COMMENT LETTER

US Environmental Protection Agency (USEPA)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

March 30, 2009

Ms. Judi Tapia
US Bureau of Reclamation
South Central California Area Office
1243 N Street, Fresno, CA 93721-1813

Subject: Draft Environmental Impact Statement for Grassland Bypass Project, 2010-2019 (CEQ# 20090025)

Dear Ms. Tapia:

The U.S. Environmental Protection Agency (EPA) has reviewed the above-referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act. Our comments are provided pursuant to the Council on Environmental Quality comment deadline date of March 30, 2009. Our detailed comments are enclosed.

The Use Agreement for the Grassland Bypass Project (Project) is due to expire on December 31, 2009. The Bureau of Reclamation (Reclamation) and the San Luis and Delta-Mendota Water Authority (Authority) propose to extend the Use Agreement for the period of January 1, 2010 through December 31, 2019. The proposed project would continue to collect agricultural drain water from the Grassland Drainage Area before it can enter the Grassland wetland water supply channels, and convey it to the San Joaquin River via the Grassland Bypass Channel, San Luis Drain, and Mud Slough. The volume and concentration of this discharge would be progressively reduced to meet water quality objectives and compliance schedules in the San Joaquin River for selenium and other constituents of concern.

EPA commends the progress that this Project has made to date. We support continued efforts by Reclamation and the Authority to increase on-farm source controls and conservation, and implement the regional agricultural drain water reuse and treatment facility (San Joaquin River Water Quality Improvement Project (SJRIP)) to meet water quality objectives in Mud Slough. The proposed updated compliance monitoring plan, revised selenium and salinity load limits, enhanced incentive performance fee system, new Waste Discharge Requirements, and additional habitat mitigation for the continued use of Mud Slough are important elements of this plan. Given the clear interconnections between surface and groundwater in this region, we urge continued efforts to both improve surface water quality and avoid degradation of groundwater quality.

While we acknowledge the significant progress that has been made by the Grassland Bypass Project we have rated the DEIS as Environmental Concerns – Insufficient Information (EC-2) (see enclosed "*Summary of Rating Definitions*"). Our main concern is the uncertainty-- acknowledged in the DEIS--of developing feasible methods of drain water treatment and disposal that would make it possible to meet selenium objectives by 2019 and arrest buildup of selenium in groundwater. To continue farming and also meet environmental objectives, a breakthrough that removes selenium from the system is needed. Reclamation re-evaluated and chose not to include in the current Project other actions (such as reducing irrigation through targeted land fallowing, and implementing on-farm drainage management systems) that could be added to the proposed action to help achieve the water quality goals. These options may prove attractive as the Project evolves—particularly if regional treatment is infeasible. USEPA-1

Our other concerns are the needs for a comprehensive monitoring program, including biological effects follow-up, and a clear commitment to detailed analysis of sediment treatment, management, and disposal options and their effects. We also believe the final environmental impact statement (FEIS) should consider how this project interacts with, and can be coordinated with, other regional efforts to address drainage issues. EPA recommends that Reclamation and the Authority continue to vigorously seek a long-term solution that minimizes environmental effects at a sustainable public and private cost. USEPA-2

We appreciate the opportunity to review this DEIS. When the FEIS is released for public review, please send one hard copy and a CD ROM to the address above (mail code: CED-2). If you have any questions, please contact me at (415) 972-3521, or contact Laura Fujii, the lead reviewer for this project. Laura can be reached at (415) 972-3852 or fujii.laura@epa.gov.

Sincerely,

Kathleen M. Goforth

Kathleen M. Goforth, Manager
Environmental Review Office
Communities and Ecosystems Division

Enclosures: Detailed Comments
Summary of Rating Definitions

cc: Joseph C. McGahan, San Luis and Delta-Mendota Water Authority
Joy Winckel, US Fish and Wildlife Service
Theresa Presser, US Geological Survey
Kathy Norton, US Army Corps of Engineers
Rudy Schnagl, Central Valley Regional Water Quality Control Board
Julie Vance, California Department of Fish and Game, Fresno, CA
John Beam, California Department of Fish and Game, Los Banos, CA.

Monitoring

Develop a comprehensive monitoring program that includes multiple contaminants and follow-up monitoring for detected biological effects. Monitoring for various purposes, such as tracking compliance and mitigation, would be conducted within the context of the Grassland Bypass Project (Project). EPA supports the mitigation monitoring and reporting program, as described in Section 15, and the recognition that this program should cover biological as well as water quality and sediment components (p. 2-20).

USEPA-3

The DEIS reports on constituents of immediate interest to the Project. However, Mud Slough and the San Joaquin River below Mud Slough are also impaired by toxicity (unknown sources), pesticides, and (for the River) mercury (Clean Water Act 303(d) list, 2006), suggesting that a comprehensive view of biological condition needs to take into account a variety of stressors. Furthermore, accumulation of contaminants in the regional agricultural drain water reuse and treatment facility is likely to occur and should continue to be monitored.

There may be monitoring gaps that prevent assessment of beneficial use conditions overall—even when taking into account both Project monitoring and the monitoring activities for other projects or by other parties in the area. Some monitoring needs might be accomplished through coordination with other programs in the region, such as monitoring associated with the San Joaquin River Restoration Settlement. According to the DEIS, the Oversight Committee has responsibilities for review and modification, as needed, of the monitoring program.

Recommendations:

The FEIS should provide a more complete discussion of monitoring activities in the area, including explanation of any differences between requirements under the Irrigated Land Regulatory Program (ILRP) and the Project. Because the Grasslands Drainage Area already has Waste Discharge Requirements, it is not subject to the ILRP and its monitoring and reporting requirements.

We recommend the Bureau of Reclamation (Reclamation) and the San Luis and Delta-Mendota Water Authority (Authority), with the guidance of the Oversight Committee, develop a comprehensive monitoring program that includes multiple contaminants (comparable to the ILRP) and follow-up monitoring for detected biological effects. For example, we recommend consideration of monitoring regarding pesticides associated with toxicity and sub-lethal effects, and regarding the effects of mercury.

We note that the DEIS analysis of potential impacts of selenium on migrating salmon in the San Joaquin River (p. 6-52) appears to conflict with analyses from the National Marine Fisheries Service and U.S. Fish and Wildlife Service.[1] We recommend coordinating with the agencies responsible for implementing the San Joaquin River Restoration Settlement to design studies and monitoring to improve the understanding of potential fish impacts. USEPA-3

Sediment Management

Reduce sediment transport, and commit to detailed analysis of sediment treatment, management, and disposal options and their effects. The DEIS states that sediment accumulation in the San Luis Drain is adversely affected by use of the drain. However, dredging and sediment disposal may be problematic because of selenium levels in the sediment. The DEIS includes a Sediment Management Plan that would remain in place during the period of the extension. Information on the sediment quality is incomplete.

Recommendation:

The FEIS should include additional information on potential sediment removal measures, their feasibility, whether or not sediment removal and disposal would require a Clean Water Act Section 404 permit, and potential adverse effects on disposal areas and continued operation of the Project. Indicate whether eventual removal of the sediment from the San Luis Drain could make the Project cost prohibitive. We recommend a clear commitment to detailed analysis of sediment treatment, management, and disposal options and their effects, when appropriate. USEPA-4

With respect to prospects of future sediment deposition, we recommend the FEIS and Sediment Management Plan include a detailed description and evaluation of options to reduce sediment mobilization and transport.

Regional Water Quality Improvement

Coordinate the Grassland Bypass Project with other regional water quality improvement efforts. Although the DEIS lists several other regional water resource programs—notably, the final settlement regarding the San Luis Unit agricultural drainage; adoption and implementation of a boron/salinity TMDL (with objectives) for the San Joaquin River upstream of Vernalis; and the San Joaquin River Restoration Program—it does not discuss how these programs may interrelate or be coordinated in the future. USEPA-5

Recommendation:

The FEIS should discuss ways in which the major programs may interrelate, particularly where they are complementary, have opportunities to coordinate, or could conflict.

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[1] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2000. Formal Section 7 Consultation on the Environmental Protection Agency's Final Rule for the Promulgation of Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.

Including more detailed maps that show key regional features, flow direction, and other water quality improvement projects would help this discussion. While the DEIS provides a useful map of the project area, it does not include detailed regional overview maps. USEPA-5

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections
The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns
EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections
EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory
EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

RESPONSE USEPA

US Environmental Protection Agency
Kathleen M. Goforth: Manager, Environmental Review Office March 30, 2009

USEPA-1

The commenter is concerned with the uncertainty associated with the final component of the regional selenium treatment and disposal system which is why the document was rated "insufficient information."

The Use Agreement, Appendix A page 6 states:

> "*E. It is also the intention and objective of RECLAMATION and the AUTHORITY, among other things, to pursue planning to report to the Oversight Committee by the end of Year Four (2013) measures to meet loads in Years Six through Ten (2015-2019) in order to meet water quality objectives in Mud Slough by the Regional Board's Basin Plan (as hereinafter defined) compliance date, as amended in relation to this Agreement. These efforts will be coordinated with the California Department of Fish and Game and the United States Fish and Wildlife Service to accommodate their activities relating to endangered and non-endangered species in or adjacent to Mud Slough.*"

The GBD will continue to evaluate treatment measures that will meet the selenium load values and objectives that are included in the new Use Agreement. Studies completed to date or ongoing include: 1) Full-scale Demonstration of Agricultural Drainage Water Recycling Process Using Membrane Technology, July 28, 2004, Water Tech Partners (Ron Enzweiler, Jurgen Strasser) ERP Grant ERP-02-P44, 2) USBR Studies as part of SLDFRE, 3) Final Engineering and Design Report Pilot Plant for Treatment of Agricultural Drainage Water at Panoche Drainage District, US Desal Inc. March 31, 2006, 4) DWR cooperative study in cooperation with UCLA just starting June 2009, 5) As part of a Integrated Water Resources Management Grant work was included for a pilot treatment plant. This work has progressed to the stage of awarding a contract to construct a pilot treatment plant to NA Water. This work was suspended by the State of California and has not been restarted. Selenium and salinity treatment will be evaluated and included in the 2013 planning report. There is land fallowing occurring within the GDA, and it is part of the planning (see discussion on active land management on page 2-7). The SJRIP is a regional drainage management system which has its benefits over individual on-farm drainage management systems. These benefits include the efficiency of a regional system which is the ability to manage one system as opposed to hundreds of smaller systems. All options will continue to be evaluated to accomplish the project goals including the completion of the Westside Plan (see discussion on page 1-3, 1-5, 2-8, 2-20,2-21, 2-29 and 8-15).

Once the treatment system is identified and designed, the GBD and Reclamation will determine if additional CEQA and NEPA compliance is required to cover site-specific details not included in the EIS/EIR. The EIS/EIR uses the best information available for defining the Proposed Project and then evaluates the impacts of what is known at present and what is reasonably foreseeable in the future.

USEPA-2

The commenter states that a comprehensive monitoring program is needed. The Project includes implementing an extensive compliance monitoring program with biological, water quality and sediment components which will be continued with the Project (page 2-20, page 4-9, Section 4.1.5 page 4-20, Section 4.1.6 page 4-50, page 5-16, 6-52, Section 15 page 15-2, and Appendix A, Use Agreement, Section V, page 19). The project proponents will continue to interact and coordinate with other regional drainage efforts.

USEPA-3

See the response to USEPA-2 for discussion regarding the monitoring program. Since the discharge from the Grassland Bypass Project is subsurface drainage water, it is unlikely that there would be pesticides in the water since the filtering through the soil tends to remove any pesticides. This is also substantiated by the toxicity testing that is performed as part of the current monitoring program that indicates little water flea toxicity at Site B which would be an indication of pesticide impacts if present (see reports published by SFEI). See response USFWS-9 for a discussion of mercury testing and source study.

Concerning the comment on potential impacts of selenium on migrating salmon, please see response to comment USFWS 10 wherein the Service asks that the Final EIS/EIR include an evaluation of effects of GBP selenium discharges on anadromous fish including the proposed San Joaquin River Restoration runs of Chinook salmon and steelhead. The response elaborates on material contained in the EIS/EIR but the conclusion remains the same. This additional information indicates that the GBP is unlikely to have a significant impact on the fish reintroduced as part of the SJRRP. Because both projects would be expected to improve conditions for salmonids in the SJR and, therefore, they would not have a cumulatively significant impact.

USEPA-4

With regard to the comment that information on sediment quality is incomplete, Section 2.2.3 of the Sediment Management Plan (SMP, Appendix B of the EIS/EIR) provides a summary of current selenium concentrations in drain sediments. The review of existing data was sufficient to determine the feasibility of potential disposal options. In addition, prior to disposal the sediment would be resampled as outlined in Section 3.1 of the SMP.

With regard to the recommendation that the FEIS include additional information on sediment removal measures, etc., Section 3.0 of the SMP provides steps to be taken during sediment removal from the Drain, including sampling and handling measures, worker safety, and potential disposal options. All necessary permits for the sediment management will be obtained. Please refer to response to comment USFWS 5 regarding the avoidances of wetland areas and applicable permits and approvals. Page 4-1 of the SMP provides guidelines for acceptable concentrations of selenium in sediment for potential disposal areas; therefore, no adverse effects are expected to occur at disposal areas. With regard to the statement that sediment removal could be cost prohibitive, the cost of sediment removal will be analyzed as part of the process in determining the most appropriate disposal option for the sediment.

In response to the recommendation for a clear commitment to detailed analysis of sediment treatment, management, and disposal options and their effects, the following response is provided. Based on the impact analyses conducted in the EIS/EIR, the SMP was developed and clearly describes sediment testing and analysis **prior to** disposal of sediment, in order to make a final determination for appropriate reuse options. Furthermore, Section 4.2.5 of the SMP requires post-application monitoring for all disposal options.

With regard to the recommendation relating analysis of options to reduce sediment mobilization and transport, these options were addressed during the EIS/EIR process, including scoping, and included in the development of alternatives which were evaluated for the EIS/EIR.

USEPA-5

The GBD will continue to participate and coordinate in all the major activities related to drainage management including the settlement related to San Luis Unit agricultural drainage, boron and salinity TMDLs, the river restoration program and other activities such as the CVSalts initiative of the Regional Board.

Creating more detailed maps of the many activities related to the Central Valley and drainage solutions is beyond the scope of this Project. The GBD continue to develop maps for project management purposes that you may peruse at the offices of Joe McGahan, Drainage Coordinator, 559-582-9237, jmcgahan@summerseng.com, 887 N. Irwin St., Hanford, CA 93232 by appointment and upon request.

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COMMENT LETTER

US Fish & Wildlife Service (USFWS)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
CRC-Grassland Bypass Project

MAR 2 3 2009

To: Ms. Judi Tapia, Resources Management Division, Bureau of Reclamation, South-Central California Area Office, Fresno, California

To: Mr. Joseph McGahan, Regional Drainage Coordinator, the San Luis Delta Mendota Water Authority, Los Banos, California

From: Acting Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Comments on the Draft Environmental Impact Statement/Environmental Impact Report for the Continuation of the Grassland Bypass Project from 2010 Through 2019

This memorandum transmits U.S. Fish and Wildlife Service (Service) review comments and recommendations on the U.S. Bureau of Reclamation's (Reclamation) Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) for the Continuation of the Grassland Bypass Project From 2010 Through 2019 (GBP Extension), dated December 2008. The Service provides these comments and recommendations under authority of, and in accordance with, provisions of the National Environmental Policy Act (NEPA) (40 CFR Part 1500).

One of the purposes of the Grassland Bypass Project is to route subsurface drainage discharges away from approximately 93 miles of Grassland wetland supply channels and to promote continuous improvement to water quality in the San Joaquin River. The Service strongly supports efforts to reduce drainwater contamination and improve water quality in the Grasslands wetland supply channels and the San Joaquin River.

In order to protect fish and wildlife resources in the Grassland watershed, and to protect existing and future runs of anadromous fish associated with the San Joaquin River, the Service recommends that the final EIS/EIR for the GBP Extension be revised to incorporate the following:

1. Inclusion of lands north of the Grassland Drainage Area into the GBP Extension that still discharge directly into the south Grasslands wetland supply channels;
2. Elimination of discharges into the Delta Mendota Canal from the drainage sumps in the Firebaugh Canal Water District owned by the U.S. Bureau of Reclamation (DMC sumps);

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3. An evaluation of alternative routes of disposal and/or storage of excess drainage flows that occur during heavy rainfall events and that have historically been discharged into the Grasslands wetland water supply channels;
4. Revision of load limits for selenium and salinity in above normal and wet water year types to show reductions in loads from the beginning of the project;
5. Revision of Sediment Management Plan (Appendix B of the DEIS/DEIR) for the disposal of dredged material from the San Luis Drain to adequately protect fish and wildlife resources. As written, the proposed acceptable concentrations for selenium in San Luis Drain dredged material for disposal on open upland areas of 2-390 µg/g, dry weight could pose a significant risk to fish and wildlife resources;
6. An evaluation of the environmental effects of the use of subsurface drainage for dust control on roadways;
7. An evaluation of the environmental effects of continued acute spikes of selenium to the biota in the vicinity of the Grasslands wetland supply channels;
8. Identification of the actions that will be implemented to meet selenium and salinity load limits through the life of the GBP Extension, should a proposed, treatment and disposal methodology not prove to be feasible; and
9. Monitoring and reporting for total mercury and methyl-mercury concentrations in water and biotic tissue at all sampling locations of the GBP to establish a mass-balance of sources of mercury in this watershed;

The final EIS should also discuss the relationship between the GBP Extension and past, present and future reasonably foreseeable projects in the Cumulative Effects Section of the DEIS. Specifically, the final EIS should provide additional information on cumulative impacts of: 1) water transfer programs such as the San Joaquin River Exchange Contract 10-year Transfer Program and the San Joaquin River Exchange Contract 25-year Transfer Program; 2) the San Joaquin River Restoration Program and effects of GBP discharges on San Joaquin River salmonids; 3) water quality impacts in the San Joaquin River under two future scenarios, with and without a continuation of the Vernalis Adaptive Management Program (after 2010); and 4) effects of south Delta temporary barriers on the transport and fate of selenium and sulfate from discharges of the GBP into the Delta.

We appreciate the opportunity to review this DEIS/DEIR. Our detailed comments are enclosed. If you have any questions or comments about this letter, please contact Mr. Mark Littlefield or Ms. Joy Winckel of my staff at (916) 414-6600.

Attachment
cc:
Laura Fuji, United States Environmental Protection Agency, San Francisco, CA
Theresa Presser, United States Geological Survey, Menlo Park, CA
Kathy Norton, U.S. Army Corps of Engineers, Sacramento, CA
Maria Rea, National Marine Fisheries Service, Sacramento, CA
Kim Forrest, U.S. Fish and Wildlife Service, San Luis National Wildlife Refuge Complex,
Los Banos, CA
David Widell, Grassland Water District, Los Banos, CA
Rudy Schnagl, Central Valley Regional Water Quality Control Board, Sacramento, CA
Julie Vance, California Department of Fish and Game, Fresno, CA
John Beam, California Department of Fish and Game, Los Banos, CA

Background

Grasslands Ecological Area

The Grasslands Ecological Area includes over 160,000 acres of Federal, State, and privately-managed marsh, native pasture and riparian zones, including the largest contiguous block of wetlands remaining within the Central Valley. Prior to the early 1900's, this area was part of a vast network of some 4,000,000 acres of wetlands spread throughout the Central Valley. Today that valley-wide network is down to 300,000 acres, of which the Grasslands area is a critical component. As much as thirty percent of the migratory birds that utilize the Central Valley frequent the watershed each winter. The area annually hosts hundreds of thousands of ducks, geese and waterbirds, and is recognized by the Western Hemisphere Shorebird Reserve Network as a place of international importance to wintering and migrant shorebirds. The Grasslands Ecological Area has also been designated a Wetlands of International Importance under the Ramsar Convention, the only international agreement dedicated to the worldwide protection of wetlands.

History of the Grassland Bypass Project

During the 1950's and 1960's, farmers on the west side of the San Joaquin Basin (north of Westlands Water District) began installation of subsurface drainage systems to maintain arability of drainage-impaired agricultural lands. Drainage water collected by those systems was commingled with agricultural tailwater and other waters and discharged into sloughs and creeks of the western Grasslands area enroute to the San Joaquin River. That commingled water was also used for management of tens of thousands of acres of wetlands in the area. In light of the findings of Kesterson Reservoir environmental studies, contamination surveys were conducted in the San Joaquin River beginning in the fall of 1984. The contamination surveys revealed elevated concentrations of salts, arsenic, boron, and/or selenium in waters, sediments, food-chain organisms, fish and wildlife collected from the area (Moore *et al.* 1990).

In 1985, drainwater stopped being used as a water supply for the Grasslands' public and private wetlands. The discovery of avian developmental abnormalities at Kesterson National Wildlife Refuge, caused by selenium contamination from drainwater disposal in surface water and disposal impoundments, resulted in changes in management by wetlands managers in the Grasslands area. Between 1985 and 1996, channels in the Grassland Water District (GWD) were used to convey both drainwater and fresh water. Through an agreement between the GWD and the surrounding agricultural districts, drainage entered the southern portion of the GWD through the Agatha Canal or the Camp 13 Ditch. When one channel was carrying drainwater, the other was used to convey fresh water to the wetlands. Then the system was switched so that the wetlands along the other channel could receive fresh water deliveries. This "flip-flop" system required flushing of the channel for 24 hours, and the flushing was an inefficient use of fresh water. Use of the "flip-flop" system was halted in 1996 with the implementation of the first Grassland Bypass Project (GBP). The original agreement for use of the San Luis Drain (Use Agreement) dated November 3, 1995, allowed the San Luis and Delta-Mendota Water Authority (Authority) to use a portion of the San Luis Drain (SLD) to convey agricultural drainwater through adjacent wildlife management areas to Mud Slough (North), a tributary to the San

Joaquin River. The 1995 Use Agreement allowed for use of the Drain until September 30, 2001. The 2001 Use Agreement allowed continuation of the use of the Drain through December 31, 2009. With implementation of the GBP from 1996 through the present, most of the drainage from farmlands in and adjacent to the Grassland Drainage Area (the agricultural lands that participate in the Grasslands Bypass Project) was no longer conveyed in about 93 miles of Grasslands wetland supply channels. The continued use of the SLD beyond December 31, 2009, requires a revised Use Agreement, an amendment of the Basin Plan Amendment implementation schedule to comply with water quality objectives in impacted waters (particularly Mud Slough [North]) and portions of the San Joaquin River, and additional environmental review and compliance.

Water Quality Objectives for the Grasslands Wetlands

In 1988 the Central Valley Regional Water Quality Control Board (Regional Board) adopted an amendment to the Basin Plan for regulation of agricultural subsurface drainage discharges from the Grassland Watershed of Merced and Fresno Counties. That amendment included a site-specific selenium objective for wetland water supplies in the Grasslands of 2 μg/L on a monthly mean basis. In 1990, the U.S. Environmental Protection Agency approved the 2 μg/L monthly mean selenium objective for the water delivered to wetland areas within the Grassland watershed. A revised Basin Plan amendment was adopted by the Regional Board in 1996, as part of a set of amendments that focused on the control of selenium-laden agriculture subsurface drainage discharges in and from the Grassland watershed. The need to reduce selenium loadings to, and concentrations in, the Grasslands wetland water supplies and downstream waters in order to protect wildlife, including threatened and endangered species, was one of the driving forces behind the Regional Board's adoption of the Control of Agricultural Subsurface Drainage Discharges (Grassland Amendments). The Service has previously reviewed and commented on drafts of these amendments. The Grassland Amendments were adopted May 3, 1996, by the Regional Board via Regional Board Resolution 96-147, and approved by the State Water Resources Control Board in State Board Resolution 96-078 and by the State Office of Administrative Law on January 10, 1997 (CVRWQCB 1998).

In 2000, the Service and the National Marine Fisheries Service (NMFS) issued a final biological opinion to the Environmental Protection Agency (EPA) on the California Toxics Rule (CTR) (USFWS and NMFS 2000). The CTR biological opinion found with respect to selenium that, "*...the chronic aquatic life criterion for selenium proposed in the CTR [5 μg/L] does not protect listed fish and wildlife dependent on the aquatic ecosystem for development and/or foraging*." The Service and NMFS concluded, "*In aggregate, the weight of scientific evidence supporting a chronic criterion for selenium of < 2 μg/L is now overwhelming*." The Service and NMFS further found that, "*Based on data collected by the U.S. Department of Interior's National Irrigation Water Quality Program (NIWQP) from 26 study areas in 14 western states (including 5 California study areas), a 5 μg/L chronic criterion for selenium is only 50-70 percent protective (Adams et al. 1998; Seiler et al. 2003), as opposed to the 95 percent level of protection that EPA's national water quality criteria are intended to achieve (Stephan et al. 1985). The Service believes the NIWQP data suggest that on a dissolved basis a criterion of*

1 μg/L would be required to achieve 95 percent protection, which is approximately equivalent to a 2 μg/L criterion on a total recoverable basis (Peterson and Nebeker 1992)."

