Exhibit 12-A

APPENDIX F
RESPONSES TO COMMENTS

November 7, 2016

Ms. Jacqueline Pearson Meyer
Fishery Biologist - California Fish Hydroacoustics Coordinator
NOAA Fisheries West Coast Region
U.S. Department of Commerce
777 Sonoma Avenue, Room 325
Santa Rosa, CA 95404

SUBJECT: Responses to Comments
Sleepy Hollow Steelhead Rearing Facility Mitigated Negative Declaration

Dear Ms. Pearson Meyer:

This is a response to comments by NOAA Fisheries West Coast Region of the National Marine Fisheries Service (NMFS) on "Initial Study/Mitigated Negative Declaration Sleepy Hollow Steelhead Rearing Facility Raw Water Intake and Water Supply System Upgrade" (the Project), prepared by the Monterey Peninsula Water Management District (District or MPWMD). NMFS submitted comments as notes within the Draft IS/MND document on November 2, 2016. The District has repeated or characterized each comment below with responses. The District intends to hold a Public Hearing on November 14, 2016 at the District office at 7 p.m. to consider approval of the Project. A Final IS/MND will be prepared to reflect comments received.

p. 11 – Sleepy Hollow Steelhead Rearing Facility (SHSRF) operations
Comment:
"Is [the statement that the facility has been unable to operate during the past several years] true? The facility has been operating. I think it did not run maybe for one or two years, but has been operational this past year for example. Please clarify this statement."

Response
The language will be changed to describe that SHSRF did not operate in 2014 and 2015, but did in 2016.

p. 19 – proposed rock vane for intake protection
Comment
"The rock vane may be an effective means to move larger grain sized material away from the screen, but it may increase deposition of smaller particles near the screen. This will depend on site specific flow field and grain size. NMFS engineers are interested in this concept and would like to participate in the analysis."

Response
The District notes that the existing drum screen in the bottom of the channel has not been

damaged by high flows, even though some debris has passed through the reach since it was installed in the late 1990s. However, the removal of San Clement Dam has altered fluvial processes and may continue to do so. MPWMD will evaluate potential changes due to changes in sediment and debris loading. The proposed cone screen and intake has been selected for its resistance to erosion at high flows. Currently, the District would prefer to delay installation of a rock vane and assess how fluvial processes in the reach change and then make a determination about installing a rock vane.

If additional flow modeling is warranted, MPWMD will consult with NMFS in the analysis and design of a rock vane, should it be required.

p. 30 – Construction Activities
Comment
"Are you going to prepare a separate B[iological] A[ssessment]? You will need take coverage for the capture and transport of steelhead during dewatering."

Response
MPWMD will submit an application to the Corps with all necessary documentation.

p. 30 – Construction Activities
Comment
"What about the annual fish rescues that are likely to occur during this time. Will dewatering of the river affect operations?"

Response
In both cases, there should be no downstream effects on flow that would be significant for the annual fish rescue effort. The nearest rescue site is more than four miles downstream near the deDampierre ballfields – and that site is rescued only when flow drops below 5 cfs. The next nearest rescue sites are from 10 to 17 miles downstream of the Project site (from approximately mid-Carmel Valley downstream to Highway 1). Both rescue areas downstream are also influenced by in-stream losses (e.g., from diversions and evapotranspiration) and in-stream gains (i.e., from surface and sub-surface flows), although in very low flow years, changes to flow at the Sleepy Hollow site can have a significant effect on flow downstream.

At the Project site, Carmel River flow will be passed around each work site in the channel so that the downstream channel should not experience dewatering. It is possible that in-channel work may require two phases in two different years. If the SHSRF is to remain operational during construction in the channel, the existing intake would remain while a new intake is constructed. A second construction season in the channel may be required to remove the existing intake after a new intake is operational. If it is determined that the SHSRF can be shut down for an entire season, then both construction phases could be completed in a single season.

p. 30 – Construction Activities
Comment
"The depth of excavation will be 6 feet below grade or down to bedrock, so intermediate pumps will need to be installed *within* the work area to control sub-surface water influx/seepage. These pumps will *not* need fish screens. This water will be turbid and will need to be pumped onto a disposal site that will not drain back to the river. This effect should be included in the analysis."

Response
It is anticipated that a flow bypass would be gravity fed, which does not require pumps. But, river conditions may change and require a pumped bypass. Water pumped out of the enclosed work areas in the channel will be drained onto nearby gravel bars with high infiltration rates on either side of the river. The text will be changed to clarify these procedures.

p. 62 – BIO-MM-1
Comment
Commenter requests that NMFS be added as a permitting agency because the Carmel River is critical habitat for S-CCC.

Response
MPWMD will either add NMFS within the text or change the text to say "... if required by permitting agencies." Text will also refer to the list of permitting agencies in the Environmental Checklist, Section 3. The District recognizes that mitigation measures in the NMFS biological opinion would most likely be incorporated into a Corps permit.

p. 65 – fish rescue
Comment
"Are fish not going to be relocated from the reach?"

Response
The in-channel work sites would first be isolated with exclusionary fencing and any steelhead relocated from within the fenced area. Steelhead relocation sites would be determined in consultation with NMFS and CDFW. If a gravity flow bypass channel is feasible, fences would be removed to allow migration after the bypass is installed and the work site areas are isolated from the river. If a piped bypass is required, the reach with the work sites would be closed off to migration until construction is complete.

MPWMD recognizes that there is a small risk of take from rescue and/or construction activities. The mortality rate for MPWMD fish rescues is < 0.2%, but still greater than zero. In addition, mitigation measures such as exclusionary fencing and/or structures can be subject to changes due to unpredictable high wind, debris, flows and other unpredictable conditions, even if the site is monitored frequently. A dewatering and steelhead rescue plan will be submitted for approval with permit applications.

p. 67 – BIO-MM-6
Comment
"Any need to mention pumps needed for disposal of water as well?"

Response
This will be described in the response to the previous comment on p.30 about dewatering.

p. 67 – potential adverse impacts to steelhead during construction period
Comment
Commenter requests insertion of language in italics into the following statement in the IS/MND:

"As described in the preceding section, impacts within the Carmel River are anticipated to be temporary and minimal, and are thus also unlikely to result in *permanent* adverse impacts to steelhead *or their habitat*. *There will be temporary adverse impacts to both*."

Response
The District will add the requested language.

p. 68 – conclusion about take of steelhead in BIO_MM-6

Comment
" 'Take' is expected for steelhead and minor temporary impacts to their habitat are likely to occur. So the effects are not really less than significant for the purposes of the ESA consultation, but would be considered likely to adversely affect steelhead. Although the benefits of the project would be considered to offset some of these adverse effects."

Response
The District agrees that the project will benefit S-CCC steelhead; however, under CEQA the District can only address impacts and not benefits. The District agrees that there are differences of standards between CEQA and the ESA and recognizes that NMFS may characterize impacts and avoidance measures somewhat differently under the ESA than what is described in the IS/MND.

p. 69 – in-channel work period
Comment
"[The District] should also include the work window for steelhead, June 1 through October 31st."

Response
MPWMD will change the text as follows (italic and strikeout):

"– Seasonal Avoidance. Work *in the channel* would be limited to the ~~dry season from April 15 to October 15~~ *period between June 1 and October 31st. Work outside of the channel or at other times of the year would be carried out in consultation with permitting agencies."*

p. 112 – Table 8 - Estimated Downstream Water Quality Conditions with the Proposed Project

Comment
"Does the document discuss anywhere that the filtration system will remove a considerable amount of the suspended and settleable solids on a long term basis from the river via the basin and sand separation system? Seems like it should be considered."

Response
Currently, the rearing channel traps some suspended sediment, which is flushed out each year after steelhead are removed and relocated into the river. Solids carried by the river into the intake system and rearing channel will eventually return to the river. Material dropped out in the settling area, trapped in microfilters, or settled out in the rearing channel will be spread on the gravel bar, where winter high flows will entrain it. This is the same as the current operation. This is described briefly in Section 4.8 in the Basis of Design Report at

http://www.mpwmd.net/environmental-stewardship/carmel-river-steelhead-resources/steelhead-rescue/sleepy-hollow-facility/

p. 146 – BIO-MM-4
Comment
"One of these, BIO-MM-4,5, or 6 (likely 5 or 6) should spell out that turbid seepage water pumped from within the construction site needs to be directed to a location that will not drain back to the river."

Response
MPWMD will change the text in BIO-MM-6 to indicate that any turbid water pumped out of in-channel work sites will be discharged to gravel bar areas that allow infiltration.

p. 147 – BIO-MM-7 Construction Season
Comment
"Again, in-water work for steelhead would be restricted to June through October."

Response
Comment noted. The language from the response to a similar comment on p. 69 will be included in this Mitigation Measure.

Thank you for your comments. If you have questions or comments about this letter, please contact me at (831) 658-5620.

Sincerely,

Larry Hampson
District Engineer

Cc: Trish Chapman, State Coastal Conservancy
Julio Gonzales, California American Water

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MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

November 4, 2016

Ms. Kim Sanders
California Regional Water Quality Control Board
Central Coast Region
895 Aerovista Place, Suite 101, San Luis Obispo, California 93401-7906

SUBJECT: Responses to Comments
Sleepy Hollow Steelhead Rearing Facility Mitigated Negative Declaration

Dear Ms. Sanders:

This is a response to Regional Water Quality Control Board (RWQCB) comments on "Initial Study/Mitigated Negative Declaration Sleepy Hollow Steelhead Rearing Facility Raw Water Intake and Water Supply System Upgrade" (the Project) prepared by the Monterey Peninsula Water Management District (District or MPWMD). Below are RWQCB comments received on October 14, 2016 and the District's responses. The District intends to hold a Public Hearing on November 14, 2016 at the District office at 7 p.m. to consider approval of the Project. A Final IS/MND will be prepared to reflect comments received.

Comment 1

"Thanks for soliciting our comment regarding the Sleepy Hollow Steelhead Rearing Facility Raw Water Intake and Water Supply System Upgrade, and thanks for asking about using MPWMD's current 401 Certification. Unfortunately, unless you can get the project built by August 2017, this project cannot be included in the current certification. Your Water Quality Certification Number 32711WQ08 for Carmel River Maintenance and Restoration, Monterey County expires on August 31, 2017."

Response 1

The District intends to submit a request to renew the current 401 Certification in early 2017; however, if RWQCB staff require a separate Certification for this project, the District will work with RWQCB staff to develop an application.

Comment 2

"Central Coast Water Board staff recognizes that the Sleepy Hollow Steelhead Rearing Facility will be beneficial to supporting the steelhead population. However, Central Coast Water Board has some

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concerns with the design and inclusion of so much rip rap among a few other concerns regarding information within the MND:

1. Central Coast Water Board staff needs to understand how you avoided impacts to waters of the State during project design. Please provide a demonstration of avoidance through project design.
2. For any design elements that you demonstrate are not avoidable, please demonstrate how you minimized impacts in those particular design elements. "

Response 2

Early in the process of drafting a Request for Proposal and selecting a Consultant for the Project, the District formed a Technical Advisory Committee consisting of staff from the National Marine Fisheries Service (NMFS), the State Coastal Conservancy (SCC), the California Department of Fish and Wildlife (CDFW), California American Water, and MPWMD. After selection of a Consultant, CDFW determined that NMFS staff could represent the interests of the two agencies during the design process (NMFS and CDFW often share resources in these types of projects).

The District worked with the TAC to select a location and design for an intake that should minimize impacts and provide conditions to minimize future maintenance and repair requirements (e.g., from high flows that could damage the intake) while allowing the Sleepy Hollow Steelhead Rearing Facility (SHSRF) to operate under a wider range of flows and river conditions. In late 2013, a site visit was held to evaluate the best location and discuss intake and other design alternatives. NMFS made several recommendations as described in Memos dated January 27, 2014 and May 6, 2014 (Enclosure 1). As recommended in those memos, the District selected the smallest screen that would meet the project design requirements.

