form to reflect conditions at each public and private crossing; this update should be complete, accurate, and dated within 6 months prior to the Quiet Zone implementation³. For instructions on how to complete the update, see the FRA website at <http://www.fra.dot.gov/Content3.asp?P=801>.
7. Using the FRA's Quiet Zone Calculator, a web-based tool that can be found at <http://safetydata.fra.dot.gov/quiet/>, determine whether the Quiet Zone Risk Index (QZRI) of the proposed Quiet Zone is less than or equal to the Nationwide Significant Risk Threshold (NSRT). If the QZRI is less than or equal to the NSRT, you can establish the Quiet Zone through public authority designation by completing the following steps:
 - a. Install required signage at each crossing. (Refer to rule sections 222.25 and 222.35 for details.)
 - b. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

³ For New Quiet Zones, the baseline conditions for calculating risk require that the minimum required traffic control devices are in place. This first Inventory update, therefore, must be completed after the gates, lights, and signs are in place, but before the SSMs and other measures are implemented. **Disclaimer: This summary of the interim final rule is for informational purposes only. Entities subject to the interim final rule should refer to the rule text as published in the Federal Register on December 18, 2003. Should any portion of this summary conflict with the interim final rule, the language of the interim final rule shall govern.**

Comment Letter I-3, Fernando and Ellen Maurizio

Note: Quiet Zones established by comparison to the NSRT are subject to annual FRA review. (Refer to rule section 222.51 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

8. The step described above involves qualifying a quiet zone without implementing any Supplementary Safety Measures (SSMs) or Alternative Safety Measures (ASMs). If FRA's Quiet Zone Calculator indicates that the proposed quiet zone will not qualify on that basis, install any measures that are needed. To qualify for Public Authority Designation, you must implement SSMs, build grade separations, close crossings, or install wayside horns.

Note: If you would like to implement any ASMs, their use must be approved in advance by FRA, in accordance with Appendix B of the rule. For guidance on ASM use, see *Section IV, Creating Quiet Zones using Engineering Alternative Safety Measures (modified SSMs)* or *Section V, Creating Quiet Zones using Non-engineering Alternative Safety Measures*.

9. If every public crossing in the proposed Quiet Zone is equipped with one or more SSMs, you can establish the Quiet Zone through public authority designation by completing the following steps:
 - a. Install required signage at each crossing. (Refer to rule sections 222.25 and 222.35 for details.)
 - b. Update the National Grade Crossing Inventory to reflect current conditions at each public and private crossing within the Quiet Zone.
 - c. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 4.5-5 years. (Refer to rule section 222.47 for details.)

10. If every public crossing is not equipped with an SSM, use FRA's Quiet Zone Calculator to determine whether enough SSMs have been implemented to reduce the QZRI to the level of risk that would exist if the train horns were still sounded (RIWH). The Quiet Zone Calculator can be found at <http://safetydata.fra.dot.gov/quiet/>. If the QZRI is less than or equal to the RIWH, you can establish the Quiet Zone through public authority designation by completing the following steps:

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Comment Letter I-3, Fernando and Ellen Maurizio

- a. Install required signage at each crossing. (Refer to rule sections 222.25 and 222.35 for details.)
- b. Update the National Grade Crossing Inventory to reflect current conditions at each public and private crossing within the Quiet Zone.
- c. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

11. Use FRA's Quiet Zone Calculator to determine whether enough SSMS have been implemented to reduce the QZRI to the Nationwide Significant Risk Threshold (NSRT). The Quiet Zone Calculator can be found at <http://safetydata.fra.dot.gov/quiet/>. If the QZRI is less than or equal to the current NSRT, you can establish the Quiet Zone through public authority designation by completing the following steps:

- a. Install required signage at each crossing. (Refer to rule sections 222.25 and 222.35 for details.)
- b. Update the National Grade Crossing Inventory to reflect current conditions at each public and private crossing within the Quiet Zone.
- c. Notify the parties listed in the rule. (Refer to rule section 222.43 for details.)

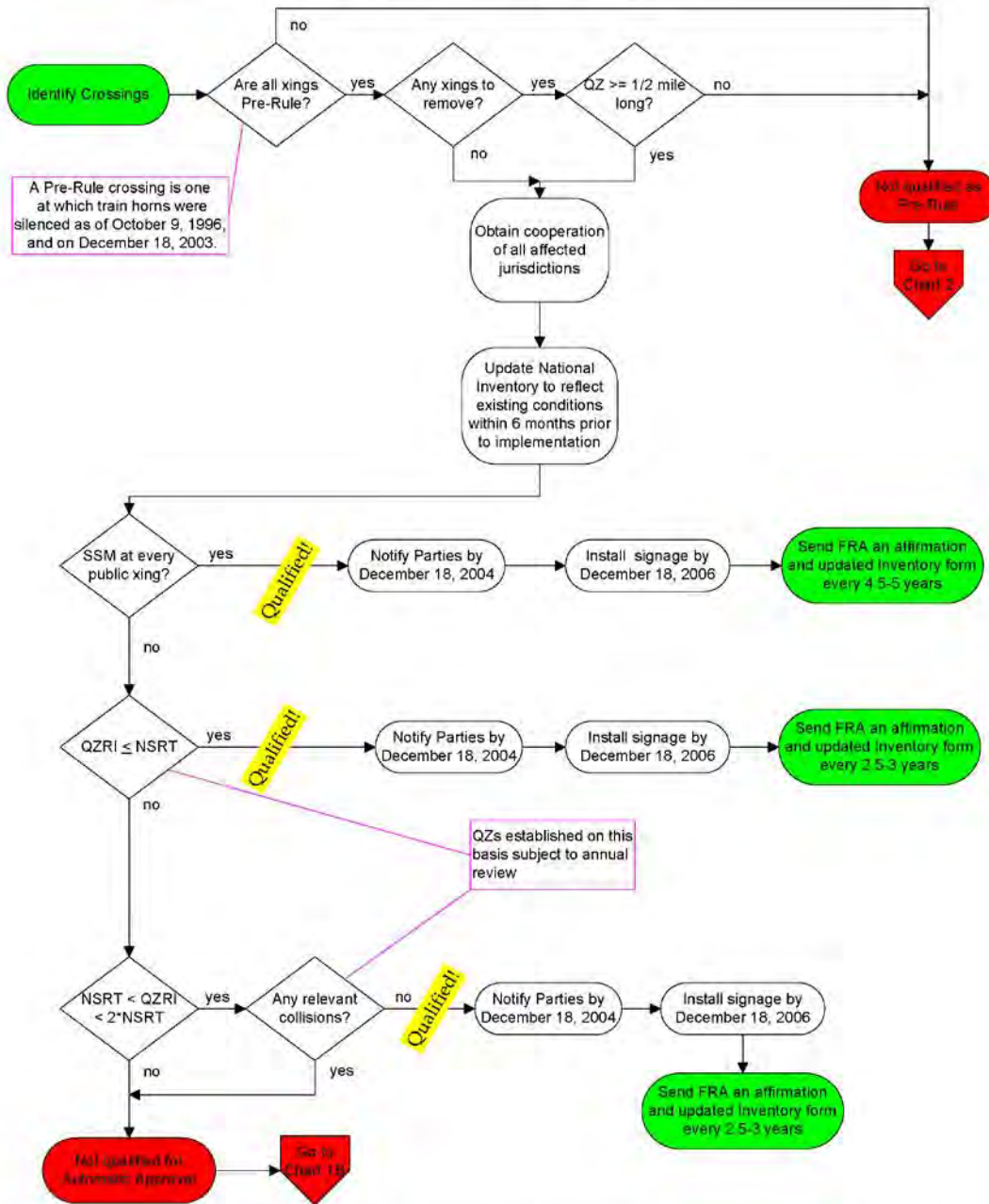
Note: Quiet Zones established by comparison to the NSRT are subject to annual FRA review. (Refer to rule section 222.51 for details.)

Note: Periodic updates, including updated USDOT Grade Crossing Inventory Forms, must be submitted to FRA every 2.5-3 years. (Refer to rule section 222.47 for details.)

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Comment Letter I-3, Fernando and Ellen Maurizio

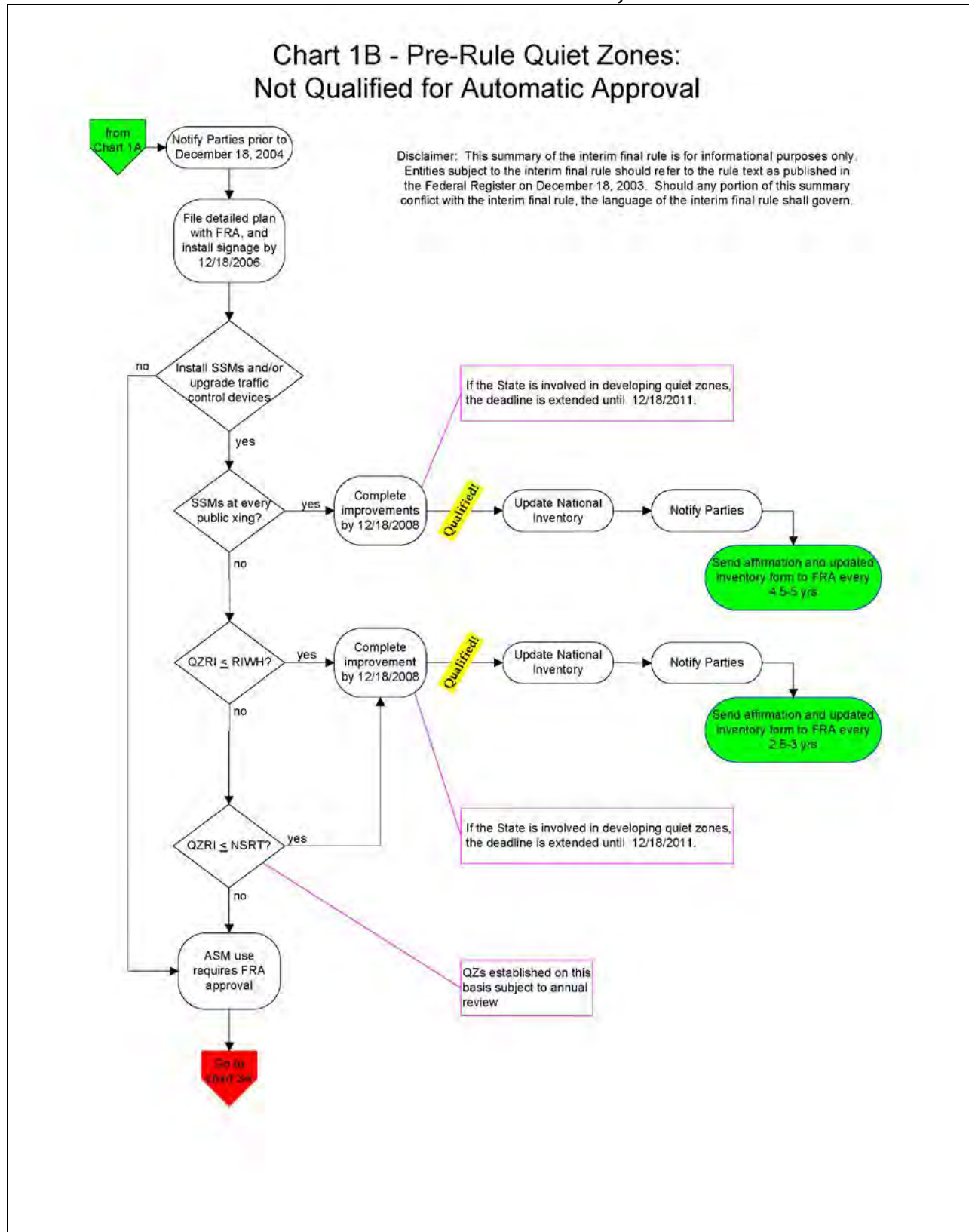
Chart 1A - Pre-Rule Quiet Zones:
Qualifying for Automatic Approval



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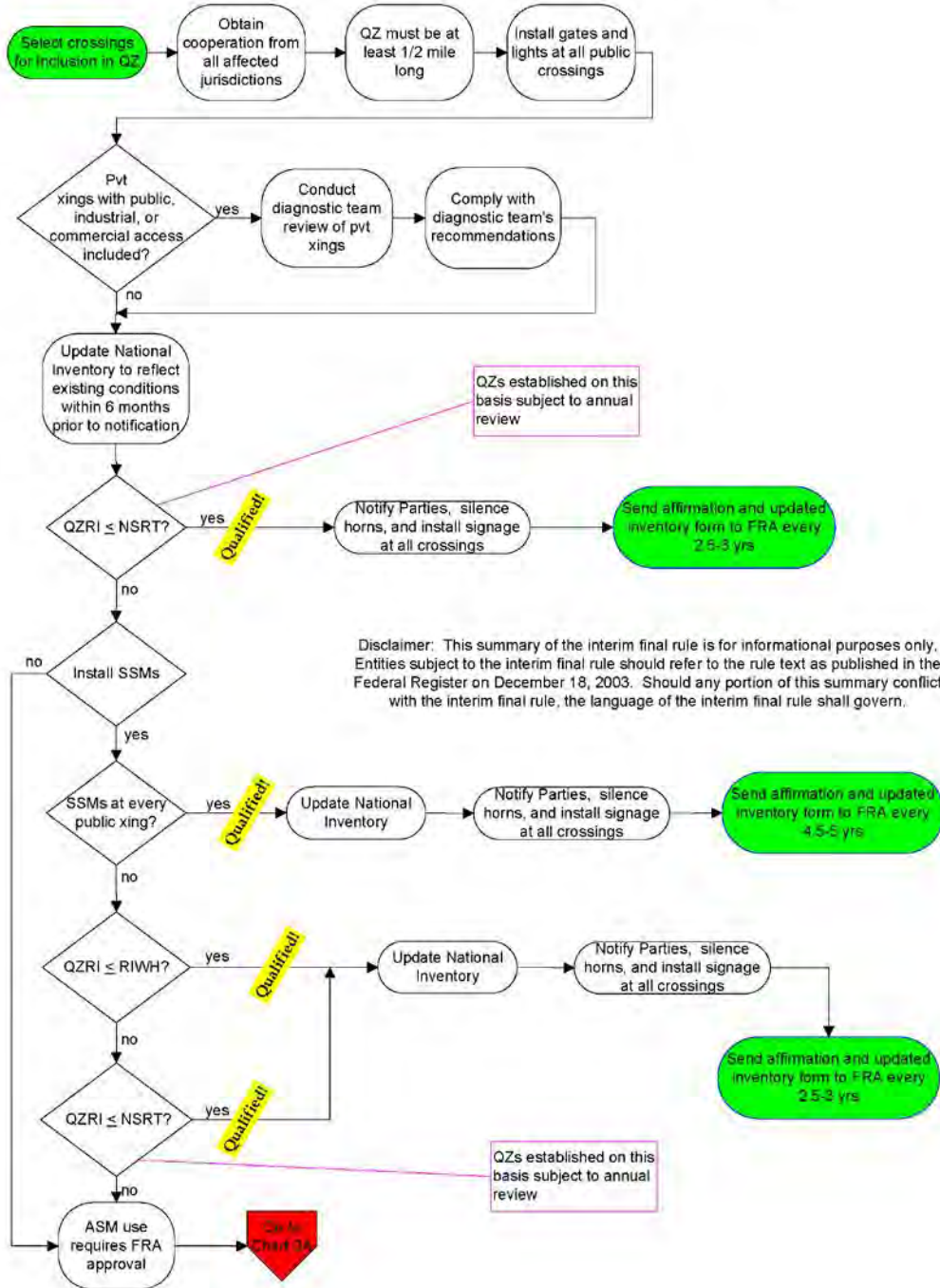
Comment Letter I-3, Fernando and Ellen Maurizio