The available body of scientific evidence (the majority of which has been produced subsequent to the EPA's 1987 aquatic life criterion derivation for selenium) supports a chronic criterion of 2 μg/L for the protection of sensitive taxa of fish and wildlife (USFWS and NMFS 2000). In the absence of site-specific and species-specific data regarding the sensitivity of particular species and/or populations, a criterion of at most 2 μg/L is required to assure adequate protection of threatened and endangered species of fish and wildlife. This is especially warranted considering the steep response curves for selenium (Hoffman *et al.* 1996; Lemly 1998; Skorupa 1998) and the well-demonstrated potential for selenium-facilitated pathogen susceptibility in controlled laboratory studies (Tully and Franke 1935; Whiteley and Yuill 1989; Larsen *et al.* 1997; Wang *et al.* 1997). The Service and NMFS concluded in the CTR biological opinion that selenium-induced immune dysfunctions have the potential to rapidly extirpate entire populations of fish and wildlife via epizootic events (USFWS and NMFS 2000).

Congressional Mandates for Refuge Water Supplies

Two Federal laws have been enacted that include requirements for provisions of adequate water quality to refuges. Section 3406(d) of the Central Valley Project Improvement Act (Public Law 102-575) requires firm water supplies be provided of "*suitable quality*" to maintain and improve wetland habitat on units of the National Wildlife Refuge System in the Central Valley of California, Los Banos and North Grasslands Wildlife Areas; and on the Grasslands Resource Conservation District. The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) Section 5(F) states that the Secretary of Interior shall, "*assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the System and the purposes of each refuge.*"

In 2001, the Bureau of Reclamation (Reclamation) and the Service entered into a Memorandum of Understanding (MOU) providing for Central Valley Project and acquired water supplies to units in the National Wildlife Refuge System in the San Joaquin Valley (USBR and Service 2001). With respect to water quality, that MOU stipulated, "*the water delivered by Reclamation to the Service pursuant to this MOU shall be of suitable quality to maintain and improve wetland habitat areas…*"

Description of Project

The proposed action would permit the Authority to continue use of the Federally-owned San Luis Drain and implement the GBP Extension from January 1, 2010 through December 31, 2019 under the terms and conditions of the proposed "2010 Use Agreement for Use of the San Luis Drain" (included as Appendix A of the DEIS/DEIR). The GBP Extension proposes to continue to consolidate subsurface drainflows on a regional basis and utilize a portion of the Federally owned San Luis Drain (SLD) to convey drainflows around wetland habitat areas after the existing use agreement expires in 2009. Under the GBP Extension, drainwater would continue to be collected from the 97,400-acre Grassland Drainage Area and place it into the SLD near Dos

Palos, California (Site A). The drainage is then conveyed to the SLD's terminus where it discharges into Mud Slough (North) (Site B).

The purposes and objectives of the proposed continuation of the Grassland Bypass Project, 2010–2019 (Proposed Action) are to:

- Extend the SLD Use Agreement to allow the Grassland Basin Drainers time to acquire funds and develop feasible drainwater treatment technology to meet revised Basin Plan objectives (amendment underway) and Waste Discharge Requirements by December 31, 2019;
- Continue the separation of unusable agricultural drainage water discharged from the GDA from wetland water supply conveyance channels for the period 2010–2019;
- Facilitate drainage management that maintains the viability of agriculture in the Project Area and promotes improvement in water quality in the San Joaquin River.

New features include a revised Use Agreement for the SLD, updated compliance monitoring plan, revised selenium and salinity load limits, a new Waste Discharge Requirement from the Regional Board, and mitigation for continued discharge to Mud Slough. In-Valley treatment/drainage reuse at the San Joaquin River Improvement Project (SJRIP) facility would be expanded to 6,900 acres. Also, it is anticipated that at some point during the life of the project, Reclamation and the Authority will need to remove existing and future sediments from the affected portion of the San Luis Drain.

In order to continue to discharge into Mud Slough (North) in the State's China Island Wildlife Area, the Authority would need to extend or amend a Memorandum of Understanding with the California Department of Fish and Game. In addition, the Regional Board will need to amend the 1998 Basin Plan to delay the date for compliance with selenium objectives in Mud Slough (North) and a portion of the San Joaquin River in all water year types.

Service Comments on GBP Extension DEIS/DEIR

Purpose and Need

The DEIS/DEIR identified several purposes and objectives for the proposed continuation of the Grassland Bypass Project, 2010–2019 (Proposed Action) These include:

> *"To continue the separation of unusable agricultural drainage water discharged from the GDA from wetland water supply conveyance channels for the period 2010–2019."*

USFWS-1

Because this project objective includes the separation of agricultural drainage water produced in the Grassland Drainage Area from the wetland water supply conveyance channels, the proposed action in the DEIS/DEIR should include the following additional sources of drainage contamination in the Grasslands wetland channels: 1) Lands to the north of the existing GBP Area that still discharge directly to the wetland supply channels; 2) drainage discharged from Delta Mendota Canal (DMC) sumps; and, 3) discharges during heavy rainfall events.

1. **Sources of selenium in the Grasslands wetland supply channels: lands outside the GBP's Drainage Project Area**

The prohibition of agricultural subsurface drainage to Salt Slough and the Grasslands wetland supply channels resulted in the diversion of most of the drainage to Mud Slough (North) via a portion of the San Luis Drain. However, as was noted in a Regional Board Report reviewing selenium concentrations in wetland water supply channels in the Grassland Watershed (Chilcott 2000), "*Two areas have been identified where agricultural subsurface drainage can enter wetland water supply canals from farmland not contained in the DPA* [Drainage Project Area]. *One area is west of the wetland water supply channels and historically drained into the Almond Drive Drain which entered South Grassland Water District at Almond Drive. A second area is a triangle-shaped area of approximately 7,000 acres south of the Poso Drain (also known as the Rice Drain) and north of the DPA which historically drained into the Poso Drain which enters South GWD from the east...*" Figure 1 below is a copy of the map from Chilcott (2000) that identifies areas where agricultural drainage still enters the wetland water supply canals.

The GBP EIS/EIR in 2001 (USBR and San Luis and Delta Mendota Water Authority, 2001) noted that the proposed action may include the addition of approximately 1,100 acres of farmland to the GBP's Drainage Project Area (DPA), found immediately adjacent to the DPA, south of the San Luis Drain and east of the Grassland Bypass Channel, that currently drain to wetland channels, in the area identified Chilcott (2000) as the Poso Rice Drain Area. The 1,100 acres proposed for inclusion in the GBP EIS/EIR of 2001 is shown in Figure 2. To date, however, these additional acres have not been incorporated into the GBP. The DEIS/DEIR for the GBP Extension notes that these 1,100 acres "*could be annexed to the GDA.*"

Figure 3 is a subset of a map of the San Joaquin Valley Drainage Authority, Westside San Joaquin River Watershed Coalition that focuses on the Grasslands Area. From that map, it appears that the lands identified in Chilcott 2000 that still discharge directly to the south Grasslands wetland channels fall within Central California Irrigation District (See Figure 3 below).

Recommendation: Because these discharges contribute to exceedences of the adopted selenium objective of 2 µg/L in the Grasslands wetland supply channels, agricultural lands that still discharge drainage directly to the wetland supply channels should be added to lands participating in the GBP Extension.

USFWS-1

Figure 1. From Chilcott 2000

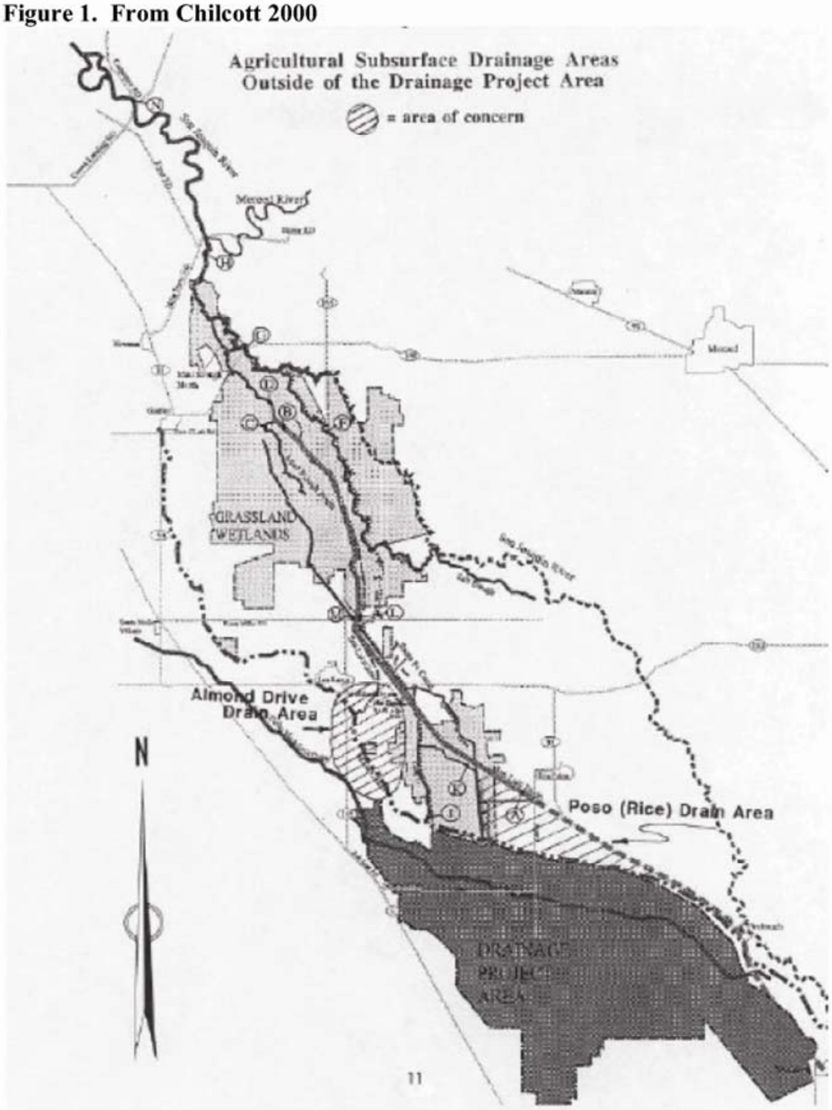


Figure 2. GBP Project Area Map including Proposed 1,100 Acres Additional Lands to be added to the DPA (from Reclamation and San Luis and Delta Mendota Water Authority, 2001)

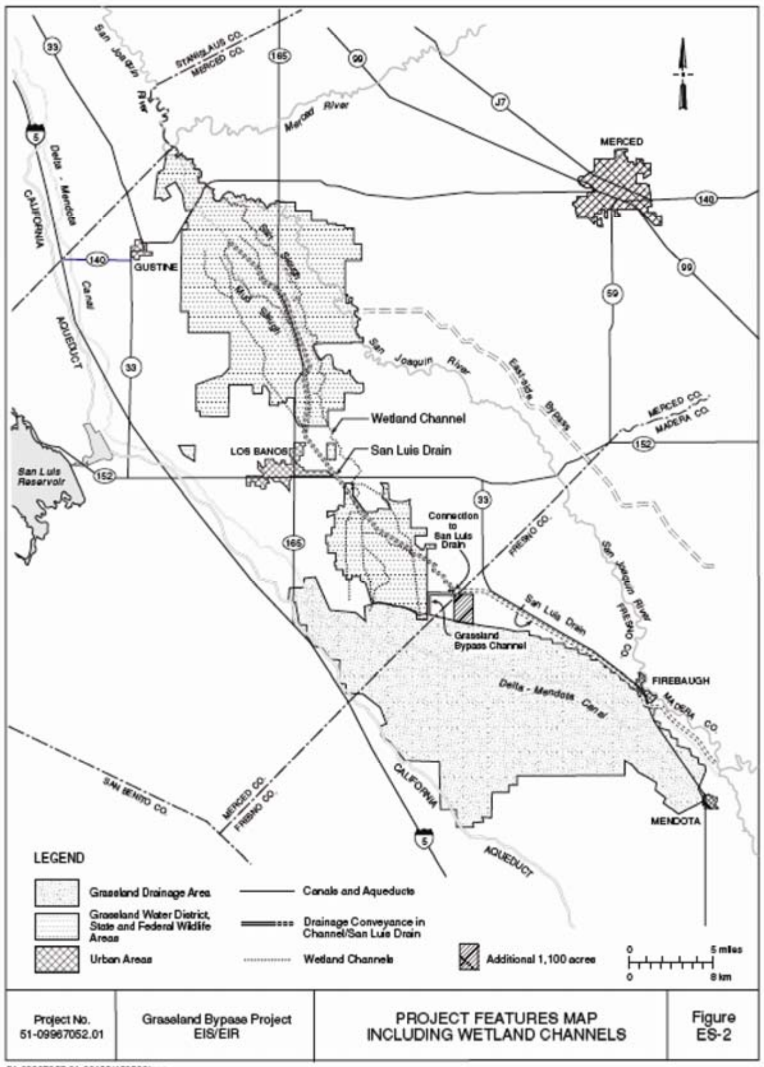
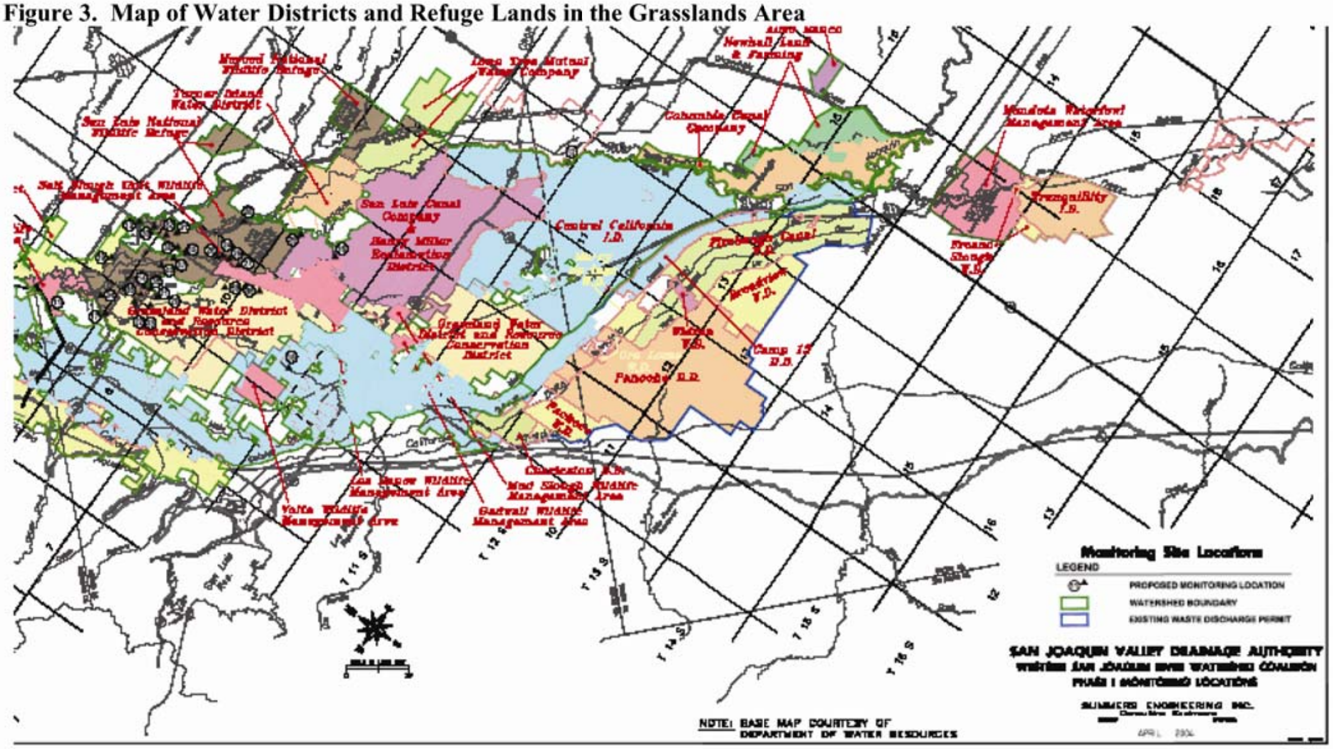


Figure 3. Map of Water Districts and Refuge Lands in the Grasslands Area



2. **Sources of selenium in the Grasslands wetland supply channels: Delta Mendota Canal sumps and check drains**

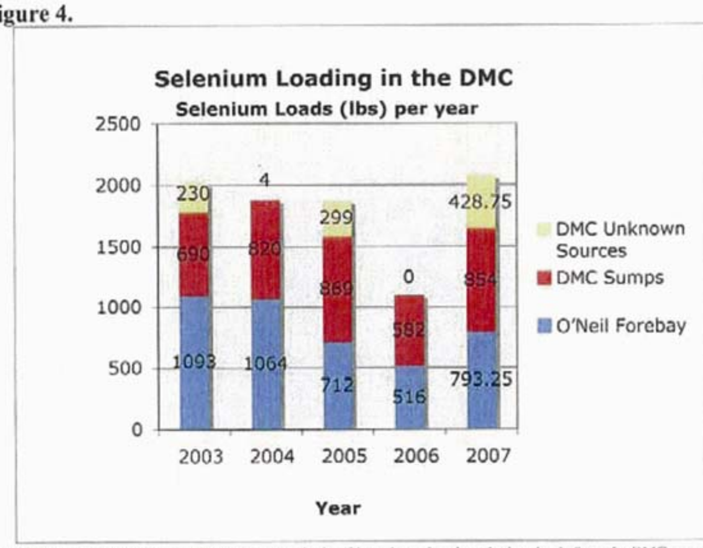
Another source of selenium in the Grasslands wetland supply channels has been identified to be supply water in the DMC (Eppinger and Chilcott, 2002). The major source of supply water to the Grasslands wetland channels and to the agricultural lands of the Grassland Drainage Area is the DMC, via Mendota Pool and the Central California Irrigation District Main Canal. Sources of selenium to the DMC include: groundwater pumping into Mendota Pool, recycling of San Joaquin River drainage into the Federal pumps in the south Delta, flood flow and sediment loading from the Panoche and Silver Creek watersheds, and discharge from DMC subsurface drains and six shallow groundwater sumps (DMC sumps) owned by Reclamation and operated by the San Luis and DMC Water Authority in the Firebaugh Canal Water District (Pierson *et al.* 1987; Chilcott 2000; USBR February 2008).

In the 1950s Reclamation installed check drains and the DMC sumps between Mileposts 99 and 110, parallel to the DMC, to collect small quantities of seepage water or surface runoff to prevent accumulation and possible damage to the canal bank or adjacent lands. Water collected in the subsurface drains is discharged into the DMC by the sumps through six drainage inlet structures. Although flow from Reclamation's DMC sumps is relatively small (the cumulative volume of drainage from the six DMC sumps averages 3.3 acre-feet per day and 110 acre-feet per month from USBR February 2008), selenium concentrations in discharged water have ranged from 57 - 2,100 µg/L between 1985 and 2000 (USBR April 2002). Reclamation monitoring data up to 1994 revealed water discharged from sump "K" exceeded California's hazardous waste threshold for selenium in water (1,000 µg/L) in one or more months sampled annually. Since 2003, selenium in water from DMC sump "K" was at or exceeded this State Hazardous Waste threshold for selenium on two separate dates (May 20, 2003 and April 26, 2006: source USBR February 2008). USFWS-2

Regional Board staff indicated a close correlation between selenium in DMC and Central California Irrigation District's Main Canal source water and selenium in wetland supply channels, during the non-flood water years of 1999 and 2000 (Eppinger and Chilcott 2002). This report noted that when the source water had elevated selenium concentrations (above 2 µg/L) a corresponding increase in selenium concentration was noted in the wetland water supply channels.

Since 2002, Reclamation has monitored the DMC sumps for selenium on a weekly basis. Reclamation water quality monitoring data from various points along the DMC from 2003 to 2007 indicate that between O'Neil Forebay and the Mendota Pool, from 582 to 1,283 pounds of selenium have been added to the DMC supply water annually (see Figure 4 below). Depending on the year, from 67 to 100 percent of that added load downstream of O'Neil Forebay is from the DMC sumps and the remainder of the added load is from unaccounted sources (e.g., DMC check drains) (USBR February 2008).

Figure 4.



1. Selenium loads from Unknown Sources were calculated by subtracting the selenium loads from the DMC sumps and at O'Neil Forebay from the selenium loads at the DMC Terminus (MP-116.48 at Bass Ave). In the case of 2006, the input from Unknown Sources was a negative number, and therefore assumed to be zero.

2. For the month of September 2007 a monthly selenium load was not available for O'Neil Forebay. For the purposes of this analysis, a monthly load was calculated as the average of the monthly selenium loads at this location from September for the years 2003-2006.

As part of the San Luis Drainage Feature Re-evaluation planning effort, Reclamation proposed the building of a DMC Drain to intercept groundwater at the DMC sumps and convey it to the GBP's reuse area for reuse, treatment and disposal of approximately 1,100 AF/year. The DMC Drain was envisioned to consist of two pipelines. The upstream pipeline would convey drainwater 300 feet from Sump A over the DMC and into the adjoining reuse area. The other 39,700 feet of buried pipeline would collect drainwater from the other five sumps and convey it along the southwestern side of the canal to the southeastern corner of the reuse area (USBR May 2006).

Recommendation: Because selenium loading in the DMC supply water can affect water quality in the Grasslands wetland supply channels, the Service recommends that drainage discharges into the DMC be routed to the SJRIP reuse area, and treatment and disposal facilities of the GBP as was proposed in the San Luis Drainage Feature Re-evaluation Final EIS (USBR May 2006).

USFWS-2

3. Sources of selenium in the Grasslands wetland supply channels: heavy rainfall events

Tile-drained farmlands in the GBP's DPA southwest of the Grasslands wetland supply channels have proven to be susceptible to flooding during winter storm events from the Panoche/Silver Creek watershed in the Coast Range. These flood flows [40,000 acre-feet during 2-week periods associated with these storm events (San Luis and Delta Mendota Water Authority 1997)] have been characterized by high selenium levels and loads. For example, selenium concentrations in flood waters from the Panoche/Silver Creek watershed ranged from 4 to 155µg/L during a February 1998 storm event (Chilcott 2000). Presser and Luoma (2006) estimated the cumulative selenium load from Panoche Creek during the *El Nino* Water Year of 1998 to be 8,045 pounds. Such flood flows have overwhelmed the GBP resulting in the diversion of selenium-contaminated water into the Grasslands wetland supply channels.

Since 1996, there also have been infrequent, short-term instances where agricultural drainage flows within the GBP have been diverted to Grasslands wetland supply channels during winter storm events. Since 1995, such events occurred in water years 1995, 1997, 1998 and 2005 and have resulted in significant spikes in selenium concentrations in the Grasslands wetland supply channels and selenium loading into the San Joaquin River (Presser and Luoma 2006, Grassland Area Farmers 2005). Releases of commingled stormwater and drainwater to the Grasslands wetland supply channels are predicted to occur at similar frequency under the proposed GBP Extension as compared to existing conditions. USFWS-3

The most recent winter storm event in 2005 was described in a report submitted to Reclamation and Regional Board (Grassland Area Farmers 2005). As a result of heavy rainfall, commingled stormwater and drainage flows that normally would have been routed into the San Luis Drain were rerouted into the Agatha Canal in the south Grasslands. During the 2005 storm event, selenium concentrations in water from Agatha Canal were elevated over 2 µg/L for several weeks as denoted in Table 1 below.

Table 1. Flood Flows into Agatha Canal, 2005 (data from Grassland Area Farmers 2005).

