Wastewater Facilities Master Plan

2016 Update

Prepared for:
San Andreas Sanitary District

Prepared by:
Stantec Consulting Services Inc.

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Sign-off Sheet

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Prepared by _____
(signature)

Richard E. Stowell, Ph.D., PE

Reviewed by _____
(signature)

David Price, PE

Stantec

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 PURPOSE

This 2016 Update (Update) of the 2007 San Andreas Sanitary District (District) Wastewater Facilities Master Plan (Master Plan) has been developed to reflect changes in District facilities and Regional Water Board policies and regulations over the past nine years. This Update does not replace the Master Plan, but rather supplements it and modifies it, as needed, to reflect new information since 2007. This Update does not repeat the analyses presented in the Master Plan because those analyses are still believed to be valid, except as modified by this Update. In other words, this Update focuses on 1) major changes relevant to the District that have arisen since 2007, and 2) how those changes impact District planning.

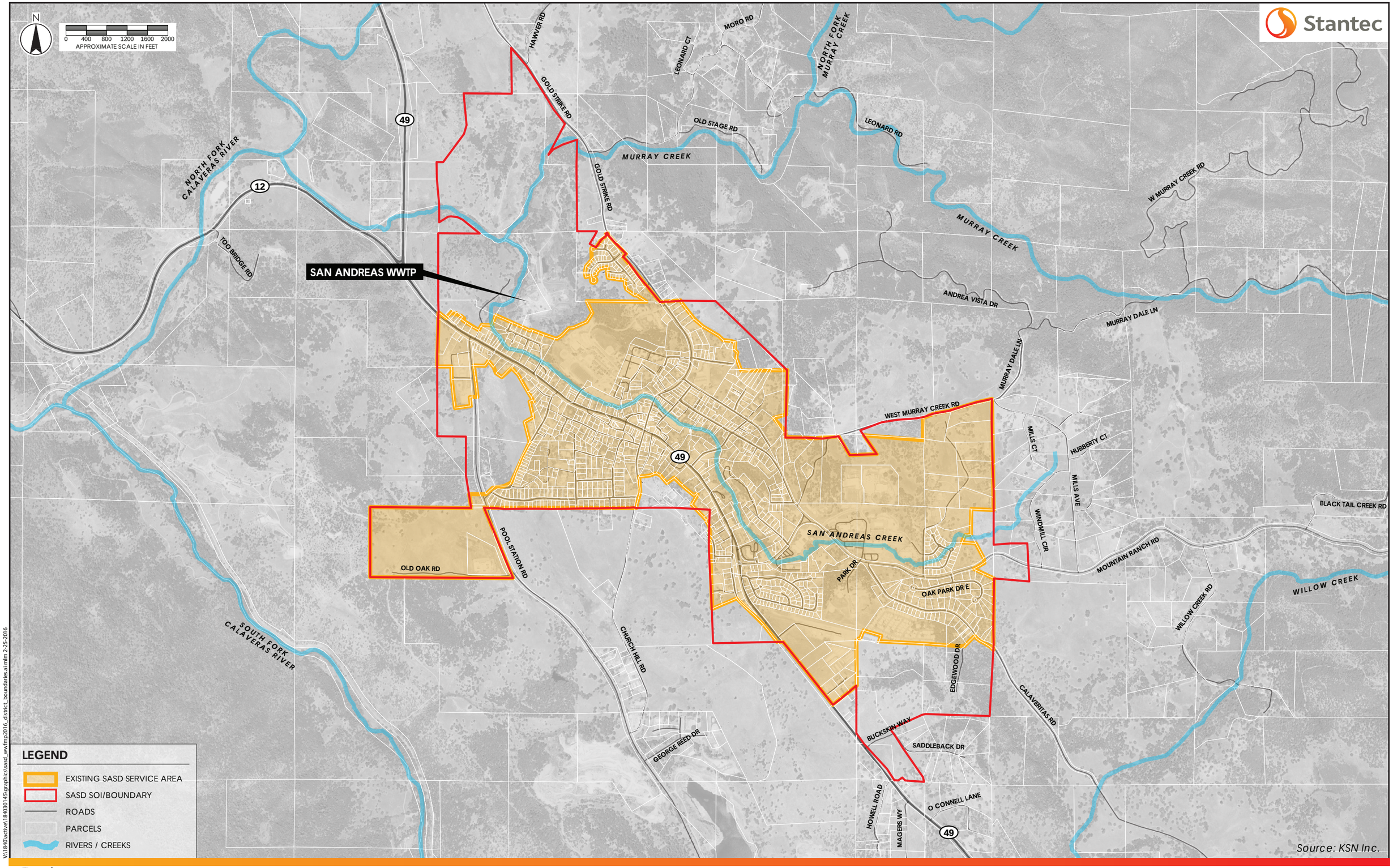
However, this Update does summarize, when needed, major concepts developed in the Master Plan to provide context and clarity to the issues discussed in this Update. These summaries are provided such that the reader does not need to refer back to the Master Plan in order to understand "big picture" issues. These summaries do not replace the Master Plan, which should be consulted for more detailed analyses of historical information presented in this Update.

2.0 OVERVIEW

The District provides wastewater (aka, sewage) collection, treatment, and disposal services to properties within District boundaries in the unincorporated community of San Andreas. The District boundary is shown in **Figure 2-1**. The District is not responsible for zoning or land use planning for its service area. Those responsibilities rest with the County of Calaveras (County) and are presented in the County's General Plan for the greater San Andreas community area. The District is responsible for 1) providing lawful sewer service for existing residences and businesses within the District's service area, 2) collecting fees from said residences and businesses to provide lawful sewer service (and thereby sustain the usability and value of said residences and businesses), and 3) having some form of plan in place that describes, roughly, how the District proposes to serve possible new developments within its service area as allowed by the General Plan, should any or all of that development occur. It is important to recognize that the proponents of development within the District's service area, not the District's existing constituency (i.e., the existing residences and businesses), are required to pay for facilities needed to serve proponents' developments. In other words, the possibility of growth in the service area, as planned by the County, does not create any material financial liability for the District or its constituency.

This Update recommends wastewater treatment and disposal facilities likely needed to lawfully serve the existing constituency, based on new, post-2007 information. It also identifies new facilities likely needed to serve possible growth in the District's service area per the County's current General Plan. Wastewater collection system improvements recommended to serve the existing constituency, and needed to serve new development allowed by the current General Plan are discussed in a separate document.

Because of new, post-2007 information discussed, herein, and the wide range of alternative means open to the District to address this new information, this Update has taken over a year to prepare. The original draft of this Update (c. February 2015) contained several alternative approaches to addressing the new information. The District Manager, District Engineer, and District Wastewater Treatment Plant (WWTP) Operations Team considered these alternatives, suggested improvements, and agreed on what appears to be the best apparent alternative. Consequently, this update does not present and discuss the range of alternatives presented in the original draft, because there is no point. The best apparent alternative has been identified and is being implemented by the District Manager and WWTP Operations Team to the extent of their ability, with available resources. Some aspects of the best apparent alternative need additional resources and/or assistance from outside professionals. These aspects of the best apparent alternative are the primary focus of this update.



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San Andreas Sanitary District
Wastewater Facilities Master Plan
2016 Update

Figure 2-1
San Andreas Sanitary District Boundary

2.1 DISTRICT PLANNING PHASES (FROM THE 2007 MASTER PLAN)

The Master Plan describes three phases of projects for the District that are still believed to be relevant:

- Phase A: Upgrade the existing Wastewater Treatment Plant (WWTP) to provide lawful sewer service to 1,920 EDUs (equivalent dwelling units), an estimate of the District's sewer service obligations in 2007. Phase A was largely completed in 2010, but aspects of the Phase A project were deferred for financial and/or regulatory reasons. The uncompleted aspects of Phase A along with additional improvements needed as a result of new regulations and other new information are discussed in this Update. The District should complete the remaining Phase A improvements in the foreseeable future.

  Based on post-2007 wastewater flow and strength data, District management believes the Phase A upgrade project may be able to serve reliably more than the 1,920 EDUs planned nine years ago. This may be the case, and District management is studying wastewater flow and strength data, estimates of current EDU vacancy rates, and related factors to determine if more EDUs can be connected to the Phase A WWTP without exceeding its design flow and load limitations. Serving more EDUs with the existing or modified Phase A WWTP would distribute the cost to build and operate these facilities over a greater service population. If more EDUs are possible, then this will reduce the need to increase sewer use fees for existing residents and businesses if/when these additional EDUs actually connect to the Phase A WWTP.

- Phase B: Build new WWTP facilities to serve an additional 800 new EDUs above and beyond whatever the service capacity of the Phase A WWTP is determined to be based on District management's on-going investigation. These 800 new EDUs were an estimate of the actual foreseeable growth potential within District boundaries based on various proposals and requests by area land developers circa 2007. Concepts for specific Phase B facilities were developed in the Master Plan, and were integrated into the overall plan and design of the Phase A improvements so that the Phase B improvements (when needed) could be added to the Phase A WWTP easily, seamlessly, and cost effectively. In these regards, Phase B is not a "stand alone" project, but rather is a fully integrated expansion of the Phase A WWTP.

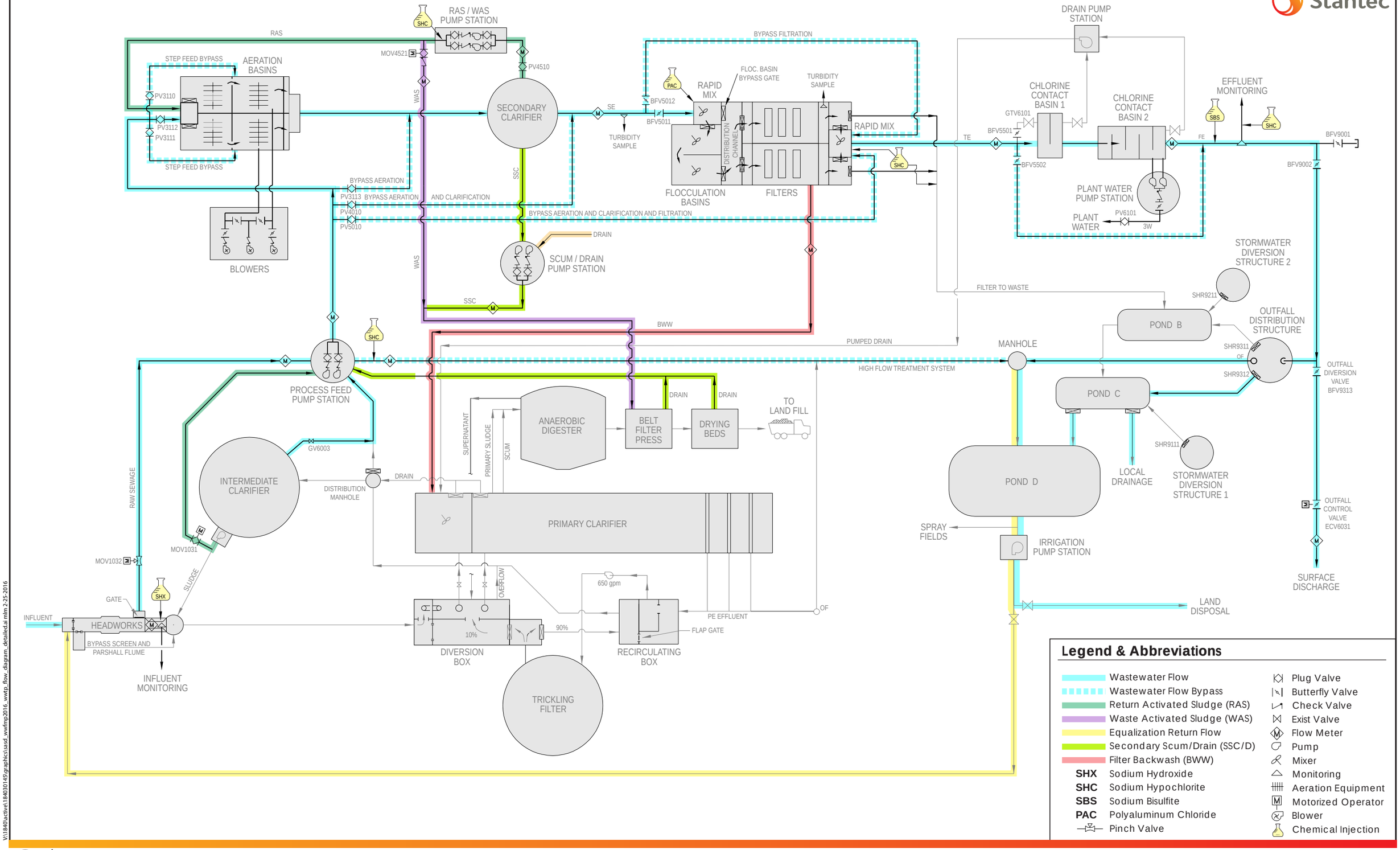
  This Update presents the Phase B plan and improvements in a somewhat modified form compared to the Master Plan to reflect 1) new information, and 2) a means to construct Phase B in two stages: Phase B1 and Phase B2. Staging construction of the Phase B improvements reduces the burden on developers trying to build in San Andreas.