**Chart 1B - Pre-Rule Quiet Zones:
Not Qualified for Automatic Approval**



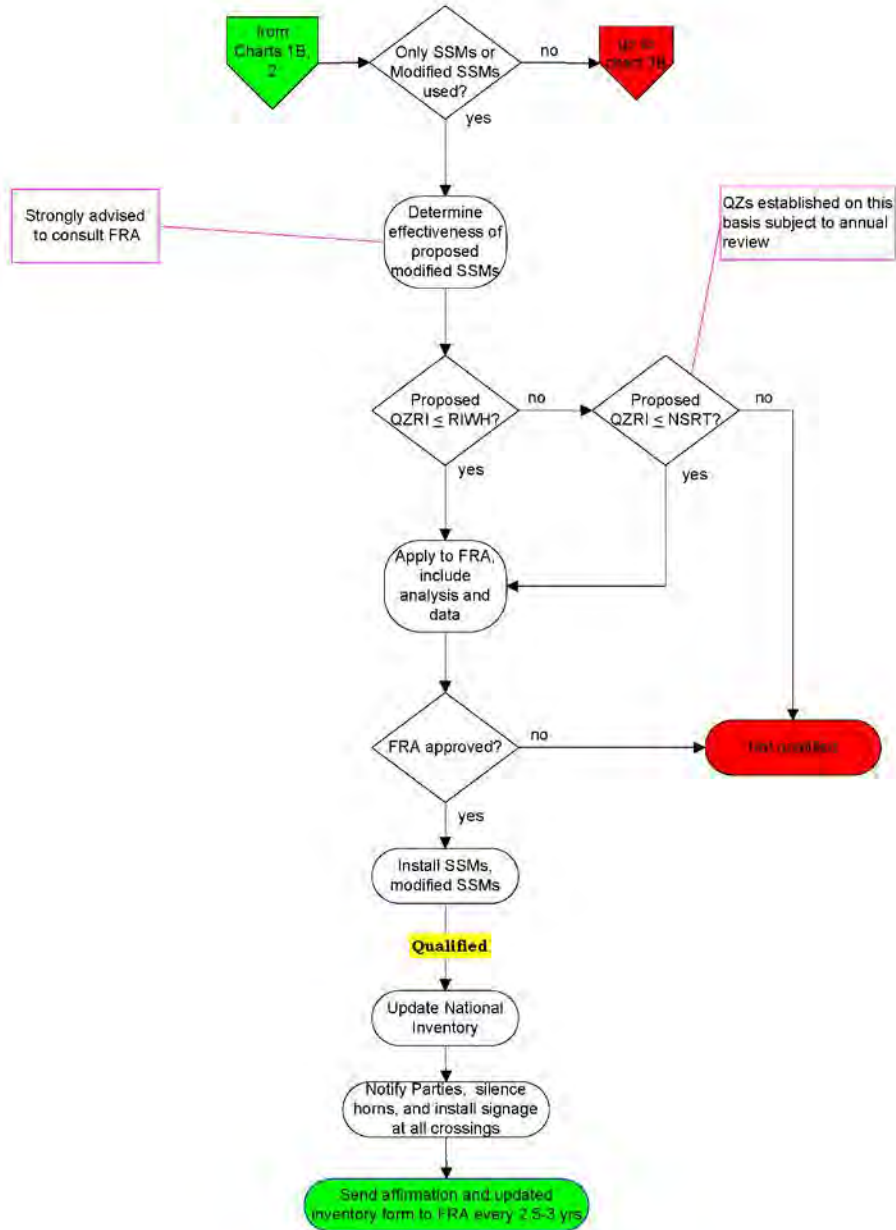
Comment Letter I-3, Fernando and Ellen Maurizio

Chart 2 - Creating a New Quiet Zone using SSMs



Comment Letter I-3, Fernando and Ellen Maurizio

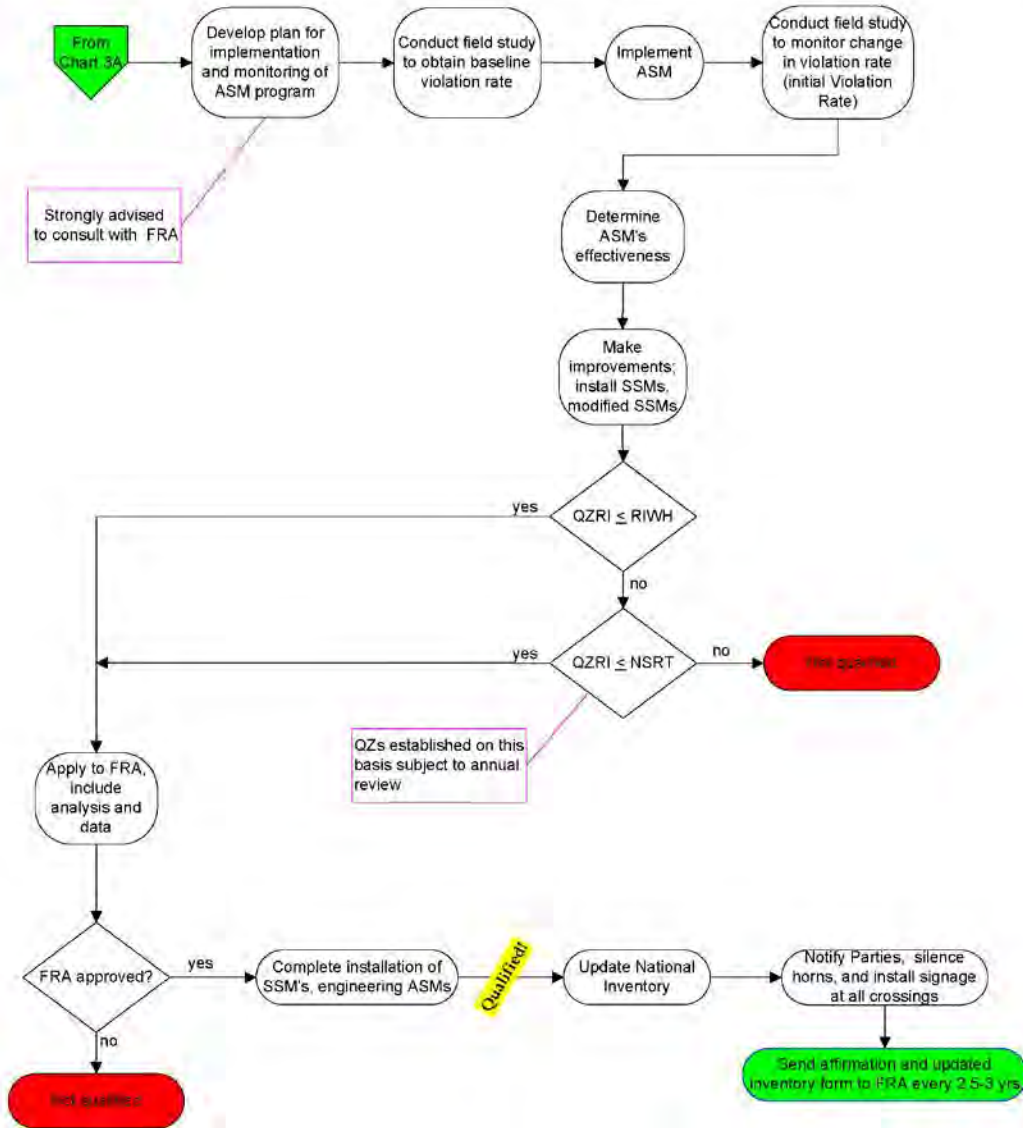
Chart 3A - Creating a Quiet Zone using Engineering ASMs (Modified SSMS)



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Comment Letter I-3, Fernando and Ellen Maurizio

Chart 3B: Creating a Quiet Zone using Non-engineering ASMs



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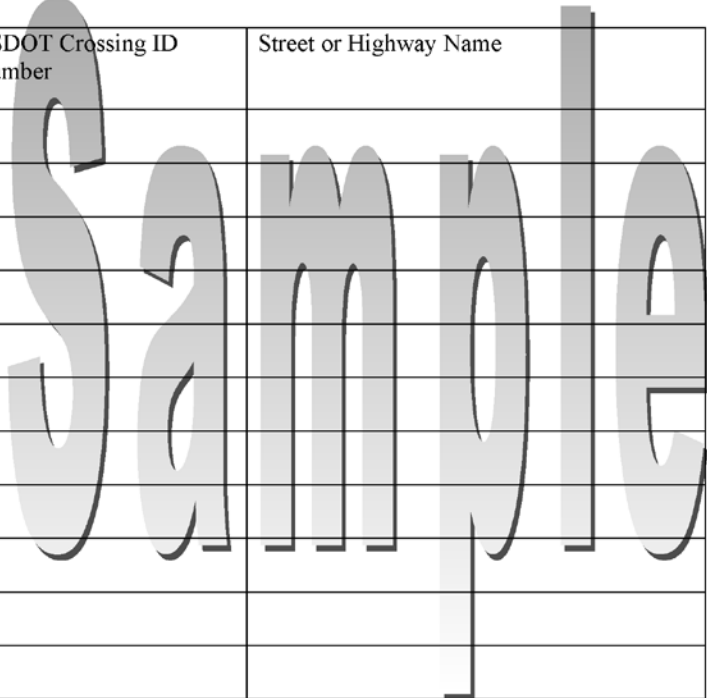
Comment Letter I-3, Fernando and Ellen Maurizio

List of Crossings within Quiet Zone

Submit to all Parties

Quiet Zone Name: _____

The following crossings are included in the above named Quiet Zone:

USDOT Crossing ID Number	Street or Highway Name
	

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Comment Letter I-3, Fernando and Ellen Maurizio

Basis for Continuation of a Pre-Rule Quiet Zone:

Submit to all Parties

Quiet Zone Name: _____

This quiet zone is being continued in compliance with the following (check all that apply):

- §222.41(a) Pre-Rule Quiet Zones that qualify for automatic approval because
 - every crossing is equipped with an SSM,
 - $QZRI \leq NSRT$, or
 - $NSRT < QZRI < 2 * NSRT$, and there have been no relevant collisions within the 5 years preceding December 18, 2003
- §222.41(b) Pre-Rule Quiet Zones that do not qualify for automatic approval

Note: Quiet Zones established in accordance with §222.41(b) can be maintained under that provision for an interim period only. Continuation of the quiet zone beyond the interim period will require implementation of SSMs or ASMs in accordance with the section of the rule governing establishment of a New Quiet Zone (§222.49).

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Comment Letter I-3, Fernando and Ellen Maurizio

FRA Quiet Zone Calculator Pages

Submit to all Parties

If the Quiet Zone is being continued under §222.41(a), Pre-Rule Quiet Zones which qualify for automatic approval, the notification to the parties must also include a copy of the FRA web page containing the quiet zone data upon which the public authority relies.

The Quiet Zone Calculator can be found at: <http://safetydata.fra.dot.gov/quiet/>

Sample

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Comment Letter I-3, Fernando and Ellen Maurizio

Certificate of Service (submit one for each party notified)

Submit to all Parties including FRA

Quiet Zone Name: _____

Notice of the establishment or continuation of this Quiet Zone was provided to the following:

Name:	
Title:	
Organization:	
Address:	
Notification Method:	
Notification Date:	

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Comment Letter I-3, Fernando and Ellen Maurizio

Grade Crossing Inventory Form (Initial)

Submit to FRA Associate Administrator, Office of Safety

Submit an accurate and complete Grade Crossing Inventory Form for each public and private crossing within the quiet zone, dated within six months prior to notification of the quiet zone. This form should reflect conditions prior to implementation of SSMs and ASMs.

Copies of the Grade Crossing Inventory Form FRA 6180.71 can be downloaded from the FRA web site at <http://safetydata.fra.dot.gov/officeofsafety/Forms/Default.asp>.

Sample

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Comment Letter I-3, Fernando and Ellen Maurizio

Grade Crossing Inventory Form Reflecting Improvements

Submit to FRA Associate Administrator, Office of Safety

Submit an additional accurate and complete Grade Crossing Inventory Form for each public and private crossing within the quiet zone, reflecting the improvements implemented within the Quiet Zone.

Copies of the Grade Crossing Inventory Form FRA 6180.71 can be downloaded from the FRA web site at
<http://safetydata.fra.dot.gov/officeofsafety/Forms/Default.asp>.

Sample

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Comment Letter I-3, Fernando and Ellen Maurizio

Point of Contact Information

Submit to FRA Associate Administrator, Office of Safety

Quiet Zone Name: _____

Date: _____

The following individual is responsible for monitoring compliance with §222:

Name: _____

Title: _____

Organization: _____

Address: _____

Phone: _____

Fax: _____

Email: _____

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Comment Letter I-3, Fernando and Ellen Maurizio

Chief Executive Officer Statement

Submit to FRA Associate Administrator, Office of Safety

Quiet Zone

Designation: _____

I hereby certify that responsible officers of the public authority of which I am the Chief Executive Officer have reviewed documentation prepared by or for the FRA, filed in Docket No. FRA-1999-6439, sufficient to make an informed decision regarding the advisability of establishing the quiet zone.

Signature _____

Date _____

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Comment Letter I-3, Fernando and Ellen Maurizio

Pre-Rule Quiet Zone Notification Checklist

Be sure to include the following information when providing notification of the continuation of a pre-rule quiet zone. Notifications must be sent by certified mail, return receipt requested.

All parties, including FRA, must receive:

- List of Crossings within Quiet Zone
- Basis for Continuation of a Pre-Rule Quiet Zone
- FRA Quiet Zone Calculator Page if quiet zone qualifies for automatic approval under §222.41(a)
- Certificate of Service (submit one for each party notified)

FRA must also receive the following:

- Grade Crossing Inventory Form (Initial)
- Grade Crossing Inventory Form Reflecting Improvements (when applicable)
- Point of Contact Information
- Chief Executive Officer Statement

Notification should be mailed to FRA at the following address:

Associate Administrator for Safety
Federal Railroad Administration
1120 Vermont Avenue, NW
Washington, DC 20590

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Comment Letter I-3, Fernando and Ellen Maurizio

Pre-Rule Quiet Zone Notification Checklist

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- Basis for Continuation of a Pre-Rule Quiet Zone
- FRA Quiet Zone Calculator Page if quiet zone qualifies for automatic approval under §222.41(a)
- Certificate of Service (submit one for each party notified)

FRA must also receive the following:

- Grade Crossing Inventory Form (Initial)
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Comment Letter I-3, Fernando and Ellen Maurizio

New Quiet Zone Notification¹

Parties to be notified

Once a public authority has successfully established a quiet zone either through public authority designation or through FRA approval, it must provide written notice to several parties. These parties include the following:

- All railroads operating over the public highway-rail grade crossings within the quiet zone,
- The highway or traffic control authority, or the law enforcement authority with jurisdiction over motor vehicle traffic at the quiet zone crossings,
- Landowners with control over any private crossings within the quiet zone,
- The State agency responsible for highway and road safety, and
- The FRA Associate Administrator.

All notices must be provided by certified mail, return receipt requested.

Deadlines

The notice sent to the above parties must designate a specific date on which the routine sounding of horns at crossings within the quiet zone shall cease. On no account shall this date be earlier than 21 days after the mailing of this written notification.

