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Prepared for
Napa Sanitation District

Wastewater Treatment Plant Master Plan

April 2011

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April 29, 2011

Timothy B. Healy P.E.
General Manager/District Engineer
Napa Sanitation District
935 Hartle Court
Napa, California 94558 137280-001

Subject: Wastewater Treatment Plant Master Plan

Dear Mr. Healy:

In partial completion of the Napa Sanitation District (District) authorization to prepare a master plan (Plan) for the District's wastewater treatment plant, the Brown and Caldwell/Carollo Engineers team is pleased to submit the accompanying Plan. We wish to express our appreciation to the District Board and staff for their guidance and assistance in preparing the Plan.

Please contact us with any questions.

Very truly yours,

BROWN AND CALDWELL

Linda Sawyer, PhD, P.E.
Project Manager

Rick L. Chan, P.E.
Deputy Project Manager

LS:ddt

cc: William K. Faisst, PhD P.E.

Attachments (1)

FINAL

WASTEWATER TREATMENT PLANT MASTER PLAN

Prepared for
Napa Sanitation District
April 2011

WASTEWATER TREATMENT PLANT MASTER PLAN

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Napa Sanitation District
April 2011

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PROJECT TEAM

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Mark Luce, Vice Chairperson
Charles Gravett, Director
Mark van Gorder, Director
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Keith Caldwell, Alternate Director
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ABSTRACT

The Napa Sanitation District (District) has prepared a Master Plan (Plan) for its Wastewater Treatment Plant (WWTP). The Plan includes a review of WWTP performance, process optimization, identification and rectification of existing deficiencies, and defines a cost-effective path for the planning period (next 20 years). The Plan growth projections match the growth projections in the 2007 Collection System Master Plan (CSMP). The planning period is through 2030. The growth projections are consistent with the City of Napa General Plan (as amended August 12, 2003) and the 1994 Napa County General Plan (as amended) and information from the General Plan Update process as it was in progress in 2007. During the planning period, average dry weather flows are projected to increase from approximately 6.8 million gallons per day (mgd) to 8.6 mgd.

Major requirements to meet District levels of service through 2030 include:

- Meeting the demands for projected growth.
- Upgrading the WWTP for future, potentially more stringent regulations.
- Possibly expanding the District's water recycling program.
- Rehabilitating and replacing aging facilities and infrastructure.

Using a rigorous business case evaluation approach (methodology for comparing and ranking alternatives), the District developed and screened numerous alternatives for both its liquid and solids treatment systems, and selected a recommended alternative. The recommended alternative would discharge effluent to satisfy requirements in the 2011 National Pollutant Discharge Elimination System Permit and produce up to 12 mgd of recycled water. The corresponding capital improvement program (CIP) for the recommended alternative is about $61 million. The influent pump station project, activated sludge capacity expansion, recycled water production capacity expansion, and second sludge digester project account for 90 percent of the total CIP cost. The Plan also presents the "trigger points" (capacity limits or demand requirements) that define when the District needs to modify existing or add new facilities, combined with the lead time required for implementing each change. Several larger projects in the CIP will need to be implemented within the first five years of the planning period, especially if the District needs to expand its capacity to deliver recycled water above the current capacity of 5.1 mgd.

The District has also developed costs for "add-on" projects that could be implemented in addition to the base projects identified in the CIP. These projects reflect additional improvements needed if future effluent ammonia nitrogen limits are lower (current limit of 21 milligrams per liter [mg/L], possibly decreasing to as low as 10 mg/L), or if the peak day recycled water demand requires implementing additional production capacity up to 14 mgd. The total cost for the add-on projects is about $21 million. Revised regulations and actual recycled water demand will drive timing for these improvements.