Date	Flow (AF)	Selenium (µg/L)	Selenium (pounds)
2/16/2005	7	3.5	0.1
2/17/2005	75	4.5	0.9
2/18/2005	50	3.5	0.5
2/19/2005	44	26.5	3.1
2/20/2005	40	39.9	4.3
2/21/2005	40	43.8	4.7
2/22/2005	14	3.7	0.1
2/23/2005	0	44.4	0
2/24/2005	N/A	24.8	N/A
2/25/2005	N/A	24.2	N/A
2/26/2005	N/A	16.6	N/A
2/27/2005	N/A	14.8	N/A
2/28/2005	N/A	9.27	N/A
3/1/2005	N/A	5.1	N/A
3/2/2005	N/A	2.83	N/A

Selenium bioaccumulates rapidly in aquatic organisms and a single pulse of selenium (>10 µg/L) into aquatic ecosystems could have lasting ramifications, including elevated selenium concentrations in aquatic food webs (Besser *et al.* 1993; Graham *et al.* 1992; Maier *et al.* 1998; Nassos *et al.* 1980; Hamilton 2004). Besser *et al.* (1993) reported that within 24-hours waterborne treatment levels of 100 µg /L selenium in the form of selenite and selenate bioaccumulated to greater than 40 µg/g in algae and 8-15 µg/g in daphnids (both extremely dangerous levels of food web selenium for higher trophic level consumers). Graham *et al.* (1992) also documented rapid bioaccumulation from waterborne spikes of selenium and much slower elimination of that selenium from the food web. Based on standard acute toxicity testing, Nassos *et al.* 1980 concluded that, "*... organisms can concentrate Se* [selenium] *several hundred times the level in the water within a period of 24 h.*" Maier *et al.* (1998) documented that a brief pulse of selenium of about 10 µg/L in a Sierra Nevada stream for less than 11 days (selenium was 10.9 µg/L at 3 hrs post-treatment and at < 1 µg/L when next measured 11 days post-treatment) resulted in elevated invertebrate selenium concentrations of > 4 µg/g (composite invertebrate samples collected before fertilization of the treatment area contained 1.67 µg/g selenium (dry weight)). Maier *et al.* found that the invertebrate food web was still contaminated at > 4 µg/g 12 months after selenium treatment when the monitoring ended even though water concentrations were < 1 µg/L. USFWS-3

Another field example of an effect of a selenium pulse in water was noted at the Tulare Lake Drainage District's flow-thru compensation wetland in the southern San Joaquin Valley. Although the water supplied to the wetland was generally managed to keep its selenium content at or below about 2- 3 µg/L, a pulse of 23 µg/L was documented on March 29, 1995, (Tulare Lake Drainage District 1996). Three months later (June 20, 1995), and without any additional selenium pulses, 16 avian eggs sampled at the site contained from 3.4 to 6.2 µg/g selenium and averaged 4.75 µg/g selenium (Tulare Lake Drainage District 1996) which exceeds the embryotoxic risk threshold reported in Skorupa (1998). In June 1995, 12 percent of sampled eggs exceeded 6 µg/g selenium which very plausibly may have been linked to the late March pulse of 23 µg/L selenium that passed through the system. In 1996, a year without any selenium pulses 16 avian eggs sampled in June at the same site contained from 2.2 to 4.1 µg/g and averaged 3.00 µg/g selenium (Tulare Lake Drainage District 1997). Twelve of the 16 eggs collected in 1995 contained more selenium than the maximum egg selenium from 1996. The average selenium value in 1995 was statistically significantly higher than in 1996 based on a two-sample nonparametric medians test (Skorupa pers. comm. January 7, 2009). USFWS-3

Recommendation: The final EIS for the GBP Extension should include an evaluation of alternative routes of disposal and/or storage of excess drainage flows that occur during heavy rainfall events and that have historically been discharged into the Grasslands wetland supply channels.

4. **<u>Selenium and salinity load limits</u>**

The purposes and objectives of the GBP Extension also include the following:

> *"To facilitate drainage management that maintains the viability of agriculture in the Project Area and promotes continuous improvement in water quality in the San Joaquin River."*

As is discussed below, the selenium and salinity load limits for wet and above normal year types are the same as load limits established for the GBP in 2005 (as shown in Tables 2 and 4 below). There is no reduction in salinity or selenium loads for wet and above normal years until 5 years into the GBP Extension (i.e. 2015). This appears inconsistent with the purpose and need, to facilitate drainage management that "*promotes continuous improvement in water quality in the San Joaquin River.*"

USFWS-4

Actual GBP selenium loads for calendar years 2002-2007 are presented in Table 3. Average annual selenium load from GBP for years 2002-2007 was: 3,684 pounds. Yet, the selenium load limits established for wet and above normal water year types in the GBP Extension are well above this average (4,480 and 4,162 pounds, respectively). Thus the new use agreement sets selenium load limits that do not show any improvement over what was required in 2005 for the first five years of the GBP Extension in wet or above normal years.

The salinity load limit is applied to the influent in the Drain at Station A. The salinity load that is actually discharged into Mud Slough (Station B) is lower due to deposition of solids in the sediment of the Drain. Actual GBP salinity loads for calendar years 2002-2007 are presented in Table 5. Average annual salinity load from GBP for years 2002-2007 was: 108,432 tons discharged from Station A into the San Luis Drain. Yet, the load limits established for wet and above normal water year types in the GBP Extension are well above this average (167,846 and 164,400 tons, respectively) and in fact are well above the highest annual salinity loads measured from the project since 2002. Thus, the new use agreement sets salinity load limits that are too high and do not show any improvement over what was required in 2005 for the first five years of the GBP Extension for wet or above normal years.

Table 2. Grassland Bypass Project Annual Selenium Load Limit in Pounds (Applied to Loads of Selenium Discharged From the San Luis Drain Terminus at Station B).

Year	Critical	Dry/Below Normal	Above Normal	Wet
2002	5328/	5328	5328	5328
2003	4995	4995	4995	4995
2004	4662	4662	4662	4662
2005	4162	4162	4162	4480
2006	3853	3995	4162	4480
2007	3545	3829	4162	4480
2008	3236	3662	4162	4480
2009	2557	3296	4162	4480
2010	1658	2864	4162	4480
2011	1075	2496	4162	4480
2012	1075	2496	4162	4480
2013	1075	2496	4162	4480
2014	1075	2496	4162	4480
2015	844	1947	3234	3510
2016	613	1398	2306	2540
2017	381	849	1378	1570
2018	150	300	450	600
2019	150	300	450	600

USFWS-4

Table 3. Actual Selenium Loading in Pounds from the GBP measured at San Luis Drain Terminus at Station B.

Calendar Year	Water Year Type for the San Joaquin Valley (from http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST)	Selenium Load Limit Based on Water Year Type	Actual Load from Station B (data from Chris Eacock pers. comm., 2.26.09)
2002	Dry	5328	4,176
2003	Below Normal	4995	4,007
2004	Dry	4662	3,672
2005	Wet	4480	4,286
2006	Wet	4480	3,690
2007	Critical	3545	2,274

Table 4. Salinity Load Values (in tons) GBP from 2001 through the Extension (2019) based on salt loading in influent into the San Luis Drain at Station A.

Year	Critical	Dry/Below Normal	Above Normal	Wet
2002	190,301	190,301	190,301	190,301
2003	180,786	180,786	180,786	180,786
2004	171,271	171,271	171,271	171,271
2005	167,845	167,845	167,845	167,845
2010	77,700	113,100	164,400	167,846
2011	58,000	98,600	164,400	167,846
2012	58,000	98,600	164,400	167,846
2013	58,000	98,600	164,400	167,846
2014	58,000	98,600	164,400	167,846
2015	49,100	79,900	132,200	144,600
2016	39,100	61,100	100,000	112,200
2017	27,500	42,400	67,800	79,800
2018	13,000	23,700	35,600	47,400
2019	13,000	23,700	35,600	47,400

USFWS-4

Table 5. Actual Salinity Load in Tons from the GBP by Calendar Year measured at San Luis Drain inflow at Station A.

Calendar Year	Water Year Type for the San Joaquin Valley (from http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST)	Salinity Load Limit Based on Water Year Type	Actual Load Discharged at Station A (data from Chris Eacock pers. comm., 2.26.09)
2002	Dry	190,301	116,200
2003	Below Normal	180,786	114,240
2004	Dry	171,271	111,860
2005	Wet	167,845	123,670
2006	Wet	None Established	113,020
2007	Critical	None Established	71,600

***Recommendation*:** Load limits for selenium and salinity in above normal and wet water year types should be revised to require reductions in loads from the beginning of the project (2010). USFWS-4

Environmental Effects of the Project Not Adequately Addressed

As is noted on Reclamation's website regarding the National Environmental Policy Act (NEPA) (from http://www.usbr.gov/mp/nepa/nepa_overview.cfm),

> "*NEPA requires full disclosure about major actions taken by Federal agencies, including alternatives to the actions, impacts, and possible mitigation. NEPA also requires that environmental concerns and impacts be evaluated during planning and decision making. For any proposed Federal action, Federal agencies such as the Bureau of Reclamation prepare a NEPA compliance document to provide this full disclosure to the public.*"

However, the Service believes that there are several aspects of the proposed action that are not adequately described and/or analyzed in the DEIS/DEIR. These include the following: 1) San Luis Drain sediment disposal on upland open areas; 2) use of subsurface drainage for dust control on roadways; 3) effects of current selenium levels in the Grasslands wetlands supply channels to biota; and, 4) identification of what measures will be implemented should the drainage treatment and disposal technologies (that have not yet been fully tested) prove technologically or economically infeasible.

1. **<u>San Luis Drain sediment disposal on upland open areas</u>**

Section 404 of the Clean Water Act requires authorization from the Corps of Engineers, for the discharge of dredged or fill material into all waters of the United States, including wetlands. Discharges of fill material generally include: placement of fill that is necessary for the construction of any structure, or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; causeways or road fills; dams and dikes; artificial islands; property protection or reclamation devices such as riprap, groins, seawalls, breakwaters, and revetments; beach nourishment; levees; fill for intake and outfall pipes and subaqueous utility lines; fill associated with the creation of ponds; and any other work involving the discharge of fill or dredged material.

USFWS-5

Waters of the United States includes essentially all surface waters such as all navigable waters and their tributaries, all interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters. Section 404 permits are required for discharges of dredged or fill material placed in these waters.

The Service recommends that Reclamation consult with the Corps of Engineers regarding the need for any section 404 permits, since the Grassland Bypass has a direct connection with Mud Slough (North) and the San Joaquin River. This direct connection would make the Grassland Bypass a tributary to the San Joaquin River and any discharges of dredged or fill material into the Bypass or adjacent wetlands would likely be subject to the Clean Water Act.

As of 2007, an estimated 222,025 cubic yards of sediment has accumulated over the entire reach of the SLD. The majority of this sediment is located in the upstream portion of the SLD near Site B. The DEIS/DEIR notes that when sediment depths exceed 4.4 feet, the 1 foot per second flow rate (corresponding to a flow of 150 cubic feet per second (cfs), to prevent the mobilization of the deposited sediment and discharge to Mud Slough) can not be met. The most recent sampling indicates that the area between SLD check 14 and SLD check 17 exceeds 4.4 feet. Most recently, between October 2006 and 2007, the volume of sediment in the SLD increased by 3,017 cubic yards. The primary concern with sediment accumulation is that sediment will restrict the capacity of the SLD to carry the maximum allowed flow (150 cfs). The sediment rate of accumulation is estimated to be about 1 to 2 inches per year spread through the entire SLD. This rate corresponds to a total average accumulation of between 8 and 16 inches of sediment over the life of the Project.

The State Water Resource Control Board found in Order No. WQ 85-1 the soils and wastewater associated with Kesterson Reservoir to be a "designated waste" that posed a hazard to the environment, and as such, should be handled, stored, or disposed of in a manner consistent with hazardous waste management provisions. This concern, prompted a recommendation for complete sediment removal from the portion of the SLD to be reopened as part of the GBP as the project was originally conceived by the San Joaquin Valley Drainage Program (1990). However, the recommendation was never carried out (Presser and Piper 1998). Rather, dredging and disposal of the sediment in the SLD is proposed in the DEIS/DEIR Sediment Management Plan (SMP) in Appendix B, even though levels of concern and hazard have been exceeded. California's criterion for solid hazardous selenium waste is defined as 100 μg/g wet weight (California Code of Regulation 1979). USFWS-5

The DEIS/DEIR proposes to dredge and dispose of SLD sediment in accordance with the new Use Agreement, applicable laws and regulations, and the SMP provided in Appendix B of the DEIS/DEIR. The SMP states, "*Sediments which contain selenium concentrations below hazardous waste criteria but exceed ecological risk criteria may be applied for reuse to lands zoned for agricultural, residential or industrial development, and upland open areas outside of the rainy season...*" The SMP establishes Ecological Risk Criteria for sediment as follows: Level of Concern - 2 – 4 μg/g selenium dry weight, and Toxic - greater than 4 μg/g of selenium on a dry weight basis (Van Derveer and Canton 1997). However, the Van Derveer and Canton (1997) paper does not provide a valid basis for setting ecological risk criteria for sediment selenium. The 4 μg/g value was derived by taking the 10th percentile of a 7-point dataset representing seven case studies where severe selenium toxicity was observed in each case study (i.e., Kesterson, Belews Lake, etc.). Thus, what 4 μg/g really represents is the estimated EC10 for catastrophic selenium contamination, not a "toxicity threshold" in the more common meaning of the term, i.e., the threshold between no toxicity and the onset of toxicity.

The correct Ecological Risk Criteria for selenium in sediment is found in the Environmental Protection Agency's (EPA) (2007) Selenium Ecological Soil Screening Levels document. EPA (2007) defined Ecological Soil Screening Levels (Eco-SSLs) as "concentrations of contaminants in soil that are protective of ecological receptors that commonly come into contact with and/or consume biota that live in or on soil. Eco-SSL's are derived separately for four groups of ecological receptors: plants, soil invertebrates, birds and mammals. As such, these values are presumed to provide adequate protection of terrestrial ecosystems. Eco-SSLs are derived to be protective of the conservative end of the exposure and effects species distribution, and are intended to be applied at the screening state of an ecological risk assessment."

Based on EPA (2007), for full protection of all life forms, an ecological risk criterion for SLD sediment of 0.5 µg/g, dry weight, should be used instead of the 4 µg/g cited in the SMP (see Table 2.1 from EPA 2007 below). The DEIS/DEIR and SMP should be revised to incorporate this information.

Table 2.1 Selenium Eco-SSLs (mg/kg dry weight in soil)

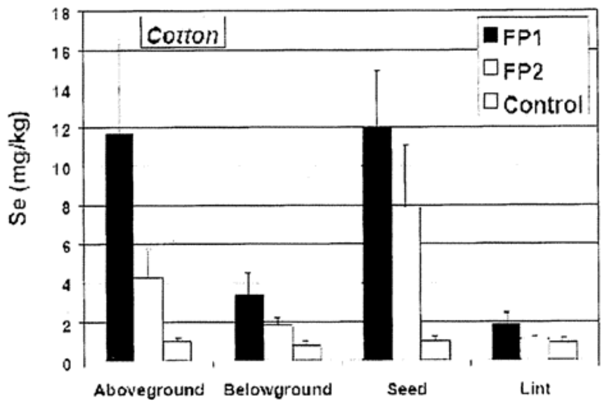
Plants	Soil Invertebrates	Wildlife	
		Avian	Mammalian
0.52	4.1	1.2	0.63

With respect to disposal of Drain sediment on open upland areas, the Service believes there is sufficient evidence to conclude that such a practice would pose a significant risk to fish and wildlife resources. The Service strongly objects to the "Acceptable Concentrations of Selenium in Sediment" presented in Table 3 of the SMP for the disposal of dredged material on Open Space (Upland Areas – outside of wet season) of 2 – 390 µg/g selenium, dry weight. This range of concentrations in sediment would likely pose a risk to wildlife foraging in the upland areas where dredged material is disposed of. We base this conclusion on the EPA document cited above and on data from two separate field studies that spread sediment from the San Luis Drain on agricultural and open space lands (Zawislanski *et al*. 2002; Banuelos *et al*. 2005). USFWS-5

In the first study, Zawislanski *et al*. (2002) applied SLD sediments to land at five sites at two locations near Dos Palos (an area with a history of selenium contamination in subsurface drainwater). Three sites were embankment plots adjacent to the San Luis Drain, and two sites were within a cultivated field. SLD sediment was applied to a 15 cm thickness. In the embankment plots applied sediment selenium concentrations averaged 2.56, 37.10, and 19.53 mg/kg, in Embankment Plot (EP)-1, EP-2, and EP-3, respectively. Alkali mallow (*Malvella leprosa*) and Russian knapweed (*Acroptilon repens*) were the dominant plant species on the embankment plots. Selenium concentrations in the aboveground parts of plants from the embankment plots ranged from 0.87 to 1.63 µg/g on a dry weight basis.

In the farm plots, selenium concentrations in SLD sediments applied averaged 111.6 and 66.7 mg/kg, in Farm Plot (FP)-1 and FP-2, respectively. Cotton, wheat and cantaloupes were grown in the cultivated field plots. Selenium uptake by cotton, wheat, and cantaloupe resulted in 5- to 20-fold increases in tissue-Se relative to plants from a control area. In all plants, selenium levels were proportional to soil selenium in the given plot; i.e., FP-1 > FP-2 > FP-C. The highest cotton tissue selenium was observed in FP-1 at 22.7 µg/g. The authors concluded that cantaloupe and wheat should not be grown in soils amended with very high Se sediment, in the 50- to 100-mg/kg range due to potential human health risks (Zawislanski *et al.*, 2002). Average selenium concentrations in tissues from cotton, wheat, and cantaloupes grown on the Farm Plots amended with San Luis Drain Sediment are represented in Figures 5 - 7 below:

Figure 5. Selenium in Above and Below Ground Cotton Tissue from Farm Plots Amended with San Luis Drain Sediment Compared with a Control Site . From Zawislanski *et al.* 2002.



USFWS-5

Figure 6. Selenium in Above and Below Ground Wheat Tissue from Farm Plots Amended with San Luis Drain Sediment Compared with a Control Site. From Zawislanski *et al.* 2002.

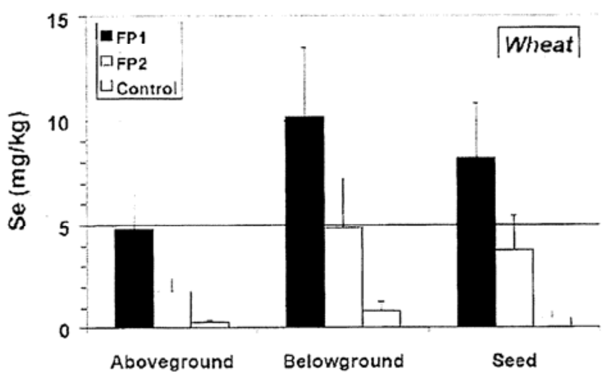
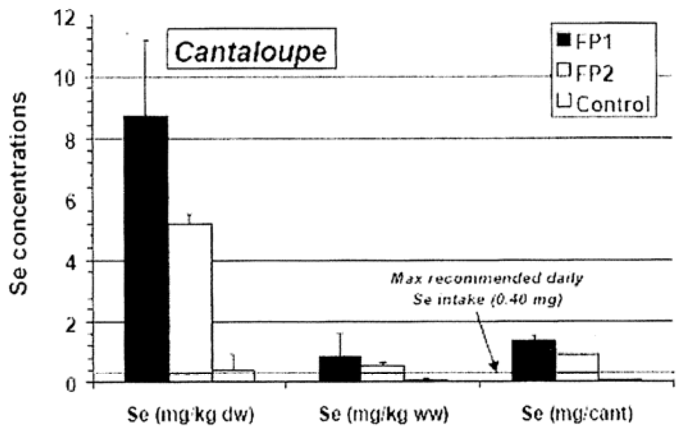


Figure 7. Selenium in Cantaloupes Grown on Farm Plots Amended with San Luis Drain Sediment Compared with a Control Site. From Zawislanski *et al.* 2002.



USFWS-5

In the second study Banuelos *et al.* (2005) conducted a two-year field trial to identify the best plant species that are salt and boron tolerant and can volatilize selenium from drainage sediment. In this experiment, sediment was collected at 0–25 cm depth from the SLD, Mendota, CA, and spread to a depth of 40 cm in a previously excavated field plot in 2000 at the USDA Research Facility in Parlier, CA (an area with no history of selenium contamination). The drainage sediment was mixed with clean soil, and vegetated with salado alfalfa (*Medicago sativa salado*), salado grass (*Sporobulus airoides salado*), saltgrass-turf (*Distichlis* spp. NYPA Turf), saltgrass-forage (*Distichlis spicata* (L.) Greene), cordgrass *(Spartina patens* Flageo), Leucaenia (*Leucaena leucocephola*), elephant grass (*Pennistum purpureum*), or wild type-Brassica (*Brassica* spp.). Selenium concentrations in crops grown on SLD-supplemented soil ranged from 7 μg/g selenium, dry weight in elephant grass, to 48 μg/g selenium, dry weight in wild-type Brassica (see Table 6 below). The authors found that overall, rates of selenium volatilization in drainage sediment were relatively low due to high levels of sulfate.

Table 6. From Banuelos *et al.*, 2005.

Mean dry weight yield and concentrations of Se, S, B, and Cl in different crops grown in drainage sediment plots for 2002 and 2003 growing seasons. The control treatment was sandy loam soil (without drainage sediment)

Plant species	Dry matter yields[*] ($g\ m^{-2}$)		Concentration in plant ($mg\ kg^{-1}$ DM)			
	Control	Sediment	Se	S	B	Cl
Elephant grass (*n* = 6)[**]	5967 (160)a	3206 (81)[***]a	7 (0.4)d	1825 (57)f	77 (2.2)[†]c	6211 (139)f
Salado grass (*n* = 6)	2105 (70)b	2306 (80)c	11 (0.7)bc	3750 (84)c	40 (1.5)d	13420 (280)d
Cordgrass (*n* = 6)	1221 (49)c	1642 (59)d	10 (0.7)bcd	7120 (156)b	35 (1.4)de	33600 (685)b
Saltgrass-turf (*n* = 4)	2209 (65)b	2708 (72)b	11 (0.6)bc	3624 (80)c	31 (1.3)e	24920 (553)c
Leucaena (*n* = 4)	2575 (62)b	2312 (69)c	13 (0.8)b	2675 (76)e	278 (9.8)b	7335 (150)ef
Salado alfalfa (*n* = 8)[††]	2502 (68)b	1353 (43)d	8 (0.5)cd	2880 (78)de	80 (3.1)c	7200 (154)ef
Saltgrass-forage (*n* = 4)	2602 (73)b	2907 (79)ab	9 (0.5)cd	3153 (80)cd	23 (1.0)f	10110 (243)de
Wild-type *Brassica* (*n* = 6)	2225 (61)b	1800 (55)d	48 (2.8)a	24025 (546)a	248 (9.6)a	41502 (861)a

[*] Mean annual total dry matter of plants grown in either control or sediment plots, which includes all clippings from perennial crops for all replications for 2002 and 2003 growing seasons. Means followed by the same letter are not significantly different at the $P < 0.05$ level within each column.

[**] Total number (*n*) of replications for each species.

[***] Values represent the mean and standard error in parenthesis for two years.

[†] Mean B concentration at first clipping was 920 $mg\ kg^{-1}$, while 77 $mg\ kg^{-1}$ was the mean concentration from clippings two through four.

[††] Data are presented for only one year due to crop destruction by gophers.

As was noted in the Biological Assessment for the Grassland Bypass Project in 2001 (USBR 2001), "*Chronic exposure to diets with selenium concentrations as low as 1 mg/kg can cause adverse effects on mammals (intestinal lesions and longevity in rats, Eisler 1985). Reproductive impairment has been reported at a dietary exposure of 3 mg/kg (rats, Olsen 1986). In dogs (in the same family as kit fox) sublethal effects were found at a dietary exposure of about 7 mg/kg (Rhian and Moxon 1943). Based on these data, 3 mg/kg would be a conservative Level of Concern threshold, and 7 mg/kg would be a reasonable Toxicity threshold for dietary exposure to selenium applicable to mammals such as the kit fox.*" USFWS-5

Further, the Biological Assessment established a Level of Concern threshold for dietary effects on mammals for plants in the SJRIP drainage reuse area of the GBP as follows, "*A monitoring program and contingency plan will be designed with recommendations from the Service to address potential kit fox exposure to selenium. Selenium uptake by salt-tolerant crops irrigated with drainwater at the IVT will continue to be monitored. If selenium concentrations in these crops reach the Level of Concern threshold for dietary effects on mammals (3 mg/kg), a contingency plan and monitoring program will be instituted to determine selenium dietary effects on the small mammal prey of kit fox.*"

With the exception of the Embankment Plots[1], all of the crops grown on soils supplemented with SLD sediment contained selenium well in excess of 3 µg/g (mg/kg), the Level of Concern threshold established for protection of mammals foraging in the SJRIP drainage reuse area in the

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[1] The plants harvested from the embankment plots likely had lower selenium concentrations because the sediment applied was lower in selenium than sediment applied to farm plots, and sediment was applied to the soil surface but not mixed in at the embankment plots whereas with the farm plots for both Zawislanski *et al.* (2002) and Banuelos *et al.* (2005) studies, the sediment was mixed in with the soil.

GBP 2001 Biological Assessment. Field studies have demonstrated that significant levels of selenium can accumulate in plant tissues where land has been amended with SLD sediment (Zawislanski *et al*. 2002; Banuelos *et al*. 2005). The Service therefore concludes that SLD sediment is not suitable for land disposal in open upland areas, and recommends that the DEIS/DEIR and SMP be revised accordingly.

USFWS-5

Recommendation: The Service recommends that Reclamation consult with the Corps of Engineers regarding the need for a section 404 permit to dredge and dispose of sediment from the SLD. Further, in order to protect fish and wildlife resources, disposal of SLD sediment exceeding 0.5 µg/g selenium (dry weight) on upland open areas should be removed as an option for consideration in the SMP.

2. **<u>Use of subsurface drainage for dust control on roadways</u>**

On page 2-20 of the DEIS/DEIR, under the section describing other drainwater actions in the Proposed Action, one sentence is included describing the use of drainage to control dust, "*Implementing drainwater displacement projects such as using subsurface drainage for dust control on roadways*." Aside from the acknowledgement that agricultural drainage is used to control dust, there is no description of the timing, quantity of drainage used, concentrations of drainage contaminants in the drainage water, sources of the drainage water, or locations of these dust control activities (e.g., proximity to wetland areas).

