RECLAMATION

Managing Water in the West

Environmental Assessment

Sacramento Deep Water Ship Channel Nutrient Enrichment Project

U.S. Department of the Interior
Bureau of Reclamation
Mid Pacific Region

June 2018

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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List of Acronyms and Abbreviations

µg/L	microgram/Liter
BMP	Best Management Practices
CEQ	Council on Environmental Quality

CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRF	California Red-legged Frog
CV	Central Valley
CVP	Central Valley Project
CWA	Clean Water Act
DIN	Dissolved Inorganic Nitrate
DOC	Dissolved Organic Carbon
DPS	Distinct Population Segments
EA	Environmental Assessment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
GGS	Giant Garter Snake
IEP	Interagency Ecological Program
IPaC	Service Information for Planning and Conservation website
ITA	Indian Trust Assets
LAA	May Affect, and Likely to Adversely Affect
MBTA	Migratory Bird Treaty Act
MGD	million gallons per day
M&I	Municipal and Industrial
NE	No Effect
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLAA	Not Likely to Adversely Affect
NL74	Navigation Light 74
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPPA	Native Plant Protection Act
PO_4-P	Orthophosphate
Quad	Quadrangle
Reclamation	Bureau of Reclamation
Service	U.S. Fish and Wildlife Service
SHPO	State Historic Preservation Officer
SSC	Sacramento Deep Water Ship Channel
SWRCB	State Water Resources Control Board
TSS	Total Suspended Solids
USGS	US Geological Survey
VOC	Volatile Organic Compound
VSS	Volatile Suspended Solids
WSP	West Sacramento Port

Section 1 Introduction

In conformance with the National Environmental Policy Act, 42 U.S.C. § 4431 et seq. (NEPA), as amended, the Bureau of Reclamation (Reclamation) has prepared this Environmental Assessment (EA) to evaluate and disclose potential environmental impacts associated with implementation of the Sacramento Deep Water Ship Channel Nutrient Enrichment Project (Proposed Action).

This EA describes the existing environmental resources in the project area, evaluates the impacts of the No Action and Proposed Action alternatives on the resources, and proposes measures to avoid, minimize, or mitigate any adverse impacts. This EA was prepared in accordance with NEPA, Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations (CFR) 1500-1508), and Department of the Interior Regulations (43 CFR Part 46).

1.1 Background

Reclamation operates the Central Valley Project (CVP), a system of reservoirs, power plants, operable gates, pumping plants and canals that supply water for irrigation, municipal and industrial use and for wildlife refuges in the Central Valley. CVP operations are thought to contribute to the decline of delta smelt (*Hypomesus transpacificus*), an endemic fish listed as 'threatened' under the federal Endangered Species Act (ESA), by adversely affecting the extent and quality of its critical habitat. Under the Central Valley Project Improvement Act of 1992, Reclamation has the authority to fund activities that have the potential to reduce CVP impacts on smelt and their critical habitat and to undertake actions to improve Delta habitat conditions.

Conceptual models for the pelagic organism decline in the Sacramento-San Joaquin Delta suggest the potential for both "top-down" and "bottom-up" drivers of fish abundance. As in many estuaries, fish and other higher trophic level production in the open waters of the Delta region is fueled by phytoplankton production. However, the Delta has notably low phytoplankton production and biomass (Van Nieuwenhuyse 2007; Jassby 2008) resulting in low overall aquatic ecosystem productivity compared to other systems. Consequently, open waters of the Delta are considered food-limited (Kimmerer 2002). Increasing food resources (i.e., phytoplankton and zooplankton) would thus be expected to have a beneficial effect on the entire system, as well as for endangered native species such as Delta smelt.

Previous research on the Toe Drain in the Yolo Bypass (Frantzich and Sommer 2015) demonstrated that pulses of algae-rich waters associated with enhanced net flows through the Toe Drain (as measured at the Lisbon Weir) can "seed" a significant algal bloom throughout the north Delta (Figure 1). A plausible mechanism for this phytoplankton bloom initiation is that the input of a large algal seed source from the Toe Drain into the relatively nutrient-rich waters from

the lower Sacramento River (primary nutrient source is Sacramento Regional wastewater treatment facility) results in greatly enhanced phytoplankton production rates that exceed zooplankton and clam (*Corbicula*) grazing pressures. This allows the phytoplankton bloom to persist and propagate downstream until it is exported to the Bay.

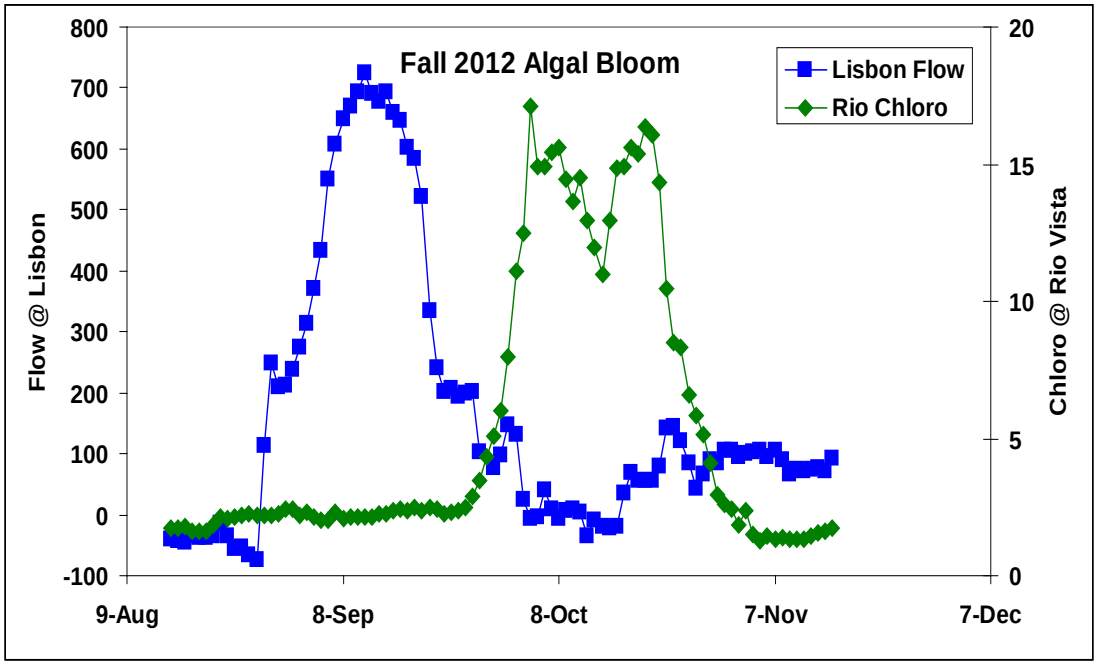

Figure 1. Outflow from Yolo toe drain and chlorophyll concentration (metric of phytoplankton standing stock) in the main stem Sacramento River at Rio Vista during fall of 2012.

A goal for food resource management in the north Delta would be to increase the standing stock of algal biomass (chlorophyll concentration) from the current range of 1-3 µg/L (microgram/Liter) to ~10 µg/L. A chlorophyll level of ~10 µg/L could support relatively high zooplankton production (Mueller-Solger et al. 2002) without adversely affecting water quality (e.g., dissolved oxygen concentration).

To optimize the export of food resources from the Sacramento Deep Water Ship Channel (SSC), Reclamation's multi-year (2012 – present) dataset suggests that nitrogen additions should enhance both primary (phytoplankton) and secondary (zooplankton) production and standing crops. It is hypothesized that it should be possible to manipulate the SSC in a manner that would allow Reclamation to grow up standing stocks of phytoplankton and zooplankton and pulse these food resources into the north Delta where the phytoplankton/zooplankton bloom may be self-sustaining for a period of time (~1 month, but depending on river flows). In the SSC, there is the potential to control both water flow rates (diversions from Sacramento River) and nutrient concentrations (e.g., through nutrient additions) should preliminary studies support the efficacy of the system to enhance food resources in the north Delta.

