

conservation value. This opinion considers the potential effects of the Project to the following evolutionarily significant units (ESUs) and distinct population segments (DPS): the endangered Sacramento River (SR) winter-run Chinook salmon ESU (*Oncorhynchus tshawytscha*), the threatened Central Valley (CV) spring-run Chinook salmon ESU (*O. tshawytscha*), California Central Valley (CCV) steelhead DPS (*O. mykiss*), and Southern DPS (sDPS) of North American green sturgeon (*Acipenser medirostris*). The current status of the above listed species and their designated critical habitats are summarized in Tables 1 and 2, respectively.

Table 1. Description of species, current Endangered Species Act (ESA) listing classifications, and summary of species status.

| Species | Listing Classification and Most Recent Federal Register Notice | Status Summary |
|-----------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| California Central Valley steelhead DPS | Threatened, 71 FR 834; January 5, 2006 | According to the NMFS (2016) 5-year species status review, the status of CCV steelhead appears to have remained unchanged since the 2011 status review that concluded that the DPS was in danger of extinction. Most natural-origin CCV 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. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to natural-origin 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. |
| Southern DPS of North American green sturgeon | Threatened, 71 FR 17757; April 7, 2006 | According to the NMFS (2015) 5-year species status review and the 2018 final recovery plan (NMFS 2018), some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barriers. Also, several habitat restoration actions have occurred in the Sacramento River Basin, and spawning was documented on the Feather River. However, the species viability continues to face a moderate risk of extinction because many threats have not been addressed, and the majority of spawning occurs in a single reach of the main stem Sacramento River. Current threats include |

| Species | Listing Classification and Most Recent Federal Register Notice | Status Summary |
|----------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | poaching and habitat degradation. A recent method has been developed to estimate the annual spawning run and population size in the upper Sacramento River so species can be evaluated relative to recovery criteria (Mora et al. 2017). |

Table 2. Description of critical habitat, Listing, and Status Summary.

| Critical Habitat | Designation Date and Federal Register Notice | Description |
|------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Sacramento River winter-run Chinook salmon (SR winter-run) critical habitat</p> | <p>June 16, 1993; 58 FR 33212</p> | <p>Designated critical habitat includes the Sacramento River from Keswick Dam (river mile (RM) 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta); 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. The designation includes the river water, river bottom and adjacent riparian zones used by fry and juveniles for rearing.</p> <p>PBFs considered essential to the conservation of the species include: access from the Pacific Ocean to spawning areas; availability of clean gravel for spawning substrate; adequate river flows for successful spawning, incubation of eggs, fry development and emergence, and downstream transport of juveniles; water temperatures at 5.8–14.1°C (42.5–57.5°F) for successful spawning, egg incubation, and fry development; riparian and floodplain habitat that provides for successful juvenile development and survival; and access to downstream areas so that juveniles can migrate from spawning grounds to the San Francisco Bay and the Pacific Ocean.</p> <p>Although the current conditions of PBFs for SR winter-run critical habitat are significantly limited and degraded, the habitat remaining is considered highly valuable.</p> |

| Critical Habitat | Designation Date and Federal Register Notice | Description |
|---------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Central Valley spring-run Chinook salmon (CV spring-run) critical habitat | September 2, 2005; 70 FR 52488 | <p>Designated critical habitat 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 ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation.</p> <p>PBFs considered essential to the conservation of the species include: spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas.</p> <p>Although the current conditions of PBFs for CV spring-run critical habitat are significantly limited and degraded, the habitat remaining is considered highly valuable.</p> |
| California Central Valley steelhead (CCV steelhead) critical habitat | September 2, 2005; 70 FR 52488 | <p>Designated critical habitat 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 ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation.</p> <p>PBFs considered essential to the conservation of the species include: spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas.</p> <p>Although the current conditions of PBFs for CCV steelhead critical habitat are significantly limited and degraded, the habitat remaining is considered highly valuable.</p> |

| Critical Habitat | Designation Date and Federal Register Notice | Description |
|-----------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Southern DPS of North American (sDPS) green sturgeon critical habitat | October 9, 2009; 74 FR 52300 | <p>Designated critical habitat includes the stream channels and waterways in the Delta to the ordinary high water line. 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. Critical habitat in 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 included as critical habitat for sDPS green sturgeon.</p> <p>PBFs considered essential to the conservation of the species for freshwater and estuarine habitats include: food resources, substrate type or size, water flow, water quality, migration corridor; water depth, sediment quality. In addition, PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas.</p> <p>Although the current conditions of PBFs for sDPS green sturgeon critical habitat are significantly limited and degraded, the habitat remaining is considered highly valuable.</p> |