¹ This collection of information will be used by FRA to increase safety at highway-rail grade crossings. Public reporting burden is estimated to average five (5) hours per response for notifications, and thirty-five (35) hours per response for the certification, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Please note that an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number for this collection of information is 2130-0560.

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Comment Letter I-3, Fernando and Ellen Maurizio

Notification contents

- The notice must unambiguously state which crossings will be contained within the quiet zone. Each public and private crossing must be identified by both the U.S. DOT National Highway-Rail Grade Crossing Inventory number and the street or highway name.
- The notification must also clearly cite the regulatory provision that provides the basis for establishing the quiet zone. For a new quiet zone, one of the following provisions should apply:
 - §222.39(a)(1), implementation of SSMs at every public crossing in the quiet zone;
 - §222.39(a)(2)(i), the QZRI is at or below the NSRT without installation of any SSMs;
 - §222.39(a)(2)(ii), SSMs were implemented at some crossings to bring the QZRI to a level at or below the NSRT;
 - §222.39(a)(3), SSMs were implemented at some crossings to bring the QZRI to a level at or below the RIWH; or
 - §222.39(b), public authority application to the FRA.
- If the quiet zone is established on the basis of §222.39(a)(1), (2), or (3), the notification must include a copy of the FRA web page containing the quiet zone data upon which the public authority is relying.
- If the quiet zone is being established on the basis of § 222.39(b) (public authority application to the FRA), the notification must include a copy of the FRA's notification of approval.
- All notifications must contain a certificate of service. This certificate of service shall show to whom the notice was provided, and by what means the notice was provided.

Additional information that must be submitted to FRA

The items listed above must be submitted to each of the parties listed in the section labeled "Parties to be notified". Public authorities are also required to submit the following information in their submission to FRA:

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Comment Letter I-3, Fernando and Ellen Maurizio

- ❑ An accurate and complete Grade Crossing Inventory Form for each public and private crossing within the quiet zone, dated within six months prior to designation or FRA approval of the quiet zone;
- ❑ An accurate, complete, and current Grade Crossing Inventory Form reflecting the SSMs and ASMs implemented within the quiet zone. (SSMs and ASMs that cannot be fully described on the Inventory Form must be described separately);
- ❑ The name and title of the person responsible for monitoring compliance with the requirements of the rule and his/her contact information. In addition to the person's name, title, and organization, contact information should include his/her business address, telephone number, fax number, and email address;
- ❑ A list of all parties notified in accordance with the rule; and
- ❑ A statement signed by the Chief Executive Officer (CEO) of each public authority establishing the quiet zone. In the CEO's statement, he or she must certify that responsible officials of the public authority have reviewed the documentation prepared by or for the FRA, and filed in Docket No. FRA-1999-6439, sufficient to make an informed decision regarding the advisability of establishing the quiet zone.

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Comment Letter I-3, Fernando and Ellen Maurizio

Pre-Rule Quiet Zone Notification¹

Parties to be notified

A public authority that wants to continue silencing the locomotive horn at grade crossings within a Pre-Rule Quiet Zone must provide written notice to several parties. These parties include the following:

- All railroads operating over the public highway-rail grade crossing within the quiet zone,
- The highway or traffic control authority, or the law enforcement authority with jurisdiction over motor vehicle traffic at the quiet zone crossings,
- Landowners with control over any private crossings within the quiet zone,
- The State agency responsible for highway and road safety, and
- The FRA Associate Administrator.

All notices must be provided by certified mail, return receipt requested.

Deadlines

Notice of the continuation of a Pre-Rule Quiet Zone must be served no later than December 18, 2004.

¹ This collection of information will be used by FRA to increase safety at highway-rail grade crossings. Public reporting burden is estimated to average five (5) hours per response for notifications, and thirty-five (35) hours per response for the certification, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Please note that an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number for this collection of information is 2130-0560.

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Comment Letter I-3, Fernando and Ellen Maurizio

Notification contents

- The notice must unambiguously state which crossings are contained within the quiet zone. All public and private crossings must be identified by both the U.S. DOT National Highway-Rail Grade Crossing Inventory Number, and by street or highway name.
- The notification must clearly cite the regulatory provision that provides the basis for continuing the Quiet Zone.

Note: The continuation of Pre-Rule Quiet Zones that qualify for automatic approval is governed by § 222.41(a). All other Pre-Rule Quiet Zones are governed by § 222.41(b).

- The notification must also include an explanation as to how the quiet zone is in compliance with § 222.41.
- If the quiet zone is being continued on the basis of §222.41(a) (automatic approval), the notification must include a copy of the FRA web page containing the quiet zone data upon which the public authority is relying.
- All notifications must contain a certificate of service. This certificate of service shall show to whom the notice was provided, and by what means the notice was provided.

Additional information that must be submitted to FRA

The items listed above must be submitted to each of the parties listed in the section labeled "Parties to be notified". Public authorities are also required to submit the following information in their submission to FRA:

- An accurate and complete Grade Crossing Inventory Form for each public and private crossing within the quiet zone, dated within six months prior to designation of the quiet zone;
- An accurate, complete, and current Grade Crossing Inventory Form reflecting the SSMs and ASMs implemented within the quiet zone;
- The name and title of the person responsible for monitoring compliance with the requirements of the rule and his/her contact information. In addition to the person's name, title, and organization, contact

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Comment Letter I-3, Fernando and Ellen Maurizio

information should include his/her business address, telephone number, fax number, and email address;

- A list of all parties notified in accordance with the rule; and
- A statement signed by the Chief Executive Officer (CEO) of each public authority continuing the quiet zone. In the CEO's statement, he or she must certify that responsible officials of the public authority have reviewed the documentation prepared by or for the FRA, and filed in Docket No. FREA-1999-6439, sufficient to make an informed decision regarding the advisability of establishing the quiet zone.

Note: Pre-Rule Quiet Zones that do not qualify for automatic approval can only be maintained for an interim period. Continuation of the quiet zone beyond the interim period will require submission of a detailed plan, as well as implementation of SSMs or ASMs in accordance with section 222.39. Please refer to sections 222.39 and 222.41 for more information.

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Response to I-3, Fernando and Ellen Maurizio

Response to Comment I-3-1

The comment is introductory and also notes support for Alternative 1. No response is necessary.

Response to Comment I-3-2

This comment acknowledges that noise barriers to reduce traffic noise are not feasible. As described on EIR/EA page 3-33, if operational noise levels as a result of the project exceed City of West Sacramento noise limits at a residential building façade after the application of noise reducing pavement, additional measures will be taken to ensure building compliance with City noise limits for interior spaces. The possible additional measures are described in detail in EIR/EA section 3.3.6. The comment also notes concern for changes in noise levels during construction of the proposed project. Increases in noise expected during construction of the project are described in the EIR/EA starting on pages 2.14-6 and 3-39, and as noted on page 3-41 may temporarily exceed the applicable noise ordinance limits. Measures will be taken to reduce construction noise to the extent feasible, however the temporary construction noise impact is noted as significant and unavoidable (EIR/EA page 3-43). No change to the Draft EIR/EA is necessary.

Response to Comment I-3-3

This comment notes noise from honking drivers at the intersection of 3rd and C Streets in West Sacramento as a result of southbound vehicles on 3rd Street turning left onto C Street toward the bridge and requests lane changes on 3rd Street. An extensive traffic analysis was conducted for the project, as summarized in EIR/EA Section 2.5. The results of the study do not indicate the need for intersection modification beyond what was identified for the project. The City of West Sacramento will continue to review intersection operations to ensure efficient movement of vehicle, bicycle and pedestrian traffic. No change to the Draft EIR/EA is necessary.

Response to Comment I-3-4

This comment requests consideration of a “quiet zone” under the Federal Railroad Administration rules in order to reduce impacts from the sound of train horns at the railroad crossing of 3rd Street. Changes to rail operation are unrelated to and outside of the scope of the bridge project. Establishing a quiet zone would need to be pursued separately. At this time, the City of West Sacramento does not propose making the 3rd Street rail crossing a “quiet zone.” No change to the Draft EIR/EA is necessary.

Response to Comment I-3-5

The comment notes support for the mitigation measures to protect purple martin and other birds as well as bats, and measures to reduce noise. The comment also requests consideration of new ways to reduce construction and operational noise as part of further development of the project. The mitigation described in the EIR/EA to reduce noise includes “quieter pavement” surfaces and is based on the current available methods. If new or different ways to reduce traffic noise levels become available prior to project construction, they may be considered as replacement mitigation. During construction, appropriate measures to reduce the temporary effects of noise will be implemented by the contractor. Possible methods are described on page 2.14-11 of the EIR/EA. No change to the Draft EIR/EA is necessary.

Response to Comment I-3-6

This comment points out text on page 2.3-9 of the EIR/EA that may benefit from a clarification. The sentence noted is not meant to indicate the absence of residential properties on C Street and such land uses are noted in preceding sentences. The EIR/EA has been changed to indicate that residential properties are also located along C Street and on cross streets within the project limits.

Comment Letter I-4, JoEllen Arnold



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

My greatest concerns are for the thousands of bats using the old structures for roosting. These bats are important pest control agents for our city and for surrounding agricultural areas. They must be appropriately and humanely excluded at a time of year (winter when the structures are not a maternity roost for pregnant and nursing mothers (summer and late spring is birthing/child rearing time)). New accommodation for the bats should be built into the new structures. Enhancing bat habitat/roosting areas can be an important tourist draw: thousands of people gather every ~~evening~~ ^{of people} summer evening to watch the bats emerge from the Congress Avenue Bridge in Austin, Texas.

Name JoEllen Arnold
Email Address joellenarnold@mac.com
Phone Number 916 501 8995

You may submit your comments to staff tonight or directly to Katie Durham at Austin, Texas
kdurham@aimconsultingco.com
or fax (916) 442-1168

Millions of dollars are spent by tourists who come to see the bats!



Response to I-4, JoEllen Arnold

Response to Comment I-4-1

Among additional protection, replacement and monitoring measures, mitigation listed in the EIR/EA to reduce effects on bat species includes the use of exclusion devices as well as the creation of replacement habitat on the new structure. Please see the mitigation listed on EIR/EA pages 2.19-49 to 2.19-51. No change to the Draft EIR/EA is necessary.

Comment Letter I-5, Kim Fettke



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

The bat colony in the approach also roosts in the adjacent railroad museum building. You'll need to account for potential construction disturbance to those bats for demo timing. Also, the museum already has trouble with the bats getting inside the building so an effort should be made to seal their points of ingress to the inside. B4 demo puts added pressure on the building roof.

1

Name Kim Fettke
Email Address Fettke.Kimi@gmail.com
Phone Number 916-300-9451

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-5, Kim Fettke

Response to Comment I-5-1

This comment notes that bats also roost in the California State Railroad Museum, adjacent to the proposed project. The concern that during construction of the proposed project, and specifically demolition of the bridge viaducts, the use of the California State Railroad Museum by bats may increase, and the likelihood of bats entering the interior of the museum may also increase, is noted. The project proponents will coordinate with the museum prior to viaduct demolition to attempt to minimize possible increased use of the museum by bats. No change to the Draft EIR/EA is necessary.

Comment Letter I-6, Kim Fettke



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

3:19 Bats - non volant pups @ this roost usually closer to June
47 1-way doors should be in place > 48 hours + surveys should
be conducted during appropriate conditions for at least
2 nights prior to final exclusion.
49 "Precarstruction surveys" should be conducted 1+ yrs in advance
of project first to assess roost habitats and mitigate appropriate
If surveys are conducted only 2 weeks prior, doesn't leave good
options for addressing an unknown occupied roosts.
51 Replacement roost design should be done with the input of one of the
few biologists experienced in this task. It is not straight-forward.

Name Kim Fettke
Email Address Fettke.Kimi@gmail.com
Phone Number 916-300-7451

You may submit your comments to staff tonight
or directly to Katie Durham at
kdurham@aimconsultingco.com
or fax (916) 442-1168



Response to I-6, Kim Fettke

Response to Comment I-6-1

This comment suggests revisions to mitigation measures proposed in EIR/EA Section 2.19, *Animals*, to reduce effects on bats prior to and during the removal of the viaducts that serve as approach structures to the existing I Street Bridge.

The commenter suggests an increase in the duration from 48-hours to 72-hours for the one-way door devices that would be installed at viaduct vent holes and along viaduct expansion joints to exclude both bats and birds from the structures prior to demolition. The 48-hour duration was developed in consultation with a qualified bat biologist who confirmed that, because the exclusion would occur during a time that bats would be active and foraging, 48 hours is enough time to have all bats exit the structures. A change to 72 hours is not necessary. Further, after the 48-hour exclusion period, the expansion joints will be inspected and will not be sealed off until it can be confirmed that the joints are unoccupied.

The commenter's suggestion that surveys be conducted for two nights prior to the final exclusion of bats from the structures was considered and declined. It was determined that observance of the one-way door devices by a qualified biologist at locations confirmed to have contained bats would be sufficient to verify that bats are exiting the structures and being excluded. The Draft EIR/EA mitigation for bats has been changed to include this verification effort.

The commenter also suggests that preconstruction surveys be conducted one or more years in advance of the project to assess bat roost habitat and mitigate appropriately. However, use of the structures by both bats and birds is already well documented in the results of past surveys, making the suggested surveys unnecessary. Surveys conducted for the proposed project, as well as information from surveys conducted by others, allowed for all suitable habitat in the project limits, whether occupied by bats or unoccupied, to be identified and mapped. Further, all suitable habitat was considered occupied for the purposes of determining project impacts and developing mitigation. The preconstruction surveys for bats proposed in the EIR/EA would occur in August to check the status of potential material roosts and their locations within the structures that will be affected by the proposed project. If maternal roosts are still active, the timing of the placement of exclusion devices and subsequent structure demolition will be adjusted to avoid affecting maternal and hibernating bat roosts.

Replacement habitat for bats has been designed in consultation with a qualified bat biologist and generally follows the guidelines in *California Bat Mitigation Techniques, Solutions, and Effectiveness*¹ (See EIR/EA page 2.19-51).

¹ Johnston, D., G. Tatarian, and E. Pierson. 2004. *California Bat Mitigation Techniques, Solutions, and Effectiveness*. December 29. Prepared for California Department of Transportation and California State University Sacramento Foundation. (Project Number 239-01.)

Comment Letter I-7, Bill Leddy



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

I WOULD LIKE TO SEE SOME TYPE OF CURBING TO SEPARATE THE CAR TRAFFIC FROM THE BIKE TRAFFIC. (CLASS IV) BIKE LANE

1

Name BILL LEDDY
Email Address BILL@WILLIESWORKSHOP.NET
Phone Number 916-602-6131

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-7, Bill Leddy

Response to Comment I-7-1

The comment requests consideration of separating bicycles from vehicular traffic with a vertical separation on the roadway. At this time, a vertical separation is not proposed as part of buffering of the bicycle lanes. Bicycle lanes on the bridge also allow for space on the roadway for disabled vehicles and to facilitate passage of emergency vehicles. Curbing or other vertical separations would prevent this and may cause an unsafe condition for bridge users. Bicyclists that wish to use a separated facility may ride on the bridge's 12-foot sidewalk which will be classified as a multi-use path since it connects two multi-use bicycle/pedestrian facilities. No change to the Draft EIR/EA is necessary.