USFWS-6

Recommendation: The final EIS should fully analyze the potential environmental effects of the use of drainage for dust control on roadways. The Service also recommends that monitoring of water and biota in the vicinity of these dust control activities be added to the monitoring program for the GBP Extension.

3. **<u>Effects of current selenium levels in the Grasslands wetlands supply channels to biota</u>**

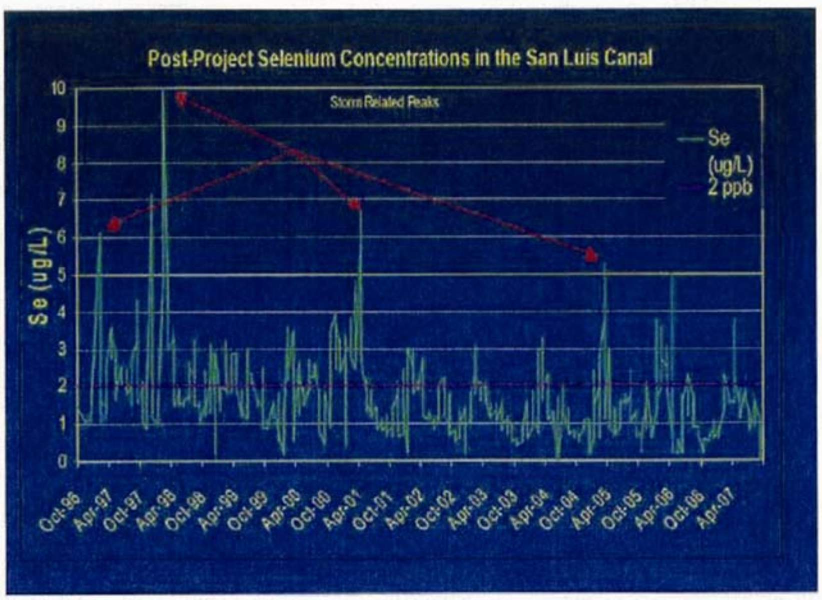
Implementation of the GBP has significantly improved water quality in the Grasslands wetland channels (with the exception of Mud Slough North where drainage is routed to the San Joaquin River), and reduced salt and selenium loading to the San Joaquin River. With respect to the Grasslands wetland channels, the Grassland Amendments, ***Basin Plan Chapter** IV,* IMPLEMENTATION, included the following prohibitions (CVRWQCB 1998):

"*Discharge of agricultural subsurface drainage water to Salt Slough and the identified wetland water supply channels after January 10, 1997, unless water quality objectives for selenium are being met. This prohibition is intended to ensure that discharge of agricultural subsurface drainage water does not interfere with achievement of water quality objectives for selenium in Salt Slough and the wetland water supply channels after 1/10/97. If selenium objectives are not met, the prohibition requires the elimination of agricultural subsurface drainage flows to Salt Slough and the wetland channels. This is consistent with one of the Fish and Wildlife Service's priorities regarding agricultural drainage in the Grassland area, as stated in written comments to the Regional Board in 1995, i.e., "[remove agricultural drainage flows from over 90 miles of Grassland channels, including Salt Slough, so as to free them for delivery of freshwater to Refuges made available pursuant to the CVPIA" (Medlin 1995b).*"

USFWS-7

However, exceedences of 2 µg/L selenium in water from wetland supply channels still occur, typically associated with heavy rainfall events and in the spring of each year (usually in March and/or April) as depicted in Figure 8 below, Post-Project Weekly Selenium Concentrations in the San Luis Canal (a wetland supply channel in the South Grasslands). As a result, the Grasslands wetland supply channels and Salt Slough were put back on the 2006 303(d) list of impaired water bodies for California due to non-compliance with water quality objectives and existing total maximum daily load (TMDL)s (for selenium) for those channels (SWRCB 2007). USFWS-7

Figure 8. Weekly Selenium Concentrations in the San Luis Canal, 1996 – 2007 from Chilcott and Schnagl, 2008



Two recent studies have documented selenium levels in biota from the Grasslands wetland supply channels (Beckon *et al.* 2007; Paveglio and Kilbride 2007). In the first study, the Service's Sacramento Fish and Wildlife Office, Environmental Contaminants Division, conducted a field investigation of sediment, aquatic invertebrates, bird eggs and fish from wetlands in the Grasslands area and analyzed these constituents for selenium from five areas that receive water from different or mixed water sources (Beckon *et al.* 2007). Sediments are thought to serve as an important reservoir of selenium contributing to long-term cycling of selenium in aquatic ecosystems long after influx of selenium has been stopped. The authors concluded that selenium concentrations in sediments and invertebrates are likely due to a continuing influx of selenium contamination that has not been fully abated in the area. The study's findings included:

- *"Of the 62 avian eggs sampled, 6.5 percent exceeded the threshold of concern for avian eggs (6 µg/g dw,). Those four eggs ranged from 6.0 to 6.9 µg/g.*
- *Of the 74 whole body fish samples collected 27 (36.5 percent) exceeded the threshold of concern for selenium in warmwater fish (4 µg/g selenium). All 12 samples of striped bass (Morone saxatilis, all of them juveniles: 11 from Gadwall Canal at Santa Cruz Gun Club, and one from Camp 13 Ditch at Checkpoint 4) exceeded the threshold of concern for selenium in warmwater fish.*
- *Thirty-two samples of invertebrates were collected in the South Grasslands. Thirteen of these (40.6 percent, Figure 5) reached or exceeded the threshold of concern for invertebrates as diet for birds (3 µg/g dietary selenium). The most effective invertebrate bioaccumulators of selenium were European freshwater snails (Physa) and Siberian shrimp (Exopalaemon modestus). The latter is a recently introduced species that evidently bioaccumulates selenium more effectively than other aquatic invertebrates in the area, such as red crayfish, that it seems to be replacing."*

In the second study, the Service's Division of Natural Resources, Branch of Refuge Biology, Vancouver, WA, conducted follow-up collections during 2005 to determine selenium concentrations in aquatic birds after long-term use (20 years) of predominately freshwater for wetland management in the Grasslands (Paveglio and Kilbride 2007). The authors found the following, *"Selenium concentrations were higher for birds from the South Grasslands during 2005, which historically received more undiluted drainage water compared with the North Grasslands. Liver selenium concentrations for black-necked stilts from the South Grasslands were within ranges associated with the first incidence of reproductive impairment. Shovelers, coots, and black-necked stilts from the South Grasslands during 2005 were found to be significantly above the background level (at a 95% confidence level)..."* The authors reported selenium concentrations in livers from northern shovelers collected in the south Grasslands (8.5 – 11 µg/g dry weight) that were comparable to levels associated with significantly reduced disease resistance and increased mortality in a controlled field experiment on mallard ducks (Hansen and Whiteley 1990; Whiteley and Yuill 1991). Paveglio and Kilbride concluded that selenium cycling within Grasslands wetlands likely is attributable to three factors: 1) historic use of agricultural drainage resulting in a reservoir of selenium in wetlands and supply channel sediments; 2) storm-water inflows; and, 3) unregulated inflows of subsurface drainage directly into wetlands or indirectly into their supply channels. USFWS-7

Recommendation: The final EIS should be revised to include an analysis of the effects of current selenium levels in the Grasslands wetland supply channels to biota in the vicinity. As noted in our comments under Purpose and Need 1 of these comments, the final EIS should incorporate actions that address the other sources of drainage contamination in the Grasslands wetland supply channels.

4. **Identification of what measures will be implemented should the drainage treatment and disposal technologies prove technologically or economically infeasible**

The proposed action relies on drainage treatment and disposal technologies that have not yet been fully tested nor proven feasible or cost effective. As is noted on page 1-2 of the DEIS/DEIR, "*It is anticipated that the proposed continuation of the Grassland Bypass Project for an additional 10 years would allow enough time to acquire funds to develop feasible treatment technology in order to meet the 1998 Basin Plan objectives and WDRs…*" And on Page 1-5 the DEIS/DEIR states, "*The proposed continuation of the Grassland Bypass Project is needed in the short term (2010–2019) to allow time for additional research and evaluation of long-term treatment options and to secure funding to implement treatment and disposal of drainage and end products, primarily salt.*"

As described on Page 2-14, drainage management to achieve the selenium and salinity load limits established in the draft Use Agreement would involve three phases:

- Phase I: Purchase of land and planting to salt-tolerant crops;
- Phase II: Installation of subsurface drainage and collection systems, and an initial treatment/salt disposal system;
- Phase III: Completion of construction of treatment removal/salt disposal system. This phase would include expansion of the pilot treatment/salt disposal (under Phase II) with construction of full-scale treatment/salt disposal facilities, as well as waste disposal units, with or without production of usable water as a byproduct of the treatment process. USFWS-8

The SJRIP facility would be implemented on up to 6,900 acres of land within the GDA. This component of the GBP already dedicates specific lands for the irrigation of salt-tolerant crops with subsurface drainwater to reduce the volume; would treat the concentrated drainwater to remove salt, selenium, and boron; and would dispose of the removed salts "in valley" to prevent them from discharging to the San Joaquin River. The treatment systems would also potentially produce a product water-sufficient in quality for reuse on agricultural lands within the GDA. At completion, the facility is planned to handle all of the drainwater produced in the GDA (up to 29,500 acre-feet annually.

In Phase I of the SJRIP, 6,900 acres of such land were acquired, of which 4,300 acres were planted with salt-tolerant crops and placed as of November 2008 (incorporating an additional 500 acres on the western side of Russell Avenue).

By late 2007, Phase II was partially implemented with the installation of subsurface drains on approximately 1,700 acres within the 3,800-acre planted area. On-site tile drainage water is returned to the irrigation system or discharged. The Proposed Action would expand the drains and sequential reuse to the full acquired and planned acreage, up to 6,900 acres. The irrigation of salt-tolerant crops on the expanded area was evaluated in an Initial Study, and a Mitigated Negative Declaration was approved by Panoche Drainage District in August 2007. CEQA compliance was included on a programmatic basis in the 2001 GBP EIS/EIR. Site-specific environmental analysis has been/will be performed for each installation, as necessary.

No treatment has been implemented to date, although a pilot treatment project has been approved with its own CEQA review and is expected to remain in effect for 1 year. The treatment process and the specific facility location have not been selected. The implementation date for Phase III is presently unknown, in part because inadequate funds have been available for development of economically viable treatment/salt disposal alternatives. The goal of treatment is to remove the salt from the drainage system, maintain a salt balance for continued agricultural production in the region, and provide appropriate salt disposal. Additional NEPA/CEQA impact analysis would be required to implement the treatment component (beyond drainage reuse on the 6,900 acres at the SJRIP). Given the significant uncertainties associated with drainwater treatment and disposal, Presser and Schwarzbach (2008) concluded in a technical Analysis of In-Valley Drainage Management Strategies for the Western San Joaquin Valley, "*The treatment sequence of reuse, reverse osmosis, selenium bio-treatment, and enhanced solar evaporation is unprecedented and untested at the scale needed to meet plan requirements.*" The DEIS/DEIR does note the following should the treatment technology prove infeasible, "*If Phase III is not fully implemented because treatment is not feasible, then the reuse area would operate as long as possible and more drainage would be recirculated on-farm with resulting impacts on production.*"

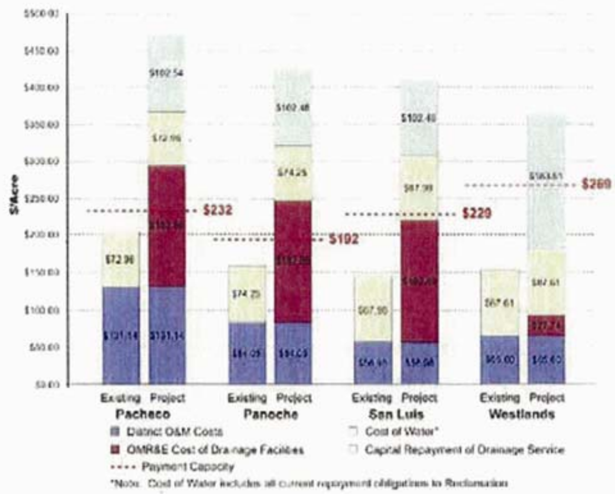
The DEIS/DEIR estimates the cost of drainage treatment to be $1500 per acre-foot of drainwater treated. Presser and Schwarzbach (2008) noted with respect to salt disposal after drainage treatment that, "*Salt produced and stored at the surface in solar evaporators in the 100,000-acre, 200,000-acre and 300,000-acre* [land retirement alternatives] *totals 412,000, 307,000 and 181,000 tons per year. At 50 years, the 100,000-acre land retirement option will require salt storage of 20 million tons in these evaporators or landfills. This salt will be contaminated with a variety of trace elements common in drainage waters including selenium, boron, molybdenum, chromium, and arsenic.*" It is unclear whether the cost figure in the DEIS/DEIR for treatment includes the cost of disposal of treatment brine, acquisition and operation of disposal sites (solar evaporators) and of landfill disposal of salts and trace elements. USFWS-8

Numerous planning efforts over the last several decades have looked into developing a feasible drainage solution in the San Joaquin Valley. The most recent of these efforts, the San Luis Drainage Feature Re-evaluation (SLDFR), selected the In-Valley/Water Needs Land Retirement Alternative in their Record of Decision (USBR March 2007). This alternative was considered as the locally preferred alternative because it most closely parallels a locally developed drainage plan—the Westside Regional Drainage Plan. The In-Valley/Water Needs Land Retirement Alternative includes drainage reduction measures, drainage water reuse facilities, treatment systems, and evaporation ponds. It differs slightly from the GBP Extension in the choice of a terminal disposal methodology (e.g., SLDFR: evaporation ponds; GBP Extension: an undefined salt disposal system). The DEIS/DEIR refers to a salt disposal system that would involve additional CEQA/NEPA analysis on the site and design-specific aspects of the facility including disposal of any treatment by-products. No other specific details are provided in the DEIS/DEIR.

In 2008 Reclamation completed feasibility-level designs and cost estimates (SLDFR Feasibility Report) for the SLDFR In-Valley/Water Needs Land Retirement Alternative (USBR March 2008). The SLDFR Feasibility Report concluded that because the In-Valley/Water Needs Land Retirement Alternative would result in net negative NED benefits, this alternative is not economically justified for implementation. The In-Valley/Water Needs Land Retirement Alternative has negative net NED benefits of ($131,146,000). The Feasibility Report concluded that the In-Valley/Water Needs Land Retirement Alternative is financially infeasible for implementation. The Feasibility Report found that, "*Only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing district O&M and assigned annual OMR&E costs of drainage service. None of the four water districts have the ability to fully repay its assigned capital costs of drainage service facilities. The implementation of either action alternative would far exceed their ability to repay the associated costs of the project when coupled with their existing obligations…*"and that, "*None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if* [the] *action alternative is implemented.*" USFWS-8

Figure 9 illustrates the four San Luis Unit water districts' payment capacity relative to their existing obligations and the implementation of the In-Valley/Water Needs Land Retirement Alternative at a cost per acre. While all four districts currently have some remaining payment capacity, implementing this alternative far exceeds their ability to repay the associated costs of the project when coupled with their existing obligations (USBR March 2008).

Figure 9. In-Valley/Water Needs Land Retirement Alternative district payment capacity ($/acre), with and without project (From USBR 2008, SLDFR Feasibility Report).



Recommendation: There remains significant uncertainty that a technically and economically feasible solution to treat and dispose of drainage will be found and implemented by 2015. If Phase III of the GBP is not fully implemented because drainage treatment and/or disposal is not economically or technically feasible, drainage would be routed to the reuse area and would be recirculated on-farm (similar to the No Action Alternative), and could result in adverse effects to fish and wildlife resources. The final EIS should identify how the GBP Extension will meet selenium and salinity load limits after year 5 of the project if the drainage treatment and disposal technologies fail to meet expectations. USFWS-8

Project Effects Not considered

<u>Mercury in the Grassland watershed</u>

In 1987, mercury was identified as a potential substance of concern in agricultural drainage water from the west side San Joaquin Valley and was assigned to the highest priority rank (Hansen and Morehardt 1987). The San Joaquin Valley Drainage Program identified mercury as a substance of concern that warrants further attention (Moore *et al.* 1990). Elevated concentrations of vanadium, chromium, and mercury have also been observed in the shallow groundwater in the San Luis Unit (Deverel *et al.* 1984 cited in USBR September 2005).

Water quality sampling of the DMC sumps (along the Delta Mendota Canal in the Firebaugh Canal Water District) from 2002 through 2007 by Reclamation has documented elevated concentrations of total mercury in the sump water currently being pumped into the Delta Mendota Canal. Total mercury in water from the DMC sumps has ranged from 200 ng/L to 3,000 ng/L and is currently being pumped into the DMC upstream of Mendota Pool (USBR February 2008).

USFWS-9

Eighteen miles of Panoche Creek (from Silver Creek to Belmont Avenue) and the San Joaquin River (from Bear Creek to the Delta Boundary) are listed on the 2006 Clean Water Act section 303(d) List of Water Quality Limited Segments for mercury impairment (SWRCB 2007). Mercury levels in fish from the lower San Joaquin River and Mud Slough have been found to be elevated (Davis *et al.* 2000; Slotton *et al.* 2000). The principal finding of a CalFed Mercury Study in the San Joaquin Basin is that Mud Slough contributes about 50 percent of the methylated mercury at Vernalis (legal boundary of the Delta) but only 10 percent of the water volume during the non-irrigation season (September to March) (Stephenson *et. al.*, 2005).

Preliminary methyl mercury water data collected from the vicinity of the San Luis Drain was provided to the Service in a letter from Dr. Chris Foe, staff scientist of the Regional Board in 2005 (Foe 2005). In that letter Dr. Foe noted, "*Regional Board staff has been monitoring methyl mercury concentrations in the San Joaquin watershed for the past two years to identify sources and to characterize concentrations and loads. The highest concentrations in the Basin occur in Mud Slough downstream of the inflow from the San Luis Drain (GBP monitoring site D). Methyl mercury loads in Mud Slough are sufficiently high that they may account for 40-60 percent of the Vernalis load during non-irrigation season. Similar calculations have not been made for the* *irrigation season as the amount of water removed and returned to the River by water agencies and others is not known. However, Mud Slough concentrations and loads remain high suggesting that the Slough is still a significant source of River methyl mercury. The non-irrigation season loads imply that Mud Slough is responsible for about half the methyl mercury accumulating in fish in the main stem San Joaquin River in winter. The source of the methyl mercury in Mud Slough is not known."* Table 7 summarizes the preliminary methyl mercury concentrations for the San Joaquin River at Vernalis, and for Mud Slough at site D and the San Luis Drain.

Dr. Foe concluded that, "*The results suggest that methyl mercury concentrations at all three sites are elevated and may constitute a health hazard to wildlife consuming local fish. Methyl mercury mass balance calculations have not yet been made for Mud Slough. Regional Board staff has commenced a mass balance study to better define the primary source(s) of methyl mercury in Mud Slough.*"

Table 7. Summary of unfiltered methyl mercury concentrations (ng/L) in the Grassland Bypass portion of the San Luis Drain, Mud Slough at Site D and San Joaquin River at Vernalis (from Foe 2005).

Date	San Luis Drain @ Site B	Mud Slough @ Site D	San Joaquin @ Vernalis
6/14/05	0.302	0.671	0.235
7/13/05	0.648	0.769	0.218
8/9/05	1.150	1.430	0.226
9/12/05	0.846	1.070	0.062

USFWS-9

Recommendation: Given the fact that some drainage sump water in the GBP DPA (i.e., DMC sumps) and the San Luis Drain is elevated in total mercury, a more comprehensive reconnaissance survey of the extent of mercury contamination in subsurface drainage in the DPA is warranted. The Service therefore recommends that if the GBP is extended, monitoring and reporting for total mercury and methyl-mercury concentrations in water and biotic tissue be required at all sampling locations of the GBP to establish a mass-balance of sources of mercury in this watershed.

Cumulative Effects Not Considered or Adequately Addressed

The Council on Environmental Quality's (CEQ) regulations (40 CFR §§ 1500 – 1508) implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 §§ 4321 *et seq.*) define cumulative effects as:

> *"The impact of the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless*

of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7)."

The final EIS should discuss the relationship between the GBP Extension and past, present and future reasonably foreseeable projects in the Cumulative Effects Section of the DEIS. Specifically, the final EIS should provide additional information on cumulative impacts of past and present water transfer programs such as the San Joaquin River Exchange Contract 10-year Transfer Program and the San Joaquin River Exchange Contract 25-year Transfer Program and future projects including the San Joaquin River Restoration. In addition, the final EIS should analyze the effects of the GBP Extension on water quality should the Vernalis Adaptive Management Program not be continued past 2010, and should assess the effect of operations of the south Delta temporary barriers on transport and environmental fate of selenium and sulfate in the Delta.

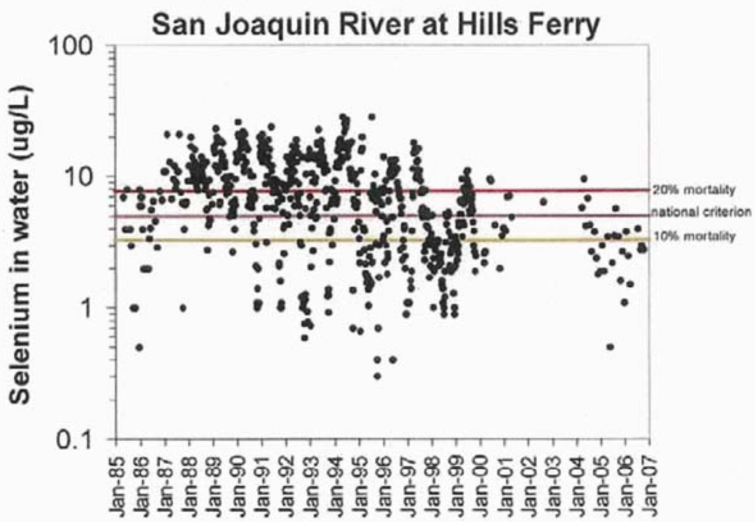
San Joaquin River Restoration Settlement

The DEIS/DEIR briefly describes the cumulative effects of the GBP Extension on the San Joaquin River Restoration Settlement (4-67 to 4-68). This section concludes, "*Alternatives would result in slightly reduced flows in the San Joaquin River, as compared to existing conditions, which would be in conflict with the San Joaquin River Restoration Settlement goals for flow; however, the two Action Alternatives will result in less Se* [selenium] *contamination in the lower San Joaquin River*."

The Service believes that further discussion and analysis in the DEIS/DEIR is needed on the effects of the GBP Extension selenium discharges on anadromous fish including the proposed San Joaquin River Restoration runs of Chinook salmon and steelhead. The San Joaquin River Restoration Program (SJRRP) is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River, ensure irrigation supplies to Friant Water users, and restore a self-sustaining Chinook salmon fishery in the river. The SJRRP will implement the San Joaquin River Litigation Settlement (Settlement), filed in Federal Court in September 2006 (SJRRP 2007). The SJRRP includes a Restoration Goal to, "*To restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish*." A Draft SJRRP Environmental Impact Statement/Environmental Impact Report (Draft Program EIS/R) is scheduled for release in Spring 2009. The Final Program EIS/R is scheduled for release in July 2009 (SJRRP 2008). The Settlement calls for interim flows to begin in the fall of 2009 and full restoration flows to begin no later than January 2014. Additionally, salmon are to be reintroduced no later than December 31, 2012, in the upper reaches of the San Joaquin River (SJRRP 2007). USFWS-10

In an analysis of the effects of San Luis Unit selenium contamination on federally-listed species, Beckon and Maurer (2008) found that seepage and flood flows carrying agricultural drainwater from the San Luis Unit into the San Joaquin River may impact Chinook salmon and steelhead and could impair efforts to restore them to upstream reaches of this river. Central Valley Chinook salmon and steelhead are among the most sensitive of fish and wildlife to selenium exposure. They are especially vulnerable during juvenile life stages when they migrate and rear in selenium-contaminated Central Valley rivers and the San Francisco Bay/Delta estuary. Rivers and sloughs that carry agricultural drainwater, concentrations of selenium in invertebrates, small (prey) fish, and larger predatory fish commonly reach levels that could kill a substantial portion of young salmon (Beckon *et al*. 2008) if the salmon, on their downstream migration, are exposed to those selenium-laden food items for long enough for the salmon themselves to bioaccumulate selenium to toxic levels. Based on existing water quality data for selenium in specific reaches of the San Joaquin River, Beckon and Maurer (2008) concluded that there remains a substantial ongoing risk to migrating juvenile Chinook salmon and steelhead in the San Joaquin River, as shown in Figure 10 below.

Figure 10. Selenium concentrations measured in the San Joaquin River at Hills Ferry (data from the Central Valley Regional Water Quality Control Board).



