SHASTA COUNTY
SERVICE AREA NO. 17 COTTONWOOD

2022 AMENDMENT TO
2013 SEWER MASTER PLAN

MAY 2022

JOB NO. 199.109

Prepared By:

PACE ENGINEERING

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May 13, 2022

199.109

SENT BY EMAIL ONLY
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Venton Trotter, Supervising Engineer
Shasta County Department of Public Works
1855 Placer Street
Redding, CA 96001

Dear Mr. Trotter:

We are pleased to present the engineering report entitled:

SHASTA COUNTY SERVICE AREA NO. 17 COTTONWOOD
2022 AMENDMENT TO THE 2013 SEWER MASTER PLAN

This report contains the results of our investigation of the CSA 17 system, including lift stations, wastewater treatment facilities, and effluent disposal. Review and recommendations of collection system pipelines were beyond the scope of this report. This report includes preliminary plans and cost estimates for major capital improvements recommended to accommodate full buildout of the existing service area boundary. A summary of the report, including our recommendations, follows the Table of Contents.

PACE Engineering, Inc. (PACE) is very pleased to have participated in this project. We thank your staff for their able assistance in its preparation and are available to meet at your convenience to discuss the 2022 Amendment to the 2013 Sewer Master Plan in detail.

5/13/22

REGISTERED PROFESSIONAL ENGINEER
LAURIE E. McCOLLUM
No. 77274
CIVIL
STATE OF CALIFORNIA

Sincerely,

Laurie McCollum, P.E.
Principal Engineer

Enclosure
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ABBREVIATIONS

The following abbreviations are used in this report:

AC	Acres
AC-FT	Acre-Feet
ADWF	Average Dry Weather Flow (The average rate of wastewater flow during summer months.)
ATS	Automatic Transfer Switch
AWWA	American Water Works Association
BLM	Bureau of Land Development
CIP	Capital Improvement Plan
County	Shasta County Department of Public Works
CRWQCB	California Regional Water Quality Control Board
CSA 17	County Service Area No. 17 Cottonwood
CT	Contact Time
DBP	Disinfection Byproduct
DCB	Density Current Baffles
DDW	Division of Drinking Water
DO	Dissolved Oxygen
ENR CCI	Engineering News Record Construction Cost Index
ET	Evapotranspiration
FRP	Fiber Reinforced Polymer
GPAD	Gallons per Acre per Day
GPD	Gallons per Day
GPM	Gallons per Minute
HDD	Horizontal Directional Drill
HDPE	High-Density Polyethylene
HE	Household Equivalent
I&I	Infiltration and Inflow
LAFCO	Local Agency Formation Commission
MCC	Motor Control Center
MG	Million Gallons
MGD	Million Gallons per Day
MLSS	Mixed Liquor Suspended Solids
MSR	Municipal Services Review
NPDES	National Pollutant Discharge Elimination System

O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
PWWF	Peak Wet Weather Flow
RAS	Return Activated Sludge
SMP	Sewer Master Plan
SSB	Sludge Storage Basin
SWRCB	State Water Resources Control Board
WAS	Waste Activated Sludge
WDRs	Waste Discharge Requirements
WWTP	Wastewater Treatment Plant
UV	Ultraviolet
VFD	Variable Frequency Drive

SUMMARY AND RECOMMENDATIONS

SUMMARY

Development of the 2022 Amendment to the 2013 Sewer Master Plan (SMP) consisted of an engineering analysis of the Shasta County Service Area No. 17 Cottonwood (CSA 17) lift stations and wastewater treatment plant (WWTP) and potential effects future wastewater flows under ultimate buildout of the existing service area have on each of these components. The wastewater collection system was not analyzed as part of this Amendment. Refer to the 2013 SMP for overview, analysis, and recommendations of the sewer collection system. Analysis of the WWTP was accomplished with the assistance and review of Shasta County Department of Public Works (County) staff. Tables, figures, and appendices are located at the end of the text. These are intended to be additions to the 2013 SMP and are numbered as such.

Sewage Lift Stations: There are presently four lift stations in CSA 17: Cottonwood, Black Lane, Quail Lane, and Crowley Creek. Cottonwood Lift Station is the main lift station, pumping about 90% of all wastewater to the WWTP, with a current effective capacity of 600 gallons per minute (GPM) (0.86 million gallons per day [MGD]). Black Lane Lift Station pumps wastewater from east Cottonwood to the WWTP and currently has an effective capacity of 150 GPM (0.22 MGD). Quail Lane Lift Station only serves a few homes, is a tributary of Cottonwood Lift Station, and has an effective capacity of 60 GPM (0.09 MGD). Crowley Creek Lift Station primarily serves Cottonwood Elementary School, is also a tributary to Cottonwood Lift Station, and has an effective capacity of 250 GPM (0.36 MGD).

Wastewater Treatment Plant: The CSA 17 WWTP has an existing design ADWF capacity of approximately 0.43 MGD, and a peak wet weather flow (PWWF) capacity of 1.32 MGD as indicated in the original 1985 WWTP Operations and Maintenance (O&M) Manual. The 2020 averave dry weather flow (ADWF) estimated at 0.33 MGD is 77% of the current plant capacity. PWWF at the WWTP has been recorded as high as 0.99 MGD, or 75% of peak design capacity.

Effluent Disposal: CSA 17 currently discharges treated wastewater to a diffuser in Cottonwood Creek. The high-density polyethylene (HDPE) diffuser was installed in July 2008. Through discussions with California Regional Water Quality Control Board (CRWQCB) representatives, it has been suggested that increased discharges to Cottonwood Creek, beyond the existing facility design capacity of 0.43 MGD (ADWF), would likely exacerbate current assimilative capacity concerns for copper and zinc.

FUTURE ULTIMATE WASTEWATER FLOWS

The current number of household equivalents (HEs) is estimated to be approximately 1,478. Ultimate growth of the existing service area boundary was considered to determine necessary improvements to the lift stations, WWTP, and effluent disposal to accommodate the projected growth. There are a few proposed developments that have tentative maps and/or preliminary plans already completed and approved. These developments were utilized in this amendment, together with the highest predicted future development densities per the Shasta County General Plan and Housing Element. This equates to a possible 1,659 HEs being added to the system, resulting in a total of 3,137 HEs at ultimate buildout. HEs have been pre-purchased in various areas of CSA 17 during approval of tentative projects, thereby ensuring their future ability to discharge to the collection and treatment system. While several of these areas have already been developed and are not likely to develop further, they must be accounted for to ensure the wastewater facilities can accommodate them. A review of County data indicates approximately 614 pre-purchased HEs have yet to be developed. It is anticipated 1,045 additional non-pre-purchased HEs will be added to CSA 17 under the ultimate buildout condition.

ANALYSIS AND RECOMMENDED IMPROVEMENTS

After reviewing the existing lift station and WWTP deficiencies under current conditions, the wastewater pumping, treatment, and disposal systems were analyzed under future ultimate buildout of the service area boundary condition.

Lift Station Improvements: Analysis of the lift stations has indicated that, overall, most of the system's lift stations have adequate capacity to handle ultimate PWWF. The analysis indicates that Cottonwood Lift Station will need to be expanded to serve ultimate development. Other recommended improvements include a new grinder at Cottonwood Lift Station, portable trash pump and piping at Black Lane Lift Station, secondary containment improvements for Crowley Creek Lift Station's emergency generator diesel tank, and bypass piping at both Crowley Creek and Quail Lane Lift Stations.

Wastewater Treatment Plant: WWTP design criteria is shown in Table 3A, which outlines process units and loading under the original 1983 design, current 2020 flow conditions, and future ultimate flows. Future ultimate design criteria were determined to meet PWWF of ultimate buildout of the existing service area based on existing zoning densities and a future infiltration and inflow (I&I) rate of 1,500 gallons per acre per day (GPAD). Major components of recommended improvements are shown on Figure 4B.

To correct current WWTP deficiencies, several improvements are recommended, including the following:

- Expand chlorine contact basin to 106,500 gallons (Phase 1)
- Construct sludge dewatering facility
- Construct a new office/lab building
- Renovate existing office building into expanded control building
- Install new lab equipment
- Replace freeze-prone yard hydrants
- Upgrade chlorination/dichlorination dosing and monitoring equipment
- Miscellaneous improvements to SCADA, electrical, and site piping
- Improve access road to effluent diffuser in Cottonwood Creek
- Pave site

The above-recommended improvements are needed to adequately and more efficiently treat current wastewater flows and are not growth related. Additional improvements are recommended to improve efficiency and redundancy as well as to expand capacity to serve projected growth. Those improvements are as follows:

- Construct expanded headworks
- Construct Aero-Mod treatment facility with blower building
- Construct an additional traveling bridge filter
- Convert existing sludge storage basins to emergency storage ponds
- Expand chlorine building
- Expand chlorine contact basin from 106,500 gallons to 142,000 gallons (Phase 2)
- Miscellaneous improvements to SCADA, electrical, and site piping
- Install an additional generator and upgrade the existing automatic transfer switch (ATS)

Effluent Disposal: In anticipation of renewal of Waste Discharge Requirements (WDRs) later this fall, preliminary discussions with CRWQCB representatives have suggested that increased discharges to Cottonwood Creek, beyond the existing facility design capacity of 0.43 MGD, would likely exacerbate current assimilative capacity concerns for copper and zinc. Thus, there is a need to either improve treatment or site a new effluent disposal facility for flows beyond 0.43 MGD. CRWQCB representatives also expressed concern that, long term, Cottonwood Creek may not be a viable receiving water for effluent due to decreasing flows in the Creek, which reduces available dilution credits and assimilative capacity. CRWQCB representatives recommended CSA 17 consider conducting a water effect ratio or translator study in addition to an antidegradation study for any future increased flows to Cottonwood Creek.

For planning purposes herein, it is assumed that CSA 17 will be able to maintain its Cottonwood Creek discharge for wastewater flows up to 0.43 MGD, and all flows beyond this will be discharged in an alternative effluent disposal facility. A feasibility study is required to verify assumptions utilized herein are correct for effluent disposal alternatives.

Based on monetary and non-monetary criteria considered in this Amendment, constructed wetlands were identified as being the preferred alternative effluent disposal facility for effluent storage and disposal. The proposed 26-acre (AC) wetlands would consist of four ponds containing wetlands vegetation and varying bottom percolation rates. The primary wetland pond would contain a very low percolation rate, but the secondary ponds would allow more percolation into the ground.

In terms of siting potential future effluent storage and disposal wetlands, several properties were reviewed. In general, it is believed that siting a reservoir on the north side of Cottonwood Creek would prevent a costly pipeline crossing Cottonwood Creek. Also, it is desirable to site future effluent disposal facilities outside the 100-year FEMA flood plain boundary. At the east end of Black Lane is a 237 AC privately owned parcel located outside the flood boundary, which would be an ideal location for constructed wetlands as there appears to be some existing wetlands on the property. It is assumed a portion of this property could be procured by the County. This will need to be verified during completion of a future effluent disposal feasibility study.

Master Plan Key Elements and Costs: The total cost for all wastewater lift stations, treatment, and effluent disposal improvements is approximately $37,893,000. Recommended improvements needed to correct existing WWTP deficiencies and provide anticipated capacity for ultimate development are shown on Figure 4B at the end of this report. A summary of costs for recommended lift station, WWTP, and effluent disposal improvements are included in Table 11B. As CSA 17 expands beyond the existing service area boundary, additional improvements for lift station, treatment, and disposal will be required to meet future development system demands. Furthermore, collection system pipeline improvements for future development will be required in addition to costs detailed herein.

Costs include a 60% adder for construction contingencies and indirect costs, including environmental and engineering. Figures are based on March 2022 dollars and do not include any allowance for inflation or financing costs.

Financial Considerations: Currently, CSA 17 has a Capital Improvement Fee of $5,651 per HE. Additionally, CSA 17 has a Collection System Improvement Fee ranging from $0 to $2,510 per HE depending on the location of the new HE within the collection system. Refer to Appendix G. These fees are adjusted annually in January by the increase in the Engineering News Record Construction Cost Index (ENR CCI), which currently stands at 12791 for March 2022. As a part of this plan, a determination was made of an appropriate revised Capital Improvement Fee based on actual and future costs for improvements. A portion of some recommended improvements benefits both future and existing customers. Therefore, a proportional share in the cost burden is recommended. Table 11B shows the computed fee of $28,300, which accounts for future improvement costs attributed to growth based on projected HEs.

With the current level of unprecedented grant funding provided by both the state and federal government, the County should pursue Clean Water State Revolving Fund grant funding for operational upgrades recommended now to serve the existing HEs. These improvements would include chlorine contact basin expansion, construction of the mechanical dewatering facility, construction of the office building including upgraded lab equipment, improvement of the access road to the diffuser in Cottonwood Creek, and renovation of the existing office/control building into only a control building.

The County calculates capital improvement fees for apartments, duplexes, motels, and hotels on a proportional HE basis. The capital improvement fee for commercial and industrial customers is based upon the size of service requested by the customer and approved by the County and the equivalent AWWA capacity ratios for different sized meters.

It is recommended the County review this SMP report carefully and, if in agreement, it be adopted as the 2022 Amendment to the 2013 SMP.

INTRODUCTION

HISTORY AND PREVIOUS STUDIES

Refer to the 2013 SMP for a history of the CSA 17 collection and treatment system and previous studies completed.

NEED AND SCOPE OF CURRENT STUDY

Photo 1 – CSA 17 WWTP

The CSA 17 wastewater collection and treatment system began operation in 1986 to alleviate problems resulting from failing septic systems. As such, the system has now been in service for more than 35 years. A recent capital improvement project at the WWTP replaced equipment that was beyond its useful service life and made much-needed operational improvements; however, there are several outstanding improvements identified in the 2013 SMP that were not constructed, and no additional hydraulic capacity was added to the plant. Renewed interest in development in Cottonwood, particularly in west Cottonwood, could lead to substantial increases in flows. The existing system was designed to serve a limited number of customers, so continued growth will eventually overtax the existing pumping, treatment, and effluent disposal facilities.

In July 2021, the County authorized PACE Engineering to work jointly with County staff to prepare an Amendment to the 2013 SMP for CSA 17. The emphasis of this planning effort was to review and analyze the existing lift station, WWTP, and effluent disposal, incorporating recent and pending improvements, and determine the need for future improvements. Projection of future PWWF of ultimate buildout of the existing service area was made, and a master plan of improvements was developed to meet future wastewater pumping, treatment, and disposal needs. The findings of this evaluation of the wastewater collection system and WWTP are presented herein and comprise the CSA 17 2022 Amendment to the 2013 SMP.

SEWER SYSTEM REVIEW

WASTEWATER COLLECTION SYSTEM

Refer to the 2013 SMP for a detailed review of the wastewater collection system.

SEWAGE LIFT STATIONS

Refer to the 2013 SMP and Table 2A for a detailed review of the sewage lift stations. A capital improvement project is planned to start construction in 2023 and will include the following improvements specific to the lift stations:

- Cottonwood Lift Station will receive new increased capacity pumps and motors, shade structure, emergency generator, ATS, electrical, controls, and alarms.
- Black Lane Lift Station will receive new increased capacity pumps and motors, shade structure, emergency generator, ATS, electrical, controls, and alarms.
- Quail Lane Lift Station will receive new pumps, motors, shade structure, emergency generator, ATS, electrical, controls, alarms, and fencing.
- Crowley Creek Lift Station will receive new pumps, shade structure, and above-grade lockable enclosure.

WASTEWATER TREATMENT PLANT (WWTP)

Refer to the 2013 SMP for a detailed overview of the WWTP and effluent disposal system. A capital improvement project recently finished construction earlier this year and included the following improvements:

- Replace headworks grinder, auger, motor controller, and basket strainer.
- Construct an open channel anoxic biological selector with mixers prior to the aeration basins, complete with mixed liquor recycle pump station.
- Replace aeration basin aerators and motors with variable frequency drive (VFD) motors and dissolved oxygen (DO)-controlled aerators.
- Installation of continuous online DO, oxidation reduction potential (ORP), and nitrate probes in the aeration basins.
- Sand blast and recoat both 35-foot secondary clarifiers and install new launder and weir baffles, density current baffles (DCBs), skimming assemblies, and drives.
- Install additional return activated sludge (RAS) pump and replace existing RAS, waste activated sludge (WAS), scum, sludge, No. 2 water, and drainage pumps.

- Retrofit the existing traveling bridge filter with a rail-mounted backwash system utilizing the existing concrete basin.
- Install an additional traveling bridge filter.
- Replace existing aluminum slide gates in the chlorine contact basin channel with fiber reinforced polymer (FRP) slide gates.
- Replace Sludge Storage Basin (SSB) 1 surface aerator and motor and install conduit and disconnect switch for a future second aerator in SSB 1.
- Replace influent and effluent composite samplers, chlorine and sulfur dioxide cylinder scales, and automatic switchover valves.
- Upgrade WWTP electrical and controls, including a new PG&E service and SCADA system.
- Install a new emergency generator, complete with updated ATS.
- Replace influent and effluent flow meters and install new RAS and mixed liquor suspended solids (MLSS) recycle flow meters.

WASTEWATER FLOWS

SERVICE AREA

The CSA 17 service area boundary shown on Figure 6 is also the current Local Agency Formation Commission (LAFCO) boundary according to the 2017 Municipal Services Review (MSR). It consists of approximately 1,581 AC. According to the 2017 MSR, there were a reported 1,365 service connections, 1,149 of which were active, serving an estimated 3,316 people.

This SMP outlines improvements needed to service existing deficiencies and anticipated ultimate growth within the existing service area boundary. To determine CSA 17 system needs, HE wastewater loadings were estimated for all undeveloped land pursuant to the County's General Plan, Housing Element, and known developments currently being considered.

EXISTING WASTEWATER FLOWS

HE Determination

An HE is defined as the average dry weather wastewater flow generated from a single-family dwelling. For CSA 17, this flow was calculated to be approximately 240 gallons of wastewater per day. Please review the 2013 SMP for a detailed HE determination. For the purpose of this study, a flow factor of 240 gallons per day (GPD) per HE was used for existing and future development throughout CSA 17 when determining ADWF.

I&I

Based on review of the 2016 to 2020 influent WWTP flow records, the five-year ADWF was approximately 0.33 MGD. According to County staff, historical instantaneous PWWFs at the WWTP have reached 0.99 MGD. Thus, during wet weather conditions, the current peaking factor is 3.0, which is very similar to the original design peaking factor of 3.07. While this I&I component is significant, some communities have peaking factors of six times or greater.

Infiltration refers to groundwater that leaks into cracks and breaks in sewers and manholes. Inflow refers to stormwater that enters the sewer system directly from such sources as illicit roof drain connections, cross connections to storm drains, surface drainage that directly enters a broken sewer, cleanouts without lids, or leaky manhole covers, etc. Infiltration tends to be prolonged leakage until the groundwater table subsides. Inflow tends to be more noticeable during a storm event when surface water is present. Since the two are very hard to separate, it is common practice to simply refer to the entire leakage problem as I&I.

A review of CSA 17 WWTP records suggests that, at PWWF, a large portion (67% or 0.66 MGD) of wastewater flow is due to I&I, and most of this is likely from infiltration. This is based on the observation that it takes a prolonged period of rain to significantly increase I&I flows at the WWTP. Furthermore, plant flows appear to drop off relatively slowly following a period of intense rainfall.

The 2013 SMP was completed during a time of very little rainfall, which prevented I&I monitoring from being completed. Unfortunately, California is still in an extreme drought period; therefore, I&I monitoring cannot yet be accomplished. However, it is recommended to verify wet weather flows if and when it can be completed.

GROWTH PROJECTIONS

Ultimate Growth Projections

Proposed developments that have tentative maps and/or preliminary plans already completed and approved were utilized in this amendment, together with the highest predicted future development densities per the Shasta County General Plan and Housing Element within the existing service area boundary. This equates to possibly 1,659 HEs being added to the system. HEs have been pre-purchased in various areas of CSA 17 during approval of tentative projects, thereby ensuring their future ability to discharge to the collection and treatment system. While several of these areas have already been developed and are not likely to develop further, they must be accounted for to ensure the wastewater facilities can accommodate them. A review of County data indicates approximately 614 pre-purchased HEs have yet to be developed. It is anticipated 1,045 additional non-pre-purchased HEs will be added to CSA 17 under ultimate buildout of the existing service area.

Recommended WWTP improvements to accommodate this growth are shown on Figure 4B. Additional studies needed to evaluate sewer main sizing to serve each of these developments are beyond the scope of this SMP. These improvements and details must be further investigated and evaluated at such a time prior to development occurring.

FUTURE WASTEWATER AND I&I FLOWS

After estimating ultimate growth and determining the number of HEs associated with that growth, existing 2022 and future ultimate wastewater, including I&I flow contributions, were estimated. Estimated ultimate flows were used to determine required lift station, treatment, and effluent disposal improvements needed to serve this projected growth.

In existing developed areas with calculated I&I values less than 1,500 GPAD, it was assumed I&I rates would gradually increase due to degradation of the collection system over time to 1,500 GPAD under future conditions. I&I flows in areas with values between 1,500 and 4,000 GPAD were assumed to remain the same in the future due to the combination of some rehabilitation being completed and some degradation due to age. All future development areas were assigned an I&I allowance of 1,500 GPAD. It is again emphasized these values and assumptions should be reevaluated when meaningful I&I flow monitoring data can be obtained.

ANALYSIS AND RECOMMENDED IMPROVEMENTS

WASTEWATER COLLECTION SYSTEM IMPROVEMENTS

Refer to the 2013 SMP for recommended existing and future sewer collection system pipeline improvements.

