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CITY OF SUNNYVALE

MASTER PLAN AND PRIMARY TREATMENT DESIGN

TECHNICAL MEMORANDUM

CIP IMPLEMENTATION (CAS):
MASTER PLAN

FINAL
March 2016

carollo in association with HDR

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CITY OF SUNNYVALE

MASTER PLAN AND PRIMARY TREATMENT DESIGN

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1.0 INTRODUCTION/SUMMARY

1.1 Introduction

The purpose of this technical memorandum (TM) is to summarize the proposed Capital Improvement Program (CIP) implementation for the City of Sunnyvale Water Pollution Control Plant (WPCP and Plant used interchangeably) for the WPCP Master Plan. Implementation of the CIP is the result of the evaluation and analysis described in the array of TMs developed in the Master Plan and assumes the secondary process expansion utilizes a conventional activated sludge (CAS) process. It describes projects, their schedules, costs, and linkages with other projects over the planning period defined as ultimate buildout or 2040±.

While it is reflective of the Master Plan, the CIP needs to be responsive to the various planning "driver" issues that could impact the timing of the implementation of each project included in the CIP. Therefore, it is recommended that the CIP be reviewed and updated annually and updates incorporated into the Master Plan as appropriate.

The CIP implementation plan was performed with staff input received at a December 4, 2014 workshop as well as numerous focused meetings on specific CIP-related topics. The key findings and recommendations included herein were developed based on Carollo's wastewater master planning experience and the input received from City staff and the program management consultant (PMC). The December 2014 workshop meeting minutes and presentation slides are included in Appendix A.

1.2 Summary

A CIP was developed for the Master Plan that identifies the capital projects required at the WPCP over the planning period through 2040±, but also identifies projects that would be more likely implemented beyond 2040± due to regulatory and growth uncertainties. The CIP project list was developed to respond to one of the following planning drivers: (1) rehabilitation and repair (R&R), (2) regulatory requirements, (3) improved performance/economic benefit, (4) increased flows and loads and (5) policy decision. In developing the overall implementation schedule for the WPCP, five major phases of improvements were identified. The project cost of implementing these five phases is summarized in Figure 1.

Site space has been reserved for several process upgrade projects which are dependent on future drivers (i.e., regulatory and policy) that are somewhat uncertain in scope and timing. These projects are anticipated to occur in the later stages of the planning period

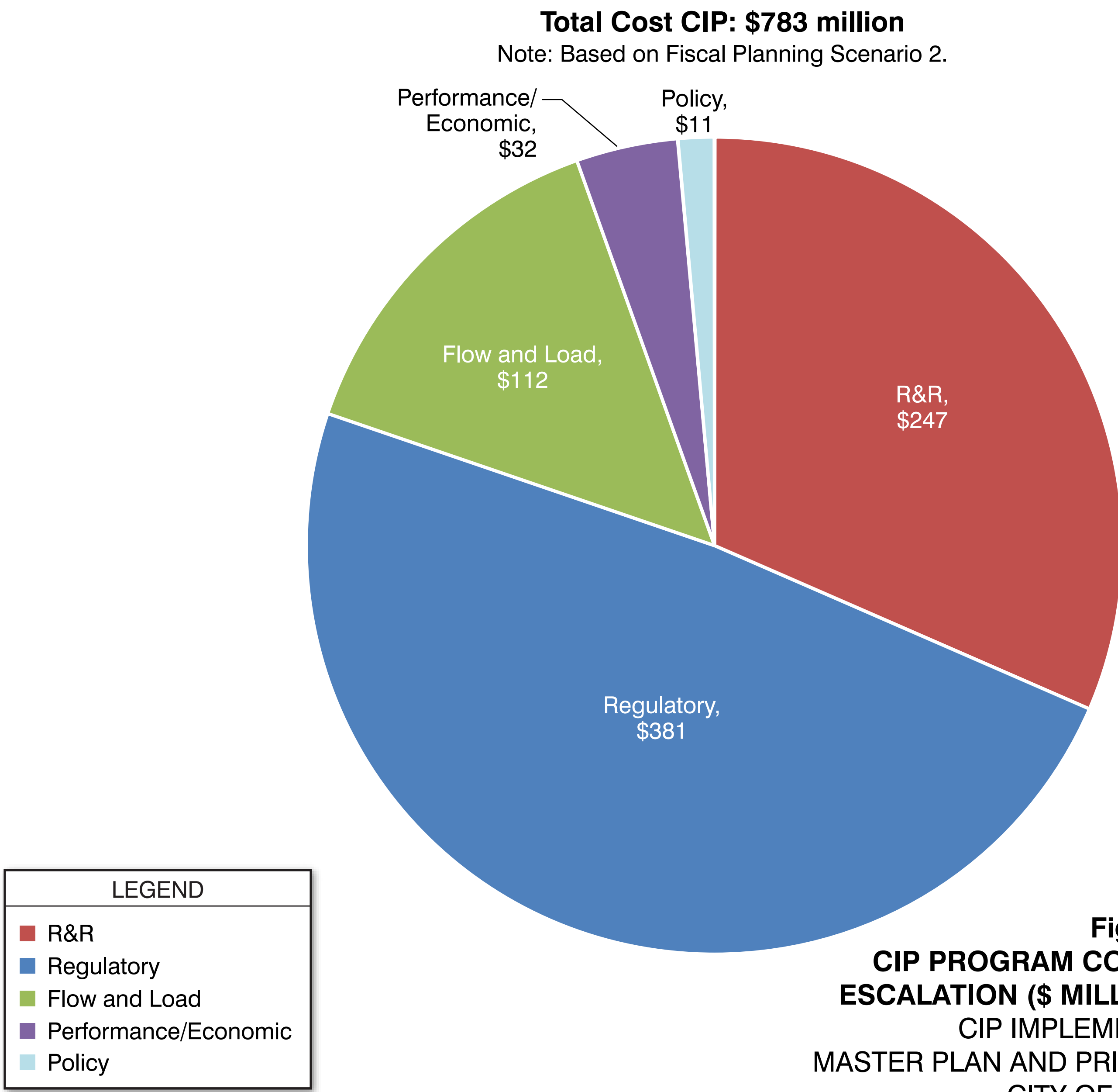

Figure 1
CIP PROGRAM COST AT TWO PERCENT ESCALATION ($ MILLION) – SPLIT FLOW CAS
CIP IMPLEMENTATION (CAS)
MASTER PLAN AND PRIMARY TREATMENT DESIGN
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(beyond 2035±), so the City will have to decide how to incorporate them into long-term financial planning scenarios. Three financial planning scenarios (fiscal scenarios) are presented in Appendix E. The City has tentatively decided to base their 20 year financial planning on Scenario 2, which assumes projects driven by phosphorus regulations, stringent nitrogen regulations (total effluent nitrogen concentration = 3± mg/L), and demand for high quality recycled water (requiring microfiltration) will not occur within the first 20 years of the planning period. The costs presented in Figure 1 are based on implementing Fiscal Planning Scenario 2.

Figure 2 presents the annual cash flow basis for the entire CIP based on the assumed implementation date for each project (Fiscal Planning Scenario 1). Project cost estimates were based on preliminary quantity takeoffs or vendor quotes, where available, to which estimating and construction contingencies are added, as well as additional program costs to the owner, namely engineering, legal, administrative, and construction management.

The CIP Summary Table presented in Appendix B includes a detailed list of all the CIP projects, along with their individual project cost and implementation schedule. The table was developed using the CIP model, which is a Microsoft Excel spreadsheet that is suitable for use by the City in future CIP planning. The CIP Implementation Schedule is presented in Appendix C. Individual project descriptions were prepared for each project and are included in Appendix D. Figures depicting the general site layout of the CIP projects are also included in Appendix D.

2.0 APPROACH TO DEVELOPING CIP

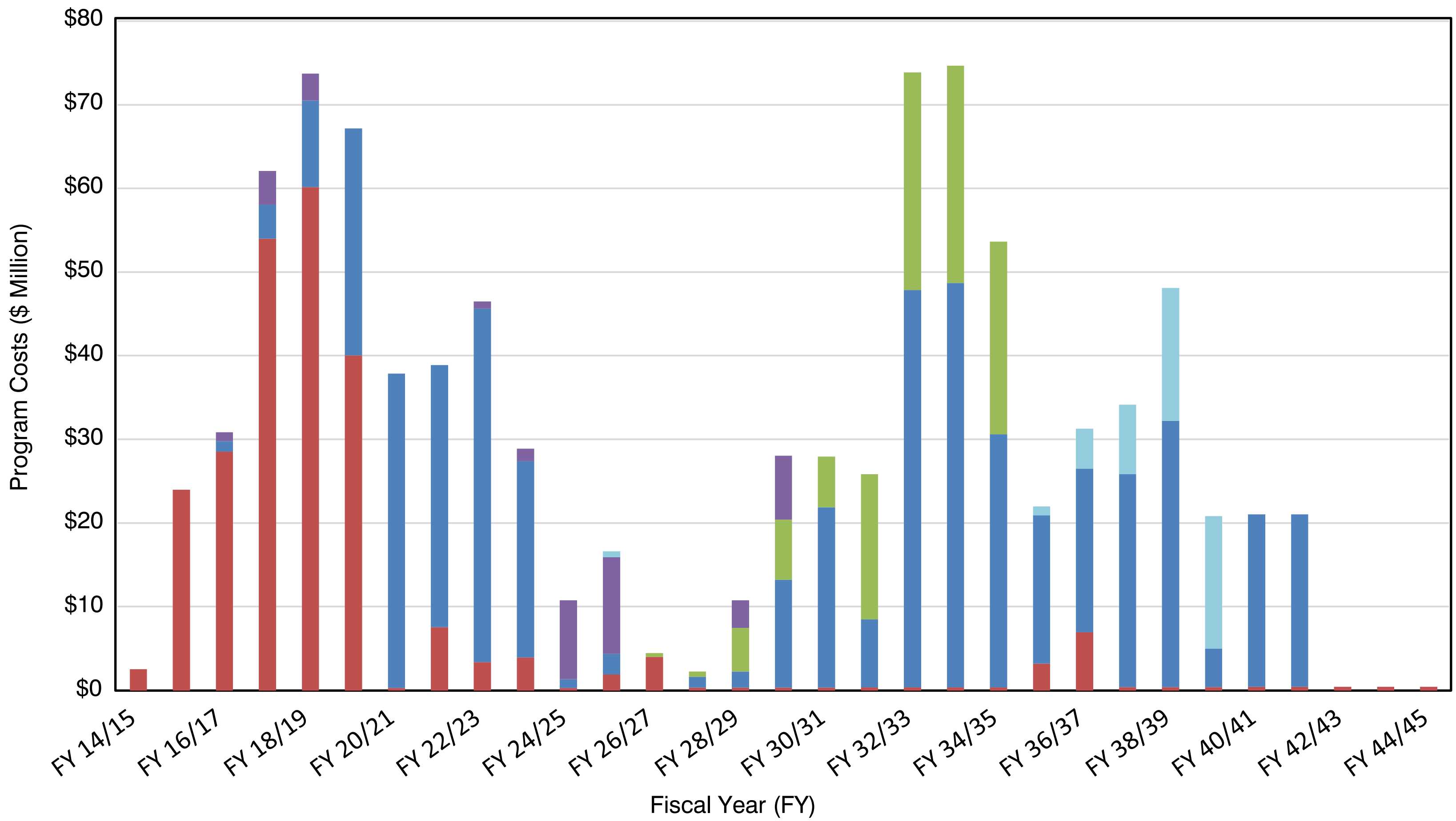
2.1 Project Drivers

Capital projects were identified and defined at a planning level in response to the drivers identified during the master planning process. These drivers can be grouped into six categories of potential drivers, and include the following:

1. **Condition (Rehabilitation/Replacement)** – A *condition driver* is assigned if the process or facility has reached the end of its economic useful life. This driver is established based on the need to maintain that process or facility as operationally sufficient to meet mission critical reliability and performance requirements.

2. **Regulatory Requirement** – A *regulatory driver* is assigned when the need is driven by local, state or national regulatory requirements.

3. **Improved Performance Benefit** – An improved *performance benefit/economic benefit driver* is assigned when there is a benefit in improved operations and maintenance performance related to overall reliability and/or reduced life cycle costs.



Note: Based on Fiscal Planning Scenario 1 (Includes All CIP projects).

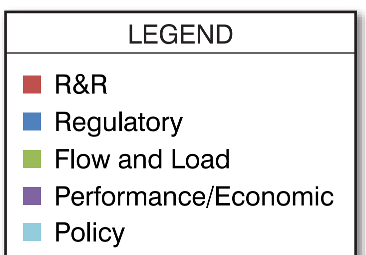


Figure 2
ANNUAL CIP PROGRAM COSTS AT TWO PERCENT ESCALATION – SPLIT FLOW CAS
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4. **Increased Flows/Loads** – An *increased flow and load driver* is assigned when the need is based on an increase in capacity to accommodate increases in flows or loads into the Plant.

5. **Policy Decision** – The *policy driver* is assigned when the reason is based on a management and/or political decision from the policy-makers.

2.2 Project Durations

The estimate of a project's duration is comprised of 1) a planning and design component, and 2) a construction/startup component.

A critical part of the planning and design component is demonstrating compliance with the California Environmental Quality Act (CEQA) requirements and other permitting requirements. An Environmental Impact Report (EIR) is being conducted for select projects as part of the Master Plan on a programmatic level and not on a project level.

- **Projects included in the Master Plan EIR.** These projects are not scheduled for implementation within the first five (5) years of the CIP. It is assumed that any additional CEQA compliance requirements for these projects would be performed concurrently with their design phases (i.e., no additional time allowance for this additional CEQA effort is needed).
- **Projects not included in the Master Plan EIR.** The CEQA requirements for CIP projects not included in the EIR, due to their nature are expected to be met through a categorically exemption or mitigated negative declaration process (as is currently practiced by the City). The planning and design duration allocations for these particular projects should be sufficiently long to accommodate the necessary CEQA requirements concurrent with their design (i.e., no additional time needs to be allocated to CEQA).

Part of the construction/startup component includes time for startup of the new facilities, which is assumed to be a 3 month period on average.

2.3 Implementation Schedule

The project drivers define not only the need for the project, but also implementation timing. The implementation timing, together with the estimated project duration, assigns each project a start and completion date. As discussed above, the implementation schedule for each of the listed CIP projects is shown schematically as Gantt charts in Appendix C. In developing the overall implementation schedule for the WPCP, five major phases of improvements were identified:

- Phase 1 – Headworks/Primary Sedimentation Tanks/Existing WPCP Rehabilitation.

- Phase 2 – Stage 1 of Activated Sludge Secondary Treatment Improvements/Administrations & Maintenance Buildings.
- Phase 3 – Process Support Facilities Upgrades.
- Phase 4 – Stage 2 of Activated Sludge Secondary Treatment Improvements.
- Phase 5 – Tertiary Treatment Upgrades.

The following implementation constraints were identified as part of developing the overall project timing:

- Constructability:
  - Contractor's access/coordination.
  - Contractor's site limitations on parking and laydown (limits the number of large contractors that can work on the site at the same time).
  - Project sequencing to accommodate for planned phasing of improvements.
- Staff Impacts:
  - Ongoing Operations and Maintenance (O&M) considerations (i.e., maintaining permit compliance, deliveries, shutdowns for maintenance).
  - Working/living space on the plant site (i.e., need to replace administrative and maintenance work space before existing facilities can be demolished).
- Cash flow impacts.
- Other projects near the WPCP (i.e., Santa Clara Valley Water District's flood control project).

Site space has been reserved for several process upgrade projects which are dependent on future drivers (i.e., regulatory). An example of these projects would include the following: (1) denitrification filters would replace the existing deep bed filtration system should nitrogen standards become very restrictive and (2) UV would replace sodium hypochlorite disinfection if chlorine byproduct requirements become more restrictive. These projects are anticipated to occur in the later stages of the planning period (beyond 2035±), so the City will have to decide how to incorporate them into long-term financial planning scenarios.

As discussed above, three financial planning scenarios (fiscal scenarios) are presented in Appendix E. The City has tentatively decided to base financial planning on Fiscal Planning Scenario 2, which assumes projects driven by phosphorus regulations, stringent nitrogen regulations (total effluent nitrogen concentration = 3± mg/L), and demand for high quality recycled water (requiring microfiltration) will not occur within the first 20 years of the planning period. As noted earlier, the costs presented in Figure 1 are based on implementing Fiscal Planning Scenario 2.

2.4 Project Linkages

The CIP implementation schedule was developed with the understanding that many projects are linked. The linkages would impact the implementation sequence of multiple projects. Depending on a particular project's position in the sequence, a change to the timing of one project would impact the timing of all the linked projects.

Some of these linkages may be quite complex, such as with the implementation of the biosolids transition projects. For example, the construction of the new administration and maintenance buildings are tied to two projects: (1) these two buildings require that public access be relocated from Carl Road to Caribbean Drive. However, the Santa Clara Valley Water District's flood improvements project must be completed to allow the relocation to occur and (2) certain of the clarifier improvements associated with the secondary expansion must be completed to allow the necessary access for construction of the administration and maintenance facilities.

The example illustrates that due to the linkages between many projects, changes to the driver for completion of a particular project may impact the implementation schedule of multiple projects. These linkages are identified in the project schedules included in Appendix C and are described at a high level in the project descriptions in Appendix D.

2.5 Fiscal vs. Calendar Year

The CIP reflects project implementation schedules, and includes an annual cash flow estimate associated with these schedules. While the implementation schedule is based on calendar years, the City's financial planning is based on a fiscal year basis. The City's fiscal year starts on July 1st and ends on June 30th of the following year, and the nomenclature followed is to name the fiscal year according to the first date of the year. For example, fiscal year 2020 would span the second half of 2020 and the first half of 2021.

To avoid confusion, and to have the implementation schedule consistent with the cash flow estimate, dates are shown as fiscal year 2020/2021 (FY 20/21). For example, FY 20/21 would represent the second half of 2020 through the first half of 2021.

2.6 Developing Project Cost Estimates

As noted in the Basis of Costs TM, the cost estimates presented in the Master Plan were developed using multiple methods and sources of information. Where available, quotes from equipment vendors were used in conjunction with preliminary quantity takeoffs to create a construction cost estimate. In addition, the cost curve approach for estimating (total cost versus process capacity curves developed from past City and other Carollo project cost data), was also used for some projects. In general, an estimating contingency of 15 percent is applied to account for uncertainties in the bidding environment. A construction contingency of 25 percent is added to cover possible change orders that are not included as part of the original estimated construction cost. (Note, different estimating and construction contingencies were applied for some projects as needed based on the method used to develop the estimate.)

Construction costs developed in this manner are then escalated to the approximate mid-point of project construction in order to get a better representation of future costs at time of construction. Calculating the escalation involves the use of the ENR Construction Cost Index (ENRCCI). The un-escalated costs presented herein are in 2015 dollars and are based on an ENR CCI of 11,155 (San Francisco, June 2015).

Subsequently, overall program related costs to the owner, such as engineering, legal, administrative, project contingencies, and construction management costs, are added to the construction costs to arrive at total project costs. For this master plan, a program cost multiplier of 1.42 was utilized as detailed in Table 1 and summarized in Appendix B.

**Table 1 Program Factor Applied to Construction Cost
Master Plan and Primary Treatment Design
City of Sunnyvale**

Item	Cost Factor
Engineering design	12%
Engineering costs during construction	3%
Third-party construction management fees	7%
Program management costs	7%
Environmental mitigation	1.5%
CEQA/permitting	0.5%
City costs	
City project management costs	1%
City legal/administrative costs/fees	0%
Construction change order allowance (construction contingency)	10%
Total Program Cost Factor	**42%**

2.7 Annual Project Cost Distribution: S-Curve

The project cost estimated for each of the CIP projects will typically not be expended in equal annual amounts over the project duration. Instead, the annual expenditure will typically be lower during the initial planning and design phases of the project, and then ramp up significantly during the construction phase of the project. When presented on a cumulative basis, the cash flow calculations are based on an S-Curve. Figure 3 includes an example S-curve. Appendix B includes the S-Curve values that were used to estimate annual expenditures of the CIP projects.

Unless specifically noted, this approach was applied to all the CIP projects with durations of up to 15 years.

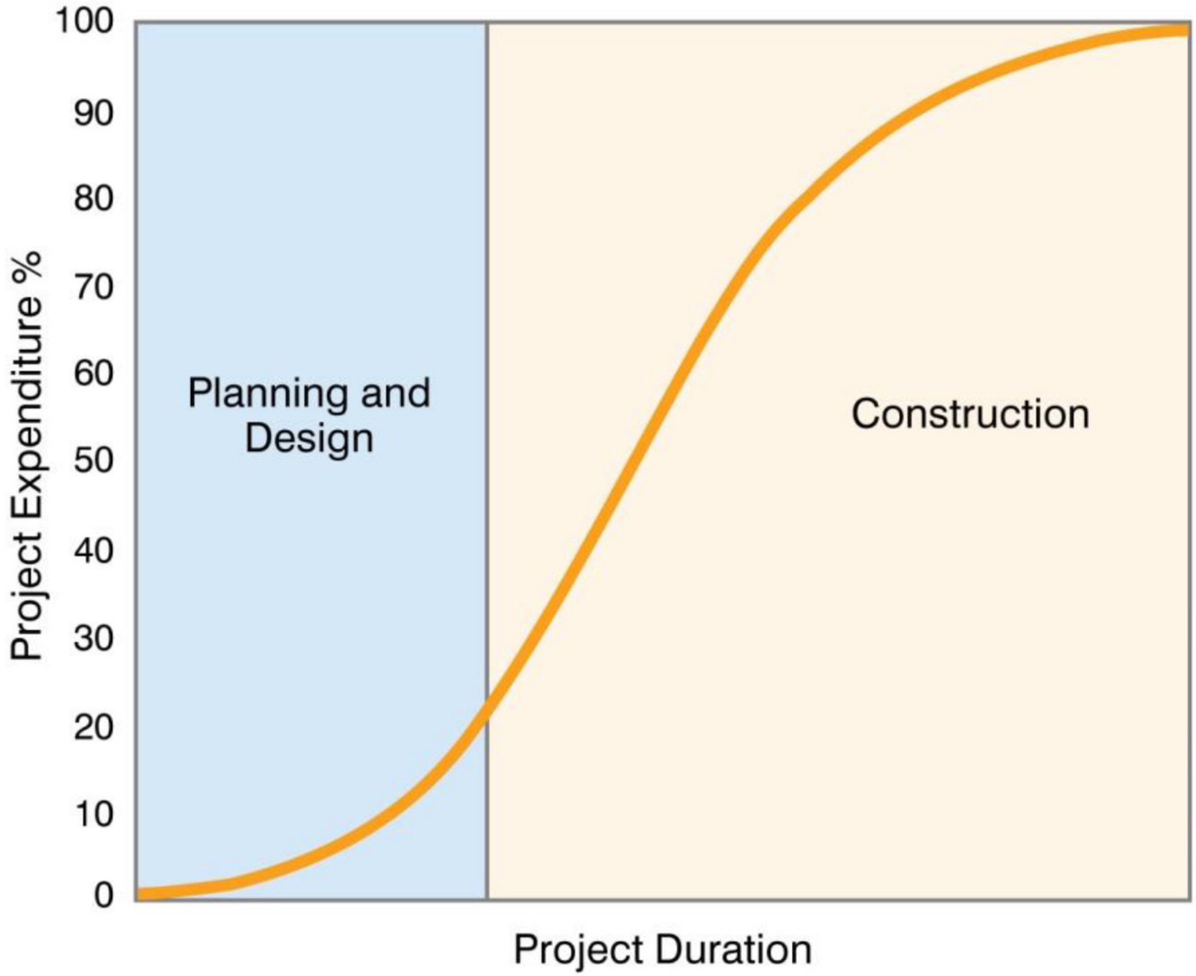

Figure 3
SCHEMATIC OF S-CURVE
DISTRIBUTION OF PROJECT COSTS
CIP IMPLEMENTATION (CAS)
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A modification to this approach is to follow the S-Curve distribution up to the start of the construction phase, at which point the entire remaining portion of the project cost estimate is encumbered. Some key components of the encumbered cash flow distribution are the following:

Engineering Design:	evenly distributed over design phase
Engineering Services During Construction (ESDC):	evenly distributed over construction phase
City Staff:	evenly distributed over both phases
Construction:	fully encumbered at start of construction phase

Depending on the calculation desired, either the S-Curve or custom cash flow mode of calculation can be selected on the CIP cash flow Excel spreadsheet.

2.8 Capital Replacement Costs

While the CIP defines projects anticipated over the master planning period, unforeseen projects cannot be avoided. This is especially true of large treatment plants with a heavy investment in conveyance and treatment infrastructure, and complex mechanical equipment. These unanticipated projects are often critical in nature requiring urgent attention from City staff. To enable these projects to be accommodated, the CIP includes a budgetary line item for these repairs, calculated as follows:

- The annual allocation for Unanticipated/Critical Repairs is based on one (1) percent of the average annual (un-escalated) project cost estimate of the entire CIP.
- Based on an un-escalated total CIP cost estimate of approximately $761 million, the average annual cost over the master planning period is approximately $260,000.
- Assuming $260,000 for 2015, the allocations have been calculated for each subsequent year assuming a two (2) percent escalation.

2.9 Community Improvements

An estimate for providing community improvements to the WPCP was based on an allowance of $400,000 established by the City.

3.0 DESCRIPTION OF MASTER PLAN CIP MODEL

As described above, the CIP Summary Table presented in Appendix B includes a detailed list of all the CIP projects, along with their individual project cost, implementation schedule, and annual cash flow. The table was developed using the CIP spreadsheet, which is a Microsoft Excel spreadsheet that is suitable for use by the City in future CIP planning. Information on how to use the CIP spreadsheet is included in Appendix F.

4.0 PROJECT DESCRIPTIONS

The project descriptions, drivers, and other details for each of the CIP projects are summarized in Appendix D. All unit costs, escalation factors, and assumptions are included in Appendix D.

5.0 APPROACH TO DEVELOPING O&M PROJECTIONS

O&M costs were developed for Sunnyvale's WPCP through the planning period, taking into consideration the impacts of the CIP on the treatment processes. For this analysis, O&M costs were comprised of three types of costs: 1) labor, 2) power, and 3) chemicals. No other O&M related costs were included in the analysis.

The O&M costs at the WPCP would typically be impacted by either an increase in the flows and loads and/or the specific O&M costs for certain CIP projects at the time they are implemented. Using unit costs and projected flows and loads, the baseline and process upgrade related O&M costs were projected over the master planning period. Figure 4 shows the unescalated annual O&M cost over the master planning period. Table 2 summarizes the cost projection for each major phase of the master plan. The impact of major CIP projects on the O&M costs is also described in Table 2. Detailed projections are presented in Appendix G.

The O&M cost impacts were developed using the following step-wise process:

Step 1: Establish baseline (i.e., current) costs for labor, power and chemical usage.

Step 2: Estimate projected labor, power and chemical demand by process area over the master planning period. Projections reflect changes in flow and load over the master planning period as well as that the O&M costs will change as certain CIP projects are implemented. It was assumed the CIP projects would be implemented as scheduled. It was assumed the O&M costs would increase proportionate to flow and load increases until a process change occurs due to a CIP project, at which time the O&M costs would change based on the process change.

Step 3: Escalate projected labor, power and chemical costs using assumed escalation factors.

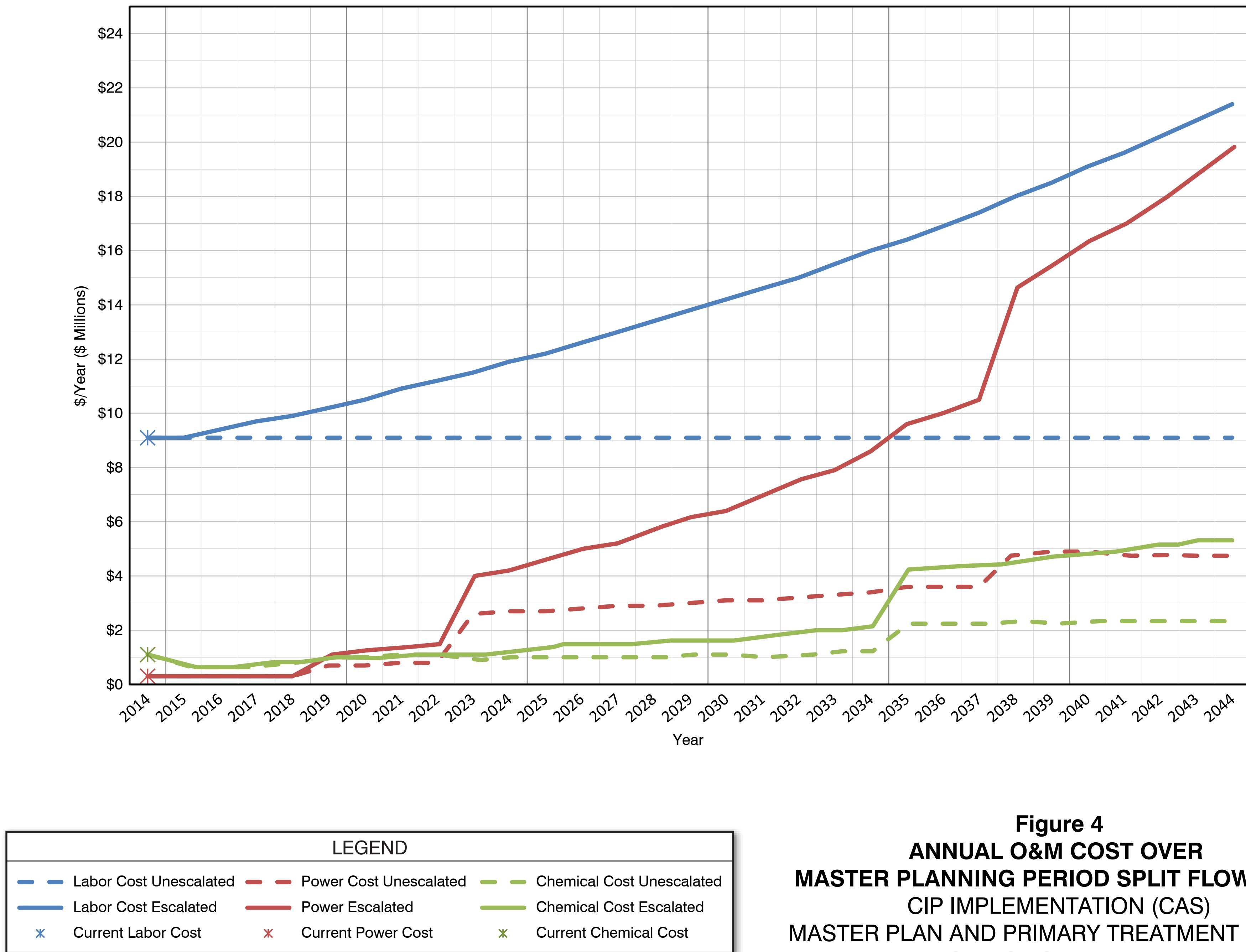

Figure 4
ANNUAL O&M COST OVER
MASTER PLANNING PERIOD SPLIT FLOW – CAS
CIP IMPLEMENTATION (CAS)
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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Table 2 **Summary of WPCP O&M Costs through Master Planning Period (Escalated) - Split Flow Master Plan and Primary Treatment Design City of Sunnyvale**

	Current	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Year	**2015**	**2019**	**2023±**	**2028±**	**2035±**	**> 2035±** [3]
Average Annual Flow, mgd	**15.2**	**16.2**	**17.3**	**18.6**	**20.4**	**20.4**
Annual O&M Cost (million)						
Labor[1]	$9.1	$10.2	$11.5	$13.4	$16.4	$19.1
Power[2]	$0.3	$1.1	$4.0	$5.7	$9.6	$16.3
Chemical[1]	$1.1	$0.9	$1.1	$1.6	$4.0	$4.7
Total	**$10.5**	**$12.2**	**$16.6**	**$20.7**	**$30.0**	**$40.1**
Major Process Change Impacting O&M Cost						
Primary		Primary Treatment Facility[4]				Chemical Phosphorus Removal[6]
Secondary			Secondary Treatment - Split Flow CAS Stage 1[4]		Secondary Treatment - Split Flow CAS Stage 2[4]	Chemical Phosphorus Removal[6]
Tertiary						• UV and Ozone Disinfection[5] • Microfiltration Facility[4] • Denitrification Filters[4]
Solids			Thickening/ Dewatering Stage 1[4]	• Digester No. 5[5] • Cogeneration Upgrade[7]	• Thickening/ Dewatering Stage 1[4] • Biosolids Post-Processing[5]	

Notes:

(1) Costs escalated 3 percent per year.
(2) Costs escalated 5 percent per year.
(3) Estimated costs for year 2040 shown.
(4) Power and chemical increase.
(5) Power increase.
(6) Chemical increase.
(7) No change.

5.1 Labor O&M Forecast

5.1.1 Baseline

In order to establish baseline labor costs, plant operations cost data from Fiscal year 2014/2015 were obtained and analyzed to establish the current annual labor cost.

5.1.2 Projection

Based on the findings of the Operations and Staffing TM, the size of the plant staff is projected to remain essentially the same over the master planning period. As a result, it was assumed the annual labor hours would remain the same over the master planning period. It was assumed labor costs would escalate at three percent per year. This escalation rate is the standard escalation rate used per the Master Plan Basis of Cost TM.

5.2 Power O&M Forecast

5.2.1 Baseline

In order to establish baseline power costs, existing power usage data was provided by plant staff. The WPCP is currently a net energy producer. The Power Generation Facility (PGF) produces an average of 1,200 kW. The power demand at the plant averages 1,050 - 1,150 kW.

Plant operations cost data from Fiscal year 2014/2015 were obtained and analyzed. It was determined that the current annual power cost is $300,000±. Although the WPCP is a net energy producer on an average basis, there are times during the year when the power demand exceeds the power produced by the PGF. At those times, the WPCP purchases power from Pacific Gas and Electric (PG&E).