The SSC consists of three longitudinally distinct zones as illustrated by the specific conductance (EC). These zones include an area of trapped water in the upper section (lentic conditions), a zone of mixing in the mid-reach, and the lower zone that experiences tidal exchange twice a day (Figure 2). Seasonally, small blooms of phytoplankton and zooplankton are observed in the "old water" zone (Figure 3 and 4); however, these food resources are trapped in this zone with minimal advection to the tidal mixing zone where it could enter into the north Delta. The more persistent blooms observed below the gates in the West Sacramento Port (WSP) are believed to be due to nutrient inputs from leakage through the gate (especially during high flow periods) and groundwater inputs from the Sacramento River. These observations suggest that nutrient enrichment has the potential to stimulate algal and zooplankton production in the SSC.

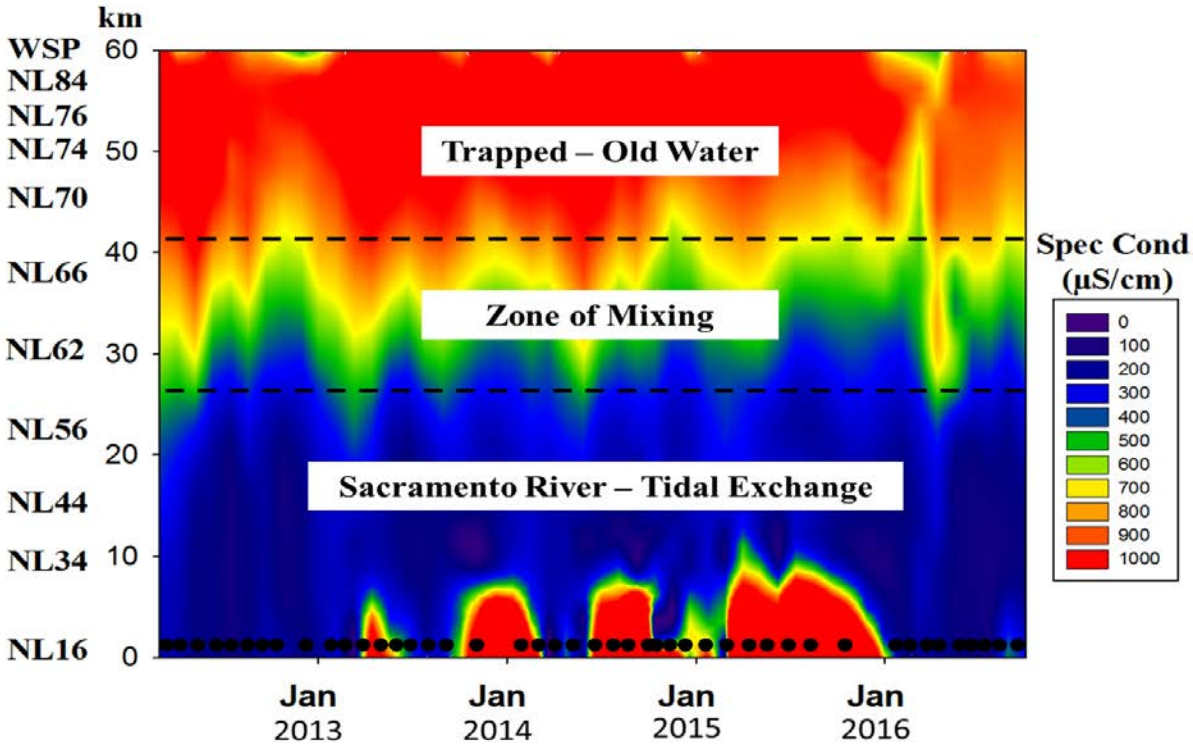

Figure 2. Longitudinal variation of specific conductance (saltiness) in the Sacramento ship channel, 2012-2016.

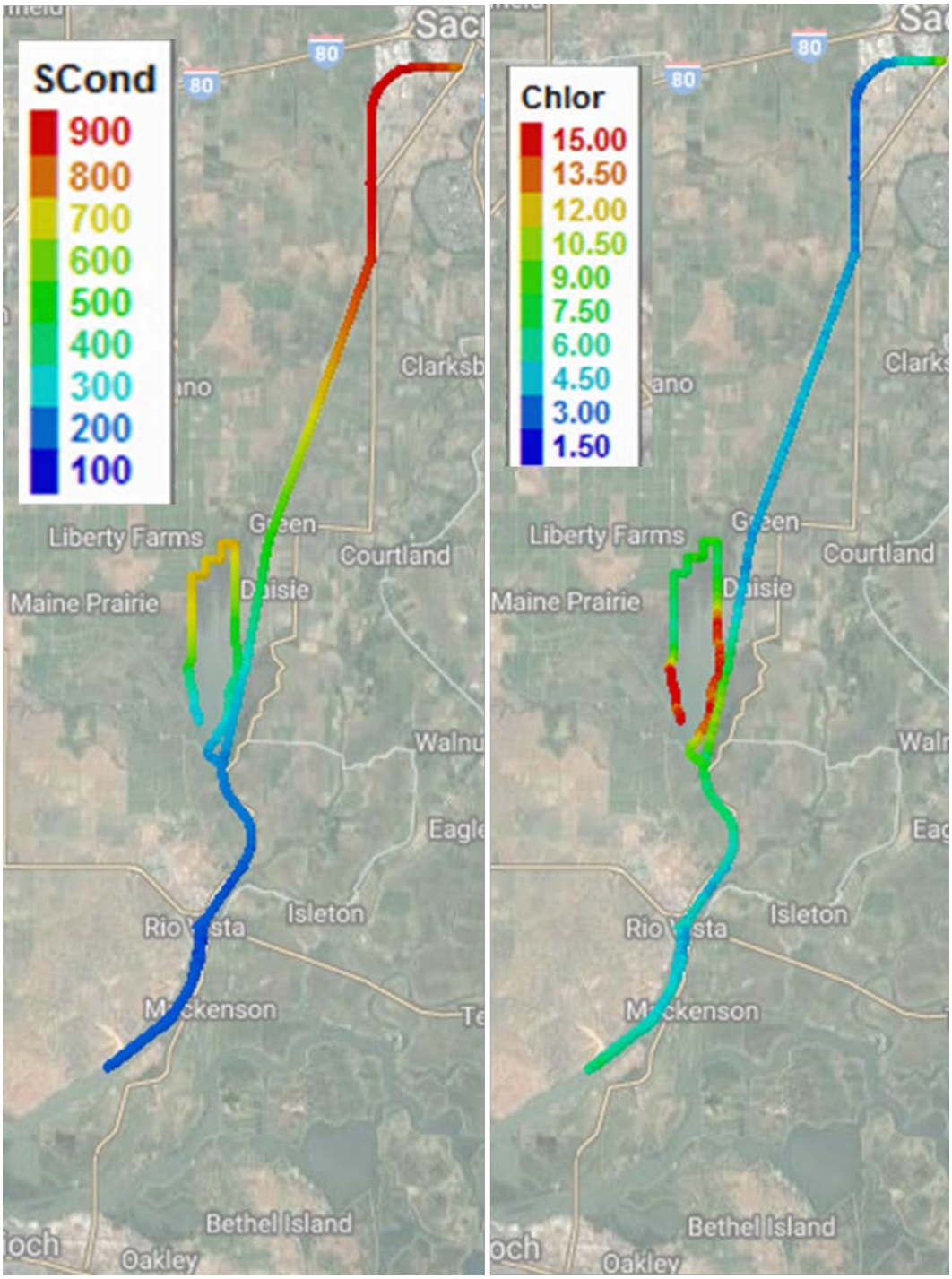

Figure 3. Longitudinal variation in specific conductance and chlorophyll concentration in the main stem Sacramento River, Cache Slough Complex and Sacramento ship channel, July 26, 2012.