2.2.1. Recovery Plans

In July 2014, NMFS released a final Recovery Plan for SR winter-run, CV spring-run, and CCV steelhead (NMFS 2014, Recovery Plan). The Recovery Plan outlines actions to restore habitat, access, and improve water quality and quantity conditions in the Sacramento River to promote the recovery of listed salmonids. Key actions from the Recovery Plan include conducting landscape-scale restoration throughout the Delta, incorporating ecosystem restoration into Central Valley flood control plans that includes breaching and setting back levees, and restoring flows throughout the Sacramento and San Joaquin River basins and the Delta.

In August 2018, NMFS released a final Recovery Plan for the sDPS green sturgeon (NMFS 2018), which focuses on fish screening and passage projects, floodplain and river restoration, and riparian habitat protection in the Sacramento River Basin, the Delta, San Francisco Estuary, and nearshore coastal marine environment as strategies for recovery.

2.2.2. Global Climate Change

One major factor affecting the rangewide status of the listed anadromous fish species in the Central Valley (CV) 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 and Cayan 1995). Projected warming is expected to affect CV 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 CV Chinook salmon populations can persist (Williams 2006).

SR winter-run Chinook salmon embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, which makes the species particularly at risk from climate warming. The only remaining population of SR winter-run Chinook salmon relies on the cold water pool in Shasta Reservoir, which buffers the effects of warm temperatures in most years. The exception occurs during drought years, which are predicted to occur more often with climate change (Yates et al. 2008). The long-term projection of how the Central Valley Project (CVP) and State Water Project (SWP) will operate incorporates the effects of climate change in three possible forms: less total precipitation; a shift to more precipitation in the form of rain rather than snow; or, earlier spring snow melt (Reclamation 2019). Additionally, air temperature appears to be increasing at a greater rate than what was previously analyzed (Beechie et al. 2012, Dimacali 2013). These factors will compromise the quantity and/or quality of SR winter-run Chinook salmon habitat available downstream of Keswick Dam. It is imperative for additional populations of SR winter-run Chinook salmon to continue to be re-established into historical habitat in Battle Creek and above Shasta Dam for long-term viability of the ESU (NMFS 2014).

CV spring-run Chinook salmon 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 salmon 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.

CCV 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 CCV 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 CCV steelhead, which range from 14°C to 19°C (57°F to 66°F).

The Anderson Cottonwood Irrigation District (ACID) Dam is considered the upriver extent of sDPS green sturgeon passage in the Sacramento River. The upriver extent of sDPS green

sturgeon spawning, however, is approximately 19 miles downriver of the ACID Dam where water temperature is warmer than at the ACID Dam during late spring and summer. Thus, if water temperatures increase with climate change, spawning locations lower in the river may be more affected.

In summary, observed and predicted climate change effects are generally detrimental to these listed 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 time period between the present and approximately 2100. While the uncertainty associated with these projections increases over time, the direction of climate change is relatively certain (McClure 2011).

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). For the purposes of this consultation, the action area encompasses all areas affected by the proposed Project’s construction, both on land and in water, including those portions of the San Joaquin River that will be impacted by the construction and removal of the coffer dam, including the area confined within it, associated with the replacement and removal of the existing intake structure located at Latitude 38.017431°, Longitude -121.802699°, in Contra Costa County, California. Centered on this location, the action area extends for a distance of approximately three miles in all directions [i.e., upstream, downstream, and laterally across the entire width of the San Joaquin River (approximately 2,483 feet at the Project location)] from the site where the temporary cofferdam will be installed. This area was selected because it is reflective of the maximum extent to which the anticipated adverse effects associated with the proposed construction activities (i.e., acoustic disturbances and temporarily degraded habitat quality) are likely to be experienced in the aquatic environment.