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FREQUENTLY ASKED QUESTIONS

Napa Sanitation District (District) has prepared this Wastewater Treatment Plant (WWTP) Master Plan (Plan) to determine the capacity of existing facilities; estimate future loads and regulation impacts; and develop a recommended plan for upgrading existing facilities, optimizing their operation and expanding capacity. The Plan growth projections match the growth projections in the 2007 Collection System Master Plan (CSMP). The planning period is through 2030. The growth projections are consistent with the City of Napa General Plan (as amended August 12, 2003) and the 1994 Napa County General Plan (as amended) and information from the General Plan Update process as it was in progress in 2007. This section presents frequently asked questions (FAQs) and answers regarding the District WWTP, effluent disposal system and effluent recycling facilities. The FAQs are grouped into major topical categories for easier reference.

Existing Wastewater Treatment Capacity

Q: What is the capacity of the existing WWTP?

A: Existing facilities can treat the wastewater from about 38,500 equivalent single-family dwellings, also known as equivalent dwelling units (EDUs).

Q: How many additional EDUs can the District connect to the WWTP before any major expansion or upgrades are required?

A: Under the most conservative assumptions, the District can connect about 200 new EDUs without any major expansion or upgrades. With minor modifications, the District could connect more EDUs while it implements upgrades to increase capacity.

Q: How could the District most rapidly expand treatment capacity to connect more EDUs? How many more EDUs and at what cost?

A: One option is to install more pond aerators and increase capacity by about 5,600 EDUs, at a cost of about $2.2 million.

Q: Is there a difference between wet weather and dry weather capacity for the WWTP?

A: Yes. The WWTP treats substantially higher flows in wet weather, approaching 60 million gallons per day (mgd) vs. about 7 mgd during dry weather. For the wet weather flows, the District needs to upgrade the Influent Pump Station to improve its reliability.

Required Improvements for Increased Wastewater Treatment Capacity

Q: What major capital projects must the District build to increase WWTP capacity?

A: Over the next 20 years, the District needs to expand the influent pump station, add activated sludge treatment capacity, expand recycled water production facilities, and complete the second egg-shaped digester to accommodate more biosolids.

Q: How long will such improvements take to implement?

A: Implementing new projects will take about one to four years, depending on project size and complexity. The District will incorporate the new projects into its Capital Improvement Plan (CIP).

Q: What will the improvements cost?

A: The projected CIP includes about $61 million in modifications and upgrades spread over the next 20 years. Table FAQ-1 presents a summary of projects, costs and completion dates. A dozen smaller projects would make up about $6 million of the CIP.

Table FAQ-1. Project Implementation Summary

Project	Capital Cost (2010 Million $)	Project Completion Date
Pond Improvements – Phase 2	2.8	2013
Increase Pond Aeration (Add 125 hp)	2.2	2013
Influent Pump Station Expansion	15.5	2015
Phase 1 Recycled Water Expansion	13.9	2015
Complete Egg-Shaped Digester	11.4	2023
Aeration Basin Expansion	4.2	2025
Phase 2 Recycled Water Expansion	4.9	Not determined
Miscellaneous Smaller Projects	6.4	Varies
Base Project Total	**61.3**	

Q: Are other improvements recommended in addition to those for capacity?

A: Yes. Improvements such as upgraded process equipment and controls are recommended to increase WWTP reliability, to upgrade aging equipment, and to make the WWTP easier to operate.

Permit Compliance

Q: When can the District discharge treated water to the Napa River?

A: The District's operating permit from the Regional Water Quality Control Board, San Francisco Bay Region (SFRWQCB) allows discharge without a limit on flow rate between November 1 and April 30. Normally the District either recycles or stores water during the summer period. Rarely, in response to late rains and cooler weather, the District must discharge effluent as an emergency discharge between May 1 and October 31 (when

regular discharge to the river is prohibited). If such an emergency discharge is required, the District must notify SFRWQCB.

Q: When the District discharges to the Napa River, does the discharge meet permit limits?

A: Yes.

Q: What additional, more stringent permit limits might the District face in the future, and will the WWTP discharge meet those requirements?

