CITY OF YUBA CITY
STAFF REPORT

Date: May 18, 2021

To: Honorable Mayor & Members of the City Council

From: Public Works Department

Presentation by: Diana Langley, Public Works Director

Summary

Subject: Wastewater Treatment Facility Effluent Discharge Outfall Diffuser Project – Final Design Authorization

Recommendation: Adopt a Resolution to award Amendment No. 4 to the Professional Services Agreement with CH2M Hill Engineers, Inc. to initiate Final Design activities for the Wastewater Treatment Facility Effluent Discharge Outfall Diffuser Project, including new scope of work tasks identified from the Predesign activities and authorize the City Manager to execute the amendment following approval as to form by the City Attorney, with the finding that it is in the best interest of the City.

Fiscal Impact: $901,857 – Account No. 981156 (New Outfall and River Levee Crossing Replacement)

Purpose:

Assure continuous and reliable discharge of treated water from the Wastewater Treatment Facility to the Feather River in compliance with permit requirements.

Background:

The City of Yuba City Wastewater Treatment Facility (WWTF) treats wastewater from the City's collection system and disposes of the treated effluent. Operation of the WWTF and discharge of treated effluent to the Feather River is regulated by the Central Valley Regional Water Quality Control Board (CVRWQCB) through amended Order No. R5-2019-0017-01 and National Pollution Discharge Elimination System (NPDES) Permit No. CA0079260 (WWTF Permit).

Historically, the WWTF has had two options to dispose of treated effluent: (1) discharge directly into the Feather River via an outfall diffuser pipe located upstream of Shanghai Falls; or (2) discharge into percolation/evaporation ponds located on the east side of the main river channel just downstream of Shanghai Falls (Attachment 1). Use of the outfall diffuser pipe is only permitted whenever river depths are sufficient to allow the treated effluent to adequately mix with river water to meet NPDES permit dilution requirements.

In 2011, the bed of the Feather River scoured in close proximity to the existing outfall diffuser pipe, cutting a deep channel to the east. This redirected a large portion of the river flow to the newly formed channel, leaving the outfall diffuser pipe exposed under normal river flows. The outfall diffuser pipe is currently unavailable for use at river flows of less than approximately 10,000

cubic feet per second (cfs), effectively rendering it unable to meet permit requirements except during substantial flood events.

Currently, the City's only option to reliably discharge treated effluent has been to the effluent disposal ponds. These ponds are limited in capacity for continuous use and require routine monitoring and maintenance. Additionally, the ponds are vulnerable to damage during times of high water and can subsequently become unavailable to use for an extended period of time.

Since the scour event in 2011, the City has actively been studying potential replacement options for the outfall diffuser pipe, including assessment studies performed by the City's consultant, Environmental Science Associates, in 2013 and 2017.

On July 17, 2018, Council awarded a Professional Services Agreement to CH2M Hill Engineers Inc. of Sacramento, CA, now a Jacobs Engineering Group, Inc. company (Jacobs), to provide professional services necessary for the WWTF Effluent Outfall Diffuser Relocation Project (Project), including predesign, design, environmental, permitting, right-of-way acquisition, and bidding services. Jacobs completed a Predesign Report for the outfall diffuser pipe replacement, which includes an estimated total cost of approximately $24.85 million for the Project. Due to the preliminary level of the design completed to date, the variance in this estimated cost is -30% to +50%, which means the Project could cost up to $35 million.

On July 7, 2020, Council authorized Jacobs to evaluate alternative advanced treatment strategies that could result in a direct discharge to the Feather River near the current outfall diffuser pipe location while meeting current and anticipated future WWTF Permit/water quality requirements in order to confirm the best use of this substantial estimated capital expenditure.

Analysis:

Jacobs has completed the Advanced Treatment Study (Study) comparing relative costs, advantages and disadvantages for continued operation of the WWTF using a new, relocated outfall diffuser pipe to alternative configurations for advanced treatment in conjunction with a new side-bank point discharge into the Feather River that would be closer to the WWTF (Attachment 2).

The Study's scope of work was based on an average dry weather flow of 10.5 million gallons per day (MGD), which corresponds to the limit in the City's current discharge permit. For perspective, current flows are approximately 5.8 MGD and full buildout conditions are expected to range between 12.8 and 14.5 MGD. The Master Plan upgrades needed up to 2040 correspond to an expected flow of 10.2 MGD with existing major industrial input (Buildout Scenario 1) and thus each alternative assumes implementation of the Master Plan recommended improvements up to the 2040 trigger.

The Study considered three alternatives:

- Baseline Alternative: Installation of a new, relocated outfall with a new diffuser in a stable and deeper location of the Feather River, and continue with the existing high-purity oxygen (HPO) treatment with WWTF improvements and expansions, as described in the Master Plan for the 2040 condition (West Yost Associates 2020).

- Alternative 1: Continue HPO treatment with improvements and expansions described in the Master Plan, up to the 2040 trigger, and provide an add-on treatment process for nitrogen removal downstream of the HPO process to allow a new side-bank effluent discharge closer to the WWTF.
- Alternative 2: Abandon HPO treatment, and construct a new biological nitrogen removal process (modified Ludzack-Ettinger assumed) to allow a new side-bank effluent discharge closer to the WWTF. All recommended improvements described in the Master Plan, up to the 2040 trigger, except those associated with the continuing operation of the HPO system, will be implemented.

A nonfinancial comparison of each alternative is provided in Table 15 in the Study and shown below.

Nonfinancial Comparison of Alternatives

Comparison Item	Baseline Alternative	Alternative 1	Alternative 2
Meet Effluent Limits	• Includes new outfall and diffuser in Feather River	• Side-bank discharge limits met by add-on treatment	• Side-bank discharge limits met by new biological nitrogen removal process
Advantages	• No major treatment upgrade (continue upgrades per the Master Plan)	• Continue existing HPO operation • Adds process for ammonia removal	• No additional carbon needed for denitrification • Avoids expansion of HPO • Adds process for ammonia removal
Disadvantages	• Existing system is somewhat unstable (may be mitigated with upcoming upgrades and Sunsweet EQ) • No process for ammonia removal	• Existing system is somewhat unstable (may be mitigated with upcoming upgrades and Sunsweet EQ) • Operation of additional process • External carbon addition required for denitrification • Side-bank – limited local installation	• Operation of new process • Abandons existing infrastructure • Side-bank – limited local installation

Organic loading from Sunsweet constitutes nearly 30% of the WWTF's influent loading. The Sunsweet waste stream is reduced during weekends resulting in a significant change in flow and organic loading to the WWTF. Variability in Sunsweet's waste stream affects stability of the HPO process. If this waste stream can be handled separately or the loading equalized to distribute the

loading more evenly, the HPO process will have a more stable operation and the aeration basins will have capacity to accept more municipal wastewater. Because the significant load variation to the WWTF would affect the biological treatment process in general, it was assumed that the cost associated with construction and operation of Sunsweet load equalization would be included in all alternatives.

The existing WWTF is nearing its ammonia discharge limit, so treatment of the return stream from WWTF solids processing was also included in the overall assessment since the return stream from the sludge thickening and dewatering processes are major contributors to ammonia loading at the WWTF. Jacobs recommends that treated effluent ammonia concentrations be reduced. Internal return flow treatment is the most cost-effective and logical way to achieve this goal, given its lower capital cost and ability remove to 50% of the ammonia load by treating a small percentage of the total flow. Internal return flow treatment is included in all alternatives.

Estimated capital, operations and maintenance, and net present value for each of the alternatives are presented in Tables 17 and 18 in the Study. Below is a summary of Table 18. The Baseline Alternative assumes the cost for the outfall to be $35 million, which is the upper range of the Predesign Report estimate. Each alternative includes $6.4 million for equalization and separate conveyance of Sunsweet's waste stream and $16.5 million for internal return flow ammonia removal.

Estimated Capital, Operations and Maintenance, and Net Present Value Costs ($ millions)

		Nitrogen Removal Evaluation by Various Methods				
Cost Type	**Baseline Alternative**	**Alt. 1**	**Alt. 2 BACWA**	**Alt. 2 BACWA and Case Study Hybrid**	**Alt. 2 Master Plan and Case Study Hybrid**	**Alt. 2 Yuba City Master Plan**
Capital	138	170	157	163	161	164
O&M annual	0.18	3.1	1.3	3.5	3.5	3.5
Total 30-year NPV	3.9	69.7	28.9	78.6	78.6	78.6
Grand Total*	142	240	186	241	240	243

*Grand Total is the sum of Capital and Total 30-year NPV.

Based on the comparison of the alternatives and finding that the Baseline Alternative of implementing the new Outfall Pipeline project described in the Predesign Report has the lowest costs in terms of capital, operations and maintenance, and net present value, staff recommends proceeding with the Baseline Alternative instead of implementing the advanced treatment

strategies. While upgrading the the WWTF to advanced treatment may potentially be necessary at some point to meet future regulatory requirements, the cost to do so at this time without such a mandate is prohibitive.

Fiscal Impact:

The initial contract with Jacobs was for a cost not to exceed $2,983,430 including $200,000 in contingency funded through Account No. 981156 (New Outfall and River Levee Crossing Replacement). Staff executed Amendment No. 1 in the amount of $162,877 from the approved contingency to complete the following out of scope tasks that were necessary to complete the preliminary design:

- Spring 2019 Bathymetric Survey
- 2019 Supplemental Riverbed-form Modeling and Evaluation
- 2019 River-bottom Geophysical Survey
- Riverbed-form Evaluation Update to Address Downstream Channel Constriction
- Supplemental Drone Survey

On July 7, 2021, Council authorized Amendment No. 2 in the amount of $289,786 to transfer funds from final design to fund out of scope work necessary to proceed towards final design, including effluent pumping system testing support, in-river geotechnical boring permitting support, dynamic modeling support, spring season bathymetry surveys, a hydraulic and scour analysis, an additional predesign workshop, and project management associated with these additional tasks. Amendment No. 2 also includes the Advanced Treatment Study.

Staff also approved Amendment No. 3 in the amount of $50,000 to transfer funds from bid services to the Advanced Treatment Study to fund additional case study evaluations and further evaluate discharge compliance for a potential side-bank discharge.

With staff's recommendation to proceed with final design and construction of a new outfall pipeline, Jacobs has evaluated the remaining scope of work necessary to complete the final design and bid the project. Taking into consideration the various transfers of funds from final design and bid services, Jacobs has determined that an additional $901,857 should be added to the contract amount (see Attachment 1 – Exhibit A) to be funded from Capital Improvement Program Account No. 981156 (New Outfall and River Levee Crossing Replacement). There is approximately $1.56 million available in this account at this time.

Alternatives:

1. Direct staff to proceed with an advance treatment alternative despite the increase costs.
2. Direct staff to further evaluate potential advanced treatment alternatives.
3. Postpone the final design of a new, relocated outfall despite the operational risks of using the effluent ponds.

Delay in the project may impact City's ability to renew future NPDES permits and impact new development in the City, as the existing ponds are limited in capacity.

Recommendation:

Adopt a Resolution to award Amendment No. 4 to the Professional Services Agreement with CH2M Hill Engineers, Inc. to initiate Final Design activities for the Wastewater Treatment Facility Effluent Discharge Outfall Diffuser Project, including new scope of work tasks identified from the Predesign activities and authorize the City Manager to execute the amendment following approval as to form by the City Attorney, with the finding that it is in the best interest of the City.

Attachment:

1. Resolution
    a. Exhibit A – Amendment No.4
2. Advanced Treatment Study

Prepared by:	Submitted by:
/s/ Kevin Bradford	/s/ Dave Vaughn
Kevin Bradford	Dave Vaughn
Deputy Public Works Director – Engineering	City Manager

Reviewed by:

Department Head	DL
Finance	SM
City Attorney	SLC by email

ATTACHMENT 1

RESOLUTION NO. _____

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF YUBA CITY APPROVING AMENDMENT NO. 4 TO THE PROFESSIONAL SERVICES AGREEMENT WITH CH2M HILL ENGINEERS, INC. TO INITIATE FINAL DESIGN ACTIVTIES FOR THE WASTEWATER TREATMENT FACILITY EFFLUENT DISCHARGE OUTFALL DIFFUSER PROJECT, INCLUDING NEW SCOPE OF WORK TASKS IDENTIFIED FROM THE PREDESIGN ACTIVITIES

WHEREAS, on July 17, 2018, the City Council awarded a Professional Services Agreement to CH2M Hill Engineers Inc., now a Jacobs Engineering Group, Inc. company (Jacobs), to provide professional services necessary for the Wastewater Treatment Facility Effluent Outfall Diffuser Relocation Project (Project); and

WHEREAS, on July 12, 2019, the City Manager approved Amendment No. 1 to the Professional Services Agreement authorizing additional Predesign tasks utilizing contingency authorized by the City Council on July 17, 2018; and

WHEREAS, on July 7, 2020, based on the Predesign Report and the potential capital expenditure on the anticipated design and construction of the outfall diffuser, the City Council authorized Amendment No. 2 to the Professional Services Agreement finding it is in the best interests of the City to evaluate alternative advanced treatment strategies that could result in alternative discharge options; and

WHEREAS, on December 1, 2020, the City Manager approved Amendment No. 3 to the Professional Services Agreement authorizing additional Predesign tasks necessary to complete evaluation of alternative advance treatment strategies; and

WHEREAS, the City Council desires to amend the Professional Services Agreement with CH2M Hill Engineers, Inc. (Jacobs) a fourth time to include final design activities for the Effluent Discharge Outfall Diffuser Project, including new scope of work tasks identified from the Predesign activities; and,

WHEREAS, such an amendment is in the public interest.

NOW, THEREFORE, the City Council of the City of Yuba City resolves as follows:

1. The City Council of the City of Yuba City authorizes the City Manager to enter into Amendment No. 4 to the Professional Services Agreement with CH2M Hill Engineers, Inc. (Jacobs), substantially in the form of the proposed scope to include final design activities for the Effluent Discharge Outfall Diffuser Project, including new scope of work tasks identified from the Predesign activities, subject to approval as to form by the City Attorney. The City Council finds that approval of such amendment in the best interest of the City.

The foregoing resolution was duly and regularly introduced, passed, and adopted by the City Council of the City of Yuba City at a regular meeting thereof held on the 18th day of May, 2021.

AYES:

NOES:

ABSENT:

Marc Boomgaarden, Mayor

ATTEST:

Ciara Wakefield, Deputy City Clerk

APPROVED AS TO FORM
COUNSEL FOR YUBA CITY:

Shannon Chaffin, City Attorney
Aleshire & Wynder, LLP

Exhibit “A” – Amendment No. 4 to the Professional Service Agreement

EXHIBIT “A”

Public Works

AMENDMENT NO. 4 TO THE AGREEMENT FOR PROFESSIONAL SERVICES
CH2M HILL ENGINEERS, INC.

CH2M Hill Engineers, Inc.
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

SUBJECT: Amendment No. 4 to Scope of Services for Yuba City WWTF - Outfall and Diffuser Project

This Amendment to the Agreement for Professional Services dated July 18, 2018 ("Fourth Amendment") is made and entered into as of the ___ day of _____, 2021 by and between the City of Yuba City ("City") and CH2M Hill Engineers, Inc. ("Consultant").

Recitals

Whereas, by Professional Services Agreement dated July 18, 2018 ("Prime Agreement"), City entered into an agreement with Consultant for professional engineering services for the City's Outfall and Diffuser Project in the amount of $2,783,430.00.

Whereas, the City Manager approved Amendment No. 1 to the Prime Agreement on July 12, 2019.

Whereas, the City Manager approved Amendment No. 2 to the Prime Agreement on July 10, 2020.

Whereas, the City Manager approved Amendment No. 3 to the Prime Agreement on December 1, 2020.

Whereas, the Parties desire to amend the Prime Agreement for a fourth time to provide for additional tasks, updated scope of service, revised compensation, schedule of performance and other items related to the Project.

Agreement

In consideration of the foregoing Recitals and for good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the City and Consultant agree as set forth herein.

1. Section 1, Scope of Services, of the Prime Agreement and all subsequent Amendments is amended to include the following:

See Attached Scope of Services
(Exhibit A)

2. Section 3, Compensation, of the Prime Agreement is amended to add the following:

   For services rendered by Consultant under this Amendment No. 4 to the Prime Agreement as outlined above, Consultant's compensation shall not exceed $901,857 without additional written authorization from the City.

3. Except as amended in this Amendment No. 4, the terms and conditions of the Prime Agreement shall remain the same and shall be in full force and effect.

4. A copy of the Prime Agreement is attached hereto as Exhibit "B" and, except as otherwise amended by this Fourth Amendment, is incorporated as though set forth in full herein.

5. A copy of Amendment No. 1 is attached hereto as Exhibit "C" and, except as otherwise amended by this Fourth Amendment, is incorporated as though set forth in full herein.

6. A copy of Amendment No. 2 is attached hereto as Exhibit "D" and, except as otherwise amended by this Fourth Amendment, is incorporated as though set forth in full herein.

7. A copy of Amendment No. 3 is attached hereto as Exhibit "E" and, except as otherwise amended by this Fourth Amendment, is incorporated as though set forth in full herein.

8. Except as amended in this Fourth Amendment, the terms and conditions of the Prime Agreement, First Amendment, Second Amendment, and Third Amendment shall remain the same and shall be in full force and effect. This Fourth Amendment is not effective until approved and executed by the authorized City representative.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement on the date and year first written above.

CITY:

CITY OF YUBA CITY, a municipal corporation

_____

Dave Vaughn, City Manager

CONSULTANT:

CH2M HILL ENGINEERS, INC.

_____

Name: John Schoonover

Title: Designated Project Executive

Kindly execute the original and two (2) copies and return to City Hall at 1201 Civic Center Boulevard, Yuba City, CA 95993; the City will return a fully-executed copy to you via mail for your files.

Attachments:

Exhibit A: Amended Exhibit A to Prime Agreement
Exhibit B: Prime Agreement
Exhibit C: Amendment No. 1 (First Amendment)
Exhibit D: Amendment No. 2 (Second Amendment)
Exhibit E: Amendment No. 3 (Third Amendment)

Exhibit A

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Yuba City WWTF Outfall and Diffuser Project

Amendment 4 - Summary

This Amendment 4 is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work) to the Yuba City Wastewater Treatment Facility (WWTF) Outfall and Diffuser Project (Project). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

Amendment 4 includes funding reconciliation for contract budget transfers to cover Amendments 2 and 3; and scope and funding to supplement additional design, bid, and other services for the Project. The City directed Jacobs to stand-down work on transitioning to final design activities for the Project on February 24, 2020, while a brief Advanced Treatment Study was conducted. Amendments 2 and 3 were executed during the Advanced Treatment Study period. The Advanced Treatment Study was completed in April 2021 and the City has directed Jacobs to recommence final design activities.

Item 4A – Reconciliation of Budget Changes from Amendment 2

Amendment 2 included scope and funding to supplement two items for follow-on work: 2A) for the predesign phase of the Project and 2B) for the Advanced Treatment Study to evaluate alternative treatment options to the Project. Amendment 2 to the Outfall and Diffuser Project added a new Task 13 for the Advanced Treatment Study, including tasks 13.1 – 13.4.

- Item 2A provided additional support for activities during the predesign phase including effluent pumping system testing support, in-river geotechnical boring permitting support, dynamic modeling support, spring season bathymetry surveys, and project management support. Additional Project elements were included in the predesign than were previously scoped including a levee access ramp, a surge control system, a hydraulic and scour analysis, WWTF pump station modifications, and an additional predesign workshop.
- Item 2B provided WWTF staff an advanced treatment study to validate their current WWTF improvement and regulatory compliance strategy. The study compared relative costs, advantages and disadvantages for continued operation of the WWTF (as configured currently with the construction of the new proposed Diffuser) with alternative configurations for advanced treatment, in conjunction with a side-bank point discharge into the Feather River.

Item 4B – Reconciliation of Budget Changes from Amendment 3

Amendment 3 included scope and funding to supplement follow-on work for the Advanced Treatment Study, initiated by Amendment 2, to evaluate alternative treatment options to the Project. Amendment 3 revised existing subtasks 13.2.2 Sunsweet Handling Options and 13.3 Project Management and added the following new subtasks: Task 13.5 Study Re-Scoping, Task 13.6 Advanced Treatment Case Study, and Task 13.7 Screening Evaluation of Discharge Compliance.

Item 4C – Additional Services

Item 4C will provide additional services to support activities during the predesign, final design, and bid phases of the Project including additional Dissolved Oxygen analyses, in-river geotechnical boring permitting support, hydraulic and scour modeling analyses, follow-on tasks to the Advanced Treatment Study, labor escalation for deferred activities, and project management support. Additional Project

elements were included in the predesign than were previously scoped and final design and bid activities are added for these elements including a levee access ramp, a surge control system, and WWTF pump station modifications.

Item 4C also includes preparation of this amendment and labor escalation for existing design-phase work originally planned for 2019/2020 that has been pushed back to 2021/2022. There are no proposed changes to the original scope of work for this effort.

The following attachment is included as follows:

- Attachment 1: Item 4C – Additional Services Scope of Work and Fee Estimate

Rates and Fees for Engineering Services

Fees for the proposed engineering services are shown in the following table. Fees for item 4A and 4B are based on the same rates as contracted for the City's Outfall and Diffuser Project. Fees for item 4C are based on a rate schedule that has been escalated from the original contracted rates for the City's Outfall and Diffuser Project through 2023.

Item	Services	Hours	Jacobs Total Labor	Total Expenses	Total Fee Estimate
4A	Reconciliation of Budget Changes from Amendment 2	--	--	--	$289,786
4B	Reconciliation of Budget Changes from Amendment 3	--	--	--	$50,000
4C	Additional Services	2,189	$520,141	41,930	$562,071
	Amendment 4 Total				**$901,857**

Current Contract Value

The Amendment 4 budget of $562,071 for additional services will be funded by additional City funding sources. Final design of the Project is anticipated to be authorized by the City in Spring 2021, funds will be added by Amendment 4 to replace Task 3 (totaling $289,786) and Task 5 (totaling $50,000) funds that were borrowed by Amendments 2 and 3, respectively. Amendment 4 adds $901,857 to the total contract value.

The table below summarizes the new total contract value to date including this amendment.

Description	Total Fee Estimate
Original Contract Value	$2,783,430
Amendment 1	$162,877
Amendment 2	$0
Amendment 3	$0
Amendment 4	$901,857
New Contract Value	$3,848,165

Attachment 1: Item 4C - Additional Services Scope of Work and Fee Estimate

Yuba City WWTF Outfall and Diffuser Project

Amendment 4 – Additional Services

Scope of Work

This Scope of Work is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

This Scope of Work is for additional services during the final design and bid phases of the Yuba City Wastewater Treatment Facility (WWTF) Outfall and Diffuser Project (Project). This amendment will add additional scope and funding to Task 1, Task 2, Task 3, Task 4, Task 5, Task 10, Task 12, and Task 13 from the original Project Scope of Work.

Project final design was original scheduled to begin in August 2019. Due to delays resulting from additional river investigations and modeling during predesign and the completion of the Advanced Treatment Study completed as part of Task 13, the initiation of final design has been moved back almost two years to May 2021. This amendment provides additional budget to adjust budgeted labor rates and staff classification changes for Jacobs and subconsultants from 2019/2020 to 2021/2022 for previously contracted work under Tasks 2, 3, 4, 5, 10, and 12. For tasks which are partially complete, only the labor hours and subcontract budget remaining to be completed have been escalated. The total fee estimate for this amendment reflects the escalation adjustments but there are no additional services included for these items.

The total fee estimate is $562,071 as provided in Appendix A based off an updated rate schedule provided in Appendix B. The total fee estimate does include labor escalation costs for existing scoped work from 2019 through 2021. The consultant is not obligated to spend above this amount. Additional activities such as engineering services during construction, startup and testing, construction management, and operations and maintenance manual are not included, and will need to be contracted separately if needed by the City.

Project tasks included in the original proposal from Jacobs are listed below. The City decided to contract with Jacobs for several of the original proposed tasks in the Agreement for Professional Services dated July 18, 2018. Those tasks included in the original Agreement are summarized below, and the contracted budgets for each task are described in detail in Appendix C.

The following tasks have been contracted with Jacobs:

- Task 1 Predesign
- Task 2 ROW Acquisitions
- Task 3 Design
- Task 4 Environmental Services/Permitting
- Task 5 Bid Services
- Task 10 Project Management
- Task 11 CA SRF Loan Application Support
- Task 12 Supplemental Services

- Task 13 Advanced Treatment Study

The following tasks have not been contracted with Jacobs, but can be added by amendment at a later date if desired by the City:

- Task 6 Services During Construction
- Task 7 Testing and Startup
- Task 8 Construction Management
- Task 9 Operations and Maintenance Manual

Task 1. Predesign

Task 1.9 – DO Sag Analysis, Anti-Degradation Analysis, and ROWD

This subtask involves continuing work on Task 1.9. The City requested that Jacobs review the DO Analysis approach with City staff in June 2020 and prepare an additional DO sampling plan for July-Oct 2020 river sampling by City with sampling results reviewed by Jacobs. Original task objectives that are still relevant include obtaining NPDES Order compliance with the CVRWQCB for the outfall/diffuser structure and related project features. The reissued 2019 NPDES Order from the CVRWQCB has required changes to original tasks to be supplemented with the following:

- The NPDES Order, reissued April 2019, requires a Work Plan submittal to the CVRWQCB, within one year, after new diffuser operation and a DO Assessment Report, within 3.5 years, after Work Plan approval by the CVRWQCB.
- In June 2020, Jacobs and the City reviewed DO data collection approaches. The City requested that Jacobs prepare a DO Sampling and Analysis Plan for Feather River Sampling by City staff in July-October 2020. Jacobs reviewed river DO sampling results reported by the City during July-October 2020 to evaluate findings and recommend modifications.
- In June 2021, Jacobs and the City will review 2021 DO data collection approaches. Jacobs will update the DO Sampling and Analysis Plan for Feather River Sampling by City staff in 2021 (if necessary). Jacobs will review river DO sampling results reported by the City in 2021 to evaluate findings and recommend modifications.
- As part of the Predesign Report for the new outfall diffuser, a Tier 2 antidegradation analysis was planned to be prepared in accordance with the State of California *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries (*SIP), to document water quality standards compliance for the City's new discharge (as required in the current permit). Revised submittal date for this Antidegradation Analysis is now April 1, 2023 – per CVRWQCB approval in December 2020.

City Involvement:

- No change from original scope.

Assumptions:

- No change from original scope.

Deliverables:

- Draft SO Sampling and Analysis Plan in electronic file format (PDF).

Task 3. Design

The City requested additional elements to be added to the project during the predesign phase, including the levee access ramp and surge control system. The levee ramp is intended for construction traffic access and City operations and maintenance access. The surge control system is intended to provide protective measures to protect the existing outfall pipeline and new outfall pipeline extension. The predesign of these elements has been completed and was included in the 30% Predesign Report and Drawings. The purpose of this task is to develop draft through final contract drawings, specifications, and cost estimate for new levee access ramps and surge control system. Work activities will include:

Final Design Levee Access Ramps

- Develop 60%, 90%, and 100% design of the levee access ramps per CVFPB encroachment and LD1 permitting requirements.
- The 60% submittal will include plan drawings, sections and details drawings, and a first draft of technical specifications. The 60% design submittal will include 4 Civil Sheets for levee ramp plans, sections, and details.
- The 90% submittal will include updates to the plan drawings, sections and details drawings, and technical specifications incorporating the City's 60% design review comments.
- The Final Contract Document submittal will include updates to the plan drawings, sections and details drawings, and technical specifications incorporating the City's 90% design review comments. The 100% design submittal will include 4 Civil Sheets for levee ramp plans, sections, and details.

Final Design Surge Control System

- Jacobs will spend up to 20 hours to review the feasibility of an Uninteruptable Power Supply (UPS) backup system to provide surge control for the existing and new effluent pipeline as an alternative to the hydropneumatic tank system described in the final Predesign Report. Jacobs will meet with City staff to develop critical performance criteria for the UPS backup system and will summarize the findings of the feasibility review in a brief technical memorandum.
- Develop a 60%, 90%, and 100% design of the surge control system, including drawings, specifications, and cost estimate.
- Civil design will include final siting of location for the surge control tanks, piping, and air compressors on a site plan and grading plan. Yard piping is required to tie the tanks into the existing wastewater plant piping.
- Structural design will identify tank saddle foundations, slabs, and miscellaneous pads and pipe supports for the tanks and ancillary equipment.
- Mechanical design will implement the final surge analysis recommendations and coordinate any changes with other disciplines. Additionally, mechanical design will confirm tank configuration including plan, sections, and details; identify air compressor package; and coordinate cathodic protection for metallic tanks and piping.
- Electrical design will identify power for the new air compressor system and power for the surge control system control panel. Other miscellaneous electrical needs include site lighting and communications that tie in the new instrumentation and alarms to the existing plant SCADA interface.

City Involvement:

- Review UPS backup system feasibility technical memorandum and provide review comments. Meet with design team by conference call to review the findings of the review and provide direction to design team regarding whether to proceed with hydropneumatic tanks system as described in the final Predesign Report. If the City decides to proceed with another type of surge control system, the estimated price to design the hydropnuematic tanks surge control system will be sufficient for final design of a UPS backup system. If the price to design another type of surge control system following the completion of the feasibility evaluation, then Jacobs will provide the City an updated scope of work and fee estimate for final design of the selected system.
- Review 60%, 90%, and 100% design drawings, specifications, and cost estimate and provide review comments.
- Provide record drawings of existing yard piping at the existing WWTF.
- Provide record geotechnical boring information and surveyed topographic information at the WWTF.
- Provide master plan layout of the WWTF at buildout and provide direction on location of surge control system location on existing plant site to coordinate with anticipated future WWTF expansion projects.

Assumptions:

- Surge control system is based on two hydropneumatics tanks as described in the final Predesign Report.
- Geotechnical borings completed at the WWTF in the early 2000's will be provided by the City for Jacobs' use in determining existing soil conditions.
- The master plan of the ultimate WWTF buildout will be provided by the City for Jacobs' use in siting the surge control system and tanks.

Deliverables:

- A maximum of (4) civil drawings for 60%, 90% and 100% design submittals for the Construction Access Ramp provided in 11 x 17 electronic file format (PDF).
- Three (3) new specifications for 60%, 90% and 100% design for the levee access ramp provided in electronic file format (PDF).
- A maximum of (9) new general, civil, structural/mechanical, electrical, and I&C drawings for 60%, 90%, and 100% design submittals for the surge control system provided in 11 x 17 electronic file format (PDF).
- A maximum of (2) contingency sheets to be used as needed.
- Three (3) new specifications for 60%, 90%, and 100% design submittals for the surge control system provided in electronic file format (PDF). Other specifications already included in the design package will also be updated to include components associated with this task as well.
- Additional drawings are included in the Updated Drawing List in Appendix A of Attachment 2A of Amendment 2.

Task 4. Environmental Services and Permitting

Task 4.2 – In-Water Permits

This subtask is follow-on work to Task 4.2. Original task objectives that are still relevant include obtaining authorization for the outfall/diffuser structure and related project features under various state and federal permits and related consultation processes. The original tasks are supplemented with the following:

Additional Permitting Effort

- Based on effort required to obtain in-water geotechnical exploration boring permits, additional consultation is anticipated for the Section 408 and 404 permits, from the U.S. Army Corp of Engineers (USACE), and encroachment permit from Central Valley Flood Protection Board (CVFPB). This amendment's scope of work describes and estimates this level of effort. Actual level of effort will largely depend on requests for additional information from permitting agencies.

Permitting Levee Access Ramps

- The addition of the new levee access ramps project feature adds a complication to the permit application assembly and review process, which in the original scope included just the pipeline crossing. Also, environmental permits require detailed field investigations for biological and cultural resources, which are based on the project footprint – now expanded to include the levee access ramps. The additional scope of work supplements the original scope. All permit applications and supporting information will now include the levee ramp as part of the project. [NOTE: Additional funding for MHM is included in Task 4.3 – Levee Permits.]

Assumptions:

- Actual level of effort for permit acquisition is unknown and current level of effort is an estimate of anticipated effort based on previous experience with the permitting agencies for the geotechnical borings permit.
- Permit agencies will not require any unexpected technical studies as a result of including the levee ramp in the permit applications.

Deliverables:

- All deliverables from original scope of work to include levee ramp.

Task 4.3 – Levee Permit

This amendment adds additional work to the subtask as described below.

Task 4.3.1 - Central Valley Flood Protection Board Hydraulic and Scour Analysis

This subtask was developed in response to the request of the CVFPB and USACE to demonstrate water surface elevation changes and any scour effects from the new Yuba City outfall diffuser structure and trap structure in the Feather River floodplain. Hydraulic and bed scour modeling will be conducted in accordance with the Modeling Plan. Work activities include:

- Conduct Hydraulic Flood and Scour Modeling using the project hydraulic model (SRH-2D) and summarize modeling results in a Draft Technical Memorandum.
- Review the Draft Hydraulic Flood and Scour Modeling TM with the City by conference call, incorporate review comments, and produce a Final TM for submittal to the CVFPB and USACE.

City Involvement:

- Provide support and coordination with the CVFPB and USACE on review of the Modeling Plan and TM submittal.

- Review and comment on draft Modeling Plan and Modeling TM. City will provide one set of adjudicated comments within two weeks of receiving draft documents.
- Accompany Jacobs in up to one conference call with CVFPB and USACE to review the Hydraulic Flood and Scour Modeling TM.

Assumptions:

- A Draft Modeling Plan has been submitted for review to USACE under this subtask in Amendment 2. The City has deferred review of Draft Modeling Plan until final design activities commence. USACE has not completed review of Draft Modeling Plan, which could lead to additional modeling effort beyond this scope and fee estimate.
- The Hydraulic Flood and Scour Modeling TM will be concise and reviewed and approved by the CVFPB and USACE. If additional modeling and analyses are requested by the agencies, then that effort will be an addition to this scope and fee estimate.
- This task does not include development of design modifications to the shoreline primer trap structure and diffuser – such modifications would be performed under another engineering task.
- All conference calls will be conducted by phone or Skype.

Deliverables:

- Hydraulic Flood and Scour Modeling TM (draft and final) in electronic file format (PDF).

Task 4.4 – Other Permits

This subtask is follow-on work to Task 4.4. Original task objectives that are still relevant include obtaining authorization for the in-water geotechnical borings under various state and federal permits and related consultation processes. The original tasks are supplemented with the following:

In-Water Geotechnical Boring Permit Support

- The list of permits for the geotechnical borings are the same as the original scope. Supplemental activities include preparing supplemental information requested by review agencies, including a detailed description of boring equipment and operations (in-water and on land), researching noise impacts of standard penetrometer tests (most research is on pile driving), calculation of in-water noise levels and contours, answering additional questions for the review agencies, and performing biological monitoring during in-water drilling activities.

City Involvement:

- No change from original scope.

Assumptions:

- No change from original scope.

Deliverables:

- Email correspondence answering review agencies questions.

Task 5. Bid Services

The purpose of this task is to provide additional bid services for the levee access ramps and surge control system as described below to supplement the currently scoped bid services. All other existing City Involvement items, Assumptions, and Deliverables described in the currently scoped bid services will apply to this work as well. Additional services will include:

Task 5.2 – Prepare Bid Documents

- Prepare Bid Documents including final design drawings and specifications to provide private bidding services company for project advertisement and distribution of Bid Documents.

Task 5.3 – Contract Advertise and Award

- Respond to contractor bid questions.
- Prepare addenda as required by bidder questions.

Task 5.4 – Prepare Conformed Documents

- Prepare Conformed for Construction Documents that incorporate clarifications and changes made by addenda.

Assumptions:

- Up to 2 additional addendums with up to 3 updated drawings each.

Task 10. Project Management

The purpose of this task is to provide additional project management services for the work added by this amendment as described below to supplement the currently scoped services. All other existing City Involvement items, Assumptions, and Deliverables described in the currently scoped project management services will apply to this work as well. Jacobs will complete additional project management tasks as described below.

Task 10.1 – External Project Meetings

Jacobs will attend the following additional project meetings with City staff:

- Up to 3 additional Special Coordination Meetings as required by project needs.

City Involvement:

- Review agendas and minutes from project progress meetings and alert project manager of any questions or corrections.

Assumptions:

- Meetings will be attended by up to two Jacobs team members and will be attended by conference call or Skype.

Deliverables:

- Meeting agendas and meeting minutes.

Task 10.2 – Develop and Maintain Project Management Tools

Jacobs will prepare and maintain up to three additional project work plans (60%, 90%, and 100% final design phases) for the levee access ramp design, surge control system design, and the WWTF Effluent Pump Station Modifications.

Task 10.3 – Project Controls and Invoicing

Jacobs project controls staff will prepare regular internal cost reports for review by the Jacobs Project Manager. Jacobs will also prepare monthly invoices (including subconsultant invoices) and a Project Status Report including progress report narrative, scope change summary, and schedule and budget status for the work added by this amendment.

Task 10.4 – Project Team Coordination

Jacobs will conduct the following internal team coordination activities:

- Regular project team coordination meetings.

Task 10.5 – Health and Safety

Jacobs will conduct internal Health and Safety (H&S) procedures to manage the safety of our staff and oversee the safety of subconsultants. Our subconsultants will be required to prepare their own H&S Plan for all field activities, and we will work with our subconsultants to monitor compliance with their own H&S Plan. Health and safety activities will include:

- Monitor Jacobs staff and subconsultant compliance with the Field Safety Instructions, and subconsultant compliance with their own H&S Plan.

Task 10.6 – Subcontract Management

Jacobs will manage the performance of our subconsultants to comply with the scope of work, schedule, and budget. This task includes setting up subconsultant contracts and required pre-procurement reviews and reviewing monthly subconsultant invoices and progress reports for the work included in this amendment.

Task 12. Supplemental Services

Jacobs will complete the following additional supplemental services as described below.

Task 12.5 – WWTF Effluent Pump Station, Flow Metering and Yard Piping Modifications

This subtask updates the existing optional Task 12.5 following completion of the final Predesign Report. The City has authorized Jacobs (under optional Task 12.5) to complete the WWTF Effluent Pump Station, Flow Metering, and Yard Piping modifications including final design and bid services. As part of the predesign phase, evaluation of the City's existing WWTF effluent pumping system recommended that three existing pumps be replaced. This amendment final design for seven additional drawings (as described below) to the six drawings included in the original scope of work.

City Involvement:

- Review 60%, 90%, and 100% design drawings, specifications, and cost estimate and provide review comments.

Assumptions:

- None.

Deliverables:

- A maximum of (2) civil drawings for 60%, 90% and 100% design submittals in 11 x 17 electronic file format (PDF).
- A maximum of (5) new electrical drawings for 60%, 90%, and 100% design submittals in 11 x 17 electronic file format (PDF).

- Additional drawings are included in the Updated Drawing List in Appendix A of Attachment 2A of Amendment 2.

Task 13. Advanced Treatment Study

The purpose of this task is to provide additional project management services for the work added by this amendment as described below to supplement the currently scoped services. Jacobs will complete additional project management tasks as described below.

Task 13.3.1 – External Project Meetings

Jacobs will attend the following project meetings with City staff:

- Biweekly Conference Call Progress Meetings. Meeting attendance will mostly be limited to Jacobs and City project managers.
- Meetings are expected to be conducted for an additional two months between April and May 2021.
- Scoping for this amendment, including meetings with City staff, and preparing draft and final scope of work and fee estimate.

City Involvement:

- Review agendas and minutes from project progress meetings and alert Jacobs project manager of any questions or corrections.

Assumptions:

- Meeting dates and times and method (in-person or by conference call) will be as agreed to between Jacobs and the City and will be subject to travel restrictions implemented by either party or by federal, state, or local public meeting limitations.

Deliverables:

- Conference call agenda and meeting summaries.

Task 13.8 – Side stream Treatment

The purpose of this subtask is to supplement activities requested under the Advanced Treatment Study. The original tasks are supplemented with the following:

- Develop a sidestream treatment cost for incorporation into the Draft Advanced Treatment Study TM. The cost estimate will be based on Bay Area Clean Water Agencies (BACWA) costs and will include construction, O&M and NPV costs for sidestream treatment only.
- Participate in conference calls with City staff, as needed, to develop the sidestream treatment costs.

City Involvement:

- City will provide the following information for incorporation into the cost estimate:
  - Recycle streams –total average flow, total average ammonia load (lb-N/day).
  - Average dry weather flow (ADWF) and load.

Assumptions:

- Conference calls and coordination time Jacobs spent with the City has been included in the fee estimate for this task.

Deliverables:

- Sidestream treatment cost estimate delivered in the Final Advanced Treatment Study TM in electronic file format (PDF).

Task 13.9 – Filtrate Sampling Plan Development

The purpose of this subtask is to supplement activities requested under the Advanced Treatment Study, specifically to develop a filtrate sampling plan that measures ammonia in the recycled treatment streams. The original tasks are supplemented with the following:

- Prepare a draft sampling plan for City review and conduct one review conference call with City staff to solicit City feedback.
- Incorporate City input into final sampling plan.
- Review sampling data, collected by City, to validate the estimated BACWA cost in $/lb to be used for sidestream treatment cost estimate.
- Summarize sampling results in Final Advanced Treatment Study TM.

City Involvement:

- Review draft sampling plan and provide input to Jacobs.
- City staff will complete sampling over a two-week period.

Assumptions:

- Up to two conference calls with Jacobs (limited to two Jacobs staff members) to review the draft sampling plan and review sampling results.

Deliverables:

- Draft and final sampling plan in electronic file format (PDF).
- Summarize sampling results in the Final Advanced Treatment Study TM in electronic file format (PDF).

Project Schedule

The start date for delivery of the activities described in this amendment is controlled by the authorization to begin final design. The activities described above will delivered on a schedule that is mutually agreeable to the City and Jacobs.

Rates and Fees for Engineering Services

The estimated fee for the proposed engineering services is shown in Appendix A. Appendix B provides a rate schedule that has been escalated from the original contracted rates for the City's Outfall and Diffuser Project through 2023.

Appendix A
Fee Estimate

Yuba City WWTF Outfall and Diffuser Project
APPENDIX A. JACOBS FEE ESTIMATE

CITY OF YUBA CITY PUBLIC WORKS DEPARTMENT WWTF Outfall and Diffuser Project Additional Services Amendment 4	Total Hours	Total Labor	Travel	Expense	Subs	10% Expense/Travel Markup	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Amendment 04 - Additional Services									
Task 1 - Predesign									
Subtotal - Subtask 1.9 - Dissolved Oxygen Sag/Anti-degradation/ROWD Analysis	46	$ 10,056	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,056
Labor Escalation for Existing Design-phase Services from August 2019 to June 2021									
Subtotal - Task 2 - Right-of-Way Acquisitions	-	$ 1,301	$ -	$ -	$ 9,475	$ -	$ 474	$ 9,949	$ 11,250
Subtotal - Task 3 - Design	-	$ 44,017	$ -	$ -	$ 5,825	$ -	$ 291	$ 6,116	$ 50,133
Subtotal - Task 4 - Environmental Services/Permitting	-	$ 6,202	$ -	$ -	$ 1,105	$ -	$ 55	$ 1,160	$ 7,362
Subtotal - Task 5 - Bid Services	-	$ 2,215	$ -	$ -	$ 1,735	$ -	$ 87	$ 1,822	$ 4,037
Subtotal - Task 10 - Project Management	-	$ 12,949	$ -	$ -	$ 1,952	$ -	$ 98	$ 2,050	$ 14,999
Subtotal - Task 12 - Supplemental Services	-	$ 28,028	$ -	$ -	$ 6,546	$ -	$ 327	$ 6,873	$ 34,901
Subtotal - Labor Escalation for Existing Design-phase Services from August 2019 to June 2021	-	$ 94,712	$ -	$ -	$ 26,638	$ -	$ 1,332	$ 27,970	$ 122,682
Levee Access Ramp									
Subtotal - Task 3 - Final Design Levee Access Ramp	198	$ 36,474	$ -	$ -	$ 8,000	$ -	$ 400	$ 8,400	$ 44,874
Subtotal - Subtask 4.2 - Permitting Levee Access Ramp	40	$ 8,058	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,058
Subtotal - Task 5 - Bid Services Levee Access Ramp	30	$ 5,725	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,725
Surge Control System									
Subtotal - Task 3 - Final Design Surge Control System	716	$ 131,805	$ 200	$ 3,000	$ 1,000	$ 320	$ 50	$ 4,570	$ 136,375
Subtotal - Task 5 - Bid Services Surge Control System	38	$ 7,152	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,152
Task 4 - Environmental Services/Permitting									
Subtotal - Subtask 4.2 - In-Water Permits (including CVFPB Permit)	160	$ 30,240	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,240
Subtotal - Subtask 4.3.1 - CVFPB Hydraulic and Scour Analysis	107	$ 26,790	$ -	$ -	$ -	$ -	$ -	$ -	$ 26,790
Subtotal - Subtask 4.4 - In-River Geotechnical Boring Permitting Support	36	$ 7,572	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,572
Task 10 - Project Management									
Subtotal - Subtask 10.1 - External Project Meetings	20	$ 4,000	$ 200	$ -	$ -	$ 20	$ -	$ 220	$ 4,220
Subtotal - Subtask 10.2 - Develop and Maintain Project Management Tools	56	$ 12,234	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,234
Subtotal - Subtask 10.3 - Project Controls and Invoicing	28	$ 6,072	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,072
Subtotal - Subtask 10.4 - Project Team Coordination	72	$ 14,656	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,656
Subtotal - Subtask 10.5 - Health and Safety	20	$ 3,908	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,908
Subtotal - Subtask 10.6 - Subcontract Management	33	$ 6,308	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,308
Subtotal - Task 10 - Project Management	229	47,178	200	-	-	20	-	220	$ 47,398
Task 12 - Supplemental Services									
Subtotal - Subtask 12.5 - WWTF Pump Station, Flow Metering, and Yard Piping Modifications	420	$ 75,820	$ 200	$ 500	$ -	$ 70	$ -	$ 770	$ 76,590
Task 13 - Advanced Treatment Study									
Subtotal - Subtask 13.3 - Advanced Treatment Project Management	114	$ 24,924	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,924
Subtotal - Subtask 13.8 - Sidestream Treatment Cost Development	31	$ 7,671	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,671
Subtotal - Subtask 13.9 - Filtrate Sampling Plan Development	24	$ 5,964	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,964
Additional Services Task Hours	2,189.0	$ 520,141							
Additional Servcies Task Budget	2,189.0	$ 520,141	$ 600	$ 3,500	$ 35,638	$ 410	$ 1,782	$ 41,930	$ 562,071

Appendix B
Rate Schedule

Appendix B - Rate Schedule

CH2M HILL ENGINEERS, INC
PROFESSIONALS AND TECHNICIANS
2018 - 2023 Hourly Billing Rates

Classification	2018	2019	2020	2021	2022	2023
Principal in Charge*	260	268	276	284	293	302
Principal Professional 2*	234	241	248	255	263	271
Principal Professional 1*	198	204	210	216	222	229
Sr. Professional 2*	177	182	187	193	199	205
Sr. Professional 1*	167	172	177	182	187	193
Project Professional 2*	156	161	166	171	176	181
Project Professional 1*	129	133	137	141	145	149
Staff Professional 2*	126	130	134	138	142	146
Staff Professional 1*	108	111	114	117	121	125
Technician	112	115	118	122	126	130
Office/Clerical	112	115	118	122	126	130

Notes:

*includes engineering, consulting, planner and scientist disciplines

**These rates are effective January 1, 2018 through December 31, 2023

A markup of 10% shall be applied to all Other Direct Costs and expenses; 5% markup shall be applied to all Subconsultants

Appendix C
Contract Budget Authorization Table

Yuba City WWTF Outfall and Diffuser Project
Amendment 4 Budget Authorization Summary
City of Yuba City

Task	Amendment 4 - Reconciliation from Amd 2 (Item 4A)	Amendment 4 - Reconciliation from Amd 3 (Item 4B)	Amendment 4 - Additional Services (Item 4C)	Amendment 4 - Total Authorized Amount and Date (TBD)
Task 1 - Predesign	$0	$0	$10,056	$10,056
Task 2 - ROW Acquisitions	$0	$0	$11,250	$11,250
Task 3 - Design	$289,786	$0	$231,382	$521,168
Task 4 - Environmental Services/Permitting	$0	$0	$80,022	$80,022
Task 5 - Bid Services	$0	$50,000	$16,914	$66,914
Task 6 - Services During Construction	$0	$0	$0	$0
Task 7 - Testing and Startup	$0	$0	$0	$0
Task 8 - Construction Management	$0	$0	$0	$0
Task 9 - Operations and Maintenance Manual	$0	$0	$0	$0
Task 10 - Project Management	$0	$0	$62,397	$62,397
Task 11 - CA SRF Loan Application Support	$0	$0	$0	$0
Task 12 - Supplement Services	$0	$0	$111,491	$111,491
Task 13 - Advanced Treatment Study	$0	$0	$38,559	$38,559
Total	**$289,786**	**$50,000**	**$562,071**	**$901,857**

Yuba City WWTF Outfall and Diffuser Project
Contract Budget Authorization

City of Yuba City

Task	Proposed Contract Budget Amount	Original Authorized Amount and Date (7/11/18)	Amendment 1 Authorized Amount and Date (9/19/19)	Amendment 2 Authorized Amount and Date (7/10/20)	Amendment 3 Authorized Amount and Date (12/1/20)	Amendment 4 - Total Authorized Amount and Date (TBD)	Total Authorized Amount To-Date
Task 1 - Predesign	$821,864	$821,864	$87,540	$71,758	$0	$10,056	$991,218
Task 2 - ROW Acquisitions	$185,305	$185,305	$0	$0	$0	$11,250	$196,555
Task 3 - Design	$570,155	$570,155	$0	-$289,786	$0	$521,168	$801,537
Task 4 - Environmental Services/Permitting	$254,423	$254,423	$0	$35,053	$0	$80,022	$369,498
Task 5 - Bid Services	$57,819	$57,819	$0	$0	-$50,000	$66,914	$74,733
Task 6 - Services During Construction	$239,751	$0	$0	$0	$0	$0	$0
Task 7 - Testing and Startup	$177,897	$0	$0	$0	$0	$0	$0
Task 8 - Construction Management	$458,476	$0	$0	$0	$0	$0	$0
Task 9 - Operations and Maintenance Manual	$21,362	$0	$0	$0	$0	$0	$0
Task 10 - Project Management	$503,617	$344,301	$10,294	$38,024	$0	$62,397	$455,016
Task 11 - CA SRF Loan Application Support	$50,000	$50,000	$0	$0	$0	$0	$50,000
Task 12 - Supplement Services	$499,564	$499,564	$65,043	$24,914	$0	$111,491	$701,012
Task 13 - Advanced Treatment Study	$0	$0	$0	$120,037	$50,000	$38,559	$208,596
Total	**$3,840,234**	**$2,783,431**	**$162,877**	**$0**	**$0**	**$901,857**	**$3,848,165**

Exhibit B

AGREEMENT FOR PROFESSIONAL SERVICES

This Agreement is made and entered into as of July 18, 2018, by and between the City of Yuba City, a municipal corporation ("City") and CH2M Hill Engineers, Inc. ("Consultant").

RECITALS

A. Consultant is specially trained, experienced and competent to perform the special services which will be required by this Agreement; and

B. Consultant possesses the skill, experience, ability, background, certification and knowledge to provide the services described in this Agreement on the terms and conditions described herein; and

C. City desires to retain Consultant to render professional services as set forth in this Agreement.

AGREEMENT

1. Scope of Services. The Consultant shall furnish the following services in a professional manner.

See Attached Scope of Services
(Exhibit A)

2. Time of Performance. The services of Consultant are to commence upon execution of this Agreement and shall continue until all authorized work is completed and approved by the City. Finalization shall be completed at the direction of the City of Yuba City.

3. Compensation. Compensation to be paid to Consultant shall be in accordance with the Schedule of Charges set forth in Exhibit A, which is attached hereto and incorporated herein by reference. In no event shall Consultant's compensation exceed **$2,783,430.00** without additional written authorization from the City. Payment by City under this Agreement shall not be deemed a waiver of defects, even if such defects were known to the City at the time of payment.

4. Method of Payment. Consultant shall submit monthly billings to City describing the work performed during the preceding month. Consultant's invoices shall include a brief description of the services performed, the date the services were performed, the number of hours spent and by whom, and a description of any reimbursable expenses. City shall pay Consultant not later than 30 days after approval of the monthly invoice by City staff. When

payments made by the City equal 90% of the maximum fee provided for in this Agreement, no further payments shall be made until the final work under this Agreement has been accepted by City.

5. Extra Work. At any time during the term of this Agreement, City may request that Consultant perform Extra Work. As used herein, "Extra Work" means any work which is determined by City to be necessary for the proper completion of the Project, but which the parties did not reasonably anticipate would be necessary at the execution of this Agreement. Consultant shall not perform, nor be compensated for, Extra Work without written authorization from City.

6. Termination. This Agreement may be terminated by the City immediately for cause or by either party without cause upon fifteen days written notice of termination. Upon termination, Consultant shall be entitled to compensation for services performed up to the effective date of termination. Such compensation is subject to the conditions of Section 4 of this agreement.

7. Ownership of Documents. All plans, studies, documents and other writings prepared by and for Consultant, its officers, employees, agents and subcontractors in the course of implementing this Agreement, except working notes and internal documents, shall become the property of the City upon payment to Consultant for such work, and the City shall have the sole right to use such materials in its discretion without further compensation to Consultant or to any other party. Consultant shall, at Consultant's expense, provide such reports, plans, studies, documents and other writings to City upon request.

* Licensing of Intellectual Property. This Agreement creates a nonexclusive and perpetual license for City to copy, use, modify, reuse, or sublicense any and all copyrights, designs, and other intellectual property embodied in plans, specifications, studies, drawings, estimates, and other documents or works of authorship fixed in any tangible medium of expression, including but limited to, physical drawings or data magnetically or otherwise recorded on computer diskettes, which are prepared or caused to be prepared by Consultant under this Agreement ("Documents & Data"). Consultant shall require all subcontractors to agree in writing that City is granted a non-exclusive and perpetual license for any Documents & Data the subcontractor prepares under this Agreement. Consultant represents and warrants that Consultant has the legal right to license any and all Documents & Data. Consultant makes no such representation and warranty in regards to Documents & Data which were prepared by design professionals other than Consultant or provided to Consultant by the City. City shall not be limited in any way in its use of the Documents & Data at any time, provided that any such use not within the purposes intended by this Agreement shall be at City's sole risk.

Confidentiality. All ideas, memoranda, specifications, plans, procedures, drawings, descriptions, computer program data, input record data, written

information, and other Documents & Data either created by or provided to Consultant in connection with the performance of this Agreement shall be held confidential by Consultant. Such materials shall not, without the prior written consent of City, be used by Consultant for any purposes other than the performance of the services under this Agreement. Nor shall such materials be disclosed to any person or entity not connected with the performance of the services under this Agreement. Nothing furnished to Consultant, which is otherwise known to Consultant or is generally known, or has become known, to the related industry shall be deemed confidential. Consultant shall not use City's name or insignia, photographs relating to project for which Consultant's services are rendered, or any publicity pertaining to the Consultant's services under this Agreement in any magazine, trade paper, newspaper, television or radio production or other similar medium without the prior written consent of City.

8. Consultant's Books and Records:

   a. Consultant shall maintain any and all ledgers, books of accounts, invoices, vouchers, canceled checks, and other records or documents evidencing or relating to charges for services, or expenditures and disbursements charged to City for a minimum period of three (3) years, or for any longer period required by law, from the date of final payment to Consultant to this Agreement.
   b. Consultant shall maintain all documents and records which demonstrated performance under this Agreement for a minimum period of three (3) years, or for any longer period required by law, from the date of termination or completion of this Agreement.
   c. Any records or documents required to be maintained pursuant to this Agreement shall be made available for inspection or audit, at any time during regular business hours, upon written request by the City Administrator, City Attorney, City Auditor or a designated representative of these officers. Copies of such documents shall be provided to the City for inspection at City Hall when it is practical to do so. Otherwise, unless an alternative is mutually agreed upon, the records shall be available at Consultant's address indicated for receipt of notices in this Agreement.
   d. Where City has reason to believe that such records or documents may be lost or discarded due to dissolution, disbandment or termination of Consultant's business, City may, by written request by any of the above named officers, require that custody of the records be given to the City and that the records and documents be maintained in City Hall. Access to such records and documents shall be granted to any party authorized by Consultant, Consultant's representatives, or Consultant's successor-in-interest.

9. Independent Contractor. It is understood that Consultant, in the performance of the work and services agreed to be performed, shall act as and be an independent contractor and shall not act as an agent or employee of the City. Consultant shall obtain no rights to retirement benefits or other benefits which accrue to City's employees, and Consultant hereby expressly waives any claim it may have to any such rights.

Consultant is not a designated employee within the meaning of the Political Reform Act because Consultant:

a. Will conduct research and arrive at conclusions with respect to his/her rendition of information, advice, recommendation or counsel independent of the control and direction of the City or of any City official, other than normal agreement monitoring; and

b. Possesses no authority with respect to any City decision beyond rendition of information, advice, recommendation or counsel. (FPPC Reg. 18700(B)(2).)

10. Interest of Consultant. Consultant (including principals, associates and professional employees) covenants and represents that it does not now have any investment or interest in real property and shall not acquire any interest, direct or indirect, in the area covered by this Agreement or any other source of income, interest in real property or investment which would be affected in any manner or degree by the performance of Consultant's services hereunder. Consultant further covenants and represents that in the performance of its duties hereunder no person having any such interest shall perform any services under this Agreement.

11. Professional Ability of Consultant. City has relied upon the professional training and ability of Consultant to perform the services hereunder as a material inducement to enter into this Agreement. Consultant shall therefore provide properly skilled professional and technical personnel to perform all services under this Agreement. All work performed by Consultant under this Agreement shall be in accordance with applicable legal requirements and shall meet the standard of quality ordinarily to be expected of competent professionals in Consultant's field of expertise. Consultant will reperform any services not meeting this standard without additional compensation.

12. Compliance with Laws. Consultant shall use the standard of care in its profession to comply with all applicable federal, state and local laws, codes, ordinances and regulations.

13. Licenses. Consultant represents and warrants to City that it has all licenses, permits, qualifications, insurance and approvals of whatsoever nature, which are legally required of Consultant to practice its profession. Consultant

represents and warrants to City that Consultant shall, at its sole cost and expense, keep in effect or obtain at all times during the term of this Agreement, any licenses, permits, insurance and approvals which are legally required of Consultant to practice its profession. Consultant shall maintain a City of Yuba City business license.

14. Indemnity. Consultant agrees to defend, indemnify and hold harmless the City, its officers, officials, agents, employees and volunteers from and against any and all claims, demands, actions, losses, damages, injuries, and liability, direct or indirect (including any and all costs, including attorney fees and expenses in connection therein), arising out of the performance of this Agreement in whole or in part by any negligent act or omission of the Consultant, or anyone directly or indirectly employed by the Consultant or anyone for whose acts the Consultant may be liable, or its failure to comply with any of its obligations contained in this Agreement, except for any such claim arising out of the sole negligence or willful misconduct of the City, its officers, agents, employees or volunteers.

15. Insurance Requirements. Consultant, at Consultant's own cost and expense, shall procure and maintain, for the duration of the contract, necessary insurance policies as described in Exhibit B.

16. Notices. Any notice required to be given under this Agreement shall be in writing and either served personally or sent prepaid, first class mail. Any such notice shall be addressed to the other party at the address set forth below. Notice shall be deemed communicated within 48 hours from the time of mailing if mailed as provided in this section.

If to City	Diana Langley Public Works Department City of Yuba City 1201 Civic Center Blvd Yuba City, CA 95993 (530) 822-4632
If to Consultant:	Jason Junkert Project Manager Jacobs 2485 Natomas Park Drive, Suite 600 Sacramento, CA 95833 (916) 286-0426

17. Entire Agreement. This Agreement constitutes the complete and exclusive statement of Agreement between the City and Consultant. All prior written and oral communications, including correspondence, drafts, memoranda, and representations, are superseded in total by this Agreement.

18. Amendments. This Agreement may be modified or amended only by a written document executed by both Consultant and City and approved as to form by the City Attorney.

19. Assignment and Subcontracting. The parties recognize that a substantial inducement to City for entering into this Agreement is the professional reputation, experience and competence of Consultant. Assignments of any or all rights, duties or obligations of the Consultant under this Agreement will be permitted only with the express consent of the City. Consultant shall not subcontract any portion of the work to be performed under the Agreement without the written authorization of the City. If City consents to such subcontract, Consultant shall be fully responsible to City for all acts or omissions of the subcontractor. Nothing in this Agreement shall create any contractual relationship between City and subcontractor nor shall it create any obligation on the part of the City to pay or to see to the payment of any monies due to any such subcontractor other than as otherwise is required by law.

20. Waiver. Waiver of a breach or default under this Agreement shall not constitute a continuing waiver of a subsequent breach of the same or any other provision under this Agreement.