  The District should complete the Phase B improvements in stages as funded by developers needing these improvements. As with the Phase A WWTP, the actual number of EDUs serviceable by the Phase B improvements will depend on the numbers and lifestyles of people occupying the Phase B EDUs. The 800 EDU estimate for Phase B is

believed to be an appropriately low number. The actual number of EDUs serviceable by the Phase B improvements can be estimated accurately only after the planned Phase B EDUs have been built and occupied for several years because all EDUs are not occupied by the same number of people with identical water use habits and lifestyles, which is why the planned number of EDUs serviceable by the Phase B improvements must be conservative in order to protect the District and its constituency.

- Phase C: Build new WWTP facilities to serve an additional 2,400 new EDUs (>5,000 EDUs, total), an estimate of area "build out" based on the County's General Plan and community development trends which existed in 2006. Phase C facilities are sufficiently far in the future based on current community growth rates that they are not discussed in this Update, which will likely be superseded by another master plan or update before any Phase C improvements are needed. Consequently, the District's existing Phase C plan (as presented in the Master Plan) is adequate, and no further Phase C analyses are needed or warranted at this time.

As noted above, most Phase A improvements were completed in 2010 and a schematic of the resulting Phase A treatment process train is shown in **Figure 2-2**. The layout of these Phase A treatment processes on the WWTP site is shown in **Figure 2-3**, along with 1) additional improvements needed by the existing constituency (based on new information and known project components that were not built in 2010), and 2) the proposed Phase B improvements. As shown, the Phase B improvements are integrated into the existing Phase A WWTP. The Phase B improvements are not a separate WWTP, but rather are an expansion "in-kind" of the existing Phase A WWTP.



Legend & Abbreviations

- Wastewater Flow
- Wastewater Flow Bypass
- Return Activated Sludge (RAS)
- Waste Activated Sludge (WAS)
- Equalization Return Flow
- Secondary Scum/Drain (SSC/D)
- Filter Backwash (BWW)

SHX Sodium Hydroxide
SHC Sodium Hypochlorite
SBS Sodium Bisulfite
PAC Polyaluminum Chloride

- Pinch Valve
- Plug Valve
- Butterfly Valve
- Check Valve
- Exist Valve
- Flow Meter
- Pump
- Mixer
- Monitoring
- Aeration Equipment
- Motorized Operator
- Blower
- Chemical Injection

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Figure 2-2
Existing (Phase A) WWTP Process Flow Schematic

SASD Wastewater Treatment Plant

Existing Facilities

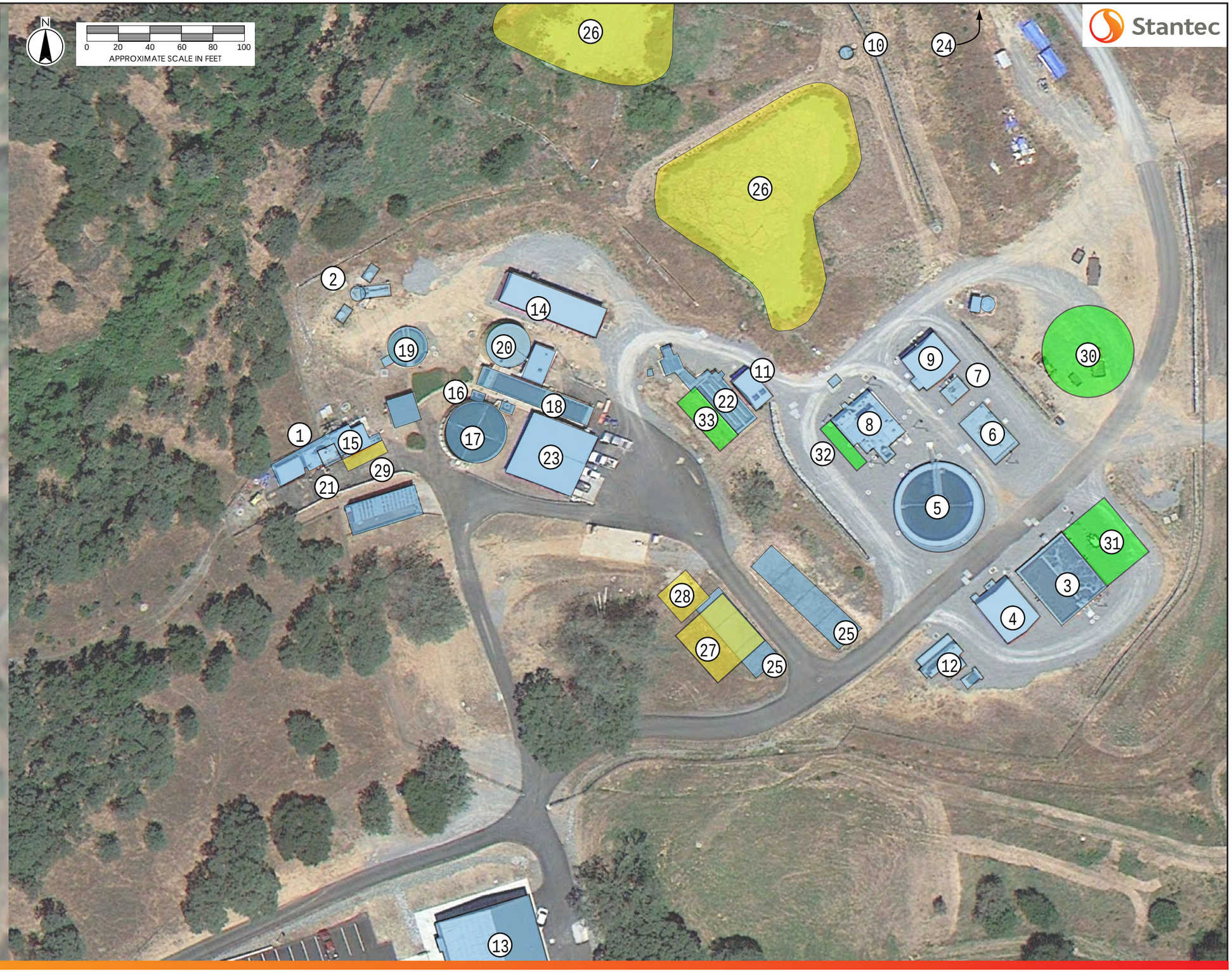
1. Influent Chemical Facilities
2. Process Feed Pump Station
3. Aeration Basins
4. Blower & MCC Building
5. Secondary Clarifier
6. RAS/WAS Pump Station
7. SCUM/Drain Pump Station
8. Flocculation and Filtration
9. Polymer Feed System and Storage
10. Effluent Control
11. Plant Water Pump Station (3W)
12. Electrical and Standby Generator
13. Office and SCADA System
14. Belt Filter Press
15. Headworks
16. Diversion Box
17. Trickling Filter
18. Primary Clarifier
19. Intermediate Clarifier
20. Digester
21. Influent Flow Meter
22. Chlorine Chamber
23. Maintenance Building
24. Irrigation Pump Station (not shown)
25. Sludge Drying Beds

Phase A - Not Constructed in 2010

26. Ponds
27. Aerobic Digester
28. Digester Blowers
29. Headworks

Phase B

30. Secondary Clarifier
31. Aeration Basin
32. Filtration
33. Chlorine Contact Basin



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San Andreas Sanitary District
Wastewater Facilities Master Plan
2016 Update

Figure 2-3
Plan View of Treatment Facilities to Serve Near-Term Growth (≤2,720 EDUs)

2.2 DISTRICT POLICIES AND PREROGATIVES

An important concept coming out of the public workshops held as part of the 2007 Master Plan development process was that existing District residents did not want to finance the Phase B project. Specifically, they did not want to pay to build and maintain the Phase B improvements in the hope that developers would buy that capacity at some point in the future, and thereby pay the existing residents back. If this desire is still relevant to District planning, then developments within the service area will be required to finance the planning, design, construction, and maintenance of WWTP improvements needed by those developments. If the District intends to increase the capacity of its WWTP in reasonable increments using facilities similar to the District's existing Phase A WWTP facilities in terms of performance, reliability, redundancy, etc., then the developers of properties within District boundaries (from 1 EDU to a subdivision of EDUs) will need to create a financing "pool" to implement the Phase B project (or possibly a stage of the Phase B project, as discussed herein). Forming such a pool takes time, and time and coordination with other developers in the pool are inconveniences to developers. Consequently, the District will come under pressure to let just a few more EDUs into the Phase A WWTP. This can be done, but this may erode the safety and reliability features included in the Phase A design, and may thereby put the District's existing constituency at increased risk of paying fines to the State for the WWTP failing to comply reliably with State requirements. As noted above, District management is investigating whether the Phase A WWTP can serve more than 1,920 EDUs reliably under reasonable worst-case conditions based on recent wastewater flow and load data, community occupancy estimates, and Phase A WWTP performance over the past five years. When this investigation is complete, the District Manager and District Engineer plan to bring the results of this investigation to the District's Board of Directors for determination of whether more EDUs should be allowed to connect to the Phase A WWTP, and if so, under what conditions. If more EDUs are to connect to the Phase A WWTP, then it needs to be determined at what connection fee and for what type(s) of community development. In 2007 the possibility of there being surplus EDUs was discussed and options voiced at that time ranged from "first come, first served" to reserving at least some surplus EDUs for single EDU projects, e.g., empty existing residential lots, lot splits, etc.

Another proposal that the District has heard as an alternative to the developers inconvenience caused by pooled financing of Phase B is to allow developers to install small factory-built wastewater treatment plants (aka, "package plants") at the WWTP to handle wastewater from their EDUs. This can be done, but the District may end up operating, maintaining, and monitoring its main Phase A WWTP, plus all of the package plants (potentially of different sizes, materials, parts, etc.) that may be installed at the WWTP by various developers over time. Because each package plant will have its own operations, effluent quality monitoring, maintenance, capital improvements/replacement program, etc., each developer's EDUs will have a different monthly service fee compared to the EDUs serviced by the Phase A WWTP. Though different billing rates based on street addresses are possible with computerized billing, it may cause conflict and misunderstanding within the District's constituency.

To control this potential source of rancor, it is recommended that the District require developers to pool their finances to create and maintain the Phase B improvements they need. This Update identifies a way to stage the Phase B improvements so as to reduce the inconvenience of pooled financing to developers to the extent feasible.

This being said, current District management is open to considering the concept of operating a single package plant on the WWTP if 1) this is the desire of the District's Board of Directors, 2) the construction, operation, maintenance, and monitoring of the package plant are funded by the requesting developer(s), 3) the package plant is District property, and 4) the package plant developer(s) still pay full rate into the Phase B financing pool. In other words, the package plant is an added cost to the developer(s) proposing it, with the benefit of the added cost being that the package plant developers can build and sell homes without waiting for the needed Phase B improvements to be complete. As an example, a developer of a 50 EDU subdivision could give the District a 50 EDU package plant to allow him to start building and selling immediately concurrently with waiting for the Phase B financing pool to form and complete the Phase B project. The developer also pays up front for his 50 EDUs of capacity in the Phase B project, and to operate, maintain, and monitor the package plant. When Phase B is built, the 50 EDUs connect to the Phase B WWTP, and the District may sell the package plant, or use it to ease the burden of future phases of pooled financing.

Another challenge that the District may face from developers is why the District's connection fee for new EDUs is based on those new EDUs producing more wastewater than existing EDUs. As documented in the Master Plan, new developments often produce more wastewater than the average of existing development. This is because new developments tend to attract families (more persons/EDU, at least initially) and/or more affluent people, both of which typically produce more wastewater than typical existing community residences on a per EDU basis. In larger cities, this potential impact of new EDUs on the WWTP is diluted out by the small ratio of new EDUs to existing EDUs. However, in smaller communities there is the potential for new development with its possibly higher wastewater flows and loads (at least in the initial years of occupancy) to have an adverse impact on WWTP performance and/or reliability unless this potential impact is mitigated in the design of facilities serving new development. To mitigate this risk, the Master Plan's Phase B improvements are based on flows and loads from new EDUs being greater than the typical values for existing EDUs, as discussed in the Master Plan. The District has no control over the number of people occupying an EDU or their water or wastewater habits. Consequently, the design of wastewater facilities must be conservative to cover reasonable worst-case conditions to protect public health and the environment when those conditions occur from time to time (e.g., the State requires WWTP hydraulic designs to handle estimates of 1 in 100 year conditions). As noted previously, this necessary conservatism in design often results in a WWTP having surplus EDUs after the new homes have been occupied for several years such that District management has factual data on the overall average wastewater characteristics coming from the people occupying these new homes, and the WWTPs ability to handle these flows considering climatic factors and wastewater utility O&M (operation/maintenance) practices.