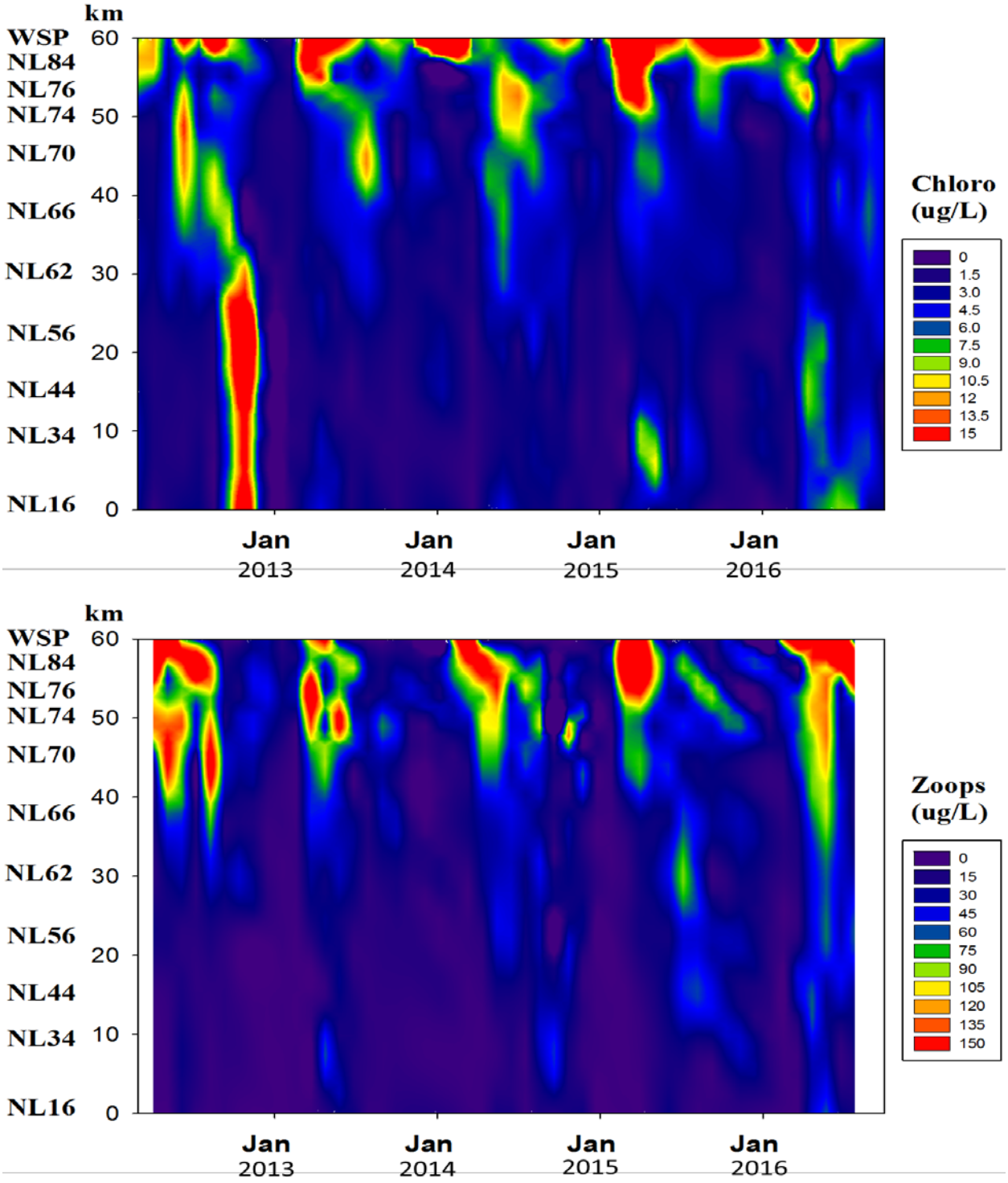

Figure 4. Longitudinal variation in chlorophyll concentration (top) and zooplankton biomass (bottom) in the main stem Sacramento River and ship channel, 2012-2016.

Given the consumption of nutrients by algal growth, dissolved inorganic nitrogen (DIN) (NH_4 + NO_3) is depleted to low levels (<0.1 mg N/L) in the upper SSC during the summer months (Figure 5). Thus, primary production is limited by the

lack of bioavailable N for much of the spring-summer-fall period. Nitrogen is depleted faster than phosphorus (the other major potentially limiting nutrient) in part because denitrification (microbial conversion of nitrate to nitrogen gas) results in the permanent loss of nitrogen from the water column over time. By contrast, no such loss process exists for phosphorus. Thus, the DIN:PO_4-P molar ratio is generally less than 6 throughout the year compared to a Redfield N:P ratio of ~16 for algae (Figure 6). These conditions suggest that nitrogen enrichment, especially during the summer growing season, could stimulate primary production that in turn should theoretically lead to higher production of zooplankton.

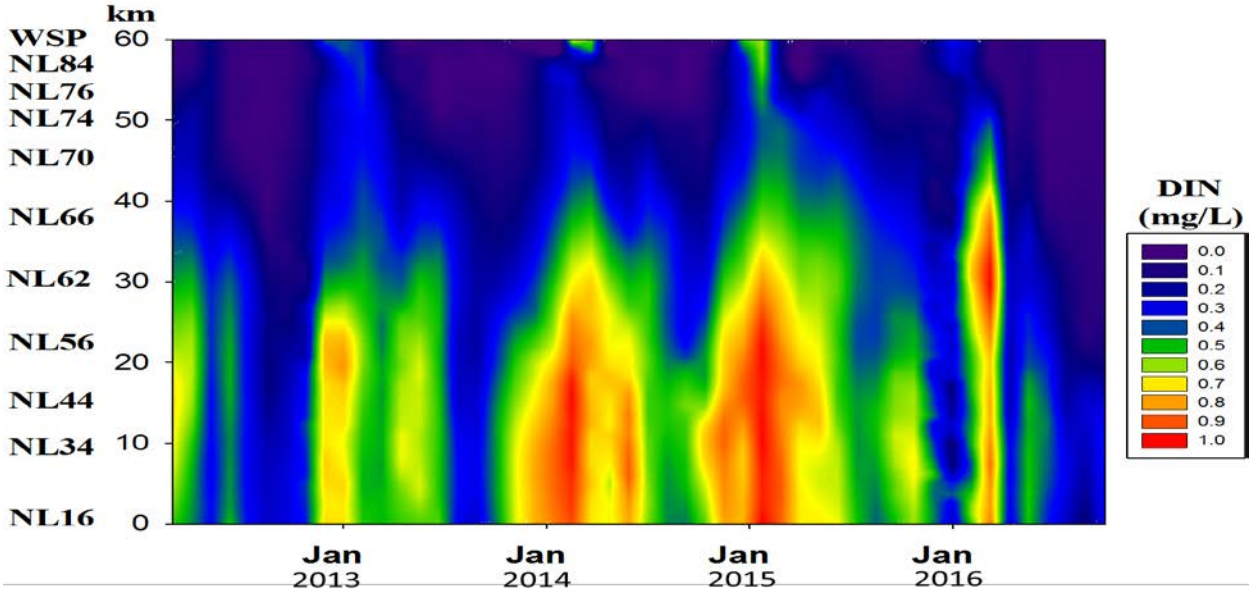

Figure 5. Longitudinal variation in dissolved inorganic nitrogen (ammonium plus nitrate-nitrite) concentration in the main stem Sacramento River and ship channel, 2012-2016.