21. Severability. If any term or portion of this Agreement is held to be invalid, illegal, or otherwise unenforceable by a court of competent jurisdiction, the remaining provisions of this Agreement shall continue in full force and effect.

22. Controlling Law Venue. This Agreement and all matters relating to it shall be governed by the laws of the State of California and any action brought relating to this Agreement shall be held exclusively in a state court in the County of Sutter.

23. Litigation Expenses and Attorneys' Fees. If either party to this Agreement commences any legal action against the other party arising out of this Agreement, the prevailing party shall be entitled to recover its reasonable litigation expenses, including court costs, expert witness fees, discovery expenses, and attorneys' fees.

24. Mediation. The parties agree to make a good faith attempt to resolve any disputes arising out of this Agreement through mediation prior to commencing litigation. The parties shall mutually agree upon the mediator and shall divide the costs of mediation equally. If the parties are unable to agree upon a mediator, the dispute shall be submitted to JAMS/ENDISPUTE ("JAMS") or its successor in interest. JAMS shall provide the parties with the names of five qualified mediators. Each party shall have the option to strike two of the five mediators selected by JAMS and thereafter the mediator remaining shall hear

the dispute. If the dispute remains unresolved after mediation, either party may commence litigation.

25. Execution. This Agreement may be executed in several counterparts, each of which shall constitute one and the same instrument and shall become binding upon the parties when at least one copy hereof shall have been signed by both parties hereto. In approving this Agreement, it shall not be necessary to produce or account for more than one such counterpart.

26. Authority to Enter Agreement. Consultant has all requisite power and authority to conduct its business and to execute, deliver, and perform the Agreement. Each party warrants that the individuals who have signed this Agreement have the legal power, right, and authority to make this Agreement and to bind each respective party.

27. Prohibited Interest. Consultant maintains and warrants that it has not employed nor retained any company or person, other than a bona fide employee working solely for Consultant, to solicit or secure this Agreement. Further, Consultant warrants that it has not paid nor has it agreed to pay any company or person, other than a bona fide employee working solely for Consultant, any fee, commission, percentage, brokerage fee, gift or other consideration contingent upon or resulting from the award or making of this Agreement. For breach or violation of this warranty, City shall have the right to rescind this Agreement without liability. For the term of this Agreement, no member, officer or employee of City, during the term of his or her service with City, shall have any direct interest in this Agreement, or obtain any present or anticipated material benefit arising there from.

28. Equal Opportunity Employment. Consultant represents that it is an equal opportunity employer and it shall not discriminate against any subcontractor, employee or applicant for employment because of race, religion, color, national origin, handicap, ancestry, sex or age. Such non- discrimination shall include, but not be limited to, all activities related to initial employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination. Consultant shall also comply with all relevant provisions of City's Affirmative Action Plan or other related programs or guidelines currently in effect or hereinafter enacted.

29. Data. City will provide to Consultant relevant data in City's possession relating to Consultant's services on the project upon request. Consultant will reasonably rely upon the accuracy, timeliness, and completeness of the information provided by City.

30. Force Majeure. Any delays in Consultant's Services caused by the following shall be added to the time for completion of any obligations of Consultant: (1) the actions of City or its employees; (2) the actions of those in direct contractual relationship with City; (3) the actions of any governmental agency

having jurisdiction over the Project; (4) the actions of any parties not within the reasonable control of the Consultant; and (5) any act of God or other unforeseen occurrence not due to any fault or negligence on the part of Consultant. Neither the City nor the Consultant shall be liable for damages, liquidated or otherwise, to the other on account of such delays.

31. Suspension, Delay or Interruption of Work. City may suspend, delay, or interrupt the Services of Consultant for the convenience of City. In such event, Consultant's contract price and schedule shall be equitably adjusted upon mutual agreement of the City and Consultant.

32. Subsurface Investigations. In soils, foundation, groundwater, and other subsurface investigations, the actual characteristics may vary significantly between successive test points and sample intervals and at locations other than where observations, exploration, and investigations have been made. Because of the inherent uncertainties in subsurface evaluations, changed or unanticipated underground conditions may occur that could affect total project cost and/or execution. Any such subsurface investigations undertaken by Consultant shall be performed pursuant to the applicable professional standard of care.

33. Hazardous Substances. If hazardous substances in any form are encountered or suspected, Consultant will stop its own work in the affected portions of the project to permit testing and evaluation. If hazardous substances are suspected, Consultant will, if requested, conduct tests to determine the extent of the problem and will perform the necessary studies and recommend the necessary remedial measures at an additional fee and contract terms to be negotiated. City recognizes that Consultant assumes no risk and/or liability for a waste or hazardous waste site originated by other than Consultant.

34. Consultant's Personnel at Construction Site. The presence or duties of Consultant's personnel at a construction site, whether as onsite representatives or otherwise, do not make Consultant or Consultant's personnel in any way responsible for those duties that belong to the City and/or the construction contractors or other entities, and do not relieve the construction contractors or any other entity of their obligations, duties, and responsibilities, including, but not limited to, all construction methods, means, techniques, sequences, and procedures necessary for coordinating and completing all portions of the construction work in accordance with the construction Contract Documents and any health or safety precautions required by such construction work. Consultant will coordinate its health, safety, and environmental program with the responsibilities for health, safety, and environmental compliance specified in the contract documents. Consultant will coordinate with responsible parties to correct conditions that do not meet applicable federal, state, and local occupation health and safety laws and regulations when such conditions expose Consultant staff or staff of

consultant subcontractors to unsafe conditions. Consultant will notify affected personnel of any site conditions posing an imminent danger to them that Consultant observes. Consultant is not responsible for the health or safety precaution of City of Contractor staff. Consultant is not responsible for the Contractor's compliance with the health and safety requirements of the contract documents or with federal, state, and local occupational health and safety laws and regulations. Consultant and Consultant's personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions and have no duty for inspecting, noting, observing, correcting, or reporting on health or safety deficiencies of the construction contractor(s) or other entity or any other persons at the site except Consultant's own personnel. The presence of Consultant's personnel at a construction site is for the purpose of providing to City a greater degree of confidence that the completed construction work will conform generally to the construction documents and that the integrity of the design concept as reflected in the construction documents has been implemented and preserved by the construction contractor(s). Consultant neither guarantees the performance of the construction contractor(s) nor assumes responsibility for construction contractor's failure to perform work in accordance with the construction documents. For this agreement only, construction sites include places of manufacture for materials incorporated into the construction work, and construction contractors include manufacturers of materials incorporated into the construction work.

35. Consultant Listed as Additional Insured by Contractor. The City shall require the prime contractor on the Project to name Consultant as additional insured on the contractor's commercial general liability insurance policy.

36. Record Drawings. Record drawings, if required, will be prepared, in part, on the basis of information compiled and furnished by others, and may not always represent the exact location, type of various components, or exact manner in which the project was finally constructed. Designer will make a good-faith effort to verify the accuracy of such information by means of a thorough interior and exterior visual survey of site and project conditions. Consultant is not responsible for any errors or omissions in the information from others that is incorporated into the record drawings provided Consultant has reviewed such information and prepared the record drawings in accordance with the applicable professional standard of care.
37. Contractor Invoice Review. Recommendations by Consultant to City for periodic construction progress payments to the construction contractor(s) will be based on Consultant's knowledge, information, and belief from selective sampling that the work has progressed to the point indicated. Such recommendations do not represent that continuous or detailed examinations have been made by Consultant to ascertain that the construction contractor(s) have completed the work in exact accordance with the construction

documents; that the final work will be acceptable in all respects; that Consultant has made an examination to ascertain how or for what purpose the construction contractor(s) have used the moneys paid; that title to any of the work, materials, or equipment has passed to the City free and clear of liens, claims, security interests, or encumbrances; or that there are not other matters at issue between the City and the construction contractors that affect the amount that should be paid.

38. Access to Facilities and Property. The City will make its facilities accessible to Consultant as reasonably necessary for Consultant's performance of its services upon timely request by Consultant.

39. Key Personnel. The Consultant will utilize its staff, including the following Key Personnel noted in the Proposal: David Wilson, Kyle Winslow, Mitchell Swanson, Lorin Davis, Matt Franck, Quitterie Cotton, and Jason Junkert. Except for substitutions required by circumstances not within its reasonable control, the Consultant may not make substitutions of Key Personnel without the prior written consent of the City, which consent will not be unreasonably withheld, delayed, or conditioned. For the purposes of this Section, "substitutions required by circumstances not within its reasonable control" means substitutions required by virtue of illness, death, injury, pregnancy, medical leave, or termination of employment or contract, but expressly excludes situations where the Key Personnel employee is called upon to perform services for another client of the Consultant, its Sub-contractor or their affiliates.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed on the date first written above.

CITY OF YUBA CITY:

By: _____
Steven C. Kroeger
City Manager

CONSULTANT:

By _____ /for
Brett Isbell
Designated Manager

Attachments: Exhibit A – Scope of Services
Exhibit B - Insurance Requirements

Exhibit A

Scope of Work
Yuba City WWTF – Outfall and Diffuser Project

This Scope of Work is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

Tasks 1 through 12 as described below, including all subtasks, are included in this Scope of Work.

Task 1. Predesign

Task 1.1 – Review of Existing Studies

- Technical studies and data collections performed for the outfall relocation effort will be obtained from the City and reviewed in detail. These existing studies include the *Hydrogeomorphic Study of Diffuser Siting Options* (2013), the *Diffuser Relocation Study* (2017), compiled land (LIDAR) and river (bathymetric) surveys, as well as initial potential pipeline route layouts by MHM Engineers. We assume that the City will be able to provide the input files and model setup records for the 2-D hydrodynamic and sediment transport models and topographic change detection analysis of the Feather River used by ESA (and Dr. Pasternak).
- Review available geotechnical data for the levee and pipeline route options, river bedform material and bathymetric survey data, current velocity data, background river chemistry data, terrestrial resource information, and relevant Feather River fish use studies for potential new outfall diffuser sites – for use in the design and permitting.
- Review available design drawings and engineering reports related to the effluent pumps and existing effluent pipeline to the Feather River.
- Develop a tabular summary cataloging studies and data sources identified, adequacy and uses of these studies, and identifying assumptions and limitations of studies. Data gaps will be identified in this summary.

City Involvement:

- Provide design drawings and engineering reports related to the effluent pumps and existing effluent pipeline, and facilitate consultation with WWTF operations staff on pumping and pipeline operations and issues.
- Provide design drawings and engineering reports related to the existing pipeline route and the potential new pipeline routes to new outfall site.
- Obtain modeling input files and survey CAD files used by ESA in their 2013 and 2017 geomorphology studies and modeling.

Assumptions:

- We assume that the input files and model setup records for the 2-D hydrodynamic and sediment transport models used by ESA (and Dr. Pasternak) will be provided in electronic files by the City. These files will also include compiled land (LIDAR) and river (bathymetric) surveys. LiDAR coverage is assumed to be available to extend the model to Boyd's Landing (RM 22.6).

- As-built drawings of effluent pump stations, effluent pipeline, and pipeline valves can be provided in CAD electronic file format.
- This activity assumes we will spend up to 24 hours reviewing available modeling documentation

Deliverables:

- Tabular summary cataloging studies and data sources, adequacy and uses of these studies, and identifying assumptions and limitations of studies. Data gaps will be identified and recommendations for additional data collections will be included in this table for review with the City.

Task 1.2 – River Bathymetry and Data Collections

Initial bathymetric survey for 2018 is described below. Follow-on annual bathymetric surveys are described in Task 12 Contingency.

1.2.a Field Operations Plan

- Prepare a concise Field Operations Plan for River Data Collections to include study approach, methods and equipment, schedule, field personnel, and communications plan.

1.2.b Bathymetric Survey and Other Field Data Collections

- Conduct bathymetry survey of the Feather River region below Shanghai Falls (RM 24.5) to Boyd's Landing (RM 22.6) using a sweep-system (multiple single-beam) sonar to record detailed river bed elevation data. JACOBS will engage a specialty hydrographic surveyor to perform this bathymetry survey in summer or early fall 2018. The vessel used for this survey will be provided by the hydrographic surveyor and the survey crew will include an ACSM certified hydrographer.
- Horizontal positions for navigation and data collection will be determined by using a Trimble base and rover system, and Hypack navigation software. The horizontal datum used will be NAD83, California State Plane Zone 2 (U.S. Survey Feet). The vertical datum used by the hydrographic surveyor will be NAVD88 (U.S. Survey Feet).
- Conduct ADCP surveys (velocities and sectional flow) at seven (7) river sections between Shanghai Falls (RM 24.5) and Boyd's Landing (RM 22.6) using a vessel-mounted RDI Workhorse Sentinel 1200 kHz ADCP to log velocities and depths using WinRiver software. Vessel navigation and position recording will use onboard RTK DGPS and the same Trimble base RTK station used in the bathymetry survey, and using Hypack navigation software. The hydrographic surveyor and JACOBS personnel will perform the ADCP surveys from the hydrographic survey vessel on days following completion of the bathymetry survey.
- Collect surface sediment samples at 16-20 sites on the Feather River study region between RM 24.5 and 22.6 using 0.05 meter^2 Ponar sediment sampler. Sediment samples will be submitted for laboratory analysis of particle size distribution by sieve and hydrometer ASTM methods. River sediment sampling to be conducted by JACOBS personnel from the work vessel with DGPS navigation to locate sampling sites, on days following completion of the bathymetry survey and ADCP measurements.
- Identify and validate suitable benchmarks for locating RTK Base Station for use during bathymetry surveys and other data collections on the river. If alternative survey control sites are required then they will be established by MHM and adjusted and calibrated to the most current documentation of NAD83 and NAVD88 (National Geodetic Survey).
- Additional river velocity measurements will be recorded in the river under higher river flows. Three one-day sampling events will be conducted between October 2018 and April 2019. JACOBS will rent a work vessel with licensed operator and GPS navigation, and a single-point electromagnetic or

ADCP current meter for measurements. JACOBS staff will perform one day of river current velocity measurements at 6 stations along 3 river transects (18 sites) near potential diffuser sites in the Feather River. The timing of these field measurements will be determined by river flow and stage, as well as safe working conditions.

- Recording water level dataloggers (duplicate) and barometric pressure recorders (duplicate) will be installed at one site located between RM 23.2 and 23.5 in September 2018 to provide water level data for model calibration, and this installation will be maintained by JACOBS until April 2019. The water level sensor will be installed in a submerged and cable anchored housing along the river shore, and it will be hidden from view onshore and offshore. The location will be marked on land with a metal stake to allow retrieval and servicing.

City Involvement:

- Facilitate access to secure survey benchmarks to allow for locating Trimble base RTK station on tripod during bathymetric survey and field data collection days.

Assumptions:

- Field services will be conducted in accordance with the project FSI and the hydrographic surveyor's Safety Plan. Vessel safety and operational safety will be the responsibility of the hydrographic surveyor. For safety reasons, all field activities on the river will be limited to daylight hours. These field measurements are assumed to require four to six consecutive field days on the Feather River.
- Prior to mobilizing personnel and equipment for any survey work, river flow and stage forecasts will be evaluated to decide if adequate and safe river conditions are forecast for the work period. Seasonal river flows will not restrict boat access and data acquisition to the point of damage or imminent danger to personnel and equipment.
- Maintenance of the recording water level dataloggers in the Feather River will require monthly site visits during November 2018 to April 2019 to retrieve deployed instruments, downloading data, cleaning the housing and instruments, and redeploying.
- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies can be provided on request.

Deliverables:

- A concise bathymetric survey report will be produced and report charts will be provided. The report charts will include depth contours at 1-foot intervals, color TIN (Triangulated Irregular Networks), and track-lines. Report charts will be produced in the horizontal and vertical datum defined above. This report will describe the control used for the survey, data acquisition methodology, calibrations, and data processing procedures. Report deliverables will include an ASCII file of the XYZ data, AutoCAD and Civil 3D DWG files.
- A concise report of ADCP survey and sediment sampling will be produced, and this report will include instruments and method used, ADCP river sections, ADCP data, and sediment sample site coordinates. In addition to this report, deliverables will include Excel files of the ADCP data.
- Tabular summary of sediment laboratory results.

Task 1.3 – River Bedform and Sediment Transport Modeling

Task Objectives: 1) utilize field data to support stability assessment and sediment transport modeling analysis; 2) develop understanding of short term and long term geomorphic processes in project reach; 3) conduct channel stability assessment to support optimal placement for proposed outfall and diffuser;

and 4) inform outfall diffuser design to maintain functionality through foreseeable variability in sediment bedload transport and bedform conditions. Work activities will include:

- Review and compile relevant data from reports and data provided by City and from publicly available sources, including ESA/PWA reports and Lower Feather River Corridor Management Plan documents.
- Review results of field data collection campaign, process data as needed to support sediment transport modeling analysis, including Feather River channel bathymetry and bed sediment grain size analysis.
- Conduct channel stability assessment and geomorphic process characterization; identify potential ranges of channel geometry and hydraulic conditions in project reach (RM 24 to RM 23).
- Estimate sediment transport modes (bedload vs suspended load), processes (scour and fill) and potential bedform(s) (e.g. sand waves, etc.).
- Evaluate existing and potential future sediment supply scenarios for upstream boundary conditions including Feather and Yuba Rivers.
  - Two model simulations will be conducted with estimates of future flow and associated sediment supply, bracketing a range of reasonable potential future conditions based on project staff's work on similar regional projects.
- Examine potential climate change effects on river flows and sediment transport.
  - Project staff have been conducting climate hazard assessments in the greater San Francisco Bay Area and Sacramento River watershed and will use standard methods to estimate increases in episodic flow events and their impacts on sediment transport. Hydrodynamic and sediment transport models will be run with scaled river inflows to represent the effects of increased precipitation scenarios under future climate. Two additional sensitivity simulations will be conducted with the SRH-2D sediment model to quality impacts for reasonable estimates of climate uncertainty.
- Extend existing SRH-2D hydraulic and sediment transport model to allow simulation of larger flows up to 100-year event (280,000 cfs) and associated sediment transport.
- Conduct sediment bedform analysis to determine potential sand dune height during high flow periods to inform diffuser riser design. The bedform analysis will be conducted using results of the hydraulic model and standard methodologies developed by van Rijn (1982) to estimate the potential bedform heights in the project reach under a full range of expected flows. These dune heights will be used in the design of vertical risers to elevate the diffuser ports above the active river bed to maintain design performance without impedance from the mobile bed.
- Prepare Technical Memorandum documenting review of existing references, field data collection efforts, channel stability analysis, and sediment transport modeling efforts.

City Involvement:

- Provide reviews and input during project review meetings and to the technical memorandum.

Assumptions:

- The river bedform and sediment transport modeling evaluation tasks will be completed at a preliminary investigation level to support pre-design. Further detailed work will be needed to support detailed design and refinements in later levels of completion.
- SRH-2D hydraulic model (ESA/PWA 2013 and 2017) will be provided by City as basis for hydrodynamic and sediment transport evaluation.

- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies can be provided on request.

Deliverables:

- Draft and final Geomorphology and Sediment Transport Technical Memorandum.

Task 1.4 – Diffuser Design and Modeling TM

Task Objectives:

1. Develop the outfall diffuser design to achieve target design dilutions, address regulatory constraints of the Basin Plan, water quality objectives, Clean Water Act Section 303(d) listings, Endangered Species Act (ESA) and California ESA listed aquatic species, and complies with the State of California *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries (*SIP) for mixing zones, fish passage, and antidegradation rules;
2. Develop diffuser design to provide a reliable and durable discharge structure design for site-specific river bed and flow conditions and with hydraulic requirements; and
3. Develop modeling of diffuser configurations to optimize dilution performance within diffuser site constraints. The activities under this task will include:
    - Develop target design performance dilutions using Yuba City WWTF effluent chemistry data, background Feather River chemistry data, and using reasonable potential analysis spreadsheets.
    - Develop up to five potential outfall diffuser riser and port configuration alternatives and/or sub-alternatives for two river sites that can meet the preliminary civil, structural, and hydraulic performance criteria.
    - Apply pipeline hydraulic model (i.e. WINHYDRO) to outfall diffuser configuration alternatives to evaluate head-loss and port discharge velocities.
    - Apply dilution models to outfall diffuser riser and port configuration alternatives to evaluate dilution performance under dry and wet season discharge conditions. Effluent flows modeled will include three scenarios when a portion of the WWTF flow is split between the river outfall and the ponds. Assume 7Q10 dry season and wet season (Nov.-April) river flow conditions in this screening-level modeling evaluation. Prepare correlation between flow and stage at downstream permanent Feather River gage at Boyd's Landing with river stage measurements recorded by temporary gage near the proposed diffuser site.
    - Models will be tested and compared for design application, including DKHW and UM3. The basis for model selection will be reviewed by our senior modeling expert (Dr. Lorin Davis), and documented in a Diffuser Design and Modeling Report. The diffuser design will compare fixed-orifice ports and elastomeric check valve ports. We would expect to select elastomeric check valve ports to provide the benefits of port velocity equalization and avoidance of sediment intrusion.
    - The diffuser design approach and configuration will include diffuser configuration layouts and modeling iterations that evaluate and incorporate options for future diffuser modifications after installation; and these will include blind flanges on the diffuser to allow addition of ports and port flanges to the diffuser riser pipes that allow for reorientation of diffuser ports.
    - Prepare a Diffuser Design and Modeling TM (to be incorporated into the Predesign Report) for review by internal reviewers and the City. The draft report will be developed based on the sediment bed-form evaluation results using the 2018 bathymetry and data collections, and the dilution modeling described in this task.

- Conduct a Diffuser Design Review Meeting with the City to review alternative concepts for diffusers and to plan the design process and establish design criteria.

City Involvement:

- Provide reviews and input during project review meetings and to the draft deliverables listed under this task.
- Select the safety factor for the diffuser design based on diffuser configuration alternatives and the reasonable potential analyses.
- Select final diffuser location based recommendations in design TM

Assumptions:

- Assume 7Q10 dry season and wet season (Nov.-April) river flow conditions for screening-level modeling evaluation.
- River bed bathymetry and current velocity measurements developed under Task 1.2 will be used in modeling and design inputs. Additional data required for the diffuser design will include: (1) site-specific background river chemistry data for reasonable potential and antidegradation analyses (from the City and other existing upstream sampling sources); (2) results from the river bedform and sediment transport modeling evaluation task, (3) river bedform material composition data; and (4) biological information of the proposed diffuser site in the Feather River.
- The dilution performance of diffuser configurations in the Feather River will be constrained by the low river flow volume, water depths, and river channel geometry. It is assumed the CVRWQCB will not allow the City to utilize complete mix (100%) of the river flow with the City effluent discharge to the river, and some lesser mix will limit the discharge dilutions under low river flow conditions. The City and JACOBS will need to reach agreement with the CVRWQCB on the portion of the river flow (and cross-sectional area) that may be used for dilution mixing prior to the initiation of 30% design (Task 1.10).
- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies can be provided on request.

Deliverables:

- Draft and final Diffuser Design and Modeling TM.

Task 1.5 – Outfall Pipeline and Pumping Predesign and Evaluation

The purpose of this task is to develop the predesign for the outfall pipeline and to evaluate the pumping requirements for the preferred pipeline routes and new river diffuser.

1.5.a Outfall Pipeline Predesign

- Develop pipeline design criteria to provide a consistent approach for pipeline alternatives and alignment evaluations through the final outfall pipeline design. Design criteria elements will include:
  - Effluent Flows
  - Design Vertical and Horizontal Datum
  - Horizontal and Vertical Alignment
  - System hydraulics criteria and Pump Station considerations
  - Pipeline diameter, material options, linings, and coatings
  - Appurtenances
  - Easements
  - Existing Subsurface Utilities and utility relocations
  - Bifurcation Valve Vault

    - Civil
    - Structural
    - Mechanical
    - Electrical
    - Instrumentation and Control and Telemetry
    - Corrosion
  - Cathodic protection requirements
  - Safety Factors
  - Earthwork and Trench
  - Temporary and permanent easement requirements: location and widths for construction, staging and access
  - Surface and Feather River bankside restoration
  - Navigation aids
  - Traffic Control
  - Safety and Security
  - Biological and cultural resources
  - Construction sequencing and constraints
  - Preliminary operations considerations
- Conduct Pipeline Alignment Alternatives Evaluation for two alignments previously identified by MHM. An analysis matrix will be prepared to evaluate and compare the alignments based on:
  - Pipeline Hydraulics
  - Environmental Compliance and Permitting
  - Stakeholder requirements and Public Impacts
  - Constructability
  - Cost
  - Pipeline Operations and Maintenance
- Prepare Pipeline Alignment Alternatives Evaluation TM that presents the information prepared and evaluated for the pipeline alignments for review and identification of preferred alignment by the City.

1.5.b Pumping Predesign

1. Vacuum Assist Feasibility Evaluation
   - Evaluate feasibility and benefit of incorporating a vacuum-assisted siphon system for the outfall pipeline at the selected levee crossing. Evaluation will include estimated reduction in TDH if vacuum system is used, estimated reduction in annual power consumption, construction cost estimate, and cost-benefit analysis for the vacuum-assisted siphon system.
2. Effluent Pump Station Evaluation
   - Develop hydraulic model of existing effluent pumps, existing outfall pipeline, new outfall pipeline, and new river diffuser to estimate the required TDH at the pump station for the selected pipeline alignment alternative and the design flow projections.
   - Conduct life cycle cost analysis of three different pipe diameters and associated pumping costs for selection of optimum pipeline diameter.

- Evaluate existing effluent pump station wet well geometry and dimensions for compliance with Hydraulic Institute pump station guidelines at ultimate buildout peak hour flow to determine whether wet well modifications are required.
- Evaluate existing effluent flow metering configuration and provide recommended metering approach. If a new flow meter vault is required, predesign and design can be scoped and funded by project amendment.
- Evaluate phased pump improvements based on flow projections and anticipated plant expansions. Evaluation will consider results of hydraulic model and future plant expansions, and will outline an approach for phasing pump replacement to match pump capacity with flow by optimizing existing pump capacity and remaining life to reduce premature replacement of existing and future pumps.
- Evaluate conditions where effluent is pumped to existing disposal ponds. Estimate power consumption for flow splits of average annual flow pumped to existing ponds and new river diffuser. Evaluation will consider flow splits of 0%, 20%, 40%, 60%, 80% and 100% of flow to existing disposal ponds with remaining flow to the new river diffuser.

City Involvement:

- Select preferred pipeline alignment.
- Select preferred pipe material.
- Select preferred pipe diameter.
- Provide direction regarding inclusion of chlorine residual de-chlorination point into pipeline design.
- Provide design flow projections and planned plant expansion information.
- Provide pump curves for existing effluent pumps 1-6.
- Provide effluent pump station wet well and plant site/structural CAD drawings.
- Provide existing outfall pipeline and diffuser drawings.
- Provide electricity rates.
- Provide direction regarding inclusion of vacuum assisted siphon system into pipeline design.

Assumptions:

- Two alignments will be evaluated, each will consider two different outfall locations if necessary.
- 3 pipe materials will be considered for outfall pipeline: Cement Mortar Lined and Coated Welded Steel, Ductile Iron, and HDPE.
- City will select preferred pipe material during review of Draft Design Criteria TM for inclusion in Final Design Criteria TM and overall pipeline design.
- 3 pipe diameters will be evaluated in the life cycle cost analysis, each will use the same Hazen-Williams C-factor for calculation of dynamic head loss.
- City will select preferred pipe diameter during review of Draft Design Criteria TM for inclusion in Final Design Criteria TM and overall pipeline design.
- Vacuum assisted siphon design is included as Task 12.3 to be authorized by City upon review of this Design Criteria TM.
- Alignment evaluation pipeline hydraulics will be estimated using a static MS Excel model.
- Cost estimates will be Class 4 based on preliminary engineering that is 1 to 15 percent complete.
- Hydraulic model will be prepared in AFT Fathom pipe flow software. JACOBS will prepare 1 scenario for the two preferred alternatives and up to 2 model iterations.

- All electrical and control panels are assumed to be contained within the bifurcation valve vault. Design of an above-ground electrical or control building is not included.

Deliverables:

- Draft and Final Design Criteria TM in PDF form will be provided by email.
- Draft and Final Alignment Alternatives Evaluation TM in PDF form will be provided by email.

Task 1.6 – Levee Crossing Predesign

Levee crossing predesign activities will include:

- Prepare predesign criteria for the levee penetration and floodway encroachment work. The predesign will be coordinated with Sutter Butte Flood Control Agency (SBFCA) such that the criteria meets or exceeds the criteria being used in the West Feather River Levee Rehabilitation Project. For instance, one of the key items will be the pipeline will be located outside of the theoretical levee prism and above the 1957 water surface profile or the 200-year water surface whichever is greater.
- Consult with SBFCA regarding the new encroachment. SBFCA does not have any approval requirements but is in the process of making DWR Urban Level of Protection (ULOP) findings for 200-year level of flood protection and FEMA 44 CFR 65.10 certification for 100-year flood protections. These are both critical to the City of Yuba City and Sutter County so all work will need to meet or exceed the criteria for flood protection.
- Prepare certifications for levee penetrations and encroachments on behalf of SBFCA. The predesign will outline the design parameters to ensure that there are no issues with the certification process. All work will meet or exceed CVFPB Title 23, DWR ULOP, and USACE regulations.

Task 1.7 – Geotechnical Exploration

Geotechnical explorations will include field explorations and laboratory testing to evaluated conditions along the proposed pipeline and at the river diffuser.

1.7.a Field Explorations

Soil borings are anticipated at 5 locations along potential pipeline routes (on land) and 2 locations at the outfall/diffuser location. The field exploration will include the following soil borings:

- Four (4) soil borings to maximum depths of 15 ft each, along the preferred pipeline alignment between the beginning of project, and the Feather River Levee crossing
- One (1) soil borings to a maximum depth of 75 ft is anticipated between the Feather River Levee and the Feather River
- Two (2) soil borings to maximum depths of 75 feet below the bottom of river channel within the Feather River.

JACOBS will obtain necessary drilling permits from Sutter County Environmental Health Department, Central Valley Flood Protection Board, and encroachment permits from the City and Sutter County.

Jacobs will coordinate and obtain any necessary right of entry agreements

The borings will be field marked using GPS Methods and taping from landmarks or other features visible from mapping or aerial photographs. A utility locating subcontractor will be used to scan the locations for existing utilities. Jacobs and the drilling subcontractor will use the Underground Services Alert 811 one-call service prior to drilling. Soil boring locations and utility markings will be photographed prior to drilling.

Mobilize truck mounted drill for soil borings along pipeline route adjacent to existing improved roads or streets. Mobilize track-vehicle-mounted drill for soil borings between toe of levee and river.

Mobilize and load a barge drill for Soil boring, from the Boyd's Pump Boat Ramp.

Soil borings will be drilled using hollow-stem auger or mud rotary drilling methods, under observation by a qualified representative of the project geotechnical engineering task lead. Continuous samples will be collected in the upper 10 ft of hollow-stem auger borings along the pipeline alignment. At greater depths, and in mud-rotary drill locations, samples will be collected at maximum depth intervals of 5 ft. Sample collection will be performed in accordance with the procedures of ASTM D1586 or D1587, to be determined in the field based on the interpreted conditions. The field representative will visually examine samples at the time of drilling, and classify the soil material in accordance with the procedures of ASTM D2488. Jacobs will also maintain a written log of the drilling activities, sample depths, observations, sample descriptions, groundwater observations, and other pertinent information.

All soil boring locations will be filled and grouted in accordance with local, state, and permit requirements.

1.7.b Laboratory Testing and Reports

A laboratory testing program will be performed to confirm and provide further detail for soil classifications, determine index properties, and estimate engineering properties for representative samples. Based on observations from the field explorations, and review of recovered samples, Jacobs will select representative samples for the testing. The scope of anticipated testing is summarized in the table below.

Test Description	Anticipated Quantity
Mechanical Sieve Analysis (ASTM 422)	10
Sieve analysis, mechanical and hydrometer (ASTM D422)	20[a]
Amount Finer than U.S. No. 200 Sieve (ASTM D1140)	10
Atterberg Limits (ASTM D4318)	10
Moisture Content (ASTM D2216)	25
Corrosion Series (pH, Sulfates, Chlorides, Resistivity)	3

[a] Performed on sediment samples recovered from Task 1.1.b

City Involvement:

- Review proposed exploration locations.

Assumptions:

- Soils encountered during the field exploration will be free of environmental contamination requiring special monitoring, handling, testing, or disposal

Deliverables:

- Draft and Final Geotechnical Data Report, including an exploration location plan, laboratory test results, typed exploration logs, and a description of the general site geology, and narrative description of findings.

Task 1.8 – Geotechnical Evaluation and Reports

JACOBS will use the findings from the Geotechnical exploration to evaluate pipeline design/pipe support conditions, and prepare a detailed report for use by the design team in preparing plans and specifications for the pipeline, diffuser, and valve vault.

The Geotechnical Report will include the following;

- Geotechnical parameters for pipeline, diffuser, and valve vault design
- Evaluation of pile behavior for support of the outfall/diffuser
- Construction considerations for pipelines and outfall/diffuser

Assumptions:

- The Geotechnical Report will provide design documentation of the recommendations for the project, and will not be a contractor furnished item for bidding purposes.

Deliverables:

- Draft and Final Geotechnical Report.

Task 1.9 – DO Sag Analysis, Anti-Degradation Analysis, and & ROWD

- Develop a Test Plan - as outlined in the current NPDES permit - to determine existing conditions, including determination of all tributaries and flow contributions in the potential DO sag areas (assuming that the City either collects samples or operates four (4) instream monitoring instruments over at least a 2-year period prior to construction and startup of the new diffuser to establish base conditions). JACOBS will assist the City in the selection of suitable water quality instruments and the City will purchase or rent these selected instruments for the monitoring program.
- During the initial field installation of instream DO monitoring instruments, JACOBS will provide an experienced field scientist to assist the City with instrument setup and installations during a three-day period.
- Review water quality data records as they are collected by the City (assume monthly), and make recommendations, if necessary, for Test Plan modifications.
- Develop and perform modeling of the DO impacts created by the City's wastewater ammonia and biological oxygen demand (BOD) discharges via the new outfall diffuser, with calibrations and comparisons using the field measured DO, temperature, and pH data.
- Prepare a report of the Feather River DO Sag Analysis that includes summaries of the field water quality measurements and modeling results of the DO impacts created by the City's wastewater ammonia and biological oxygen demand (BOD) discharges via the new outfall diffuser to fulfill the requirements of Section VI.C.2.b in the City's Order R5-2013-0094.
- As part of the Predesign Report for the new outfall diffuser, a Tier 2 antidegradation analysis will be prepared in accordance with the State of California *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries (*SIP), to document water quality standards compliance for the City's new discharge (as required in the current permit).
- Prepare a new Report of Waste Discharge (ROWD) after the new outfall and diffuser design is completed and it is constructed. This report will be prepared based on the detailed design information applied in the Predesign Report, and updated with effluent chemistry and river water quality data sources collected through the completion of outfall construction and will include dynamic (Monte Carlo) modeling for copper and ammonia.
- Provide recommendations to the City for data collections prior to preparation of the ROWD. Perform quarterly reviews of available effluent sampling data to provide recommendations to the City.

- JACOBS representative will attend two meetings with the City at the CVRWQCB Sacramento office to discuss the DO Sag Analysis Test Plan and results, and two meetings with the City during the development of the ROWD for the new outfall discharge.
- Task lead for JACOBS will attend up to twelve teleconference meetings (1-hour meetings) to review the development of the Test Plan with the City, quarterly data reviews, DO modeling approach, DO modeling results, review Draft DO Sag Analysis Report, review draft antidegradation analysis, plan for new ROWD, and discuss the Draft ROWD review by City and CVRWQCB.

City Involvement:

- Provide test data gathered during sampling and testing
- Provide reviews and input during project review meetings and to the draft deliverables listed under this task.
- Attend teleconference meetings (1-hour meetings) to review the development of the Test Plan with the City, quarterly data reviews, DO modeling approach, DO modeling results, review Draft DO Sag Analysis Report, review draft antidegradation analysis, plan for new ROWD, and review the Draft ROWD. Skype connections will be used to facilitate information sharing during teleconference meetings.
- Attend meetings with JACOBS and CVRWQCB at Sacramento office to discuss the DO Sag Analysis Test Plan and results (two meetings) and the development of the ROWD for the new outfall discharge (two meetings).

Assumptions:

- DO impact modeling will include Streeter-Phelps model and Monte Carlo model.
- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies can be provided on request.

Deliverables:

- Draft and final Test Plan for the Feather River DO Sag Analysis
- Draft and final Feather River DO Sag Analysis Report
- Draft and final ROWD

Task 1.10 – 30% Design Development, Predesign Report, Schedule, and Cost Estimate

The activities under this task will include:

- Develop a 30% Design Submittal including: plan and profile drawings, drawings index, and table of contents for technical specifications.
- Prepare a Class 3 construction cost estimate (-20% to +30%)
- Prepare a Draft Predesign Report for City review (and eventual submittal to CVRWQCB once finalized in 60% design phase). The report will include: project background, objectives and benefits; existing outfall conditions; river site physical characteristics and a summary of the sediment bed-form analyses; outfall design inputs and considerations (effluent flow and hydraulics, discharge dilutions, water quality standards compliance, structural requirements) and review of improvement options; and details of the selected outfall pipe and diffuser alternative (construction methods and materials, 30% design drawings, schedule, permitting, and construction cost estimate).
- Prepare updated project schedule.

City Involvement:

- Provide reviews and input during project review meetings and to the draft deliverables listed under this task.
- Attend teleconference meetings (1-hour meetings) to review the development of the outfall pipeline alternatives, hydraulics results, review of the 30% Design Submittal, and review of the Draft Predesign Report. Skype connections will be used to facilitate information sharing during teleconference meetings.

Assumptions:

- Development of civil, structural, and hydraulic design for the new outfall pipeline and diffuser will be limited by the available information on the existing outfall pipeline condition and information developed on the Feather River outfall route and diffuser site.
- 30% Design development of civil, structural, and hydraulic design of the outfall pipeline and diffuser will focus on the one alternative selected by the City.
- The Draft Predesign Report will incorporate the River Bed-form and Sediment Transport Evaluation TM and the Diffuser Design and Modeling Report, and other TMs associated with design development as described in Task 1. If the City elects to not have JACOBS perform the River Bedform and Sediment Transport Evaluation that includes hydrodynamic and sediment transport evaluations for a range of river flows and stages, then the City will be accepting added risk and uncertainty in the diffuser design life because the design will not have input on potential changes and trends in river bedform elevations at the diffuser site.
- This task does not include development of WWTF effluent pump station, flow metering or yard piping modifications. Modifications for these facilities are described in optional Task 12.
- All deliverables will be provided to the City in an electronic file format and limited hard copies can be provided to the City on request.

Deliverables:

- Draft Predesign Report with Class 3 Construction cost estimate
- 30% Design Submittal

Task 1.11 – Predesign Meetings and Workshop

- Conduct three (3) Predesign teleconference meetings (3-hour meetings) with the City to review predesign inputs and development, and to establish design criteria.
- Conduct an Outfall and Diffuser Project Predesign Workshop with the City to review alternative concepts for outfall pipeline designs, pumping scenarios and approaches, diffuser design configurations, constructability, and permitting considerations.

City Involvement:

- Attend three (3) teleconference meetings (3-hour meetings) to review the development of the outfall and diffuser design development. Skype connections will be used to facilitate information sharing during teleconference meetings.
- Attend Outfall and Diffuser Project Predesign Workshop at the WWTF.
- Provide reviews and input during project review meetings and to meeting notes.

Assumptions:

- All deliverables will be provided to the City in an electronic file format and limited hard copies can be provided on request.

Deliverables:

- Agendas and meeting minutes from project meetings and the Predesign Workshop.

Task 1.12 – Surveying and Mapping

- Field survey operations will commence by locating the centerline of the proposed design alignment on the ground to establish stationing and extend primary and secondary survey control monuments along the alignment. All control surveys will be conducted utilizing a combination of Global Positioning System (GPS) technology and conventional survey methods. The method used to capture the point data will be controlled by the accuracy specifications required by the project specifications. Permanent control monuments will be established outside the project limits for later use with supplemental topographic and construction surveys.
- Conduct the topographic survey at 100-foot intervals over a 100- foot width along the alignment from the northerly project limit extending south and crossing the west levee of the Feather River to the west bank.
- Captured point data from initial control surveys will be immediately evaluated and post processed to conform to the project accuracy standards. The processed control data shall be adjusted and calibrated to the most current documentation of NAD83 and NAVD88 by the National Geodetic Survey. All point data captured for the topographic mapping will be post processed and exported in an ASCII format and imported into an electronic drawing file to initiate the development of the final base mapping.
- The topographic survey for the project shall capture all surface data within the 100-foot strip along the alignment and/ or outside the project area as directed. The survey work will identify all information requested by the engineering design team including but not limited to surface features, existing utilities, geotechnical borings, potholes, trees larger than 6 inches in diameter and tree species, ground profile, critical points of connection and features creating design constraints. The base mapping will include the line work of existing surface improvements, property lines where practical, underground utilities of record or from "as built" documents and the preparation of a digital terrain model (DTM) using the post processed point data from the topographic surveys. Break lines of the DTM will be determined based on the collected survey data and field notes identifying accurate physical conditions in the field. Surface modeling is proposed to develop minor contours at one foot (1') and major contours at five feet (5') utilizing the triangular irregular network (TIN) lines developed through the software Autodesk Civil 3D with AutoCAD 2017. The base mapping shall be refined as necessary to conform to the requirements of the engineering design team.

Assumptions:

- All survey work is proposed to be based upon the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD88) calibrated to local control monuments established and documented by the National Geodetic Survey.
- Length of alignment to mapped is assumed to be not more than 10,000 feet.

Deliverables:

- Topographic Survey
- Digital Terrain Model (DTM)

Task 1.13 – Utility Investigations

1.13.a – Utility Investigation

- Conduct an existing utility investigation by contacting utility owners in the project area and prepare a list of providers. The list will include names of providers, responsible contacts, addresses, phone numbers, and email addresses for each.
- Prepare and send letter and exhibit showing project area to utility owners requesting utility record drawings for existing and proposed future utilities. Letter will request any procedures or design requirements for relocating or crossing utilities.
- Collect and organize record drawing maps provided by utility owners and maintain a list of information obtained by the providers.
- Perform field reconnaissance and verification of received utility information and to identify utilities that information was not received for or privately-owned utilities.

1.13.b – Potholing

- After selection of a preferred pipeline alignment, prepare a list of recommended potholing locations. List of potholing locations will be accompanied with an aerial map that defines visually the location of the desired potholing.
- Contract with a competent subcontractor to pothole utilities. Field generated pothole site maps will be developed as part of the field work which will document depth and dimensions to the potholed utility.

City Involvement:

- Provide record drawings for all City utilities in the project location.

Assumptions:

- Up to 8 potholes will be required through final design.
- Surveying for the exposed utilities is provided in Task 1.13.
- All necessary permits will be acquired by potholing subcontractor.

Deliverables:

- Utility provider contact list (agency, name, phone number, etc.)

Task 2. Right of Way Acquisition

Task 2.1 – Survey Support for Right of Way Acquisition

Survey Support for Right of Way Acquisition will be provided by MHM. The following subtasks are included:

2.1.a Boundary Surveys (includes research and boundary resolution)

1. Research:
    - Once the design alignment has been selected and the required construction easements and permanent right of way limits are defined the initial survey work for this task shall commence with examination of written evidence through records research necessary to identify the described location of the properties underlying the selected alignment. The research will include public record of subdivision maps, parcel maps, records of survey, corner records, right of way documents, miscellaneous maps as well as all available private records sufficient to identify the affected boundaries with reasonable certainty.

2. Reconnaissance and Field Surveys:
    - Coordinate surveying services with the project right of way agent to prepare the initial documents for property appraisal and acquisition negotiation.
    - Search and recover survey monuments identified through the project research to locate the proposed easement and right of way positions on the ground during the negotiation process.
3. Survey Documents
    - Prepare survey documents in coordination with the project right of way agent and include a legal description and exhibit plat identifying the right of way and easements required for each affected property. Modifications to the easement and right of way documents will be provided throughout the right of way acquisition process.

File a Record of Survey to document the right of way acquisition to conform to Section 8762 of the California Professional Land Surveyors Act.

- Provide ROW support during acquisition of easement or right-of-entry required for this project. An APN list of the 6 parcels needed for the project are included below. It is anticipated that the project will require right-of-way in form of easements from the following parcels:
    - Netherby REV 04 Trust ETAL (23-110-007)
    - Surjeet Takhar (23-040-014)
    - Surjeet Takhar (23-040-018)
    - Red Hawk Farms LLC (23-110-003)
    - George R McFeely ETAL (23-040-019)
    - Levee District No. 1 of Sutter County (23-040-020)

Assumptions:

- Initial right of way and easement locations will be revised once during the acquisition process due to potential property negotiation, design changes, or the eminent domain process.

Deliverables:

- Field data Boundary Survey and Resolution
- Record of Survey

2.1.b Right-of-Entry Agreement from Existing Landowners

- Obtain right-of-entries from six (6) landowners to perform design, environmental, and right-of-way surveys. Initial contact the landowners will be made with the use of standard forms followed by a site visit with the landowners to explain the project and the purpose of the survey.
- Communicate and coordinate all contact with the Right-of-Way Agent to meet the spirit of Section 846.5 (a) of the Civil Code of California which grants licensed land surveyors the right of trespass.

2.1.c Preparation of Plats and Descriptions

- Prepare survey documents in coordination with the project right-of-way agent and include a legal description and exhibit plat identifying the right-of-way and easements required for each affected property.
- Include the recently acquired SBFCA easements and Fee Title on the exhibits. Some of these transactions are still pending so will work with SBFCA to acknowledge the future transactions. It has been our experience that initial right of way and easement locations are revised at least once during the acquisition process due to property negotiation, design issues or the eminent domain process.

MHM is prepared to accommodate the modifications to the easement and right of way documents throughout the right of way acquisition process.

2.1.d Field Location of Proposed Easement Areas

- Work with the Right-of-Way Agent to perform "show me" staking along the proposed right-way limits. The "show me" stakes will be placed every 100 to 200 feet so the property owner can visually see the impact of the proposed easement.

2.2.e Preliminary Title Reports

- Obtain Preliminary Title Reports from Old Republic Title Company or First American Title Company. The Preliminary Title Reports will be used to perform the research on existing easements, boundary, ownership, and other potential restrictions. It is anticipated that the project will require Preliminary Title Reports on the following parcels:
  - Netherby REV 04 Trust ETAL (23-110-007)
  - Surjeet Takhar (23-040-014)
  - Surjeet Takhar (23-040-018)
  - Red Hawk Farms LLC (23-110-003)
  - George R McFeely ETAL (23-040-019)
  - Levee District No. 1 of Sutter County (23-040-020)

Deliverables:

- Survey Right of Entry
- Plats and Descriptions for six (6) parcels
- Preparation of Easement Acquisition Figures for six (6) parcels
- One set of "show me" staking for up to six (6) parcels
- Preliminary Title Reports

Task 2.2 – Appraisal and Acquisition Services

Appraisal and Acquisition Services will be provided by Bender Rosenthal and are described as follows.

2.2.a Valuation Services

- Develop complete appraisals for the City that state the estimated fair market value of the interests to be acquired from each referenced property.
- Prepare summary appraisal reports in conformance with and subject to the requirements of the Code of Professional Ethics and the Standards of Professional Practice of the Appraisal Institute, which fully incorporate the Uniform Standards of Professional Appraisal Practice (USPAP) of the Appraisal Foundation. Jurisdictional exceptions may apply in some cases.

Assumptions:

- The Code of Federal Regulations [49 CFRs 24.102 (c) 2] provides that an appraisal is not required for parcels estimated at $10,000 or less. Use of this method assumes the valuation problem is uncomplicated and the fair market value is estimated at $10,000 or less based on a review of available data. The $10,000 amount includes severance damages but excludes any insignificant construction contract work. The "Waiver Valuation" is not an appraisal and is to be used merely for documentation in support of the estimated compensation to be paid to the property owner. Criteria considered in making the determination as to "uncomplicated" valuations included:
  - There is no serious question as to the highest and best use;
  - There is adequate market data available;
  - There are no substantial damages and benefits involved;

  - All interests in parcels are estimated to be valued at less than $10,000; and
  - There is no substantial decrease in market value due to the presence of hazardous material/ waste.
- Waiver Valuations cannot be used to condemn. Should court action be determined necessary, an Appraisal Report will be required, resulting in the additional work not included in this SOW.
- For the purposed of this SOW, it is assumed that 6 appraisals will be completed.
- In the event the major improvements are located on the remainder and not subject to potential severance damages, the appraiser may elect not to value these improvements. This is assumed to be the case for most of the properties affected by this project. If it is later determined that the improvements are affected, additional SOW and budget will be required.
- Ultimately, the fair market value opinions and conclusions within the appraisal report will be used as the basis for the City to establish the offer of just compensation as required by law.
- This scope specifically excludes any goodwill appraisals, dual appraisals, furniture/fixture/equipment appraisals, and detailed construction cost estimates for site reconfiguration or building reconstruction.
- Plats and legal descriptions for each of the properties to be appraised will be provided to BRI by the Client. Preliminary Title reports are not included in this SOW.
- Some of the items that may affect the appraisal process include:
  - Complexity of the valuation;
  - Impact of the interests to be acquired (e.g. Temporary Construction Easements, Public Utility easements, or Fee Acquisitions).
  - Damage Analysis (Severance Damage, Cost to Cure, etc.)
- No residential or business relocation is involved.
- Full documentation to Federal and State standards for all tasks.
- No expert witness testimony is anticipated.
- No Coordination with State or Federal RW departments, other than listed in scope.
- Notice of Decision to Appraise letters will be sent within 5 days of task authorization.
- No significant severance damages are anticipated.

Deliverables:

- One electronic copy of each Appraisal Report; hard copy to be provided if requested – up to 6

2.2.b Appraisal Review

Per Federal and State regulations, (Uniform Act) a qualified reviewing appraiser shall examine all appraisals to assure that they meet applicable appraisal requirements and shall, prior to acceptance, seek necessary correction or revisions. In addition, the review appraiser shall certify that the opinion of fair market value is reasonably supported by an acceptable appraisal.

Deliverables:

- Review certification appraisal reports – up to 6.

2.2.c Acquisition Services

- Develop all contracts, conveyance documents and escrow instructions necessary to make offers in accordance with state and federal laws and following our client's processes.
- Prepare the offer letter based on the "Just Compensation" value determined by the County staff.
- Meet with the owners and convey documents until acceptance or impasse is reached regarding necessary acquisitions and easements.
- Contact each property owner at least six (6) times within the first 60 days of approval to proceed.
- Meet with each owner at least one time in person and may make additional contacts by phone, e-mail or through the postal service.
- Steps within the acquisition process are outlined below and will be tailored to the client's need for services:

  1. Review the project concept and design with staff and other consultants.
  2. Review appraisals, title reports, maps and descriptions of the required parcels.
  3. Conduct field review of the project area.
  4. Prepare purchase agreements contracts and other acquisition documents.
  5. Meet with the property owners to discuss the project in general; review of maps and legal descriptions; confirm information about occupants/owners and make the official First Written Offer to owner.
  6. The acquisition task assumes a settlement by the sixth contact either in person, telephone, or e-mail. A recommendation to client will be made after impasse has been reached. To reach impasse:

     A. Go through the *acquisition steps* outlined; plus

     B. Make up to six attempts to contact the owner (personal call, letter or phone call) in any combination. Contact attempts will be made at least once each week; plus

     C. Respond to property owner inquiries verbally and in writing within two business days.

  7. Deliver signed purchase agreement and signed and acknowledged documents for a closed transaction or deliver a memorandum explaining impasse.
  8. If the property owner provides a counter-offer, BRI staff will prepare a recommendation to the client to accept, reject, or modify the counter-offer.
  9. If the client accepts the counter-offer, BRI will prepare up to one (1) Administrative Settlement that complies with State and Federal guidelines.
  10. BRI will work with all parties to encourage acquisition within 60 days of the approval of the appraisal.
  11. BRI's acquisition agents will maintain a parcel diary to document all interactions with property owners and their tenants.
  12. BRI will prepare escrow instructions for Title to clear exceptions as needed

- The following items are excluded from this SOW but can be added using Contingency upon the City's authorization:
  - Obtaining tenant consent/releases or quit claim deeds
  - Providing support for Resolutions of Necessity and/or condemnation activities

- Continued negotiations with property owners after the RON is obtained

Deliverables:

- Signed Purchase Agreements and Permanent Easement or Temporary Construction Easement Deeds from up to 6 parcels

2.2.d Escrow Services

- To facilitate the closing of the various property acquisition transactions, the project will need escrow and title support. The exact scope for this task cannot be exactly estimated, therefore an allowance of $3,900 is included.
- Activities which may be necessary as part of this task include:
  - Review existing easements and permits. Prepare escrow instructions to clear title exceptions as necessary.
  - Review legal descriptions and plats for the project.
  - Title Company to draft consent to easement, and/or subordination agreement. Title Company to follow through with appropriate lenders, beneficiaries and trustees.
- Prepare and send Request for Invoice and Demand to the Title Company.
- Copy and forward fully executed easement deed and purchase agreement to City for acceptance.
- Receive approved fully executed purchase agreement from the City. Forward approved executed copy to property owner.
- Review the Final Policy of Title to assure that all Title has cleared all exceptions indicated in the escrow instructions. Coordinate escrow closings.
- Send all executed acquisition documents through escrow and transmit to the appropriate parties, (property owner and City)
- Prepare transmittal and forward closed files to the City's Project Manager.
- Does <u>not</u> include research and securing owner's Trust Certificates and Statement of Identities.

Deliverables:

- Facilitate Title and Escrow support as outlined above for up to 6 parcels.

Task 3. Design

Task 3.1 – Prepare 60% Design Documents

The purpose of this task is to develop draft contract drawings, specifications, and cost estimate for City review. Key activities during this phase are described below.

3.1a 60% Design Plans and Specifications

- Develop a 60% Design of the selected alternative during the 30% design development phase. The 60% submittal will include plan and profile drawings, details drawings, updated drawings index, and table of content with first draft of technical specifications.
- 60% Design Submittal will consist of 64 sheets that will include the following sheets as described in the Preliminary Drawing List included in **Appendix A**:
  - 12 General Sheets (cover sheet, lists of drawings, general notes, abbreviations, 5 legend sheets, a key plan and Survey control, hydraulic profile, and construction access).

- 8 Plan and Profile sheets
- 12 Civil Sheets (8 Levee crossing design sheets, 2 pipeline cross section sheets, 1 river restoration plan, 1 bifurcation vault detail)
- 5 Structural/Mechanical Sheets
- 2 Electrical sheets
- 3 I&C Sheets
- 8 Traffic Control Plans
- 6 Standard Details sheets
- 8 Contingency sheets

- Control Narrative for the new bifurcation valve vault

City Involvement:

- Review draft documents and comment.
- Attend three 1.5-hour teleconference meetings to review and discuss 60% design development, construction approaches.

Assumptions:

- This task does not include development of WWTF effluent pump station, flow metering or yard piping modifications. Modifications for these facilities are described in optional Task 12.
- All deliverables will be provided to the City in PDF file format and 5 hard copies will be provided.

Deliverables:

- 60% Design Submittal with 11 x 17 Drawings and Specifications
- Updated Design TMs

3.1b Technical Workshops – 60% Design

- Following completion of the Predesign Report and 30% Design Drawing deliverables, conduct a Value Engineering workshop. JACOBS will contract with one construction consultant with marine construction experience to perform a value engineering review on the completed 30 percent design drawings. The workshop will solicit input on project design concepts, materials of construction, general construction methods available to construct the project, as well as potential cost or schedule considerations. JACOBS will review the value engineering comments with the City and determine which comments, if any, should be incorporated into the 60% design.
- During this phase, one Technical Workshop will be facilitated with City staff to review the development of the design and work products. Workshop materials will be developed based on the technical work being conducted, and presented to the City in a workshop.

City Involvement:

- Attend 60% Design Workshops.

Assumptions

- For the 60% design phase, assume one 4-hour workshop with design leads at WWTF to review the progress of the work, make decisions, and provide direction.
- Travel time and expenses for staff from other offices in included.

Deliverables

- Draft and Final Agendas for Value Engineering workshops
- Meeting notes from Value Engineering workshops
- Agenda and meeting materials in advance of the workshops.
- Draft and final minutes from the 60% workshop, distributed to attendees for comment.

3.1c Quality Management – 60% Design

- As part of each design phase, Jacobs will implement the Quality Management Plan developed in Task 10 Project Management. Quality Assurance (QA) activities will be managed for all discipline Quality Control (QC) review activities with the senior reviewers. Formal QC review will be performed before the City's review of the deliverables.
- JACOBS will perform a constructability review on the completed 60% design package. The constructability review will focus on project element sequencing, schedule considerations, construction document coordination, and general construction methods available to construct the project; and will suggest potential changes or improvements to the project design. The constructability review will also review the 60% design for items identified during the Value Engineering workshops.

Assumptions

- Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.
- The City will consolidate the City staff review comments into one comprehensive package before submitting review comments. Comments will be sent within 2 to 3 weeks of receiving the deliverable.
- This task does not include development of WWTF effluent pump station, flow metering or yard piping modifications. Modifications for these facilities are described in optional Task 12.
- Consultant's responses to the City's consolidated review comments will be returned to the City for their records.

Deliverables

- Responses to City comments to document quality review comments.
- Review-related correspondence with City staff and other external agencies or entities.

3.1d 60% Class 2 Cost Estimate

- Provide construction cost estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 2 cost estimate: -15% to +20%.

Deliverables

- Class 2 cost estimate

City Involvement:

- Review Cost Estimate and provide comments

Task 3.2 – Prepare 90% Design Documents

The purpose of this task is to develop updated draft contract drawings, specifications, and cost estimate for City review based on the 60% draft documents and City review comments. Key activities during this phase are described below.

3.2a 90% Design Plans and Specifications

- Develop a 90% Design Submittal including: plan and profile drawings, details drawings, updated drawings index, and technical specifications.
- The 90% Design will include incorporating 60% design review comments while updating and further developing the 60% design drawings:
  - General Sheets including general notes, legend sheets, key plan and survey control, hydraulic profile, and overall site plan with final location of structures, staging, storage, and construction access.
  - Revised Plan and Profile sheets
  - Updated Civil Sheets with levee crossing design, pipeline cross sections as well as river restoration, bifurcation vault details, and vandalism mitigation measures.
  - Structural and Mechanical plans, sections, and details coordinated with other design disciplines with final location of major equipment, piping, and appurtenances.
  - Revised Electrical and I&C sheets
  - Updated Traffic Control Plans
  - 90% Details including trench sections, outfall and diffuser design and other civil details.
- Updated specifications incorporating comments from the 60% submittal review and reflecting full coordination with drawings. Include final construction sequence, milestones and constraints, measurement and payment, and proposed bid form.
- Loop specifications for the valve vault will be included in the technical specifications based on the Control Narrative prepared during the 60% design.
- Responses to 60% City design review comments will be prepared and transmitted to the City prior to significant work on 90% submittal.

City Involvement:

- Review 90% drawings and specifications and provide comments. Division 0 and 1 specifications will be provided by the City and included in the 90% submittal.
- Attend two 1.5-hour teleconference meetings to review and discuss 90% design development. Skype connections between JACOBS and THE CITY will be used to facilitate information sharing during teleconference meetings.

Assumptions

- PLC programming and modification of the City's SCADA to include effluent pump modifications, new bifurcation valve vault, and vacuum-assisted siphon system (if feasible) will be completed by the City's integrator.
- 90% Design submittal assumes preparation of 64 sheets in the drawing package
- Clarifications and changes to the design submittal documents will be provided as required to address plan review comments from the City.
- Design submittal documents will incorporate and consolidate all changes made during the permit review.
- This task does not include development of WWTF effluent pump station, flow metering or yard piping modifications. Modifications for these facilities are described in optional Task 12.

- All deliverables will be provided in PDF file format and 5 hard copies will be provided to the City

Deliverables

- 90% Design Submittal with 11 x 17 Drawings and Specifications.
- Draft PG&E power service application

3.2b Technical Workshops – 90% Design

- During this phase, one Technical Workshop will be facilitated with City staff to review the development of the design and work products. Workshop materials will be developed based on the technical work being conducted, and presented to the City in a workshop.
- In addition to the workshop with the City described above, the design team will conduct one full-day workshops at the end of design development to review work products associated with that phase of the work.

City Involvement:

- Attend 90% Design Workshops

Assumptions:

- For the 90% design phase, assume two 4-hour workshops with design leads at WWTP location to review the progress of the work, make decisions, and provide direction.
- Travel time and expenses for staff from other offices in included.

Deliverables

- Agenda and meeting materials in advance of the workshops.
- Draft meeting minutes from the workshops, distributed to attendees for comment.

3.2c Quality Management – 90% Design

- QA activities will continue to be conducted during the 90% design phase and will be managed for all discipline QC review activities with the senior reviewers. Formal QC review will be performed before the City's review of the deliverables.