A: Since neither the United States Environmental Protection Agency (USEPA) nor SFRWQCB has decided on which constituents to regulate in future permits and to what limits, the Plan does not address predicted requirements. The District will address future requirements when regulators request a response. The WWTP infrastructure can accommodate more advanced treatment by modifying existing facilities or adding new facilities. The District would do so without stranding assets (losing the value of existing investments).

Q: Does the Plan address chemicals of emerging concern (CEC) such as pharmaceuticals and personal care products?

A: Since neither USEPA nor the State has decided which CEC are more important, nor have they established numerical limitations for such constituents, the Plan does not address CEC. The District will address CEC when the regulators request a response.

Recycled Water Program and Capacity

Q: What quality water does the District deliver to its recycled water customers?

A: Recycled water from the WWTP meets all State requirements for irrigation and body contact, sometimes referred to in California as Title 22 Unrestricted Use water.

Q: How much recycled water can the District produce and deliver now?

A: With existing facilities, about 1,800 acre-feet (AF) in a typical year.

Q: How quickly can the District expand its facilities to maximize recycled water production?

A: Implementation time would be two to four years to increase capacity up to 3,700 AF for current flows into the WWTP.

Q: What is the maximum quantity of recycled water the District could produce?

A: With expanded facilities and increased future wastewater flows, about 4,500 AF in a typical year.

Q: Can the District recycle all the wastewater that the WWTP receives?

A: No, not with existing facilities. The District receives its highest flows in the winter when it has very little or no demand for recycled water, and it has inadequate storage to carry over the wet weather flows so that it can recycle them when demands are greater.

Q: Are there plans to expand the recycled water treatment system? What is the timeline for expansion?

A: The Plan presents projects to expand the treatment system over the next 20 years if the demand for recycled water increases.

Q: Are there plans to expand the recycled water distribution system, and what areas will be served?

A: The District's separate Recycled Water Strategic Plan addresses expanding the distribution system to serve new customers.

Capital Improvement Program

Q: How large is the CIP for the next 20 years?

A: The projected CIP includes about $61 million in WWTP modifications and upgrades spread over the next 20 years.

Q: How will the District fund new projects?

A: The District will cover these costs using both capacity charges and sewer service charges, in a manner equitable to its existing and new customers. Projects may also be financed through the use of long-term debt.

Sustainability and Greenhouse Gas Emissions

Q: Can the District accept FOG (fats, oils and grease), food wastes and winery wastes?

A: The District is designing new facilities to accept FOG to produce methane so that it can be converted to energy to run the WWTP using the existing digestion and cogeneration systems. The District does not plan to accept food wastes now. The District is considering accepting trucked-in winery wastes for treatment in the District's pond system. It is not recommended that the District accept winery waste into the ponds until the pond aeration improvements are implemented.

Q: Does the Plan recommend new facilities to increase the WWTP's energy efficiency?

A: Yes. The Plan incorporates several recommendations from the recent WWTP Energy Alternatives Study into the overall CIP. The WWTP digests waste sludge to produce biogas that the District converts to electrical energy to offset its electrical power needs. It also recovers waste heat through its cogeneration system to enhance sludge digestion and biogas production. Receiving FOG and converting it to energy will offset energy use and reduce the District's energy bill.

Q: Did the District study greenhouse gas (GHG) emissions and emissions reduction as part of the Plan?

A: No. The District's facilities have emissions that fall under current thresholds for GHG emissions inventories. Such requirements now only apply to very large emissions sources, such as major power plants, large wastewater treatment plants (e.g., East Bay Municipal Utility District and the City of Los Angeles), and oil refineries.

Q: Does the Plan address ways to use algae harvested from the ponds beneficially?

A: No. The quantity of algae available from the ponds is too small to justify conversion to fuel or similar beneficial products based on currently available technology. The District does, however, apply algae in solids harvested from the ponds to its ranches, where algae nutrient value is used.

Master Plan – General

Q: Does the Plan alter or recommend altering the District service area?

A: No.

Q: What documents did the District use to estimate future growth?

A: The District based the Plan on the City General Plan (as amended August 12, 2003) and 1994 County General Plan (as amended) and information from the General Plan Update process as it was in progress in 2007.