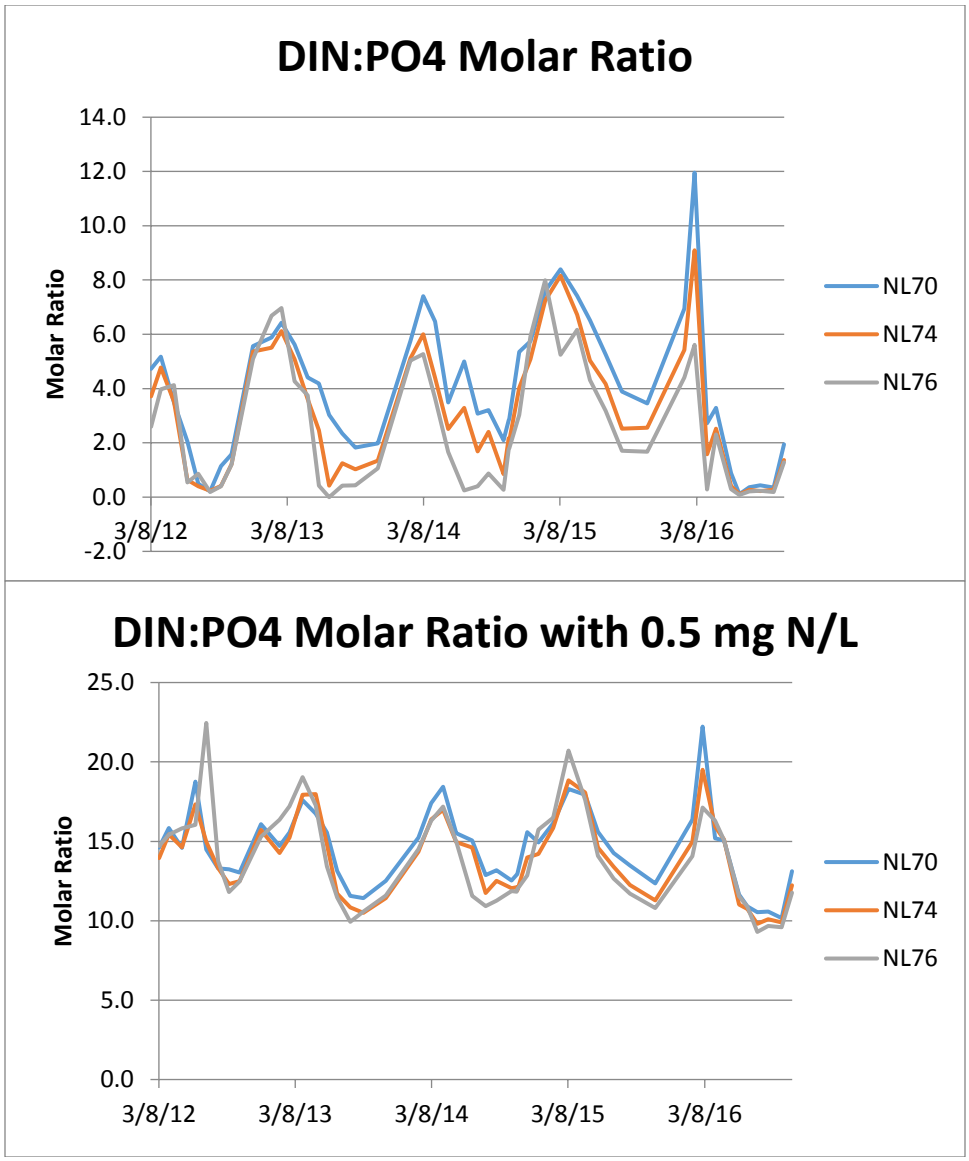

Figure 6. Variation in ratio of dissolved inorganic nitrogen to orthophosphate concentration at three stations in the upper Sacramento ship channel, 2012-2016 (top) and projected ratio after addition of fertilizer (bottom).

1.2 Purpose and Need for the Project

The purpose of the Proposed Action is to determine if the addition of nitrogen can stimulate plankton (fish food organisms) production in a section of the SCC that currently does not exchange water with the rest of the Delta. This pilot project is an initial step in a broader effort to determine the potential ecological benefits of repairing or replacing the West Sacramento lock system (locks) to hydraulically reconnect the ship channel with the main stem Sacramento River to adaptively manage production and exportation of plankton to the north Delta to benefit delta smelt and the Bay-Delta ecosystem.

The need for the action derives from the low production levels of phytoplankton biomass in the Bay-Delta ecosystem, contributing to a food-limited habitat for delta smelt.

Section 2 Alternatives Including the Proposed Action

This EA considers two possible alternatives: the No Action Alternative and the Proposed Action. The No Action Alternative reflects future conditions without the Proposed Action and serves as a basis of comparison for determining potential impacts to the human environment that would result from implementation of the Proposed Action.

Identification of the reasonable range of alternatives for this EA was based upon consideration of the purpose and need. Additional alternatives were considered but eliminated due to them being substantially similar in design and impacts as the Proposed Action (40 C.F.R. § 1502.14(a)).

2.1 No Action Alternative

Under the No Action Alternative, Reclamation would not apply nitrogen into the SSC, nor would the broader effort of adaptively managing and exporting plankton to the north Delta occur. Regions of the Bay-Delta ecosystem and habitat for delta smelt would continue to be food-limited.

2.2 Proposed Action Alternative

Reclamation proposes a nitrogen enrichment pilot study at Navigation Light 74 (NL74) to test nutrient stimulation of primary and secondary production. NL74 is located within the "old" water zone and, therefore, experiences no net advection to the north Delta. Seasonally (summer), the DIN concentrations in the water column at NL74 are depleted to <0.1 mg N/L while PO_4-P concentrations (data not shown) remain in a narrow range of 0.10 – 0.12 mg P/L (Figure 7). Chlorophyll-a concentrations vary seasonally between 3 to 10 µg/L (Figure 8).

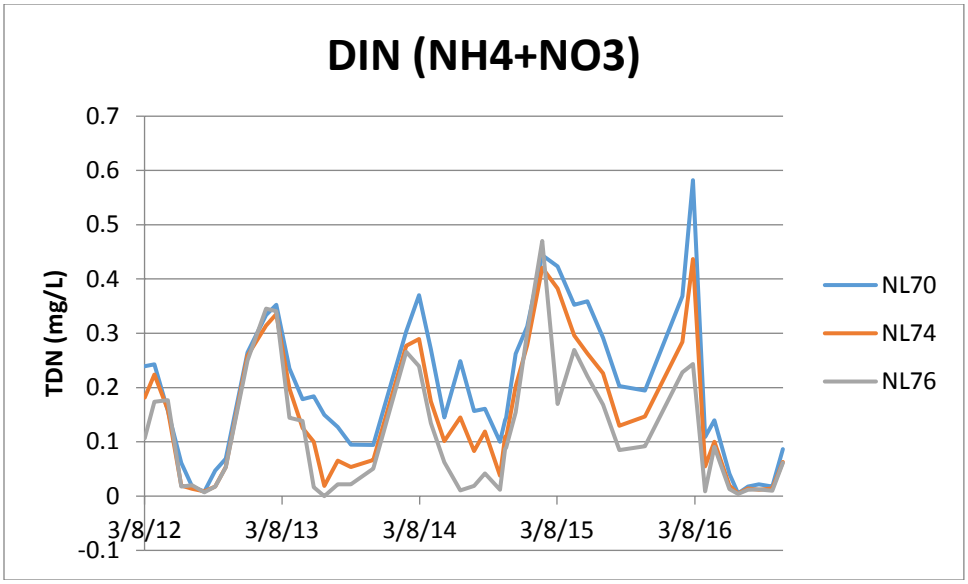

Figure 7. Variation in dissolved inorganic nitrogen at three locations in the upper Sacramento ship channel, 2012-2016.

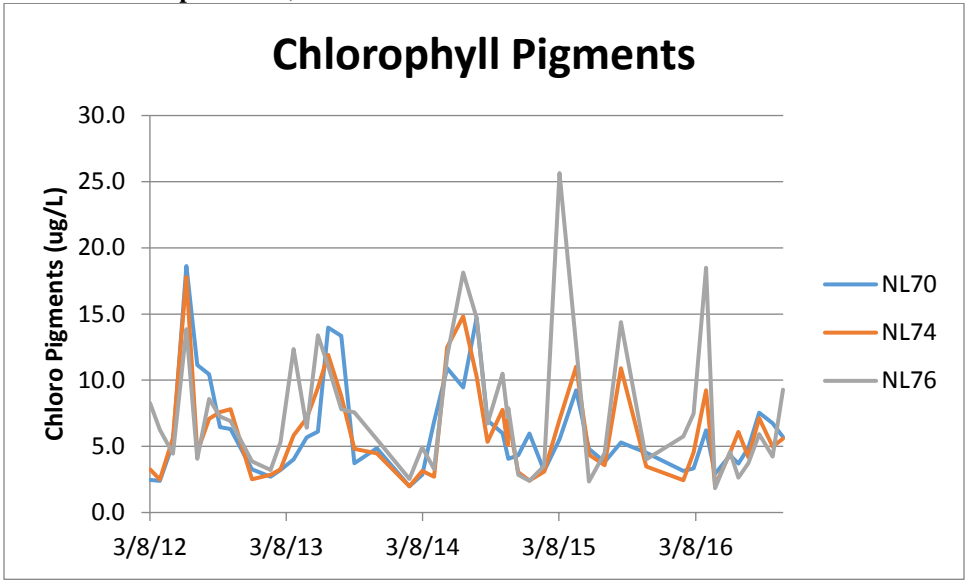

Figure 8. Variation in chlorophyll concentration (phytoplankton standing stock) at three locations in the upper Sacramento ship channel, 2012-2016.