Assumptions

- Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.
- The City will consolidate the City staff review comments into one comprehensive package before submitting review comments. Comments will be sent within 2 to 3 weeks of receiving the deliverable.
- Consultant's responses to the City's consolidated review comments will be returned to the City for their records.

Deliverables

- Responses to City comments to document quality review comments.
- Review-related correspondence with City staff and other external agencies or entities.

3.2d 90% Class 1 Cost Estimate

- Provide construction cost estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 1 cost estimate: -10% to +15%.

Deliverables

- Class 1 cost estimate.

City Involvement:

- Review Cost Estimate and provide comments

Task 3.3 – Prepare 100% Design Documents

The purpose of this task is to develop updated draft contract drawings, specifications, and cost estimate for City review based on the 90% draft documents and City review comments. After the 100% deliverable has been reviewed, final Bid Documents will be prepared as part of Task 5. Key activities during this phase are described below.

3.3a Final Contract Document Completion

- Prepare 100% construction drawings.
- Prepare 100% technical specifications.
- Prepare 100% design documentation.
- Complete 100% checking and coordination review.

City Involvement:

- Review 100% drawings and specifications and provide comments
- Attend two 1.5-hour teleconference meetings to review and discuss 90% design development. Skype connections between JACOBS and THE CITY will be used to facilitate information sharing during teleconference meetings.

Assumptions:

- 100% Design submittal assumes preparation of 64 sheets in the drawing package
- Clarifications and changes to the design submittal documents will be provided as required to address plan review comments from the City.
- Design submittal documents will incorporate and consolidate all changes made during the permit review.
- All deliverables will be provided in PDF file format and 5 hard copies will be provided to the City

Deliverables:

- 100% Design Submittal with 11 x 17 Drawings and Specifications

3.3b Quality Management – 100% Design

- As part of each the Final design phase, QA activities will be conducted for all disciplines activities with the senior reviewers. Formal final QC reviews by the Consulting team will be performed before the preparation of the final drawings and specifications.

Assumptions

- Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.
- The City will consolidate the City staff review comments into one comprehensive package before submitting review comments. Comments will be sent within 2 weeks of receiving the deliverable.
- Consultant's responses to the City's consolidated review comments will be returned to the City for their records.

Deliverables

- Responses to City comments to document quality review comments.
- Review-related correspondence with City staff and other external agencies or entities.

3.3c Final (100%) Cost Estimate

- Provide final revised construction cost estimate to reflect Engineer's Estimate of final drawings and to include final modifications to design and City's 100% comments on previous cost estimate.

Deliverables

- Final revised Class 1 cost estimate.

Task 4. Environmental Services and Permitting

Task 4.1 – California Environmental Quality Act

4.1.a Data Collection and Outreach

- Compile project description information sufficient for a CEQA Initial Study, including project features (including GIS-based exhibits), likely construction methods, and construction schedule.
- Conduct the following database searches:
  - California Historical Resources Information System (Northeast Information Center).
  - Native American Heritage Commission Sacred Lands Database and Native American Tribes list
  - Special-Status Species databases maintained by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Native Plant Society
  - California Natural Diversity Database
  - Known hazardous materials sites recorded on Geotracker and Envirostor
- Conduct the following field data collection tasks:
  - Pedestrian archaeological survey (requires coordination on access to private properties)
  - Test pit excavations along pipeline alignment for potential Native American archaeological sites can be authorized as part of Task 12 Supplemental Services.
  - Reconnaissance-level biological surveys to review potential for special status species (e.g., nesting raptors or yellow-billed cuckoos) and record species observed
  - Stem counts of affected elderberry shrubs within 200 feet of pipeline alignment
- Conduct the following outreach activities:
  - Write information letters to and telephone representatives of potentially affected Native American tribes
  - Coordinate preliminary meeting with City representatives, design team, and the United Auburn Indian Community
  - Coordinate one follow-up meeting with the United Auburn Indian Community (if needed)
  - Prepare draft letters documenting consultation with Native American Tribes consistent with AB 52 requirements
- Coordinate with geotechnical and bathymetric survey teams to ensure data collection on Feather River conditions as potential fish habitat

4.1.b Initial Study and Mitigated Negative Declaration

1. Contents of Initial Study and Mitigated Negative Declaration
   - Compile the information collected in Task 4.1.a into the CEQA Appendix G Initial Study template
   - Prepare remainder of Initial Study analysis information – i.e., minor resources not discussed in Section 4.1.a
   - Editing, QA/QC, and other polishing of the Initial Study including preparation of reference library and administrative record
   - Prepare one Administrative Draft for review by Public Works staff and other City departments following normal City review procedures
   - Prepare on Screencheck Draft for review by Public Works
   - Prepare Mitigated Negative Declaration following preferred City template
   - Prepare public review Initial Study and (Draft) Negative Declaration for a 30-day public and agency review period, including up to 40 hard copies (including 15 hard copies to be filed with the State Clearinghouse)
   - Prepare Mitigation Monitoring and Reporting Plan following preferred City template
2. Processes for IS/MND Adoption
   - Prepare Notice of Availability, and lead the effort to advertise using the following methods:
     - Mailing to property owners and residents with APNs along the project footprint, using information compiled in Task 2 by Bender Rosenthal
     - Mailing to a small stakeholder list (e.g., United Auburn Indian Community, Levee District 1)
   - Respond to comments on the Initial Study, prepare addenda material (if needed), and support City processes to prepare a Staff Report for City Council adoption
   - Attend up to one City Council meeting to help support adoption process
   - File a Notice of Determination with the County Clerk and State Clearinghouse, including payment of "Fish and Game" fees (check for fees to be provided by the City)

Task 4.2 – In Water Permits

1. Corps of Engineers Permit Stack
   - Prepare Pre-Construction Notification for Nationwide Permit 7 (encompassing Section 10 of the Rivers and Harbors Act) of 1899, using standard Sacramento District format
     - Prepare a biological resources information packet to support USACE Section 7 Consultation with NMFS
     - Prepare a biological resources information packet to support USACE Section 7 Consultation with USFWS
     - Prepare a cultural resources information packet to support USACE Section 106 Consultation with SHPO
   - Prepare Section 401 Water Quality Certification application, using standard Central Valley RWQCB format [Fee payment required]
2. California Department of Fish and Wildlife Streambed Alteration Agreement

- Prepare application for Streambed Alteration Agreement (encompassing Section 2081 of the California Endangered Species Act), using standard CDFW application forms. Permit Fee payment will be required, and will be paid separately by the City.

3. State Lands Commission Land Use Lease
    - Prepare application for Land Use Lease, using standard SLC application forms. Permit fee payment will be required, and will be paid separately by the City.

Task 4.3 – Levee Permit

The Levee permit application will be prepared and coordinated by MHM. The following activities will be performed for this task.

- Apply for a CVFPB Encroachment Permit from Central Valley Flood Protection Board.
- Work with Levee District No. 1 of Sutter County and Reclamation District No. 784 to obtain endorsements.
- Prepare the application in accordance with the procedure developed for the West Feather River Project. The application will include the standard application, Environmental Questionnaire, LMA endorsements, APN Map, Surrounding Parcels, USACE Transmittal, Drawing Sheet (will need at least 60% design), and vicinity map, location map, and footprint map.
- Coordinate with design team to get information required for the application.
- Attend and coordinate meetings with CVFPB, USACE, and DWR to facilitate the encroachment process. A complete certified environmental document and at least 60% plans are critical to the process.

Task 4.4 Other Permits

1. Geotechnical Borings
    - Jacobs will prepare a CEQA Notice of Exemption for in-water exploratory borings (CEQA Class 6 Categorical Exemption), and will file the NOE with the Sutter County Clerk and State Clearinghouse.
    - Permits will be required for geotechnical investigations that include in-water borings.
        - USACE Nationwide Permit 6. Prepare technical information supporting use of NWP 6, Survey Activities. A pre-construction notification is not required, but potential impacts (e.g., to adult steelhead migration) must be avoided.
        - RWQCB Water Quality Certification has been issued for NWP 6 – no further action is required.
        - CDFW Streambed Alteration Agreement. Prepare application for Streambed Alteration Agreement (encompassing Section 2081 of the California Endangered Species Act), using standard CDFW application forms. Permit Fee payment will be required, and will be paid separately by the City.
        - SLC Geological/Geophysical Survey Permit. Prepare application for Geological/Geophysical Survey Permit, using standard SLC application forms. Permit Fee payment will be required, and will be paid separately by the City.
2. Other Permits
    - No other discretionary, environmental permits have been identified. However, an allowance for construction permit support is provided for the following permits:

- US Coast Guard
- Sutter County Encroachment Permit (for the portion of Garden Highway in the County)
- Yuba City Encroachment Permit (for the portion of Garden Highway in the City limits)
- Sutter County and Yuba City Tree Permits

Task 4 City Involvement:

- City will prepare a Notice of Exemption for in-water exploratory borings (CEQA Class 6 Categorical Exemption)
- Public Works will coordinate internal review of the Administrative Draft documents, including review by Planning and (if necessary) City Attorney's Office
- Public Works will complete internal check request process for required "Fish and Game" fees, due at Notice of Determination filing
- Completion of CEQA process is at filing of the Notice of Determination, indicating official approval of the project. The City will determine the appropriate City Council action that indicates project "approval" (e.g., Resolution).

Task 4 Assumptions:

- The permitting and design team will provide QA/QC review of levee permitting documents and processes described in this task.
- Project description will be limited to one pipeline alignment for detailed consideration
- Project description assumes that the existing outfall/diffuser would be abandoned in place (no separate in-water construction project)
- Construction vehicle emissions will be less than the CEQA significance thresholds adopted by the Feather River Air Quality Management District. Exceeding the thresholds would require an EIR, which is not included as part of this Task. If an IS/MND is not sufficient, additional SOW is described in Supplemental Services Task 12.
- Meeting participation will be limited to three meetings at 4 hours each with USACE/DWR/CVFPB
- No Phase 1 Environmental Site Assessment (ESA) will be required.
- It is assumed that a Low Threat Discharge Permit will not be required from the RWQCB for outfall pipeline construction or diffuser construction

Task 4 Deliverables:

- Administrative Draft Initial Study
- Screencheck Draft Initial Study
- Mitigated Negative Declaration
- Mitigation Monitoring and Reporting Plan
- Public Review Draft Initial Study and Mitigated Negative Declaration
- Notice of Availability
- Responses to Comments and (if needed) addenda material to update Initial Study
- USACE, RWQCB, CDFW, SLC, and CVFPB draft and final (for submittal) applications

Task 5. Bid Services

Task 5.1 – Contractor Prequalification

Prepare prequalifying criteria and identify prequalified construction contractors for work within the existing levee and river channel. JACOBS will work with the City to identify potential contractors and will request a list of three to five recent projects with similar levee and in-river work that the contractors completed and a list of proposed equipment that will be used for this work from the identified contractors. The contractor pre-qualification process will include the following activities:

- Develop a list of contractors to be invited to complete a pre-qualification process
- Develop criteria for pre-qualification (in conjunction with City staff) and produce a draft and final Request for Qualifications (RFQs)
- Distribute the RFQ to previously identified contractors
- Review contractor Statements of Qualifications (SOQs), and provide a TM evaluating the contractor SOQs and recommending a list of pre-qualified contractors
- Conduct interviews with short-listed contractors if necessary

City Involvement:

- Review and approve JACOBS recommended contractor prequalification criteria
- Approve recommended list of prequalified contractors

Assumptions:

- Request for Qualifications will be a written description of the proposed work and experience requirements, and will not include any drawings.
- Interviews with up to five contractors (if necessary) at the City's WWTF, including two JACOBS staff and one MHM staff for up to three hours

Deliverables:

- Draft and Final Request for Qualifications
- Contractor SOQ evaluation technical memorandum

Task 5.2 – Prepare Bid Documents

- Prepare Bid Documents including final design drawings and specifications and provide to private bidding services company for project advertisement and distribution of Bid Documents.

Assumptions:

- No full-size drawings (bond or mylars) are included. City will contract with reproduction company for production of full-size drawings.

Deliverables:

- Final 11 x 17 drawings: 5 printed copies and electronic copy in PDF format.
- Final specifications and design details (8 1/2 x 11 format): 5 printed copies and electronic copy in PDF format.
- Sealed project plans, specifications, calculations, and other reports.
- AutoCAD files of design drawings and survey data.

Task 5.3 – Contract Advertise and Award

- Attend and facilitate one pre-bid conference.
- Prepare addenda as required by bidder questions.
- Attend bid opening, compile contractor bid results into a matrix for review and evaluation of contractor bids. Verify status of apparent low bidder's contractor license and check performance on several recent projects. Prepare a recommendation of award and transmit to the City.

Task 5.4 – Prepare Conformed Documents

- Prepare Conformed for Construction Documents that incorporate clarifications and changes made by addenda.

City Involvement:

- Identify preferred bidding services company.
- Pay all bid advertising costs directly to the bidding services company.
- Provide location for pre-bid conference.
- Attendance of pre-bid conference by City PM.

Assumptions:

- No hard copies of project documents are required, all documents will be transmitted in electronic format.
- City will receive questions from contractors and forward to JACOBS as needed.
- Up to 2 addenda with up to 3 updated drawings each will be required.
- Addenda will be transmitted to bidding services company for distribution to plan holders.
- Final addenda will be issued a minimum of 5 working days before bid opening.
- Conformed for Construction Documents will include fully executed bid forms, insurance certificates, bid and performance bonds, addenda, and contract for the low bidder.
- Construction contract will be successfully awarded with one advertisement and bid opening.

Deliverables:

- Final Bid Documents drawings (half- and full-size) and Specifications in PDF form will be provided by email or file sharing service.
- Pre-Bid agenda and meeting minutes.
- Addenda as required.
- Letter recommendation of award.
- Conformed for Construction Documents drawings (half- and full-size) and Specifications in PDF form will be provided by email or file sharing service.
- Native files for conformed drawings will be provided in AutoCAD format on DVD. City to indicate what version of AutoCAD is desired at time of delivery.

Task 6. Services During Construction

Task 6.1 – Office Services During Construction

6.1.a Meetings and Site Visits

- Attend and facilitate preconstruction meeting with Project Manager and discipline leads with City Project Manager; including preparation of agenda and meeting minutes.
- Attend regular construction progress meetings.
- Provide periodic environmental monitoring by biologist.

City Involvement:

- Attendance at preconstruction and construction progress meetings.

Assumptions:

- OSDCs are based on the construction period of 9 months.
- One preconstruction meeting and bi-weekly construction coordination meetings for duration of assumed construction period.
- Up to 80 hours will be required for environmental monitoring site visits (could include both periodic biological and periodic archeological monitoring)

Deliverables:

- Preconstruction meeting agenda and minutes.

6.1.b Submittals

- Review all shop drawings, testing plans, samples and submittals for general conformance with the design concept and general compliance with the requirements of the contract for construction.

Assumptions:

- Maximum of two submissions (original and one re-submittal) by Contractor for each shop drawing, sample, or submittal.
- Construction Manager will log and track submittals.
- Up to 85 submittals will be reviewed (total includes re-submittals), each requiring an average of about 5 hours of review and processing time.

6.1.c RFIs

- Review and respond to the Contractor's requests for information (RFI) or clarification of the contract documents. Response will be coordinated with the design team, City and Construction Manager as appropriate.

RFI responses will identify whether response will have a low, medium, high, or no cost impact, and whether there will be a schedule impact. **Assumptions:**

- Up to 70 RFI will be reviewed, each requiring an average of about 3 hours of review and processing time.

6.1.d Product Substitution Requests

- Review technical aspects of the Contractor's requests for substitution (RFSs) of materials, equipment, and specified procedures as well as proposed deviation from the contract requirements.
- Advise the City and Construction Manager as to the acceptability of proposed substitutions.

- Coordinate with City and Construction Manager and provide technical written responses to the Contractor's RFSs.

City Involvement:

- Review RFSs with JACOBS and Construction Manager.

Assumptions:

- Up to 10 RFSs will be reviewed, each requiring an average of about 5 hours of review and processing time.

6.1.e Record Drawings and Specifications

- Record drawings will be prepared based on contractor's field as-built drawings.
- Record drawings will not include revision numbers, clouds, or bold highlights.
- Record specifications will be prepared based on changes from RFI responses, design clarifications, or change orders.

City Involvement:

- Review and comment on draft record drawing and specification deliverable.

Assumptions:

- A single marked up set of drawings and specifications will be provided and prepared using the color code outlined in the contract documents.
- Draft Record Drawings and specifications will be submitted to City for review within 90 days after project final acceptance.
- Final Record Drawings and specifications will be submitted to City within 30 days of receipt of City's Draft Record Drawing review comments.

Deliverables:

- Draft Record Drawings (half-size) and Specifications in PDF form will be provided by email or file sharing service.
- Final Record Drawings (half- and full-size) in PDF and AutoCAD form and Specifications in PDF and MS Word form will be provided by email or file sharing service.

Task 7. Testing & Startup

Task 7.1 – Diffuser Performance Testing

Following the installation of the new outfall diffuser in the Feather River, an outfall dilution performance study will be planned and performed to measure the diffuser dilution performance, calibrate and validate dilution modeling, and document these field and modeling results in a report to the City and for submittal to the Central Valley RWQCB.

The specific objectives of the Outfall Dilution Performance Study will include:

1. Take site-specific field measurements of the outfall diffuser site under low river flow, and develop river flow and stage statistics for critical discharge conditions (seasonal low-flow conditions),
2. Field-measured dilutions and ambient currents to apply in dilution modeling for accurate modeling results for critical river flow conditions and effluent flows,

3. Define dilution credits for the new outfall diffuser under critical river and effluent flow conditions, as defined in the State Implementation Plan (SIP),
4. Determine mixing zone boundary distances based on field and modeling results, and
5. Develop summaries of study findings in a detailed study report

To meet these project objectives, the outfall mixing zone and dilution study will be performed to provide accurate and defensible field measurements of the outfall dilution performance and ambient river conditions in the mixing zone region, to provide reliable dilution modeling, to document the biological and human uses near the outfalls, and to document the selection of dilution ratios and mixing zone dimensions for the outfall.

A Study Plan will be developed to define the field measurements, quality assurance (QA) and quality control (QC) measures and requirements for the field studies and dilution modeling, and to align the study activities with the SIP requirements. This field and modeling study will be implemented by experienced personnel. This study will be conducted in accordance with the State of California SIP, and the specific requirements in the *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins*. It is assumed that the dilution credits and mixing zones developed through this performance study will be applied by the RWQCB in developing effluent limitations for pollutants regulated through water quality criteria and the California Toxics Rule (CTR) criteria. The study plan will be prepared to allow submittal to the RWQCB following completion of the outfall construction, so that approval is secured and the field tracer study can be conducted in September or October under low river flow conditions. Jacobs will conduct a field performance test of the new Yuba City WWTF outfall diffuser during low river flow conditions in either September or October following construction completion. The field study will be conducted during a five-day period using a team experienced with tracer studies, and following the Study Plan. The field study will include simultaneous measurements of ambient current velocities, water depth, and tracer dye during a period that corresponds with low river stage. Dye will be injected into the WWTF effluent and measured in the river during an 8-10-hour period. The focal points for in-stream dye measurements will be distances of 30, 50, 100, 200, 300, and 500 feet downstream from the diffuser.

Jacobs will provide all instruments for the study including current meters, SeaBird SBE-19 water quality instruments, fluorometers, dye injection and sample pumps, and Rhodamine WT tracer. A survey vessel with DGPS will be contracted to provide the work vessel for instrument installations, tracer sampling, and site-specific field measurements. The field study will include: setup and calibrate the tracer injection, fluorometer calibration and testing, installation and retrieval of instruments in the river, water column measurements of tracer, temperature, and conductivity during daylight hours, data download from instruments, and post-study instrument calibrations. The tracer study field data will be analyzed and summarized, and these data will be used for the dilution modeling and in the study report development.

Modeling will be used to predict wastewater dilutions and temperatures for the field-measured conditions (river flow during tracer study) and for the seasonal critical river flow conditions defined in the SIP. Dilutions and plume behavior will be predicted using the selected model (Visual Plumes or CORMIX2). Dilution modeling will be developed to represent the same conditions as the tracer study and seasonal critical river flow conditions defined in the SIP. The comparison of model-predicted versus field-measured dilutions will also be summarized in the report.

A draft and final diffuser performance study report will be prepared based on the results of the field tracer study, dilution modeling, and effluent and receiving water data. The report will summarize the results of the field data collections, diffuser dilution performance measurements, dilution modeling, and an assessment of the attainment of water quality standards. Water column measurements of tracer concentrations, temperatures, and current speeds will be summarized in graphical and tabular formats.

The dilution modeling will be summarized in the report and model input and output will be in report appendices. The existing effluent chemical concentration data and available background data will be used to calculate chemical concentrations in the receiving water at the edge of the defined mixing zone boundaries (reasonable potential analyses). The City will provide the effluent chemistry data to Jacobs.

The draft and final report will be prepared for review by the City. A meeting will be held with the City to review the results presented in the draft report and discuss comments. Jacobs will incorporate client comments and a final report will be provided for submittal to the RWQCB.

- In the event that the field-measured dilutions are greater than 10 percent below the minimum design model-predicted dilutions for 2025 under 7Q10 low river flow conditions that were developed through dilution modeling and presented in the predesign report and approved by the Regional Board, or more than 10 percent below model-predicted dilutions for the CVRWQCB-approved river flow dilution test conditions (in the event 7Q10 flows are not achieved during testing period), then JACOBS will provide modification recommendations such as installation of spare risers with ports onto blind flanges on the outfall diffuser or alternative measures/recommendations to achieve the expected dilution. This response will be included as a Technical Memorandum and design documents to bid the project (if needed), professional engineering services/support during recommended modifications and re-testing at no additional cost to the City. The City will pay for all construction management, construction, and City costs to implement the recommended modifications in the Technical Memorandum/Design Documents for such modifications.
- Task lead for JACOBS will attend up to six teleconference meetings (1-hour meetings) to review the development of the Study Plan with the City, field study preparations, preliminary results of the field study, modeling results, and to review City comments on the Draft Diffuser Performance Study Report.

City Involvement:

- Provide WWTF support during the field study, including time for study logistics planning, safety review meetings, on-site access to dye injection into effluent discharge, space in the WWTF laboratory for field instrument testing and calibrations, space in the WWTF for equipment storage and working space for field team during the field study week.
- Provide reviews and input during project review meetings and to the draft deliverables listed under this task.
- Attend teleconference meetings (1-hour meetings) to review the development of the Study Plan, pre-study logistics planning, and review the draft performance study report. Skype connections will be used to facilitate information sharing during teleconference meetings.
- Attend two meetings with JACOBS at the CVRWQCB Sacramento office, one to discuss the Draft Study Plan and one to Review the Final Diffuser Performance Study Report.

Assumptions:

- The City's WWTF staff will provide support during the field study including time for logistics planning, safety review meetings, on-site access to dye injection into effluent discharge, space in the WWTF laboratory for field instrument testing and calibrations, space in the WWTF for equipment storage and working space for field team during the field study week.
- Prior to mobilizing personnel and equipment for the field study week, river flow and stage forecasts will be evaluated to decide if adequate and safe river conditions are forecast for the work period. Seasonal river flows will not restrict boat access and data acquisition to the point of damage or imminent danger to personnel and equipment.

- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies will be provided.

Deliverables:

- Draft and final Study Plan for the Outfall Diffuser Performance Study
- Draft and final Outfall Diffuser Performance Study Report

Task 7.2 – O & M Staff Training

- Prepare syllabus outline and complete training syllabus for review and comment by City. Prepare aids as needed for training.
- Provide in person training for City O&M staff. Training will be provided on overall project description, operation and maintenance of project components and new equipment and appurtenances. Training will include description of system operation and operational considerations.

City Involvement:

- Review and comment/approve training syllabus outline and complete training syllabus.
- Attendance at a minimum of one training session by key City staff/Plant Operators (staff and operators to be identified by City).
- Provide access to new facilities and any required ancillary systems required for operation of the project.

Assumptions:

- Up to 3 trainings for eight hours each will be required to accommodate City staff schedules.
- JACOBS will provide one trainer for each training session.
- Except for effluent pump station pumps, training will not be provided for any existing treatment plant process.
- Training will not include actual operation of project facilities (unless in use as part of normal Plant operations), rather it will focus on how to operate the system and operational considerations based on Plant effluent flow, river conditions, and blending requirements.

Deliverables:

- Syllabus outline, complete training syllabus and training aids.

Task 8. Construction Management

Task 8.1 – Document Management

8.1.a Construction Progress Meetings

- Conduct regular construction progress meetings with the Contractor, City, and others (as necessary) to review safety, RFI status, submittal status, changes, completed and ongoing activities, planned work schedules, and to discuss key issues.
- Conduct other job meetings as required to coordinate construction activities with other agencies.
- Record and prepare minutes of all project meetings, and distribute the minutes to all parties within two business days following meeting.

8.1.b Submittals

- Develop list of required and anticipated Submittals.
- Receive, process, track, and review Contractor's submittals on materials, equipment, and methods. Review of submittals shall be limited to completeness review – technical review will be done by the design engineer.
- Develop and maintain an electronic control system for processing all submittals to indicate the date received, review status, and date returned to the Contractor.

8.1.c Substitution Requests

- Receive, process, track, and review Contractor's substitution requests. Review of substitution requests shall be limited to completeness review – technical review of substitution requests will be done by the design engineer.

8.1.d Requests for Information (RFI's)

- Review and respond to RFI's from the Contractor within the time frame allowed by the Contract Documents. Review of RFI's shall be limited to completeness review – technical review of RFI's will be done by the design engineer.
- Develop and maintain an electronic log to track all RFI's, indicating subject of request, date of request, originator of request, person responsible for response, and date of response.
- Facilitate and expedite responses to requests for clarification to the maximum extent possible, confirming that the appropriate party is resolving outstanding issues.

8.1.e Project Files

- Maintain at the project site a current set of project correspondence, job files, change order documentation, approved shop drawings, contract documents, erosion control inspection reports, meeting minutes, and other records required by the specifications.
- Files and records may be hard copy or electronic.
- Develop and maintain an excel-based document-tracking/filing system to facilitate retrieval and archival needs. A web-based software system may be considered by the City prior to construction. Consultant will estimate cost of web-based software system and City may funded by contract amendment.
- Transmit all files to the City upon completion of the project.

8.1.f Monthly Reports

- Issue monthly reports to keep the City apprised of the project status and focus attention on critical issues requiring action.
- Monthly reports will include the following information:
  - Executive summary
  - Description of major work performed
  - Summary of outstanding issues
  - Selected project photographs
  - Schedule status, including potential time extensions
  - Construction cost status, including original contract amount, current contract amount, and forecast at completion

- Pending and executed change order summary
- Quality issues, including list of deficiencies
- Pending or potential claims report
- Summary of Engineer's budget status.

8.1.g Project Closeout

- Transmit all files to the City upon completion of the project.
- Provide copies of warranties to the City.
- Establish warranty tracking procedures.
- Provide copy of final payment with supporting documentation.

City Involvement:

- Review and comment on select submittals
- Review and comment on select RFI's
- Review and comment on substitution requests

Assumptions:

- The cost proposal is based on processing 85 submittals at an average of 2.5 hours per submittal, and 70 RFIs at an average of 2.5 hours per RFI.
- Submittals will be submitted electronically, in PDF format.

Deliverables:

- Construction progress meeting minutes
- Submittal log
- Submittal responses
- RFI log
- Substitution log
- RFI responses
- Project files
- Monthly reports
- Final site inspection report
- Final punch list
- One set of contractor as-built drawings

Task 8.2 – Construction Contract Administration

8.2.a Project Schedule

- Review the Contractor's baseline computer-based, cost-loaded, critical path method (CPM) construction schedule to ensure that the activities are comprehensive, that workflow is logical, that the schedule is not front-end loaded, and that the costs for activities are reasonably distributed.
- Monitor the Contractor's actual work progress as compared to schedule activities by reviewing contractor monthly schedule submittals and providing comments. Require contractor to submit monthly project as-built schedule.
- Conduct monthly schedule update meetings with the Contractor to review progress.
- The cost-loaded schedule will be the basis of progress payments to the Contractor.

8.2.b Progress Payments

- Review monthly applications for payment with the Contractor, noting particularly the relationship of the payment requested to the schedule of values based on the cost loaded CPM schedule.
- Confirm that the Contractor submits required certified payroll information.
- Forward reviewed payment application to the City with recommendation for payment.
- Maintain accurate project cost records, including, monthly payments, change orders, etc. and the effect on the established project budget.

8.2.c Construction Change Orders

- Review all proposed changes to the work requested by the Contractor to ascertain the need and to check for cost-effectiveness.
- Prepare Requests for Proposal (RFP's) for Owner or Engineer-generated requests for changes.
- Lead change order negotiations with the Contractor to evaluate the requested cost and/or time extensions.
- Make recommendations to the Owner regarding acceptance of change orders.
- Maintain a computerized monitoring log to track the status of proposed changes, review status and evaluate for schedule impact or potential claim.

City Involvement:

- Process contractor progress payments
- Review and approve contract change orders

Assumptions:

- Construction Contract Administration assumes a 9-month construction period with on-site construction contract administration for 4 months (16 weeks) full-time and 4.5 months (18 weeks) half-time, 8 hour days, with no overtime.

Deliverables:

- Contractor progress payment recommendation
- Contract change orders

Task 8.3 – Construction Field Inspections

8.3.a Quality Assurance

- Provide qualified inspection staff to observe materials, equipment, work in progress, and completed work to ascertain compliance with the plans and specifications, subsequent contract modifications, and approved submittals.
- Notify the Contractor in writing of any observed noncompliance or variances from the contract requirements.
- Prepare daily field reports of the status of the work, daily activities, manpower, equipment (including idle equipment), weather, and other pertinent observations.
- Make daily reports available to the City for review/reference at all times and submit all reports with other project records at the completion of the project.
- Maintain a continuous log of deviations throughout the project to reflect Contract change orders and field changes.

- Maintain a record of construction progress through photographic documentation. Digital Photos will be organized to allow ease of future search for photos of interest.
- Accompany visitors representing public or other agencies and record the visits in the daily log.
- Observe the Contractor's documentation of erosion control efforts and perform and document inspections of erosion control devices on a weekly basis, or as needed following rainfall events.
- Perform periodic quality assurance surveys

8.3.b Material Testing

- Provide quality assurance field sampling and testing of soils, aggregate, and concrete, along with associated laboratory work. Anticipated testing includes:
  - Soils compaction tests
  - Moisture density curves (10 total)
  - Concrete strength (6 sets of test cylinders for the bifurcation valve vault)
  - CLSM testing (1 set of test cylinders)
- Coordinate with the contractor to schedule inspectors to be onsite when testing is required.
- This activity includes an allowance of $26,000 for owner-provided weld inspection testing in case the outfall pipeline is decided to be constructed of welded steel. This allowance covers a pipeline length up to 2.5 miles in length.
- This activity also includes an allowance of $10,000 for specialty inspections as required by the California Building Code, actual pipe material selected for construction, and as requested by the City.

8.3.c Dive Inspection

- Perform New Construction Inspection(s) in accordance with the American Society of Civil Engineer's Waterfront Facilities Inspection and Assessment Guidelines to document that the underwater pipeline and diffusers meet the requirements of the construction contract documents as well as:
  - Verify quantities installed for Contractor payment
  - Respond to field questions and resolve field problems
  - Develop a list of deficiencies for Contractor to correct
- Jacobs Engineer Dive Team will be led by Professional Engineer and certified diver.
- Prepare a diving inspection plan based on discussions with the City and with the marine construction subcontractor.
- As needed and based on the diving inspection plan, perform milestone inspections of underwater trench and bedding, pipe joints, and pipe joint assembly, pipe backfill, and pipe coating and lining systems.
- Provide underwater still photographs of pipe installation details where possible using a clear water box. Much of the diving is anticipated in conditions with near zero visibility. Where of value, provide underwater video of the project.
- Diving operations shall be governed by applicable state, federal, and industry standards, and shall conform to the "Consensus Standards for Commercial Diving Operations" of the Association of Diving Contractors International (ADCI).
- Diving inspections shall be coordinated with the outfall project marine contractor. Diving operations shall be conducted from the outfall project marine subcontractor's vessel or work trestle, unless specifically directed otherwise by the City or unless shore deployment is adequate.

City Involvement:

- City to review inspection reports and provide comments in a timely manner to avoid construction contractor delays.

Assumptions:

- Construction Quality Assurance assumes a 9-month construction period with on-site construction quality assurance for 60 days, 8 hours per day, with no overtime.
- Construction contractor will be responsible for continuous Quality Control inspections and Quality Control materials testing.
- Diving inspectors to work from Construction Contractor's barge. Includes two dive days over a two-week period for a three-person dive team. Standby charges will apply if scheduled dive inspections are delayed or cannot occur.
- The City acknowledges that ultimate responsibility for any deficiencies in materials or completed work, and for compliance with plans and specifications and approved submittals, shall be attributable solely to the Contractor, notwithstanding Construction Manager's observations and inspections hereunder.

Deliverables:

- Daily field reports
- Material test reports
- Construction photographs
- Diving inspection reports including still photography of underwater conditions.

Task 9. Operations and Maintenance Manual

- Develop a facility Operation and Maintenance (O&M) manual describing the operation of the Project facilities and systems and where appropriate, reference will be made to the manufacturer's detailed O&M manual. It is anticipated that the O&M Manual will include the following:
  - Applicable record drawings that illustrate concepts as needed.
  - Photos of equipment and human-machine interface (HMI) screens to illustrate concepts as needed.
  - Operational criteria based on varying plant flows and Feather River conditions (based on diffuser performance testing results).
  - Equipment/Appurtenance preventive maintenance inspection forms and schedule.

City Involvement:

- Review and comment on draft O&M Manual.

Assumptions:

- Outfall Diffuser Performance Testing results will be available for incorporation into the O&M manual.
- O&M staff training is included in Task 7 and is not included in this task.
- The O&M manual will address the outfall pipeline, bifurcation valve vault, and diffuser. O&M elements for modifications to WWTF pumps, flow measurement, or piping are not included in this task.

Deliverables:

- Draft O&M Manual in PDF form will be provided by email, and 3 hard copies.
- Final O&M Manual in PDF form will be provided by email, and 3 hard copies.

Task 10. Project Management

JACOBS and MHM will complete project management tasks as outlined below. The budget assumes that overall project scope is as defined in the preceding Tasks (excluding the Contingency task).

Task 10.1 – External Project Meetings

JACOBS will attend the following project meetings with City staff:

- Project Chartering Meeting at the WWTP including up to six JACOBS team members and MHM. JACOBS will prepare meeting agenda and meeting minutes.
- Biweekly Progress Meetings at the WWTP including two JACOBS team members. JACOBS will prepare meeting agendas and meeting minutes.
- Special Coordination Meetings at the WWTP as required by project needs

City Involvement:

- Review agendas and minutes from project progress meetings and alert project manager of any questions or corrections.

Assumptions:

- Up to 58 biweekly Progress Meetings between August 2018 and December 2020 during Predesign, Design, and Environmental Services and Permitting
- Subconsultants will attend bi-weekly Progress Meetings as necessary
- Up to 11 Special Coordination Meetings including local staff and up to 6 person-trips for remote team members
- No biweekly Progress Meetings during Bid Services or Testing & Startup
- Meetings for Construction are included under Services During Construction and Construction Management

Deliverables:

- Chartering Meeting agenda and meeting minutes
- Progress Meeting agendas and meeting minutes

Task 10.2 – Develop and Maintain Project Management Tools

JACOBS will prepare and maintain the following project management tools:

- Project Execution Plan (PXP)
- Quality Management Plan (QMP)
- Risk Register
- Work Plans
- Decision Log

Task 10.3 – Project Controls and Invoicing

JACOBS project controls staff will prepare regular internal cost reports for review by the JACOBS Project Manager. JACOBS will also prepare monthly invoices (including subconsultant invoices) and a Project Status Report including progress report narrative, scope change summary, and schedule and budget

status. Monthly invoices Project Status Reports will be submitted to the City Project Manager for review and approval.

City Involvement:

- Review and approve monthly invoice

Assumptions:

- Assumes 60 months of project cost reports, monthly invoices, and progress reports
- Budget status burn charts are not included

Deliverables:

- Monthly invoices and Project Status Reports

Task 10.4 – Project Team Coordination

JACOBS will conduct the following internal team coordination activities:

- Project Kickoff Meeting
- Regular project team coordination meetings

Task 10.5 – Health and Safety

JACOBS will conduct internal Health and Safety (H&S) procedures to manage the safety of our staff, and oversee the safety of subconsultants. Our subconsultants will be required to prepare their own H&S Plan for all field activities, and we will work with our subconsultants to monitor compliance with their own H&S Plan. Health and safety activities will include:

- Preparation and management of Field Safety Instructions for design and construction phases
- Quarterly construction phase H&S management audits for 2 years of construction
- Monitor JACOBS staff and subconsultant compliance with the Field Safety Instructions, and subconsultant compliance with their own H&S Plan.

Deliverables:

- Copies of the JACOBS Field Safety Instructions (both design and construction phases) are available for review by the City upon request

Task 10.6 – Subcontract Management

JACOBS will manage the performance of our subconsultants to comply with the scope of work, schedule, and budget. This task includes setting up subconsultant contracts and required pre-procurement reviews, reviewing monthly subconsultant invoices and progress reports, maintaining annual insurance and safety documents, and monitoring and tracking subconsultant payments.

This task also includes project management activities for MHM.

Task 10.7 – Project Management for Supplemental Services

Provide management for scope, schedule, and budget associate with work authorized by the City under the Supplemental Services task, specifically Tasks 12.1 through 12.4. Maintain coordination with City, internal project team, subconsultants, and outside agencies. Maintain Decision Log and prepare meeting agendas and meeting minutes as needed. Prepare schedule update and maintain schedule during work progress.

City Involvement:

- City will authorize funding for this task when funds are authorized from the Contingency task

Task 11. California SRF Loan Application Support

JACOBS will provide engineering services to support the City's application to apply for grant/loan/bond funding for the Outfall and Diffuser Project. This task consists of a $50,000 allowance for general SRF support, not aligned to a particular SRF package. Support activities will be as requested by the City, with no scoped deliverables. The consultant will not be required to spend more than the $50,000 allowance to support the City in this task without an amendment to the contract.

City Involvement:

- Provide direction regarding requested engineering services

Assumptions:

- Schedule is estimated and is controlled by the City. Schedule for activities requested by the City will be agreed upon mutually by the City and JACOBS.

Deliverables:

- No scoped deliverables. The consultant will support the City with SRF application related activities on a time and materials basis up to the contracted allowance.

Task 12. Supplemental Services

12.1 – Bathymetric Surveys in 2019, 2020 and 2021

- Conduct bathymetry survey of the Feather River region below Shanghai Falls (RM 24.5) to Boyd's Landing (RM 22.6) using a sweep-system (multiple single-beam) sonar to record detailed river bed elevation data. JACOBS will engage a specialty hydrographic surveyor to perform this bathymetry survey in the summer or fall of 2019, 2020 and 2021, as requested by the City. The vessel used for this survey will be provided by the hydrographic surveyor and the survey crew will include an ACSM certified hydrographer.
- Horizontal positions for navigation and data collection will be determined by using a Trimble base and rover system, and Hypack navigation software. The horizontal datum used will be NAD83, California State Plane Zone 2 (U.S. Survey Feet). The vertical datum used will be NAVD88 (U.S. Survey Feet).
- MHM will identify and validate benchmarks for locating RTK Base Station for use during bathymetry surveys and other data collections on the river. If alternative survey control sites are required then they will be established by MHM and adjusted and calibrated to the most current documentation of NAD83 and NAVD88 (National Geodetic Survey).

City Involvement:

- Facilitate access to secure survey benchmarks to allow for locating Trimble base RTK station on tripod during bathymetric survey and field data collection days.

Assumptions:

- Field services will be conducted in accordance with JACOBS's Field Safety Instructions (FSI) for this project. Vessel safety and operational safety will be the responsibility of the hydrographic surveyor. For safety reasons, all field activities on the river will be limited to daylight hours. These field measurements are assumed to require four to six consecutive field days on the Feather River.
- Prior to mobilizing personnel and equipment for the week of survey work, river flow and stage forecasts will be evaluated to decide if adequate and safe river conditions are forecast for the work

period. Seasonal river flows will not restrict boat access and data acquisition to the point of damage or imminent danger to personnel and equipment.

- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies can be provided on request.

Deliverables:

- A concise bathymetric survey report will be produced and report charts will be provided. The report charts will include depth contours at 1-foot intervals, color TIN (Triangulated Irregular Networks), and track-lines. Report charts will be produced in the horizontal and vertical datum defined above. This report will describe the control used for the survey, data acquisition methodology, calibrations, and data processing procedures. Report deliverables will include an ASCII file of the XYZ data, AutoCAD and Civil 3D DWG files.

12.2 – Environmental Impact Report

This scope of work is based on CEQA compliance using an Initial Study/Mitigated Negative Declaration. This implies that environmental impacts will be less than significant with the inclusion of mitigation measures, such that a full Environmental Impact Report (EIR) will not be required. This assumption is based on study of the potential impacts of concern and the reasonable (although early) conclusion that no impacts will remain significant and unmitigable. However, there is some possibility that the analysis will reveal impacts that cannot be mitigated to a less than significant level, and thus an EIR will need to be prepared. The following items will be required to "convert" the Initial Study into an EIR, and replace the Mitigated Negative Declaration with the appropriate decision documents for an EIR.

- Prepare a Notice of Preparation and conduct reasonable scoping activities well in advance of releasing the Draft EIR for agency and public review
- Conduct additional analysis and write additional text to reflect topics not considered in an Initial Study, including:
  - Statement of project objectives
  - Environmental and regulatory setting
  - Development and evaluation of a reasonable range of alternatives to the project, and a No Project alternative
  - Cumulative and growth-inducing impacts
- Hold a public meeting on the Draft EIR, including sufficient advertising to solicit appropriate interest
- Formally respond to comments (from agency and public review) and prepare a separate Final EIR
- Prepare Findings of Fact and Statement of Overriding Considerations

City Involvement:

- Assist in coordinating public meetings, which would normally occur during the scoping and Draft EIR stages, by securing meeting rooms
- Provide internal coordination to advance the CEQA process, such as preparing staff reports
- Coordinate with the Planning Division, as needed, to follow normal City processes for CEQA review

Assumptions:

- None

Deliverables:

- Notice of Preparation
- Administrative Draft EIR
- Screencheck Draft EIR
- Public Review Draft EIR
- Mitigation Monitoring and Reporting Plan
- Notice of Availability
- Administrative Final EIR
- Screencheck Final EIR
- Final EIR (for City Council adoption)
- Findings of Fact/Statement of Overriding Considerations
- Notice of Determination

12.3 – Vacuum-Assist Siphon Predesign, Design, and other Services

12.3.a (i) 30% Design Development, Predesign Report, Schedule, and Cost Estimate
The scope of work outlined under Task 1.10 will be supplemented as follows:

- Vacuum assisted siphon system incorporated in applicable plan and profile, electrical, and I&C and remote telemetry drawings and vacuum assist system specific civil site plan, structural, mechanical, electrical plans, sections and details.
- Incorporate vacuum assisted siphon system in Class 3 construction cost estimate (-20% to +30%)
- Incorporation of vacuum assisted siphon into the Draft Predesign Report.

City Involvement:

- As outline under Task 1.10.

Assumptions:

- Development of civil, structural, and mechanical design for vacuum assisted siphon system.
- 30% Design development of civil, structural, electrical, I&C and mechanical design of the vacuum assisted siphon based on City selected outfall location and pipeline alignment alternative.
- The Draft Predesign Report, included under Task 1.10 will incorporate the vacuum assisted siphon design.
- All deliverables will be provided to the City in an electronic file format and limited hard copies can be provided to the City on request.

Deliverables:

- As outlined under Task 1.10

12.3.a (ii) 60% Design Plans and Specifications
The scope of work outlined under Task 3.1 will be supplemented as follows:

- Develop a 60% Design of the vacuum assisted siphon system. The 60% submittal will incorporate the vacuum assisted siphon into the plan and profile, electrical, and I&C and remote telemetry drawings and the addition of vacuum assist system specific civil site plan, structural, mechanical (including condensate drainage disposal), electrical plans, sections and details. The vacuum assisted siphon system will be incorporated into the Specifications
- 60% Vacuum Assisted Siphon Design Submittal will incorporate the revised or additional drawings to the drawings outlined in Task 3.1 and as described in the Preliminary Drawing List included in **Appendix A**:

  - 1 Plan and Profile sheet (updated)
  - 1 Civil Sheet (new Vacuum System Building site plan)
  - 2 Structural/Mechanical Sheets (new building and mechanical plans and sections)
  - 2 Electrical sheets (updated single line and 1 new building electrical plan)
  - 1 I&C Sheets (updated)
  - 1 Standard Details sheet (new details)
  - 1 Contingency sheets
- Control Narrative for vacuum assisted siphon system
- Incorporate vacuum assisted siphon system into technical workshops.
- Incorporate vacuum assisted siphon system into Quality Management QA and QC.
- Incorporate vacuum assisted siphon system into Class 2 Cost Estimate.

City Involvement:

- As outlined in Task 3.1.

Assumptions:

- As outlined in Task 3.1.

Deliverables:

- As outlined in Task 3.1.

12.3.a (iii) 90% Design Plans and Specifications

The scope of work outlined under Task 3.2 will be supplemented as follows:

- Continued development of vacuum assisted siphon system into the 90% Design Submittal including: plan and profile electrical, I&C and remote telemetry, civil site plan, structural, mechanical (including condensate drainage disposal), electrical plans, sections and details, and technical specifications.
- Loop specifications for the vacuum assisted siphon system will be included in the technical specifications based on the Control Narrative prepared during the 60% design.
- Incorporate vacuum assisted siphon system into technical workshops.
- Incorporate vacuum assisted siphon system into Quality Management QA and QC.
- Incorporate vacuum assisted siphon system into Class 1 Cost Estimate.
- Complete PG&E power service request

City Involvement:

- As outlined in Task 3.2.

Assumptions

- 90% Design submittal assumes preparation of 6 additional vacuum assisted siphon sheets in the drawing package.

Deliverables

- As outlined in Task 3.2.

12.3.a (iv) 100% Design Plans and Specifications

The scope of work outlined under Task 3.3 will be supplemented as follows:

- Prepare 100% vacuum assisted siphon system Design Drawings including: plan and profile electrical, I&C and remote telemetry, civil site plan, structural, mechanical (including condensate drainage disposal), electrical plans, sections and details, and technical specifications.
- Incorporate vacuum assisted siphon system into Quality Management QA and QC.
- Incorporate vacuum assisted siphon system into final revised construction cost estimate to reflect Engineer's Estimate of final drawings and to include final modifications to design and City's 100% comments on previous cost estimate.

City Involvement:

- As outlined in Task 3.3.

Assumptions:

- 100% Design submittal assumes preparation of 6 additional vacuum assisted siphon sheets in the drawing package.
- Clarifications and changes to the design submittal documents will be provided as required to address plan review comments from the City.
- Design submittal documents will incorporate and consolidate all changes made during the permit review.
- All deliverables will be provided in PDF file format and 5 hard copies will be provided to the City

Deliverables:

- As outlined in Task 3.3.

12.3.b – Services During Construction – Vacuum Assisted Siphon
The scope of work outlined under Task 6 will be supplemented as follows:

- Meetings and Site Visits – two additional site visits by design engineer for observation of siphon system construction.
- Submittals – up to 5 additional submittals for equipment associated with the siphon system.
- RFIs – up to 5 additional RFIs associated to the construction of the siphon system.

City Involvement:

- As outlined under Task 6.

Assumptions:

- As outlined under Task 6.

Deliverables:

- As outlined under Task 6.

12.3.c – Vacuum System Testing
Following construction of the new outfall pipeline and vacuum assisted siphon system the components of the system will be tested as part of the overall project start-up and testing. The vacuum system design engineer will be on site to confirm proper operation of the system.

City Involvement:

- Provide WWTF support during testing.
- Provide site access and facilitate testing.

Assumptions:

- Proper installation and operation of specific and individual components of the vacuum system will be completed and confirmed as part of the construction contract by the individual responsible manufacturers or manufacturers' representatives. This will be complete prior to design engineer's system testing.
- The City will be able to facilitate testing of the vacuum system by operating the effluent outfall system in such a manner that allows testing to the design engineer's satisfaction.
- Maximum of two days of testing and time on site are required for design engineer.

Deliverables:

- System operational test report.

12.3.d – O & M Staff Training – Vacuum Assisted Siphon

Incorporate vacuum assisted siphon system into O&M Staff Training outlined in Task 7.2.

City Involvement:

- As outlined under Task 7.2.

Assumptions:

- Up to 2 trainings for four hours each will be required to accommodate City staff schedules.
- JACOBS will provide one trainer for each training session.
- Training will not be provided for any existing treatment plant process.
- Training will not include actual operation of the vacuum assisted siphon system (unless in use as part of normal pipeline operations), rather it will focus on how to operate the system and operational considerations based on Plant effluent flow, and river conditions.

Deliverables:

- Syllabus outline, complete training syllabus and training aids.

12.3.e – Operation and Maintenance Manuals – Vacuum Assisted Siphon

Incorporate vacuum assisted siphon system into Operation and Maintenance manuals as outlined under Task 9.

City Involvement:

- As outlined under Task 9.

Assumptions:

- As outlined under Task 9.

Deliverables:

- As outlined under Task 9.

12.3.f – Project Management – Vacuum Assisted Siphon

Included under Task 10.7.

12.4 – Test Pits for Archaeological Investigation

As an optional task to this scope of work, JACOBS proposes the completion of initial archaeological testing along the pipeline alignment within the vicinity of the levees. The initial archaeological testing

will be completed over a 1-week period using mechanical drilling/coring at 50-meter sampling intervals along the levee. Two archaeologists will be present during the testing, including a geoarchaeologist who meets the Secretary of Interior qualifications. The archaeological testing will use available information from the geotechnical analysis to augment information collected as part of this optional task.

Prior to competing the initial archaeological testing, background research through primary and secondary sources will be completed on the existing soils and geology of the area, as well as to assess the likelihood of the area's past uses and association with Native American tribes, to determine the sensitivity of the area to contain buried cultural resources. Additional primary and secondary source research will be completed through repositories and collections available with Native American tribes, the National Archives in San Bruno, and local/state agencies and historical societies.

A Work Plan will be prepared that describes the known sensitivity of the area, records search results (to be obtained under the primary scope of work), information obtained from interaction and research with Native Americans, a research design, and the field methods for the initial archaeological testing. The results of the initial archaeological testing will be included in a Technical Memorandum and provided to the City of Yuba City.

Deliverables

- Draft and Final Work Plan
- Draft and Final Technical Memorandum

Assumptions

- Up to three additional meetings with Native American individuals and tribes may be needed to complete this additional task.
- Native American monitoring of the initial archaeological testing by the United Auburn Indian Community and the Enterprise Rancheria may be requested. The cost for any Native Americans monitor is not included in this scope of work.
- It is assumed that no more than two small cultural resources (less than 2 meters in size) will be discovered during the initial archaeological testing. A separate scope and cost will be prepared for any supplemental assessment that may be required following their identification.

12.5 – WWTF Effluent Pump Station, Flow Metering and Yard Piping Modifications

As an optional task to this scope of work and upon authorization from The City, JACOBS will complete WWTF Effluent Pump Station, Flow Metering, and Yard Piping modifications design including 30%, 60%, 90%, 100% and Bid Documents. The design will include additional drawings and specifications required for design development and contractor bidding.

Additional services associated with the WWTF modifications include additional services during construction, construction management and inspection, and an expanded O&M Manual.

Deliverables

- Predesign report will incorporate WWTF Modifications.
- Up to 6 additional drawings – 2 Civil, 2 Structural/Mechanical, and 2 Electrical.

Assumptions

- The City will provide authorization before any work on this task begins.
- Authorization from City for this task will be provided prior to task beginning, otherwise overall project schedule may be impacted.
- Up to 10 additional RFIs will be submitted and reviewed.

- Construction Contract Administration assumes an additional 2 weeks of half-time on-site construction contract administration, 4 hour days, with no overtime.
- Construction Quality Assurance assumes an additional 20 days of on-site construction quality assurance for 8 hours per day, with no overtime.
- Construction Material Testing includes 6 additional concrete test cylinders for a new flowmeter vault.