USFWS-10

Recommendation

The final EIS should include an evaluation of effects of GBP selenium discharges on anadromous fish including the proposed San Joaquin River Restoration runs of Chinook salmon and steelhead. USFWS-10

San Joaquin Exchange Contractors 10-Year Transfer Program

In 2005, Reclamation finalized an EIS/EIR on the San Joaquin Exchange Contractors' 10-year Transfer Program (SJEC EIS/EIR; USBR December 2004). This program allows for the transfer of up to 130,000 acre-feet of substitute water annually to several potential agricultural, municipal and wetland users for a period of 10 years. The preferred alternative would develop up to 130,000 acre feet of water during non-critical years, with up to 80,000 acre feet of water made available through conservation (including tailwater recovery) and groundwater substitution (up to 20,000 acre feet) and up to 50,000 acre feet of water made available through crop idling/temporary land fallowing. During critical years, up to 50,000 acre feet of water may be made available through crop fallowing, and no water is to be made available from conservation/tailwater recovery and groundwater resources.

Modeling of the effects of the preferred alternative in the SJEC EIS/EIR estimated up to a 47 percent flow reduction in Mud and Salt Sloughs during the late spring and dry and below normal water years. The largest reductions in flow would occur during April (36 percent) and May (47 percent) as shown in Table 6-5 of that document. Reclamation determined that the flow reduction would not have a significant effect on the extent or quality of the aquatic or upland habitats in Mud and Salt Sloughs because the flow reductions were in the range of fluctuation that occurs during normal and dry/below normal years (USBR December 2004). The Final SJEC EIS/EIR did not, however, compare the frequency of such flow reductions between the "with project" and "without project" conditions. The effect of reduced flows in Mud and Salt Slough on selenium concentrations in these channels was likewise not analyzed (S. Leach, pers. comm. March 6, 2006). It is reasonable to expect that a reduction of flow in these channels combined with continued selenium inputs into the Grasslands wetland supply channels could result in higher selenium concentrations and potentially a greater frequency of occurrence of water quality objective exceedences in these channels. USFWS-11

Modeling of the effect of the preferred alternative in the SJEC EIS/EIR also indicated reduction in flows in the San Joaquin River at Vernalis. These reductions were shown to vary from 0 to 11 percent. During the late spring out-migration period for anadromous fish, flows would be reduced by 3 to 8 percent (Table 4-44 of the SJEC EIS/EIR). Summer flow reductions would be as high as 11 percent in July. Smaller (2 percent) reductions were predicted in the fall when salmonids begin to migrate upstream in the San Joaquin River. Reclamation determined these reductions in flow did not have a significant effect on the flow or water quality in the San Joaquin River because flow reductions were still within the range of inter-annual variations in monthly river flow as shown in Table 4-1 of that document (USBR December 2004).

Recommendation: The effects of flow reductions in Mud and Salt Sloughs and the San Joaquin River as a result of the SJEC 10-Year Transfer Program combined with continued drainage discharges from the GBP Extension needs to be evaluated in the final EIS. USFWS-11

San Joaquin River Exchange Contract 25-year Transfer Program

In 2007 Reclamation and the San Joaquin Exchange Contractors finalized an Environmental Assessment/Initial Study (EA/IS) for a 25-Year Groundwater Pumping/Water Transfer Project (GW/Transfer Project) proposed by the San Joaquin River Exchange Contractors Water Authority. The Proposed Action would develop up to 20,000 acre-feet/year (AFY) of substitute water from a combination of groundwater pumping and conservation/rotational land fallowing. The Proposed Action would include a maximum groundwater pumping regime of 15,000 AFY from up to 20 wells located in the drainage impaired area of Firebaugh Canal Water District and Central California Irrigation District (CCID). The groundwater would be pumped from the upper aquifer above a depth of 350 feet (above the Corcoran clay) but below the drainage-impaired shallow groundwater, blended with surface water deliveries into two CCID canals (Outside and Main) to ensure adequate water quality for irrigation needs, and then delivered downstream for agricultural use and refuge water supplies. The pumped groundwater would substitute for CVP surface water delivery primarily from the Delta Mendota Canal. An additional 5,000 AFY of water would be "developed" for transfer from conservation and/or rotational land fallowing. The Proposed Action would free up a commensurate quantity of water of the San Joaquin Exchange Contractors' contract supply equivalent to the quantity developed by this project (up to 20,000 AFY) for transfer to San Luis Unit contractors and Santa Clara Valley Water District (USBR November 2007). USFWS-12

The Service submitted comments on the EA/IS for this project that included the following concerns regarding impacts to water supplies used by the public and private wetlands in the Grasslands Area (USFWS 2007): *"Groundwater substitution (pumping groundwater in the drainage impacted area of Firebaugh and Central California Irrigation District) will likely reduce quality (increase total dissolved solids) of water delivered to Grasslands wetlands and refuges. Effects of groundwater degradation and associated effects to downstream refuge water quality were not adequately addressed in the EA/IS for this project. This transfer program also utilizes land fallowing or tailwater recapture and canal lining for up to 5,000 AFY which could likely have an added effect (beyond what was considered in the 10-year transfer program EIS/EIR for the San Joaquin Exchange Contractors) on reducing dilution flows in the Grassland wetland channels which could result in further water quality degradation (increases in selenium, boron, and salt concentrations) in those waters."*

Recommendation: The effects to flow and water quality of this 25-year transfer program in combination with the 10-year transfer program described above needs to be addressed in the Cumulative Effects Section of the final EIS for the GBP Extension.

Vernalis Adaptive Management Program

As is noted on Page 4-66 of the DEIS/DEIR the Vernalis Adaptive Management Program (VAMP) is, "*designed to provide augmented flows to the San Joaquin River to benefit fish* USFWS-13 *migration from 1990–2010. This plan resulted in the planned releases of up to 110,000 acre-feet (or more under some hydrologic conditions) during the April to May period, and an additional 12,500 acre-feet of flow during the month of October. The influence of these flows is included in the receiving water model for the Grassland Bypass Project. Therefore, cumulative affects of these flows have already been included in the analysis.*" However, the DEIS/DEIR notes, "*At issue is whether the plan will continue after 2010 when the current San Joaquin River Agreement expires.*" USFWS-13

Recommendation: The Service recommends that the final EIS include an analysis of the GBP Extension and associated effects to water quality in the San Joaquin River both with a continued VAMP and with no VAMP after 2010.

Operation of South Delta Barriers

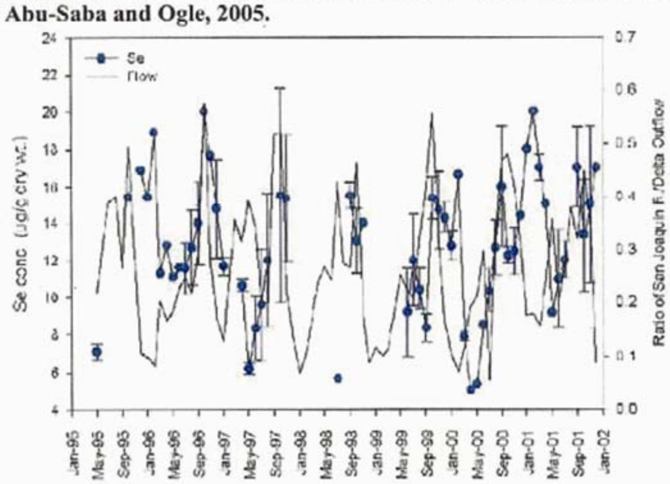
The south Delta barriers project consists of four rock barriers across South Delta channels. In various combinations, these barriers improve water levels and San Joaquin River salmon migration in the South Delta. The existing temporary barriers program in the south Delta consists of installation and removal of temporary rock barriers at the following locations: 1) Middle River near Victoria Canal, about 0.5 miles south of the confluence of Middle River, Trapper Slough, and North Canal; 2) Old River near Tracy, about 0.5 miles east of the DMC intake; 3) Grant Line Canal near Tracy Boulevard Bridge, about 400 feet east of Tracy Boulevard Bridge; and, 4) the head of Old River at the confluence of Old River and San Joaquin River. Operational effects of the south Delta temporary barriers were assessed in the Service's Biological Opinion on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP), dated December 15, 2008 (Service File No. 81420-2008-F-1481-5). USFWS-14

As was noted in Monsen *et al.* (2007) localized diversions such as the south Delta barriers can have regional-scale consequences, some unintended and conflicting with other management objectives. Specifically with respect to the Old River barrier Monsen *et al.* (2007) found, "The head of Old River barrier directs San Joaquin flow to the central Delta mixing zone rather than to the south Delta toward the export pumps." Greater outflow of the San Joaquin River associated with operations of south Delta temporary barriers could result in transport of selenium and sulfate from agricultural drainage discharges of the GBP Extension into the Delta (Lucas and Stewart 2007).

In a report assessing the selenium impairment of San Francisco Bay, Abu-Saba and Ogle (2005) included a graph of selenium concentrations in *Corbula amurensis* plotted against the ratio of San Joaquin River/Delta Outflow (see Figure 11 below). Concentrations of selenium were found to be generally highest when proportionally more San Joaquin River to Sacramento River water contributed to Delta Outflow. Lucas and Stewart (2007) provided some discussion on seasonal trends of bivalve selenium concentrations in the North Delta and its relationship to the San Joaquin River, "*Several explanations for the temporal trends in bivalve Se concentrations (which did not exist in the 1980's) are possible. One possibility is that refinery inputs of selenium have been replaced by San Joaquin River inputs. Models indicate that if SJR inflows to* *the Bay increase, as they may have in recent years with barrier management, particulate Se concentrations in the Bay could double, even with no increase in irrigation drainage inputs to the SJR. The fall increase in Se in C. amurensis also occurs during the time period when the ratio of SJR/Sac River inflow is highest. Further changes in water management could exacerbate these trends..."*

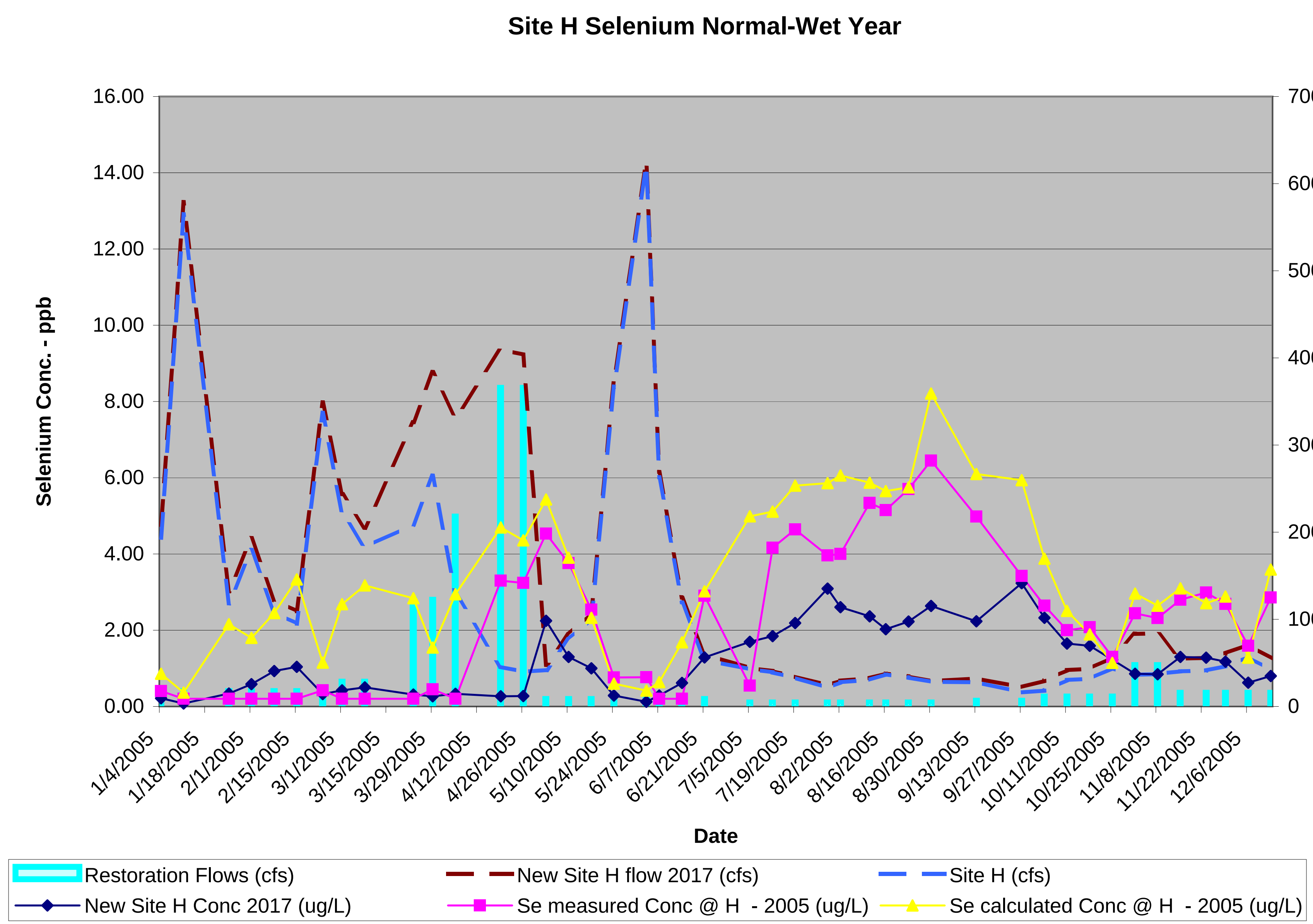
Since its introduction in 1986, the clam *C. amurensis* has been found to be a dominant food item in the digestive tracts of benthivorous sturgeon and older splittail (Stewart *et al.*, 2004). The highest concentrations of selenium in fish were observed in older Sacramento splittail (length 18 cm; age 1-2 yr) and white sturgeon (length 135-171 cm; age 14-20 yr). Stewart *et al.* (2004) noted that older splittail and white sturgeon accumulated concentrations of selenium that, "*... are beyond the toxicity threshold and have been correlated with adverse reproductive effects.*" Linville (2006) concluded that, "*Se concentrations in the benthic food web* [of the North Delta] *should be routinely monitored since relatively small increases of Se in the food web can lead to increased toxicity to this species. Careful management of all processes with potential to increase Se concentrations in the benthic food web is essential to protect sturgeon in San* USFWS-14 *Francisco Bay-Delta and other high-Se systems.*" Kaufman *et al.* (2008) reported that green sturgeon were found to be much more sensitive to selenium exposure than white sturgeon at levels currently found in the SF bay-Delta.

Figure 11. Monthly selenium concentrations (µg/g, dry wt) in *Potamocorbula amurensis* at Carquinez Strait. Also plotted is the ratio of monthly flow from the San Joaquin River relative to total Delta outflow. Data from Linville *et al.* (2002) and Luoma (unpublished data). From Abu-Saba and Ogle, 2005.



Sulfate loading in the San Joaquin River from the GBP Extension and in association with operations of south Delta temporary barriers could result in downstream impacts not considered in the DEIS/DEIR. Quinn *et al.* (2006) reported that of the total salt load exported to the San Joaquin River, agricultural subsurface drainage discharged to the San Joaquin River (most from the GBP) accounts for about 34.6 million m^3 per year (28,000 ac-ft per yr), and 110,000 metric tons (121,000 tons) of salt (primarily as sodium sulfate). Wood *et al.* (2006) found that sulfate concentrations are about seven times higher in the San Joaquin River than in the Sacramento River. An indirect consequence of the south Delta barriers is that their operation will affect sulfate concentrations in much of the central and southern Delta. Sulfate reducing bacteria are the primary agents responsible for the methylation of mercury in aquatic ecosystems. Wood *et al.* (2006) noted that addition of sulfate is predicted to stimulate methylmercury production when it is limiting. Two factors influencing sulfate concentrations in the Bay-Delta are the electrical conductivity concentrations (EC) and the ratio of San Joaquin River to Sacramento River water. USFWS-14

Recommendation: The final EIS should assess the effect of operations of south Delta temporary barriers on transport and environmental fate of selenium and sulfate from the GBP into the Delta. Specifically, the final EIS should assess the effects of south Delta barriers on: selenium transport in the San Joaquin River to the impacted benthic foodweb in the Delta, and sulfate loading and its effect on methylation of mercury in the Delta.



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RESPONSE USFWS

US Fish & Wildlife Service
Jan Knight March 23, 2009

The GDA does not include the lands that are described, and they are not under the jurisdiction of the Grassland Basin Drainers (GBD). Additionally the GBD have no authority to compel these lands to become part of the GBP. However, the GBD will work with the landowners in the areas described to encourage management of drain waters that may contain selenium that is entering wetland supply channels and specifically will work with the 1,100 acres of lands that are identified as lands that "... could be annexed to the GDA." Proposals related to the DMC sumps, see response 2 below, should go a long way to minimize the infrequent occurrences of selenium exceedances from areas outside of the GDA that cause the selenium concentrations to be above the 2 ppb monthly mean water quality objective that has been identified for the wetland channels (see Figures 4-16 to 4-19 on pages 4-36 through 4-37 of the EIS/EIR). It should be noted that for the vast majority of the time, the monthly average selenium concentrations are below the 2 ppb monthly mean selenium water quality objective. Additionally the occasional exceedances of the objective occur when there is little to no flow in the channels.

USFWS-2
The GBD have requested that Reclamation enter into a process to identify and negotiate terms to include Reclamation's Delta-Mendota Canal (DMC) sumps into the GBP and SJRIP facility reuse area and to remove DMC sump discharges from the Delta-Mendota Canal. These sumps were installed under a long-term commitment by Reclamation to mitigate for drainage impacts in the unlined portion of the Delta-Mendota Canal resulting from its construction and operation. The DMC sumps provide a benefit to Central Valley Project operations generally and are separate from the Grassland Bypass Project. Therefore, any agreement to reroute the sumps for disposal through the Grassland Bypass Project must address Reclamation's responsibility for treatment and disposal of this additional subsurface drainage water and how this reduction fits into the respective obligations under the Regional Board's salt, boron and selenium TMDLs.

USFWS-3
The issues, described in the recommendation under comment 3 on sources of Se/heavy rainfall events, were recognized and are dealt with in the Use Agreement in Appendix A of the EIS/EIR. Recital K on page 7 states:

> *"K. RECLAMATION anticipates that any long-term use of the Drain beyond the term of this Agreement will be for a program for discharging storm water only. Any such stormwater discharge program will require further specific planning and compliance with all environmental laws, including the National Environmental Policy Act and the Endangered Species Act. Terms of this Agreement have been negotiated by a group of agricultural and environmental stakeholders, and contains three distinct mechanisms to provide incentives to implement an in-valley drainage management solution as soon as possible, such that (i) Load Values decrease over the term of this Agreement;(ii) Incentive Fees increase over the term of this Agreement and (iii) mitigation obligations increase over the term of this Agreement, with significant changes*

> *applying during Years Six through Ten (2015-2019) in particular; however, such mechanisms do not constitute a model, or form the baseline of requirements for any long-term storm water discharge program, which will be required to meet regulatory requirements for such program."*

In addition the Use Agreement states in Section III Permits and Responsibilities on page 12:

> *"2. No later than Year Seven (2016), the Draining Parties shall begin developing a long-term storm water management plan, which may include evaluation of utilizing the San Luis Drain to bypass storm water flows around some wetland areas."*

This Use Agreement was negotiated by a stakeholder group that included Contra Costa County, Contra Costa Water District, Environmental Defense, The Bay Institute, U.S. Fish and Wildlife Service (Service), California Department of Fish and Game, Environmental Protection Agency, and the Central Valley Regional Water Quality Control Board (Regional Board).

The existing Storm Water Plan would continue as part of the Project (see EIS/EIR pages ES-6, 1-3, and 2-9).

USFWS-4

The comment and recommendation deal with Se and salinity load limits especially in above normal and wet water year types.

The existing Basin Plan includes a TMDL for selenium which was approved by EPA on March 28, 2002. This TMDL includes monthly and annual selenium load targets separated into four water year types as defined in the TMDL, wet, above normal, dry/below normal and critical. The load values in the Use Agreement (Appendix A of the EIS/EIR) comply with this approved TMDL. The GBD have operated in good faith over the last few years, assuming that discharging less than the TMDL was a good thing and that there would not be penalties for discharging short of what was allowed. The quantity of selenium load that is discharged is not controllable to the exact amount. The GBD agreed to reduce loads starting in year 6 of the new Use Agreement (Appendix A of the EIS/EIR) below the approved TMML.

In addition there are other provisions in the new Use Agreement which promote continuous improvement in water quality in the San Joaquin River in every year of the agreement. First the dramatically reduced load values, increased incentive fees, and increased mitigation costs in years 6 -10 of the Agreement will encourage and promote the GAF to develop and implement load reducing projects in an effort to eliminate discharges prior to year 6 of the agreement. The stringent terms in years 6 and beyond will result in the GAF testing projects in order to prove their effectiveness prior to year 6. These provisions promote improvement in San Joaquin River water quality in every year of the agreement. Additionally, the incentive fee credit system provides an on going incentive to discharge as little as possible. These incentives in the current Use Agreement have proven effective at inducing the GAF to discharge below the applicable load limits and have resulted in continuous improvement in water quality in the San Joaquin River such that the Regional Board recently approved the delisting (from CWA section 303(d)) of the San Joaquin River (below the Merced River to the Delta Boundary) for selenium (June 2009).

The continuation of the Grassland Bypass Project for 2010-2019 is needed because without Phase III treatment, all of the drainwater from the CDA cannot be managed. See Section 2.2.1.2.1 for the selenium and salt load reductions through 2019 and Section 2.2.1.2.2 for the Phase III treatment and disposal discussion and the transcript from the public hearing with comments by Jose Faria on the pilot treatment plant.

USFWS-5

The comment is that sediment disposal on upland open areas is not adequately addressed, and the EIS/EIR preparers disagree and provide the following clarification.

With regard to the Clean Water Act and required permits, the Sediment Management Plan (SMP, Appendix B) states on page 4-3 that, "Application of sediments on open space lands is of concern due to leaching of sediments into wetlands and other areas of ecological significance which may result in impacts to wildlife. Prior to application of dredged materials onto open space areas, wetland areas will be delineated and avoided." Therefore, the Proposed Action would not be subject to any permits under the Clean Water Act. However, to provide even greater clarity and assurance that impacts to wetlands will be avoided, and a Section 404 permit would not be required from the U.S. Army Corps of Engineers, the following statement has been added to the SMP:

> "Application of sediments on open space lands is of concern due to leaching of sediments into wetlands and other areas of ecological significance which may result in impacts to wildlife. Prior to application of dredged materials onto open space areas, wetland areas will be delineated and avoided. <u>All required permits and approvals would be obtained prior to application of sediment on adjacent areas."</u>

With regard to the comment related to hazardous waste concerns, page 2-2 of the SMP provides a definition of hazardous waste as defined by the State of California. Further, page 3-1 of the SMP, states that none of the sediment samples taken over the last decade have exceeded hazardous waste criteria; and page 4-1 of the SMP specifies "If the concentration of selenium in the dredged material is equal to or greater than 100 µg Se/g, wet weight the sediment will be handled according to all applicable State and local regulations for hazardous materials and disposed in a licensed hazardous waste facility. The nearest facility to the Site which accepts hazardous material is Kettleman Hills Landfill, located in Kings County."

The comment that the ecological risk criteria used in the SMP represents the estimated EC10 for catastrophic selenium contamination, and recommending that the correct Ecological Risk Criteria for selenium in sediment (0.5 µg/g, dry weight) found in the Environmental Protection Agency's (EPA) (2007) Selenium Ecological Soil Screening Levels should be used is noted.

The EPA 2007 Selenium SSL 0.5 mg/kg dry weight threshold recommended by the USFWS is intended as a screening level for concentrations of selenium in soil that would be harmful to plant life; however, the study referenced in the SMP (Zawislanski et al 2001) shows that plants are tolerant to selenium concentrations much greater than this level under these site-specific conditions. A further analysis of ecological risk analyses of the effects of selenium to wildlife is provided in Section 6.2.1.4 of the EIS/EIR. The ecological risk criteria used in the SMP corresponds with the guidelines shown in Table 6-4 of the EIS/EIR. Further, these criteria are also more conservative that the toxicity threshold stated in the 2001 USFWS Biological Opinion for the Grassland Bypass Project (quoted by the commenter); therefore, no changes to the ecological risk criteria have been made.

With regard to the commenter's objection to the "Acceptable Concentrations of Selenium in Sediment" presented in Table 3 of the SMP for the disposal of dredged material on Open Space (Upland Areas – outside of wet season) of 2 – 390 µg/g selenium, dry weight, that this range of concentrations in sediment would likely pose a risk to wildlife foraging in the upland areas where dredged material is disposed of, this comment has been noted and considered. The SMP has been revised as follows:

Table 3. Acceptable Concentrations of Selenium in Dredged Material by Land Use

Land Use	Acceptable Concentration of Se in Sediment
Residential development	< 100 µg Se /g, wet weight
Industrial development	< 100 µg Se /g, wet weight
Agriculture	< 10 µg Se /g, dry weight*
Open Space (Wetland and Upland)	< 2 µg Se /g, dry weight
~~Open Space (Upland – outside of wet season)~~	~~2 – 390 µg Se /g, dry weight~~
~~Open Space (Upland – wet season)~~	~~< 2 µg Se /g, dry weight~~

4.2.3 Application on Open Space Lands

Application of sediments on open space lands is of concern due to leaching of sediments into wetlands and other areas of ecological significance which may result in impacts to wildlife. Prior to application of dredged materials onto open space areas, wetland areas will be delineated and avoided. Sediments~~, not~~ deemed not hazardous material and meeting the criteria provided in Table 3, may be applied to upland areas outside of the wet season.