Q: How often does the District prepare a WWTP master plan?

A: In general, the Plan looks at a 20-year planning period. The last Plan update was prepared in 1990.

Q: To implement the Plan, what must the District do to comply with the California Environmental Quality Act (CEQA)?

A: Approving the Plan is not a project under CEQA. As the District implements projects from the Plan, it will complete appropriate CEQA review as needed for each project. No physical changes to the environment from the projects will occur without required CEQA compliance.

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TECHNICAL SUMMARY

In early 2009, Napa Sanitation District (District) engaged the consulting team of Brown and Caldwell and Carollo Engineers, under program management direction from HDR, to prepare a Master Plan (Plan) for the District's Wastewater Treatment Plant (WWTP). The Plan includes WWTP performance, optimization, identification and rectification of existing deficiencies, and defines a cost-effective path for the next 20 years. This planning period, and related information on such items as population and commercial growth, is consistent with the City of Napa General Plan (as amended August 12, 2003) and the 1994 Napa County General Plan (as amended) and information from the General Plan Update process as it was in progress in 2007. Major requirements through 2030 include:

- Delivering services for projected growth
- Understanding how the WWTP could be upgraded for future, potentially more stringent regulations
- Possibly expanding the District's water recycling program
- Rehabilitating and replacing aging facilities and infrastructure

Goals

The primary Plan goal is to provide adequate wastewater treatment capacity through 2030, based on meeting District-defined levels of service (LOS) at the lowest practical cost. LOS are the District's commitments to its customers regarding the quality of the services that it will provide. The Plan assumes that permit requirements from the 2010 permit renewal cycle (adopted in February 2011) will apply throughout that 20-year planning period; however, the Plan does present limited evaluation of, and recommendations for, the most likely change in requirements beyond 2010 (i.e., ammonia removal prior to river discharge), but does not consider more stringent trace constituent removal. In addition, the Plan considered expanding the secondary treatment system to accommodate capacity needs (projected growth and possible expansion in recycled water demands).

Additional key Plan goals include:

- Determining current treatment capacity and existing facility condition.
- Identifying unit processes' useful lifetime, redundancy requirements and any expansion needs.
- Identifying and analyzing alternatives to meet future capacity needs by using a business case evaluation (BCE) process (methodology for comparing and ranking alternatives) and selecting a preferred alternative.

- Generating a prioritized phased Capital Improvement Program (CIP) with key parameters and decision points to trigger project implementation. Trigger charts provide an approximate time required to design, bid, construct and start new facilities.

Planning Basis

The Plan uses population projections and commercial growth estimates based on the Collection System Master Plan prepared by Winzler & Kelly (2007). CSMP based its projections on anticipated development provided by City and County planners. Projections are consistent with the City of Napa General Plan (as amended August 12, 2003) and the 1994 Napa County General Plan (as amended) and information from the General Plan Update process as it was in progress in 2007. These projections were used to derive likely future flows and loadings. Current and 2030 flows are as follows, with flows in million gallons per day (mgd):

- Average Dry Weather Flow (ADWF): 6.8 mgd vs. 8.6 mgd
- Peak Dry Weather Flow: 12.2 mgd vs. 15.4 mgd
- Un-attenuated Peak Hour Wet Weather Flow (PHWWF): 86.4 mgd vs. 89.9 mgd

The collection system has conveyance capacity constraints that limit the peak flow received at the WWTP; thus, the immediate firm capacity requirement is 60 mgd. Depending on the results of the District's I/I reduction efforts and collection system upgrades, the firm capacity might need to be increased to handle as much as 90 mgd as stated in the Collection System Master Plan. This Plan is based on a 60-mgd firm capacity, with provisions to expand if necessary. Organic, solid and nutrient loadings are projected to increase in proportion to increasing flows; thus, pollutant concentrations (e.g., biochemical oxygen demand [BOD], total suspended solids [TSS] and ammonia) would essentially remain constant, and equal to current concentrations, over the planning horizon.