The WPCP's average cost of power is estimated to be about $0.30/kilowatt-hour (kWh). In comparison, neighboring wastewater treatment plants of a similar size pay around $0.11/kWh. This average unit cost is comprised of a baseline fixed cost for power service and the cost per kilowatt hours of power used. Given the WPCP does not use much power from PG&E, the WPCP's average cost of power is higher than neighboring facilities. In addition to this, the WPCP currently purchases power from PG&E during peak power usage times. During these peak power usage periods, PG&E charges more per kilowatt hour.

5.2.2 Projection

To estimate the projected power usage, the power demand was estimated for each process area over the master planning period. The projected power demand was estimated based on the duty loads established for each process area as part of the Master Plan. (The duty loads for each process area are summarized in the Master Plan Basis of Design Report). Power demand was scaled by flow where appropriate.

It was assumed the PGF would continue to produce an average of 1,000 kW of power. This assumed power production was subtracted from the projected demand.

To estimate the projected power cost, the projected power demand was then multiplied by an assumed average cost of power. Based on the projected power demand, the amount of power purchased from PG&E will increase over the master planning period. As the power purchased from PG&E increases, the average cost of power is expected to decrease. For the purposes of this analysis, it was assumed the average cost of power would be about $0.20 kWh over the master planning period. The major process changes that will impact power usage and therefore the average cost of power, include:

- When the Primary Treatment Facility is implemented, the City would need to purchase a moderate amount of PG&E power on a regular basis.
- When the Secondary Treatment Improvements - Stage 1 are implemented, the City would need to purchase about four times the amount power it currently purchases from PG&E.
- When the Secondary Treatment Improvements - Stage 2 are implemented, the City would need to purchase about seven times the amount power it currently purchases from PG&E.

It was assumed power costs would escalate at five percent per year. This escalation rate is a typical escalation rate used by Carollo/HDR to project power costs in the SF Bay area.

5.3 Chemical O&M Forecast

5.3.1 Baseline

To establish the baseline chemical costs, current chemical usage was estimated based on information provided by plant staff (e.g., type of chemical, chemical dosage, frequency of chemical use, etc.). The unit costs established in the Master Plan Basis of Cost TM were used to estimate the current chemical cost.

5.3.2 Projection

To estimate the projected chemical cost, chemical dosages and associated costs were estimated for each process area over the master planning period. Assumptions are summarized in Table 3. See Appendix G for details.

It was assumed chemical costs would escalate at three percent per year. This escalation rate is the standard escalation rate used for the Master Plan per the Master Plan Basis of Cost TM.

Table 3 Summary of WPCP Chemical Usage through Master Planning Period - Split Flow Master Plan and Primary Treatment Design City of Sunnyvale

Year	Current 2015	Phase 1[1] 2019	Phase 2[2] 2023±	Phase 3 2026±	Phase 4[3] 2035±	Phase 5[4, 5] > 2035± [6]
Polymer - Chemically Enhanced Primary Treatment						
Continuous/Intermittent Operation	None	2 mo/yr	2 mo/yr	2 mo/yr	2 mo/yr	2 mo/yr
Usage, pounds per year	0	1,700	1,800	1,900	2,100	2,100
Process Change		Primary Treatment Facility Implemented - CEPT treatment required part of the year				
Polymer - Thickening						
Continuous/Intermittent Operation	None	None	Continuous	Continuous	Continuous	Continuous
Usage, pounds per year	0	0	33,000	36,000	41,000	41,000
Process Change			Secondary Treatment Improvements Implemented - Mechanical Thickening Starts			
Polymer - Dual Media Filters						
Continuous/Intermittent Operation	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Usage, pounds per year	46,000	50,000	53,000	28,000	31,000	31,000
Process Change	None					
Polymer - Dewatering						
Continuous/Intermittent Operation	None	None	Continuous	Continuous	Continuous	Continuous
Usage, pounds per year	0	0	114,000	121,000	132,000	132,000
Process Change			Secondary Treatment Improvements Implemented - Mechanical Dewatering			
Polymer - Air Flotation Tanks						
Continuous/Intermittent Operation	Continuous	Continuous	Continuous	Continuous	None	None
Usage, pounds per year	85,000	91,000	97,000	104,000	0	0
Process Change					AFTs fully replaced with CAS facilities	
Sodium Bisulfilte ($NaHSO_3$) - Dechlorination						
Continuous/Intermittent Operation	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Usage, pounds per year	360,000	388,000	416,000	450,000	448,000	448,000
Usage, gallons per year	142,000	153,000	163,000	177,000	176,000	176,000

Table 3 Summary of WPCP Chemical Usage through Master Planning Period - Split Flow
Master Plan and Primary Treatment Design
City of Sunnyvale

	Current	Phase 1(1)	Phase 2(2)	Phase 3	Phase 4(3)	Phase 5(4, 5)
Year	**2015**	**2019**	**2023±**	**2026±**	**2035±**	**> 2035± (6)**
Process Change	None					
Ferric Chloride ($FeCl_3$) - Chemically Enhanced Primary Treatment						
Continuous/Intermittent Operation	None	2 mo/yr	2 mo/yr	2 mo/yr	None	None
Usage, pounds per year	0	165,000	175,000	189,000	0	0
Usage, gallons per year	0	38,000	41,000	44,000	0	0
Process Change		Primary Treatment Facility Implemented - CEPT Treatment Required Part of The Year			Chemical phosphorus removal implemented. Additional ferric chloride for CEPT not required.	
Sodium Hypochlorite (NaOCl) - Disinfection						
Continuous/Intermittent Operation	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Usage, pounds per year	535,000	571,000	608,000	654,000	718,000	718,000
Usage, gallons per year	420,000	449,000	478,000	514,000	564,000	564,000
Process Change	None					
Ferric Chloride ($FeCl_3$) - Chemical Phosphorous Removal						
Continuous/Intermittent Operation	None	None	None	None	Continuous	Continuous
Usage, pounds per year	0	0	0	0	3,354,000	3,354,000
Usage, gallons per year	0	0	0	0	783,000	783,000
Process Change					Chemical Phosphorous Removal Implemented	
Methanol - Chemical Phosphorous Removal						
Continuous/Intermittent Operation	None	None	None	None	Continuous	Continuous
Usage, pounds per year	0	0	0	0	412,000	412,000
Usage, gallons per year	0	0	0	0	63,000	63,000
Process Change					Chemical Phosphorous Removal Implemented	

Table 3 Summary of WPCP Chemical Usage through Master Planning Period - Split Flow
Master Plan and Primary Treatment Design
City of Sunnyvale

	Current	Phase 1[1]	Phase 2[2]	Phase 3	Phase 4[3]	Phase 5[4, 5]
Year	**2015**	**2019**	**2023±**	**2026±**	**2035±**	**> 2035± [6]**

Notes.
(1) The Primary Treatment Facility is implemented. Polymer and ferric chloride usage at the primary sedimentation tanks (PSTs) begins for chemically enhanced primary treatment (CEPT) during wet weather flows.
(2) The Secondary Treatment - Stage 1 facilities are implemented. Secondary effluent water quality improves. As a result, the polymer dose at the air flotation tanks (AFTs) drops to 40% of the current polymer dose; and the polymer dose at the dual media filters (DMFs) drops to 50% of the current polymer dose. Polymer usage for mechanical thickening and dewatering begins.
(3) The Secondary Treatment - Stage 2 facilities are implemented. The AFTs are no longer used, so polymer usage at the AFTs ends. More WAS sludge is produced by the secondary treatment facilities, so polymer usage for mechanical thickening and dewatering increases.
(4) Chemical phosphorous removal is implemented. Ferric chloride is added at the primary sedimentation tanks (PSTs) to facilitate chemical phosphorous removal. Chemical phosphorus removal reduces the carbon in the aeration basins, so methanol is added at the aeration basins to facilitate nitrification.
(5) Membrane filtration costs are not shown, because it is assumed it is unlikely membrane filtration will be implemented.
(6) Estimated costs for year 2040 shown.

6.0 SUMMARY

This CIP spreadsheet was developed based on numerous discussions with a wide cross-section of WPCP staff. While it aims to identify projects at the WPCP over the next 30± plus years, there is greater knowledge of the projects required in the initial than later years. For that reason, it is recommended that the project drivers be re-evaluated annually and the spreadsheet updated to reflect any possible changes. The spreadsheet has already been used to develop the current 5-year CIP. It is anticipated that the spreadsheet would be routinely updated to facilitate the development of future CIPs.

APPENDIX A - DECEMBER 2014 CIP WORKSHOP MEETING MINUTES AND PRESENTATION SLIDES

Engineers...Working Wonders With Water™

CONFERENCE MEMORANDUM

Project:	Master Plan and Primary Treatment Design	**Conf. Date:**	December 4, 2014
Client:	City of Sunnyvale	**Issue Date:**	December 10, 2014
Location:			

Attendees:	**City:**	**PMC:**	**Carollo/ HDR/ Subconsultants:**
	Bryan Berdeen (BB)	Vanessa Asis (VA) (CDM)	Jamel Demir (JD)
	Craig Mobeck (CM)	Erin McGuire (EM) (CDM)	Jim Hagstrom (JH)
	Stephen Napier (SN)	Mike Oriol (MO) (B&V)	Katy Rogers (KR)
	Manuel Pineda (MP)	Dave Parry (DP) (CDM)	
	John Stufflebean (JS)	Sanjay Ready (SR) (B&V)	
	Bhavani Yerrapotu (BY)		

Purpose: CIP Implementation Workshop

Distribution: Attendees **File:** 9265A.00

Discussion:
The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

1. Approach to CIP Implementation

a. MP: When we go to council with the final MND for the Primary Treatment Facility, what action are we taking? CM: Just approval to proceed with final design.

b. Flood Protection

1) BY: We talked about sea level rise in the past. Where in the Master Plan is this discussed? JD: The Site Layout TM is being updated right now to address the sea level rise issues as well as riverine and tidal flooding issues. Based on the approach used at San Jose, Jill Hamilton said the City could address the sea level rise issue at a lower level of detail in the PEIR because there is a regional project (Army Corps/SCWVD) in the works. The City will get this updated TM in the next couple of weeks. BY: Melody Tovar has some items she is trying to address for the Climate Action Plan.

2) JD: We do not believe we have enough information for the City to proceed with a definitive plan for addressing sea level rise right now. Near-term, the master plan needs to address the impacts of riverine and tidal flooding (which is being updated as part of the updated Site Layout TM).

3) BY: There is a 2016 study for the conceptual study/design of the Alviso Section. The project is anticipated to be designed in 2017 and completed in 2025. Right now the alignment is south of the ponds, so our ponds are not connected.

4) JS: What is the elevation of the existing pond levees? JD: Ranges from elevation 108.0 to 110.0 ± (plant datum) JS: How does the tidal elevation of 111.0 affect the elevation of the pond levees. JD: You would deal with some flooding in the ponds. In a major tidal incident, you would breach the pond levees. It is assumed that you would protect the activated sludge facilities but not the ponds during a 100-year tidal event. If there is a 100-year event, there is going to be major flooding in the South Bay.

5) BY: Palo Alto and Mountain View are doing their own study because they do not want to wait for the SCVWD 2016 study to get started. They want their independent studies to feed into SCVWD's studies. City will compete for federal funding based on calculated "economic impact areas." CM: This warrants a follow-up conversation. JS: I am concerned that the flood level is 111 and the pond levee elevation is 108. Would like to understand the vulnerability. JD: Will plan on a separate meeting to discuss ASAP.

2. Proposed Implementation Plan

a. Split Flow Approach

1) BY: If there are only ammonia limits, the City could push more flow through the split-flow process because we can operate the CAS facilities in step-feed mode. BB: We had the same situation at San Jose (two CAS plants with different water quality goals that combined into a blended effluent).

2) DP: With split-flow, we also have flexibility to produce recycle water using only the CAS effluent, not the pond effluent. This would improve the quality of the recycled water.

3) MO: Why is there a minimum flow to the ponds? JD: It is required just to keep the ponds functioning as a treatment process.

4) JS: How can the net present value (NPV) be cheaper for split flow? I thought it was more expensive than full CAS for the total program. JH: It is more expensive on a capital basis. It is cheaper when you factor in O&M.

b. MBR Variant

1) JS: As I understand it, SCVWD ideally needs to decide on MBR in one year (by the end of 2015). JH: What Joan had talked about at one meeting is that SCVWD could wait as long as 2017. The risk is they would pay $90± million and not have a right to build an IPR facility there (she expressed concern about the District's ability to make a decision on IPR that quickly). Essentially this is a $90 million option to preserve the right to proceed with the IPR option (which could be in jeopardy depending on the outcome of the CEQA process).

2) JD: Each agency needs to be sensitive to the other's goals. BY: We may be driving their IPR decision one way or another. Best case scenario is to have the District commit to doing an IPR option by the end of 2015. We don't know how long the IPR CEQA process is going to take. They just postponed their RO brine disposal meeting.

3) JS: They invested $70 million in the San Jose MF/RO plant, without any guarantee that IPR will ever happen. SR: It could always be used as a demonstration to prove that IPR can work.

4) JS: The other issue is SCVWD hires new people all the time. We need to keep new team members up to speed. We need to have very clear documents that capture institutional knowledge throughout the process.

5) JD: The reason to discuss all of this is to let SCVWD know that the City will continue to move forward with the implementation of their WPCP improvements. SR: I wonder if SCVWD may come back with something in between the 2015 and 2017 milestones. BY: The MBR variant slide will be good to present at next week's meeting.

c. Phasing of Major Improvements

1) JD: Reviewed five major phases of expansion. May want to consider re-naming Phase 5 to "Post-Tertiary Treatment."

2) JS: We do not need to worry too much about cash flow beyond 2035. SN: We will start looking at the 2035 cycle next year.

d. Phase 0

1) The City has identified "gap" projects, which are projects that needed to get started independent of the Master Plan being completed.

2) DP: The gas management project includes blending the gases onsite so that the PGF engines see a consistent gas quality, with a consistent BTU content.

3) JS: This phase does not include all of the "gap" projects (i.e., digester upgrades). JD: It includes all of the projects that are not in construction as of yet. JS: What about emergency flow? Why isn't it included? CM: That project includes a generator and bypass options. It isn't included because it's not quite a project yet.

4) JS: Is the City in total alignment with the sodium hypochlorite conversion project and the spilt flow alternative (i.e., will the facilities being upgraded for simultaneous recycled water flows be ready to accept split flow effluent)? JD: As far as we know, there are no inconsistencies between these two projects. DP: There is an option to determine how many filters you put on for recycled water. There is more of an interest to add filters for split flow effluent to increase you RW production. BB: We have the entire filter system split evenly right now, half for recycled water and half for bay discharge. You could tie in the spit flow effluent at the filter influent channel. The construction is being done so 2 of the 4 filters can be operated in RW mode.

5) JS: If the City decides to proceed with split flow, would we have had to do the simultaneous RW project anyway, in which case they wouldn't be wasted expenditures? Assume it would only be wasted monies if MBR is selected? BY: That's correct. DP: Under the CAS alternative, there is also an MF facility in the long-term planning horizon. The City could build and operate a small-scale MF facility and see how well it works.

e. Phase 1 – Headworks/ Existing WPCP Rehabilitation

1) JD: Part of the Existing Plant Rehabilitation project would be to do a condition assessment to confirm what WPCP assets need to be rehabilitated as part of this project.

2) MP: As part of our design, we will have to determine where the contractor's lay down areas are right? JD: Yes, that is something that will need to be determined for each project as part of the design project and overall program implementation effort coordinated by the PMC.

3) JD: City needs to think hard about what improvements they want to include in this project (need to review the project descriptions as a starting point). BY: We may want to include some controls improvements, polymer improvements. There are many studies going on right now, that may inform what elements go into this project. JD: Input from the City staff on the project descriptions will let us know if we need to increase the scope/costs for this project.

BY: On control system upgrades, how can you give us a good number? In my experience, rehab projects are very difficult to estimate. JD: Between, Carollo/CDM/BV, we need to give you a good placeholder number, which we can do if you have a general sense of the upgrades you want to do. We spent a lot of time documenting what needs to be upgraded, as part of the Master Plan ACS Plan. We can leverage that study.

4) BB: When you do the condition assessment, we will have a chance to decide how many assets get implemented considering split flow will be online. Those decisions need to be made as part of the condition assessment. JH: The challenge is potentially planning on going to a TN of 8 mg/L while the existing plant is still running. What is hard to know is whether you will need to fully replace the existing facilities to meet a TN of 8 mg/L or not. You might not need to, in which case you could keep the existing facilities longer, which means you need to do more rehab for the existing facilities, which is more cost.

5) JS: What if we do MBR? You would do list 1 (CAS) but not list 2? JD: Correct, you would do list 1. JS: Is that factored into the $90 million being discussed under the MBR option? JD: Not sure - need to look into this. JH: Don't believe the $90 million estimate was that granular to capture the difference between these two rehabilitation project options.

f. Phase 2 – Initial CAS/ Administration and Maintenance Building

1) MP: For Phase 2A the CAS contractor needs to do work before the Admin contractor can work? JD: Yes. We are going to direct them on specific construction work that needs to be done at a certain time.

2) BB: Thickening/dewatering in 2025? Our temporary dewatering facility is located to the north of the primary sed tanks. This will need to be moved again. JD: Yes, it will.

3) JD: If you can replace the functionality of the Primary Control Building, then you could build the Maintenance Building sooner. That is a something that could be refined by the PMC. The Master Plan implementation schedule is based on the most conservative sequencing approach

4) BB: Based on discussions with Synagro, $1 million is allocated for contract dewatering of PS and another $1 million is allocated for contract dewatering of the ponds solids.

g. Phase 3 – Support Facilities Upgrades

1) No discussion.

h. Phase 4 – Second CAS Expansion

1) No discussion.

i. Phase 5 – Tertiary Treatment Upgrades

1) JS: Can we build the FOG station earlier? Why is it scheduled so late? JD: In theory, as soon as the tunnel is constructed as part of the HW/PST project, then you could implement it. JS: Would like to see if the FOG station could be implemented earlier.

2) CM: When you start building the secondary facilities, need to think through any constraints associated with early implementation of the FOG facility. JS: I want to balance the timing of the FOG station with energy benefits and getting the grease out of the collection system. DP: Earlier implementation of the FOG facility could affect future digester needs.

3. Cash Flow Impacts

a. CM: As part of this plan, we are going to need to get to a number to put into a budget. JD: Yes. For comparison purposes, we need to talk in more round numbers.

b. JD: We are going to run through the same effort for the MBR variant.

4. SIP vs. MP Construction Cost Comparison

a. BY: The SIP number of $270 million is a construction cost only. The $318 million value was a budget number. Nobody knows how the $318 million value was arrived at. It was not included in the SIP document.

b. Differences between the SIP and MP estimate are the result of the following:

1) Increased flow and load projections.
2) Escalation due to later implementation of projects.
3) Drainage ditch replacement.
4) Completion of more detailed SCADA evaluation/costs.

c. In general, there is a $100 million+/- difference between the SIP and Master Plan (in June 2014 construction dollars).

d. JS: We will need a summary document that summarizes how the MP budget is different from the SIP budget. CM: We need to explain the $318 million budget was not even included in the SIP.

5. Next Steps

a. Finalizing the CIP Implementation Plan.

1) JS: Will we have the same level of detail for the MBR effort? JD: Yes. We will build on the work done to date on the CAS and MBR alternatives. The MBR work will be done in late January.

b. City/PMC to evaluate impacts/approach to delivering the CIP.

c. BB: What happens if we can't construct the buildings because SCVWD is not done with their flood protection project? MP: They have a design and funding. They are just waiting on the permits, which they should get.

d. BY: Appears we do not have an option if for some reason we don't get the permit for the drainage ditch. Is this a fatal flaw we should address? CM: As we move along, we will know how soon we can get this permit. From there we can develop options for moving the project forward (e.g., starting Package 2 construction earlier).

6. Updates to the Implementation Plan

a. Add gas improvements into the project description and use "gap project' nomenclature.

b. BY to send information about the ammonia dosing project being proposed under the simultaneous recycled water project.

c. BY to send the O&M Level 3 and Level 4 report for O&M cost estimates.

d. Carollo to add contract dewatering costs to the O&M cost estimates. Craig will send the updated contract for dewatering.

7. ACTION ITEMS

a. Carollo and City to meet to discuss flood protection approach (sea level rise, riverine flooding, tidal flooding).

b. Carollo and City to determine approach to second emergency bypass pipeline (i.e., separate project or included in Headworks/PST project).

c. City to resolve program cost markup factor for use in the CIP.

Prepared By:

Katy Rogers

KR

This meeting will be a success if …

- Receive input on proposed CIP implementation approach
  - Implementation constraints
  - Cash flow impacts
- Decision to be made on path forward
  - Major implementation adjustments
  - Finalize final CIP implementation to allow further refinement by PMC and City

Sunnyvale_CIP_Sequence_Dec4.pptx/2

Agenda

- ✓ Approach to CIP Implementation
- ✓ Proposed Implementation Plan
- ✓ Cash Flow Impacts
- ✓ SIP vs. MP Construction Cost Comparison
- ✓ Next Steps

Approach to CIP Implementation

Potential CIP Implementation Constraints

- Constructability
  - Contractor’s access/coordination
  - Contractor’s limitations on parking and laydown
  - Sequencing (number of contractors that can be working on the site at the same time)
- Staff impacts
  - Ongoing O&M considerations (i.e., maintaining permit compliance, deliveries, shutdowns)
  - Working/living space on plant site (i.e., replacement for admin/maint space)

Sunnyvale_CIP_Sequence_Dec4.pptx/5

Potential CIP Implementation Constraints (cont)

- Cash flow impacts for conventional activated sludge (CAS) vs. split flow CAS
- Other
  - Baylands Pump Station #1
  - SCVWD projects (i.e., flood channel project)
  - Permits (i.e., Army Corps, Fish & Wildlife, BCDC, etc.)

Sunnyvale_CIP_Sequence_Dec4.pptx/6

Impacts of Potential Constraints

- Limit on number of large contractors – no more that two on the site at one time
- Hdwks/PST Package 1 construction dictated by Army Corps permit approval
- Relocation of Bay Trail access cannot happen any earlier than mid-2017
- New Admin. & Maint. Buildings assumes relocation of Bay Trail access

Sunnyvale_CIP_Sequence_Dec4.pptx/7

Impacts of Potential Constraints (cont)

- Timing for Admin. & Maint. Buildings assumes continued use of existing facilities
- Existing PSTs to be removed as part of the Headworks/PST project
- Tidal flooding protection must be addressed early on

Sunnyvale_CIP_Sequence_Dec4.pptx/8

Proposed

Implementation Plan

Sunnyvale_CIP_Sequence_Dec4.pptx\9

Key Implementation Issue – Approach to Secondary Treatment

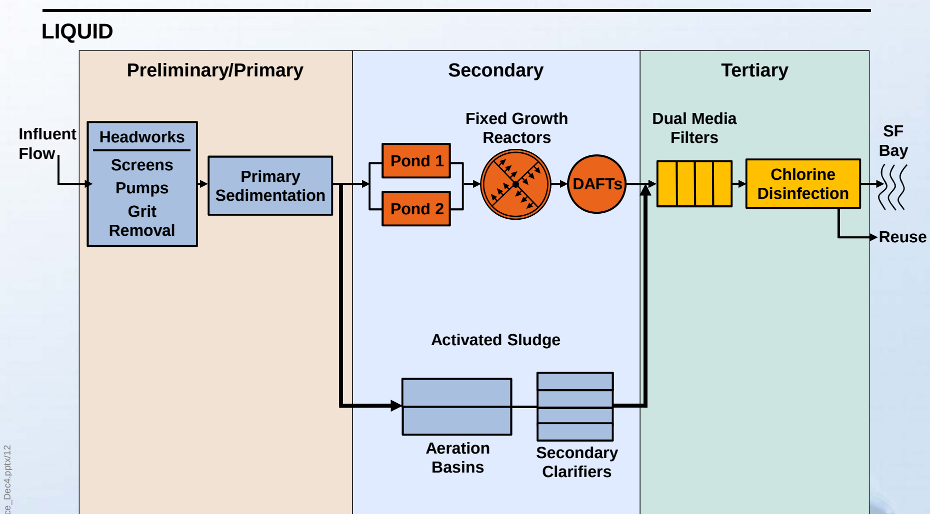
- Evaluation of potential secondary treatment options completed
- Conventional activated sludge (CAS) and MBR were deemed most viable
- CAS selected pending future reuse considerations
- Alternative to full conversion to CAS was evaluated (split flow scenario)

Sunnyvale_CIP_Sequence_Dec4.pptx\10

Drivers For Split Flow Treatment

- Regulatory uncertainty (primarily based on higher levels of nitrogen removal)
- Higher costs to implement secondary treatment than presented in the SIP
- Growth uncertainty

Split Flow Concept



Phasing Comparison

	Full Treatment AS		Split Flow AS	
Item	**2025**	**2035**	**2025**	**2035**
Aeration Tanks	3 tanks	1 tank	2 tanks	2 tanks
Clarifiers	6 clarifiers	-	3 clarifiers	3 clarifiers
Blower Bldg.	Bldg w/ 5 blowers	-	Bldg w/ 4 blowers	1 blower
Diurnal EQ	Full EQ	-	-	Full EQ
Emergency EQ	Partial EQ	Full EQ	-	Full EQ

Present Worth Summary

	Conventional AS ($ in Millions)	Split Flow Conven. AS ($ in Millions)
Capital Costs - 2035[1]	$171M±	$186M±
O&M/year in 2025	$1.5M±	$1.2M±
Present Worth – Capital[2]	$128M±	$116M±
Present Worth – O&M[2,3]	$16M±	$14M±
Net Present Value (NPV)	$146M±	$133M±

Notes:
(1) Includes ABs, SCs, Equalization and Emergency Storage
(2) Inflation = 3%, Cost of money = 7%, Real discount rate = 3.8%.
(3) 20 year period

Implementation Considerations for Secondary Treatment

- Due to site constraints, CAS construction follows Headworks/Primary Sed Tank project
- CAS design begins third quarter 2017
- Consultant selection begins first quarter 2017
- Impact of MBR variant on final design, approach would include either:
  - By third quarter 2015 – District commits to EIR for implementation of IPR scenario
  - By first quarter of 2017 – District commits to paying for MBR design at risk (in parallel with EIR addressing IPR to be completed by first quarter 2020)

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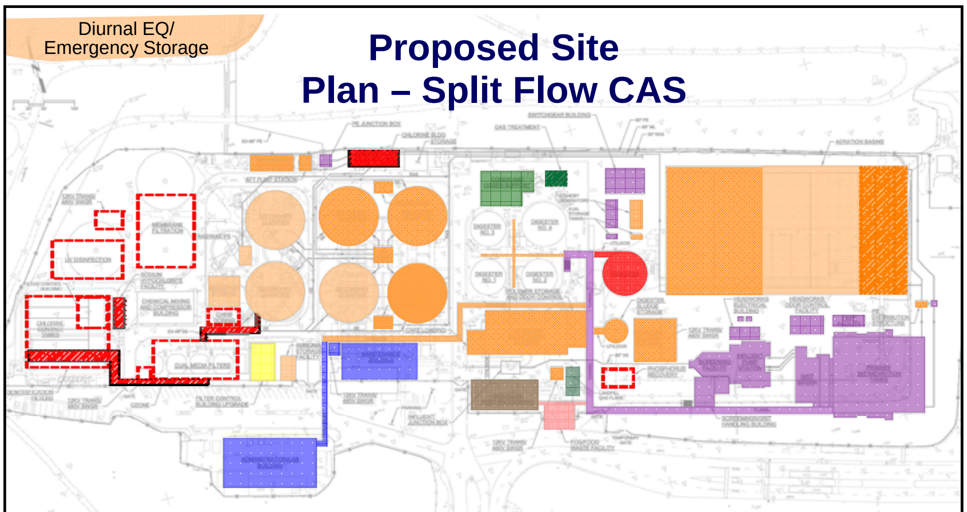
Proposed Site Plan – Split Flow CAS



Implementation – Major Phases

- Phase 1 – Headworks/Existing WPCP Rehab
- Phase 2 – Initial CAS/Admin and Maintenance
- Phase 3 – Support Facilities Upgrades
- Phase 4 – Second CAS Expansion
- Phase 5 – Tertiary Treatment Upgrades

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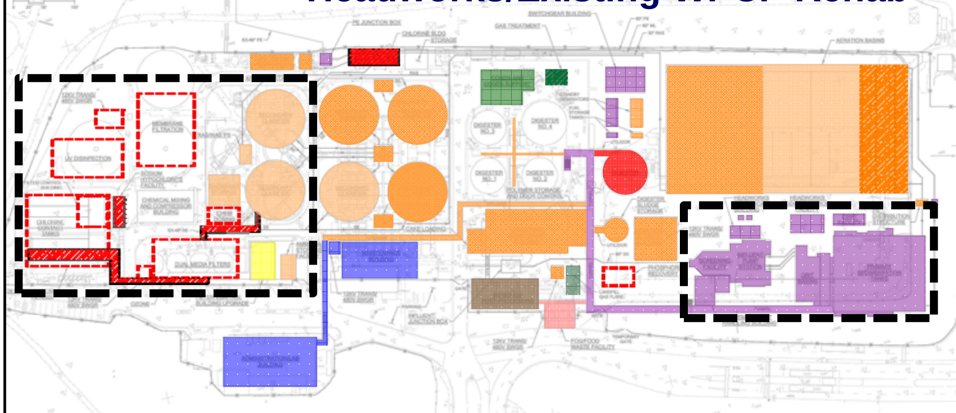
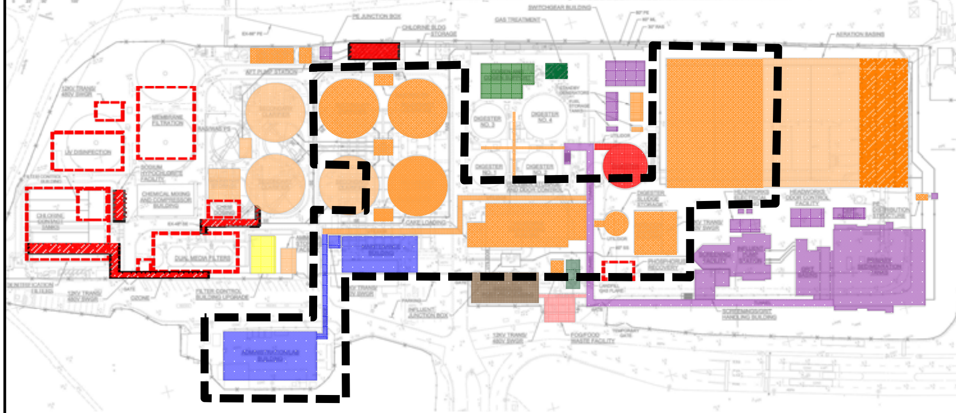
Diurnal EQ/
Emergency Storage

Implementation – Phase 1
Headworks/Existing WPCP Rehab



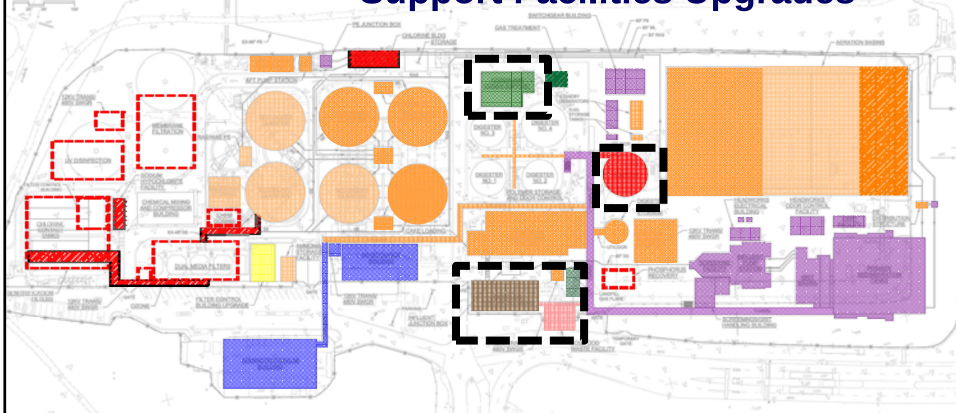
Diurnal EQ/
Emergency Storage

Implementation – Phase 2
Initial CAS/Admin and Maintenance

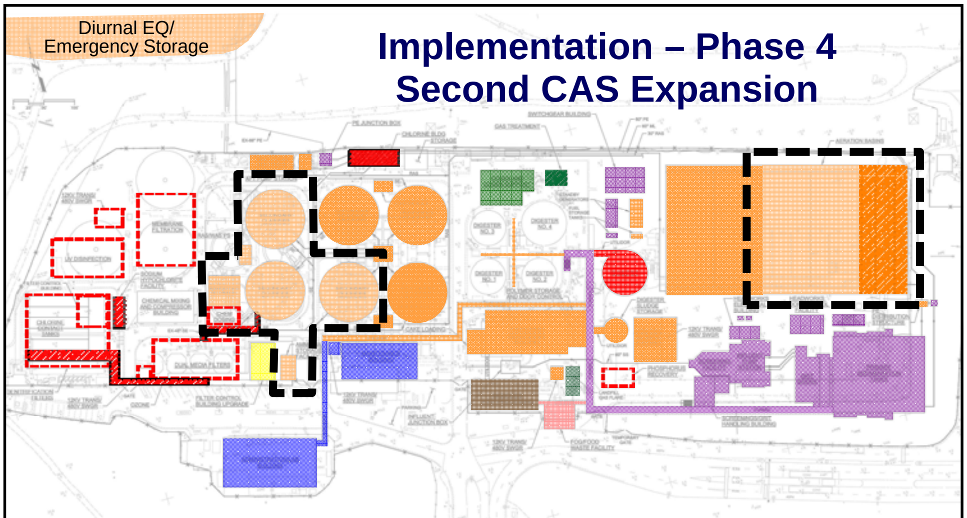


Diurnal EQ/
Emergency Storage

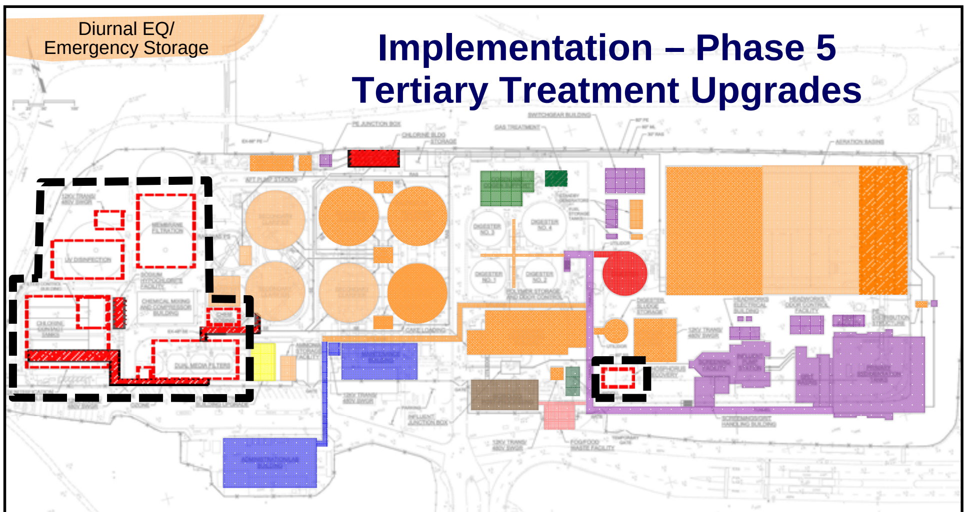
Implementation – Phase 3
Support Facilities Upgrades