In addition, the following change has been made to Section 2.2.1.2.3 of the EIS/EIR:

> Sediments that contain Se concentrations below hazardous waste criteria but exceed ecological risk criteria may be applied for reuse to lands zoned for residential or industrial development, ~~and upland open areas outside of the rainy season~~. Sediments that are below the ecological risk criteria may be applied with unrestricted use. Possible agricultural lands for sediment disposal have been identified in close proximity to the Drain, and no sediment disposal to residential or industrial lands is proposed. The SMP also includes post-application monitoring protocol for all land application sites.

The comment regarding the Zawislanski et al 2002 study conclusion that cantaloupe and wheat should not be grown in soils amended with very high Se sediment, in the 50- to 100-mg/kg range due to potential human health risks is noted and considered. Section 4.2.2 of the SMP has been revised as follows:

> The majority of land available for application of dredged sediments in the vicinity of the San Luis Drain is zoned for agriculture and open space. Plot experiments conducted by

the Lawrence Berkeley National Laboratory (Zawislanski et al 2001) indicate that while application of sediments on these lands is appropriate with regards to human health PRGs and hazardous material criteria, leaching of selenium into groundwater is of concern due to the physical mixing of soils and irrigation which occur regularly as part of agricultural operations. Therefore, this study recommends that only dredged sediments with selenium concentration below 10 micrograms per gram be applied to agricultural lands. With regard to plant uptake and human ingestion, selenium concentration within sediments is well below stated PRGs. However, sediments with selenium concentrations above 50 micrograms per gram may result in plant concentrations above U.S. Department of Agriculture Recommended Daily Levels (Zawislanski et al 2002); therefore, sediments with selenium concentrations greater than 10 micrograms per gram may only be applied to agricultural fields growing non-consumptive crops (e.g. pasture, alfalfa, wheatgrass) until monitoring shows selenium levels have decreased to 10 micrograms/gram. ~~therefore, t~~This plan does not place a limit on the type of agricultural field that sediments with concentrations below 10 micrograms per gram may be applied to. For sediments that exceed the 10 microgram per gram recommendation (but that are still below human health PRGs and hazardous material criteria) to be applied to agricultural lands the following sections apply.

The commenter noted that the 2001 Biological Assessment stated that a monitoring program would be designed with recommendations from the Service to address potential kit fox exposure to selenium. Comment noted and considered. The following bullet has been added to the end of Section 4.2.5 of the SMP:

- In agricultural area where sediments greater than 10 mg/kg are applied and crops are grown for human consumption, the selenium concentration of the plants will be tested prior to harvest. If the selenium concentration is greater than 10 mg/kg, compliance monitoring designed for small mammals as required by the 2001 USFWS Biological Opinion will be implemented to confirm that selenium uptake by wildlife is not being accumulated to levels of concern.

USFWS-6

Drainage water sprayed on dirt roads for dust control is a fully controlled operation. The operation is used to wet dirt roadways in agricultural areas, not to pond water on them. The dust control operation is fully controlled using timers to prevent any ponding and to not allow runoff from the roadways. The activities are within the agricultural area of the GDA and are not near any wildlife habitat areas. Selenium that is in the water was removed from immediately adjacent fields, so there is no selenium addition to the area.

USFWS-7

Sensitive fish species do not occur in the Grassland wetlands or their supply channels and thus would not be affected by release of selenium from sediments. Additional data on current selenium levels in biota found in the Grasslands wetlands areas has been added as Appendix E3. Potential effects due to changes in selenium bioaccumulation in wetland areas (including special status species) are already discussed for the No Action, Proposed Action, and Alternative Action (Sections 6.2.2.1, 6.2.2.2, and 6.2.2.3, respectively).

The comment notes that exceedances of the 2 µg/L selenium objective in water from water from wetland supply channels still occurs. This is shown in Figures 4-13 through 4-19 of the EIS/EIR, which graph the monthly mean selenium concentrations at multiple locations in the wetland channels. However, Figure 8 in the USFWS comments inappropriately compares the 2 µg/L monthly mean objective to weekly grab concentrations. Figures 4-13 through 4-19 show that exceedances of the objective have decreased substantially in recent years.

The following revisions have been made in Section 6 to refer to the new material presented in Appendix E3:

6.2.2.1.1

IMPACTS WITHIN AREA 2

Currently, waterways and wetlands channels within Area 2 do not receive water from the GDA except under storm flow conditions. As described in Appendix E3, selenium levels in biota inhabiting the wetlands areas already exceed toxicity thresholds for avian eggs, fish, and invertebrates. Under the No Action Alternative, seepage of high Se water from the GDA to Area 2 would occur. Many of these waterways are located within state and federal wildlife management areas.

6.2.2.1.2

Drainage water would also seep into canals and channels conveying water to wetlands in Area 2, which would cause significant adverse effects on water quality in all wetlands within those areas. As this water would contain higher salt levels, there is potential that this would degrade a substantial portion of the vegetation within these wetlands, a significant adverse impact to wetlands. In addition, this water would contain elevated concentrations of Se, which could increase risk to fish and birds feeding in the wetlands. As described in Appendix E3, selenium levels in biota inhabiting the wetlands areas already exceed toxicity thresholds for avian eggs, fish, and invertebrates. Water with high concentrations of Se is not expected to reach Mud Slough, and with no Se input from the San Luis Drain, Mud Slough wetland water quality is expected to improve.

6.2.2.1.4

Under the No Action Alternative, cooperative interagency drainwater management would be limited to the SJRIP. Agricultural subsurface drainwater from the GDA would neither be channeled into the San Luis Drain, nor could it be legally discharged into wetland channels under the terms of applicable waste discharge requirements. However, some subsurface drainage may migrate laterally into wetland channels. In addition, some subsurface drainage may seep into open ditches in the agricultural areas within the GDA. During major storm events, these ditches may overtop their banks, and surface flow of floodwaters mixed with surface and subsurface drainwater may spill uncontrollably into wetlands channels. This is expected to have a significant adverse effect on refuge ecosystems in the Project Area due to recontamination of wetland water supply channels that have benefited from declining contaminant levels since the Grassland Bypass Project began in 1996. Aquatic communities in most of these channels would be subject to increased risks due to higher concentrations of Se, boron, manganese, and other salts. Similarly, wetlands that receive their water supply from these channels would experience increased risks. As described in Appendix E3, selenium levels in biota inhabiting the wetlands areas already exceed toxicity thresholds for avian eggs, fish, and invertebrates. In terrestrial ecosystems surrounding the water channels and wetlands, species such as waterfowl and shorebirds that directly or indirectly use aquatic and wetland resources also would be subject to increased risks due to higher contaminant concentrations. These adverse effects are likely to be significant.

6.2.2.2.1

IMPACTS WITHIN AREA 2

Under the Proposed Action Alternative, agricultural drainage from the GDA would continue to be diverted away from Area 2 waterways except during high storm events. As described in Appendix E3, under existing conditions, selenium levels in biota inhabiting the wetlands areas exceed toxicity thresholds for avian eggs, fish, and invertebrates. Predatory birds such as the American peregrine falcon, bald eagle, Swainson's hawk, burrowing owl, and northern harrier that may forage in Area 2 are likely to receive lower Se exposure under this Alternative than under the No Action Alternative. Therefore, these species may be positively impacted under the Grassland Bypass Project compared to the No Action Alternative, but there would be no significant change compared to existing conditions.

6.2.2.2.4

The San Luis Drain has a capacity of 150 cfs, which is insufficient to fully accommodate the elevated drainwater flows resulting from major storm events. Drainwater flows induced by those events necessitated the release of some flood-borne drainwater into wetland supply channels. If such floods occur while the Grassland Bypass Project is in operation, it may be necessary to release the excess drainwater into wetland supply channels at Agatha Canal and/or Camp 13 Ditch, upstream of the Grassland Bypass. Therefore contamination of wetland supply channels with subsurface drainwater may occasionally recur under the continuation of the Grassland Bypass Project. Depending on the length of these events, they may pose significant contaminant risks to aquatic and associated terrestrial ecosystems along waterways in the Project Area. As described in Appendix E3, under existing conditions, selenium levels in biota inhabiting the wetlands areas exceed toxicity thresholds for avian eggs, fish, and invertebrates.

6.2.2.3.1

IMPACTS WITHIN AREA 2

As described in Appendix E3, under existing conditions, selenium levels in biota inhabiting the wetlands areas exceed toxicity thresholds for avian eggs, fish, and invertebrates. Predatory birds such as the Swainson's hawk, American peregrine falcon, bald eagle, burrowing owl, and northern harrier that may forage in Area 2 are likely to receive lower Se exposure under the 2001 Requirements Alternative. Therefore, these species may be beneficially affected under the continuation of the Grassland Bypass Project compared to the No Action Alternative, but there would be no significant change compared to existing conditions. Effects would be similar to those discussed under the Proposed Action.

6.2.2.3.4

If flood-swollen drainage water flows exceed the Grassland Bypass Channel capacity of 150 cfs, it may be necessary to release drainwater into wetland supply channels at Agatha Canal and/or Camp 13 Ditch, upstream of the Grassland Bypass, resulting in the contamination of wetland supply channels with subsurface drainwater. Depending on the length and frequency of these events, aquatic and associated terrestrial ecosystems along waterways in the Project Area may be at risk of significant contaminant. <u>As described in Appendix E3, under existing conditions, selenium levels in biota inhabiting the wetlands areas exceed toxicity thresholds for avian eggs, fish, and invertebrates.</u>

USFWS-8

The Use Agreement (Appendix A, page 6) states the following:

> *"E. It is also the intention and objective of RECLAMATION and the AUTHORITY, among other things, to pursue planning to report to the Oversight Committee by the end of Year Four (2013) measures to meet loads in Years Six through Ten (2015-2019) in order to meet water quality objectives in Mud Slough by the Regional Board's Basin Plan (as hereinafter defined) compliance date, as amended in relation to this Agreement. These efforts will be coordinated with the California Department of Fish and Game and the United States Fish and Wildlife Service to accommodate their activities relating to endangered and non-endangered species in or adjacent to Mud Slough."*

The GBD will continue to evaluate treatment measures that will enable them to meet the selenium load values and objectives that are included in the new Use Agreement. Studies completed to date or ongoing include: (1) Full-scale Demonstration of Agricultural Drainage Water Recycling Process Using Membrane Technology, July 28, 2004, Water Tech Partners (Ron Enzweiler, Jurgen Strasser) ERP Grant ERP-02-P44, (2) USBR Studies as part of SLDFRE, (3) Final Engineering and Design Report Pilot Plant for Treatment of Agricultural Drainage Water at Panoche Drainage District, US Desal Inc. March 31, 2006, 4) DWR cooperative study in cooperation with UCLA just starting June 2009, and (4) As part of a Integrated Water Resources Management Grant work was included for a pilot treatment plant. This work has progressed to the stage of awarding a contract to construct a pilot treatment plant to NA Water. This work was suspended by the State of California and has not been restarted. Selenium and salinity treatment will be evaluated and included in the 2013 planning report.

There is land fallowing occurring within the GDA, and it is part of the planning (see discussion on active land management on page 2-7 of the EIS/EIR) for drainage management. The SJRIP is a regional drainage management system which has its benefits over individual on-farm drainage management systems. These benefits include the efficiency of a regional system which is the ability to manage one system as opposed to hundreds of smaller systems. All options will continue to be evaluated to accomplish the project goals including the completion of the Westside Plan (see discussion in the EIS/EIR on pages 1-3, 1-5, 2-8, 2-20, 2-21, 2-33 and 8-15).

The Use Agreement deals with the situation that would result in selenium loads exceeding load values including the assessment of incentive fees if monthly or annual salt or selenium loads are exceeded (see Appendix H of the Use Agreement, page 41.)

In addition the Use Agreement incorporates termination provisions in Section VII on page 21.

USFWS-9

Scientific studies on mercury contamination in the DMC sumps are not a part of this EIS/EIR. However, the GBD agreed in 2006 to participate with the Regional Board on a mercury source study. So far the Regional Board has not developed or implemented that study. The GBD propose to add mercury testing at Site B to determine compliance with applicable water quality objectives. In addition the GBD will participate in an overall mercury source study when requested by the Regional Board. Also see response USEPA-3.

USFWS-10

The Service asks that the Final EIS/EIR include an evaluation of effects of GBP selenium discharges on anadromous fish including the proposed San Joaquin River Restoration runs of Chinook salmon and steelhead. The response elaborates on material contained in the EIS/EIR.

The effects of the GBP on existing anadromous fish and their habitats were discussed in Section 6 of the EIS/EIR for the alternatives as follows:

- **No Action:** pages 6-29 to 6-33
- **Proposed Action:** pages 6-38 to 6-40
- **Alternative Action:** pages 6-45 to 6-46

Impacts to the proposed anadromous runs of Chinook salmon and steelhead under the SJRRP were described qualitatively in Section 6.2.3, Cumulative Effects, page 6-52. This discussion has been expanded as described below, but this does not affect the determination that the GBP would not result in cumulatively significant effects with the SJRRP.

Cumulative Effects of GBP and SJRRP

The SJRRP will restore flows and habitat in the SJR below Friant Dam beginning in 2009 and Chinook salmon will begin to be re-introduced in fall 2012. The ultimate goal is to establish a run of spring-run Chinook salmon in the river[1]. Per the terms of the Settlement Agreement, the spring-run Chinook salmon introduced to the SJR as part of the SJRRP will be an “experimental population” and as such will not be listed under the ESA. Wild steelhead may take advantage of the improved conditions in the upper San Joaquin River and these fish would potentially experience greater contact with the Project Area than they do under existing conditions. Once these populations become established, juvenile Chinook salmon will migrate downstream from

[1] A run of fall-run Chinook salmon may also be established if there is sufficient habitat to accommodate both races.

the spawning and rearing areas below Friant, downstream past the Grasslands area, where they would be exposed to elevated concentrations of selenium from the project, and then on to the Delta and the ocean. Returning adult spring-run Chinook salmon would also pass through the affected area during their upstream migration 2 to 5 years later.

The effects of this exposure would depend upon the duration of exposure, the mechanisms by which exposure occurs, and the concentrations of selenium in the environment.

Salmonid Use of the Project Area

Adult spring-run Chinook salmon would migrate upstream from April through August, although water temperatures would likely be too warm to allow migration beginning sometime in June or July. Based on the first introductions of Chinook salmon into the river in late 2012, the first adults would be expected to return in about 2014. These adults would migrate upstream rapidly, to holding areas in large, cold pools below Friant Dam, likely in Reach 1 and 2A. These fish would not be expected to remain within the 3 mile reach maximally affected by the project, between the mouths of Mud Slough and the Merced River, for more than a day or two and would not be expected to remain in the affected reach of the San Joaquin River (from Mud Slough to Crows Landing) for more than a few days. Adult steelhead migrate upstream from December through April. Steelhead may be able to begin colonizing the upper San Joaquin as soon as passage is provided past several barriers between the Merced River and Mendota Pool. Like spring-run Chinook salmon, adult steelhead tend to migrate rapidly upstream as far as they can to spawn. They would also be expected to be in the area affected by the project for only a few days. Adult Chinook salmon and steelhead do not eat after entering freshwater. Based on their short duration in the affected area and limited pathway of exposure to selenium, effects on adult salmon would likely be minimal to non-existent.

Spawning for both species would occur in Reaches 1 and 2A, well upstream of the project area in a location that would not be affected by Se from the project.

Emergent fry and young Chinook salmon would rear in the SJR for a period of several months before emigration. Steelhead would rear for one to two years prior to emigration. It is anticipated that the primary areas for juvenile rearing would be in Reaches 1 and 2A, about 100 miles upstream of the Grassland Project Area (Stillwater Sciences 2003[2]). The suitability of rearing habitat would decrease with distance downstream from Friant Dam, due to changes in thermal regime and habitat structure.

Emigration for spring-run Chinook salmon would occur from January through mid-May, with a peak in January through March, based on the timing of emigration from Butte Creek (Ward et al. 2004) and limited historic information on the SJR (SJRRP TAC 2009). The timing for steelhead would be similar. A few individuals might be observed at any time of year when temperatures are suitable, however. Based on a review of the literature, Williams (2006) reports migration rates for Chinook salmon range from 1 to 20 miles (2 to 32 km) per day. The rate of migration appears to be related to fish size, time of year, suitability of foraging habitat, and temperature, with migration rates increasing with increasing values of all of these parameters. Migration rates for Central Valley steelhead are not well-documented (Williams 2006), and rates are assumed to

[2] Stillwater Sciences. 2003. Draft Restoration Strategies for the San Joaquin River. Prepared for the Friant Water Users Authority and the Natural Resources Defense Council. February.

be similar to Chinook salmon. Suitability of foraging habitat may also affect emigration rates, as described below.

Juvenile Chinook salmon have been observed to use favorable habitat to grow during their emigration for periods exceeding two months, however (Ward et al. 2004). The SJRRP TAC (Feb 2009) cites historical CDFG information indicating that SJR Chinook salmon might have migrated slowly, rearing and growing along the way. This information indicates a peak migration past Mendota Dam in February and March 1946 and peak migration past Mossdale in April and May 1939-1941. The SJRRP TAC indicate this shows a potential 2 months spent in the river between these two points. However, it must be noted that these data are not from the same year and reflect peaks of migration, not movements of specific fish. Indeed, the data from Mendota Dam is from a time after Friant Dam was completed, while the data from Mossdale was from before Friant Dam was completed. Thus the difference between these peaks may reflect differences in timing due to hydrologic conditions due to closure of Friant Dam or meteorologic conditions between these years, runs from intervening tributaries, or other factors.

Suitable rearing and foraging habitat for juvenile Chinook salmon is strongly associated with floodplain habitat (SJRRP 2008, SJRRP TAC 2009, Williams 2006, Ward 2004). As described by the SJRRP TAC (2009), It is unknown what flows would be required in the SJR to connect the river to it floodplains. Assuming the river would be connected to its floodplains only during normal-wet or wet years, and the migration rates in the main channel are the 1 to 20 miles per day described above, then the downstream migrant fish might be expected to be within the Project Area for only a few days. In wetter years, if salmonids were able to access the floodplains, they might be expected to spend more time migrating downstream, perhaps as much as a couple of months. The wetland areas in the vicinity of the project are relatively extensive, but anadromous salmonids have rarely been observed using these areas (Saiki 1998). It is unclear whether this area would be used more extensively once the SJRRP and GBP are implemented. The portion of the SJR maximally affected by the project represents less than 1 percent of the total length of the SJR between its confluence with the Sacramento River and Friant Dam. Thus a only small proportion of the total population would be expected to use this area for prolonged periods, unless this area provided substantially better habitat than other areas of the SJR. As described in Section 6.1.2.1.6 of the EIS/EIR, the habitat in the project area is largely degraded.

Selenium Concentrations under Existing Conditions and the Proposed Action

The likely selenium concentrations that would be present in the SJR between Mud Slough and the Merced River (Site H) with the GBP in place were evaluated based on calculated selenium concentrations in 2005, a normal-wet year, and 2008, a critical-high year (using the terminology of the SJRRP), taking into account the flow and selenium concentration reductions that would occur as a result of the GBP, and imposing the SJRRP flows upon those concentrations. Selenium concentrations were projected for 2012 through 2017.

The Regional Board stopped monitoring at Site H (on the SJR between Mud Slough and the Merced River) in 1999 because they determined that the floodplain in this reach of the River is subject to overflow from the Merced River and there was not a single site that could be monitored without possible influence from Merced River flows. Therefore the Waste Discharge Requirements for the Grassland Bypass Project do not require, and the RWQCB does not require sampling at Site H. It is sampled (by the Grassland Basin Drainers-GBD) and sent in to S.

Dakota State University (by GBD) for analysis and that information is sent to the San Francisco Estuary Institute (SFEI) for inclusion in the Grassland Bypass Project reports.

Existing data were used to estimate flows and selenium concentrations at Site H. Since there is no flow station at Site H, upstream gages and diversion were used to calculate the flows at Site H. These locations are depicted on the attached map (at end of this response) and include:

- San Joaquin River at Hwy 165
- Salt Slough at Hwy 165
- Mud Slough at Site D
- Los Banos Creek at Hwy 140
- Diversions from Los Banos Creek to the Newman Land Co.

Under SJRRP, releases from Friant Dam are made for the benefit of downstream fish resources. The volume and timing of these releases varies with water year type (NRDC vs. Rogers 2006)[3]. Review of the SJRRP criteria and discussion with modelers familiar with the hydrology indicated that 2005 would be typical of a Normal-Wet year and 2008 would be typical of a Critical-High year. Although these two year types are not the maximums from the SJRRP year types, they were two recent year types in which the best data were available and they were representative of high and low flow periods. The section of the SJR between Mud Slough and Merced River is within Reach 5 as identified by the SJRRP, and additional flows were specified accordingly. It was determined that the first year that salmon would be introduced to the upstream reaches of the San Joaquin River would be 2012, and the first year juveniles would migrate out through this reach would be in the Spring of 2013. In order to estimate what the selenium concentrations at Site H would be under the proposed new Use Agreement, the modeled concentration at Site B (discharge from the San Luis Drain) and the calculated Site H flow were used. There would be no change in loads for 2012-2014, and loads would be ramped down starting in 2015. For the years 2012 – 2016 projections were made for Critical-High and Normal-Wet water year types as defined by the SJRRP, and for 2017 a projection was made for the Normal-Wet water year type in order to bracket the range of expected selenium concentrations. After 2016 the selenium loads allowed under the new Use Agreement reduce sharply and the impacts at Site H would reduce accordingly.

The attached Figures (Site H 2012-2014 Critical-High, 2015 Critical-High, 2016 Critical-High, 2012-2014 Normal-Wet, 2015 Normal-Wet, 2016 Normal-Wet and 2017 Normal-Wet) present the analysis of Site H present the analysis of Site H. The information shown on the figures is as follows:

- **Restoration flows** - it was determined there would be additional flows in this reach of the river starting in 2013. (These are given as CFS per day in the restoration program agreement documents).
- Two year types are shown using 2005 and 2008 as a basis. 2005 was determined to be a “Normal-Wet” year type per the river restoration criteria and 2008 a “Critical-High” year.

[3] NRDC et al. vs. Rogers et al. 2006. Notice of Lodgement of Stipulation of Settlement. U.S. District Court, Eastern District of California (Sacramento Division). Case No. CIV S-818-1658 LKK/GGH.

Adjustments were then made to selenium loads and river restoration flows to project into future years.

- **Site H (cfs)**-calculation of the actual flows at Site H using upstream gages as shown on the attached map.
- **Se calculated concentration**-using the selenium load at Site B (discharge from the San Luis Drain) and the calculated Site H flow.
- **Se measured Conc @ H**-weekly samples are taken at Site H but the Regional Board has noted the sampling location is subject to overflow from the Merced River. Therefore, these concentrations would be equal to or less than the calculated concentrations. Therefore these concentrations are not used except to compare for verification the calculated Site H concentrations.
- **New Site H flow** - (for the year indicated on the figure), adjusted for the addition of river restoration flows and an adjustment for changes in Site B flows. Site B flows were proportionally reduced in the future based on loads in the base years compared to loads in the future years. Then river restoration flows were added. (As future Site B loads are monthly numbers, the daily load for the future years is the monthly load divided by the days in the month).
- **New Site H Conc** - (for the year indicated on the figure), using the new Site H flows and the Site B load values for the years indicated selenium concentrations were calculated.

Year 2013 is the first year that restoration flows are due at Site H so this was the first year calculated (2012 and 2014 would look identical to 2013, and 2012 water concentrations were used to calculate the 1-3 month prior time averaged concentrations for 2013.). Projections were then made to future years to see what the lower loads did to the concentrations. In 2013 for both year types the concentrations during the spring period and several months before are low. In normal-wet years the summertime concentrations get higher. This is mainly because the allowable loads are higher and the flows in summer are pretty consistent between wet and dry years. In 2016, the concentrations are below 3.3 µg/L in critical-high years. Concentrations are below 3.3 µg/L in normal-wet years by 2017. The summertime concentrations are projected to be below 5 by 2016 in normal-wet and below 5 in critical-high in 2013.

Selenium Concentration in Fish

The comment references an analysis by Beckon and Maurer (2008) that concluded there is a substantial ongoing risk to migrating juvenile Chinook salmon and steelhead in the San Joaquin River due to selenium bioaccumulation. This analysis relies on data from a laboratory study done by Hamilton et al (1990) that measured the survival of juvenile Chinook salmon after exposure to various levels of dietary selenium for 90 days. This study and other cited in the comments suffer from several weaknesses, some of which are noted by Beckon and Maurer (2008) and USEPA (2004). In addition, the control exhibited significant mortality between 60 – 90 days. However, the full data set was used by Beckon and Maurer in their analysis of potential effects.