A final point that may be of interest to the District is the argument that the monthly residential sewer use fee should not be "flat rate" per residential EDU, but rather should be based on the number of people occupying the EDU, and/or by the amount of potable water used by the EDU, and/or by the number of plumbing fixtures in the EDU, etc. While such arguments appear to have merit, it needs to be recognized that the amount of waste produced by an individual is independent of the amount of water used by that individual in the home. In other words, an individual using less water in the home produces a smaller amount of wastewater that is of higher strength. Higher strength waste may be more expensive to treat than lower strength waste, particularly for refractory wastewater contaminants such as salts, metals, and pharmaceutical residuals. Additionally, lower use of water in an EDU containing copper water pipes results in higher copper concentrations (and possibly higher zinc and lead concentrations) in the resulting wastewater from that EDU, in general. These pipe corrosion related increases in wastewater metals concentrations are in addition to any metals concentration increases resulting from reduced water use in the home that are not of pipe origins. Elevated metals concentrations caused by any of the foregoing conditions are of concern to the District.

When trying to estimate the actual cost to serve each EDU in the District, another parameter as important as (and as confounding as) the number of people per EDU and water use quantities is the type and amount of products used in the EDU, including personal care products, cleaning products, pesticides of any sort, and prescription medications. Many of these contaminants are refractory and have the potential to threaten the performance of the existing WWTP.

In summary, a flat rate residential sewer use fee is recommended over the alternative of custom fees developed for each EDU based on a myriad of inter-related, complex factors that are subject to change, and therefore would need to be monitored and policed. Factors affecting EDU-specific use fees include changes in 1) in-home water use, 2) in-home use of products including medications, 3) the number of people using the EDU, etc. The District provides a community-wide service, and has been disinclined to pry into the affairs of its constituency. A flat rate residential sewer use fee best serves this community service model.

2.3 OVERVIEW SUMMARY

The District is believed to have excellent wastewater treatment and disposal facilities (i.e., the Phase A WWTP) for its current service obligation of approximately 1,920 EDUs, though some additional improvements are needed. Improvements potentially needed by the existing constituency are shown in **Figure 2-3**, and are discussed in greater detail in this Update.

The District has a realistic plan for serving both near-term and long-term growth, if/when it occurs. District management is studying conditions at the WWTP and within the community to determine if the current Phase A WWTP can serve more than 1,920 EDUs reliably under reasonable worst-case conditions. If the Phase A WWTP has surplus EDU capacity, then this could facilitate some near-term development within the community, and could reduce the need to increase sewer use fees for existing residents if near-term development actually occurs.

It appears that the District and its constituency, in general, have adequate means to finance, plan, design, construct, operate, maintain, and monitor the Phase A WWTP and its needed improvements. This is important to maintaining the value of residential and commercial properties within the District.

New WWTP facilities needed to serve near-term Phase B community growth in the foreseeable future are identified in this Update, and are shown in **Figure 2-3**. This Update also identifies how these Phase B improvements can be constructed in two stages (which reduces the size of the "pool" needed to finance each stage of improvements). Staging Phase B improvements to the extent feasible minimizes inconvenience to community developers without placing the District and its existing constituency at material financial risk. District management is open to consideration of operating a single, small wastewater treatment "package plant" on the WWTP site under certain conditions to further reduce the burden of pooled financing, and thereby facilitate community development. Any such plan would have to be proposed and funded by community developers, and approved by the District Board of Directors. Such a plan is so speculative at this time that it warrants mention, but no further development in this Update.

An alternative to requiring community developers to finance the WWTP improvements they need is for the District (i.e., its existing constituency) to finance a portion (or all) of the Phase B improvements in one or both of the Phase B improvement stages. Such a change in District financial planning would be appropriate if a majority of the District's existing constituency believes that 1) this use of their money will encourage new development in San Andreas, and that 2) new development is important to the overall health and prosperity of the community.

3.0 NEW INFORMATION

The need for this Update is driven primarily by new information since 2007. The most important new information material to District planning is discussed in this section.

3.1 NEW REGULATORY INFORMATION

The District is permitted by the California Regional Water Quality Control Board (Regional Water Board) to dispose treated wastewater (termed "effluent") by two means: 1) effluent may be discharged to North Fork (NF) Calaveras River (termed "the receiving water") in the November through April period if certain conditions are met, and 2) effluent is discharged to District-owned land whenever feasible (with feasibility being determined primarily by rainfall and soil moisture conditions). Any effluent that cannot be discharged immediately to NF Calaveras River and/or land for any reason is stored in Pond D until it can be discharged by either of these means. All discharges of effluent to surface waters (such as NF Calaveras River) are regulated by federal NPDES (National Pollution Discharge Elimination System) permits. NPDES permits may also regulate effluent discharges to land. This is the case with the District's NPDES permit: it covers both effluent discharges to NF Calaveras River, and effluent discharges to land.

NPDES permits are renewed/updated every 5 years by the Regional Water Board to reflect new wastewater regulations and policies, and new receiving water and effluent water quality data since the last NPDES permit renewal. All of these factors, which are relevant to NPDES permits, tend to be in a state of flux to some extent. The 2007 Master Plan was based on the District's 2003 NPDES permit, in anticipation of the District's upcoming 2008 NPDES permit renewal (which did not actually occur until 2009). The District's 2009 NPDES permit was, again, renewed and updated in 2014 (Order No. R5-2014-0104; NPDES No. CA0079464), and this Update reflects new information coming out of the 2014 NPDES permit, and important late-2014 changes in Regional Water Board policies not reflected in the District's 2014 NPDES permit.

Material differences between the District's 2003, 2009, and 2014 NPDES permits are presented in Table 3-1. Table 3-1 covers key limits on effluent discharges to NF Calaveras River and to land. As shown in Table 3-1, the list of major water quality constituents regulated in effluent discharged to NF Calaveras River has reduced from 16 in 2003, to 14 in 2009, to 8 in 2014. Of the eight constituents regulated currently, six constituents (BOD, TSS, total coliform, pH, electrical conductivity, and ammonia) are not believed to be problematic for the existing Phase A WWTP under the 2014 permit. Effluent cyanide and chlorine residual concentrations have been problematic, and should be addressed by the District in some manner.

Table 3-1 A Summary of Wastewater Permit Requirements since the 2003 NPDES Permit

Effluent Parameter	Effluent Discharged to NF Calaveras River			Effluent Discharged to District-Owned Lands		
	2003 Permit	2009 Permit	2014 Permit	2003 Permit	2009 Permit	2014 Permit
Beneficial uses of surface waters potentially impacted by effluent discharged. (a)	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	N/A	N/A	N/A
BOD						
Monthly avg, mg/L	≤30	≤30	≤30	≤40	≤40	≤40
Weekly avg, mg/L	≤45	≤45	≤45	N/A	N/A	N/A
Max day, mg/L	≤60	≤60	≤60	≤80	≤80	≤80
TSS						
Monthly avg, mg/L	≤30	≤30	≤30	N/A	N/A	N/A
Weekly avg, mg/L	≤45	≤45	≤45	N/A	N/A	N/A
Max day, mg/L	≤60	≤60	≤60	N/A	N/A	N/A
Total Coliform Organisms						
7-day median, MPN/100 mL	N/A	≤23	≤23	N/A	N/A	N/A
Monthly median, MPN/100 mL	≤23	N/A	N/A	≤23	≤23	≤23
Max day, MPN/100 mL	≤230	N/A	N/A	≤230	≤230	≤240
Other	N/A	≥240 no more than once in any 30-day period	≥240 no more than once in any 30-day period	N/A	N/A	N/A
Flow limit, Mgal/d	≤1.5	≤1.5	≤1.5	≤0.4 ADWF	≤0.4 ADWF	≤0.4 ADWF

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Effluent Parameter	Effluent Discharged to NF Calaveras River			Effluent Discharged to District-Owned Lands		
	2003 Permit	2009 Permit	2014 Permit	2003 Permit	2009 Permit	2014 Permit
Chlorine Residual						
4-day avg, mg/L	≤0.011	≤0.011	≤0.011	N/A	N/A	N/A
1-hour avg, mg/L	≤0.019	≤0.019	≤0.019	N/A	N/A	N/A
pH, min/max in std. units	6.5/8.5	6.5/8.5	6.5/8.5	Daily average 6.5/9.0	Daily average 6.5/9.0	Daily average 6.5/9.0
Electrical Conductivity, µmhos/cm	N/A	Water supply + 500, or 700, whichever is less	≤700 as average for all effluent discharged	N/A	N/A	N/A
Daily River: Effluent Dilution Ratio	≥20:1	≥20:1	≥20:1	N/A	N/A	N/A
Discharge Period, Calendar Months	Nov. through Apr.	Nov. through Apr.	Nov. through Apr.	Year-round, as practicable		
Nitrate+Nitrite, monthly avg, mg-N/L	10	N/A	N/A	N/A	N/A	N/A
Ammonia						
Monthly avg, mg-N/L	N/A	≤1.2	≤1.8	N/A	N/A	N/A
Max day, mg-N/L	Equation	≤2.1	≤3.6	N/A	N/A	N/A
Total Nitrogen, monthly avg, mg/L	N/A	N/A	N/A	N/A	N/A	34
Cyanide						
Monthly avg, µg/L	N/A	≤4.3	≤3.8	N/A	N/A	N/A
Max day, µg/L	N/A	≤8.5	≤9.4	N/A	N/A	N/A
Bis (2-ethylhexyl) phthalate						
Monthly avg, µg/L	≤13.7	≤34	N/A	N/A	N/A	N/A
Max day, µg/L	N/A	≤95	N/A	N/A	N/A	N/A

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Effluent Parameter	Effluent Discharged to NF Calaveras River			Effluent Discharged to District-Owned Lands		
	2003 Permit	2009 Permit	2014 Permit	2003 Permit	2009 Permit	2014 Permit
Copper						
Monthly avg, µg/L	Equation	≤5.4	N/A	N/A	N/A	N/A
Max day, µg/L	Equation	≤7.9	N/A	N/A	N/A	N/A
Dichlorobromomethane						
Monthly avg, µg/L	≤2.1	≤9.7	N/A	N/A	N/A	N/A
Max day, µg/L	N/A	≤22	N/A	N/A	N/A	N/A
Zinc						
Monthly avg, µg/L	Equation	≤48	N/A	N/A	N/A	N/A
Max day, µg/L	Equation	≤77	N/A	N/A	N/A	N/A
Diazinon						
Monthly avg, µg/L	≤0.04	≤0.03	N/A	N/A	N/A	N/A
Max day, µg/L	≤0.08	≤0.08	N/A	N/A	N/A	N/A
Iron						
Monthly avg, µg/L	≤300	N/A	N/A	N/A	N/A	N/A
Annual avg, µg/L	N/A	≤300	N/A	N/A	N/A	N/A
Aluminum						
Monthly avg, µg/L	≤216	N/A	N/A	N/A	N/A	N/A
Max day, µg/L	≤373	N/A	N/A	N/A	N/A	N/A
Manganese, monthly avg, µg/L	≤50	N/A	N/A	N/A	N/A	N/A
MBAS, monthly avg, µg/L	≤500	N/A	N/A	N/A	N/A	N/A
Method of Effluent Discharge to Land	N/A	N/A	N/A	Trenches	Trenches	Sprinklers

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Effluent Parameter	Effluent Discharged to NF Calaveras River			Effluent Discharged to District-Owned Lands		
	2003 Permit	2009 Permit	2014 Permit	2003 Permit	2009 Permit	2014 Permit
Use Of Land Disposal Method During Rainfall	N/A	N/A	N/A	Permitted	Permitted	Prohibited
Number Of Major Effluent Water Quality Parameters Regulated	16	14	8	3	3	4

(a) MUN = municipal use; AGR = agricultural use; REC-1 = water contact recreation; REC-2 = non-contact water recreation; WARM = habitat for warm freshwater species; COLD = habitat for cold freshwater species; MIGR = water is used as an aquatic life migration route; SPWN = habitat for spawning and early development of species; WILD = wildlife habitat.

3.1.1 Effluent Cyanide

The District's effluent cyanide problem is primarily a result of the District's use of chlorine as an effluent disinfectant. Cyanide forms as an unintended "disinfection byproduct" of the chlorination process, but not necessarily to insurmountable problematic concentrations. In other words, the current cyanide "problem" does not mean that the District necessarily must bear the expense of replacing its chlorine disinfection system with an alternative, such as a UV (ultraviolet light) disinfection system. The Regional Water Board has given the District until December 1, 2018 to investigate and implement a cyanide compliance plan appropriate to the District. Accordingly, the District developed the following step-by-step course of action for achieving compliance with effluent cyanide requirements.