An important consideration is whether nitrogen enrichment will decrease the algal doubling-time (increase reproduction rate) as postulated by Michaelis-Menten kinetics (Figure 9). At a typical summer-time DIN concentration of 0.05 mg/L, the doubling rate for the illustrated diatom is ~0.3 d^{-1}. If DIN concentrations were increased to 0.5 mg/L, the doubling rate is expected to increase to ~0.7 d^{-1}. Thus, primary production could be stimulated by a factor of 2×, potentially increasing zooplankton productivity and allowing the algae to outpace the grazing pressure exerted by the clam *Corbicula*.

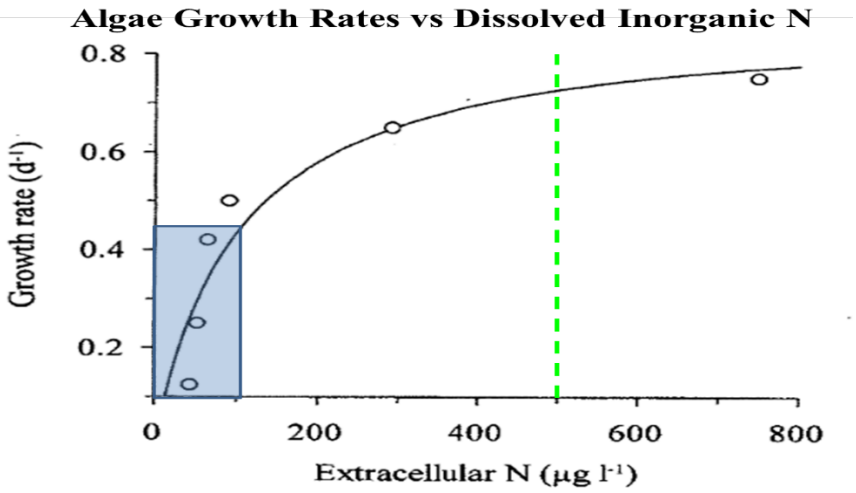

Figure 9. Relationship between dissolved inorganic nitrogen concentration and doubling rate of phytoplankton (*Cyclotella*) under laboratory conditions.

A proposed target level of DIN of 0.5 mg N/L will be conducted for this nitrogen enrichment study. This DIN level may be expected to increase the doubling rate of algae by a factor of ~2×, a level that should be easily detectable by field measurements. Moreover, the addition of 0.5 mg N/L will increase the DIN:PO_4-P molar ratio to a value in the vicinity of 15, which is close to the Redfield ratio for algae. Finally, Reclamation's previous studies of nutrient:chlorophyll stoichiometry in the north Delta indicate that 0.5 mg N/L could, under ideal conditions, produce a maximum of 50 µg/L of chlorophyll. The actual chlorophyll concentration is likely to be substantially lower, however, owing to phytoplankton loss processes such as grazing and sedimentation and the conversion of nitrate to nitrogen gas by denitrifying bacteria. The N enrichment target of 0.5 mg/L compares to maximum seasonal DIN levels of ~0.4 mg/L experienced naturally at or around NL74 (Figure 7). The enrichment study will occur in June to coincide with the maximum solar radiation inputs and the lowest DIN concentrations of the year in the upper SSC.

The addition of nitrogen will be in the form of nitrate, which is the dominant form of N contributing to DIN in the upper SSC. The nitrogen, in the form of calcium nitrate commercial fertilizer, will be added to a ~400 m length of the SSC centered at NL74. Assuming a background DIN concentration of 0.1 mg/L and a target DIN value of 0.5 mg N/L, a total of 112 kg N (equivalent to 723 kg or 1593 lbs of $Ca(NO_3)_2$) would be applied. Aerial application (via crop duster) of the solid fertilizer source will be conducted in order to achieve a relatively uniform distribution pattern of fertilizer to the water surface. Crop duster application via GPS guided control provides a much better option for uniform distribution than application from a boat. The crop duster will provide certification that the equipment used will be pesticide/herbicide-free. Following aerial application, a 40-ft research vessel will be used to mix the upper water column.

2.2.1 Monitoring Plan

Since each water parcel within the SSC has a distinct longitudinal specific conductance (Figure 2), Reclamation can identify any given water parcel by its specific conductance. Reclamation will place YSI water quality sondes (chlorophyll fluorescence, dissolved oxygen, temperature, specific conductance, turbidity) at depths of 1 and 5 meters within the water column at NL74 (center point of the fertilizer application)(Figure 10). These sondes will be able to monitor the entire plug of fertilizer enrichment during a tidal cycle by using the specific conductance to identify each water parcel as if moves up- and down-stream during a tidal cycle.

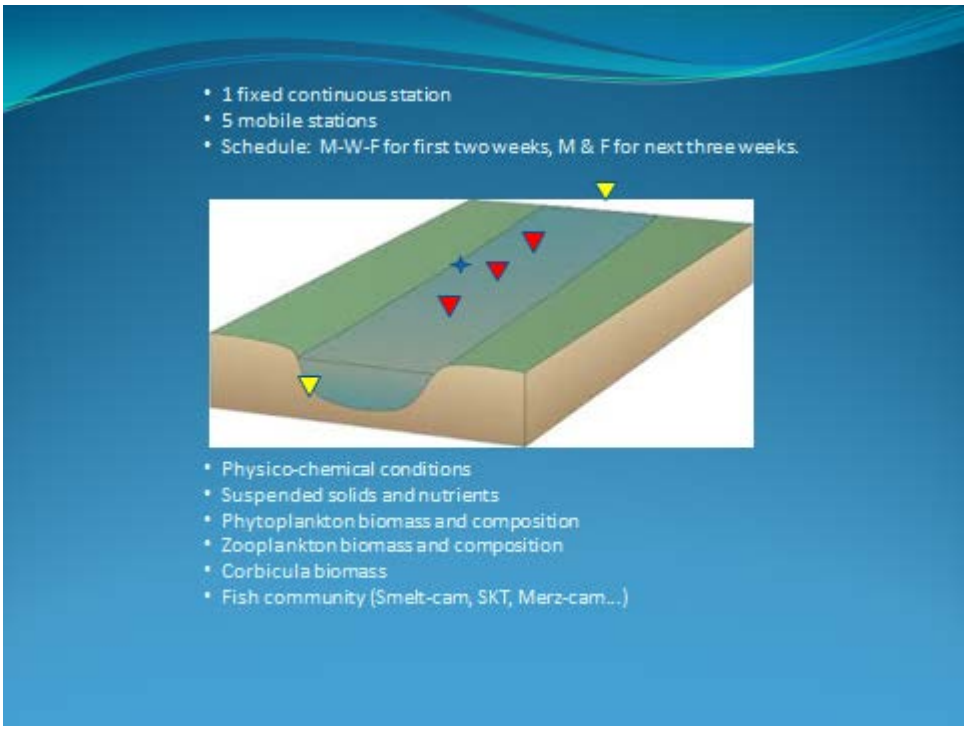

Figure 10. Schematic of monitoring locations within and up and downstream of experimental reach centered on Navigation Light 74 in the upper Sacramento Deepwater ship channel.

Prior to and following nutrient addition, YSI depth profiles will be collected at a 2 day interval during the first 10 days and at 5 day intervals to a total of ~30 days post-nutrient enrichment. These longitudinally-based vertical profiles will be used to calculate whole system metabolism using the differences in dissolved oxygen concentrations from morning to evening. Sediment oxygen demand will be determine for use in the metabolism calculations and reaeration rates will be calculated using water column dissolved oxygen concentrations and metrological data.