Comment Letter I-8, Susan Martimo



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

I appreciate the careful planning that has happened so far. I am happy that the new bridge will accommodate bicycles and pedestrians as well as vehicles. The existing bridge is very unaccommodating to walkers & bicyclists.

1

Name Susan Martimo
Email Address susanmartimo@hotmail.com
Phone Number 926-372-5098
Sacramento Walking Sticks

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168

City of SACRAMENTO



Response to I-8, Susan Martimo

Response to Comment I-8-1

The comment expresses support for the project in that the new bridge will accommodate both bicycles and vehicles. No response is necessary.

Comment Letter I-9, Rick Mocerin



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

I live in the River West Sac. I know many people in my area and in South Port, Everyone I know is in support of this bridge. Not a one is opposed.

Our words to you "lets get this bridge built."

1

Name Rick Mocerin
Email Address r.mocerin@yahoo.com
Phone Number _____

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or call (916) 442-1168



Response to I-9, Rick Mocerin

Response to Comment I-9-1

This comment expresses support for the project. No response is necessary.

Comment Letter I-10, Steve Peterson



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

Bridge design should look to future not just mimic Tower Bridge and historical elements. Bike & pedestrian connections should include signage & way finding to direct folks to West Sac & Railyards. Bypass of Brew interface is important to residents on West Sac side to compliment redevelopment of housing (Metro Place). Traffic should be diverted to I-5 rather than using C Street as pass thru traffic thru the West Sac Washington neighborhood. Construction impacts (noise, traffic) should be thoroughly analyzed as it affects residents.

1
2
3

Name Steve Peterson
Email Address Steve.peterson3103@gmail.com
Phone Number 916 710-4273

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-10, Steve Peterson

Response to Comment I-10-1

Please see Master Response C for information about how the bridge architecture will be developed. Wayfinding signage will be part of riverfront improvements in both cities. No change to the Draft EIR/EA is necessary.

Response to Comment I-10-2

The primary purpose of the proposed project is to replace the crossing of the Sacramento River currently provided by the I Street Bridge. Diverting the local traffic to I-5 is not a viable alternative to the project since I-5 does not cross the Sacramento River to connect the cities of Sacramento and West Sacramento.

Response to Comment I-10-3

The effects of construction of the proposed project are analyzed in the EIR/EA, including in discussions of traffic and noise. See Section 2.5, *Traffic and Transportation/Pedestrian and Bicycle Facilities*, and Section 2.14, *Noise*, as well as Chapter 3 of the EIR/EA for a discussion of these topics. No change to the Draft EIR/EA is necessary.

Comment Letter I-11, Russell Rawlings



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

Recommendation:
Next meeting be held in an ADA accessible
venue.

1

Name Russell Rawlings
Email Address _____
Phone Number _____

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-11, Russell Rawlings

Response to Comment I-11-1

This is not a comment on the Draft EIR/EA but rather a request that future meetings be held in a venue that is ADA accessible. The location of the I Street Bridge Replacement Project community open house held on October 26, 2017 is the Stanford Gallery. The gallery, located at 111 I Street in Sacramento, is ADA compliant. There is a ramp that leads from the parking lot to I Street, in addition to a ramp that leads from I Street to the building. The gallery has two sets of double doors, both of which can be propped open to accommodate people with disabilities or mobility constraints, including those who require the use of a wheelchair. The recommendation to use other venues will be taken into consideration. No change to the Draft EIR/EA is necessary.

Comment Letter I-12, Will Rowe



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

- ① Retain bicycle & ped access to upper deck of I- St Bridge. Losing access will cause much longer walk/bicycle trip times bet, W Sac & Sacramento.
- ② Consider a park (with ped/bike access) on upper deck of old bridge - like the High Line in NYC

Name Will Rowe
Email Address warowe1@msn.com
Phone Number _____

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-12, Will Rowe

Response to Comment I-12-1

This comment requests that bicycle and pedestrian access to the upper deck of the existing bridge be retained to prevent an increase in walking and cycling trip times. No such use is proposed as part of the I Street Bridge Replacement Project because of the restrictions of FHWA bridge replacement funding. Please see Master Response A. There are no bicycle facilities on the existing I Street Bridge, and the bridge has narrow sidewalks that do not comply with current design standards. As such, the existing bridge does not safely allow for, or encourage, these modes of travel. While commute routes and times for some travelers will change, the below-standard conditions on the existing bridge will be eliminated. People walking and on bicycles will still be able to cross the river at Tower Bridge and will have up-to-date facilities on the new I Street Bridge once it is constructed.

As a separate project, the City of West Sacramento is conducting a study to determine the feasibility of using the upper deck of the existing bridge for a recreational use, including providing access for bicycles and pedestrians. Please see Master Response B. No change to the Draft EIR/EA is necessary.

Comment Letter I-13, Dan Roy



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

1
 • What is the plan for the riverfront between Railyards Blvd + current bridge that will be freed up by removal of current ~~bridge~~ bridge's ramps? This is an opportunity for river-oriented public space, but no info is provided (ownership? future use? supporting infrastructure, like waterfront promenade, supporting policy?)

2
 • What happens to current median? Light it too + blend it (Capitol corridor crossing?) Use a neon sign to convey the mood.

Name Dan Roy
 Email Address dan.roy@turner2.com
 Phone Number 530-219-7541

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-13, Dan Roy

Response to Comment I-13-1

This comment is about development of the riverfront and is not about the proposed project. The riverfront area between Railyards Boulevard and the existing I Street Bridge is part of the Sacramento Railyards Specific Plan area. Development plans for the Railyards include enhancing the riverfront area, including the creation of public spaces. Development of the Railyards area is separate from the I Street Bridge Replacement Project. Please refer to the website for the Sacramento Railyards for more information.

<https://www.cityofsacramento.org/Community-Development/Planning/Major-Projects/Railyards-Project/Sacramento-Railyards> No change to the Draft EIR/EA is necessary.

Response to Comment I-13-2

This comment is about the outcome of the existing bridge and suggests the addition of lighting and branding. The bridge will remain in use by the railroad. Any plans for the addition of lighting or signage would be considered separate from the proposed project. See also Master Response B. No change to the Draft EIR/EA is necessary.

Comment Letter I-14, Peter Saucerman



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

"THE BEST OPPORTUNITY IN A GENERATION TO DESIGN [A PUBLIC PROJECT] THAT WILL REPRESENT THE BEST..." ~ DORIS MATSUDA

THESE ARE GREAT IDEAS - LET'S NOT ACCEPT THE LOWEST COMMON DENOMINATOR; \$104M. IS A SUBSTANTIAL CAPITAL INVESTMENT - WE SHOULD GET A NOTABLE PROJECT, FUNCTIONAL AS WELL AS AESTHETICALLY FORWARD-LEANING. I'M HAPPY TO HEAR OF THE RFP PROCESS - WE NEED AS MANY CREATIVE IDEAS AS PRACTICAL, TO ENSURE THE BEST DESIGN POSSIBLE. BOTH CITIES MUST STAND UP FOR QUALITY, AND PUSH BACK ON CAL. TRANS AS TO "FUNCTIONALITY ONLY" FUNCTIONAL MUST ALSO BE BEAUTIFUL!

Name PEER SAUCERMAN, AIA
Email Address PSAUCERMAN@GMAIL.COM
Phone Number 916-268-5444

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168

CITY OF SACRAMENTO



Response to I-14, Peter Saucerman

Response to Comment I-14-1

Please see Master Response C.

Comment Letter I-15, Rosanna Southern



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

Roundabouts are awesome!
Especially for closely-spaced intersections, growing with traffic signals could be problematic. However, costs and feasibility could lean either way. It will be interesting to see what the City decides. Would love to see modern-day roundabouts within the city!

1

Thank you!

Name Rosanna Southern
Email Address rosanna.southern@ghd.com
Phone Number _____

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-15, Rosanna Southern

Response to Comment I-15-1

The comment supports roundabouts (Alternative 2—Roundabout Intersection at Jibboom Street and Bercut Drive). No response is necessary.

Comment Letter I-16, Chris Tucker



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

RE 2.5-28 : WHY, GIVEN ALL WE KNOW ABOUT CYCLE SAFETY AND USAGE INCENTIVE, ARE THE BIKEWAYS ON THE BRIDGE NOT SEGREGATED? THIS WILL BE A SIGNIFICANT TRAFFIC AREA, AND A SIMPLE PAINTED LINE ON A FAST ROADWAY DOES NOTHING TO PROTECT CYCLISTS
** PLEASE ADD A CURB **. 12 FEET FOR PEDESTRIANS? THEN BIKE USES A BONE HERE!
AZT 1 VS AZT 2 -> BIKE FACILITIES ON THE DUBBE ROUNDABOUT ARE UNCLEAR, AND ARE HIGHLY PROBLEMATIC.

Name CHRIS TUCKER
Email Address CTUCKER1@GMAIL.COM
Phone Number 916 644 4594

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168



Response to I-16, Chris Tucker

Response to Comment I-16-1

See the response to comment I-7-1 for a discussion of the physical segregation of bicycle lane and vehicle lanes. Under Alternative 2, the bicycle lanes on the bridge would merge with a shared pedestrian/bicycle path and route through the roundabout so that bicycles are separated from the vehicles in the roundabout. No change to the Draft EIR/EA is necessary.

Comment Letter I-17, Anonymous (1)



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

Though I understand the reasons for putting bike adjacent to travel lane, within the structure, I believe that bike adjacent to sidewalk must be considered.

1

Name _____
Email Address _____
Phone Number _____

You may submit your comments to staff tonight
or directly to Katie Durham at
kdurham@aimconsultingco.com
or fax (916) 442-1168



Response to I-17, Anonymous (1)

Response to Comment I-17-1

The Class II bicycle lanes on the roadway across the bridge will be buffered from the adjacent vehicle lane by a 2-foot-wide painted separator. See the response to comment I-7-1 for a discussion of the physical segregation of bicycle lane and vehicle lanes and use of the bridge sidewalk by people on bicycles. No change to the Draft EIR/EA is necessary.

Comment Letter I-18, Anonymous (2)



COMMENT CARD

Please share your thoughts, comments, or questions about the I Street Bridge Replacement Project.

One traffic lane each is awful
at 5:14 PM M-F

1

Name _____
Email Address _____
Phone Number _____

You may submit your comments to staff tonight
or directly to Katie Durham at
kdurham@aimconsultingco.com
or fax (916) 442-1168



Response to I-18, Anonymous (2)

Response to Comment I-18-1

This comment notes concern for one traffic lane in each direction. The results of the traffic modeling conducted for the new bridge are included in EIR/EA Section 2.5. See Tables 2.5-8 and 2.5-13. Overall, traffic operations are shown to be better than on the existing bridge. EIR/EA Section 1.5.4 describes why a bridge with more than two lanes was eliminated from further discussion. Bridge designs with additional lanes resulted in lower performance for traffic operations compared to the proposed project. No change to the Draft EIR/EA is necessary.

Comment Letter I-19, JoEllen Arnold



COMMENT CARD

Please share any ideas you have for the future bridge architect to consider.

Removing the viaducts will remove a lot of bat roost habitat. It's vital that new roosts be provided.

Public art monies should be used to provide bat related art and education panels. Use the city of Austin, Texas as a model to see what they have done, also I think the Univ of Florida in Gainesville has some really cool bat house structures that could be emulated. Millions of dollars in tourist money come into Austin, drawn by the bat emergence nightly in the summer. Thousands of people come to watch every summer night.

Name

JoEllen Arnold

Email Address

joellenarnold@mac.com

Phone Number

916 501 8995

Contact Bat Conservation International
You may submit your comments to staff tonight in Austin or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168 to get ideas that would promote bats here, beautifully.

CITY OF SACRAMENTO



Response to I-19, JoEllen Arnold

Response to Comment I-19-1

This comment is not about the EIR/EA but rather is directed to the future bridge architect and suggests use of public art monies to create bat related art and educational materials. See the response to I-04-1 for information about replacement habitat. No change to the Draft EIR/EA is necessary.

Comment Letter I-20, Kim Fettke



COMMENT CARD

Please share any ideas you have for the future bridge architect to consider.

- When the bridge is designed to incorporate bat roost habitat, you should consult one of the few bat biologists with experience in this type of design. It is not straight forward and the loss of this colony would be a very significant impact - it could eliminate an entire local population - if the replacement habitat is not used.

- It would be great if you could incorporate the bat roost as a positive feature to attract and educate visitors, like in Austin, TX. You may submit your comments to staff tonight or directly to Katie Durham at kcdurham@aimconsultingco.com or fax (916) 442-1168. Incorporate interpretive signs and art work.

Name Kim Fettke
Email Address Fettke.Kimi@gmail.com
Phone Number 916-300-9451



1

Response to I-20, Kim Fettke

Response to Comment I-20-1

This comment is not about the EIR/EA but rather is directed to the future bridge architect and suggests that a bat biologist be consulted for design of bat habitat on the new structure. Design of the replacement habitat will generally follow the guidelines in *California Bat Mitigation Techniques, Solutions, and Effectiveness*² (See EIR/EA page 2.19-51). Final plans will be approved by the CDFW. The suggestion to make the use of the bridge by bats a tourist attraction similar to bridges in Austin Texas will be taken into consideration by the project team. Please also see Master Response C. No change to the Draft EIR/EA is necessary.

² Johnston, D., G. Tatarian, and E. Pierson. 2004. California Bat Mitigation Techniques, Solutions, and Effectiveness. December 29. Prepared for California Department of Transportation and California State University Sacramento Foundation. (Project Number 239-01.)

Comment Letter I-21, Heather Johnson



COMMENT CARD

Bats provide ecological services essential to our ecosystem.
Please share any ideas you have for the future bridge architect to consider.

I have concerns that the bat habitat in the approach structures/viaducts are being removed which will displace thousands of bats from their traditional roosting sites. I would like to see new bat habitat erected on site as mitigation, or incorporated into the new bridge - which could be a splendid tourist attraction. Also, the humane exclusion of the bats at the appropriate time of year (October to February non-reproductive season) must occur.

Name Heather Johnson
Email Address heatherj@calweb.com
Phone Number 916 206-3569

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168

Thank you!
Austin bridge in Sacramento
Congress Ave bridge
bats - we could have another one!!



Response to I-21, Heather Johnson

Response to Comment I-21-1

This comment is not about the EIR/EA but rather is directed to the future bridge architect, is similar to comment I-04-1, and also suggests bats can be a tourist attraction, like in Austin Texas. Please see the response to comment I-04-1 and I-20-1. No change to the Draft EIR/EA is necessary.

Comment Letter I-22, Heather Johnson



COMMENT CARD

Please share any ideas you have for the future bridge architect to consider.

Please incorporate bat habitat into the new bridge. We would like a tourist attraction like the Congress Avenue Bridge in Austin Texas. East-west oriented expansion joints, 1/2 inch to 1 inch width and more than 12 inches deep. Artwork depicting bats stamped into concrete would be wonderful.
Thank you!

1

Name

Heather Johnson

Email Address

heather.j@calweb.com

Phone Number

916 206 3569

You may submit your comments to staff tonight or directly to Katie Durham at kdurham@aimconsultingco.com or fax (916) 442-1168

City of SACRAMENTO



Response to I-22, Heather Johnson

Response to Comment I-22-1

This comment is not about the EIR/EA but rather is directed to the future bridge architect and provides specifications for replacement bat habitat on the new bridge. Replacement habitat for bats has been designed generally following the guidelines in *California Bat Mitigation Techniques, Solutions, and Effectiveness*³ (See EIR/EA page 2.19-51) and will be integrated into the bridge architectural design. The comment also suggests bat-related design elements. See also the response to comment I-20-1. No change to the Draft EIR/EA is necessary.