Subsequently, the SCC, NMFS, MPWMD, and Cal-Am reviewed a draft Basis of Design (BOD) report and there were several comments that the Consultant responded to in a memo dated November 18, 2015 (Enclosure 2). The BOD is available on the District web site at:

http://www.mpwmd.net/environmental-stewardship/carmel-river-steelhead-resources/steelhead-rescue/sleepy-hollow-facility/

In a February 2016 review of the IS/MND, SCC raised concerns about the initial proposal for structural protection in the active channel that included building a concrete wall to protect the intake structure (similar to the wall shown in Image 1 of the NMFS May 6, 2014 memo). A teleconference between NMFS, SCC, MPWMD and TetraTech was held on March 8, 2016 to discuss the river intake design and in particular, the following: erosion protection, alternatives to retaining wall, effects on screen O&M (risk tradeoffs), and effects on channel and bank stability. In response to comments received at that meeting, TetraTech revised the design to reduce the footprint of the Project within the river channel to the area and design described in the IS/MND.

Design changes to the intake and screen during this process can be summarized as follows:

1) intake and screen location chosen to minimize need for vegetation clearing for access and to reduce the potential for failure due to erosion and need for future maintenance operations in the active channel; 2) permanent access road to intake screen for maintenance deleted in favor of using a large crane if screen needs to be removed and replaced; 3) deleted protective retaining wall in favor of loose riprap that can be revegetated coupled with a small concrete box to allow a piped connection to the screen; 4) footprint of concrete pad reduced by going from original dimensions of 10 ft. x 10 ft. to a 9-ft diameter; 5) cone screen alternative protects steelhead from impingement/entrainment while being resistant to debris/rock flows; 6) substitution of backing rock for traditional filter cloth under riprap to allow root penetration into streambank.

<u>Comment 3</u>

"Once we receive the above information we will also require

1. A demonstration of the need for the precast concrete box that will be embedded into the river bank forming a wall,
2. A demonstration of how the proposed concrete boxes/bases installed in the river bed will not cause erosion, and why the river-facing side of the box would be exposed,
3. A demonstration of how the proposed rip rap laid into the river bed will not cause erosion downstream or upstream of the facility,
4. A shear stress analysis demonstrating the need for any proposed bank rip rap and the proposed precast concrete box on the bank including:
    a. The flows for which the project is designed, the return period of those flows, and the shear stress and velocity of those flows;
    b. The least invasive bank stabilization material that will withstand the shear stress based on Table 2, Permissible Shear and Velocity for Selected Lining Materials, in the Corps' technical note[1]), and
    c. Quantitative demonstration of why non-hardscape means of stabilization are infeasible.

   Please note that we prefer to balance protection from erosion with availability of habitat. Therefore, we prefer to protect the banks to a lesser year flood to avoid the use of harder-scape materials and more of those materials."

<u>Response 3</u>

The District understands that these comments will be addressed during the permitting phase of the project; however, here are some initial responses that will be more fully developed during final design and with a permit application.

Shear stress and velocity analysis show that there is a high risk of erosion just due to water flow at the intake site (see Enclosure 3). The District has a concern that this type of analysis is unable to explain how large boulders and riprap far in excess of what the flow can theoretically move are present in this reach and have moved over time (see Enclosure 4).

There is also a new, unquantified risk to the intake and nearby streambank from the reintroduction of large wood below the site of the former San Clemente Dam. With the removal of San Clemente Dam in 2015, large wood weighing several tons is more likely to be passing through this reach and posing an erosion risk either from directly impinging on the streambank and intake and/or causing the formation of a logjam nearby.[1] Such logjams are common in natural rivers and may be persistent over time; however, there is no body of evidence to indicate where logjams may form and how large wood may influence channel geometry in this reach. Based on experience in the lower 16 miles of the river, the presence of large wood can increase the risk of failure to infrastructure placed in the active channel.[2]

There is also a design risk introduced from the relatively short record of peak flows. The current predicted 100-year magnitude event at this site is 10,200 cfs. There have been a wide range of estimates for peak flows in this reach and a significant amount of uncertainty surrounding peak flow estimates.[3] The 1911 flood event swept away the gage at the Old Carmel River Dam about 0.5 miles upstream at a flow of 18,000 cfs and was estimated to peak at 20,000 cfs. The 1995 and 1998 peak events at San Clemente Dam were at or near the current estimated 100-year flood peak prediction. The great flood of 1862 was estimated to exceed 30,000 cfs in the lower river.

The District understands the reasoning for maintaining suitable streamside habitat in this reach and believes that the habitat that will grow up around the proposed new intake will be compatible with maintaining its high value. Significant damage to the intake area during an erosion event would likely cause the SHSRF to be inoperable for an extended period and repairs would cause additional disturbance.

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[1] Prior to removal of San Clemente Dam, the superstructure on the dam, which was comprised of 10-foot wide ports, trapped significant portions of the large wood coming into the reservoir from upstream. To pass this material downstream, Cal-Am would cut large wood into 8 to 10 foot sections and manually pass the wood through the ports.

[2] Almost every bridge across the lower 16 miles of the river has had abutments and/or piers scoured and damaged during high flows. Most of the damage has involved debris. Eight of the 20 bridges across the lower 16 miles of the river were washed out at high flows. Six were rebuilt. Several bridges have needed repairs to abutments or supports.

[3] One the predictions for the 100-year event at the USGS Robles Del Rio gage at RM 14.5 varies from 15,600 cfs to 43,000 cfs. See Carmel River Flood Insurance Study Hydrology Report, Prepared for FEMA, Prepared by Northwest Hydraulic Consultants, January 2006.

NMFS and CDFW have both expressed that the SHSRF will need to be operated for a minimum of 10 years. It is likely to be run for far longer, given that the S-CCC population will not recover in that time period. Therefore, the risk of an event greater than the design event (i.e., getting toward the upper limits in the confidence interval) will increase the longer the facility is operated. It would be prudent, in my opinion, to use hardscape materials at this site to reduce the risk due to streambank failure or damage to the intake.

Comment 4

5. "An understanding of what will be used as backfill for the current intake feature. "

Response 4

Because the existing pump housing was not anchored into the streambank or channel bottom and consisted of concrete rings stacked vertically to form a caisson, there is a possibility the rings can simply be lifted straight up without disturbing the streambank; however, if material around the existing intake must be excavated to remove the caisson, riprap and native material would be used for backfill, with native material over riprap and native vegetation incorporated into the material. The former approach will be used first.

Comment 5

"Thank you for not proposing petroleum based fabrics for laying underneath your rip rap."

Response 5

MPWMD has not used fabrics to prevent piping under riprap since 1993. Currently, the District prohibits fabrics from being used in projects requiring MPWMD River Work Permits. Instead, project applicants are encouraged to substitute materials that can provide the same function, but that allows more natural development of rooted vegetation.

Comment 6

Other General MND Comments:

1. Section 3.3.4.1.2 Reads, "Carmel River waters below the ordinary high water mark would qualify as jurisdictional waters of the U.S. and State, falling under the jurisdiction of the USACE and RWQCB. Improvements within the channel, channel banks, and adjacent riparian areas would also be subject to review and approval by CDFW." While the first sentence is correct, the

second sentence should also include RWQCB as having regulatory authority over channel, channel banks, and adjacent riparian areas. Please revise.

2. Please revise BIO-MM-2 to read, "Replacement planting for riparian trees would occur at a ratio determined through consultation with CDFW and the RWQCB, to..." since the RWQCB has regulatory authority over impacts to riparian areas.

We may have additional questions once we receive your application for this project.

Response 6

MPWMD will revise the Final IS/MND to either list RWQCB specifically or change the description to be more general to say "federal and state permitting authorities" and include a table of the permitting agencies.

If you have questions or comments about this letter, please contact me at (831) 658-5620.

Sincerely,

Larry Hampson
District Engineer

Cc: Trish Chapman, State Coastal Conservancy
David White, Jacqueline Pearson-Meyer, National Marine Fisheries Service
Julio Gonzales, California American Water

Enclosures: 1. NMFS Memo dated May 6, 2014
2. Memo dated November 18, 2015
3. Memo dated Nov. 2, 2016

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[1] Fischenich, J.C. (2001) *Stability Thresholds for Stream Restoration Materials, EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-29)*, U.S. Army Engineer Research and Development Center, U.S. Army Corps of Engineers, Vicksburg, MS

Enclosure 1

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

January 27, 2014

MEMORANDUM FOR: Joyce Ambrosius

CC: Rick Wantuck, Steve Thomas

FROM: David White

SUBJECT: Sleepy Hollow SRF Water Intake Recommendations

INTRODUCTION

This memo has been prepared to provide comments in response to the Sleepy Hollow Steelhead Rearing Facility Sediment Control and Intake Retrofit reports (List Engineering Company 2010, 2003) and observations made during a site visit on November 15, 2013. These comments are meant to supplement the discussion of facility improvements and possible upgrades.

SUMMARY

The highest priorities at this facility are 1. Improved access to the pumps and controls during extreme high and low water events, 2. An improved fish screen that does not clog with leaves or go dry during low water conditions, and 3. Reduced sediment input and associated damage to pumps and other equipment. The List Engineering reports appropriately identify these priorities. Design suggestions are provided in the Existing Intake *Recommendations* section.

Another important priority, not highlighted in the reports, is improving the reliability of the water supply source. In some years (including this past year), river flows are less than the level needed to supply the facility, requiring the premature release of fish back to the river. In addition, future sediment levels may increase in response to the dam removal. Finally, facility capabilities may need to be changed or upgraded in response to the needs of the steelhead population. These factors call for an improved water source.

The water supply source could be improved by moving the intake to the deep pool near the facility outfall, or by adding a recirculating water system. A recirculating system is ultimately a more secure and predictable water source. If needed, a recirculating system can be isolated from the river entirely for extended periods. A recirculating system may allow the new intake and screen to be reduced in size. Other benefits and drawbacks are provided in the Existing Water Supply *Recommendations* section. A recirculating system for this facility could likely be constructed for approximately $500,000.

DETAILED COMMENTS

EXISTING INTAKE

The existing intake is a drum screen on the river bottom supplying water to a pump housing on the river bank. The screen is vulnerable to clogging or damage from leafy debris and sediment moving downstream. The pump housing is a confined space containing pumps, motors, and electrical connections. This makes intake operation and maintenance difficult. At high river levels, the pump housing is underwater and operation and maintenance is not possible.

Recommendations

<u>Intake</u>

The intake should be moved out of the stream channel to a location where it is deeper and better protected from debris and sediment moving downstream. One way to do this is to build a concrete alcove into the stream bank that houses the fish screen (Image 1 below). This would require bank excavation for the alcove, as well as digging a trench for the supply pipe to the pumps. This would likely require additional environmental permitting.

Image 1- Example of alcove built into stream bank to house a cone-shaped fish screen.

Another possibility is relocating the intake from the current location to the 12 foot deep pool at the facility outfall. Water supply may be somewhat colder at this location, and water level would be more secure during drought periods. An intake at this location would also be more protected from leaves and other debris, reducing maintenance. However, pumping costs at this location would be significantly higher.

Fish Screen

Various types of fish screens are possible at this location. A cone screen (Image 2 below) is able to operate in as little as a foot of water depth. A cone screen also performs well under high debris and sediment loads. Given the shallow depth of this stream in summer, as well as past trouble here with heavy leafy debris and an expected increase in sediment supply, a cone screen would be a good choice for this project. A 3 cfs flow to the facility can easily be supplied by a relatively small (5 and 1/2 foot diameter) cone screen.

Image 2- Example of cone screen underwater in an alcove with external cleaning brushes in operation.

Pump Housing

The existing pump housing (wet well) should be improved. Maintenance, repair, and switching from one pump to another is difficult because the pump housing is in a cramped and partially submerged space. At higher flows, the entire pump housing is submerged and is therefore inaccessible. There are several ways that safety and functionality of the pump housing could be improved, including:

1. Enlarge the housing.
2. Replace existing pumps with retractable pumps that are raised from above on rails.
3. Raise the motors and/or valve controls above the high water mark (Image 3 below). This would likely require installing a raised platform, and access during high water events would likely require a significant catwalk or a boat.

Image 3- Example of pump motor and electrical supply raised out of wet well to improve access.

EXISTING WATER SUPPLY

The facility currently operates between May and December in order to rear steelhead when river conditions are unfavorable. Approximately 900 gpm (2 cfs) of river water is pumped to the cooling tower, and from there flows into a cold well. From the cold well, water is pumped into the raceways, where it supports from 16,000 to 48,000 juveniles. After the last rearing pond, the water flows through a lava rock filter and back to the river. This is a single-pass system, meaning there is no water recirculation.