A water balance model was developed to model climatic variations effecting evaporation and irrigation and better project recycled water demands. Modeling predicted irrigation water deficits in dry years and emergency discharges in wet years. Varying irrigation on District-controlled lands would reduce, but does not eliminate, the need for emergency discharges. Using the currently available storage in the oxidation ponds and varying District land irrigation, the District could supply an average of 3,700 acre-feet (AF) of water while limiting emergency discharges to approximately once in nine years. With increased WWTP influent flows, the District could increase recycled water supply to an average of 4,500 AF, but emergency discharges would occur more than every two years. For either of these median year recycled water delivery volumes, the District would need to curtail its recycled water deliveries about once in 10 years, somewhat owing to drier conditions. Additional water can be supplied during the winter months. To supply 1,800 AF during the off-season, water deliveries must begin by November 1 and continue through the winter.

Current Conditions and Capacity Limitations

The Plan includes a comprehensive analysis of current WWTP capacity. There are several key capacity limitations:

- Influent pumping station firm capacity (25.0 mgd) is significantly less than current peak hour flows (60 mgd).
- BOD loading capacity is limited under worst winter weather conditions to an annual average loading of 18,500 pounds per day (lb/day) of BOD (approximately 6.8 mgd ADWF), which is equivalent to the loading from about 38,500 equivalent single-family dwelling units, also known as equivalent dwelling units (EDUs). Total loading currently is about 38,300 EDUs.
- Winter river discharge capacity is limited to 20.7 mgd (approximately 7.1 mgd ADWF).
- Recycled water production is limited by filtration capacity to 5.1 mgd.
- Solids handling facilities are limited by anaerobic digestion with the capacity to treat solids from an ADWF of 7.5 mgd.

Development and Evaluation of Alternatives

Using a rigorous BCE approach and sensitivity analysis, the District developed and screened alternatives for both its liquid (six) and solids (three) systems and selected a recommended project. For the liquid treatment system, three alternatives that would produce effluent with a higher ammonia nitrogen concentration (45 milligrams per liter [mg/L] monthly average) and three alternatives that would produce a lower effluent ammonia nitrogen concentration (10 mg/L monthly average) were carried forward for detailed analyses. Adoption of the new permit obviates the need for the District to pursue any lower ammonia alternatives now, so those alternatives are not discussed in this Technical Summary. All alternatives meet the District developed core LOS. For all alternatives, the ponds could treat diluted winery wastes received in the summer and fall. Table TS-1 summarizes the major components for the high ammonia alternatives.

Table TS-1. Major New Components of High Ammonia Alternatives

Improvement	Alternative			Comments
	H1	H2	H3	
Add additional aerators (hp)	125	200	200	Located on Ponds 1 and 2
Add aeration basin volume to activated sludge biological treatment system (MG)	0.66	--	--	Piped ahead of Aeration Basins 1 and 2
Add AS effluent equalization prior to effluent filtration (MG)	1.3	1.3	1.3	Located ahead of effluent filters
Add effluent equalization basin pump station to transfer equalized activated sludge effluent into the effluent filters (mgd)	8	7	--	Located ahead of effluent filters
Expand continuous backwash filters with additional capacity (sf)	1,400	1,200	1,200	
Add pond transfer pump station to move pond water into new basin with floating covers (mgd)	--	--	16	At lower pond levels, transfers pond water into new covered storage for algae removal
Add floating covers to control algae in pond effluent (acres)	--	--	40	Constructed as two cells at the east end of Pond 4

Notes:
Horsepower (hp), million gallon (MG), million gallons per day (mgd), square foot (sf)
Selected alternative is shaded.

Preliminary work also identified three solids treatment alternatives for detailed evaluation. All the alternatives meet the core LOS. Table TS-2 summarizes the solids alternatives.