2.4. Environmental Baseline

The “environmental baseline” refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline (50 CFR 402.02).

The segment of the San Joaquin River located within the action area is heavily channelized and leveed and bordered primarily by agricultural, industrial, and municipal land uses, although much of the surrounding landscape is also being considered or secured for several current and planned tidal habitat restoration projects. This segment of the San Joaquin River is characterized primarily by slow moving deep water which is tidally influenced and predominantly depositional

in nature. This section of the river is hydrologically influenced by the confluence of the Sacramento and San Joaquin rivers where they converge to form the Delta. As such, it has generally lower water clarity and habitat diversity relative to the upper reaches of either river.

The action area is considered an important rearing and migratory corridor for all ESA-listed anadromous fish species. Juvenile sDPS green sturgeon utilize the waters of the Delta for rearing habitat for a period of up to 3 years as they acclimate to higher concentrations of salinity prior to ocean entry. As such, they have the potential to be present in the action area during every month of the year, and would therefore also have the potential to be exposed to the effects of the Project. Adult CCV steelhead begin to migrate into the watersheds of the Central Valley during the late summer or early fall months (i.e., September through November), particularly when early winter rains create increased flows in the system. NMFS does not expect them to be present in the action area in any significant numbers, however, until the months of December through February, which is the peak of their spawning migration. The peak of juvenile CCV steelhead emigration from the tributaries in the Sacramento and San Joaquin river basins to the ocean occurs from February through May. Therefore, conducting in-water construction activities from August 1 through October 31 should avoid impacts to the majority of outmigrating juvenile steelhead smolts. There are larger steelhead smolts that migrate at other times of the year, including the fall and early winter period, that may be exposed to the direct effects of the Project during their passage through the action area, albeit in very small numbers. As with adults, however, NMFS expects the most likely period for them to be present is during the month of December.

Baseline and cumulative effects from activities such as continued municipal, industrial, and agricultural practices, bank and levee stabilization projects, and both commercial shipping traffic and recreational boating and fishing will continue to negatively affect the federally listed species in the action area. Runoff from municipal, industrial, and agricultural activities may contain contaminants such as pesticides, sediments, and nutrients that may affect listed species through lethal and sublethal impacts. Levee construction and bank protection can reduce floodplain connectivity, change substrate size, and decrease riparian habitat and shaded riverine aquatic cover. However, NMFS expects the species and their designated critical habitats to improve with the implementation of both ongoing and planned habitat restoration efforts incorporating and advancing progress on recovery actions identified in NMFS (2014, 2018).

2.5. Effects of the Action

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Equipment mobilization and staging to prepare the site for cofferdam installation will require general excavation and earth moving activities both in the water and on the nearby bank. These activities generate noise and a physical disturbance in the aquatic environment, which could

displace fish into adjacent habitats, and also have the potential to transfer kinetic energy through the adjoining substrates and temporarily generate increased turbulence and turbidity in the river. Migrating fish generally react to this disturbance with a startle response in which they are likely to suddenly disperse in random directions (Carlson et al. 2001). This displacement can lead them into predator-occupied habitat where opportunistic predators can take advantage of behavioral changes to target and prey on juvenile salmonids. Carlson et al. (2001) observed this behavior occurring in response to routine channel maintenance activities in the Columbia River. Some of the fish that did not immediately recover from the disorientation of turbidity and noise from channel dredges and pile driving swam directly into the point of contact with predators.

Disturbances to the substrate on the channel bottom during construction will resuspend sediments in the water column, resulting in increased turbidity in the action area. The action area typically exhibits relatively high concentrations of suspended sediments as a natural background condition due to its position at the confluence of two large rivers forming the Sacramento San Joaquin Delta. Nevertheless, short-term increases in turbidity and suspended sediment concentrations in the water column from in-water construction disturbances may disrupt feeding activities of fish or result in their temporary displacement from preferred habitats. Numerous studies show that suspended sediment and turbidity levels moderately elevated above natural background values can result in non-lethal detrimental effects to salmonids, such as decreasing reproductive success, reducing feeding success and growth, causing avoidance of rearing habitats, and disrupting migration cues (Bash et al. 2001). NMFS expects turbidity to affect CCV steelhead in much the same way that it affects the other salmonids used in these studies because of similar physiological and life history requirements between species. The disturbance of the channel banks and bottom during construction and removal of the coffer dam will increase suspended sediments locally, which will produce turbidity plumes that will extend up and down the river from the construction activity in accordance with the prevailing tide. The duration of turbidity plumes resulting from in-water construction-related activities is expected to last throughout the time the disturbance is occurring and for several hours after the work has ceased each day, including during the early evening hours, before gradually dissipating and returning to natural background levels.