There are several water supply issues with the existing single-pass system. In some drought years, water depth at the existing intake is too low to operate. As a result (last year included), fish have had to be released from the facility prematurely, before river conditions were optimal. Also, the existing cooling tower is not cooling water to optimal levels (<60F) during periods of hot, humid weather and warm river temperatures.

As described previously, facility operations are limited to the periods when the river levels are below the level of the pumps, which are submerged at high flows and cannot be accessed. Access in the pump housing is difficult even when water levels are below the pumps. Additionally, at low water conditions in the Fall, the screen becomes clogged with leaves and requires frequent maintenance. Finally, there is no water disinfection system.

Recommendations

Water Recirculation

Installing a full or partial water recirculation system would improve the reliability of operations, improve fish health, and expand the capabilities of the facility to potentially include year-round operation. While at this time year-round operation is not required, it may make sense to plan for this potential need during facility improvements.

In such a system, water would be collected at the downstream end of the rearing facility and pumped back upstream to the beginning of the system (Diagram 1). There it would be chilled, filtered (solids filter, biofilter, and protein skimmer), disinfected, and passed back into the rearing ponds. A concept diagram is provided below. A small quantity of water would still need to be drawn from the river to make up for evaporative loss, water leakage in the rearing channels, and to dilute waste build-up in the recirculating system. Also, single pass operation may still be needed during periods of salt or chemical treatments in the rearing ponds.

Benefits of a recirculating system:

1. Sediment protection- Protect the intake pumps and recirculating pumps from damage from sediment, since intake water could be stopped when sediment levels in the river are high.
2. Reduced size of the fish screen and intake pumps, since less intake water would be needed.
3. Year round facility operation, if desired.
4. Improving control of temperature and water quality by selecting when water is drawn from the river.
5. Reduced energy cost to pump intake water. (This would be offset by increased energy costs to pump for recirculation).

6. Possibly increasing effectiveness of cooling tower- In hot and humid weather, water in the downstream rearing channels is cooler than river temperatures, and recirculating it will likely yield lower overall temperatures.

Drawbacks of a recirculating system:

1. Additional capital costs of pumps and piping to recirculate water.
2. Additional capital costs of filtration (solids filter, biofilter, and protein skimmer to remove fish waste).
3. Additional energy cost to pump water from facility end to beginning. (This would be partially offset by reduced pumping costs of intake water).
4. Additional cost of water disinfection.

Potential Costs:

Adding recirculation to this facility would require a water collection tank below the last rearing pond, additional pumping, piping, filtration, protein skimmers, and disinfection. Based on the costs of two other recirculating facilities, a very rough estimate of the cost of additional equipment needed for recirculation at this facility is $500,000.

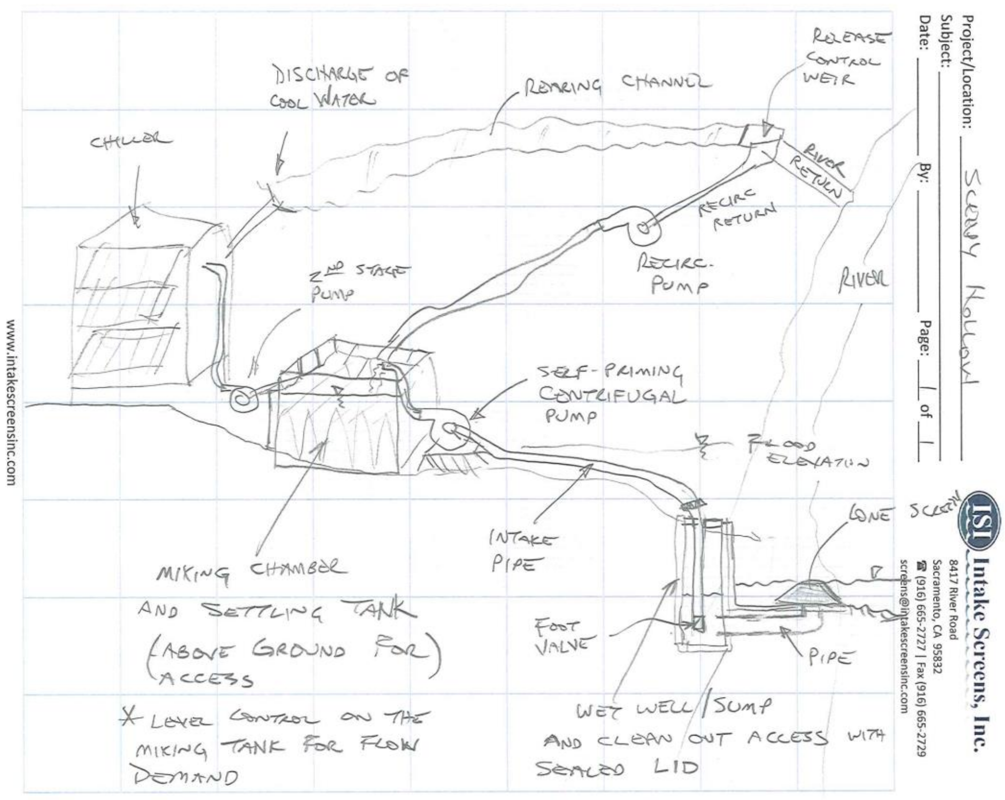

Diagram 1- Concept Drawing of Recirculating System (from Darryl Hayes, ISI)

Enclosure 1
UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

May 5, 2014

MEMORANDUM FOR: Joyce Ambrosius

CC: Rick Wantuck, Steve Thomas

FROM: David White

SUBJECT: Sleepy Hollow SRF Water Intake Recommendations

INTRODUCTION

This memo has been prepared to provide comments in response to the Sleepy Hollow Steelhead Rearing Facility Sediment Control and Intake Retrofit reports (List Engineering Company 2010, 2003) and observations made during a site visit on November 15, 2013. These comments are meant to supplement the discussion of facility improvements and possible upgrades.

SUMMARY

High priority needs at this facility include 1. Improved access to the pumps and controls during extreme high and low water events, 2. An improved fish screen that does not clog with leaves or go dry during low water conditions, and 3. Reduced sediment input and associated damage to pumps and other equipment. The List Engineering reports appropriately identify these priorities. Design suggestions are provided in the Existing Intake *Recommendations* section.

Another important priority, not highlighted in the reports, is improving the reliability of the water supply source. In some years (including this past year), river flows are less than the level needed to supply the facility, requiring the premature release of fish back to the river. In addition, future sediment levels may increase in response to the dam removal. Finally, facility capabilities may need to be changed or upgraded in response to the needs of the steelhead population. These factors call for an improved water source.

The water supply source could be improved by moving the intake to the deep pool near the facility outfall, or by adding a recirculating water system. A recirculating system is ultimately a more secure and predictable water source. If needed, a recirculating system

can be isolated from the river entirely for extended periods. A recirculating system may allow the new intake and screen to be reduced in size.
Another priority is sufficient water storage and a system to deal with occasional disease treatments (either storage tanks or on-land dispersal) to deal with treated water when it is not appropriate to discharge treated water directly into the stream or back into a recirculating system.

Other benefits and drawbacks are provided in the Existing Water Supply *Recommendations* section. A recirculating system for this facility could likely be constructed for approximately $500,000.

DETAILED COMMENTS

EXISTING INTAKE

The existing intake is a cylindrical Tee screen on the river bottom supplying water to a pump housing on the river bank. The screen is vulnerable to clogging or damage from leafy debris and sediment moving downstream. The pump housing is a confined space containing pumps, motors, and electrical connections. This makes intake operation and maintenance difficult. At high river levels, the pump housing is underwater and operation and maintenance is not possible.

Recommendations

<u>Intake</u>
The intake should be moved out of the stream channel to a location where it is deeper and better protected from debris and sediment moving downstream. One way to do this is to build a concrete alcove into the stream bank that houses the fish screen (Image 1 below). This would require bank excavation for the alcove, as well as digging a trench for the supply pipe to the pumps. This would likely require additional environmental permitting.


Image 1- Example of alcove built into stream bank to house a cone-shaped fish screen.

Another possibility is relocating the intake from the current location to the 12 foot deep pool at the facility outfall. Water supply may be somewhat colder at this location, and water level would be more secure during drought periods. An intake at this location would also be more protected from leaves and other debris, reducing maintenance. However, pumping costs at this location would be significantly higher.

Fish Screen

Various types of fish screens are possible at this location. A cone screen (Image 2 below) is able to operate in as little as a foot of water depth. A cone screen also performs well under high debris and sediment loads. Given the shallow depth of this stream in summer, as well as past trouble here with heavy leafy debris and an expected increase in sediment supply, a cone screen would be a good choice for this project. A 3 cfs flow to the facility can easily be supplied by a relatively small (5 and 1/2 foot diameter) cone screen.

Image 2- Example of cone screen underwater in an alcove with external cleaning brushes in operation.

Pump Housing

The existing pump housing (wet well) should be improved. Maintenance, repair, and switching from one pump to another is difficult because the pump housing is in a cramped and partially submerged space. At higher flows, the entire pump housing is submerged and is therefore inaccessible. There are several ways to improve the safety and functionality of the pump housing, including:

1. Enlarge the housing.
2. Replace existing pumps with retractable pumps that are raised from above on rails.
3. Raise the motors and/or valve controls above the high water mark (Image 3 below). This would likely require installing a raised platform, and access during high water events would likely require a significant catwalk or a boat.

Image 3- Example of pump motor and electrical supply raised out of wet well to improve access.

EXISTING WATER SUPPLY

The facility currently operates between May and December in order to rear steelhead when river conditions are unfavorable. Approximately 900 gpm (2 cfs) of river water is pumped to the cooling tower, and from there flows into a cold well. From the cold well, water is pumped into the raceways, where it supports from 16,000 to 48,000 juveniles. After the last rearing pond, the water flows through a lava rock filter and back to the river. This is a single-pass system, meaning there is no water recirculation.

There are several water supply issues with the existing single-pass system. In some drought years, water depth at the existing intake is too low to operate. As a result (last year included), fish have had to be released from the facility prematurely, before river conditions were optimal. Also, the existing cooling tower is not cooling water to optimal levels (<60F) during periods of hot, humid weather and warm river temperatures.

As described previously, facility operations are limited to the periods when the river levels are below the level of the pump motors, which are submerged at high flows and cannot be accessed. Access in the pump housing is difficult even when water levels are below the pump motors. Additionally, at low water conditions in the fall, the screen becomes clogged with leaves and requires frequent maintenance. Finally, there is no water disinfection system.

Recommendations

Water Recirculation

Installing a full or partial water recirculation system would improve the reliability of operations, improve fish health, and expand the capabilities of the facility to potentially include year-round operation. While at this time year-round operation is not required, it may make sense to plan for this potential need during facility improvements.

In such a system, water would be collected at the downstream end of the rearing facility and pumped back upstream to the beginning of the system (Diagram 1). There it would be chilled, filtered (solids filter, biofilter, and protein skimmer), disinfected, and passed back into the rearing ponds. A concept diagram is provided below. A small quantity of water would still need to be drawn from the river to make up for evaporative loss, water leakage in the rearing channels, and to dilute waste build-up in the recirculating system. Also, single pass operation may still be needed during periods of salt or chemical treatments in the rearing ponds.

Benefits of a recirculating system:

1. Sediment protection- Protect the intake pumps and recirculating pumps from damage from sediment, since intake water could be stopped when sediment levels in the river are high.
2. Reduced size of the fish screen and intake pumps, since less intake water would be needed.
3. Year round facility operation, if desired.
4. Improving control of temperature and water quality by selecting when water is drawn from the river.
5. Reduced energy cost to pump intake water. (This would be offset by increased energy costs to pump for recirculation).
6. Possibly increasing effectiveness of cooling tower- In hot and humid weather, water in the downstream rearing channels is cooler than river temperatures, and recirculating it will likely yield lower overall temperatures.

Drawbacks of a recirculating system:

1. Additional capital costs of pumps and piping to recirculate water.
2. Additional capital costs of filtration (solids filter, biofilter, and protein skimmer to remove fish waste).
3. Additional cost of water disinfection.
4. Additional energy cost to pump water from facility end to beginning. (This would be partially offset by reduced pumping costs of intake water).
5. Possible additional energy cost to chill water on an annual basis (see number 6 under “Benefits” above).
6. O&M costs of recirculation system components.