Grab samples from 1, 3 and 8 meters will be collected at the center point and +/- 50 meters upstream and downstream of the central nutrient plug. Grab samples

will also be collected 200 meters upstream and downstream of the nutrient addition boundary for use as a reference condition and to determine if any nutrient dispersion has occurred. Grab samples will be analyzed for nutrients (TN, TDN, NH_4, NO_3, TP, TDP, PO_4, Si), extractable chlorophyll/pheophytin pigments, dissolved organic carbon (DOC), turbidity, and total and volatile suspended solids concentration (TSS/VSS). A subsample from the 1 m depth will be used for quantification of each phytoplankton species' biovolume. In addition, 5 L of raw water filtered through a 150-micron mesh will be collected and transported back to the University of California, Davis lab to determine phytoplankton doubling rate. A vertical zooplankton tow will be performed using a 150 µm tow net. The dry weight equivalent of each zooplankton species will be determined. Phytoplankton and zooplankton samples will be preserved in Lugol's solution and identified using standard methods.

Finally, an attempt to document fish community response to the experiment will be made with special emphasis on delta smelt. The experiment will be timed to overlap with the Interagency Ecological Program (IEP) summer townet and 20-mm surveys and with U.S. Fish and Wildlife Survey Enhanced Delta Smelt Monitoring Survey sampling. It is also anticipated that the area will be surveyed before, during and after the experiment by the U.S. Geological Survey using its 'Smelt-Cam' underwater video system.

Section 3 Affected Environment and Environmental Consequences

This section describes the affected environment and evaluates the environmental consequences that may occur with implementation of the Proposed Action and the No Action Alternative. Potential impacts on several environmental resources were examined and found to be minimal or nonexistent. These resources include:

Indian Trust Assets (ITAs): ITAs are legal interests in assets that are held in trust by the U.S. for federally recognized Indian tribes or individuals. There are no Indian reservations, Rancherias or allotments in the project area. The nearest ITA is the Wilton Rancheria, about 18 miles away.

Indian Sacred Sites: Sacred sites are defined in Executive Order 13007 (May 24, 1996) as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, and Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." There are no identified Indian Sacred Sites within the Proposed Action area; therefore this project would not inhibit use or access to any Indian Sacred Sites.

Cultural Resources: Reclamation has determined that the Proposed Action is type of undertaking that does not have the potential to cause effects on historic properties, should such properties be present, pursuant to 36 CFR § 800.3(a)(1). As such, Reclamation has no further obligations under 54 U.S.C. § 306108, commonly known as Section 106 of the National Historic Preservation Act (NHPA).

Environmental Justice: Executive Order 12898 requires each Federal agency to identify and address disproportionately high and adverse human health or environmental impacts, including social and economic effects of its program, policies, and activities on minority populations and low-income populations. The Proposed Action would not result in adverse human health or environmental impacts to minority or low-income populations.

3.1 Biological Resources

3.1.1 Affected Environment

The project area is centered at NL74 (38.5062 N, 121.5836 W) in the upper SSC, located West of Sacramento City. The SSC includes both natural habitat and

man-made navigation features, beginning with the Sacramento River near Suisun Bay. The SSC accounts for approximately 13% of the Sacramento River's overall area where the two overlap. The SSC diverges from the Sacramento River into the man-made channel approximately 2 miles north of Rio Vista. In total, the SSC comprises an approximately 17-mile section of the Sacramento River and a 29-mile navigation channel, of which 25 miles are man-made (USACE 2011).

Tidal wetlands, tidal mudflats, and riparian habitat are present along portions of levees and the banks of SSC. Land adjacent to the banks of the SSC as it passes through the Delta is used primarily for agricultural purposes with pockets of residential, commercial, and industrial development. Within the man-made portion of the SSC, warm water temperatures (in summer, generally 10 degrees Fahrenheit [°F] warmer than in the Sacramento River portion), higher salinities, lack of riparian vegetation, and the presence of predators combine to create conditions that generally are unfavorable to rearing and out-migrating juvenile salmonids (NMFS 2006).

Typical wildlife species associated with the riparian and floodplain communities include mammals such as striped skunk, raccoon, and gray fox. Riparian bird species include red-shouldered hawk, wood duck, great blue heron, black crowned night heron. Amphibians and reptiles include Pacific tree frog, Pacific gopher snake, garter snake, and western pond turtle. Special status species that associate with riparian and floodplain habitats include federally listed western yellow-billed cuckoo and valley elderberry longhorn beetle (Reclamation, 2016).

Special Status Species

Special-status species addressed in this section include plants and animals that are legally protected or are otherwise considered sensitive by Federal, State, or local resource conservation agencies and organizations. These include species that are State listed and/or Federally listed as rare, threatened, or endangered; those considered as candidates or proposed for listing as threatened or endangered; and plants considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered.

California Native Plant Protection Act

The Native Plant Protection Act (NPPA) of 1977 protects rare and endangered plants in California and prohibits take of endangered or rare native plants. Based on a review of California Natural Diversity Database (CNDDB) and CNPS database searches for rare and endangered plant species was conducted for the surrounding U.S. Geological Survey (USGS) Quads (quadrangle) (2015), the federally threatened Colusa Grass and federally endangered Solano Grass returned occurrences. Under the California Rare Plant Rank they are listed as 1B (Plants Rare, Threatened, or Endangered in California or Elsewhere). CNPS further designates the level of endangerment with a Threat Rank, with .1 meaning a plant is seriously threatened, a rank of .2 means fairly threatened, and a rank of .3 means not very threatened in California. The following is a list of rare and endangered plants with recorded occurrences surrounding Quads:

- Solano Grass (*Tructoria mucronata*) 1B.1 Federally Endangered
- Colusa Grass (*Neostapfia colusana*) 1B.1 Federally Threatened

Due to the scale of the Proposed Action, any impacts to existing vegetation will be negligible and unlikely to occur within the project area.

Migratory Bird Treaty Act
A list of bird species with recorded occurrences within the surrounding quads was also obtained from the CNDDB (2015). The list was compared to the Service's list of protected species under the Migratory Bird Treaty Act (MBTA) of 1918 (2015a). There are no protected migratory bird species with recorded occurrences in the Proposed Action project area and are, therefore, not discussed further.

Threatened or Endangered Species
The U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service (NMFS) have jurisdiction over federally listed threatened and endangered species. An endangered species is defined as "…any species which is in danger of extinction throughout all or a significant portion of its range." A threatened species is defined as "…any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 USC Section 1532). Section 9 of the Endangered Species Act of 1973 (ESA) makes it illegal to "take" (defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct") endangered and threatened species (16 USC 1538).

A special-status species list was generated from the Service Information for Planning and Conservation (IPaC) website for the surrounding area on March 29, 2018 (USFWS 2017). The following Table 3 includes those federally listed species with recorded occurrences within the surrounding USGS 7.5-minute Quads based on the CNDDB (2015). The table also includes the species' status, determination of impacts from the Proposed Action, and a summary of the rationale supporting the determination.

Table 1 – Special Status Species List				
Common Name	**Scientific Name**	**Status[1]**	**Effect[2]**	**Summary of Effects Determination[3]**
Plants				
Colusa Grass	*Neostapfia colusana*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
Solano Grass	*Tuctoria mucronata*	FE	NE	Occurences[4] and Critical Habitat outside of the Action Area
Invertebrates				
Delta Green Ground Beetle	*Elaphrus viridis*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
San Bruno Elfin Butterfly	*Callophrys mossil bayensis*	FE	NE	
Valley Elderberry Longhorn Bettle	*Desmocerus californicus dimorphus*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
Conservancy Fairy Shrimp	*Branchinecta conservation*	FE	NE	Occurences[4] and Critical Habitat outside of the Action Area
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
Vernal Pool Tadpole Shrimp	*Lepidurus packardi*	FE	NE	Occurences[4] and Critical Habitat outside of the Action Area
Birds				
California Clapper Rail	*Rallus longirostris obsoletus*	FE	NE	
Lest Bell's Vireo	*Vireo bellii pusillus*	FE	NE	Occurences[4] and Critical Habitat outside of the Action Area
Yellow-billed Cuckoo	*Coccyzus americanus*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
Amphibians				
California Red-legged Frog	*Rana draytonii*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
California Tiger Salamander	*Ambystoma californiense*	FT	NE	Occurences[4] and Critical Habitat outside of the Action Area
Fish				
Delta Smelt	*Hypomesus transpacificus*	FT	NLAA	
Reptiles				
Giant Garter Snake	*Thamnophis gigas*	FT	NE	The giant garter snake inhabits marshes, sloughs, ponds, small lakes, low-gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals and rice fields. Unlikely to occur due to a lack of suitable habitat.