Table TS-2. Major New Components for Solids Alternatives

Alternative	Key Components
S1- Add Conventional Digester	• A 1.36-MG conventional digester with associated heating and mixing equipment. • A 300-gpm pump station to transfer digested sludge from conventional digester to the half-egg-shaped digester • An extended tunnel system that connects to the new digester
S2- Finish Second Egg-Shaped Digester **(Selected alternative)**	• Convert the existing half-egg-shaped digester to a complete unit with associated heating and mixing equipment. • Add a digested sludge and gas storage tank with a total volume of 0.35 MG. • Extend the tunnel system to the new digester.
S3- Covered Anaerobic Lagoon	• Create seven acres (in four cells) of covered anaerobic lagoon (13 MG total volume) in Pond 1

Notes:
Selected alternative is shaded.

A comprehensive BCE alternatives comparison included developing capital and life-cycle costs for all nine alternatives and using a pair-wise evaluation approach that considered economic and non-economic factors. Table TS-3 presents the weighting factors used for the comparison. The analyses also included sensitivity analyses to determine if the relative alternatives ranking changed if the District applied different weighting factors. The most attractive alternatives were H1 and S2. The sensitivity analyses maintained the relative ranking except for the high ammonia

alternatives when the relative weighting for sustainability was increased to 40 percent, in which case H3 ranked higher than H1. Such a weighting is unreasonable relative to the importance of cost to the District and its rate payers.

Table TS-3. Major Selection Criteria Scoring Weight

Major Criteria	Weight, percentage
Life-cycle cost	40
Confidence: Operability, performance and future regulations	35
Sustainability: Energy, chemical, and greenhouse gases	10
Acceptance of winery waste	5
Acceptance of non-traditional wastes	5
Water recycling benefits	5

Recommended Project, Trigger Points and Capital Improvement Plan

The recommended project uses all major facilities in the existing WWTP. It would gain capacity for growth and increased recycled water demand by expanding existing unit processes. Additionally, expected future improvements would strand no investment in existing or new facilities. The Plan presents the "trigger points" (capacity limits or demand requirements) that define when the District needs modified or new facilities, combined with the lead time required for implementing each change. The corresponding CIP is $61.3 million. Table TS-4 presents a summary of proposed projects. Influent pumping, activated sludge capacity expansion, pond improvements, pond capacity expansion, recycled water production capacity, and a second sludge digester make up about 90 percent of the CIP; 12 smaller projects comprise the remainder. Table TS-4 also shows the estimated implementation time and projected completion date. For the projects, existing deficiency or capacity needs drive implementation. The Plan also describes and develops costs for three projects that the District could implement to further increase recycled water production, decrease effluent ammonia concentrations should regulations become stricter, and enhance its facilities for competing maintenance activities with District resources by constructing a new maintenance building.

Table TS-4. Base Project Implementation Summary

Project	Capital Cost Million $[1]	Trigger to Begin Predesign	Permitting, Design and Construction Duration, months	Priority[2]	Project Completion Date
Flocculating Clarifier Weirs	0.6	ADWF of 6.8 mgd (2011)	10	A	2012
Full-Scale Testing of Flocculating Clarifier Effluent to Activated Sludge	0.3	Peak day recycled water demand of 5.1 mgd and Phase 1 Recycled Water Expansion not on-line	NA	A	2012[3]
Purchase Spare Digester Mixer	0.4	Redundancy – start in 2011	10	A	2012
Increase Pond Aeration (Add 125 hp)	2.2	AA BOD Load of 18,700 lb/day (2011)	23	A	2013
Recycled Water Jockey Pump	0.2	Reduce maintenance - immediate (2011)	24	A	2013
Activated Sludge Diffuser Replacement	0.9	Condition/age - start in 2011 based on useful life of existing equipment	25	C	2013
Pond Improvements – Phase 1	0.1	Condition/age - immediate (2011)	25	C	2013[4]
Pond Improvements – Phase 2	2.8	Condition/age - immediate (2011)	25	A	2013[5]
Tertiary Treatment Improvements	1.1	Condition/operational enhancements - immediate (2011)	24	C	2013
3W System Improvements	0.3	Condition/operational enhancement - immediate (2011)	24	C	2013
Solids Handling Improvements	0.8	Operational enhancements – immediate (2011)	31	C	2014
IPS Expansion	15.5	PHWWF of 25.0 mgd (2011)	48	A	2015
Phase 1 Recycled Water Expansion	13.9	Four years before peak day recycled water demand exceeds 5.1 mgd (2011) or ADWF of 7.1 mgd (2014)	50	A	2015
Line Recycled Water Reservoir	0.2	Recycled water storage needs	23	C	2015
Headworks Improvements	1.2	Condition/age - start in 2014 based on useful life of existing equipment	25	C	2016
Primary Treatment Improvements	0.3	Operational enhancements - Start in 2014 in parallel with Headworks Improvements.	22	C	2016
Complete Egg-Shaped Digester	11.4	Maximum month sludge loading of 24,700 lb/day (approximately AA influent TSS loading of 20,500 lb/day) (2019)	46	B	2023
Aeration Basin Expansion	4.2	AA BOD loading of 20,200 lb/day (2021) or ADWF of 7.5 (2021)	40	B	2025[6]
Phase 2 Recycled Water Expansion	4.9	Four years before peak day recycled water demand exceeds 11.1 mgd	38	D	-[7]
Base Project Total	**61.3**				