Implementation – Phase 4
Second CAS Expansion

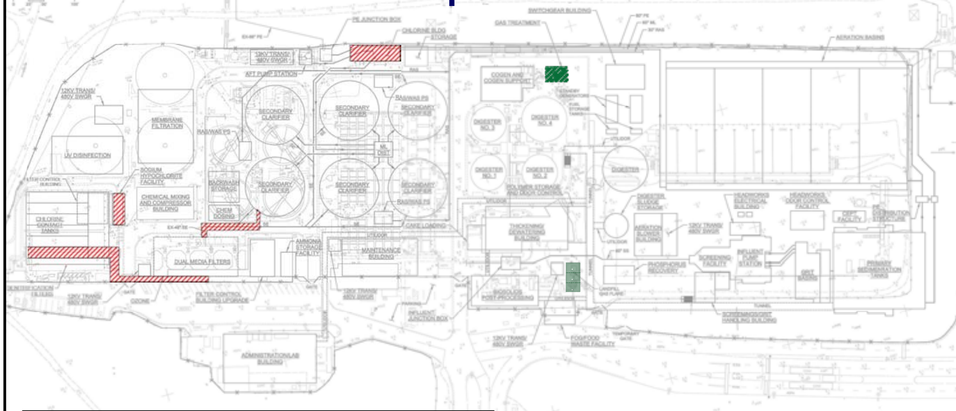


Implementation – Phase 5
Tertiary Treatment Upgrades



Phase 0

Program Implementation Plan – Split Flow CAS



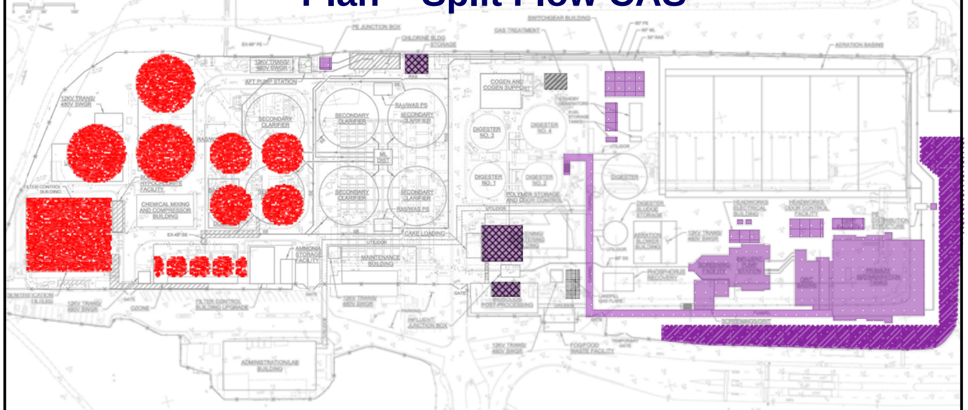
LEGEND

- Hypo Conversion/Simultaneous Recycle (2015-16)
- Gas Management (2015)
- Gas Treatment (2016-17)

2015 2020 2025 2030 2035 2040

Phase 1A

Program Implementation Plan – Split Flow CAS



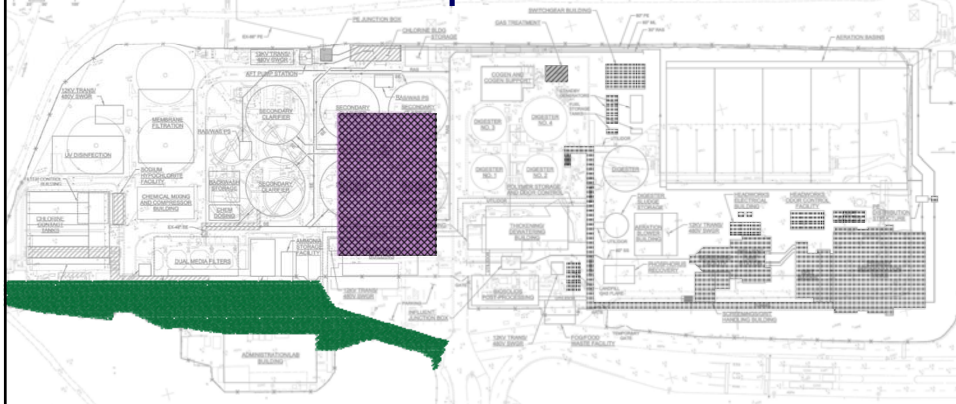
LEGEND

- Headworks/PSFs (2016-19) – Packages 1 and 2
- (Includes Demo/Decommission)
- Existing Plant Rehabilitation (2018-19)

2015 2020 2025 2030 2035 2040

Phase 1B

Program Implementation Plan – Split Flow CAS



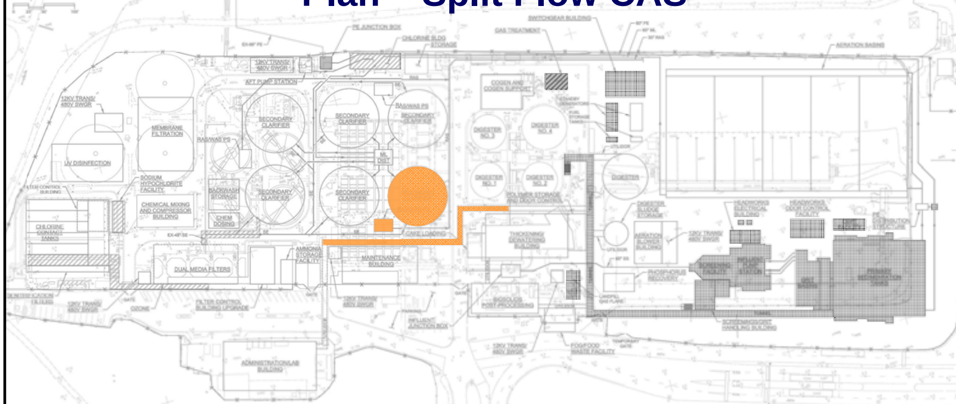
LEGEND

- Headworks/PSFs (2019-20) – Package 3 (Includes Demo/Decommission)
- Relocation of Bay Trail Access (2018)

2015 2020 2025 2030 2035 2040

Phase 2A

Program Implementation Plan – Split Flow CAS



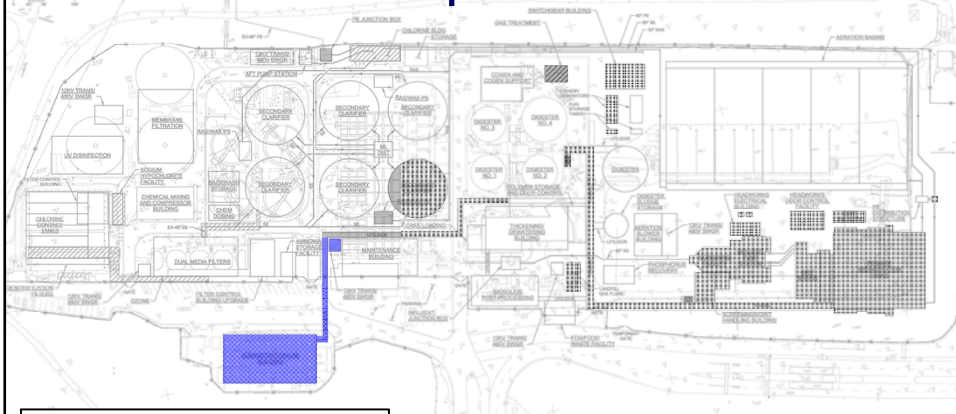
LEGEND

- Split Flow CAS (2020-21) – Milestone 1 (Clarifier/Utilidor)

2015 2020 2025 2030 2035 2040

Phase 2B

Program Implementation Plan – Split Flow CAS



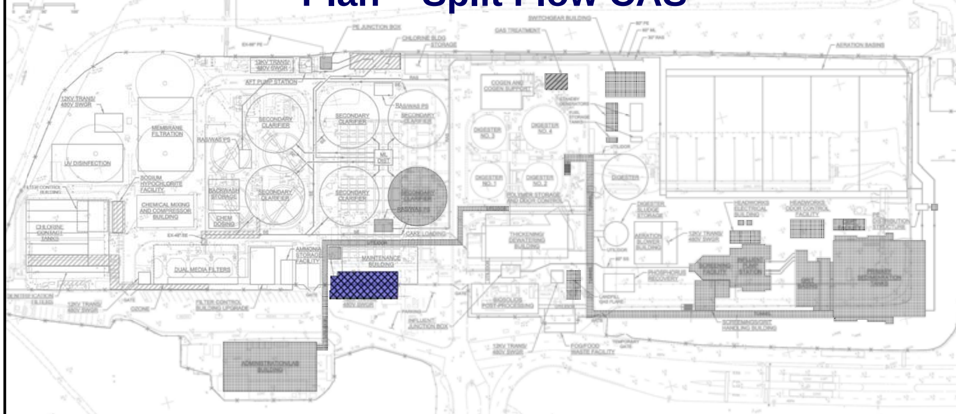
LEGEND

Administration/Lab Building (2020-21)

2015 2020 2025 2030 2035 2040

Phase 2C

Program Implementation Plan – Split Flow CAS



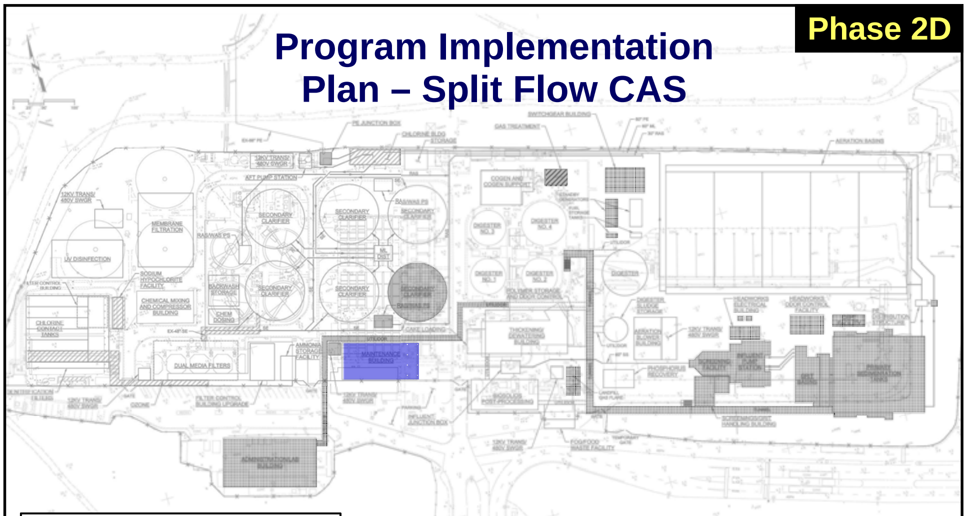
LEGEND

Maintenance Building (2021-22) (Includes Administration Building Demo)

2015 2020 2025 2030 2035 2040

Program Implementation Plan – Split Flow CAS

Phase 2D

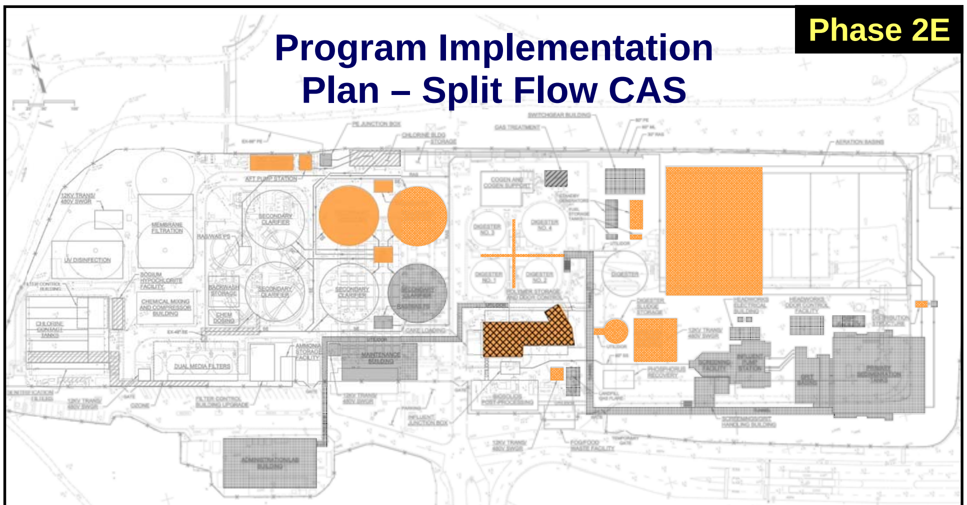


LEGEND
Maintenance Building (2021-22)

2015 2020 2025 2030 2035 2040

Program Implementation Plan – Split Flow CAS

Phase 2E

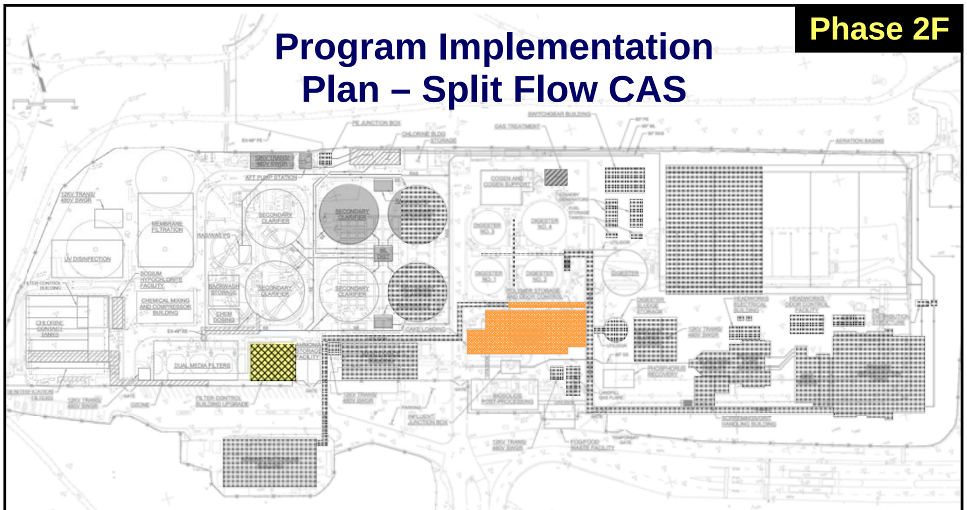


LEGEND
Split Flow CAS (2020-24) – Milestone 2 (Includes Primary Control Building Demo)

2015 2020 2025 2030 2035 2040

Phase 2F

Program Implementation Plan – Split Flow CAS



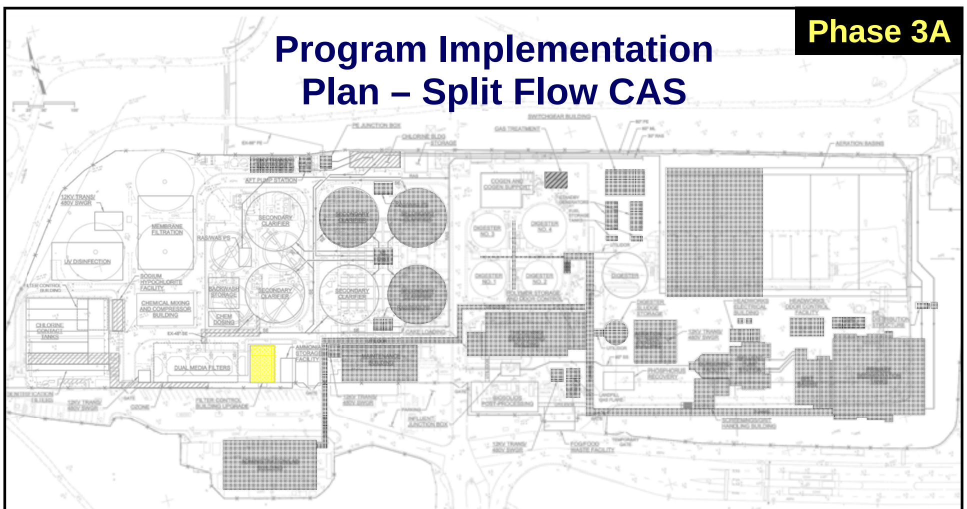
LEGEND

- Split Flow CAS (2023-24) – Milestone 3 (Thickening/Dewatering)
- Filter Control Building (2023-24) - Demolition

2015 2020 2025 2030 2035 2040

Phase 3A

Program Implementation Plan – Split Flow CAS



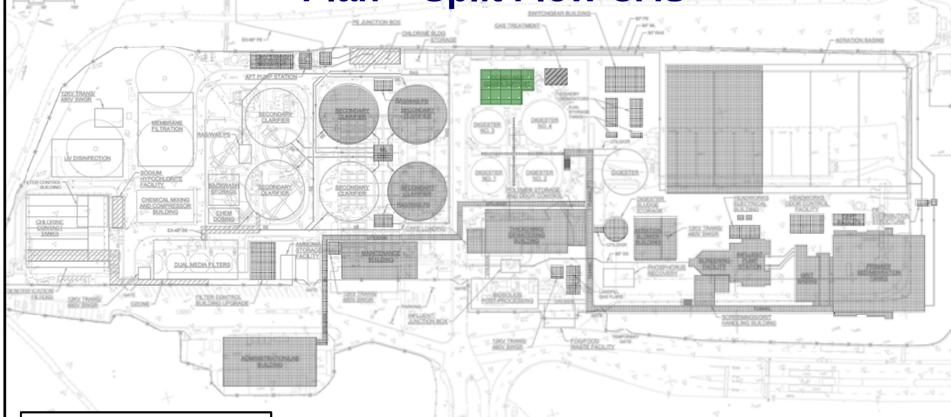
LEGEND

- Filter Control Building (2023-24)

2015 2020 2025 2030 2035 2040

Phase 3B

Program Implementation Plan – Split Flow CAS

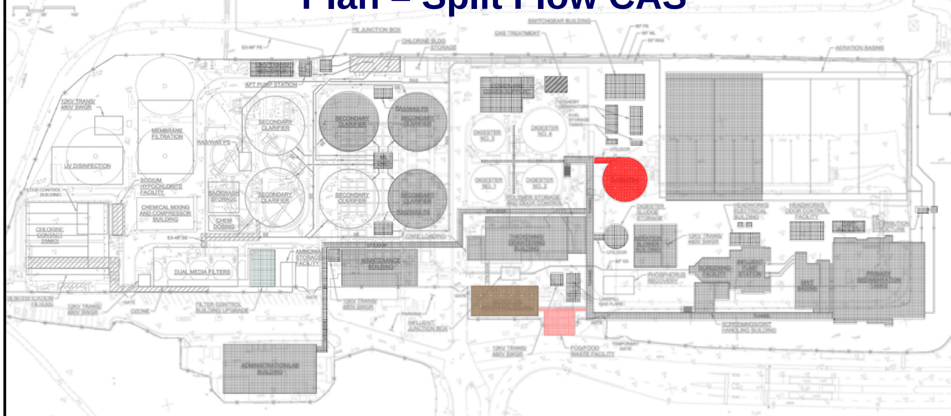


LEGEND
Cogeneration (2024-25)

2015 2020 2025 2030 2035 2040

Phase 3C

Program Implementation Plan – Split Flow CAS



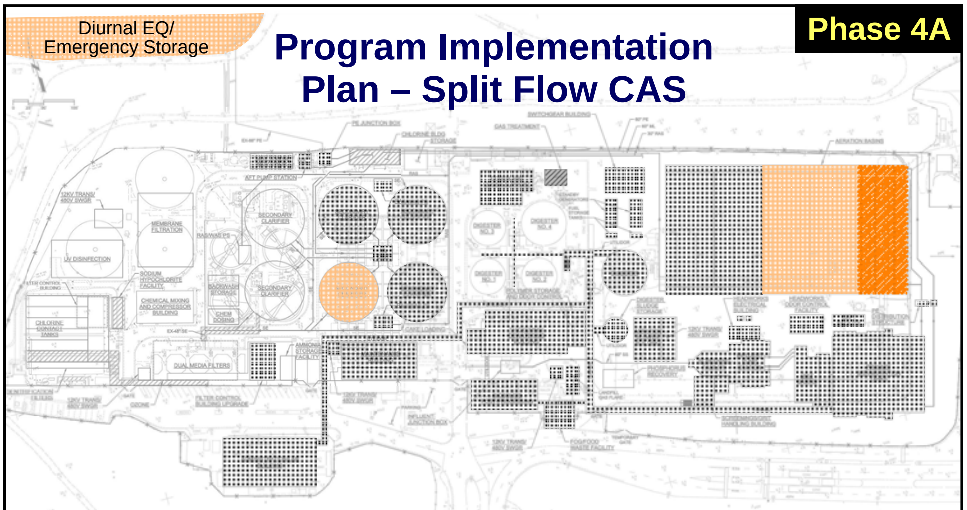
LEGEND
FOG (2026)
Digester #5 (2029-30)
Biosolids Post-Processing (2030-31)

2015 2020 2025 2030 2035 2040

Phase 4A

Program Implementation Plan – Split Flow CAS

Diurnal EQ/ Emergency Storage



LEGEND

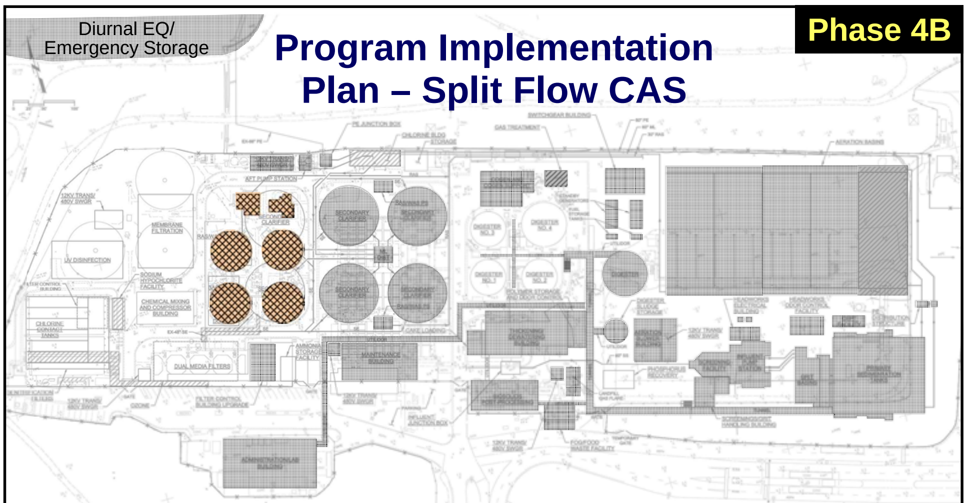
Split Flow CAS (2032-35) (Except 5th and 6th Clarifier)

2015 2020 2025 2030 2035 2040

Phase 4B

Program Implementation Plan – Split Flow CAS

Diurnal EQ/ Emergency Storage



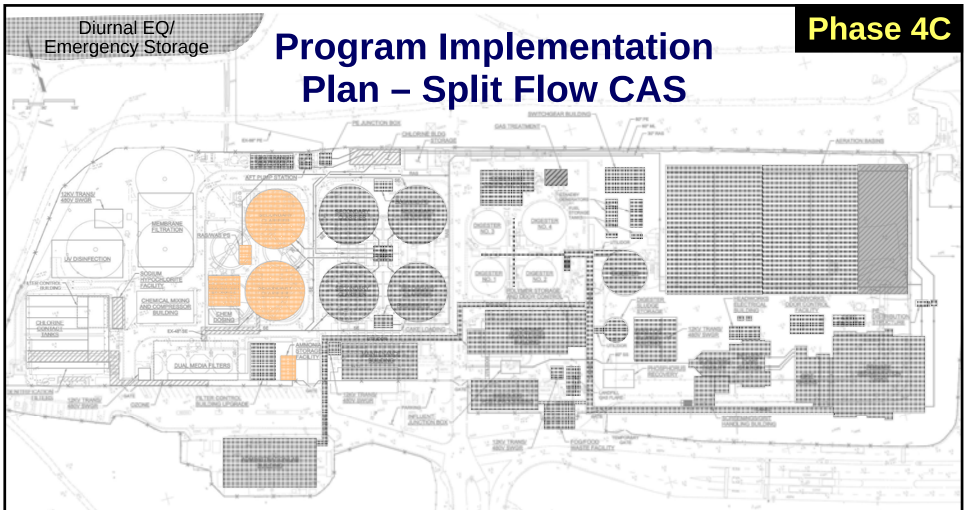
LEGEND

Split Flow CAS – Demolish FGR Pump Station and AFTs

2015 2020 2025 2030 2035 2040

Phase 4C

Program Implementation Plan – Split Flow CAS



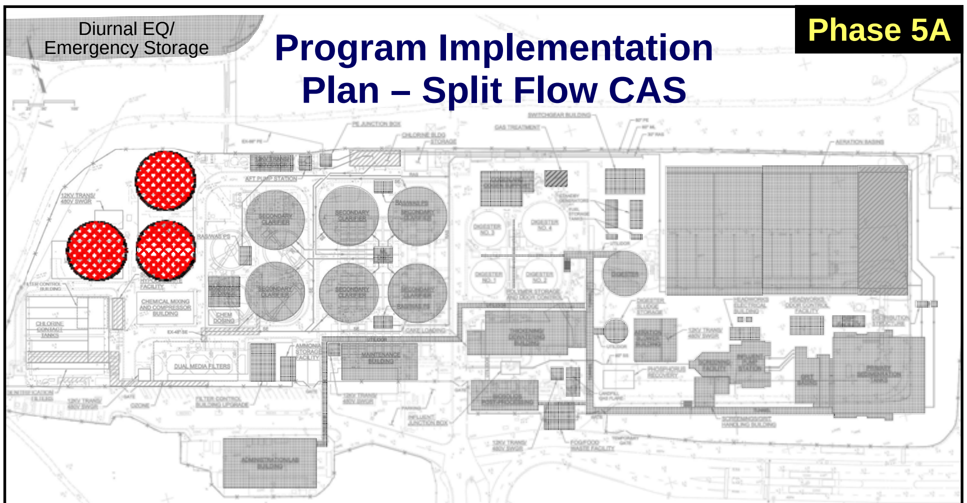
LEGEND

Split Flow CAS – 5th and 6TH Clarifier/Ammonia Storage/Backwash Storage

2015 2020 2025 2030 2035 2040

Phase 5A

Program Implementation Plan – Split Flow CAS



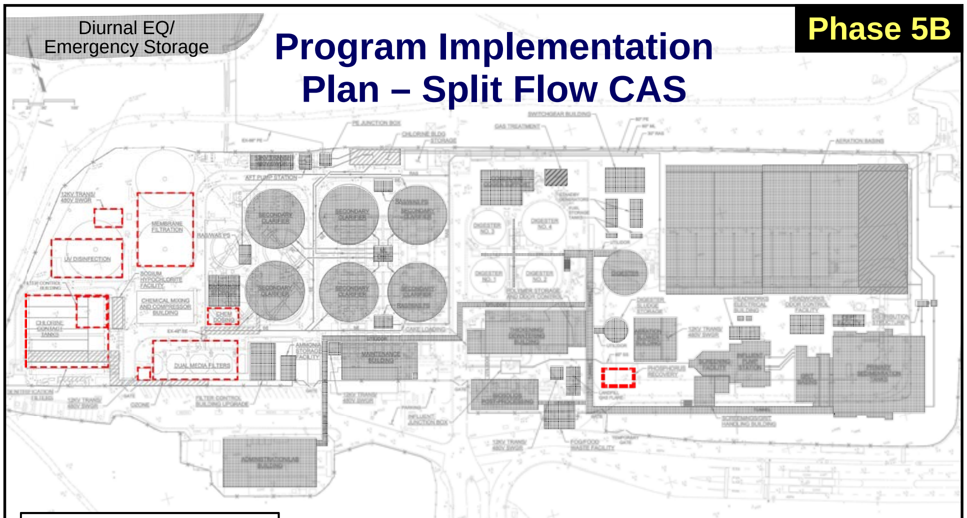
LEGEND

Decommission Ponds/Demolish FGRs (>2035)

2015 2020 2025 2030 2035 2040

Phase 5B

Program Implementation Plan – Split Flow CAS



LEGEND

Future Facilities (>2035)

2015 2020 2025 2030 2035 2040

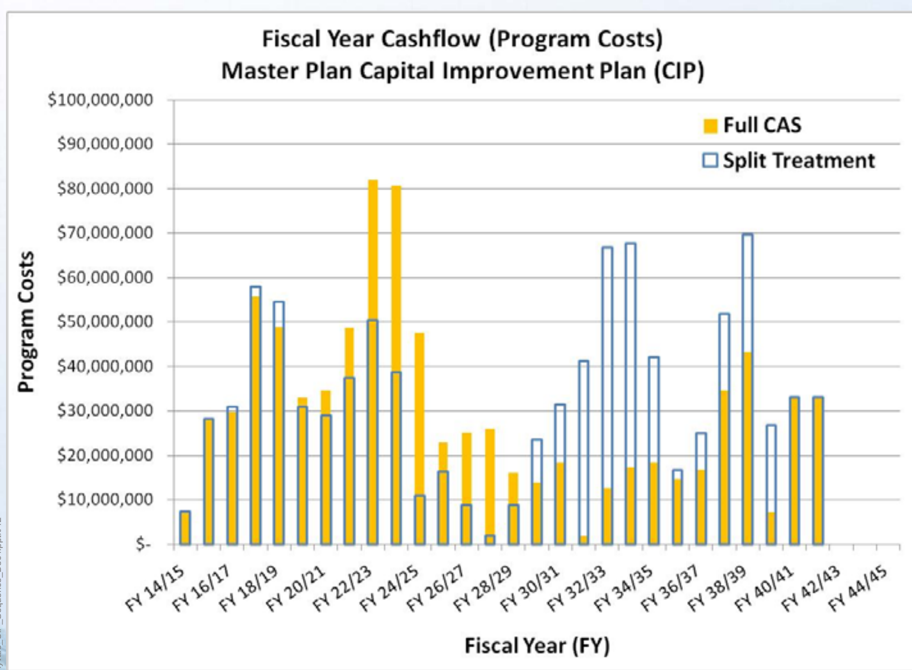
Cash Flow Impacts

Sunnyvale_CIP_Sequence_Dec4.pptx/40

Cash Flow Considerations

- Two scenarios
  - Full CAS vs. Split Flow CAS
- Construction costs escalated to mid-point (3% per year)
- Program cost factor of 1.40 used
- Includes all potential process upgrades (i.e., UV, denitrification filters, ozone, microfiltration)

Sunnyvale_CIP_Sequence_Dec4.pptx/41



Sunnyvale_CIP_Sequence_Dec4.pptx/42

Expenditure Summary
Full CAS vs. Split Flow (SF) CAS
(Dollars in Millions)

Master Plan Cost Summary – Thru 2030	Full CAS	SF CAS
Construction Costs (Escalated)	$437±	$326±
Program Costs (Escalated)	$580±	$425±

Master Plan Cost Summary - >2040±	Full CAS	SF CAS
Construction Costs (Escalated)	$634±	$691±
Program Costs (Escalated)	$856±	$936±

Sunnyvale_CIP_Sequence_Dec4.pptx/43

SIP vs. MP Construction Cost Comparison

Sunnyvale_CIP_Sequence_Dec4.pptx/44

SIP vs. MP Construction Cost Estimate (June 2014) - $Millions

Major Elements	SIP	MP	Delta
Headworks /PST Project	$62.2	$96.2	(+) $34.0
Secondary Treatment (CAS related facilities)	50.4	98.2	(+) 47.8
Thickening & Dewatering (with storage)	41.7	35.4	(-) 6.3
Flow Equalization / Emergency Storage	22.8	51.8	(+) 29.0
Filtration & Disinfection	7.3	13.9	(+) 6.6
Digestion & Cogeneration	63.8	40.7	(-) 23.1
Support Facilities (Admin/Lab, Maint/Ware)	4.9	12.1	(+) 7.2
Existing Plant Rehabilitation	8.8	16.8	(+) 8.0
Misc. Plant Improvements	9.5	12.0	(+) 2.5
Total	**$271.7±**	**$377.1±**	**(+) $105.4±**
Does not include UV, Denit Filters, Ozone, Microfiltration, FOG, 2nd Chem P Dosing Point	**NA**	**$84±**	

Next Steps

Next Steps

- Finalizing the CIP Implementation Plan
  - City/PMC review of the project descriptions
  - Finalizing the implementation plan
  - Developing projected O&M budget impacts based on the proposed implementation plan
  - Finalizing the CIP Implementation TM
- City/PMC evaluate impacts/approach to delivering CIP

Sunnyvale_CIP_Sequence_Dec4.pptx/47

APPENDIX B - CIP SUMMARY TABLE

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
WPCP Master Plan
City of Sunnyvale

Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category General Split Flow Not Included	Individual Element Const. Cost (Unescalated)	Total Package Const. Cost (Unescalated)	Years to Midpoint of Const.	Total Package Const. Cost (Escalated) 2%	Total Package Project Cost (Escalated) 2%	Project Driver	Project Start Date	Fiscal Year Project Start	Planning/ Design (months)	Permitting / CEQA (months)	Gap (months)	Const. (months)	Project Duration (months)	Project Duration (years)	Fiscal Year On-Line
1			**PRIMARY TREATMENT**																
1.1	1	n/a	Primary Treatment Facility	General	$ 99,700,000	$ 104,500,000	3	$ 112,500,000	$ 133,100,000	R&R	4/1/2014	2013	33	12	-15	54	72	6	2019
1.2	1	n/a	Rehabilitation Primary Effluent Pipeline from Central Plant to Ponds	General	$ 1,830,000	$ 1,830,000	3	$ 1,952,000	$ 2,800,000	R&R	7/1/2016	2016	12	9	0	12	24	2	2018
1.3	1	n/a	Rehabilitation Influent Pipelines to WPCP	General	$ 1,000,000	$ 1,000,000	3	$ 1,066,000	$ 1,500,000	R&R	1/1/2017	2016	12	9	0	12	24	2	2018
2			**SECONDARY TREATMENT**																
2.1	1	n/a	Existing Plant Rehabilitation - Split Flow	Split Flow	n/a	$ 27,600,000	5	$ 30,473,000	$ 43,300,000	R&R	7/5/2016	2016	21	15	0	24	45	4	2020
n/a	n/a	n/a	36" Secondary Effluent Pipeline (from ponds) Rehabilitation	n/a	$ 1,400,000	Incl. in Project 2.1													
n/a	n/a	n/a	Recirculation Pump Station Electrical Improvements	n/a	$ 500,000	Incl. in Project 2.1													
n/a	n/a	n/a	New Pond Effluent Pump Station and Screen (Includes Demo of Existing)	n/a	$ 4,500,000	Incl. in Project 2.1													
n/a	n/a	n/a	Fixed Growth Reactor (FGR) Upgrades - Split Flow	n/a	$ 6,900,000	Incl. in Project 2.1													
n/a	n/a	n/a	Air Flotation Tank (AFT) Upgrades - Split Flow	n/a	$ 2,500,000	Incl. in Project 2.1													
2.2	2	n/a	Secondary Treatment Improvements - Split Flow Stage 1	Split Flow	$ 66,600,000	$ 77,500,000	7	$ 88,146,000	$ 125,200,000	Regulatory	1/1/2017	2016	33	9	0	48	81	7	2023
2.3	4	n/a	Secondary Treatment Improvements - Split Flow Stage 2	Split Flow	$ 39,800,000	$ 42,300,000	19	$ 61,016,000	$ 86,600,000	Flow and Load	1/1/2029	2028	36	9	0	42	78	7	2035
2.4	4	n/a	Primary Effluent Diurnal Equalization and Emergency Storage	Split Flow	$ 64,100,000	$ 64,100,000	20	$ 95,485,000	$ 135,600,000	Regulatory	9/23/2030	2030	15	36	0	21	57	5	2035
2.5	4	n/a	Active Retirement of Ponds	Split Flow	$ 4,700,000	$ 4,700,000	23	$ 7,430,000	$ 10,600,000	Policy	5/24/2036	2035	12	18	0	15	33	3	2038
2.6	2	n/a	AFT Pump Station and Pipeline	Split Flow	$ 4,700,000	$ 4,700,000	4	$ 5,062,000	$ 7,200,000	Performance/Econ.	1/1/2017	2016	12	9	0	24	36	3	2019
2.7	5	n/a	Chemical Dosing (P-Removal)	Split Flow	$ 1,000,000	$ 1,000,000	21	$ 1,519,000	$ 2,200,000	Regulatory	7/1/2034	2034	12	9	0	9	21	2	2036
3			**TERTIARY TREATMENT**																
n/a	2	n/a	Dual Media Filter (DMF) Rehabilitation - Split Flow	n/a	$ 5,800,000	Incl. in Project 2.1													
3.1	3	n/a	Filter Control Building (Includes Demolition of Existing)	Split Flow	$ 3,200,000	$ 3,500,000	8	$ 4,131,000	$ 5,900,000	R&R	4/14/2022	2021	12	9	0	15	27	3	2024
3.2	4	n/a	Filter Backwash Storage	Split Flow	$ 5,400,000	$ 5,400,000	22	$ 8,307,000	$ 11,800,000	Regulatory	5/30/2035	2034	18	9	0	12	30	3	2037
3.3	5	n/a	Denitrification Filters	General	$ 28,000,000	$ 28,000,000	24	$ 44,814,000	$ 63,600,000	Regulatory	7/1/2035	2035	24	9	0	24	48	4	2039
n/a	n/a	n/a	Simultaneous Production of Recycled Water/Sodium Hypochlorite Conversion	Not Included	$ 5,380,000	$ 5,680,000	2	$ 5,909,000	$ 8,400,000		7/1/2014	2014	18	9	0	18	36	3	2017
n/a	1	n/a	Chlorine Contact Tank (CCT) Rehabilitation	n/a	$ 2,700,000	Incl. in Project 2.1													
n/a	2	n/a	Effluent Monitoring Stations	n/a	$ 400,000	Incl. in Project 2.1													
3.4	3	n/a	Chloramine Disinfection	General	$ 2,000,000	$ 2,000,000	11	$ 2,499,000	$ 3,500,000	Regulatory	10/1/2024	2024	12	9	0	12	24	2	2026
3.5	5	n/a	UV Disinfection	General	$ 9,500,000	$ 9,500,000	22	$ 14,614,000	$ 20,800,000	Regulatory	7/1/2033	2033	24	9	0	24	48	4	2037
3.6	5	n/a	Ozone Disinfection	General	$ 16,000,000	$ 19,000,000	27	$ 32,271,000	$ 45,800,000	Regulatory	7/1/2039	2039	12	9	0	24	36	3	2042
3.7	5	n/a	Membrane Filtration (MF) Improvements	Split Flow	$ 15,100,000	$ 15,100,000	25	$ 24,773,000	$ 35,200,000	Policy	1/1/2038	2037	18	9	0	18	36	3	2040
4			**SOLIDS FACILITIES**																
n/a	n/a	n/a	Digester No. 1 and 2 Upgrades	Not Included	$ 5,600,000	$ 5,600,000	0	$ 5,628,000	$ 8,000,000		7/1/2014	2014	0	9	0	12	21	2	2016
4.1	2	n/a	Digester Supernatant PS and Drainage Piping Upgrades	General	$ 800,000	$ 800,000	9	$ 961,000	$ 1,400,000	R&R	7/1/2022	2022	12	9	0	12	24	2	2024
4.2	2	n/a	Thickening and Dewatering Facility - Stage 1	General	$ 27,600,000	$ 31,300,000	8	$ 36,703,000	$ 52,100,000	Regulatory	1/1/2017	2016	33	9	32	21	86	8	2024
4.3	4	n/a	Thickening and Dewatering Facility - Stage 2	General	$ 6,800,000	$ 6,800,000	20	$ 10,055,000	$ 14,300,000	Flow and Load	10/1/2033	2033	9	6	0	12	21	2	2035
n/a	n/a	n/a	Digester Sludge Storage Tank	n/a	$ 2,700,000	Incl. in Project 4.2													
n/a	n/a	n/a	Digester Sludge Feed System	n/a	$ 1,000,000	Incl. in Project 4.2													
4.4	3	n/a	Digester No. 5	Split Flow	$ 5,800,000	$ 5,800,000	14	$ 7,672,000	$ 10,900,000	Flow and Load	4/1/2027	2026	18	9	0	21	39	4	2030
4.5	3	n/a	FOG/Food Waste Facility	Split Flow	$ 1,180,000	$ 1,180,000	11	$ 1,464,000	$ 2,100,000	Performance/Econ.	4/1/2024	2023	18	9	0	15	33	3	2026
4.6	4	n/a	Phosphorus Recovery Facility	General	$ 5,700,000	$ 5,700,000	15	$ 7,710,000	$ 10,900,000	Performance/Econ.	7/1/2028	2028	12	9	0	12	24	2	2030
4.7	4	n/a	Biosolids Post-Processing	General	$ 16,600,000	$ 16,600,000	16	$ 22,676,000	$ 32,200,000	Regulatory	1/1/2028	2027	24	9	0	24	48	4	2031
5			**COMBINED HEAT AND POWER**																
n/a	n/a	n/a	Cogeneration Gas Treatment	Not Included	$ 2,000,000	$ 2,000,000	1	$ 2,045,000	$ 2,900,000		7/1/2015	2015		9	0	9	18	2	2017
5.1	3	n/a	Cogeneration Upgrade	Split Flow	$ 12,000,000	$ 12,000,000	11	$ 14,957,000	$ 21,200,000	Performance/Econ.	8/17/2022	2022	24	15	0	21	45	4	2026
6			**ELECTRICAL**																
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 1 - Primary Treatment Facility	n/a		Incl. in Project 1.1													
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 2 - Secondary Treatment	n/a	$ 5,400,000	Incl. in Project 2.2													
7			**PROCESS CONTROL AND AUTOMATION (SCADA)**																
n/a	n/a	n/a	SCADA System Improvements - Stage 1 - Headworks and Primary Treatment	n/a		Incl. in Project 1.1													
n/a	n/a	n/a	SCADA System Improvements - Stage 2 - Secondary Treatment	n/a	$ 500,000	Incl. in Project 2.2													
8			**SUPPORT FACILITIES**																
n/a	n/a	n/a	Tidal Flood Protection - Stage 1	n/a		Incl. in Project 1.1													
n/a	n/a	n/a	Tidal Flood Protection - Stage 2	n/a	$ 2,600,000	Incl. in Project 2.1													
n/a	n/a	n/a	Borregas Avenue Parking Lot	Not Included	$ 300,000	Included in Sim. RW													
8.1	1	n/a	New Access to Bay Trails	General	$ 400,000	$ 400,000	4	$ 429,000	$ 600,000	Performance/Econ.	3/16/2017	2016	18	9	0	6	24	2	2018
8.2	1	n/a	Household Hazardous Waste Demolition/ Solid Waste Removal	General	$ 300,000	$ 300,000	3	$ 320,000	$ 500,000	Performance/Econ.	7/1/2016	2016	12	9	0	12	24	2	2018
8.3	2	n/a	Administration and Lab Building	General	$ 16,300,000	$ 16,600,000	6	$ 18,510,000	$ 26,300,000	R&R	3/11/2018	2017	18	15	0	18	36	3	2020
8.4	2	n/a	Maintenance Building	General	$ 4,600,000	$ 4,600,000	6	$ 5,206,000	$ 7,400,000	R&R	3/11/2018	2017	18	9	18	12	48	4	2021
9			**SUPPORT UTILITIES**																
n/a	n/a	n/a	Site Security Improvements - Stage 1	n/a	$ 600,000	Incl. in Project 1.1													
n/a	n/a	n/a	Site Security Improvements - Stage 2	n/a	$ 300,000	Incl. in Project 2.1													
9.1	2	n/a	Recycle Water Improvements (New Recycled Water PS)	General	$ 2,300,000	$ 2,300,000	12	$ 2,931,000	$ 4,200,000	R&R	7/1/2025	2025	12	9	0	12	24	2	2027
9.2	2	n/a	Community Improvements	General	$ 400,000	$ 400,000	11	$ 495,000	$ 700,000	Policy	7/1/2025	2025	6	0	0	6	12	1	2026
9.3	2	n/a	Landfill Gas Flare and Booster System Upgrades	General	$ 200,000	$ 200,000	12	$ 255,000	$ 400,000	R&R	7/1/2025	2025	12	9	0	12	24	2	2027
9.4	2	n/a	Miscellaneous Civil Site/Support Utility Improvements	General	$ 400,000	$ 400,000	12	$ 510,000	$ 700,000	R&R	7/1/2025	2025	12	9	0	12	24	2	2027

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
WPCP Master Plan
City of Sunnyvale

Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category (General / Split Flow / Not Included)	Individual Element Const. Cost (Unescalated)	Total Package Const. Cost (Unescalated)	Years to Midpoint of Const.	Total Package Const. Cost (Escalated) 2%	Total Package Project Cost (Escalated) 2%	Project Driver	Project Start Date	Fiscal Year Project Start	Planning/ Design (months)	Permitting / CEQA (months)	Gap (months)	Const. (months)	Project Duration (months)	Project Duration (years)	Fiscal Year On-Line
10			**DEMOLITION**																
n/a	n/a	n/a	Demolition of Primary Sedimentation Tanks	n/a	$ 2,800,000	Incl. in Project 2.2													
n/a	n/a	n/a	Demolition of Primary Control Building	n/a	$ 2,200,000	Incl. in Project 2.2													
n/a	n/a	n/a	Demolition of Auxiliary Pump Station	n/a	$ 600,000	Incl. in Project 1.1													
n/a	n/a	n/a	Demolition Chlorine Building	n/a	$ -	Included in Sim. RW													
n/a	n/a	n/a	Demolition Chemical Storage Area	n/a	$ 600,000	Incl. in Project 1.1													
n/a	n/a	n/a	Demolition Dechlorination Building	n/a	$ 200,000	Incl. in Project 1.1													
n/a	n/a	n/a	Demolition of Administration Building	n/a	$ 300,000	Incl. in Project 8.3													
n/a	n/a	n/a	Demolition of Laboratory Building	n/a	$ 300,000	Incl. in Project 3.1													
n/a	n/a	n/a	Demolition DAFT	n/a	$ 1,500,000	Incl. in Project 2.3													
n/a	n/a	n/a	Demolition Float Pump Station	n/a	$ 1,000,000	Incl. in Project 2.3													
10.1	4	n/a	Demolition Fixed Growth Reactor (FGR) Pump Station	Split Flow	$ 1,200,000	$ 1,200,000	22	$ 1,864,000	$ 2,600,000	R&R	7/1/2035	2035	12	9	0	12	24	2	2037
10.2	5	n/a	Demolition Fixed Growth Reactors (FGRs)	Split Flow	$ 3,100,000	$ 3,100,000	22	$ 4,816,000	$ 6,800,000	R&R	7/1/2035	2035	12	9	0	12	24	2	2037
n/a	n/a	No	Demolition Dual Media Filters (DMFs)	n/a	$ 3,000,000	Incl. in Project 3.6													
11			**OPERATIONS AND MAINTENANCE**																
11.1	n/a	n/a	Capital Replacement (1% of All New Construction)	Split Flow	Annual allowance			$ 7,429,577	$ 10,550,000	R&R									
			ANNUAL TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included															
			CUMULATIVE TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included		$ 13,280,000		$ 13,582,000	$ 19,300,000										
			ANNUAL TOTAL - GENERAL IMPROVEMENTS	General															
			CUMULATIVE TOTAL - GENERAL IMPROVEMENTS	General		$ 252,230,000		$ 316,477,000	$ 422,800,000										
			ANNUAL TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow															
			CUMULATIVE TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow		$ 269,180,000		$ 364,544,577	$ 517,750,000										
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION																
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION			**$ 521,410,000**		**$ 681,021,577**	**$ 940,550,000**										

Legend
Value to input
Value calculated
Project element included in another CIP project
Project already funded and underway (not included in total CIP cashflow)

Annual Rate of Escalation	
ENR Construction Cost Index for Unescalated Costs (San Francisco, June 2015)	11,155
All CIP Projects unless noted otherwise	2.0%
Primary Treatment Facility	*

* See Primary Treatment Facility cost details (HW-PST Detail)

Program Factor*	Factor	Element Const. Cost (unescalated)
All CIP Projects unless noted otherwise	42.0%	
Primary Treatment Facility	19.6%	$ 104,500,000
Base Elements (Headworks, Primary Sedimentationk Tanks, etc.)	19.5%	$ 99,700,000
Additional Elements Package 2	42.0%	$ 600,000
Additional Elements Package 3	19.5%	$ 4,200,000

* See Basis of Program Factor for Additional Information

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
WPCP Master Plan
City of Sunnyvale

Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category General Split Flow Not Included	Phase 1 2013-2019 Total Package Project Cost (Escalated) 2%	Phase 2 2020-2023 Total Package Project Cost (Escalated) 2%	Phase 3 2024-2029 Total Package Project Cost (Escalated) 2%	Phase 4 2030-2036 Total Package Project Cost (Escalated) 2%	Phase 5 2037-2042 Total Package Project Cost (Escalated) 2%	FY 14/15 6/14 - 7/15 2014 FYB 2014	FY 15/16 6/15 - 7/16 2015 FYB 2015	FY 16/17 6/16 - 7/17 2016 FYB 2016	FY 17/18 6/17 - 7/18 2017 FYB 2017	FY 18/19 6/18 - 7/19 2018 FYB 2018	FY 19/20 6/19 - 7/20 2019 FYB 2019	FY 20/21 6/20 - 7/21 2020 FYB 2020	FY 21/22 6/21 - 7/22 2021 FYB 2021
1			PRIMARY TREATMENT														
1.1	1	n/a	Primary Treatment Facility	General	$ 133,100,000	$ -	$ -	$ -	$ -	$ 2,538,000	$ 23,715,271	$ 25,246,963	$ 45,444,533	$ 30,296,355	$ 5,858,879	$ -	$ -
1.2	1	n/a	Rehabilitation Primary Effluent Pipeline from Central Plant to Ponds	General	$ 2,800,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 840,000	$ 1,960,000	$ -	$ -	$ -	$ -
1.3	1	n/a	Rehabilitation Influent Pipelines to WPCP	General	$ 1,500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 450,000	$ 1,050,000	$ -	$ -	$ -	$ -
2			SECONDARY TREATMENT														
2.1	1	n/a	Existing Plant Rehabilitation - Split Flow	Split Flow	$ 43,300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,732,000	$ 2,598,000	$ 17,320,000	$ 21,650,000	$ -	$ -
n/a	n/a	n/a	36" Secondary Effluent Pipeline (from ponds) Rehabilitation	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Recirculation Pump Station Electrical Improvements	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	New Pond Effluent Pump Station and Screen (Includes Demo of Existing)	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Fixed Growth Reactor (FGR) Upgrades - Split Flow	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Air Flotation Tank (AFT) Upgrades - Split Flow	n/a	n/a	n/a	n/a	n/a	n/a								
2.2	2	n/a	Secondary Treatment Improvements - Split Flow Stage 1	Split Flow	$ -	$ 125,200,000	$ -	$ -	$ -	$ -	$ -	$ 1,252,000	$ 2,504,000	$ 8,764,000	$ 25,040,000	$ 37,560,000	$ 31,300,000
2.3	4	n/a	Secondary Treatment Improvements - Split Flow Stage 2	Split Flow	$ -	$ -	$ -	$ 86,600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2.4	4	n/a	Primary Effluent Diurnal Equalization and Emergency Storage	Split Flow	$ -	$ -	$ -	$ 135,600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2.5	4	n/a	Active Retirement of Ponds	Split Flow	$ -	$ -	$ -	$ 10,600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2.6	2	n/a	AFT Pump Station and Pipeline	Split Flow	$ -	$ 7,200,000	$ -	$ -	$ -	$ -	$ -	$ 720,000	$ 3,240,000	$ 3,240,000	$ -	$ -	$ -
2.7	5	n/a	Chemical Dosing (P-Removal)	Split Flow	$ -	$ -	$ -	$ -	$ 2,200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3			TERTIARY TREATMENT														
n/a	2	n/a	Dual Media Filter (DMF) Rehabilitation - Split Flow	n/a													
3.1	3	n/a	Filter Control Building (Includes Demolition of Existing)	Split Flow	$ -	$ -	$ 5,900,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 590,000
3.2	4	n/a	Filter Backwash Storage	Split Flow	$ -	$ -	$ -	$ 11,800,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.3	5	n/a	Denitrification Filters	General	$ -	$ -	$ -	$ -	$ 63,600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	n/a	Simultaneous Production of Recycled Water/Sodium Hypochlorite Conversion	Not Included	n/a	n/a	n/a	n/a	n/a	$ 840,000	$ 3,780,000	$ 3,780,000	$ -	$ -	$ -	$ -	$ -
n/a	1	n/a	Chlorine Contact Tank (CCT) Rehabilitation	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	2	n/a	Effluent Monitoring Stations	n/a													
3.4	3	n/a	Chloramine Disinfection	General	$ -	$ -	$ 3,500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.5	5	n/a	UV Disinfection	General	$ -	$ -	$ -	$ -	$ 20,800,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.6	5	n/a	Ozone Disinfection	General	$ -	$ -	$ -	$ -	$ 45,800,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.7	5	n/a	Membrane Filtration (MF) Improvements	Split Flow	$ -	$ -	$ -	$ -	$ 35,200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4			SOLIDS FACILITIES														
n/a	n/a	n/a	Digester No. 1 and 2 Upgrades	Not Included	n/a	n/a	n/a	n/a	n/a	$ 2,400,000	$ 5,600,000	$ -	$ -	$ -	$ -	$ -	$ -
4.1	2	n/a	Digester Supernatant PS and Drainage Piping Upgrades	General	$ -	$ 1,400,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.2	2	n/a	Thickening and Dewatering Facility - Stage 1	General	$ -	$ 52,100,000	$ -	$ -	$ -				$ 1,563,000	$ 1,563,000	$ 2,084,000		
4.3	4	n/a	Thickening and Dewatering Facility - Stage 2	General	$ -	$ -	$ -	$ 14,300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	n/a	Digester Sludge Storage Tank	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Digester Sludge Feed System	n/a	n/a	n/a	n/a	n/a	n/a								
4.4	3	n/a	Digester No. 5	Split Flow	$ -	$ -	$ 10,900,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.5	3	n/a	FOG/Food Waste Facility	Split Flow	$ -	$ -	$ 2,100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.6	4	n/a	Phosphorus Recovery Facility	General	$ -	$ -	$ -	$ 10,900,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.7	4	n/a	Biosolids Post-Processing	General	$ -	$ -	$ -	$ 32,200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5			COMBINED HEAT AND POWER														
n/a	n/a	n/a	Cogeneration Gas Treatment	Not Included	n/a	n/a	n/a	n/a	n/a	$ -	$ 870,000	$ 2,030,000	$ -	$ -	$ -	$ -	$ -
5.1	3	n/a	Cogeneration Upgrade	Split Flow	$ -	$ -	$ 21,200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6			ELECTRICAL														
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 1 - Primary Treatment Facility	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 2 - Secondary Treatment	n/a	n/a	n/a	n/a	n/a	n/a								
7			PROCESS CONTROL AND AUTOMATION (SCADA)														
n/a	n/a	n/a	SCADA System Improvements - Stage 1 - Headworks and Primary Treatment	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	SCADA System Improvements - Stage 2 - Secondary Treatment	n/a	n/a	n/a	n/a	n/a	n/a								
8			SUPPORT FACILITIES														
n/a	n/a	n/a	Tidal Flood Protection - Stage 1	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Tidal Flood Protection - Stage 2	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Borregas Avenue Parking Lot	Not Included													
8.1	1	n/a	New Access to Bay Trails	General	$ 600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 180,000	$ 420,000	$ -	$ -	$ -	$ -
8.2	1	n/a	Household Hazardous Waste Demolition/ Solid Waste Removal	General	$ 500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 150,000	$ 350,000	$ -	$ -	$ -	$ -
8.3	2	n/a	Administration and Lab Building	General	$ -	$ 26,300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,630,000	$ 11,835,000	$ 11,835,000	$ -	$ -
8.4	2	n/a	Maintenance Building	General	$ -	$ 7,400,000	$ -	$ -	-		$ -			$ 370,000	$ 370,000		$ 6,660,000
9			SUPPORT UTILITIES														
n/a	n/a	n/a	Site Security Improvements - Stage 1	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Site Security Improvements - Stage 2	n/a	n/a	n/a	n/a	n/a	n/a								
9.1	2	n/a	Recycle Water Improvements (New Recycled Water PS)	General	$ -	$ 4,200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9.2	2	n/a	Community Improvements	General	$ -	$ 700,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9.3	2	n/a	Landfill Gas Flare and Booster System Upgrades	General	$ -	$ 400,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9.4	2	n/a	Miscellaneous Civil Site/Support Utility Improvements	General	$ -	$ 700,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
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Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category General Split Flow Not Included	Phase 1 2013-2019 Total Package Project Cost (Escalated) 2%	Phase 2 2020-2023 Total Package Project Cost (Escalated) 2%	Phase 3 2024-2029 Total Package Project Cost (Escalated) 2%	Phase 4 2030-2036 Total Package Project Cost (Escalated) 2%	Phase 5 2037-2042 Total Package Project Cost (Escalated) 2%	FY 14/15 6/14 - 7/15 2014 FYB 2014	FY 15/16 6/15 - 7/16 2015 FYB 2015	FY 16/17 6/16 - 7/17 2016 FYB 2016	FY 17/18 6/17 - 7/18 2017 FYB 2017	FY 18/19 6/18 - 7/19 2018 FYB 2018	FY 19/20 6/19 - 7/20 2019 FYB 2019	FY 20/21 6/20 - 7/21 2020 FYB 2020	FY 21/22 6/21 - 7/22 2021 FYB 2021
10			**DEMOLITION**														
n/a	n/a	n/a	Demolition of Primary Sedimentation Tanks	n/a													
n/a	n/a	n/a	Demolition of Primary Control Building	n/a													
n/a	n/a	n/a	Demolition of Auxiliary Pump Station	n/a													
n/a	n/a	n/a	Demolition Chlorine Building	n/a													
n/a	n/a	n/a	Demolition Chemical Storage Area	n/a													
n/a	n/a	n/a	Demolition Dechlorination Building	n/a													
n/a	n/a	n/a	Demolition of Administration Building	n/a													
n/a	n/a	n/a	Demolition of Laboratory Building	n/a													
n/a	n/a	n/a	Demolition DAFT	n/a	n/a	n/a	n/a	n/a	n/a								
n/a	n/a	n/a	Demolition Float Pump Station	n/a	n/a	n/a	n/a	n/a	n/a								
10.1	4	n/a	Demolition Fixed Growth Reactor (FGR) Pump Station	Split Flow	$ -	$ -	$ -	$ 2,600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10.2	5	n/a	Demolition Fixed Growth Reactors (FGRs)	Split Flow	$ -	$ -	$ -	$ -	$ 6,800,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	No	Demolition Dual Media Filters (DMFs)	n/a													
11			**OPERATIONS AND MAINTENANCE**														
11.1	n/a	n/a	Capital Replacement (1% of All New Construction)	Split Flow	$ 1,360,000	$ 1,180,000	$ 1,960,000	$ 2,600,000	$ 3,450,000	$ -	$ 260,000	$ 270,000	$ 270,000	$ 280,000	$ 280,000	$ 290,000	$ 290,000
			ANNUAL TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included						$ 3,240,000	$ 10,250,000	$ 5,810,000	$ -	$ -	$ -	$ -	$ -
			CUMULATIVE TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included	$ -	$ -	$ -	$ -	$ -	$ 3,240,000	$ 13,490,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000
			ANNUAL TOTAL - GENERAL IMPROVEMENTS	General						$ 2,538,000	$ 23,715,271	$ 26,866,963	$ 53,417,533	$ 44,064,355	$ 20,147,879	$ -	$ 6,660,000
			CUMULATIVE TOTAL - GENERAL IMPROVEMENTS	General	$ 138,500,000	$ 93,200,000	$ 3,500,000	$ 57,400,000	$ 130,200,000	$ 2,538,000	$ 26,253,271	$ 53,120,234	$ 106,537,766	$ 150,602,121	$ 170,750,000	$ 170,750,000	$ 177,410,000
			ANNUAL TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow						$ -	$ 260,000	$ 3,974,000	$ 8,612,000	$ 29,604,000	$ 46,970,000	$ 37,850,000	$ 32,180,000
			CUMULATIVE TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow	$ 44,660,000	$ 133,580,000	$ 42,060,000	$ 249,800,000	$ 47,650,000	$ -	$ 260,000	$ 4,234,000	$ 12,846,000	$ 42,450,000	$ 89,420,000	$ 127,270,000	$ 159,450,000
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION							$ 2,538,000	$ 23,975,271	$ 30,840,963	$ 62,029,533	$ 73,668,355	$ 67,117,879	$ 37,850,000	$ 38,840,000
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION		**$ 183,160,000**	**$ 226,780,000**	**$ 45,560,000**	**$ 307,200,000**	**$ 177,850,000**	$ 2,538,000	$ 26,513,271	$ 57,354,234	$ 119,383,766	$ 193,052,121	$ 260,170,000	$ 298,020,000	$ 336,860,000

Legend
Value to input
Value calculated
Project element included in another CIP project
Project already funded and underway (not included in total CIP cashflow)

Annual Rate of Escalation	
ENR Construction Cost Index for Unescalated Costs (San Francisco, June 2015)	11,155
All CIP Projects unless noted otherwise	2.0%
Primary Treatment Facility	*

* See Primary Treatment Facility cost details (HW-PST Detail)

Program Factor*	Factor
All CIP Projects unless noted otherwise	42.0%
Primary Treatment Facility	19.6%
Base Elements (Headworks, Primary Sedimentationk Tanks, etc.)	19.5%
Additional Elements Package 2	42.0%
Additional Elements Package 3	19.5%

* See Basis of Program Factor for Additional Information

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
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Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category General Split Flow Not Included	FY 22/23 6/22 - 7/23 2022 FYB 2022	FY 23/24 6/23 - 7/24 2023 FYB 2023	FY 24/25 6/24 - 7/25 2024 FYB 2024	FY 25/26 6/25 - 7/26 2025 FYB 2025	FY 26/27 6/26 - 7/27 2026 FYB 2026	FY 27/28 6/27 - 7/28 2027 FYB 2027	FY 28/29 6/28 - 7/29 2028 FYB 2028	FY 29/30 6/29 - 7/30 2029 FYB 2029	FY 30/31 6/30 - 7/31 2030 FYB 2030	FY 31/32 6/31 - 7/32 2031 FYB 2031	FY 32/33 6/32 - 7/33 2032 FYB 2032
1			**PRIMARY TREATMENT**												
1.1	1	n/a	Primary Treatment Facility	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1.2	1	n/a	Rehabilitation Primary Effluent Pipeline from Central Plant to Ponds	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1.3	1	n/a	Rehabilitation Influent Pipelines to WPCP	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2			**SECONDARY TREATMENT**												
2.1	1	n/a	Existing Plant Rehabilitation - Split Flow	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	n/a	36" Secondary Effluent Pipeline (from ponds) Rehabilitation	n/a											
n/a	n/a	n/a	Recirculation Pump Station Electrical Improvements	n/a											
n/a	n/a	n/a	New Pond Effluent Pump Station and Screen (Includes Demo of Existing)	n/a											
n/a	n/a	n/a	Fixed Growth Reactor (FGR) Upgrades - Split Flow	n/a											
n/a	n/a	n/a	Air Flotation Tank (AFT) Upgrades - Split Flow	n/a											
2.2	2	n/a	Secondary Treatment Improvements - Split Flow Stage 1	Split Flow	$ 18,780,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2.3	4	n/a	Secondary Treatment Improvements - Split Flow Stage 2	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ 866,000	$ 1,732,000	$ 6,062,000	$ 17,320,000	$ 25,980,000
2.4	4	n/a	Primary Effluent Diurnal Equalization and Emergency Storage	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,424,000	$ 8,136,000	$ 47,460,000
2.5	4	n/a	Active Retirement of Ponds	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2.6	2	n/a	AFT Pump Station and Pipeline	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2.7	5	n/a	Chemical Dosing (P-Removal)	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3			**TERTIARY TREATMENT**												
n/a	2	n/a	Dual Media Filter (DMF) Rehabilitation - Split Flow	n/a											
3.1	3	n/a	Filter Control Building (Includes Demolition of Existing)	Split Flow	$ 2,655,000	$ 2,655,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.2	4	n/a	Filter Backwash Storage	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.3	5	n/a	Denitrification Filters	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	n/a	Simultaneous Production of Recycled Water/Sodium Hypochlorite Conversion	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	1	n/a	Chlorine Contact Tank (CCT) Rehabilitation	n/a											
n/a	2	n/a	Effluent Monitoring Stations	n/a											
3.4	3	n/a	Chloramine Disinfection	General	$ -	$ -	$ 1,050,000	$ 2,450,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.5	5	n/a	UV Disinfection	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.6	5	n/a	Ozone Disinfection	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3.7	5	n/a	Membrane Filtration (MF) Improvements	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4			**SOLIDS FACILITIES**												
n/a	n/a	n/a	Digester No. 1 and 2 Upgrades	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.1	2	n/a	Digester Supernatant PS and Drainage Piping Upgrades	General	$ 420,000	$ 980,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.2	2	n/a	Thickening and Dewatering Facility - Stage 1	General	$ 23,445,000	$ 23,445,000									
4.3	4	n/a	Thickening and Dewatering Facility - Stage 2	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	n/a	Digester Sludge Storage Tank	n/a											
n/a	n/a	n/a	Digester Sludge Feed System	n/a											
4.4	3	n/a	Digester No. 5	Split Flow	$ -	$ -	$ -	$ -	$ 436,000	$ 654,000	$ 4,360,000	$ 5,450,000	$ -	$ -	$ -
4.5	3	n/a	FOG/Food Waste Facility	Split Flow	$ -	$ 210,000	$ 945,000	$ 945,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4.6	4	n/a	Phosphorus Recovery Facility	General	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,270,000	$ 7,630,000	$ -	$ -	$ -
4.7	4	n/a	Biosolids Post-Processing	General	$ -	$ -	$ -	$ -	$ -	$ 1,288,000	$ 1,932,000	$ 12,880,000	$ 16,100,000	$ -	$ -
5			**COMBINED HEAT AND POWER**												
n/a	n/a	n/a	Cogeneration Gas Treatment	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5.1	3	n/a	Cogeneration Upgrade	Split Flow	$ 848,000	$ 1,272,000	$ 8,480,000	$ 10,600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6			**ELECTRICAL**												
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 1 - Primary Treatment Facility	n/a											
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 2 - Secondary Treatment	n/a											
7			**PROCESS CONTROL AND AUTOMATION (SCADA)**												
n/a	n/a	n/a	SCADA System Improvements - Stage 1 - Headworks and Primary Treatment	n/a											
n/a	n/a	n/a	SCADA System Improvements - Stage 2 - Secondary Treatment	n/a											
8			**SUPPORT FACILITIES**												
n/a	n/a	n/a	Tidal Flood Protection - Stage 1	n/a											
n/a	n/a	n/a	Tidal Flood Protection - Stage 2	n/a											
n/a	n/a	n/a	Borregas Avenue Parking Lot	Not Included											
8.1	1	n/a	New Access to Bay Trails	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8.2	1	n/a	Household Hazardous Waste Demolition/ Solid Waste Removal	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8.3	2	n/a	Administration and Lab Building	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8.4	2	n/a	Maintenance Building	General											
9			**SUPPORT UTILITIES**												
n/a	n/a	n/a	Site Security Improvements - Stage 1	n/a											
n/a	n/a	n/a	Site Security Improvements - Stage 2	n/a											
9.1	2	n/a	Recycle Water Improvements (New Recycled Water PS)	General	$ -	$ -	$ -	$ 1,260,000	$ 2,940,000	$ -	$ -	$ -	$ -	$ -	$ -
9.2	2	n/a	Community Improvements	General	$ -	$ -	$ -	$ 700,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9.3	2	n/a	Landfill Gas Flare and Booster System Upgrades	General	$ -	$ -	$ -	$ 120,000	$ 280,000	$ -	$ -	$ -	$ -	$ -	$ -
9.4	2	n/a	Miscellaneous Civil Site/Support Utility Improvements	General	$ -	$ -	$ -	$ 210,000	$ 490,000	$ -	$ -	$ -	$ -	$ -	$ -