[1] Status: Federal Listing (**FE**: Endangered; **FT**: Threatened; **X**: Critical Habitat)
State Listing (**SE**: Endangered; **ST**: Threatened; **SC**: Candidate)
MBTA: Migratory Bird Treaty Act
[2] Effects determination
NE: No Effect to federally listed species anticipated from the Proposed Action.
NLAA: Not Likely to Adversely Affect with Environmental Protection Measures
LAA: May Affect, and Likely to Adversely Affect
[3] Summary of rationale supporting determination
[4] California Natural Diversity Database 2014 recorded occurrences in the surrounding 9 Quads.

Vernal Pool Species

Vernal pools are ephemeral wetlands that fill during the rainy season and disappear during the dry season. During the time water is present they provide unique habitat for species like vernal pool fairy shrimp, vernal pool tadpole shrimp, and Colusa grass. Revised critical habitat for vernal pool crustaceans was designated on August 11, 2005 (70 FR 46923). There is no Critical Habitat for vernal pool species within the Proposed Action area.

Giant Garter Snake (*Thamnophis gigas*)

Giant garter snakes (GGS) require habitat with adequate water during their active season and emergent herbaceous wetland vegetation (USFWS 2006a). GGS also require higher elevation upland habitat. Rice production areas, irrigated agriculture, and channels and canals provide the majority of GGS habitat in the Central Valley. GGS typically breed in March and April with young born late July through early September (Hansen and Hansen 1990).

Delta Smelt (*Hypomesus transpacificus*)

Delta Smelt were listed as threatened under the ESA on March 5, 1993 (58 FR 12854). Critical habitat for Delta Smelt includes all water and submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained in the legal Delta (as defined in Section 12220 of the California Water Code) (USFWS 1994a). Through the Proposed Action, an increase in food resources (i.e. phytoplankton and zookplankton) would be expected to have a beneficial effect on the entire Delta system, as well as for endangered native species such as Delta Smelt. As mentioned previously, a target level of DIN of 0.5mg N/L would not be expected to have any detrimental aquatic ecosystem effects, such as eutrophication and hypoxia, and, therefore, would not have a detrimental effect on Delta Smelt because a DIN of 0.5 mg/L is the concentration that occurs naturally before

nitrogen is drawn down to below detection by phytoplankton uptake.

California Central Valley Steelhead Distinct Population Segments (DPS) (*Oncorhynchus mykiss*)

California Central Valley (CV) Steelhead were listed as threatened under the ESA on January 5, 2006 (71 FR 834) and include all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries, excluding steelhead from San Francisco and San Pablo bays and their tributaries and two artificial propagation programs: the Coleman National Fish Hatchery and Feather River Fish Hatchery steelhead hatchery programs. The DPS excludes steelhead spawned and reared at Nimbus Fish Hatchery. Critical habitat was designated for CV steelhead on September 2, 2005 and includes the Sacramento delta watershed (70 FR 52488). As described for Delta Smelt, CV Steelhead will not be impacted by the Proposed Action. This is in part due to the proposed target level of DIN of 0.5mg N/L, which is not expected to have any detrimental aquatic ecosystem effects and will likely have a beneficial effect of increasing food resources for native fish. In addition, because there is no hydrological connection between SSC and the Sacramento River, steelhead do not use the man-made portion of the SSC for migration or spawning. While it is possible that steelhead use the upper portion of the water column within the man-made portion of the SSC as habitat for rearing, it is unlikely due to the absence of CV steelheads during fish community surveys in SSC conducted in 2008 (SWCA 2009).

Critical Habitat

The federal ESA requires that the Service and NMFS designate critical habitat for species listed as federally endangered or threatened. “Critical habitat” is defined in ESA as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to a species’ conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation (16 USC 1531 et seq).

Critical habitat has been designated for the following species located within the project area:

- Delta Smelt

Physical and Biological Features of Critical Habitat

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act (Public Law 104 to 297), mandates all federal agencies consult with NMFS on any activities or proposed activities authorized, funded, or conducted by that agency that may adversely impact essential fish

habitat (EFH) of commercially managed marine and anadromous fish species (Section 305(b)(2). These regulations require that federal action agencies provide NMFS with a written assessment of the effects of their action on EFH (50 CFR Section 600.920). EFH includes specifically identified waters and substrate necessary for fish spawning, breeding, feeding, or growing to maturity. Important components of EFH for spawning, rearing, and migration include suitable substrate composition; water quality (e.g., dissolved oxygen, nutrients, temperature); water quantity, depth and velocity; channel gradient and stability; food; cover and habitat complexity (e.g., large woody debris, pools, channel complexity, aquatic vegetation); space; access and passage; and floodplain and habitat connectivity (Pacific Fishery Management Council 2003). EFH also includes all habitats necessary for the production of commercially valuable aquatic species, to support a long-term sustainable fishery, and contribute to a healthy ecosystem (16 USC 1802[10]).

The SSC is not designated by NMFS to contain EFH for any listed species of fish.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, as amended in 1964, was enacted to protect fish and wildlife when Federal actions result in the control or modification of a natural stream or body of water. The statute requires Federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife resources. Consultation and coordination with the Service and State fish and game agencies are required to address ways to prevent loss of and damage to fish and wildlife resources and to further develop and improve these resources.

3.1.2 Environmental Consequences

No Action Alternative

Under the No Action Alternative, Reclamation would not apply nitrogen into the SSC, nor would the broader effort of adaptively managing and exporting plankton to the north Delta occur. Regions of the Bay-Delta ecosystem and habitat for delta smelt would continue to be food-limited.

Proposed Action

Rare and Endangered Plants

Colusa Grass and Solano Grass generally occurs in vernal pools. Within the Proposed Action area, there is no critical habitat for vernal pool species. The Proposed Action would have no effect on rare and endangered plants.

California Tiger Salamander (*Ambystoma californiense*)

California tiger salamanders are typically found in annual grasslands, grass understory of valley foothill woodland, and uncommonly along streams. Adults breed and lay eggs in vernal pools and other temporary ponds. There are no vernal

pools at the project site. The Proposed Action would have no effect on California Tiger Salamander.

California Red-Legged Frog (*Rana aurora draytonii*)
Red-legged frogs (CRF) require variety of habitat types including aquatic, riparian and upland areas. Adults often utilize dense, shrubby or emergent vegetation closely associated with deep-water pools with fringes of cattails and dense stands of overhanging vegetation such as willows.

In addition to there being no Critical Habitat in SSC, the Proposed Action would also occur outside of the CRF breeding season. The Proposed Action would have no effect on the California Red-Legged Frog.

Vernal Pools
There is no vernal pool habitat within the project area. Vernal pools are generally not present within the active floodplain. The Proposed Action would have no effect on vernal pools.

Fisheries

Delta Smelt have Critical Habitat within the project area. Given that a DIN of 0.5 mg/L is the concentration that occurs naturally before nitrogen is drawn down to below detection by phytoplankton uptake, a proposed target level of DIN of 0.5 mg N/L is not expected to have detrimental aquatic ecosystem effects on the SSC, and, therefore, would not have any negative effect on native fish species. The California Department of Fish and Wildlife has been sampling four stations in the SSC as part of its Fall Mid-Water Trawl Survey since 2009. In that time, no Delta Smelt have been captured at the most upstream station where the nutrient addition experiment will be conducted. Moreover, the experiment will be conducted at a time of the year (late June) when surface water temperature can exceed the roughly 25°C threshold for Delta Smelt. Consequently, the probability that the experiment will have any effect on Delta Smelt is essentially zero. The objective of the experiment is to determine the feasibility of a food-enhancement initiative designed to benefit the Delta Smelt, and potentially other native fish species. Nitrogen enrichment, in the SSC, during the summer growing season, could stimulate primary production that in turn should theoretically lead to higher production of zooplankton or fish food. The Proposed Action would have no detrimental effect on native fish species.