Potential Costs:

Adding recirculation to this facility would require a water collection tank below the last rearing pond, additional pumping, piping, filtration, protein skimmers, and disinfection. Based on the costs of two other recirculating facilities, a very rough estimate of the cost of additional equipment needed for recirculation at this facility is $500,000.

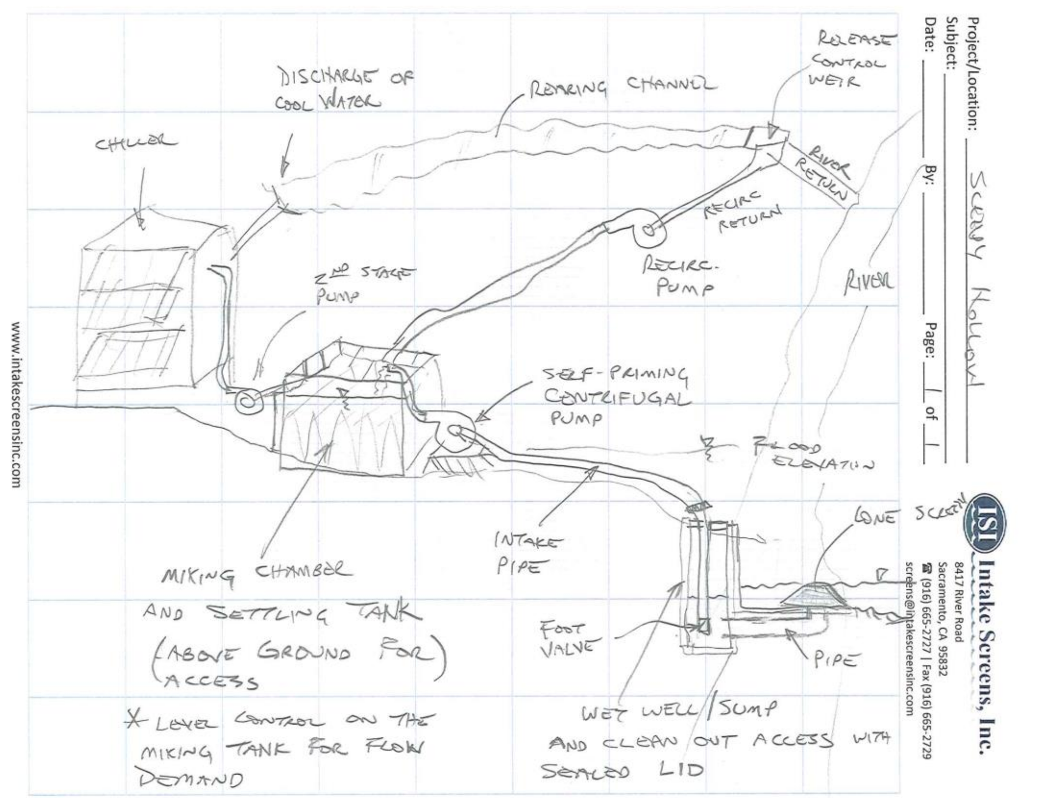

Diagram 1- Concept Drawing of Recirculating System (from Darryl Hayes, ISI)

TETRA TECH

Enclosure 2

Memorandum

Date:	November 18, 2015
To:	Larry Hampson, Monterey Peninsula Water Management District
Cc:	Kevan Urquhart, MPWMD; Katie Chamberlin, Anchor QEA; Brian Vinci, Freshwater Institute
From:	Darrel Nice, Tetra Tech
Project:	Sleepy Hollow Steelhead Rearing Facility – Raw Water Intake and Water Supply System Upgrade
Project Number:	135-124674-15001
Subject:	Response to Review Comments for Basis of Design Report

The purpose of this memorandum is to provide responses to review comments of the October 2015 Basis of Design (BOD) report. The BOD report was reviewed by the Coastal Conservancy and by NMFS. A brief summary of the comment is provided prior to each response. The original comments are attached to this memo for reference. Draft responses below are prepared by Tetra Tech and will be supplemented by Freshwater Institute and MPWMD. The final memo will be used during our meeting on November 24 (need to confirm date).

Responses to Coastal Conservancy Review Comments

Comment 1a: Additional analysis of the feasibility of a recirculation system is needed due to its significant cost. Consult with NMFS and CDFW to determine what flows the agencies would allow for diversions from the river.

Response: These agencies will be consulted to determine allowable diversion rates during low river flows. Technically the system requires a minimum river flow to replenish water lost in the rearing system, and to keep fresh water supplying the intake without causing flow reversal in the river. About 0.2 cfs of river flow beyond what is being withdrawn should keep water moving past the intake, resulting in at least 1.4 cfs flow needed in the river.

Comment 1b: Prepare an analysis of how often the recirculation system will be needed, taking into account any restrictions on water withdrawals. Analysis to take into account historical river flows.

Response: In addition to use during low river flows, the system will also operate during high river turbidity events and can improve normal facility operation. We estimate without reuse the river flow would need to be about 3 cfs, and with reuse river flow could be as low as 1.4 cfs for extended periods.

Comment 2: For option #3, is the second set of pipes that bypasses the treatment facility necessary? Is the increased cost of pipeline construction worth the savings in energy cost?

Response: The pipeline that goes directly from in RW intake pump station to the cooling tower provides operational flexibility to bypass the treatment facility when the river water quality is good. There is some increased energy costs associated with running the filters and re-pumping the

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river water. The second pipeline allows the sediment basin and filter to be taken offline for maintenance, while still providing river water to the facility. Fish rearing operations benefit from this type of redundancy and the added pipe cost is minimal when two pipes are installed in one excavated trench as is planned.

Comment 3: Provide more information and justification for need of the proposed aeration/oxygenation tower. Consider installing a second smaller fan on existing cooling tower for aeration.

Response: The second fan option can be reviewed during design. The additional aeration tower is more efficient and allows for supplementation with pure oxygen in the future if it is needed. This will be discussed during the teleconference.

Comment 4a: Is the quarantine flow from river needed throughout the season?

Response: Yes, the quarantine occurs any time fish are rescued, which occurs throughout the season.

Comment 4b: Concern about formalin and other treatment chemical effects on river water quality during low river flows.

Response: The quarantine tanks are used to observe and sort fish and reduce shock when the fish first arrive. Formalin is the first treatment in every quarantine effort and is often the only treatment. When it is used the drain water is diverted to small storage tanks where it is treated and tested before release onto the gravel bar in accordance with the District's waiver form the RWQCB. The majority of the time the drain water is chemical free and safe for fish and returns to the river in an underdrain pipe that is installed below the rearing channel. This water could be used in the reuse system, but it is difficult to capture because of its lower elevation hydraulic grade line and was determined not cost effective.

Comment 5: When pumps are turned off will rearing channel quickly go dry? Consider channel modifications to address concern.

Response: The channel is already constructed to hold a certain level of water in each pool. There is some leakage that is unavoidable, which limits the amount of time it can hold water at a safe level. Another time limitation comes from fish consumption of oxygen and maintaining safe oxygen level. This does provide risk mitigation, but the only for limited time.

Comment 6: In the last sentence of section 4.8 "Effluent Water Treatment and Discharge" what is meant by "in the future"?

Response: This sentence should be revised. There is no requirement to store or remove the solids. The permitting agency has indicated discharge to the flood plain is acceptable and is consistent with the current practice.

Comment 7: Separate permitting and phased construction will not make sense unless it is agreed that the recirculation facilities are worth the cost.

Response: Permitting for the intake work will take longer because it impacts the river bank and includes in-water work. The reuse system construction is outside the normal river levels, and could be operated using the existing intake making the system more reliable.

Comment 8a: Revise cost summary table 6-1 to include line items for sub-total, contingency, and sales tax.

Response: This is a planning level cost estimate. The comments are helpful and will be included in future cost estimates once additional design detail is developed.

Comment 8b: Sales tax should be applied to materials only

Response: Tax will be clarified in future cost estimates.

Comment 8c: 25% contingency seems low given vague nature of the cost estimate

Response: At this planning level design each cost item also includes contingency.

Comment 8d: Cost estimate backup does not show how lump sum values were estimated

Response: Lump sum values and unit costs are based on several sources of information including: experience from similar past projects, bid tabs and schedules of values from other projects, consultation with RS Means, and correspondence with equipment suppliers.

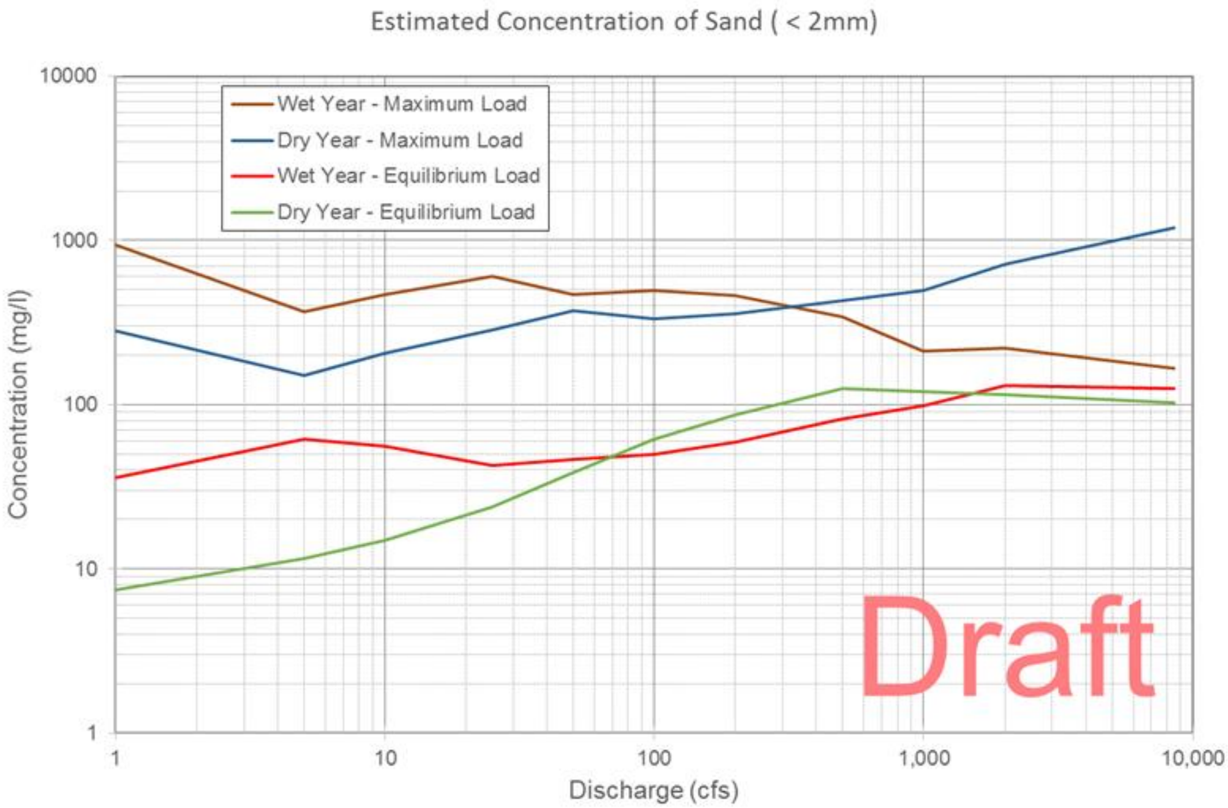
Comment 8e: Cost estimate does not include environmental monitoring and mitigation.

Response: These items will be reviewed more closely in future cost estimates.

Responses to NMFS Review Comments

Comment 1: Additional analysis of recirculation elements should include both low flow years and sediment mobilizing flows. Primary benefit of the recirculation system is as an insurance policy for future sediment transport events related to upstream dam removal. Recirculation may allow for improvements in normal facility operations such as increasing feed rates or increasing population density.

Response: The design for the project did incorporate the potential for some erosion of sediment deposited at the upstream end of the former San Clemente Reservoir. It is unknown how quickly that area will adjust to the new river grade, but we estimate it will happen fairly quickly if there are average flows. However, that area of reservoir deposits has the highest fraction of gravel (5-10%) and the sand fraction is likely to move downstream to the alluvial reach within a few years. Although MPWMD experience with Carmel River channel work is further downstream in a lower energy part of the system, from what was seen at the Reroute Project, we expect an initial adjustment of the Reroute Channel that could result in an elevated sediment level that will decrease over a number of years. The channel and floodplain are built with structural components (i.e., rip-rap and energy dissipaters) to withstand the 50-year and 10-year flood levels, respectively. Naturally recruited and planted vegetation will further reduce the potential for erosion in large events. The chart below shows estimated near term (Maximum Load) and long term (Equilibrium Load) sediment concentrations related to river discharge.