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
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Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category: General / Split Flow / Not Included	FY 22/23 6/22 - 7/23 2022 FYB 2022	FY 23/24 6/23 - 7/24 2023 FYB 2023	FY 24/25 6/24 - 7/25 2024 FYB 2024	FY 25/26 6/25 - 7/26 2025 FYB 2025	FY 26/27 6/26 - 7/27 2026 FYB 2026	FY 27/28 6/27 - 7/28 2027 FYB 2027	FY 28/29 6/28 - 7/29 2028 FYB 2028	FY 29/30 6/29 - 7/30 2029 FYB 2029	FY 30/31 6/30 - 7/31 2030 FYB 2030	FY 31/32 6/31 - 7/32 2031 FYB 2031	FY 32/33 6/32 - 7/33 2032 FYB 2032
10			**DEMOLITION**												
n/a	n/a	n/a	Demolition of Primary Sedimentation Tanks	n/a											
n/a	n/a	n/a	Demolition of Primary Control Building	n/a											
n/a	n/a	n/a	Demolition of Auxiliary Pump Station	n/a											
n/a	n/a	n/a	Demolition Chlorine Building	n/a											
n/a	n/a	n/a	Demolition Chemical Storage Area	n/a											
n/a	n/a	n/a	Demolition Dechlorination Building	n/a											
n/a	n/a	n/a	Demolition of Administration Building	n/a											
n/a	n/a	n/a	Demolition of Laboratory Building	n/a											
n/a	n/a	n/a	Demolition DAFT	n/a											
n/a	n/a	n/a	Demolition Float Pump Station	n/a											
10.1	4	n/a	Demolition Fixed Growth Reactor (FGR) Pump Station	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10.2	5	n/a	Demolition Fixed Growth Reactors (FGRs)	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
n/a	n/a	No	Demolition Dual Media Filters (DMFs)	n/a											
11			**OPERATIONS AND MAINTENANCE**												
11.1	n/a	n/a	Capital Replacement (1% of All New Construction)	Split Flow	$ 300,000	$ 300,000	$ 310,000	$ 320,000	$ 320,000	$ 330,000	$ 340,000	$ 340,000	$ 350,000	$ 360,000	$ 360,000
			ANNUAL TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			CUMULATIVE TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000
			ANNUAL TOTAL - GENERAL IMPROVEMENTS	General	$ 23,865,000	$ 24,425,000	$ 1,050,000	$ 4,740,000	$ 3,710,000	$ 1,288,000	$ 5,202,000	$ 20,510,000	$ 16,100,000	$ -	$ -
			CUMULATIVE TOTAL - GENERAL IMPROVEMENTS	General	$ 201,275,000	$ 225,700,000	$ 226,750,000	$ 231,490,000	$ 235,200,000	$ 236,488,000	$ 241,690,000	$ 262,200,000	$ 278,300,000	$ 278,300,000	$ 278,300,000
			ANNUAL TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow	$ 22,583,000	$ 4,437,000	$ 9,735,000	$ 11,865,000	$ 756,000	$ 984,000	$ 5,566,000	$ 7,522,000	$ 11,836,000	$ 25,816,000	$ 73,800,000
			CUMULATIVE TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow	$ 182,033,000	$ 186,470,000	$ 196,205,000	$ 208,070,000	$ 208,826,000	$ 209,810,000	$ 215,376,000	$ 222,898,000	$ 234,734,000	$ 260,550,000	$ 334,350,000
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION		$ 46,448,000	$ 28,862,000	$ 10,785,000	$ 16,605,000	$ 4,466,000	$ 2,272,000	$ 10,768,000	$ 28,032,000	$ 27,936,000	$ 25,816,000	$ 73,800,000
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION		$ 383,308,000	$ 412,170,000	$ 422,955,000	$ 439,560,000	$ 444,026,000	$ 446,298,000	$ 457,066,000	$ 485,098,000	$ 513,034,000	$ 538,850,000	$ 612,650,000

Legend
Value to input
Value calculated
Project element included in another CIP project
Project already funded and underway (not included in total CIP cashflow)

Annual Rate of Escalation	
ENR Construction Cost Index for Unescalated Costs (San Francisco, June 2015)	11,155
All CIP Projects unless noted otherwise	2.0%
Primary Treatment Facility	*

* See Primary Treatment Facility cost details (HW-PST Detail)

Program Factor*	Factor
All CIP Projects unless noted otherwise	42.0%
Primary Treatment Facility	19.6%
Base Elements (Headworks, Primary Sedimentationk Tanks, etc.)	19.5%
Additional Elements Package 2	42.0%
Additional Elements Package 3	19.5%

* See Basis of Program Factor for Additional Information

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
WPCP Master Plan
City of Sunnyvale

Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category General Split Flow Not Included	FY 33/34 6/33 - 7/34 2033 FYB 2033	FY 34/35 6/34 - 7/35 2034 FYB 2034	FY 35/36 6/35 - 7/36 2035 FYB 2035	FY 36/37 6/36 - 7/37 2036 FYB 2036	FY 37/38 6/37 - 7/38 2037 FYB 2037	FY 38/39 6/38 - 7/39 2038 FYB 2038	FY 39/40 6/39 - 7/40 2039 FYB 2039	FY 40/41 6/40 - 7/41 2040 FYB 2040	FY 41/42 6/41 - 7/42 2041 FYB 2041	FY 42/43 6/42 - 7/43 2042 FYB 2042	FY 43/44 6/43 - 7/44 2043 FYB 2043	FY 44/45 6/44 - 7/45 2044 FYB 2044	Total
1			**PRIMARY TREATMENT**														
1.1	1	n/a	Primary Treatment Facility	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 133,100,000
1.2	1	n/a	Rehabilitation Primary Effluent Pipeline from Central Plant to Ponds	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,800,000
1.3	1	n/a	Rehabilitation Influent Pipelines to WPCP	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,500,000
2			**SECONDARY TREATMENT**														
2.1	1	n/a	Existing Plant Rehabilitation - Split Flow	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 43,300,000
n/a	n/a	n/a	36" Secondary Effluent Pipeline (from ponds) Rehabilitation	n/a													
n/a	n/a	n/a	Recirculation Pump Station Electrical Improvements	n/a													
n/a	n/a	n/a	New Pond Effluent Pump Station and Screen (Includes Demo of Existing)	n/a													
n/a	n/a	n/a	Fixed Growth Reactor (FGR) Upgrades - Split Flow	n/a													
n/a	n/a	n/a	Air Flotation Tank (AFT) Upgrades - Split Flow	n/a													
2.2	2	n/a	Secondary Treatment Improvements - Split Flow Stage 1	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 125,200,000
2.3	4	n/a	Secondary Treatment Improvements - Split Flow Stage 2	Split Flow	$ 21,650,000	$ 12,990,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 86,600,000
2.4	4	n/a	Primary Effluent Diurnal Equalization and Emergency Storage	Split Flow	$ 47,460,000	$ 27,120,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 135,600,000
2.5	4	n/a	Active Retirement of Ponds	Split Flow	$ -	$ -	$ 1,060,000	$ 4,770,000	$ 4,770,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,600,000
2.6	2	n/a	AFT Pump Station and Pipeline	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,200,000
2.7	5	n/a	Chemical Dosing (P-Removal)	Split Flow	$ -	$ 660,000	$ 1,540,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,200,000
3			**TERTIARY TREATMENT**														
n/a	2	n/a	Dual Media Filter (DMF) Rehabilitation - Split Flow	n/a													
3.1	3	n/a	Filter Control Building (Includes Demolition of Existing)	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,900,000
3.2	4	n/a	Filter Backwash Storage	Split Flow	$ -	$ 1,180,000	$ 5,310,000	$ 5,310,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,800,000
3.3	5	n/a	Denitrification Filters	General	$ -	$ -	$ 2,544,000	$ 3,816,000	$ 25,440,000	$ 31,800,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 63,600,000
n/a	n/a	n/a	Simultaneous Production of Recycled Water/Sodium Hypochlorite Conversion	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,400,000
n/a	1	n/a	Chlorine Contact Tank (CCT) Rehabilitation	n/a													
n/a	2	n/a	Effluent Monitoring Stations	n/a													
3.4	3	n/a	Chloramine Disinfection	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,500,000
3.5	5	n/a	UV Disinfection	General	$ 832,000	$ 1,248,000	$ 8,320,000	$ 10,400,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,800,000
3.6	5	n/a	Ozone Disinfection	General	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,580,000	$ 20,610,000	$ 20,610,000	$ -	$ -	$ -	$ 45,800,000
3.7	5	n/a	Membrane Filtration (MF) Improvements	Split Flow	$ -	$ -	$ -	$ -	$ 3,520,000	$ 15,840,000	$ 15,840,000	$ -	$ -	$ -	$ -	$ -	$ 35,200,000
4			**SOLIDS FACILITIES**														
n/a	n/a	n/a	Digester No. 1 and 2 Upgrades	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,000,000
4.1	2	n/a	Digester Supernatant PS and Drainage Piping Upgrades	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,400,000
4.2	2	n/a	Thickening and Dewatering Facility - Stage 1	General													$ 52,100,000
4.3	4	n/a	Thickening and Dewatering Facility - Stage 2	General	$ 4,290,000	$ 10,010,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,300,000
n/a	n/a	n/a	Digester Sludge Storage Tank	n/a													
n/a	n/a	n/a	Digester Sludge Feed System	n/a													
4.4	3	n/a	Digester No. 5	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,900,000
4.5	3	n/a	FOG/Food Waste Facility	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,100,000
4.6	4	n/a	Phosphorus Recovery Facility	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,900,000
4.7	4	n/a	Biosolids Post-Processing	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 32,200,000
5			**COMBINED HEAT AND POWER**														
n/a	n/a	n/a	Cogeneration Gas Treatment	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,900,000
5.1	3	n/a	Cogeneration Upgrade	Split Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,200,000
6			**ELECTRICAL**														
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 1 - Primary Treatment Facility	n/a													
n/a	n/a	n/a	12 kV Electrical Distribution System - Stage 2 - Secondary Treatment	n/a													
7			**PROCESS CONTROL AND AUTOMATION (SCADA)**														
n/a	n/a	n/a	SCADA System Improvements - Stage 1 - Headworks and Primary Treatment	n/a													
n/a	n/a	n/a	SCADA System Improvements - Stage 2 - Secondary Treatment	n/a													
8			**SUPPORT FACILITIES**														
n/a	n/a	n/a	Tidal Flood Protection - Stage 1	n/a													
n/a	n/a	n/a	Tidal Flood Protection - Stage 2	n/a													
n/a	n/a	n/a	Borregas Avenue Parking Lot	Not Included													$ -
8.1	1	n/a	New Access to Bay Trails	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 600,000
8.2	1	n/a	Household Hazardous Waste Demolition/ Solid Waste Removal	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500,000
8.3	2	n/a	Administration and Lab Building	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 26,300,000
8.4	2	n/a	Maintenance Building	General													$ 7,400,000
9			**SUPPORT UTILITIES**														
n/a	n/a	n/a	Site Security Improvements - Stage 1	n/a													
n/a	n/a	n/a	Site Security Improvements - Stage 2	n/a													
9.1	2	n/a	Recycle Water Improvements (New Recycled Water PS)	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,200,000
9.2	2	n/a	Community Improvements	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 700,000
9.3	2	n/a	Landfill Gas Flare and Booster System Upgrades	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 400,000
9.4	2	n/a	Miscellaneous Civil Site/Support Utility Improvements	General	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 700,000

Master Plan CIP Summary - Conventional Activated Sludge (CAS) - Split Flow
WPCP Master Plan
City of Sunnyvale

Project ID	Phase	Different from Split Flow CIP	Project Title (Descriptive)	Category General Split Flow Not Included	FY 33/34 6/33 - 7/34 2033 FYB 2033	FY 34/35 6/34 - 7/35 2034 FYB 2034	FY 35/36 6/35 - 7/36 2035 FYB 2035	FY 36/37 6/36 - 7/37 2036 FYB 2036	FY 37/38 6/37 - 7/38 2037 FYB 2037	FY 38/39 6/38 - 7/39 2038 FYB 2038	FY 39/40 6/39 - 7/40 2039 FYB 2039	FY 40/41 6/40 - 7/41 2040 FYB 2040	FY 41/42 6/41 - 7/42 2041 FYB 2041	FY 42/43 6/42 - 7/43 2042 FYB 2042	FY 43/44 6/43 - 7/44 2043 FYB 2043	FY 44/45 6/44 - 7/45 2044 FYB 2044	Total
10			**DEMOLITION**														
n/a	n/a	n/a	Demolition of Primary Sedimentation Tanks	n/a													
n/a	n/a	n/a	Demolition of Primary Control Building	n/a													
n/a	n/a	n/a	Demolition of Auxiliary Pump Station	n/a													
n/a	n/a	n/a	Demolition Chlorine Building	n/a													
n/a	n/a	n/a	Demolition Chemical Storage Area	n/a													
n/a	n/a	n/a	Demolition Dechlorination Building	n/a													
n/a	n/a	n/a	Demolition of Administration Building	n/a													
n/a	n/a	n/a	Demolition of Laboratory Building	n/a													
n/a	n/a	n/a	Demolition DAFT	n/a													
n/a	n/a	n/a	Demolition Float Pump Station	n/a													
10.1	4	n/a	Demolition Fixed Growth Reactor (FGR) Pump Station	Split Flow	$ -	$ -	$ 780,000	$ 1,820,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,600,000
10.2	5	n/a	Demolition Fixed Growth Reactors (FGRs)	Split Flow	$ -	$ -	$ 2,040,000	$ 4,760,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,800,000
n/a	n/a	No	Demolition Dual Media Filters (DMFs)	n/a													
11			**OPERATIONS AND MAINTENANCE**														
11.1	n/a	n/a	Capital Replacement (1% of All New Construction)	Split Flow	$ 370,000	$ 380,000	$ 390,000	$ 390,000	$ 400,000	$ 410,000	$ 420,000	$ 430,000	$ 440,000	$ 440,000	$ 450,000	$ 460,000	$ 10,550,000
			ANNUAL TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,300,000
			CUMULATIVE TOTAL - CURRENT IMPROVEMENTS (Not Included)	Not Included	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000	$ 19,300,000
			ANNUAL TOTAL - GENERAL IMPROVEMENTS	General	$ 5,122,000	$ 11,258,000	$ 10,864,000	$ 14,216,000	$ 25,440,000	$ 31,800,000	$ 4,580,000	$ 20,610,000	$ 20,610,000	$ -	$ -	$ -	$ 422,800,000
			CUMULATIVE TOTAL - GENERAL IMPROVEMENTS	General	$ 283,422,000	$ 294,680,000	$ 305,544,000	$ 319,760,000	$ 345,200,000	$ 377,000,000	$ 381,580,000	$ 402,190,000	$ 422,800,000	$ 422,800,000	$ 422,800,000	$ 422,800,000	$ 422,800,000
			ANNUAL TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow	$ 69,480,000	$ 42,330,000	$ 11,120,000	$ 17,050,000	$ 8,690,000	$ 16,250,000	$ 16,260,000	$ 430,000	$ 440,000	$ 440,000	$ 450,000	$ 460,000	$ 517,750,000
			CUMULATIVE TOTAL - SPLIT FLOW IMPROVEMENTS	Split Flow	$ 403,830,000	$ 446,160,000	$ 457,280,000	$ 474,330,000	$ 483,020,000	$ 499,270,000	$ 515,530,000	$ 515,960,000	$ 516,400,000	$ 516,840,000	$ 517,290,000	$ 517,750,000	$ 517,750,000
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION		$ 74,602,000	$ 53,588,000	$ 21,984,000	$ 31,266,000	$ 34,130,000	$ 48,050,000	$ 20,840,000	$ 21,040,000	$ 21,050,000	$ 440,000	$ 450,000	$ 460,000	$ 940,550,000
			ANNUAL TOTAL - SPLIT FLOW IMPLEMENTATION		$ 687,252,000	$ 740,840,000	$ 762,824,000	$ 794,090,000	$ 828,220,000	$ 876,270,000	$ 897,110,000	$ 918,150,000	$ 939,200,000	$ 939,640,000	$ 940,090,000	$ 940,550,000	$ 940,550,000

Legend
Value to input
Value calculated
Project element included in another CIP project
Project already funded and underway (not included in total CIP cashflow)

Annual Rate of Escalation	
ENR Construction Cost Index for Unescalated Costs (San Francisco, June 2015)	11,155
All CIP Projects unless noted otherwise	2.0%
Primary Treatment Facility	*

* See Primary Treatment Facility cost details (HW-PST Detail)

Program Factor*	Factor
All CIP Projects unless noted otherwise	42.0%
Primary Treatment Facility	19.6%
Base Elements (Headworks, Primary Sedimentationk Tanks, etc.)	19.5%
Additional Elements Package 2	42.0%
Additional Elements Package 3	19.5%

* See Basis of Program Factor for Additional Information

Basis of CIP Program Factor
Master Plan
City of Sunnyvale

Item	Master Plan Program Factor [1]	Primary Treatment Facility Program Factor [2]
Program Cost Factor Applied to Construction Cost		
Engineering design/ESDC fees [3]	15.0%	0.0%
Third-party construction management fees	7.0%	7.0%
Program management costs	7.0%	0.0%
Environmental mitigation	1.5%	1.5%
CEQA/permitting	0.5%	0.0%
City costs		
City project management costs	1.0%	1.0%
City legal and administrative costs and fees	0.0%	0.0%
Construction change order allowance (design contingency)	10.0%	10.0%
Total Program Cost Factor	**42.0%**	**19.5%**

Notes:
(1) Program factor applied to all Master Plan CIP projected unless noted otherwise.
(2) Program factor applied to Primary Treatment Facility project because a portion of the project (planning and design) was completed prior to the finalization of the Master Plan.
(3) Varies accordingly:
Master Plan Program Factor based on 12% design and 3% ESDC.
Primary Treatment Program Factor based on 0% design and 0% ESDC because planning and design already underway prior to finalization of the Master Plan.
Secondary Treatment Improvements Factor based on 11% design and 3% ESDC.

Standard S Curve Distribution of Project Costs

Project Duration (Years)	Percentage of project cost spent in year																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
2	30%	70%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
3	10%	45%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
4	4%	6%	40%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
5	4%	6%	35%	35%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
6	1%	4%	5%	35%	35%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
7	1%	2%	7%	20%	30%	25%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
8	1%	2%	7%	10%	15%	25%	25%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
9	1%	2%	5%	7%	10%	15%	25%	20%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
10	1%	1%	2%	5%	7%	12%	15%	22%	20%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
11	1%	1%	2%	5%	5%	7%	12%	15%	22%	15%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
12	1%	1%	2%	2%	5%	5%	7%	12%	15%	20%	15%	15%	0%	0%	0%	0%	0%	0%	0%	0%	100%
13	1%	1%	2%	2%	3%	5%	5%	7%	11%	14%	20%	15%	14%	0%	0%	0%	0%	0%	0%	0%	100%
14	1%	1%	2%	2%	2%	3%	5%	5%	7%	11%	14%	19%	14%	14%	0%	0%	0%	0%	0%	0%	100%
15	1%	1%	2%	2%	2%	2%	3%	5%	5%	7%	11%	14%	18%	14%	13%	0%	0%	0%	0%	0%	100%

Escalation and S-Curve Detail for Primary Treatment Facility Project

Fiscal Year Cashflow for HW/PSTs
Primary Treatment Facility Project
City of Sunnyvale — 9/25/2014

	Escalation Rate	Program Factor	Total Construction Cost	Total Construction Cost	Total Program Cost[(1)(2)]	Cashflow[(1)(3)]						
			Unescalated	Escalated	Escalated	2014	2015	2016	2017	2018	2019	2020
Base Elements												
Design	0.0%	0.0%	$5,400,000	$ 5,400,000	$5,400,000	$2,538,000	$2,862,000	$0	$0	$0	$0	$0
ESDC	0.0%	0.0%	$2,100,000	$ 2,100,000	$2,100,000	$0	$353,271	$421,963	$759,533	$506,355	$58,879	$0
Construction Package 1	5.0%	19.5%	$16,330,000	$ 17,136,000	$20,500,000	$0	$20,500,000	$0	$0	$0	$0	$0
Construction Package 2	8.6%	19.5%	$75,830,000	$ 82,338,000	$98,400,000	$0	$0	$24,600,000	$44,280,000	$29,520,000	$0	$0
Construction Package 3	16.2%	19.5%	$0		$0	$0	$0	$0	$0	$0	$0	$0
Subtotal			**$99,700,000**	**$107,000,000**	**$126,400,000**	**$2,538,000**	**$23,715,271**	**$25,021,963**	**$45,039,533**	**$30,026,355**	**$58,879**	**$0**
Subtotal Project S-Curve						**2%**	**19%**	**20%**	**36%**	**24%**	**0%**	**0%**
Additional Elements												
Additional Elements Package 2	8.6%	42%	$600,000	$651,480	$900,000	$0	$0	225,000	$405,000	$270,000	$0	$0
Additional Elements Package 3	16.2%	19.5%	$4,200,000	$4,879,231	$5,800,000	$0	$0	$0	$0	$0	$5,800,000	$0
Subtotal			**$4,800,000**	**$5,500,000**	**$6,700,000**	**$0**	**$0**	**$225,000**	**$405,000**	**$270,000**	**$5,800,000**	**$0**
Subtotal Project S-Curve						**0%**	**0%**	**3%**	**6%**	**4%**	**87%**	**0%**
Total			**$104,500,000**	**$ 112,500,000**	**$133,100,000**	**$2,538,000**	**$23,715,271**	**$25,246,963**	**$45,444,533**	**$30,296,355**	**$5,858,879**	**$0**
Total Project S-Curve						**2%**	**18%**	**19%**	**34%**	**23%**	**4%**	**0%**

Note:
(1) All costs are escalated.
(2) Cashflow excludes City and Program Management Consultant (PMC) costs.
(3) Cashflow based on Primary Treatment Facility Project schedule updated on 9/8/14 and total project budget as of 9/25/14.

Custom S-Curve for Fiscal Year Cashflow for HW/PSTs
Primary Treatment Facility Project
City of Sunnyvale — 9/25/2014

Project Phase	Start Date	End Date	Start Year	End Year	Duration (Years)	Cashflow[(1)(3)] FYB 2014	FYB 2015	FYB 2016	FYB 2017	FYB 2018	FYB 2019	FYB 2020
						2014	2015	2016	2017	2018	2019	2020
Design	7/1/2015	1/29/2016	2015	2016	1	47%	53%	0%	0%	0%	0%	0%
ESDC	9/9/2015	2/3/2020	2015	2020	5		17%	20%	36%	24%	3%	0%
Construction Package 1	9/9/2015	6/9/2016	2015	2016	1		100%	0%	0%	0%	0%	0%
Construction Package 2	8/1/2016	5/2/2019	2016	2019	3		0%	25%	45%	30%	0%	0%
Construction Package 3	5/3/2019	2/3/2020	2019	2020	1		0%	0%	0%	0%	100%	0%
Construction Add Pack 2	8/1/2016	5/2/2019	2016	2019	3	0%	0%	25%	45%	30%	0%	0%
Construction Add Pack 3	8/1/2016	5/2/2019	2016	2019	3	0%	0%	0%	0%	0%	100%	0%

Note:
(1) All costs are escalated.
(2) Cashflow excludes City and Program Management Consultant (PMC) costs.
(3) Cashflow based on Primary Treatment Facility Project schedule updated on 9/8/14 and total project budget as of 9/25/14.

Custom S-Curve Package 2

Project Phase	2014	2015	2016	2017	2018	2019	2020
Package 2		0%	25%	45%	30%	0%	0%

Custom S-Curve - ESDC

Project Phase	Total Capital Cost	FYB 2014	FYB 2015	FYB 2016	FYB 2017	FYB 2018	FYB 2019	FYB 2020
ESDC - Package 1	$ 360,000	$0	$360,000	$0	$0	$0	$0	$0
ESDC - Package 2	$ 1,720,000	$0	$0	$430,000	$774,000	$516,000	$0	$0
ESDC - Package 3	$ 60,000	$0	$0	$0	$0	$0	$60,000	$0
Total ESDC	**$2,140,000**		**$360,000**	**$430,000**	**$774,000**	**$516,000**	**$60,000**	**$0**
Total ESDC			**16.8%**	**20.1%**	**36.2%**	**24.1%**	**2.8%**	**0.0%**

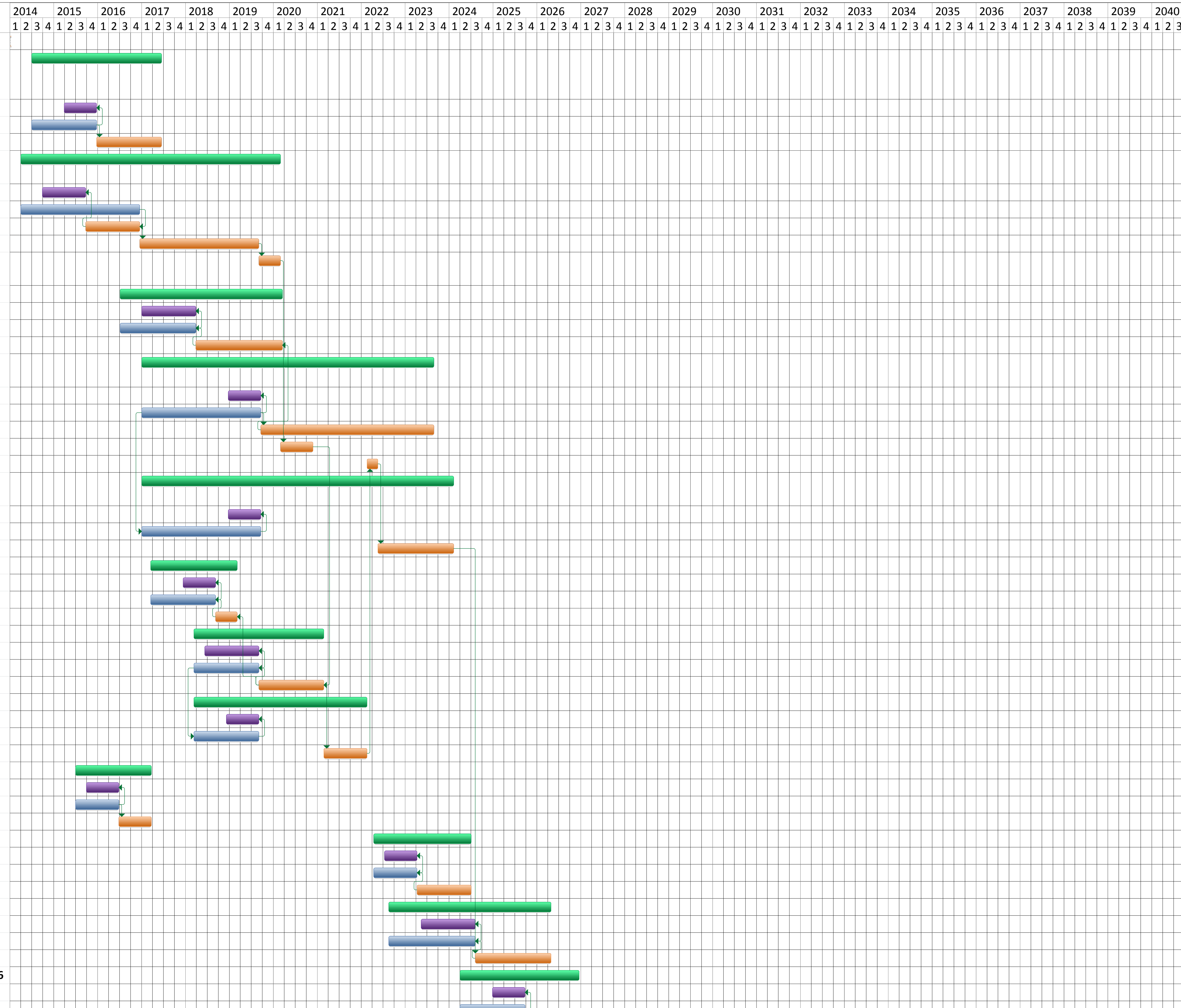
Standard S Curve Distribution of Project Costs

Project Duration (Years)	Percentage of project cost spent in year: 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
2	30%	70%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
3	10%	45%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
4	4%	6%	40%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
5	4%	6%	35%	35%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
6	1%	4%	5%	35%	35%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
7	1%	2%	7%	20%	30%	25%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
8	1%	2%	7%	10%	15%	25%	25%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
9	1%	2%	5%	7%	10%	15%	25%	20%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
10	1%	1%	2%	5%	7%	12%	15%	22%	20%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
11	1%	1%	2%	5%	5%	7%	12%	15%	22%	15%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
12	1%	1%	2%	2%	5%	5%	7%	12%	15%	20%	15%	15%	0%	0%	0%	0%	0%	0%	0%	0%	100%
13	1%	1%	2%	2%	3%	5%	5%	7%	11%	14%	20%	15%	14%	0%	0%	0%	0%	0%	0%	0%	100%
14	1%	1%	2%	2%	2%	3%	5%	5%	7%	11%	14%	19%	14%	14%	0%	0%	0%	0%	0%	0%	100%
15	1%	1%	2%	2%	2%	2%	3%	5%	5%	7%	11%	14%	18%	14%	13%	0%	0%	0%	0%	0%	100%