Appendix A
Preliminary Drawing List

Appendix A – Preliminary Drawing List

Sheet Number	Drawing Number	Description
General		
1	G-1	Cover Sheet, Vicinity and Location Maps
2	G-2	Sheet List
3	G-3	General Notes
4	G-4	Abbreviations
5	G-5	Civil Legend and Notes
6	G-6	General Structural Notes
7	G-7	Mechanical Legend
8	G-8	Electrical Legends and Abbreviations
9	G-9	Instrumentation Legend
10	G-10	Key Plan and Survey Control
11	G-11	Hydraulic Profile
12	G-12	Construction Access
Plan and Profile		
13	PP-1	Plan and Profile STA 10+00 To 20+00
14	PP-2	Plan and Profile STA 20+00 To 30+00
15	PP-3	Plan and Profile STA 30+00 To 40+00
16	PP-4	Plan and Profile STA 40+00 To 50+00
17	PP-5	Plan and Profile STA 50+00 To 60+00
18	PP-6	Plan and Profile STA 60+00 To 70+00
19	PP-7	Plan and Profile STA 70+00 To 80+00
20	PP-8	Plan and Profile STA 80+00 To 90+00
Civil		
21	C-1	Bifurcation Vault Site Plan and Details
22	C-2	Feather River Site Plan and Restoration Plan
23	C-3	Pipeline Cross Sections 1 Of 2
24	C-4	Pipeline Cross Sections 2 Of 2
25	C-5	Levee Crossing Plan
26	C-6	Levee Crossing Section
27	C-7	Levee Crossing Details - Pipe Backfill
28	C-8	Levee Crossing Details - Pipe Connections
29	C-9	Levee Crossing Details - Valve Vault
30	C-10	Levee Crossing Details - Access Cover
31	C-11	Levee Crossing Details - Miscellaneous 1

Sheet Number	Drawing Number	Description
32	C-12	Levee Crossing Details - Miscellaneous 2
Structural/Mechanical		
33	SM-1	Bifurcation Vault Plan
34	SM-2	Bifurcation Vault Sections
35	SM-3	Feather River Diffuser Plan and Sections
36	SM-4	Feather River Diffuser Details 1 Of 2
37	SM-5	Feather River Diffuser Details 2 Of 2
Electrical		
38	E-1	Bifurcation Vault Electrical Floor Plan
39	E-2	Bifurcation Vault One-Line Diagram, Panel Board Schedule, and Conduit/Conductor Schedules
Instrumentation and Control		
40	IC-1	P&ID Bifurcation Vault
41	IC-2	Network Block Diagram
42	IC-3	Control Panel Typical Wiring Diagrams
Traffic Control		
43	TC-1	Legend and General Notes
44	TC-2	Traffic Control and Restoration Plan
45	TC-3	Traffic Control and Restoration Plan
46	TC-4	Traffic Control and Restoration Plan
47	TC-5	Traffic Control and Restoration Plan
48	TC-6	Lane Closure with Flagger Control Plan
49	TC-7	Sections and Details 1 Of 2
50	TC-8	Sections and Details 2 Of 2
Standard Details		
51	SD-1	Standard Details
52	SD-2	Standard Details
53	SD-3	Standard Details
54	SD-4	Standard Details
55	SD-5	Standard Details
56	SD-6	Standard Details
Optional Drawings - WWTF Effluent Pump Station, Flow Metering and Yard Piping Modifications		
57	C-13	WWTP Pump Station and Yard Piping Plan
58	C-14	WWTP Yard Piping Plan and Details
59	SM-6	WWTP Pump Station Plan
60	SM-7	WWTP Pump Station Section and Details
61	E-3	WWTP Pump Station Electrical Plan

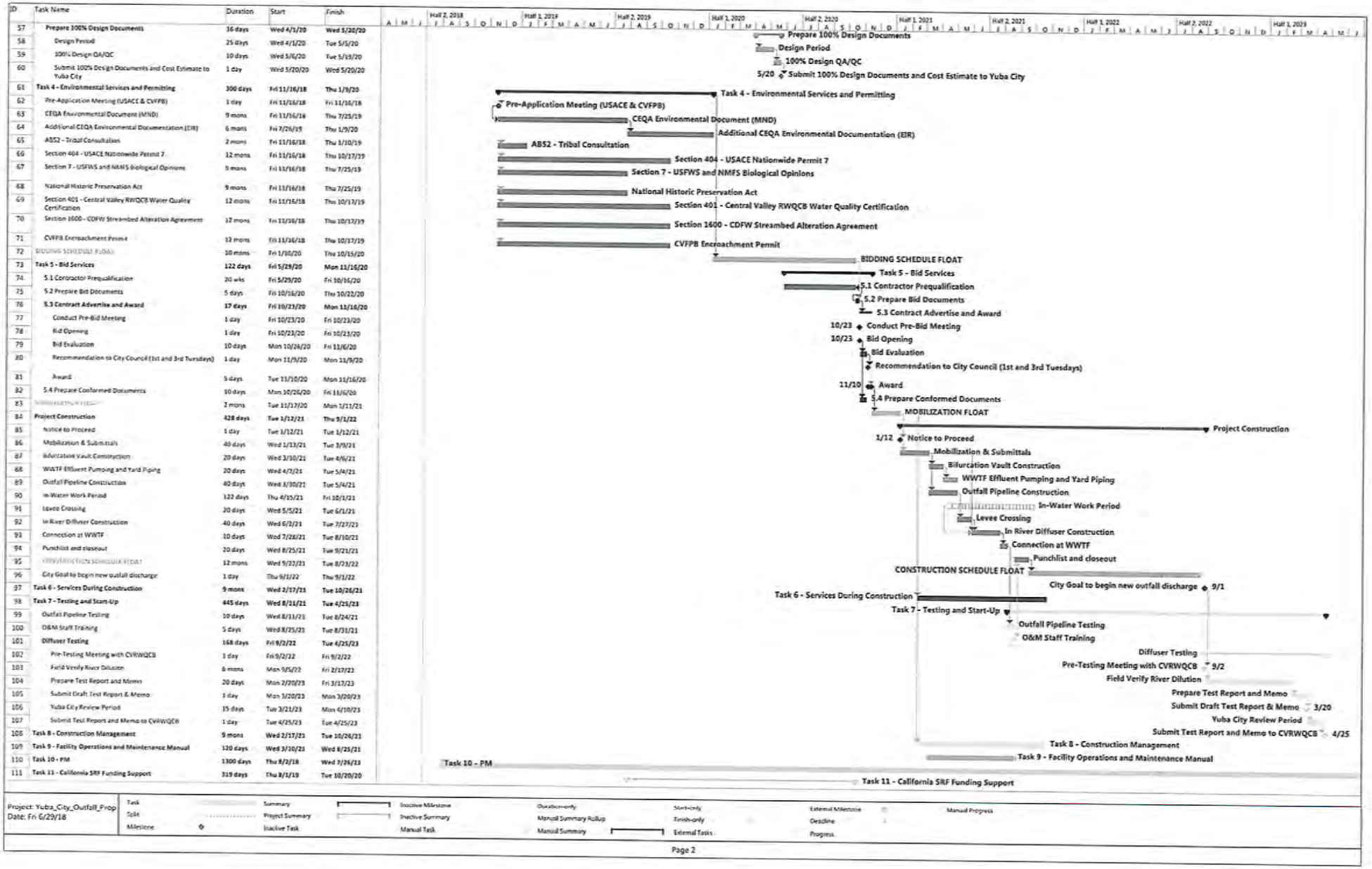
Sheet Number	Drawing Number	Description
62	E-4	WWTP Pump Station One-Line Diagram, Panel Board Schedule, and Conduit/Conductor Schedules
Contingency Drawings		
63		Contingency Drawing 1
64		Contingency Drawing 2
65		Contingency Drawing 3
66		Contingency Drawing 4
67		Contingency Drawing 5
68		Contingency Drawing 6
69		Contingency Drawing 7
70		Contingency Drawing 8

Appendix B
Preliminary Project Schedule

ID	Task Name	Duration	Start	Finish
1	Notice to Proceed	1 day	Wed 8/1/18	Wed 8/1/18
2	**Task 1 - Predesign**	**864 days**	**Wed 8/22/18**	**Mon 12/13/21**
3	Team Chartering	1 day	Wed 8/22/18	Wed 8/22/18
4	1.1 Review of Existing Studies	14 days	Thu 8/23/18	Tue 9/11/18
5	1.2 River Bathymetry	20 days	Wed 9/12/18	Tue 10/9/18
6	1.3 River Bedform and Sediment Transport Evaluation	40 days	Mon 10/1/18	Fri 11/23/18
7	**1.4 Dilution Technical Memorandum (TM)**	**71 days**	**Mon 11/26/18**	**Mon 3/4/19**
8	Prepare Dilution TM	40 days	Mon 11/26/18	Fri 1/18/19
9	Dilution TM QA/QC Review	15 days	Mon 1/21/19	Fri 2/8/19
10	Deliver Draft Dilution TM	1 day	Mon 2/11/19	Mon 2/11/19
11	Yuba City Review and Direction	15 days	Tue 2/12/19	Mon 3/4/19
12	**1.5 Outfall Pipeline and Pumping Evaluation**	**61 days**	**Thu 8/23/18**	**Thu 11/15/18**
13	Prepare Draft Pipeline and Pumping TM	30 days	Thu 8/23/18	Wed 10/3/18
14	Pipeline and Pumping TM QA Review	10 days	Thu 10/4/18	Wed 10/17/18
15	Deliver Draft Pipeline and Pumping TM	1 day	Thu 10/18/18	Thu 10/18/18
16	Yuba City Review	10 days	Fri 10/19/18	Thu 11/1/18
17	Fix-up draft and submit final TM	10 days	Fri 11/2/18	Thu 11/15/18
18	**1.7 and 1.8 Geotechnical Explorations and Reporting**	**213 days**	**Thu 8/23/18**	**Mon 6/17/19**
19	In-River Boring Permitting	7 mons	Thu 8/23/18	Wed 3/6/19
20	In-River Geotechnical Borings	15 days	Tue 3/26/19	Mon 4/15/19
21	Landside Geotechnical Borings	15 days	Tue 3/5/19	Mon 3/25/19
22	Geotechnical Reporting	3 mons	Tue 3/26/19	Mon 6/17/19
23	**1.9 DO Sag Analyis Field Testing Plan**	**770 days**	**Tue 1/1/19**	**Mon 12/13/21**
24	Develop field testing plan	5 mons	Tue 1/1/19	Mon 5/20/19
25	City testing period	31 mons	Tue 5/21/19	Mon 10/4/21
26	Prepare DO Sag Analyis Report	50 days	Tue 10/5/21	Mon 12/13/21
27	**1.10 30% Design and Predesign Report**	**92 days**	**Tue 3/26/19**	**Wed 7/31/19**
28	Prepare Draft Predesign Report	55 days	Tue 3/26/19	Mon 6/10/19
29	Deliver Draft Predesign Report	1 day	Tue 6/11/19	Tue 6/11/19
30	Yuba City Review	35 days	Wed 6/12/19	Tue 7/2/19
31	Prepare Final Predesign Report	20 days	Wed 7/3/19	Tue 7/30/19
32	Deliver Final Predesign Report	1 day	Wed 7/31/19	Wed 7/31/19
33	1.12 Predesign Surveys	20 days	Fri 11/16/18	Thu 12/13/18
34	**1.13 Utility Investigations**	**50 days**	**Fri 11/16/18**	**Thu 1/24/19**
35	Utility Letters and Records Research	30 days	Fri 11/16/18	Thu 12/27/18
36	Utility potholing	20 days	Fri 12/28/18	Thu 1/24/19
37	**Task 2 - Right of Way Acquisition**	**141 days**	**Thu 8/1/19**	**Thu 2/13/20**
38	Prepare Plats and Legal Descriptions	20 days	Thu 8/1/19	Wed 8/28/19
39	Deliver Property Easement/Acquisition Documents	1 day	Thu 8/29/19	Thu 8/29/19
40	Negotiate and Aquire Easements	5 mons	Fri 8/30/19	Thu 2/13/20
41	**Task 3 - Design**	**210 days**	**Thu 8/1/19**	**Wed 5/20/20**
42	**Project Meetings and Coordination**	**10 days**	**Thu 8/1/19**	**Wed 8/14/19**
43	Value Engineering Review	10 days	Thu 8/1/19	Wed 8/14/19
44	**Prepare 60% Design Documents**	**87 days**	**Thu 8/1/19**	**Fri 11/29/19**
45	Design Period	60 days	Thu 8/1/19	Wed 10/23/19
46	60% Design QA/QC	10 days	Thu 10/24/19	Wed 11/6/19
47	Submit 60% Design Documents and Cost Estimate to Yuba City	1 day	Thu 11/7/19	Thu 11/7/19
48	Yuba City Review Period	15 days	Fri 11/8/19	Thu 11/28/19
49	Constructability Review	10 days	Fri 11/8/19	Thu 11/21/19
50	Workshop to Receive Comments	1 day	Fri 11/29/19	Fri 11/29/19
51	**Prepare 90% Design Documents**	**87 days**	**Mon 12/2/19**	**Tue 3/31/20**
52	Design Period	60 days	Mon 12/2/19	Fri 2/21/20
53	90% Design QA/QC	10 days	Mon 2/24/20	Fri 3/6/20
54	Submit 90% Design Documents and Cost Estimate to Yuba City	1 day	Mon 3/9/20	Mon 3/9/20
55	Yuba City Review Period	15 days	Tue 3/10/20	Mon 3/30/20
56	Workshop to Receive Comments	1 day	Tue 3/31/20	Tue 3/31/20

Project: Yuba_City_Outfall_Prop
Date: Fri 6/29/18

Task · Split · Milestone · Summary · Project Summary · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Deadline · Progress · Manual Progress



ID	Task Name	Duration	Start	Finish
57	**Prepare 100% Design Documents**	**16 days**	**Wed 4/1/20**	**Wed 5/20/20**
58	Design Period	25 days	Wed 4/1/20	Tue 5/5/20
59	100% Design QA/QC	10 days	Wed 5/6/20	Tue 5/19/20
60	Submit 100% Design Documents and Cost Estimate to Yuba City	1 day	Wed 5/20/20	Wed 5/20/20
61	**Task 4 - Environmental Services and Permitting**	**300 days**	**Fri 11/16/18**	**Thu 1/9/20**
62	Pre-Application Meeting (USACE & CVFPB)	1 day	Fri 11/16/18	Fri 11/16/18
63	CEQA Environmental Document (MND)	9 mons	Fri 11/16/18	Thu 7/25/19
64	Additional CEQA Environmental Documentation (EIR)	6 mons	Fri 7/26/19	Thu 1/9/20
65	AB52 - Tribal Consultation	2 mons	Fri 11/16/18	Thu 1/10/19
66	Section 404 - USACE Nationwide Permit 7	12 mons	Fri 11/16/18	Thu 10/17/19
67	Section 7 - USFWS and NMFS Biological Opinions	9 mons	Fri 11/16/18	Thu 7/25/19
68	National Historic Preservation Act	9 mons	Fri 11/16/18	Thu 7/25/19
69	Section 401 - Central Valley RWQCB Water Quality Certification	12 mons	Fri 11/16/18	Thu 10/17/19
70	Section 1600 - CDFW Streambed Alteration Agreement	12 mons	Fri 11/16/18	Thu 10/17/19
71	CVFPB Encroachment Permit	12 mons	Fri 11/16/18	Thu 10/17/19
72	BIDDING SCHEDULE FLOAT	10 mons	Fri 1/10/20	Thu 10/15/20
73	**Task 5 - Bid Services**	**122 days**	**Fri 5/29/20**	**Mon 11/16/20**
74	5.1 Contractor Prequalification	20 wks	Fri 5/29/20	Fri 10/16/20
75	5.2 Prepare Bid Documents	5 days	Fri 10/16/20	Thu 10/22/20
76	**5.3 Contract Advertise and Award**	**17 days**	**Fri 10/23/20**	**Mon 11/16/20**
77	Conduct Pre-Bid Meeting	1 day	Fri 10/23/20	Fri 10/23/20
78	Bid Opening	1 day	Fri 10/23/20	Fri 10/23/20
79	Bid Evaluation	10 days	Mon 10/26/20	Fri 11/6/20
80	Recommendation to City Council (1st and 3rd Tuesdays)	1 day	Mon 11/9/20	Mon 11/9/20
81	Award	5 days	Tue 11/10/20	Mon 11/16/20
82	5.4 Prepare Conformed Documents	10 days	Mon 10/26/20	Fri 11/6/20
83	MOBILIZATION FLOAT	2 mons	Tue 11/17/20	Mon 1/11/21
84	**Project Construction**	**428 days**	**Tue 1/12/21**	**Thu 9/1/22**
85	Notice to Proceed	1 day	Tue 1/12/21	Tue 1/12/21
86	Mobilization & Submittals	40 days	Wed 1/13/21	Tue 3/9/21
87	Bifurcation Vault Construction	20 days	Wed 3/10/21	Tue 4/6/21
88	WWTF Effluent Pumping and Yard Piping	20 days	Wed 4/7/21	Tue 5/4/21
89	Outfall Pipeline Construction	40 days	Wed 3/10/21	Tue 5/4/21
90	In-Water Work Period	122 days	Thu 4/15/21	Fri 10/1/21
91	Levee Crossing	20 days	Wed 5/5/21	Tue 6/1/21
92	In River Diffuser Construction	40 days	Wed 6/2/21	Tue 7/27/21
93	Connection at WWTF	10 days	Wed 7/28/21	Tue 8/10/21
94	Punchlist and closeout	20 days	Wed 8/25/21	Tue 9/21/21
95	CONSTRUCTION SCHEDULE FLOAT	12 mons	Wed 9/22/21	Tue 8/23/22
96	City Goal to begin new outfall discharge	1 day	Thu 9/1/22	Thu 9/1/22
97	**Task 6 - Services During Construction**	**9 mons**	**Wed 2/17/21**	**Tue 10/26/21**
98	**Task 7 - Testing and Start-Up**	**445 days**	**Wed 8/11/21**	**Tue 4/25/23**
99	Outfall Pipeline Testing	10 days	Wed 8/11/21	Tue 8/24/21
100	O&M Staff Training	5 days	Wed 8/25/21	Tue 8/31/21
101	**Diffuser Testing**	**168 days**	**Fri 9/2/22**	**Tue 4/25/23**
102	Pre-Testing Meeting with CVRWQCB	1 day	Fri 9/2/22	Fri 9/2/22
103	Field Verify River Dilution	6 mons	Mon 9/5/22	Fri 2/17/23
104	Prepare Test Report and Memo	20 days	Mon 2/20/23	Fri 3/17/23
105	Submit Draft Test Report & Memo	1 day	Mon 3/20/23	Mon 3/20/23
106	Yuba City Review Period	15 days	Tue 3/21/23	Mon 4/10/23
107	Submit Test Report and Memo to CVRWQCB	1 day	Tue 4/25/23	Tue 4/25/23
108	**Task 8 - Construction Management**	**9 mons**	**Wed 2/17/21**	**Tue 10/26/21**
109	**Task 9 - Facility Operations and Maintenance Manual**	**120 days**	**Wed 3/10/21**	**Wed 8/25/21**
110	**Task 10 - PM**	**1300 days**	**Thu 8/2/18**	**Wed 7/26/23**
111	**Task 11 - California SRF Funding Support**	**319 days**	**Thu 8/1/19**	**Tue 10/20/20**

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Appendix C
Fee Estimate and Rate Schedule

JACOBS PROJECT FEE ESTIMATE

CITY OF YUBA CITY PUBLIC WORKS DEPARTMENT Wastewater Treatment Facility Outfall and Diffuser Project	Total Hours	Total Labor	Travel	Expense	Subs	10% Expense/Travel Markup	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Task 1 - Predesign	3,215	585,599	13,300	10,527	200,053	2,383	10,003	236,265	821,864
Task 1.1 - Review of Existing Studies	106	21,408	-	102	-	10	-	113	21,521
Task 1.2 - River Bathymetry	188	36,678	1,950	8,700	51,351	1,065	2,568	65,634	102,312
Task 1.3 - River Bedform and Sediment Transport Modeling Evaluation	436	96,834	650	50	-	70	-	770	97,604
Task 1.4 - Diffuser Design and Modeling TM	226	43,656	-	101	-	10	-	111	43,767
Task 1.5 - Outfall Pipeline and Pumping Predesign	596	101,730	400	150	-	55	-	605	102,335
Task 1.6 - Levee Crossing Predesign (MHM Task 1)	19	3,915	-	-	10,302	-	515	10,817	14,732
Task 1.7 - Geotechnical Exploration	143	18,872	600	269	110,755	87	5,538	117,249	136,121
Task 1.8 - Geotechnical Evaluation and Reports	193	28,562	-	104	-	10	-	114	28,676
Task 1.9 - DO Sag Analysis, Anti-Degradation Analysis, and & ROWD	298	56,648	6,300	467	-	677	-	7,443	64,091
Task 1.10 - 30% Design Development, Predesign Report, Schedule, and Cost Estimate	778	137,270	-	84	12,822	8	641	13,556	150,826
Task 1.11 - Predesign Meetings and Workshop	150	27,928	3,000	200	3,000	320	150	6,670	34,598
Task 1.12 - Surveying and Mapping	26	4,350	-	-	8,490	-	425	8,915	13,265
Task 1.13 - Utility Investigations	56	7,748	400	300	3,333	70	167	4,269	12,017
Task 2 - Right of Way Acquisition	53	9,445	-	-	167,486	-	8,374	175,860	185,305
Task 2.1 – Survey Support for Right of Way Acquisition	34	6,188	-	-	85,236	-	4,262	89,498	95,686
Task 2.2 - Appraisal and Acquisition Services	19	3,257	-	-	82,250	-	4,113	86,363	89,620
Task 3 - Design	3,086	512,216	6,200	223	48,451	642	2,423	57,939	570,155
Task 3.1 - Prepare 60% Design Documents	1,391	231,222	3,000	205	17,575	320	879	21,979	253,201
Task 3.2 – Prepare 90% Design Documents	981	162,948	3,000	18	15,869	302	793	19,983	182,931
Task 3.3 – Prepare 100% Design Documents	714	118,046	200	-	15,007	20	750	15,977	134,023
Task 4 - Environmental Services and Permitting	1,277	229,915	2,600	8,200	12,027	1,080	601	24,508	254,423
Task 4.1 – California Environmental Quality Act	1,277	229,915	2,600	8,200	12,027	1,080	601	24,508	254,423
Task 5 - Bid Services	224	36,911	600	5	19,279	60	964	20,908	57,819
Task 5.1 – Contractor Prequalification	62	11,304.0	200.0	4.6	6,554.0	20.5	327.7	7,106.8	18,410.8
Task 5.2 – Prepare Bid Documents	27	4,187.0	-	-	-	-	-	-	4,187.0
Task 5.3 – Contract Advertise and Award	106	17,177.0	400.0	-	10,189.0	40.0	509.5	11,138.5	28,315.5
Task 5.4 – Prepare Conformed Documents	29	4,243.0	-	-	2,536.0	-	126.8	2,662.8	6,905.8
Task 6 - Services During Construction	1,256	224,204	4,500	31	10,060	453	503	15,547	239,751
Task 6.1 – Office Services During Construction	1,256	224,204	4,500	31	10,060	453	503	15,547	239,751
Task 7 - Testing & Startup	678	141,098	2,800	14,426	17,000	1,723	850	36,799	177,897
Task 7.1 – Diffuser Performance Testing	622.0	130,626	2,500	14,426	17,000	1,693	850	36,469	167,095
Task 7.2 – O & M Staff Training	56.0	10,472	300	-	-	30	-	330	10,802
Task 8 - Construction Management	1,636	285,464	4,200	2,800	157,440	700	7,872	173,012	458,476
Task 8.1 – Document Management	416	51,036	800	-	10,090	80	505	11,475	62,511
Task 8.2 – Construction Contract Administration	1,032	198,824	-	-	-	-	-	-	198,824
Task 8.3 – Construction Field Inspections	188	35,604	3,400	2,800	147,350	620	7,368	161,538	197,142
Task 9 - Operations and Maintenance Manuals	112	20,812	-	500	-	50	-	550	21,362
Task 10 - Project Management	2,425	450,555	5,000	32	45,263	503	2,263	53,062	503,617
Task 10.1 - External Project Meetings	1,045	207,765	5,000	2	-	500	-	5,503	213,268
Task 10.2 - Develop and Maintain Project Management Tools	103	16,489	-	-	-	-	-	-	16,489
Task 10.3 – Project Controls and Invoicing	486	83,292	-	-	-	-	-	-	83,292
Task 10.4 – Project Team Coordination	541	98,990	-	30	-	3	-	33	99,023
Task 10.5 - Health and Safety	98	19,642	-	-	-	-	-	-	19,642
Task 10.6 – Subcontract Management	152	24,377	-	-	45,263	-	2,263	47,526	71,903
Task 11. California SRF Loan Application Support	292	49,864	-	124	-	12	-	136	50,000
Project Total without Supplemental Services (Task 12)	14,254	2,546,083	39,200	36,868	677,059	7,607	33,853	794,586	3,340,669
Task 12. Contingency	2,195	382,800	2,900	2,805	126,300	570	6,315	138,890	499,564
12.1 – Bathymetric Surveys in 2019, 2020 and 2021	158.0	30,312.0	150.0	150.0	67,900.0	30.0	3,395.0	71,625.0	101,937.0
12.2 – Environmental Impact Report	344.0	55,536.0	250.0	2,000.0	-	225.0	-	2,475.0	58,011.0
12.3 – Vacuum Assisted Siphon	462.0	96,034.0	900.0	-	10,000.0	90.0	500.0	11,490.0	85,398.0
12.4 – Archaeological Test Pits	272.0	44,728.0	1,600.0	650.0	20,000.0	225.0	1,000.0	23,475.0	68,203.0
12.5 – WWTF Effluent Pump Station, Flow Metering and Yard Piping Modifications	833.0	132,822.0	-	4.6	28,400.0	0.5	1,420.0	29,825.1	162,647.1
12.6 – Project Management for Contingency Tasks	126.0	23,368.0	-	-	-	-	-	-	23,368.0
Project Total with Supplemental Services (Task 12)	16,449	2,928,883	42,100	39,672	803,359	8,177	40,168	933,477	3,840,234

CH2M HILL ENGINEERS, INC.
Professionals and Technicians*
2018 Hourly Billing Rates**

Classification	Rate
Principal-in-Charge*	$260
Principal Professional 2*	$234
Principal Professional 1*	$198
Sr. Professional 2*	$177
Sr. Professional 1*	$167
Project Professional 2*	$156
Project Professional 1*	$129
Staff Professional 2*	$126
Staff Professional 1*	$108
Engineering Technician	$190
Technician	$112
Office/Clerical	$112

Notes:

* includes engineering, consulting, planner and scientist disciplines

**These rates are effective January 1, 2018 through December 31, 2018; rates are subject to 3% escalation annually

A markup of 10% shall be applied to all Other Direct Costs and Expenses ; 5% markup shall be applied to Subconsultants

An additional premium of 25% will be added to the above rates for Expert Witness and Testimony Services

Exhibit B
Professional Services Agreement
Insurance Requirements

I. **Workers' Compensation Coverage**. Consultant shall maintain Workers' Compensation Insurance for his/her employees in accordance with the laws of the State of California and Employers Liability Insurance in an amount not less than one million dollars ($1,000,000) per accident for bodily injury and/or disease. In addition, Consultant shall require each subcontractor to similarly maintain Workers' Compensation Insurance in accordance with the laws of the State of California and Employers Liability Insurance in an amount not less than one million dollars ($1,000,000) per accident for bodily injury and/or disease for all of the subcontractor's employees. Any notice of cancellation or non-renewal of all Workers' Compensation policies must be received by the City at least thirty (30) days prior to such change. The insurer shall agree to waive all rights of subrogation against City, its officers, agents, employees and volunteers for losses arising from work performed by Consultant for City. This provision shall not apply if Consultant has no employees performing work under this Agreement. If the Consultant has no employees for the purposes of this Agreement, Consultant shall sign the "Certificate of Exemption from Workers' Compensation Insurance" which is attached hereto as Exhibit C.

II. **General Liability Coverage**. Consultant shall maintain commercial general liability insurance in an amount not less than one million dollars ($1,000,000) per occurrence for bodily injury, personal injury and property damage. If a commercial general liability insurance form or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to the work to be performed under this Agreement or the general aggregate limit shall be at least twice the required occurrence limit.

III. **Automobile Liability Coverage**. Consultant shall maintain automobile liability insurance covering bodily injury and property damage for all activities of the Consultant arising out of or in connection with the work to be performed under this Agreement, including coverage for owned, hired and non-owned vehicles, in an amount of not less than one million dollars ($1,000,000) combined single limit for each occurrence.

IV. **Professional Liability Coverage**. Consultant shall maintain professional errors and omissions liability insurance for protection against claims alleging negligent acts, errors or omissions which may arise from Consultant's operations under this Agreement, whether such operations are by the Consultant or by its employees, subcontractors, or sub-consultants. The amount of this insurance shall not be less

than one million dollars ($1,000,000) on a claims-made annual aggregate basis, or a combined single-limit per occurrence basis.

V. **Endorsements**. Each general liability and automobile liability insurance policy shall be with insurers possessing a current A.M. Best's rating of no less than A:VII and shall be endorsed with the following specific language or equivalent:

A. The City, its elected or appointed officers, officials, employees, agents and volunteers are to be covered as additional insured with respect to liability arising out of work performed by or on behalf of the Consultant, including materials, parts or equipment furnished in connection with such work or operations. Conforms to ISO CG 2009 and CG 2037 10 01. Both are required.

B. This policy shall be considered primary insurance as respects to the City, its elected or appointed officers, officials, employees, agents and volunteers. Any insurance maintained by the City, including any self-insured retention the City may have, shall be considered excess insurance only and shall not contribute with it.

C. This insurance shall act for each insured and additional insured as though a separate policy had been written for each, except with respect to the limits of liability of the insuring company.

D. The insurer waives all rights of subrogation against the City, its elected or appointed officers, officials, employees or agents.

E. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the City, its elected or appointed officers, officials, employees, agents or volunteers.

F. The insurance provided by this policy shall not be suspended, voided, canceled, or reduced in coverage except after thirty (30) days written notice has been received by the City.

VI. **Deductibles and Self-Insured Retentions.** Any deductibles or self-insured retentions must be declared to and approved by the City. At the City's option, Consultant shall demonstrate financial capability for payment of such deductibles or self-insured retention's.

VII. **Certificates of Insurance**. Consultant shall provide certificates of insurance with original endorsements to City, as evidence of the insurance coverage required herein. Certificates of such insurance shall be filed with the City on or before commencement of performance of this agreement. Current certification of insurance shall be kept on file with the City at all times during the term of this Agreement.

Exhibit C

1201 Civic Center Boulevard • Yuba City, California 95993 • YubaCity.net

Public Works

AMENDMENT NO. 1 TO THE AGREEMENT FOR PROFESSIONAL SERVICES CH2M HILL ENGINEERS, INC.

Brett Isbell
CH2M Hill Engineers, Inc.
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

SUBJECT: Wastewater Treatment Facility's Outfall and Diffuser Project

This Amendment to the Agreement for Professional Services dated July 18, 2018 is made and entered into as of the 12th day of July 2019 by and between the City of Yuba City ("City") and CH2M Hill Engineers, Inc. ("Consultant").

Whereas, by Agreement for Professional Services dated July 18, 2018 ("Prime Agreement"), City awarded to Consultant the development of construction design documents for the Wastewater Treatment Facility Outfall and Diffuser Project in the amount of $2,783,430. The parties agree to amend the contract provisions to be made part of the Prime Agreement as follows:

SECTION 1, SCOPE OF SERVICES

The following paragraph shall be added to the Scope of Services of the Prime Agreement:

Consultant shall perform the services described on **Exhibit A-1** which is attached hereto and incorporated herein by reference. Consultant shall provide said services at the time, place, and in the manner specified in Exhibit A-1, subject to the direction of the City through its staff that it may provide from time to time.

SECTION 3, COMPENSATION

The following paragraph will be added to the Compensation of the Prime Agreement:

Compensation to be paid to Consultant shall be in accordance with the Schedule of Charges set forth in Exhibit A-1, which is attached hereto and incorporated herein by reference. In no event shall Consultant's additional compensation for the amended scope of services exceed one hundred sixty-two thousand eight hundred seventy-seven dollars ($162,877), for a contract total of **two million nine hundred forty-six thousand three hundred seven dollars ($2,946,307),** without additional written authorization from the City. Payment by City under this Agreement shall not be deemed a waiver of defects, even if such defects were known to the City at the time of payment.

Public Works

Except as amended in this Amendment No. 1, the terms and conditions of the Prime Agreement shall remain the same and shall be in full force and effect. This Amendment No. 1 is not effective until approved and executed by the authorized City representative.

We, the undersigned Consultant, agree that, if this Amendment is approved and executed by the City, we will furnish all materials, equipment, and services required, except as noted, to accomplish the above specified work, and will accept as full payment therefore the prices indicated.

Accepted:

Date: 7/8/2019

Brett Isbell
Designated Manager

Approved:

Date: 7/12/19

Diana Langley
Interim City Manager

Kindly execute the original and two (2) copies and return to City Hall at 1201 Civic Center Boulevard, Yuba City, CA 95993; the City will return a fully-executed copy to you via mail for your files.

Public Works

EXHIBIT A-1

Amendment 1 - Attachment 1

Summary of Recommended Sediment Transport Evaluation Follow-Up Activities (New Task 13.2)
(River Bathymetry and Bedform Data Collections, Modeling, Analyses, and Reporting)
May 6, 2019

Topic and Issues	How it Informs the Project	Workplan to Address Issue	Estimated Level of Effort	Schedule Considerations
Spring 2019 Bathymetric Survey and ADCP Current Measurements *(will be allocated to Task 1.3.1.a)*	Provides updated river bed survey data to document response of Feather River bed to winter/spring 2019 high river flows. Provides key input to bedform modeling and elevation change predictions. Provides updated detailed river current velocities for model calibration update and for dilution modeling inputs.	Solmar Hydro Inc. (SHI) to perform 2019 river data collections in May rather than October 2019, along with ADCP current measurements to feed into diffuser design and site selection. Solmar Hydro Inc. (SHI) to perform 1.5-mile downstream longitudinal transect survey.	2019 Bathymetric Survey is already included under Task 12.1 and ADCP current measurements are already included under Task 1.2.b. River-bottom downstream longitudinal transect survey, data processing, and report (SHI) – $8,663 with Jacobs markup. Jacobs to review River-bottom downstream longitudinal transect survey and report. Additional Jacobs labor effort is approximately 6 hours for senior technical review. Jacobs to update the river bed profile and geomorphic evaluation in the draft Geomorphology, Sediment Transport, and Bedform Analysis TM. Additional Jacobs labor effort is approximately 40 hours for TM revisions and review. Additional cost is $20,000 for SHI subcontract and Jacobs labor, including project management.	Need to perform bathymetric survey in May 2019 to allow collected data to inform the dilution modeling and diffuser design and siting. Approximately 8 weeks to complete this work.
2019 Supplemental River Bedform Modeling and Evaluation *(will be allocated to Task 1.3.1.b)*	Provides additional river modeling and geomorphology analyses of the Feather River Study Reach to respond to enquiries from the City at the River Bedforms and Sediment Transport Workshop (January 2019), and to use the results in the Geomorphology, Sediment Transport, and Bedform Analysis TM for diffuser site selection.	Jacobs hydraulic modeler and geomorphologist will perform additional modeling and analyses of the Feather River Study Reach to expand and complete the development of the Geomorphology, Sediment Transport, and Bedform Analysis TM.	Jacobs will perform additional river modeling and geomorphology analyses of the Feather River to complete the development of the Geomorphology, Sediment Transport, and Bedform Analysis TM. Additional Jacobs labor effort is approximately 35 hours for senior modeler, 35 hours for geomorphologist, and 10 hours for senior technical reviews. Jacobs project manager and geomorphologist to attend and contribute to a new Diffuser Site Selection Workshop – 8 hours each. Senior modeler attends by phone – 4 hours. Additional cost is $25,000 for Jacobs labor.	This work has already been completed as part of the preparation of the draft Geomorphology, Sediment Transport, and Bedform Analysis TM.
2019 River-Bottom Geophysical Survey *(will be allocated to Task 1.3.1.c)* Unknown depth to bedrock (or hardened layers) below fluvial deposits in channel bed at potential diffuser sites between River Cross-sections 13-16. Data about the depth to bedrock would increase understanding of the potential for the channel to scour in this location, and in the exact siting and design of the diffuser structure.	Provides site-specific information on depth to bedrock for a more accurate determination of potential geomorphic risks associated with locating the diffuser, and a more detailed assessment for siting and design of the diffuser. This data collection will be used to update and refine geologic assumptions used in the geomorphic assessments and provide a more refined estimate of potential for these areas to be undermined/scoured for a range of hydrologic scenarios. Design team to also use this data to provide a more detailed estimate of diffuser pipe location and design concepts.	Solmar Hydro Inc. (SHI) will perform river-bottom geophysical surveys in the river immediately following the spring bathymetric survey work. A marine geophysicist will direct the data collections using Electrical Resistivity Tomography (ERT) and Refraction Microtremor (RM) methods to determine the depth to bedrock (or hardened layers) below fluvial deposits between River Cross-Sections 13-16. Refer to the Solmar Hydro Proposal (separate document).	River-bottom Geophysical Survey and Data Report (SHI) – $54,180 with Jacobs markup. Jacobs will review data report and incorporate into geomorphic evaluation in the Geomorphology, Sediment Transport, and Bedform Analysis TM. Additional Jacobs labor effort is approximately 40 hours of modeling with variations in substrate configuration to determine sensitivity of sediment assumptions on predicted bed changes, approximately 40 hours for TM revisions, and approximately 5 hours for senior technical reviews. Additional cost is $75,000 for SHI subcontract and Jacobs labor, including project management.	Need to perform river-bottom survey coordinated with the bathymetric survey in May 2019 to optimize cost of survey vessel and SHI staff. Data to inform the diffuser design and siting.
Bedform Evaluation Update to Address Downstream Channel Constriction *(will be allocated to Task 1.3.1.d)* The significant "sediment mound" at the south end of the project study reach is a channel depth constriction that appears to control channel bed stability and depths at Cross-Sections 13-16 (target diffuser site).	The stability of the downstream "sediment mound" is key to the long-term stability of the channel bed between Cross-Sections 13-16 and additional modeling and analyses will inform assessment of bedform risks at the target diffuser site. Additional analyses will improve our understanding of the stability this feature, indicate potential future changes to the channel bed elevation at Cross-sections 13-16, and reduce uncertainty in design.	Integrate CVFED HEC-RAS (2011?) cross-sections into SRH-2D model to determine channel bed and hydraulic slope for several miles downstream of the Study Reach to determine the potential erodibility of sediment mound and potential bed elevation changes at Cross-Sections 13-16. Rerun hydraulic and sediment model for range of hydrologic and hydraulic scenarios to determine stability of this feature.	Jacobs will conduct modeling and update geomorphic evaluation in the Geomorphology, Sediment Transport, and Bedform Analysis TM. Additional Jacobs labor effort is approximately 50 hours of modeling, 40 hours of geomorphic evaluation, and 40 hours of TM revisions and review. Additional cost is $30,000 for Jacobs labor, including project management.	Approximately 3 weeks to complete this work following the bathymetric survey (May 2019) to inform the diffuser design and siting.
		Total Cost:	$150,000 + $12,877* = $162,877.00	

* Supplemental Drone Survey completed in 2018 in the amount of $12,877

Yuba City WWTF Outfall and Diffuser Project

Amendment 1 - Summary

This Amendment 1 is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work) to the Yuba City Wastewater Treatment Facility Outfall and Diffuser Project. Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

Amendment 1 includes scope and funding to supplement two items for follow-on work for the predesign phase of the Yuba City Wastewater Treatment Facility Outfall and Diffuser Project.

Item 1A - Supplemental Drone Survey

Item 1A will provide supplemental site topography with 1-foot contours and a digital terrain model using data from an Unmanned Aircraft System (UAS) technology to supplement bathymetric surveys completed in the fall of 2018. The following attachments are included as follows:

- Attachment A1: Supplemental Drone Survey Scope of Work and Fee Estimate

Item 1B - River Bedform and Sediment Transport Follow Up Items

Item 1B will provide additional river bedform and sediment transport modelling and evaluation under Task 1.3 and 12.1 with follow up analysis to refine the selection of the river diffuser location. Amendment 1 will add additional scope and funding to Task 1.3 and Task 12.1 from the original Project Scope of Work. Subtasks for new follow up work are identified under Task 1.3.1 and 12.1.1. Attachments are included as follows:

- Attachment A2: River Bedform and Sediment Transport Follow Up Scope of Work and Fee Estimate

Rates and Fees for Engineering Services

Fees for the proposed engineering services are shown in the following table and are based on the same rates as contracted for the City's Outfall and Diffuser Project.

Item	Services	Hours	Jacobs Total Labor	Total Expenses	Total Fee Estimate
1A	Supplemental Surveys to Support River Bathymetry	15	$2,778	$10,099	$12,877
1B	Sediment Transport Follow-Up Items	425	$86,640	$63,360	$150,000
	Amendment 1 Total				$162,877

Current Contract Value

The table below summarizes the new total contract value to date including this amendment.

Description	Total Fee Estimate
Original Contract Value	$2,783,430
Amendment 1	$162,877
New Contract Value	$2,946,307

Yuba City WWTF – Outfall and Diffuser Project Amendment 1A – Supplemental Surveys to Support River Bathymetry

Scope of Work

This Scope of Work is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

Amendments to Tasks 1 and 10 as described below, including listed subtasks, are included in this Scope of Work.

Task 1. Predesign

JACOBS will complete additional predesign tasks as outlined below.

Task 1.2 – River Bathymetry and Data Collections

1.2.c Supplemental Surveys to Support River Bathymetry

- Jacobs will subcontract with MHM to provide supplemental aerial mapping surveys for the Shanghai Bend Falls Area and the Hock Farm Area as described below.
- The consultant shall use data derived from Unmanned Aircraft System (UAS) technology to provide site topography with 1-foot contours, and this data will also be joined into a seamless three-dimensional reconstruction of the ground surface. The topography will include the terrain as well as aboveground features such as rocks, structures, and treetops. The limits of this work in mostly within the river banks so there are no structures. This surface will be produced as georeferenced .tiff files which are compatible for use Geographic Information Systems (GIS) like any other elevation raster. Post-processing of UAS data will also generate contours from the topographic surfaces as GIS shapefiles or ACAD dwg files. The positional accuracy relative to project control, of the data collected shall be a standard error of less than 0.10 ft on hard surface topography and less than 0.50 ft on soft surface topography. All control surveys will be conducted utilizing the most efficient combination of Global Positioning System (GPS) technology and conventional survey methods. The method used to capture the point data will be controlled by the accuracy specifications required by the project specifications.
- Captured point data from initial control surveys will be immediately evaluated and post processed to conform to the project accuracy standards. The processed control data shall be adjusted and calibrated to the most current documentation of NAD83 and NAVD88 by the National Geodetic Survey. All point data captured for the topographic mapping will be post processed and exported in an ASCII format and imported into an electronic drawing file to initiate the development of the final base mapping.

City Involvement:

- None

Assumptions:

- None

Deliverables:

- Aerial Topographic Mapping
- Aerial Imagery
- Survey Control Data Sheet
- Digital Terrain Model (DTM)

Task 10. Project Management

JACOBS will complete project management tasks as outlined below.

Task 10.6 – Subcontract Management

JACOBS will manage the performance of our subconsultants to comply with the scope of work, schedule, and budget described in this amendment. This task includes setting up subconsultant contracts and required pre-procurement reviews, reviewing monthly subconsultant invoices and progress reports, and monitoring and tracking subconsultant payments.

Rates and Fees for Engineering Services

Fees for the proposed engineering services are shown in Appendix A and are based on the same rates as contracted for the City's Outfall and Diffuser Project.

Appendix A
Fee Estimate

Engineering Services Estimate
Supplemental Surveys to Support River Bathymetry
City of Yuba City, California

Task & Year	Jacobs Total Hours	Jacobs Total Labor	Travel	Expense	10% ODC & Travel Markup	Subcontract	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Task 1.2.c - Supplemental Surveys to Support River Bathymetry					10%		5%		
2019	4								
Subtotal Labor & Expenses	$936		$0	$0	$0	$9,618	$481	$10,099	$11,035
Task 10 - Project Management									
2018	11								
2019	0								
Subtotal Labor & Expenses	$1,842		0	0	$0	0	$0	$0	$1,842
Total Hours	15								
Total Labor & Expenses	$2,778		$0	$0	$0	$9,618	$481	$10,099	$12,877

Yuba City WWTF Outfall and Diffuser Project

Amendment 1B – Sediment Transport Follow-Up Items

Scope of Work

This Scope of Work is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

This Scope of Work is for River Bedform and Sediment Transport Follow Up Activities. This amendment will add additional scope and funding to Task 1.3, Task 10, and Task 12.1 from the original Project Scope of Work. The intent is to finish the river bedform and sediment transport modelling and evaluation started under Task 1.3 and 12.1 with follow up analysis to refine the selection of the river diffuser location.

The total cost estimate is $149,923 (Appendix A). The consultant is not obligated to spend above this amount.

Task 1. Predesign

Task 1.3 River Bedform and Sediment Transport Modeling

River Bedform and Sediment Transport Follow Up

This subtask is follow-up work to Task 1.3. Original task objectives that are still relevant include: 1) utilize new field data to support stability assessment and sediment transport modeling analysis; 2) further develop understanding of short term and long-term geomorphic processes in project reach; 3) continue to conduct channel stability assessment to support optimal placement for proposed outfall and diffuser; and 4) inform outfall diffuser design to maintain functionality through foreseeable variability in sediment bedload transport and bedform conditions. Work activities will include:

Spring 2019 Bathymetric Survey and ADCP Current Measurements

- River data collections, along with ADCP current measurements, will be completed under Task 12.1.
- Provide senior technical review of river-bottom downstream longitudinal transect survey and report.
- Provide updated river bed survey data of Feather River during winter/spring 2019 high river flows.
- Provide updated detailed river current velocities for model calibration update and for dilution modeling inputs.

- Revise the river bed profile and geomorphic evaluation in the draft Geomorphology, Sediment Transport, and Bedform Analysis TM to incorporate new river data and further calibrate dilution model.

2019 Supplemental River Bedform Modeling and Evaluation

- Perform additional modeling and analyses of the Feather River Study Reach to expand and complete the development of the Geomorphology, Sediment Transport, and Bedform Analysis TM.
- Respond to enquiries from the City at the River Bedforms and Sediment Transport Workshop (January 2019), about river modeling and geomorphology questions of the Feather River Study Reach.
- Select a recommended diffuser site selection based off further river modeling and geomorphology analysis.
- Prepare for, attend, and contribute to diffuser site location discussion at Diffuser Site Selection Workshop.

2019 River-Bottom Geophysical Survey

Unknown depth to bedrock (or hardened layers) below fluvial deposits in river channel bed at potential diffuser sites between River Cross-sections 13-16 need to be investigated. Data about the depth to bedrock would increase understanding of the potential for the channel to scour in this location, and in the exact siting and design of the diffuser structure.

- Review results of River-bottom Geophysical Survey and Data Report prepared under Task 12.1 below.
- Update and refine geologic assumptions used in the geomorphic assessments and provide a more refined estimate of potential for these areas to be undermined/scoured for a range of hydrologic scenarios.
- Provide a more detailed estimate of diffuser pipe location and design concepts, using the refined geologic assumptions.
- Refine development of the Geomorphology, Sediment Transport, and Bedform Analysis TM to incorporate new information and results.

Bedform Evaluation Update to Address Downstream Channel Constriction

The significant "sediment mound" at the south end of the project study reach is a channel depth constriction that appears to control channel bed stability and depths at Cross-Sections 13-16 (target diffuser site). Additional modeling and analyses will inform assessment of bedform risks at the target diffuser site.

- Integrate CVFED HEC-RAS cross-sections into SRH-2D model to determine channel bed and hydraulic slope for several miles downstream of the Study Reach to determine the potential erodibility of sediment mound and potential bed elevation changes at Cross-Sections 13-16.
- Perform additional analyses to improve understanding of the stability of the downstream channel feature, indicate potential future changes to the channel bed elevation at Cross-sections 13-16, and reduce uncertainty in design.
- Rerun hydraulic and sediment model for range of hydrologic and hydraulic scenarios to determine stability of the downstream channel feature.
- Refine development of the Geomorphology, Sediment Transport, and Bedform Analysis TM to incorporate new information and results.

City Involvement:

- Provide reviews and input during project review meetings and to the technical memorandum.
- Attends and provides input during Diffuser Site Selection Workshop.

Assumptions:

- Bathymetric survey will be completed in May 2019 to allow collected data to inform the dilution modeling and diffuser design and siting. Dilution modeling and diffuser siting work will take approximately 8 weeks and can't begin until the bathymetric survey (May 2019) is complete.
- River-bottom survey will be performed in coordination with the bathymetric survey in May 2019 to optimize cost of survey vessel and SHI staff.
- Bedform evaluations to address the downstream channel constriction can't occur until the bathymetric survey (May 2019) has been completed, this will take approximately 3 weeks to complete this work.

Deliverables:

- Diffuser Site Selection Workshop presentation and materials
- River-bottom Geophysical Survey and Data Report
- Final Geomorphology, Sediment Transport, and Bedform Analysis Technical Memorandum

Task 10. Project Management

Jacobs will complete project management tasks as outlined below.

Task 10.3 – Project Controls and Invoicing

Jacobs project controls staff will prepare regular internal cost reports for review by the Jacobs Project Manager. Jacobs will also prepare monthly invoices (including subconsultant invoices) and a Project Status Report including progress report narrative, scope change summary, and schedule and budget status for the work added by this amendment.

City Involvement:

- Review and approve monthly invoice.

Assumptions:

- Budget status burn charts are not included.

Deliverables:

- Monthly invoices and Project Status Reports

Task 10.4 – Project Team Coordination

Jacobs will conduct the following internal team coordination activities:

- Regular project team coordination meetings

Task 10.6 – Subcontract Management

Jacobs will manage the performance of our subconsultants to comply with the scope of work, schedule, and budget. This task includes setting up subconsultant contracts and required pre-procurement reviews, reviewing monthly subconsultant invoices and progress reports, maintaining annual insurance and safety documents, and monitoring and tracking subconsultant payments.

Task 12. Supplemental Services

12.1 – Bathymetric Surveys in 2019, 2020 and 2021

Jacobs will subcontract with Solmar Hydro to complete the following activities:

- Perform river-bottom geophysical surveys in the river immediately following the spring bathymetric survey work. A marine geophysicist will direct the data collections using Electrical Resistivity Tomography (ERT) and Refraction Microtremor (RM) methods to determine the depth to bedrock (or hardened layers) below fluvial deposits between River Cross-Sections 13-16.
- Provide site-specific information on depth to bedrock for a more accurate determination of potential geomorphic risks associated with locating the diffuser, and a more detailed assessment for siting and design of the diffuser.
- Provide river-bottom Geophysical Survey Data and Report.
- Perform 1.5-mile additional bathymetric survey along the river thalweg downstream of the current study area to investigate the changes in the sand bench downstream of the study area.

City Involvement:

- Facilitate access to secure survey benchmarks to allow for locating Trimble base RTK station on tripod during bathymetric survey and field data collection days.

Assumptions:

- Field services will be conducted in accordance with JACOBS's Field Safety Instructions (FSI) for this project. Vessel safety and operational safety will be the responsibility of the hydrographic surveyor. For safety reasons, all field activities on the river will be limited to daylight hours. These field measurements are assumed to require four to six consecutive field days on the Feather River.
- Prior to mobilizing personnel and equipment for the week of survey work, river flow and stage forecasts will be evaluated to decide if adequate and safe river conditions are forecast for the work period. Seasonal river flows will not restrict boat access and data acquisition to the point of damage or imminent danger to personnel and equipment.
- All deliverables will be provided to City in an electronic file format (pdf) and limited hard copies can be provided on request.

Deliverables:

- A concise bathymetric survey report will be produced, and report charts will be provided. The report charts will include depth contours at 1-foot intervals, color TIN (Triangulated Irregular Networks), and track-lines. Report charts will be produced in the horizontal and vertical datum defined above. This report will describe the control used for the survey, data acquisition methodology, calibrations, and data processing procedures. Report deliverables will include an ASCII file of the XYZ data, AutoCAD and Civil 3D DWG files.
- River-bottom Downstream Longitudinal Transect Survey and Report

Project Schedule

Delivery of the activities described in this amendment is controlled by the completion of the bathymetric survey, river-bottom geophysical survey, and river-bottom downstream longitudinal transect survey. These surveys are needed to refine the riverbed and geomorphic analysis and modeling. Bedform evaluations to address the downstream channel constriction can't occur until the bathymetric survey (May 2019) has been completed, this will take approximately 3 weeks to complete this work.

Furthermore, other tasks such as the dilution modeling and diffuser design (Task 1.4) can't begin until the bathymetric survey (May 2019) is complete. Immediately upon issuing a Notice to Proceed, Jacobs will subcontract with Solmar Hydro Inc. (SHI) to perform the bathymetric, river-bottom geophysical, and river-bottom downstream longitudinal transect surveys.

Rates and Fees for Engineering Services

Fees for the proposed engineering services are shown in Appendix A and are based on the same rates as contracted for the City's Outfall and Diffuser Project.

Appendix A
Fee Estimate

Yuba City WWTF Outfall and Diffuser Project
Sediment Transport Follow-Up Items
APPENDIX A. JACOBS FEE ESTIMATE

CITY OF YUBA CITY PUBLIC WORKS DEPARTMENT WWTP Outfall and Diffuser	2018 2019 2020 2021 2022 2023 PDC	Total Hours	Total Labor	Travel	Expense	Subs	10% Expense/Travel Markup	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Amendment 18										
River Bedform and Sediment Transport Follow Up Task										
Subtask 1.3 - Spring 2019 Bathymetric Survey and ADCP Current Measurements										
Subtotal - Subtask 1.3 - Spring 2019 Bathymetric Survey and ADCP Current Measurements		40	$ 7,893	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,893
Subtotal - Subtask 1.3 - 2019 Supplemental River Bedform Modeling and Evaluation		109	$ 22,866	$ 200	$ 100	$ -	$ 30	$ -	$ 330	$ 23,196
Subtotal - Subtask 1.3 - 2019 River-Bottom Geophysical Survey		80	$ 17,078	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,078
Subtotal - Subtask 1.3 - Bedform Evaluation Update to Address Downstream Channel		129	$ 28,151	$ -	$ 170	$ -	$ 17	$ -	$ 187	$ 28,338
Subtotal - Task 10 - Project Management		56	$ 8,452	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,452
Subtotal - Subtask 12.1 - River-bottom Geophysical Survey and Downstream Longitudinal Transect Survey		11	$ 2,200	$ -	$ -	$ 8,250	$ -	$ 413	$ 8,663	$ 65,043
River Bedform and Sediment Transport Follow Up Task Hours		425								
River Bedform and Sediment Transport Follow Up Task Budget			$ 86,640	$ 200	$ 270	$ 59,850	$ 47	$ 2,993	$ 63,360	$ 150,000

TOTAL $ 150,000

Exhibit D

1201 Civic Center Boulevard • Yuba City, California 95993 • YubaCity.net

Public Works

AMENDMENT NO. 2 TO THE AGREEMENT FOR PROFESSIONAL SERVICES
CH2M HILL ENGINEERS, INC.

CH2M Hill Engineers, Inc.
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

SUBJECT: Amendment No. 2 to Scope of Services for Yuba City WWTF - Outfall and Diffuser Project

This Amendment to the Agreement for Professional Services dated July 18, 2018 ("Second Amendment") is made and entered into as of the 10th day of July 2020 by and between the City of Yuba City ("City") and CH2M Hill Engineers, Inc. ("Consultant").

Recitals

Whereas, by Professional Services Agreement dated July 18, 2018 ("Prime Agreement"), City entered into an agreement with Consultant for professional engineering services for the City's Outfall and Diffuser Project in the amount of $2,783,430.00.

Whereas, the City Manager approved Amendment No.1 to the Prime Agreement on July 12, 2019.

Whereas, the Parties desire to amend the Prime Agreement for a second time to provide for additional tasks, and updated scope of service, revised compensation, and other items related to the Project.

Agreement

In consideration of the foregoing Recitals and for good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the City and Consultant agree as set forth herein.

1. Section 3, Compensation, of the Prime Agreement is amended to add the following:

   For services rendered by Consultant under this Amendment No. 2 to the Prime Agreement as outlined above, Consultant is authorized to transfer $289,786 from Task 3 (Design) of Prime Agreement to other appropriate tasks to complete the scope of work described in Exhibit "A". The total cost of Amendment No. 2 shall not exceed $289,786. The City shall consider adding additional funds needed to complete Task 3 at a later date if decided to proceed with the final design.

2. Except as amended in this Second Amendment, the terms and conditions of the Prime Agreement (attached as Exhibit "B") and First Amendment (attached as Exhibit "C") shall remain the same and shall be in full force and effect. This Second Amendment is not effective until approved and executed by the authorized City representative.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement on the date and year first written above.

CITY:

CITY OF YUBA CITY, a municipal corporation

Diana Langley

Diana Langley, Interim City Manager

APPROVED AS TO FORM:
ALESHIRE & WYNDER, LLP

Shannon Chaffin, City Attorney

CONSULTANT:

CH2M HILL ENGINEERS, INC.

July 14, 2020

Name: Lisa Alliger, PE

Title: Designated Project Executive

Kindly execute the original and two (2) copies and return to City Hall at 1201 Civic Center Boulevard, Yuba City, CA 95993; the City will return a fully-executed copy to you via mail for your files.

Attachments:

Exhibit A: Amended Exhibit A to Prime Agreement
Exhibit B: Prime Agreement
Exhibit C: Amendment No. 1 (First Amendment)

Exhibit A

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Yuba City WWTF Outfall and Diffuser Project

Amendment 2 - Summary

This Amendment 2 is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work) to the Yuba City Wastewater Treatment Facility Outfall and Diffuser Project (Project). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

Amendment 2 includes scope and funding to supplement two items for follow-on work: 2A) for the predesign phase of the Project and 2B) for the Advanced Treatment Study to evaluate alternative treatment options to the Project. The City directed Jacobs to stand-down work on transitioning to final design activities for the Project on February 24, 2020, while a brief Advanced Treatment Study was conducted. However, there was some finalization of predesign activities and project management activities that were authorized by the City to continue during the Stand-down period. Scope and funding of these activities are included in item 2A.

Item 2A – Predesign Follow-up Work and Activities during Stand-down Period

Item 2A will provide additional support for activities during the predesign phase including effluent pumping system testing support, in-river geotechnical boring permitting support, dynamic modeling support, spring season bathymetry surveys, and project management support. Additional Project elements were included in the predesign than were previously scoped including a levee access ramp, a surge control system, a hydraulic and scour analysis, WWTF pump station modifications, and an additional predesign workshop.

Item 2A also includes project management activities and continuation of authorization predesign activities during the stand-down period.

The following attachments are included as follows:

- Attachment 2A: Predesign Follow-up Work Scope of Work and Fee Estimate

Item 2B – City of Yuba City WWTF Advanced Treatment Study

Item 2B will provide WWTF staff an advanced treatment study to validate their current WWTF improvement and regulatory compliance strategy. At the completion of the WWTF Outfall and Diffuser predesign phase the City has opportune time for conducting this study given the potential need to invest up to approximately $35 million to construct the Outfall and Diffuser Project. The study will compare relative costs, advantages and disadvantages for continued operation of the WWTF (as configured currently with the construction of the new proposed Diffuser) with one or two alternative configurations for advanced treatment, in conjunction with a side-bank point discharge into the Feather River per detailed scope of work for the advanced treatment study.

Amendment 2 will add additional scope and funding to the original Project Scope of Work under a new Task 13 for this study. Subtasks for new Task 13 will include subtask 13.1 - Project Development Assistance, subtask 13.2 – Advanced Wastewater Treatment Study, subtask 13.3 – Project Management, and subtask 13.4 – Owner's Authorized Supplemental Services. Approximately $40,000 will be included in subtask 13.4 for an owner's authorized supplemental services to be utilized upon City approval of scope and fee, if needed.

Attachments are included as follows:

- Attachment 2B: City of Yuba City WWTF Advanced Treatment Study Scope of Work and Fee Estimate

Rates and Fees for Engineering Services

Fees for the proposed engineering services are shown in the following table and are based on the same rates as contracted for the City's Outfall and Diffuser Project.

Item	Services	Hours	Jacobs Total Labor	Total Expenses	Total Fee Estimate
2A	Predesign Follow-up Work and Activities during Stand-down Period	892	$159,339	$10,410	$169,749
2B	City of Yuba City WWTF Advanced Treatment Study	565	$119,274	$762	$120,037
	Amendment 2 Total				$289,786

Current Contract Value

The Amendment 2 budget of $289,786 will be funded by a portion of the existing authorized contract tasks such as Task 3 Final Design budget of $570,154 for the Project. If the final design of the Project is authorized by the City in late 2020, funds will be added by separate amendment to replace Task 3 funds.

The table below summarizes the new total contract value to date including this amendment.

Description	Total Fee Estimate
Original Contract Value	$2,783,430
Amendment 1	$162,877
Amendment 2	$0
New Contract Value	$2,946,307

Attachment 2A: Predesign Follow-up Work Scope of Work and Fee Estimate

Yuba City WWTF Outfall and Diffuser Project

Amendment 2: Item 2A

Predesign Follow-Up Work

Scope of Work

This Scope of Work is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

This Scope of Work is for 30% predesign follow-on activities. This amendment will add additional scope and funding to Task 1, Task 2, Task 4, Task 10, and Task 12 from the original Project Scope of Work. The intent is to supplement the existing predesign budgets for additional authorized activities that occurred during the Predesign phase.

The total cost estimate is $169,749 (Appendix A). The consultant is not obligated to spend above this amount. Additional activities such as final design elements from the recommendations included in the final Predesign Report and other services like engineering services during construction, startup and testing, and construction management are not included in this amendment, and will need to be contracted separately if needed by the City.

Task 1. Predesign

Task 1.5.b – Pumping Predesign

Effluent Pumping System Testing Support

This subtask is follow-on work to Task 1.5.b for refinement of the hydraulic model and additional model calibration required to resolve inconsistencies observed following field pumping tests. Work activities included:

- Evaluate field test data to reconcile inconsistencies in pumping system behavior (up to 3 new model revisions).
- Attend field testing and assist in collection of field test data on February 5, 2020 by two Jacobs team members.
- Revise and calibrate effluent pumping hydraulic model to estimate the required TDH at the pump station for the selected pipeline alignment alternative and the design flow projections.
- Reengage pump vendors for revised pump selections.
- Revise Predesign Report Appendix E: Hydraulic Evaluation Technical Memorandum to incorporate field test results and generate recommendations for pumping system upgrades.

- Evaluate existing effluent pipeline air release valve at existing levee crossing and provide recommendation for a new combination air release valve.
- Conduct conference call meeting with City staff on March 5, 2020.
- Develop recommendations for additional City field pump testing.

City Involvement:

- Perform pumping tests and provided resultant flows and pressures for multiple pumping scenarios, up to 3 times.
- Attend and assist in field calibration testing on February 5, 2020.

Assumptions:

- None.

Deliverables:

- Revised Predesign Report Appendix E: Hydraulics Evaluation Technical Memorandum in the final Predesign Report.
- Combination air release valve recommendation for existing levee crossing.
- Recommendations for additional City field pump testing.

Task 1.9 – DO Sag Analysis, Anti-Degradation Analysis, and ROWD

Dynamic Modeling Support

This subtask was developed at the request of the City to support dynamic modeling analyses conducted by Larry Walker & Associates (LWA) with data provided by Jacobs. Dynamic modeling objectives include applying hydraulic modeling results and replacement outfall diffuser design configuration and modeling results developed by Jacobs as inputs to support LWA dynamic modeling of ammonia and copper discharges to the Feather River. Work activities include:

- Develop approaches to pursuing dynamic modeling of ammonia discharges to Feather River through discussions with City. Review of objectives, approach, and inputs required for the dynamic modeling in coordination with LWA.
- Develop and provide the following inputs for dynamic modeling:
    - Draft profile drawing of new river diffuser
    - Summary of replacement diffuser configuration and model inputs (no. ports, spacing, horizontal and diffuser port orientation, port elevation, river bed elevation, effective port diameter, port velocities)
    - CORMIX2 model runs for diffuser at river Section 14.4 (CMX and PRD files)
    - Tideflex hydraulic system analysis for TFD Series 35 check valve ports (HC 733) for full range of effluent flow (existing through buildout) and effective port diameters summary
    - Table summary of river velocities, water depths, and water surface width at Section 14.4 for a wide range of river flows from 1,000 cfs to a 100-yr flood (311,400 cfs) flow
    - River stage/discharge rating curve, and results for river flow and stage that constitutes bank-full condition
- Review the draft dynamic modeling results and technical memorandum developed by LWA and provided by the City for inclusion in the final Predesign Report.
- Incorporate a concise summary of the dynamic modeling results into the body of the final Predesign Report and the complete LWA Dynamic Modeling Technical Memorandum as an appendix.

City Involvement:

- Provide direction and coordination with LWA during development of dynamic modeling.
- Provide coordination of dynamic modeling results with Jacobs.

Assumptions:

- Dynamic modeling results and technical memorandum will be provided to Jacobs by the City in an electronic file format (pdf) and tables in Word format for use in the final Predesign Report.

Deliverables:

- Input files for dynamic modeling to City and LWA in early December 2019.
- Provide review comments to the City.

Task 1.10 – 30% Design Development, Predesign Report, Schedule, and Cost Estimate

This subtask adds two additional design elements to the 30% design and cost estimate. The City requested predesign of a levee ramp for construction traffic access and City operations and maintenance access. This subtask also adds a surge analysis to determine the need for protective measures to protect the existing outfall pipeline and new outfall pipeline extension. Work activities include:

Predesign for Levee Access Ramps

- Develop a 30% design including plan sheet with levee access ramp alignments, grading details and sections, access from Garden Hwy, and security considerations.

Predesign for Surge Control System

- Prepare a transient analysis and model of the existing outfall pipeline and proposed outfall pipeline extension, make recommendations to protect the outfall pipeline against surge, and document the findings and recommendations in a technical memorandum.
- Incorporate an initial surge tank concept description into the final Predesign Report and Appendix B: Design Criteria.

City Involvement:

- Provide direction on which predesign elements will be retained for inclusion in the final Predesign Report and appendixes.

Assumptions:

- No surge control design drawings are included.

Deliverables:

- Construction Access Ramps Plan Sheet including grading details and sections for incorporation in the 30% drawings.
- Surge criteria for incorporation in Appendix B: Design Criteria.
- Appendix D: Transient Analysis Technical Memorandum provided in electronic file format (PDF) and included in the final Predesign Report.

Task 1.11 – Predesign Meetings and Workshops

This subtask adds an additional predesign workshop as requested by the City to review the main predesign elements and to prepare for the City Council meeting that will authorize final design of the project. Work activities include:

Predesign Review Workshop

- Prepare for and attend a predesign workshop at the WWTF on January 30, 2020 to discuss project elements and finalize predesign phase.
- Provide information needed by the City to prepare draft and final staff reports for the City Council meeting that will authorize final design.

City Involvement:

- Provide direction on which predesign elements will be retained for inclusion in the final Predesign Report and appendixes.
- Provide a copy of the draft City Council staff report.

Assumptions:

- None.

Deliverables:

- Inserts for the City Council staff report as requested.
- Meeting summary of predesign workshop.

Task 2. Right of Way Acquisition

This modification reduces the assumed effort for property acquisition for valuation and appraisal review based on the number of parcels anticipated for property acquisition following completion of the project predesign and uses the available budget to support right-of-entry acquisitions, landowner consultation services, and encroachment permit support. Jacobs will provide these additional services up to the limit of the re-allocated budget. There is no change to the original Task 2 budget for this scope change.

Task 2.1.b – Right-of-Entry Agreement from Existing Landowners

BRI will complete a Real Estate Estimate for three parcels to be provided by Jacobs. Real Estate Estimate will be provided by January 9, 2020.

Task 2.2.a – Valuation Services

Reduce the total number of assumed parcels from 6 to 4.

Task 2.2.b – Appraisal Review

Reduce the total number of assumed parcels from 6 to 3.

Task 2.2.c – Acquisition Services

BRI will assist Jacobs with conducting preliminary landowner meetings, encroachment permit support, and Right of Entry support.

City Involvement:

- None.

Assumptions:

- None.

Deliverables:

- Real Estate Estimate for three parcels: State of California Fish and Wildlife, Netherby, and Yokohari.
- Right-of-Entries for four parcels: State of California Fish and Wildlife, Red Hawk Farms, Tahkar, and Yokohari.

Task 4. Environmental Services and Permitting

Task 4.3 – Levee Permit

This amendment adds a new subtask as described below.

Task 4.3.1 - Central Valley Flood Protection Board Hydraulic and Scour Analysis
This subtask was developed in response to the request of the Central Valley Flood Protection Board (Board) to demonstrate water surface elevation changes and any scour effects from the new YC outfall diffuser structure and trap structure in the Feather River floodplain. Hydraulic and bed scour modeling will be conducted in accordance with the Modeling Work Plan that is approved by the Board and USACE, as appropriate. Work activities include:

- Develop a Draft Hydraulic Flood and Scour Modeling Work Plan that is consistent with the USACE River Hydraulics Engineering Manual 1110-2-1416 and other guidance documents, as appropriate. Incorporate 60% design drawings to illustrate the project elements in the river floodplain, limited above grade exposure, and rock protection measures.
- Submit the Draft Hydraulic Flood and Scour Modeling Work Plan to the Board for review prior to initiating detailed modeling.