The more important and significant increase in sediment may come from other areas of the watershed. For example, intense rainfall on the 1,000-acre Tassajara fire (see photo) could send a mudslide into Cachagua Creek that will eventually pass by the Sleepy Hollow facility. In the past, erosion and sedimentation from upstream of the former San Clemente Dam appear to have been much more episodic than chronic. But, significant episodes can take several years to work through the system. So, the RAS can definitely benefit the facility by decreasing the volume of sediment reaching the rearing channel after an episodic event.

Comment 2: The Maximum Screen Approach Velocity in Table 2-1 should be changed to 0.33 feet/second and reference the NMFS Southwest Region Fish Screening Criteria for Anadromous Salmonids, 1997.

Response: Comment noted. Table 2-1 will be revised.

Comment 3: Did you consider a vertical cylinder screen located a bit downstream of the proposed location in a deeper area of the pool?

Response: We have considered the vertical cylinders and do not feel they are justified at this project. The river depth even in the pools is very limiting and cone screens are better for shallow conditions.

Comment 4: If there is significant current, internal baffles may be needed inside the fish screen to get the approach velocities right.

Response: Maximum river velocity at the screen location will be reviewed during design and baffles added if required.

Comment 5: Spray bar system suggested improvements / modifications

Response: The spray bar suggestions will be used during design and we may want to see some photos and details if they are available. We will also take a closer look at what we have designed at other facilities.

Comment 6: Air burst systems don't tend to much move sediment and they often promote growth of stubborn black algae on the screen

Response: It has been our experience that air burst does not remove sediment very well. However, based on the operators experience at Sleepy Hollow, air burst may be useful in removing lighter debris such as leaf mats that stick to the screen. This will be reviewed with the screen vendor during design.

Comment 7: Figure 2-3 River Pump Station: Should gate valve by provided between pump and check valve? Should the pipeline increase in size where the two 12" pipes come together at the wye?

Response: The isolation valve located downstream of the check valve is standard configuration for pump stations we have designed in the past, and is the recommended configuration in manufacturer literature and industry design references. The valve in this location can still be used for pump isolation and maintenance. The pumps will not need to be throttled open as there is sufficient static head to prevent the pumps from running off their curve. However, if throttling is needed, such as during testing, it can still be done downstream of the check valve.

The pumps are sized for one pump to deliver the entire facility flow. The pipe size increase is not needed because both pumps will typically not operate at the same time.

Comment 8: Ozone systems can be difficult to operate and maintain and can produce harmful byproducts. UV systems have been effectively used in other recirculating applications.

Response: We do not anticipate ozone use on this project. This will be discussed during the teleconference.

Comment 9: When calculating recirculation capacity, are you able to assume decreased feed rates or is cannibalism too big a problem?

Response: This will be discussed during the teleconference.

Comment 10: How much (if any) extra power does recirculating require? Would it require new transformers? Can the back-up generators power the recirculation system?

Response: The initial assessment concluded that the facility only has enough power for existing operations. TetraTech is working with PG&E to determine what additional power infrastructure will be required to add the RAS. Right now, the design goal is to be able to operate the facility under all conditions for as long as necessary (this will come under discussion in the near future). So, depending on the back-up generator to power the RAS may not be desirable (would we need a back-up for the back-up?).

11/18/15 Response Memo
Attachment #1

SHSRF Raw Water Intage and Water Supply System Upgrade
Basis of Design Report, October 2015

Coastal Conservancy comments and questions

1. The recirculation elements of the project are a significant part of the cost. Before moving into more detailed design, additional analysis of the feasibility of using the system needs to be done. Specifically
    a. Consultation with NMFS and CDFW to determine at what flows the agencies would allow diversions from the river, with the understanding the other than evaporative losses, the water would be returned to the extraction point. For instance the river flow is now less than 2 cfs – would CDFW allow you to take out 1.2 cfs to operate at 75% recirc?
    b. Based on the outcome of these consultations, prepare an analysis of how often when recirc would be needed due to low river flows, water withdrawals would actually be allowed. For instance, in looking backwards at which years would have used recirc, what percentage of those had flows high enough throughout the rearing seasons to have successfully operated the system.
2. The preferred option #3 has a second set of pipes to allow for flow through of river water rather than having clean river water go through a solids treatment process (settling and filtration). Is this really necessary? If the river water is clean, wouldn't the "solids treatment process" by fast and easy? It will cost more to construct, so will it save significant energy costs?
3. Report does not adequately explain what the new aeration/oxygenation tower would be. Is this incorporated into the cooling tower or a separate structure? In either case, is a new structure more cost effective than just having a second smaller fan that can be used when only aeration is needed? More explanation and justification needed.
4. Quarantine flow from river
    a. Does this need apply throughout the season or only at the beginning when fish are being brought in?
    b. If you are operating on recirc, is there a level at which the channel water being discharged is not sufficient to dilute the formalin and other treatment chemical s in the water. I ask that particularly in light of the fact that recirc would be needed in dry years when the facility could be taking a very high percentage of the river flow out, so the new river water would be primarily outflow from the facility. For instance if you are running at 50% recirc and the river has 2 cfs, the flow from the holding tanks would be 30% of the flow. Is that going to be okay from an impact on the river standpoint?
5. It is my understanding that if the pump system is turned off or fails, then the channel will go dry fairly quickly. Is this correct? Is there a design revision that would allow for temporarily changing the channel to a system of holding ponds (by damning up the downstream end of the end of each segment? Would this be a valuable risk mitigation?

6. P25, Section 4.8, last sentence of paragraph – Explain what is meant by this sentence: "in the future" – what is this referring to?; "for storage and periodic removal as required" – required by who? Is it required now?
7. Permitting and Construction Strategy – It will only make sense to move forward with the recirc elements first if the regulatory agencies have signed off on the water withdrawal protocols that prove that recirc facilities are worth the cost. Based on this, I'm not sure separating the permitting will make sense.
8. Cost Estimate
    a. Summary cost estimate on page 30 should include line items for the subtotal of itemized elements, plus lines for contingency and tax.
    b. Sales tax is applied on materials, but not on labor. Why is 8% applied to everything.
    c. 25% contingency seems low given the very vague nature of the cost estimate.
    d. Cost estimate backup is largely based on lumpsum numbers that provide no indication of how they were estimated.
    e. Cost estimate is missing the cost of environmental monitoring and mitigation. For instance you will likely need to deal with bird surveys, woodrats, and revegation. $5K for erosion control doesn't seem adequate.

11/18/15 Response Memo
Attachment #2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

November 2, 2015

MEMORANDUM FOR: Joyce Ambrosius

CC: Rick Wantuck

FROM: David White

SUBJECT: Environmental Services Branch Comments on Sleepy Hollow Raw Water Intake and Water Supply System Upgrade BOD Report

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1. Regarding recirculation elements being a significant part of the cost-- If further analysis of the benefits of a recirculation system is performed, the analysis should include both low flow years (when recirculation will expand the operational capacity of the SHSRF) ***and sediment mobilizing flows*** and bank failure events (from the newly constructed channel above the dam) that may overwhelm the proposed single pass screening and sediment removal system.

   For me, the primary benefit of the recirculation system is as an insurance policy for sediment transport events caused by dam removal, and secondarily as a means to expand the operational or seasonal capacity of the facility. I haven't been been closely involved in the sediment studies, but I would think that sediment transport risks will exist for several years as the newly cut channel and banks stabilize, especially in El Nino years. Perhaps someone more intimate with potential sedimentation issues can weigh in? Also, recirculation may allow significant improvements in normal operations such as increasing feed rates (to decrease cannibalism) or increasing allowable population density without increasing diversion from the river.

2. The Maximum Screen Approach Velocity in Table 2-1 should be changed to 0.33 feet/second and reference the NMFS Southwest Region Fish Screening Criteria for Anadromous Salmonids, 1997 (rather than the NMFS Northwest Region document, 2011). While the Northwest and Southwest regions have merged into a single West Coast Region, in California we still use the more protective 1997 criteria. Required Screen Effective Area should reflect this change. This should not affect the screen selected as the screen selected was sized with some excess

capacity.

3. The chosen location and type of cone screen will be a dramatic improvement over the existing configuration. Just curious--Did you consider a vertical cylinder screen located a bit downstream of the proposed location in a deeper area of the pool? Darryl Hayes has been having some success with that shape in deeper areas. Deeper may mean slower velocities and more sedimentation of course, but it makes me wonder if there is a circulation pattern or scouring that has caused that deeper pool to develop and persist and might be a good location. I only visited the site once so my recollection of the pool may be off on this.

4. If there is significant current, internal baffles may be needed inside the fish screen to get the approach velocities right. Without baffles, water tends to flow into the screen on the upstream side and out of the screen on the downstream side, reducing the effective surface area of the screen. We have found that 4 vertical baffles (dividing the cone into 4 quarter pie shapes) are effective.

5. In our fish screen inspections, we have seen spray bars work very well for resuspending sand and silt near fish screens. The most effective openings are small holes drilled in galvanized pipe--Nozzles tend to erode or plug. The spray bars work to about 2 feet away from the sprayer, so I don't think one spray bar will keep the whole 10 foot by 10 foot pad clean. I suggest building a spray ring around the cone rather than on just one side of it. In the plan view in Figure 2-2, the spray bar looks below the 12" pipe, but in the profile view below, it looks above the 12 inch pipe. It might be more effective to have the spray bar below the pipe so that it sprays and deflects near the hard pad.

6. We have not had much luck with air burst systems. They don't tend to much move sediment and they often promote growth of stubborn black algae on the screen. I have little experience with low elevation vanes in this type of application.

7. In Figure 2-3, I'm used to seeing a gate valve downstream from the pumps but before the check valve so we could throttle the pumps open, or isolate a pump for maintenance as check valves can fail. I defer to the designers however as I've never worked with 12" pipe or variable speed pumps. Where the two 12" pipes come together at the Y, should the pipe diameter increase?

8. I know of two expensive hatchery ozone systems that are not in use because they are complicated and can produce harmful byproducts, depending on what's in the water

supply. We ended up using UV effectively for raising endangered winter run Chinook in a near total recirculating system. Our water was free of sediment, however, and we were using Cornell-type tanks.

9. When calculating recirculation capacity, are you able to assume decreased feed rates or is cannibalism too big a problem? I would think that recirculation ability would be greatly enhanced by decreasing feed rate.

10. I see on page 28 that existing transformers barely provide enough power to the existing system. How much (if any) extra power does recirculating require? Would it require new transformers? Can the back-up generators power the recirculation system? How about adding a section on emergency procedures (power outage, high sediment load, water shortage)?

Enclosure 3

DRAFT

Sleepy Hollow Steelhead Rearing Facility Hydraulic Report and Scour Analysis

November 2, 2016

1 Introduction

This memo provides background information and hydraulic analysis to support the design of a cone screen intake structure at the Sleepy Hollow Steelhead Rearing Facility (SHSRF) on the Carmel River in Monterey County, CA. The current facility is located approximately 18.5 miles upstream from the Pacific Ocean and the proposed intake location is on the outside of a natural bend in the river at the upstream end of a deep pool (**Figure 1**). A one-dimensional HEC-RAS hydraulic model (USACE, 2010) was used to predict hydraulic conditions in the vicinity of the proposed location. These results were then used to estimate the amount of scour and specify appropriate countermeasures.

2 Hydrology

The Monterey County Flood Insurance Study (FEMA, 2009) contains a flood-frequency analysis developed for the Carmel River. This analysis provides projected peak discharge values for a range of recurrence intervals at the location “Below San Clemente Dam”. This location is appropriate for the SHSRF analysis because the facility is located approximately 1.4 miles downstream of the former San Clemente Dam (SCD) site. Though the SCD has been removed since the FEMA study was completed, this is not expected to alter the discharge values because the former dam did not provide any meaningful flood storage or flow attenuating capacity (FEMA, 2009). **Table 1** summarizes the peak discharge values from the FEMA analysis.

Table 1. Project peak discharge values below San Clemente Dam (from FEMA, 2009).