1. Determine if the District's WWTP Operations Team can reduce chlorine use, and thereby reduce effluent cyanide concentrations to less than problematic levels while still maintaining reliable compliance with the 2014 permit limit on total coliform of ≤23 MPN/100 mL (see Table 3-1). Recent chlorine doses are known to be higher than needed in general at the WWTP because current effluent total coliform values are well below the 23 MPN/100mL requirement, as shown in Table 3-2. However, "over chlorinating" the effluent to some extent is appropriate as a public health protection measure. This is because the current chlorination system is not automated, i.e., the chlorine dose must be set manually by the WWTP Operations Team at a sufficiently high value to cover all reasonable worst-case effluent conditions that may occur over the course of a day, and into the night when the WWTP is unmanned. Reducing chlorine doses to reduce effluent cyanide problems without exceeding effluent coliform requirements requires automating the chlorination system such that the chlorine dose rate changes automatically over the course of the day and night with changes in a) effluent flow, and b) effluent chlorine demand. These automation improvements are fairly standard, but were not added to the existing chlorine system as a Phase A upgrade in 2010 because of a) the possibility of other less costly cyanide compliance options being available to the District, and b) the possibility that UV disinfection would be required by the Regional Water Board in the near future e.g., the 2014 permit. The WWTP Operations Team reports that reducing the chlorine dose, alone, does not appear to produce compliant results reliably; thus, the Operations Team has begun to automate aspects of the chlorination/de-chlorination system.

Table 3-2 Recent Effluent Cyanide and Total Coliform Results

Date	Cyanide, µg/L	Total Coliform, MPN/100
12/8/2010	<5	<1.8
1/5/2011	<5	<1.8
2/2/2011	<5	2
3/2/2011	<5	2
4/6/2011	<5	<1.8
2/15/2012	3.8	<1.8
3/7/2012	5.2	<1.8
4/4/2012	5.7	<1.8
4/18/2012	<5	2
12/5/2012	6.8	<1.8
1/2/2013	6.2	<1.8
2/6/2013	9	<1.8
3/5/2013	6.2	<1.8
4/2/2013	11	<1.8
2/12/2014	10	1.8
3/5/2014	8.8	2
4/2/2014	4.1	<1.8
2014 Permit Adopted		
9/17/2014	3.7	---
10/15/2014	2.4	---
11/5/2014	6.7 (a)	---
12/12/2014	<1.2	<1.8
1/7/2015	<1.2	<1.8
2/11/2015	6.0 (a)	---

(a) Problematic effluent cyanide concentrations under the 2014 permit.

2. Determine if the WWTP Operations Team can reduce effluent cyanide formation by reducing the food to micro-organism (F/M) ratio in the treatment process. This would be accomplished by operating both existing aeration basins (see **Figure 2-3**) under maximum design microbial solids concentrations. This approach may reduce chlorine dose needs and/or cyanide precursor compound concentrations in the effluent. Either approach should reduce effluent cyanide concentrations. Whether this approach will reduce effluent cyanide concentrations reliably to less than problematic concentrations can be determined only by monitoring and observation. The WWTP Operations Team reports preliminarily that this, alone, does not appear to be an adequately reliable compliance plan.

3. Determine if the effluent cyanide problem is caused materially by the effluent cyanide sample preservation process. Effluent cyanide samples must be preserved chemically unless the cyanide analysis can be initiated within 15 minutes of the sample being collected. The cyanide sample preservation process is known to create some cyanide in the sample. EPA is working to address this problem, which unfortunately varies from effluent to effluent. While EPA is attempting to resolve the problem, the Regional Water Board is accepting results from effluent-specific studies of ways to address cyanide creation during the sample preservation step. Such a study was completed by the City of Stockton. These studies are relatively expensive and do not necessarily resolve the problem based on case studies to date. Though a study is an option for the District, it is not recommended unless other less costly compliance plans are not effective in eliminating the current problem.

4. Determine if the District's current effluent cyanide sampling time is representative of typical effluent cyanide concentrations over the course of the day. With the District's chlorination system not being automated, the District's late night/early morning low flow effluent is typically over chlorinated, and the chlorine contact time in the District's chlorine contact basin is greatest. Both factors tend to increase cyanide formation. Thus, the District may be sampling its effluent (via a grab sample, not a composite sample) when effluent cyanide concentrations are atypically high (and coliform results are atypically low). This potential problem should be reduced by current District efforts to automate aspects of the chlorination/de-chlorination system. When automation is complete, the District may still wish to conduct a survey of approximately when during the day the effluent cyanide concentration is most representative of the daily, flow-weighted, average cyanide concentration, and collect all subsequent effluent cyanide grab samples at that time. Note, effluent cyanide samples are not 24-hour composite samples because of the preservation step; however, options for compositing a set of preserved cyanide grab samples can be explored with the Regional Water Board if a representative time for a single effluent cyanide grab sample cannot be determined.

5. Conduct a Mixing Zone and Dilution Study documenting the spatial area in NF Calaveras River potentially impacted adversely by the District's effluent cyanide concentration as it mixes into and is diluted by NF Calaveras River water. Because the 2014 permit requires that each gallon of effluent discharged to the river must be diluted by at least 20 gallons of river water (i.e., the 20 to 1 dilution requirement in the District's permit, see **Table 3-1**), and because NF Calaveras River water should contain essentially no cyanide, the District should be able to show via a Mixing Zone and Dilution Study that current effluent cyanide concentrations are quickly and safely diluted by river water and pose no material risk to aquatic life (or people) using either the river or New Hogan Reservoir.

   When considering such a request by the District to receive cyanide "dilution credits" in the river, the Regional Water Board must decide whether the District has taken all feasible cyanide control measures, considering local economics and the cost of alternative cyanide compliance measures. Based on the District's commitment to

protect public health and the limited success of the District's on-going effluent cyanide control measures, District management has indicated that it plans to conduct a Mixing Zone and Dilution Study in 2016 to allow permit inclusion of cyanide dilution credits by late 2016/early 2017, well before the December 2018 compliance date such that the District has time to implement other cyanide control measures should the Regional Water Board fail to grant the District cyanide dilution credits (which is possible, though unlikely).

6. Replace the existing chlorination/de-chlorination effluent disinfection system with a UV effluent disinfection system, which does not create cyanide. UV disinfection is used primarily to meet a ≤2.2 MPN/100 mL "tertiary" effluent disinfection standard, not the ≤23 MPN/100 mL "secondary" disinfection standard required by the District's current 2014 permit. In other words, UV disinfection is "overkill" based on the District's current disinfection requirements. Additionally, UV is not a "panacea" disinfectant; it has two limitations: UV is relatively ineffective if the WWTP treatment process is upset for any reason (whereas chlorine still works), and UV does not oxidize refractory organics (e.g., some pharmaceuticals) whereas chlorine does. Pharmaceuticals, such as endocrine disrupting substances (e.g., residues from use of birth control pills in the community), have been linked to adverse impacts on aquatic life that are not detected by current effluent monitoring procedures except possibly by reduced reproduction of Ceriodaphnia in the 3-tier bioassay test that the District conducts on its effluent annually. Thus, changes to the wastewater treatment process that reduce oxidation of refractory organics in the effluent should be considered holistically and carefully to avoid spending money fixing one problem, only to have the "fix" create additional problems and expenses for the District.

In summary regarding effluent cyanide, the Regional Water Board has given the District until December 1, 2018 to address the effluent cyanide issue. The "fix" had the potential to be as simple as reducing chlorine use, automating the chlorination system reducing the F/M ratio, and/or changing the cyanide sampling time. District efforts to date suggest that these steps, alone, will not result in reliable compliance with current effluent cyanide limitations. Consequently, the District plans to conduct a Mixing Zone and Dilution Study in 2016. In the unlikely event that the Regional Water Board does not grant the District cyanide dilution credits in late 2016/early 2017, the District will reconsider a site-specific sample preservation study, and/or replacing the chlorination system with UV.

3.1.2 Effluent Chlorine Residual

Effluent chlorine residual (from the effluent disinfection process) has potential to be problematic for the District. This is because chlorine residual (should any leave the WWTP site for any reason) is so acutely toxic to aquatic life in NF Calaveras River. December 2014 events suggest that some action by the District to prevent chlorine residual violations is appropriate. Options to reduce potential for chlorine residual violations include:

1. Automate the existing chlorination/de-chlorination system (which should also reduce effluent cyanide concentrations); or,

2. Replace the chlorination/de-chlorination system with a UV system (which should also virtually eliminate effluent cyanide concentrations).

As noted above, UV is expensive and is not a panacea disinfectant. Any proposal to install UV must evaluate the problematic aspects of UV disinfection. Consequently, the WWTP Operations Team is automating aspects of the existing chlorination/de-chlorination system. This should address the current potential chlorine residual problem. No further assessment of potential chlorine residual problems is warranted at this time.

3.1.3 Change in Beneficial Use Designation for Permitting Purposes

Another important change in the 2014 permit is the elimination of MUN (i.e., municipal use) as a beneficial use of water in NF Calaveras River per the Regional Water Board's Basin Plan (the overall planning document for preserving adequate water quality in the water resources of the Central Valley). This change eliminates drinking water standards as a basis for developing effluent limits for the District's effluent discharge to NF Calaveras River. The District's current discharge location on NF Calaveras River is believed to be within the high water line of New Hogan Reservoir, which is listed for MUN use in the Basin Plan. The Regional Water Board is aware of this situation, and has chosen to delete the MUN beneficial use from its consideration when developing effluent limitations for the District's discharge. The basis for this choice is believed to be that 1) the reservoir is rarely filled to where lake water levels reach the effluent discharge point, 2) on those rare occasions when the effluent discharge point is within the water surface area of the lake, there is very high dilution of any effluent discharged, and 3) the current effluent discharge location is in what is termed the "river run" portion of the reservoir. What this last point means is that when the effluent discharge location is under reservoir water, the overlying reservoir water still has a specific flow direction and known flow volume (for dilution calculation purposes), both of which are caused by the inflow (i.e., "run") of river water from NF Calaveras River into New Hogan Reservoir. If effluent discharge within the high water line of New Hogan Reservoir ever becomes a regulatory issue, then the District, if appropriate, can move the discharge point to a more upstream location on NF Calaveras River that is above the high water line of the reservoir.

In the event that the Regional Water Board reinstates the MUN beneficial use in some future NPDES permit renewal, the greatest potential impacts on the District's WWTP are from regulation of a) effluent nitrate concentration (which was in the 2003 permit), and b) effluent chlorine disinfection byproducts, specifically: dichlorobromomethane (which was in the 2003 and 2009 permits), dibromochloromethane, and cyanide (in the 2009 and 2014 permits). The District's Master Plan and Phase A improvements include provisions to address these effluent quality concerns, should they arise in the future. These provisions include conducting a Mixing Zone and Dilution Study, and if the Regional Water Board does not grant needed dilution credits to the District (which is unlikely), then a) add denitrification basins to the WWTP treatment process for

nitrate control, and/or b) replace chlorine disinfection with UV to remove all chlorine disinfection byproduct concerns. Replacing chlorine disinfection with UV disinfection is straight forward, and is primarily a matter of cost and mitigating the potential limitations of UV disinfection.

Regarding effluent nitrate concentrations, adding denitrification basins, if/when needed at some future date, is a complicated issue for the District. This is because the District's situation regarding the overall cost of adding denitrification basins is rather unique. Typically, much of the life cycle cost of an effluent denitrification process (i.e., the denitrification basins and ancillary facilities) can be offset in the construction of an entirely new WWTP. This cost offset is achieved largely by the reduced size and power usage of the aeration basins that follow the denitrification basins. This is not the case in the District's situation because for denitrification basins to work, they need to receive wastewater containing both nitrate (a byproduct of wastewater treatment) and readily biodegradable organic carbon (common in raw wastewater or primary clarified wastewater, but not in trickling filter or activated sludge effluent). Thus, for denitrification to work at San Andreas requires 1) denitrification basins before the trickling filter which may "starve" the activated sludge process into a state of unreliability, or 2) denitrification basins after the trickling filter or activated sludge process with methanol (or equal) being added to the effluent to serve as the readily biodegradable organic carbon, or 3) replacing the trickling filter with denitrification basins and increasing the size of the existing activated sludge process (because of the loss of the trickling filter process). With each option there are substantial additional ancillary facilities needed specific to each option in the forms of recirculating pumps and piping (when the denitrification basins are before the activated sludge process), or an additional clarifier (when the denitrification basins are after the activated sludge process). Thus, adding a denitrification process for the District's existing constituency requires a major rework of the existing WWTP. Of the three identified options, replacing the trickling filter with denitrification basins appears to be the most practicable long-term. To implement this option requires the existing constituency to fund a) construction of the denitrification basins, a third aeration basin, and the denitrification process recirculation system; b) demolition of the trickling filter; and c) modification of the piping system to allow primary clarifier effluent to flow directly to the denitrification basins.