Both migrating and rearing fish are expected to move through, rather than hold position or remain in the immediate vicinity of ongoing construction activities for more than a few hours or days. Although CCV steelhead are highly migratory and capable of moving freely throughout the action area, a substantial increase in turbidity may injure fish by temporarily disrupting normal behaviors that are essential to their growth and survival, such as feeding, sheltering, and migrating. Disrupting these behaviors increases the likelihood that individual fish will face increased competition for food and space, and experience reduced growth rates or possibly weight loss resulting in harm to individuals and increased risk to the affected species. Turbidity increases may also affect the sheltering abilities of some fish and may decrease their likelihood of survival by increasing their susceptibility to predation. Conversely, some turbidity is helpful in reducing predation by shielding individual fish from visual predators in a turbid field (Gregory and Levings 1998). Adherence to erosion control measures and BMPs, such as the use of silt fences, straw bales, and straw wattles as described in the BA (ESA 2019), will minimize the amount of suspended sediment generated by construction activities and will minimize the potential for post-construction turbidity changes should precipitation events occur after construction has been completed. In addition, in-water construction activities will adhere to

CVRWQCB turbidity objectives for the Sacramento and San Joaquin River basins that stipulate where natural turbidity is between 5 and 50 nephelometric turbidity units (NTUs), turbidity levels may not be elevated by 20 percent above ambient conditions; where ambient conditions are between 50 and 100 NTUs, conditions may not be increased by more than 10 NTUs; and where natural turbidity is greater than 100 NTUs, increases will not exceed 10 percent above ambient conditions (CVRWQCB 2018). NMFS expects that most fish will actively avoid the elevated turbidity plumes. For those fish that do not or cannot avoid the turbid water, exposure is expected to be brief (i.e., minutes to hours) and not likely to cause injury or death from reduced growth or physiological stress. This expectation is based on the general avoidance behaviors of salmonids. However, some juveniles that are exposed to turbidity plumes may be injured or killed by predatory fish that take advantage of disrupted normal behavior. Once fish migrate past the turbid water, normal feeding and migration behaviors are expected to resume.

Construction activities are also expected to generate underwater noise from both terrestrial and in-water sources, occasionally reaching intense levels. Intense noise will be produced in the aquatic environment primarily by pile driving operations to install the cofferdam, but also by heavy machinery operating in close proximity to the river. Feist et al. (1992) found that noise from pile driving activities in Puget Sound affected the general behavior of juvenile salmon by temporarily displacing them from active construction areas. Nearly twice as many fish were observed at construction sites on non-pile driving days compared to days when pile driving occurred. The level of noise generated from impact pile driving the sheet piles during cofferdam installation is expected to reach levels that have the potential to either cause instantaneous mortality (>206 decibels peak, referenced to 1 μ Pa) to fish swimming within 29.5 feet (9 meters) of the source of the acoustic signal, or incur tissue injury (>187 decibels accumulated sound exposure level, re: 1 μ Pa) to fish swimming within 1,119 feet (341 meters) of the source of the acoustic signal. Greater than 150 decibels root mean square (re: 1 μ Pa) is also likely to cause altered behavioral responses of fish swimming within 3 miles (4.82 kilometers) of the source of the acoustic signal.