City Involvement:

- Provide support and coordination with the Board on the Modeling Work Plan submittal.
- Review and comment on draft Modeling Work Plan. City will provide one set of adjudicated comments within two weeks of receiving draft documents.

Assumptions:

- This amendment will add scope and budget for the development of a Draft Hydraulic Flood and Scour Modeling Work Plan that will be communicated to the Board. Hydraulic and bed scour modeling work will be conducted under this task with additional authorized budget from another amendment after final design has been authorized to continue by the City.
- A concise Modeling Work Plan will be reviewed by the Board and USACE. Board and USACE review of modeling plan could lead to additional modeling effort beyond this scope and fee estimate.

Deliverables:

- Hydraulic Flood and Scour Modeling Work Plan (draft and final) in electronic file format (PDF).

Task 4.4 – Other Permits

This subtask is follow-on work to Task 4.4. Original task objectives that are still relevant include obtaining authorization for the in-water geotechnical borings under various state and federal permits and related consultation processes. The original tasks are supplemented with the following:

In-Water Geotechnical Boring Permit Support

- The list of permits for the geotechnical borings are the same as the original scope. Supplemental activities include preparing supplemental information requested by review agencies, including a detailed description of boring equipment and operations (in-water and on land), researching noise impacts of standard penetrometer tests (most research is on pile driving), calculation of in-water noise levels and contours, and analysis of potential impacts to fish.

City Involvement:

- No change from original scope.

Assumptions:

- Jacobs has provided an allowance of $27,100 to support additional information requests. Jacobs will not be obligated to spend more than this allowance.
- The ongoing consultation processes being led by the USACE, Section 408 Program, will not result in any substantial new data requests or new technical studies other than those information requests described above.

Deliverables:

- Biological Technical Memorandum in electronic file format (PDF).

Task 10. Project Management

The purpose of this task is to provide additional project management services for the work added by this amendment as described below to supplement the currently scoped services. All other existing City involvement items, assumptions, and deliverables described in the currently scoped project management services will apply to this work as well. Jacobs will complete additional project management tasks as described below.

Task 10.3 – Project Controls and Invoicing

Jacobs project controls staff will prepare regular internal cost reports for review by the Jacobs Project Manager. Jacobs will also prepare monthly invoices (including subconsultant invoices) and a Project Status Report including progress report narrative, scope change summary, and schedule and budget status for the work added by this amendment.

This subtask also includes scoping for this amendment, including meetings with City staff, and preparing draft and final scope of work and fee estimate.

Task 10.7 – Project Management During Stand-down

Jacobs will perform additional project management tasks during the stand-down period of the Project requested by the City while an advanced treatment evaluation is completed for the WWTF, between the completion of the Predesign Phase and authorization of the 60% Design Phase. Work activities include the following:

- Additional email and phone coordination with City during the stand-down period.
- Additional team coordination for authorized activities to continue during the stand-down period.
- Conduct re-chartering meeting with project team following the stand-down period.
- Update the project schedule included in the final Predesign Report (Section 10).

City Involvement:

- Provide approval regarding which project activities are to continue during the stand-down period.
- Provide direction to Jacobs regarding timing and completion of stand-down period.

Assumptions:

- Stand-down period is anticipated to last 9 months from March 2020 through November 2020.

Deliverables:

- Updated project schedule to be completed following completion of the stand-down period.

Task 12. Supplemental Services

Jacobs will complete the following additional supplemental services as described below.

Task 12.1 – Bathymetric Surveys in 2019, 2020, and 2021

This amendment adds the following services to the Bathymetric Surveys in 2020 and 2021:

- The original project scope envisioned bathymetric surveys in 2019, 2020, and 2021 to be completed in the fall when Feather River flows were at the lowest for the year, thus minimizing the river surface area to be surveyed. The City and Jacobs agreed to complete the 2019 supplemental survey during the spring season in order to incorporate survey data into the project predesign.
- Subsequent surveys in 2020 and 2021 are also intended to be completed during the spring season. Additional budget is provided for each annual survey for either river flows between 3,000 cfs and 5,000 cfs ($2,500), or an additional allocation for river flows above 5,000 cfs ($4,800). These additional costs are offset by $2,100 of remaining budget not utilized for in-river instrument maintenance.

Task 12.5 – WWTF Effluent Pump Station, Flow Metering and Yard Piping Modifications

This subtask updates the existing optional Task 12.5 following completion of the final Predesign Report. The City has authorized Jacobs (under optional Task 12.5) to complete the WWTF Effluent Pump Station, Flow Metering, and Yard Piping modifications including final design and bid services. As part of the predesign phase, evaluation of the City's existing WWTF effluent pumping system recommended that three existing pumps be replaced. The original scope of work assumed up to 6 drawings – following completion of predesign the drawing list was revised to add an additional 7 drawings, some of which will be shared with the new surge control system. This amendment adds predesign for the additional drawings described in the Predesign Report for WWTF effluent pump station modifications.

City Involvement:

- Review 30% design descriptions in the Predesign Report and cost estimate and provide review comments.

Assumptions:

- Another amendment will fund development of 60%, 90% and 100% design drawings, specifications, cost estimate, and quality control review.

Deliverables:

- Description of planned effluent pumping station modifications in Predesign Report.

Project Schedule

The start date for delivery of the activities described in this amendment is controlled by the approval of the project predesign by the City Council. The activities described above will delivered on a schedule that is mutually agreeable to the City and Jacobs.

Rates and Fees for Engineering Services

The estimated fee for the proposed engineering services is shown in Appendix B and is based on the rates as contracted for the City's Outfall and Diffuser Project.

Appendix A
Updated Drawing List

Appendix A – Updated Drawing List

Sheet Number	Drawing Number	Description	Originally Scoped Sheets	Delivered 30%	Final Design Total	Notes
General			**12 Sheets**	**10 Sheets**	**12 Sheets**	
1	G-1	Cover Sheet, Vicinity and Location Maps	X	X	X	
2	G-2	Sheet List	X	X	X	
3	G-3	Design Data Tables	X	X	X	
4	G-4	Abbreviations	X	X	X	
5	G-5	Civil Legend and Notes	X	X	X	
6	G-6	General Structural Notes	X	X	X	
7	G-7	Mechanical Legend	X	X	X	
8	G-8	Electrical Legends and Abbreviations	X	X	X	
9	G-9	Instrumentation and Control Legend	X	X	X	
10	G-10	Key Plan and Survey Control	X	X	X	
11	G-11	Hydraulic Profile	X		X	
12	G-12	Construction Access	X		X	
Plan and Profile			**8 Sheets**	**12 Sheets**	**12 Sheets**	
13	PP-1	Plan and Profile STA 10+00 To 20+00	X	X	X	
14	PP-2	Plan and Profile STA 20+00 To 30+00	X	X	X	
15	PP-3	Plan and Profile STA 30+00 To 40+00	X	X	X	
16	PP-4	Plan and Profile STA 40+00 To 50+00	X	X	X	
17	PP-5	Plan and Profile STA 50+00 To 60+00	X	X	X	
18	PP-6	Plan and Profile STA 60+00 To 70+00	X	X	X	
19	PP-7	Plan and Profile STA 70+00 To 80+00	X	X	X	
20	PP-8	Plan and Profile STA 80+00 To 90+00	X	X	X	
21	PP-9	Plan and Profile STA 90+00 To 100+00		X	X	Funded by Contingency Dwg #1.
22	PP-10	Plan and Profile STA 100+00 To 110+00		X	X	Funded by Contingency Dwg #2.
23	PP-11	Plan and Profile STA 110+00 To POE		X	X	Funded by Contingency Dwg #3.
24	PP-12	Feather River Diffuser Site Plan and Restoration Plan		X	X	Funded by Contingency Dwg #4.
Civil			**12 Sheets**	**8 Sheets**	**14 Sheets**	
25	C-1	Bifurcation Vault Site Plan and Details	X		X	
26	C-2	Vacuum-Assisted Siphon System Building Site Plan			X	Funded by Task 12.3 Dwg.
27	TBD	Feather River Diffuser Site Plan and Restoration Plan	X		X	

Sheet Number	Drawing Number	Description	Originally Scoped Sheets	Delivered 30%	Final Design Total	Notes
28	C-3	Pipeline Cross Sections 1 Of 2	X		X	
29	C-4	Pipeline Cross Sections 2 Of 2	X		X	
30	C-5	Construction Access Ramps Site Plan		X	X	Funded by Future Amendment.
31	TBD	Construction Access Ramps Sections			X	Funded by Future Amendment.
32	TBD	Construction Access Ramps Details			X	Funded by Future Amendment.
33	TBD	Construction Access Ramps Details			X	Funded by Future Amendment.
34	C-6	Levee Crossing Plan	X	X	X	MHM Drawing.
35	C-7	Levee Crossing Section	X	X	X	MHM Drawing.
36	C-8	Levee Crossing Details - Pipe Backfill	X	X	X	MHM Drawing.
37	C-9	Levee Crossing Details - Pipe Connections	X	X	X	MHM Drawing.
38	C-10	Levee Crossing Details - Valve Vault	X	X	X	MHM Drawing.
39	C-11	Levee Crossing Details - Access Cover	X	X	X	MHM Drawing.
40	C-12	Levee Crossing Details - Miscellaneous 1	X	X	X	MHM Drawing.
41	C-13	Levee Crossing Details - Miscellaneous 2	X		X	MHM Drawing.
Structural/Mechanical			**5 Sheets**	**7 Sheets**	**8 Sheets**	
42	SM-1	Bifurcation Station Plan	X	X	X	
43	SM-2	Bifurcation Station Sections	X	X	X	
44	SM-3	Feather River Diffuser Plan and Sections	X	X	X	
45	SM-4	Feather River Diffuser Details 1 Of 2	X	X	X	
4	SM-5	Feather River Diffuser Details 2 Of 2	X		X	
47	SM-6	Vacuum-Assisted Siphon – Building Plan		X	X	Funded by Task 12.3 Dwg.
48	SM-7	Vacuum-Assisted Siphon – Building Sections		X	X	Funded by Task 12.3 Dwg.
49	SM-8	Primer Trap Structure Plans and Sections		X	X	Funded by Contingency Dwg #5.
Electrical			**2 Sheets**	**1 Sheet**	**6 Sheets**	
50	E-1	Bifurcation Station Site Plan			X	Funded by Contingency Dwg #6.
51	E-2	Vacuum-Assisted Siphon Site Plan			X	Funded by Contingency Dwg #7.
52	E-3	One-line Diagrams	X	X	X	Updated One-line funded by Task 12.3 Dwg. Sheet originally scoped for Bifurcation Station.
53	E-4	Bifurcation Station Power Plan	X		X	
54	E-5	Vacuum-Assisted Siphon Electrical Power Plan			X	Funded by Task 12.3.
55	E-6	Panel Board Schedules and Conduit/Conductor Schedules			X	Funded by Contingency Dwg #8.

Sheet Number	Drawing Number	Description	Originally Scoped Sheets	Delivered 30%	Final Design Total	Notes
Instrumentation and Control			**3 Sheets**	**2 Sheets**	**4 Sheets**	
56	IC-1	P&ID Bifurcation Station	X	X	X	
57	IC-2	P&ID Vacuum-Assisted Siphon		X	X	Funded by Task 12.3 Dwg.
58	IC-3	Network Block Diagram	X		X	
59	IC-4	Control Panel Typical Wiring Diagrams	X		X	
Traffic Control			**8 Sheets**	**0 Sheets**	**8 Sheets**	
60	TC-1	Legend and General Notes	X		X	
61	TC-2	Traffic Control and Restoration Plan	X		X	
62	TC-3	Traffic Control and Restoration Plan	X		X	
63	TC-4	Traffic Control and Restoration Plan	X		X	
6	TC-5	Traffic Control and Restoration Plan	X		X	
65	TC-6	Lane Closure with Flagger Control Plan	X		X	
66	TC-7	Sections and Details 1 Of 2	X		X	
67	TC-8	Sections and Details 2 Of 2	X		X	
Standard Details			**6 Sheets**	**4 Sheets**	**8 Sheets**	
68	SD-1	Standard Details	X	X	X	
69	SD-2	Standard Details	X	X	X	
70	SD-3	Standard Details	X	X	X	
7	SD-4	Standard Details	X	X	X	
72	SD-5	Standard Details	X		X	
73	SD-6	Standard Details	X		X	
74	SD-7	Standard Details			X	Funded by Task 12.3.
75	SD-8	Standard Details			X	Funded by Task 12.3 Contingency #1 Dwg.
WWTF Effluent Pump Station, Flow Metering and Yard Piping Modifications + Surge Control System			**6 Sheets**	**0 Sheets**	**24 Sheets**	
1	G-13	WWTF Construction Coordination Plan			X	Funded Future Amendment. Counted as one of the 11 Surge Sheets.
2	C-14	WWTF Pump Station and Surge Control System Site Plan	X		X	Funded by Task 12.5. Shared WWTF/Surge Dwg. Counted as one of the 7 additional WWTF Sheets.
3	C-15	Surge Control System Site Grading and Survey Control			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
4	C-16	WWTF and Surge Control System Yard Piping Plan	X		X	Funded by Task 12.5. Shared WWTF/Surge Dwg. Counted as one of the 7 additional WWTF Sheets.

Sheet Number	Drawing Number	Description	Originally Scoped Sheets	Delivered 30%	Final Design Total	Notes
5	C-17	WWTF and Surge Control System Yard Piping Details			X	Funded by Future Amendment. Shared WWTF/Surge Dwg. Counted as one of the 11 Surge Sheets.
6	D-1	WWTF Demolition #1			X	Funded by Future Amendment.
7	SM-9	WWTF Pump Station Plan	X		X	Funded by Task 12.5.
8	SM-10	WWTF Pump Station Sections and Details	X		X	Funded by Task 12.5.
9	SM-11	Surge Control Tank Plan			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
10	SM-12	Surge Control System Sections			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
11	SM-13	Surge Control System Details			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
12	E-7	Overall Electrical Site Plan			X	Funded by Future Amendment. Counted as one of the 7 additional WWTF Sheets.
13	E-8	WWTF Pump Station Electrical Site Plan	X		X	Funded by Task 12.5.
14	E-9	Surge Control System Electrical Site Plan			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
15	E-10	WWTF Effluent Pump Station Plan			X	Funded by Future Amendment.
16	E-11	WWTF Pump Station and Surge Control System One-Line Diagrams	X		X	Funded by Task 12.5. Shared WWTF/Surge Dwg. Counted as one of the 7 additional WWTF Sheets.
17	E-12	WWTF Pump Station and Surge Control System MCC Elevations			X	Funded by Future Amendment. Counted as one of the 7 additional WWTF Sheets.
18	E-13	WWTF Pump Station and Surge Control System Panel Board Schedules and Conduit/Conductor Schedules			X	Funded by Future Amendment. Counted as one of the 7 additional WWTF Sheets.
19	E-14	WWTF Pump Station and Surge Control System Wiring Diagrams			X	Funded by Future Amendment. Counted as one of the 7 additional WWTF Sheets.
20	IC-5	P&ID WWTF Effluent Pump Station			X	Funded by Future Amendment.
21	IC-6	P&ID Surge Control System			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
22	IC-7	Control Panel Wiring Diagrams			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.

Sheet Number	Drawing Number	Description	Originally Scoped Sheets	Delivered 30%	Final Design Total	Notes
23		Contingency 1			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
24		Contingency 2			X	Funded by Future Amendment. Counted as one of the 11 Surge Sheets.
Contingency Drawings			***8 Sheets***	***8 Sheets***	***8 Sheets***	
1	PP-9	Contingency Drawing 1	X	X	X	Used by PP-9.
2	PP-10	Contingency Drawing 2	X	X	X	Used by PP-10.
3	PP-11	Contingency Drawing 3	X	X	X	Used by PP-11.
4	PP-12	Contingency Drawing 4	X	X	X	Used by PP-12.
5	SM-8	Contingency Drawing 5	X	X	X	Used by SM-8.
6	E-1	Contingency Drawing 6	X	X	X	Used by E-1.
7	E-2	Contingency Drawing 7	X	X	X	Used by E-2.
8	E-6	Contingency Drawing 8	X	X	X	Used by E-6.

Appendix B
Fee Estimate

Item 2A - PreDesign Follow-up Work
APPENDIX B. JACOBS FEE ESTIMATE

CITY OF YUBA CITY PUBLIC WORKS DEPARTMENT WWTF Outfall and Diffuser	2018 2019 2020 2021 2022 2023 PDC	Total Hours	Total Labor	Travel	Expense	Subs	10% Expense/Travel Markup	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Amendment 02 - Item 2A - Predesign Follow-up Work										
Task 1 - Predesign										
Subtotal - Subtask 1.5.b - Effluent Pumping System Testing Support		185	$ 30,721	$ 200	$ -	$ -	$ 20	$ -	$ 220	$ 30,941
Subtotal - Subtask 1.9 - LWA Dynamic Modeling		33	$ 6,377	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,377
Subtotal - Subtask 1.10 - Pre-Design Report		18	$ 3,780	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,780
Subtotal - Subtask 1.11 - Predesign Meetings and Workshops		55	$ 9,907	$ 100	$ 150	$ -	$ 25	$ -	$ 275	$ 10,182
Subtotal - Subtask 1.10 - Pre-Design Levee Access Ramp		71	$ 11,984	$ -	$ -	$ 500	$ -	$ 25	$ 525	$ 12,509
Subtotal - Subtask 1.10 - Predesign Surge Control System		45	$ 7,969	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,969
Task 4 - Permitting										
Subtotal - Subtask 4.3.1 - CVFPB Hydraulic and Scour Analysis		33	$ 7,994	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,994
Subtotal - Subtask 4.4 - In-River Geotechnical Boring Permitting Support		136	$ 27,059	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,059
Task 10 - Project Management										
Subtotal - Subtask 10.3 - Project Controls and Invoicing		158	$ 25,819	$ 200	$ -	$ -	$ 20	$ -	$ 220	$ 26,039
Subtotal - Subtask 10.7 - Project Management Stand-down		71	$ 11,985	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,985
Task 12 - Supplemental Services										
Subtotal - Task 12.1 - Bathymetric Surveys in 2020 and 2021		-	$ -	$ -	$ -	$ 8,000	$ -	$ 400	$ 8,400	$ 8,400
Subtotal - Task 12.5 - WWTF Pump Station, Flow Metering, and Yard Piping Modification		87	$ 15,744	$ 200	$ 500	$ -	$ 70	$ -	$ 770	$ 16,514
PreDesign Follow Up Task Hours		892.0	$ 159,339							
PreDesign Follow Up Task Budget		892.0	$ 159,339	$ 700	$ 650	$ 8,500	$ 135	$ 425	$ 10,410	$ 169,749

Attachment 2B: City of Yuba City WWTF Advanced Treatment Study Scope of Work and Fee Estimate

Yuba City WWTF Outfall and Diffuser Project
Amendment 2: Item 2B
Advanced Treatment Study
Scope of Work

Following completion of the Yuba City Wastewater Treatment Facility (WWTF) Outfall and Diffuser Predesign, the City met with Jacobs on March 6, 2020 to discuss an alternative surface water discharge strategy (i.e., side-bank discharge) and potential ramifications to the WWTF. Several alternative treatment approaches were discussed at the meeting along with current challenges imposed by the Sunsweet discharge, its impact on existing WWTF processes, and the inability of the existing pure oxygen activated sludge process to meet more stringent effluent discharge limits if imposed in the future. The alternatives discussed at the meeting were based on projected effluent limits developed by Larry Walker and Associates (LWA) for a potential side-bank discharge located near the City's existing diffuser at the Shanghai Falls in the Feather River. The projected effluent limits were provided by the City in a draft Technical Memorandum (TM) dated March 4, 2020.

Background

WWTF staff have elected to conduct an advanced treatment study to validate their current WWTF improvement and regulatory compliance strategy. At the completion of the WWTF Outfall and Diffuser predesign phase the City has opportune time for conducting this study given the potential need to invest $35 million to construct the Outfall and Diffuser Project. The study will compare relative costs, advantages and disadvantages for continued operation of the WWTF (as configured currently) with one or two alternative configurations. These configurations were limited to meeting the projected nitrogen and nitrite limits of 2.1 and 1.0 mg-N/L reported in the TM and were to be based on more traditional, proven technologies. Additional projected side-bank effluent discharge requirements and treatment alternatives can be considered and reviewed in more depth as part of a subsequent, alternative development and comparison effort, if desired by WWTF staff. An action item developed at the March 6, 2020 meeting was for Jacobs to review the existing WWTF process facilities, existing information and data, and develop an outline and scope of work for an advanced treatment study.

The City is interested in comparing continued operation of the pure oxygen activated sludge process and associated future investments with one or two alternative treatment technologies suitable for meeting more stringent effluent quality requirements projected for a side-bank discharge:

1. Develop one or two alternative approaches to upgrade the existing WWTF to meet proposed effluent limits for a side-bank discharge near the City's existing diffuser at the Shanghai Falls in the Feather River. The proposed effluent limits were provided by the City in a draft TM prepared by LWA and dated March 4, 2020. Only the projected ammonia and nitrite limits will be considered at this time. Other constituents and treatment alternatives could be considered as part of a subsequent, more in-depth effort.
2. List and leverage estimated costs for capital improvement program projects[1] which can be avoided by alternative approaches such as the addition of a 3rd digester, 4th secondary clarifier

[1] Cost estimates developed by others or obtained from readily available sources (i.e., draft WWTF master plan, BACWA and Echo Water).

and new PSA system, rotary drum WAS thickener and digested gas flare. Majority of this cost information will be obtained and copied from the Draft Wastewater Master Plan (April 2020).

3. Provide rough order of magnitude comparison with current approach (i.e., continued use of pure oxygen activated sludge process and installation of new river diffuser).

Purpose

Document the scope of work, schedule and estimated fee to complete the WWTF Advanced Treatment Study. The study will leverage past, readily available information and data to describe the historic issues related to pollutant loading from the Sunsweet processing facility, its impact on wastewater treatment operation and develop an alternative treatment facilities configuration for evaluation and comparison of relative capital, operating and maintenance (O&M) and net present worth costs, and other identified criteria. Alternative treatment approaches will be combined with a side-bank outfall and compared to current technology (i.e., continued Sunsweet discharge into sewer, use of pure oxygen activated sludge process, and new outfall pipeline extension and river diffuser as described in WWTF Outfall and Diffuser Predesign Report).

Tasks 1, 2 and 3 describe the scope of work for the advanced treatment study.

Task 1. Project Development Assistance

Jacobs will assist the City in developing and defining the WWTF Advanced Treatment Study project. Services provided in this task include:

- Attend project development meeting at WWTF (attended by up to three Jacobs team members)
- Review background documents and studies relevant to project development and definition.
- Prepare draft outlines for project scope of work.
- Attend conference calls with City staff to review draft outlines and to assist in project definition.

City Involvement:

- Provide background documents and studies relevant to project development and definition.
- Review and comment on draft versions of project scope of work outlines.
- Attend meeting at WWTF and conference calls.
- Approve final project scope of work outline.

Assumptions:

- Up to 3 conference calls of 1.5 hours each.
- Up to 4 draft versions of project scope of work outline.

Deliverables:

- Draft outlines for project scope of work.
- Final project scope of work.

Task 2. WWTF Advanced Treatment Study

Compare relative advantages, disadvantages and rough order of magnitude capital, O&M and net present worth costs for the following alternatives:

- Current Technology – Continued use of existing pure oxygen activated sludge process and install new river diffuser as described in the final WWTF Outfall and Diffuser Predesign Report. Represents 10.5 MGD average dry weather flow (ADWF) capacity as described in the current discharge permit.
- Alternative 1. Addition of nitrogen removal process downstream of the existing treatment facility. Review Sunsweet waste stream characteristics, develop recommended handling and treatment approach and include in Alternative 1.
- Alternative 2. Biological nutrient removal process in place of existing pure oxygen biological treatment. Review Sunsweet waste stream characteristics, develop recommended handling and treatment approach and include in Alternative 2.

Total project cost will include advanced treatment improvements as well as the new side-bank discharge and associated outfall pipeline. Conceptual design of the outfall pipeline and side-bank discharge is described in Task 2.3 below.

Considerations to be addressed in the study:

- The City cannot nitrify/denitrify in existing pure oxygen activated sludge reactors.
- If the City converts to a Biological Nutrient Removal process, the existing reactors could be used as anoxic zone or repurposed for other uses (e.g., Sunsweet load equalization tank).
- There is potential to segregate, separately convey and treat Sunsweet influent waste stream at Sunsweet or/and at the WWTF. Determine whether the stream can be used to increase methane production within the existing digesters and/or as a carbon source for Biological Nutrient Removal process (BNR) based on readily available data and information provided by the City.
- If Sunsweet were to stop operation and discharge to the WWTF or segregate their waste stream, there is potential to repurpose aeration tanks to treat the remaining residential and commercial wastewater stream.
- Review historic raw wastewater influent characterization data, and more specifically temperature, to determine if the influent appears to be warmer than typical ranges, and if so, determine its relative impact on process sizing and estimated construction costs.

Task 2.1 – Review Existing Studies, Data and Other Information

At a minimum, Jacobs will request and review the following documents in a Request for Information (RFI).

- Draft Wastewater Master Plan Update dated April 2020 already provided to Jacobs in pdf format.
- Historic (last 3 years) WWTF operating costs broken down into labor (operations, maintenance), power, chemical and other consumables in electronic MS Excel format.
- Historic (last 3 years) of raw wastewater influent characteristics (i.e., Total influent and Sunsweet flows and pollutant concentrations), operating and monitoring data, and effluent quality data in electronic MS Excel format.
- Responses to Jacobs questions and comments to the LWA TM, City of Yuba City Reasonable Potential Analysis and Effluent Limits Re-Calculation and Final LWA TM.

- Historic (last 3 years) of Sunsweet historic flows, pollutant concentrations and sampling and laboratory analysis results in MS Excel format. The data Jacobs currently has is limited to the Industrial Pretreatment Technical Memorandum (HDR, January 15, 2001), May 15-21, 2019 TKN sampling results and January 2018 through February 2019 Sunsweet Discharge flow, pH, total suspended solids (TSS) and biochemical oxygen demand (BOD).
- Conduct conference calls to review project data requests and data utilization

C**ity Involvement:**

- Provide additional information pertaining to Sunsweet discharge and WWTF impacts.
- Facilitate consultation with WWTF operations staff regarding effluent pumping and outfall operations and addressing Jacobs comments, issues and concerns associated with new side-bank outfall.

Assumptions:

- Projected flows and loads from the master plan update will be used as the basis of the assessment.
- Up to 3 conference calls of 1.5 hours each

Deliverables:

- Summarize, in tabular format, past information and data to be leveraged for this assessment, how it will be applied and limitations.
- Identification of data gaps and additional information required to further alternative treatment and regulatory compliance strategies to a preliminary design level.

Task 2.2 – Sunsweet Characterization and Recommended Handling Option

Jacobs will review past Sunsweet influent characterization and pretreatment data provided by the City and evaluate options to treat and handle the Sunsweet waste stream. The following is a listing and description of the proposed steps/activities:

A. Determine daily flows, seasonal flow variations, discharge hours and flow rates, Sunsweet's contractual discharge capacity, ability to equalize and control sewer discharge, as well as current discharge practices. Historic data will be reviewed by Jacobs and supplemented by information provided by Sunsweet through a questionnaire.

B. Evaluate potential Sunsweet discharge mitigation measures based on the alternatives considered in the Industrial Pretreatment Technical Memorandum. Evaluation will be limited to the following considerations: (1) separate treatment at Sunsweet or the WWTF, (2) solids separation with solids diverted to existing WWTF digesters (3) Sunsweet discharge diversion to digester, (4) storing Sunsweet discharge and re-distributing load to WWTF influent stream, (5) use of Sunsweet discharge stream as a carbon source for BNR process and (6) repurposing Sunsweet WWTF facilities due to Sunsweet ceasing discharge. Evaluate and summarize the technical feasibility of each of the configurations described, potential impacts and benefits to the liquid treatment process (e.g., added revenue). Recommend a single Sunsweet discharge handling method based on the evaluation results and incorporate into Task 2.4.

Jacobs will present recommended Sunsweet discharge handling method and the preliminary evaluation to the City by conference call, and the City will select a preferred configuration to be carried forward into the alternative wastewater facilities configuration described in Task 2.4.

City Involvement:

- Communicate and coordinate Sunsweet questionnaire.

Assumptions:

- No additional sampling of Sunsweet discharge is assumed for this study.
- For completeness, Jacobs will include and briefly describe Onsite Sunsweet Treatment (eliminate discharge to WWTF) alternative, but limit level of effort for this alternative by:
    - Describing (footnoting) how the Segregate and Treat Sunsweet Discharge at WWTF alternative would be different than the Onsite Sunsweet Treatment alternative (e.g., in comparison table footnote that force main and pump station would be not be needed along with other differences)
    - Include other relative advantages and disadvantages in the Onsite Sunsweet Treatment alternative description (e.g., free up capacity in collection system and WWTF).

Deliverables:

- Draft and final Sunsweet questionnaires.
- Draft and final presentation materials for one conference call, see Task 3.1 below.

Task 2.3 – Outfall Pipeline and Side-Bank Discharge Location Development

In this task Jacobs will provide written comments to LWA TM then, once LWA responses are received, develop up to three alternative locations for a new side bank discharge, taking into consideration river hydraulics, geomorphology, river bank stability, and length of new effluent pipeline to the new outfall structure. Jacobs will estimate conceptual level costs for construction, permitting, and soft costs.

Jacobs will present the identified alternatives and the preliminary evaluation to the City by conference call and the City will select a preferred alternative to be carried forward into the alternative wastewater facilities configuration described in Task 2.4.

City Involvement:

- Coordinate LWA responses to Jacobs' Technical Memorandum comments.
- Select preferred side-bank discharge location and outfall pipe alignment.

Assumptions:

- Side bank discharge will be based on a submerged free-pipe end with a check valve and pile supports located downstream of the Shanghai Falls. No other discharge configuration options will be developed or estimated.
- Outfall pipe and discharge concept will be based on buildout peak hour flow.
- Viability of side-bank discharge permit approval with the RWQCB will be determined by the City. Conceptual design of side-bank discharge included in this task does imply or guarantee approval by the RWQCB.

Deliverables:

- Written comments pertaining to LWA Technical Memorandum.
- Narrative of alternative discharge locations and preferred alternative will be included in draft and final advanced treatment study technical memorandum.
- Map figure of 3 alternative bank locations and outfall pipeline alignments.
- Class 5 construction cost estimate, including permitting and operation, for new bank side discharge.

- Draft and final presentation materials for one conference call, see Task 3.1 below.

Task 2.4 – Alternative Development and Comparison with Current Technology

Develop alternative wastewater facilities configuration for:

Baseline: Constructing new proposed diffuser assuming regulations will stay the same,

Alternative 1: Add-on treatment downstream of existing treatment process (nitrification/denitrification), and

Alternative 2: Biological nutrient removal process using Modified Ludzack-Ettinger (MLE) Process.

Treatment processes are sized for the rated 10.5 MGD ADWF capacity and targeting BACWA Level 2 (2 mg/L ammonia, 15 mg/L TN) for treatment goals, which appears suitable to meet project ammonia requirements projected for side-bank discharge. Jacobs will compare the alternative treatment facilities configurations and current technology then prepare a brief technical memorandum summarizing comparison findings, results and recommendations. For each alternative, a sub-alternative to separately handle Sunsweet waste stream is considered, based on the findings from Task 2.2. Discuss how each alternative can be impacted if Sunsweet were to shutdown in the future. Qualitatively discuss expandability of each alternative for increased flows and loads from new growth to the WWTF. The TM is anticipated to be less than 5 pages in length, and include process flow schematics illustrating proposed alternative treatment concepts and approaches, a table summarizing comparison results and capital, O&M and net present worth costs.

Assumptions:

- Nitrogen, and its forms (i.e., ammonia, nitrite + nitrate and total nitrogen) will be the primary focus of the study and comparison. Limits for other constituents listed in the March 4, 2020 LWA TM will not be considered at this time but may be considered later if desired.
- Capital and O&M costs to be derived from unit costs readily available information obtained from the Nutrient Reduction Study (BACWA, June 22, 2018) for Level 2 treatment (e.g., $12.1/gal capital cost); potentially with some adjustments made by Jacobs to address WWTF-site specific conditions and configuration (e.g., pumping).
- Typical, proven technologies (e.g., conventional diffused fine bubble aeration and blowers) to be used as the basis for unit costs, not innovative less proven technologies (e.g., Invent aerator/mixers). However, innovative options can be described in the study report (without costs).
- City will provide one set of adjudicated comments on draft technical memorandum within three weeks of receipt.

Deliverables:

- Draft and final technical memorandum for City review and comment.
- Draft and final Workshop agenda and review materials.

Task 3. Project Management

JACOBS will complete project management tasks as outlined below. The budget assumes that overall project scope is as defined in the preceding Tasks.

Task 3.1 – External Project Meetings

JACOBS will attend the following project meetings with City staff:

- Project Kickoff Meeting at the WWTF. Jacobs will prepare meeting agenda, presentation materials and meeting summary.
- Biweekly Conference Call Progress Meetings. Meeting attendance will mostly be limited to Jacobs and City project managers.
- Up to 5 Conference Calls total for Tasks 2.1, 2.2, and 2.3.
- Workshop 1 Comparison of Alternatives and Recommended Alternative

City Involvement:

- Review agendas and minutes from project progress meetings and alert Jacobs project manager of any questions or corrections.

Assumptions:

- Meeting dates and times and method (in-person or by conference call) will be as agreed to between Jacobs and the City and will be subject to travel restrictions implemented by either party or by federal, state, or local public meeting limitations.
- Up to 6 biweekly Progress Meetings between July 2020 and September 2020.

Deliverables:

- Conference call and Workshop agenda and meeting summaries.

Task 3.2 – Develop and Maintain Project Management Tools

JACOBS will prepare and maintain the following project management tools:

- Project Execution Plan (PXP)
- Quality Management Plan (QMP)
- Risk Register
- Work Plans
- Decision Log

Task 3.3 – Project Controls and Invoicing

JACOBS project controls staff will prepare regular internal cost reports for review by the Jacobs Project Manager. Jacobs will also prepare monthly invoices and a Project Status Report including progress report narrative, scope change summary, and schedule and budget status. Monthly invoices Project Status Reports will be submitted to the City Project Manager for review and approval.

City Involvement:

- Review and approve monthly invoice and project status report.

Assumptions:

- Assumes 3 months of project cost reports, monthly invoices, and progress reports
- Budget status burn charts are not included

Deliverables:

- Monthly invoices and Project Status Reports

Task 3.4 – Project Team Coordination

Jacobs will conduct the following internal team coordination activities:

- Project Team Kickoff Meeting
- Regular project team coordination meetings

Task 3.5 – Health and Safety

Jacobs will conduct internal Health and Safety (H&S) procedures to manage the safety of our staff. Health and safety activities will include:

- Preparation and management of Field Safety Instructions for field trips to the WWTF
- Monitor Jacobs staff and subconsultant compliance with the Field Safety Instructions

Deliverables:

- Copies of the Jacobs Field Safety Instructions are available for review by the City upon request

Task 4. Owner Authorized Supplemental Services

This task adds additional budget for owner authorized supplemental services and will only be utilized upon receipt of written approval by the City Project Manager. Upon request for supplement services, Jacobs will prepare a scope of work and fee estimate for review and approval by the City and will only spend up to the authorized budget amount, unless otherwise approved by the City Project Manager. The budget established in this task is an allowance. Because the exact scope of supplemental services is not known, Jacobs is not obligated to spend more than the budget included in this allowance.

City Involvement:

- Request supplement services as needed.
- Review and approve draft scopes of work and fee estimates for supplemental services.

Assumptions:

- The budget for this task is an allowance.

Deliverables:

- As requested by the City and agreed to in approved scope of work and fee estimate.

Schedule

Table 1 presents a summary of the project schedule along with key client meetings, conference calls, and submittal dates.

Table 1. Schedule for WWTF Advanced Treatment Study Project

Task/Activity	Milestone / Submission Date
Notice to Proceed (City, assumed date)	July 15, 2020
Kick-off Meeting[1]	July 29, 2020
WWTF Staff submit questionnaire to Sunsweet	August 7, 2020
Sunsweet response (assumed)	August 28, 2020
Task 2.1 Conference Call (summarize past info, data, & gaps)	
Task 2.2 Sunsweet handling alternatives	September 7, 2020
Task 2.3 Effluent outfall concepts	
Task 2.4 Workshop	September 17, 2020
Draft Technical Memorandum (TM)	September 25, 2020
Client Consolidated TM Review Comments	October 14, 2020
Final TM	November 4, 2020

1. Draft Sunsweet questionnaire submitted with draft agenda and meeting materials.

Rates and Fees For Engineering Services

The estimated fee for the proposed engineering services is shown in Appendix A and is based on the rates as contracted for the City's Outfall and Diffuser Project.

Appendix A
Fee Estimate

Item 2B - City of Yuba City WWTF Advanced Treatment Study
APPENDIX A. JACOBS FEE ESTIMATE

CITY OF YUBA CITY PUBLIC WORKS DEPARTMENT WWTF Outfall and Diffuser	Total Hours	Total Labor	Travel	Expense	Subs	10% Expense/Travel Markup	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Amendment 02 - Item 2B - City of Yuba City WWTF Advanced Treatment Study									
Task 1 - Project Development Assistance	57	12,088	-	-	-	-	-	-	12,088
Subtotal - Task 1. Project Development Assistance	57	12,088	-	-	-	-	-	-	12,088
Task 2 - Advanced Wastewater Treatment Study	251	53,561	-	100	-	10	-	110	53,671
Subtotal - Subtask 2.1 - Review Existing Studies, Data, and Other Information	32	5,932	-	-	-	-	-	-	5,932
Subtotal - Subtask 2.2 - Sunsweet Characterization and Recommended Handling Option	68	15,532	-	-	-	-	-	-	15,532
Subtotal - Subtask 2.3 - Outfall Pipeline and Side-bank Discharge Location Concept Development	61	12,187	-	-	-	-	-	-	12,187
Subtotal - Subtask 2.4 - Alternative Development and Comparison with Current Technology	90	19,910	-	100	-	10	-	110	20,020
Task 3 - Project Management	70	14,355	593	-	-	59	-	652	15,007
Subtotal - Subtask 3.1 - External Project Meetings	32	7,214	593	-	-	59	-	652	7,866
Subtotal - Subtask 3.2 - Develop and Maintain PM Tools	6	1,010	-	-	-	-	-	-	1,010
Subtotal - Subtask 3.3 - Project Controls and Invoicing	18	2,811	-	-	-	-	-	-	2,811
Subtotal - Subtask 3.4 - Project Team Coordination	12	2,824	-	-	-	-	-	-	2,824
Subtotal - Subtask 3.5 - Health and Safety	2	496	-	-	-	-	-	-	496
Task 4 - Owner Authorized Supplemental Services	187	39,270	-	-	-	-	-	-	39,270
Subtotal - Task 4. Owner Authorized Supplemental Services	187	39,270	-	-	-	-	-	-	39,270
Advanced Treatment Study Task Budget	565	$ 119,274	$ 593	$ 100	$ -	$ 69	$ -	$ 762	$ 120,037

Yuba City WWTF Outfall and Diffuser Project
Contract Budget Authorization
City of Yuba City

Task	Proposed Contract Budget Amount	Original Authorized Amount and Date (7/11/18)	Amendment 1 Authorized Amount and Date (9/19/19)	Original + Amendment 1	Amendment 2 Authorized Debit Amount and Date (TBD)	Amendment 2 Authorized Credit Amount and Date (TBD)	Total Authorized Amount Amount To-Date
Task 1 - Predesign	$821,864	$821,864	$87,540	$909,404	$0	$71,758	$981,162
Task 2 - ROW Acquisitions	$185,305	$185,305	$0	$185,305	$0	$0	$185,305
Task 3 - Design	$570,155	$570,155	$0	$570,155	-$289,786	$0	$280,369
Task 4 - Enviromental Services/Permitting	$254,423	$254,423	$0	$254,423	$0	$35,053	$289,476
Task 5 - Bid Services	$57,819	$57,819	$0	$57,819	$0	$0	$57,819
Task 6 - Services During Construction	$239,751	$0	$0	$0	$0	$0	$0
Task 7 - Testing and Startup	$177,897	$0	$0	$0	$0	$0	$0
Task 8 - Construction Management	$458,476	$0	$0	$0	$0	$0	$0
Task 9 - Operations and Maintenance Manual	$21,362	$0	$0	$0	$0	$0	$0
Task 10 - Project Management	$503,617	$344,301	$10,294	$354,595	$0	$38,024	$392,619
Task 11 - CA SRF Loan Application Support	$50,000	$50,000	$0	$50,000	$0	$0	$50,000
Task 12 - Supplement Services	$499,564	$499,564	$65,043	$564,607	$0	$24,914	$589,521
Task 13 - Advanced Treatment Study	$0	$0	$0		$0	$120,037	$120,037
Total	**$3,840,234**	**$2,783,431**	**$162,877**	**$2,946,308**	**-$289,786**	**$289,786**	**$2,946,308**

Exhibit E

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Public Works

AMENDMENT NO. 3 TO THE AGREEMENT FOR PROFESSIONAL SERVICES
CH2M HILL ENGINEERS, INC.

CH2M Hill Engineers, Inc.
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

SUBJECT: Amendment No. 3 to Scope of Services for Yuba City WWTF - Outfall and Diffuser Project

This Amendment to the Agreement for Professional Services dated July 18, 2018 ("Third Amendment") is made and entered into as of the 1ST day of December 2020 by and between the City of Yuba City ("City") and CH2M Hill Engineers, Inc. ("Consultant").

Recitals

Whereas, by Professional Services Agreement dated July 18, 2018 ("Prime Agreement"), City entered into an agreement with Consultant for professional engineering services for the City's Outfall and Diffuser Project in the amount of $2,783,430.00.

Whereas, the City Manager approved Amendment No. 1 to the Prime Agreement on July 12, 2019.

Whereas, the City Manager approved Amendment No. 2 to the Prime Agreement on July 10, 2020.

Whereas, the Parties desire to amend the Prime Agreement for a third time to provide for additional tasks, updated scope of service, revised compensation, schedule of performance and other items related to the Project.

Agreement

In consideration of the foregoing Recitals and for good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the City and Consultant agree as set forth herein.

1. Section 3, Compensation, of the Prime Agreement is amended to add the following:

   For services rendered by Consultant under this Amendment No. 3 to the Prime Agreement as outlined above, Consultant is authorized to transfer $50,000 from Task 5 (Bid Services) of Prime Agreement to Task 13 (Advanced Treatment Study) to complete the scope of work described in Exhibit "A". The total cost of Amendment No. 3 shall not exceed $50,000. The City shall consider adding additional funds needed to complete Task 5 at a later date if decided to proceed with bidding a project.

2. Except as amended in this Amendment No. 3, the terms and conditions of the Prime Agreement shall remain the same and shall be in full force and effect.

3. A copy of the Prime Agreement is attached hereto as Exhibit "B" and, except as otherwise amended by this Third Amendment, is incorporated as though set forth in full herein.

4. A copy of Amendment No. 1 is attached hereto as Exhibit "C" and, except as otherwise amended by this Third Amendment, is incorporated as though set forth in full herein.

5. A copy of Amendment No. 2 is attached hereto as Exhibit "D" and, except as otherwise amended by this Third Amendment, is incorporated as though set forth in full herein.

6. Except as amended in this Third Amendment, the terms and conditions of the Prime Agreement, First Amendment, and Second Amendment shall remain the same and shall be in full force and effect. This Third Amendment is not effective until approved and executed by the authorized City representative.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement on the date and year first written above.

CITY:

CITY OF YUBA CITY, a municipal corporation

Diana Langley

Diana Langley, Interim City Manager

CONSULTANT:

CH2M HILL ENGINEERS, INC.

Name: John Schoonover

Title: Manager of Projects

Kindly execute the original and two (2) copies and return to City Hall at 1201 Civic Center Boulevard, Yuba City, CA 95993; the City will return a fully-executed copy to you via mail for your files.

Attachments:

Exhibit A: Amended Exhibit A to Prime Agreement
Exhibit B: Prime Agreement
Exhibit C: Amendment No. 1 (First Amendment)
Exhibit D: Amendment No. 2 (Second Amendment)

Exhibit A

1201 Civic Center Boulevard • Yuba City, California 95993 • YubaCity.net

Yuba City WWTF Outfall and Diffuser Project

Amendment 3 - Summary

This Amendment 3 is provided by CH2M HILL Engineers, Inc. (referred to as Jacobs in this Scope of Work) to the Yuba City Wastewater Treatment Facility Outfall and Diffuser Project (Project). Please note that on December 15, 2017, CH2M Hill Companies Ltd. became part of Jacobs Engineering Group Inc. (Jacobs). CH2M HILL Engineers, Inc. is now a wholly owned direct subsidiary of Jacobs. CH2M Hill Engineers, Inc. presently remains a separate legal entity and will continue to operate and conduct business.

Amendment 3 includes scope and funding to supplement follow-on work for the Advanced Treatment Study, initiated by Amendment 2, to evaluate alternative treatment options to the Project. The City directed Jacobs to stand-down work on transitioning to final design activities for the Project on February 24, 2020, while a brief Advanced Treatment Study was conducted.

City of Yuba City WWTF Advanced Treatment Study

In July 2020, the City of Yuba City initiated an Advanced Treatment Study to develop estimates for advanced treatment at the City's Wastewater Treatment Facility (WWTF), including options for handling existing flows and loads from the Sunsweet facility (reference Item 2B in Amendment 2). Advanced treatment was to be paired with a new side-bank discharge located near the City's existing diffuser at the Shanghai Falls in the Feather River. The projected effluent limits were developed by Larry Walker and Associates (LWA) and were provided by the City in a draft Technical Memorandum (TM) dated March 4, 2020.

Following completion of the Sunsweet handling options included in Task 2.2 of the Advanced Treatment Study and presentation to the City by conference call on September 17, 2020, the City requested that Jacobs stop work on the Advanced Treatment Project while the City determined whether the scope of the study still met the needs of the City to determine an appropriate course of action between the proposed Project and a potential advanced treatment project at the existing WWTF. During the month of September and October the City and Jacobs engaged in a series of conference calls to understand the City's needs and to develop a path forward to prepare a revised scope of work for the Advanced Treatment Study.

Amendment 2 to the Outfall and Diffuser Project added a new Task 13 for the Advanced Treatment Study, including tasks 13.1 – 13.4. Amendment 3 revises existing tasks 13.2.2 Sunsweet Handling Options and 13.3 Project Management, and adds the following new tasks:

- Task 13.5 Study Re-Scoping
- Task 13.6 Advanced Treatment Case Study Comparison
- Task 13.7 Screening Evaluation of Discharge Compliance

Attachments are included as follows:

- Attachment 1: City of Yuba City WWTF Advanced Treatment Study – Case Study Comparison and Discharge Compliance Screening Evaluation Scope of Work and Fee Estimate

Rates and Fees for Engineering Services

Fees for the proposed engineering services are shown in the following table and are based on the same rates as contracted for the City's Outfall and Diffuser Project.

Item	Services	Hours	Jacobs Total Labor	Total Expenses	Total Fee Estimate
1	Advanced Treatment Study – Case Study Comparison and Discharge Compliance Screening Evaluation	448	$89,234	$0	$89,234
2	Task 13.4 – Owner's Authorized Supplemental Services (Authorized in Amendment 2)	-187	-$39,270	$0	-$39,270
3	Transfer from Task 5 – Bid Services	-261	-$49,964	$0	-$49,964
	Amendment 3 Total	0	$0	$0	$0

Current Contract Value

The fee for the Amendment 3 scope of work is $89,234. This amount will be funded by the existing Task 13.4 Owner Authorized Supplemental Services budget of $39,720 and a transfer of approximately $50,000 from Task 5 Bid Services budget for the Project. Amendment 3 adds no additional funds to the total contract value. If the final design of the Project is authorized by the City in 2021, funds will be added by separate amendment to replace Task 5 funds.

The table below summarizes the new total contract value to date including this amendment.

Description	Total Fee Estimate
Original Contract Value	$2,783,430
Amendment 1	$162,877
Amendment 2	$0
Amendment 3	$0
New Contract Value	$2,946,307

Attachment 1: Advanced Treatment Study – Case Study Comparison and Discharge Compliance Screening Evaluation Scope of Work and Fee Estimate

Scope of Work for City of Yuba City WWTF Advanced Treatment Study – Case Study Comparison and Discharge Compliance Screening Evaluation

In July 2020 the City of Yuba City executed Amendment 2 to Jacob's existing Outfall and Diffuser Project to add, among other items, an Advanced Treatment Study to develop estimates for advanced treatment at the City's Wastewater Treatment Facility (WWTF), including options for handling existing flows and loads from the Sunsweet facility (reference Item 2B in Amendment 2). Advanced treatment was to be paired with a new side-bank discharge located near the City's existing diffuser at the Shanghai Falls in the Feather River. The projected effluent limits were developed by Larry Walker and Associates (LWA) and were provided by the City in a draft Technical Memorandum (TM) dated March 4, 2020.

Following completion of the Sunsweet handling options included in Task 2.2 of the Advanced Treatment Study and presentation to the City by conference call on September 17, 2020, the City requested that Jacobs stop work on the Advanced Treatment Project while the City determined whether the scope of the study still met the needs of the City to determine an appropriate course of action between the proposed Outfall and Diffuser project and a potential advanced treatment project and the existing WWTF. During the month of September and October the City and Jacobs engaged in a series of conference calls to understand the City's needs and to develop a path forward to prepare a revised scope of work for the Advanced Treatment Study.

Amendment 2 to the Outfall and Diffuser Project added a new Task 13 for the Advanced Treatment Study, including tasks 13.1 – 13.4. This amendment revises existing tasks 13.2.2 Sunsweet Handling Options and 13.3 Project Management, and adds the following new tasks:

- Task 13.5 Study Re-Scoping
- Task 13.6 Advanced Treatment Case Study Comparison
- Task 13.7 Screening Evaluation of Discharge Compliance

Unless specifically modified in this scope of work, all other tasks in the original Advanced Treatment Study amendment remain unchanged.

Task 13.2 – WWTF Advanced Treatment Study

Task 13.2.2 is modified as described below.

Task 13.2.2 Sunsweet Characterization and Recommended Handling Options

Jacobs will develop a new cost estimate for a Sunsweet equalization tank at Sunsweet as described in Jacob's Sunsweet Waste Handling Options presentation on September 17, 2020, Option 4a for flow equalization at Sunsweet.

City Involvement:

- Review proposed flow equalization concept.

Assumptions:

- New cost estimate will be a Class IV estimate appropriate for a feasibility-level estimate.

Deliverables:

- The flow equalization tank cost will be included in the draft Advanced Treatment Study.

Task 13.3 – Project Management and Meetings

The original Advanced Treatment Study anticipated completion by the end of September 2020. This change extends project management activities through March 2021 as described below.

JACOBS will complete project management tasks as outlined below. These activities are in addition to those already included in Amendment 2 – Item 2B Advanced Treatment Study. The budget assumes that overall project scope is as defined in the preceding Tasks.

Task 13.3.1 – External Project Meetings
JACOBS will attend the following project meetings with City staff:

- Biweekly Conference Call Progress Meetings. Meeting attendance will mostly be limited to Jacobs and City project managers.
- Meetings are expected to be conducted for up to 6 months between October 2020 and March 2021.
- Up to 2 Conference Calls for Tasks 13.6 and 13.7 below.

City Involvement:

- Review agendas and minutes from project progress meetings and alert Jacobs project manager of any questions or corrections.

Assumptions:

- Meeting dates and times and method (in-person or by conference call) will be as agreed to between Jacobs and the City and will be subject to travel restrictions implemented by either party or by federal, state, or local public meeting limitations.
- Up to 12 biweekly Progress Meetings between October 2020 and March 2020.

Deliverables:

- Conference call and Workshop agenda and meeting summaries.

Task 13.3.2 – Develop and Maintain Project Management Tools
JACOBS does not anticipate any additional effort on this task.

Task 13.3.3 – Project Controls and Invoicing
JACOBS project controls staff will prepare regular internal cost reports for review by the Jacobs Project Manager. Jacobs will also prepare monthly invoices and a Project Status Report including progress report narrative, scope change summary, and schedule and budget status. Monthly invoices Project Status Reports will be submitted to the City Project Manager for review and approval.

City Involvement:

- Review and approve monthly invoice and project status report.

Assumptions:

- Assumes 5 months of project cost reports, monthly invoices, and progress reports
- Budget status burn charts are not included

Deliverables:

- Monthly invoices and Project Status Reports

Task 13.3.4 – Project Team Coordination
Jacobs will conduct the following internal team coordination activities:

- Regular project team coordination meetings

Task 3.5 – Health and Safety
JACOBS does not anticipate any additional effort on this task.

Task 13.5 – Study Re-Scoping

Jacobs will assist the City in revising the WWTF Advanced Treatment Study project. Services provided in this task include:

- Prepare draft outlines for revised project scope of work.
- Attend conference calls with City staff to review draft outlines and to assist in project definition.
- Develop preliminary table - Estimated Nitrogen-Related Improvement Costs as Percentage of Total Improvement Costs for Case Studies
- Develop preliminary table - Screening Assessment of Means for Discharge Compliance with Water Quality Orders (WQOs)
- Project List Development - Contact preliminary list of agencies listed in Table 6-1 to ensure that the data is available prior to finalizing scope, fee, and schedule.

C**ity Involvement:**

- Review and comment on draft versions of project scope of work outlines.
- Attend conference calls.
- Approve final project scope of work.

Assumptions:

- Up to 3 conference calls of 1.5 hours each.
- Up to 2 draft versions of project scope of work outline, one draft SOW, and final SOW.

Deliverables:

- Draft outlines for revised project scope of work.
- Final revised project scope of work.

Task 13.6 – Advanced Treatment Study Case Study Comparison

Task Objectives

Attempt to obtain capital (e.g., capacity) and nutrient removal improvement costs from other North California Public Operated Treatment Works (POTWs) to provide Yuba City (City) staff a better understanding of relative capital and nutrient removal improvement costs. It is anticipated that the cost data will indicate that nutrient relative improvement costs represent the majority (e.g., 70 to 80 percent) of overall capital improvement costs.

Effort associated with obtaining readily available cost information from reports, data, and other information will be limited to estimated capital and operations and maintenance (O&M) costs and the specific agencies listed in Table 6-1.

Primary Activities

Complete Table 6-1 and conduct one 1.5-hour conference call to review results of findings and receive comments from the City.

City Involvement

Review list of agencies included in Table 6-1 and draft Table 6-1 once it has been completed by Jacobs.

Assumptions

- Case study costs (both capital and O&M) will be divided into “Nitrogen-Related Improvements” and “Non-Nitrogen Related Improvements” and shown in Table 6-1.
- No additional costs will be estimated, and no further effort will be made to estimate potential costs for constituents specific to Yuba City.
- Evaluation will NOT review or consider treatment approaches taken by other Northern California Valley POTWs to address constituents other than nitrogen.

Deliverables

Limited to Draft and Final versions of Table 6-1 with brief description and writeup limited to 2-3 pages and primarily consisting of the information contained in this scope of work followed by a brief summary of results and findings and limited to that described in Table 6-1. Deliverable is intended to be stand-alone and separate from the Advanced Treatment Study TM, but we can include as an appendix to the TM if requested.

Task 13.7 – Screening Evaluation of Discharge Compliance

Task Objectives

1) Develop updated reasonable potential analysis (RPA) of YC WWTF effluent discharge compliance with water quality criteria to identify potential dilution requirements for the Advanced Treatment Facility using the proposed submerged bank-side outfall, and

2) Develop screening-level dilution modeling for the proposed submerged bank-side outfall at site downstream of Shanghai Falls.

Primary Activities

- Develop an updated RPA to identify dilution requirements for the Yuba City WWTF effluent chemistry data to meet current water quality criteria (based on updated effluent chemistry data for November 2017 through September 2020), existing available background Feather River chemistry data through September 2020, and using reasonable potential analysis spreadsheets.
- Develop screening-level dilution modeling for the proposed submerged bank-side outfall at one site downstream of Shanghai Falls using CORMIX1 model for a single-port discharge with an elastomeric check valve port. Model cases will apply projected build-out effluent flows and Feather River critical discharge conditions as applied in the YC WWTF Outfall and Diffuser Project Predesign Report (Jacobs, February 2020). Summarize modeling inputs and results in a table, and provide recommendations for aquatic life and human health mixing zone boundaries.
- Conduct one 1.5 hour conference call to review results of findings and receive input and comments from the City.
- Develop text to summarize the results and assumptions of the RPA update and the discharge modeling to be included in the Advanced Treatment Study Technical Memorandum.

City Involvement

- Provide effluent chemistry data for November 2017 through September 2020 – including ammonia, metals, and priority pollutant organics.
- Provide the City's Feather River monitoring data for November 2017 through September 2020 – including ammonia, metals, and priority pollutant organics.
- Provide reviews and input during project review meetings and to the draft deliverable listed under this task.

Assumptions

- Feather River bathymetry will be based on June 2020 survey and current velocities calculated using the existing SRH-2D model output for Human Health (Harmonic Mean), Acute (1Q10), and Chronic (7Q10) river flow conditions.
- Ammonia water quality criteria applied will be based on EPA 2013 ammonia criteria assuming mussels are present, and CVCWA proposed ammonia criteria with mussels present – to represent conservative ammonia criteria conditions in the future.
- The dilution provided by the proposed submerged bank-side outfall in the Feather River will be constrained by the low river flow volume, water depths, and river channel geometry.
- Recommended aquatic life mixing zone boundaries will be in alignment with SIP and it is assumed the CVRWQCB will allow the City to utilize complete mix of river flow with the City effluent discharge to the river for the human health mixing region.
- Dynamic modeling of any constituents is not included.

Deliverables

- Updated RPA
- Dilution model summary table
- Meeting summary from review conference call
- Incorporate results into Advanced Treatment Study Technical Memorandum

Schedule

Table 1 presents a summary of the revised project schedule along with key client meetings, conference calls, and submittal dates.

Table 1. Revised Schedule for WWTF Advanced Treatment Study Project

Task/Activity	Milestone / Submission Date
Notice to Proceed (City, assumed date)	November 23, 2020
City to Provide Feather River Monitoring Data	December 4, 2020
Deliver Draft Table 6-1 and Summary	December 18, 2020
City Review Period	December 18 – January 8, 2021
City Closed for Holidays	December 24 – January 4, 2021
Task 13.6 Case Study Review Conference Call	January 12, 2021
Task 13.7 Discharge Compliance Review Conference Call	January 14, 2021
City provides direction to resume completion of Advanced Treatment Study	January 15, 2021
Deliver Draft Workshop Materials	January 29, 2021
City Reviews Workshop Materials	February 1-8, 2021
Task 2.4 Alternative Development Workshop	February 9, 2021
Draft Technical Memorandum	February 26, 2021
Client Consolidated TM Review Comments	March 12, 2021
Final TM	April 2, 2021

Fees Estimate and Rate Schedule

Appendix A presents our fee estimate for the changes to the Advanced Treatment Study. The Rate Schedule will be the same as the Outfall and Diffuser Project.