3.2 Hydrology and Water Quality

3.2.1 Affected Environment

Hydrology
Under the Propose Action, Reclamation would not be altering the hydrology of flows of SSC or any surrounding bodies of water.

Water Quality

The SSC obtains minor flows from the Sacramento River and from the tidal inflow of the northern portion of the Delta. The main sources of water from the Sacramento River are rain and snowmelt that collect upstream in reservoirs and are released in response to water needs or flood control. The quality of surface water within the downstream portions of Sacramento River is also influenced by other human activities including; historical mining, agricultural, and municipal and industrial (M&I) activities. Water quality issues within the primary project area include the presence of mercury, pesticides, trace metals, turbidity, and toxicity from unknown origin (CALFED 2000a).

3.2.2 Environmental Consequences

No Action Alternative

Under the No Action Alternative, Reclamation would not apply nitrogen into the SSC, nor would the broader effort of adaptively managing and exporting plankton to the north Delta occur. Therefore, no impacts on hydrology or water quality would occur.

Proposed Action

Water Quality

The Proposed Action would be completed in accordance with permit conditions and Best Management Practices (BMP) to protect water quality. These practices would prevent fuels, hazardous materials, and other pollutants from entering the ship channel.

Excessive concentrations of nitrate can cause excessive growth of algae and other plants, leading to accelerated eutrophication, and occasional loss of dissolved oxygen. In order to mitigate these detrimental effects, a proposed target level of DIN of 0.5 mg N/L will be conducted for this nitrogen enrichment study. Previous studies of nutrient:chlorophyll stoichiometry in the north Delta indicate that 0.5 mg N/L should produce a maximum of 50 µg/L of chlorophyll. Thus, if all the nitrogen were immediately incorporated into algal biomass (assuming no grazing, no denitrification, no algal sedimentation), the maximum 50 µg/L chlorophyll level would not be expected to have any detrimental aquatic ecosystem effects, such as eutrophication and hypoxia. The N enrichment target of 0.5 mg/L compares to maximum seasonal DIN levels of ~0.4 mg/L experienced naturally at or around NL74 (Fig. 7). The enrichment study will occur in June to coincide with the maximum solar radiation inputs and the lowest DIN concentrations of the year in the upper SSC.

The aerial application of nitrogen will be conducted by crop-duster. The crop-duster will provide certification that the equipment used will be pesticide/herbicide-free

National Pollutant Discharge Elimination System (NPDES)

Section 402 of the Clean Water Act (CWA) specifically required Environmental Protection Agency (EPA) to develop and implement the NPDES program. In California, EPA authorizes the State Water Resources Control Board (SWRCB) to oversee the NPDES program.

Reclamation is in the process of applying for a NPDES permit as covered under the Limited Threat General Order.

The Limited Threat General Order applies to Reclamation as the proposed action involves:

- Clean or relatively pollutant-free wastewaters that pose little or no threat to water quality
    - Discharge of less than 0.25 million gallons per day (MGD) or less than 4 months in duration or
    - Discharges greater than or equal to 0.25 MGD and greater than or equal to 4 months in duration
- Wastewater that may contain toxic organic constituents, volatile organic compounds (VOC), petroleum fuel pollution constituents, pesticides, inorganic constituents, chlorine, and other chemical constituents for which treatment technologies are well-established to eliminate constituents that pose a threat to water quality and that require treatment prior to discharge (CRWQB).

The following BMPS are included to minimize adverse impacts to water quality:

- All equipment working within the ship channel would be inspected daily for fuel, lubrication, and coolant leaks; and for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs); and all equipment must be free of fuel, lubrication, and coolant leaks.
- Vehicles or equipment would be washed/cleaned only at approved off-site areas.

3.3 Recreation

3.3.1 Affected Environment

Recreational activities occur throughout the SSC, and predominantly include fishing and boating opportunities.

3.3.2 Environmental Consequences

No Action Alternative

Under the No Action Alternative, Reclamation would not apply nitrogen into the SSC, nor would the broader effort of adaptively managing and exporting plankton

to the north Delta occur. Therefore, no impacts to recreation would occur.

Proposed Action
Impacts to recreational fishing opportunities on the SSC would not occur. As described previously, the proposed target level of DIN 0.5 mg N/L is not expected to have any detrimental aquatic ecosystem effects and, therefore, would not affect local fish populations or impede fishing opportunities.

Additionally, impacts to boating recreational activities are not expected to occur. Use of a crop duster and the 40ft research vessel are not expected to impact boating traffic in the SSC. Use of the YSI water quality sondes and collection of grab samples are also not expected to have an impact. Therefore, the Proposed Action would not impact recreational activities in the SSC.

3.4 Environmental Commitments

Environmental commitments are measures or practices adopted to reduce or avoid adverse effects that could result from project implementation. These are also known as protective measures and are in accordance with relevant permits. The following section describes the best management practices, environmental commitments, and mitigation measures that would be implemented under the Proposed Action:

Protection Measure #1 – Water Quality

- The Proposed Action will occur in June to coincide with maximum solar radiation inputs and the lowest DIN concentrations of the year in the upper SSC. This will restore nitrogen to levels that occur naturally earlier in the season.
- Nitrate, as opposed to ammonium or urea nitrogen, will be used for the Proposed Action. This will limit the risk of creating a *Microcystis* bloom, which favors reduced forms of nitrogen (urea and ammonium).

Protective Measure #2 – Cultural Resources

- In the unlikely event that human remains are uncovered, the project would cease immediately and Reclamation cultural resource staff would provide direction on how to proceed.
- If human remains are discovered on lands under the jurisdiction of Reclamation, they would be treated in accordance to the provisions of the Native American Graves Protection and Repatriation Act of 1990 (25 U. S. C 3001).
- If human remains are discovered on lands owned by any other non-federal entity, they would be treated in accordance to the provisions in the California Health and Safety Code (HSC 7050.5).

3.5 Cumulative Effects

The cumulative effects of implementation of reasonably foreseeable projects and the alternatives as compared to conditions under the No Action Alternative and the Proposed Action are discussed below. Cumulative effects are impacts on the environment that result from the incremental impacts of an alternative when added to other past, present, and reasonably foreseeable future actions of Federal, state, or local agencies or individual entities or persons (40 CFR 1508.7). Such impacts can result from individually minor, but collectively significant, actions taking place over time (40 CFR 1508.8). Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the project area.

Due to the relatively short timeframe and low impact of the Proposed Action, there would not be any significant cumulative effects.

Section 4 Consultation and Coordination

Several Federal laws, permits, licenses and policy requirements have directed or guided the NEPA analysis and decision making process included in this EA.

4.0 Public Review Period

This EA will be available for public comment for five days and additional analysis will be prepared if substantive comments identify impacts that were not previously analyzed or considered.

4.1 Federal Laws, Regulations, and Policies

National Historic Preservation Act (54 USC § 300101 et seq.)

54 U.S.C. § 304108, commonly known as Section 106 of the NHPA, requires that Federal agencies take into consideration the effects of their undertakings on historic properties. Historic properties are cultural resources that are included in, or eligible for inclusion in, the National Register. The 36 CFR Part 800 regulations implement Section 106 of the NHPA and outline the procedures necessary for compliance with the NHPA. Compliance with the Section 106 process follows a series of steps that are designed to identify if significant cultural resources are present in the proposed action project area and to what level they would be affected by the proposed Federal undertaking.

The proposed project action would have no impact on historical or cultural resources, therefore Reclamation will not consult with the State Historic Preservation Officer (SHPO).

Section 7 of the Endangered Species Act (16 USC § 1531 et seq.)

Section 7 of the Endangered Species Act requires Federal agencies to ensure that discretionary federal actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of the critical habitat of these species.

Reclamation will seek informal consultation with the Service and NMFS.

National Pollutant Discharge Elimination System

Reclamation must obtain a NPDES permit from the SWRCB. The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Reclamation has submitted appropriate NPDES applications to the SWRCB.

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