NMFS expects both juvenile and adult life stages of fish to be at some risk of exposure to these construction activities. Typically, smaller fry- and larval-sized fish would have the highest potential risk of exposure due to their near shore orientation and slower swimming speeds. However, fry- and larval-sized fish are unlikely to be present in the action area due to the season and the location of the construction site, which is downstream of the natal reaches of CCV steelhead and sDPS green sturgeon. Juvenile green sturgeon may be present in the action area throughout the year, and would therefore be exposed to the effects of the action. In contrast to this, adult CCV steelhead do not begin to migrate into the watersheds of the Central Valley until the late summer or early fall months (i.e., September through November) when early winter rains create increased flows in the system. NMFS, therefore, does not expect them to be present in the action area in any significant numbers until the months of December through February, which is the peak of their spawning migration. Similarly, the peak of juvenile CCV steelhead emigration from the tributaries in the Sacramento and San Joaquin river basins to the ocean occurs from February through May. Therefore, conducting in-water construction activities from August 1 through October 31 should also avoid impacts to the majority of outmigrating juvenile steelhead smolts. NMFS generally expects most migrating and rearing fish to avoid entering the zone of active construction activity, or to have a startle response when construction activity begins. Although behavioral reactions of fish to in-water disturbances vary greatly between species,

many studies have also demonstrated that avoidance behavior is not limited to a simple startle response, but that directional changes and shifting stratification within the water column also exhibit deflective movement directly in response to, and away from, the source signal in an attempt to selectively avoid the disturbance (Shafiei Sabet et al. 2015). These behavioral modifications may delay migration for several hours or more. When construction activity is curtailed or paused, such as when crews take breaks or suspend activities overnight, fish are generally expected to continue their migration. Migratory movement is generally thought to occur under low light conditions, which is when construction activity would not be occurring. However, individual fish may mobilize at any time and would consequently face a higher level of risk of exposure to construction-related effects.

In-water construction activities additionally have the potential to temporarily negatively affect the designated critical habitat PBFs of migratory corridors and rearing habitat for all of the listed anadromous fish. This includes increased exposure to noise, turbidity, and suspended sediments as described above, as well as by precluding access to approximately 0.15 acres of aquatic habitat that will be dewatered for a period of up to one year while the proposed coffer dam is in place. Increased turbidity, used as an indicator of increased suspended sediments, also is correlated with a decline in primary productivity, a decline in the abundance of periphyton, and reductions in the abundance and diversity of invertebrate fauna in the affected area (Lloyd 1987, Newcombe and MacDonald 1991). Reduction in prey/food for anadromous fish may result in short term localized degradation of the rearing habitat PBFs. However, these effects on critical habitat would be minimized by implementing the previously described BMPs and conservation measures such as implementing spill and stormwater prevention plans and adhering to regional water quality standards. In addition to the temporary construction-related effects to designated critical habitat, the proposed Project, once completed, will also permanently displace approximately 0.02 acres of currently available habitat due to the presence of the newly installed intake structure in the San Joaquin River.

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 and 402.17(a)). 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).

Non-Federal actions that occur in the action area include ongoing municipal, industrial, and agricultural activities and increased urbanization. Agricultural practices throughout the San Joaquin Delta hydrologic unit (hydrologic unit code 18040003) may negatively affect riparian and wetland habitats. Unscreened agricultural diversions along the San Joaquin and Sacramento

rivers entrain fish, including juvenile salmonids and sDPS green sturgeon. Grazing activities from dairy and cattle operations can degrade or reduce suitable critical habitat for listed salmonids and sturgeon by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the Delta. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may negatively affect salmonid and sturgeon reproductive success and survival rates (Dubrovsky et al. 1998, Daughton 2003).

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased anthropogenic 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 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. Increased urbanization is also expected to result in an expansion of increased recreational activities throughout the action area. Among the activities expected to increase in both volume and frequency is recreational boating, which typically results in greater increased wave action and propeller wash in waterways. These activities will potentially degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity in hydrologically connected waters. Wakes and propeller wash also disturb benthic sediments and, thereby, potentially re-suspend contaminated sediments and further degrading areas of submerged vegetation. This disturbance, in turn, would reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and sDPS green sturgeon entering and moving throughout the action area. Expanded recreational boat operation is also expected to result in elevated concentrations of contaminants from the operation of gasoline and diesel powered engines on watercraft entering the streams and waterways of the action area.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat 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 diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