CITY OF YUBA CITY PUBLIC WORKS DEPARTMENT WWTF Advanced Treatment Study (ATS) Case Study Comparison and Discharge Compliance Screening Evaluation	Total Hours	Total Labor	Travel	Expense	Subs	10% Expense/Travel Markup	5% Subcontract Markup	Total Expenses	Total Fee Estimate
Task 13 Advanced Treatment Study Amended Tasks									
Task 13.2 - Sunsweet Characterization									
Subtotal - Task 13.2.2 Sunsweet Handling Options	12	$ 2,644	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,644
Task 13.3 - Project Management and Meetings									
Subtotal - Subtask 13.3 - Project Management and Meetings	164	$ 29,032	$ -	$ -	$ -	$ -	$ -	$ -	$ 29,032
Task 13.5 - Study Rescoping									
Subtotal - Task 13.5. Study Rescoping	101	$ 21,113	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,113
Task 13.6 - ATS Case Study Evaluation									
Subtotal - Task 13.6 ATS Case Study Evaluation	88	$ 19,754	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,754
Task 13.7 - Screening Evaluation of Discharge Compliance									
Subtotal - Subtask 13.7 - Screening Evaluation of Discharge Compliance	83	$ 16,692	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,692
Task 13 Advanced Treatment Study Amended Task Budget	448	$ 89,234	$ -	$ -	$ -	$ -	$ -	$ -	$ 89,234

Yuba City WWTF Outfall and Diffuser Project
Contract Budget Authorization
City of Yuba City

Task	Proposed Contract Budget Amount	Original Authorized Amount and Date (7/11/18)	Amendment 1 Authorized Amount and Date (9/19/19)	Amendment 2 Authorized Amount and Date (7/10/20)	Amendment 3 Authorized Amount and Date (TBD)	Total Authorized Amount Amount To-Date
Task 1 - Predesign	$821,864	$821,864	$87,540	$71,758	$0	$981,162
Task 2 - ROW Acquisitions	$185,305	$185,305	$0	$0	$0	$185,305
Task 3 - Design	$570,155	$570,155	$0	-$289,786	$0	$280,369
Task 4 - Enviromental Services/Permitting	$254,423	$254,423	$0	$35,053	$0	$289,476
Task 5 - Bid Services	$57,819	$57,819	$0	$0	-$50,000	$7,819
Task 6 - Services During Construction	$239,751	$0	$0	$0	$0	$0
Task 7 - Testing and Startup	$177,897	$0	$0	$0	$0	$0
Task 8 - Construction Management	$458,476	$0	$0	$0	$0	$0
Task 9 - Operations and Maintenance Manual	$21,362	$0	$0	$0	$0	$0
Task 10 - Project Management	$503,617	$344,301	$10,294	$38,024	$0	$392,619
Task 11 - CA SRF Loan Application Support	$50,000	$50,000	$0	$0	$0	$50,000
Task 12 - Supplement Services	$499,564	$499,564	$65,043	$24,914	$0	$589,521
Task 13 - Advanced Treatment Study	$0	$0	$0	$120,037	$50,000	$170,037
Total	**$3,840,234**	**$2,783,431**	**$162,877**	**$0**	**$0**	**$2,946,308**

ATTACHMENT 2

Jacobs

City of Yuba City Wastewater Treatment Facility Outfall and Diffuser Project

Yuba City Advanced Treatment Study

Contract Task 13

Final

April 30, 2021

City of Yuba City

City of Yuba City Wastewater Treatment Facility Outfall and Diffuser Project

Project No:	708865CH.A3.13
Document Title:	Yuba City Advanced Treatment Study
Document No.:	PPS0311210823SAC
Revision:	0
Date:	April 30, 2021
Client Name:	City of Yuba City
Project Manager:	Jason Junkert, Jacobs
Author:	Kevin Kennedy & Ryujiro Tsuchihashi, Jacobs

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April 30, 2021

Document History and Status

Revision	Date	Description	By	Review	Approved
0	3/18/2021	Draft for City Review	R. Tsuchihashi, D. Wilson, K. Kennedy, J. Junkert	CL	JJ
1	4/16/21	Draft Final for City Review	R. Tsuchihashi, D. Wilson, K. Kennedy, J. Junkert	CL	JJ
2	4/27/2021	Final	K. Kennedy	CL	JJ

Contents

Appendixes

Attachment

Tables

Figures

Acronyms and Abbreviations

°F	degree(s) Fahrenheit
µmhos/cm	micromho(s) per centimeter
ADWF	average dry weather flow
AMEL	average monthly effluent limit
AWEL	average week effluent limit
AWWA	American Water Works Association
BACWA	Bay Area Clean Water Agencies
Baseline Alternative	continued operation of the existing pure oxygen activated sludge process with necessary improvements identified in the Master Plan
BNR	biological nutrient removal
BOD_5	biological oxygen demand, 5-day
City	City of Yuba City
CLSM	controlled low-strength material
COD	chemical oxygen demand
ENR	Engineering News-Record
EPA	U.S. Environmental Protection Agency
EQ	flow equalization
gpd	gallon(s) per day
HDD	horizontal directional drilling
HDPE	high-density polyethylene
HPO	high-purity oxygen
kWh	kilowatt-hour(s)
lb/d	pound(s) per day
lb-N	pound(s) of nitrogen
lb-N/d	pound(s) of nitrogen per day
LF	linear foot (feet)
LOX	liquid oxygen
LWA	Larry Walker and Associates
MCL	maximum contaminant level
MG	million gallons
mg/L	milligram(s) per liter
MGD	million gallons per day
MLE	modified Ludzack-Ettinger

N	nitrogen
NH_3-N	ammonia-nitrogen
NO_3+NO_2-N	nitrate and nitrite-nitrogen
NPDES	National Pollutant Discharge Elimination System
NPV	net present value
O&M	operations and maintenance
POTW	Publicly Owned Treatment Work
Project	Outfall and Diffuser Project
PS	primary sludge
PSA	pressure swing adsorption
PV	present value
RAS	return activated sludge
RDT	rotary drum thickener
RPA	reasonable potential analysis
RWQCB	Regional Water Quality Control Board
SBFCA	Sutter Butte Flood Control Agency
SRT	solids retention time
Study	Advanced Treatment Study
TBEL	technology-based effluent limit
TDS	total dissolved solids
TIN	total inorganic nitrogen
TM	technical memorandum
TMDL	total maximum daily load
TN	total nitrogen
TRC	total residual chlorine
TSS	total suspended solids
U.S.	United States
UV	ultraviolet
VPSA	vacuum pressure swing adsorption
WAS	waste activated sludge
WQBEL	water quality-based effluent limit
WQO	water quality objective
WSE	water surface elevation
WWTF	wastewater treatment facility

1. Introduction

1.1 Background

Following completion of the Yuba City Wastewater Treatment Facility (WWTF) Outfall and Diffuser Predesign, the City of Yuba City (City) met with Jacobs on March 6, 2020, to discuss an alternative surface water discharge approach (that is, side-bank discharge) and potential ramifications to the WWTF. Several alternative treatment approaches were discussed at the meeting, along with current challenges imposed by the Sunsweet discharge, its impact on existing WWTF processes, and the inability of the existing pure oxygen activated sludge process to meet more stringent effluent discharge limits if imposed in the future. The alternatives discussed at the meeting were based on projected effluent limits for a potential side-bank discharge assuming no dilution credits (LWA 2020).

WWTF staff have elected to conduct the Advanced Treatment Study (Study), which resulted in this report, to validate their current WWTF improvement and regulatory compliance strategy. At the completion of the Yuba City WWTF Outfall and Diffuser Project (Project) predesign phase, the City was at the opportune time to conduct this Study, given the potential need to invest up to $35 million to construct the Outfall and Diffuser Project.

This Study compares relative costs, advantages, and disadvantages for continued operation of the WWTF (as configured currently) with one or two alternative configurations. These configurations were limited to meeting the projected ammonia-nitrogen (NH_3-N) and nitrate + nitrite-nitrogen (NO_3-N + NO_2-N) limits of 2.1 and 1.0 milligram of nitrogen per liter (mg-N/L), respectively (as defined in water quality objectives [WQOs] for the receiving water), described in Table 1 of the 2020 Larry Walker and Associates (LWA) technical memorandum (TM); and were to be based on more conventional technologies.

1.2 Purpose and Approach

The City executed Amendment 2 to Jacobs' existing Project to add the Study. The purpose of this Study was to:

- Provide a high-level cost comparison between the City's current plan, hereafter defined as the Baseline Alternative, and nitrogen removal with side-bank discharge alternatives and options for handling contributions from the Sunsweet facility at the City's WWTF.
- Inform the City whether investigations would be warranted to further any of the alternatives or Sunsweet options.

Advanced treatment consisting of nitrogen removal was paired with a new side-bank discharge located near the City's existing diffuser at Shanghai Falls in the Feather River. Results for advanced treatment and side-bank discharge were compared to the Baseline Alternative that includes continued operation of the existing pure oxygen activated sludge process and improvements recommended in the Master Plan (West Yost Associates 2020), combined with a new outfall pipeline extension and river diffuser, as described in the *Predesign Report* (Predesign Report). The projected side-bank discharge effluent limits were developed by LWA.

This Study approach consists of the following activities:

- Review existing studies, data, and other readily available information.
- Characterize Sunsweet flow, and develop and evaluate potential handling options.
- Develop and evaluate alternative outfall pipeline alignments for a new side-bank outfall location.

- Develop alternative approaches to upgrade the existing WWTF to meet proposed effluent limits for a side-bank discharge near the City's existing diffuser at Shanghai Falls in the Feather River. The proposed effluent limits were provided by the City in a draft TM (LWA 2020). This Study focuses on nitrogen removal, as it is the most substantial process upgrade necessary for changing from an outfall diffuser to a side-bank discharge. Other constituents and treatment alternatives could be considered as part of a subsequent, more in-depth effort. Sidestream treatment is included in each of the treatment alternatives described in this report.
- Compare alternative approaches and the Baseline Alternative, and provide recommendations derived from the findings and results. Develop rough order of magnitude cost estimates from the recently completed Master Plan and the Bay Area Clean Water Agencies' (BACWA's) Nutrient Reduction Study (2018).
- Complete a case study evaluation of similar advanced treatment projects in the Sacramento region.
- Develop a screening-level evaluation of discharge compliance for the proposed side-bank discharge.

1.3 Associated Evaluations

1.3.1 Sunsweet Handling Options Evaluation

The City's sewer system receives various industrial streams, the most significant being from Sunsweet, a prune processor and juice bottler. Because of the significant flow and organic loading contributions and variability from Sunsweet's waste stream to the WWTF, the City is interested in evaluating potential diversion or equalization of the stream, or a combination of these, including using the Sunsweet stream for energy production (such as diversion to anaerobic digester) or in advanced treatment (such as using organic matter for biological nutrient removal [BNR]).

Evaluation of the Sunsweet waste stream management options were summarized in an interim TM, and further discussed in the workshop conducted on September 17, 2020. Section 3 provides a summary of the evaluation, and Appendix A provides the interim TM.

1.3.2 Side-bank Outfall Evaluation

The concept for this Study includes cost savings resulting from discharging WWTF effluent at a location closer to the WWTF using a submerged single-port side-bank discharge instead of a multi-port diffuser situated on the riverbed and perpendicular to river flow. To allow effluent discharge from a single-port discharge, the WWTF will have to meet more stringent treatment requirements, as described in Section 5 and Appendix C of this report and in the LWA TM (2020). To estimate the cost savings from a single-port side-bank discharge, Jacobs developed two alternatives for a new outfall pipeline alignment and side-bank discharge locations into the Feather River. Section 4 summarizes this evaluation, and Appendix B provides details.

1.3.3 Screening Evaluation of Discharge Compliance

Effluent dilution requirements and outfall dilution capabilities for a submerged single-port side-bank outfall to comply with WQOs, criteria, and standards applicable to the Feather River were evaluated. This evaluation included an updated reasonable potential analysis (RPA) of the WWTF effluent discharge compliance with WQOs and criteria to identify potential dilution requirements for an advanced treatment facility that would discharge via a proposed submerged single-port side-bank outfall, as well as screening-level dilution modeling for the proposed submerged side-bank outfall at a site downstream of Shanghai Falls. Section 5 summarizes this evaluation, and Appendix C provides details.

1.3.4 Case Study Evaluation

The City had an interest in gaining a better sense of anticipated total costs rather than limiting costs to nutrient (nitrogen) removal only. Capacity-related and nutrient removal improvement costs for specific Northern California Publicly Owned Treatment Works (POTW) improvement projects or programs were obtained and used to determine relative total and nutrient removal improvement costs. Evaluation efforts were limited to obtaining readily available information from studies, reports, and other information primarily via internet searches and direct contact with agencies.

The outcome of the Case Study Evaluation was compiled in a separate memorandum (Appendix D). The information is integrated into this Study as described in Sections 7 and 8.

2. Basis of Evaluation

Important considerations for the advanced treatment portion of the Study are flows and loads, as well as the recommended rehabilitation and capacity-related improvements described in the Master Plan (West Yost Associates 2020). The Study's scope of work defined the basis of evaluation as 10.5 million gallons per day (MGD) average dry weather flow (ADWF) capacity as defined by the current discharge permit.

The Master Plan defined the planning basis for the near-term population and buildout population, and the buildout condition was further defined by the following four scenarios:

- Buildout Scenario 1: Existing major industrial flows and loads
- Buildout Scenario 2: Double existing major industrial flows and loads
- Buildout Scenario 3: 50% of existing major industrial flows and loads
- Buildout Scenario 4: No major industrial flows and loads

The near-term condition was defined with an average flow of 7.0 MGD, whereas the buildout conditions were defined with the average flow ranging between 12.8 and 14.5 MGD. As the near-term improvements will not accommodate the targeted 10.5 MGD ADWF, the upgrades needed up to 2040, which correspond to the expected flow of 10.2 MGD with existing major industrial input (Buildout Scenario 1), were used as a basis for the Baseline Alternative and other alternatives.

2.1 Review of Historical Data

To confirm the basis of evaluation, recent influent flows and loads, plant operational data, effluent flows, and water quality data were reviewed and compared with the flows and loads defined in the Master Plan (West Yost Associates 2020). Operational cost information was provided by the City to estimate current operations and maintenance (O&M) costs for the existing WWTF. For the Sunsweet waste stream evaluation, both the City and Sunsweet provided data, and additional information was obtained through the Sunsweet questionnaire completed in August 2020.

2.1.1 Wastewater Treatment Facility Influent Flows and Loads

The WWTF influent data for the period that followed the data used for the Master Plan were reviewed to confirm the Study basis and compare the outcome with the recommendations from the Master Plan (West Yost Associates 2020). The City provided recent influent and effluent flows and water quality data.

Table 1 provides a summary of WWTF influent data for July 2017 through August 2020. Flows and loads reported in Tables 3-7 and 3-8 of the Master Plan are also shown as references. While there are slight variations from the values reported in the Master Plan, the flows and loads basis used in the Master Plan are generally consistent with the most recent data. This finding confirmed the use of flows and loads defined in the Master Plan, as well as the plant improvements defined in the Master Plan for the Baseline Alternative in this Advanced Treatment Study.

Table 1. Wastewater Treatment Facility Influent Data Summary, July 1, 2017 through August 1, 2020

Data From	Flow, MGD	BOD, lb/d	COD, lb/d	TSS, lb/d	NH_3-N, lb/d
Annual average (2017 - 2020)	6.9	22,100	47,900	16,600	1,700
30-day maximum (2017 - 2020)	8.5	26,400	58,200	22,300	2,200
Master Plan average	6.8	24,700	52,500	18,300	1,800
Master Plan 30-day maximum	9.4	29,100	62,800	25,400	2,200

Notes:
BOD_5 = biological oxygen demand, 5-day
COD = chemical oxygen demand
lb/d = pound(s) per day
NH_3-N = ammonia-nitrogen
TSS = total suspended solids

2.1.2 Major Industrial Input (Sunsweet) Flows and Loads

Historical Sunsweet waste stream influent data were obtained for January 2017 through March 2020 and are summarized in Table 2.

Table 2. Sunsweet Data Summary, January 1, 2017 through March 19, 2020.

Day[a]	Flow, gpd	Loadings			Concentrations[a]		
		BOD, lb/d	COD, lb/d	TSS, lb/d	BOD, mg/L	COD, mg/L	TSS, mg/L
Monday	439,000	2,700	4,800	410	650	1,050	98
Tuesday	884,000	7,400	12,100	840	900	1,500	102
Wednesday	927,000	8,200	13,400	990	1,020	1,700	120
Thursday	928,000	8,100	13,300	1,010	990	1,600	120
Friday	912,000	8,000	13,000	1,040	1,000	1,600	130
Saturday	825,000	-	-	-	-	-	-
Sunday	492,000	-	-	-	-	-	-
Average	773,125	6,933	11,356	868	935	1,534	120

[a] Concentrations for each weekday were calculated from the sum of flows and loads. Average concentration values are the average of all available concentration data (not weighed for the flow contribution).

Notes:
- = not applicable
gpd = gallon(s) per day
mg/L = milligram(s) per liter

Compared with the WWTF's average flows and loads, BOD loading contribution to the WWTF is approximately 31%, whereas the TSS loading contribution is approximately 5%. The Sunsweet COD to BOD ratio is approximately 1.6, compared to approximately 2.2 at the plant influent. These results indicate that the Sunsweet waste stream is higher in biodegradable soluble organics than typical municipal wastewater influent.

Another notable observation is there is a significant decrease in flows and loads from Sunsweet during the weekend due to Sunsweet's processing schedule. The flow record showed lower flows, nearly half, for the data on Sundays and Mondays. While water quality data were not available for the weekends, the average organic loading for Mondays was nearly one-third of the loads in the middle of the week (that is, Wednesdays). As constituent loadings from domestic wastewater are not expected to change as significantly between weekdays and weekends, the relative organic load contributions from Sunsweet appear to vary significantly between the weekdays and weekends.

Compared to the data presented in the Master Plan (West Yost Associates 2020), there was a slight decrease in loading during weekdays. However, the difference was considered not significant enough to warrant a completely renewed evaluation of the data.

In summary, similar to the flows and loads to the WWTF, the flows and loads basis used for the major industrial input in the Master Plan was considered consistent with the most recent data. Section 3 provides an additional data analysis for the Sunsweet stream.

2.2 Project Alternatives

The Project alternatives evaluated in this Study are as follows:

- **Baseline Alternative:** Assume installation of a new outfall with a new diffuser in the Feather River, and continue with the existing high-purity oxygen (HPO) treatment with WWTF improvements and expansions, as described in the Master Plan for the 2040 condition (West Yost Associates 2020). Effluent to be discharged through the new outfall and diffuser.
- **Alternative 1:** Assume the same HPO treatment with improvements and expansions described in the Master Plan, and provide an add-on treatment process for nitrogen removal downstream of the HPO process. Effluent to be discharged through a new side-bank discharge.
- **Alternative 2:** Abandon HPO treatment, and construct a new biological nitrogen removal process (modified Ludzack-Ettinger [MLE] assumed) to allow side-bank discharge. For this evaluation, use the BACWA Study (2018) to develop cost estimates. Effluent to be discharged through a new side-bank discharge.

2.3 Assumptions

This section describes the assumptions made to develop and compare conceptual-level cost estimates and identify nonfinancial advantages and disadvantages.

The Study is limited to evaluating nitrogen only; it does not fully evaluate all constituents, and compliance may require further treatment or a dilution allowance. For example, with side-bank discharge, different water quality criteria may be applied, such as for coliform or disinfection by-products, which may require filtration or conversion to ultraviolet (UV) disinfection for compliance.

Following the discussion on the Sunsweet handling options alternatives (Section 3), all alternatives were assumed to include a flow equalization (EQ) tank and a new pipeline conveying the Sunsweet discharge separately to the WWTF site.

2.3.1 Side-bank Discharge Permitting Viability

The following assumptions were made about the viability of side-bank discharge permitting:

- Side-bank discharge will be based on a submerged, free pipe end, with a check valve and pile supports located downstream of Shanghai Falls.
- The outfall pipe and discharge concept will be based on the buildout peak-hour flow (Master Plan Table 3-19, Scenario 2).
- Viability of side-bank discharge permit approval with the Regional Water Quality Control Board (RWQCB), as well as mixing zone boundaries and dilution credits allowed, are undetermined. The conceptual design of the side-bank discharge included in this task does not imply or guarantee RWQCB approval.

2.3.2 Treatment Levels Assumed

The following treatment assumptions were made:

- The Baseline Alternative was defined by the Master Plan, including all upgrades and improvements listed through the 2040 trigger point. Treatment levels are anticipated to be the same as the existing WWTF to meet current discharge limits.
- Alternative 1 was developed using recent flows and loads data to derive the flows and loads at an ADWF of 10.2 MGD by proportionally increasing the values. The treatment requirement was set to meet the WQOs defined by LWA (2020, Tables 2 and 3), which corresponds to the effluent average monthly total inorganic nitrogen (TIN) of 12 mg/L for nitrogen.
- Alternative 2 was developed using the BACWA Study for the Level 2 treatment level. While the Level 2 in the BACWA Study was defined with effluent TIN level of 15 mg/L, instead of a TIN of 12 mg/L. The treatment process required to achieve a TIN level of 15 mg/L is similar to the slightly stricter level of treatment required to achieve a TIN of 12 mg/L. Given this is a high-level comparison, this approach was agreed to and considered valid for this Study.

2.3.3 Capital Cost

The following assumptions were made for the development of capital costs for each alternative:

- **Baseline Alternative:** As described in the Master Plan, including near- and long-term costs up to the 2040 trigger point. Use the $35 million estimated cost for the new outfall and diffuser as described in the Project Predesign Report (Jacobs 2020).
- **Alternative 1:** Include all costs included in the Master Plan. The cost for add-on treatment will be derived based on the price quote by supplier, including associated costs such as piping, site preparation, and markups as appropriate. Use the cost estimate for the side-bank discharge described in Section 5.
- **Alternative 2:** Assume abandoning HPO treatment, and constructing a new BNR process to allow side-bank discharge. Use the 2018 BACWA Study to develop a planning-level cost estimate. Use the average cost per volume treated, as derived in the BACWA Study, as the basis; and use 10.2 MGD as the flow rate. Use the cost estimate for the side-bank discharge described in Section 5.

For all alternatives, the capital costs estimated for the installation of the Sunsweet equalization tank and associated equipment, as well as a separate conveyance pipeline for the equalized Sunsweet waste stream from the Sunsweet site to the WWTF, were added to the total capital cost estimate. Section 3 provides the basis of equalization tank and conveyance cost estimate.

Cost estimates developed for this Study are considered conceptual and are feasibility level, early Project development stage costs. Costs were developed to evaluate rough order of magnitude costs and differences between alternatives.

Cost estimates for the alternatives used different approaches and relied mostly on the 2018 BACWA Study and 2020 Master Plan. Additional information was obtained from the case studies evaluation.

2.3.4 Operations and Maintenance Costs

This section describes the assumptions made for the O&M cost estimate for each alternative. The O&M cost estimates for the diffuser or side-bank discharge were added to the total O&M cost estimate, and both were derived based on a percentage of the estimated capital cost. The O&M cost for the Sunsweet EQ tank was assumed to be negligible compared to WWTF O&M costs. A total present value was calculated for each alternative using a 30-year planning period and net discount rate of 2%, which are the same parameters and values used in the 2018 BACWA Study. This total present value is expressed as a factor of 22 multiplied by the annual O&M costs.

- **Baseline Alternative:** Use the 3 years of data provided by the City for O&M costs, with an average of $13.1 million per year; and assume the O&M costs will stay the same.
- **Alternative 1:** Use the parametric cost estimating tool and estimated chemical usage to estimate the add-on treatment process O&M costs, which included:
  - Annual maintenance and repair at about 3% of the capital cost
  - Annual replacement cost at 3.3% of the capital cost
  - $0.13 per kilowatt-hour (kWh) for power, and chemical costs, including $3/gallon for an external carbon (non-methanol, conservative estimate)

  The total O&M costs for this alternative were determined by adding the add-on treatment process O&M cost to the Baseline Alternative.
- **Alternative 2:** Use the O&M cost estimate described in the 2018 BACWA Study, which calculated incremental additions to O&M costs due to conversion of the secondary treatment process to BNR. Add this cost to the O&M cost estimate for the Baseline Alternative, assuming the avoided cost due to abandoning of the HPO process is insignificant, as the BACWA Study O&M cost estimate was the incremental increase.

3. Sunsweet Waste Stream Handling Options

This section describes the Sunsweet data analysis and results of the handling options evaluation. Evaluating Sunsweet waste stream handling options was important because:

- Organic loading from Sunsweet constitutes nearly 30% of the plant's influent loading. If this stream can be handled separately or diverted to a different part of the WWTF (such as digesters and nutrient removal process), the aeration basins will have capacity to accept more municipal wastewater.
- Variability in Sunsweet's waste stream affects the HPO process's stability. If this stream can be handled separately or the loading equalized to distribute the loading more evenly, the HPO process will have more stable operation.

3.1 Handling Alternative and Components

The following handling alternatives and components were included in the handling evaluation:

- Separate treatment at Sunsweet or the WWTF
- Solids separation, with solids diverted to existing WWTF digesters
- Sunsweet discharge diversion to existing digesters
- Storing Sunsweet discharge, and redistributing the load to the WWTF influent stream
- Using the Sunsweet discharge stream as a carbon source for the BNR process (for denitrification filter)
- Repurposing Sunsweet WWTF facilities due to Sunsweet ceasing discharge

The technical feasibility of each of the handling alternatives and components was evaluated, along with potential impacts and benefits to the liquid treatment process (for example, added revenue). The intent of the evaluation was to select one of the alternatives or components as the recommended option and carry it forward to the Study. The results of the technical evaluation are described in the TM and presentation provided in Appendix A, and the evaluation results were discussed at a workshop on September 17, 2020.

3.2 Initial Result of Evaluation and Recommendation

Table 3 provides a summary of the technical and operational feasibility of the six Sunsweet stream handling alternatives and components. The initial recommendation for the Sunsweet stream handling option was not to carry forward any of the handling alternatives or components into the Study. However, during the workshop on September 17, 2020, it was reiterated by the City that the Sunsweet stream is causing process instability for the existing WWTF due to excessive organic loading Monday through Friday, followed by reduced loading during weekends.

The existing WWTF employs HPO process, which is a high-rate biological process. For the process to operate in a stable condition, the oxygen supply and oxygen demand in the bioreactor need to be in balance.

Recent studies of plant processes by the City indicate the instability in the sludge settling process is largely due to inability of the oxygen dissolution system to get enough oxygen into the first stage reactors during the high organic loadings brought on by the Sunsweet discharge.

With the limitations of the oxygen feed system and the high oxygen demand of the Sunsweet discharge, the plant's sludge settling becomes problematic toward the end of each week. Wednesday through Saturday, the secondary clarifiers typically have higher blankets, reflecting the decreasing sludge quality. Sunday is a day of recovery. Sunsweet flows typically resume early Monday morning, and the secondary clarifier blankets start rising again.

Plant operators strive to maintain a consistent, relatively low solids retention time (SRT) so that nitrification will not occur in the bioreactors. To achieve this, wasting rates are increased and decreased in a weekly cycle that correlates with plant loading rates.

As a result, the City requested that Alternative 4 EQ be carried forward to provide the ability to store Sunsweet discharge, including a separate conveyance to address flow capacity limitations in the collection system between the Sunsweet plant and the WWTF, and redistributing load to the WWTF influent stream.

Table 3. Summary of Sunsweet Stream Handling Options Evaluation

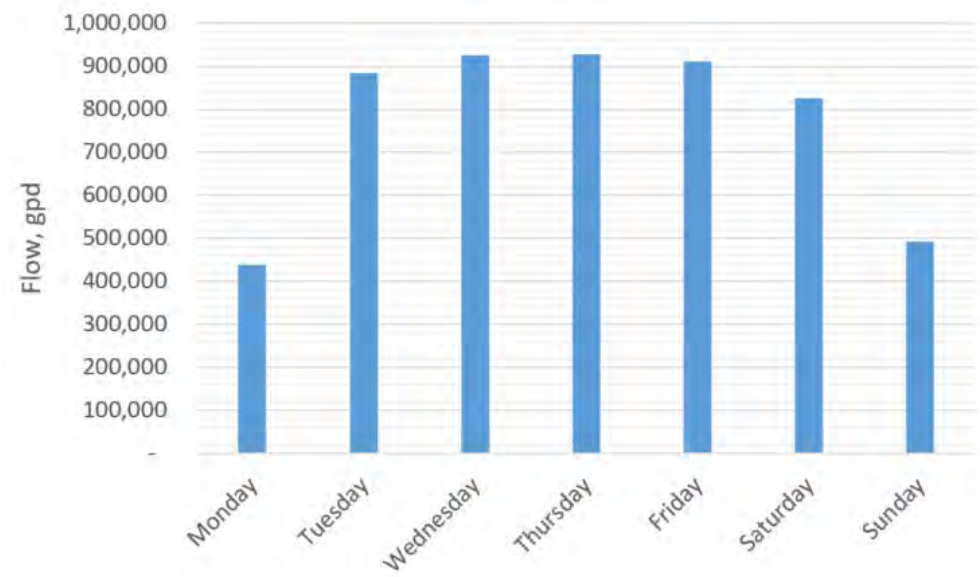
Option	Technical Feasibility	Operational feasibility
1) Provide separate treatment	Yes	Yes (additional unit process)
2) Employ solids separation	Yes	Yes (questionable benefit for additional unit process)
3) Send to digesters	No	-
4) Use EQ	Yes	Critical for stable operation for all alternatives
5) Use BNR	Maybe	Difficult to control, unstable dentification filter operation, insufficient carbon
6) Stop treatment	Yes	Additional capacity for municipal wastewater

3.3 Sunsweet Flow Equalization and Separate Conveyance

As discussed during the workshop on September 17, 2020, the critical issue related to the Sunsweet waste stream was the significant change in flow and organic loading to the WWTF during weekends when the Sunsweet stream is reduced. To mitigate for the loading variability during the weekend, EQ was considered and a planning-level cost estimate developed for the Study. Because the significant load variation to the WWTF would affect the biological treatment process in general, it was assumed that the cost associated with construction and operation would be included in all alternatives. Based on the discussion with the City, it was assumed for planning purposes that the EQ tank would be placed at the Sunsweet location. However, a separate conveyance system was included to account for potentially siting the EQ at the WWTF for the later evaluation should the Sunsweet stream flow equalization be implemented. Additional evaluation should be conducted to consider EQ siting (either at the Sunsweet site or the WWTF), and whether a separate conveyance would be necessary if EQ moves forward into predesign.

Table 2 summarizes average Sunsweet waste stream flows and loads, and Figure 1 shows a typical weekly flow profile. Based on the flows and loads data, the expected EQ volume to "flatten" loading into the WWTF was estimated to be approximately 600,000 gallons. For the planning-level estimate, the EQ tank volume of 1 million gallons (MG) was assumed for capital and O&M cost estimating purposes.

The EQ tank was assumed to be placed near the southeastern corner of the Sunsweet's main building. The EQ system would include duty and standby pumps to convey the screened waste stream after Sunsweet's existing pretreatment system to a new EQ tank, with another set of duty and standby pumps to discharge the waste stream to a separate conveyance system from the EQ tank (Figure 2). The separate conveyance system would be an 8-inch-diameter, 16,000-linear-foot (LF) pipeline, using the same route considered during the previous Industrial Pretreatment Study (HDR 2001). The 2001 study estimated the separate conveyance system capital cost to be $1.4 million. This 2001 estimate was incorporated into this Study by escalating the cost to 2019 using the *Engineering News-Record* (ENR) index (October 2019).



Notes: Data are recorded for the preceding 24 hours for each day of the week: Sunday flow represents flow between Saturday and Sunday, and Monday flow represents flow between Sunday and Monday (January 1, 2017 through March 19, 2020).

Figure 1. Sunsweet Waste Stream Average Weekly Flow Rate Profile.

Notes:

Red oval shape to the left is the location of existing pretreatment system; red circle to the right is the assumed EQ tank location.

Tank has the following identifying information Sun Growers, Inc. APN 58-060-027, Assessor's Map Book 58, page 06, County of Sutter, California 2016-1

Figure 2. Sunsweet Assumed Tank Location

Table 4 provides a summary of the estimated costs. The capital cost for the EQ tank system, including inlet pump station, EQ tank, and effluent pump station, is $3.9 million. The $1.4 million conveyance cost estimate developed in the 2001 Industrial Pretreatment Study was escalated to $2.4 million to reflect October 2019 dollars (the Master Plan's cost estimate year) using the ENR index. With the EQ tank and the conveyance pipeline combined, the total cost estimated for the Sunsweet EQ and conveyance system is $6.4 million (rounded). These cost estimates will need to be updated if the City elects to proceed with this work based on the escalated costs from 2001.

O&M costs for the EQ system were assumed to be negligible compared to O&M of the WWTF, so they were not added to the total O&M cost.

Table 4. Sunsweet Waste Stream Flow Equalization Tank and Separate Conveyance Cost Estimate

Cost Item	Direct Total ($)	Grand Total with Markups ($)
EQ Tank		
Sitework	55,000	120,500
Yard piping	28,100	62,200
1-MG tank	1,325,000	2,718,000
Pump station (to tank)	218,700	470,80
Pump station (to discharge)	231,300	497,300
Subtotal: EQ Tank	1,858,000	**3,900,000 (rounded)**
Conveyance		
8-inch, 16,000-foot pipeline (per 2001 study)	-	**2,400,000 (rounded)**
Total	-	**6,400,000 (rounded)**

4. Outfall Pipeline and Side-bank Discharge Location Development

Jacobs developed a conceptual outfall pipeline design to estimate approximate Project costs for the new outfall pipeline and side-bank discharge. As part of this conceptual design, Jacobs developed alternative locations for the new side-bank discharge, considering the following factors:

- Existing City outfall and site conditions
- Feather River hydraulics, geomorphology, and riverbank stability
- Length of new effluent pipeline to the new discharge site

Jacobs prepared a conceptual-level cost estimate for construction, O&M, and soft costs.

4.1 Existing City Outfall and Site Conditions

The City constructed a 1.6-mile-long, 24-inch-diameter outfall pipeline and six effluent disposal ponds as part of the original WWTF in 1972. The City later added a 24-inch-diameter diffuser in the Feather River near Shanghai Falls on the southern side of Shanghai Bend. The existing diffuser has forty 3.5-inch-diameter ports spaced at 4 feet.

In 1992, the City completed construction of a 30-inch-diameter parallel outfall pipeline from the WWTF to the western side of the Feather River western levee. The parallel outfall project retained the existing 24-inch-diameter levee crossing and river crossing, and added a 30-inch-diameter parallel pipe from the eastern side of the levee to the Feather River, including a new connection to the existing diffuser. The parallel outfall project also constructed a new 30-inch-diameter parallel pipe from the eastern side of the river along a new alignment to connect to the existing control box at Effluent Disposal Pond 1.

Following significant river flows in 2012, which damaged the existing 24-inch-diameter outfall pipeline crossing the river, an emergency project replaced the damaged pipe with a new 36-inch-diameter high-density polyethylene (HDPE) pipe installed by horizontal directional drilling (HDD).

As part of the Sutter Butte Flood Control Agency (SBFCA) Feather River West Levee Improvements Project in 2014, the City replaced the original 24-inch-diameter levee crossing pipe with a new parallel 24-inch-diameter pipe just north of the original levee crossing.

4.2 New Outfall Pipeline Considerations

As part of this Study, Jacobs developed two alternatives for a new outfall pipeline and side-bank discharge locations into the Feather River. The outfall pipeline attributes assumed for the Study include:

- Design Flow: 33.9 MGD (peak-hour wet weather flow at buildout) from Master Plan, Table 3-19, Scenario 2 (West Yost Associates 2020)
- Pipe Material, Strength, and Diameter: American Water Works Association (AWWA) *C906, Polyethylene (PE) Pressure Pipe And Fittings, 4 In. Through 65 In. (100 Mm Through 1,650 Mm), For Waterworks,* HDPE, DR 21, 42-inch diameter
- Discharge Condition: Submerged pipe end with a nominal 36-inch-diameter elastomeric check valve
- Pipe End Support: Pile supported with rock placement for scour protection
- Pipe Bedding and Pipe Zone Backfill: Controlled low-strength material (CLSM)

- Trench Backfill: Native material
- Dewatering: Limited to portion of pipe in river channel and bank

4.3 Horizontal Alignment Alternatives Evaluation

Jacobs developed and evaluated two alternative outfall pipeline alignments and river discharge locations at the preferred discharge site. Figure 3 shows the locations of each alternative alignment from the existing outfall pipeline to the Feather River. These alternatives are summarized as follows:

- **Alignment Alternative 1 - Western bank south of existing Shanghai Falls.** This alternative begins at a new connection to the City's existing 30-inch-diameter outfall on the eastern side of the existing Feather River western levee. The alignment then proceeds approximately 1,400 feet south to a location approximately 300 feet south of the end of the Shanghai Falls chute. This location is anticipated to require two pipe supports in the riverbed. The stability of the riverbed and water depths at the site is uncertain and dependent on the stability and rate of change of the Shanghai Falls crest.
- **Alignment Alternative 2 – Eastern bank south of existing Shanghai Falls.** This alternative begins at a new connection to the City's existing 30-inch-diameter outfall on the eastern side of the Feather River just north of the existing Pond 1 Distribution Box. The alignment then proceeds approximately 500 feet west to a location just south of the eastern end of the Shanghai Falls chute. This location is anticipated to require three pipe supports. The stability of the riverbed and water depths at the site is uncertain and dependent on the stability and rate of change of the Shanghai Falls crest.

Both alignments were evaluated and compared based on the following characteristics:

- Riverbed depth and stability
- Reliability
- Environmental documentation
- Permitting
- Stakeholder and public impacts
- Property ownership
- Constructability
- Existing utilities
- O&M
- Estimated capital cost

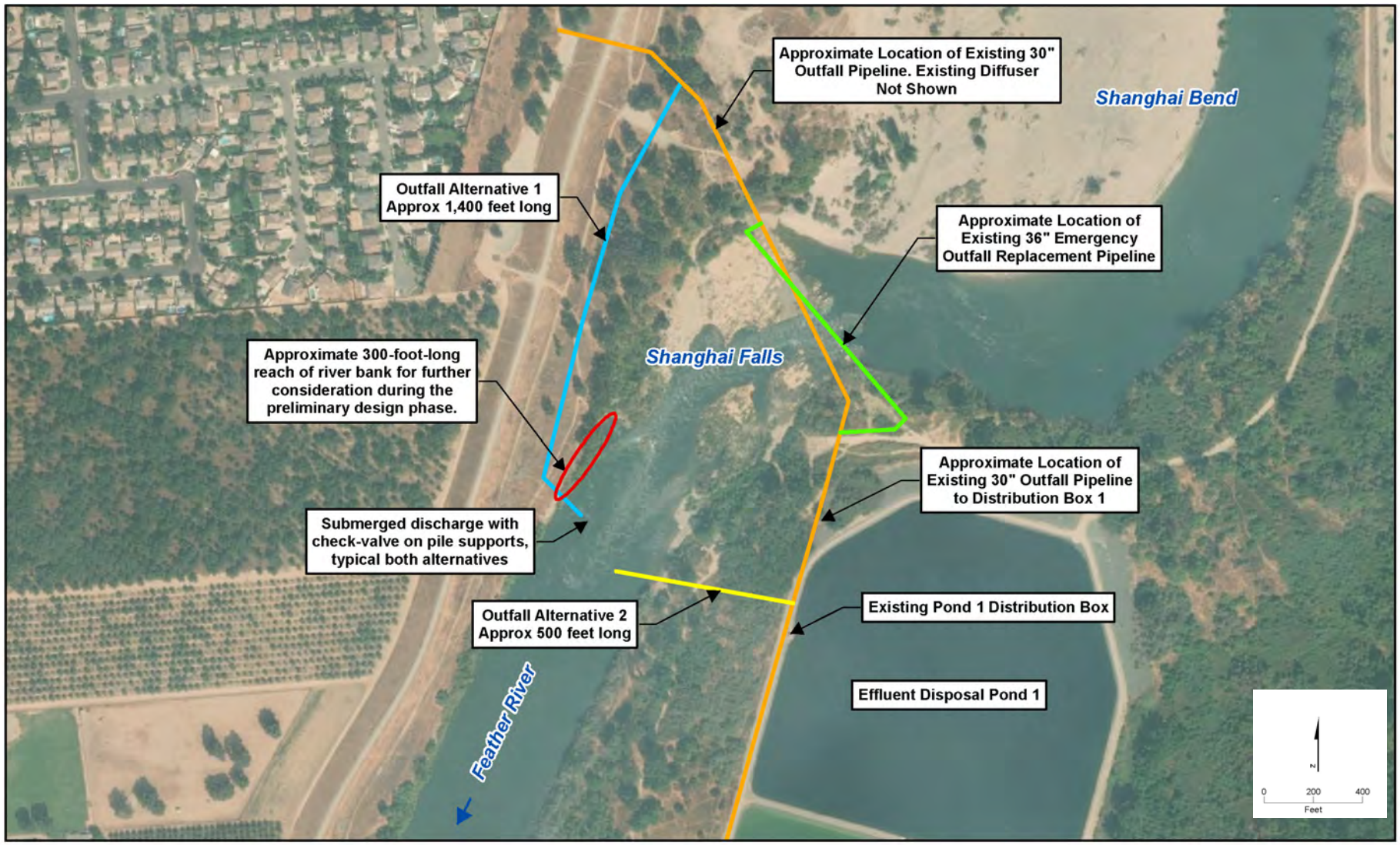
Appendix B provides the full alignment alternatives evaluation TM.

4.4 Capital Cost Estimate

Table 5 summarizes the estimated capital cost for each alignment alternative.

Table 5. Estimated Capital Cost Range

Alternative	Estimated Capital Cost ($ million)
1	0.9-1.7
2	0.4-0.7



Service layer credits: Source: Esri, Maxar, Earthstar Geographics, USDA FSA, USGS, Aerogrid, IGN, IGP, and the GIS User Community. Created 2009; updated 2021.

Figure 3. Outfall Pipeline Alignment Alternatives

4.5 Recommendations

Jacobs conducted an Outfall Concept Review conference call with City staff on September 10, 2020, to review the preliminary pipeline alignment evaluation summary. The location approximately 300 feet downstream of Shanghai Falls was recommended as the preferred site for the side-bank discharge (Alternative 1). The City concurred with this recommendation, and the Project cost for Alignment Alternative 1 is included in the Study, as described in Table 6. Total Project cost includes an allowance for soft costs, such as:

- Engineering
- Permitting
- Easement acquisition
- Environmental mitigation
- Engineering services during construction
- Startup and testing
- Construction Management

Table 6. Side-bank Outfall Project Cost (Based on Alignment Alternative 1)

Cost Element	Cost ($ million)	Notes
Capital costs	1.7	Includes +50% estimate accuracy envelope
Soft costs	0.3	20% of construction cost
O&M costs	0.2	0.5% of construction cost annually * 22 (NPV factor)
Total Project Cost	**2.2**	Net 30-year present value

Note:

NPV = net present value

5. Screening Evaluation of Discharge Compliance

As part of the Study, dilution requirements and outfall dilution capabilities for a submerged single-port side-bank outfall to comply with WQOs, criteria, and standards applicable to the Feather River were identified and compiled into a TM (Appendix C). This TM includes an updated RPA of Yuba City WWTF effluent discharge compliance with WQOs and criteria to identify potential dilution requirements for an advanced treatment facility that would discharge via a proposed submerged single-port side-bank outfall, and screening-level dilution modeling for the proposed submerged side-bank outfall at a site downstream of Shanghai Falls.

This section briefly reviews the following:

- Regulatory basis for effluent discharge compliance with WQOs and criteria
- Effluent limits established in the National Pollutant Discharge Elimination System (NPDES) Order and Permit
- How target design dilutions have been developed
- What dilution performance can be expected for the proposed submerged side-bank outfall for Yuba City WWTF effluent from an advanced treatment facility for nutrient control

5.1 Effluent Limits and Target Design Dilutions

The WWTF 2019 NPDES Order and Permit includes technology-based effluent limits (TBELs) and water quality-based effluent limits (WQBELs), including some WQBELs developed based on the applicable Clean Water Act Section 303(d) listings and total maximum daily loads (TMDLs) for the Feather River. The existing TBELs will remain in future permits, and most WQBELs will remain with minor changes.

The 2019 Order and Permit includes WQBELs for effluent constituents that showed a reasonable potential to exceed WQOs or criteria, and these include:

- Ammonia
- Total residual chlorine (TRC)
- Copper
- Dichlorobromomethane
- Mercury
- Nitrate plus nitrite
- pH
- Settleable solids
- Total coliform

TRC effluent limits were set equal to the acute and chronic aquatic life criteria – with no dilution assumed – and these will remain unless the RWQCB allows dilution credits for TRC.

In addition, dynamic modeling was applied in the 2019 Order and Permit to calculate WQBELs for ammonia and copper discharges to the Feather River. Dynamic modeling was based on the existing WWTF Outfall 001 diffuser (multi-port diffuser situated at Shanghai Falls crest in the Feather River), and the modeling results provided accurate calculations of the WQBELs necessary for ammonia and copper discharges.

For this screening evaluation, projected effluent ammonia concentrations developed by LWA (2020) were applied to represent the average week effluent limit (AWEL) and average monthly effluent limit (AMEL). A screening evaluation RPA was developed to identify target dilutions required for the Yuba City WWTF

discharge of effluent metals, detected organic chemicals, and conventional pollutants. The screening RPA is based on WWTF effluent data collected from January 2014 through November 2020 and background Feather River data for the same period. Based on these screening-level RPAs, effluent concentrations of ammonia, cyanide, bis (2-ethylhexyl) phthalate, and conductivity would require the greatest dilutions for the design of the submerged single-port side-bank outfall for the Yuba City WWTF Advanced Treatment Facility.

Table 7 summarizes the dilution factors needed for Yuba City WWTF effluent (with nutrient treatment) to meet WQOs and criteria in the Feather River. This evaluation does not represent ammonia and copper dilutions based on dynamic modeling that may result in lower dilutions required for compliance. In addition, this evaluation assumes that the RWQCB will assign dilution credits and mixing zone boundaries for the submerged single-port side-bank discharge; however, dilution allowance is decided the CVRWQCB and not guaranteed.

Table 7. Dilution Factor Screening-level Evaluation[a]

Effluent Parameters Needing Dilution	Dilution to Meet Acute Aquatic Life Criteria	Dilution to Meet Chronic Aquatic Life Criteria	Dilution to Meet Human Health Criteria
Aluminum (total)	-	2	-
bis (2-ethylhexyl) Phthalate	-	-	4
Copper (total recoverable)	2	2	-
Conductivity	-	-	16 [b]
Cyanide (free)	2	4	-
Dichlorobromomethane	-	-	3
Lead (total recoverable)	-	1	-
Manganese (total recoverable)	-	-	2
Mercury (total recoverable)	-	-	2
Nitrate and nitrite-nitrogen	-	-	1
TDS	-	-	1
Zinc (total recoverable)	1	-	-
Ammonia-nitrogen (total) – based on 1999 EPA criteria	2	1 (30-day)	-
Ammonia-nitrogen (total) – based on 2013 EPA criteria	2	2 (30-day) / 1 (4-day)	-
Preliminary Dilutions Predicted for Submerged Side-bank Outfall under Critical River Flows (range from minimum to maximum potential allowable dilutions)	**2-4.3**	**18-37**	**30-62**

[a] Dilution factors required for Yuba City WWTF Advanced Treatment Facility compared to preliminary predicted outfall dilutions

[b] Electrical conductivity is a long-term average of 150 µmhos/cm applied as a rolling average over 10 years (Basin Plan objective) and a secondary drinking water MCL is 900 µmhos/cm.

Notes:

µmhos/cm = micromho(s) per centimeter
EPA = U.S. Environmental Protection Agency
MCL = maximum contaminant level
TDS = total dissolved solids

In addition, the Yuba City WWTF discharge needs to comply with the temperature WQO in the Feather River. The Basin Plan (RWQCB 2018) limits temperature increases to less than 5 degrees Fahrenheit (°F) due to a point source. Based on a 95th percentile effluent temperature of 85°F and a 90th percentile river temperature of 69.5°F, a dilution of only 4 is needed at the chronic mixing zone boundary for the discharge to comply with the WQO for temperature in the Feather River.

5.2 Side-bank Outfall Design for Discharge Compliance

The preliminary outfall configuration was developed and modeled as a concept for a new submerged side-bank outfall to discharge effluent from the Yuba City WWTF Advanced Treatment Facility. The Feather River site identified for this replacement outfall for the existing Outfall 001 diffuser is located downstream of the Shanghai Falls rapids. This conceptual-level design assumes that the riverbed and water depths at the outfall discharge site will be stable; however, riverbed stability is uncertain and dependent on the Shanghai Falls crest's stability and rate of change .

Screening-level dilution modeling of the proposed submerged side-bank outfall was developed in accordance with the state's guidance for dilution credits and mixing zones, defined in the State Implementation Plan.

The EPA supported CORMIX 1 model was applied to model the submerged single-port outfall fitted with a 36-inch-diameter elastomeric check valve port. The model cases all applied projected buildout effluent flows for the WWTF and Feather River critical discharge flow and stage conditions. These buildout effluent flows and critical river flow conditions were previously developed and applied in the *WWTF Outfall and Diffuser Project Predesign Report* (Jacobs 2020).Outfall dilutions would be higher than these predictions for effluent flows less than buildout flows.

The conditions applied for the submerged single-port outfall are summarized as follows:

- Submerged single-port outfall with 36-inch-diameter elastomeric check valve located at depth below Shanghai Falls in tailrace region
- Outfall terminus located approximately 50 feet off western shoreline at a discharge depth of -15 feet below the water surface elevation (WSE) at 1Q10 and 7Q10 low river flow conditions
- Outfall terminus at more than 5 feet above riverbed
- Outfall modeling-projected WWTF buildout effluent flows and three critical low river flow conditions: 1Q10, 7Q10, and harmonic mean flows
- Model-predicted dilution factors at distances downstream of the outfall port used to define proposed acute and chronic mixing zone boundaries for aquatic life, and a chronic human health mixing zone boundary
- Predicted dilution factor at the proposed Acute Mixing Zone boundary (20 feet) of 4.3
- Predicted dilution factor at the proposed Chronic Mixing Zone boundary (200 feet) of 37
- Predicted dilution factor at the proposed Human Health Mixing Zone boundary (500 feet) of 62

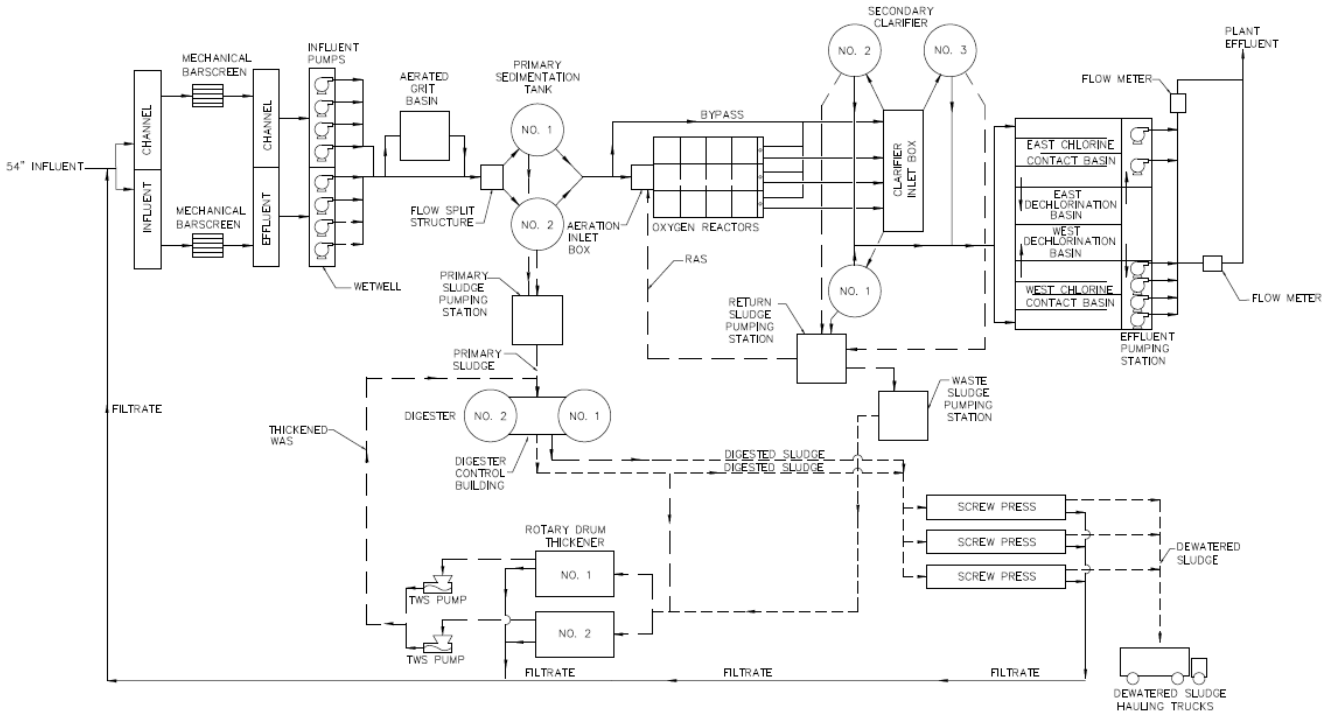
This evaluation indicates that the parameters detected in existing Yuba City WWTF effluent can meet WQOs and criteria in the Feather River using a submerged side-bank outfall with check valve port and advance nutrient treatment. The estimated dilution factors at these proposed acute and chronic mixing zone boundaries are preliminary and would be subject to review and approval by the CVRWQCB for use in the NPDES Order and Permit. The CVRWQCB may elect to assign the minimum dilution credits and mixing zone boundaries they deem necessary for discharge compliance. Once dilution credits are reduced in the Order and Permit, they cannot be increased.

6. Alternative Analysis

An alternative analysis was conducted to compare the Baseline Alternative (continuing operation of the existing WWTF with necessary improvements as identified in the Master Plan) with the two alternatives described in this section.

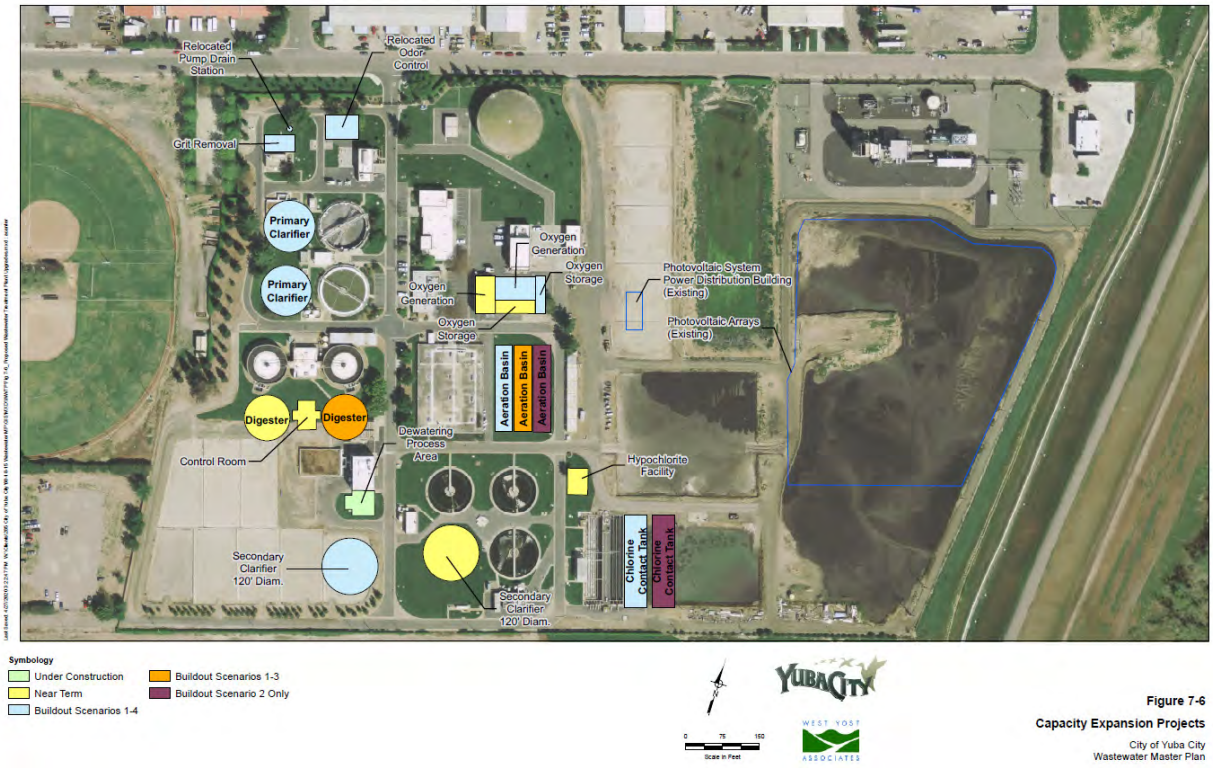
6.1 Baseline Alternative

Figure 4 is a process flow diagram of the existing WWTF. The Baseline Alternative assumes that all of the recommended improvements described in the Master Plan (West Yost Associates 2020) are implemented, up to the 2040 trigger. Figure 5 shows the recommended improvements.



Source: Master Plan (West Yost Associates 2020)

Figure 4. Existing Wastewater Treatment Facility Process Flow Diagram



Source: Master Plan (West Yost Associates 2020)

Notes: For Scenario 1, near-term is shown in yellow. Buildout capacity projects in light blue and orange are included in the estimate.

Figure 5. Baseline Alternative and Improvements.

With the Baseline Alternative, the future discharge will rely on the new outfall and diffuser. The estimated Project cost for the outfall was estimated at $35 million, and the cost for EQ and separate conveyance of equalized Sunsweet waste stream was estimated to be $6.4 million. Combining all expected work, the total capital cost was estimated to be $144 million as a present value, as described in Table 8.

Table 8. Improvement Up to 2040 Trigger

Timeline	Description	Estimated Cost ($ million)
Sunsweet EQ and conveyance	EQ tank at Sunsweet and separate conveyance	6.4
Near-term improvements, 1-5 years	Replace LOX tank, evaporator, and other auxiliary equipment to address condition-related issues	1.05
Near-term improvements, 6-10 years	Condition-related improvements: Replace PSA system with an entirely new VPSA system	5.71
Near-term improvements, 2022	Anaerobic digesters	19.7
Near-term improvements, 2024	Secondary clarifiers, RAS pumps	10.1
Near-term subtotal		36.6
2029	Chlorine contact tanks, chlorine feed system	2.6
2030	Pure oxygen aeration basins, oxygen generation	32.0
2035	Influent pump station, screw press	2.3
2040	Primary clarifiers, PS pumps, pure oxygen aeration basins, secondary clarifiers, RAS pumps, WAS pumps, RDTs	29.5
Future capacity needs 2029 - 2040 trigger points subtotal		66.4
Nitrogen removal	Not required	0
Outfall and diffuser	Replacement of existing	35
Total up to 2040		144

Source: Master Plan (West Yost Associates 2020)

Notes:

LOX = liquid oxygen
PS = primary sludge
PSA = pressure swing adsorption
RAS = return activated sludge
RDT = rotary drum thickener
VPSA vacuum pressure swing adsorption
WAS = waste activated sludge

O&M costs were estimated from the approved budgets and expenditures provided by the City for fiscal years 2017 and 2018, 2018 and 2019, and 2019 and 2020. Based on the provided data, the average annual O&M costs of $13.1 million per year was used for the Study. These annual WWTF O&M costs were used for all alternatives without discounting the avoided cost due to process changes for nitrogen removal, assuming that the additional (or avoided) cost is embedded in the O&M costs estimated for the nitrogen removal O&M costs, which were estimated separately for Alternatives 1 and 2.

O&M costs associated with the outfall and diffuser were calculated based on 0.5% of the capital cost. For the outfall and diffuser, the estimated O&M costs were $0.18 million. The total annual O&M costs were estimated to be $13 million (rounded), as summarized in Table 9. Using the 2% net discount rate and 30-year period, the NPV of the O&M costs was estimated to be $297 million.

Table 9. Baseline Alternative Annual Operations and Maintenance Cost Estimate and 30-year Net Present Value

Item	Cost ($ million)
Nitrogen removal	0
Non-nitrogen	13.1
Outfall	0.18
Total (rounded)	13
30-year NPV	297

6.2 Alternative 1

For Alternative 1, an add-on treatment process will be added after the existing HPO treatment and secondary clarification processes, prior to disinfection, to remove nitrogen. All existing processes and expansion projects up to 2040 are included in this alternative's costs. Effluent will be conveyed by a new outfall pipeline and discharged via a new side-bank outfall, instead of the currently planned outfall pipeline and diffuser.

The add-on treatment to the existing WWTF considered for this alternative are nitrifying filters followed by denitrification filters. To develop a planning-level cost estimate, Veolia was contacted to obtain a planning-level quote for the Biostyr process with denitrification. Figures 6 and 7 show Alternative 1.

A planning-level construction cost estimate was developed using Jacobs' parametric cost estimating tool for the add-on process, and all other non-nitrogen WWTF improvement costs were carried forward from the Baseline Alternative. The outfall capital cost was estimated to be $2 million, as shown in Table 9. Table 10 provides a summary of capital costs for Alternative 1.

O&M cost for the add-on treatment was estimated at $3.1 million per year. More than half of this O&M cost was attributed to the purchase of an external carbon source required for denitrification. The estimated cost for the external carbon was conservative, as a nonhazardous carbon source at $3/gallon was assumed; whereas, lower-cost external carbon may be available, including methanol, which is a hazardous and combustible chemical that will require additional safety measures for installation.