LIFT STATION IMPROVEMENTS

Photo 2 – Cottonwood Lift Station Electrical

Cottonwood Lift Station: The effective capacity of 0.86 MGD is adequate to meet current PWWF but is not large enough to meet the anticipated ultimate PWWF of 1.93 MGD. It is hoped that funding in the upcoming 2023 capital improvement project will be sufficient to replace the existing 150 GPM pumps with 225 GPM pumps and the existing 300 GPM pumps with 450 GPM pumps, for an effective lift station capacity of 1.30 MGD. As development occurs and PWWF begins to approach 1.30 MGD, it is recommended the 225 GPM pumps be replaced with 325 GPM pumps and the existing 450 GPM pumps be replaced with 700 GPM pumps, for an effective lift station capacity of 1.94 MGD. Assuming these future flows, the existing 10-inch force main is adequate to handle future ultimate PWWF. Additionally, a Taskmaster Grinder® or similar is recommended to be installed prior to the screen to minimize pump clogging, which has been an issue according to County staff.

Black Lane Lift Station: The forthcoming capital improvement project will replace and upsize the existing pumps, increasing the effective capacity from 0.22 MGD to 0.33 MGD. This is adequate to handle ultimate PWWF. The existing 6-inch force main is adequate to handle future ultimate PWWF. It is recommended piping be installed to allow for connection of a portable gas-driven trash pump for emergency bypass pumping.

Crowley Creek Lift Station: The effective capacity of 0.36 MGD at this lift station is more than adequate to meet ultimate PWWF. The diesel gas tank for the emergency generator does not have secondary containment. It is recommended adequate secondary containment be installed. It is also recommended piping be installed to allow for emergency bypass pumping.

Quail Lane Lift Station: The effective capacity of 0.09 MGD at this lift station is more than adequate to meet ultimate PWWF. It is also recommended piping be installed to allow for emergency bypass pumping.

Costs for improvements planned as part of the upcoming 2023 capital improvement project are not included herein; however, costs to complete all the other recommended improvements described above and shown in Table 2A are included in Tables 11A and 11B.

WASTEWATER TREATMENT PLANT IMPROVEMENTS

The existing WWTP produces final effluent that is currently discharged to Cottonwood Creek. The existing WWTP was designed for an ADWF of 0.43 MGD and a PWWF of 1.3 MGD. The WWTP is currently operating at an ADWF of 0.33 MGD, or 77% of the original design, and a PWWF of 0.99 MGD, or 75% of design. According to discussions with the CRWQCB, it is anticipated any growth beyond the current 0.43 MGD design capacity will require significant WWTP improvements, including consideration of possibly moving the discharge from Cottonwood Creek to the Sacramento River and/or effluent storage during low dilution periods. This is based on existing and future anticipated effluent discharge quality and more stringent anticipated future dilution requirements for discharge to Cottonwood Creek. Growth assumptions utilized in the 2013 SMP indicated the WWTP capacity could be reached by year 2032. The current WWTP National Pollutant Discharge Elimination System (NPDES) Discharge Permit No. CA0081507, Order R5-2016-0066 (WDRs) requires the County to notify CRWQCB by January 31 when any project shows that capacity of any part of the facilities may be exceeded in four years. For CSA 17, this could happen by year 2028 if the growth projections in the 2013 SMP are realized. Within 120 days of the notification, the discharger must submit a technical report showing how it will prevent flow volumes from exceeding capacity or how it will increase capacity to handle the larger flows. In order to meet future flows, several improvements are recommended.

WWTP design criteria shown in Table 3A outlines the process units and loading under the original 1983 design, current 2020 flow conditions, and future ultimate flows. A site plan of the major recommended improvements is shown on Figure 4B.

Headworks: The existing headworks is adequate for the existing design capacity of the WWTP. To serve flows beyond the design capacity, the headworks will need to be replaced with a larger one. Cost for this improvement is included in Tables 11A and 11B.

Secondary Treatment: The existing secondary treatment processes could be expanded by constructing a second anoxic biological selector and two additional oxidation ditches to handle ultimate flow conditions. The existing 35-foot-diameter clarifiers are sufficient for the designed capacity of the WWTP; however, as flows exceed the design capacity and approach ultimate flow conditions, two additional 35-foot-diameter clarifiers would need to be constructed. Alternatively, two 60-foot-diameter clarifiers could be constructed instead to handle ultimate flows. These large-diameter clarifiers will have much better performance than the 35-foot-diameter clarifiers due to their large surface area. Additional pumps will be needed throughout the treatment plant to handle ultimate flows. This primary treatment alternative is shown on Figure 4A, and associated costs are included in Table 11A.

Alternatively, these processes could all be replaced with Sequential Oxidation Activated Sludge Process, developed by Aero-Mod. This system incorporates all of the above secondary processes (selector, oxidation ditches, clarifier) into one structure and utilizes concrete common-wall construction to form two parallel treatment trains consisting of a selector, aeration tank, sequencing aeration tank, clarifier, and aerobic digester. This type of construction has lower up-front capital costs due to the savings from not having to construct multiple independent basins. A blower building facility will need to be constructed to provide aeration and to operate the air lift pumps built into the system that conveys wastewater to the different basins. This primary treatment alternative is shown on Figure 4B, with associated costs included in Table 11B. This is the recommended alternative.

Traveling Bridge Filter: Last year, the WWTP's original traveling bridge filter was upgraded with a rail-mounted backwash system utilizing the existing concrete basin, and an additional traveling bridge filter was also constructed. This provided improved performance and much-needed hydraulic capacity to ease O&M and provide redundancy. To handle ultimate PWWF, a third traveling bridge filter will need to be installed. Alternatively, the two existing traveling bridge filters could be retrofitted with disk filters utilizing the existing basins to provide the necessary capacity and avoid constructing a third traveling bridge filter. The increased total project cost (which includes contingency and

Photo 3 – Traveling Bridge Filters

indirect costs to retrofit and is estimated at $2.31M) versus constructing a third traveling bridge filter (which would have an approximately $1.65M total project cost) is not justified at the present time. As such, Tables 11A and 11B include costs for construction of a third filter.

<u>Chlorine Contact Basin:</u> The WWTP discharge has had issues with disinfection byproducts (DBPs) as a result of adding excessive chlorine, primarily due to overflows in the old, inadequate filter but also due in part to low contact times (CTs). As such, it is recommended the existing chlorine contact basin be modified to provide more volume and, therefore, longer CT particularly during PWWF.


Photo 4 – Chlorination System

California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) recommends achieving a minimum 90-minute modal chlorine CT to result in a minimum 450 mg-min/L at all times when sending effluent to Cottonwood Creek where reclamation may occur. It is highly recommended the chlorine contact basin be enlarged from 27,300 gallons to 142,000 gallons to provide a minimum 90-minute CT during future ultimate PWWF.

There are nine standpipes throughout the WWTP, which do not work well with highly chlorinated secondary effluent. The freeze-proof valves malfunction, causing the pipes to freeze and leak and the WWTP No. 2 water pumps lose pressure. It is recommended freeze-proof yard hydrants be installed with an isolation valve below grade that can be turned on and off. It is also recommended to upsize the WWTP No. 2 water pumps to provide flows to future processes. Costs for these recommended improvements are included in Tables 11A and 11B.

To avoid equipment deterioration due to chlorine and the possibility of an accidental or intentional release of chlorine gas, the County should consider converting from chlorine gas to ultraviolet (UV) disinfection. There are several benefits to UV over the existing disinfection process including the following:

- Once installed, the UV system only needs power to operate, i.e., no need to rely on hazardous chemical (chlorine and sulfur dioxide) deliveries.
- Existing filtration removes total suspended solids from the secondary effluent and improves efficacy of the UV disinfection process.

- Regulated DBPs, such as total trihalomethanes, are not created as a result of the disinfection process.
- Equipment is easy to operate and maintain, although maintenance must be performed on a regular basis to prevent fouling of UV glass.
- No on-site storage of large quantities of hazardous materials is required.
- Total dissolved solids will be reduced in the final effluent by not using chlorine and sulfur dioxide, thus meeting a Salinity Evaluation and Minimization Plan goal.
- Greenhouse gas emissions will be reduced by not trucking chemicals from the supplier to the WWTP.
- Possibility of a release of gaseous chlorine and/or sulfur dioxide to operators and the public is eliminated.

Fortunately, the WWTP is located away from the general public in a relatively remote area. As such, the increased cost for converting to UV (approximately $3.75M) versus expansion of the chlorination system (approximately $1.98M) is not justified at the present time and is not included in the costs herein. However, it is recommended CSA 17 begin measuring UV transmittance to better determine the viability of conversion to UV in the future. Increased community growth will make the use of chlorine gas a more immediate threat to public safety in the future, therefore requiring a greater need for a safer disinfection process.

Photo 5 – Sludge Storage Basin 2

Sludge Treatment: The SSBs are aerated with surface aerators in an attempt to encourage biodegradation of the WAS and subsequent reduction in the volume of sludge sent to the drying beds. The northern aerated SSB (SSB 1) is 4.3 AC-FT compared to 0.63 AC-FT for SSB 2. At the current size, a substantial amount of water must be decanted and sent back through the WWTP before the sludge can be reached. Consequently, it fills the drying beds up with wet sludge. SSB 1 could be divided in half for ease of operations in cleaning and to allow for alternation between the two SSBs. Alternatively, the existing 35-foot-diameter clarifiers could be converted into aerobic digesters. The aerobic digesters would aerate to promote biodegradation and produce more stable sludge, thus reducing its volume. While more energy intensive than the existing SSBs, this would be a major operational improvement in treating sludge. The existing SSBs would then be converted into emergency storage ponds. This sludge treatment alternative is shown on Figure 4A, with associated costs included in Table 11A.

Alternatively, the Aero-Mod system incudes concrete basins for aerobic digestion. As mentioned above, this system has lower up-front capital costs due to the savings from not having to construct multiple independent basins. This sludge treatment alternative is shown on Figure 4B, with associated costs included in Table 11B, and is the recommended alternative.

Sludge Dewatering: The existing sludge drying beds pose an operational challenge for CSA 17. The current design does not allow for operators to drive along the south wall because the sludge never dries in this area. Until recently, due to the poor design and deficient drying in the existing beds, existing sludge handling operations were to move “dried” sludge from the beds to an area adjacent to the WWTP entrance road to allow for additional sludge drying. However, the CRWQCB has since indicated this will no longer be allowed given that the area is not lined. As such, the existing beds would need to be replaced with an upgraded efficient design of concrete side walls and concrete floors sloped to a center drain to allow for better drying and ease of operations. Piping currently on top of the drying bed walls should be relocated down into the beds to avoid pipe saddles and valves failing due to the sun and heat exposure that occasionally occurs. Currently, all drying beds are connected, so only one drying cycle per season can be completed. Furthermore, the existing three sludge drying beds would need to be expanded to seven to handle projected ultimate sludge quantities.

Photo 6 – Sludge Drying Beds

Alternatively, instead of upgrading and expanding the sludge drying beds, a sludge dewatering facility is recommended to be constructed. This facility would utilize the latest mechanical dewatering technology to safely and efficiently reduce the percent moisture in the solids for hauling and disposal. While more energy intensive than the existing sludge drying bed operations, this would be a major operational improvement in handling future increased sludge disposal needs. Costs to construct a sludge dewatering facility are included in Tables 11A and 11B.

Photo 7 – Office/Storage Space

Support Facilities: The existing WWTP control building has inadequate room for office and storage space. It is recommended the existing building be converted to only a control building and a new office building be constructed adjacent to the existing building. The new building would house SCADA equipment, with reasonable workstations for processing CRWQCB monthly reports.

Nearly all existing lab and recording equipment is outdated, obsolete, inoperable, or inadequate. It is recommended all existing lab equipment be replaced as needed, as there has been no recent quality assurance and/or quality control of existing outdated sampling and testing equipment. Costs for these improvements are included in Tables 11A and 11B.

CONTROL SYSTEM IMPROVEMENTS

Photo 8 – WWTP MCC and Control Panel

The existing WWTP motor control center (MCC) and control panel located in the control building were upgraded last year and provide a central location for control of most plant equipment and annunciation of abnormal conditions. These will need to be expanded in the future to handle the additional processes. Additionally, a second diesel standby generator with ATS will be needed. Costs for these improvements have been included in Tables 11A and 11B.

EFFLUENT DISPOSAL FACILITIES IMPROVEMENTS

Cottonwood Creek is a Water of the United States and a tributary to the Sacramento River. The current CSA 17 WDRs require specific dilution requirements during the discharge period to meet water quality objectives for some constituents, including ammonia nitrogen, chlorodibromomethane, copper, zinc, nitrate plus nitrite, and dichlorobromomethane.

In anticipation of renewal of WDRs later this fall, preliminary discussion with CRWQCB representatives have suggested that increased discharges to Cottonwood Creek, beyond the existing facility design capacity of 0.43 MGD, would likely exacerbate current assimilative capacity concerns for copper and zinc. Thus, there is a need to either improve treatment or site a new effluent disposal facility for flows beyond 0.43 MGD. CRWQCB representatives also expressed concern that, long term, Cottonwood Creek may not be a viable receiving water for effluent due to decreasing flows in the creek, which reduce available dilution credits and assimilative capacity.

To avoid the regulatory uncertainty associated with this issue, it is desirable to at least consider effluent disposal options for future wastewater ADWF in excess of 0.43 MGD. Furthermore, two options were also considered that involve eliminating the Cottonwood Creek discharge completely by either (1) discharging to the Sacramento River – Option 1 or (2) moving to 100% land disposal – Option 4. In general, it is desirable to evaluate potential land disposal sites that reside outside the FEMA flood zone. As such, the existing ponds located south of the WWTP were not considered because (1) they reside within a Regulatory Flood Way, as shown in Appendix F, (2) there are many unknowns pertaining to potential hydraulic connectivity to Cottonwood Creek, and (3) CRWQCB representatives indicated this would be considered a discharge to surface water and carry the same concerns as discharging to Cottonwood Creek. Five effluent disposal options were considered herein as follows:

Option 1 – 100% Discharge to Sacramento River
Option 2 – Effluent Storage/Seasonal Discharge to Cottonwood Creek
Option 3 – Effluent Storage/Irrigation for ADWF in Excess of 0.43 MGD
Option 4 – Effluent Storage/Irrigation and No Discharge
Option 5 – Constructed Wetlands for ADWF in Excess of 0.43 MGD

Effluent Disposal Design Criteria

Effluent disposal options utilizing some form of land disposal facilities, i.e., effluent storage and/or irrigation, were evaluated using hydraulic balance spreadsheets included in Appendix F. This hydraulic balance considers wastewater flows, 100-year precipitation, local evaporation rates, crop evapotranspiration (ET), pond percolation, and Cottonwood Creek discharge volumes. The hydraulic balance determines the amount of required effluent storage in AC-FT. A spreadsheet tool was then utilized to determine the earthwork and area requirements for a specific effluent storage reservoir size. Below are general design criteria used to evaluate effluent disposal options that contain a land disposal element:

- Wastewater Flows: Wastewater ADWF was determined for ultimate buildout within the current service area boundary, estimated to be approximately 0.75 MGD. Two of the effluent disposal options (3 and 5) assume that the Cottonwood Creek effluent discharge would be maintained until wastewater flows reach the current facility ADWF design capacity of 0.43 MGD. Flows beyond 0.43 MGD would utilize one of the considered land disposal options. Option 2 assumes that treated wastewater is only discharged to Cottonwood Creek between the months of December to April.
- Precipitation: Monthly precipitation totals are based on the 100-year rainfall, utilizing Department of Water Resources Bulletin 195 for Coleman Fish Hatchery.
- Evaporation: Evaporation rates were estimated using the Chico, CA pan evaporation multiplied by 0.7 pan coefficient.
- ET: ET is based on 21 years of data for irrigated pastureland in Gerber, CA.
- Irrigation: Irrigation application volumes were determined by subtracting monthly precipitation from ET and multiplying by 1.3 to account for losses resulting from sprinkler irrigation.
- Effluent Storage Reservoirs:
    - Top dike width: 12 feet
    - Inside/outside dike slope: 2:1
    - Overall dike height: 12 feet
    - Freeboard: 2 feet
    - Earthwork: Site balancing with 15% shrinkage
- Irrigation Areas:
    - Buffers: 50 feet to property line, 200 feet to residences
    - Grading: Graded/Ditched to direct runoff to tailwater pump station(s)
    - Tailwater Return: Pump station to collect runoff for return to effluent storage reservoir
    - Crop: Irrigated pasture for cattle grazing or crop production and harvesting
- WWTP Improvements: WWTP expansion improvements are required to accommodate ultimate wastewater flows for all disposal options.

All effluent disposal options are based on accommodating wastewater flows for 100% (ultimate) development within the current CSA 17 service area boundary. The effluent disposal options are described hereinafter. For the purpose of option comparison, it was assumed that all property required for each option could be procured by the County. This needs to be verified prior to pursuing future improvements.

Option 1 – 100% Discharge to Sacramento River: For this option, it is assumed there would be no discharge to Cottonwood Creek, and all treated wastewater would be conveyed to a new effluent diffuser in the Sacramento River. Figure 7 shows a proposed preliminary 12-inch effluent pipeline alignment and diffuser location in the Sacramento River. A new effluent pump station would be constructed at the WWTP.

The alignment shown on Figure 7 follows the public right-of-way almost all the way to the Sacramento River. The last parcel between the public right-of-way and the Sacramento River is owned by the Bureau of Land Management (BLM). The County will need to obtain necessary easements from BLM to install the pipeline across the parcel and install the diffuser.

Option 2 – Effluent Storage/Seasonal Discharge to Cottonwood Creek: For Option 2, it is assumed that seasonal effluent discharge to Cottonwood Creek would be limited to the months of December through April. For all other months, treated effluent would be stored in a 300 AC-FT effluent storage reservoir. This option would require further study of assimilative capacity limitations in Cottonwood Creek for copper and zinc. The theory is that limiting discharge to higher creek flows during winter months would improve the ability to meet effluent discharge requirements.

Comparing historical low Cottonwood Creek flows for December through April, the theoretical ultimate wastewater flows would be less than 3% of the total creek flow and less than 2% in most months.

In terms of siting a potential future effluent storage reservoir, several properties were reviewed. In general, it is believed that siting a reservoir on the north side of Cottonwood Creek would prevent a costly pipeline crossing Cottonwood Creek. Also, it is desirable to site future effluent disposal facilities outside the 100-year FEMA flood plain boundary. Located at the east end of Black Lane is a 237 AC privately owned parcel located outside the flood boundary.

Figure 8 shows a proposed preliminary 12-inch effluent disposal pipeline from the WWTP to the 300 AC-FT effluent storage reservoir. Appendix F contains spreadsheets showing the hydraulic balance and reservoir parameters for this option.

<u>Option 3 – Effluent Storage/Irrigation for ADWF in Excess of 0.43 MGD:</u> Option 3 assumes CSA 17 would maintain its Cottonwood Creek discharge for wastewater ADWF up to 0.43 MGD. All flows beyond this would require a 195 AC-FT effluent storage reservoir and 70 AC of irrigation area. The same 237 AC parcel at the east of Black Lane could accommodate these facilities as shown in Figure 9. Hydraulic balance and reservoir parameters are included in Appendix F.

<u>Option 4 – Effluent Storage/Irrigation and No Discharge:</u> Option 4 assumes the Cottonwood Creek discharge would be eliminated and all treated effluent would be conveyed to land disposal facilities. Appendix F contains the hydraulic balance and reservoir parameters for a 450 AC-FT effluent storage reservoir and 165 AC of irrigation area. The site at the east end of Black Lane is not large enough to accommodate these facilities, so lands south of Cottonwood Creek were selected.

There are two privately owned parcels residing along the south edge of Cottonwood Creek that appear to be used for orchard and pastureland agricultural activities. One of the parcels contain a sizable reservoir that appears to contain irrigation pumping facilities for surrounding agricultural activities.

Option 4 would expand the existing reservoir to 450 AC-FT and utilize existing irrigated lands west and east of the reservoir for effluent disposal. Refer to Figure 10. A 12-inch pipeline would be constructed from the WWTP, south across Cottonwood Creek and an existing BLM parcel, to property owned by the proposed site for the effluent storage reservoir. It would be necessary to obtain easements from potentially three different property owners to construct the pipeline.
For crossing Cottonwood Creek and to minimize impacts to riparian habitat along the creek, it is proposed that approximately 2,000 feet of horizontal directional drilled (HDD) pipeline be utilized. The pipeline would need to be deep enough to reside below potential future creek scouring depths and avoid drilling mud “fracking” during installation. Further geotechnical evaluation will need to be performed before establishing the viability and cost for this HDD installation.

Option 5 - Constructed Wetlands for ADWF in Excess of 0.43 MGD: Option 5 is similar to Option 2 except that effluent disposal would utilize constructed wetlands for effluent storage and disposal. The wetlands would likely consist of four ponds containing wetlands vegetation and varying bottom percolation rates as shown in Figure 11. The primary wetland pond would contain a very low percolation rate, but the secondary ponds would allow more percolation into the ground.

PACE Engineering recently designed and facilitated construction of a wetlands disposal system for Rio Alto Water District (which serves the community of Lake California), located approximately 4.5 miles southeast of the Cottonwood WWTP. The wetlands volume needs are only about 19% more than the Rio Alto facility.

The 237 AC parcel, located at the east end of Black Lane, would be an ideal location for constructed wetlands as there appears to be some existing wetlands on the property. However, to prove site viability, it will be necessary to hire an outside expert, such as Lawrence & Associates, to perform a groundwater impacts model to demonstrate if adequate separation to groundwater can be maintained at all times. The model considers site hydrogeology, long-term rainfall patterns, and varying pond percolation rates to determine the final required volume requirements.

For the purpose of option comparison, the Rio Alto design criteria was utilized and determined that approximately 220 AC-FT of storage capacity and about 26 AC of pond area are required. Appendix F contains the wetlands hydraulic balance and earthwork parameters for this option. Figure 11 shows the proposed preliminary effluent pipeline along Black Lane and wetland pond layout.

Effluent Disposal Cost Estimates

Overall preliminary project cost estimates were developed for all five effluent disposal options. Costs are based on recently bid public works projects residing in northern California. To obtain total project costs, construction contingencies and indirect costs were added to construction costs. Construction contingencies at this stage are usually estimated to be 25% of construction costs. Indirect costs include engineering, administration, legal, and environmental costs and typically amount to about 25% of construction cost plus 10% contingency. These figures will vary considerably depending upon the complexity of the work and the uncertainties of construction costs and raw materials. Costs for acquiring necessary rights-of-way, interest during construction, regulatory requirements, and/or other financing costs should be added when preparing any financial plan.