³ Johnston, D., G. Tatarian, and E. Pierson. 2004. California Bat Mitigation Techniques, Solutions, and Effectiveness. December 29. Prepared for California Department of Transportation and California State University Sacramento Foundation. (Project Number 239-01.)

Comment Letter I-23, David Krasko

11/8/2017

Dana Mahaffey
Associate Planner
City of Sacramento
Community Development Department
Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811

Subject: Comments on the Draft EIR/EA for the I Street Bridge Replacement Project

To whom it may concern:

I have some comments and questions about the Draft EIR/EA. I'm a business owner on the West Sacramento side of the proposed bridge and commute the current I street bridge each day. I own property at 320 C street, an area effected by the proposed bridge replacement.

1

1. It is not clear to me if the sidewalks along C Street between 3rd and 4th will be changed. I'm referring to page 13-14 in the Technical studies. Will the sidewalks be reduced or changed in anyway in front of the Washington Square lofts? If so, what will be the impact?

2

2. Over the past few years the 3rd and C St. area in West Sacramento has expanded both residential and businesses. Over the past few years this has impacted the parking in the area. The city of West Sacramento has met with the owners of Washington Square and temporarily solved the parking problem by using the area that will be lost if the bridge replacement moves forward. Removal of the 2nd Street elbow and the location for the bridge approach along C Street in West Sacramento, all of which are locations with existing parking spaces that will be affected. On street spaces are on 2nd Street and off-street spaces are in the small lot on C Street near the corner of 2nd Street, and the lot at the corner of C Street and 3rd Street. How will this loss of parking be mitigated by the City of West Sacramento?

3

3. There is an emergency flood gate located on the Sacramento side at North B and 7th street. What arrangements have been made for traffic routes should that gate be in use and closed?

4

I'm looking forward to hearing answers to my questions or even reference to where I might find details if they already are in published documents.

Thank you,



David Krasko

320 C Street
West Sacramento, CA 95605

Response to I-23, David Krasko

Response to Comment I-23-1

This comment is introductory. No response is necessary.

Response to Comment I-23-2

No changes are proposed to the sidewalks on the north side of C Street Between 3rd and 4th Streets as part of the proposed project. Trees along the sidewalk will also remain. The roadway and frontage on the south side of C Street between 2nd and 4th Streets will be modified to accommodate the new lane configuration and improved bicycle circulation, but the sidewalk in front of Washington Square and Metro Place will not be affected.

Response to Comment I-23-3

Parking will not be removed from project-adjacent streets with the exception of parking located within the proposed landing of the new bridge in West Sacramento between 2nd and 3rd Streets (the on-street parking spaces east of 3rd Street and a row of the spaces in the surface lot). The discussion of the loss of parking is on page 2.3-6 of the EIR/EA and the creation of new parking areas and circulation for parking access is proposed as mitigation. The mitigation is first mentioned in the EIR/EA on page 2.3-8 under “Construct Mid-block East West Road.” A new east/west access road south of C Street, just south of the Washington Firehouse property, will be constructed and will include new on-street parking. The roadway will be consistent with the 2nd Street reconfiguration shown in *Washington Realized—a Sustainable Community Strategy*,⁴ Figures 2.81 and 2.85. No change to the Draft EIR/EA is necessary.

Response to Comment I-23-4

Both the City of Sacramento and the City of West Sacramento have flood emergency preparedness mapping documents that indicate evacuation routes in the event of levee breaches or other significant flood events or emergencies. Recommended evacuation routes are shown on maps on the following City of Sacramento website in the event the closure of the flood gate at North B and 7th streets is necessary due to a flood inundation:

<http://www.cityofsacramento.org/UTILITIES/EDUCATION/FLOOD-READY/FLOOD-DEPTH-AND-EVACUATION-MAPS>. Map 18 depicts a hypothetical levee break scenario at

the American River north of Sacramento’s River District and depicts evacuation routes when the flood gate at North B Street and 7th Street is closed. Evacuation routes in West Sacramento are on the following City of West Sacramento website:

http://blob.cityofwestsacramento.org/city/depts/comdev/flood/emergency_preparedness/default.asp. No change to the Draft EIR/EA is necessary.

⁴ City of West Sacramento. 2015. *Washington Realized—a Sustainable Community Strategy*. Available:<<https://www.cityofwestsacramento.org/civica/filebank/blobdload.asp?BlobID=13210>>.

Comment Letter I-24, Melissa Buckley

November 9, 2017

Dana Mahaffey
Associate Planner
City of Sacramento
Community Development Department
Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811

Dear Dana Mahaffey and others:

Subject: Written Comments to the Draft EIR/EA for the "I" Street Bridge Replacement Project:

I am writing to you because I live in the Metro Place community which is being effected by the bridge replacement project. As it is, we have a very hard time with parking. There are simply not enough parking spots. And the community is growing with the Good Project homes as well as other vacant lots slated for housing development. All of these new neighbors will also need places to park, on the street, as well as at the business that have been developed (Burgers and Brew, Bean and Barrel, Devil May Care, etc.) I strongly oppose any plan that requires existing parking spots on the street and elsewhere to be removed in order to accommodate the project.

1

I am also very concerned about losing sidewalk space and the proposal to remove trees. The trees along the sidewalk of the loft area of Metro Place add so much to the quality of living in our area. They help clean the air from the heavy traffic on "C" street. They beautify the neighborhood. They provide shade and thus lessen electricity bills and help us use less AC in the summer time. In fact, the city of West Sacramento had a program where they gave away trees for the citizens to plant on and around their property. This is because our city recognizes the many benefits of tree lined streets. To remove our beautify trees is not an acceptable option to me.

2

I am all for modernizing the current "I" street bridge, but not at the detriment of my neighborhood. Please find an alternative to removing any parking spaces. If anything, we need more, not less. And please do not even consider removing the trees along "C" street. We have a lot of foot traffic there, and need all the side walk space and shade that we can get.

Sincerely,

Melissa Buckley
Resident of Metro Place at 251 4th Street, West Sacramento
916-752-6842

Response to I-24, Melissa Buckley

Response to Comment I-24-1

Mitigation is proposed for the loss of parking caused by the proposed project. Please see the response to comment I-23-3.

Response to Comment I-24-2

No change to the sidewalks or removal of trees is proposed on C Street, including in front of Metro Place. Please see the response to comment I-23-2.

Comment Letter I-25, Susan Greene

11/9/2017

Dana Mahaffey
Associate Planner
City of Sacramento
Community Development Department
Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811

To Whom it May Concern:

Subject: Written Comments to the Draft EIR/EA for the I Street Bridge Replacement Project

As a resident of Metro Place at the bottom of the I Street Bridge, I have some comments and questions about the Draft EIR/EA. I am an original owner of a loft at Metro Place, which was one of the first redevelopment projects in what was formerly Broderick. I was unable to get through the entire Draft EIR so the answers to my questions may be there, and I just haven't found them. Please bear with me.

1

- Metro Place has had West Sacramento's transportation planner come to several of our homeowner's meetings to address the traffic and parking issues in the neighborhood. There are several new development projects in the area (Burger and Brew, B&B, Goode Housing, the ice cream shop, a new café, etc.) and it has created significant parking issues in our neighborhood. The City 'mitigated' that by installing lighting and traffic spaces on 2nd behind Burgers and Brew and under the current bridge. If I understand the EIR/EA, those are some of the parking spaces that will be eliminated with the new bridge. Is there mitigation for the mitigation we just got and our now losing?

2

- As a novice, I'm trying to look at the maps and determine what other parking is being eliminated. According to one map it looks like bike / ped access goes through the trees in front of the lofts on C Street between 3rd and 4th. Is this one of the sidewalks that will be impacted? Are you in fact narrowing the sidewalk and removing those trees? The City of West Sacramento is very aware of the accidents occurring on that block. I had a car totaled less than a year ago, two neighbors have had three different vehicles hit, there are only ten of us in the lofts and most of us have had someone plow into our cars if they are parked in the street. If you are narrowing the sidewalk does this mean speeding and drunk drivers will be driving into our living rooms rather than wrecking our cars? Will the foot traffic be at my doorstep rather than on the sidewalk? I really would like to see a map or something to better understand what parking and sidewalks will be impacted. I am vehemently opposed to any modifications on the North side of C Street in front of the lofts. It will impact my safety and my property value considerably.

3


Comment Letter I-25, Susan Greene

- There are red hash marks on the 3rd street across from Metro Place. As I understand it auxiliary roads will be needed for emergency vehicles. Is that what the hash marks mean? Is that property the city is seizing to accommodate the new bridge. Again, all of the streets around Metro Place experience high traffic, limited parking, and speeding. An understandable map for a non-planner/engineer would be helpful to better understand what is planned, what the hash marks mean, and how this is going to affect the people that live here.

4

I'm confident if I had more time, I would have more question. I appreciate your time and patience. Please let me know when I might expect answers.

Sincerely,



Susan Greene

330 C Street

West Sacramento, CA 95605

916.709.0914

Response to I-25, Susan Greene

Response to Comment I-25-1

This comment is introductory and provides context. No response is necessary.

Response to Comment I-25-2

Mitigation is proposed for the loss of parking caused by the proposed project. Please see the response to comment I-23-3.

Response to Comment I-25-3

No change to the sidewalks or removal of trees is proposed on C Street, including between 3rd and 4th Streets. Please see the response to comment I-23-2.

Response to Comment I-25-4

This comment may be referring to EIR/EA Figure 1-2. On that figure, the legend lists red hatching as “Remove Roadway/Bridge.” The red hatching shown across from Metro Place indicates the proposed removal of the viaduct leading to the existing bridge, and a portion of 2nd Street, as part of the project. These properties are owned by the City of West Sacramento. The new bridge would connect to C Street in a different location, affecting private properties on 2nd Street and 3rd Street. Please see Figure I-1 in Master Response A. No change to the Draft EIR/EA is necessary.

**Comment Letter I-26, Gail Ann Overhouse, Gary Bonetti, Sandy Kay Cunha,
Michael and Carol Edmonds**

November 12, 2017

DMahaffey@cityofsacramento.org

Dana Mahaffey, Associate Planner
City of Sacramento, Community Development Department
300 Richards Blvd., 3rd Floor
Sacramento, CA 95811

mccoyj@cityofwestsacramento.org

Jason McCoy, AICP, Project Manager
City of West Sacramento, Public Works Department
1110 West Capitol Avenue, 1st Floor
West Sacramento, California 95691

**RE: COMMENTS ON DRAFT ENVIRONMENTAL IMPACT REPORT,
FEDERAL PROJECT NO.: BRLS 5002(164),
I STREET BRIDGE REPLACEMENT PROJECT**

This letter provides comments on the above referenced Draft Environmental Impact Report (EIR). These comments represent the view of multiple property owners who are directly affected by the project. Specifically, we are joint owners of the following West Sacramento parcels within the project scope:

- APN 010-372-001
- APN 010-372-002
- APN 010-372-003

After completing a review of the Draft EIR, we have the following objections and concerns on the project:

1. We are opposed to the use of our properties for the staging and storage of construction materials and equipment. The report makes multiple references to the use of our properties for this purpose via temporary construction easements (TCE). Using the land for this purpose could create a hazardous condition from the accidental release of toxic materials during construction activities. Construction would involve the use of heavy equipment and hazardous materials such as petroleum and other chemicals to operate and maintain the construction equipment. In addition, the TCE would restrict or prohibit the use of our properties, causing economic impact to the owners.

If the project wishes to pursue the use of the properties for construction staging and storage, a possible mitigation could be soil and air testing before and after construction, with the City of Sacramento and West Sacramento taking responsibility for any hazardous material clean-up as a result of the project.

To mitigate the economic loss due to the unavailability of our properties, appropriate rental use fees would need to be provided to the owners at fair market rates.

1

**Comment Letter I-26, Gail Ann Overhouse, Gary Bonetti, Sandy Kay Cunha,
Michael and Carol Edmonds**

2. We are opposed to the project's plan to remove the current 2nd Street roadway without a comparable access road replacement. The current project plan would cut off the existing access to our properties which impacts our ability to access and develop the property for future use. The plan needs to be modified to provide non-restrictive access to our parcels. | 2

3. We are opposed to the planned right-of-way acquisitions related to our properties. The Draft EIR indicates acquisitions of our property for the new bridge roadway and use of the levee on our properties for bike and pedestrian trails. It is unclear how much of our usable land will be impacted by all of these acquisitions, especially the levee plans. Additional and specific details need to be provided so that we can assess the impact to our properties. | 3

On behalf of the property owners named below, we appreciate the opportunity to provide our comments and feedback on the Draft EIR and look forward to further discussions on how the identified issues can be mitigated. If you have any questions, I can be reached at email address: gailoverhouse@att.net.

Sincerely,

Gail Ann Overhouse, Trustee
Gail Ann Bonetti Overhouse Revocable Trust

Gary Bonetti, Trustee
Gary Bonetti Living Trust

Sandy Kay Cunha, Trustee
The Cayocca Family 1983 Revocable Trust

Michael A. Edmonds, Carol A. Edmonds, Co-Trustees
The Edmonds Irrevocable Grantor Trust

Response to I-26, Gail Ann Overhouse, Gary Bonetti, Sandy Kay Cunha, Michael and Carol Edmonds

Response to Comment I-26-1

The staging locations shown in the EIR/EA are proposed options for staging and storage activities. It is not yet confirmed that the identified properties will be selected for this use. The proposed project is funded with federal aid that requires the Cities to comply with federal real estate statutes and regulations including The Uniform Relocation Assistance and Real Property Acquisition Policies act of 1970, as amended, for acquisition of permanent or temporary property rights associated with the new bridge. This Act provides protection and benefits to property owners including just compensation for persons whose property is acquired for any project purpose, including a temporary lease or construction easement. Please also see Appendix C of the EIR/EA. No change to the Draft EIR/EA is necessary.

Response to Comment I-26-2

Mitigation to restore on-street parking, emergency access, and circulation to parcels currently served by 2nd Street is described in the EIR/EA on page 2.3-8. A new east/west access road south of C Street, just south of the Washington Firehouse property, will be constructed consistent with the 2nd Street reconfiguration shown in *Washington Realized—a Sustainable Community Strategy*,⁵ Figures 2.81 and 2.85. The new roadway has not been fully designed; however it will be designed to accommodate and restore circulation access to the properties that would be impaired or unusable due to removal of the portion of 2nd Street shown in EIR/EA Figure 1-2. No change to the Draft EIR/EA is necessary.

Response to Comment I-26-3

The proposed alignment of the new bridge was accessed in consultation with the U.S. Coast Guard and selected based on the results of the Bridge Location Feasibility Study (see Chapter 1, Section 1.5, *Alternatives Considered but Eliminated from Further Discussion*, for more information about considered locations and other alternatives). In West Sacramento, the proposed project includes acquisition of real property rights to extend C Street to the east, improve the levee for flood control and provide for recreational use of the existing levee, as described in Chapter 1, *Project Description*, of the EIR/EA. Also see the response to I-26-1, above. The new bridge does not impact the location, dimensions or regulatory environment of the existing levee facilities or levee prism. The proposed project would construct a flood slurry wall within the existing levee, designed as the final flood protection solution for this location. Flood improvements cannot be constructed after the new bridge is in place without demolishing the bridge and rebuilding it. The construction of a bicycle trail on the top of the levee does not impact or modify the buildable or developable land area. No change to the Draft EIR/EA is necessary.