While the evidence of selenium-related effects to salmonids and selection of appropriate toxicity thresholds for coldwater species is controversial, it is recognized that there is significant uncertainty regarding potential effects to salmonids. For this reason, it was assumed in the Draft EIS/EIR that there could be potential negative impacts to Chinook salmon and steelhead under the Proposed Action and Alternative Action, independent of the SJRRP (see Table 6-8). However, in response to USFWS comments we have compared the predicted selenium concentrations at Site H (described above) to the potential effects thresholds cited in the comments.

As shown in Appendix E2 (where the original analysis of historical data was done by Bill Beckon of USFWS for the 2001 EIS/EIR, and updated by URS for the 2009 EIS/EIR to incorporate more recent data), historical data indicate that the best prediction of fish selenium equilibrium concentrations (and hence toxicity to fish) is provided by the logarithmic transformation of selenium concentrations in water averaged over the period one to seven months prior to collection of the fish sample. This analysis was based on all species of fish collected in the Grasslands region, and Se uptake and bioaccumulation in these fish is not necessarily representative of salmonids. Bill Beckon of USFWS has recently done similar analyses evaluating existing data on species that may be more similar to salmonids (large mouth bass and sunfish) and found that the lag time for Se bioaccumulation is much longer for these species (approximately 300 days for large mouth bass) (Beckon 2009 – personal communication). Because large mouth bass become piscivorous approximately a month after hatching, the bioaccumulation lag time for this species is likely to be longer than that for fish that feed at lower trophic levels.

At this time there is not sufficient data to evaluate appropriate Se bioaccumulation lag times and averaging windows for anadromous fish such as salmonids, and the analysis is complicated by migration patterns because individuals are exposed to different concentrations in different locations. However, in order to address the concerns raised by commentors an attempt was made to make a reasonable prediction of the juvenile salmon exposure to Se during migration through SJR downstream of the Grasslands region.

It is assumed that juvenile salmon would receive the highest Se exposure during the time they remain in the Grasslands region, as Se water concentrations upstream and downstream are generally lower. It is recognized that most Se uptake in fish occurs through the diet rather than through direct uptake from water. While the Se bioaccumulation lag time for juvenile salmonids has not been determined due to insufficient data, it may be somewhat longer than the 1 month lag time for the "all resident fish" category used for the regression analysis presented in Appendix E, which includes some species of lower trophic level, but it likely to be shorter than the lag time for large mouth bass, which feed at a higher trophic level. Because the period of interest for this analysis is the time that juvenile salmonids remain in the Grasslands region during migration, the approach taken was to use an water concentration averaging window expected to represent bioaccumulation of the prey the salmon would consuming during this time.

An averaging window of 2 months (30 to 90 days prior) was selected for the following reasons:

- For invertebrates (which are expected to comprise the bulk of the diet of juvenile salmonids as they migrate through the Grasslands region), the best predictor of invertebrate selenium equilibrium concentration was found to be a shorter period (30 to 60 days prior to measurement of Se in invertebrate tissue). Using a longer period (30 to 90 days) is more conservative because it includes higher concentrations predicted to occur earlier in the fall.
- The toxicity data referenced in comments received on the Draft EIR was generally based on exposure periods of about 60 to 90 days.

- As discussed above, it is unlikely that juvenile salmonids would remain in the area of concern longer than about 2 months and it is likely that they would be in the area of concern for only a few days. Therefore, it seems reasonable to use a time-averaged concentrations of 2 months for comparison to the lowest survival threshold cited in the comments received (3.3 µg/L, level associated with 10 percent mortality in juvenile Chinook salmon).

As discussed above, available evidence indicates that juvenile salmon migrate through the area of concern between January and May. The attached table labeled Site H Selenium Concentrations presents the calculated 2 month running average concentrations for 1 – 3 months prior to each date shown.

Instantaneous selenium concentrations in blue font are greater than or equal to the 3.3 µg/L value cited for coldwater fish, concentrations in red font are greater than or equal to the 4 µg/L level of concern for warm water fish, and concentrations in pink font are greater than or equal to the 5 µg/L existing water quality objective. However, the 1-3 month prior time-averaged concentrations for the Jan – May periods are all lower than 3.3, the lowest juvenile mortality threshold cited. As discussed above, the number of juveniles that do linger in this area and may be affected is likely to be very low. Due to the low probability of extended exposure and the low time-averaged concentrations, it is unlikely that there will be significant effects to juvenile salmon migrating through this reach. However, as discussed above, there is considerable uncertainty in this analysis due to lack of data on Se bioaccumulation and toxicity in salmonids as well as limited data on likely exposure periods. Due to this uncertainty, it was assumed in the Draft EIS/EIR that there could be potential negative impacts to Chinook salmon and steelhead under the Proposed Action and Alternative Action, independent of the SJRRP

Conclusions

The available information indicates that Chinook salmon and steelhead reintroduced by the SJRRP would likely have some exposure to selenium as they pass through the Project Area during emigration and immigration. The GBP would reduce the selenium exposure from what these fish might encounter under existing conditions, and with the Project, selenium concentrations would decrease over time. The amount of time these fish would be exposed to the selenium would likely be short, for upstream migrant adults, a few days; for downstream migrant juveniles a few days to a few weeks. Adults would have limited pathways to exposure, as they do not eat after they enter freshwater, and so are not expected to be affected by their limited exposure. Juveniles may be exposed through the food chain. However, selenium concentrations are low during the time the juveniles are most likely to be present and most juveniles would not reside in the affected area long enough to receive a biologically meaningful dose.

This information indicates that the GBP is unlikely to have a significant impact on the fish reintroduced as part of the SJRRP. Because both projects would be expected to improve conditions for salmonids in the SJR and, therefore, they would not have a cumulatively significant impact.

USFWS-11

The comment is concerned with the cumulative impacts of reductions in flow associated with tailwater recovery by the Exchange Contractors in non-critical water years on water quality in Mud and Salt Sloughs combined with discharges from non-GDA properties to wetland supply channels, from the additional lands mentioned in comment 1. Concerning the Exchange Contractors' 10-year water transfer program EIS/EIR in 2004, your comments are noted and considered to the extent appropriate for the Grassland Bypass Project.

The Exchange Contractors' tailwater does not contain high levels of Se. Concerning salt, the refuge water balance modeling conducted for the 10-year program, which included acquisition of transfer water for delivery to the wildlife refuges, found that more salt was discharged from the wetlands than was in the receiving water supply, that salt was being leached from the wetlands into the San Joaquin River due to the provision of additional water to the refuges from the 10-year transfer. This relates to the commenter's assertion that water quality of the combined 10-year and 25-year programs needs to be addressed in comment 12. See response USFWS-12 below.

The analysis for the Grassland Bypass Project EIS/EIR would have included the Exchange Contractors transfer project's reduced flows from tailwater recovery in the baseline data described in Section 4.1.5.7 and then in Section 4.1.5.8 for the San Joaquin River downstream to Crows Landing. Additional analysis of water quality (Se concentrations) at Site H is provided for response USFWS-10, and no further analysis is warranted.

USFWS-12

The commenter states that the Exchange Contractors' 25-year groundwater pumping and water transfer program will degrade groundwater, reduce the quality of water delivered to the Grasslands wetlands, and further reduce dilution flows in the wetlands channels and result in further water quality degradation; and he wants these 'impacts" addressed in the cumulative impacts analysis. The 25-year program utilizes groundwater pumping, conservation, and/or land fallowing to generate the substitute water for transfer to other water users. It did not propose additional tailwater recovery or delivery of water to the wildlife refuges.

First of all, these issues were addressed in responses to comments on the Exchange Contractors' EA/IS in October 2007 (Exchange Contractors 2007). Highlights of those responses include the following:

- The wells are to be designed to tap lower salinity water in the profile below a depth of about 150 feet and above the Corcoran Clay, as opposed to shallower poor quality groundwater.
- Selenium is not a constituent that would be introduced into water deliveries from this project. Concerning other constituents, e.g., TDS, the project would not directly cause the CVP to exceed suitability objectives.
- The EA/IS illustrates that there would be no effect to the users that receive waters from the Main Canal upstream of O'Banion Bypass, including the refuges.
- While past and present projects will need to meet current salt TMDLs, reasonably foreseeable plans and projects on the San Joaquin River point to improved water quality (Grassland Bypass Project, San Joaquin River Restoration Program, potential Basin Plan amendments) over time. The indirect localized incremental effect to the Grasslands refuges caused by delivery of the blended water to CCID using the Outside Canal is further offset by reductions in poor quality drainage that would otherwise be discharged as part of the Grassland Bypass Project to Mud Slough.

- For surface water, the incremental impacts of barely perceptible changes in salt in blended supplies in the Main Canal, which could affect deliveries to the refuges, is minor. The project would also result in a reduction in drainage discharges to Mud Slough under the Grassland Bypass Project.
- The EA/IS identifies that there is no direct hydraulic continuity between the project and the San Joaquin River; therefore, there would be no resulting change in flow in the San Joaquin River. There would also be not substantive, if any, change in water quality in the San Joaquin River due to Exchange Contractors return flows to the San Joaquin River, since the lands being affected by the project have little if no hydraulic continuity with the San Joaquin River. The slight effect to other uses that may be affected by the project and resulting effects have been considered and determined to be not significant and beyond the responsibility of the project (i.e., part of the context in which the project occurs).

USFWS-13

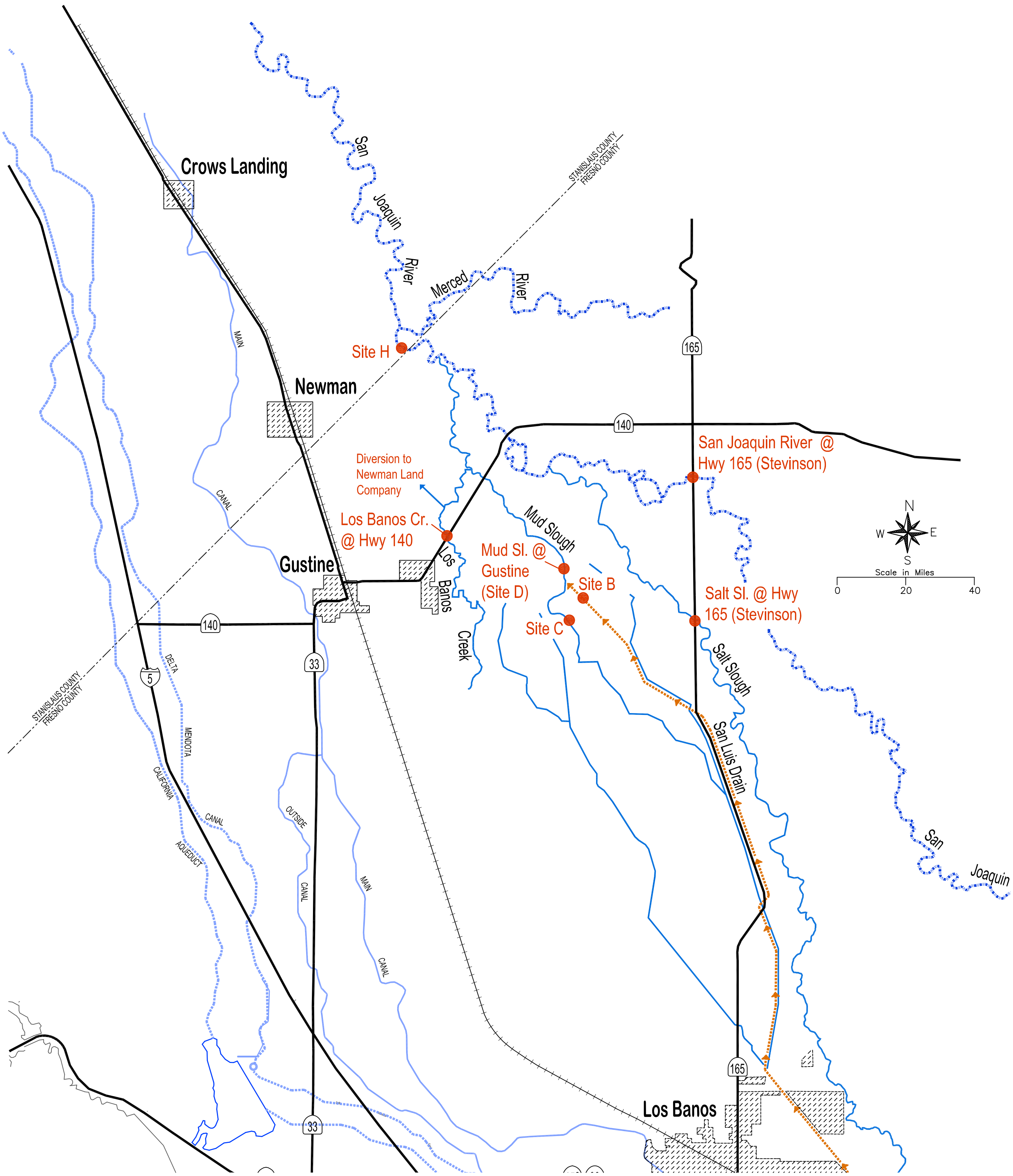
It is our understanding that VAMP may continue for another 2 years as an extension of the current San Joaquin River Agreement (SJRA) but then will be completely re-evaluated for a new flow regime/agreement or allowed to expire, but the extension is on hold[4]. Clearly, without the VAMP/SJRA water releases, spring and fall flows in the San Joaquin River downstream of the Merced River will be less than the baseline used in the EIS/EIR analysis. While the commenter and students of the San Joaquin River would be interested in the hypothetical with and without VAMP/SJRA flows, it is not critical to the Grassland Bypass Project impact analysis because the GBP is proposing discharge reductions to reduce Se loads to the river, an improvement over time regardless of whether the additional flows below the Merced River occur under VAMP/SJRA.

If the flows are a part of the TMDL and they are changed, then the TMDL will change. The Grassland Bypass Project Use Agreement covers the situation in which there is a new TMDL for this Project (see Use Agreement in Appendix A of the EIS/EIR, Appendix D page 33).

USFWS-14

The commenter wants the effects of the operation of the south Delta temporary barriers on transport and environmental fate of selenium and sulfate from the GBP into the Delta, specifically the impacted benthic foodweb in the Delta and sulfate loading and its effect on methylation of mercury. This EIS/EIR surface water analyses for existing conditions and No Action baselines assumed there would be no change to operation of these temporary barriers, and the request to carry the surface water analysis into the Delta is beyond the scope of what is reasonably foreseeable and, therefore, reasonable to evaluate in the GBP EIS/EIR given the uncertainty of Delta operations and physical improvements to be determined in the future and with subsequent CEQA and NEPA compliance evaluations.

[4] Personal communication with Lowell Ploss and Dennis Wescot, by email to Susan Hootkins, on July 14, 2009.



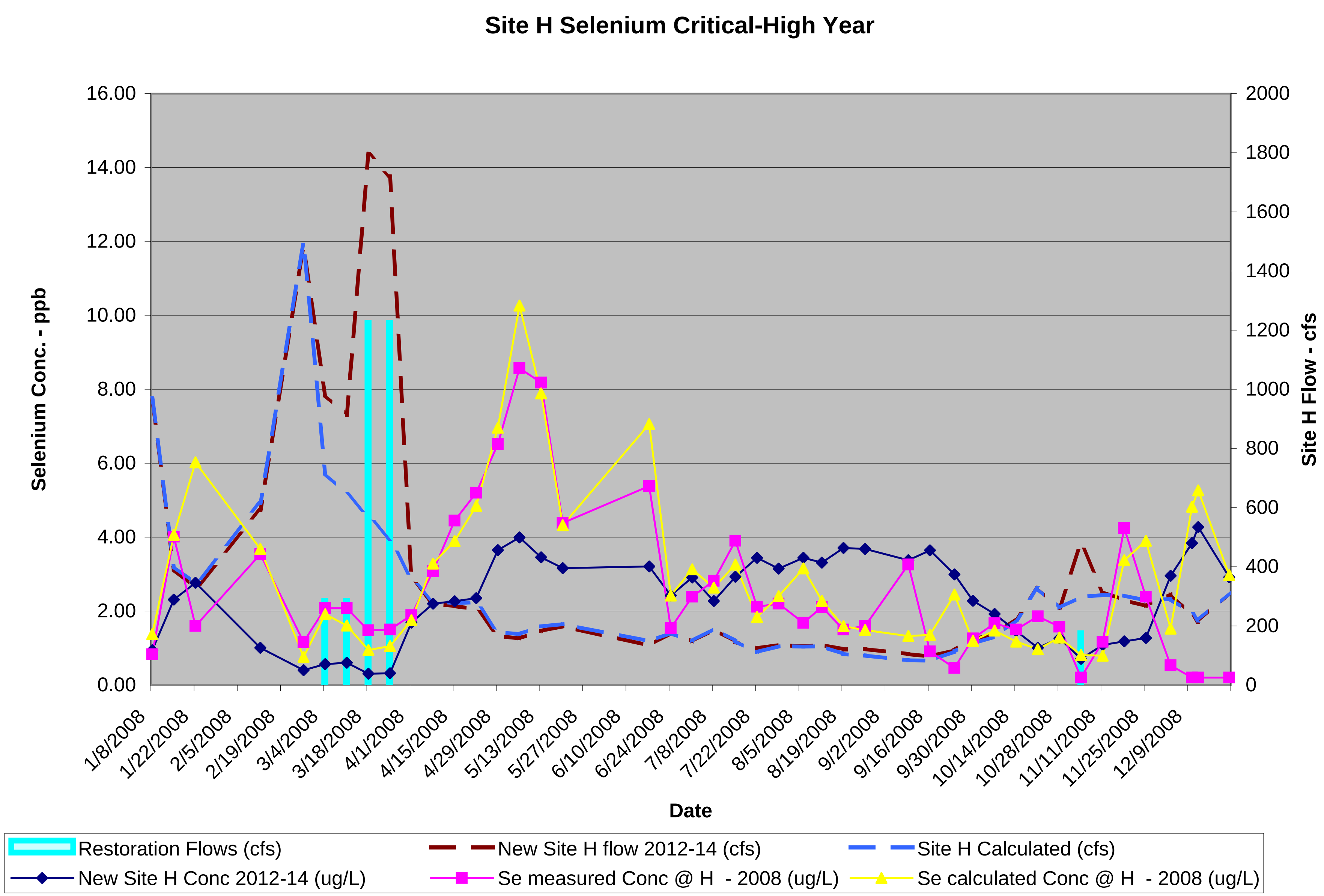
Crows Landing
Newman
Gustine
Los Banos
San Joaquin River
Merced River
Site H
Diversion to Newman Land Company
Los Banos Cr. @ Hwy 140
Los Banos Creek
Mud Slough
Mud Sl. @ Gustine (Site D)
Site B
Site C
San Joaquin River @ Hwy 165 (Stevinson)
Salt Sl. @ Hwy 165 (Stevinson)
Salt Slough
San Luis Drain
San Joaquin
STANISLAUS COUNTY
FRESNO COUNTY
MAIN CANAL
DELTA MENDOTA CANAL
CALIFORNIA AQUEDUCT
OUTSIDE CANAL
165
140
33
5
N
S
W
E
Scale in Miles
0
20
40

Projected Instantaneous and Time-Averaged Concentrations for Normal-Wet Water Year Types

Date	New Site H Se Conc 2012-2014 (ug/L)		New Site H Se Conc 2015 (ug/L)		New Site H Se Conc 2016 (ug/L)		New Site H Se Conc 2017 (ug/L)	
	Predicted Instantaneous Concentration	Average 1-3 months prior	Predicted Instantaneous Concentration	Average 1-3 months prior	Predicted Instantaneous Concentration	Average 1-3 months prior	Predicted Concentration	Average 1-3 months prior
1/4/05	0.60	3.32	0.47	3.32	0.34	2.66	0.21	1.96
1/11/05	0.22	2.99	0.17	2.99	0.12	2.39	0.08	1.76
1/25/05	0.95	2.57	0.74	2.57	0.54	2.04	0.34	1.50
2/1/05	1.64	2.60	1.30	2.60	0.95	2.06	0.59	1.52
2/8/05	2.57	2.35	2.03	2.33	1.49	1.85	0.93	1.35
2/15/05	2.88	1.87	2.28	1.85	1.67	1.46	1.04	1.07
2/23/05	0.92	1.61	0.71	1.58	0.52	1.25	0.33	0.91
3/1/05	1.19	1.23	0.93	1.17	0.68	0.91	0.42	0.65
3/8/05	1.41	1.22	1.11	1.10	0.81	0.84	0.50	0.58
3/23/05	0.89	1.48	0.70	1.16	0.51	0.85	0.31	0.53
3/29/05	0.76	1.40	0.59	1.10	0.43	0.81	0.27	0.50
4/5/05	0.91	1.48	0.71	1.17	0.53	0.85	0.33	0.53
4/19/05	0.76	1.65	0.60	1.30	0.43	0.95	0.27	0.59
4/26/05	0.77	1.64	0.60	1.29	0.44	0.95	0.27	0.59
5/3/05	5.91	1.52	4.76	1.19	3.54	0.87	2.25	0.54
5/10/05	3.60	1.28	2.85	1.01	2.08	0.74	1.30	0.46
5/17/05	2.78	1.01	2.20	0.79	1.60	0.58	1.00	0.36
5/24/05	0.81	0.99	0.64	0.77	0.46	0.56	0.29	0.35
6/3/05	0.35	1.63	0.27	1.30	0.20	0.96	0.12	0.60
6/7/05	0.80	1.67	0.63	1.33	0.46	0.98	0.29	0.62
6/14/05	1.71	1.94	1.35	1.54	0.99	1.14	0.62	0.71
6/21/05	3.45	2.21	2.75	1.76	2.04	1.29	1.28	0.81
7/5/05	4.54	2.14	3.63	1.70	2.69	1.25	1.70	0.79
7/12/05	4.84	1.97	3.90	1.57	2.90	1.15	1.85	0.72
7/19/05	5.59	2.09	4.54	1.66	3.41	1.22	2.19	0.77
7/29/05	7.49	2.43	6.18	1.93	4.72	1.42	3.09	0.89
8/2/05	6.46	1.93	5.29	1.53	4.02	1.12	2.60	0.70
8/11/05	6.12	2.06	4.95	1.64	3.71	1.21	2.36	0.76
8/16/05	5.27	2.36	4.26	1.88	3.19	1.39	2.03	0.88
8/23/05	5.68	3.04	4.62	2.44	3.48	1.81	2.23	1.15
8/30/05	6.75	3.60	5.49	2.91	4.12	2.17	2.64	1.39
9/13/05	5.88	5.50	4.73	4.46	3.51	3.35	2.23	2.15
9/27/05	8.14	5.75	6.64	4.67	5.01	3.51	3.24	2.25
10/4/05	5.99	6.03	4.85	4.90	3.63	3.69	2.32	2.37
10/11/05	4.40	6.20	3.53	5.05	2.61	3.81	1.65	2.45
10/18/05	4.06	6.24	3.30	5.07	2.48	3.82	1.59	2.45
10/25/05	3.19	6.24	2.58	5.07	1.92	3.82	1.23	2.45
11/1/05	2.37	6.31	1.88	5.12	1.37	3.84	0.86	2.45
11/8/05	2.33	6.26	1.85	5.08	1.35	3.81	0.85	2.43
11/15/05	3.56	6.14	2.83	4.97	2.07	3.73	1.30	2.38
11/23/05	3.45	5.87	2.75	4.75	2.03	3.56	1.28	2.28
11/29/05	3.22	5.28	2.55	4.27	1.87	3.19	1.17	2.04
12/6/05	1.71	4.86	1.35	3.93	1.00	2.93	0.62	1.87
12/13/05	2.22	4.36	1.75	3.52	1.29	2.63	0.80	1.68
12/20/05	1.70	4.26	1.35	3.43	1.00	2.56	0.63	1.63

Projected Instantaneous and Time-Averaged Concentrations for Critical-High Water Year Ty