All costs indicated in this report are based upon March 2022 dollars. In projecting future costs, both short-term and long-term inflationary trends should be considered.

Overall project cost estimates are shown in Tables 12 through 16 for each effluent disposal option and are summarized below:

Option 1:	$19.22M
Option 2:	$11.80M
Option 3:	$14.64M
Option 4:	$23.37M
Option 5:	$11.49M

As indicated, Option 4 has the highest upfront capital cost and Option 5 has the lowest.

Decision Matrix – Option Selection Tool

A decision matrix is a common tool used to evaluate and select a project option, as it considers weighted monetary and non-monetary selection criteria. The process of evaluating options against one another can be somewhat subjective; however, the decision matrix is still considered a viable tool for this purpose. For CSA 17 Cottonwood, we used the following evaluation criteria and applied weight factors to evaluate and rank effluent disposal options described hereinbefore:

1. Present Worth Cost – 30%: Present worth cost represents the sum of (1) upfront capital cost and (2) present worth of O&M cost over a period of time – typically 20 years. Therefore, present worth accounts for capital and O&M costs. When evaluating project alternatives, cost is usually the most important factor, but it is not the only factor. For this evaluation, a weight factor of 30% was assigned to Present Worth Cost. Refer to Table 18 for Present Worth for each option.

2. Environmental and Construction Permitting Constraints – 15%: Each option will have varying degrees of environmental impacts and permitting constraints. Those options incorporating land disposal facilities will undergo more environmental scrutiny than options relying on pipeline construction and/or exclusive discharge to Cottonwood Creek or Sacramento River. Also, the pipeline crossing Cottonwood Creek in Option 4 will require permits from California Department of Fish and Wildlife and U.S. Army Corps of Engineers. A weight factor of 15% was used for this evaluation criterion.

3. Ease of Compliance with NPDES/WDRs – 20%: Currently, CSA 17 has an NPDES permit. If land disposal elements are added, the CRWQCB will issue WDRs not regulated under an NPDES Permit, which address treated wastewater disposal to land. Typically, standalone WDRs have less stringent effluent discharge requirements than an NPDES permit. Therefore, disposal options relying more exclusively on discharge to the Sacramento River or Cottonwood Creek are ranked a little lower. Since consistent compliance with regulatory requirements is of utmost importance, this criterion was assigned a 20% weight factor.

4. Ability to Obtain Needed Land and Right-of-Way – 10%: None of the impacted property owners for which effluent disposal facilities are shown have been contacted to determine their support (or lack thereof) for the project. Therefore, unknowns exist as to how difficult it may be to acquire needed lands. In general, options requiring use of the property at the east end of Black Lane are ranked lower than properties on the south side of Cottonwood Creek. This is due to increased impacts to the existing residential community at the east end of Black Lane.

   Properties on the south side of Cottonwood Creek are owned by large agriculture enterprises that currently have substantial irrigation demand. Thus, a project on their lands may be viewed more positively. This criterion is assigned a 10% weight factor.

5. Ease of Construction – 10%: Ease of construction considers several factors, such as general construction difficulty, availability of materials and equipment, construction mitigation associated with project permits, etc. Most of the disposal options require earthwork and pipeline construction, which are common public works construction elements. However, the long HDD pipeline across Cottonwood Creek for Option 4 will present construction challenges. This criterion was assigned a 10% weight factor.

6. Public Acceptance – 10%: Any newly planned wastewater land disposal options are going to be scrutinized by the public. To the extent planned facilities can be sited away from current developed areas will reduce concerns. Any option utilizing the property at the east end of Black Lane will be ranked lower than others due to the presence of rural residential development in the area. The property located south of the Cottonwood Creek, utilized for Option 4, will be ranked higher because there is little to no residential development in the area. Also, the property is currently utilized for agriculture irrigation. This criterion was assigned a weight factor of 10%.

7. Security and Safety to Workers/Public – 5%: One disadvantage of land disposal options is the lack of operator presence due to sites being located away from the WWTP. New land disposal sites will have fencing and signage, but those typically do not keep all people out. Therefore, disposal options utilizing land disposal facilities are generally ranked lower than others. This criterion was assigned a weight factor of 5%.

Utilizing the weighted evaluation criteria described hereinbefore, a decision matrix was prepared and assigned numbers one (1) through ten (10) for each evaluation criterion for each effluent disposal option, where one (1) is the least favorable and ten (10) is the most favorable. Table 17 provides a summary of the results, which is an average of County and engineering staff responses received from those familiar with the project. As shown, Option 5 – Constructed Wetlands for ADWF in excess of 0.43 MGD appears to be the most favorable based on the decision matrix; however, Option 2 - Effluent Storage/Seasonal Discharge to Cottonwood Creek and Option 1 – 100% Discharge to Sacramento River are not far behind.

Long-Term Effluent Disposal Considerations

Option 5 – Constructed Wetlands for ADWF in excess of 0.43 MGD has the lowest net present worth, as shown in Table 18. Beyond that, other non-monetary considerations make it the most attractive alternative. Option 4 – Effluent Storage and Irrigation, No Discharge is the only option that would eliminate a surface water discharge, but it is ranked last amongst the five options considered. It also has an estimated present worth cost of $12.7M more than Option 5 and $4.61M more than Option 1. Due to these cost disparities, it is unlikely that a practical solution exists for eliminating a surface water discharge unless future regulatory constraints force these to be the only feasible options.

While the most attractive effluent disposal option appears to be Option 5 – Constructed Wetlands, this option does not eliminate the regulatory burden associated with discharging treated wastewater to Cottonwood Creek. As mentioned herein, CRWQCB representatives have indicated that, long term, Cottonwood Creek may not be a viable receiving water due to elevated levels of some constituents together with decreasing flows in the creek, which reduce dilution credits. CRWQCB representatives recommended CSA 17 consider conducting a water effect ratio or translator study in addition to an antidegradation study for any future increased flows to Cottonwood Creek. This effort is beyond the scope of this Amendment, but it is recommended that CSA 17 conduct a detailed feasibility study. The study should thoroughly investigate CRWQCB assimilative capacity concerns and develop a detailed plan for long-term effluent disposal, with a potential for siting a new effluent disposal facility, such as the constructed wetlands, or improving treatment to achieve higher quality effluent if at all possible. Assumptions associated with any/all effluent disposal alternatives considered herein should be further investigated as part of the future feasibility study.

ESTIMATES OF COST AND FINANCIAL CONSIDERATIONS

BASIS OF COST ESTIMATES

Cost elements cannot be properly evaluated until final design. Consequently, estimates in this report should be considered as "order-of-magnitude" estimates, which may vary from actual construction costs for a particular project element. However, overall SMP costs should be reasonably close and satisfactory for the basis of planning a financial program.

To obtain total project costs, construction contingencies and indirect costs were added to construction costs. Construction contingencies at this stage are usually estimated to be 25% of construction costs. Indirect costs include engineering, administration, legal, and environmental costs and typically amount to about 25% of construction cost plus 10% contingency. These figures will vary considerably depending upon the complexity of the work and the uncertainties of construction costs and raw materials. Costs for acquiring necessary rights-of-way, interest during construction, and/or other financing costs should be added when preparing any financial plan.

All costs indicated in this report are based upon March 2022 dollars. In projecting future costs, both short-term and long-term inflationary trends should be considered. Note that preliminary project cost estimates included in all tables of this report are capital improvement costs only, which do not include any O&M costs of the wastewater system.

A preliminary cost estimate for the recommended WWTP and lift station improvements is shown in Table 11B. Table 11B, together with the recommended improvements shown on Figure 4B, in essence, is the 2022 Amendment to the 2013 SMP. Total project costs including contingency and indirect costs are approximately $794,000; $25,640,000; and $11,460,000 (March 2022 dollars) for lift station, WWTP, and effluent disposal improvements, respectively, and are anticipated to be needed for ultimate development. These costs include a 60% adder for construction contingencies, environmental, and engineering. The cost estimate in Table 11B includes improvements needed to first correct existing deficiencies and to allow for growth up to the projected ultimate ADWF capacity of 0.75 MGD and PWWF capacity of 2.26 MGD.

If sewer service is extended beyond the existing service area boundary or the density is higher than anticipated, additional improvements will be needed. It is recommended a master plan of sewer improvements be updated every 10 years, or sooner if growth projections that occur are substantially different than utilized herein.

FINANCIAL CONSIDERATIONS

As part of this SMP, a recommendation for an updated Capital Improvement Fee for the CSA 17 sewer system has been prepared. As of 2022, CSA 17 currently has a Capital Improvement Fee of $5,651 per HE. Additionally, CSA 17 has a Collection System Improvement Fee ranging from $0 to $2,510 per HE, depending on the location of the new HE within the collection system. Refer to Appendix G. These fees are adjusted annually in January by the increase in the ENR CCI, which currently stands at 12791 for March 2022.

Capital Improvement Fees are often referred to as Connection Fees, but this is a misleading term applied to a charge that is intended to be a revenue producer for capital improvements. Such fees are also often called a capacity charge. In the American Water Works Association (AWWA) Manual M26, "Water Rates and Related Charges," these fees are referred to as System Development Costs.

Herein, such fees will be referred to as Capital Improvement Fees, which are intended as a fair share payment towards capital improvements, specifically referred to herein as General Improvements.

As part of this plan, a determination was made of an appropriate revised Capital Improvement Fee based on actual and future costs for improvements. These charges are strictly a Capital Improvement Fee, and costs for the actual sewer lateral are an additional Service Connection Fee if the County installs the connection. The Capital Improvement Fee should continue to be updated annually based upon the ENR CCI.

<u>General Improvement Costs (Used To Determine Capital Improvement Fee)</u>

General Improvement Costs in this Amendment are defined as those improvements needed for a total wastewater lift station, treatment, and effluent disposal system. It is important to note, no pipeline collection system improvement costs were considered or included herein. Future pipeline improvements needed to serve new developments will be considered on a case-by-case basis. As such, costs herein include only the following:

1. Wastewater treatment facilities.
2. Sewage lift stations benefitting large areas.

Capital Improvement Fee

The purpose of the Sewer Capital Improvement Fee is to generate capital from new customers to pay for their fair share of General Improvements. CSA 17 utilizes the following method to determine this charge:

> Determine all capital costs of general improvements needed to serve future users and divide that amount by the number of future users that will benefit. This method often uses a defined planning period, such as a 10- to 20-year period, or a specific growth amount (number of new connections). AWWA Manual M26 refers to this approach as the “incremental cost” method. However, under the incremental cost method, the Capital Improvement Fee is determined by dividing a project cost by the number of users benefiting. In this case, the project may or may not have already been built but is reflective of the costs needed to serve future users.

This method (future improvement costs divided by future connections benefitting) is likely more representative of the true cost incurred for future users. AWWA Manual M26 states “this method is considered most appropriate when a significant portion of the capacity required to serve new customers must be provided by the construction of new facilities.”

Capital Improvement Fees have become the norm (especially since Proposition 13, Jarvis-Gann Initiative), and the purpose is to raise revenue for capital improvements and to bring about equity so new customers pay for a fair share of the capital cost of general improvements.

Refer to Table 11B for the recommended WWTP and lift station improvements and Capital Improvement Fee basis. The General Improvement Costs were developed based on the in-depth study of the wastewater lift station pumping, treatment, and disposal system discussed herein. Following the cost for each item in Table 11B is a percentage assigned for new development. A portion of some improvements benefit existing users and are needed to resolve existing deficiencies. For those improvements that benefit both future and existing customers, a proportional share in the cost burden is recommended.

Cost proportioning is based upon the number of future HEs that are expected to occur within the existing service area boundary. Given these estimates, CSA 17 will add 1,659 additional HEs. As mentioned, 614 of these HEs have been pre-purchased in various areas of CSA 17 during approval of tentative projects thereby ensuring their future ability to discharge to the collection and treatment system. While several of these areas have already been developed and are not likely to develop further, they need to be accounted for to ensure the wastewater facilities can accommodate them.

As such, for the purpose of determining appropriate future Capital Improvement Fees and monthly user fee rate increases, it is anticipated 1,045 additional non-pre-purchased HEs (1,659 - 614) will be added to CSA 17 under ultimate development conditions. This represents approximately 84% of the HEs beyond 0.43 MGD and 33% [1,045 / (1,659 + 1,478)] of the total number of HEs. Based upon the estimates presented here, the Wastewater Capital Improvement Fee as calculated in Table 11B is $28,300 per HE. Customers that represent more than one HE, such as a commercial development, should pay a proportionately larger fee based upon the estimated number of HEs as determined by the County's engineer.

With the current level of unprecedented grant funding provided by both the state and federal government, the County should pursue Clean Water State Revolving Fund grant funding for operational upgrades recommended now to serve the existing HEs. These improvements would include chlorine contact basin expansion, construction of the mechanical dewatering facility, construction of the office building including upgraded lab equipment, improvement of the access road to the diffuser in Cottonwood Creek, and renovation of the existing office/control building into only a control building. Otherwise, the remaining portion of the Capital Improvement Plan (CIP) ($37,893,000 - $29,573,000 = $8,320,000) not paid by future customers is paid by existing customers through the bimonthly user fee. This cost spread over the existing 1,478 HEs for the next 20 years amounts to a charge of $46.91 per HE every two months.

It is highly recommended the County continue to adjust these fees annually based on the ENR CCI to account for inflation, the anticipated growth rate, and annexations. It is also appropriate to recalculate the fee every five to ten years, especially at the time of preparation of an updated master plan. Before adopting a new Capital Improvement Fee, County counsel should be consulted and shown this report to ensure the process is done correctly pursuant to government code.

It is important to keep in mind there are a number of factors affecting an entity's capacity charge, such as:

- Age and condition of the existing collection system as well as the number of lift stations in the system.
- Wastewater treatment processes and method of effluent disposal.
- Method used to finance latest system expansion and the capacity remaining.
- Date of latest master plan or rate study.

Given that significant WWTP and effluent discharge improvements are anticipated to be needed in the near future, Table 11B suggests that a fee of $28,300 appears to be a reasonable Wastewater Capital Improvement Fee for new customers to CSA 17.

TABLES

TABLE 2A
2022 Amendment to 2013 SMP
Existing Lift Stations

Lift Station	Type	Number of Pumps & Horsepower	Flow Meter (Y/N)	Current Effective Capacity[(1)] (MGD)	Number of HEs Served		Estimated PWWF (MGD)		Recommended Improvements
					2020	Service Area	2020	Service Area	
Main	Submersible centrifugal nonclog	(2) 15 HP (2) 7.5 HP	Y	0.86	1,379	2,676	0.72	1.93	Install grinder and upsize existing 225 GPM pumps to 325 GPM and existing 450 GPM pumps to 700 GPM, piping, and valving.
Black Lane	Submersible centrifugal nonclog	(2) 10 HP	Y	0.22[(2)]	99	461	0.24	0.33	Install portable trash pump and piping.
Quail Lane	Grinder	(2) 3 HP	Y	0.09	24	48	0.023	0.035	Install bypass piping.
Crowley Creek	Submersible centrifugal nonclog	(2) 2.8 HP	Y	0.36	22	22	0.008	0.016	Modify secondary containment for diesel gas tank, and install bypass piping.

(1) Effective capacity assumes the largest pump is out of service.

(2) 2022 Collection System Improvement Project will upsize existing pumps to have a resulting effective capacity of 0.33 MGD.

	TABLE 3A 2022 Amendment to 2013 SMP WASTEWATER TREATMENT PLANT DESIGN CRITERIA			
	Description	Original 1983 Design (1)	Current 2020 Flows	Ultimate Service Area Flows(3)
1	**Population**	4,100	3,240	7,937
2	**Household Equivalents (HEs)**	1,800	1,478	3,137
3	**Flows**			
4	Average Dry Weather Flow, ADWF (MGD)	0.43	0.33	0.75
5	Peak Wet Weather Flow, PWWF (MGD)	1.32	0.99	2.26
6	PWWF : ADWF	3.1	3.0	3.0
7	**Sewage Loadings (2)**			
8	Five-Day Biochemical Oxygen Demand (BOD)			
9	ADWF BOD (mg/L)	200	275	275
10	ADWF BOD (Lbs/Day)	720	760	1,730
11	Total Suspended Solids (TSS)			
12	ADWF TSS (mg/L)	240	205	205
13	ADWF TSS (Lbs/Day)	860	560	1,290
14	Chemical Oxygen Demand (COD)			
15	ADWF Soluble COD (mg/L)	150	150	150
16	ADWF Soluble COD (Lbs/Day)	540	410	940
17	**Headworks**			
18	Mechanical Screen	1	1	1
19	Number of Bar Screen (Bypass) Channels	1	1	1
20	Bar Screen (Bypass) Channel Width (In)	24	24	24
21	Minimum Clearance Between Bars (In)	0.75	0.75	0.75
22	Automatic Screening Unit with Grinder	-	1	1
23	Parshall Flume Width (In)	6	6	6
24	Maximum Measurable Flow (MGD)	1.9	2.5	2.5
25	**Biological Selector**			
26	Number of Basins	-	3	6
27	Water Depth (Ft)	-	10	10
28	Selector Basins 1 and 2 Volume (CF) (ea.)	-	4,000	4,000
29	Selector Basins 1 and 2 Volume (Gal) (ea.)	-	29,920	29,920
30	Selector Basin 3 Volume (CF)	-	8,000	8,000
31	Selector Basin 3 Volume (Gal)	-	59,840	59,840
32	Total Selector Volume (CF)	-	16,000	32,000
33	Total Selector Volume (Gal)	-	119,680	239,360
34	Q_{RAS} @ ADWF (MGD)	-	0.50	1.13
35	Q_{RAS}/ Q	-	1.50	1.50
36	Q_{MLSS} @ ADWF (MGD)	-	0.66	1.51
37	Q_{MLSS}/ Q	-	2.00	2.00
38	Loading Overall (mg VSS/L)	-	1,533	1,533
39	F:M Basin 1 (g COD/g VSS/Day)	-	4.86	11.08
40	F:M Basin 2 (g COD/g VSS/Day)	-	2.43	5.54
41	F:M Overall (g COD/g VSS/Day)	-	1.21	2.77
42	Overall Hydraulic Retention Time @ ADWF (Hr)	-	8.7	7.6
43	Basin 1 Hydraulic Retention Time @ ADWF + Q_{RAS} + Q_{MLSS} (Hr)	-	0.48	0.21
44	Basin 3 Hydraulic Retention Time @ ADWF + Q_{RAS} + Q_{MLSS} (Hr)	-	0.97	0.42
45	Overall Hydraulic Retention Time @ ADWF + Q_{RAS} + Q_{MLSS} (Hr)	-	1.9	1.7
46	Overall Hydraulic Retention Time @ PWWF (Hr)	-	2.9	2.5
47	MCRT (Days)	-	5	9
48	Mixers per Basin (No.)	-	2, 4	2, 4
49	Mixer Motor Horsepower (HP)	-	1.0	1.0
50	**Oxidation Ditch**			
51	Number of Oxidation Ditches	2	2	4
52	Operating Water Depth (Ft)	7.5	7.5	7.5
53	Operating Volume per Basin (CF)	28,700	28,700	28,700
54	Operating Volume per Basin (Gal)	215,000	215,000	215,000
55	MLSS (mg/L)	4,000	1,500	1,500
56	MLVSS (mg/L)	3,600	1,350	1,350
57	RAS (mg/L)	-	3,000	3,000
58	RAS VSS (mg/L)	-	2,700	2,700
59	SVI (mL/gm)	-	350	350
60	Hydraulic Retention Time @ ADWF (Hr)	24	31	27
61	Hydraulic Retention Time @ PWWF (Hr)	8	10	9
62	Volumetric Loading (Lb BOD/1000 ft^3/d)	13	13	15
63	F:M Overall (Lb BOD5/Lb MLSS/Day)	0.050	0.141	0.160
64	MCRT (Days)	20	8	15
65	Rotors (No.)	2	2	2
66	Aerator Motor Horsepower (HP)	15	40	40
67	Oxygen Transfer Capacity (Lbs O^2/Hp/Hr)	1	1	1
68	Oxygen Supplied with One Aerator in Service (Lbs/day)	360	960	960
69	**Mixed Liquor Recycle Pumps**			
70	Number	-	2	3
71	HP	-	7.5	7.5
72	Flow (GPM) ea.	-	400	400
73	Flow (MGD) ea.	-	0.58	0.58
74	Max Return Rate with All Pumps On (MGD)	-	1.15	1.73
75	**Secondary Clarifier**			
76	35' Diameter Clarifiers			
77	Number of Clarifiers	2	2	0
78	Diameter (Ft)	35	35	35
79	Effective Water Depth (Ft)	12	12	12
80	Surface Area of Clarifier (SF)	960	960	960
81	65' Diameter Clarifiers			
82	Number of Clarifiers	0	0	2
83	Diameter (Ft)	60	60	60
84	Effective Water Depth (Ft)	12	12	12
85	Surface Area of Clarifier (SF)	2,830	2,830	2,830
86	Normal Operations			
87	Number of Clarifiers in Service	2	2	2
88	Overflow Rate @ ADWF (GPD/SF)	220	170	130
89	Overflow Rate @ PWWF (GPD/SF)	690	520	400
90	Extreme Operating Conditions			
91	Number of Clarifiers in Service	1	1	1
92	Overflow Rate @ ADWF (GPD/SF)	450	340	270
93	Overflow Rate @ PWWF (GPD/SF)	1,380	1,030	800
94	Solids Loading @ ADWF (Lbs/SF/Day) w/o Q_{RAS}	15	4	3
95	Solids Loading @ PWWF (Lbs/SF/Day) w/o Q_{RAS}	46	13	10
96	Solids Loading @ PWWF (Lbs/SF/Day) with 50% ADWF ML Recycle	68	19	15
97	Weir Overflow Rate @ ADWF (GPD/LF)	3,910	3,000	3,990