⁵ City of West Sacramento. 2015. *Washington Realized—a Sustainable Community Strategy*. Available:<<https://www.cityofwestsacramento.org/civica/filebank/blobdload.asp?BlobID=13210>>.

Comment Letter I-27, Mabel Salon

From: Mabel Salon [<mailto:masalon@ucdavis.edu>]
Sent: Sunday, November 12, 2017 8:50 PM
To: Katie Durham <kdurham@aimconsultingco.com>; DMahaffey@cityofsacramento.org
Subject: Comment for I Street Bridge Replacement Project

I am writing to voice concern regarding the anticipated impacts of the I Street Replacement Bridge to the southeast corner of the West Sacramento Washington Area and the proposed 2nd Street reconfiguration. As a resident of River's Side at Washington Square it is clear to me that my neighbors and I would bear significant negative impacts. I request continued analysis and development and exploration of other alternatives. Thank you.

1

Mabel Salon
231 McDowell Lane
West Sacramento, CA 95605
530.400.2327

Response to I-27, Mabel Salon

Response to Comment I-27-1

This comment indicates a concern for impacts at River's Side at Washington Square and changes to 2nd Street in West Sacramento, and requests exploration of other alternatives. No alternatives to the project are suggested in the comment. The effects of the project on properties along C Street are described in the EIR/EA in multiple locations. The effects of the changes to 2nd Street north of C Street are first described in EIR/EA Section 2.3, *Community Impacts*. In Section 2.3.1.3 and 2.3.2.3 the changes in parking and proposed property acquisitions are discussed. Mitigation for the loss of parking is first mentioned in the EIR/EA on page 2.3-8 under "Construct Mid-block East West Road." See also responses to comments I-23-2 and I-23-3. No changes to the Draft EIR/EA are necessary.

Comment Letter I-28, Rob Turner

From: Rob Turner <rob@sactownmag.com>
Date: November 12, 2017 at 2:41:31 PM PST
To: DMahaffey@cityofsacramento.org
Cc: Jesse Gothan <jgothan@cityofsacramento.org>, Hector Barron <HBarron@cityofsacramento.org>
Subject: Bridge EIR Public Comment

Hi Dana,

I understand that you're the person to contact to register public comments on the I Street Bridge Project, and that this afternoon at 4pm is the deadline to do so.

1

For starters, I am thrilled that this process will be opened up to architects throughout the world. My biggest hope is that this process yields extraordinary ideas for us to build on in regards to this once-in-a-lifetime project.

But reading through the Draft EIR, I'm concerned by a number of things which I'd like to bring to the city's attention.

2

While I realize the EIR is different than the RFP/RFQ document, my biggest concern is that I fear the architects that who are reading this EIR report will feel far too constrained by some of the language contained in the document.

For example, at several points in the EIR, it says, "**The bridge design has not been solidified, but it would be designed in a manner that carries forward elements from the nearby Tower and existing I Street Bridges** or that creates a new visual focal point to facilitate creation of a new gateway between Sacramento and West Sacramento."

Similarly, the EIR also states: "**As described in Section 2.6, viewers within the project area are familiar with existing bridges along this segment of the river, and the proposed bridge would largely be in keeping with the existing visual environment.**"

And again here: "**The City shall promote the enhancement of river-crossings and bridges to create strong, positive, and memorable gateways into West Sacramento and to reinforce the significance of historical bridges.**"

If the city is to have the best chance of an extraordinary design, I believe we should strike all references that suggest that it "would be designed" in a way that borrows elements from two bridges built in 1911 and 1935. The many uses of this language in the EIR sends a strong signal to designers that we're looking backward, not forward.

The EIR also states: "**The new bridge should meet the requirements of the Neighborhood Friendly Bridge definition that the City of Sacramento City Council adopted by resolution on October 18, 2011.**"

3

Perhaps I missed it, but does the EIR contain these "requirements"? Regardless, I also believe we should remove all references to the words "neighborhood friendly" from this document because it implies small and simple, not bold or iconic. The very presence of these words will dissuade

Comment Letter I-28, Rob Turner

designers from creating a work befitting a \$170 million project that has the potential to help define the city for generations.

3
cont.

Further, the EIR states that "**a high-elevation, long bridge would not meet the project purpose—including the adopted Neighborhood Friendly Bridge definition.**"

Again, more language about restricting the design of the structure. What if an architect proposes an idea of building an observation tower into the design? Is there a height limit in place? If so, that will only further limit the imagination of the proposals.

And then, in regards to lighting, the EIR also states: "**All artificial outdoor lighting and overhead street lighting is to be limited to safety and security requirements and the minimum required for driver safety... All lighting will be designed to have minimum impact on the surrounding environment and will use downcast, cut-off type fixtures that are shielded and direct the light only toward objects requiring illumination. Therefore, lights will be installed at the lowest allowable height and cast low-angle illumination while minimizing incidental light spill onto adjacent properties or open spaces, or backscatter into the nighttime sky. The lowest allowable wattage will be used for all lighted areas, and the amount of nighttime lights needed to light an area will be minimized to the highest degree possible.**"

4

I hope this section above does not prohibit the architects from lighting the structure in a dynamic way. That will be a critical component of any design. Look no further than the Tower Bridge or Golden Gate or many others throughout the world. I understand that light pollution should be a consideration and that the wildlife and fish under the bridge need to have lighting restrictions as well, but to my non-trained eye, it looks like very heavy restrictions are being placed on this project when it comes to lighting.

In addition to the heavy use of restrictive language throughout, there is also no use of words like "bold" or "iconic" throughout the EIR. Congresswoman Doris Matsui, West Sacramento Mayor Christopher Cabaldon and former Sacramento Director of Public Works Jerry Way have all used the word "iconic" in reference to this proposed bridge when quoted in local media in the past year, including [here](#), [here](#) and [here](#). And Mayor Steinberg has spoken at length about creating a "destination city." There are precious few opportunities to make a significant impact on the physical landscape of our city, and this is certainly one of them.

5

I hope the EIR will be updated to reflect this unified vision for our city.

Thank you,

Rob Turner

Rob Turner
CEO, Co-Editor-in-Chief
Sactown Magazine
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Sacramento, CA 95814
916-443-8340
SactownMag.com

Response to I-28, Rob Turner

Response to Comment I-28-1

The comment is introductory and is in support of an architect selection process. No response is necessary.

Response to Comment I-28-2

Please see Master Response C.

Response to Comment I-28-3

The commenter is correct that one of the stated purposes of the project is for the new bridge to meet the requirements of the Neighborhood Friendly Bridge definition. The proposed project meets the purpose and objectives listed on page 1-2 of the EIR/EA, including the adopted definition of a Neighborhood Friendly Bridge. The definition relates primarily to the engineering design, such as the elevation of the bridge in relation to the surrounding area, not the architectural design or other details. The Neighborhood Friendly Bridge definition does however include the following: “A bridge with aesthetics and dimensions which are architecturally pleasing and contextually appropriate for the adjacent neighborhoods.” Nothing in the definition of a Neighborhood Friendly bridge prevents design of a bold or iconic structure. No changes to the Draft EIR/EA are necessary.

Response to Comment I-28-4

This comment raises concerns about measures in the EIR/EA that seem to restrict the architect’s design of lighting on the bridge. In Section 2.6, *Visual/Aesthetics*, Section 2.19, *Animals*, Section 2.20, *Threatened and Endangered Species*, and Chapter 3, *California Environmental Quality Act (CEQA) Evaluation*, of the EIR/EA, mitigation measures are identified to protect humans from significant and adverse effects that could be caused by light glare from bright unshielded lights, and protect wildlife from artificial light shining into their habitat at night, disrupting their natural behavior. The measures would reduce or avoid significant adverse effects of artificial lighting on both humans and wildlife. As noted by the commenter, “light pollution should be a consideration and ... wildlife and fish under the bridge need to have lighting restrictions.” It should also be noted that appropriate lighting can also be aesthetically pleasing, unique, and innovative lighting well suited for this new and important bridge. No change to the Draft EIR/EA is necessary.

Response to Comment I-28-5

This comment requests that the EIR/EA use words like “bold” and “iconic.” The purpose of the EIR/EA is to disclose the proposed project, its effects on the environment, and mitigation to reduce significant or adverse effects. The EIR/EA does not limit the architectural design beyond design elements required to mitigate any significant environmental effects, such as the inclusion of replacement habitat for bats in the bridge design. Architectural design details are developed in a process separate from the environmental analysis required by CEQA and NEPA. Terms such as “bold” or “iconic” are not environmental impact criteria. No change to the Draft EIR/EA is necessary.

Comment Letter I-29, Port Telles

From: Port Telles [<mailto:port@telles.biz>]
Sent: Monday, November 13, 2017 11:00 AM
To: Dana Mahaffey <DMahaffey@cityofsacramento.org>
Cc: Port Telles <port@telles.biz>
Subject: I Street Bridge EIR Comments

Hello Dana –

All of these comments relate to the West Sacramento side of the river. | 1

The City was closed November 12th (Sunday), preventing me from submitting my comment card. My preference was to submit in person to confirm receipt.

I am now submitting my comments on the draft EIR for the I Street bridge via this email.

My prior comments made during the scoping process apply to the current draft of the EIR.

As stated in those comments and questions, what is being done to prevent the creation of economic blight caused by the blocking of properties on 2nd Street, i.e., cancellation of views and creation of an isolated pocket for homeless people to gather and camp?

Will the tunnel proposed through 2nd street on the West Sacramento side of the river become a gathering place for homeless people to sleep and for other activities to take place, such as the sale of drugs? What will be put in place to prevent this? | 2

Will the setbacks for flood protection prevent the development and buildout of properties on 2nd street, furthering aesthetic and potential for economic blight? | 3

What mitigation efforts will be done to prevent the noise from car travel over the bridge and its impact on residents on 2nd street, and increased traffic impacts, pollution, from more cars traveling over the bridge? | 4

Has the creation of added car exhaust and its impact on residents living on 2nd street been fully analyzed, i.e., health implications. What mitigation efforts are being put in place to prevent adverse health consequences if they exist? | 5

Is there sufficient distance to allow drivers to safely make the first right turn off the bridge? | 6

The orientation of the homes on 2nd street will be extremely awkward, i.e., the front is now the back of the house. How will people living on 2nd street enter their houses, through the back door? | 7

Will the bridge have negative flood protection impacts to people living on 2nd street? | 8

Will the levees be improved before the installation of the I Street Bridge? If not, what will prevent the bridge from washing away if there is a levee breach?

Will moving the historic water tower have implications impacting aesthetics and historic character of the neighborhood? | 9

Are there global warming impacts caused by increased traffic over the new bridge? | 10

Comment Letter I-29, Port Telles

Will you please confirm receipt of this e-mail and consideration of my prior comments and above comments in the City's further analysis. 11

Thank you.

Port Telles

Port Telles
2800 5th Street
Suite 110
Davis, CA 95618

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F: (530) 204-4064
M: (916) 204-7678

Response to I-29, Port Telles

Response to Comment I-29-1

This comment references and summarizes comments provided during the scoping process for the proposed project and states that properties on 2nd Street would be blocked, suggesting that the project would create economic blight and result in the possible use of the project area by people who are homeless. Properties on 2nd Street would not be blocked by construction of the proposed project as access would be provided via a new connection to 2nd Street from both C Street and 3rd Street (described on page 1-7 of the EIR/EA and shown in Figure 1-2). The proposed project would not change the residential use of the properties. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-2

This comment states that the proposed project includes a tunnel through 2nd Street and raises concerns that the tunnel could be used by people who are homeless or people who sell drugs. However, the project does not propose to construct a tunnel for 2nd Street. North of C Street, 2nd Street would terminate at the embankment that will support the realigned C Street and the approach to the new bridge. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-3

The levee improvements are consistent with future development plans for the area. Levee improvements are included in the proposed project because, while improvements to the levee north and south of the new bridge could be constructed, once the new bridge is in place the needed improvements could not easily be constructed under the new bridge. The levee improvements that are part of the proposed project would not impact or alter the location of the levee facility, require building setbacks from the levee, or result in changes to current or future land uses adjacent to the levee.

Separate from the proposed project, buildout of and redevelopment along the West Sacramento waterfront in the project vicinity will follow the *City of West Sacramento General Plan 2035 Policy Document*⁶ and the *Washington Specific Plan*,⁷ and be guided by *Washington Realized—a Sustainable Community Strategy*,⁸ The proposed project is consistent with the goals and policies of the General Plan and future plans to develop in the Washington District. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-4

The comment asks what mitigation will be implemented for impacts on residents of 2nd Street related to vehicular noise level changes, traffic volume changes and changes in air quality. The EIR/EA describes the projects effects related to traffic noise starting on pages 2.14-5 and 3-31.

⁶ City of West Sacramento. 2016. *City of West Sacramento General Plan 2035 Policy Document*. Adopted November 2016. City of West Sacramento Community Development Department. Available:<<https://www.cityofwestsacramento.org/government/departments/community-development/planning-division/general-plan-2035>>.

⁷ _____. 1996. *Washington Specific Plan*. Adopted by the West Sacramento City Council on May 15, 1996. West Sacramento, CA. Available: <<https://www.cityofwestsacramento.org/Home/ShowDocument?id=6785>>.

⁸ _____. 2015. *Washington Realized—a Sustainable Community Strategy*. Available:<<https://www.cityofwestsacramento.org/Home/ShowDocument?id=6858>>.

Mitigation for significant changes in traffic noise levels is identified on page 3-33 and described starting on page 3-73. Noise mitigation includes the use of a “quieter pavement” surface on C Street, ensuring compliance with the City of West Sacramento’s noise limits for interior spaces and using noise-reducing construction practices. Changes in vehicular traffic volumes are described starting on pages 2.5-19 and 3-35. Mitigation for significant traffic impacts caused by the project is identified starting on page 2.5-36 and page 3-75. The mitigation includes roadway modifications at three West Sacramento intersections in order to improve traffic operations. Implementation of the proposed project would result in only a negligible change in air emissions compared to the no-project condition. Changes in air quality are described starting on pages 2.13-6 and 3-26. Mitigation for temporary changes in levels of pollutants during construction is identified on page 3-26 and described starting on page 3-46. The identified measures in the EIR/EA will mitigate the significant impacts of the project associated with noise, traffic and air quality. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-5

The exposure of residents, including those on 2nd Street, to mobile source pollutants as a result of the proposed project is addressed in the EIR/EA in Section 2.13, *Air Quality*, and starting on page 3-13. The findings in the EIR/EA indicate that there would be no appreciable difference in mobile source air toxics emissions in the study area as a result of the proposed project (EIR/EA page 2.13-12). No change to the Draft EIR/EA is necessary.