In summary, adding denitrification basins to the District's Phase A WWTP is expensive, and is of limited water quality value considering the 20 to 1 dilution requirement in the North Fork Calaveras River. Denitrification basins for Phase B are also inappropriate because the Phase B improvements are an expansion "in-kind" of the Phase A WWTP. Requiring Phase B to include denitrification basins would be tantamount to requiring the District to operate two separate treatment processes on the same WWTP site: The Phase A trickling filter/activated sludge process and a separate Phase B nitrification/denitrification activated sludge process.

3.1.4 New Concerns Regarding Freshwater Mollusk Sensitivity to Ammonia

A new regulatory issue of ammonia sensitive mollusks (e.g., clams) arose in 2014 shortly after the District's 2014 NPDES permit was adopted. The new issue deals with specific freshwater mollusks that are more sensitive to ammonia than the fish that the current effluent ammonia limits are

designed to protect. The Regional Water Board has proposed it may adopt new, lower, ammonia effluent limits in the District's 2019 NPDES permit of around 0.7 mg-N/L (monthly average) and 1.7 mg-N/L (max day) versus the current values of 1.8 mg- N/L and 3.6 mg-N/L, respectively. The Phase A WWTP was not designed to comply with these proposed new lower ammonia effluent limits. However, these proposed mollusk-driven ammonia effluent limits will not be adopted in the 2019 NPDES permit if the District demonstrates that ammonia sensitive mollusks are absent from NF Calaveras River, which is likely because the river dries up for extended periods of time in most summers. Options open to the District to address the evolving freshwater mollusk/ammonia issues include:

1. Evaluate whether the Phase A WWTP can comply reliably with these proposed, new, lower ammonia limits under a wide range of reasonable worst-case effluent discharge scenarios. This work is on-going as a normal part of WWTP operations and effluent monitoring.

2. If reliable compliance cannot be assured beyond reasonable doubt, then conduct a site-specific mollusk survey to determine if ammonia sensitive mollusks are present or absent in NF Calaveras River. If sensitive mollusks are absent, then the current effluent ammonia limits should not change materially in the 2019 NPDES permit, and no further work should be necessary.

3. If ammonia sensitive mollusks are present in NF Calaveras River, and if the WWTP cannot comply reliably with mollusk-driven ammonia effluent limits, then apply the Mixing Zone and Dilution Study being undertaken by the District for cyanide to the ammonia/mollusk issue.

4. If the Regional Water Board does not grant ammonia dilution credits to the District for any reason (e.g., Anti-Degradation Policy issues, or critical habitat issues), then modify the Phase A WWTP process to meet lower effluent ammonia limits. Any such modification would be designed to integrate denitrification basins, but denitrification basins would not be built until either required for regulatory reasons, or desired by the District.

3.1.5 Regulation of the District's New Method for Discharging Effluent to Land

A final material change in the 2014 NPDES permit relates to District effluent discharges to land. Because of concerns expressed by the Regional Water Board over the possibility of District effluent disposal on land via trenches causing degradation of area groundwater quality, the District converted its land disposal method from open trenches (excavated down to bedrock in some areas) to sprinklers applying effluent to vegetated soil surfaces. This change results in all land disposed effluent being applied to the soil's surface, and therefore receiving advanced treatment by the soil mantle as the effluent percolates through the soil down to the soil/bedrock interface. At this interface some effluent is believed to percolate into seams and fissures in the bedrock, and thereby eventually reach area groundwater. This improvement in land disposal method has a downside for the District. Heretofore, effluent could be discharged to the disposal

trenches in rainy weather (under the 2003 and 2009 permits). However, now (under the 2014 permit), effluent cannot be sprinkler applied to land under rainy conditions, or when the soil is saturated. Thus, effluent that was disposed via the trenches during some rainy weather conditions historically must, now, be stored in Pond D, which has limited storage capacity. This new limit on land disposal of effluent, coupled with Pond D's limited storage capacity, is a problem for the District, as evidenced by Pond D overflowing in the heavy rains of December 2014. Options to address this new problem include:

1. Reduce inflow and infiltration (termed "I/I") of stormwater into the District's wastewater collection system. The District has an on-going I/I control program. Permanent elimination of I/I in foothill settings is a virtual impossibility. It is believed that the District is controlling I/I to the extent feasible; thus, material mitigation of the aforementioned new problem is not expected to result from the District's on-going I/I control program.

2. Re-excavate the disposal trenches and restore the effluent conveyances to these trenches. This could resurrect Regional Water Board groundwater impact concerns and trigger equivalent tertiary treatment standards for effluent applied to land. Re-excavating the disposal trenches in some form (e.g., either as originally designed open trenches, or as sand filled leachfields) is not recommended unless other options are determined to be infeasible.

3. Optimize operational strategies to keep Pond D water levels as low as possible at all times. This includes facilitating movement of Pond D water back to the WWTP for retreatment and discharge to NF Calaveras River when appropriate. The WWTP Operations Team has initiated this option at this time.

4. Add more effluent storage volume (i.e., upsize Pond D, and/or build a new Pond E on the flatter portions of the District's property).This option appears to involve material capital cost.

5. Reduce surface and subsurface flow of rainfall into Pond D. Surface flow has been reduced to the extent feasible. Reducing subsurface flow involves material capital expense.

6. Modify the 2014 NPDES permit to reduce the current timing and dilution restrictions on effluent discharges to NF Calaveras River. Reducing the 20:1 dilution requirement will trigger equivalent tertiary treatment standards for effluent applied to the river. The District's existing Phase A WWTP is capable of producing secondary, equivalent tertiary, or tertiary effluent, except for the effluent disinfection system which predates the 2010 Phase A improvements project. The existing chlorine disinfection system is capable of producing secondary effluent or equivalent tertiary effluent, but not tertiary effluent without modification. District management would prefer to stay with secondary effluent treatment standards, if feasible economically.

3.1.6 An Overview of Secondary, Equivalent Tertiary, and Tertiary Treatment Standards

The foregoing section makes reference to three levels of wastewater treatment pertinent to District planning: secondary treatment, equivalent tertiary treatment, and tertiary treatment. An understanding of these levels of treatment is important to understanding the wastewater treatment and disposal options open to the District, and discussed in this Update.

Title 22 of the California Code of Regulations provides the following definitions for wastewater treatment, though they are not directly pertinent to the District's situation or NPDES permit because the District does not recycle its effluent in any way governed by Title 22:

60301.225. Disinfected secondary-23 recycled water

> "Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period.

The term "oxidized" is used in the foregoing definition, and means the wastewater's BOD has been reduced to around the 30-40 mg/L BOD range, or less, though not specified in Title 22. Secondary-23 treatment is the effluent treatment and disinfection standard required in the District's 2014 NPDES permit for both land disposal and river discharge. Secondary-23 treatment is appropriate for river discharge as long as 20 to 1 dilution is maintained, and is appropriate for land disposal irrigation, not involving cultivation of food crops or irrigation of landscaping with direct general public access, e.g., parks, school yards, etc.

60301.220. Disinfected secondary-2.2 recycled water

> "Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period.

60301.230 Disinfected tertiary recycled water

"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

a) The filtered wastewater has been disinfected by either:

1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contract time of at least 90 minutes, based on peak dry weather design flow; or

2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

Tertiary effluent is required to irrigate parks, school yards, food crops, etc.

Title 22 does not describe "equivalent tertiary treatment". This treatment standard is a creation of the Regional Water Board that is described succinctly in the City of Jackson's 2013 NPDES permit as follows:

> Wastewater shall be oxidized, coagulated, filtered, and adequately disinfected pursuant to the Department of Public Health (DPH; formerly the Department of Health Services) reclamation criteria, CCR, Title 22, division 4, chapter 3, (Title 22), or equivalent. This Order does not include the requirements for unrestricted beneficial reuse contained in Chapter 3. For wastewater disposal, the Discharger is required to meet Title 22 tertiary numeric effluent quality criteria (hence the use of "or equivalent"), but not the monitoring, alarm, process design, redundancy and storage requirements for beneficial reuse that is the full suite of Title 22 requirements. (Note: DPH is now the State Water Board Division of Drinking Water).

In other words, equivalent tertiary effluent is oxidized, coagulated, filtered, and disinfected, and meets BOD and TSS limits of ≤10 mg/L, a turbidity limit of ≤ 2 NTU, and a 7-day median total coliform concentration of ≤ 2.2 MPN/100 mL, but does not have all of the safety features of "Title 22" tertiary treatment, and does not meet the CT ≥ 450 mg • min/L and 90-minute modal contact time design criteria required when chlorine is used as the disinfectant. The Regional

Water Board requires equivalent tertiary treatment of effluents discharged to surface waters such as NF Calaveras River when the effluent does not receive at least 20 to 1 dilution by the surface water.

As noted above, the Phase A WWTP is capable of producing secondary or equivalent tertiary effluent at this time. It can also produce tertiary effluent if the chlorination system is modified to provide the needed CT and model contact time, and various monitoring, alarm, and redundancy features are added to the Phase A WWTP facility. Currently, the 2014 permit requires secondary effluent. If the District requests reducing the 20:1 dilution requirement when discharging to NF Calaveras River, then equivalent tertiary effluent will be required. Tertiary effluent (including monitoring, alarm, process design [i.e., CT and medal contact time limits], redundancy, and storage requirements of Title 22) would be required only if effluent is used to irrigate the high school athletic fields, or any similar direct reuse of the effluent where general public access to the irrigated land is likely.

3.2 NEW OPERATIONAL INFORMATION

Since development of the Master Plan in 2007 and completion of the bulk of the Phase A improvements in 2010, three new operational issues have arisen:

1. The District's effluent chlorination disinfection system is producing effluent with a) elevated amounts of effluent cyanide, and b) total coliform results meeting the ≤2.2 MPN/100 mL equivalent tertiary standard rather than the secondary standard required by the 2014 NPDES permit. It appears that recent chlorine doses are in excess of what is needed to comply with regulatory requirements, in general. However, this "over dosing" may be necessary to comply with the 23 MPN/100 mL standard reliably under unusual effluent conditions because the existing chlorination system is not automated, as discussed previously. Automating the chlorination/de-chlorination effluent disinfection system is recommended, and is being completed by the District's WWTP Operations Team at this time (February 2016).

2. The District's WWTP Operations Team would like more flexibility in how it can operate the Phase A WWTP trickling filter/activated sludge process. Specifically, the team would like to have the ability to bypass the trickling filter at times, and increase the aeration potential of the activated sludge basins. This requires modification of both the 2014 permit and the Phase A WWTP.

3. Pond D overflowed in the heavy rains of December 2014 as a result of several factors including a) the 2014 permit prohibition on applying effluent to land during rainfall, and b) the slow hydrologic response of NF Calaveras River flow to early seasonal rains. Based on this new operational information, the District Engineer prepared new water balances for the WWTP based on the District's conversion from trench disposal of effluent to sprinkler disposal of effluent (and associated 2014 permit limitations associated therewith), and new information on how the District's overall wastewater utility performs

under high rainfall conditions. District management with assistance from its consultants considered various approaches to prevent a repeat of December 2014 Pond D overflow problem. The best apparent approach involves a) increasing the storage volume capacity of Pond D to 7.2 Mgal, b) increasing to 900 gpm the ability to pump effluent from Pond D back to the WWTP for retreatment and discharge to NF Calaveras River, c) increasing to 1,000 gpm the ability to pump effluent to the District land disposal area, and d) with these improvements, minimizing the volume of water in Pond D at all times so as to maximize the volume of storage available to handle unusual and/or unforeseeable WWTP conditions. These improvements should be made as soon as possible. The WWTP Operations Team is making the improvements it can, but additional assistance and funding will be needed to complete the identified improvements.

3.3 NEW WWTP FACILITIES

Major changes to the WWTP have been completed or begun since the 2007 Master Plan was prepared:

1. The bulk of the recommended Phase A WWTP improvements were completed in 2010 to comply with regulatory requirements in force and/or anticipated at that time. The major WWTP-related components of the 2010 project are presented below. :

    - Two activated sludge aeration basins and the necessary ancillary facilities of aerators, a secondary clarifier, and return activated sludge (RAS) system were added to reduce effluent BOD and ammonia concentrations.

    - Effluent coagulation, flocculation, and filtration facilities were added to insure compliance with secondary treatment standards and facilitate production of equivalent tertiary effluent, or tertiary effluent if/when needed to preserve the ability to discharge effluent to NF Calaveras River under a wide range of possible technical and regulatory conditions.

2. The District converted its effluent disposal method on land from disposal trenches (running along the contour lines of the District's effluent disposal lands) to sprinklers.

3. The District added piping and ancillary facilities in 2015 to improve the ease of returning Pond D water to the WWTP for retreatment and disposal to NF Calaveras River when the river has sufficient flow to assimilate an effluent flow containing both incoming wastewater and previously stored effluent from Pond D.