	TABLE 3A 2022 Amendment to 2013 SMP WASTEWATER TREATMENT PLANT DESIGN CRITERIA			
	Description	**Original 1983 Design (1)**	**Current 2020 Flows**	**Ultimate Service Area Flows(3)**
98	**RAS Sludge Pumps**			
99	Number	2	3	4
100	HP	5	7.5	7.5
101	Flow (GPM) (ea.)	140	325	325
102	Flow (MGD) (ea.)	0.20	0.47	0.47
103	Max Return Rate with All Pumps On (MGD)	0.39	1.40	1.87
104	**WAS Sludge Pumps**			
105	WAS (Gallons/Day)		14,400	32,853
106	WAS Sludge Pumps Run Time (Mins/Day)		60	70
107	Number of Pumps	1	1	2
108	WAS Sludge Pumps Required Flow Rates (GPM)		240	235
109	HP	3	3	3
110	Flow (GPM) (ea.)	100	240	240
111	**Scum Pump**			
112	Number	1	1	2
113	HP	3	3	3
114	Flow (GPM) (ea.)	100	240	240
115	**Traveling Bridge Sand Filter**			
116	Number of Filters	1	2	3
117	Total Filter Bed Area (SF)	315	642	962
118	Filter Rate (GPM/SF) @ ADWF	0.9	0.4	0.5
119	Filter Rate (GPM/SF) @ PWWF	2.9	1.1	1.6
120	**Aerobic Digester (Former Secondary Clarifiers)**			
121	Number of Digesters			3
122	Diameter (Ft)			35
123	Depth (Ft)			16
124	Volume (CF)			46,180
125	WAS sent to Digester (Lbs/Day)			1,598
126	Volume of WAS Sent to Digester (CF/Day)			4,492
127	Volume of Supernatant Returned From Sludge Lagoon (CF/Week)			4,492
128	Hydraulic Retention Time (Days)			10
129	Volatile Solids (%)			60%
130	Solids Loading (Lbs Volatile Solids/CF/Day)			0.06
131	Volatile Solids Reduction Assumed (%)			40%
132	Volatile Solids Reduction (Lbs/Day)			639
133	Solids Retention Time @ 1.5% TSS in Digester (Days)			45
134	Volatile Solids Reduction Oxygen Requirement (Lbs O_2/Day)			1,470
135	Volume of Air Required @ STP (CF/Day) to Equal O_2 Requirement			86,659
136	Volume of Air Delivered @ 19.3% Transfer Efficiency (CF/min)			312
137	Mixing Air Required Criteria (SCFM/SF)			0.24
138	Mixing Air Required (SCFM)			231
139	**Sludge Drying Beds(4)**			
140	Number of Beds	3	3	7
141	Area, Total (SF)	19,500	19,500	45,500
142	Waste Sludge (Design) (Lbs/Day)	480	309	175
143	Loadings per Season	5	1	1
144	Volume of WAS Sent to Digester (Gal/Day)	6,000	14,400	33,600
145	Volume of Sludge (CF/Day)	95	227	531
146	Volume of Sludge per Season (CF)	34,587	83,008	193,686
147	Loading Rate (CF/SF)	1.8	4.3	4.3
148	**Sludge Storage Basin**			
149	Number	2	2	2
150	North SSB (CF)	33,800	189,000	189,000
151	South SSB (CF)	33,800	27,300	27,300
152	**Sludge Transfer Pump**			
153	Number	1	1	1
154	HP	5	7.5	7.5
155	Flow (GPM) (ea.)	420	375	375
156	**Drainage Pumps**			
157	Number	2	2	4
158	HP	3	3	3
159	Flow (GPM) (ea.)	275	275	275
160	**Chlorine Contact Basin**			
161	Number of Chlorine Basins	1	1	2
162	Average Water Depth (Ft)	5	5	5
163	Volume (CF)	3,650	3,650	18,980
164	Volume (Gal)	27,300	27,300	142,000
165	Detention Time @ ADWF (Hr)	1.5	2.0	4.5
166	Detention Time @ PWWF (Min)	30	40	91
167	**Chlorinators**			
168	Number	2	2	3
169	Capacity per Chlorinator (Lbs/Day)	150	150	150
170	Max Dosage @ ADWF (mg/L)	42	30	30
171	Max Dosage @ ADWF (Lbs/Day)	150	80	190
172	Max Dosage @ PWWF (mg/L)	13	13	13
173	Max Dosage @ PWWF (Lbs/Day)	140	110	240
174	**Dechlorinators**			
175	Number	1	1	2
176	Capacity per Dechlorinator (Lbs/Day)	150	150	150
177	Max Dosage @ ADWF (mg/L)	42	7	7
178	Max Dosage @ ADWF (Lbs/Day)	150	20	40
179	Max Dosage @ PWWF (mg/L)	13	7	7
180	Max Dosage @ PWWF (Lbs/Day)	140	60	130

(1) Design criteria as indicated in the original June 1985 WWTP O&M Manual.
(2) Influent BOD and TSS based on average July-Sept flows from 2017-2020.
(3) Ultimate Service Area Flows were analyzed based on expansion of existing processes. The AeroMod alternative is not analyzed in this table.
(4) No additional sludge drying beds would be needed if the sludge dewatering facility is constructed.

TABLE 11A
2022 Amendment to 2013 SMP
ALTERNATIVE 1 - EXPANSION IMPROVEMENTS AND CAPITAL IMPROVEMENT FEE BASIS[1]

Item No.	Description	Ultimate Development of Service Area	% Attributed to Growth	Cost Attributed to Growth
LIFT STATION IMPROVEMENTS				
COTTONWOOD LIFT STATION IMPROVEMENTS				
1	Grinder	$110,000	0%	$0
2	Two 700 GPM and Two 325 GPM Centrifugal Pumps, Motors, and Starters	$250,000	100%	$250,000
BLACK LANE LIFT STATION IMPROVEMENTS				
3	Portable Trash Pump and Piping	$60,000	0%	$0
CROWLEY CREEK LIFT STATION IMPROVEMENTS				
4	Diesel Gas Tank Secondary Containment Improvements	$10,000	0%	$0
5	Install Bypass Piping	$20,000	0%	$0
QUAIL LANE LIFT STATION IMPROVEMENTS				
6	Install Bypass Piping	$20,000	0%	$0
	LIFT STATION IMPROVEMENTS SUBTOTAL:	**$470,000**		**$250,000**
WWTP IMPROVEMENTS				
7	Expand Headworks	$300,000	84%	$252,000
8	New Selector	$968,000	84%	$814,000
9	Two New Oxidation Ditches	$2,500,000	84%	$2,100,000
10	Two New 60' Diameter Secondary Clarifiers	$3,110,000	84%	$2,613,000
11	New Traveling Bridge Filter	$977,000	100%	$977,000
12	Expand Chlorine Contact Basin	$838,000	33%	$277,000
13	Expand Chlorine Building	$184,000	84%	$155,000
14	New Chlorination/Dechlorination Dosing and Monitoring Equipment	$150,000	84%	$126,000
15	Misc. Site Piping Improvements	$200,000	84%	$168,000
16	SSB 1 Modifications	$140,000	84%	$118,000
17	Convert Existing 35' Secondary Clarifiers to Digesters	$2,100,000	0%	$0
18	New 35' Digester	$1,555,000	100%	$1,555,000
19	Blower Building Facility	$900,000	33%	$297,000
20	Sludge Dewatering Facility	$1,450,000	84%	$1,218,000
21	Upsize Pumps	$610,000	84%	$513,000
22	New Office Building	$367,000	33%	$122,000
23	Renovate Existing Office Building	$230,000	33%	$76,000
24	SCADA and Electrical Improvements	$430,000	84%	$362,000
25	New Generator	$210,000	84%	$177,000
26	New Lab Equipment	$69,000	0%	$0
27	Replace Freeze-Proof Yard Hydrants	$27,000	0%	$0
28	AC Paving	$505,000	0%	$0
29	Site Fencing Improvements	$40,000	0%	$0
	WWTP IMPROVEMENTS SUBTOTAL:	**$17,860,000**		**$11,920,000**
EFFLUENT DISPOSAL IMPROVEMENTS				
30	Improve Access Road to Cottonwood Creek Diffuser	$100,000	0%	$0
31	Constructed Weltands Effluent Disposal Facillity	$4,200,500	84%	$3,529,000
32	Effluent Pipeline to Wetlands	$1,740,500	84%	$1,463,000
33	WWTP Effluent Pump Station	$250,000	84%	$210,000
34	Site Acquisition/Easements	$500,000	84%	$420,000
	EFFLUENT DISPOSAL IMPROVEMENTS SUBTOTAL:	**$6,791,000**		**$5,622,000**
	TOTAL ESTIMATED CONSTRUCTION COSTS:	$25,121,000		$17,792,000
	Construction Contingency (25%):	$6,280,000		$4,448,000
	Environmental, Engineering, and Indirect Costs (35%):	$10,990,000		$7,784,000
	TOTAL ESTIMATED PROJECT COSTS:	**$42,391,000**		**$30,024,000**
			Additional HEs within Existing Service Area Boundary:	1,045
			Recommended Captial Improvement Fee per HE:	**$28,731**

[1] All costs in March 2022 dollars at an ENR index of 12791.

TABLE 11B
2022 Amendment to 2013 SMP
ALTERNATIVE 2 - AEROMOD IMPROVEMENTS & CAPITAL IMPROVEMENT FEE BASIS[1]

Item No.	Description	Ultimate Development of Service Area	% Attributed to Growth	Cost Attributed to Growth
LIFT STATION IMPROVEMENTS				
COTTONWOOD LIFT STATION IMPROVEMENTS				
1	Grinder	$110,000	0%	$0
2	Two 700 GPM and Two 325 GPM Centrifugal Pumps, Motors, and Starters	$250,000	100%	$250,000
BLACK LANE LIFT STATION IMPROVEMENTS				
3	Portable Trash Pump and Piping	$60,000	0%	$0
CROWLEY CREEK LIFT STATION IMPROVEMENTS				
4	Diesel Gas Tank Secondary Containment Improvements	$10,000	0%	$0
5	Install Bypass Piping	$20,000	0%	$0
QUAIL LANE LIFT STATION IMPROVEMENTS				
6	Install Bypass Piping	$20,000	0%	$0
	LIFT STATION IMPROVEMENTS SUBTOTAL:	**$470,000**		**$250,000**
WWTP IMPROVEMENTS				
7	Expand and Elevate Headworks	$400,000	84%	$336,000
8	AEROMOD	$7,900,000	84%	$6,636,000
9	Blower Building Facility	$1,100,000	84%	$924,000
10	New Traveling Bridge Filter	$977,000	100%	$977,000
11	Expand Chlorine Contact Basin	$838,000	33%	$277,000
12	Expand Chlorine Building	$184,000	84%	$155,000
13	New Chlorination/Dechlorination Dosing and Monitoring Equipment	$150,000	84%	$126,000
14	Misc. Site Piping Improvements	$200,000	84%	$168,000
15	Sludge Dewatering Facility	$1,450,000	84%	$1,218,000
16	New Office Building	$367,000	33%	$122,000
17	Renovate Existing Office Building	$230,000	33%	$76,000
18	SCADA and Electrical Improvements	$430,000	84%	$362,000
19	New Generator	$210,000	84%	$177,000
20	New Lab Equipment	$69,000	0%	$0
21	Upsize No. 2 Water Pumps	$117,000	84%	$99,000
22	Replace Freeze-Proof Yard Hydrants	$27,000	0%	$0
23	AC Paving	$505,000	0%	$0
24	Site Fencing Improvements	$40,000	0%	$0
	WWTP IMPROVEMENTS SUBTOTAL:	**$15,194,000**		**$11,653,000**
EFFLUENT DISPOSAL IMPROVEMENTS				
25	Improve Access Road to Cottonwood Creek Diffuser	$100,000	0%	$0
26	Constructed Weltands Effluent Disposal Facillity	$4,200,500	84%	$3,529,000
27	Effluent Pipeline to Wetlands	$1,740,500	84%	$1,463,000
28	WWTP Effluent Pump Station	$250,000	84%	$210,000
29	Site Acquisition/Easements	$500,000	84%	$420,000
	EFFLUENT DISPOSAL IMPROVEMENTS SUBTOTAL:	**$6,791,000**		**$5,622,000**
	TOTAL ESTIMATED CONSTRUCTION COSTS:	$22,455,000		$17,525,000
	Construction Contingency (25%):	$5,614,000		$4,381,000
	Environmental, Engineering, and Indirect Costs (35%):	$9,824,000		$7,667,000
	TOTAL ESTIMATED PROJECT COSTS:	**$37,893,000**		**$29,573,000**
			Additional HEs within Existing Service Area Boundary:	1,045
			Recommended Capital Improvement Fee per HE:	**$28,300**

[1] All costs in March 2022 dollars at an ENR index of 12791.

TABLE 12 2022 Amendment to 2013 SMP OPTION 1 – 100% DISCHARGE TO SACRAMENTO RIVER PRELIMINARY COST ESTIMATE[1]					
ITEM NO.	**DESCRIPTION**	**QTY**	**UNIT**	**INSTALLED COST**	
				UNIT	**TOTAL**
1	12" Effluent Piping Class A1 (Shoulder Backfill) From WWTP	14,000	LF	$200	$2,800,000
2	12" Effluent Piping Class A5 (Pavement Backfill) From WWTP	14,000	LF	$275	$3,850,000
3	12" Isolation Valves	15	EA	$8,000	$120,000
4	Air Valves/Clean-Outs	10	EA	$10,000	$100,000
5	Bore & Jack Railroad Crossings	2	EA	$100,000	$200,000
6	Culvert Crossings	20	LS	$10,000	$200,000
7	New Effluent Diffuser In Sacramento River	1	LS	$2,900,000	$2,900,000
8	WWTP Effluent Pump Station	1	LS	$500,000	$500,000
9	Misc.	1	LS	$100,000	$100,000
				SUBTOTAL:	**$10,770,000**
				Construction Contingency (25%):	$2,693,000
				TOTAL ESTIMATED CONSTRUCTION COSTS:	$13,463,000
				Easement Acquisition:	$100,000
				Environmental, Engineering, and Indirect Costs (35%):	$5,655,000
				TOTAL ESTIMATED PROJECT COSTS:	**$19,218,000**

(1) All costs in March 2022 dollars at an ENR index of 12791.

TABLE 13
2022 Amendment to 2013 SMP
OPTION 2 - EFFLUENT STORAGE/SEASONAL DISHCARGE TO COTTONWOOD CREEK
PRELIMINARY COST ESTIMATE[1]

ITEM NO.	DESCRIPTION	QTY	UNIT	INSTALLED COST	
				UNIT	TOTAL
1	12" Effluent Piping Class A1 (Shoulder Backfill) From WWTP	1,300	LS	$200	$260,000
2	12" Effluent Piping Class A5 (Pavement Backfill) From WWTP	7,000	LF	$275	$1,925,000
3	12" Isolation Valves	5	EA	$8,000	$40,000
4	Air Valves/Cleanouts	4	EA	$10,000	$40,000
5	Culvert Crossings	6	LS	$10,000	$60,000
6	Reservoir Site Stripping	35	AC	$8,000	$280,000
7	Effluent Storage Reservoir Earthwork	85,000	CY	$30	$2,550,000
8	Aggregate Base (Access, Pond Dike and Parking)	80,000	SF	$5	$400,000
9	Reservoir Slope Protection	25,000	SF	$10	$250,000
10	Reservoir Inlet Structure	1	LS	$30,000	$30,000
11	Field Fencing	6,500	LF	$20	$130,000
12	WWTP Effluent Pump Station	1	EA	$300,000	$300,000
13	Misc.	1	LS	$100,000	$100,000
				SUBTOTAL:	**$6,365,000**
				Construction Contingency (25%):	$1,591,000
				TOTAL ESTIMATED CONSTRUCTION COSTS:	$7,956,000
				Easement Acquisition:	$500,000
				Environmental, Engineering, and Indirect Costs (35%):	$3,341,000
				TOTAL ESTIMATED PROJECT COSTS:	**$11,797,000**

(1) All costs in March 2022 dollars at an ENR index of 12791.

TABLE 14

2022 Amendment to 2013 SMP

OPTION 3 – EFFLUENT STORAGE AND 0.43 MGD EXCESS IRRIGATION

PRELIMINARY COST ESTIMATE[1]

ITEM NO.	DESCRIPTION	QTY	UNIT	INSTALLED COST	
				UNIT	TOTAL
1	8" Effluent Piping Class A1 (Shoulder Backfill) From WWTP	1,300	LS	$175	$227,500
2	8" Effluent Piping Class A5 (Pavement Backfill) From WWTP	7,000	LF	$200	$1,400,000
3	8" Isolation Valves	5	EA	$5,000	$25,000
4	Air Valves/Cleanouts	4	EA	$10,000	$40,000
5	Culvert Crossings	6	LS	$8,000	$48,000
6	Reservoir Site Stripping	24	AC	$8,000	$192,000
7	Effluent Storage Reservoir Earthwork	65,000	CY	$30	$1,950,000
8	Aggregate Base (Access, Pond Dike and Parking)	65,000	SF	$5	$325,000
9	Reservoir Slope Protection	20,000	SF	$10	$200,000
10	Reservoir Inlet Structure	1	LS	$30,000	$30,000
11	Irrigation Sprinkler System	70	AC	$15,000	$1,050,000
12	Diversion V-Ditch	3,200	LF	$55	$176,000
13	Border Ditch/Dike	11,500	LF	$50	$575,000
14	Tailwater Return Pump Station	1	EA	$200,000	$200,000
15	Tailwater Return Pipleline	530	LF	$100	$53,000
16	Slide Gates	4	EA	$5,000	$20,000
17	Irrigation Pump Station	1	LS	$300,000	$300,000
18	Field Fencing	12,000	LF	$20	$240,000
19	WWTP Effluent Pump Station	1	EA	$250,000	$250,000
20	Misc.	1	LS	$100,000	$100,000
				SUBTOTAL:	**$7,401,500**
				Construction Contingency (25%):	$1,850,000
				TOTAL ESTIMATED CONSTRUCTION COSTS:	$9,251,500
				Easement Acquisition:	$1,500,000
				Environmental, Engineering, and Indirect Costs (35%):	$3,886,000
				TOTAL ESTIMATED PROJECT COSTS:	**$14,637,500**

[1] All costs in March 2022 dollars at an ENR index of 12791.

TABLE 15

2022 Amendment to 2013 SMP

OPTION 4 – EFFLUENT STORAGE/IRRIGATION AND NO DISCHARGE

PRELIMINARY COST ESTIMATE[1]

ITEM NO.	DESCRIPTION	QTY	UNIT	INSTALLED COST	
				UNIT	TOTAL
1	12" Effluent Piping Class A1 (Shoulder Backfill) From WWTP	4,200	LS	$200	$840,000
2	12" Effluent Piping Horizontal Directional Drill (HDD) From WWTP	1,800	LF	$500	$900,000
3	12" Isolation Valves	4	EA	$8,000	$32,000
4	Air Valves/Cleanouts	2	EA	$10,000	$20,000
5	Reservoir Site Stripping	52	AC	$8,000	$416,000
6	Effluent Storage Reservoir Earthwork	105,000	CY	$30	$3,150,000
7	Aggregate Base (Access, Pond Dike and Parking)	80,000	SF	$5	$400,000
8	Reservoir Slope Protection	35,000	SF	$10	$350,000
9	Reservoir Inlet Structure	1	LS	$30,000	$30,000
10	Irrigation Sprinkler System	165	AC	$15,000	$2,475,000
11	Diversion V-Ditch	8,500	LF	$55	$467,500
12	Border Ditch/Dike	17,000	LF	$50	$850,000
13	Tailwater Return Pump Station	2	EA	$200,000	$400,000
14	Tailwater Return Pipeline	1,900	LF	$100	$190,000
15	Slide Gates	8	EA	$5,000	$40,000
16	Irrigation Pump Station	1	LS	$400,000	$400,000
17	Field Fencing	20,000	LF	$20	$400,000
18	WWTP Effluent Pump Station	1	EA	$300,000	$300,000
19	Misc.	1	LS	$100,000	$100,000
				SUBTOTAL:	**$11,760,500**
				Construction Contingency (25%):	$2,940,000
				TOTAL ESTIMATED CONSTRUCTION COSTS:	$14,700,500
				Easement Acquisition:	$2,500,000
				Environmental, Engineering, and Indirect Costs (35%):	$6,174,000
				TOTAL ESTIMATED PROJECT COSTS:	**$23,374,500**

[1] All costs in March 2022 dollars at an ENR index of 12791.

TABLE 16
2022 Amendment to 2013 SMP
OPTION 5 - CONSTRUCTED WETLANDS FOR 0.43 MGD EXCESS FLOWS
PRELIMINARY COST ESTIMATE[1]

ITEM NO.	DESCRIPTION	QTY	UNIT	INSTALLED COST	
				UNIT	TOTAL
1	8" Effluent Piping Class A1 (Shoulder Backfill) From WWTP	1,300	LS	$175	$227,500
2	8" Effluent Piping Class A5 (Pavement Backfill) From WWTP	7,000	LF	$200	$1,400,000
3	8" Isolation Valves	5	EA	$5,000	$25,000
4	Air Valves/Cleanouts	4	EA	$10,000	$40,000
5	Culvert Crossings	6	LS	$8,000	$48,000
6	Wetlands Site Stripping	30	AC	$8,000	$240,000
7	Wetlands Earthwork	80,000	CY	$30	$2,400,000
8	Aggregate Base (Access, Pond Dike and Parking)	70,000	SF	$5	$350,000
9	Reservoir Slope Protection	50,000	SF	$10	$500,000
10	Reservoir Inlet Structures	5	LS	$30,000	$150,000
11	Wetlands planting	20	AC	$10,000	$200,000
12	Field Fencing	13,000	LF	$20	$260,000
13	WWTP Effluent Pump Station	1	EA	$250,000	$250,000
14	Misc.	1	LS	$100,000	$100,000
				SUBTOTAL:	**$6,190,500**
				Construction Contingency (25%):	$1,548,000
				TOTAL ESTIMATED CONSTRUCTION COSTS:	$7,738,500
				Easement Acquisition:	$500,000
				Environmental, Engineering, and Indirect Costs (35%):	$3,250,000
				TOTAL ESTIMATED PROJECT COSTS:	**$11,488,500**

[1] All costs in March 2022 dollars at an ENR index of 12791.