APPENDIX C - CIP SCHEDULE

WPCP Master Plan Implementation Schedule
Split Flow - CAS

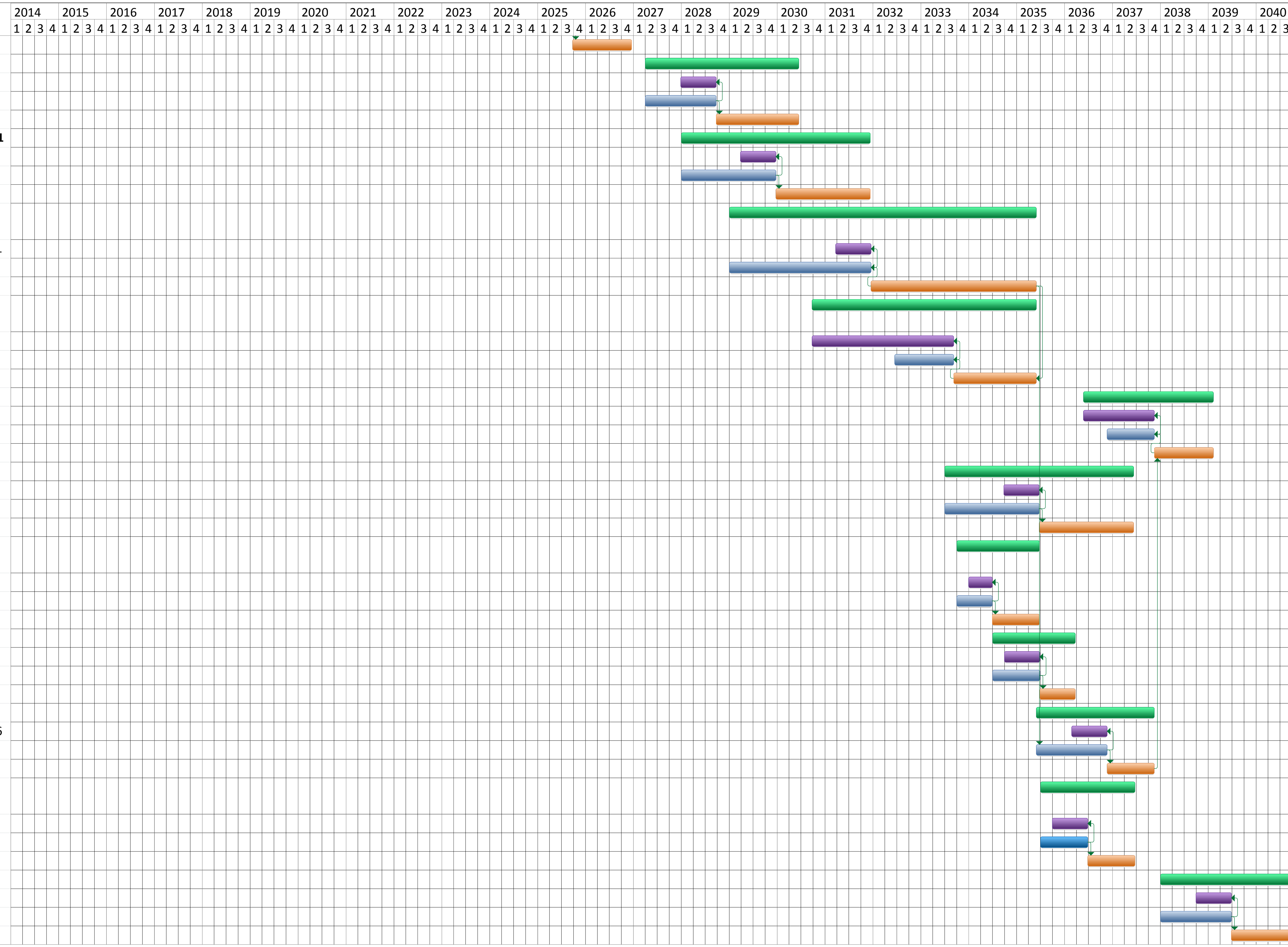
ID	Task Name	Duration	Predecessors	Start	Finish
1	CIP Start				
2	**Simultaneous Production of Recycled Water/Sodium Hypochlorite Conversion**	**36 mons**		**Tue 7/1/14**	**Wed 6/14/17**
3	Permitting/CEQA	9 mons	4FF	Sat 3/28/15	Tue 12/22/15
4	Design	18 mons		Tue 7/1/14	Tue 12/22/15
5	Construction	18 mons	4	Wed 12/23/15	Wed 6/14/17
6	**Headworks and Primary Treatment Facility**	**72 mons**		**Tue 4/1/14**	**Fri 2/28/20**
7	Permitting/CEQA	12 mons	9SF	Sun 9/28/14	Wed 9/23/15
8	Design	33 mons		Tue 4/1/14	Thu 12/15/16
9	Construction Pkg. 1 - Sitework	15 mons	8FF	Wed 9/23/15	Thu 12/15/16
10	Construction Pkg. 2 - Facilities	33 mons	9	Fri 12/16/16	Sun 9/1/19
11	Construction Pkg. 3 - Demolition PSTs	6 mons	10	Mon 9/2/19	Fri 2/28/20
12	**Existing Plant Rehabilitation**	**45 mons**		**Tue 7/5/16**	**Sun 3/15/20**
13	Permitting/CEQA	15 mons	14FF	Sun 1/1/17	Tue 3/27/18
14	Design	21 mons	15SF	Tue 7/5/16	Tue 3/27/18
15	Construction	24 mons	19SF+6 mons	Tue 3/27/18	Sun 3/15/20
16	**Secondary Treatment Improvements - Stage 1**	**81 mons**		**Sun 1/1/17**	**Sun 8/27/23**
17	Permitting/CEQA	9 mons	18FF	Sat 12/22/18	Tue 9/17/19
18	Design	33 mons		Sun 1/1/17	Tue 9/17/19
19	Construction - All Elements	48 mons	18	Wed 9/18/19	Sun 8/27/23
20	Construction - Sec. Clarifiers	9 mons	11	Sat 2/29/20	Tue 11/24/20
21	Demolition of P.C. Building	3 mons	37	Fri 2/18/22	Wed 5/18/22
22	**Thickening and Dewatering Facility - Stage 1**	**86.47 mons**		**Sun 1/1/17**	**Wed 2/7/24**
23	Permitting/CEQA	9 mons	24FF	Sat 12/22/18	Tue 9/17/19
24	Design	33 mons	18SS	Sun 1/1/17	Tue 9/17/19
25	Construction	21 mons	21	Thu 5/19/22	Wed 2/7/24
26	**New Access to Bay Trails**	**24 mons**		**Thu 3/16/17**	**Tue 3/5/19**
27	Permitting/CEQA	9 mons	28FF	Mon 12/11/17	Fri 9/7/18
28	Design	18 mons	29SF	Thu 3/16/17	Fri 9/7/18
29	Construction	6 mons	33SF-6 mons	Fri 9/7/18	Wed 3/6/19
30	**Administration and Lab Building**	**36 mons**		**Sun 3/11/18**	**Mon 2/22/21**
31	Permitting/CEQA	15 mons	32FF	Sat 6/9/18	Mon 9/2/19
32	Design	18 mons	33SF	Sun 3/11/18	Mon 9/2/19
33	Construction	18 mons	20FF+3 mons	Mon 9/2/19	Mon 2/22/21
34	**Maintenance Building**	**48 mons**		**Sun 3/11/18**	**Thu 2/17/22**
35	Permitting/CEQA	9 mons	36FF	Thu 12/6/18	Sun 9/1/19
36	Design	18 mons	32SS	Sun 3/11/18	Sun 9/1/19
37	Construction	12 mons	33	Tue 2/23/21	Thu 2/17/22
38	**Cogeneration Gas Treatment**	**21 mons**		**Wed 7/1/15**	**Tue 3/21/17**
39	Permitting/CEQA	9 mons	40FF	Tue 9/29/15	Fri 6/24/16
40	Design	12 mons		Wed 7/1/15	Fri 6/24/16
41	Construction	9 mons	40	Sat 6/25/16	Tue 3/21/17
42	**Filter Control Building**	**27 mons**		**Thu 4/14/22**	**Mon 7/1/24**
43	Permitting/CEQA	9 mons	44FF	Wed 7/13/22	Sun 4/9/23
44	Design	12 mons	45SF	Thu 4/14/22	Sun 4/9/23
45	Construction	15 mons		Sun 4/9/23	Mon 7/1/24
46	**Cogeneration Upgrade**	**45 mons**		**Wed 8/17/22**	**Mon 4/27/26**
47	Permitting/CEQA	15 mons	48FF	Sun 5/14/23	Tue 8/6/24
48	Design	24 mons	49SF	Wed 8/17/22	Tue 8/6/24
49	Construction	21 mons	25FS+6 mons	Tue 8/6/24	Mon 4/27/26
50	**FOG/Food Waste Facility**	**33 mons**		**Mon 4/1/24**	**Wed 12/16/26**
51	Permitting/CEQA	9 mons	52FF	Fri 12/27/24	Mon 9/22/25
52	Design	18 mons		Mon 4/1/24	Mon 9/22/25



Date: Wed 2/24/16 — Overall Project | Permitting/CEQA | Design | Construction

WPCP Master Plan Implementation Schedule
Split Flow - CAS

ID	Task Name	Duration	Predecessors	Start	Finish
53	Construction	15 mons	52	Tue 9/23/25	Wed 12/16/26
54	**Digester No. 5**	**39 mons**		**Thu 4/1/27**	**Thu 6/13/30**
55	Permitting/CEQA	9 mons	56FF	Mon 12/27/27	Thu 9/21/28
56	Design	18 mons		Thu 4/1/27	Thu 9/21/28
57	Construction	21 mons	56	Fri 9/22/28	Thu 6/13/30
58	**Biosolids Post-Processing**	**48 mons**		**Sat 1/1/28**	**Wed 12/10/31**
59	Permitting/CEQA	9 mons	60FF	Mon 3/26/29	Thu 12/20/29
60	Design	24 mons		Sat 1/1/28	Thu 12/20/29
61	Construction	24 mons	60	Fri 12/21/29	Wed 12/10/31
62	**Secondary Treatment Improvements - Stage 2**	**78 mons**		**Mon 1/1/29**	**Tue 5/29/35**
63	Permitting/CEQA	9 mons	64FF	Sat 3/22/31	Wed 12/17/31
64	Design	36 mons	65SF	Mon 1/1/29	Wed 12/17/31
65	Construction	42 mons		Wed 12/17/31	Tue 5/29/35
66	**Primary Effluent Diurnal Equalization and Emergency Storage**	**57 mons**		**Mon 9/23/30**	**Tue 5/29/35**
67	Permitting/CEQA	36 mons	68FF	Mon 9/23/30	Wed 9/7/33
68	Design	15 mons	69SF	Mon 6/14/32	Wed 9/7/33
69	Construction	21 mons	65FF	Wed 9/7/33	Tue 5/29/35
70	**Active Retirement of Ponds**	**33 mons**		**Sat 5/24/36**	**Mon 2/7/39**
71	Permitting/CEQA	18 mons	72FF	Sat 5/24/36	Sun 11/15/37
72	Design	12 mons	73SF	Thu 11/20/36	Sun 11/15/37
73	Construction	15 mons	89	Sun 11/15/37	Mon 2/7/39
74	**UV Disinfection**	**48 mons**		**Fri 7/1/33**	**Tue 6/9/37**
75	Permitting/CEQA	9 mons	76FF	Sun 9/24/34	Wed 6/20/35
76	Design	24 mons		Fri 7/1/33	Wed 6/20/35
77	Construction	24 mons	76	Thu 6/21/35	Tue 6/9/37
78	**Thickening and Dewatering Facility - Stage 2**	**21 mons**		**Sat 10/1/33**	**Fri 6/22/35**
79	Permitting/CEQA	6 mons	80FF	Fri 12/30/33	Tue 6/27/34
80	Design	9 mons		Sat 10/1/33	Tue 6/27/34
81	Construction	12 mons	80	Wed 6/28/34	Fri 6/22/35
82	**Chemical Dosing (P-Removal)**	**21 mons**		**Sat 7/1/34**	**Fri 3/21/36**
83	Permitting/CEQA	9 mons	84FF	Fri 9/29/34	Mon 6/25/35
84	Design	12 mons		Sat 7/1/34	Mon 6/25/35
85	Construction	9 mons	84	Tue 6/26/35	Fri 3/21/36
86	**Filter Backwash Storage**	**30 mons**		**Wed 5/30/35**	**Sat 11/14/37**
87	Permitting/CEQA	9 mons	88FF	Sun 2/24/36	Wed 11/19/36
88	Design	18 mons	65	Wed 5/30/35	Wed 11/19/36
89	Construction	12 mons	88	Thu 11/20/36	Sat 11/14/37
90	**Demolition - FGRs and FGR Pump Station**	**24 mons**		**Sun 7/1/35**	**Fri 6/19/37**
91	Permitting/CEQA	9 mons	92FF	Sat 9/29/35	Tue 6/24/36
92	Design	12 mons		Sun 7/1/35	Tue 6/24/36
93	Demolition	12 mons	92	Wed 6/25/36	Fri 6/19/37
94	**Microfiltration (MF) Improvements**	**36 mons**		**Fri 1/1/38**	**Sat 12/15/40**
95	Permitting/CEQA	9 mons	96FF	Tue 9/28/38	Fri 6/24/39
96	Design	18 mons		Fri 1/1/38	Fri 6/24/39
97	Construction	18 mons	96	Sat 6/25/39	Sat 12/15/40



Date: Wed 2/24/16 — Overall Project — Permitting/CEQA — Design — Construction

APPENDIX D - CIP PROJECT DESCRIPTIONS AND FIGURES

CIP PROJECT DESCRIPTIONS AND SITE LAYOUT

This section includes a description of each of the CIP projects. It also includes site layout drawings depicting the approximate location of each CIP project.

The CIP projects are organized and numbered by the following process/functional areas:

1. Primary Treatment
2. Secondary Treatment
3. Tertiary Treatment
4. Solids Facilities
5. Combined Heat and Power
6. Electrical
7. Process Control and Automation (SCADA)
8. Support Facilities
9. Support Utilities
10. Demolition
11. Operations and Maintenance

1.0 CIP Project Descriptions

Each project description summarizes the following information about the project:

- Project ID number
- Project name
- Process area primarily impacted by project
- Project driver
- Implementation scenario (whether the project is part of the general CIP implementation or is specific to Split Flow conventional activated sludge [CAS], Full CAS, or MBR CIP implementation scenarios)
- Project justification
- Project description (description of project elements)

- Project implementation considerations (e.g., major stages of the project, linkages to other projects)
- Permits required (not all inclusive, i.e., grading permits, building permits, stormwater permits, etc. are not identified)

2.0 CIP Site Layouts

The CIP project site layouts are shown on Figures D.1 - D.4.

- Figure D.1 shows the site layout of most of the CIP projects.
- Figure D.2 shows the site layout of CIP projects located in the existing oxidation pond area.
- Figure D.3 shows the site layout of the 12 kV Electrical Distribution System and SCADA System Improvement projects.
- Figure D.4 shows the site layout of projects located at the WPCP perimeter (i.e., Tidal Flood Protection and Site Security Improvements) and projects outside the WPCP perimeter (e.g., the New Access to Bay Trails project).

Some CIP projects are not depicted on the site layouts. These projects include:

- Borregas Avenue Parking Lot (project is located along Borregas Avenue, is already underway, and does not impact other CIP projects)
- Household Hazardous Waste Demolition/Solid Waste Removal (facility is to be relocated off the WPCP site; demolition not shown on site layouts for clarity)
- Community Improvements (improvements to occur throughout plant site)
- Miscellaneous Civil Site/Support Utility Improvements (improvements occur throughout the central plant site)
- Demolition projects not shown for clarity

3.0 Split Flow CAS versus Full CAS

The City has decided to implement Split Flow CAS instead of Full CAS; however, project descriptions for projects that are specific to Full CAS implementation are included herein for reference.

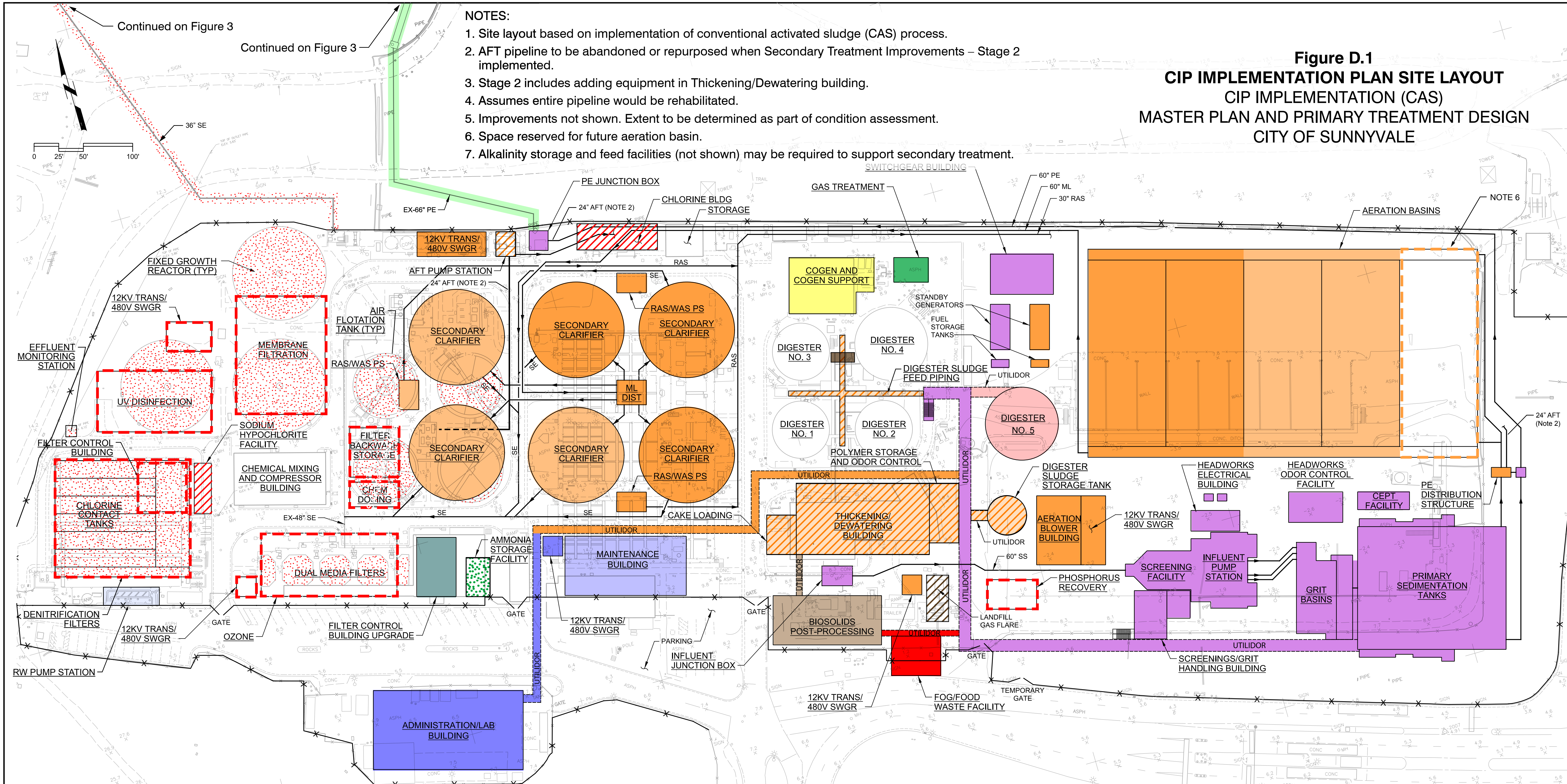


Figure D.1
CIP IMPLEMENTATION PLAN SITE LAYOUT
CIP IMPLEMENTATION (CAS)
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

NOTES:
1. Site layout based on implementation of conventional activated sludge (CAS) process.
2. AFT pipeline to be abandoned or repurposed when Secondary Treatment Improvements – Stage 2 implemented.
3. Stage 2 includes adding equipment in Thickening/Dewatering building.
4. Assumes entire pipeline would be rehabilitated.
5. Improvements not shown. Extent to be determined as part of condition assessment.
6. Space reserved for future aeration basin.
7. Alkalinity storage and feed facilities (not shown) may be required to support secondary treatment.

Primary
- Primary Treatment Facility
- Rehabilitation PE Pipeline (Note 4)
- Rehabilitation Influent Pipelines (Note 5)

Secondary
- Existing Plant Rehabilitation
- Secondary Treatment Improv. – Stage 1
- Secondary Treatment Improv. – Stage 2
- AFT Pump Station and Pipeline

Tertiary
- Sim. RW/Sodium Hypo. Conversion
- Filter Control Building
- Chloramine Disinfection

Solids
- Digester Supernatant/Drainage Upgrades
- Thickening/Dewatering Facility – Stage 1 and Stage 2 (Note 3)
- Digester No. 5
- FOG/Food Waste Facility
- Biosolids Post-Processing Facility
- Landfill Gas Flare Upgrades

Other
- Cogeneration Gas Treatment
- Cogeneration Upgrade
- Administration/Lab Building
- Maintenance Building
- Recycled Water Improv.

Future Facilities:
- Chemical Dosing (Phosphorus)
- Filter Backwash Storage
- Denitrification Filters
- UV Disinfection
- Ozone Disinfection
- Membrane Filtration Improv.
- Phosphorus Recovery Facility

PIPE ABBREVIATIONS:

CEPT	Chemically Enhanced Primary Treatment
FOG	Fats, Oils, Grease
ML	Mixed Liquor (Effluent from Aeration Basins)
PE	Primary Effluent
RAS	Return Activated Sludge
SE	Secondary Effluent
T/S	Transformer/Switchgear

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OVERALL SITE LAYOUT

DETAILED SITE LAYOUT

LEGEND

- Active Retirement of Ponds (Proposed for Restoration Following Decommissioning)
- Rehabilitation PE Pipeline
- Existing Plant Rehabilitation
- Primary Effluent Diurnal Equalization and Emergency Storage

NOTES:

1. Location and configuration of equalization and emergency storage is tentative and could change.

Figure D.2
CIP POND IMPROVEMENTS SITE LAYOUT
CIP IMPLEMENTATION (CAS)
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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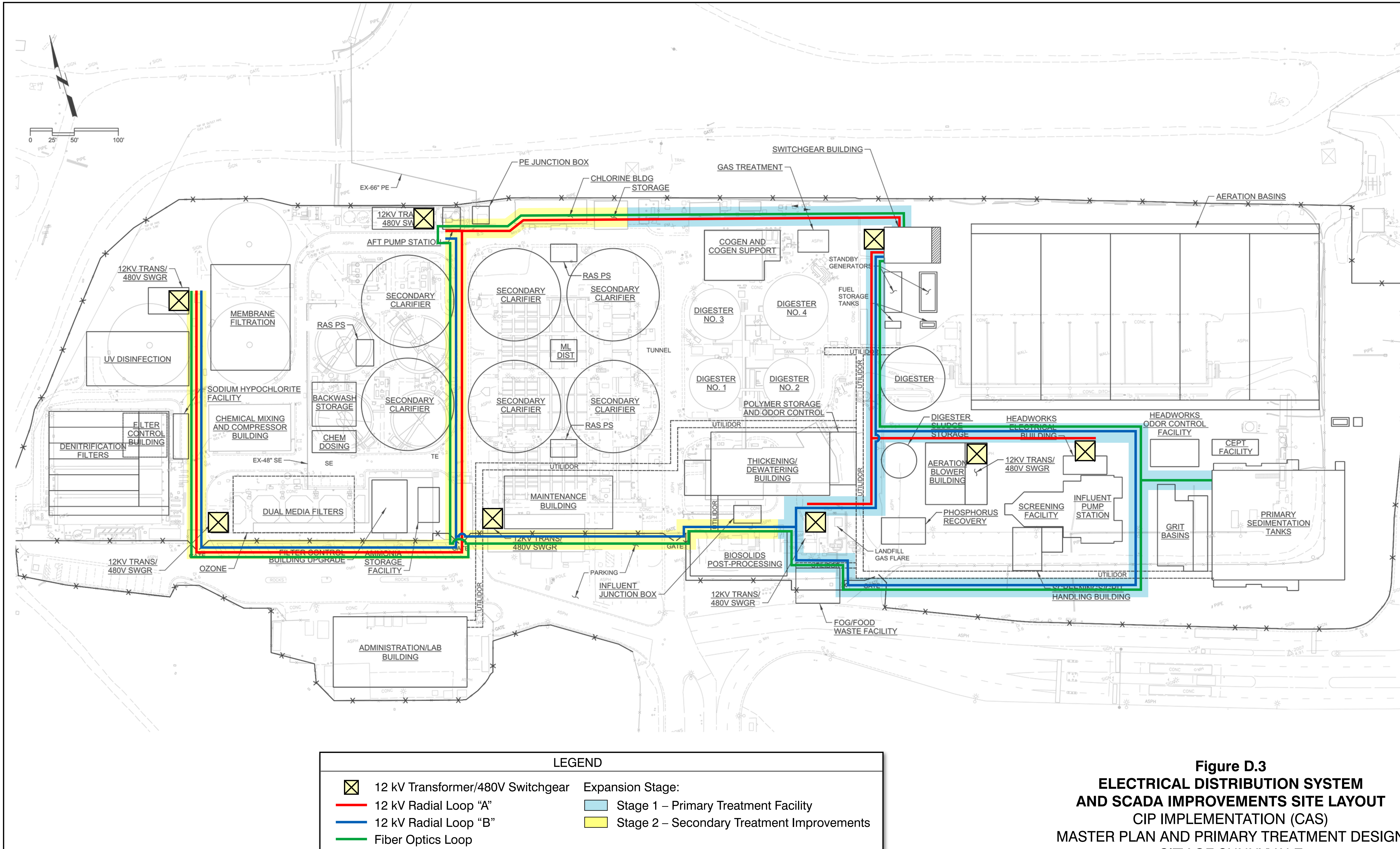

Figure D.3
ELECTRICAL DISTRIBUTION SYSTEM AND SCADA IMPROVEMENTS SITE LAYOUT
CIP IMPLEMENTATION (CAS)
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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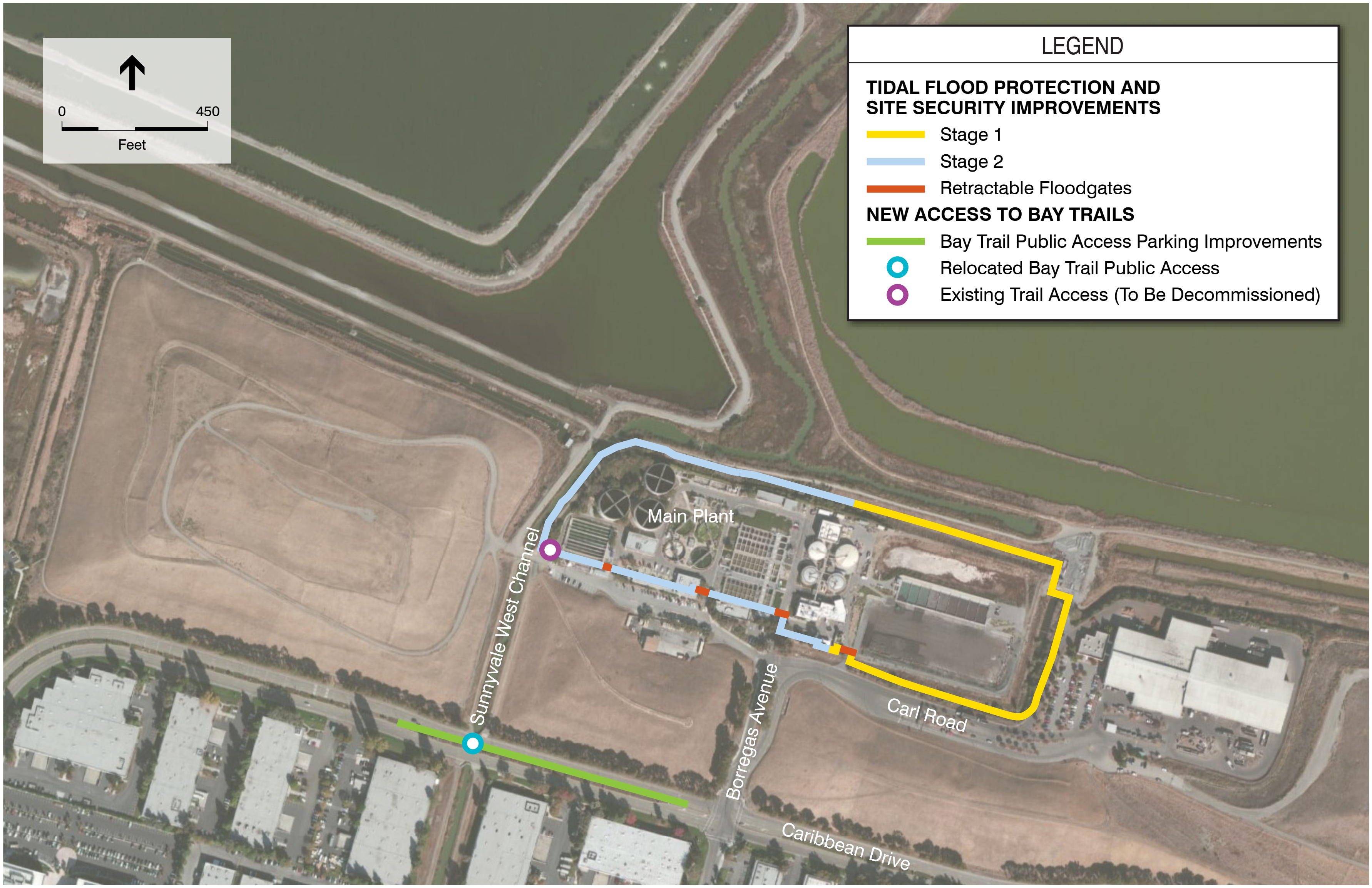

Figure D.4
SITE PERIMETER AND OTHER CIP IMPROVEMENTS
CIP IMPLEMENTATION (CAS)
MASTER PLAN AND PRIMARY TREATMENT DESIGN
CITY OF SUNNYVALE

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1.0 - PRIMARY TREATMENT

Project ID Number	1.1
Project Name:	Headworks and Primary Treatment Facility
Process Area:	Primary Treatment
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: A new headworks and primary treatment facility is required to replace the existing headworks and primary treatment facilities, because: (1) The existing primary treatment facilities are structurally deficient, deteriorated, and susceptible to significant failure during a seismic event; (2) the headworks facility includes gas driven influent pumps that will not meet future emissions limits; (3) the headworks facility does not include screening facilities; and (4) the grit removal system does not perform as well as more modern grit removal systems. Implementing screening facilities and a new grit removal system would improve the effectiveness of subsequent treatment processes, as well as reduce long-term maintenance of equipment.

Project Description: This project entails replacing the existing headworks and primary treatment facilities with new facilities. The major project elements include:

- Screening facility
- 39.6 mgd influent pump station (expandable to 58.5 mgd)
- Three multi-tray vortex-type grit basins
- Screenings/grit handling building
- Six primary sedimentation tanks (PSTs)
- Chemically enhanced primary treatment (CEPT) facility
- Odor control facility
- New 60-inch primary effluent pipeline from the new PSTs to a new junction box located at the existing primary effluent pipeline along the north fenceline of the WPCP
- Utilidors
- Standby power and fuel supply
- Exhaust heat recovery system at the existing power generation facility
- Stage 1 site safety and security improvements
- Stage 1 tidal flooding improvements (should be coordinated with site safety and security improvements)

Project Implementation: Currently this project is proposed to be implemented in three construction packages: Package 1 includes site development (grading & preconsolidation along with the replacement of a drainage ditch with a box culvert), Package 2 includes the major structural, mechanical, site civil, electrical and instrumentation facilities and Package 3 includes the decommissioning and demolishing of various existing facilities. Note, Package 3 includes decommissioning of the primary sedimentation tanks (PSTs), which includes removal of mechanical and electrical equipment. The demolition of the PSTs (e.g., removal of the concrete tanks, etc.) is included in the Secondary Treatment Improvements Stage 1 Project.

Permits Required: The following permits will be required:

- Authority to Construct (Bay Area Air Quality Management District)
- Nationwide Permit (Army Corps of Engineers)
- 401 Water Quality Certification (Regional Water Quality Control Board)
- Bay Conservation and Development Commission (BCDC) permit

- California Department of Fish and Wildlife (CDFW) permit.

Special Considerations/Additional Notes: The City will need to initiate a contract for the use of a trailer-mounted dewatering unit prior to demolition of the existing dewatering tiles. This trailer-mounted unit will remain in operation until permanent dewatering facilities are constructed as part of the CAS project.

Project ID Number	1.2
Project Name:	Rehabilitation Primary Effluent Pipeline from Central Plant to Ponds
Process Area:	Primary Treatment
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: The primary effluent (PE) pipeline has been in continuous service since the early 1980's and is the main link between the WPCP and the oxidation ponds. A condition assessment in 2007 noted deterioration of the junction structures; however, due to limited access, an inspection of the pipe interior was not possible. A second, more detailed assessment was performed in October 2014 to better determine rehabilitation needs for this pipeline.

Project Description: The major project elements include:

- Rehabilitation (sliplining) of the existing 60" primary effluent pipeline extension from the from Manhole #2 to the oxidation pond recirculation channel
- Miscellaneous repairs of the various manholes/junction structures

Project Implementation: This project could be completed as a standalone project or could be included with the Existing Plant Rehabilitation project or the Headworks and Primary Treatment Facility project.

Permits Required: It is anticipated that following permits would be required:

- Bay Conservation and Development Commission (BCDC)

Special Considerations/Additional Notes: As part of an early study phase for this project, a rehabilitation technique needs to be selected. Based on the selected rehabilitation technique and the location of the access pits associated with that technique, additional resource agency permits may be required.

Project ID Number	1.3
Project Name:	Rehabilitation Influent Pipelines to WPCP
Process Area:	Primary Treatment
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: As part of the Headworks and Primary Treatment Improvements project, raw sewage will be diverted into a new influent junction structure which transitions to a 66-inch pipeline which conveys the influent into the new bar screen facility. The location of the new influent junction structure was selected due to the difficulty in finding a convenient location to intercept the various sewers which feed the WPCP. Certain of these raw sewage plpelines in the immediate vicinity of the WPCP have been in service for over 40 years and their condition is unknown. There is a risk that one or more of these sewers could fail, which would result in raw sewage not being conveyed to the new preliminary treatment facilities.

Project Description: This project would initially involve a condition assessment of the raw sewage pipelines which feed the WPCP. Following this assessment, an evaluation would be made as to how this influent system of pipelines could be consolidated through a program of rehabilitation and/or replacement. Major elements of this project would be defined as part of the detailed evaluation but could include pipeline/manhole rehabilitation (i.e., sliplining) and replacement of pipelines/manholes along with the construction of a diversion structure.

Project Implementation: This project could be implemented as a standalone project or be included as part of the WPCP rehabilitation project.

Permits Required: None

Special Considerations/Additional Notes: A detailed condition assessment would be completed to better define the scope for rehabilitation and/or replacement. This condition assessment could be completed as a standalone effort or be included as the first Stage of the WPCP rehabilitation project.

2.0 - SECONDARY TREATMENT

Project Number:	2.1
Project Name:	Existing Plant Rehabilitation – Split Flow
Process Area:	Secondary Treatment
Project Driver:	Condition (R&R)
Implementation Scenario:	Split Flow CAS

Project Justification: Due to the age of overall facilities at the WPCP, key elements of the existing treatment process need to be rehabilitated or replaced to maintain permit compliance. These include elements of the existing secondary and tertiary treatment process.

Elements of the secondary treatment process (ponds/FGRs/AFTs) need to be rehabilitated to keep them operational until they are fully replaced with conventional activated sludge (CAS) facilities. Given the expected period over which split flow operation could occur, major upgrades are required to keep the existing secondary treatment facilities operational until they are fully replaced with CAS facilities in 2035±.

Elements of the tertiary treatment process (chlorine contact tanks) need to be rehabilitated to keep them operational until they are fully replaced with ultraviolet (UV) disinfection facilities (which are assumed to be operational > 2035±).

In addition, because the existing point of compliance is located approximately 10 feet downstream of the bisulfate induction unit, a new compliance point (effluent monitoring station) is being considered. This would provide for better monitoring of the dechlorinated effluent and could result in less bisulfate usage. The City is currently implementing an interim change to the point of compliance (to be implemented as part of the Sodium Hypochlorite Conversion Project).

Project Description: This project entails rehabilitating the existing secondary treatment facilities (ponds/FGRs/AFTs) and tertiary treatment facilities (chlorine contact tanks). The major project elements are listed below. Most of these elements are common to the project elements included in the Existing Plant Rehabilitation – Full CAS project. Elements highlighted in gray are not common.