4. The District began automating aspects of the existing chlorination/de-chlorination effluent disinfection system in 2015.

3.3.1 Phase A WWTP Improvements Completed in 2010

Design criteria for the District's Phase A WWTP as it was completed in 2010 and exists today (2015) are shown in Table 3-3. These various flow (Mgal/d) and load (lb/day) capacities for the Phase A WWTP were designed to provide reliable sewer service to 1,920 EDUs with full occupancy, under reasonable worst-case conditions, based on community sewage production characteristics available in 2007/2008. As long as these flow and load capacities are not exceeded, the Phase A WWTP and District WWTP Operations Team should be able to produce equivalent tertiary effluent (BOD and TSS each ≤10 mg/L, turbidity ≤2 NTU, and total coliform ≤2.2 MPN/100 mL), or tertiary effluent if the effluent disinfection system is upgraded to full tertiary standards, and if Title 22 monitoring, alarm, and redundancy features are added.

Table 3-3 also shows the 2014 NPDES permit requirements and actual influent and effluent data from the Phase A WWTP in recent years. Influent flows or loads exceeding any one of the Phase A WWTP's flow or load design criteria (except for peak hour flow and peak day flow) can cause the WWTP to not perform as designed. Peak hour and peak day flows influent to the WWTP can exceed the Phase A WWTP design criteria without upsetting the Phase A WWTP treatment processes because the overall WWTP facility has a High Flow Treatment System (HFTS) which receives that portion of influent wastewater flows in excess of the hydraulic capacity of the Phase A portion of the WWTP. The HFTS was developed and built by the District to discharge only to Pond D; therefore, the HFTS effluent needs to comply only with requirements for effluent discharges to land (e.g., monthly average BOD ≤ 40 mg/L, monthly median total coliform ≤23 MPN/100mL, max day total coliform ≤240 MPN/100 mL, etc., see Table 3-1).

Based on comparing recent WWTP influent flow and load data (with the exception of peak hydraulic flows) to the flow and load design criteria for the Phase A WWTP as presented in Table 3-1, District management believes the Phase A WWTP may be able to serve more than 1,920 EDUs reliably under reasonable worst-case conditions, and is investigating this possibility at this time. At a minimum, the District's investigation will identify which of the Phase A WWTP's design criteria are the weakest "links" (using a "chain" analogy) so that the District can determine the most cost-effective way(s) to address the current restriction on Phase A WWTP EDU service capacity based on recent real world WWTP flow, load, and performance data. This approach by District management maximizes the value of the Phase A WWTP to the District, its existing constituency, and future community residents.

3.3.2 District Effluent Sprinkler Disposal System

Based on Regional Water Board concerns that the District's effluent disposal trenches had the potential to degrade shallow groundwater quality, the District in a phased manner converted its effluent application method from trenches to sprinklers beginning in 2011. This conversion eliminated effluent from being in direct contact with the underlying bedrock seams (and groundwater via percolation into these seams). With sprinkler application, the effluent percolates through unsaturated soil before reaching the underlying bedrock. Because effluent percolation through unsaturated soil provides advanced treatment, this conversion materially

addressed Regional Water Board concerns. When the conversion was complete, the trenches were backfilled.

The current sprinkler system covers approximately 30 acres of District owned land, and is believed to be adequate for Phase A WWTP design conditions based on field experiments conducted by the District as part of the conversion process. The District Engineer's water balances reflecting post-2014 permitting conditions and operations crew field experience forecast that the 30-acre area is adequate for Phase A WWTP conditions, but that more effluent storage and improved hydraulics to move effluent more quickly are needed.

3.3.3 District Improvements to Effluent Hydraulics System

Specific improvements/operational adjustments already made by the WWTP Operations Team in 2015/16 include:

- Maintaining Pond D level as low as possible to maximize storage available during storm events that occur prior to 20:1 dilution in the river.
- Restored capacity to return flow from Pond D to the plant influent to allow for lowering pond level when there is sufficient 20:1 river dilution available, but land application is not available due to runoff or forecasted rain events.
- Staffing strategies implemented to maximize opportunity to use land application at maximum rate prior to and after forecasted rain events.

3.3.4 District Automation of the chlorination/De-chlorination Effluent Disinfection System

The WWTP Operations Team has made the following improvements to the chlorination/de-chlorination system in 2015/16:

- Installation of new chlorine residual analyzer, bisulfite residual analyzer, and redundant sample pumps.
- Relocation of sodium bisulfite (de-chlorination) feed pump, installation of new bisulfite storage tank, and heating system.
- Installation of new, separate sodium bisulfite injection point closer with carrier water, further upstream to chlorine contact basin.
- Optimization of control programming to optimize chlorine and sodium bisulfite dosing.

Table 3-3 Phase A WWTP Design Criteria and Performance Relative to 2014 NPDES Permit Requirements

Parameter	2010 Phase A Project Design Criteria	2014 NPDES Permit Requirements	Maximum Values from WWTP in Recent Years
Flows: • Avg dry weather flow (July-Sept), Mgal/d	≤0.32	≤0.4	
• Max month flow, Mgal/d basis	≤0.79	N/A	
• Peak day flow, Mgal/d	≤1.26	N/A	
• Peak hour flow, Mgal/d	≤1.88 (a)	N/A	
BOD: • Max month load, lb/day basis	≤1,217	N/A	
• Peak day load, lb/day	≤1,826	N/A	
• Effluent limit mg/L as monthly average	≤10	≤30	
TSS: • Max month load, lb/day basis	≤1,217	N/A	
• Peak day load, lb/day	≤1,826	N/A	
• Effluent limit, mg/L as monthly average	≤10	≤30	
Nitrogen Compounds: • Max month TKN load, lb/day basis	≤243	N/A	
• Peak day TKN load, lb/day	≤365	N/A	
• Ammonia max month limit, mg-N/L	≤1.2	≤1.8	
• Ammonia max day limit, mg-N/L	≤2.4	≤3.6	
Effluent Total Coliform: • 7-day median, MPN/100mL	≤2.2	≤23	
• Max value (to be exceeded no more than once in 30-day period, MPN/100 mL	23	240	
Turbidity: • Daily average limit, NTU	≤2	N/A	
• Max limit, NTU	≤10	N/A	

(a) Influent flows in excess of the value are diverted to the High Flow Treatment System.

4.0 SUGGESTED PLAN AND OPINION OF PROBABLE COST TO COMPLETE, UPDATE, AND IMPROVE THE PHASE A WWTP

Based on the foregoing discussion of new information, a series of projects have been developed by Stantec, the District Manager, and the District Engineer to improve the long-term reliability of providing lawful sewer service to existing residences and businesses. These projects are listed below by priority and then discussed in greater detail in the following sections. Each discussion includes an opinion of probable cost so that the District and its constituency have some idea of expenses the District will face in the foreseeable future to continue to provide reliable, lawful sewer service to existing residences and businesses.

1. Highest Priority Projects (Needs Directly Related to Immediate Compliance Issues)

    a. Pond D needs to be expanded to a volume of at least 7.2 Mgal.

    b. Hydraulic conveyance capacities need to be increased: from Pond D back to the WWTP, and from the WWTP facilities to the land disposal area. Aspects of this work are on-going by District staff, but additional improvements are needed.

    c. The chlorination/de-chlorination effluent disinfection system needs to be automated. Aspects of this work are on-going by District staff, but additional improvements are needed.

    d. A Mixing Zone and Dilution Study needs to be conducted in NF Calaveras River, specifically to address cyanide issues at this time.

2. High Priority Projects (Near-Term Needs)

    a. The 60-year old anaerobic digester needs to be replaced

    b. Older electrical gear and control systems at the effluent pumping station should be replaced.

    c. The presence or absence of ammonia-sensitive mollusks in NF Calaveras River needs to be determined by field survey of the dry river bed in late summer.

3. Desirable Projects ("Should Do" projects)

    a. The 60-year old headworks should be replaced.

    b. Older electrical gear and control systems at the headworks should be replaced.

    c. Ponds B and C should be modified to facilitate their use during WWTP maintenance activities.

d. If feasible, the 2014 permit and Phase A WWTP physical plant should be modified to provide the Operations Team with greater flexibility in operating the Phase A WWTP.

e. District management should review the EDU service capacity of the Phase A WWTP, and revise the estimated service capacity as may be appropriate. This work is on-going by District staff.

4.1 OPINIONS OF PROBABLE COST

Before describing the Phase A update projects summarized above, it is important to have an understanding of what significance should be assigned to engineering planning-level opinions of probable cost, i.e., cost estimates. Such estimates are prepared before the project has been developed fully and before the project has been subject to CEQA review (i.e., environmental impact analysis), permitting with the Regional Water Board, and detailed design (including geotechnical reports on structural foundation conditions). All of these factors impact a project's cost. Monetary inflation and construction market forces at the time of project construction also have a major impact on actual project costs. In other words, the actual cost of any major engineering project is known only when the construction contract is completed and closed because of the many unknowns that may arise in the course of permitting, designing, and building a project. With all of these qualifiers, one may legitimately ask if there is any significance to planning-level opinions of probable cost? The answer is "yes". The purposes of opinions of probable cost (i.e., planning-level project cost "estimates") are to provide the District with a basis for beginning financial planning for projects. Another important aspect of opinions of probable cost is that they provide the District with an opinion of the relative cost of project alternatives: which alternative project is likely to cost the least, and which is likely to cost the most. Even if there are material changes in inflation and/or the construction market and/or other design factors, the relative cost differences (i.e., the cost ranking) between the alternative projects is likely to remain similar.

4.2 HIGHEST PRIORITY PROJECTS

The highest priority projects are believed to be needed as soon as feasible to maintain the Phase A WWTP in a state of compliance with Regional Water Board requirements, especially with requirements for the WWTP to 1) handle 100-year precipitation conditions, 2) prevent chlorine residual violations and 3) achieve full compliance with cyanide requirements by December 1, 2018 (which is just around the corner if the permit is to be amended and/or WWTP construction is required). These requirements all relate to the District's effluent discharge to NF Calaveras River, which is the most highly regulated and closely monitored aspect of the District's operator. These are high priority projects for the District.

4.2.1 Project 1.A: Increase Pond D to a Volume of 7.2 Mgal

Based on the District Engineer's revised water balances, the capacity of Pond D needs to be increased from its current capacity of 4.3 Mgal to 7.2 Mgal in order to serve the needs of the District's existing constituency through 100-year rainfall conditions, and thereby avoid a repeat of events in December 2014. This increase in storage volume capacity will be achieved by two activities:

1. The District Engineer proposes to revise the 2014 permit to allow operation of Pond D with only one foot of freeboard (the 2014 permit requires two feet of freeboard). This revision will increase the effective storage volume of Pond D from 4.3 Mgal to 6.1 Mgal. This revision requires various submittals to regulatory agencies, and is estimated to have a capital cost of approximately $80,000. This project has no significant annual cost, thereafter, associated with it. This should be a "one time" expense.

2. To increase the storage volume of Pond D, from 6.1 Mgal to 7.2 Mgal, soil and accumulated debris will be excavated/removed from Pond D. The Pond D excavation project is planned to leave a soil layer between the effluent and any bedrock exposed during excavation to avoid a repeat of Regional Water Board concerns regarding Secondary-23 effluent being in direct contact with the seamed bedrock underlying the WWTP site. An opinion of probable cost for the proposed excavation and disposition of the removed material is $190,000 capital cost. To prevent the accumulation of debris in Pond D and thereby maintain a true storage volume capacity of 7.2 Mgal long-term, some debris will need to be removed from Pond D from time-to-time, probably on the order of every 3 to 5 years. The District's annual budget should include a line item to fund Pond D debris removal and disposal.

4.2.2 Project 1.B: Improve WWTP Hydraulics

Based on the District Engineer's revised water balances, the District's WWTP Operations Team needs more flexibility and capacity to move effluent under critical climatic conditions to avoid a repeat of December 2014. Specific improvements/operational adjustments already made by the WWTP Operations Team in 2015/16 include:

- Maintaining Pond D level as low as possible to maximize storage available during storm events that occur prior to 20:1 dilution in the river

- Restored capacity to return flow from Pond D to the plant influent to allow for lowering pond level when there is sufficient 20:1 river dilution available, but land application is not available due to runoff or forecasted rain events.

- Staffing strategies implemented to maximize opportunity to use land application at maximum rate prior to and after forecasted rain events.

Remaining improvements that should be completed by outside contractors include:

- Upgrade effluent pump station to provide additional capacity.
- Upgrade electrical switchgear and control systems at effluent pump station.

An opinion of probable cost to have an outside contractor complete these remaining improvements is estimated to be $1,050,000, capital cost. The added O&M annual cost to maintain these facilities is estimated to be approximately $10,000/year, above and beyond the District's current O&M budget. These costs include electrical preventive maintenance (IR testing), power costs, and pump preventive maintenance/replacement.