TABLE 17

2022 Amendment to 2013 SMP

EFFLUENT DISPOSAL – DECISION MATRIX

No.	Criteria	Weight Factors (%)	Effluent Disposal Options				
			1 - Discharge to Sac River	2 - Effluent Storage - Seasonal Discharge	3 - Effluent Storage - Irrigation	4 - Effluent Storage/Irrig - No Discharge	5 - Constructed Wetlands
1	Present Worth Capital and O&M	30	6	9	7	5	10
2	Environmental and Construction Permitting Constraints	15	6	6	5	4	8
3	Ease of Compliance with NPDES/WDRs	20	6	5	5	8	6
4	Ability to Obtain Needed Land and Right-of-Way	10	6	6	5	5	6
5	Ease of Construction	10	8	8	6	4	6
6	Public Acceptance	10	7	7	6	6	7
7	Security and Safety to Workers/Public	5	8	7	6	6	6
	Weighted Totals:	100	**64%**	**69%**	**58%**	**56%**	**76%**

Notes:

1= Least Favorable

10= Most Favorable

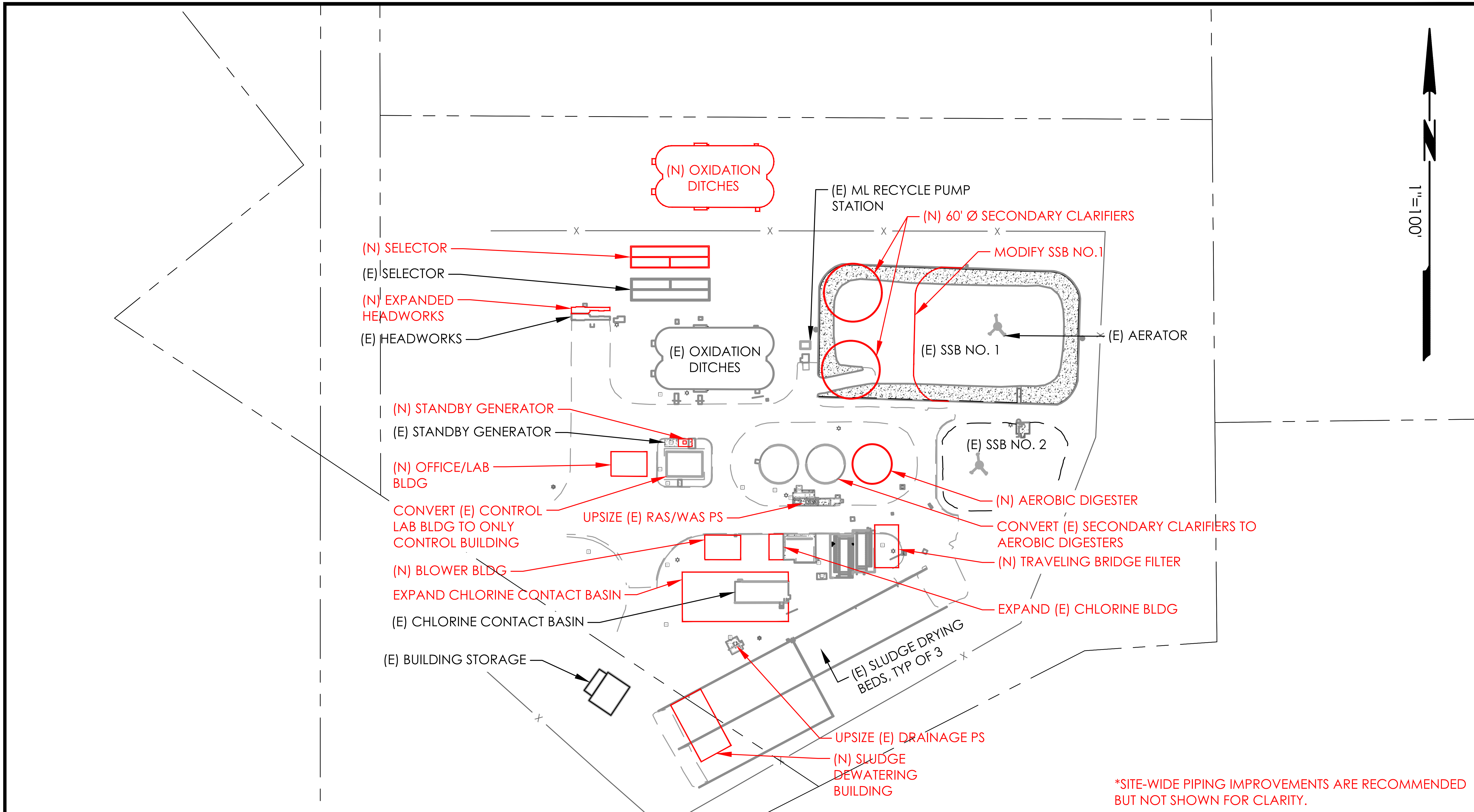
TABLE 18

2022 Amendment to 2013 SMP

EFFLUENT DISPOSAL - PRESENT WORTH

Criteria	Effluent Disposal Options				
	1 - Discharge to Sac River	2 - Effluent Storage - Seasonal Discharge	3 - Effluent Storage - Irrigation	4 - Effluent Storage/Irrig - No Discharge	5 - Constructed Wetlands
Project Cost	$19,218,000	$11,797,000	$14,637,500	$23,374,500	$11,488,500
Present Worth O&M	$693,144	$390,578	$590,152	$1,151,739	$297,565
Total Net Present Worth	$19,911,144	$12,187,578	$15,227,652	$24,526,239	$11,786,065

FIGURES



*SITE-WIDE PIPING IMPROVEMENTS ARE RECOMMENDED BUT NOT SHOWN FOR CLARITY.

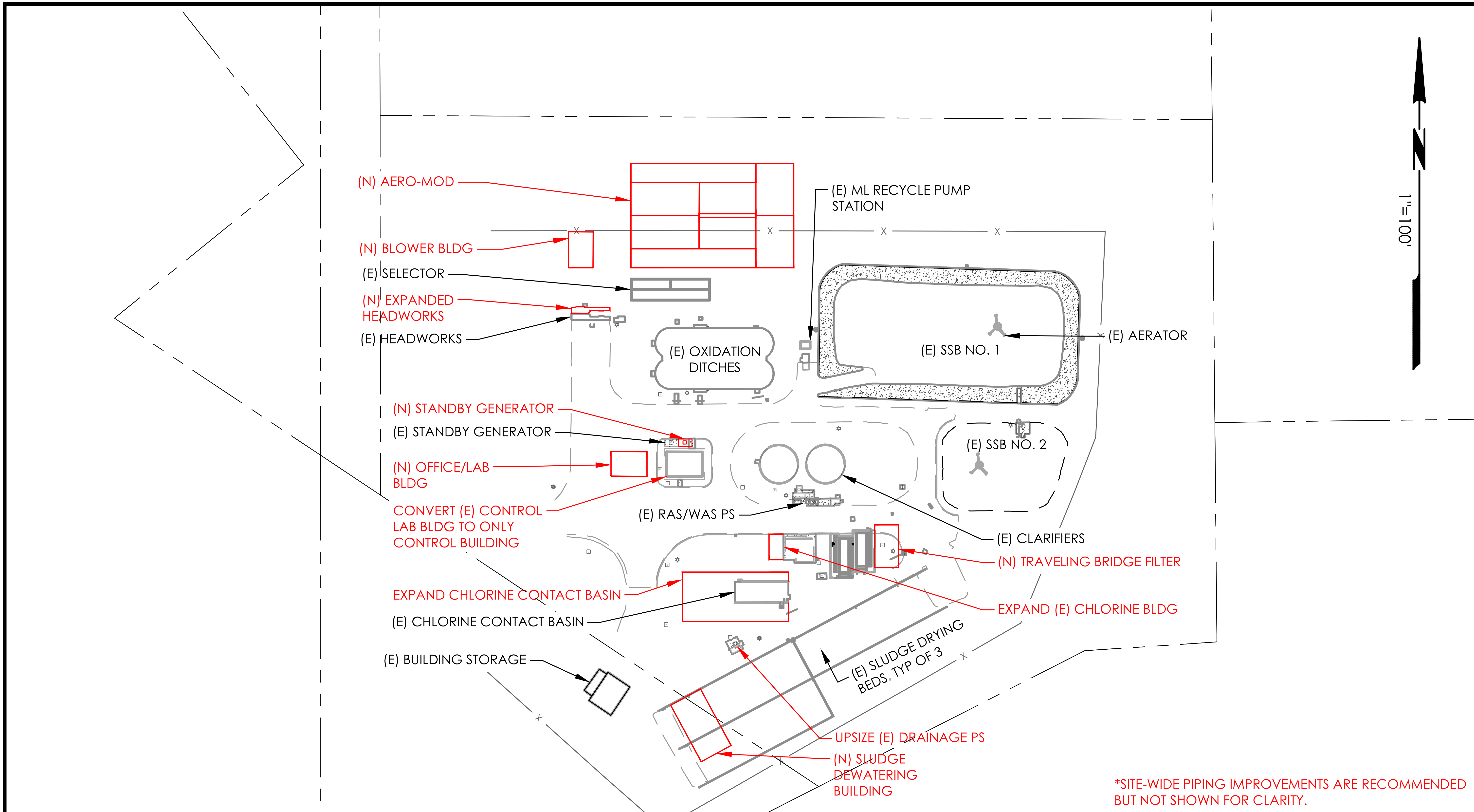
PACE® ENGINEERING

SHASTA COUNTY CSA NO.17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
WWTP IMPROVEMENTS - ALT 1

FIGURE 4A

DATE: 3/2022

JOB # 199.109



*SITE-WIDE PIPING IMPROVEMENTS ARE RECOMMENDED BUT NOT SHOWN FOR CLARITY.

PACE® ENGINEERING

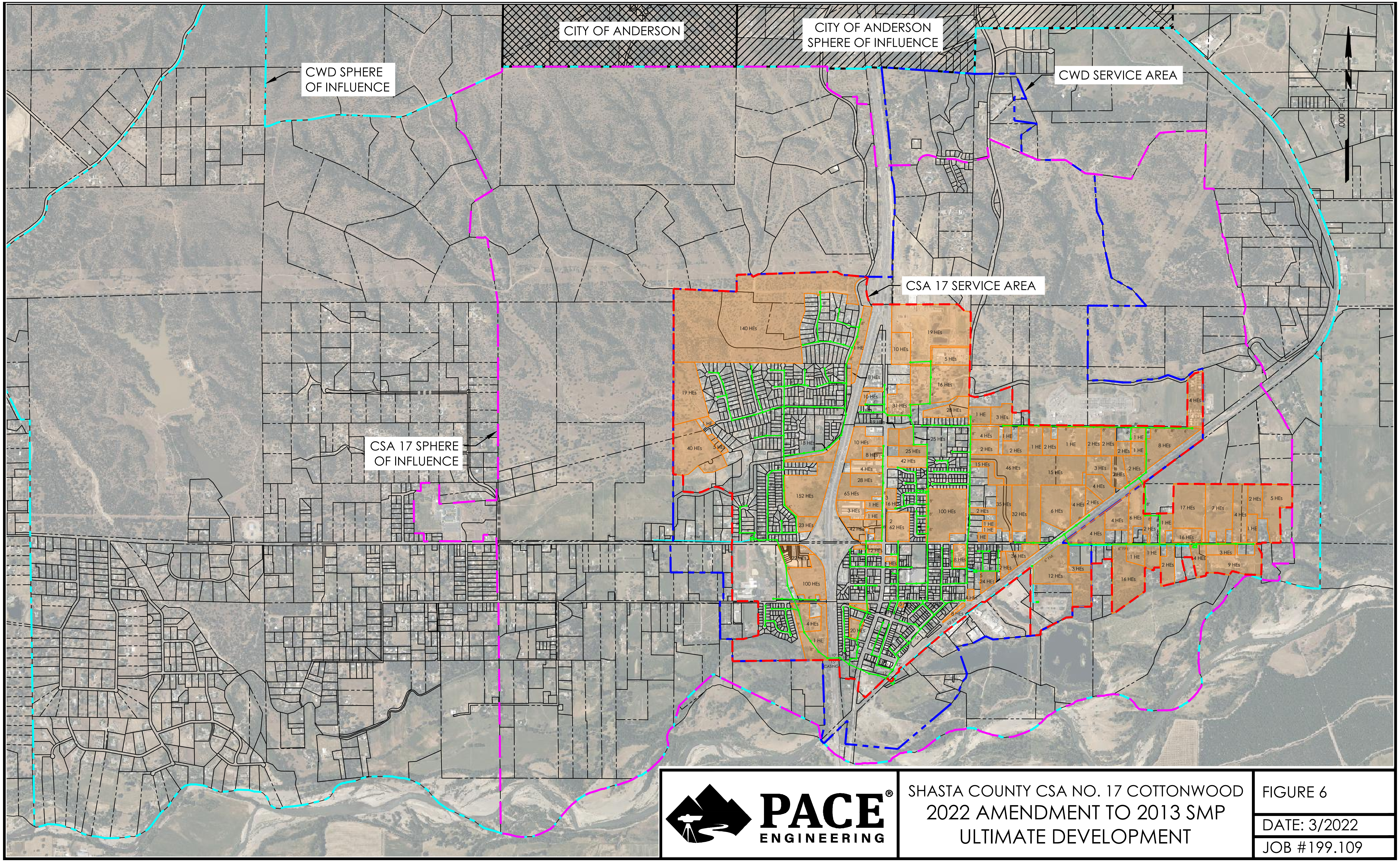
SHASTA COUNTY CSA NO.17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
WWTP IMPROVEMENTS - ALT 2

FIGURE 4B

DATE: 3/2022

JOB # 199.109

Plot Date: March 28, 2022 - 11:08 am Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Civil - WWTP IMPROVEMENT.dwg, Layout: 2022 MSP UPDATE- ALT 2



PACE® ENGINEERING

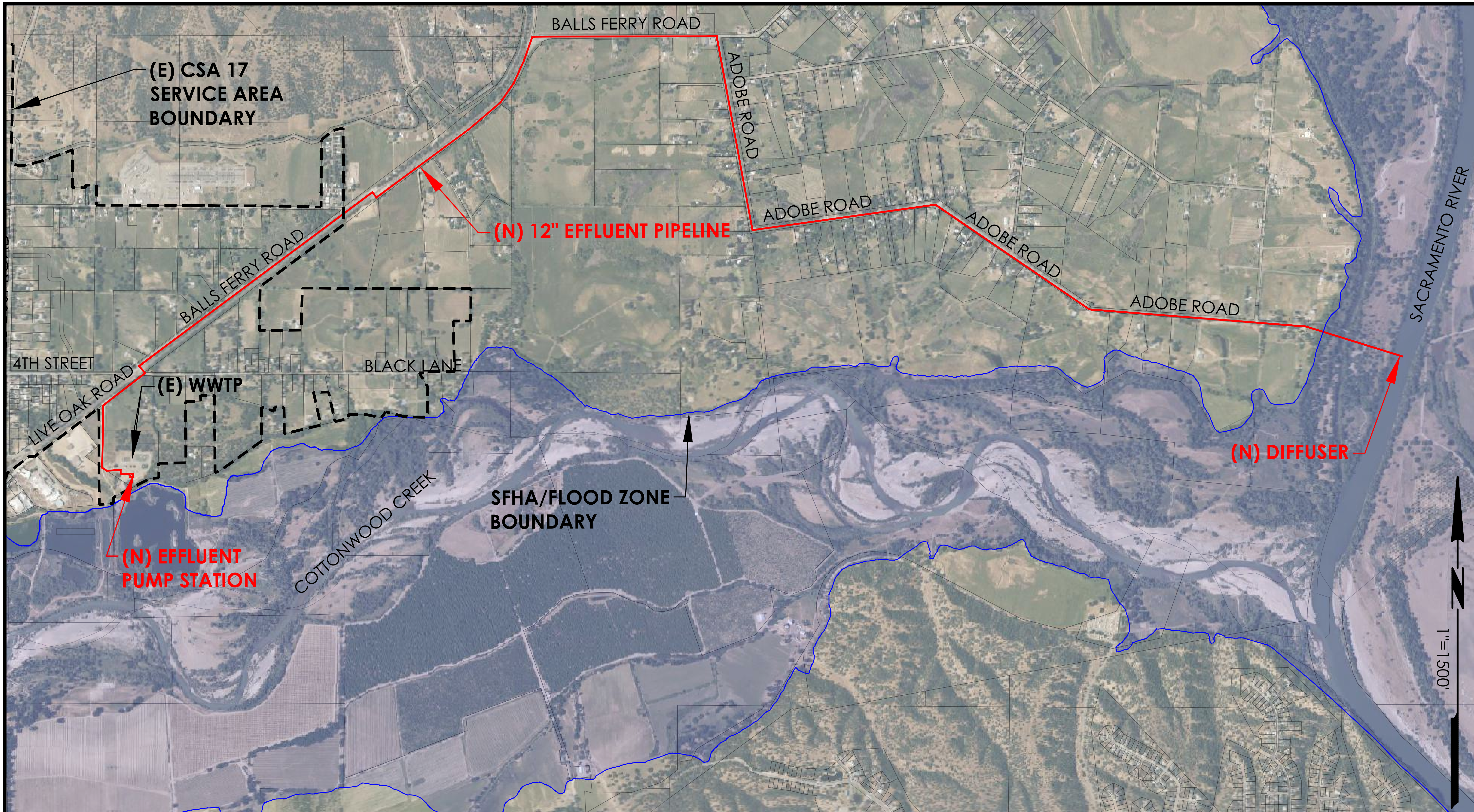
SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
ULTIMATE DEVELOPMENT

FIGURE 6

DATE: 3/2022

JOB #199.109

Plot Date: March 25, 2022 - 7:58 am Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Figure 6_Ultimate Development.dwg, Layout: FIG1



PACE® ENGINEERING

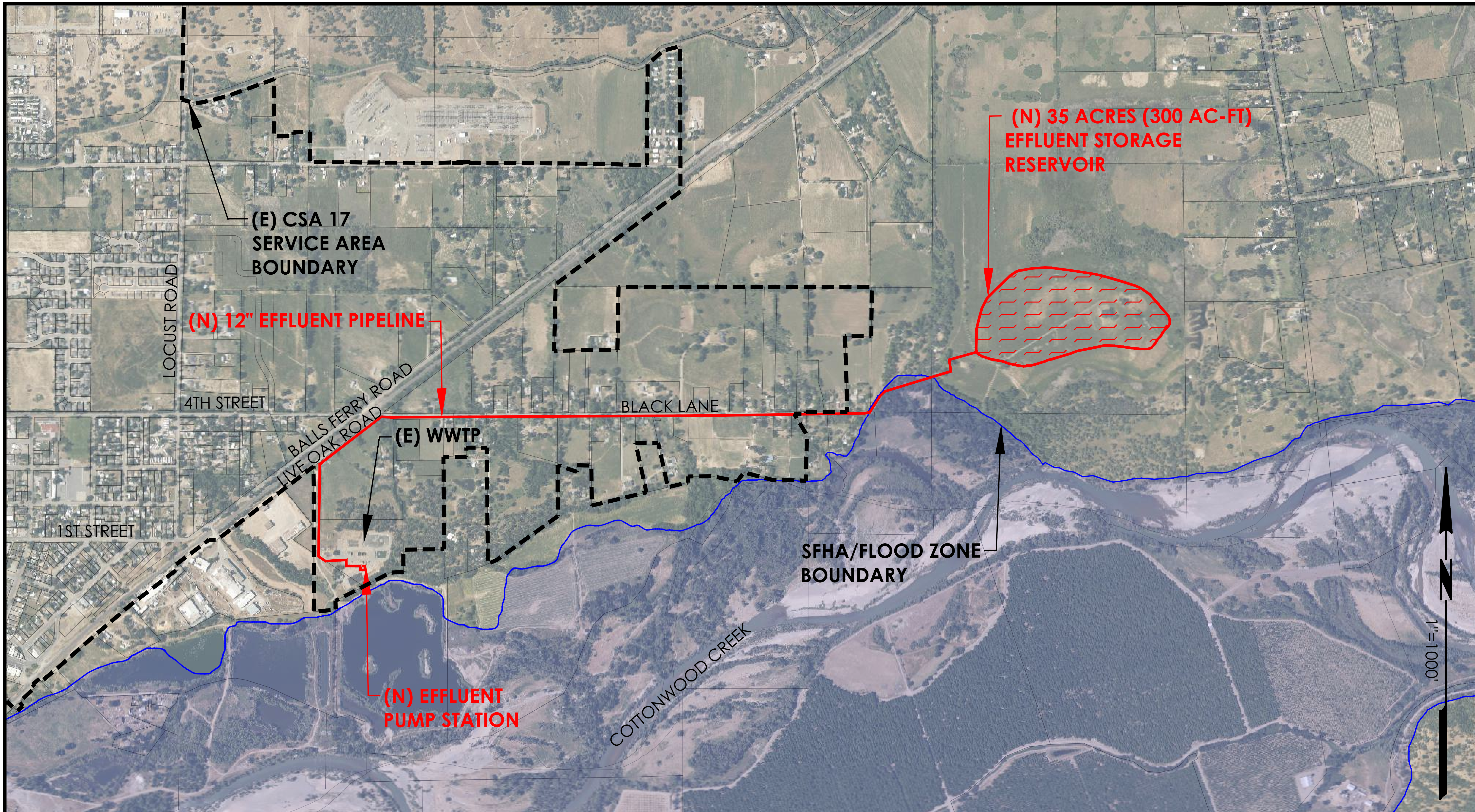
SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 1 - 100% DISCHARGE TO SACRAMENTO RIVER