The major project elements include:

- Oxidation Pond Facilities
  - Rehabilitation of the 36” pipeline from the oxidation ponds to the fixed growth reactor distribution structure
  - Replacement of three existing 4160 kV feeders to the pond recirculation pump station to three separate substations; replacement of three separate substations; replacement of 480 volt electrical distribution from substations.
  - New pond effluent pump station
    - Wooden pump station structure
    - Four pond effluent pumps, VFDs, and MCCs
    - Electrical panels
    - Telemetry SCADA system
  - Permanent, automated screening device to remove debris upstream of the pond effluent pump station
  - Decommissioning and demolition of existing pond effluent pump station
  - Demolition of existing boom used to collect debris upstream of the pond effluent pump station
- Fixed Growth Reactors (FGRs) (assumes upgrades made to all three FGRs)
  - Full media replacement

    - Media support structure replacement (may not be required per results of FGR condition assessment)
    - Replace protective grid for media
    - Replace geotextile liner
    - Rehabilitate drainage structure (including return lines, supply lines, and plenums)
    - Plumbing of FGR structure and rehabilitation of seals to improve flow distribution
    - Distribution arm replacement and flow distribution controls
    - Replacement of FGR pumps
- Air Flotation Tanks (AFTs) (assumes upgrades made to all four AFTs)
    - Structural rehabilitation of tank effluent channel, which supports the distributor arm
    - Coating of concrete structures
    - Replacement of variable speed positive displacement float collection pumps
    - Baffle improvements (increase baffle depth)
- Chlorine Contact Tank Rehabilitation
    - Seismic retrofits to the CCTs (internal separation walls)
    - Coating of concrete structures
    - Repairs to effluent channel downstream of dechlorination point
    - Replacement of effluent flow meter
    - Replacement of all mechanical equipment, including pumps, gates, gate seals, meters, mud valves, and water champ
    - Addition of an effluent monitoring station (the point of compliance may change)
- Stage 2 site safety and security improvements
- Stage 2 tidal flooding improvements (should be coordinated with site safety and security improvements)

Project Implementation: These improvements are assumed to be packaged into one larger WPCP R&R project (as opposed to smaller individual projects). This assumes preparation of a six month condition assessment report to further define the required improvements.

Permits Required: None

Special Considerations/Additional Notes: A detailed condition assessment evaluation would be completed to better refine the scope for rehabilitation. This condition assessment could be completed as a standalone effort or be included as the first stage of a rehabilitation project.

The scope for this project includes all the major elements included in the Full CAS project description and expands on the elements as necessary to provide extended use of the existing facilities under split flow operation.

Project Number:	2.1M
Project Name:	Existing Plant Rehabilitation – MBR or Full CAS
Process Area:	Secondary Treatment
Project Driver:	Condition (R&R)
Implementation Scenario:	MBR or Full CAS

Project Justification: Due to the age of overall facilities at the WPCP, key elements of the existing treatment process need to be rehabilitated or replaced to maintain permit compliance. These include elements of the existing secondary and tertiary treatment process.

Elements of the secondary treatment process (ponds/FGRs/AFTs) need to be rehabilitated to keep them operational until they are fully replaced with conventional activated sludge (CAS) facilities (which are assumed to be operational in 2023±.).

Elements of the tertiary treatment process (chlorine contact tanks) need to be rehabilitated to keep them operational until they are fully replaced with ultraviolet (UV) disinfection facilities (which are assumed to be operational > 2035±).

In addition, because the existing point of compliance is located approximately 10 feet downstream of the bisulfate induction unit, a new compliance point (effluent monitoring station) is being considered. This would provide for better monitoring of the dechlorinated effluent and could result in less bisulfate usage. The City is currently implementing an interim change to the point of compliance (to be implemented as part of the Sodium Hypochlorite Conversion Project).

Project Description: This project entails rehabilitating the existing secondary treatment facilities (ponds/FGRs/AFTs) and tertiary treatment facilities (chlorine contact tanks). The major project elements include:

- Oxidation Pond Facilities
  - Replacement of three existing 4160 kV feeders to the pond recirculation pump station to three separate substations; replacement of three separate substations; replacement of 480 volt electrical distribution from substations.
- Fixed Growth Reactors (FGRs) (assumes upgrades made to all three FGRs)
  - Replacement of top third of media
  - Replacement of protective grid for media
  - Replacement of FGR pumps
- Air Flotation Tanks (AFTs) (assumes upgrades made to all four AFTs)
  - Structural rehabilitation of tank effluent channel, which supports the distributor arm
  - Baffle improvements (increase baffle depth)
- Chlorine Contact Tank Rehabilitation
  - Seismic retrofits to the CCTs (internal separation walls)
  - Coating of concrete structures
  - Repairs to effluent channel downstream of dechlorination point
  - Replacement of effluent flow meter
  - Replacement of all mechanical equipment, including pumps, gates, gate seals, meters, mud valves, and water champ
  - Addition of an effluent monitoring station (the point of compliance may change)
- Stage 2 site safety and security improvements
- Stage 2 tidal flooding improvements (should be coordinated with site safety and security improvements)

Project Implementation: These improvements are assumed to be packaged into one larger WPCP R&R project (as opposed to smaller individual projects). This assumes preparation of a six-month condition assessment report to further define the required improvements.

Permits Required: None

Special Considerations/Additional Notes: A detailed condition assessment evaluation would be completed to better refine the scope for rehabilitation. This condition assessment could be completed as a standalone effort or be included as the first stage of a rehabilitation project.

Project ID Number	2.2 and 2.3
Project Name:	Secondary Treatment Improvements – Split Flow Stages 1 and 2
Process Area:	Secondary Treatment
Project Driver:	Regulatory (Stage 1); Flow and Load (Stage 2)
Implementation Scenario:	Split Flow CAS

Project Justification: The existing secondary treatment system (ponds/FGRs/ AFTs) cannot meet future, stringent nitrogen standards. Given the uncertainty associated with future nitrogen standards, this project would assume parallel operation of the existing secondary treatment system and a smaller conventional activated sludge (CAS) system. This would result in a overall reduction in effluent nitrogen concentrations and would allow for a delay in the implementation of full CAS treatment based upon actual regulatory timelines. This would minimize cash flow expenditures and reduce overall O&M costs.

Project Description: This project entails implementing CAS secondary treatment facilities in two Stages. The Stage 1 facilities would be operated in parallel with the existing secondary treatment system. The Stage 1 facilities would be base loaded and excess flows would be treated by the existing secondary treatment system. The Stage 2 facilities would fully replace the existing secondary treatment system with CAS. Stage 2 includes demolition of the existing AFTs.

The major project elements, by project Stage, include:

- Stage 1
    - Two aeration basins
    - Blower building and aeration blowers
    - Three secondary clarifiers
    - Two return activated sludge (RAS)/ waste activated sludge (WAS) pump stations
    - Primary effluent distribution structure
    - Demolition of the primary sedimentation tanks
    - Demolition of the primary control building

- Stage 2
    - Two aeration basins
    - Aeration blowers
    - Three secondary clarifiers
    - One RAS/WAS pump station
    - Demolition of existing air flotation tanks (AFTs) and AFT pump station

Project Implementation: This project would be implemented in two Stages as described above. Due to site constructability limitations, Stage 1 would be implemented following construction of the Headworks and Primary Treatment Facility Project. Stage 2 would be implemented based on regulatory and or flow and load drivers depending on which controls (i.e., if the regulatory compliance schedule is delayed, then increased flow and loads would drive implementation).

Permits Required: The following permits will be required:

- Authority to Construct.

Stage 2 of this project will be implemented with the Primary Effluent Diurnal Equalization and Emergency Storage project, which will require additional permits. Refer to the project description of that project element for more information.

Special Considerations/Additional Notes: Active retirement of the ponds is not included in this project because it is assumed that effort would be delayed until filter backwash storage facilities are implemented.

Demolition of the FGRs is not included in this project because it is not required until the FGR site space is needed for further process needs.

As discussed in the Basis of Design, the need for alkalinity feed facilities and surface wasting facilities should be evaluated during design. These facilities are not shown on the site layout or included in the cost estimate.

Project ID Number	2.2Full and 2.3Full
Project Name:	Secondary Treatment Improvements – Full CAS Stages 1 and 2
Process Area:	Secondary Treatment
Project Driver:	Policy (Stage 1); Flow and Load (Stage 2)
Implementation Scenario:	Full CAS

Project Justification: The existing secondary treatment system (ponds/FGRs/ AFTs) cannot meet future, stringent nitrogen standards. This project would entail full replacement of those facilities at the earliest possible date, to meet current ammonia standards and future total nitrogen standards. This project would be implemented although the timing and extent of the standards are unknown at this time.

Project Description: This project entails replacing the existing secondary treatment system with conventional activated sludge (CAS) secondary treatment facilities. The CAS secondary treatment facilities would be implemented in two stages. The Stage 1 facilities would fully replace the existing secondary treatment system. Stage 1 includes demolition of the existing AFTs.

The major project elements, by project stage, include:

- Stage 1
    - Three aeration basins
    - Blower building and aeration blowers
    - Five secondary clarifiers
    - Two return activated sludge (RAS)/ waste activated sludge (WAS) pump stations
    - Primary effluent distribution structure
    - Demolition of existing primary sedimentation tanks
    - Demolition of existing primary control building
- Stage 2
    - One aeration basin
    - Aeration blowers
    - One secondary clarifier
    - One RAS/WAS pump station
    - Demolition of existing air flotation tanks (AFTs) and AFT pump station

Project Implementation: This project would be implemented in two stages as described above. Due to site constructability limitations, Stage 1 would be implemented following construction of the Headworks and Primary Treatment Facility Project. Stage 2 would be implemented based on flow and load drivers. Stage 2 could potentially be delayed if chemically enhanced primary treatment (CEPT) is implemented.

Permits Required: The following permits will be required:

- Authority to Construct.

This project will be implemented with the Primary Effluent Diurnal Equalization and Emergency Storage project, which will require additional permits. Refer to the project description of that project for more information.

Special Considerations/Additional Notes:

Active retirement of the ponds is not included in this project because it is assumed that effort would be delayed until the filter backwash storage facilities are implemented.

Demolition of the FGRs is not included in this project because it is not required until the FGR site space is needed for further process needs.

Project ID Number	2.4
Project Name:	Primary Effluent Diurnal Equalization and Emergency Storage
Process Area:	Secondary Treatment
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: These facilities would be required when the new secondary treatment facilities are fully implemented and the oxidation ponds are decommissioned.

The primary effluent diurnal equalization facilities are required to:

- Minimize the size of the secondary treatment facilities so they fit on the plant site
- Minimize the cost of the secondary treatment facilities
- Allow more steady influent flow to the secondary treatment process, resulting in more reliable process operations

The emergency storage facilities are required to store process flows during emergency process failures such as major power outages or major process upsets, as well as during major plant maintenance.

Project Description: This project entails constructing equalization tanks and emergency storage basins at the current site of Oxidation Pond #1. The major project elements of include:

- Primary Effluent Diurnal Equalization (EQ) Facilities
  - Removal of sludge/sediment along southern section of Pond #1
  - Access road improvements (raise road above projected sea level rise elevation) from the central plant site to the EQ tanks
  - Earthwork to raise berms and site area to accommodate sea level rise
  - Plant water supply pipeline for washdown uses
  - Three 2.7± million gallon circular concrete EQ tank (e.g., DYK-type)
  - EQ pump station to return flows from the diurnal EQ and emergency EQ basins to the secondary treatment process
  - Extension of primary effluent pipeline from existing primary effluent pipeline (that discharges to the recirculation channel) to the EQ tanks.
- Primary Effluent Emergency Storage
  - Removal of sludge/sediment along southern section of Pond #1
  - 60-MG± (3-days of storage at 2035 average annual flows) earthen storage basin (partitioned into three cells) with basin washdown capabilities (for periodic cleaning)
  - Piping connections to the EQ pump station

The scope (and associated cost) of these facilities may change in the future, if the City decides to locate the diurnal EQ tanks and emergency storage in a different location. Potential alternative locations include the Pond A4 or the Cargill Channel.

Project Implementation: This project would be implemented when the existing secondary treatment system (ponds/FGRs/AFTs) are decommissioned and fully replaced with new secondary treatment facilities (e.g., aeration basins and secondary clarifiers under CAS implementation, or aeration basins and MBRs under MBR implementation). Because of the unknowns associated with the alternatives associated with protection against sea level rise, construction of the access road improvements could be delayed until those protection alternatives are better defined.

Permits Required: Permits required for the construction of the access road and EQ basins are as follows (expected to take up to two years± to obtain):

- Army Corps individual permit
- RWQCB Section 401
- California Dept. of Fish & Wildlife (CDFW) Section 1600
- BCDC
- US Fish & Wildlife Services (USFWS)
- National Marine Fisheries Service (NMFS)

Special Considerations/Additional Notes: If implemented properly, there could be long-term ecological protection and habitat enhancement opportunities if this project were implemented at the alternative sites (Cargill or Pond A4). Extensive pre-work would be required (alternative analysis) to present the overall environmental benefit of the Cargill and Pond A4 options for siting of these facilities. The permitting effort would take approximately 2 years and would include close coordination between the various permitting agencies (with the Army Corps acting as the lead agency). Further background on this can be found in the June 2014 Biological Resources Constraints and Opportunities Report prepared as part of the Master Plan.

Project ID Number	2.5
Project Name:	Active Retirement of Ponds
Process Area:	Secondary Treatment
Project Driver:	Policy
Implementation Scenario:	General

Project Justification: The existing oxidation ponds currently serve as the first step of the existing secondary treatment process (ponds/FGRs/AFTs). When the new secondary treatment facilities are fully implemented, these ponds could be removed from service. Once abandoned for use as treatment, the Army Corps could claim jurisdiction of the ponds. The RWQCB could require approval for removing these ponds from service and could also claim jurisdiction as waters of the State. Active restoration of the ponds could help mitigate issues associated with removing these facilities from use as a treatment process.

Project Description: The major project elements include:

- Construction of planned breaches of the pond levees
- Re-grading and re-vegetation of the ponds

Project Implementation: This project would only be implemented once the new secondary treatment expansion is completed and operational (which would allow for the two oxidation ponds to be removed from service).

Permits Required: Permits required for enhancement activities are as follows (expected to take up to two years± to obtain):

- Army Corps 404 permit
- Rivers and Harbors Act Section 10 Letter of Permission
- RWQCB Section 401
- BCDC administrative permit
- Streambed Alteration Agreement from the California Dept. of Fish & Wildlife

Special Considerations/Additional Notes: Active restoration of the ponds provides potential for wetland mitigation banking opportunities. Approval from agencies that regulate tidal habitats and species would be required (Army Corps, RWQCB, US Fish & Wildlife, California Dept. of Fish & Wildlife and National Marine Fisheries Service). Further background on this can be found in the June 2014 Biological Resources Constraints and Opportunities Report prepared as part of the Master Plan. Final disposition of the ponds once they are no longer used for active treatment will need to consider all potential impacts (i.e., future sea level rise considerations).

Project ID Number	2.6
Project Name:	Air Flotation Tank (AFT) Pump Station and Pipeline
Process Area:	Secondary Treatment
Project Driver:	Performance
Implementation Scenario:	Split Flow CAS or Full CAS

Project Justification: Based on implementing a split flow secondary operation (i.e., parallel operation of existing secondary ponds system with conventional activated sludge system), this project would allow for flexibility in developing alternatives for meeting total nitrogen removal using both existing facilities in combination with the new CAS facilities. If successful, this would delay or possibly eliminate future CAS facilities expansion needs to meet future total nitrogen standards.

Project Description: This project entails implementing facilities that allow a portion of the oxidation pond effluent (FGR/AFTs) to be pumped to the aeration basins for further treatment. With these facilities, some primary effluent flows could be stored and partially treated in the ponds during the winter. In the summer, when influent flows are low, the flow could be returned to the central plant site and treated by the fixed growth reactors (FGRs) and air flotation tanks (AFTs). Provision would be provided to pump a portion of the AFT effluent directly to the aeration basins for additional secondary treatment.

The major project elements include:

- Existing AFT Pump Station modifications (connecting 24” pipeline to existing wet well)
- New AFT Pump Station
  - Wet well
  - Three 20±-hp submersible pumps with VFDs
  - Flow metering
- 24”± pipeline from existing AFT Distribution Box to AFT Pump Station
- 24”± pipeline from AFT Pump Station to PE Distribution Box

Project Implementation: This project would be implemented as part of Stage 1 of the Secondary Treatment Improvement – Split Flow Project.

Permits Required: None

Special Considerations/Additional Notes: Based on the estimated cost for this project, further justification for including this project may need to be developed to confirm the benefit of proceeding with this project.

Project ID Number	2.7
Project Name:	Chemical Dosing (P-Removal)
Process Area:	Secondary Treatment
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: The WPCP may need to meet a phosphorous limit of 1 mg/L around 2034±. To meet this limit, chemically enhanced primary clarification (CEPT) facilities, which will be implemented as part of the Primary Treatment Facility project, would need to be utilized continuously and a second stage chemical addition facility would need to be implemented. Once this occur, the WPCP will most likely need a higher dose of methanol to the anoxic zones of the aeration basins to meet the total nitrogen limits. The methanol dosing facility is planned to be implemented as part of the Secondary Treatment Facility project.

Project Description: This project entails implementing a second stage chemical addition facility that would add either ferric chloride or alum at the dual media filters. The major project elements would include:

- Chemical storage tank
- Chemical metering pumps
- Chemical piping at the dual media filters

Project Implementation: None

Permits Required: None

Special Considerations/Additional Notes: 6 months of full-scale field-testing would need to be implemented as the initial Stage of this project to determine design criteria for the facilities.

3.0 - TERTIARY TREATMENT

Project ID Number	n/a
Project Name:	Dual Media Filter (DMF) Rehabilitation – Split Flow
Process Area:	Tertiary Treatment
Project Driver:	n/a (part of another project)
Implementation Scenario:	Split Flow CAS

Project Justification: Based on the implementation of conventional activated sludge (CAS), the existing dual media filters (DMFs) will continue to be utilized for bay discharge and production of Title 22 recycled water. Based on the split flow implementation scenario, the DMFs will continue to filter both pond effluent and CAS effluent until the existing secondary treatment process (ponds/FGRs/AFTs) is fully replaced with CAS facilities.

In 2013, the City upgraded the media and nozzles in DMFs No. 3 and 4. In 2016, the City plans to perform the same upgrades to DMFs No. 1 and 2. In conjunction with those upgrades, the City's plans to perform an overall condition assessment of the DMFs and disinfection systems by the end of 2015 to help determine needed upgrades to the facilities and SCADA for the tertiary systems (the results of which will be utilized as part of the plant-wide condition assessment to be performed under the Existing Plant Rehabilitation project).

Under the split flow implementation, these DMFs will continue to be used over the next 15± years until more stringent nitrogen standards are implemented. At that time a decision may need to be made whether to retire the DMFs and replace them with denitrification filters. With the understanding that the DMFs need to operate for at least another 15± years, a major retrofit will be required to keep these units operational.

Project Description: This project entails rehabilitation of the DMFs. It is assumed the upgrades would be made to all four DMFs. The major project elements include:

- Separate chemical feed system upstream of filters
- Filter re-rating study to determine maximum filter loading rate (gallons per minute per square foot) for recycled water production
- Potential, selective replacement of filter media with a different type of media that is more compatible with conventional activated sludge treatment and recycle water production
- Replacement of filter underdrains (including nozzles and nozzle support structure)
- Replacement of backwash pumps and backwash air blowers
- Replacement of filter control valves and flow measuring equipment
- Replacement of mechanical equipment including values and actuators
- Upsizing of existing filter piping

Project Implementation: This project will be implemented as part of the Existing Plant Rehabilitation Project.

Permits Required: None

Special Considerations/Additional Notes: The results from the 2015 Tertiary System Condition Assessment Evaluation would be incorporated into the results of the condition assessment to be completed as part of the Existing Plant Rehabilitation project. Any additional elements not evaluated as part of the 2015 Tertiary System Condition Assessment Evaluation could be evaluated as part of the condition assessment completed as part of the Existing Plant Rehabilitation project.

Project ID Number	n/a
Project Name:	Dual Media Filter (DMF) Rehabilitation – MBR or Full CAS
Process Area:	Tertiary Treatment
Project Driver:	n/a (part of another project)
Implementation Scenario:	MBR of Full CAS

Project Justification: Based on the implementation of membrane bioreactors (MBR), the existing dual media filters (DMFs) will continue to be utilized for bay discharge and production of Title 22 recycled water. Based on the MBR implementation scenario, the DMFs will continue to filter pond effluent until the existing secondary treatment process (ponds/FGRs/AFTs) are fully replaced with the MBR facilities in the 2023 - 2024± time frame.

In 2013, the City upgraded the media and nozzles in DMFs No. 3 and 4. In 2016, the City plans to perform the same upgrades to DMFs No. 1 and 2. In conjunction with those upgrades, the City's plans to perform an overall condition assessment of the DMFs and disinfection systems by the end of 2015 to help determine needed upgrades to the facilities and SCADA for the tertiary systems (the results of which will be utilized as part of the plant-wide condition assessment to be performed under the Existing Plant Rehabilitation project).

Under the MBR implementation scenario, these DMFs will continue to be used over the next 8± years. Therefore is it anticipated that less extensive upgrades would be required.

Project Description: This project entails rehabilitation of the DMFs. It is assumed the upgrades would be made to all four DMFs. The major project elements include:

- Separate chemical feed system upstream of filters
- Potential, selective replacement of filter media with a different type of media that is more compatible with conventional activated sludge treatment and recycle water production
- Replacement of filter underdrains (including nozzles and nozzle support structure)
- Replacement of filter control valves and flow measuring equipment

Project Implementation: This project will be implemented as part of the Existing Plant Rehabilitation Project.

Permits Required: None

Special Considerations/Additional Notes: The results from the 2015 Tertiary System Condition Assessment Evaluation would be incorporated into the results of the condition assessment to be completed as part of the Existing Plant Rehabilitation project. Any additional elements not evaluated as part of the 2015 Tertiary System Condition Assessment Evaluation could be evaluated as part of the condition assessment completed as part of the Existing Plant Rehabilitation project.

Project ID Number	3.1
Project Name:	Filter Control Building (Includes Demolition of Existing)
Process Area:	Tertiary Treatment
Project Driver:	Condition (R&R)
Implementation Scenario:	Split Flow CAS or Full CAS

Project Justification: The existing Filter Control Building is currently co-located with the main laboratory, which will be re-located into the new Administration Building. This will allow the Filter Control Building and associated facilities to be updated with modern electrical and automation control equipment.

Project Description: This project entails replacing the existing Filter Control Building with a new Filter Control Building. The major project elements include:

- Demolition of existing Filter Control/Lab Building and equipment
- Installation of temporary SCADA controls
- New Filter Control Building
- New electrical equipment, including motor control centers (MCCs)
- New instrumentation and controls
- Extension/connection into the upgraded WPCP SCADA system

Project Implementation: This project would be implemented following completion of the proposed Administration/Laboratory building (which would allow for demolition of the existing laboratory facilities) as well as a new Maintenance Building. The construction of these buildings would provide an updated 480 kV switchgear panel from the 12 kV distribution system that would also be used by the Filter Control Building.

Permits Required: None

Special Considerations/Additional Notes: The condition assessment, proposed to be completed as part of the Existing Plant Rehabilitation Project, would include assessment of the Filter Control Building (even though rehabilitation/replacement of these facilities would likely be completed as a standalone project).

Project ID Number	3.2
Project Name:	Filter Backwash Storage
Process Area:	Tertiary Treatment
Project Driver:	Regulatory
Implementation Scenario:	Split Flow CAS or Full CAS

Project Justification: Filter backwash flows from the existing dual media filters (DMFs) currently flow to the existing oxidation ponds. As a result, new filter backwash storage facilities located on the central plant site would be required when the oxidation ponds are decommissioned.

Project Description: This project entails implementing filter backwash storage facilities, which include a storage tank and pump station. The storage tank would store backwash flows from the DMFs. The pump station would pump the backwash flows from the storage tank to the influent channel of the future primary sedimentation tanks (PSTs). The storage tank would provide enough storage capacity so backwash flows could be pumped to the PSTs when influent flow is low (e.g., at off-peak times).

The major project elements include:

- 0.94 MG filter backwash storage tank equipped with internal baffle walls, overflow weirs, and mixers)
- Filter backwash pump station
  - Wet well
  - Three 20-hp submersible pumps
  - Flow metering
- 48"± pipeline from existing DMFs to the filter backwash storage tank
- 15"± pipeline from filter backwash storage tank to the PST influent channel
- CMU room for the pump and mixer motor control centers (MCCs) and VFDs

Project Implementation: This project would be implemented after the CAS is operational because the filter run times and the filter backwash volumes are anticipated to change when the CAS is implemented. This will allow for the development of more accurate final design criteria for sizing and operation (assumes six months of data collection and analysis before design begins). Backwash flows would be sent to the existing ponds until this backwash tank becomes operational.

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	3.3
Project Name:	Denitrification Filters
Process Area:	Tertiary Treatment
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: The WPCP may need to meet a total nitrogen limit of 3 mg/L in the 2035 to 2045 timeframe. This nitrogen limit cannot be achieved with new secondary treatment facilities alone. Based on current available technology, denitrification filters are a proven, attached-growth process that has been used to achieve the anticipated, stringent nitrogen limits. If required, these denitrification filters would replace the functionality of the existing DMFs, while at the same time providing the required total nitrogen removal.

Project Description: This project entails implementing a denitrification filter facility. The major project elements include:

- Denitrification filters contained in concrete tanks
- Backwash air and backwash water systems
- Methanol chemical storage and feed system

Project Implementation: This project would only be implemented if the WPCP needs to comply with a total nitrogen limit of 3 mg/L.

Permits Required: The following permits will be required:

- Authority to Construct (Bay Area Air Quality Management District).

Special Considerations/Additional Notes: None

Project ID Number	n/a
Project Name:	Simultaneous Production of Recycled Water/Sodium Hypochlorite Conversion
Process Area:	Tertiary Treatment
Project Driver:	Performance
Implementation Scenario:	General

Project Justification:

Modifications to the existing filtration and disinfection facilities (dual media filters/ chlorine contact tanks) are required to replace aging elements of the disinfection process, increase the safety of the disinfection process, and provide simultaneous production of recycled water.

The existing gaseous chlorine disinfection facilities need to be replaced with sodium hypochlorite disinfection facilities because these facilities are reaching the end of their useful life and there are safety concerns associated with gaseous chlorine, which is considered a toxic compressed gas per the Hazardous Materials portion of the Uniform Fire Code.

Improvements to the existing filtration and disinfection facilities are required to facilitate simultaneous production of disinfected, secondary effluent for bay discharge and Title 22 quality recycled water for reuse. The WPCP currently produces disinfected, secondary effluent that is discharged to San Francisco Bay. The WPCP also produces recycled water that is pumped off-site to the San Lucar Recycled Water Storage Tank for reuse. Due to the difference in the treatment and discharge requirements for Bay discharge and recycled water, the WPCP produces recycled water in batch mode by changing the operational parameters to the existing treatment processes for Bay discharge. This method of recycled water production is labor intensive, inefficient, and difficult to control. As a result, the City is proceeding with improvements to existing facilities to allow for simultaneous production of Title 22 quality recycled water.

Project Description: This project entails: (1) replacing the existing gaseous chlorine disinfection system with a sodium hypochlorite disinfection system; and (2) modifying the existing chlorine contact tanks and dual media filters to allow for simultaneous production of disinfected, secondary effluent for Bay discharge and Title 22 recycled water for reuse.

Modifications to the existing tertiary facilities will include the following major project elements:

- Sodium Hypochlorite Conversion
  - Sodium hypochlorite storage tanks, metering pumps, induction units and
  - Chemical feed piping to convey 12.5 percent hypochlorite solution to the existing chlorine contact tanks (CCTs), filter backwash water and tertiary filter influent box.
  - Demolition of existing gaseous chlorine facilities including the chemical scrubber and the building
- Modifications for Simultaneous Production of Recycled Water
  - Segregating one air floatation tank (AFT), one dual media filter (DMF) and two chlorine contact tanks (CCTs) with ability to treat wastewater for Bay discharge
  - New pumps installed at the fixed growth reactors distribution structures to pump flow required for recycled water production to AFT No. 2
  - New pumps installed at AFT No. 2 to pump flow required for recycled water production to DMF No. 4

    - Piping/valving modifications to allow filtered water from DMF No.4 to be isolated and sent to CCT No. 1 influent box, which will be isolated from rest of the CCTs influent channel.
    - Hypochlorite will be added to CCT No. 1 inflow through a w induction unit. CCT No. 2 will be used as a storage tank in addition to the existing off-site storage tank.
    - The downstream system from recycled water disinfection will remain same.
- 21± parking stalls along Borregas Avenue

Project Implementation: None

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	3.4
Project Name:	Chloramine Disinfection
Process Area:	Tertiary Treatment
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: If a full new secondary treatment process becomes operational in 2023± (either Full CAS or MBR), trihalomethane (THM) formation may increase. The WPCP may need to comply with THM limits and the effluent concentration may exceed the regulated limits. The existing chlorine disinfection process would need to be converted to an alternate disinfection process. Chloramine disinfection could be implemented to reduce THM formation.

If split-flow operation is implemented, there would not be a need for chloramine disinfection because the effluent would contain sufficient ammonia for disinfection.

Project Description: This project entails converting the existing chlorine disinfection system to a chloramine disinfection system. Both chlorine and ammonia would be added at the existing chlorine contact tanks (CCTs) to form chloramines that would provide disinfection within the CCTs. A sodium hypochlorite system (which would be implemented as a separate project prior to the implementation of this project) would be used to dose chlorine to the CCTs. A new aqueous ammonia storage and feed facility would be implemented to dose ammonia to the CCTs. The major project elements include:

- Pilot testing chloramine disinfection
- An aqueous ammonia storage and feed system
- Ammonia piping from the aqueous ammonia storage and feed system to the existing CCTs
- Ammonia induction system located at the CCTs
- Modifications to the sodium hypochlorite induction system located at the CCTs

Project Implementation: For planning purposes, it was assumed THM regulations may be included in the permit cycle following the implementation of the new secondary treatment process, around 2023±. It is assumed the existing chlorine disinfection process would need to be modified by 2029± to comply with the anticipated THM regulations.

Permits Required: None

Special Considerations/Additional Notes: If pilot testing indicates that THM limits cannot be achieved with chloramine disinfection, then the existing disinfection system would need to be replaced with a UV disinfection system. For planning purposes, it was assumed that chloramines disinfection would be implemented as a first Stage project.

If chloramine disinfection is feasible and is implemented, the chloramines disinfection facility would need to be replaced with a UV disinfection facility if: (1) THM limits become more stringent; or (2) if over time the ammonia addition required for chloramine disinfection becomes an operational issue (i.e., the ability to meet effluent ammonia limits becomes difficult).

The ammonia storage and feed facilities would be located where the existing Filter Control Building is located. If CAS treatment is implemented at the plant, the Filter Control Building will be demolished and replaced with a smaller Filter Control Building as part of the Filter Control Building Project. The Filter Control Building Project will occur prior to the Chloramine Disinfection Project and will provide site space for the ammonia storage and feed facilities. If

MBR treatment is implemented at the plant, then the Filter Control Building would need to be demolished as part of the Chloramine Disinfection Project to provide site space for the ammonia storage and feed system.

Project ID Number	3.5
Project Name:	UV Disinfection
Process Area:	Tertiary Treatment
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: If a full new secondary treatment process becomes operational in 2023±, trihalomethane (THM) formation may increase. An increase in THM formation may introduce THM limits in the permit cycle after the new secondary treatment process is operational. To meet the THM limits, the existing disinfection process may need to be converted to an alternate disinfection process, such as chloramine or UV disinfection.

If chloramine disinfection is implemented, N-nitrosodimethylamine (NDMA) formation may increase. NDMA is not currently regulated, but an increase in NDMA formation may introduce effluent NDMA limits in the permit cycle after ammonia addition is implemented. Should NDMA become a regulatory driver, ammonia addition (chloramine disinfection) would need to be discontinued and UV disinfection would need to be implemented.

If split-flow operation is implemented, there would not be a need for chloramine disinfection because the effluent would contain sufficient ammonia for disinfection. In this case, it is likely that UV disinfection would be implemented when the split-flow operation is discontinued and replaced with a full new secondary treatment process operation.

Project Description: This project entails replacing the existing chlorine disinfection system with a UV disinfection system. The major project elements include:

- Pilot testing UV disinfection equipment
- Open-channel UV disinfection system comprised of low-pressure, high-output UV lamps installed in concrete channels
- Flow split structure to distribute flow to the UV channels
- Weirs structure to regulate water surface elevation through the UV channels
- Flow metering for UV dose control
- Canopy to cover the UV disinfection facility
- Demolition of the fixed growth reactors (FGRs) and FGR pump station could be included as part of this project or as a separate demolition project

Project Implementation: For planning purposes, it was assumed THM regulations may be included in the permit cycle following the implementation of the new secondary treatment process, around 2023±. It is assumed the existing chlorine disinfection process would need to be replaced with an alternate disinfection process by 2037± to comply with the anticipated THM regulations (assumes chloramines disinfection would be implemented as a first Stage project in 2029±).

Because of the proposed site location for the UV facilities, this project could not be implemented until the FGRs and AFTs are removed from service and demolished.

Permits Required: None

Special Considerations/Additional Notes: For financial planning purposes, it was assumed demolition of the FGRs and FGR pump station would be completed as part of a separate demolition project.

Project ID Number	3.6
Project Name:	Ozone Disinfection
Process Area:	Tertiary Treatment
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: The State Water Resources Control Board may implement regulatory guidelines and/or limits for contaminants of emerging concern (CECs). If the SWRCB decides to initiate a statewide CEC monitoring process, it would be at least three permit cycles (2029±) before guidelines for CEC regulation are established and included in discharge permits. To meet CEC limits, an ozone disinfection process would need to be implemented to operate in conjunction with a sodium hypochlorite disinfection process or a UV disinfection process.

Project Description: This project entails implementing an ozone disinfection system that would be operated in conjunction with a sodium hypochlorite disinfection process or a UV disinfection process (whichever is the current disinfection process when this project is implemented). The major project elements include:

- Pilot testing ozone technology
- Pipeline contactor
- Liquid oxygen system
- Ozone generation facility
- Ozone pump station
- Demolition of the existing dual media filters (DMFs)

Project Implementation: For planning purposes, it was assumed it would be at least four permit cycles (2033±) before guidelines for CEC regulation are established and included in discharge permits. It is assumed an ozone disinfection process would need to be implemented in 10 years after limits are included in discharge permits (2043±).

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	3.7
Project Name:	Membrane Filtration (MF) Improvements
Process Area:	Tertiary Treatment
Project Driver:	Policy
Implementation Scenario:	Split Flow CAS or Full CAS

Project Justification: The City completed a Recycled Water System Feasibility Study in April 2013 which identified the estimated long-term recycled water demand. This water demand could increase based on industrial demands, which could be impacted by water quality concerns. Having the capability to provide microfiltration (MF) quality recycled water would provide the City more flexibility in supplying recycled water to certain industrial customers.