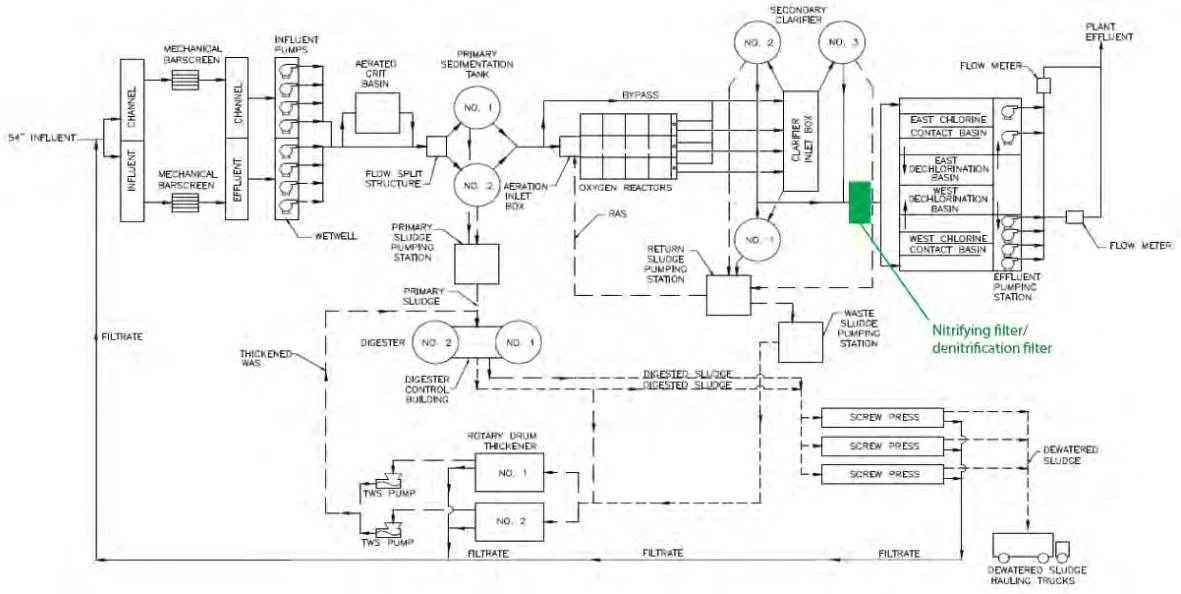
O&M costs associated with the side-bank outfall were based on 0.5% of the capital cost. For the side-bank outfall, the estimated O&M cost was $0.01 million. The total annual O&M costs were estimated to be $16 million (rounded), as summarized in Table 11. Using the 2% net discount rate and a 30-year planning period, the NPV for the O&M cost was estimated to be $363 million.

Table 10. Alternative 1 Capital Cost Estimate Summary

Item	Cost ($ million)
Sunsweet EQ and separate conveyance	6.4
Non-nitrogen, near-term improvements	33.6
Non-nitrogen, 2029 – 2040	66.4
Nitrogen removal	65
Side-bank outfall	2.0
Total up to 2040	176

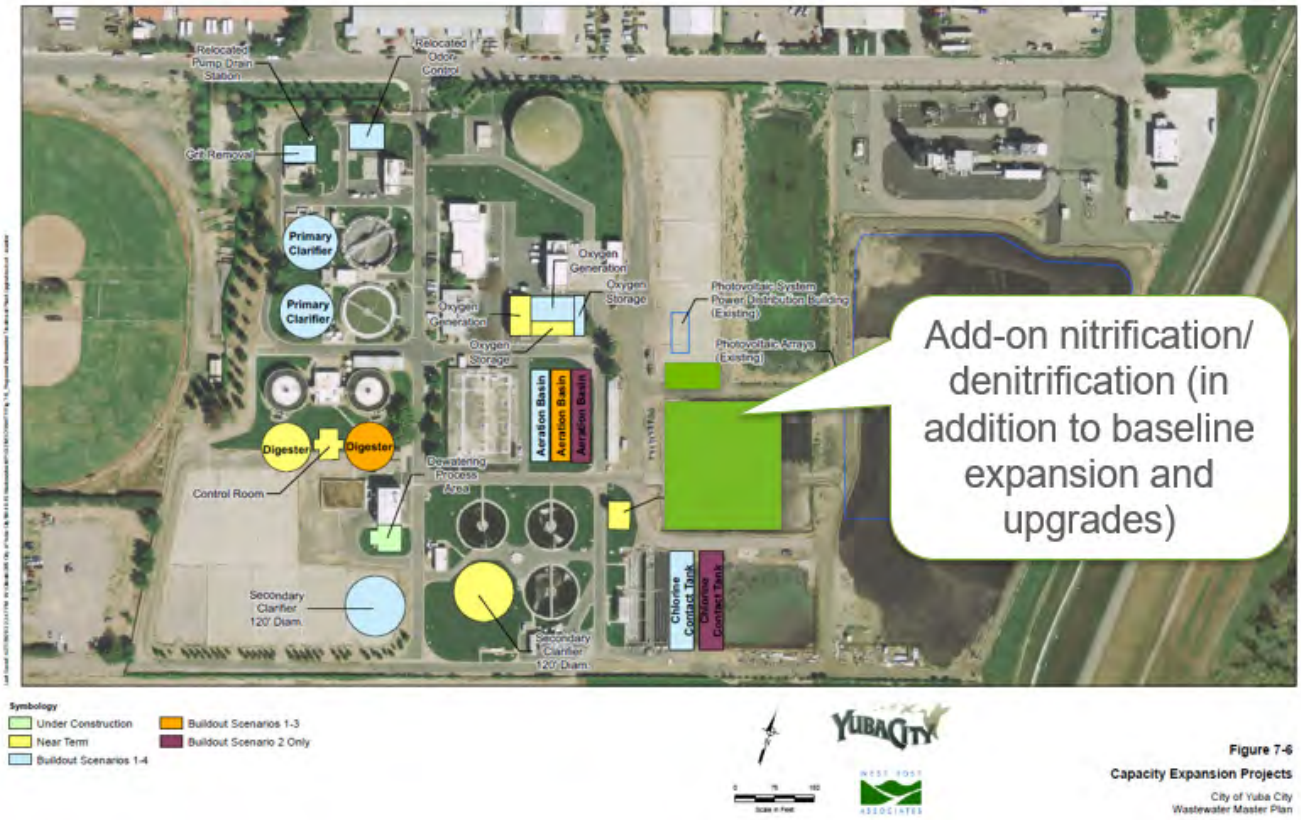
Table 11. Alternative 1 Annual Operations and Maintenance Cost Estimate and 30-year Net Present Value

Item	Cost ($ million)
Nitrogen removal	3.1
Non-nitrogen	13.1
Side-bank outfall	0.01
Total (rounded)	16.2
30-year NPV	363



Notes: Based on the Baseline Alternative, as shown in the Master Plan (West Yost Associates 2020), with add-on treatment

Figure 6. Alternative 1 Process Flow Diagram



Notes: Based on the Baseline Alternative, as shown in the Master Plan (West Yost Associates 2020), with add-on treatment

Figure 7. Alternative 1 Site Layout

6.3 Alternative 2

In this alternative, the existing HPO tanks and the oxygen generation facility will be abandoned in place, and new aeration basins will be configured for biological nitrogen removal, such as an MLE process. As this alternative will provide oxygen by ambient air aeration, improvements and upgrades associated with the continuing operation of the HPO system will not be necessary, such as an oxygen generation facility upgrade.

Figure 8 shows the Alternative 2 concept in a process flow diagram, and Figure 9 shows a site layout. Effluent will be conveyed by a new outfall pipeline and discharged via a new side-bank outfall, instead of the currently planned outfall pipeline and diffuser.

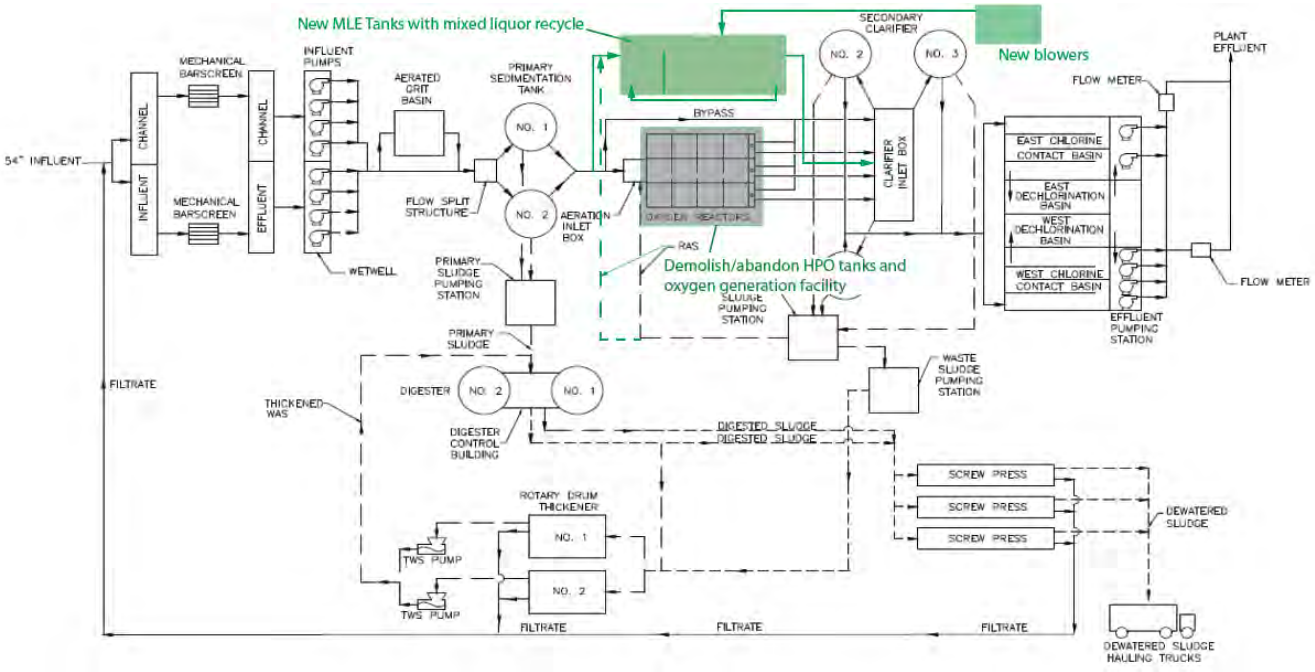


Figure 8. Alternative 2, Separate Biological Nitrogen Removal Process Concept

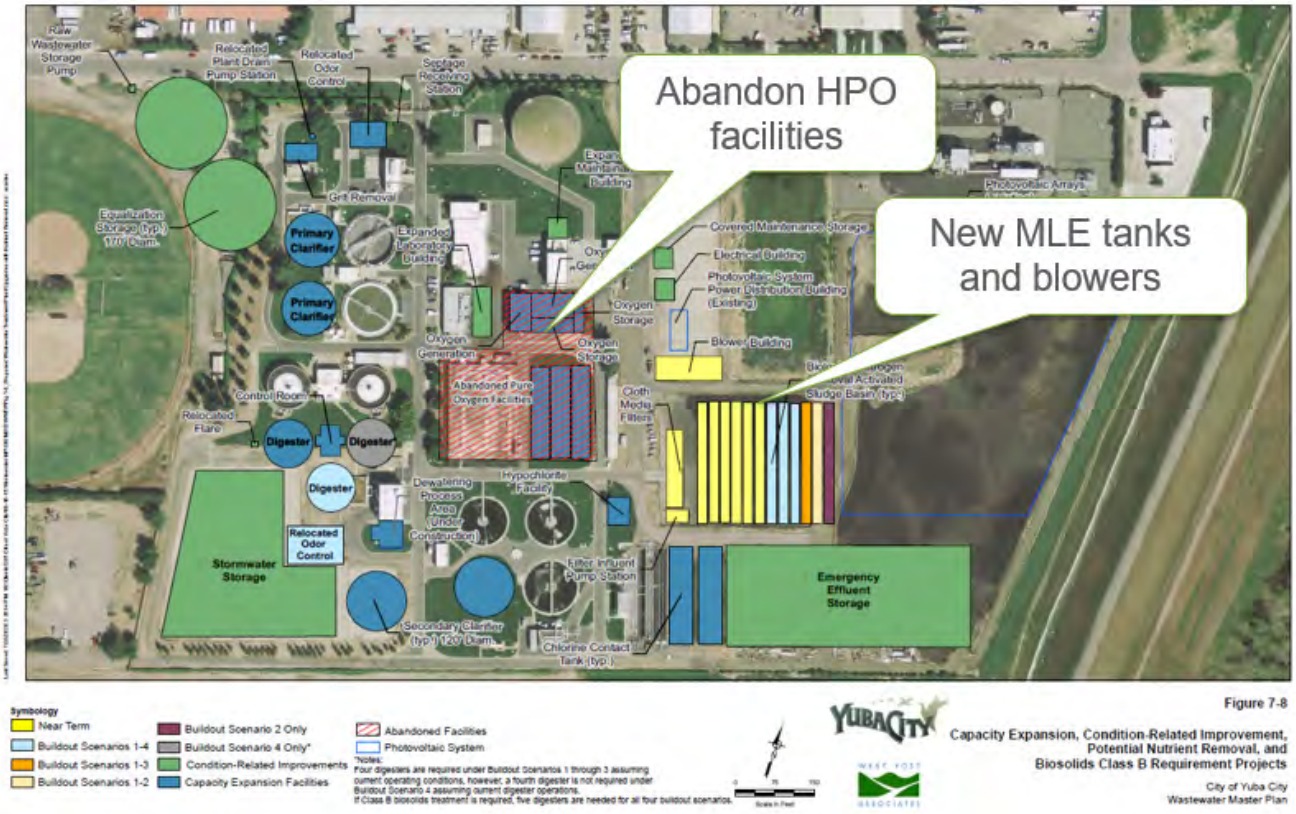


Figure 9. Alternative 2 Site Layout

The estimated cost for Alternative 2 was derived from the 2018 BACWA Study. BACWA conducted a study on 37 participating agencies to optimize or upgrade the treatment plants to meet future Level 2 nutrient limits. It was agreed by Jacobs and the City that this Study would use the capital and O&M costs presented in the BACWA Study. The basis of the BACWA Study was a target effluent TIN of 15 mg/L, instead of total nitrogen (TN) limit of 10 mg/L. However, the treatment process used generally to achieve the TIN of 15 mg/L is similar to the process to be used to achieve the TN level of 10 mg/L, even though slight configuration and operational modifications would be necessary. Therefore, the average cost reported in the BACWA Study for Level 2 was deemed close enough to be used for this high-level analysis. Table 12 provides a summary of the BACWA Study overall cost estimate.

The BACWA Study presented O&M costs as incremental cost increases associated with an upgrade to BNR, in terms of the 30-year present value (PV), assuming a 2% discount rate. The annual O&M costs were calculated using the following formula:

$$\textit{Annual O\&M cost increase due to BNR upgrade (\$/year)} = \textit{(30-year PV)} \times \frac{Discount\ rate}{1-(1+Discount\ rate)^{(-n)}}$$

Table 12. Bay Area Clean Water Agencies' Study Level 2 Average Cost

Parameter	Value
Number of plants evaluated	37
Total flow, MGD	869
Total capital cost, $ million	6,976
Total O&M PV costs (calculated total annual O&M), $ million	2,443 (110)
Total PV (30-year PV), $ million	9,240
Average unit costs, $/gpd adjusted for January 2018	10.8
Per unit flow capital cost, $/gpd	8.03
Per unit flow O&M cost, $/gpd	2.81 as 30-year PV (or $0.126/gpd/year)

With the estimated $8.03/gpd capital cost and 10.2-MGD ADWF for planning, the capital cost estimate for the BNR process is $81.9 million.

The near-term and buildout capital costs not related to nitrogen removal (non-nitrogen removal) include all capital costs listed in Table 8, less the work related to improvements for the HPO system (avoided cost). The total non-nitrogen capital cost up to the 2040 trigger was estimated to be $73 million, (a total of $30 million in avoided cost). As with Alternative 1, the outfall capital cost was estimated to be $2 million.

Combining with the Sunsweet EQ and conveyance cost of $6.4 million, the total capital cost for Alternative 2 based on the nitrogen removal process capital cost of $81.9 million derived from the 2018 BACWA Study was $163 million, as summarized in Table 13.

At $0.126/gpd annual O&M costs, the estimated annual O&M cost for the BNR part of the treatment process will be $1.3 million per year. O&M costs associated with the side-bank outfall were calculated as 0.5% of the capital cost. For the side-bank outfall, the estimated O&M costs were $0.01 million. The total annual O&M costs were estimated to be $14.4 million (rounded), as summarized in Table 14. Using the

2% net discount rate and a 30-year planning period, the NPV for the O&M costs was estimated to be $322 million.

Table 13. Alternative 2 Capital Cost Estimate Summary

Item	Cost ($ million)
Sunsweet EQ and separate conveyance	6.4
Non-nitrogen, near-term improvements	29.8
Non-nitrogen, 2029 – 2040	43.2
Nitrogen removal	82
Side-bank outfall	2.0
Total	163

Table 14. Alternative 2 Annual Operations and Maintenance Cost Estimate and 30-year Net Present Value

Item	Cost ($ million)
Nitrogen removal	1.3
Non-nitrogen	13.1
Side-bank outfall	0.01
Total (rounded)	14.4
30-year NPV	322

6.4 Technical (Nonfinancial) Comparison of Alternatives

In addition to the cost evaluation and comparison, the nonfinancial aspects of the alternatives were assessed and compared. Table 15 provides a summary of the technical comparison of the alternatives presented at the workshop in the February 9, 2021.

Table 15. Nonfinancial Comparison of Alternatives

Comparison Item	Baseline Alternative	Alternative 1: Add-on Treatment	Alternative 2: New BNR Process (MLE)
Meet Effluent Limits	▪ Includes new outfall and diffuser in Feather River	▪ Side-bank discharge limits met by add-on treatment	▪ Side-bank discharge limits met by new BNR reactors
Advantages	▪ No major treatment upgrade (continue upgrades per the Master Plan)	▪ Continue existing HPO operation ▪ Adds process for ammonia removal	▪ No additional carbon needed for denitrification ▪ Avoids expansion of HPO ▪ Adds process for ammonia removal
Disadvantages	▪ Existing system is somewhat unstable (may be mitigated with upcoming upgrades and Sunsweet EQ) ▪ No process for ammonia removal	▪ Existing system is somewhat unstable (may be mitigated with upcoming upgrades and Sunsweet EQ) ▪ Operation of additional process ▪ External carbon addition required for denitrification ▪ Side-bank – limited local installation	▪ Operation of new process ▪ Abandons existing infrastructure ▪ Side-bank – limited local installation

7. Comparison with Case Study

A comparison of capacity and nutrient removal related improvements costs for specific Northern California POTWs was conducted to provide City staff with a better understanding of anticipated total costs. The information developed for the case study comparison was presented and discussed with Yuba City staff on January 12, 2021. Based on the values presented and discussions with City staff, the following recommendations are provided:

- **Total Capital Costs**. The average (mean) percentage of about 51% was used for estimating total costs from nutrient removal costs derived from the 2018 BACWA Study. This is less than the percentage originally anticipated of 60 to 80%.
- **O&M Costs**. Nutrient removal O&M costs are anticipated to be 25 to 40% of total O&M costs.

A more detailed description of the case study comparison activities, results, and recommendations can be found in the Case Study Comparison TM provided in Appendix D.

8. Costs, Comparison of Alternatives, and Recommendations

8.1 Sidestream Treatment Costs

The City requested that treatment of the return stream from solids processing be included in the overall assessment, noting that the existing WWTF is nearing its ammonia discharge limit, and the return stream from the sludge thickening and dewatering processes are major contributors to ammonia loading at the WWTF. According to the Master Plan (West Yost Associates 2020), the ammonia loading to the WWTF influent was 1,800 lb/d between 2014 and 2018, of which approximately 900 lb/d came from the return stream from solids processing. The evaluation was conducted for the reduction of ammonia discharge loading at 900 lb/d for the preliminary evaluation, based on the current ammonia loading from the return flow.

Sidestream treatment capital and annual O&M costs were estimated from the 2018 BACWA Study. The BACWA Study assumed deammonification sidestream treatment and facilities with similar size sidestream ammonia loadings; Table 16 summarizes important information from the sidestream cost data obtained from the BACWA Study. Sidestream costs presented in Table 16 were included in Tables 17 and 18.

Table 16. Bay Area Clean Water Agencies' Study Ammonia Reduction Sidestream Treatment Costs

Cost Item	Delta Diablo	Oro Loma Sanitary District	Average	Yuba City (2040 trigger)
ADWF, MGD	19.5	20.0	19.8	10.2
Ammonia discharge loading reduction, lb-N/d	770	1,070	920	**900**
Capital cost, $ million	14.5	19.0	16.8	**16.5**
Capital cost, $/lb-N reduced	1.7	1.6	1.7	-
Annual O&M cost, $ million	0.4	0.5	0.4	**0.4**
Annual O&M cost, $/lb-N reduced	1.4	1.3	1.4	-

Notes:

lb-N = pound(s) of nitrogen

lb-N/d = pound(s) of nitrogen per day

Historical WWTF 2013 through 2020 treated effluent ammonia concentrations and additional return stream data collected in March and April 2021 were reviewed by Jacobs and discussed with City staff. More recent data (March 2019 through December 2020) indicate average 30-day treated effluent ammonia concentrations are getting close to the average monthly ammonia limit of 31 mg-N/L.

Additional return stream data for March and April 2021 indicated that the average ammonia loading from the screw press filtrate return stream is approximately 800 lb/d, as estimated in the Master Plan; whereas, the contribution from other return streams may be greater than the Master Plan's estimate, and the total filtrate loading may be greater than 900 lb/d. The amount of data are limited, and City staff will continue to conduct additional monitoring.

The screw press filtrate return stream is more concentrated (generally around 1,000 mg/L) than other return streams, and it is anticipated that segregating the concentrated screw press filtrate for sidestream

treatment is likely a preferred approach, so the use of 900 lb/d at this point for the planning-level assessment was deemed appropriate.

Based on this finding, it is recommended that treated effluent ammonia concentrations be reduced. Side-stream treatment is the most cost-effective and logical way to achieve this goal, given its lower capital cost, ability to isolate 50% of the ammonia load, and ability to treat cost-effectively. Other considerations include (1) implementing side-stream treatment now would reduce capital costs associated with implementation of nitrogen removal as part of a future plant upgrade and (2) implementing side-stream treatment now may not require rate adjustments whereas nitrogen removal implementation typically requires rate review and adjustments to accommodate the significant capital and O&M cost increases.

8.2 Estimated Costs

Table 17 summarizes the estimated capital, O&M, and total NPV costs for each alternative. Costs include the recommended Sunsweet handling and outfall options, either with a new diffuser or new side-bank outfall. Consideration of sidestream treatment is included in Table 17 and described in Section 8.1.

Table 17 columns are described as follows. The following number, title, and description correspond with the column number.

1) **Improvement Components:** System and discrete elements of Yuba City's wastewater system costs were developed for.
2) **Baseline Alternative:** Estimated costs associated with continued operation of the HPO activated sludge process, new outfall, and diffuser, and all of the recommended improvements described in the Master Plan (West Yost Associates 2020), Buildout Scenario 1, up to the 2040 trigger.
3) **Alt 1. Add-on Nitrogen Removal**. Assumes a new treatment process will be added after the existing HPO treatment and secondary clarification processes, prior to the disinfection, to remove nitrogen. Treated effluent will be conveyed to a new side-bank discharge. All of the recommended improvements described in the Master Plan, up to the 2040 trigger, will be implemented. Tables 10 and 11 provide details about capital and O&M cost development.
4) **Alt 2a. BACWA with Side-bank Discharge.** Assumes the existing HPO tanks and oxygen generation facility will be abandoned in place, and new aeration basins installed for biological nitrogen removal. Treated effluent will be conveyed to a new side-bank discharge. As this alternative will provide oxygen by ambient air aeration, improvements and upgrades associated with the continuing operation of the HPO system will not be necessary, such as an oxygen generation facility upgrade. All other recommended improvements described in the Master Plan, up to the 2040 trigger, will be implemented. Nitrogen removal costs were derived from BACWA, and non-nitrogen costs were derived from the Master Plan; Tables 13 and 14 provide further details.
5) **Alt 2b**. **BACWA and Case Study Hybrid**. Same components as Alternative 2a, but non-nitrogen capital costs were derived from the Case Study Evaluation 0.51 factor, and nitrogen removal O&M costs were derived from the 25 to 40% Case Study Evaluation range.
6) **Alt 2bb. Master Plan and Case Study Hybrid**. Same components as Alternative 2a, but nitrogen removal capital costs were obtained from Table 8-13 of the Master Plan and based on the average of Buildout Scenarios 2 and 4; non-nitrogen capital costs were derived from the Case Study Evaluation 0.51 factor; and nitrogen removal O&M costs were derived from the 25 to 40% Case Study Evaluation range.
7) **Yuba City Master Plan**. Same components as Alternative 2a, but nitrogen removal capital costs were obtained from Table 8-13 of the Master Plan and based on the average of the Buildout Scenarios 2

and 4; non-nitrogen capital costs were derived from the Master Plan; and nitrogen removal O&M costs were derived from the 25 to 40% Case Study Evaluation range.

Table 17. Estimated Capital, Operations and Maintenance, and Total Net Present Value Costs

1	2	3	4	5	6	7
	Baseline Alternative	**Nitrogen Removal Evaluation by Various Methods**				
Improvement Components	**Master Plan and Outfall Project**	**Alt 1. Add-on Nitrogen Removal**	**Alt 2a. BACWA with Side-bank Discharge**	**Alt 2b. BACWA and Case Study Hybrid**	**Alt 2bb. Master Plan and Case Study Hybrid**	**Yuba City Master Plan**
Capital Cost, $ million						
Sunsweet	6.4	6.4	6.4	6.4	6.4	6.4
Side-stream ammonia removal	16.5	16.5	16.5	16.5	16.5	16.5
Non-nitrogen	103.0	103.0	73.0	78.7	69.8	73.0
Nitrogen removal	0	65	81.9	81.9	89.2	89.2
Discharge (outfall)	35	2.0	2.0	2.0	2.0	2.0
Total	161	193	180	185	184	187
O&M Cost, $ millions						
Side-stream ammonia removal	0.4	0.4	0.4	0.4	0.4	0.4
Nitrogen removal	-	3.1	1.3[a]	3.5	3.5	3.5
Non-nitrogen removal	13.1	13.1	13.1[a]	13.1	13.1	13.1
Discharge	0.18	0.01	0.01	0.01	0.01	0.01
Total annual	13.7	16.7	14.8	17.1	17.1	17.1
Total 30-year NPV	307	373	331	382	382	382
Grand Total, $ million						
Grand Total	468	566	511	567	566	569

[a] The estimated Alternative 2a nitrogen removal O&M cost appears to be low given that the case study comparison found that nutrient removal O&M is about 25 to 40% of the total O&M costs. The estimated Alternative 2a nitrogen removal O&M shown of $1.3 million is slightly less than 10% of the current WWTF O&M budget.

A higher-resolution approach for presenting alternative costs was prepared by eliminating costs common to all alternatives. Table 18 presents the estimated capital, O&M, and total NPV costs for each alternative for this approach.

Table 18. Higher-resolution Approach for Estimating Capital, Operations and Maintenance, and Total Net Present Value Costs

Improvement Components	Baseline Alternative	Nitrogen Removal Evaluation by Various Methods				
	Master Plan and Outfall Project	Alt 1. Add-on Nitrogen Removal	Alt 2a. BACWA with Side-bank Discharge	Alt 2b. BACWA and Case Study Hybrid	2bb. Master Plan and Case Study Hybrid	Yuba City Master Plan
Capital Cost, $ million						
Sunsweet	-	-	-	-	-	-
Side-stream ammonia removal	-	-	-	-	-	-
Non-nitrogen	103.0	103.0	73.0	78.7	69.8	73.0
Nitrogen removal	0	65	81.9	81.9	89.2	89.2
Discharge (outfall)	35	2.0	2.0	2.0	2.0	2.0
Total	138	170	157	163	161	164
O&M Costs, $ million						
Side-stream ammonia removal	-	-	-	-	-	-
Nitrogen removal	-	3.1	1.3	3.5	3.5	3.5
Non-nitrogen removal	-	-	-	-	-	-
Discharge	0.18	0.01	0.01	0.01	0.01	0.01
Total annual	0.18	3.1	1.3[a]	3.5	3.5	3.5
Total 30-year NPV	3.9	69.7	28.9	78.6	78.6	78.6
Grand Total, $ million						
Grand Total	142	240	186	241	240	243

[a] The estimated Alternative 2a nitrogen removal O&M cost appears to be low, given that the case study comparison found that nutrient removal O&M is about 25-40% of the total O&M costs. The estimated Alternative 2a nitrogen removal O&M cost of $1.3 million is slightly less than 10% of the current WWTF O&M budget.

8.3 Comparison of Alternatives

Comparison of the values shown in Table 17 indicate that the Baseline Alternative is:

- The lowest-cost alternative with respect to capital, O&M, and NPV
- Approximately $24.8 million (13%) less than the average of the other alternatives with respect to capital cost
- $63 million (17%) less than the average of the other alternatives with respect to total 30-year NPV of O&M costs
- Approximately $88 million (16%) less than the average of the other alternatives with respect to grand total costs.

Comparison of the values shown in Table 18 indicate that the Baseline Alternative is:

- The lowest-cost alternative with respect to capital, O&M, and NPV
- Approximately $25 million (15%) less than the average of the other alternatives with respect to capital cost
- Approximately $63 million (94%) less than the average of the other alternatives with respect to O&M costs
- Approximately $88 million (38%) less than the average of the other alternatives with respect to grand total costs

8.4 Recommendation and Proposed Next Steps

Based on the comparison of the alternatives and finding that the Baseline Alternative has the lowest costs in terms of capital, O&M, and NPV, Jacobs recommends the City select and implement the Baseline Alternative. The advantage the Baseline Alternative has over the others is reduced O&M due to not having to remove nutrients. The average NPV of annual O&M costs was about twice that of the average capital costs. In other words, O&M costs had twice the weight of capital costs in the cost comparison.

1) Furthermore, with respect to informing the City whether investigations would be warranted to further any of the alternatives or Sunsweet options, Jacobs recommends the following: Given the relatively high treated effluent ammonia concentrations observed from review of historical data (2013 – 2020) and expected improved process stability, Jacobs recommends implementation of sidestream treatment, including:

    a. Conducting short-term sampling to confirm or adjust the estimated average return stream load of 900[1] lb-N/d, sidestream treatment costs, and the percent of the WWTF ammonia load the return stream represents

    b. Conducting longer term sampling to gather the information and data required for preliminary and detailed design of a sidestream treatment system

2) Given the influence the Sunsweet discharge has over WWTP operations and performance, Jacobs recommends implementation of storage and conveyance improvements described in Section 3. It is understood that implementation would be subject to the City's and Sunsweet's willingness to participate and develop funding and a mutually beneficial solution.

[1] Estimated 900 lb-N/d load consists of RDT return and belt filter press return streams of 100 and 800 lb-N/d, respectively, as described in Table 3-6 of the Master Plan (West Yost Associated 2020).

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Appendix A
Sunsweet Handling Options Evaluation

Jacobs

Memorandum

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Subject	Task 13 - Advanced Treatment Study: Task 2.2 Sunsweet Handling Alternatives
Project Name	City of Yuba City Outfall and Diffuser Project
Attention	Katherine Willis
From	Jacobs Engineering Group Inc.
Date	September 11, 2020
Copies to	Kevin Bradford/City, Bill Lewis/City

1. Introduction and Purpose

This interim memorandum provides a high-level assessment of Sunsweet waste-stream handling options, addressing Task 2.2 in the Scope of Work. Details of this assessment will be described in the Technical Memorandum (TM) Sections 4.2 and 4.3. Details of this analysis are provided in the TM sections and Appendices.

Task 2.2. Scope of Work Items

Sunsweet Waste Stream Characterization	TM Section 2.1
Mitigation Measure Evaluation	TM Section 3

Sunsweet is a prune processor and a juice bottler. All streams are collected through floor drains and pumped to their treatment area where the waste stream is screened and pH adjusted to comply with the discharge requirements. There is a 30,000-gallon diversion tank for times when the in-line pH adjustment is not sufficient to meet the discharge requirement. As of August 2020, Sunsweet does not have a plan to change their operations that may affect wastewater quality or quantity.

The objectives to assess alternative handling options for the Sunsweet waste stream are as follows:

- Organic loading from Sunsweet constitutes nearly 30 percent of the plant's influent loading. If this stream can be handled separately or diverted to a different part of the Wastewater Treatment Facility (WWTF) (such as digesters and nutrient-removal process), the aeration basins will have capacity to accept more municipal wastewater.
- Variability in Sunsweet's waste stream affects the HPO process's stability. If this stream can be handled separately or the loading equalized to distribute the loading more evenly, the HPO process will have more stable operation.

2. Sunsweet Waste Stream Characterization (TM Section 4.2)

The data provided by Sunsweet include the following:

- 3 years of historical flows, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), electrical conductivity (EC), anions, dissolved oxygen (DO), Total Kjeldahl Nitrogen (TKN), and pH data

- Examples of diurnal, weekly flows, and pH data
- Response to questionnaire

Sunsweet's average flow between 2017 and 2020 was approximately 0.77 million gallons per day (mgd), which constitutes 11 percent of the current average flow to the City's treatment plant, whereas BOD loading is 31 percent of the plant's current average influent loading. A summary of Sunsweet waste stream flows and loads are shown in Table 4-1.

Table 4-1. Sunsweet Weekly Average Flows, Loads, and Constituent Concentrations of Waste Stream, January 1, 2017, through March 19, 2020.

Day	Flow, gpd	Loadings			Concentrations[a]		
		BOD, lb/d	COD, lb/d	TSS, lb/d	BOD, mg/L	COD, mg/L	TSS, mg/L
Monday	439,345	2,700	4,800	410	650	1,050	98
Tuesday	883,687	7,400	12,000	840	900	1,500	100
Wednesday	926,685	8,200	13,000	990	1,000	1,700	120
Thursday	928,155	8,100	13,000	1,000	990	1,600	120
Friday	911,940	7,900	13,000	1,000	1,000	1,600	130
Saturday[b]	825,174	-	-	-	-	-	-
Sunday[b]	491,707	-	-	-	-	-	-
Average	773,125	6,900	11,000	870	940	1,500	120

[a] Concentrations for each weekday were calculated from the sum of flows and sum of loadings. Average concentration values are the average of all available concentration data (not weighed for the flow contribution).

[b] No data for constituent loadings during weekends.

Notes:
lb/d = pound(s) per day
mg/L = milligram(s) per liter

TKN was measured for five samples in May 2019. An average of the five measurements was 7.2 mg/L, indicating significantly lower nitrogen content relative to the organic compounds in Sunsweet's waste stream compared with typical municipal wastewater. The BOD-to-N ratio is almost 130, indicating the stream will have nutrient deficiencies if it is treated separately in a biological treatment process. However, it may be a good source for the carbon required for denitrification.

3. Sunsweet Waste Stream Handling Options Evaluation (TM Section 4.3)

The evaluation included the following considerations:

a) Separate treatment at Sunsweet or the WWTF (TM Section 4.3.1)
b) Solids separation with solids diverted to existing WWTF digesters (TM Section 4.3.2)
c) Sunsweet discharge diversion to digester (TM Section 4.3.3)
d) Storing Sunsweet discharge and re-distributing load to WWTF influent stream (TM Section 4.3.4)
e) Use of Sunsweet discharge stream as a carbon source for BNR process (TM Section 4.3.5)
f) Repurposing Sunsweet WWTF facilities due to Sunsweet's ceasing discharge (TM Section 4.3.6)

Additional description will be provided in the Advanced Treatment Study Technical Memorandum. A brief summary of the findings is provided below in a table format (Table 4-2).

Table 4-2. Summary of Sunsweet Waste Stream Mitigation Evaluation

Options Evaluated	Infrastructure Required	Operation and Maintenance Requirements	Expected Benefits	Expected Drawbacks	Technical Feasibility
(1) Separate treatment	▪ Separate treatment system (either at Sunsweet or at WWTF) ▪ Separate Sunsweet waste stream pump station and conveyance system (for treatment at WWTF)	▪ O&M of a separate treatment system	▪ Anaerobic treatment processes such as evaluated in the 2001 Pretreatment Study (e.g., UASB, EGSB, anaerobic filters) as well as newer treatment technologies that have less proven records can be used to treat the waste stream. ▪ At 85% BOD removal with separate treatment, approximately 5,900 lb/d BOD reduction to the plant influent (approximately 27% of influent BOD), which can be used for additional treatment capacity for municipal wastewater.	▪ Capital and O&M cost for construction and operation of a separate treatment system and separate conveyance system. ▪ Challenges with the treatment system siting, cost allocation (capital and O&M), and operational responsibilities. ▪ Solids generated from the separate treatment process needs to be sent to the City's WWTF. ▪ Net reduction in biogas production in the digesters due to less organic loading at WWTF. ▪ Likely nutrient deficient and additional nutrient must be added for the biological process to work. ▪ The reactors likely need to be heated. ▪ External carbon addition will be needed for the Add-On nitrogen removal option	▪ Technically feasible ▪ It will provide additional capacity for municipal wastewater ▪ Nontechnical issues must be addressed ▪ If treated separately, it cannot be used for denitrification
(2) Solids separation and diversion of solids to WWTF digesters	▪ Solids separation process unit, including solids separation such as filtration and thickening (either at Sunsweet or at WWTF) ▪ Separate Sunsweet waste stream pump station and conveyance system (for treatment at WWTF)	▪ Solids separation unit process O&M (for both) ▪ Solids hauling/ conveyance from Sunsweet to WWTF (for separation at Sunsweet)	▪ At 2017-20 discharge level, assuming 95% solids capture, average 820 lb/d, MM 1,300 lb/d TSS to digesters. Current configuration sends the same solids to digester via primary clarification. Assuming 85% VSS, 50% VSR, 15 cf/VSR biogas production, 600 Btu/cf biogas heating value, and $5/MMBtu of heating value credit, net gain in digester gas value is ~$1,500/year.	▪ Capital and O&M cost for construction and operation of a separate solids separation system. ▪ Difficulties collecting and thickening solids from 100-150 mg/L range to similar concentration for thickened sludge. ▪ Minimal (~5% as of current TSS loading, and smaller fraction at 10.5 mgd) reduction in solids loading to the City's WWTF liquid treatment trains. ▪ Minimal net increase in digester solids increase (2017 VSS loading per Master Plan = 170 lb/1,000 cu-ft/day, 0r ~23,000 lb VSS/d, Net VSS loading increase to digester due to separation counting on assumed biomass production in aeration basin is approx. 160 lb/d, or <1%). ▪ If solids separation is done at the WWTF, Sunsweet stream must be conveyed separately. If solid separation is done at Sunsweet, the solids must be hauled to the WWTF.	▪ Technically plausible but operationally questionable ▪ Solids balance and biogass production and aeration requirements need to be evaluated with process modeling ▪ Does not affect the direction with BNR options except for small decrease in carbon content (due to TSS removal)
(3) Waste stream diversion to WWTF digesters	▪ Separate Sunsweet waste stream pump station and conveyance system ▪ Storage tank for equalization ▪ Pump station to send Sunsweet stream to digesters	▪ O&M for the conveyance, storage, and pump station	▪ None	▪ Cannot divert ~1 mgd of liquid into a digester. The volumetric loading to the digesters will result in the SRT/HRT in the range anaerobic digestion process will not be able to sustain biomass. ▪ NOT FEASIBLE.	▪ Technically not feasible
(4) Flow equalization and load distribution	▪ Flow EQ tank (either at Sunsweet, or a separate conveyance system and an EQ tank at WWTF)	▪ EQ tank level control, plant loading control	▪ Potentially stabilize the WWTF bioreactor by equalizing organic loading for low loading time over the weekend/holidays.	▪ To equalize low Sunsweet flow during the weekend, at least 50-60% of the weekday loading to be provided when there is insufficient loading. Larger EQ volume will be necessary to equalize longer holiday low flows. ▪ Sunsweet responded that there is no flow EQ at the site. It will need to be newly constructed if Sunsweet stream EQ is to be implemented.	▪ Technically feasible; benefit is mostly for process stability ▪ Does not affect nutrient-removal options
(5) Use of Sunsweet stream for BNR	▪ Separate Sunsweet waste stream pump station and conveyance system ▪ Flow EQ and flow control structure to dose Sunsweet waste to denitrification filters	▪ EQ tank control and denitrification filter control.	▪ Current COD loading in the Sunsweet stream is about 11,000 lb/d by average. If 90% of the COD is readily biodegradable, approximately 10,000 lb/d of carbon is available. Based on 6:1 COD-to-N ratio, this stream can denitrify nitrate up to about 1,700 lb/d. The plant influent has approximately 1,700 lb/d of ammonia by average as of 2017-2020. Effluent ammonia concentration is 23 mg/L. At the current flow of approximately 6 mgd, carbon in the Sunsweet stream may be sufficient to provide denitrification in the add-on treatment downstream of HPO. ▪ Additional process analysis will be required to determine whether the current loading of the Sunsweet waste can provide enough carbon to meet TN of 10 mg/L at the current and future conditions.	▪ Require pipeline and storage to divert ~1 mgd flow, and provide nitrogen loading-based flow control, which may be technically challenging. ▪ Due to diurnal loading variations and low loading during weekend, flow equalization will be required. The EQ size requirement will need to be determined in further analysis. ▪ The Sunsweet stream is significantly more dilute than typical external carbon added for denitrification (typically around 1,000,000 mg/L COD compared to 1,000–1,500 mg/L with Sunsweet). This will pose challenges to the flow control to the denitrification process. ▪ Depending on the nature of nitrogen in the waste, while it can provide a carbon source, it may raise effluent TN and effluent ammonia. ▪ While the TSS concentration is low and will be added to a filter, which should remove particulates, it can raise effluent TSS. ▪ Based on 2017–2020 data, an average effluent ammonia concentration was 23 mg/L. At 10.5 mgd, effluent ammonia loading is approximately 2,000 lb/d. Even though additional analysis will be required, it is not likely the Sunsweet stream will continue to provide sufficient carbon source up to 10.5 mgd.	▪ Technically plausible but operationally challenging, handling near 1 mgd flow directed to denitrification filters ▪ For current wastewater flows and loads, Sunsweet stream may provide sufficient carbon but likely not enough for the future loadings ▪ Additional evaluation of the nitrogen content in the Sunsweet stream is desired to understand the potential impact on effluent TN

Table 4-2. Summary of Sunsweet Waste Stream Mitigation Evaluation

Options Evaluated	Infrastructure Required	Operation and Maintenance Requirements	Expected Benefits	Expected Drawbacks	Technical Feasibility
				▪ If Sunsweet stream is not enough to provide denitrification, an external carbon source will need to be obtained, making the process control complicated. ▪ This option will not be meaningful for the MLE option (influent BOD will be used – no need to separate).	
(6) Consideration for potential ceasing of Sunsweet discharge	▪ N/A	▪ N/A	▪ Additional treatment capacity (currently approximately 30% of influent BOD loading), potentially deferring some of expansion work ▪ Oxygen generation/supply reduction at aeration basins ▪ Less influent load variation in weekends and holidays	▪ Reduction in biogas production	▪ N/A

Notes:

BNR = biological nutrient removal
EGSB = expanded granular sludge bed
EQ = equalization
HRT = hydraulic retention time
MLE = modified Ludzack Ettinger
O&M = operation and maintenance
UASB = up-flow anaerobic sludge blanket
SRT = solids retention time
TN = total nitrogen
VSS = volatile suspended solids

Appendix B
Side-bank Outfall Evaluation

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Memorandum

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Subject	**Task 13.2.3 – Outfall Pipeline and Side-Bank Discharge Location Evaluation**
Project Name	City of Yuba City – Outfall and Diffuser Project, Task 13 - Advanced Treatment Study
Attention	Katherine Willis
From	Jacobs Engineering Group Inc.
Date	March 10, 2021

1. Introduction and Purpose

The City of Yuba is considering constructing a new side-bank discharge in the Feather River. This preliminary outfall pipeline alignment alternatives evaluation assesses several reaches of the Feather River near the Shanghai Falls to determine a concept level location for the side-bank discharge. Figure 1 depicts the location of each river reach considered as a potential discharge site, as well as two outfall pipeline alignment alternatives to reach the preferred location for the new side-bank discharge. Table 1 evaluates each outfall pipeline alignment alternative.

2. River Reaches Considered for Side-Bank Discharge Location

This section presents the river reaches that were considered as possible locations for a new side-bank discharge location and the characteristics of each reach. Each reach is evaluated for its suitability as a location, and a final recommendation is presented.

Upstream of Shanghai Bend: The reach upstream of Shanghai Bend nearer to the existing wastewater treatment facility was considered as a location for the new river diffuser during preliminary design but was eliminated from further consideration based on shallow river depths. A minimum depth of 9 feet below the low water line is recommended to provide a minimum of 3 feet of submergence and 2 feet of clearance below the bottom of pipe. Shallow depth prevents sufficient clear space beneath the bottom of the discharge check valve and also limits the available submergence. This river reach was not considered viable for a submerged outfall pipe discharge.

Shanghai Falls: The entire zone of the falls at Shanghai Bend from the head feature through the approximately 800-foot-long chute consists of more resistant geologic formations than the riverbed outside the chute. The Shanghai Falls formation has exhibited significant erosion as a headcut advances through this feature at an estimated rate of approximately 11 feet per year. The headcut is expected to breach and result in significant geomorphic instability that extends through the falls, the Shanghai Bend meander bend and point bar, and potentially farther north through the Feather River channel in the near future. The exact future erosion pattern cannot be reliably predicted as the headcut advances. This river reach was not considered reliable for a submerged outfall pipe discharge.

Downstream of Shanghai Falls: Downstream of Shanghai Falls, the river has eroded a local area of scour (scour pool) that extends to approximately 300 feet downstream of the end of the chute that is currently considered relatively stable while the Shanghai Falls feature remains in place. This local area provides deeper water, which allows for sufficient clear space beneath the bottom of the discharge check valve and also provides good submergence.

The scour hole feature is currently, and will likely remain, a persistent feature, even if (or when) the bedrock sill that creates the Shanghai Bend falls breaches, and headward erosion begins to advance up the stream channel. This is because the gradient change from the bottom of the scour hole upstream will remain large, and because even after the sill breaches, it will likely take many years for the gradient to begin to readjust as the channel incises northward. Also, the bedrock sill at Shanghai Bend falls will remain a lateral constriction even after it breaches, accelerating and concentrating flows in this area, further reinforcing the scour feature, and ensuring that sediment released in the channel as a result of headward erosion will likely be forced downstream of the scour hole (keeping it deep).

This reach is considered a good location for a submerged outfall pipe discharge. During preliminary design, the designer should refine the exact location of the discharge in this local area, especially the potential opportunity to move the discharge up to 300 feet upstream of this location near the end of the Shanghai Falls chute.

Farther downstream of Shanghai Falls: Farther downstream of Shanghai Falls, the Feather River riverbed is depositional in nature and consists of a field of sand dunes. Similar to the reach upstream of the Shanghai Bend, this reach has shallow river depths and is subject to bottom elevation changes based on sediment transport and deposition. This reach is not considered a favorable location for a submerged outfall pipe discharge.

For additional details regarding geomorphological characterization of the Feather River near the project, refer to the *Wastewater Treatment Facility Outfall and Diffuser Project Predesign Repor*t (Jacobs 2020).

The location approximately 300 feet downstream of Shanghai Falls is recommended as the preferred site for the side-bank discharge. Further consideration should be given to the 300-foot-long reach of the western riverbank immediately downstream of the Shanghai Falls.

3. Preliminary Outfall Pipeline Alignment Alternatives Evaluation

Jacobs developed and evaluated two alternative outfall pipeline alignments and river discharge locations at the preferred discharge site. Figure 1 illustrates the locations of each alternative alignment from the existing outfall pipeline to the Feather River. These alternatives are summarized as follows:

- **Alignment Alternative 1- West bank south of existing Shanghai Falls.** This alternative begins at a new connection to the City's existing 30-inch-diameter outfall on the eastern side of the existing Feather River western levee. The alignment then proceeds approximately 1,400 feet south to a location approximately 300 feet south of the end of the Shanghai Falls "chute." This location is anticipated to require two pipe supports in the riverbed.
- **Alignment Alternative 2 – East bank south of existing Shanghai Falls.** This alternative begins at a new connection to the City's existing 30-inch-diameter outfall on the eastern side of the Feather River just north of the existing Pond 1 Distribution Box. The alignment then proceeds approximately 500 feet west to a location just south of the eastern end of the Shanghai Falls "chute." This location is anticipated to require three pipe supports.

Both alignments were evaluated and compared based on the following characteristics:

- Reliability
- Environmental documentation
- Permitting
- Stakeholder and public impacts
- Property ownership
- Constructability
- Existing utilities
- Operation and maintenance
- Estimated construction capital cost

Table 1 presents the evaluation of each outfall pipeline alignment alternative. Jacobs conducted an Outfall Concept Review conference call with City staff on September 10, 2020, to review the preliminary pipeline alignment evaluation summary. The location approximately 300 feet downstream of Shanghai Falls was recommended as the preferred site for the side-bank discharge (Alternative 1). The City concurred with this recommendation, and the project cost for Alignment Alternative 1 will be included in the Advanced Treatment Study.

Table 1. Outfall Pipeline Alignment Evaluation Summary

Evaluation Criteria	Alignment Alternative 1 (West Bank of Feather River) Approximate Length: 1,400 ft	Alignment Alternative 2 (East Bank of Feather River) Approximate Length: 500 ft
Reliability	Does not require existing outfall crossing of Feather River. The existing "shelf" adjacent to the western levee and above the normal river channel is not expected to experience significant erosion from high river flows.	Relies on existing outfall crossing of Feather River. Existing outfall pipeline on the eastern side of the river adjacent to the effluent pipelines has experienced periodic erosion from high river flows.
Environmental Documentation	Anticipated CEQA Mitigated Negative Declaration. Additional impacts to trees and elderberry shrubs may increase mitigation costs. Pipeline can be routed to avoid existing resources where possible. Close proximity to existing levee may be more likely to encounter Native American cultural resources and potentially require pre-construction surveys in addition to construction monitoring.	Similar impacts as Alternative 1.
Permitting	CVFPB Encroachment Permit will be required, triggering USACE Section 408 review and associated consultations (USFWS, NMFS, SHPO). Two geotechnical borings are recommended: one on the "shelf" close to the tie-in location, and the other down near the water level, but not in the "wet" part of the channel. A CVFPB Encroachment Permit will be required for the geotechnical borings, as described previously. Pipeline will be placed outside of the USACE levee influence area and beyond the existing Sacramento and San Joaquin Drainage District easement. CDFW Streambed Alteration Agreement, RWQCB Water Quality Certification (Section 401), and USACE Section 404 permits will be required.	Similar impacts as Alternative 1.
Stakeholder and Public Impacts	The public occasionally accesses the riverbank adjacent to the outfall discharge point for activities such as fishing. With sufficient pipe submergence, public impacts are anticipated to be minimal.	The outfall discharge point is located near a beach area used occasionally by the public. The discharge point would need to be moved farther from shore to reduce contact with the public.
Property Ownership	Existing property owned by the State of California Department of Fish and Game and the City of Yuba City, and it is maintained by Levee District 1. An easement will be required from the State. No permanent or temporary construction easements are required from private parties.	Existing property owned by the City of Yuba City. No permanent or temporary construction easements are required from private parties.

Table 1. Outfall Pipeline Alignment Evaluation Summary

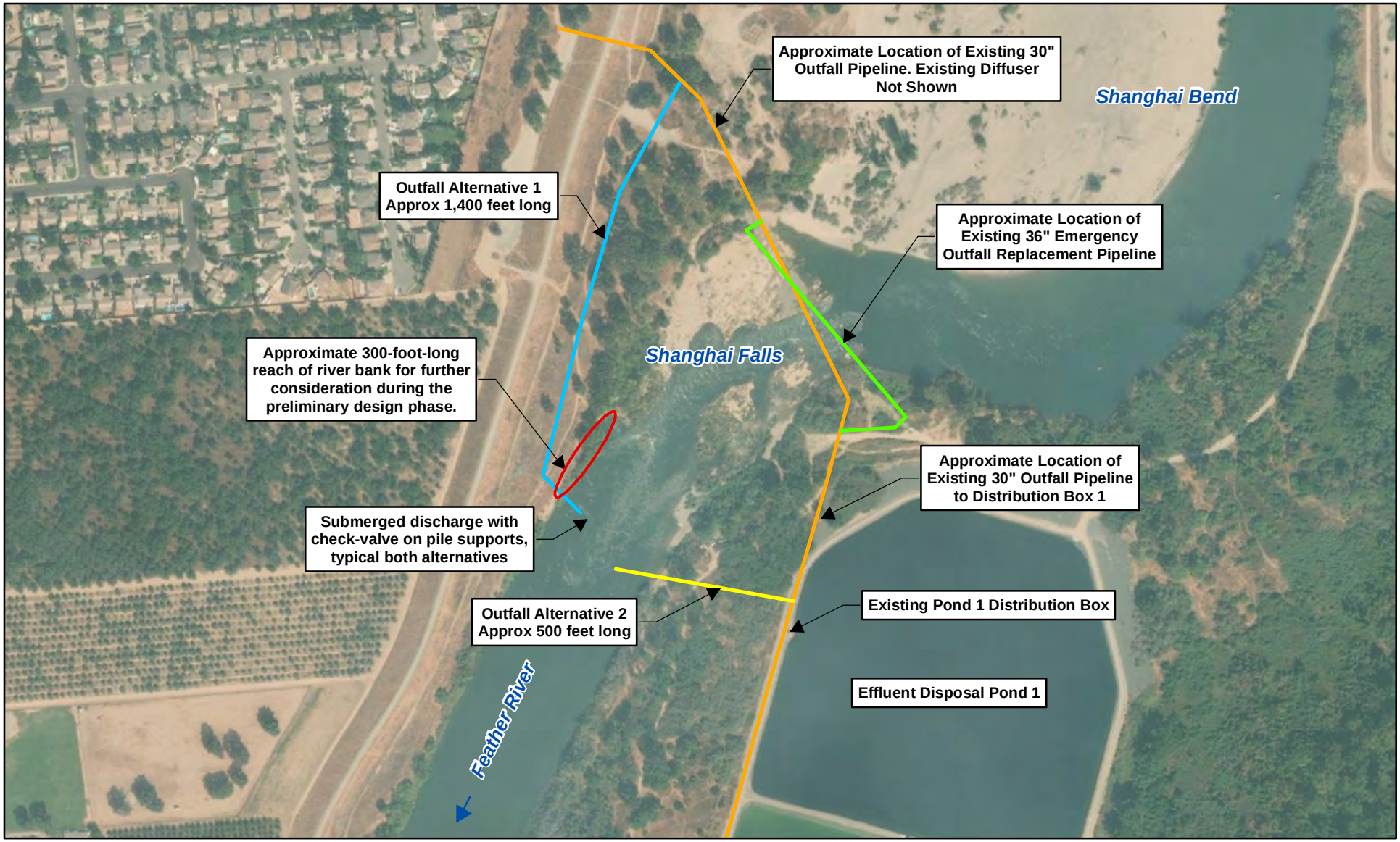
Evaluation Criteria	Alignment Alternative 1 (West Bank of Feather River) Approximate Length: 1,400 ft	Alignment Alternative 2 (East Bank of Feather River) Approximate Length: 500 ft
Constructability	Staging and Working Area: Sufficient work area is available for pipeline installation and is accessible from the western side of the existing levee. The western bank of the river is relatively steep, and the pipe will not need to extend very far from the bank into the river channel. The free end of the pipe discharge can be installed and anchored from the riverbank.	Staging and Working Area: Sufficient work area is available for pipeline installation but is not easily accessible from the eastern side of the river. The eastern bank of the river is relatively shallow, and the pipe will need to extend farther from the bank into the river channel. The free end of the pipe discharge can be installed and anchored from the riverbank or from a temporary work ramp. This may require additional armoring of the buried pipeline.
Existing Utilities	No significant utility conflicts identified.	No significant utility conflicts identified.
Operations and Maintenance	Access to pipeline valves and appurtenances (such as air release valves) for visual inspection and maintenance is easiest from the western bank of the river.	Access is more difficult than Alternative 1.
Estimated Construction Capital Cost	$0.9M – $1.7M	$0.4M - $0.7M

Construction Cost Estimate Notes:

1. Construction Costs are based on unit rate for pipeline installation and also includes pipe anchorage in the river channel and armoring. Estimate includes a 25% contingency to include additional items, including manual isolation valves and discharge check valve.
2. Estimated costs are for comparison only.
3. Construction Cost Estimate is accurate to a Class IV level as defined by the Association for the Advancement of Cost Engineering.

Notes:

CDFW = California Department of Fish and Wildlife
CEQA = *California Environmental Quality Act*
CVFPB = Central Valley Flood Protection Board
ft = foot/feet
NMFS = National Marine Fisheries Service
RWQCB = Regional Water Quality Control Board
SHPO = State Historic Preservation Office
USACE = United States Army Corps of Engineers
USFWS = U.S. Fish and Wildlife Service



Service layer credits: Source: Esri, Maxar, Earthstar Geographics, USDA FSA, USGS, Aerogrid, IGN, IGP, and the GIS User Community. Created 2009; updated 2021.

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FIGURE 1
Outfall Pipeline Alignment Alternatives
Advanced Treatment Study Project
City of Yuba City, California

Appendix C
Screening Evaluation of Discharge Compliance

Jacobs

Memorandum

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Subject	**Screening Evaluation of Discharge Compliance**
Project Name	City of Yuba City – Outfall and Diffuser Project, Task 13 – Advanced Treatment Study
Attention	Kathleen Willis, City of Yuba City
From	David Wilson, Jacobs Jason Junkert, Jacobs
Date	April 29, 2021

1. Objectives and Approach

This technical memorandum (TM) has been developed to support the Advanced Treatment Study of the Yuba City Wastewater Treatment Facility (WWTF) and to identify dilution requirements and outfall dilution capabilities for a submerged, single-port bank-side outfall to comply with water quality objectives, criteria, and standards applicable to the Feather River. This TM includes an updated reasonable potential analysis (RPA) of Yuba City WWTF effluent discharge compliance with water quality objectives and criteria to identify potential dilution requirements for an Advanced Treatment Facility that would discharge via a proposed submerged, single-port bank-side outfall, and screening-level dilution modeling for the proposed submerged bank-side outfall at a site downstream of Shanghai Falls.

This TM briefly reviews the regulatory basis for effluent discharge compliance with water quality objectives and criteria, effluent limits established in the National Pollutant Discharge Elimination System (NPDES) Order/Permit, how target design dilutions have been developed, and what dilution performance can be expected for the proposed submerged bank-side outfall for Yuba City WWTF effluent from an advanced treatment facility for nutrient control. These methods and results are presented in the following sections:

- Water Quality Standards and Other Discharge Restrictions
- Effluent Limits and Target Design Dilutions
- Bank-side Outfall Design for Discharge Compliance
- Summary of Screening Evaluation of Discharge Compliance for an Advanced Treatment Facility

2. Water Quality Standards and Other Discharge Restrictions

2.1 Water Quality Standards

The water quality standards specified in the *Basin Plan for the Sacramento River and San Joaquin River Basins* (the Basin Plan) defines the water quality objectives, beneficial uses in surface waters, and implementation programs to achieve water quality objectives in the Feather River. These water quality objectives establish numerical limits for water quality measures and chemicals instream to protect

instream beneficial uses. The water quality criteria for priority pollutants not addressed in the Basin Plan are listed in the California Toxics Rule (CTR) and the National Toxics Rule.

The Basin Plan also implements State Water Board Resolution 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. Beneficial uses applicable to the Feather River are as follows: Municipal and domestic supply; agricultural supply, including irrigation; water contact recreation, including canoeing and rafting; noncontact water recreation; warm freshwater habitat; cold freshwater habitat; warm and cold migration of aquatic organisms; warm and cold spawning, reproduction, and early development; and wildlife habitat.

Defining dilution credits and mixing zone regions for a discharge to the Feather River is required for a wastewater discharger to meet water quality objectives unless the discharger can meet all objectives and criteria prior to discharge. The state guidance for developing dilution credits and mixing zones under critical effluent flow and river conditions is defined in the *State of California Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries (*SIP).

Other restrictions in water quality standards that control the design and permitting of a relocated Yuba City WWTF outfall include existing water quality impairments (referred to as 303(d) listings) and total maximum daily loads (TMDLs), discharge compliance with water quality chemical objectives and temperature standards, and effluent toxicity to aquatic organisms.

2.2 303(d) Listing and Total Maximum Daily Loads

California's current Section 303(d) List of Water Quality Limited Segments (WQLSs) was approved by the United States Environmental Protection Agency (EPA) in 2016. The Basin Plan references this list of WQLSs, and the Category 5 303(d) listings for the Lower Feather River (Lake Oroville Dam to the confluence with the Sacramento River) include chlorpyrifos, Group A pesticides, mercury, polychlorinated biphenyls (PCBs), and toxicity. The state has developed or is developing TMDL studies with waste load allocations for these 303(d) listings on the Feather River:

- Chlorpyrifos – TMDL adopted in August 2008
- Group A Pesticides – TMDL planned completion in 2021
- PCBs – TMDL planned completion in 2021
- Mercury and Toxicity – TMDL planned completion in 2027

The Yuba City WWTF 2019 Order/Permit includes water quality-based effluent limits (WQBELs) that are consistent with the applicable 303(d) listings and TMDLs.