The proposed action is scheduled to occur during a period of time that corresponds with the recommended in-water work window for the Sacramento-San Joaquin River Delta, from August 1 through October 31, in a reach of the river where there is historically no spawning habitat present. Despite being the major migratory corridor for all of the Sacramento River Basin populations of listed species considered in this opinion, the numbers of individuals from those populations present at the time of construction are expected to be very low, and impacts to those individuals are not likely to translate into population level effects. Specifically, a few CCV

steelhead adults and juveniles have the potential to be migrating through the action area during the in-water work window when it overlaps with the rising and falling limbs of their migration and emigration seasons, respectively, as do juvenile sDPS green sturgeon, which are present year round in the action area. In contrast, however, adult and juvenile Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon are not anticipated to be present at all. In addition, the action area represents a very small proportion of the adjacent habitat available for fish to disperse into, and the effects from the action are expected to dissipate rapidly within the context of the larger surrounding habitat as well. Therefore, construction effects to listed species are expected to be temporary and limited to behavioral responses and injury or death to a very few individual adult and juvenile CCV steelhead and juvenile sDPS green sturgeon migrating through the action area for approximately two weeks during the period from August 1 through October 31 in two successive years. In addition, the Project will result in the permanent loss of up to 0.02 acres of designated critical habitat displaced by the presence of the new intake structure, and the temporary disturbance of up to 0.15 acres of designated critical habitat for all of the species for a period of one year while the cofferdam is in place.

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, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of California Central Valley steelhead DPS, the southern DPS of North American green sturgeon, or destroy or adversely modify the designated critical habitats of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, or the southern DPS of North American green sturgeon.

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 CCV steelhead and sDPS green sturgeon through construction-related impacts in the action area is reasonably certain to occur. Specifically, NMFS anticipates that juvenile and adult CCV steelhead and juvenile sDPS green sturgeon may be killed, injured, or harassed during construction activities.

Using the best available information, NMFS cannot specifically quantify the anticipated amount of incidental take of individual CCV steelhead and sDPS green sturgeon because of the variability and uncertainty associated with the response of listed species to the effects of the action, uncertainty with regard to the varying population size of the two DPSs, annual variations in the timing of migration and emigration, and individual habitat use within the action area. However, it is possible to designate ecological surrogates for the extent of incidental take anticipated to be caused by the proposed Project, and to monitor those surrogates to determine the level of incidental take that is occurring. The most appropriate ecological surrogate for the extent of incidental take caused by the proposed Project is the amount and duration of pile driving conducted during cofferdam construction and removal.

2.9.2. Ecological Surrogates

- The analysis of the effects of the Project anticipates that the installation of up to 300 interlocking 24-inch thick steel sheet piles will require the use of an impact pile driving hammer operating for approximately 2 weeks between August 1 and October 31 during daylight hours resulting in acoustic effects exceeding:
 - 150 decibels (dB) out to a distance of 4,642 meters (2.88 miles) from the source,
 - 187 dB at a distance of 341 meters (0.21 miles) from the source, and
 - 206 dB at a distance of 9 meters (29.5 feet) from the source.

If any specific parameter of this ecological surrogate is exceeded, the anticipated incidental take levels are also exceeded, triggering the need to reinitiate consultation on the proposed Project.

2.9.3. 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.

2.9.4. 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).

NMFS has determined that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take of CCV steelhead and southern DPS of North American green sturgeon resulting from construction of the proposed Project.

1. Measures shall be taken to minimize the amount and duration of pile driving and its potential impacts on listed anadromous fish.
2. Measures shall be taken to monitor and report the amount or extent of incidental take that occurs in connection with implementation of the proposed Project.

2.9.5. Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps 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 terms and conditions described below are non-discretionary, and the Corps and the applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps and the applicant have a continuing duty to monitor the impacts of incidental take and must report the progress of the Project 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.

1. The following term and condition implements RPM 1:
 - a. The permit applicant, including all employees contracted by the applicant to carry out the permitted work, shall ensure that all in-water pile driving activity commences during a period of low tide each day.
2. The following term and condition implements RPM 2:
 - a. Any Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, or sDPS green sturgeon found dead or injured within the action area during construction shall be reported within 48 hours to NMFS via fax or by phone:

Attention: Cathy Marcinkevage, Acting Assistant Regional Administrator
NMFS California Central Valley Office
Fax: (916) 930-3629
Phone: (916) 930-3600

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:

Cathy Marcinkevage, Acting Assistant Regional Administrator
California Central Valley Office
National Marine Fisheries Service