Recurrence Interval (yr)	Annual Exceedance Probability (%)	Discharge (cfs)
10	10	5,700
50	2	10,200
100	1	12,100

3 Hydraulics

The HEC-RAS model boundary conditions were based on a model of the Sleepy Hollow Ford area developed for the Monterey Peninsula Water Management Agency in 2012 (Avila and Associates, 2012). A survey of the bathymetry in the area around the proposed intake was conducted in 2015 and used to create detailed digital surface of the existing conditions (**Figure 2**). From this survey additional model cross-sections were added to improve the understanding of the hydraulics in the area. The proposed intake was modeled as a solid obstruction into the channel (**Figure 3**). The model was then run over a range of flows from 1 cfs to the 100-year peak flow of 12,100 cfs. As expected, velocity, depth and shear stress increase with discharge and are predicted to have maximum values at the highest discharges **(Figures 4 through 7)**. Results indicate that at levels between the 10-year peak and 100-year peak discharge, the proposed intake location flow depths would vary between about 15 and 19 feet, velocities would be about 7 ft/s and shear stress would vary between about 3.5 lb/ft^2 and 3.7 lb/ft^2 (**Table 2**).

Table 2. Predicted hydraulics at proposed intake location.

Discharge (cfs)	Depth (ft)	Velocity (ft)	Shear Stress (lb/ft^2)
10-yr (5,700)	15.4	6.8	3.7
50-yr (10,200)	18.4	6.8	3.4
100-yr (12,100)	19.3	7.0	3.5

4 Scour Analysis

The proposed intake location is at the upstream end of a natural pool that forms as the Carmel River makes a right hard turn against a bedrock outcropping. The geometric configuration and resulting hydraulic conditions at this location will provide the flow depths and sweeping velocities that will optimize the intake operation over a range of flows. Mature vegetation and large substrate along the banks indicate a stable planform geometry that is not expected to migrate significantly over the expected lifetime of the installation. Evidence exists that indicates some amount of periodic natural erosion (scour) and deposition has occurred in the area and is projected to continue. Scour along the outside of the bend, however, may threaten the stability of the proposed intake and should be mitigated.

Bend scour represents erosion of the channel bed caused by the transverse or secondary flow that occurs within the bend of a meandering channel. The magnitude of the amount of scour was estimated by using the ratio of shear stress along the outside of the bend to the average shear across the channel using the following equation:

$$S_b = (\sqrt{K} - 1)y \tag{1}$$

where S_b is the bend scour depth, K is the ratio of local shear stress on the outside of the bend to the average shear across the channel, and y is the flow depth. The shear stress multiplier (K) was estimated using a relationship published by the U.S. Soil Conservation Service (1977) (**Figure 8**). For the range of flows examined, the maximum resulting scour depth occurred during the 100-year peak flow and was about 6 feet.

Installing the intake is anticipated to induce local scour due to the projection of the structure into the channel. The National Cooperative Highway Research Program (NCHRP) Abutment Scour Approach as outlined in the Federal Highway Administration (FHWA) HEC-18 circular (Arneson et al., 2012) was used to estimate the total anticipated scour depth. This approach has the advantage of considering both the effects of the acceleration of flow due to the contraction in channel width as well as the turbulence that develops in the immediate vicinity of the structure. At the 100-year peak discharge, the expected scour depth was about 7.5 feet. While this amount is larger than the predicted bend scour, the abutment scour approach is somewhat conservative and likely over-predicts the amount of scour that will occur. For this reason, the bend scour limit of 6 feet was used as the determining depth.

5 Erosion Protection

With an understanding of the amount of scour to anticipate, it is necessary to determine the material that will resist movement and maintain protection over the range of expected flow conditions. Given the predicted hydraulic conditions at the proposed location with velocities up to 7 ft/s (100-year peak flow) and shear stresses up to 3.7 lb/ft^2 (10-year peak flow), a review of potential materials indicates that stone riprap is the most suitable application (Frischneich, 2001). Using the approach outlined in the FHWA HEC-23 circular (Lagasse et al., 2009) for sizing revetment riprap and hydraulic input from the HEC-RAS model, the stone should have a median diameter (D_{50}) of 12 inches and conform to the FHWA Class III size and shape as outlined in **Table 3**. The stone size assumes that it is placed at a slope angle of 2H:1V and that it is quarried, angular rock. If the final slope angle is steeper or angular rock is not available, the median stone size should be increased.

Table 3. Minimum and maximum allowable particle size (inches).*

Nominal Riprap Class by Median Particle Diameter		d_{15}		d_{50}		d_{85}		d_{100}
Class	Size	Min	Max	Min	Max	Min	Max	Max
I	6 in	3.7	5.2	5.7	6.9	7.8	9.2	12.0
II	9 in	5.5	7.8	8.5	10.5	11.5	14.0	18.0
III	12 in	7.3	10.5	11.5	14.0	15.5	18.5	24.0
IV	15 in	9.2	13.0	14.5	17.5	19.5	23.0	30.0
V	18 in	11.0	15.5	17.0	20.5	23.5	27.5	36.0
VI	21 in	13.0	18.5	20.0	24.0	27.5	32.5	42.0
VII	24 in	14.5	21.0	23.0	27.5	31.0	37.0	48.0
VIII	30 in	18.5	26.0	28.5	34.5	39.0	46.0	60.0
IX	36 in	22.0	31.5	34.0	41.5	47.0	55.5	72.0
X	42 in	25.5	36.5	40.0	48.5	54.5	64.5	84.0
Note: Particle size d corresponds to the intermediate ("B") axis of the particle.								

*Source: FHWA HEC-23 Table 4.1.

6 Summary and Recommendations

Scour calculations based on modeling results indicate that the design of the proposed cone intake structure should expect up to 6 feet of scour below the existing grade. A stone riprap application is recommended to mitigate the scour based on the predicted velocities and shear stresses, with a D_{50} of 12 inches (FHWA Class III Riprap). The stone should be placed down to the expected level of scour, unless bedrock is discovered in which case the bedrock layer can serve as the minimum depth. The stone must be placed at the recommended 2H:1V slope and should extend up to the top of the bank. The stone layer thickness of the application must be a minimum of 2 feet (the D_{100} for Class III Riprap). The rock protection should also be underlain by a granular filter or geotextile filter fabric to prevent piping. Final determination of the appropriate filter should be determined once the excavated surface is exposed and the native bank material is examined. Riprap placement along the bank should extend upstream and downstream of the structure a distance equal to the longitudinal distance (width) of the proposed structure such that the total distance is three times the width of the structure. At the up- and downstream limits, the riprap should be keyed into the bank over a distance of 6 feet based on a minimum key length equal to three times the stone layer thickness.

7 References

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U.S. Soil Conservation Service, 1977. Design of Open Channels, Engineering Division, Technical Release No. 25, Washington, D.C.

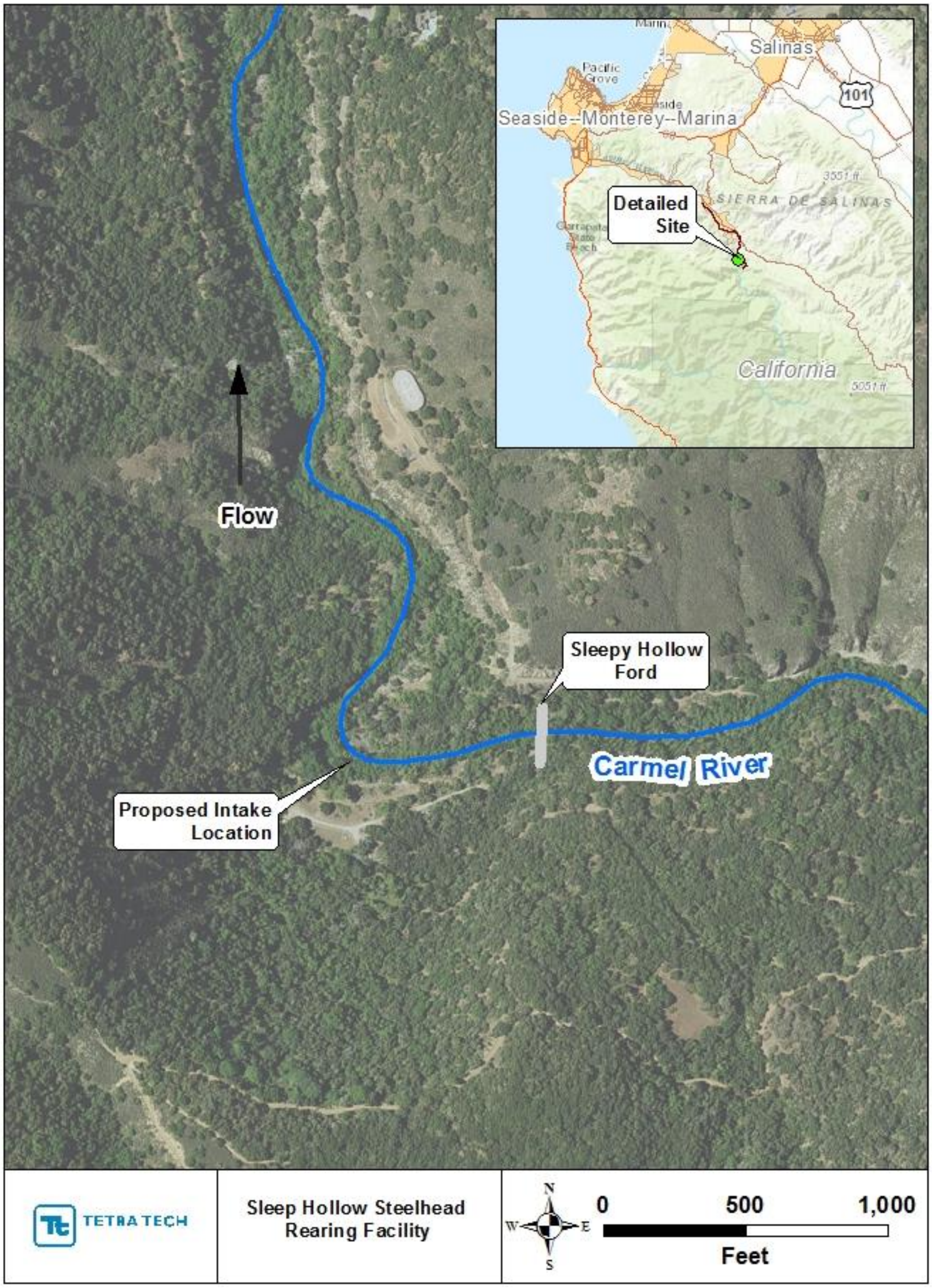

Figure 1. Sleepy Hollow Steelhead Rearing Facility site map.