Date	New Site H Se Conc 2012-2014 (ug/L)		New Site H Se Conc 2015 (ug/L)		New Site H Se Conc 2016 (ug/L)	
	Predicted Instantaneous Concentration	Average 1-3 months prior	Predicted Instantaneous Concentration	Average 1-3 months prior	Predicted Instantaneous Concentration	Average 1-3 months prior
1/8/08	0.94	1.37	0.74	1.37	0.54	1.09
1/15/08	2.31	1.95	1.83	1.95	1.33	1.56
1/22/08	2.77	2.17	2.20	2.17	1.60	1.73
2/12/08	1.01	2.48	0.79	2.46	0.58	1.95
2/26/08	0.40	2.86	0.32	2.68	0.23	2.09
3/4/08	0.56	2.84	0.44	2.63	0.32	2.04
3/11/08	0.60	2.23	0.47	1.92	0.34	1.45
3/18/08	0.31	1.99	0.24	1.70	0.17	1.27
3/25/08	0.32	1.76	0.25	1.39	0.18	1.01
4/1/08	1.74	1.49	1.33	1.18	1.02	0.86
4/8/08	2.27	1.41	1.74	1.12	1.34	0.81
4/15/08	2.34	1.07	1.79	0.84	1.37	0.61
4/22/08	2.43	0.58	1.87	0.45	1.44	0.33
4/29/08	3.76	0.53	2.90	0.42	2.23	0.30
5/6/08	4.00	0.71	3.15	0.55	2.33	0.41
5/13/08	3.45	0.89	2.73	0.69	2.02	0.52
5/20/08	3.16	1.07	2.52	0.82	1.88	0.62
6/17/08	3.21	2.54	2.55	1.97	1.87	1.49
6/24/08	2.42	2.89	1.93	2.25	1.42	1.70
7/1/08	2.87	3.06	2.34	2.39	1.73	1.80
7/8/08	2.23	3.19	1.81	2.49	1.32	1.88
7/15/08	2.88	3.36	2.36	2.63	1.74	1.98
7/22/08	3.39	3.52	2.82	2.77	2.11	2.07
7/29/08	3.10	3.25	2.53	2.58	1.87	1.91
8/6/08	3.44	3.02	2.76	2.41	2.05	1.78
8/12/08	3.31	2.78	2.67	2.23	2.00	1.64
8/19/08	3.71	2.72	3.06	2.20	2.34	1.62
8/26/08	3.68	2.83	3.07	2.30	2.39	1.70
9/9/08	3.38	2.94	2.84	2.39	2.17	1.77
9/16/08	3.64	2.96	3.02	2.40	2.27	1.78
9/24/08	3.00	3.12	2.44	2.54	1.80	1.90
9/30/08	2.28	3.22	1.87	2.63	1.39	1.98
10/7/08	1.92	3.36	1.56	2.75	1.17	2.07
10/14/08	1.46	3.43	1.17	2.82	0.86	2.13
10/21/08	1.00	3.47	0.79	2.85	0.58	2.16
10/28/08	1.27	3.45	1.00	2.84	0.73	2.15
11/4/08	0.71	3.29	0.56	2.71	0.41	2.05
11/11/08	1.08	3.09	0.87	2.55	0.64	1.93
11/18/08	1.18	2.77	0.93	2.28	0.68	1.72
11/25/08	1.28	2.38	1.00	1.96	0.73	1.46
12/3/08	2.96	2.24	2.37	1.84	1.77	1.37
12/10/08	3.84	1.91	3.06	1.55	2.27	1.15
12/12/08	4.27	1.82	3.42	1.48	2.56	1.09
12/22/08	2.92	1.54	2.32	1.24	1.72	0.92



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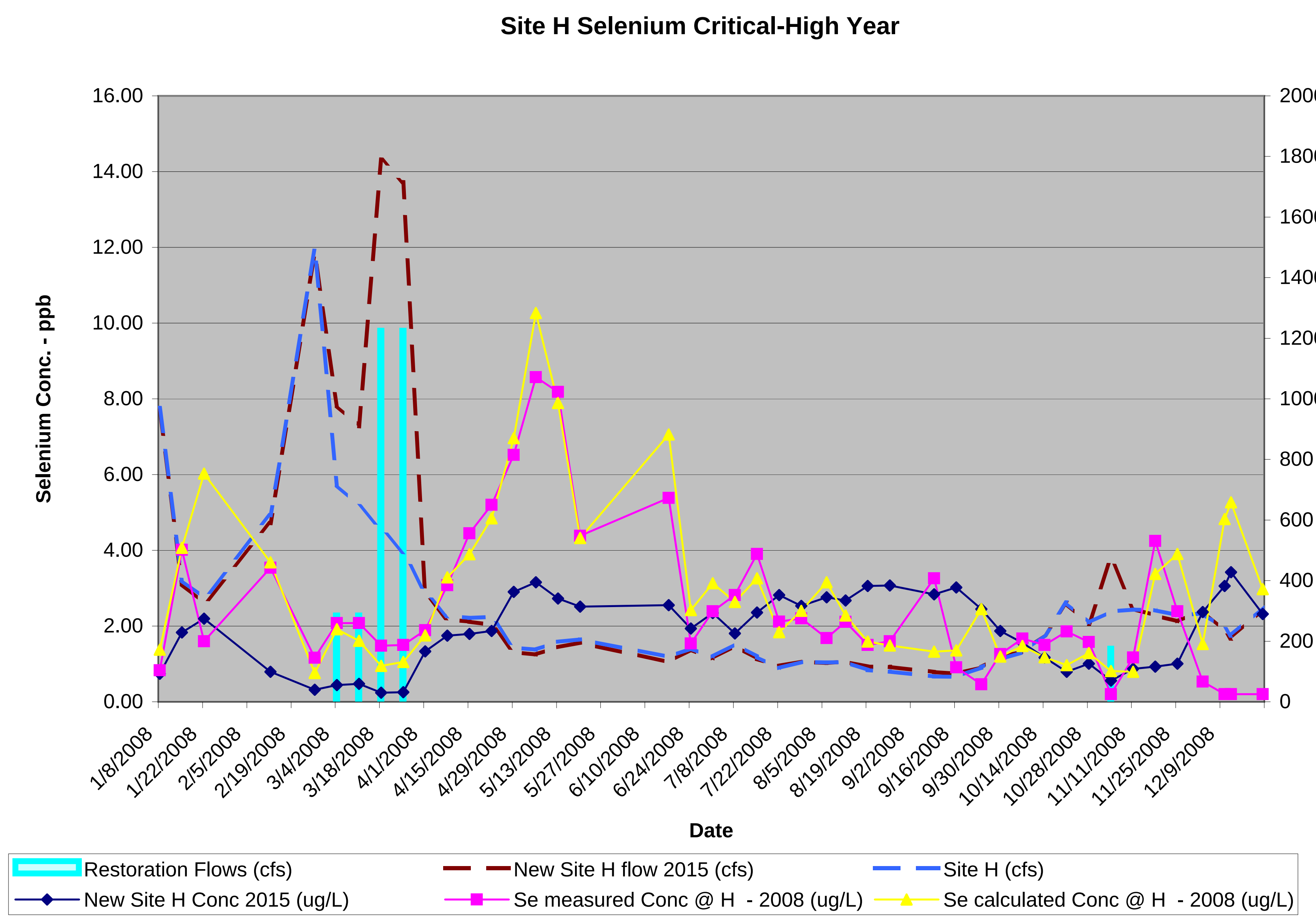

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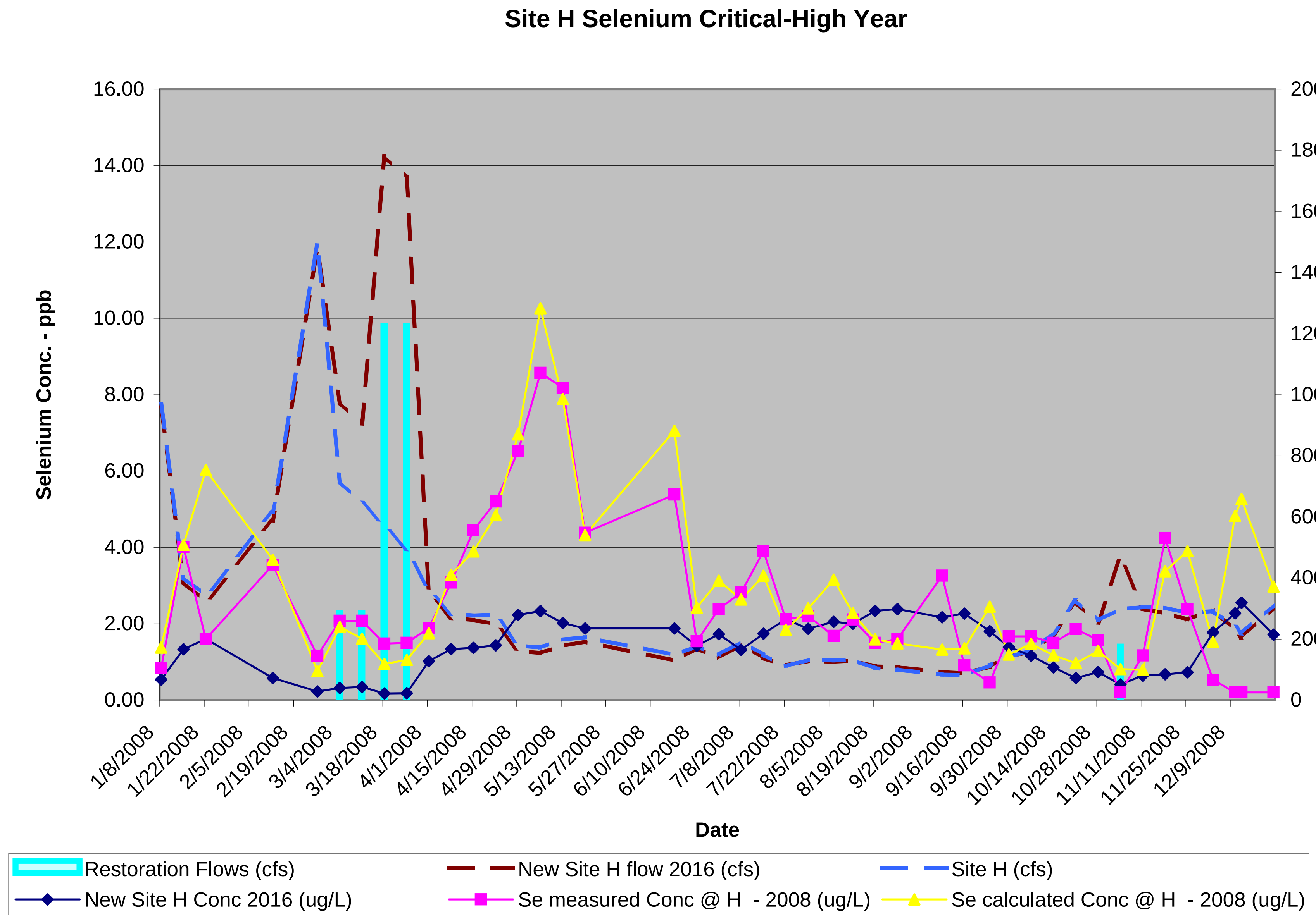

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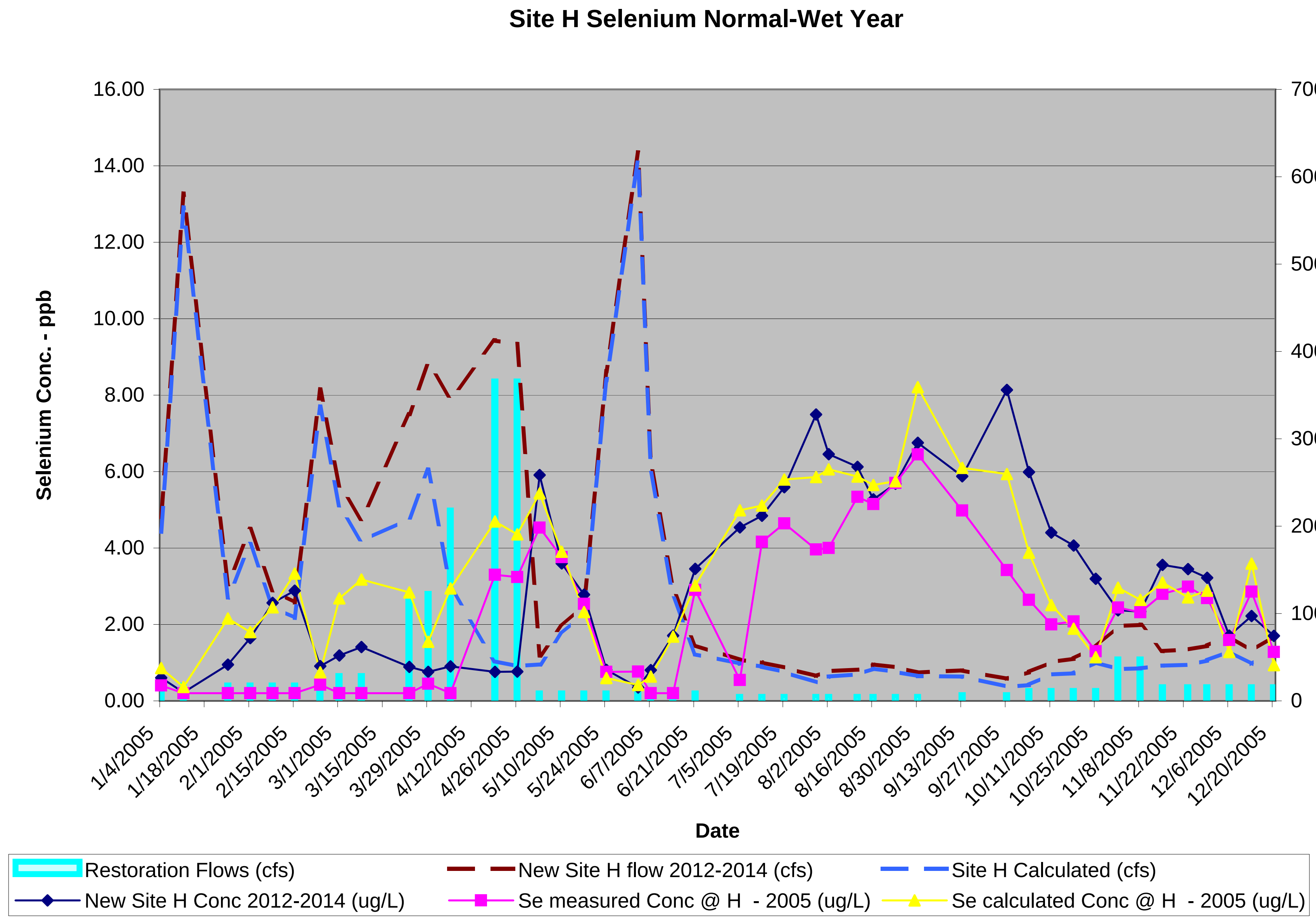
Site H Selenium Normal-Wet Year



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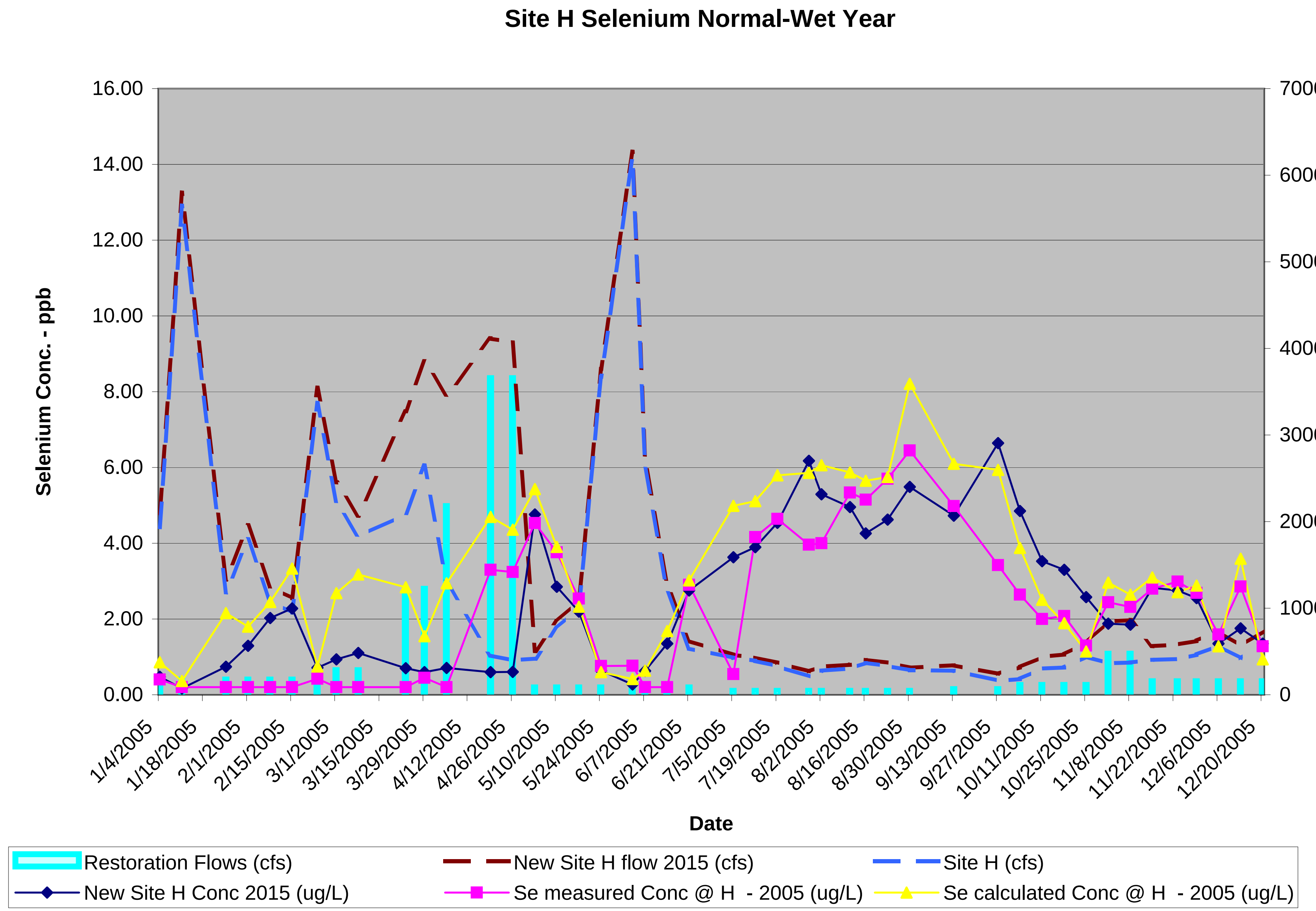

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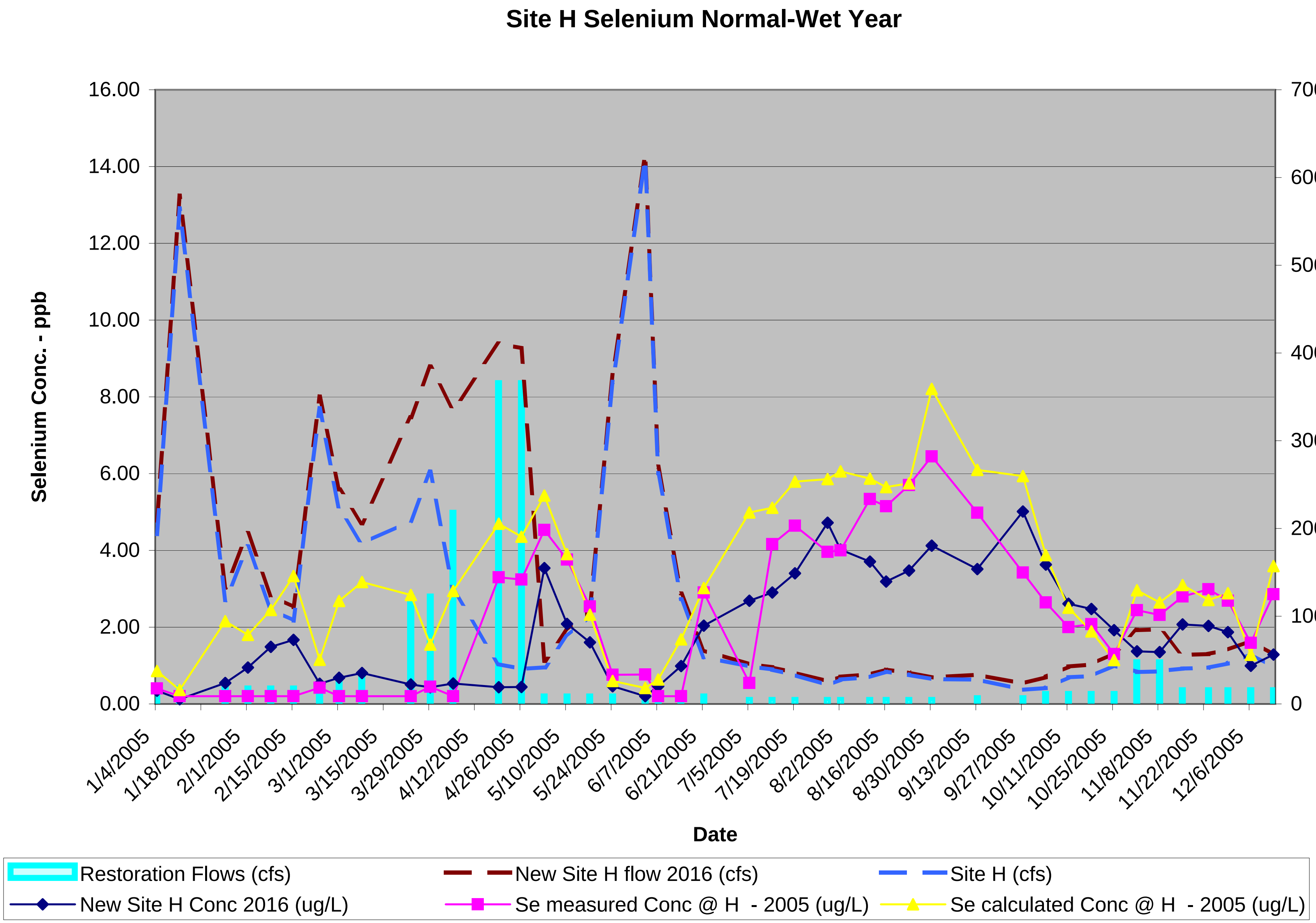

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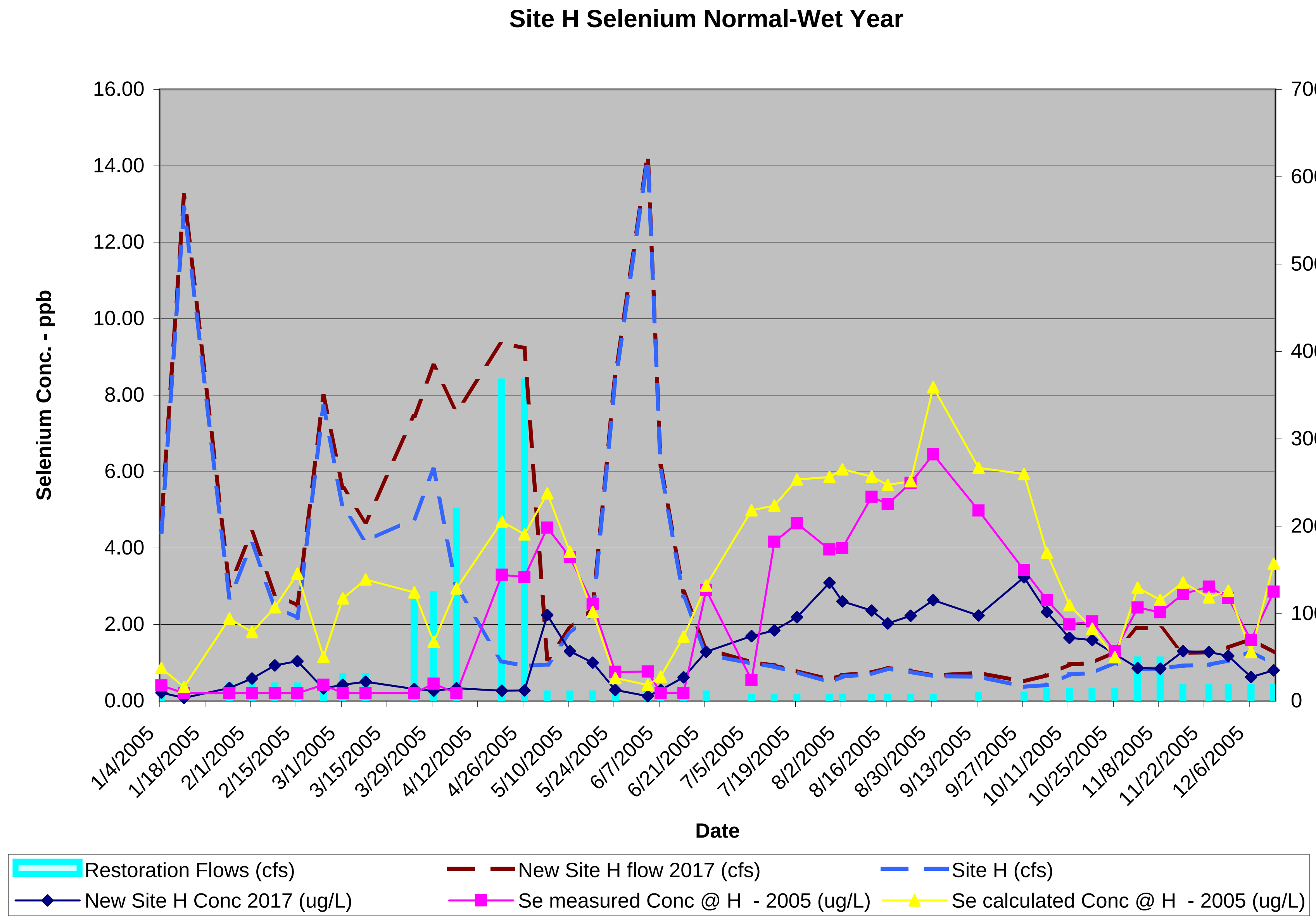

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