Response to Comment I-29-6

The project’s roadway configurations comply with City of Sacramento and City of West Sacramento design standards, which include providing sufficient lane configurations for safe turning movements onto other roadways. For example, westbound drivers will be able to properly position their vehicle for safe right turns after crossing over the bridge. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-7

Access to the residential parcels located on 2nd Street north of C Street will be provided by a new connection to 2nd Street from both C Street and 3rd Street, as described on page 1-7 of the EIR/EA and shown in Figure 1-2. Residents of properties along 2nd Street will be able to enter their homes from 2nd Street after using the new access to get to the street. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-8

Improvements to the levees proposed as part of the project are described in the EIR/EA on page 1-8. Because the levee would be located under the new roadway approach and bridge, the levee improvements would be constructed prior to the installation of the new roadway approach, bridge abutments, and bridge. The project would not change the risk of flooding for residents on 2nd Street or elsewhere in the project area. The project would bring the levee segment within the project limits up to current design standards. Floodplains in the project area are discussed in the EIR/EA in Section 2.8, *Hydrology and Floodplain*. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-9

As described in EIR/EA Chapter 1, Proposed Project, the grading necessary for the levee improvements would require relocation of the Washington Water Company water tower. The

tower would be relocated approximately 43 feet to the northwest of its current location (EIR/EA page 1-8). The assessment of the project's visual changes in West Sacramento is included in the EIR/EA starting on page 2.6-10 and a visual depiction of the change is shown in EIR/EA Figure 2.3-3. Moving the tower just over 40 feet from its current location would not change the historic character of neighborhood and the tower would still be visible from 2nd Street and C Street. Also, the water tower is not an historic resource under NEPA or CEQA and it is not eligible for listing in the National Register of Historic Places. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-10

The assessment of the project's effects on greenhouse gas emissions and climate change is discussed in the EIR/EA starting on page 3-15. The results of the analysis show that the proposed project would have a less-than-significant effect on greenhouse gas emissions. No change to the Draft EIR/EA is necessary.

Response to Comment I-29-11

The City of Sacramento sent an email to the commenter to document the receipt of this comment letter. All comments received will be considered prior to approval of the Final EIR/EA. No change to the Draft EIR/EA is necessary.

I.4.3 Organizations

Comment Letter O-1, Powerhouse Science Center, Harry Laswell

From: Harry Laswell [mailto:hlaswell@powerhousesc.org]
Sent: Friday, October 27, 2017 11:49 AM
To: Katie Durham <kdurham@aimconsultingco.com>
Subject: Fwd: Reminder: Join us Tomorrow! | Street Bridge Replacement Project Community Meeting 10/26

Hi Katie

I had planned to attend but when I arrived in Old Sac I found \$15 parking at the garage due to a Kings game, and no street parking available so skipped it and thought I would provide you some inputs by email

1

I'm the Executive Director of the Powerhouse Science Center. The bridges immediate neighbor to the north.

I have two concerns about the project.

First this is an opportunity to make a real impact through design. The preliminary concepts I saw in a meeting a few months back with congresswoman Matsui and the City were less than inspiring. Just a new skin on the very old concept of a two tower vertical lift bridge. I know it is a very constrained site, but certainly some much more interesting architecture has been done with bridges recently. I hope the City will take advantage of this all too rare opportunity to do something fresh and will do an international design competition for this bridge!

The second comment would be the landscaping around the east end of the bridge. Powerhouse is working the Sacramento Tree Foundation to implement the Hanami Line in a renovation of Matsui Waterfront Park. We would hope that the bridge landscaping will be consistent with this

2

Best regards,

Harry Laswell
Interim Executive Director
Powerhouse Science Center

916.225.9329

Comment Letter O-1, Powerhouse Science Center, Harry Laswell



Comment Letter O-1, Powerhouse Science Center, Harry Laswell



Response to O-1, Powerhouse Science Center, Harry Laswell

Response to Comment O-1-1

This comment is in relation to the architecture of the bridge and includes photographs of single and double bascule bridges. Based on the river width, navigational channel and freeboard requirements, the proposed I Street Bridge must be a tower/lift bridge. The reasons for this are described in chapter 1 of the EIR/EA on page 1-5 and also in Section 1.5.3. Preliminary concepts shared at public meetings were to show what having an additional bridge would be like. The bridge's architecture has not yet been developed or selected. Please see Master Response C for a discussion of the process that will be followed for the architectural design of bridge.

Response to Comment O-1-2

This comment is about landscaping at the east end of the bridge. Landscaping plans have not yet been developed but will be part of the final design process. It is the City of Sacramento's intention to install landscaping that is suitable for the location with consideration of adjacent development plans. No change to the Draft EIR/EA is necessary.

Comment Letter O-2, Sacramento Audubon Society, Larry Hickey



October 31, 2017

Dana Mahaffey,
Associate Planner City of Sacramento,
Community Development Department Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811
DMahaffey@cityofsacramento.org

Subject: City of Sacramento's Draft Environmental Impact Report for the I St. Bridge Replacement Project

To: Dana Mahaffey Sent by e-mail

The Sacramento Audubon Society represents about 3000 members in the Sacramento area. I am writing in response to proposals to remove the existing I street bridge. We think part of it should be retained. The I St. Bridge supports a substantial proportion of the Purple Martin nesting population. The Purple Martin is recognized by the California Department of Fish and Wildlife as a species of special concern. We want that part of the bridge to be retained. Keeping that part of the bridge will also be better for cyclists and walkers (like me).

1

In short, we oppose the removal of the hollow box-girder portion of the west-bound approach section and ask that the City retain this area as critical wildlife habitat and as an additional pedestrian and bicycle route. We stress that we are not concerned about removal of the northbound viaduct from the bridge.

The westbound approach to the I St. Bridge supports a substantial proportion of the Sacramento Purple Martin nesting population. The Purple Martin is recognized by the California Department of Fish and Wildlife as a species of special concern as a result of substantial reduction in geographic range and population size (Airola and Williams 2008). The Sacramento population has declined by over 80% during the last 14 years (Airola and Kopp 2017a, b). The Sacramento population is the last population remaining in the Central Valley, where it was once locally common. The Sacramento Audubon society has shown intense interest in the status of Purple Martins in Sacramento since the 1950s (Airola and Grantham 2003), and has financially supported research and conservation efforts there since the mid-2000s (<http://www.sacramentoaudubon.org/birdquestions/localbirdsinfo.html>).

2

Comment Letter O-2, Sacramento Audubon Society, Larry Hickey

The project proposes to create replacement habitat for the Purple Martin in the section of the new bridge over the Sacramento River. This will not work. We have asked Daniel Airola, a recognized species expert on the Purple Martin, for his opinion regarding the potential suitability of the new bridge for martins. He has studied the Purple Martin population over the last 26 years at the project site and has published over 25 scientific papers on the biology and management of Purple Martin in Sacramento and elsewhere in California, including the Purple Martin species account in *California Birds of Special Concern* (Airola and Williams, 2008)

3

Dan Airola's assessment of the replacement habitat is as follows: *"I am confident in saying that the proposed mitigation of providing access through weep (vent) holes to chambers in the new bridge is highly unlikely to work in attracting nesting Purple Martins. The birds are highly unlikely to use the holes in the bridge over the Sacramento River because the site is too windy. Afternoon winds ("The Delta Breeze") blow unimpeded up the river nearly daily during the martin nesting season. These winds will prevent adults from entering weep holes to feed young for a substantial portion of most days. Similar conditions occur in numerous hollow box girder bridges over the American River (Howe, Watt, Hazel Ave.), all of which have never been recorded as occupied in over 50 years of recording bird observations and my 25 years of monitoring Purple Martins in Sacramento. In contrast, the existing I St Bridge onramp is protected from the prevailing winds by its location on the north side of the California State Railroad Museum."*

The I St Bridge Purple Martin colony is the most protected and well-managed colony site in Sacramento. It also is the most accessible and safest to visit, due to the absence of homeless people and active rail traffic nearby. This is the main site that the birding community visits in Sacramento (and thus the Central Valley) to see Purple Martins. Audubon Chapters conduct organized field trips to the site annually and many informal visits are made. The area immediately across the Sacramento River in Yolo County is the only reliable area in the County to see the species, which many birders attempt to do annually for their "year lists".

4

Retention of the bridge approach also could allow continued use of the bridge by pedestrians (including birders) and bicyclists. Maintaining an additional river crossing without motor vehicle traffic would encourage more bicycle and pedestrian activity, which would provide recreation opportunities, reduce emission of pollutants, increase community health, and increase attraction of tourists to Sacramento. Rather than viewing the decommissioned bridge as a liability, the City needs to show vision needed to protect its existing values and increase its value as a healthy asset to the community.

5

Retention of the I St. Bridge approach also would maintain habitat for White-throated Swifts and various bat species that use the approach as breeding and roosting habitat.

Save the bridge for the birds.
Bike riders and walkers will thank you

Larry Hickey
Conservation Chair
Past President
Sacramento Audubon Society
larryhickey1@gmail.com
phone: 415-305-0651

Comment Letter O-2, Sacramento Audubon Society, Larry Hickey

References

Airola, D. A., and J. Grantham. 2003. Purple Martin population status, nesting habitat characteristics, and management in Sacramento. *Western Birds* 34:235-251.

Airola, D.A. and D. Kopp. 2017a. Status of the Sacramento Purple Martin breeding population in 2016: yet more decline. *Central Valley Bird Club Bulletin* 20:18-23.

Airola, D. A. and D. Kopp. 2017b. Sacramento Purple Martin nesting population in 2017: First increase in 12 years. *Central Valley Bird Club Bulletin* 20: 81-88.

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Response to O-2, Sacramento Audubon Society, Larry Hickey

Response to Comment O-2-1

This comment is introductory and also notes opposition to the removal of the concrete hollow box-girder portion of the bridge approach viaduct in Sacramento that supports a purple martin nesting population. Please see Master Responses A and D.

Response to Comment O-2-2

This comment provides information on the purple martin nesting population in Sacramento. It is not a comment on the project or the Draft EIR/EA. No response is necessary.

Response to Comment O-2-3

Please see Master Response D.

Response to Comment O-2-4

The comment provides information about the purple martin colony, the birding community's interest in the colony and the accessibility of the bird colony to visitors. It is not a comment on the project or the Draft EIR/EA. No response is necessary.

Response to Comment O-2-5

Please see Master Responses A and D.

**Comment Letter O-3, Central Valley Bird Club, Audubon California, Yolo
Audubon, Chris Conard (CVBC)**

November 7, 2017

Dana Mahaffey,
Associate Planner City of Sacramento,
Community Development Department Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811
DMahaffey@cityofsacramento.org

**Subject: Comments on treatment of the Purple Martin in the City of Sacramento's Draft
Environmental Impact Report for the I St. Bridge Replacement Project**

We submit the following comments on the I St. Bridge Replacement Project and the project's Draft Environmental Impact Report (DEIR). Our comments are focused on treatment of the occupied Purple Martin nesting habitat in the westbound approach to the existing I St. Bridge, the consequences of removal of the bridge to the martin population and for the birding community. In short, we oppose the removal of the hollow box-girder portion of the west-bound approach section and ask that the City retain this area as critical wildlife habitat and as an additional pedestrian and bicycle route. We stress that we are not concerned about removal of the northbound viaduct from the bridge.

1

Background. As noted in the DEIR, the westbound approach to the I St. Bridge supports a substantial proportion of the Sacramento Purple Martin nesting population. The Purple Martin is recognized by the California Department of Fish and Wildlife as a species of special concern as a result of substantial reduction in geographic range and population size (Airola and Williams 2008). The Sacramento population has declined by over 80% during the last 14 years (Airola and Kopp 2017a, b). The Sacramento population is the last population remaining in the Central Valley, where it was once locally common. The Sacramento Audubon society has shown intense interest in the status of Purple Martins in Sacramento since the 1950s (Airola and Grantham 2003), and has financially supported research and conservation efforts there since the mid-2000s (<http://www.sacramentoaudubon.org/birdquestions/localbirdsinfo.html>).

2

Project Objectives. None of the Project Objectives noted on Page 1-2 are consistent with removal of the existing I St Bridge approach. To the contrary, retaining the approach and allowing it to be used by pedestrians and bicyclists would better meet the project objective to "improve the connectivity to, and accessibility of, businesses, recreational areas, and new or redevelopment opportunity sites" in the project area.

3

Alternatives Considered. As noted on Page 1-3 the range of project alternatives listed under the Project Description is very narrow and improperly do consider retention of the existing approaches to the I St. Bridge as alternative. Given that the DEIR concludes that the impacts of this removal are a significant and unavoidable impact, any feasible mitigation measure that would avoid this impact should be considered as an alternative and adopted as a part of the project. Given that retention of the bridge approach also would better meet project objectives, such an alternative should be analyzed and adopted.

4

**Comment Letter O-3, Central Valley Bird Club, Audubon California, Yolo
Audubon, Chris Conard (CVBC)**

Inconsistency with the Railyards EIR Findings. We also note that retention of the I St. Bridge approach is an assumed condition in the City of Sacramento’s EIR for the adjacent Railyards project. The mitigation measures for that project call for studies designed to protect the site from being degraded by the placement and design of buildings at the Railyards. The EIR mitigation measure that included these measures was used to determine the impacts of the Railyards project. It would seem that if the I St. Bridge project destroys the martin colony site, then the conclusions regarding the impacts of Railyards are invalidated. 5

Significance and Avoidability of Impacts. The DEIR determines in the Summary Table, but not in the main section of the DEIR, that impacts to the Purple Martin population are significant and unavoidable due to the uncertainty of the effectiveness of mitigation measures. The impacts, however, are not unavoidable. Retention of the existing approach to the I St. Bridge is never considered as a mitigation measure. Retention is feasible and would be the most effective way to avoid project impacts to the species. It would also protect populations of bats and White-throated Swifts. 6

Adequacy of Replacement Habitat. The project proposes to create replacement habitat for the Purple Martin in the section of the new bridge over the Sacramento River. We have asked Daniel Airola, a recognized species expert on the Purple Martin, for his opinion regarding the potential suitability of the new bridge for martins. He has studied the Purple Martin population over the last 26 years at the project site and has published over 25 scientific papers on the biology and management of Purple Martin in Sacramento and elsewhere in California. 7

Dan Airola’s assessment of the replacement habitat is as follows: *“I am confident in saying that the proposed mitigation of providing access through weep (vent) holes to chambers in the new bridge is highly unlikely to work in attracting nesting Purple Martins. The birds are highly unlikely to use the holes in the bridge over the Sacramento River because the site is too windy. Afternoon winds (“The Delta Breeze”) blow unimpeded up the river nearly daily during the martin nesting season. These winds will prevent adult from entering weep holes to feed young for a substantial portion of most days. Similar conditions occur in numerous hollow box girder bridges over the American River (Howe, Watt, Hazel Ave.), all of which have never been recorded as occupied in over 50 years of recording bird observations and my 25 years of monitoring Purple Martins in Sacramento. In contrast, the existing I St Bridge onramp is protected from the prevailing winds by its location on the north side of the California State Railroad Museum.”*

Loss of Recreational Birding and Aesthetic Value. Other than the threats posed by this project, the I St Bridge Purple Martin colony is the most protected and well-managed colony site in Sacramento. It also is the most accessible and is safest to visit, due to the absence of homeless encampments and active rail traffic nearby. This is the main site that the birding community visits in Sacramento (and thus the Central Valley) to see Purple Martins. Audubon Chapters conduct organized field trips to the site annually and many informal visits are made. The area immediately across the Sacramento River in Yolo County is the only reliable area in the County to see the species, which many birders attempt to do annually for their “year lists.” 8

Retention of the bridge approach also could allow continued use of the bridge by pedestrians (including birders) and bicyclists. Maintaining an additional river crossing without motor vehicle traffic would encourage more bicycle and pedestrian activity, which provides recreation opportunities, reduces emission of pollutants, increase community health, and increase attraction of tourists to Sacramento. 9

**Comment Letter O-3, Central Valley Bird Club, Audubon California, Yolo
Audubon, Chris Conard (CVBC)**

Rather than viewing the decommissioned bridge as a liability, the City needs to show vision needed to protect its existing values and increase its value as a healthy asset to the community.