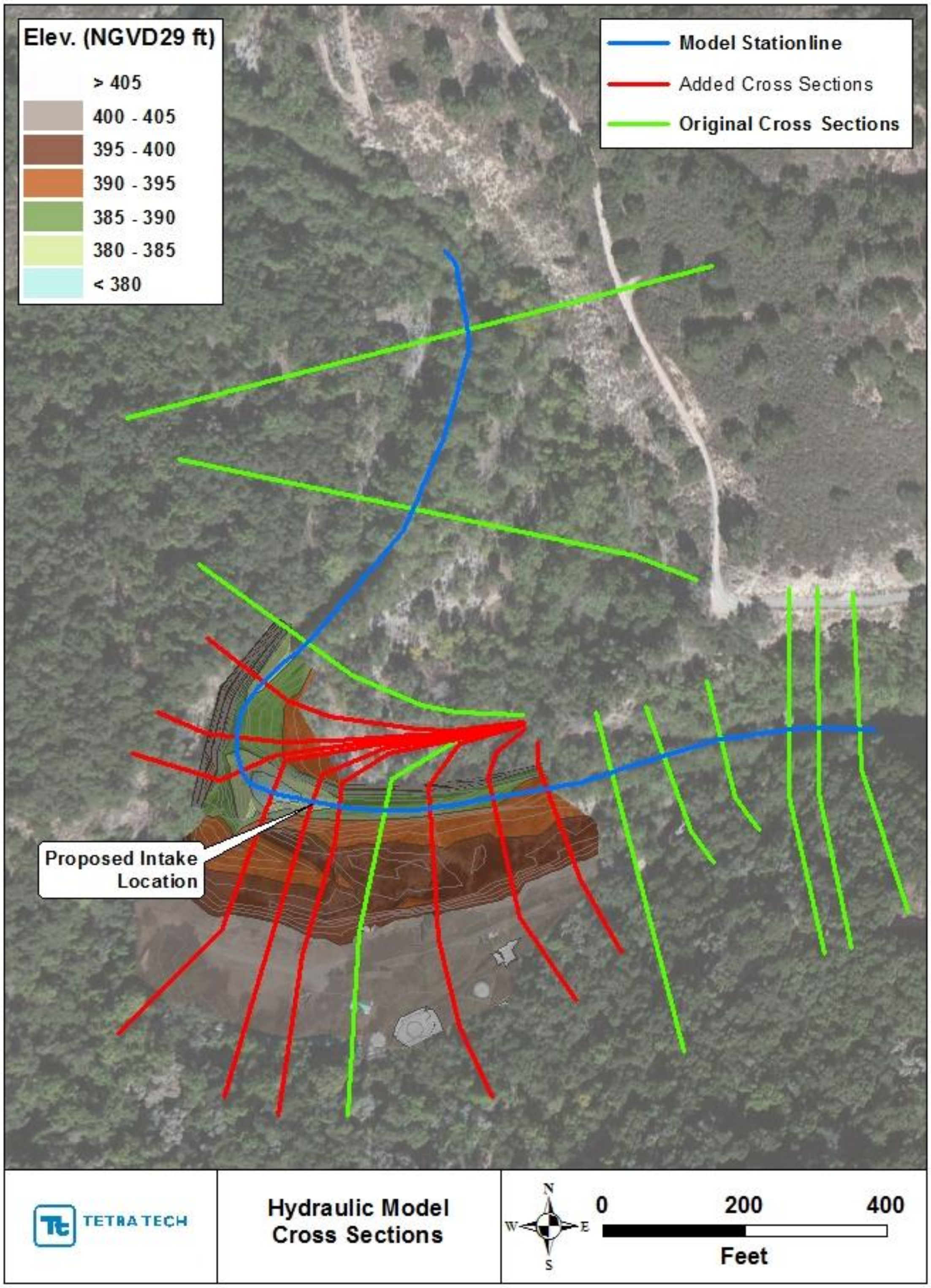

Figure 2. Detailed layout of digital surface and HEC-RAS model cross sections.

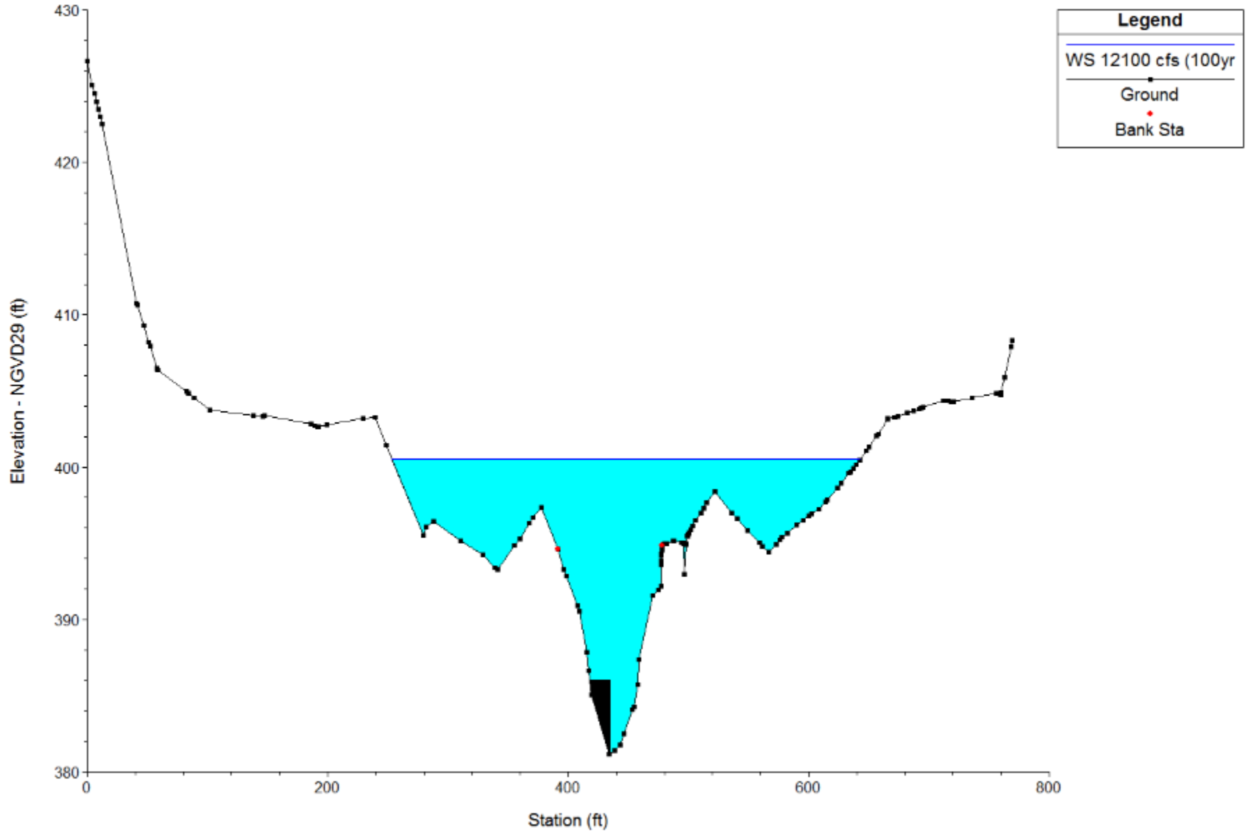

Figure 3. HEC-RAS cross section showing modeled proposed intake and water-surface elevation at the 100-year discharge (12,100 cfs).

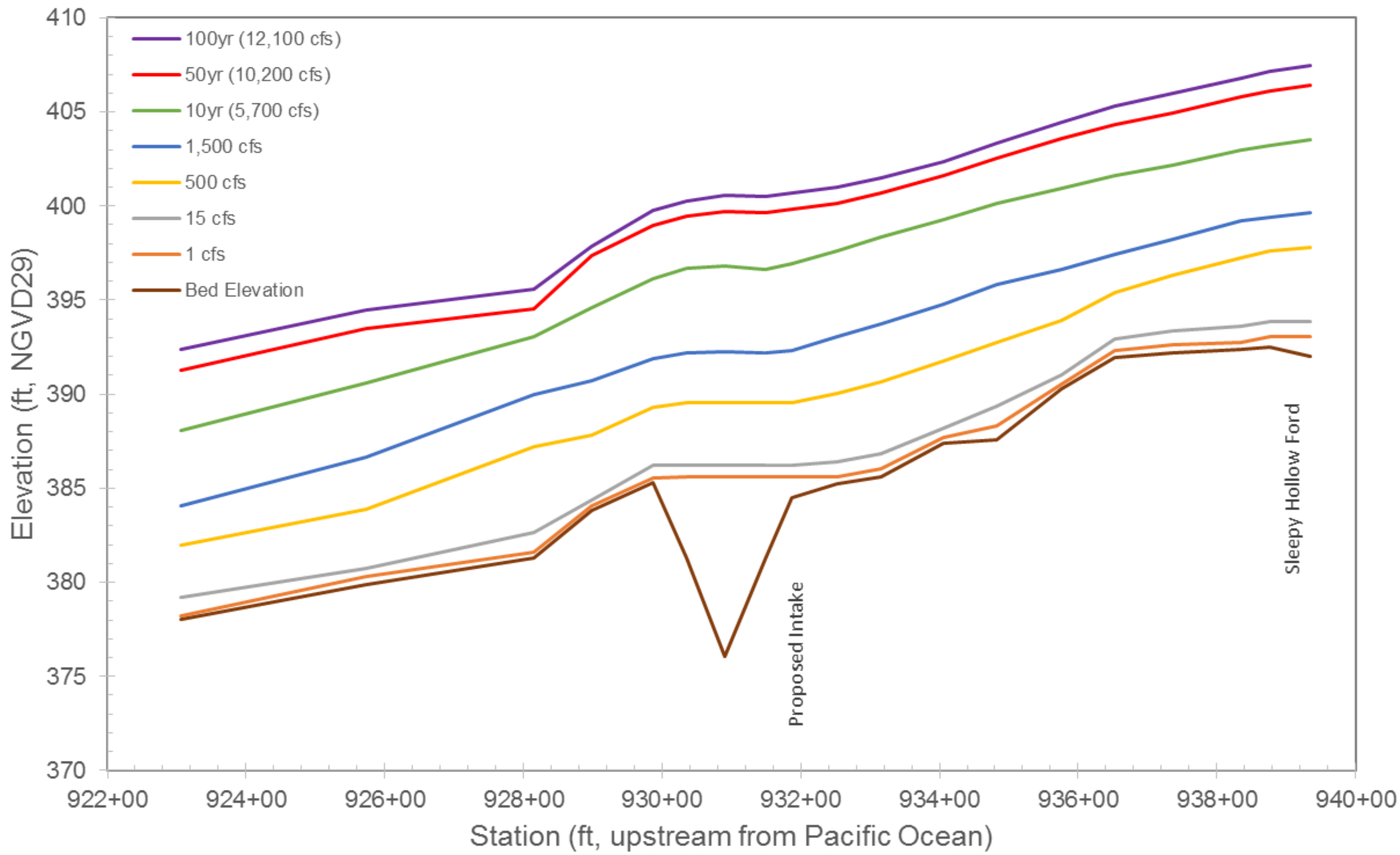

Figure 4. Predicted water-surface elevation of proposed condition.

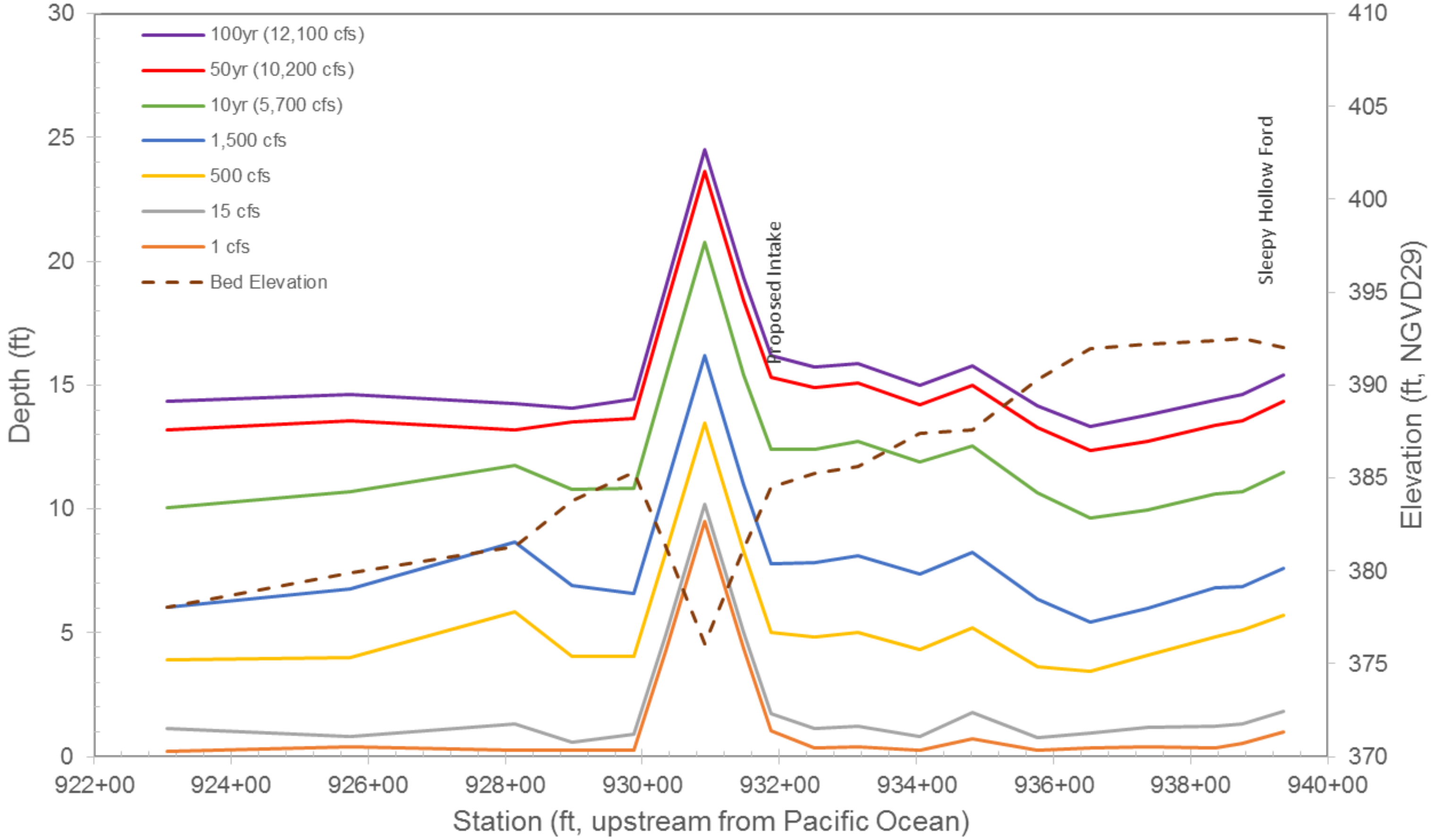

Figure 5. Predicted flow depths of proposed condition.