4.2.3 Project 1.C: Automate the Chlorination/De-chlorination Effluent Disinfection System

This project is necessary for three main reasons: t0 reduce the potential for the effluent discharge to exceed effluent limitations on chlorine residual, reduce the potential for cyanide formation during effluent disinfection, and improve the reliability and efficiency of the effluent disinfection system. The WWTP Operations Team has made the following improvements to the chlorination/de-chlorination system in 2015/16:

- Installation of new chlorine residual analyzer, bisulfite residual analyzer, and redundant sample pumps
- Relocation of sodium bisulfite (de-chlorination) feed pump, installation of new bisulfite storage tank, and heating system.
- Installation of new, separate sodium bisulfite injection point closer with carrier water, further upstream to chlorine contact basin
- Optimization of control programming to optimize chlorine and sodium bisulfite dosing

The added O&M annual cost to maintain the foregoing automated effluent disinfection system is estimated to remain essentially the same. These improvements a) reduce chlorine and de-chlorinating agent usage, and b) reduce WWTP operations time operating the automated system.

4.2.4 Project 1.D: Conduct a Cyanide Mixing Zone and Dilution Study

Results to date indicate that the most cost effective way to comply with cyanide requirements is to conduct a Mixing Zone and Dilution Study in NF Calaveras River in late Spring 2016 as the river's hydrograph recedes. The study must be conducted when river flows are as low as the lowest river flow under which the District plans to discharge effluent. The purpose of the Mixing Zone and Dilution Study is to demonstrate to the Regional Water Board that allowing a certain amount of effluent cyanide to mix into the river and be diluted by the river is both safe and

consistent with the State's Anti-Degradation Policy (State Board Resolution No. 68-16) and the State Implementation Policy(SIP).

Regional Water Board policies have evolved regarding mixing zones; thus, it may be necessary to plug the openings on a portion of the District's effluent outfall diffuser in NF Calaveras River to provide what is now termed a "zone of passage".

An opinion of probable cost to complete the entire Mixing Zone and Dilution Study process, including completing a revised Anti-Degradation Analysis and amending the 2014 permit, is estimated to be $50,000, excluding any cost associated with plugging a portion of the diffuser openings (if required by the Regional Water Board). There is no annual cost associated with this project. Completion of this project should reduce stress on the WWTP Operations Team. Specifically, with the Mixing Zone and Dilution Study completed and accepted by the Regional Water Board, the WWTP Operations Team can focus on operating the effluent disinfection system to protect public health. The possibility of the effluent disinfection process producing minor amounts of cyanide from time-to-time for reasons not fully understood by EPA (or anyone else, to our knowledge) would no longer be a concern for the WWTP Operations Team.

An important consideration in the Regional Water Board's decision to grant cyanide dilution credits is whether the effluent discharger (i.e., the District) has taken all reasonable steps to reduce contaminant concentrations. The WWTP Operations Team's extensive efforts to date to reduce effluent cyanide concentrations should satisfy Regional Water Board criteria regarding completion of all reasonable steps to reduce cyanide concentrations.

4.3 HIGH PRIORITY PROJECTS

These high priority projects need to be completed in the near-term future. These are not "discretionary" projects, they must be done soon.

4.3.1 Project 2.A: Replace the 60-Year Old Anaerobic Digester

This project was postponed from the 2010 Phase A WWTP project for economic reasons. The digester treats solids removed from the wastewater as part of the treatment process. Once "digested" (i.e., treated) and de-watered, these solids can be disposed safely at a landfill. The existing digester needs to be replaced for two reasons:

1. At 60 years old, it is past its expected life, and its materials are beginning to deteriorate because of the corrosive conditions in anaerobic digesters.

2. The Phase A WWTP converted the District from trickling filter treatment to activated sludge treatment. Solids from activated sludge processes are best treated in aerobic digesters, not anaerobic digesters.

The proposed anaerobic digester replacement project contains the following elements.

- New aerobic digester
- New aeration equipment (blowers and piping)
- Improvements to the existing belt filter press building

An opinion of probable cost for these improvements is estimated to be $2.6 million. Currently, the District has been approved to receive a $1.3 million grant from the State Water Board Division of Financial Assistance (DFA) to facilitate these improvements. Based on recent conversations with DFA staff (February 2016), it is possible that the District may qualify for even more grant funds. The availability of grant money is a material incentive to complete this project (and other priority projects identified in this Master Plan Update) while the grant funds are available. The net added O&M annual cost of this new digestion system is estimated to be approximately $25,000/year based primarily on increased use of electricity to aerate the new digester not being off-set fully by the reduced O&M effort to operate the new aerobic digester.

4.3.2 Project 2.B: Conduct an Ammonia Sensitive Mollusk Survey

NF Calaveras River immediately upstream and downstream of the effluent discharge diffuser may need to be surveyed for the presence of ammonia sensitive mollusks by qualified biologists during the late summer period when the river bed is often dry. The dry river bed simplifies the survey for mollusk shells on the river bed surface and up to several inches below the surface in areas with ideal substrate conditions. The seasonal drying of the river, itself, is not sufficient evidence that these mollusks will be absent because they can survive for extended periods of time without river flow by burrowing down into the river bed sediments. However, a seasonally dry river bed is not ideal habitat. This mollusk survey is a priority project because the results will be a major determinant of effluent ammonia limitations in the District's upcoming 2019 permit. The mollusk survey is not a highest priority project because the District has conducted a literature review and submitted a letter to the Regional Water Board stating that they believe fresh water mollusks are not present in the NF Calaveras River. Regardless, new, lower effluent ammonia limitations in the 2019 permit should be accompanied by a time schedule for the District to achieve compliance, and the Regional Water Board appears to be considering the mollusk data submitted to it in 2015.

4.4 DESIRABLE PROJECTS

The following projects are very desirable to improve overall WWTP safety, efficiency, ease of operation, etc. These projects should be completed as time and financial resources become available. These are important projects for the District and the people it represents; however their need does not appear to be as urgent as the "priority" projects discussed above.

4.4.1 Project 3.A: Replace the 60-Year Old Headworks

This project was postponed from the 2010 Phase A WWTP for economic reasons, and could be postponed further if necessary based on input from the WWTP Operations Team. Basic issues with the headworks (where raw sewage enters the WWTP) are:

1. The 60-year-old concrete is deteriorating (hydrogen sulfide in raw sewage forms sulfuric acid, which attacks concrete).

2. The influent sewer pipe was up-sized years ago, and for economic reasons, the bottom of the new, larger pipe was placed below the floor of the headworks structure. This "step up" from the bottom of the sewer pipe into the bottom of the headworks accumulates debris and limits the capacity of the influent sewer.

3. The headworks was designed to be a "pass through" structure. However, as the WWTP has evolved over time, this "pass through" structure must, now, function as an influent flow splitting structure between the trickling filter, activated sludge process, and HFTS (High Flow Treatment System).

The existing headworks should be replaced to get rid of the problems, and to automate the influent flow splitting function of the headworks. An opinion of probable cost to replace the headworks is estimated to be approximately $1 million. The new headworks would include the following specific features and functions:

- Hydraulic improvements to improve flow characteristics (align influent trunk sewer invert with headworks structure invert)

- Automation of influent flow splitting functions

- New mechanical influent screen

- New electrical service and motor control center (MCC)

Due to the operator effort necessary to keep the existing headworks operating, it is unclear at this time how O&M annual costs related to a new headworks may change. Selection of specific equipment will be a factor, specifically as it relates to horsepower requirements and the potential for a new screen to be more efficient, increasing solid waste disposal of screenings. However, it is also possible overall O&M at the plant will be reduced with a new headworks due to more modern and efficient electric motors as well as potential reduced fouling of equipment downstream due to more effective screening. Currently it is assumed that overall there will be no operation cost changes with a new headworks.

As noted previously, WWTP Operations Team members say they can make the existing headworks "work", at least for a few more years, with effort. Thus, this project can be postponed, if necessary, for economic reasons, but the District must plan to replace it in the foreseeable future.

4.4.2 Project 3.B: Modify Ponds B and C

Ponds B and C were part of the pre-2010 WWTP and have limited usefulness as currently configured and permitted for use in the 2014 permit. The specific problem is that these ponds receive stormwater runoff, and therefore can overflow to San Andreas Creek. Because they can overflow, they cannot be used in any way that may leave significant contaminants, solids, or pathogens of wastewater origins in these ponds. The WWTP Operations Team would like to be able to use these ponds, such as to receive water from a WWTP process being drained for maintenance purposes. Possible modifications to Ponds B and C included in this project are:

1. Route stormwater runoff around these ponds

2. Install return pumping and piping to allow ponds to be drained after use

An opinion of probable project cost to complete these modifications is estimated to be approximately $185,000. Having these ponds in a useful capacity would simplify maintenance operations and is estimated to reduce annual O&M costs. The WWTP Operations Team believes this project is desirable for ease of operation, but is not essential at this time. Therefore, it could be postponed, if necessary, for economic reasons.

4.4.3 Project 3.C: Improve Phase A WWTP Process Operational Flexibility

Based on 5 years of experience with the Phase A WWTP trickling, filter/activated sludge process under a wide range of climate and wastewater conditions, the WWTP Operations Team is requesting additional flexibility in how the WWTP can be operated. Specifically, the team would like to have the ability to take the trickling filter in and out of service based on situation-specific conditions and needs. Additionally, the team would like the ability to have more flexibility with the activated sludge aeration system and potentially more capacity. From discussions with the WWTP Operations Team, these requests appear to be realistic and potentially have the dual benefits of 1) increased ease of operations seasonally, and 2) increased load capacity (i.e., creating capacity for new EDUs at very low incremental cost).

This project to increase Phase A WWTP flexibility (and possibly load capacity) involves the following components:

- Improved flexibility and control with regards to flow spilling at the headworks between wastewater going to the trickling filter/activated sludge process, and wastewater going directly to the activated sludge process.

- Conveyance modifications to allow the flexibility in where wastewater goes for treatment.

- Means to keep the trickling filter biology alive during periods when the trickling filter is not being used to treat wastewater.

- Increased aeration potential for the existing activated sludge basins.
- Revisions to the 2014 permit language to allow revisions to how the Phase A WWTP is operated.

An opinion of probable cost to complete these modifications is estimated to be $65,000, capital cost. In terms of annual costs, these improvements will involve increased use of aeration equipment (i.e., electricity) at times (a cost), and increased ease of operations (a savings). On balance improving the operational flexibility of the Phase A WWTP is estimated to cause no material increase or decrease over current annual costs to operate and maintain the current trickling filter/activated sludge processes.

4.4.4 Project 3.D: Assess EDU Service Capacity of Phase A WWTP

The final recommended project under the Phase A WWTP improvement plan is for District management to investigate the reliable EDU service capacity of the Phase A WWTP. This is important for several reasons:

1. Provide assurance that EDU wastewater flow and load trends are not increasing to where the Phase A WWTP plus High Flow Treatment System may not be able to serve the District's 1,920 EDU service commitment reliably under reasonable worst-case conditions and full occupancy. This is not expected to be the case, but should be confirmed based on post-2010 Phase A WWTP wastewater flow, load, and performance data.

2. Determine if the Phase A WWTP can serve reliably more than 1,920 EDUs based on a) current EDU wastewater flow and load trends, and b) WWTP Operations Team field experience with the Phase A WWTP over the past several years. More EDU service capacity is of benefit to the community and the District's existing constituency for two reasons:

    - More EDUs under the Phase A WWTP project allows some community development and jobs in the near-term future, without the inconvenience of pooled financing recommended for the Phase B projects discussed in Section 5.0 of this Update.

    - More EDUs under the Phase A WWTP project spreads the debt service cost and annual O&M cost of the Phase A WWTP over more EDUs. This reduces Phase A WWTP costs to the existing constituency as each extra Phase A WWTP EDU is sold and occupied.

3. Determine which flow and/or load characteristics of the existing Phase A WWTP are most limiting based on current and forecast EDU wastewater flow and load trends. The importance of this is that it allows the District to determine if there are ways to bolster these "weakest links" in the Phase A WWTP design criteria based on new information regarding EDU wastewater flow and load characteristics. If the "weakest links" can be

bolstered, then the Phase A WWTP may be able to serve more EDUs at low incremental cost. As noted above, increasing the EDU service capacity of the Phase A WWTP is a benefit to the community, the District, and its constituency.

While most of the work with this task will be completed by District management, some outside assistance is expected to be necessary. There is no annual cost with this project.

4.5 PHASE A WWTP IMPROVEMENTS SUMMARY

Recommended projects related to modifying the Phase A WWTP for the benefit of the existing constituency are summarized in Table 4-1, along with opinions of probable capital and annual costs (and savings).