FIGURE 7

DATE: 3/2022

JOB # 199.109

Plot Date: March 28, 2022 - 105 pm Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Figure 7_Option 1- 100% Discharge to Sacramento River.dwg, Layout: FIGURE 7



PACE ENGINEERING

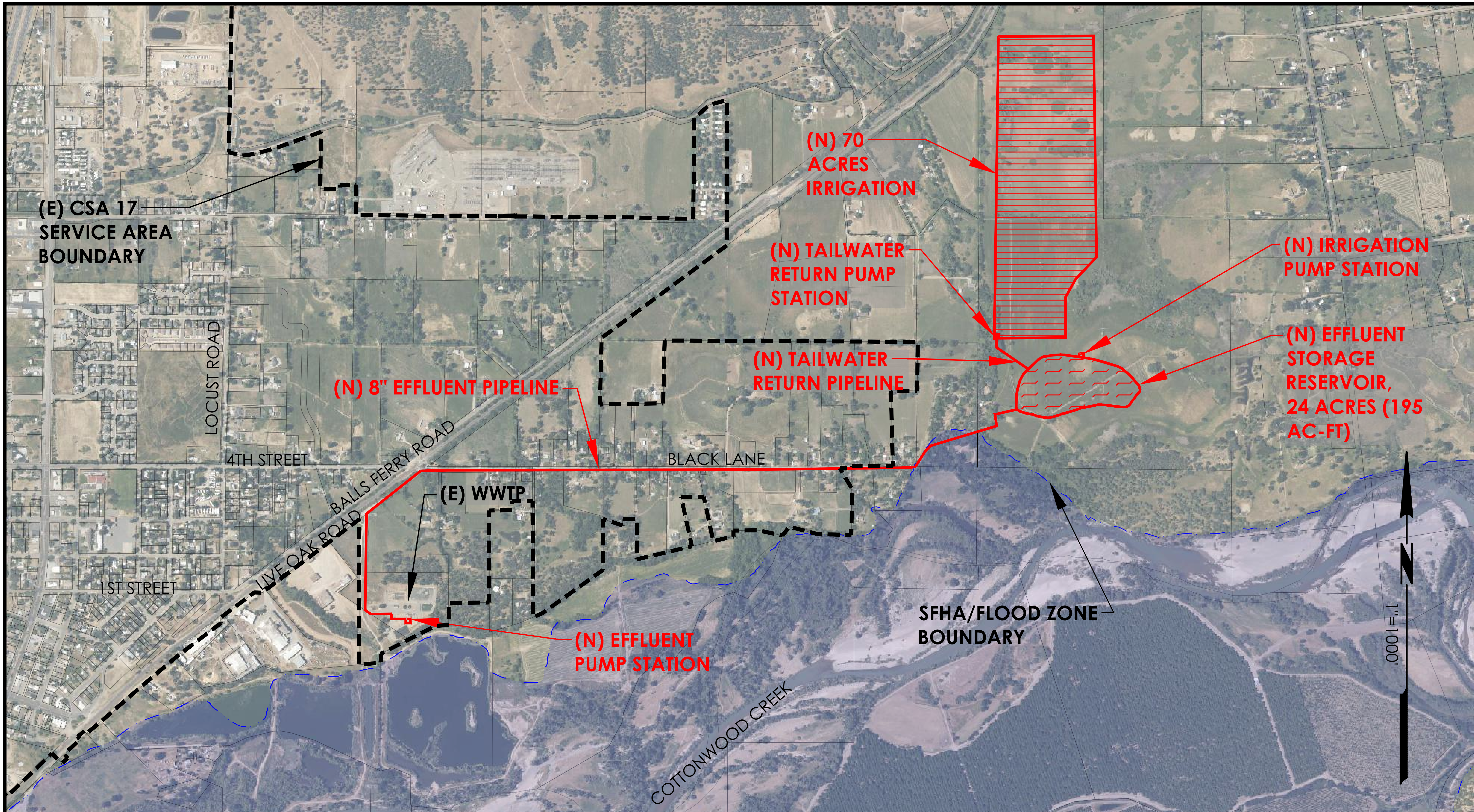
SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 2 - EFFLUENT STORAGE AND
SEASONAL DISCHARGE

FIGURE 8

DATE: 03/2022

JOB # 199.109

Plot Date: March 28, 2022 - 106 pm Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Figure 8_Option 2- Effluent Storage & Pasture Irrigation.dwg, Layout: FIGURE 8



PACE ENGINEERING

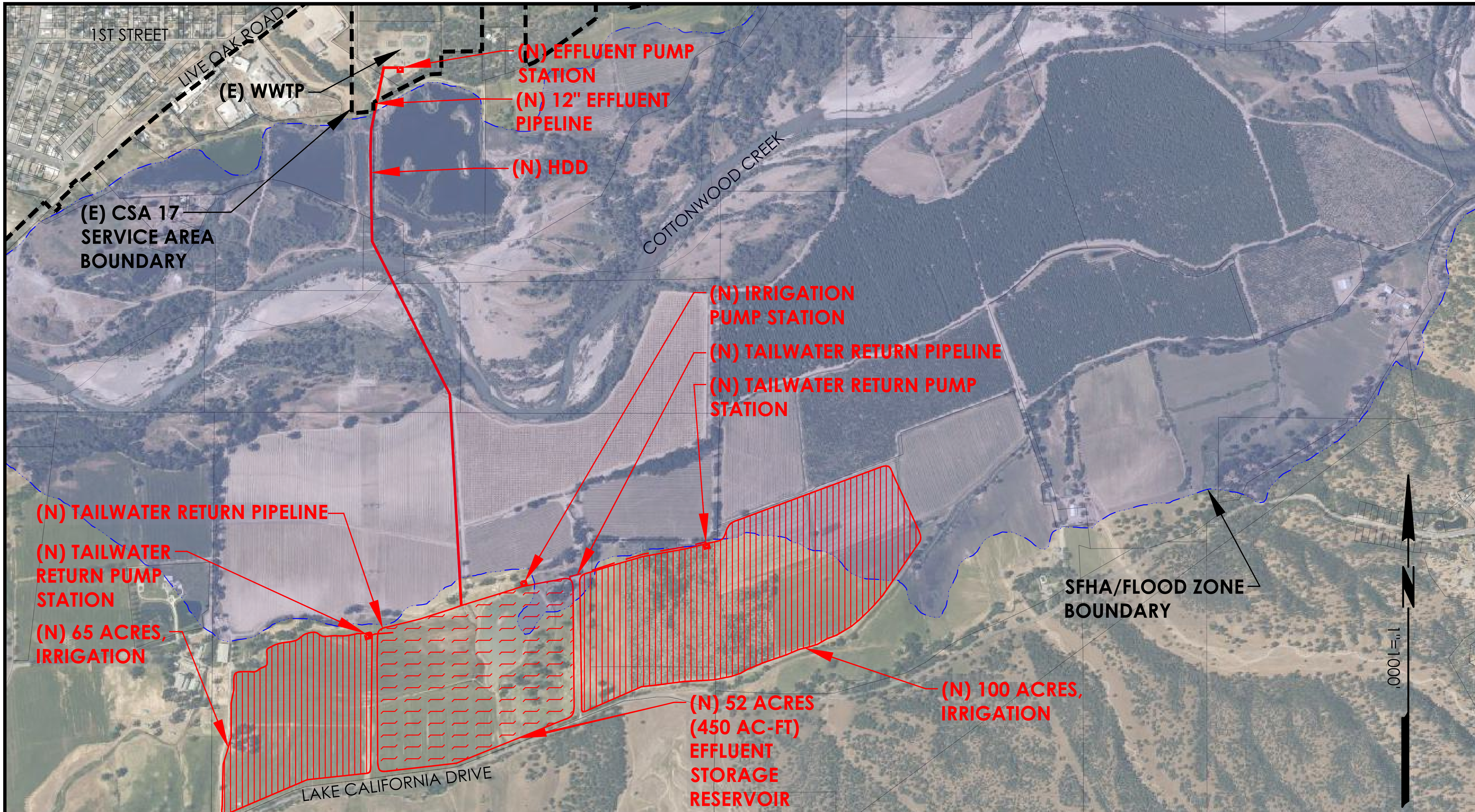
SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 3 - EFFLUENT STORAGE AND 0.43 MGD EXCESS IRRIGATION

FIGURE 9

DATE: 03/2022

JOB # 199.109

Plot Date: March 28, 2022 - 107 pm Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Figure 9_Option 3- Effluent Storage & Pasture Irrigation.dwg, Layout: FIGURE 9



PACE® ENGINEERING

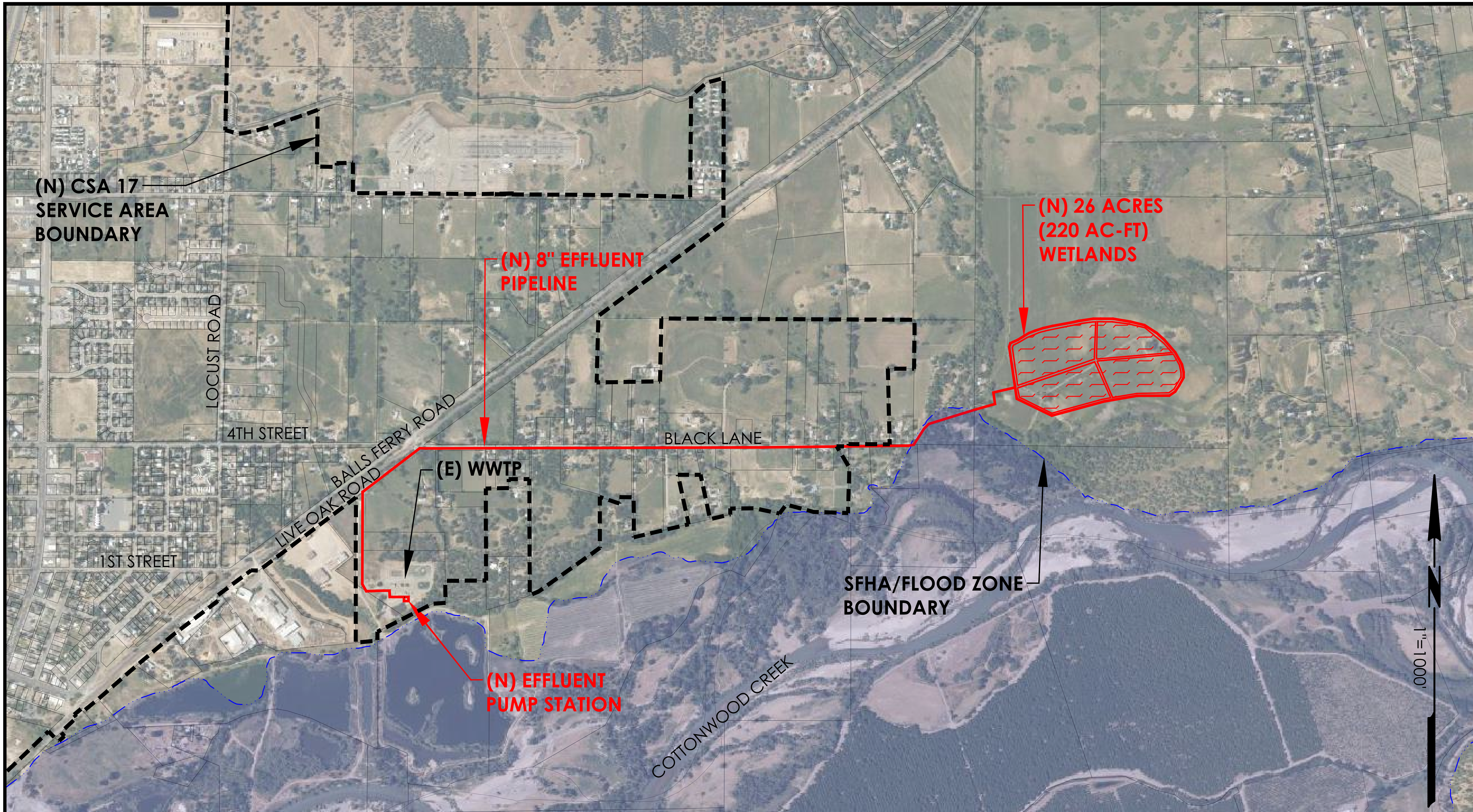
SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 4 - EFFLUENT STORAGE AND IRRIGATION- NO DISCHARGE

FIGURE 10

DATE: 03/2022

JOB # 199.109

Plot Date: March 31, 2022 - 7:14 am Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Figure 10_Option 4- Effluent Storage & Pasture Irrigation.dwg, Layout: FIGURE 10



PACE® ENGINEERING

SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 5 -
CONSTRUCTED WETLANDS

FIGURE 11

DATE: 3/2022

JOB # 199.109

Plot Date: March 28, 2022 - 1:10 pm Login Name: CPaget
File Name: M:\Land Projects\0199.109 CSA 17 Cottonwood SMP Update\Figure 11_Option 5- Constructed Wetlands.dwg, Layout: Figure 11- Opt 5

APPENDIX F

EFFLUENT DISPOSAL

SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 1 - 100% DISCHARGE TO SACRAMENTO RIVER
OPERATION AND MAINTENANCE COST ESTIMATE

EFFLUENT PUMPING

Power Cost ($/KW-HR):	$0.30	
Avg Pumping Rate (GPM):	1,000	
Estimated Pumping Head (FT):	120	Estimated based on 1,000 GPM in 12" plus static lift and minor losses
Pump HP:	43.3	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	70.28	22,899,248	382	12,325	$3,697.58
Nov	70.28	22,899,248	382	12,325	$3,697.58
Dec	77.31	25,189,825	420	13,558	$4,067.45
Jan	77.31	25,189,825	420	13,558	$4,067.45
Feb	77.31	25,189,825	420	13,558	$4,067.45
Mar	77.31	25,189,825	420	13,558	$4,067.45
Apr	77.31	25,189,825	420	13,558	$4,067.45
May	77.31	25,189,825	420	13,558	$4,067.45
Jun	70.28	22,899,248	382	12,325	$3,697.58
Jul	70.28	22,899,248	382	12,325	$3,697.58
Aug	70.28	22,899,248	382	12,325	$3,697.58
Sep	70.28	22,899,248	382	12,325	$3,697.58
					$46,590.19

IRRIGATION PUMPING

Irrigation Area (AC):	0	
Max Irrigationn Rate (In/Day):	0	(Based on 9.92 in./mo. irrigation rate for July)
Max Daily Application (Gal):	0	
Max 24-Hr Application Rate (GPM):	0	Minimum Pumping Rate
Avg Pumping Rate (GPM):	0	Estimated total irrigation pumping rate
Estimated Pumping Head (FT):	0	Estimated based on 75 PSI at sprinkler plus friction/minor losses
Pump HP:	0.0	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	0	0	0	0	$0.00
Nov	0	0	0	0	$0.00
Dec	0	0	0	0	$0.00
Jan	0	0	0	0	$0.00
Feb	0	0	0	0	$0.00
Mar	0	0	0	0	$0.00
Apr	0	0	0	0	$0.00
May	0	0	0	0	$0.00
Jun	0	0	0	0	$0.00
Jul	0	0	0	0	$0.00
Aug	0	0	0	0	$0.00
Sep	0	0	0	0	$0.00
					$0.00

TOTAL POWER CONSUMPTION:	**$46,590.19**
Discount Rate (%):	3.0%
Period (years):	20
20-YEAR PRESENT WORTH:	**$693,144**

Date: 1/29/2022
By: PJR
Job. No. 199.109

2022 AMENDMENT TO 2013 SMP
OPTION 2 - ULTIMATE BUILDOUT-SEASONAL DISCHARGE TO COTTONWOOD CREEK & EFFLUENT STORAGE
100-YEAR RAINFALL HYDRAULIC LOADING AND STORAGE REQUIREMENTS

Month Ending	100 Year Rainfall[1] (Inches/Month)	Potential ET Rate[2] (Inches/Month)	Evaporation[3] (Inches/Month)	Irrigation Rate[4] (Inches/Month)	Sewage[5] (Ac-Ft/Month)	Rainfall on Pond (Ac-Ft/Month)	Pond Evaporation (Ac-Ft/Month)	Landscape Irrigation (Ac-Ft/Month)	Pond Percolation (Ac-Ft/Month)	Reclaimed Water to Cottonwood Creek (Ac-Ft/Month)	Potential Change in Storage (Ac-Ft/Month)	Estimated Total in Active Storage (Ac-Ft)
OCT	2.78	3.50	3.36	0.94	70.28	7.31	8.39	0.00	30.40	0.00	38.80	38.80
NOV	7.14	0.00	1.36	0.00	70.28	18.80	3.41	0.00	26.60	0.00	59.07	97.87
DEC	7.96	0.00	0.94	0.00	77.31	20.97	2.36	0.00	22.80	170.99	-97.87	0.00
JAN	8.77	0.00	0.94	0.00	77.31	23.09	2.36	0.00	7.60	90.44	0.00	0.00
FEB	6.47	0.00	1.36	0.00	77.31	17.04	3.41	0.00	3.80	87.14	0.00	0.00
MAR	6.46	0.00	2.83	0.00	77.31	17.01	7.08	0.00	7.60	79.64	0.00	0.00
APR	3.56	4.50	4.09	1.23	77.31	9.37	10.23	0.00	11.40	65.05	0.00	0.00
MAY	2.31	6.20	6.09	5.06	77.31	6.07	15.21	0.00	15.20	0.00	52.97	52.97
JUN	0.90	7.60	7.34	8.72	70.28	2.36	18.36	0.00	30.40	0.00	23.88	76.85
JUL	0.37	8.00	8.18	9.92	70.28	0.97	20.46	0.00	30.40	0.00	20.39	97.23
AUG	0.72	6.70	7.13	7.77	70.28	1.90	17.84	0.00	30.40	0.00	23.95	121.18
SEP	1.70	5.40	5.35	4.81	70.28	4.47	13.38	0.00	30.40	0.00	30.97	152.16
TOTAL	49.13	41.90	49.00	38.45	885.54	129.38	122.50	0.00	247.00	493.26	152.16	

CONSTANTS	93.56	40.66		68.40	15.49
Storage pond runoff area (acres):	A	31.6	From Reservoir Earthwork Spreadsheet		
Average storage pond water surface (acres):	B	30.0	From Reservoir Earthwork Spreadsheet		
Estimated landscape irrigation area (acres):	C	0.0	Input		
Storage pond percolation rate @ 5 ft water level (in/day):	D	0.5		1.5E-05 cm/s	
Design ADWF (mgd):	E	0.43			

NOTES:
1. 100-year rainfall based on Coleman Fish Hatchery Precipitation Depth-Duration-Frequency Table from DWR Bulletin 195.
2. Potential ET based on 21 years of data for irrigated pasture in Gerber, California.
3. Evaporation estimated using Chico, CA pan evaporation x 0.70 pan coefficient.
4. All effluent is applied directly during April-October. Application rate = (ET - Precipitation) * 1.30 Inefficiency
5. Sewage flows for Option 2 are the Ultimate flows in excess of the 0.43 MGD (ADWF) design capacity. Winter flows are 1.1 times summer flows to account for Inflow & Infiltration.

SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 2 - EFFLUENT STORAGE/SEASONAL DISCHARGE TO COTTONWOOD CREEK
OPERATION AND MAINTENANCE COST ESTIMATE

EFFLUENT PUMPING

Power Cost ($/KW-HR):	$0.30	
Avg Pumping Rate (GPM):	1,000	
Estimated Pumping Head (FT):	120	Estimated based on 1,000 GPM in 12" plus static lift and minor losses
Pump HP:	43.3	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	70.28	22,899,248	382	12,325	$3,697.58
Nov	70.28	22,899,248	382	12,325	$3,697.58
Dec	0	0	0	0	$0.00
Jan	0	0	0	0	$0.00
Feb	0	0	0	0	$0.00
Mar	0	0	0	0	$0.00
Apr	0	0	0	0	$0.00
May	77.31	25,189,825	420	13,558	$4,067.45
Jun	70.28	22,899,248	382	12,325	$3,697.58
Jul	70.28	22,899,248	382	12,325	$3,697.58
Aug	70.28	22,899,248	382	12,325	$3,697.58
Sep	70.28	22,899,248	382	12,325	$3,697.58
					$26,252.95

IRRIGATION PUMPING

Irrigation Area (AC):	0	
Max Irrigationn Rate (In/Day):	0	(Based on 9.92 in./mo. irrigation rate for July)
Max Daily Application (Gal):	0	
Max 24-Hr Application Rate (GPM):	0	Minimum Pumping Rate
Avg Pumping Rate (GPM):	0	Estimated total irrigation pumping rate
Estimated Pumping Head (FT):	0	Estimated based on 75 PSI at sprinkler plus friction/minor losses
Pump HP:	0.0	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	0	0	0	0	$0.00
Nov	0	0	0	0	$0.00
Dec	0	0	0	0	$0.00
Jan	0	0	0	0	$0.00
Feb	0	0	0	0	$0.00
Mar	0	0	0	0	$0.00
Apr	0	0	0	0	$0.00
May	0	0	0	0	$0.00
Jun	0	0	0	0	$0.00
Jul	0	0	0	0	$0.00
Aug	0	0	0	0	$0.00
Sep	0	0	0	0	$0.00
					$0.00

TOTAL POWER CONSUMPTION:	**$26,252.95**
Discount Rate (%):	3.0%
Period (years):	20
20-YEAR PRESENT WORTH:	**$390,578**

File:	Reservoir Earthwork
Date:	1/29/2022
By:	PJR
Job No:	199.109

OPTION 2 - EEFLUENT STORAGE/SEASONAL DISCHARGE TO COTTONWOOD CREEK
EARTH RESERVOIR SIZING AND EARTHWORK ESTIMATE

DESIGN: Shasta County CSA 17 - 2022 Amendment to 2013 SMP

INPUT VARIABLES:

Storage volume, (ac-ft)	300
Water depth, WD, (ft)	10
Depth of freeboard, (ft)	2
Ratio of length to wide,	2
Inside side slope,	2
Outside side slope,	2
Top dike width, (ft)	12
Fill swrinkage factor,	1.15

STORAGE VOLUME (cu.ft.)	AVERAGE WS AREA (sq. ft.)	AVERAGE WS WIDTH (ft)	AVERAGE WS LENGTH (ft)	BOTTOM WIDTH (ft)	BOTTOM LENGTH (ft)	BOTTOM AREA (sq. ft.)	MAX. WS AREA (ac)	RUNOFF AREA (ac)	DIKE WIDTH @CL (ft.)	DIKE LENGTH @CL (ft.)	DIKE PERIMETER (ft)
13,068,000	1,306,800	808	1617	788	1597	1,258,700	31.12	31.58	848	1657	5010
	30.0 AC										

INPUT DIKE FILL DEPTH (ft)	DIKE FILL VOLUME (cy./ft)	TOTAL DIKE FILL (cu.yd.)	DEPTH OF CUT (ft)	BOTTOM EXC (cu. yd.)
3.00	2.30	13,251	9.00	433,985
3.50	2.83	16,319	8.50	409,113
4.00	3.41	19,632	8.00	384,331
4.50	4.03	23,190	7.50	359,639
5.00	4.69	26,994	7.00	335,037
5.50	5.39	31,043	6.50	310,525
6.00	6.13	35,337	6.00	286,103
6.50	6.92	39,877	5.50	261,771
7.00	7.75	44,662	5.00	237,528
7.50	8.63	49,693	4.50	213,374
8.00	9.54	54,969	4.00	189,310
8.50	10.50	60,490	3.50	165,335
9.00	11.50	66,257	3.00	141,450
9.50	12.54	72,269	2.50	117,653
10.00	13.63	78,527	2.00	93,945
10.50	14.76	85,030	1.50	70,326
11.00	15.93	91,778	1.00	46,795
11.50	17.14	98,772	0.50	23,353
12.00	18.40	106,011	0.00	0

2022 AMENDMENT TO 2013 SMP
OPTION 3 - ULTIMATE BUILDOUT-EFFLUENT STORAGE & IRRIGATION FOR FLOWS BEYOND 0.43 MGD (ADWF)
100-YEAR RAINFALL HYDRAULIC LOADING AND STORAGE REQUIREMENTS

Month Ending	100 Year Rainfall[1] (Inches/Month)	Potential ET Rate[2] (Inches/Month)	Evaporation[3] (Inches/Month)	Irrigation Rate[4] (Inches/Month)	Sewage[5] (Ac-Ft/Month)	Rainfall on Pond (Ac-Ft/Month)	Pond Evaporation (Ac-Ft/Month)	Landscape Irrigation (Ac-Ft/Month)	Pond Percolation (Ac-Ft/Month)	Reclaimed Water to Cottonwood Creek (Ac-Ft/Month)	Potential Change in Storage (Ac-Ft/Month)	Estimated Total in Active Storage (Ac-Ft)
OCT	2.78	3.50	3.36	0.94	30.17	4.81	5.46	5.48	19.76	0.00	4.29	4.29
NOV	7.14	0.00	1.36	0.00	30.17	12.37	2.22	0.00	17.29	0.00	23.04	27.32
DEC	7.96	0.00	0.94	0.00	33.19	13.81	1.53	0.00	14.82	0.00	30.64	57.96
JAN	8.77	0.00	0.94	0.00	33.19	15.20	1.53	0.00	4.94	0.00	41.91	99.88
FEB	6.47	0.00	1.36	0.00	33.19	11.22	2.22	0.00	2.47	0.00	39.72	139.60
MAR	6.46	0.00	2.83	0.00	33.19	11.20	4.60	0.00	4.94	0.00	34.85	174.45
APR	3.56	4.50	4.09	1.23	33.19	6.17	6.65	7.15	7.41	0.00	18.15	192.60
MAY	2.31	6.20	6.09	5.06	33.19	4.00	9.89	29.52	9.88	0.00	-12.10	180.49
JUN	0.90	7.60	7.34	8.72	30.17	1.55	11.94	50.85	19.76	0.00	-50.82	129.67
JUL	0.37	8.00	8.18	9.92	30.17	0.64	13.30	57.88	19.76	0.00	-60.13	69.54
AUG	0.72	6.70	7.13	7.77	30.17	1.25	11.59	45.33	19.76	0.00	-45.26	24.28
SEP	1.70	5.40	5.35	4.81	30.17	2.94	8.70	28.07	19.76	0.00	-23.41	0.87
TOTAL	49.13	41.90	49.00	38.45	380.16	85.16	79.63	224.27	160.55	0.00	0.87	
CONSTANTS						61.59	26.43		44.46	9.30		

Storage pond runoff area (acres):	A	20.8	From Reservoir Earthwork Spreadsheet
Average storage pond water surface (acres):	B	19.5	From Reservoir Earthwork Spreadsheet
Estimated landscape irrigation area (acres):	C	70.0	Input
Storage pond percolation rate @ 5 ft water level (in/day):	D	0.5	1.5E-05 cm/s
Design ADWF (mgd):	E	0.43	

NOTES:
1. 100-year rainfall based on Coleman Fish Hatchery Precipitation Depth-Duration-Frequency Table from DWR Bulletin 195.
2. Potential ET based on 21 years of data for irrigated pasture in Gerber, California.
3. Evaporation estimated using Chico, CA pan evaporation x 0.70 pan coefficient.
4. All effluent is applied directly during April-October. Application rate = (ET - Precipitation) * 1.30 Inefficiancy
5. Sewage flows for Option 3 are the Ultimate flows in excess of the 0.43 MGD (ADWF) design capacity. Winter flows are 1.1 times summer flows to account for Inflow & Infiltration.

Month Ending	Existing WW Flow (AC-FT/Mo)	Projected WW Flows for 0.43 MGD (AC-FT/Mo)	Ultimate WW Flow (AC-FT/Mo)	Delta Ultimate to Projected 0.43 MGD (AC-FT/Mo)
OCT	30.42	40.11	70.28	30.17
NOV	26.22	40.11	70.28	30.17
DEC	30.79	44.12	77.31	33.19
JAN	40.21	44.12	77.31	33.19
FEB	38.44	44.12	77.31	33.19
MAR	38.81	44.12	77.31	33.19
APR	36.48	44.12	77.31	33.19
MAY	40.31	44.12	77.31	33.19
JUN	36.39	40.11	70.28	30.17
JUL	34.15	40.11	70.28	30.17
AUG	33.96	40.11	70.28	30.17
SEP	32.56	40.11	70.28	30.17
TOTAL	418.74	505.38	885.54	380.16

SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 3 - EFFLUENT STORAGE IRRIGATION FOR FLOWS > 0.43 MGD (ADWF)
OPERATION AND MAINTENANCE COST ESTIMATE

EFFLUENT PUMPING

Power Cost ($/KW-HR):	$0.30	
Avg Pumping Rate (GPM):	700	
Estimated Pumping Head (FT):	120	Estimated based on 700 GPM in 8" plus static lift and minor losses
Pump HP:	30.3	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	30.17	9,830,255	234	5,291	$1,587.31
Nov	30.17	9,830,255	234	5,291	$1,587.31
Dec	33.19	10,814,258	257	5,821	$1,746.20
Jan	33.19	10,814,258	257	5,821	$1,746.20
Feb	33.19	10,814,258	257	5,821	$1,746.20
Mar	33.19	10,814,258	257	5,821	$1,746.20
Apr	33.19	10,814,258	257	5,821	$1,746.20
May	33.19	10,814,258	257	5,821	$1,746.20
Jun	30.17	9,830,255	234	5,291	$1,587.31
Jul	30.17	9,830,255	234	5,291	$1,587.31
Aug	30.17	9,830,255	234	5,291	$1,587.31
Sep	30.17	9,830,255	234	5,291	$1,587.31
					$20,001.05

IRRIGATION PUMPING

Irrigation Area (AC):	70	
Max Irrigationn Rate (In/Day):	0.32	(Based on 9.92 in./mo. irrigation rate for July)
Max Daily Application (Gal):	608,214	
Max 24-Hr Application Rate (GPM):	422	Minimum Pumping Rate
Avg Pumping Rate (GPM):	1,000	Estimated total irrigation pumping rate
Estimated Pumping Head (FT):	200	Estimated based on 75 PSI at sprinkler plus friction/minor losses
Pump HP:	72.2	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	5.48	1,785,542	30	1,602	$480.52
Nov	0	0	0	0	$0.00
Dec	0	0	0	0	$0.00
Jan	0	0	0	0	$0.00
Feb	0	0	0	0	$0.00
Mar	0	0	0	0	$0.00
Apr	7.15	2,329,676	39	2,090	$626.96
May	29.52	9,618,466	160	8,628	$2,588.52
Jun	50.85	16,568,394	276	14,863	$4,458.88
Jul	57.88	18,858,971	314	16,918	$5,075.32
Aug	45.33	14,769,820	246	13,250	$3,974.85
Sep	28.07	9,146,014	152	8,205	$2,461.37
					$19,666.43

TOTAL POWER CONSUMPTION:	**$39,667.48**
Discount Rate (%):	3.0%
Period (years):	20
20-YEAR PRESENT WORTH:	**$590,152**

File:	Reservoir Earthwork
Date:	1/29/2022
By:	PJR
Job No:	199.109

OPTION 3 - EFFLUENT STORAGE & IRRIGATION FOR FLOWS > 0.43 MGD (ADWF)
EARTH RESERVOIR SIZING AND EARTHWORK ESTIMATE

DESIGN: Shasta County CSA 17 - 2022 Amendment to 2013 SMP

INPUT VARIABLES:

Storage volume, (ac-ft)	195
Water depth, WD, (ft)	10
Depth of freeboard, (ft)	2
Ratio of length to wide,	2
Inside side slope,	2
Outside side slope,	2
Top dike width, (ft)	12
Fill swrinkage factor,	1.15

STORAGE VOLUME (cu.ft.)	AVERAGE WS AREA (sq. ft.)	AVERAGE WS WIDTH (ft)	AVERAGE WS LENGTH (ft)	BOTTOM WIDTH (ft)	BOTTOM LENGTH (ft)	BOTTOM AREA (sq. ft.)	MAX. WS AREA (ac)	RUNOFF AREA (ac)	DIKE WIDTH @CL (ft.)	DIKE LENGTH @CL (ft.)	DIKE PERIMETER (ft)
8,494,200	849,420	652	1303	632	1283	810,718	20.41	20.77	692	1343	4070
	19.5 AC										

INPUT DIKE FILL DEPTH (ft)	DIKE FILL VOLUME (cy./ft)	TOTAL DIKE FILL (cu.yd.)	DEPTH OF CUT (ft)	BOTTOM EXC (cu. yd.)
3.00	2.30	10,766	9.00	281,838
3.50	2.83	13,258	8.50	265,566
4.00	3.41	15,949	8.00	249,368
4.50	4.03	18,840	7.50	233,242
5.00	4.69	21,930	7.00	217,188
5.50	5.39	25,220	6.50	201,207
6.00	6.13	28,708	6.00	185,299
6.50	6.92	32,397	5.50	169,462
7.00	7.75	36,284	5.00	153,698
7.50	8.63	40,371	4.50	138,006
8.00	9.54	44,657	4.00	122,386
8.50	10.50	49,143	3.50	106,837
9.00	11.50	53,828	3.00	91,361
9.50	12.54	58,713	2.50	75,955
10.00	13.63	63,796	2.00	60,622
10.50	14.76	69,080	1.50	45,360
11.00	15.93	74,562	1.00	30,169
11.50	17.14	80,244	0.50	15,049
12.00	18.40	86,125	0.00	0

Date: 2/5/2022
By: PJR
Job. No. 199.109

2022 AMENDMENT TO 2013 SMP
OPTION 4 - ULTIMATE BUILDOUT-EFFLUENT STORAGE & IRRIGATION FOR ENTIRE ULTIMATE FLOW
100-YEAR RAINFALL HYDRAULIC LOADING AND STORAGE REQUIREMENTS

Month Ending	100 Year Rainfall[1] (Inches/Month)	Potential ET Rate[2] (Inches/Month)	Evaporation[3] (Inches/Month)	Irrigation Rate[4] (Inches/Month)	Sewage[5] (Ac-Ft/Month)	Rainfall on Pond (Ac-Ft/Month)	Pond Evaporation (Ac-Ft/Month)	Landscape Irrigation (Ac-Ft/Month)	Pond Percolation (Ac-Ft/Month)	Reclaimed Water to Cottonwood Creek (Ac-Ft/Month)	Potential Change in Storage (Ac-Ft/Month)	Estimated Total in Active Storage (Ac-Ft)
OCT	2.78	3.50	3.36	0.94	70.28	10.85	12.59	12.92	45.60	0.00	10.02	10.02
NOV	7.14	0.00	1.36	0.00	70.28	27.90	5.12	0.00	39.90	0.00	53.16	63.19
DEC	7.96	0.00	0.94	0.00	77.31	31.13	3.54	0.00	34.20	0.00	70.70	133.88
JAN	8.77	0.00	0.94	0.00	77.31	34.27	3.54	0.00	11.40	0.00	96.64	230.52
FEB	6.47	0.00	1.36	0.00	77.31	25.30	5.12	0.00	5.70	0.00	91.79	322.31
MAR	6.46	0.00	2.83	0.00	77.31	25.25	10.62	0.00	11.40	0.00	80.54	402.85
APR	3.56	4.50	4.09	1.23	77.31	13.90	15.35	16.84	17.10	0.00	41.92	444.78
MAY	2.31	6.20	6.09	5.06	77.31	9.02	22.82	69.59	22.80	0.00	-28.89	415.89
JUN	0.90	7.60	7.34	8.72	70.28	3.50	27.54	119.85	45.60	0.00	-119.21	296.68
JUL	0.37	8.00	8.18	9.92	70.28	1.44	30.69	136.44	45.60	0.00	-141.01	155.66
AUG	0.72	6.70	7.13	7.77	70.28	2.83	26.76	106.84	45.60	0.00	-106.09	49.58
SEP	1.70	5.40	5.35	4.81	70.28	6.64	20.07	66.16	45.60	0.00	-54.91	-5.34
TOTAL	49.13	41.90	49.00	38.45	885.54	192.02	183.75	528.64	370.50	0.00	-5.34	
CONSTANTS						138.87	60.99		102.60	24.72		

Storage pond runoff area (acres):	A	46.9	From Reservoir Earthwork Spreadsheet
Average storage pond water surface (acres):	B	45.0	From Reservoir Earthwork Spreadsheet
Estimated landscape irrigation area (acres):	C	165.0	Input
Storage pond percolation rate @ 5 ft water level (in/day):	D	0.5	1.5E-05 cm/s
Design ADWF (mgd):	E	0.43	

NOTES:
1. 100-year rainfall based on Coleman Fish Hatchery Precipitation Depth-Duration-Frequency Table from DWR Bulletin 195.
2. Potential ET based on 21 years of data for irrigated pasture in Gerber, California.
3. Evaporation estimated using Chico, CA pan evaporation x 0.70 pan coefficient.
4. All effluent is applied directly during April-October. Application rate = (ET - Precipitation) * 1.30 Inefficiency
5. Sewage flows for Option 4 are the Ultimate flows with no discharge to Cottonwood Creek. Winter flows are 1.1 times summer flows to account for Inflow & Infiltration.

Month Ending	Existing WW Flow (AC-FT/Mo)	Projected WW Flows for 0.43 MGD (AC-FT/Mo)	Ultimate WW Flow (AC-FT/Mo)	Delta Ultimate to Projected 0.43 MGD (AC-FT/Mo)
OCT	30.42	40.11	70.28	30.17
NOV	26.22	40.11	70.28	30.17
DEC	30.79	44.12	77.31	33.19
JAN	40.21	44.12	77.31	33.19
FEB	38.44	44.12	77.31	33.19
MAR	38.81	44.12	77.31	33.19
APR	36.48	44.12	77.31	33.19
MAY	40.31	44.12	77.31	33.19
JUN	36.39	40.11	70.28	30.17
JUL	34.15	40.11	70.28	30.17
AUG	33.96	40.11	70.28	30.17
SEP	32.56	40.11	70.28	30.17
TOTAL	418.74	505.38	885.54	380.16

SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 4 - EFFLUENT STORAGE IRRIGATION FOR FLOWS > 0.43 MGD (ADWF)
OPERATION AND MAINTENANCE COST ESTIMATE

EFFLUENT PUMPING

Power Cost ($/KW-HR):	$0.30	
Avg Pumping Rate (GPM):	1,000	
Estimated Pumping Head (FT):	80	Estimated based on 1,000 GPM in 12" plus static lift and minor losses
Pump HP:	28.9	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	70.28	22,899,248	382	8,217	$2,465.06
Nov	70.28	22,899,248	382	8,217	$2,465.06
Dec	77.31	25,189,825	420	9,039	$2,711.63
Jan	77.31	25,189,825	420	9,039	$2,711.63
Feb	77.31	25,189,825	420	9,039	$2,711.63
Mar	77.31	25,189,825	420	9,039	$2,711.63
Apr	77.31	25,189,825	420	9,039	$2,711.63
May	77.31	25,189,825	420	9,039	$2,711.63
Jun	70.28	22,899,248	382	8,217	$2,465.06
Jul	70.28	22,899,248	382	8,217	$2,465.06
Aug	70.28	22,899,248	382	8,217	$2,465.06
Sep	70.28	22,899,248	382	8,217	$2,465.06
					$31,060.13

IRRIGATION PUMPING

Irrigation Area (AC):	165	
Max Irrigationn Rate (In/Day):	0.32	(Based on 9.92 in./mo. irrigation rate for July)
Max Daily Application (Gal):	1,433,647	
Max 24-Hr Application Rate (GPM):	996	Minimum Pumping Rate
Avg Pumping Rate (GPM):	1,200	Estimated total irrigation pumping rate
Estimated Pumping Head (FT):	200	Estimated based on 75 PSI at sprinkler plus friction/minor losses
Pump HP:	86.6	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	12.92	4,209,708	58	3,776	$1,132.92
Nov	0	0	0	0	$0.00
Dec	0	0	0	0	$0.00
Jan	0	0	0	0	$0.00
Feb	0	0	0	0	$0.00
Mar	0	0	0	0	$0.00
Apr	16.84	5,486,957	76	4,922	$1,476.65
May	69.59	22,674,426	315	20,340	$6,102.14
Jun	119.85	39,050,582	542	35,031	$10,509.28
Jul	136.44	44,456,081	617	39,880	$11,964.01
Aug	106.84	34,811,549	483	31,228	$9,368.48
Sep	66.16	21,556,833	299	19,338	$5,801.37
					$46,354.84

TOTAL POWER CONSUMPTION:	**$77,414.97**
Discount Rate (%):	3.0%
Period (years):	20
20-YEAR PRESENT WORTH:	**$1,151,739**

File:	Reservoir Earthwork
Date:	2/5/2022
By:	PJR
Job No:	199.109

OPTION 4 - EFFLUENT STORAGE & IRRIGATION, NO DISCHARGE

EARTH RESERVOIR SIZING AND EARTHWORK ESTIMATE

DESIGN: Shasta County CSA 17 - 2022 Amendment to 2013 SMP

INPUT VARIABLES:

Storage volume, (ac-ft)	450
Water depth, WD, (ft)	10
Depth of freeboard, (ft)	2
Ratio of length to wide,	2
Inside side slope,	2
Outside side slope,	2
Top dike width, (ft)	12
Fill swrinkage factor,	1.15

STORAGE VOLUME (cu.ft.)	AVERAGE WS AREA (sq. ft.)	AVERAGE WS WIDTH (ft)	AVERAGE WS LENGTH (ft)	BOTTOM WIDTH (ft)	BOTTOM LENGTH (ft)	BOTTOM AREA (sq. ft.)	MAX. WS AREA (ac)	RUNOFF AREA (ac)	DIKE WIDTH @CL (ft.)	DIKE LENGTH @CL (ft.)	DIKE PERIMETER (ft)
19,602,000	1,960,200	990	1980	970	1960	1,901,200	46.37	46.93	1030	2020	6100
	45.0 AC										

INPUT DIKE FILL DEPTH (ft)	DIKE FILL VOLUME (cy./ft)	TOTAL DIKE FILL (cu.yd.)	DEPTH OF CUT (ft)	BOTTOM EXC (cu. yd.)
3.00	2.30	16,135	9.00	651,421
3.50	2.83	19,869	8.50	614,298
4.00	3.41	23,903	8.00	577,285
4.50	4.03	28,235	7.50	540,382
5.00	4.69	32,867	7.00	503,589
5.50	5.39	37,797	6.50	466,907
6.00	6.13	43,025	6.00	430,334
6.50	6.92	48,553	5.50	393,872
7.00	7.75	54,379	5.00	357,519
7.50	8.63	60,504	4.50	321,275
8.00	9.54	66,928	4.00	285,141
8.50	10.50	73,651	3.50	249,117
9.00	11.50	80,673	3.00	213,202
9.50	12.54	87,993	2.50	177,396
10.00	13.63	95,612	2.00	141,699
10.50	14.76	103,530	1.50	106,111
11.00	15.93	111,746	1.00	70,632
11.50	17.14	120,262	0.50	35,262
12.00	18.40	129,076	0.00	0

Date: 2/8/2022
By: PJR
Job. No. 199.109

2022 AMENDMENT TO 2013 SMP
OPTION 5 - ULTIMATE BUILDOUT-CONSTRUCTED WETLANDS FOR FLOWS BEYOND 0.43 MGD (ADWF)
100-YEAR RAINFALL HYDRAULIC LOADING AND STORAGE REQUIREMENTS

Month Ending	100 Year Rainfall[1] (Inches/Month)	Potential ET Rate[2] (Inches/Month)	Evaporation[3] (Inches/Month)	Irrigation Rate[4] (Inches/Month)	Sewage[5] (Ac-Ft/Month)	Rainfall on Pond (Ac-Ft/Month)	Pond Evaporation (Ac-Ft/Month)	Landscape Irrigation (Ac-Ft/Month)	Pond Percolation (Ac-Ft/Month)	Reclaimed Water to Cottonwood Creek (Ac-Ft/Month)	Potential Change in Storage (Ac-Ft/Month)	Estimated Total in Active Storage (Ac-Ft)
OCT	2.78	3.50	3.36	0.94	30.17	5.40	6.16	0.00	14.27	0.00	15.15	15.15
NOV	7.14	0.00	1.36	0.00	30.17	13.89	2.50	0.00	12.48	0.00	29.07	44.23
DEC	7.96	0.00	0.94	0.00	33.19	15.50	1.73	0.00	10.70	0.00	36.26	80.48
JAN	8.77	0.00	0.94	0.00	33.19	17.06	1.73	0.00	3.57	0.00	44.95	125.43
FEB	6.47	0.00	1.36	0.00	33.19	12.59	2.50	0.00	1.78	0.00	41.50	166.93
MAR	6.46	0.00	2.83	0.00	33.19	12.57	5.19	0.00	3.57	0.00	37.00	203.94
APR	3.56	4.50	4.09	1.23	33.19	6.92	7.50	0.00	5.35	0.00	27.26	231.20
MAY	2.31	6.20	6.09	5.06	33.19	4.49	11.16	0.00	7.13	0.00	19.39	250.58
JUN	0.90	7.60	7.34	8.72	30.17	1.74	13.47	0.00	14.27	0.00	4.18	254.76
JUL	0.37	8.00	8.18	9.92	30.17	0.71	15.00	0.00	14.27	0.00	1.61	256.37
AUG	0.72	6.70	7.13	7.77	30.17	1.41	13.08	0.00	14.27	0.00	4.23	260.60
SEP	1.70	5.40	5.35	4.81	30.17	3.30	9.81	0.00	14.27	0.00	9.40	270.00
TOTAL	49.13	41.90	49.00	38.45	380.16	95.60	89.83	0.00	115.93	0.00	270.00	

CONSTANTS	69.14	29.82		32.10	-7.22
Storage pond runoff area (acres):	A	23.4	From Reservoir Earthwork Spreadsheet		
Average storage pond water surface (acres):	B	22.0	From Reservoir Earthwork Spreadsheet		
Estimated landscape irrigation area (acres):	C	0.0	Input		
Storage pond percolation rate @ 5 ft water level (in/day):	D	0.32		9.4E-06 cm/s	
Design ADWF (mgd):	E	0.43			

NOTES:
1. 100-year rainfall based on Coleman Fish Hatchery Precipitation Depth-Duration-Frequency Table from DWR Bulletin 195.
2. Potential ET based on 21 years of data for irrigated pasture in Gerber, California.
3. Evaporation estimated using Chico, CA pan evaporation x 0.70 pan coefficient.
4. All effluent is applied directly during April-October. Application rate = (ET - Precipitation) * 1.30 Inefficiency
5. Sewage flows for Option 5 are the Ultimate flows in excess of the 0.43 MGD (ADWF) design capacity. Winter flows are 1.1 times summer flows to account for Inflow & Infiltration.