[1] *Costs were determined for April 2010 for Napa, California, using the San Francisco ENRCCI (ENR construction cost index) of 9,730.*

[2] *Priority A indicates projects required to accommodate capacity by 2016, projects critical for reliability of WWTP operations, and projects expected to save significant maintenance cost. Priority B projects accommodate capacity increases after 2016. Priority C projects are mainly facilities condition/age related. Priority D projects are unscheduled.*

[3] *Testing will take approximately one year, so results could be available by 2012.*

[4] *Install transfer structures between Ponds 1 and 2.*

[5] *Install replacement aerators, remaining transfer structures and distribution piping. The District may choose to delay some parts of this project, to reduce early expenditures. Aerator replacement is most important.*

[6] *Triggered by AA BOD loading increase. River discharge capacity required in 2025.*

[7] *Project is triggered by peak day recycled water demand based on District plan to maximize recycled water delivery. Project timing will depend on recycled water demand.*

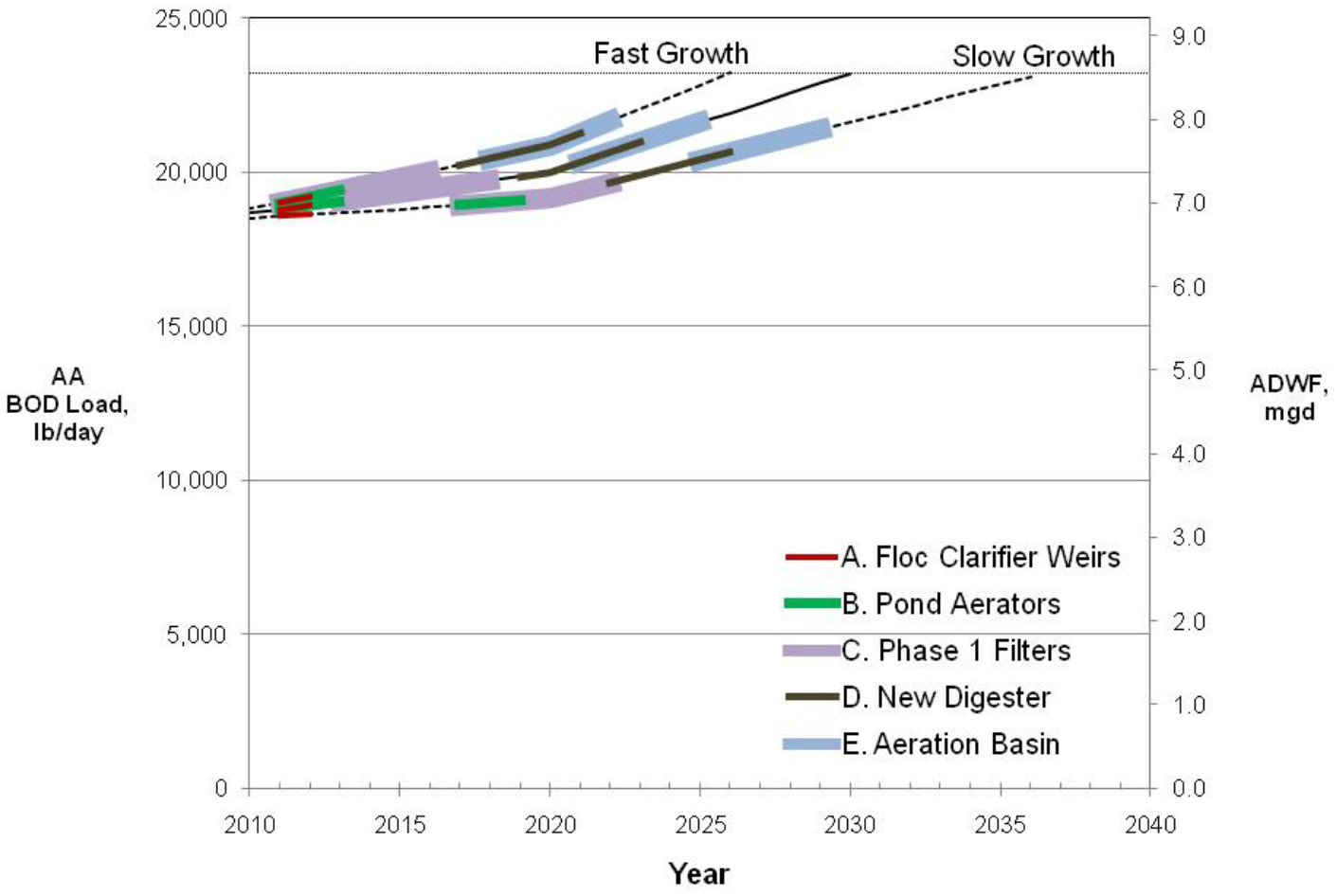
Sensitivity Analysis on Varying Growth Rates

A sensitivity analysis has been performed to clarify the impacts to the recommended CIP of development occurring at rates greater than and less than the Plan's base projected development rate. The results show how slower or faster growth rates would impact the phasing for major capital projects needed to increase