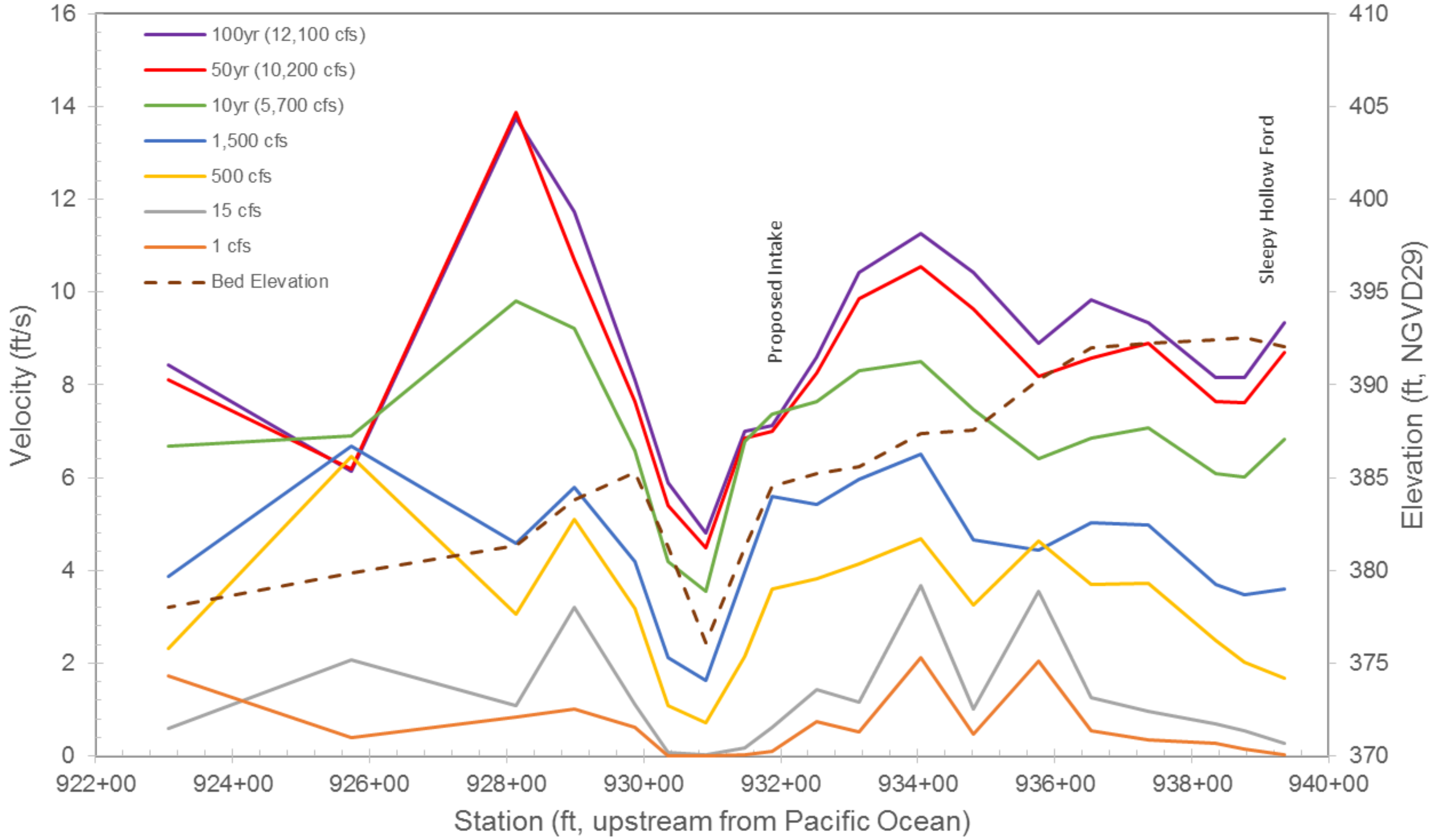

Figure 6. Predicted velocities of proposed condition.

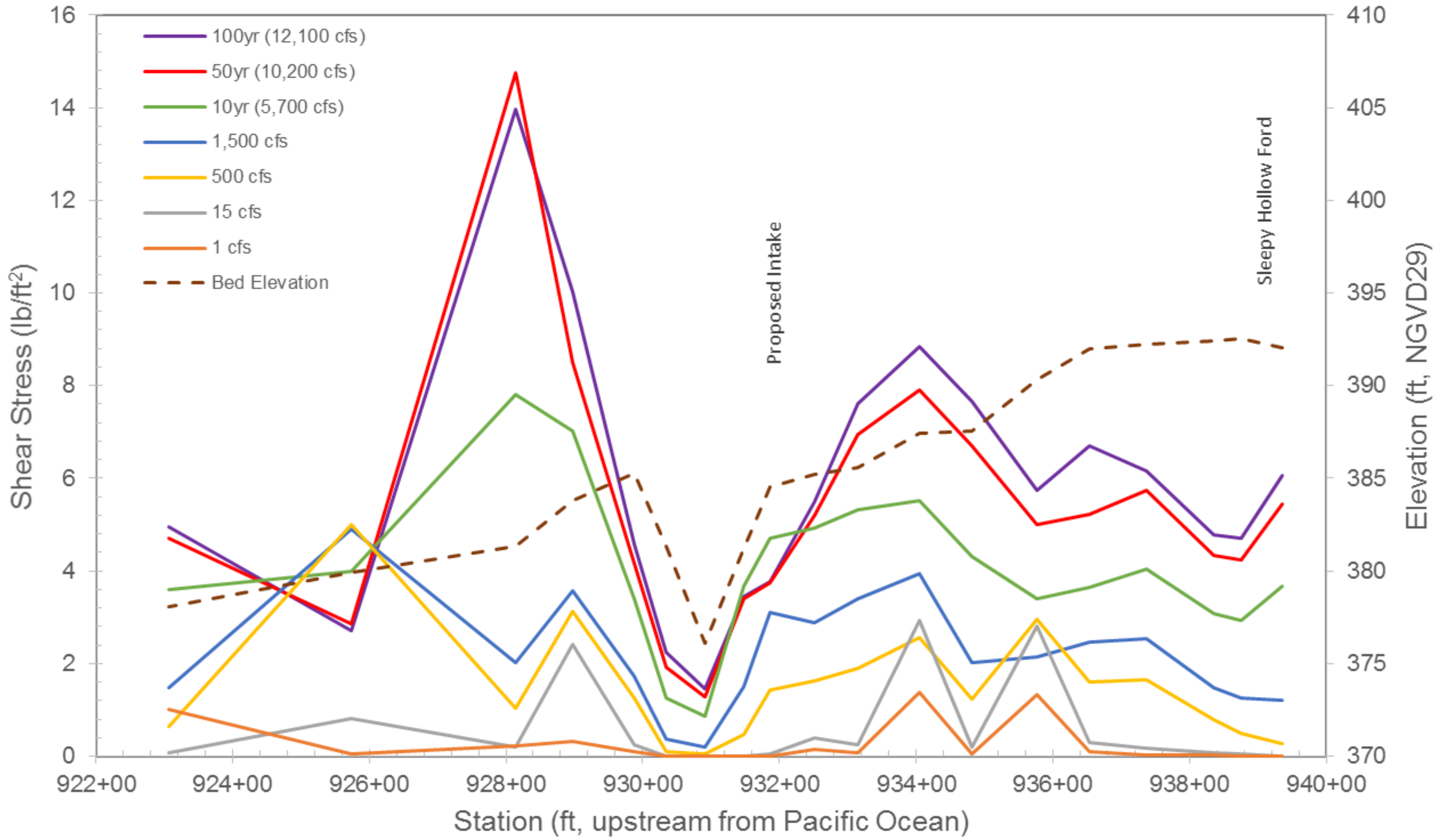

Figure 7. Predicted shear stress for proposed condition.

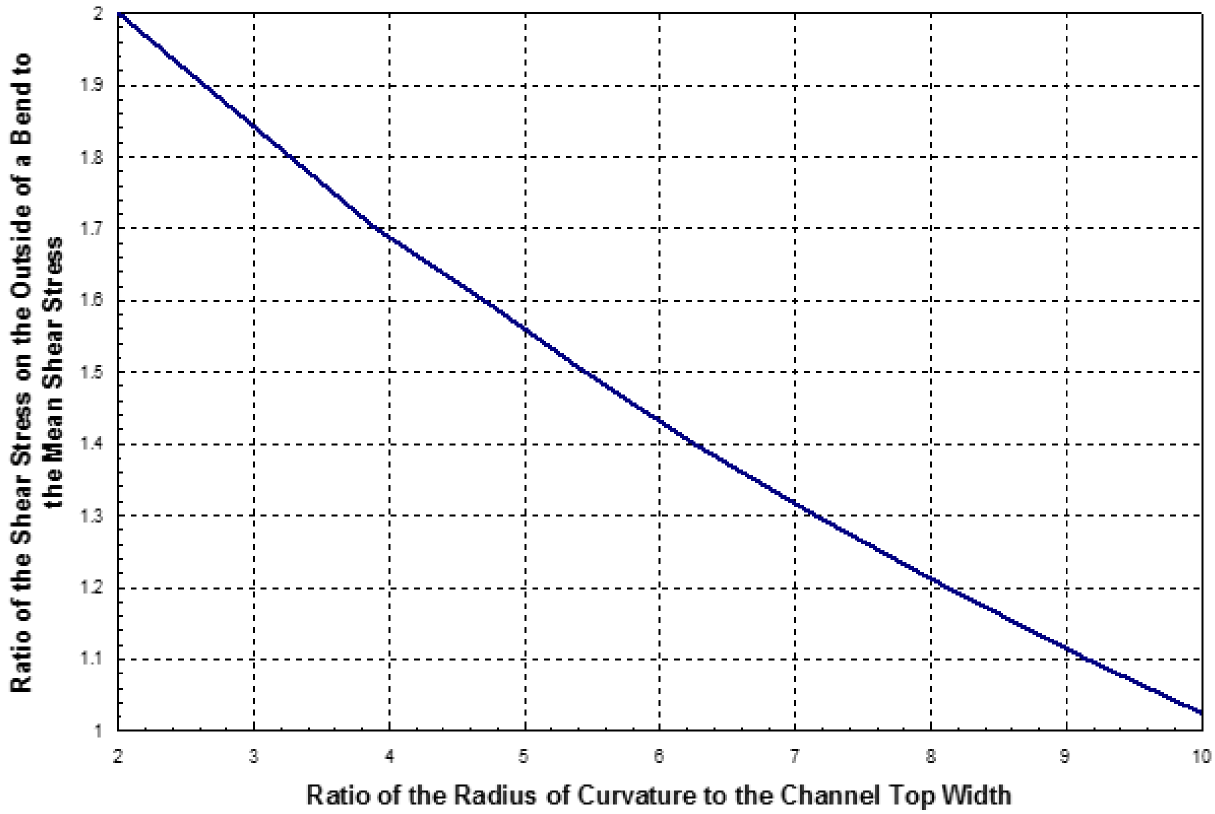

Figure 8. Relationship of bend shear stress to the mean shear stress (modified from U.S. Soil Conservation Service, 1977).


Enclosure 4