Table 4-1 Summary of Recommended Phase A WWTP Improvements and Opinions of Probable Cost

Project	Capital Cost [(a)]	Annual Cost [(b)]
Highest Priority Projects:		
1.A: Increase Pond D Volume to 7.2 Mgal	$245,000	$0
1.B: Improve WWTP Hydraulic Flexibility	$220,000	$0
1.C: Automate Effluent Disinfection System	complete	$0
1.D: Conduct Mixing Zone and Dilution Study	$50,000	$0
Subtotal	$515,000	$0
High Priority Projects:		
2.A: Replace 60-year old Anaerobic Digester	$2,600,000	$25,000
2.B: Conduct Ammonia Sensitive Mollusk Survey	$0	$0
Subtotal	$2,600,00	$25,000
Desirable Projects:		
3.A: Replace 60-year old Headworks	$1,007,000	$0
3.B: Modify Ponds B and C	$185,000	$0
3.C: Improve Phase A WWTP Operational Flexibility	$65,000	$0
3.D: Assess EDU Service Capacity of Phase A WWTP	$10,000	$0
Subtotal	$1,267,000	$0
Grand Total	**$4,382,000**	**$25,000**

(a) Opinions of cost base on ENR, CCI Index for November 2015, 10092.
(b) Annual costs based on current electrical rates.
(c) At this time it is not considered necessary, therefore, no budget is included in Table 4-1.

5.0 PROVIDING CAPACITY FOR NEAR-TERM GROWTH: PHASE B

The Master Plan describes a Phase B expansion project that increases the ADWF capacity of the WWTP from 0.32 Mgal/d to 0.55 Mgal/d. This Phase B 0.23 Mgal/d increase in capacity has been designed to conservatively serve an estimated 800 EDUs of community growth. Ideally, the Phase B project would be built all at once. However, this requires area developers to finance the planning, permitting, design, construction, and maintenance of all 800 EDUs up-front, long before there will be actual demand for 800 EDUs of development in San Andreas. As noted, the maintenance of created capacity is also paid by the developer/owner of each EDU of created capacity, until the EDU is sold; at which time the maintenance fee shifts to the EDU's new owner.

This Update identifies a way to split the Phase B project into two sub-projects: Phase B1 providing 0.09 Mgal/d of capacity (servicing 320 EDUs), and Phase B2 providing 0.13 Mgal/d of capacity (serving 480 EDUs). Design criteria for the Phase B1 and B2 projects are presented in Table 5-1. With this subdivision of the original Phase B project, the District can, now, offer area developers participation in 1) the Phase B1 pool financing 320 EDUs of capacity for Phase B1 pool use, and 2) the subsequent Phase B2 pool financing 480 EDUs of capacity for Phase B2 pool use. Because of the nature of these phased improvements, Phase B2 cannot be built before Phase B1, i.e., Phase B2 must be built concurrent with or after Phase B1. Also, it is important to understand that building Phase B1 does not necessitate that Phase B2 be built, ever. The Phase B1 improvements in concert with the existing Phase A WWTP (with its necessary upgrades) create 0.41 Mgal/d of firm, reliable capacity to treat design strength wastewater to comply with 2014 permit requirements, as well as produce equivalent tertiary effluent if/when needed (as can the Phase A WWTP).

Ways to break the Phase B project into more than two sub-projects (e.g., Phases B1, B2, B3, and B4) could not be identified without the resulting sub-projects placing the District and its existing constituency at some risk of non-compliance. Because of the regulatory risks to the District from subdividing Phase B beyond the proposed Phase B1 and Phase B2 projects, further subdivision is not recommended based on information available at this time. However, as will become evident, it is technically possible to construct the components comprising the Phase B1 and B2 projects one-by-one, serially over time. Thus, construction of Phases B1 and B2 can be subdivided into the individual components comprising each project, but "firm WWTP capacity" will not be created until all components of Phase B1 are built (which creates 0.09 Mgal/d or 320 EDUs of capacity), and subsequently until all components of Phase B2 are built (which creates 0.13 Mgal/d or 480 EDUs of additional capacity). Issuing EDUs to developers based on their funding the construction and maintenance of individual components of the recommended Phase B1 and Phase B2 projects is possible, but should be avoided by the District unless the District Engineer and Chief WWTP Operator both provide written endorsements of the proposal based on situation-specific information. Such information may include the number of EDUs being proposed, the amount of under-utilized capacity in the existing WWTP, performance of the

WWTP, etc. It is important to note that the Regional Water Board will not increase the permitted ADWF capacity of the WWTP (currently limited to 0.4 Mgal/d, see Table 3-1) until firm wastewater treatment and disposal capacity has been constructed. The current 0.4 Mgal/d ADWF limit covers most of the Phase B1 flow increase from 0.32 Mgal/d to 0.41 Mgal/d. Thus, constructing Phase B1 component-by-component appears to be largely possible from a regulatory perspective at this time if the aforementioned endorsements are provided to the District. However, the District's new water balances will be a required component of the Districts application to renew the 2014 permit. Based on this new information, the Regional Water Board may reduce the permitted ADWF capacity to 0.32 Mgal/d. This change to the permit may limit the District's ability to implement to Phase B1 project on a component-by-component basis from a regulatory perspective. Component-by component construction of Phase B2 is not possible under the 2014 permit, and is unlikely to be possible under the 2019 permit.

5.1 PHASE B1 IMPROVEMENTS

As noted above, the Phase B1 improvements to the existing 0.32 Mgal/d Phase A WWTP (with its necessary upgrades) will increase the firm, reliable ADWF capacity of the WWTP to 0.41 Mgal/d based on the wastewater strength characteristics developed in the Master Plan. The design inflow wastewater characteristics for the treatment portion of the District's WWTP after completion of the Phase B1 project are presented in Table 5-1. The Phase B1 increase in flow capacity of 0.09 Mgal/d is designed to reliably and conservatively serve 320 EDUs of new development in San Andreas. The specific Phase B1 improvements to the WWTP are itemized in **Table 5-2**, and have an opinion of probable capital cost of $3,294,000 (ENR CCI, November 2015, 10092). A layout of these improvements relative to the existing Phase A WWTP (with necessary upgrades) is shown in **Figure 2-3**.

Besides the **Table 5-2** cost, Phase B1 developers also need to pay 1) their pro rata share of wastewater collection, treatment, and disposal facilities and District land that they will use that already exist (including the Phase A upgrade improvements which should be built prior to Phase B1), and 2) any collection system modifications necessary to serve the specific Phase B1 developments being proposed. The monetary value of Phase B1's pro rata share of existing facilities should be determined by a specific connection fee and rate study. This study should assess the value of existing facilities (including the proposed Phase A upgrades) used by Phase B1 developments and determine how much of that value has already been paid for, and how much of that value is still being paid for by the debt service component of current District monthly sewer use fees. Because the District's objective has been to have one flat rate monthly residential sewer use fee, the Phase B1 EDUs will be paying the same debt service component as existing users. The present worth of the new EDUs debt service for existing facilities could be 1) subtracted from the total, upfront fee paid by the developers of those EDUs for wastewater collection, treatment, and disposal services, or 2) not subtracted from the total, depending on input from the District's legal counsel. If the present worth sum is not subtracted, then this portion of the developer's up-front fee would be held as a "bond/guarantee" for payment of the on-going necessary maintenance fees for the Phase B1 capacity created for Phase B1 developer use until the developer occupies the EDU, at which time monthly operation and

maintenance sewer use fees are paid by the occupant, and any unused "bond" money is returned to the developer. As will be shown by the connection fee and rate study, the present worth of remaining debt service payments by the existing constituency will depend on when the Phase B1 improvements are built.

Table 5-1 Design Criteria for Phased Expansion of the WWTP

Design Criteria	Existing Total, Phase A	Phase B1 Increase	Design Total, Phase A/B1 WWTP	Phase B2 Increase	Design Total, Phase A/B WWTP
Estimate of EDUs served	1,920	320	2,240	480	2,720
Influent flow, Mgal/d [a]					
• ADWF	0.322	0.090	0.412	0.134	0.546
• Peak month flow	0.789	0.157	0.946	0.235	1.181
• Peak day flow	1.256	0.224	1.480	0.336	1.816
• Peak hour flow	1.878	0.314	2.192	0.470	2.662
Influent BOD load, lb/d					
• Peak month load	1,217	370	1,587	554	2,141
• Peak day load	1,826	554	2,381	832	3,212
Influent TKN load, lb/d [b]					
• Peak month load	243	74	317	111	428
• Peak day load	365	111	476	166	642
Effluent BOD, mg/L					
• Peak month	10	---	10	---	10
• Peak week	15	---	15	---	15
• Peak day	30	---	30	---	30
Effluent TSS, mg/L					
• Peak month	10	---	10	---	10
• Peak week	15	---	15	---	15
• Peak day	30	---	30	---	30
Effluent ammonia, mg-N/L					
• Peak month	1.2	---	1.2	---	1.2
• Peak day	2.4	---	2.4	---	2.4
Effluent turbidity, NTU					
• Peak day	2	---	2	---	2
• Instantaneous max	10	---	10	---	10
Effluent total coliform, MPN/100 mL					
• 7-day median	2.2	---	2.2	---	2.2
• Max [c]	23	---	23	---	23

(a) Flow through the WWTP, excluding flows diverted to the High Flow Treatment System.
(b) TKN = total Kjeldahl nitrogen.
(c) Not to be exceeded more than once in any 30 day period.

Table 5-2 Phase B1 WWTP Improvements and Opinions of Probable Cost [a]

Item	Opinion Regarding Cost [b]
Secondary Clarifier	$1,830,000
Effluent filter upgrade	$150,000
Expand chlorination/de-chlorination system	$50,000
Additional sprinkler area [c]	$424,000
Additional storage volume[c]	$840,000
Total	**$3,294,000**

(a) Excluding developer buy-in costs for use of facilities already funded by others, any cost related to modifying the wastewater collection system, etc.

(b) ENR, CCI for November 2015, 10092.

(c) Source, KSN Technical Memorandum 3, dated March 14, 2016. Costs apportioned by ratio of 320 EDU/800 EDU.

Table 5-3 Phase B2 WWTP Improvements and Opinions of Probable Cost [a]

Item	Opinion Regarding Cost [b]
Aeration Basin	$640,000
Aeration Equipment for Aeration Basin	$330,000
Further expansion of chlorination/de-chlorination system	$370,000
Additional sprinkler area [c]	$636,000
Additional storage volume[c]	$1,260,000
Total	**$3,236,000**

(a) Excluding developer buy-in costs for use of facilities already funded by others, any cost related to modifying the wastewater collection system, etc.

(b) ENR, CCI for November 2015, 10092.

(c) Source, KSN Technical Memorandum 3, dated March 14, 2016. Costs apportioned by ratio of 480 EDU/800 EDU.

5.2 PHASE B2 IMPROVEMENTS

As noted above, Phase B2 improvements to the Phase A/B1 WWTP will increase the firm, reliable ADWF capacity of the WWTP to approximately 0.55 Mgal/d based on the wastewater strength characteristics developed in the Master Plan. The design inflow wastewater characteristics for the treatment portion of the District's WWTP after completion of the Phase B2 project are presented in **Table 5-1**. The Phase B2 increase in flow capacity of 0.14 Mgal/d is designed to reliably and conservatively serve 480 EDUs of new development in San Andreas. Specific Phase B2 improvements to the WWTP are itemized in **Table 5-3**, and have an engineering planning level cost estimate of $3,236,000 (ENR CCI, November 2015, 10092). A layout of how these improvements integrate into the Phase A/B1 WWTP (with necessary upgrades) is shown in **Figure 2-3**.

Besides the **Table 5-3** cost, the Phase B2 developers also need to pay 1) their pro rata share of wastewater collection, treatment, and disposal facilities that they will use that already exist (including the Phase A upgrade improvements and Phase B1 improvements which should be built prior to Phase B2), and 2) any collection system modifications necessary to serve the specific Phase B2 developments being proposed. The monetary value of Phase B2's pro rata share of existing facilities should be determined by a specific connection fee and rate study. This study should assess the value of existing facilities (including the proposed Phase A upgrades and Phase B1 improvements) used by Phase B2 developments and determine how much of that value has already been paid for, and how much of that value is still being paid for by the debt service component of current District monthly sewer use fees. Because the District's objective has been to have one flat rate monthly residential sewer use fee, the Phase B2 EDUs will be paying the same debt service component as existing users. The present worth of the new EDUs debt service for existing facilities could be 1) subtracted from the total, upfront fee paid by the developers of those EDUs for wastewater collection, treatment, and disposal services, or 2) not subtracted from the total, depending on input from the District's legal counsel. If the present worth sum is not subtracted, then this portion of the developer's up-front fee would be held as a "bond/guarantee" for payment of the on-going necessary maintenance fees for the Phase B2 capacity created for Phase B2 developer use, as discussed in the Phase B1 improvements section. As will be shown by the connection fee and rate study, the present worth of remaining debt service payments by the existing constituency will depend on when the Phase B2 improvements are built.