the WWTP capacity and hence the CIP. This sensitivity analysis shows the base scenario that follows the population and growth assumptions developed for the Collection System Master Plan and carried over into the WWTP Plan. It also shows a slow growth scenario—150 fewer EDUs each year and a fast growth scenario—150 more EDUs each year. Table TS-5 and Figure TS-1 present the approximate start and completion dates for five major CIP projects for the three growth scenarios. Figure TS-1 also indicates the approximate duration for the major projects, with the duration rounded up to the nearest calendar year. With the slow growth rate the WWTP would reach capacity in about 2036 compared to about 2030 for the Plan growth rate, and about 2026 for the fast growth rate.

Table TS-5. WWTP Improvement Projects for Three Growth Scenarios

	Project	Projected Growth	High Growth (150 EDU per year more than projected)	Low Growth (150 EDU per year less than projected)	Capital Cost, Million $
A	Floc Clarifier Weirs	2011 – 2012	2011 – 2012	2011 – 2012	0.6
B	Pond Aerators	2011 – 2013	2011 – 2013	2017 – 2019	2.2
C	Phase 1 Filters	2013 – 2018	2011 – 2016	2017 – 2022	13.9
D	New Digester	2019 – 2023	2017 – 2021	2022 – 2026	11.4
E	Aeration Basin	2021 – 2025	2018 – 2022	2025 – 2029	4.2

Note: Project durations rounded up to whole years.. Figure TS-1 shows project durations.



TS-1. WWTP Improvement Projects for Three Growth Scenarios.

The figure shows project durations. Table TS-5 shows project start and completion dates.