3. Effluent Limits and Target Design Dilutions

3.1 Background on Effluent Limits

The Yuba City WWTF 2019 Order/Permit includes technology-based effluent limits (TBELs) (Table 1) and WQBELs (Table 2). These TBELs are not expected to be modified for a Yuba City WWTF Advanced Treatment Facility operation.

WQBELs included in the 2019 Order/Permit for the Yuba City WWTF were developed by the Central Valley Regional Water Quality Control Board (CVRWQCB), which used RPA and Yuba City WWTF effluent data to evaluate their potential to exceed water quality objectives in the Basin Plan and water quality criteria in the CTR. The CVRWQCB assessed RPAs for approximately 200 effluent constituents in the WWTF 2019 Order/Permit development. Conventional chemicals such as ammonia, total coliform bacteria, and

settleable solids were also evaluated by using other calculation methods to determine their potential to exceed water quality objectives and water quality criteria.

Table 1. Technology-Based Effluent Limits in the 2019 Order/Permit for Yuba City WWTF

Parameters	Average Monthly Effluent Limit	Average Weekly Effluent Limit	Maximum Daily Effluent Limit	Percentage Removal
BOD (5-day)	30 mg/L	45 mg/L		85%
Total Suspended Solids	30 mg/L	45 mg/L		85%
pH			6.5 to 8.5	6.5 to 8.5

mg/L = milligrams per liter

The Yuba City WWTF 2019 Order/Permit includes WQBELs for effluent constituents that showed a reasonable potential to exceed water quality objectives or criteria, including the following: ammonia, total residual chlorine (TRC), copper, dichlorobromomethane, mercury, nitrate plus nitrite, pH, settleable solids, and total coliform organisms. The WQBELs for priority pollutants and nonconventional pollutants in the current Yuba City WWTF Order/Permit are listed in Table 2. WQBELs were not included for constituents that did not show a reasonable potential to exceed applicable water quality objectives. TRC effluent limits were set equal to the acute and chronic aquatic life criteria, with no dilution assumed.

Dynamic modeling was developed and applied in the Yuba City WWTF 2019 Order/Permit to represent WQBELs for ammonia and copper discharges from the Yuba City WWTF to the Feather River. The dynamic modeling was based on the dilution modeling of the existing WWTF Outfall 001; modeling results represent a reasonable estimate of the WQBELs necessary for ammonia and copper discharges.

Table 2. WQBELs in the Yuba City WWTF 2019 NPDES Order/Permit

Parameters	Average Monthly Effluent Limit	Average Weekly Effluent Limit	Maximum Daily Effluent Limit
Copper (total recoverable)	50 µg/L		85 µg/L
Dichlorobromomethane	10 µg/L		30 µg/L
Ammonia Nitrogen (total-N)	31 mg/L 2,700 lb/d	51 mg/L 4,500 lb/d	
Nitrate + Nitrite	10 mg/L	21 mg/L	
Total Residual Chlorine	0.011 mg/L (4-day average)		0.019 mg/L (1-hour average)
Mercury	Total annual mass limit of 0.67 pound		
Diazinon and Chlorpyrifos	< 1.0 µg/L	< 1.0 µg/L	
Total Coliform Organisms	240 MPN/100 mL allowed once in 30-day period	23 MPN/100 mL as 7-day median	
Settleable solids	0.1 mL/L		0.2 mL/L
Whole Effluent Toxicity – Acute	70% minimum survival for any one bioassay; and 90% median survival for any three consecutive bioassays		

Notes:

µg/L = microgram(s) per liter; lb/d = pound(s) per day; mg/L = milligram(s) per liter; mL = milliliter(s)
mL/L = milliliter(s) per liter; MPN = most probable number

Some of these WQBELs will be modified for a Yuba City WWTF Advanced Treatment Facility operation that discharges via a submerged, single-port outfall. The WQBELs that would be expected to be lowered include ammonia and possibly nitrate plus nitrite. Depending on effluent data and dilution credits applied by the CVRWQCB in the RPAs developed for permitting the Advanced Treatment Facility, other constituents may be assigned WQBELs.

3.2 Target Design Dilutions

A screening-level evaluation of dilution requirements for the Yuba City WWTF Advanced Treatment Facility (ATF) effluent was developed to define dilutions required to meet the Basin Plan water quality standards and the projected ammonia effluent limits for the WWTF ATF. This evaluation is developed to identify the effluent constituents that require the greatest dilution to meet the water quality standards, which will represent the target design dilutions or minimum design dilutions for a relocated bank-side Outfall 001 below Shanghai Falls.

These RPAs have been developed to be consistent with the SIP and are conservative. The objective of these analyses is to identify the dilutions required for the WWTF effluent discharge to meet acute and chronic water quality criteria for the protection of aquatic organisms and human health. These evaluations of target design dilutions for the Yuba City WWTF effluent discharge have included effluent ammonia, metals, and organic chemicals detected in effluent. The WWTF effluent ammonia, metals, and organic chemical data applied in the RPA were collected during January 2014 through November 2020, and background Feather River data were collected during the same period. These effluent data were used to select the maximum effluent concentrations to apply in the RPA, in accordance with Section 1.3 of the SIP. The WWTF effluent is continuously monitored for TRC and subject to dichlorination before discharge. The TRC WQBELs in the 2019 Order/Permit are equal to the water quality objectives or criteria, so the effluent limits are end-of-pipe limits and do not account for any acute or chronic dilution credits.

A different methodology was applied for the Yuba City WWTF effluent ammonia concentrations because the Advanced Treatment Facility would remove nutrients and allow for the WWTF effluent to discharge through a relocated bank-side Outfall 001 below Shanghai Falls. This method is defined in Section 3.2.1.

3.2.1 Ammonia

The Basin Plan currently applies the 1999 EPA National Ambient Ammonia Water Quality Criteria for the Protection of Freshwater Aquatic Life to comply with the narrative toxicity objective in the Basin Plan. However, in 2013, the EPA published an update to the ammonia criteria titled the *Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater 2013.* The 2013 updated criteria recognize that sensitive aquatic species (that is, salmonids and freshwater mussels of the Family Unionidae) may be present, and apply criteria based on ambient pH and temperatures. In April 2014, the CVRWQCB issued an order requiring dischargers to participate in studies to determine whether Unionidae freshwater mussels were present in the river reaches where they discharge. Yuba City is a participant in the Central Valley Clean Water Association Freshwater Collaborative Mussel Study. In 2014, Unionidae mussels were found in the Feather River near Oroville. This indicates a very high probability that these mussels are present in the Feather River near Yuba City and should be assumed in applying the ammonia criteria.

Projected effluent ammonia concentrations in the ammonia screening RPA applied Average Week Effluent Limit (AWEL) and Average Monthly Effluent Limit (AMEL) developed by Larry Walker Associates (LWA) in February 2020 for the City of Yuba City, with a multiplier to conservatively represent potential effluent concentration variability. Maximum day effluent ammonia concentrations have been estimated based on the AWEL developed by LWA (2020). Table 3 summarizes the projected effluent ammonia concentrations developed by LWA in February 2020. The multiplier applied in the ammonia RPA to conservatively

represent potential effluent concentration variability and the resultant ammonia concentrations assumed in the ammonia screening RPA are shown in Table 4.

Table 3. Projected AMEL and AWEL Ammonia Effluent Limits for the Yuba City WWTF Advanced Treatment Facility

Parameters	Average Monthly Effluent Limit	Average Weekly Effluent Limit	Maximum Daily Effluent Limit
Ammonia Effluent Limits	2.0 mg/L	2.9 mg/L	
Multiplier Used for RPA Screening Evaluation	1, 2, or 3	1 or 2	2 or 3 times AWEL
Ammonia Conc. Assumed in Screening RPA (Table 4)	2.0, 4.0, or 6.0 mg/L	2.9 or 5.8 mg/L	5.8 or 8.7 mg/L

The ammonia screening RPA is presented in Table 4 and is based on both the 1999 EPA freshwater ammonia criteria (upper portion of the table) and the 2013 updated EPA freshwater ammonia criteria (lower portion of the table). Worst-case dry season Feather River pH and temperatures have been applied to develop the acute and chronic ammonia criteria presented in Table 4. The ammonia screening RPA provides a range of ammonia discharge concentrations and the associated dilutions required to meet the acute (1-hour average) and chronic (4-day and 30-day) ammonia criteria at the acute and chronic mixing zone boundaries. These RPA results represent static worst-case conditions in the river and do not account for continuous changing variables that are addressed by using dynamic modeling as applied by the City for the NPDES Order/Permit.

Based on 1999 EPA ammonia criteria and with a 3x multiplier applied in the ammonia RPA scenarios, the projected maximum daily effluent ammonia concentration (8.7 mg/L) requires an acute dilution of 4, and the projected maximum monthly effluent ammonia concentration (6.0 mg/L) requires chronic 30-day dilution of 3 and chronic 4-day dilution of 2 to comply with acute and chronic ammonia criteria (Table 4). Based on 1999 EPA ammonia criteria and projected (without multipliers), the maximum daily effluent ammonia concentration (2.9 mg/L) requires an acute dilution of 2 and the projected maximum monthly effluent ammonia concentration (2.0 mg/L) requires chronic 30-day dilution of 1 and chronic 4-day dilution of 0 to comply with acute and chronic ammonia criteria (Table 4).

The lower portion of Table 4 shows the screening ammonia RPA results based on the updated 2013 EPA ammonia criteria, which have lower acute and chronic ammonia criteria. Based on 2013 EPA ammonia criteria and with a 2x multiplier applied in the ammonia RPA scenarios, the projected maximum daily effluent ammonia concentration (5.8 mg/L) requires an acute dilution of 4, and the projected maximum monthly effluent ammonia concentration (4.0 mg/L) requires chronic 30-day dilution of 5 and chronic 4-day dilution of 2 to comply with acute and chronic ammonia criteria. Based on 2013 EPA ammonia criteria and projected (without multipliers), the maximum daily effluent ammonia concentration (2.9 mg/L) requires an acute dilution of 2, and the projected maximum monthly effluent ammonia concentration (2.0 mg/L) requires chronic 30-day dilution of 2 and chronic 4-day dilution of 1 to comply with acute and chronic ammonia criteria (Table 4). These required dilutions in Table 4 provide the estimated range of target design dilutions for ammonia discharged from the Advanced Treatment Facility via a relocated, submerged, single-port bank-side Outfall 001 below Shanghai Falls.

3.2.2 Metals, Organics and Conventional Parameters

Table 5 summarizes the screening evaluation RPA to identify target dilutions required for the Yuba City WWTF discharge of effluent metals, detected organic chemicals, and conventional pollutants to meet water quality objectives and criteria. The WWTF effluent ammonia, metals, and organic chemical data applied in the RPA were collected between January 2014 through November 2020, and background Feather River data were collected during the same period. These effluent chemistry data were used to select the maximum effluent concentrations to apply in the RPA, and the multiplier factor applied is based on the number of samples for each parameter. Background river concentrations used in the RPA represent the 90th percentile concentrations in Feather River collected upstream of the WWTF Outfall 001. This screening evaluation of discharge compliance for the Yuba City WWTF effluent shows that very limited dilutions are required for compliance with acute and chronic water quality criteria (Table 5).

The Yuba City WWTF effluent meets acute and chronic water quality criteria for protection of aquatic life for metals discharged with a minimum dilution of 2 at an acute mixing zone boundary and a minimum dilution of 2 at a chronic mixing zone boundary (both based on copper). The WWTF discharge of detected organic chemicals meets acute and chronic water quality criteria without dilution. The WWTF discharge of cyanide requires dilutions of 2 and 4 to meet acute and chronic water quality criteria, respectively.

Table 5 also shows dilutions required for the WWTF effluent to meet water quality criteria for the protection of human health. Many of the constituents detected in the WWTF effluent have human health criteria, including bis (2-ethylhexyl) phthalate, chloride, copper, conductivity, dichlorobromomethane, manganese, mercury, nitrate and nitrite nitrogen, nitrite nitrogen, nickel, sulfate, and total dissolved solids. The 2019 Order/Permit includes WQBELs for dichlorobromomethane, mercury, and nitrate plus nitrite based on RPAs, and diazinon and chlorpyrifos effluent limits based on TMDL load allocations. Table 5 shows five effluent constituents that require some dilution to comply with water quality criteria for the protection of human health: bis (2-ethylhexyl) phthalate, dichlorobromomethane, manganese, mercury, and conductivity. The only constituent that would require dilution greater than 4 is conductivity, and the water quality objective for conductivity (Basin Plan) is a 10-year rolling average.

Based on these screening-level RPAs, effluent concentrations of ammonia, cyanide, bis (2-ethylhexyl) phthalate, and conductivity determine the target dilutions required for the design of the submerged, single-port bank-side outfall for the Yuba City WWTF Advanced Treatment Facility.

In addition, the Yuba City WWTF discharge needs to comply with the temperature water quality objective in the Feather River. The Basin Plan limits temperature increases to less than 5 degrees Fahrenheit (°F) because of a point source. Based on an effluent 95th percentile temperature of 85 °F and a 90th percentile river temperature of 69.5 °F, a dilution of only 4 is needed at the chronic mixing zone boundary for the discharge to comply with the water quality objective for temperature in the Feather River.

Table 4. Evaluation of Ammonia Discharge Compliance with EPA 1999 and 2013 Ammonia Water Quality Criteria and Definition of Target Design Dilutions for the Yuba City WWTF Advanced Treatment Facility Discharge of Ammonia to the Feather River

RPA Based on 1999 EPA Ammonia Criteria – as Applied in Order/Permit										
	1999 Water Quality Criteria[a]			Projected Max. Day, Monthly Avg. and Weekly Avg. Effluent Concentration (mg N/L)[e]						
Parameter	Acute Criteria (mg/L)[c]	30-day Chronic Criteria (mg/L)[d]	4-day Chronic Criteria (mg/L)[d]			Basis of Projected Revised Effluent Concentrations [f]	Background River Concentration (90th %) (mg N/L)	Dilution to Meet Acute Water Quality Criteria at Acute Zone Boundary	Dilution to Meet 30-day Chronic Criteria at Chronic Mixing Zone	Dilution to Meet 4-day Chronic Criteria at Chronic Mixing Zone
Ammonia (Total NH_3)	2.14			**8.7**	**Max. Day**	***AWEL (2.9 mg/L) x 3***	0.075	**4**		
Dry Season - Low Flow		1.8	4.52	**6.0**	**Mon. Avg.**	***AMEL (2.0 mg/L) x 3***			**3**	**2**
Ammonia (Total NH_3)	2.14			**2.9**	**Week Avg.**	***AWEL (2.9 mg/L)***	0.075	**2**		
Dry Season - Low Flow		1.8	4.52	**2.0**	**Mon. Avg.**	***AMEL (2.0 mg/L)***			**1**	**0**
RPA Based on 2013 EPA Ammonia Criteria – Assumed to be Applied in Future Order/Permit										
	2013 Water Quality Criteria[b]			Projected Max. Day, Monthly Avg. and Weekly Avg. Effluent Concentration (mg N/L)[e]						
Parameter	Acute Criteria (mg/L)[c]	30-day Chronic Criteria (mg/L)[d]	4-day Chronic Criteria (mg/L)[d]			Basis of Projected Revised Effluent Concentrations [f]	Background River Concentration (90th %) (mg N/L)	Dilution to Meet Acute Water Quality Criteria at Acute Zone Boundary	Dilution to Meet 30-day Chronic Criteria at Chronic Mixing Zone	Dilution to Meet 4-day Chronic Criteria at Chronic Mixing Zone
Ammonia (Total NH_3)	1.7			**5.8**	**Max. Day**	***AWEL (2.9 mg/L) x 2***	0.075	**4**		
Dry Season - Low Flow		0.88	2.1	**4.0**	**Mon. Avg.**	***AMEL (2.0 mg/L) x 2***			**5**	**2**
Ammonia (Total NH_3)	1.7			**2.9**	**Week Avg.**	***AWEL (2.9 mg/L)***	0.075	**2**		
Dry Season - Low Flow		0.88	2.1	**2.0**	**Mon. Avg.**	***AMEL (2.0 mg/L)***			**2**	**1**

[a] Freshwater acute & chronic criteria from EPA 1999 Freshwater Ammonia Criteria (used in Order/Permit). Acute criteria based on dry season 95th percentile river temperature of 21.1 degrees Celsius (°C) and worst-case pH of 8.5; chronic criteria based on dry season 95th percentile river temperature of 21.1°C and 95th percentile river pH of 7.9.

[b] Freshwater acute & chronic criteria from EPA August 2013 Revised Freshwater Ammonia Criteria (with unionid mussels and salmonids present) to be implemented by CVRWQCB. Acute and chronic criteria based on dry season 95th percentile river temperature of 21.1°C and worst-case pH of 8.4; chronic criteria based on dry season 95th percentile river temperature of 21.1°C and 95th percentile river pH of 7.9.

[c] Freshwater acute criterion is a 1-hour average concentration not to be exceeded more than once every 3 years on the average.

[d] Freshwater chronic criterion is expressed as a 30-day average and as a 4-day average concentration not to be exceeded more than once every 3 years on the average.

[e] Projected effluent concentrations based on AWEL and AMEL developed by LWA in February 2020. Maximum daily concentrations estimated based on AWEL from LWA (2020).

[f] Basis for projected effluent ammonia maximum and 95th percentile concentrations is provided.

mg N/L = milligram(s) nitrogen per liter

Table 5. Evaluation of Discharge Compliance with State Water Quality Standards and Definition of Target Design Dilutions for Priority Pollutants Discharged to Feather River from the Yuba City WWTF Advanced Treatment Facility

Parameter	Water Quality Criteriaa			No. of Samples	Maximum Effluent Concentration (µg/L)[d]	Multiplying Factor (99% Confidence Interval and 95% Probability)[e]	Background River Concentration (90th %) (µg/L)[f]	Dilution Needed to Meet Aquatic Life Acute Criteria at Acute Zone Boundary	Dilution Needed to Meet Aquatic Life Chronic Criteria at Chronic Mixing Zone	Dilution Needed to Meet Human Health Criteria at Chronic Mixing Zone
	Acute Criteria (µg/L)[b]	Chronic Criteria (µg/L)[c]	Human Health Criteria (µg/L)[c]							
Aluminum (total)	1,300	650	1,000	8	97	1.9	492	0	2	
Arsenic (total)	340	150		14	1.8	1.7	0.9	0	0	
Bis (2-Ethylhexyl) Phthalate			1.8	73	6.8	1.0	0			4
Cadmium (total recoverable)	2.2	1.5		14	0.06	1.7	0.05	0	0	
Chloride (mg/L)	860	230	250	258	75	1.0	2.3	0	0	0
Chromium (total recoverable)	1,000	120		14	1.0	1.7	2.5	0	0	
Copper (total recoverable)	7.6	5.3	1,300	89	8.5	1.0	0.6	2	2	0
Conductivity (µmhos/cm)			150	3,718	675	1.0	108			16 g
Cyanide (free)	22	5.2	700	14	7.4	1.7	2.1	2	4	
Dichlorobromomethane			0.56	47	1.6	1.1	0			3
Lead (total recoverable)	36.0	1.4		70	0.6	1.0	0.71	0	1	
Manganese (total recoverable)			50	74	58	1.0	43			2
Mercury (total recoverable)			0.012	89	0.017	1.0	0.0017			2
Nitrate plus Nitrite (mg/L as N)			10	188	4.85	1.0	0.097			0
Nitrite Nitrogen (mg/L as N)			1	193	1.35	1.0	0.025			1
Nickel (total recoverable)	270	30	610	14	2.5	1.7	3.7	0	0	0

Table 5. Evaluation of Discharge Compliance with State Water Quality Standards and Definition of Target Design Dilutions for Priority Pollutants Discharged to Feather River from the Yuba City WWTF Advanced Treatment Facility

Parameter	Water Quality Criteriaa			No. of Samples	Maximum Effluent Concentration (µg/L)[d]	Multiplying Factor (99% Confidence Interval and 95% Probability)[e]	Background River Concentration (90th %) (µg/L)[f]	Dilution Needed to Meet Aquatic Life Acute Criteria at Acute Zone Boundary	Dilution Needed to Meet Aquatic Life Chronic Criteria at Chronic Mixing Zone	Dilution Needed to Meet Human Health Criteria at Chronic Mixing Zone
	Acute Criteria (µg/L)[b]	Chronic Criteria (µg/L)[c]	Human Health Criteria (µg/L)[c]							
Selenium (total recoverable)		5	35	14	0.46	1.7	0.2		0	
Silver (total recoverable)	1.3			14	0.05	1.7	0.01	0		
Sulfate (mg/L)			250	258	48.9	1.0	3.1			0
Total Dissolved Solids (mg/L)			500	200	350	1.0	70			1
Zinc	69			14	51	1.7	2.7	1		

[a] Water quality criteria for protection of aquatic life from CTR (40 Code of Federal Regulations 131, May 18, 2000); human health criteria from CTR, Basin Plan, and Federal Drinking Water Standards. Metal criteria for cadmium, chromium, copper, lead, nickel, silver and zinc based on CTR criteria developed in 2019 Order/Permit.

[b] Freshwater acute criteria is a 1-hour average concentration not to be exceeded more than once every three years on the average, with the exception of silver, which is an instantaneous concentration not to be exceeded at any time. Hardness-dependent metals criteria based on Feather River hardness of 52 mg/L as defined in Order/Permit.

[c] Freshwater chronic criteria is a 4-day average concentration not to be exceeded more than once every three years on the average. Hardness-dependent metals criteria based on Feather River hardness of 52 mg/L as defined in Order/Permit.

[d] Effluent inputs based on January 2014 through November 2020 analytical data. Effluent metals based on total recoverable metals data. If nondetected result, then one-half of detection limit used.

[e] Reasonable potential multiplying factor assumes a coefficient of variation of 0.6, based on guidance on Table 3-2 (p. 57) in the Technical Support Document (TSD) (EPA 1991).

[f] Background receiving water analytical results were used as measured values from Feather River monitoring station R1. Analytical data collected in April 2014 through November 2020.

[g] Electrical conductivity is a long-term average of 150 µmhos/cm applied as rolling average over 10 years (Basin Plan objective) and a secondary drinking water maximum contaminant level is 900 µmhos/cm.

µg/L = microgram(s) per liter; µmhos/cm = micromhos per centimeter

4. Submerged Bank-side Outfall Design Concept for Discharge Compliance

Preliminary outfall design configuration development and modeling were conducted to develop a concept for a new submerged, bank-side outfall to discharge effluent from the Yuba City WWTF Advanced Treatment Facility. The Feather River site identified for this replacement outfall for the existing Outfall 001 diffuser is located downstream of the Shanghai Falls rapids and in the rapids scour region caused by the falls (Figure 1). Screening-level dilution modeling for the proposed submerged bank-side outfall was developed in accordance with the state's guidance for dilution credits and mixing zones, defined in the SIP. The CORMIX 1 model was applied to model the submerged single-port outfall fitted with an elastomeric check valve port. The model cases all applied projected buildout effluent flows for the WWTF and Feather River critical discharge flow and stage conditions. These buildout effluent flows and critical river flow conditions were previously developed and applied in the Yuba City WWTF Outfall and Diffuser Project Predesign Report (Jacobs 2020).

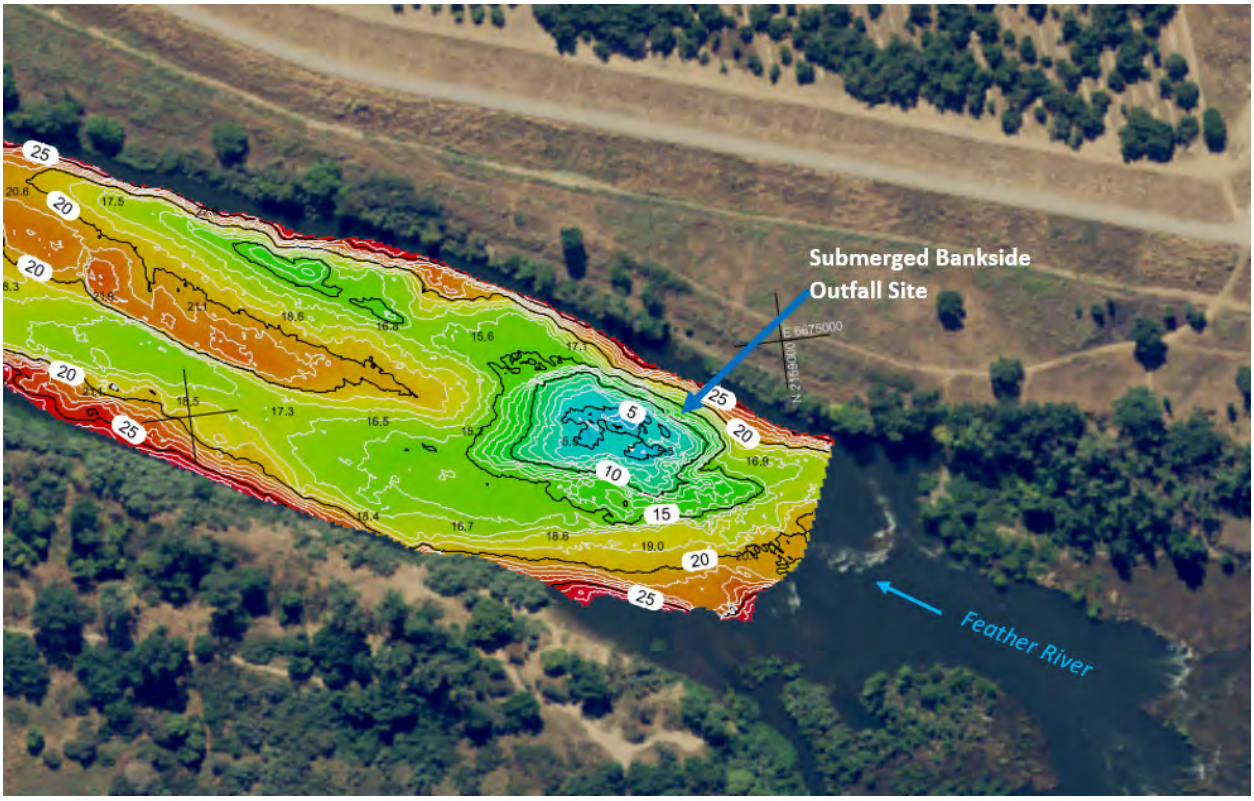

Figure 1. Site for a Submerged Bank-side Outfall on the Feather River Below Shanghai Falls (SHI Bathymetry 2020)

4.1 State Guidance for Dilution Credits and Mixing Zones

Section 1.4.2 of the SIP (*Mixing Zones and Dilution Credits*) defines the receiving water and effluent flow conditions that are used to develop dilution credits and mixing zone size under critical discharge conditions. The SIP guidance is applied in dilution modeling to determine dilution credits for acute aquatic life criteria, chronic aquatic life criteria, and human health criteria, as well as for determining potential mixing zone dimensions. Table 6 defines the effluent flows and receiving water flows that were modeled in this outfall conceptual design to calculate dilutions, and these flows are in accordance with the SIP for completely mixed discharges.

Table 6. Effluent and Receiving Water Flows to Calculate Dilutions According to the SIP

Criteria Condition	Critical Receiving Water Flow	Discharged Effluent Flow
Acute Aquatic Life Criteria and Objectives	1Q10 Low Flow (1,200 cfs)	Maximum Daily Flow during Period of Discharge (22.7 mgd at Buildout)
Chronic Aquatic Life Criteria and Objectives	7Q10 Low Flow (1,200 cfs)	4-Day Average Daily Maximum Flows during Period of Discharge (21.8 mgd at Buildout)
Chronic Aquatic Life Criteria and Objectives	7Q10 Low Flow (1,200 cfs)	30-Day Average Daily Maximum Flows during Period of Discharge[a] (20.9 mgd at Buildout)
Human Health Criteria and Objectives	Harmonic Mean Flow (3,252 cfs)	Long-term Arithmetic Mean Flow during Period of Discharge (14.8 mgd at Buildout)

[a] The 30-day average maximum effluent flow condition is added to represent the EPA 2013 ammonia 30-day chronic criteria condition.

cfs = cubic feet per second, mgd = million gallons per day

Section 1.4.2.2 (Mixing Zone Conditions) of the SIP defines the specific requirements for allowing and defining mixing zones in state waters. Section 1.4.2.2 of the SIP also states that the CVRWQCB will limit a mixing zone to protect beneficial use and comply with the SIP. Mixing zones can be limited by the assimilative capacity for discharges in a receiving water if there are multiple nearby dischargers. The only discharger located within 2.5 river miles of the replacement WWTF Outfall 001 site in the Feather River is the Linda County Wastewater Treatment Plant (LCWWTP) discharge located near River Mile 25 and 1/2 mile upstream of Shanghai Falls. The LCWWTP facility provides tertiary treatment for up to 5.0 mgd and uses infiltration beds to discharge wastewater. The LCWWTP tertiary-treated effluent is discharged via their outfall, then it is completely mixed into the Feather River below Shanghai Falls and fully assimilated into background at the point of reaching the proposed Yuba City WWTF relocated Outfall 001.

4.2 Submerged Single-port Outfall Modeling, Dilutions, and Mixing Zones

This section summarizes the dilution modeling approach, assumptions, inputs, and results.

- The CORMIX 1 model was used in the screening-level analysis. This modeling system was one of two previously evaluated and applied in modeling the dilution performance of the Yuba City WWTF outfall diffuser options for a range of defined critical discharge scenarios. Because the CORMIX model is better suited for prediction when plume attachment to a riverbank or bottom may occur, this model was selected over the use of Visual Plumes.
- The site for the proposed submerged, bank-side outfall is approximately 1,000 feet downstream of crest elevation of Shanghai Falls and corresponds to the location of a large scour hole created by the current velocities and rapids below the falls. The proposed submerged outfall would exit the western riverbank at a port centerline elevation of approximately 15 feet NAVD88 (refer to Figure 1). The submerged bank-side outfall structure would require trenched burial of the outfall pipe and construction of the bank-side structure into the river slope with bank protection around the outfall.
- The critical low receiving water conditions evaluated for modeling include the 1Q10 for acute conditions (1,200 cfs), the 7Q10 for chronic conditions (1,236 cfs), and the harmonic mean for human health conditions (3,252 cfs).

- Acoustic Doppler Current Profiler velocities and river discharge measurements were conducted at the proposed discharge site in 2018 under low river flow (2,985 cfs) and in 2019 high river flow (14,230 cfs) conditions. Based on these field measurements, and making adjustments for channel geometry and cross sectional area, the channel average current speeds under 1Q10 and 7Q10 critical low flow and under harmonic mean flow have been calculated to be approximately 1.4 feet per second (ft/sec) and 1.5 ft/sec, respectively. These current speed estimates under low river flow conditions were also confirmed by the SRH model predictions that were previously developed for the *Feather River Geomorphology, Sediment Transport, and Bedform Analyses* (Jacobs, January 2019).
- Feather River water surface elevations (WSE) at the proposed submerged, bank-side outfall site for 1Q10, 7Q10, and harmonic mean river flow conditions were developed based on the bathymetry survey measurements of river WSE at the site in 2018 and 2019. These measurements indicate that the WSE at the 7Q10 low flow at the proposed submerged, bank-side outfall site is 30 feet NAVD88. Water depths at the outfall port centerline were calculated to be approximately 15 feet at 1Q10 and 7Q10 river flows, and 17 feet at harmonic mean flow.
- Projected buildout effluent flows applied in the modeling include the maximum daily flow for acute conditions (22.7 mgd), the maximum 4-day and 30-day average flows for chronic conditions (21.8 and 20.9 mgd, respectively), and the annual average (dry weather) flow for human health (14.8 mgd).
- The submerged bank-side outfall assumes an elastomeric check fitted to the terminus. Elastomeric check valves provide a variable port opening that responds to effluent flows and provides more uniform port discharge velocities over a wide range of flows, reduced port head-loss with proper sizing, enhanced rapid mixing proximate to the outfall port, and the ability to restrict potential river sediment intrusion into the outfall pipe. This outfall concept design shows that one 36-inch elastomeric check valve would be well suited to the range of effluent flows. The check valve specifications and hydraulics developed for modeling are based on a Proco ProFlex Series 710 standard weight valve. Effective port areas (equivalent round port diameters) used in the model were calculated for the check valve at the various effluent flows based on information provided by the valve manufacturer.
- To provide optimal discharge angles for the outfall port, sensitivity analyses were conducted by using the maximum daily (acute) buildout flow of 22.7 mgd (worst case) for various horizontal and vertical port angles. These analyses demonstrated that a vertical angle of 0° (horizontal port) and a discharge angle of 90° (perpendicular to river flow direction) would provide the best dilution performance while helping to keep the plume submerged as long as possible to mix in the river flow. The port height above the sloping riverbed was set at 5 feet for all modeling scenarios, which aids in keeping the plume from contacting the riverbed.
- **Table 7** provides a summary of the model-predicted dilutions at proposed acute and chronic aquatic life mixing zone boundaries and at the proposed human health criteria mixing zone boundary. Dilution factors are provided at various distances downstream of the discharge for use in providing recommendations on mixing zone size. The selection of mixing zone boundary distances were based on mixing performance within the confines of river flow-based dilutions and EPA guidance for acute and chronic mixing zone allocations, and additional details are provided in the next bullet.

Table 7. Summary of Dilutions for the Bank-side Outfall in the Feather River for Buildout Effluent Flows – Assumed Acute, Chronic and Human Health Mixing Zones

Water Quality Criteria	Effluent Flow (mgd)	River Flow (cfs)	Dilution at Acute Aquatic Life Mixing Zone (20 feet)	Dilution at Chronic Aquatic Life Mixing Zone (200 feet)	Dilution at Chronic Human Health Mixing Zone (500 feet)
Acute	22.7	1,200	**4.3**	NA	NA
Chronic 4-day	21.8	1,236	NA	**37**	NA
Chronic 30-day	20.9	1,236	NA	**38**	NA
Human Health	14.8	3,252	NA	NA	**62**

NA = not applicable; specific dilutions only apply at specific mixing zone boundaries by definition.

Table 8 provides a detailed summary of modeling assumptions and inputs, maximum river flow-based dilution available (based on effluent flow and river flow), model-predicted dilutions at downstream distances from the outfall, and lists the model-predicted plume width at the acute zone boundary, chronic mixing zone boundary, and human health criteria mixing zone boundary. These mixing zone boundary distances were developed in accordance with EPA's TSD (1991) and the CVRWQCB SIP, as follows:

- Based on the dilution modeling results for chronic 4-day river and effluent flow conditions, the model-predicted dilution at 200 feet equals the maximum river flow-based dilution (37), so 200 feet was selected for the chronic mixing zone boundary distance.
- Based on the EPA's TSD guidance, the acute mixing zone boundary is defined as the shortest length of the following three calculation methods: (1) 5 times the water depth (75 feet), (2) 50 times the length scale (square root of port diameter – 2.15 feet) = 73 feet, or 3) 10% of the chronic mixing zone distance (20 feet). The shortest acute zone length is 20 feet.
- The proposed chronic mixing zone boundary for human health water quality criteria is 500 feet, which is less than 2 times the river channel width at low river stage (325 feet), as applied by the CVRWQCB in the past to assign chronic mixing zone lengths. Further, the model-predicted dilution at 500 feet is 62, a conservative dilution to apply because this is less than 50% of the maximum river flow-based dilution available (143).

Table 8
Yuba City WWTF Submerged Single-port Bankside Discharge to the Feather River below Shanghai Falls
Outfall Configuration: 1, 36-inch ProFlex check valve; 90° horizontal discharge angle and 0° vertical discharge angle

CORMIX Model Case	Water Quality Criteria	Effluent Flow [1] (mgd)	Effluent Flow [1] (cfs)	River Flow Condition	River Flow [2] (cfs)	River Width (ft)	Discharge Depth (ft)	Diffuser Port Dia. (in)	*Max. River Flow-Based DF*	Predicted Dilution Factors at Downstream Distances [3] 20 ft	25 ft	50 ft	75 ft	100 ft	150 ft	200 ft	500 ft
YC-BS-01	Acute	22.7	35.1	1Q10	1,200	320	15	27.9	***35***	**4.3**	5.8	8.7	15.3	22	34	35	
YC-BS-02	Chronic-4 day	21.8	33.7	7Q10	1,200	320	15	27.7	***37***		5.8	8.5	16.0	23	35	**37**	
YC-BS-03	Chronic-30 day	20.9	32.3	7Q10	1,200	320	15	27.5	***38***		6.1	8.5	16.0	23	35	**38**	
YC-BS-04	Human Health	14.8	22.9	Harm. Mean	3,252	335	17	25.8	***143***		11.1	18.9	24.8	30.4	38	41	**62**
Proposed Aquatic Life Criteria (Acute and Chronic) and Human Health Criteria (HHC) Mixing Zone Boundaries [4]										***Acute***						***Chronic***	***HHC***

Notes:

Model-predicted dilution factors in **bold** represent dilution factors at the Acute Mixing Zone Boundary, Chronic Mixing Zone Boundary, and the Human-health Criteria Mixing Zone Boundary.

[1] Effluent flows are projected Yuba City WWTF at buildout condition as developed in the Yuba City facilities planning, as applied in the Predesign Report.

[2] Feather River flows applied in modeling were developed in accordance with the State SIP guidance for Mixing Zones and Dilution Credits (Section 1.4.2), and consistent with the Predesign Report.

[3] A conservative peak-to-mean ratio of 1.7 was used to adjust model-predicted centerline dilutions to flux-averaged values based on guidance in the CORMIX User Manual (Doneker and Jirka, 2017).

[4] Proposed mixing zone boundaries are: Acute Aquatic Life Criteria at 20 feet, Chronic Aquatic Life Criteria at 200 feet, and Human-health Criteria at 500 feet downstream.

5. Summary of Screening Evaluation of Discharge Compliance for a Yuba City WWTF Advanced Treatment Facility

This TM has been developed to support the Advanced Treatment Study of the Yuba City WWTF and to identify dilution requirements and outfall dilution capabilities for a submerged, single-port bank-side outfall to comply with water quality objectives, criteria, and standards applicable to the Feather River. This TM includes an updated RPA of Yuba City WWTF effluent discharge compliance with water quality objectives and criteria to identify potential dilution requirements for an Advanced Treatment Facility that would discharge via a proposed submerged, single-port bank-side outfall, and screening-level dilution modeling for the proposed submerged bank-side outfall at a site downstream of Shanghai Falls.

This TM briefly reviews the regulatory basis for effluent discharge compliance with water quality objectives and criteria, effluent limits established in the NPDES Order/Permit, how target design dilutions have been developed, and what dilution performance can be expected for the proposed submerged bank-side outfall for Yuba City WWTF effluent from an advanced treatment facility for nutrient control.

5.1 Effluent Limits and Target Design Dilutions

The Yuba City WWTF 2019 Order/Permit includes TBELs and WQBELs, including some WQBELs that are developed based on the applicable 303(d) listings and TMDLs for the Feather River. The existing TBELs will remain in future permits, and most WQBELs will remain with minor changes. The 2019 Order/Permit includes WQBELs for effluent constituents that showed a reasonable potential to exceed water quality objectives or criteria, including ammonia, TRC, copper, dichlorobromomethane, mercury, nitrate plus nitrite, pH, settleable solids, and total coliform organisms. TRC effluent limits were set equal to the acute and chronic aquatic life criteria, with no dilution assumed, and these will remain unless the CVRWQCB allows dilution credits for TRC. In addition, dynamic modeling was applied in the 2019 Order/Permit to calculate WQBELs for ammonia and copper discharges to the Feather River. Dynamic modeling was based on the existing WWTF Outfall 001 diffuser, and the modeling results represent a reasonable estimate of the WQBELs necessary for ammonia and copper discharges.

For this screening evaluation, projected effluent ammonia concentrations developed by LWA in February 2020 for Yuba City were applied to represent AWEL and AMEL. The screening evaluation RPA to identify target dilutions required for the Yuba City WWTF discharge of effluent metals, detected organic chemicals, and conventional pollutants were based on WWTF effluent data collected between January 2014 through November 2020 and background Feather River data for the same period. Based on these RPAs, effluent concentrations of ammonia, cyanide, bis (2-ethylhexyl) phthalate, and conductivity determine the target dilutions required for the design of the submerged, single-port, bank-side outfall for the Yuba City WWTF Advanced Treatment Facility. Table 9 summarizes the dilutions needed for Yuba City WWTF effluent (with nutrient treatment) to meet water quality objectives and criteria in the Feather River.

In addition, the Yuba City WWTF discharge needs to comply with the temperature water quality objective in the Feather River. The Basin Plan limits temperature increases to less than 5 °F because of a point source. Based on an effluent 95th percentile temperature of 85 °F and a 90th percentile river temperature of 69.5 °F, a dilution of only 4 is needed at the chronic mixing zone boundary for the discharge to comply with the water quality objective for temperature in the Feather River.

5.2 Bank-side Outfall Design for Discharge Compliance

Preliminary outfall design configuration development and modeling were conducted to develop a concept for a new submerged, bank-side outfall to discharge effluent from the Yuba City WWTF Advanced

Treatment Facility. The Feather River site identified for this replacement outfall for the existing Outfall 001 diffuser is located downstream of the Shanghai Falls rapids. Screening-level dilution modeling for the proposed submerged, bank-side outfall was developed in accordance with the state's guidance for dilution credits and mixing zones, defined in the SIP. The CORMIX 1 model was applied to model the submerged single-port outfall fitted with a 36-inch elastomeric check valve port. The model cases all applied projected buildout effluent flows for the WWTF and Feather River critical discharge flow and stage conditions. These buildout effluent flows and critical river flow conditions were previously developed and applied in the Yuba City WWTF Outfall and Diffuser Project Predesign Report (Jacobs 2020).

The conditions applied for the submerged, single-port outfall are summarized as follows:

- Located submerged, single-port outfall with 36-inch elastomeric check valve at depth below Shanghai Falls in tailrace region
- Outfall terminus located approximately 50 feet off western shoreline at a discharge depth of -15 feet below WSE at 1Q10 and 7Q10 low river flow conditions
- Outfall terminus greater than 5 feet above riverbed
- Outfall modeling, using projected WWTF buildout effluent flows and three critical low river flow conditions: 1Q10, 7Q10, and Harmonic Mean flows
- Model-predicted dilutions at distances downstream of the outfall port used to define proposed acute and chronic mixing zone boundaries for aquatic life, and a chronic human health mixing zone boundary
- Predicted dilution at the Acute Mixing Zone boundary (20 ft) is 4.3
- Predicted dilution at the Chronic Mixing Zone boundary (200 ft) is 37
- Predicted dilution at the Hyman Health Mixing Zone boundary (500 ft) is 62

Table 9 provides a comparison of the dilutions needed for the Yuba City WWTF effluent (with advanced nutrient treatment) parameters to meet water quality objectives and criteria in the Feather River with the dilutions predicted to be achieved by a submerged, bank-side outfall with check valve port. This summary indicates that the parameters detected in existing Yuba City WWTF effluent can meet water quality objectives and criteria in the Feather River by using a submerged, bank-side outfall with check valve port and advance nutrient treatment.

Table 9. Comparison of Dilutions Required for Yuba City WWTF with Advanced Treatment Facility to Dilutions Predicted for Submerged Bank-side Outfall Concept

Effluent Parameters Needing Dilution	Dilution to Meet Acute Aquatic Life Criteria	Dilution to Meet Chronic Aquatic Life Criteria	Dilution to Meet Human Health Criteria
Aluminum (total)		2	
Bis (2-Ethylhexyl) Phthalate			4
Copper (total recoverable)	2	2	
Conductivity			16 [a]
Cyanide (free)	2	4	
Dichlorobromomethane			3
Lead (total recoverable)		1	

Table 9. Comparison of Dilutions Required for Yuba City WWTF with Advanced Treatment Facility to Dilutions Predicted for Submerged Bank-side Outfall Concept

Effluent Parameters Needing Dilution	Dilution to Meet Acute Aquatic Life Criteria	Dilution to Meet Chronic Aquatic Life Criteria	Dilution to Meet Human Health Criteria
Manganese (total recoverable)			2
Mercury (total recoverable)			2
Nitrite Nitrogen			1
Total Dissolved Solids			1
Zinc (total recoverable)	1		
Ammonia Nitrogen (total-N) – based on 1999 EPA Criteria	2	1 (30-day)	
Ammonia Nitrogen (total-N) – based on 2013 EPA Criteria	2	2 (30-day) / 1 (4-day)	
Dilutions Predicted for Submerged, Bank-side Outfall under Critical River Flows	**4.3**	**37**	**62**

Electrical conductivity is a long-term average of 150 µmhos/cm applied as rolling average over 10 years (Basin Plan objective), and a secondary drinking water MCL is 900 µmhos/cm.

Appendix D
Case Study Evaluation

Jacobs

Memorandum

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Subject	**Task 13.6 – Case Study Comparison**
Project Name	City of Yuba City – Outfall and Diffuser Project, Task 13 - Advanced Treatment Study
Attention	Katherine Willis
From	Jacobs
Date	January 8, 2021

1. Introduction, Background, and Purpose

The City of Yuba City (City) executed Amendment 2 to Jacobs' existing Outfall and Diffuser Project (Project) to add, among other items, an Advanced Treatment Study to develop cost estimates for advanced treatment at the City's Wastewater Treatment Facility (WWTF), including options for handling contributions from the Sunsweet facility. Advanced treatment (that is, nitrogen nutrient removal) was to be paired with a new side-bank discharge located near the City's existing diffuser at the Shanghai Falls in the Feather River. The projected effluent limits were developed by Larry Walker and Associates (LWA) and were provided by the City to Jacobs in a draft technical memorandum (TM).

After developing the Sunsweet handling options and presenting the options to City staff by conference call, Jacobs was requested stop work while City staff determined whether the scope met its needs for developing a conceptual-level cost estimate for the proposed Project and a potential advanced treatment alternative consisting of the following:

- New side-bank discharge
- Modifications and improvements to the existing WWTF to incorporate nutrient removal anticipated to be required for side-bank discharge method as described in the LWA TM

Over the past two months, Jacobs has engaged in a series of conference calls with the City to better understand the City's needs and revise its approach to give the City a better sense of the anticipated total costs rather than limiting cost estimates to nutrient (nitrogen) removal only.

2. City-Selected Approach for Task 13.6: Advanced Treatment Study Case Study Comparison

Jacobs presented and discussed a few alternative approaches with the City to increase the City's understanding of total costs; City staff ultimately selected the approach described in Table 1. Conceptually, the approach gathers capacity-related and nutrient-removal improvement costs from the Northern California Publicly Owned Treatment Works (POTWs) to illustrate relative total and nutrient-removal improvement costs. Jacobs anticipates that the data will indicate that nutrient-removal costs represent the majority (that is, 60 to 80%) of overall costs. Efforts associated with populating Table 1 were

limited to obtaining readily available information from studies, reports, and other information primarily via internet searches, and estimating total and nutrient-removal improvement costs and operations and maintenance (O&M) costs.

3. Results, Key Findings, and Recommendations

The following summarizes the information and data used for each case study described in Table 1.

1) **Sacramento Regional County Sanitation District (Regional San)**. Data were obtained from the Ammonia Study (March 2011), discussion with Program Management Office staff, the most recent project cost of $1.2 billion, and the selected Alternative H-2. Estimated total and nutrient-removal capital costs are estimated at $1,200 million and $581 million, respectively. Estimated O&M costs are anticipated to increase by $2.7 million per year once Alternative H-2 has been implemented and the pure oxygen-activated sludge system has been taken out of service. Compared with the other case studies, construction costs are anticipated to be low, given that additional secondary clarifiers are not required.

   As indicated in Table 1, O&M costs for nutrient removal are anticipated to be about 25%[1] higher than O&M for the pure oxygen-activated sludge process.

2) **City of Davis**. The City of Davis (Davis) essentially replaced its existing wastewater pond treatment system with a new, conventional nutrient (nitrogen) removal POTW between 2013 and 2018. Davis hired NBS in June 2015 to develop a rate study and evaluate several issues, including incorporating changes related to the new WWTF. Graphics included in the rate study project O&M costs to increase from about $6 million per year to an average of about $10 million per year between 2019 and 2026, which is assumed to be attributed to the new WWTF's O&M. As indicated in Table 1, O&M costs for nutrient removal are anticipated to be about 40% higher than conventional carbonaceous BOD5 removal using the previous pond treatment system. Construction cost data were not readily available or obtained for this work.

3) **Linda County Water District**. A construction progress payment request dated April 20, 2012, for Linda County's Wastewater Upgrade and Expansion Project described costs associated with specific tasks, facilities, and the like, by work division. Jacobs categorized costs based on work division and its professional experience to develop the estimates listed in Table 1. Costs specific to the aeration basins, secondary clarifiers, control building, return-activated sludge and waste-activated sludge pumping, and blowers were added together to represent nutrient-removal costs. Common costs (for example, mobilization/demobilization, site improvement, yard piping, electrical, instrumentation) were proportioned accordingly. As indicated in Table 1, nutrient-removal costs were 50% of the overall total project costs.

4) **Sewer Commission Oroville (SC-OR):** The 60% design submittal cost estimate served as the basis for developing the costs shown in Table 1 and used an approach similar to that described for Linda County. As indicated in Table 1, nutrient-removal costs were 56% of the overall total project costs.

Capital cost comparison derived from the final Yuba City wastewater master plan were developed for comparison purposes. Nutrient-removal costs reported in the master plan were limited to biological nutrient removal and filters; common or other improvements were not listed but were included and obtained from Tables ES-11 and ES-12. As indicated in Table 1, nutrient-removal costs were 38% of the overall total estimated improvement costs.

[1] 25% = 2.7/10.7

4. Recommendations

Jacobs recommends the following, based on the values reported in Table 1:

Total Capital Costs. The average (mean) percentage of about 51% (not including the Yuba City Master Plan) reported in Table 1 be used for estimating total costs from nutrient-removal costs derived from the Bay Area Clean Water Agencies. This percentage is less than the percentage originally anticipated of 60 to 80%.

O&M Costs. Nutrient-removal O&M costs are anticipated to be 25 to 40% of total O&M costs as shown in Table 1.

Table 1. Total and Nitrogen-Related Wastewater Improvement Costs

Estimated Nitrogen-Related Improvement Costs as Percentage of Total Costs for Listed Case Studies, January 8, 2021

Number POTW	Nutrient Removal- and Capacity Increase-Related Costs for Valley Discharges Listed (Millions $)				
	1 Sac Regional San	2 City of Davis	3 Linda County	4 SC-OR	5 Yuba City Master Plan
TOTAL COSTS					
Nitrogen Removal-Related Costs	581	NA	14.6	19.8	70.3
Total Costs Minus Nitrogen Removal-Related Improvement Costs	619	NA	14.6	15.6	115.5
TOTAL COSTS	**1,200**	**NA**	**29.2**	**35.4**	**185.8**
O&M COSTS					
Nitrogen Removal-Related O&M Costs	2.7	4	NA	NA	NA
O&M Costs Non-Nitrogen-Related Improvements	8	6	NA	NA	NA
O&M COSTS	**10.7**	**10**	**NA**	**NA**	**NA**
% OF TOTAL COST	**48**		**50**	**56**	**38**
% OF TOTAL O&M COSTS	**25**	**40**			
Notes	Considered more of Nutrient Removal Conversion than capacity expansion. No secondary clarifiers installed. 181 MGD capacity, economy of scale.	Replacement of most components, including new activated sludge oxidation ditch system. O&M obtained from Rate Study p 3. Roughly 7.5 MGD facility.	Capacity increase-related improvement project with nutrient removal and filters. Obtained from one of the last construction pay requests.	Capacity increase-related improvement project. Derived from 60% Submittal cost estimate.	Derived from Final Master Plan.

NA = Data requested but not obtained for this work.

MGD = million gallons per day

Attachment 1
Memorandum – City of Yuba City Reasonable Potential Analysis and Effluent Limits Recalculations (LWA 2020)

Memorandum

LARRY WALKER ASSOCIATES

DATE: March 4, 2020

TO: Mike Finnigan, City of Yuba City

CC: Mitch Mysliwiec, LWA

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SUBJECT: **City of Yuba City Reasonable Potential Analysis and Effluent Limits Re-Calculation**

REASONABLE POTENTIAL ANALYSIS

To inform the treatment requirements of a wastewater treatment plant (WWTP) that could meet permit requirements corresponding to a side bank discharge, it was assumed no dilution would be granted for aquatic life water quality objectives (WQOs). A reasonable potential analysis (RPA) was performed on data collected from Yuba City WWTF's effluent and upstream ambient (RSW-001) between January 2015 and December 2019. The RPA is used to determine which constituents require effluent limitations, and the process is specified in the State Implementation Plan (SIP). The dataset used by the Central Valley Regional Water Quality Control Board (Regional Board) in NPDES Permit Order No. R5-2019-0017-01 (the 2019 permit) ranged from June 2014 to May 2017, so all data collected between June 2017 and December 2019 could trigger new reasonable potential. The detected maximum effluent and ambient concentrations were compared with the WQOs. The applicable WQOs were taken from the 2019 permit (selected for the protection of MUN beneficial uses and aquatic life). The WQOs for metals and ammonia were recalculated using updated information.

The WQOs for certain metals including cadmium, copper, lead, nickel, and zinc are hardness-dependent. The Regional Board selected the highest ambient hardness (52 mg/L) that was less than the lowest effluent hardness (60 mg/L) to calculate the WQOs used the 2019 RPA. The updated effluent and ambient hardness dataset does not change the selected hardness.

The Regional Board calculated WQOs for ammonia using the 1999 NAWQC equations (as the 2013 Statewide Final Ammonia Criteria equations were not yet finalized) using the maximum permitted pH of 8.5 for the acute criterion and the minimum 30-day average chronic criterion based on rolling 30-day average paired downstream pH and temperature data. The ammonia WQOs were re-calculated in this analysis using the 2019 CVCWA adjustment of the 2013 statewide equations, assuming mussels and *Oncorhynchus* species are present. The acute criterion was calculated using a pH of 8.0 and the maximum effluent temperature, and the minimum 30-day average chronic criterion was based on rolling 30-day average paired effluent pH and temperature data. The

resulting updated WQO was higher than the WQO used in the 2019 permit. However, if the permitted maximum pH of 8.5 was used for the updated acute criterion, the updated WQO would be lower than the WQO in the 2019 permit.

The results of the RPA are shown in **Table 1**. Bold constituents are those which trigger reasonable potential. Of these, cyanide and MBAS do not have limits in the 2019 permit. Regardless of the discharge method, the RPA using the current dataset results in new permit limitations for cyanide and MBAS. The data for these constituents should be reviewed and verified.

Table 1. Reasonable Potential Analysis Results

Constituent	EFF-001 Maximum	RSW-001 Maximum	WQO	Result
Copper, µg/L	8.5	3.5	5.3	Reasonable potential exists due to effluent maximum, there are existing permit limits.
Mercury, µg/L	0.017	0.011	0.012	Reasonable potential exists due to effluent maximum, there are existing permit limits (mass limit).
Dichloro-bromomethane, µg/L	1.5	<0.16	0.56	Reasonable potential exists due to effluent maximum, there are existing permit limits.
Ammonia as N, mg/L	54	0.26	2.1	Reasonable potential exists due to effluent maximum, there are existing permit limits.
Nitrite as N, mg/L (**NO3+NO2-N**)	2.21	<0.05	1.0	Reasonable potential exists due to effluent maximum, there are existing permit limits for nitrate+nitrite-N.
Cyanide, µg/L	7.4 in 2018	<0.9	5.2	New effluent maximum triggers reasonable potential with the chronic California Toxic Rule, no existing permit limits.
MBAS, µg/L	530 daily, 500 2018 annual average	<50	500	The annual average effluent equals the WQO (secondary Maximum Contaminant Level or MCL). This could trigger reasonable potential.
Bis (2-Ethylhexyl) Phthalate, µg/L	1.9 in 2016	<0.5	1.8	Regional Board found no reasonable potential due to possible sample contamination. No new data trigger reasonable potential.
Aluminum, Total, µg/L	74	800 in 2017	200	Regional Board found no reasonable potential using the same ambient dataset although the maximum ambient concentration exceeds: the same result is likely.
Iron, Total, µg/L	360 daily, 145 2018 annual average	1300 in 2017	300	Regional Board found no reasonable potential using the effluent annual average and the same ambient dataset: the same result is likely.

Constituents which may receive effluent limits due to reasonable potential are shown in **bold**. Constituents which may receive new permit limits are shown in **red**.

EFFLUENT LIMITS CALCULATION

In the current permit, the Regional Board calculated effluent limits for copper and ammonia using a dynamic model, applying acute and chronic dilution allowances of 11 and 12, respectively. Effluent limits for constituents with human health criteria were calculated using a dilution of 221. This analysis re-calculated the effluent limits for constituents showing reasonable potential without the acute or chronic dilution allowances, to estimate the potential effluent limits that would be issued to a side-bank discharge. The effluent limit calculations for copper, ammonia, dichlorobromomethane, cyanide, and MBAS are shown in **Table 2**. Nitrate+Nitrite-N limits were not re-calculated, as dilution was not allowed in the 2019 permit so they will not have changed. Likewise, the 2019 permit includes a performance-based mass limit for mercury which is not expected to change with dilution.

A summary and comparison of the new effluent limits with the 2019 Permit limits is shown in **Table 3**.

Table 2. Effluent Limit Calculations Corresponding to a Side-Bank Discharge.

	Copper, µg/L		Ammonia-N, mg/L		DCBM, µg/L	Cyanide, µg/L		MBAS, mg/L
	CMC	CCC	CMC	CCC	HH	CMC	CCC	HH
WQO	7.6	5.3	3.1	2.1	0.56	22.0	5.2	0.50
Max ambient (B)	3.5	3.5	0.26	0.26	0.16	0.9	0.9	0.05
Dilution (D)	0	0	0	0	221	0	0	221
ECA	7.6	5.3	3.1	2.1	88.96	22.0	5.2	100
CV[a]	0.37	0.37	0.33	0.33	0.47	1.00	1.00	0.36
ECA Multiplier	0.47	0.67	0.499	0.871	none	0.20	0.37	none
LTA	3.5	3.6	1.6	1.8		4.5	1.9	
n		4	4		4		4	4
AMEL Multiplier		1.33	1.29		1.43		1.95	1.32
AMEL		**4.7**	**2.0**		**89**		**3.8**	**100**
MDEL Multiplier		2.14			2.56		4.90	2.10
MDEL HH multiplier					1.8			1.6
MDEL		**7.6**			**160**		**9.5**	**160**
AWEL Multiplier			1.84					
AWEL			**2.9**					

[a] The coefficients of variation were taken from the 2019 permit for copper, ammonia, and DCBM, and calculated from the dataset for cyanide and MBAS, as no values were available in the 2019 Permit.

Table 3. Summary and Comparison of Re-Calculated Effluent Limits

Constituent	Limit Type	Existing permit limits	Updated limits	Notes
Copper, Total, µg/L	AMEL	50	**4.7**	Effluent limits decrease significantly.
	MDEL	85	**7.6**	
DCBM, µg/L	AMEL	10	10	Previous permit limits were carried over in the 2019 permit, this is not expected to change.
	MDEL	30	30	
Cyanide, µg/L	AMEL	-	**3.8**	New potential limits (driven by the chronic pathway, no dilution).
	MDEL		**9.5**	
MBAS, mg/L	AMEL	-	**100**	New potential limits (affected by HH dilution).
	MDEL		**160**	
Ammonia-N, mg/L	AMEL	31	**2.0**	Updated CVCWQ 2013 equations increase the WQOs, but lack of dilution decreases the effluent limits significantly.
	AWEL	51	**2.9**	
Nitrate+Nitrite-N, mg/L	AMEL	10	10	No dilution was allowed in 2019 permit, no change in limits is expected.
	AWEL	21	21	

Other constituents with limits in the 2019 permit include conventional technology-based effluent limits (BOD, TSS, pH, settleable solids, percent removal, toxicity, total residual chlorine, and total coliform) and effluent limits for diazinon and chlorpyrifos due to 303(d) listing of the Lower Feather River. The permit limits for diazinon and chlorpyrifos are consistent with the applicable wasteload allocations in the Basin Plan Amendment for Control of Diazinon and Chlorpyrifos Runoff in the Sacramento and Feather Rivers and are not expected to change with a change in dilution. A mercury TMDL is planned for completion in 2027 which may cause the effluent limits to be adjusted. These technology-based limits would be carried over from the current permit.

CONCLUSION

The effluent limits for copper and ammonia decrease significantly with the lack of aquatic life dilution. Limits for dichlorobromomethane and nitrate+nitrite-N are expected to remain the same, unaffected by dilution. New limits could be issued for cyanide and MBAS due to a new finding of reasonable potential. Potential effluent limits for MBAS, if issued, will likely be calculated with available human health dilution, therefore compliance should not be a problem. Potential effluent limits for cyanide would not be calculated with dilution and may pose a compliance difficulty.

It is recommended the City review the MBAS and cyanide data to ensure the data are representative of the effluent quality.