9
cont.

Benefits to Other Species. Retention of the I St. Bridge approach also would maintain habitat for White-throated Swifts and various bat species that use the approach as breeding and roosting habitat.

Conclusion. We believe that the I St. Bridge Replacement Project design and the project's Draft EIR are flawed and both require substantial revision. We are happy to meet with you to work to devise a better project that protects the resource needs of Purple Martins, bats, and other bridge-nesting birds, while also serving to protect birding and other recreational uses of the site.

10

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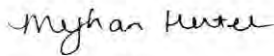
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Airola, D.A. and B.D.C. Williams 2008. Purple Martin (*Progne subis*). In: California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. W. D. Shuford and T. Gardali (editors). *Studies of Western Birds* 1. Western Field Ornithologists, Camarillo, CA and California Department of Fish and Game, Sacramento, CA. <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=10417&inline>

Sincerely,



Meghan Hertel
Interim State Co-Director
Director Land and Water
Conservation
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Central Valley Bird Club

Response to O-3, Central Valley Bird Club, Audubon California, Yolo Audubon, Chris Conard (CVBC)

Response to Comment O-3-1

This comment is introductory and also notes opposition to the removal of the hollow box-girder portion of the bridge approach in Sacramento that supports a purple martin nesting population. Please see Master Response A and D.

Response to Comment O-3-2

This comment provides information on the purple martin nesting population in Sacramento. It is not a comment on the project or the Draft EIR/EA. No response is necessary.

Response to Comment O-3-3

Please see Master Response A and D.

Response to Comment O-3-4

Please see Master Response A.

Response to Comment O-3-5

This comment is about the validity of the Railyards Specific Plan Update EIR⁹ (Railyards EIR) as it relates to the analysis included in the EIR/EA for the proposed project. The Railyards EIR was certified by the City of Sacramento on November 10, 2016. On the same day, the City of Sacramento also adopted a mitigation monitoring plan for that project. Since CEQA requires analysis based on existing conditions, the existing conditions described in the Railyards EIR includes the I Street Bridge and viaducts in their condition at the time of the preparation of the Railyards Draft EIR. Because of this, the Railyards Draft EIR notes that its Impact 4.3-2 does not account for the removal of the I Street viaducts and the creation of replacement habitat in the new bridge, as proposed in the Draft EIR/EA for the proposed project. However, the Railyards Draft EIR does account for the I Street Bridge Replacement Project in its cumulative analysis (Railyards Impact 4.3-11). The Railyards Draft EIR notes that the demolition of the viaducts is planned as part of the I Street Bridge Replacement Project (Railyards Draft EIR page 4.3-41). The Railyards Draft EIR also acknowledges the replacement habitat for purple martin planned on the new I Street Bridge as proposed in the Draft EIR/EA. Subsequent to public circulation of the Draft EIR/EA and through coordination with local stakeholders and experts, the mitigation proposed for purple martin was revised (see Master Response D) but the impact remains significant and unavoidable for the proposed project and the impact findings in the Railyards EIR remain unchanged.

Railyards EIR Mitigation Measure 4.3-2(b) applies to the I Street Bridge and its viaducts in their condition at the time of the preparation of the Railyards EIR, as well as the demolition of the I Street viaduct, and the construction of the new bridge in the new location (Railyards Draft EIR

⁹ City of Sacramento. 2016a. *Sacramento Railyards Specific Plan Update, KP Medical Center, MLS Stadium & Stormwater Outfall Draft Subsequent Environmental Impact Report*. P15-040. SCH No. 2006032058. Prepared by ESA for the City of Sacramento. June.

City of Sacramento. 2016b. *Sacramento Railyards Specific Plan Update, KP Medical Center, MLS Stadium & Stormwater Outfall Final Subsequent Environmental Impact Report*. P15-040. SCH No. 2006032058. Prepared by ESA for the City of Sacramento. October.

page 4.3-73). The measure would also apply to the replacement habitat that would now be installed for the proposed project.

The Railyards EIR finds the impact of Railyards development on purple martin, after mitigation proposed for the impacts of the development, significant and unavoidable. The conclusions in the Railyards EIR are not invalidated by the findings in the I Street Bridge Replacement Project EIR/EA. Rather, the conclusions are consistent. No changes to the Draft EIR/EA are necessary.

Response to Comment O-3-6

The significance of impacts under CEQA are described in Chapter 3, *California Environmental Quality Act (CEQA) Evaluation*, and the unavoidable impact is specifically discussed as such on EIR/EA pages 3-38 and 3-39. Please also see Master Response A.

Response to Comment O-3-7

Please see Master Response D.

Response to Comment O-3-8

This comment notes the popularity of and ease of access to the I Street purple martin colony by birders and birding groups. Organized and informal visits to this section of the river would be able to continue after the new bridge is constructed. No change to the Draft EIR/EA is necessary.

Response to Comment O-3-9

Please see Master Responses A and D.

Response to Comment O-3-10

This comment presents the conclusions of the letter. Please see Master Responses A, B and D.

**Comment Letter O-4, Environmental Council of Sacramento, Habitat 2020,
Rob Burness and Sean Wirth**



PO Box 1526 • Sacramento, CA • 95812
(916) 444-0022

November 9th, 2017

Dana Mahaffey,
Associate Planner City of Sacramento,
Community Development Department Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811
DMahaffey@cityofsacramento.org

Re: Purple Martin and the I St. Bridge Replacement Project

Dear Dana Mahaffey,

Habitat 2020 is a coalition dedicated to protecting the natural resources of the greater Sacramento region, and is the Conservation Committee of The Environmental Council of Sacramento (ECOS), a 501c3 organization. Habitat 2020 member organizations include the Sacramento Audubon Society, California Native Plant Society, Friends of the Swainson's Hawk, Save the American River Association, Save Our Sandhill Cranes, Sierra Club Sacramento Group, Friends of Stone Lakes National Wildlife Refuge, and the Sacramento Area Creeks Council.

We write here to express our support for the concerns and recommendations made by the Sacramento Audubon Society with regards to the I St. Bridge Replacement Project in their letter to you, dated October 31st 2017.

The Purple Martin is not yet a listed endangered species, but it is recognized as a species of concern, with significantly dwindling populations in recent years. While Habitat 2020 primarily focuses on the preservation of natural habitat for the region's sensitive species, this human-made nesting habitat is one of the few remaining sites in the region where Purple Martin are observed to be thriving, and every effort should be made to preserve the ability of this population to continue to do so.

Thank you for your consideration and the opportunity to comment.
Sincerely,

Rob Burness
Co-Chair, Habitat 2020

Sean Wirth
Co-Chair, Habitat 2020

1
2

Response to O-4, Environmental Council of Sacramento, Habitat 2020, Rob Burness and Sean Wirth

Response to Comment O-4-1

This comment describes the Habitat 2020 coalition and also references support for the comments provided by the Sacramento Audubon Society. The Sacramento Audubon Society letter is included in this document as O-2. Please see the responses to O-2-1 through O-2-5 and Master Responses A and D.

Response to Comment O-4-2

This comment describes the primary focus of Habitat 2020, and requests efforts be made to preserve the purple martin nesting population at the project site. Please see Master Responses A and D.

Comment Letter O-5, Western Purple Martin Working Group, Stan Kostka

From: stan Kostka lynn Schmidt <lynnandstan@earthlink.net>
Date: November 13, 2017 at 6:19:51 AM PST
To: DMahaffey@cityofsacramento.org
Subject: Comments on Impacts of I Street Bridge Replacement Project

Dana, see below: copy of letter posted to you via USPS certified mail on 11/7, scheduled delivery 11/10. Stan Kostka.

Western Purple Martin Working Group
Facilitating international coordination of research, conservation,
management, and recovery of the Western Purple Martin

Stan Kostka, Secretary
Western Purple Martin Working
Group
28603 Kunde Rd, Arlington, WA
98223
November 6, 2017

Dana Mahaffey,
Associate Planner City of Sacramento,
Community Development Department Environmental Planning Services
300 Richards Boulevard, 3rd Floor
Sacramento, CA 95811
DMahaffey@cityofsacramento.org

**Subject: Comments on Impacts of the City of Sacramento's Proposed I
St. Bridge Replacement Project on the Purple Martin**

The Western Purple Martin Working Group is an international organization of scientists and conservationists dedicated to conserving and restoring populations of the Western Purple Martin (*Progne subis arboricola*). Our group includes members from the Pacific and Rocky Mountain States and western Canada, and coordinates and supports activities in research, management, and conservation.

The Working Group was formed in response to concerns regarding alarming declines of Purple Martin populations throughout Western North America (Tautin et al. 2009). Through our cooperative efforts, we have established research programs to understand the history, genetics, population biology, and habitat needs of the species (Baker et al 2007, Cousens and Lee, 2012). More importantly, the Working Group has supported large-scale volunteer-based population recovery programs involving installation of nest boxes and protection of natural and man-made nesting habitats (WPMWG 2005).

Comment Letter O-5, Western Purple Martin Working Group, Stan Kostka

The Working Group has been intensely involved in the conservation of the Purple Martin in California as a whole and especially in Sacramento. Our local members have monitored and implemented conservation actions on behalf of the species for over 25 years. Working Group members from as far away as Washington volunteered over many years to conduct banding studies and perform conservation measures (installation of nest boxes and “nest guards” in nest holes to reduce fallout of nestlings). This work has led to publication of over 25 scientific and popular articles. The following published articles have included contributions from Working Group collaborators from outside of California (Airola et al. 2003, 2004, 2006, 2009, 2014; Baker et al. 2007, Kostka et al. 2003, Tautin et al. 2009). Much of this work has been performed at the colony in the I St. Bridge approach, because of its safe working conditions and cooperation afforded by the California State Railroad Museum.

1
cont.

The Working Group received a report on the I St. Bridge Replacement Project and its potential effects on Purple Martins at its Nov. 3, 2017, Annual Meeting. The group has unanimously endorsed the following comments on the project and its environmental document.

As noted in the project Draft Environmental Impact Report (DEIR), the Purple Martin is recognized by the California Department of Fish and Wildlife as a species of special concern as a result of substantial reduction in its geographic range and population size (Airola and Williams 2008). The Sacramento population has declined by over 80% during the last 14 years (Airola and Kopp 2017a, b). This is the last population remaining in the Central Valley, where it was once locally common.

2

From a global perspective, the Sacramento Purple Martin population is important for several reasons:

1. It is by far the most intensively studied Purple Martin population in California.
2. The population uses overpasses and elevated roadways as nesting sites, which is unique to California and the exclusive nesting habitat in Sacramento.
3. As the last Central Valley population, and one that is substantially isolated from other Purple Martin populations, it has a unique genetic composition that deserves protection.
4. As a highly threatened population, the Sacramento population requires intensive and concerted conservation action.
5. Failure in conserving the Sacramento population could lead to the listing of the Purple Martin under the State Endangered Species Act, which could result in imposition of burdensome restrictions on projects throughout the state and most notably in Sacramento.

The I St. Bridge approach is particularly important to the Sacramento population because:

3

Comment Letter O-5, Western Purple Martin Working Group, Stan Kostka

- | | |
|---|--------------------|
| <ol style="list-style-type: none"> 1. It regularly supports up to 25% of the annual Sacramento annual nesting population. 2. It is the most protected martin colony site in Sacramento (other than from the threats of this project). 3. It provides the best access to conduct ongoing research, monitoring, and conservation activities. | <p>3
cont.</p> |
|---|--------------------|

<p>The Western Purple Martin Working Group submits the following comments on the I St. Bridge Replacement Project and the project DEIR. We focus on treatment of the occupied Purple Martin nesting habitat in the westbound approach to the existing I St. Bridge and the consequences of removal of the bridge to the martin population. We oppose the removal of the hollow box-girder portion of the west-bound approach section. We request that the City retain this area as critical wildlife habitat and as an additional pedestrian and bicycle route. We stress that we are not concerned about removal of the portion of the approach that is not of hollow box-girder design, nor are we concerned about removal of the northbound viaduct from the bridge.</p>	<p>4</p>
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<p>Project Objectives. The Project Objectives noted on Page 1-2 do not demonstrate a need for removal of the existing I St Bridge approach. Rather, retaining the approach and allowing it to be used by pedestrians and bicyclists would seem to better meet the project objective to “<i>improve the connectivity to, and accessibility of, businesses, recreational areas, and new or redevelopment opportunity sites</i>” in the project area.</p>	<p>5</p>
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<p>Alternatives Considered. As noted on Page 1-3 the range of project alternatives listed under the Project Description is very narrow. Retention of the existing approaches to the I St. Bridge should be included as an alternative, so that its effects (and benefits) can be fully presented. We disagree with the DEIR conclusions that the impacts of this removal are a significant and unavoidable impact. There is no analysis presented that demonstrates that retention of the approach structure is infeasible and therefore that removal is unavoidable. Given that retention of the bridge approach would also better meet project objectives, such an alternative should be analyzed and adopted.</p>	<p>6</p>
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<p>Adequacy of Replacement Habitat. The project proposes to create replacement habitat for the Purple Martin in the section of the new bridge over the Sacramento River. Daniel Airola (regional Purple Martin volunteer conservation and recovery program coordinator) and several of our other members who have worked with Purple Martins in the project area for many years believe that the proposed mitigation of providing access through weep (vent) holes to chambers in the new bridge is highly unlikely to succeed in attracting and sustaining nesting Purple Martins. Conditions at the new bridge over the Sacramento River are unlikely to be suitable because the site is too windy, as a result of the near-daily afternoon upriver Delta Breeze. The wind will prevent adult martins from entering weep holes to feed young for a substantial portion of most days, resulting in nestling starvation mortality and nest failure. We have observed an absence of nesting martins in all similar</p>	<p>7</p>
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Comment Letter O-5, Western Purple Martin Working Group, Stan Kostka

over-water bridges in the Sacramento region. The existing I St Bridge on-ramp is protected from the prevailing winds by the adjacent California State Railroad Museum.

7
cont.

Conclusion. The I St. Bridge Replacement Project design and the project's Draft EIR are flawed and both require substantial revision. On behalf of our organization, I ask that you reconsider the project design to protect the I St. Bridge approach and the Purple Martin nesting colony it supports.

8

We appreciate the opportunity to comment on the I St. Bridge project. Please keep us informed as the process proceeds.

Sincerely,

Stan Kostka, Secretary,
Western Purple Martin Working Group
28603 Kunde Rd, Arlington, WA 98223

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Comment Letter O-5, Western Purple Martin Working Group, Stan Kostka

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Response to O-5, Western Purple Martin Working Group, Stan Kostka

Response to Comment O-5-1

This comment is introductory, is not a comment on the Draft EIR/EA and describes the Western Purple Martin Working Group. No response is necessary.

Response to Comment O-5-2

This is not a comment on the Draft EIR/EA but describes the regulatory status of the purple martin and provides information about the species. No response is necessary.

Response to Comment O-5-3

This comment provides the views of the commenter regarding the importance of the habitat provided by the I Street Bridge viaduct approach (assumed to reference the eastbound J Street viaduct). It is not a comment on the Draft EIR/EA and no response is necessary. For information on the removal of the concrete box girder viaduct, please see Master Response A.

Response to Comment O-5-4

Please see Master Response A and D.

Response to Comment O-5-5

Please see Master Response A and D.

Response to Comment O-5-6

Please see Master Response A.

Response to Comment O-5-7

Please see Master Response A.

Response to Comment O-5-8

Please see Master Response A and D.