Month Ending	Existing WW Flow (AC-FT/Mo)	Projected WW Flows for 0.43 MGD (AC-FT/Mo)	Ultimate WW Flow (AC-FT/Mo)	Delta Ultimate to Projected 0.43 MGD (AC-FT/Mo)
OCT	30.42	40.11	70.28	30.17
NOV	26.22	40.11	70.28	30.17
DEC	30.79	44.12	77.31	33.19
JAN	40.21	44.12	77.31	33.19
FEB	38.44	44.12	77.31	33.19
MAR	38.81	44.12	77.31	33.19
APR	36.48	44.12	77.31	33.19
MAY	40.31	44.12	77.31	33.19
JUN	36.39	40.11	70.28	30.17
JUL	34.15	40.11	70.28	30.17
AUG	33.96	40.11	70.28	30.17
SEP	32.56	40.11	70.28	30.17
TOTAL	418.74	505.38	885.54	380.16

SHASTA COUNTY CSA NO. 17 COTTONWOOD
2022 AMENDMENT TO 2013 SMP
OPTION 5 - CONSTRUCTED WETLANDS FOR FLOWS > 0.43 MGD (ADWF)
OPERATION AND MAINTENANCE COST ESTIMATE

EFFLUENT PUMPING

Power Cost ($/KW-HR):	$0.30	
Avg Pumping Rate (GPM):	700	
Estimated Pumping Head (FT):	120	Estimated based on 700 GPM in 8" plus static lift and minor losses
Pump HP:	30.3	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	30.17	9,830,255	234	5,291	$1,587.31
Nov	30.17	9,830,255	234	5,291	$1,587.31
Dec	33.19	10,814,258	257	5,821	$1,746.20
Jan	33.19	10,814,258	257	5,821	$1,746.20
Feb	33.19	10,814,258	257	5,821	$1,746.20
Mar	33.19	10,814,258	257	5,821	$1,746.20
Apr	33.19	10,814,258	257	5,821	$1,746.20
May	33.19	10,814,258	257	5,821	$1,746.20
Jun	30.17	9,830,255	234	5,291	$1,587.31
Jul	30.17	9,830,255	234	5,291	$1,587.31
Aug	30.17	9,830,255	234	5,291	$1,587.31
Sep	30.17	9,830,255	234	5,291	$1,587.31
					$20,001.05

IRRIGATION PUMPING

Irrigation Area (AC):	0	
Max Irrigationn Rate (In/Day):	0	(Based on 9.92 in./mo. irrigation rate for July)
Max Daily Application (Gal):	0	
Max 24-Hr Application Rate (GPM):	0	Minimum Pumping Rate
Avg Pumping Rate (GPM):	0	Estimated total irrigation pumping rate
Estimated Pumping Head (FT):	0	Estimated based on 75 PSI at sprinkler plus friction/minor losses
Pump HP:	0.0	

Month	Volume Pumped (AC-FT)	Volume Pumped (Gal)	Hours Pumped	Total KW-HRS	Monthly Power Cost
Oct	0	0	0	0	$0.00
Nov	0	0	0	0	$0.00
Dec	0	0	0	0	$0.00
Jan	0	0	0	0	$0.00
Feb	0	0	0	0	$0.00
Mar	0	0	0	0	$0.00
Apr	0	0	0	0	$0.00
May	0	0	0	0	$0.00
Jun	0	0	0	0	$0.00
Jul	0	0	0	0	$0.00
Aug	0	0	0	0	$0.00
Sep	0	0	0	0	$0.00
					$0.00

TOTAL POWER CONSUMPTION:	**$20,001.05**
Discount Rate (%):	3.0%
Period (years):	20
20-YEAR PRESENT WORTH:	**$297,565**

File:	Reservoir Earthwork
Date:	2/8/2022
By:	PJR
Job No:	199.109

OPTION 5 - CONSTRUCTED WETLANDS FOR FLOWS > 0.43 MGD (ADWF)
EARTH RESERVOIR SIZING AND EARTHWORK ESTIMATE

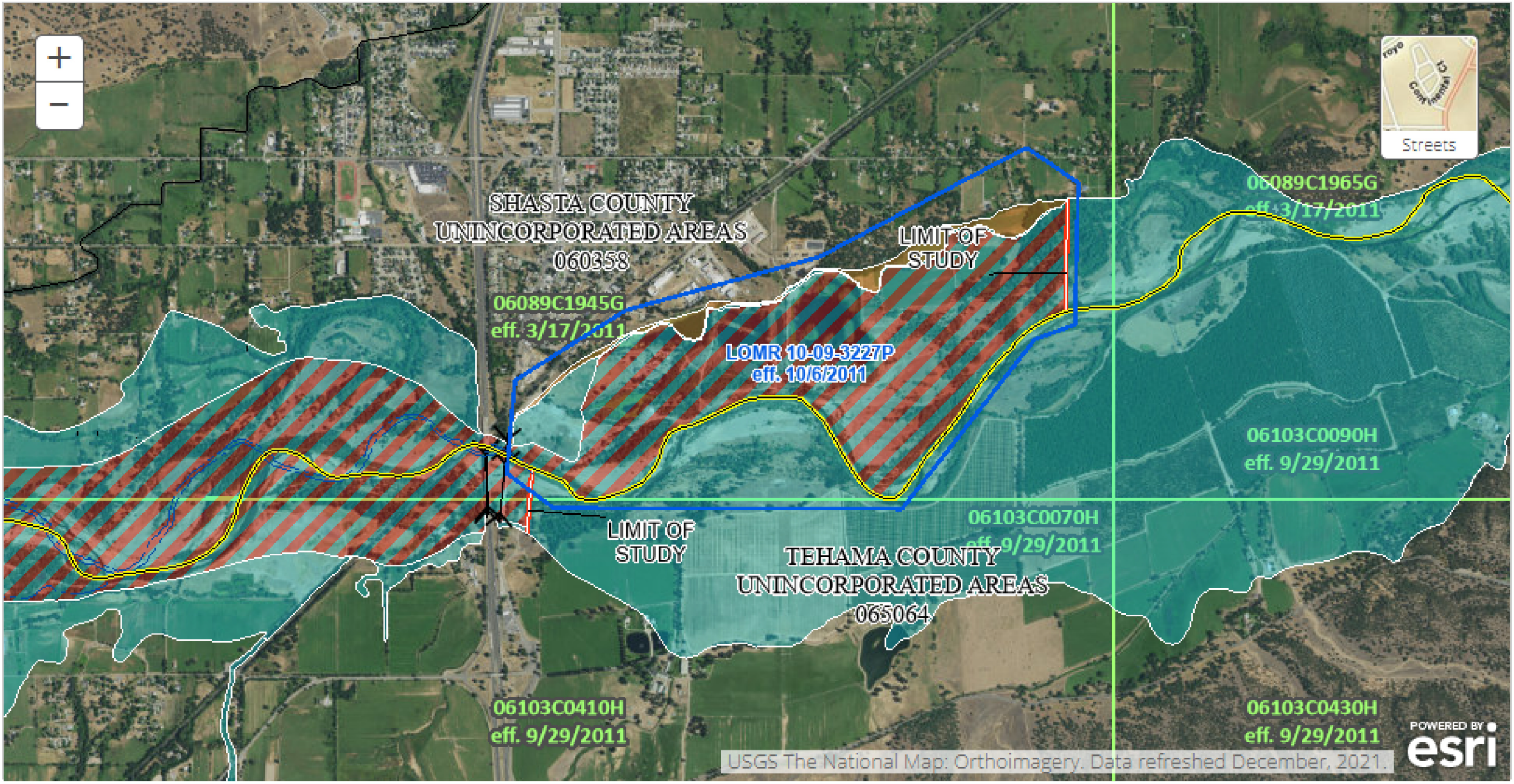
DESIGN: Shasta County CSA 17 - 2022 Amendment to 2013 SMP

INPUT VARIABLES:

Storage volume, (ac-ft)	220
Water depth, WD, (ft)	10
Depth of freeboard, (ft)	2
Ratio of length to wide,	2
Inside side slope,	2
Outside side slope,	2
Top dike width, (ft)	12
Fill swrinkage factor,	1.15

STORAGE VOLUME (cu.ft.)	AVERAGE WS AREA (sq. ft.)	AVERAGE WS WIDTH (ft)	AVERAGE WS LENGTH (ft)	BOTTOM WIDTH (ft)	BOTTOM LENGTH (ft)	BOTTOM AREA (sq. ft.)	MAX. WS AREA (ac)	RUNOFF AREA (ac)	DIKE WIDTH @CL (ft.)	DIKE LENGTH @CL (ft.)	DIKE PERIMETER (ft)
9,583,200	958,320	692	1384	672	1364	917,187	22.96	23.35	732	1424	4313
	22.0 AC										

INPUT DIKE FILL DEPTH (ft)	DIKE FILL VOLUME (cy./ft)	TOTAL DIKE FILL (cu.yd.)	DEPTH OF CUT (ft)	BOTTOM EXC (cu. yd.)
3.00	2.30	11,409	9.00	318,057
3.50	2.83	14,050	8.50	299,735
4.00	3.41	16,902	8.00	281,490
4.50	4.03	19,965	7.50	263,323
5.00	4.69	23,240	7.00	245,232
5.50	5.39	26,726	6.50	227,219
6.00	6.13	30,423	6.00	209,282
6.50	6.92	34,332	5.50	191,423
7.00	7.75	38,451	5.00	173,640
7.50	8.63	42,782	4.50	155,933
8.00	9.54	47,325	4.00	138,303
8.50	10.50	52,078	3.50	120,749
9.00	11.50	57,043	3.00	103,271
9.50	12.54	62,219	2.50	85,870
10.00	13.63	67,607	2.00	68,544
10.50	14.76	73,205	1.50	51,295
11.00	15.93	79,015	1.00	34,121
11.50	17.14	85,037	0.50	17,023
12.00	18.40	91,269	0.00	0



PIN
- Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
- Selected FloodMap Boundary
- Digital Data Available
- No Digital Data Available
- Unmapped

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*
- Otherwise Protected Area
- Coastal Barrier Resource System Area

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

FEMA FLOOD MAP

APPENDIX G

RATE ADOPTION ORDINANCE

See Ordinance 727
for fees

ORDINANCE NO. 705

AN ORDINANCE OF THE BOARD OF SUPERVISORS OF THE COUNTY OF SHASTA REPEALING ORDINANCE NO. 664 AND SETTING FORTH THE CHARGES AND RATES FOR SEWER RELATED SERVICES FOR COUNTY SERVICE AREA NO. 17–COTTONWOOD SEWER

The Board of Supervisors of the County of Shasta ordains as follows:

Section 1. Rate Schedules: The following rate schedules for sewer service shall be adopted for County Service Area (CSA) No. 17–Cottonwood Sewer.

Basic Bi-monthly Charge Effective August 1, 2015:

The basic bi-monthly charge per household equivalent shall be $77.52.

Basic Bi-monthly Charge Effective August 1, 2016:

The basic bi-monthly charge per household equivalent shall be $86.82.

Basic Bi-monthly Charge Effective August 1, 2017:

The basic bi-monthly charge per household equivalent shall be $96.37.

Basic Bi-monthly Charge Effective August 1, 2018:

The basic bi-monthly charge per household equivalent shall be $106.01.

Basic Bi-monthly Charge Effective August 1, 2019:

The basic bi-monthly charge per household equivalent shall be $111.32.

Bi-Monthly Standby Charge (Unchanged):

For Parcels with 1-5 unused assessment units:	$10.00
For Parcels with 6-10 unused assessment units:	$20.00
For Parcels with more than 10 unused assessment units:	$30.00

The applicable standby charge shall be paid by the owner of each parcel in the service area for which delivery of sewer service is readily available but has not been initiated, whether structures are present on the property or not. The Public Works Director may waive the monthly standby charge if the Public Works Director determines that service is not readily available to a particular parcel. This determination will include factors such as size of the property, the topography of the property, and the shape of the property.

Installation: Main line extension installations shall be at the sole expense of the person or entity applying. When main line extensions are required, extension of service shall be constructed at the sole expense of the person or entity applying for the extension, and shall meet or exceed minimum standards and requirements of the County. A deposit to cover the improvement plan check and construction inspection will be required. The minimum deposit shall be $500.00.

Capital Improvement Fee: For new land uses that will generate wastewater in excess of the household equivalents that were previously purchased for the affected property, the property owner shall pay a Capital Improvement Fee of $4,560.00 for each additional household equivalent based on the proposed zoning or use.

a.) Commencing January 1, 2016 and annually thereafter, the amount of the Fee shall be automatically adjusted by a percentage equal to the percentage change in the Engineering News Records' construction cost index from the index for January of the preceding year to index for the January of the adjustment year.

The Capital Improvement Fees shall be deposited into the CSA No. 17 Capital improvement fund for future expansion of the system.

Collection System Improvement Fee: For new land uses that will generate wastewater in excess of the household equivalents that were previously purchased for the affected property, the property owner shall pay a Collection System Improvement Fee in accordance with the following schedule for each additional household equivalent based on the proposed zoning or use.

West Area:	$2,025.00
Central Area:	$1,015.00
East Area:	$ 0.00

a.) Commencing January 1, 2016 and annually thereafter, the amount of the Fee shall be automatically adjusted by a percentage equal to the percentage change in the Engineering News Records' construction cost index from the index for January of the preceding year to index for the January of the adjustment year.

Area boundaries are as shown on the attached **Exhibit "A."**

The Collection System Improvement Fees shall be deposited into the CSA No. 17 Capital improvement fund for future improvements to the main collection system in the western and central portions of the CSA.

NOTE: For purposes of this Ordinance, one "Household Equivalent" will discharge an average wastewater flow of approximately 250 gallons per day into the sanitary sewer system.

Inspection Fees

A sewer inspection fee of $150.00 will be collected at building permit issuance where connection to the sewer system is a requirement of the building permit.

Section 2. For the purposes of this Ordinance, the term "bi-monthly" shall mean occurring once every two months.

Section 3. Effective August 1, 2015, this Ordinance supersedes any prior ordinance or resolution setting water and sewer rates, fees, and charges for County Service Area No. 17–Cottonwood Sewer.

Section 4. This Ordinance shall be in full force and effect from and after 30 days after its passage. The Clerk shall cause this Ordinance to be published as required by law.

DULY PASSED AND ADOPTED this 30th day of June, 2015 by the Board of Supervisors of the County of Shasta by the following vote:

AYES:	Supervisors Giacomini, Schappell, Baugh, Kehoe and Moty
NOES:	None
ABSENT:	None
ABSTAIN:	None
RECUSE:	None

LEONARD MOTY, CHAIRMAN
Board of Supervisors
County of Shasta
State of California

ATTEST:

LAWRENCE G. LEES
Clerk of the Board of Supervisors

By: ______________ Deputy

THIS INSTRUMENT IS A CORRECT COPY OF THE ORIGINAL ON FILE IN THIS OFFICE

ATTEST JUN 30 2015

CLERK OF THE BOARD
Supervisors of the County of Shasta, State of California
By: ______________

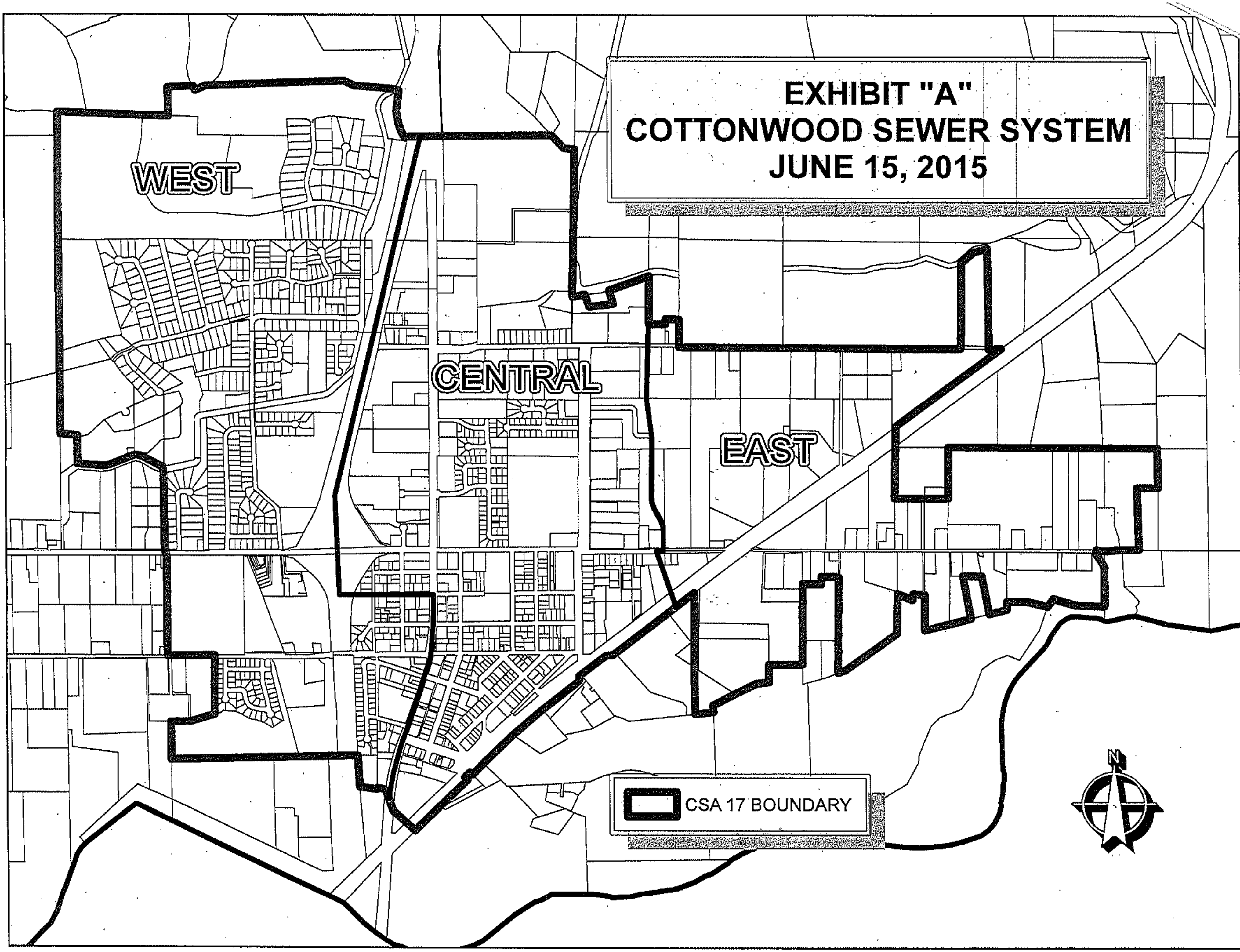


EXHIBIT "A"
COTTONWOOD SEWER SYSTEM
JUNE 15, 2015
WEST
CENTRAL
EAST
CSA 17 BOUNDARY
N