650 Capitol Mall, Suite 5-100
Sacramento, California 95814

Any dead specimen(s) should be placed in a cooler with ice, then sent to:

NMFS, Southwest Fisheries Science Center, Fisheries Ecology Division
110 Shaffer Road
Santa Cruz, California 95060

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) The Corps and the permit applicant/holder should support and promote aquatic and riparian habitat restoration in the Sacramento and San Joaquin river basins for listed aquatic species. Practices that avoid or minimize negative impacts to listed species should be encouraged.
- (2) The Corps and the permit applicant/holder should continue to 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 habitat restoration projects.
- (3) The Corps should use species recovery plans to help ensure that their actions will address the underlying processes that limit fish recovery, and to identify key actions in the action area when prioritizing project sites each year.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Antioch Desalination Intake Replacement Project.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12. “Not Likely to Adversely Affect” Determinations

Exposure of both Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon to the direct effects of the Project is expected to be entirely avoided largely because in-water work will occur during the summer and fall months when these species are typically not present in the action area. A brief discussion of the likelihood of exposure of listed fish by time of year, species, and life stage follows:

For Sacramento River winter-run Chinook salmon, the proposed work window for construction of the cofferdam in the San Joaquin River (August 1 through October 31) should preclude most, if not all, instances of exposure to the direct effects of the Project. Adult Sacramento River winter-run Chinook salmon may begin to enter the action area in November, but are most likely to be migrating through the action area in December. Similarly, juveniles may be present in the action area as early as November and December, especially if significant rainfall events occur to trigger their outmigration behavior.

Adult Central Valley spring-run Chinook salmon are not expected to be present in the action area during the in-water work window from August 1 through October 31. Yearling fish may appear in the action area as early as late October, but are not likely to occur in any substantial numbers until after February when the bulk of yearling and young-of-year spring-run Chinook salmon begin to enter the Delta.

Based on the timing of Sacramento River winter-run Chinook salmon or Central Valley spring-run Chinook salmon movements in and through the action area described above, NMFS does not anticipate the proposed Project will result in adverse effects to Sacramento River winter-run Chinook salmon or Central Valley spring-run Chinook salmon. NMFS reached these conclusions based on the timing of the in-water work, and pile driving activity in particular, associated with the construction of the cofferdam being limited to the period from August 1 to October 31, during the time of year when Chinook salmon are not expected to be present in the action area.

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 the Corps and descriptions of EFH for Pacific Coast salmon [Pacific Fishery Management Council (PFMC) 2014] contained in

the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The PFMC has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon FMP (PFMC 2000). The action area is within the region identified as EFH for Pacific salmon in Amendment 14 of the Pacific Coast Salmon FMP. Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998), and includes the San Joaquin Delta (Delta) hydrologic unit (i.e., number 18040003). Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CV fall-/late fall-run Chinook salmon are species managed under the Pacific Coast Salmon FMP that occur in the Delta unit.

The San Joaquin River within the action area provides upstream migratory habitat for adult Chinook salmon, and downstream migratory and rearing habitat for all Chinook salmon runs. Chinook salmon juveniles may rear throughout the action area; however, spawning does not occur in the action area, as Chinook salmon spawning occurs well upstream.

3.2. Adverse Effects on Essential Fish Habitat

Temporary adverse construction impacts of the Project include pile driving noise and increased turbidity. The full impacts of the Project on Chinook salmon habitat are the same as those described in section 2.5 of this opinion and are generally expected to apply to Pacific salmon EFH.

3.3. Essential Fish Habitat Conservation Recommendations

The Project includes adequate measures described in Section 1.3 of this opinion to avoid, minimize, or otherwise offset the adverse effects to EFH. Therefore, additional EFH Conservation Recommendations are not being provided at this time.

3.4. Supplemental Consultation

The Corps 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(1)).

4. 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.

4.1. 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 are the U.S. Army Corps of Engineers and the City of Antioch. Other interested users could include the Central Valley Regional Water Quality Control Board, the U.S. Fish and Wildlife Service, the California Department of Fish and Wildlife, and the California Department of Water Resources. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository. The format and naming adheres to conventional standards for style.

4.2. 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.

4.3. 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.

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