Project Description: This project entails implementing a 3 mgd microfiltration/ultrafiltration (MF/UF) facility for the production of recycled water for potential high-end industrial uses. The major project elements include:

- Demolition of FGRs and AFTs (depending upon timing these facilities may be demolished as part of another project)
- Building to contain MF facility
- Three, one mgd MF trains including piping, membrane modules, a clean-in-place (CIP) system, pre-strainers, and on-skid instrumentation and controls
- Chemical storage and feed system
- MF feed equalization basin
- MF feed pumps
- Backwash feed tank
- Backwash waste equalization tank
- Process piping
- Yard piping
    - Piping from the existing dual media filter effluent pipe to the MF Facility
    - Piping from the MF Facility to the future UV Disinfection Facility
    - Waste washwater piping
- Electrical equipment

Project Implementation: Because of the proposed site location for the MF facilities, this project could not be implemented until the FGRs and AFTs are removed from service and demolished.

Permits Required: None

Special Considerations/Additional Notes: None

4.0 - SOLIDS FACILITIES

Project ID Number	n/a
Project Name:	Digester No. 1 and 2 Upgrades
Process Area:	Solids Facilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: Key components of the existing Digesters No. 1 and 2 will reach the end of their useful life during the master planning period. Upgrades are required to keep them operational beyond the master planning period. Minor improvements to Digester No. 3 are also required.

Project Description: This project entails rehabilitation of existing Digesters No. 1 and 2 and minor improvements to Digester No. 3. The major project elements include:

- Demolition of existing mechanical (non-structural) equipment at Digesters No. 1 and 2
  - Two floating digester covers and associated concrete ballasts, guiderails, manholes, sampling wells, etc.
  - Sludge recirculation pumps and heating water pumps
  - Digester gas mixing system
  - Gas collection system
  - Digester motor control center (MCC)
  - Ancillary equipment such as piping and valves
- Digester No. 1 and 2 Rehabilitation
  - Structural modifications
  - Fixed steel covers with external supports
  - Mixing system
  - Heating system
  - Gas system
  - Electrical and instrumentation and control improvements
- Digester No. 3 Improvements
  - Placement of non-slip surface to the existing cover

Project Implementation: Given the age of Digesters No. 1 and 2, the City considers rehabilitating these digesters a high priority and began this project prior to the completion of the Master Plan.

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	4.1
Project Name:	Digester Supernatant PS and Drainage Piping Upgrades
Process Area:	Solids Facilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: Due to the age of the overall facilities as well as proposed process upgrades at the WPCP, key elements of the digester supernatant pump station and drainage piping need to be rehabilitated or replaced to maintain reliable operation.

Project Description: This project entails rehabilitating selected components of the existing support utility systems. The major project elements include:

- Repair of concrete within supernatant pump station
- Replacement of digester supernatant pumps
- Repair of portions of drainage piping from digesters to supernatant pump station

Project Implementation: These improvements are assumed to take place around the same time as the Thickening and Dewatering Stage 1 project.

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	4.2 and 4.3
Project Name:	Thickening and Dewatering Facility – Stages 1 and 2
Process Area:	Solids Facilities
Project Driver:	Regulatory (Stage 1); Flow and Load (Stage 2)
Implementation Scenario:	General

Project Justification: An initial stage of thickening and dewatering facilities would be required for solids treatment when the initial stage of new secondary treatment facilities is implemented. A second stage of thickening and dewatering facilities would be required for solids treatment when the second stage of new secondary treatment facilities is implemented.

Due to the proposed process upgrades at the WPCP, key elements of solids treatment facilities (digesters and digester support facilities) need to be upgraded to maintain reliable operation. The digester support facilities would need to be upgraded to include a new digester sludge storage tank and new separate PS and WAS sludge feed systems.

- In order to provide operational flexibility for the dewatering facilities, upstream storage of digested sludge is typically provided to store digested sludge prior to dewatering. Because the WPCP has limited digester storage volume, a separate storage tank is proposed.
- The existing treatment process produces primary sludge (PS) which is fed to the digesters by the primary sludge feed system. Once the new secondary treatment facilities are operational, the treatment process will produce both primary sludge and waste activated sludge (WAS). Both types of sludge will need to be stabilized through anaerobic digestion. Given the challenges associated with digesting WAS, separate WAS and PS feed systems would need to be implemented so O&M staff could control and monitor the WAS and PS feed to the digesters. The existing PS feed system would need to be abandoned because it would not provide the necessary level of control and monitoring.

Due to the overall age of the solids treatment facilities (digesters and digester support facilities), key elements of the existing facilities need to be rehabilitated or replaced to maintain permit compliance.

Project Description: This project entails implementing a facility to thicken secondary sludge (produced by the new secondary treatment facilities) and to dewater digested biosolids produced by the anaerobic digestion process. The facility will be implemented in two Stages. Stage 1 includes implementing thickening and dewatering facilities required to support the first phase of new secondary treatment improvements. Stage 2 includes implementing additional thickening and dewatering facilities to support the required expansion of the new secondary treatment improvements. In addition to the new thickening and dewatering facilities, this project also include rehabilitating aging elements of the existing digester support facilities and upgrading the existing digester support facilities to include a digester sludge storage tank and separate PS and WAS sludge feed systems.

The major project elements, by project Stage, include:

- Stage 1
    - Pilot testing thickening and dewatering equipment
    - Building to house the equipment (with bridge crane)
    - Two thickening units (i.e., rotary drum thickeners)

- Thickened waste activated sludge (TWAS) pumps
  - Thickening polymer storage and feed system
  - Digester sludge feed piping upgrades
  - Digester sludge storage tank
  - Three dewatering units (i.e., screw presses)
  - Cake pumps
  - Dewatering polymer storage and feed system
  - Provisions to remove equipment from the building (e.g., bridge crane)
  - Cake storage hopper and truck loading facility
  - Odor control system comprised of biotrickling scrubber
- Stage 2
  - One thickening unit (i.e., rotary drum thickener) and associated TWAS pump, polymer system, and support utilities
  - One dewatering unit (i.e., screw press) and associated cake pump, polymer system, and support utilities
- Rehabilitation of digester support facilities
  - Replace supernatant pumps
  - Replace piping underneath digesters
- Digester sludge storage tank
  - 1-MG digester sludge storage tank
  - Tank mixing system (similar to the existing digester mixing pumps)
  - Digester sludge pump station
  - Yard piping (to be routed in a utilidor system)
    - Piping from the anaerobic digesters to the digester sludge storage tank
    - Piping from the digester sludge storage tank to the dewatering facility
- Separate PS and WAS feed systems
  - Existing PS feed system
    - Piping modifications to allow for the installation of automated control valves and flow metering to automatically control sludge feed to each digester
  - WAS Feed System
    - Piping from WAS thickening facilities to each anaerobic digester
    - Automated control valves and flow metering to automatically control sludge feed to each digester

Project Implementation: The WPCP will be utilizing contract dewatering until these permanent facilities are operational. Therefore it has been assumed that these facilities, which would be included as part of the Secondary Treatment Improvements Stage 1 project, would be identified as a potential early completion element. This would eliminate the need to operate the contract dewatering until the Secondary Treatment facilities are operational. The location for the proposed thickening & dewatering facilities is the site of the existing Primary Control Building. Either this working space needs to be replaced with temporary facilities or the dewatering facilities must be delayed until the new Maintenance & Warehouse Building is completed.

Permits Required: See Secondary Treatment Improvements Stage 1 and 2

Special Considerations/Additional Notes: This project has been developed so that either screw presses or centrifuges could be installed for dewatering (i.e., accommodation for space requirements for screw presses and power requirements for centrifuges).

Project ID Number	4.4
Project Name:	Digester No. 5
Process Area:	Solids Facilities
Project Driver:	Flow and Load
Implementation Scenario:	General

Project Justification: Based on projections for solids loadings, it is anticipated that additional digester volume would be required (equivalent to the volume of existing Digester No. 4).

Project Description: This project entails constructing a new anaerobic digester, Digester No. 5. The major project elements include:

- One anaerobic digester (equivalent in size to Digester No. 4; about 1.0 MG)
- 50± LF of utilidor to connect the digester to the utilidor system
- Digester mixing system
    - Digester mixing pump
- Digester heating system
    - Heat exchanger
    - Digester sludge circulating pump
    - Digester hot water circulating pump
    - Raw sludge hot water pump
- Digester sludge pumping system
    - Digester supernatant pump
- Influent sludge grinder

Project Implementation: This project would be implemented earlier under MBR (or Full CAS) implementation, than it would be under Split Flow implementation. Under MBR (or Full CAS) implementation, the Secondary Treatment Improvements - Stage 1 would generate more waste activated sludge (WAS) and require utilization of more digester capacity.

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	4.5
Project Name:	FOG/Food Waste Facility
Process Area:	Solids Facilities
Project Driver:	Economic
Implementation Scenario:	General

Project Justification: Digesting fats, oils, and grease (FOG) and food wastes, in addition to the biosolids produced at the WPCP, can increase digester gas production. Given the City uses digester gas to produce electricity, additional gas production would provide additional benefit to the City. Digesting FOG and food waste is anticipated to be economically beneficial only if excess digester capacity is used.

Project Description: This project entails implementing a FOG and food waste facility that would store and feed FOG and food waste to the digesters. This project is based on using the excess digester capacity, as opposed to constructing additional digester capacity to accommodate FOG and food waste processing. This project is also based on accepting and digesting emulsified (liquid) food wastes (as opposed to whole food wastes) to minimize capital and operational costs and minimize footprint.

The major project elements include:

- FOG and food waste market analysis (assumes three months to further refine design criteria before beginning design)
- FOG and food waste receiving program development
- 3,000 gallon per day FOG storage and feed facility (based on FOG projections included in the Rehabilitation of Anaerobic Digesters No. 1 and 2 and Improvements to No. 3, Kennedy Jenks, 2012)
  - Storage tank
  - Grinder pumps
  - Feed pumps
- 3,000 gallon per day emulsified food waste storage and feed facility
  - Storage tank
  - Grinder pumps
  - Feed pumps

Project Implementation: It is recommended the City gain experience with digesting primary and WAS sludge before accepting and digesting FOG and/or food waste. As a result, it is assumed this project would be implemented after Stage 1 of the Secondary Treatment Improvements project. However, this project could be implemented at any time the City deems it financially beneficial.

Permits Required: None

Special Considerations/Additional Notes: A FOG and food waste market analysis would be need to be completed at the onset of this project to confirm digesting FOG and food waste is economically beneficial.

Project ID Number:	4.6
Project Name:	Phosphorus Recovery Facility
Process Area:	Solids Facilities
Project Driver:	Performance/Economic
Implementation Scenario:	General

Project Justification: The Master Plan anticipated that by the year 2035, the City will be required to meet at total phosphorus limit of 1 mg/L. This limit could be met with either a chemical phosphorus removal or biological phosphorus removal approach. If the City decides to meet the phosphorus limit through a biological approach, phosphorus will accumulate within the cells of the phosphorus accumulating organisms contained within the waste activated sludge (WAS). When the WAS is exposed to the anaerobic conditions of the anaerobic digester, the cells could release their stored phosphorus. That phosphorus can then combine with magnesium and ammonium to form magnesium-ammonium-phosphate (or struvite). This struvite can attach to the walls of the anaerobic digester, pipe walls, valves or pumps, yielding maintenance problems for the City. Additionally, the released phosphorus that does not form struvite will be returned to the head of the plant and will need to be removed through the secondary process again. One way to combat this maintenance problem and to reduce the phosphorus content of the dewatering return is to build a struvite recovery facility to harvest the struvite from the dewatering return stream. The struvite recovered from the struvite recovery facility can then be sold as fertilizer.

Project Description: This project entails the construction of a struvite recovery facility. This facility would be designed to produce a marketable fertilizer. The major project elements include:

- Struvite recovery facility building including
    - Struvite harvesting reactors and associated mechanical systems
    - Product storage area
    - Dryer
    - Dewatering screen
    - Conveyor
    - Classifying screen
    - Storage silo
    - Bagging system
- Centrate storage/equalization
- Chemical feed system

Project Implementation: This project would be implemented when phosphorous removal is implemented at the WPCP.

Permits Required: The following permits will be required:

- Authority to Construct.

Special Considerations/Additional Notes: A market analysis for recovered struvite should be performed to determine if this project is economically feasible.

Project ID Number	4.7
Project Name:	Biosolids Post-Processing
Process Area:	Solids Facilities
Project Driver:	Regulatory
Implementation Scenario:	General

Project Justification: The cost and availability of biosolids disposal alternatives could dictate the necessity for the City to direct a portion of the dewatered cake to a thermal drying facility. This would reduce the volume of solids that would ultimately need to be taken offsite and would open up options for disposal or beneficial use of the solids.

Project Description: The major project elements include:

- Biosolids dryer or equivalent technology fueled with a mixture of gases including landfill gas, digester gas, and natural gas.
- Support equipment for dryer (wet cake storage, cake feed pump, product cooling conveyor, product screening conveyor, off gas handling system, thermal fluid heating system, instrumentation/controls)
- Odor control
- Loading conveyor & trailer loader system
- Bridge crane
- 5000± sq. ft. building to house equipment
- 50± LF of utilidor to connect to Thickening & Dewatering Building

Project Implementation: This project would be implemented only after the Thickening & Dewatering Building is operational.

Permits Required: The following permits will be required:

- Permit to Operate and Authority to Construct (Bay Area Air Quality Management District).

Special Considerations/Additional Notes: If biosolids post-processing is implemented, at least one or two of the dewatering screw presses would need to be replaced with dewatering centrifuges to achieve drier cake solids (minimum 22 percent solids) to make thermal drying cost-effective.

5.0 - COMBINED HEAT AND POWER

Project ID Number	n/a
Project Name:	Cogeneration Gas Treatment
Process Area:	Combined Heat and Power
Project Driver:	Economic
Implementation Scenario:	General

Project Justification: The existing gas treatment system is antiquated and needs to be replaced. A new gas cleaning system is required to serve the existing PGF facility as well as the future PGF facilities (that will be constructed in 2020-2025±, depending on the condition of the existing engines). Gas treatment is required because the biogas fed to the existing and future PGF facilities is contaminated with hydrogen sulfide and siloxanes. Hydrogen sulfide can damage the engines because sulfurous and sulfuric acid can be produced in the combustion process and undesirable sulfur dioxide can be produced in the PGF exhaust. Siloxanes in the biogas from the WPCP can produce harmful silica deposits on the interior of the engines. As a result, both the hydrogen sulfide and siloxanes need to be removed.

Project Description: This project entails demolition of the existing gas cleaning system and construction of new hydrogen sulfide and siloxane treatment systems on a concrete slab, adjacent to the existing PGF building. Desulfurization could be achieved with an iron sponge, biological treatment, or with specialty treatment media (e.g., sulfatreat). Siloxane treatment could be achieved by chilling the biogas, removing moisture, and then treating with activated carbon. The major project elements include:

- Siloxane removal equipment
- H2S removal equipment
- Equipment concrete slab
- Related piping and supports
- Electrical instrumentation and controls

Project Implementation: This work will be done under a separate contract and not part of Stage 2 improvements. If this project is not implemented as a standalone project, then these proposed improvements would be incorporated as part of the cogeneration upgrades.

Permits Required: The following permits will be required:

- Permit to Operate and Authority to Construct (Bay Area Air Quality Management District).

Special Considerations/Additional Notes: None

Project ID Number	5.1
Project Name:	Cogeneration Upgrade
Process Area:	Combined Heat and Power
Project Driver:	Economic
Implementation Scenario:	General

Project Justification: Even with proposed gas treatment improvements, it is anticipated that the existing cogeneration facilities will need to be replaced in-kind by 2025± to take advantage of new technologies. New engine technology is more efficient and requires less maintenance. The existing cogeneration facilities would be refurbished in the same location.

Project Description: This project entails replacing existing facilities while maintaining operation of at least one cogeneration unit at all times. The project includes installing new power generation engines in the existing PGF building and replacing all related controls and heat recovery equipment with the exception of the exhaust heat recovery units, which will be installed as part of the Primary Treatment Facility Project. This project also includes installing gas cleaning equipment that would be installed outside, to the east of the PGF building (assuming gas treatment is not installed earlier).

The major project elements include:

- Demolition of existing generators heat exchangers and exhaust facilities
- Reuse of the existing PGF building
- Miscellaneous structural and architectural modifications to existing PGF building
- Two new engine generators with a capacity of approximately 800 kW each
- Waste heat recovery facilities from jackets (typically provided in engine vendor package)
- Heat exchangers (typically provided in engine vendor package)
- Pumps for heat loops (typically provided in engine vendor package)
- Related replacement of piping for lube oil and ancillary facilities as needed
- Upgrades to electrical equipment as needed to meet current codes or replace equipment that causes maintenance or safety issues
- Electrical, instrumentation and control equipment for new facilities.
- Civil and site work

Project Implementation: The PGF facility would be upgraded by modifying the existing facility rather than building a new cogeneration facility. Construction would be staged to allow the operation of one unit at all times.

Permits Required: The following permits will be required:

- Permit to Operate and Authority to Construct (Bay Area Air Quality Management District).

Special Considerations/Additional Notes: The PGF external architecture would be modified to match the existing architecture.

6.0 - ELECTRICAL

Project ID Number	n/a
Project Name:	12 kV Electrical Distribution System
Process Area:	Electrical
Project Driver:	n/a (part of another project)
Implementation Scenario:	General

Project Justification: Due to the age and overall condition of the existing 4160 volt (V) electrical distribution system, it needs to be replaced with a 12 kilovolt (kV) electrical distribution system.

Project Description: This project entails implementing a 12 kilovolt (kV) electrical distribution system to distribute power to the existing and future WPCP facilities. The 12 kV distribution system would be implemented in Stages and would gradually replace the existing 4160 V electrical distribution system.

The 12.4 kV distribution system would be a radial system. A radial system provides two feeds to each substation via an independent path. Each feed and transformer would be sized to accommodate the entire substation load. In the event of an equipment failure, (cable or transformer), the substation could be operated in a "single-ended" manner maintaining complete plant operations.

The major project elements of each Stage of implementation include:

- 12 kV cable, conduit, and ductbanks with provisions for fiber optics cable
- 12 kV-480V transformers
- Manholes provided at the limits of the 12 kV ductbanks to facilitate extending the 12-kV ductbanks in future Stages.
- Demolition of 4160 V distribution system on an as-needed basis as it conflicts with future projects

Project Implementation:

This project will be implemented in the following Stages:

- Stage 1 – Headworks and Primary Treatment Facility
    - Includes 12 kV distribution to headworks, primary treatment, and cogeneration facilities.
- Stage 2 – Secondary Treatment Improvements - Stage 1
    - Includes 12 kV distribution to all other facilities at the WPCP

Stage 1 would be implemented with the Headworks and Primary Treatment Facility project. Stage 2 would be implemented with the Secondary Treatment Improvements project.

Permits Required: None

Special Considerations/Additional Notes: None

7.0 - PROCESS CONTROL AND AUTOMATION

Project ID Number	n/a
Project Name:	SCADA System Improvements
Process Area:	Process Control and Automation (SCADA)
Project Driver:	n/a (part of another project)
Implementation Scenario:	General

Project Justification: The WPCP currently has a semi-automated control system comprised of antiquated equipment, disparate manufacturers and no unified interface for plant staff to monitor or control the various processes. An Automated Control System (ACS) master plan has been developed which provides the foundation for a unified plant-wide automation control system that leverages state-of-the-art technology. Implementing the proposed system would allow WPCP plant staff the ability to manage process facilities in a highly efficient manner.

Project Description: This project entails implementing automation system improvements for automation and control of the existing and future WPCP facilities. The new automation system would gradually replace the existing automation system.

The new automation system would be a four level network, comprised of the following levels:

- Field Network. The field network would be comprised of discrete and analog devices connected either directly to input/output (I/O) cards or through a fieldbus to a programmable logic controller (PLC).
- Control Network. The control network would be comprised of PLCs that collect data from the field network devices and provide communication between the various control devices.
- Process Control System (PCS) Network. The PCS network would link the PLCs with the personal computer (PC)-based Human Machine Interface (HMI) systems. Plant staff would use the PCS to control the plant processes.
- Business Network. The Business Network would extend the plant process controls to ancillary systems to either optimize operations or provide information on performance of the process facilities. This network would house systems like the Computerized Maintenance Manager Systems (CMMS) and Laboratory Information Management Systems (LIMS).

The major project elements of each Stage of implementation include:

- Instrumentation
    - Digital bus instrumentation
- Communications Backbone
    - 72 strand single-mode fiber optics cable, installed in a loop configuration
    - Ductbank
    - Communications cabinets
- Hardware/software/programming
    - Smart motor control centers
    - PLC cabinets
    - Remote I/O cabinets
    - PLC programming
    - HMI programming
- Infrastructure (all elements to be implemented in Stage 1)
    - Servers

- Workstations/tablets
- Wireless network nodes
- Communications cabinets
- SCADA software/licensing
- Configuration

Project Implementation:

This project will be implemented in the following Stages:

- Stage 1 – Headworks and Primary Treatment Facility
  - Establishes SCADA backbone and initial fiber optics distribution for the headworks, primary treatment, and cogeneration facilities.
- Stage 2 – Secondary Treatment Improvements - Stage 1
  - Includes fiber optics distribution and SCADA upgrades to all other facilities at the WPCP

Stage 1 would be implemented with the Headworks and Primary Treatment Facility project. Stage 2 would be implemented with the Secondary Treatment Improvements project.

Permits Required: None

Special Considerations/Additional Notes: None

8.0 - SUPPORT FACILITIES

Project ID Number	1.1 and 2.1 (1.1 and 2.1M for MBR implementation)
Project Name:	Tidal Flood Protection – Stages 1 and 2
Process Area:	Support Facilities
Project Driver:	n/a (part of another project)
Implementation Scenario:	General

Project Justification: Santa Clara County's shoreline is at risk from coastal flooding due to extreme storm events combined with high tides. Based on the location of the WPCP, as well as the local topography, the plant site would be subject to inundation from a 100-year tidal flooding event. Per Santa Clara County flood control ordinance requirements, tidal flooding protection is required to elevation 13.00 (plant datum elevation 113.00).

Project Description: The major project elements include:

- Construction of a sheet pile flood wall, approximately 4,000± linear feet in length, around the entire perimeter of the WPCP site.
    - In Stage 1, about 2,400± linear feet of the flood wall will be constructed to encompass the western half of the main plant site.
    - In Stage 2, about 1,500± linear feet of the flood wall will be constructed to encompass the remaining eastern half of the main plant site.
- Construction of a retractable flood barrier at each entrance to the WPCP. Retractable flood barriers will be installed in both Stages of this project.

Project Implementation: This project would be implemented in two stages. Stage 1 would be completed at part of the Headworks/PST project. Stage 2 would be completed as part of the Existing Plant Rehabilitation project.

Permits Required: It is anticipated that following permits would be required:

- Bay Conservation and Development Commission (BCDC)
- Regional Water Quality Control Board (RWQCB).

Special Considerations/Additional Notes: None

Project ID Number	8.1
Project Name:	New Access to Bay Trails
Process Area:	Support Facilities
Project Driver:	Performance
Implementation Scenario:	General

Project Justification: Because of the proposed improvements to the WPCP, it is necessary to re-locate the public access point from Carl Road to Caribbean Drive. This would provide for a safer access for the public and allow the City to utilize the Carl Road space more readily for temporary and permanent WPCP improvements.

Project Description: This project entails re-routing of public access to a location where the West Flood channel crosses Caribbean Drive. There is currently an access point at this location, which would be enhanced by the following improvements:

- Approximately 950 feet of one lane of Caribbean Drive, to the east and west of the proposed bay trail access location, would be converted to parking in combination with sidewalk improvement for access.
- Grading and landscaping improvements would be provided along the new parking areas and new access location

Project Implementation: These improvements could not begin until completion of the SCVWD's East/West channel improvements project. In addition, the new Administration and Maintenance Buildings cannot proceed until this New Access to Bay Trails project is implemented.

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	8.2
Project Name:	Household Hazardous Waste Demolition/ Solid Waste Removal
Process Area:	Solids Facilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: The household hazardous waste facility needs to be relocated to provide site space for the new Administration and Lab Building. The facility will be located off the WPCP site.

Project Description: This project entails relocating the household hazardous waste facility to an offsite location. The major project elements include:

- Relocation of the household hazardous waste facility

Project Implementation: These improvements are assumed to take place early in the master planning period, before the Administration Building project starts.

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	8.3
Project Name:	Administration and Lab Building
Process Area:	Support Facilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: A support building programming evaluation was completed which evaluated the space use and needs for the following functional areas: (1) administration; (2) operations and control; (3) maintenance; (4) laboratory; (5) compliance inspection and (6) general staff support. Key findings and recommendations from that effort included the following:

- Most functional areas have adequate space for current staff levels. Notable functional area deficiencies include:
  - Laboratory
  - Accessible meeting and training space
  - Maintenance Shop and storage
  - Offices and workstations for future staff
- The existing occupied spaces are located in multiple locations including existing buildings, temporary trailers, repurposed structures, and underutilized space in process buildings. Efficiency of space use, communication and circulation between functional groups is compromised by the decentralized facilities.
- Storage of some materials, parts and equipment are remote from primary functional locations. Access to storage is inefficient and inventory more difficult to maintain.
- Recommend consolidation of Administration, Outreach, Laboratory, Compliance Inspection and Operations/Control functions in single building to increase efficiencies, accommodate future staff, maximize shared use space and minimize building space requirements.
- Recommend consolidation of Maintenance Shop, Storage and Maintenance staff facilities with Warehouse for efficiency and inventory control.

Project Description: This project entails implementing a new Administration Building that would house administration, outreach, operations, laboratory, and compliance inspection functions. The new Administration Building would replace the functionality of the existing Administration Building, Laboratory/Control Building, and Compliance Inspection Building. As a result, these buildings would be demolished.

The major project elements include:

- Site preparation (includes removal of landfill material at the building site)
- 21,600 SF two-story building
- Landscaping
- 68± parking stalls
- Demolition of existing Administration Building

Project Implementation: The project cannot proceed until public access to the Bay Trail system is relocated from Carl Road to Caribbean Drive. In addition, due to support utility considerations, the new Administration Building must be coordinated with an early milestone completion for the CAS facilities (i.e, secondary clarifiers, RAS/WAS pump station, utilidor). It is assumed that this project and the Maintenance Building project would be designed under one set of contract documents and constructed as one project.

Permits Required: The following permits will be required:

- Santa Clara County Health Department CalRecycle Local Enforcement Agency.

Special Considerations/Additional Notes: Tidal flooding protection is being provided for the main plant site at the WPCP. The proposed location for the Administration Building is outside of the proposed flood protection perimeter and therefore special provisions would need to be provided for this structure.

The City intends construct this building to meet LEED Silver standards, but not pursue the formal application process for certification.

Due to the location of the building, the Landfill Closure Plan will need to be reopened so that landfill material can be removed from the site. Refer to the Hazardous Materials TM for boring information in this area.

Project ID Number	8.4
Project Name:	Maintenance Building
Process Area:	Support Facilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: A support building programming evaluation was completed which evaluated the space use and needs for the following functional areas: (1) administration; (2) operations and control; (3) maintenance; (4) laboratory; (5) compliance inspection and (6) general staff support. Key findings and recommendations from that effort included the following:

- Most functional areas have adequate space for current staff levels. Notable functional area deficiencies include:
  - Laboratory
  - Accessible meeting and training space
  - Maintenance Shop and storage
  - Offices and workstations for future staff
- The existing occupied spaces are located in multiple locations including existing buildings, temporary trailers, repurposed structures, and underutilized space in process buildings. Efficiency of space use, communication and circulation between functional groups is compromised by the decentralized facilities.
- Storage of some materials, parts and equipment are remote from primary functional locations. Access to storage is inefficient and inventory more difficult to maintain.
- Recommend consolidation of Administration, Outreach, Laboratory, Compliance Inspection and Operations/Control functions in single building to increase efficiencies, accommodate future staff, maximize shared use space and minimize building space requirements.
- Recommend consolidation of Maintenance Shop, Storage and Maintenance staff facilities with Warehouse for efficiency and inventory control.

Project Description: This project entails implementing a new Maintenance Building that would include a maintenance shop, staff space, warehouse and storage areas. The Maintenance Building would have exterior yard space for storage and vehicle access. The new Maintenance Building would replace the functionality of the existing Maintenance Shop, Maintenance Storage Yard, Instrumentation Shop, and Primary Control Building. As a result, these buildings would be demolished as part of this project.

The major project elements include:

- 8,200 SF one-story building
- Landscaping
- Yard space for storage and vehicle access

Project Implementation: The project cannot proceed until public access to the Bay Trail system is relocated from Carl Road to Caribbean Drive. In addition, because the proposed location for the new maintenance building uses the space currently occupied by the existing Administration Building, the new Administration Building must be completed and staff relocated before demolition and construction of new facilities can begin. It is assumed that this project and the Administration Building project would be designed under one set of contract documents and constructed as one project.

Permits Required: None

Special Considerations/Additional Notes: The City intends construct this building to meet LEED Silver standards, but not pursue the formal application process for certification.

Project ID Number	n/a
Project Name:	Sea Level Rise Protection
Process Area:	Support Facilities
Project Driver:	Regulatory and Policy
Implementation Scenario:	General

Project Justification: Santa Clara County's shoreline is at risk from coastal flooding due to extreme storm events combined with high tides and in the future as sea levels rise. The South San Francisco Bay Shoreline Study (SSFBSS), which is congressionally funded through the Army Corps, is evaluating the feasibility of options for managing flood risk along the South Bay shoreline as well as undertaking ecosystem restoration and expanding public access. Using a combination of flood levees and natural wetlands, the goal is to provide natural infrastructure to provide sea level rise flood protection and restore Bay habitats. This would allow the flood protection approach to evolve as more information on sea level rise impacts is developed. A feasibility study being managed by the Santa Clara County Valley Water District (SCVWD) will be completed in late 2016. This feasibility study will better define potential long-term alternatives for the South Bay shoreline.

Project Description: In order to evaluate the cost/benefit for each proposed alternative for shoreline levee flood protection, the SSFBSS has identified ten (10) Economic Impact Areas (EIA) along the South San Francisco Bay Shoreline from San Francisquito Creek to Guadalupe River. Three of those EIAs, Nos. 7, 8 and 9, are within the City of Sunnyvale. A preliminary routing for a future shoreline flood levee has been developed and would be evaluated as part of the SCVWD feasibility study.

Project Implementation: Based on discussions with the SCVWD, it is anticipated that due to the costs and the desire to coordinate these efforts with other goals (i.e., South Bay Salt Pond Restoration Project's desire to restore 15,000 acres of former salt ponds to wetlands), implementation for these projects would be outside of the current Master Plan planning period (> 2050).

Permits Required: It is anticipated that following permits would be required:

- Army Corps of Engineers
- Bay Conservation and Development Commission
- California Department of Fish and Wildlife
- Regional Water Quality Control Board.

Special Considerations/Additional Notes: It is anticipated that once the existing oxidation ponds are no longer part of the treatment process train at the WPCP, the ponds could become part of the long-term alternatives being evaluated as part of the SSFBSS and South Bay Salt Pond Restoration Project.

9.0 - SUPPORT UTILITIES

Project ID Number	1.1 and 2.1 (1.1 and 2.1M for MBR implementation)
Project Name:	Site Security Improvements – Stages 1 and 2
Process Area:	Support Utilities
Project Driver:	n/a (part of another project)
Implementation Scenario:	General

Project Justification: These improvements are required to maintain overall plant safety and security.

Project Description: The major project elements include:

- Construction of perimeter fence and closed circuit video camera system
    - In Stage 1, about 2,400± linear feet of the fence would be constructed to encompass the western half of the main plant site.
    - In Stage 2, about 1,500± linear feet of the flood wall would be constructed to encompass the remaining eastern half of the main plant site.
    - Includes: intrusion detention alarms, electronic access control systems, lighting requirements, system communication requirements

Project Implementation: This project would be implemented in two stages. Stage 1 would be completed at part of the Headworks/PST project. Stage 2 would be completed as part of the Existing Plant Rehabilitation project.

These improvements will be closely coordinate with the tidal flood wall improvements.

Permits Required: It is anticipated that following permits would be required:

- Bay Conservation and Development Commission (BCDC)
- Regional Water Quality Control Board (RWQCB).

Special Considerations/Additional Notes: None

Project ID Number	9.1
Project Name:	Recycle Water Improvements (New Recycled Water Pump Station)
Process Area:	Support Utilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: Due to the age of the recycled water pump station facilities, the facilities would need to be rehabilitated or replaced to maintain reliable operation.

Project Description: This project entails rehabilitating selected components of the existing recycled water pump station. The major support utility systems include:

- Replacement of recycled water pumps
- Replacement of miscellaneous mechanical equipment (e.g., valves) and piping

Project Implementation: These improvements should be implemented when a majority of the recycled water pump station facilities near the end of their useful life.

Permits Required: None

Special Considerations/Additional Notes: The condition assessment, proposed to be completed as part of the Existing Plant Rehabilitation Project, would include an assessment of the recycled water pump station (even though rehabilitation/replacement of these facilities would likely be completed as a standalone project). Depending upon the timing of these improvements, the recycled water pump station section of that condition assessment may need to be updated.

Project ID Number	9.2
Project Name:	Community Improvements
Process Area:	Support Utilities
Project Driver:	Policy
Implementation Scenario:	General

Project Justification: City ordinance dictates that a certain percentage of capital improvements projects need to include community enhancements.

Project Description: This project entails community and environmental enhancements. These enhancements could include:

- Educational features in the Public Outreach Meeting Space of the new Administration Building
- Public parking, sidewalks, signage, and road markings to facilitate plant tours
- Americans with Disabilities Act (ADA) related improvements for public tours
- Kiosks at the entrance of the oxidation ponds

Project Implementation: None

Permits Required: None

Special Considerations/Additional Notes: None

Project ID Number	9.3
Project Name:	Landfill Gas Flare and Booster System Upgrade
Process Area:	Support Utilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: Due to the age of the landfill gas flare and booster system, the facilities would need to be rehabilitated or replaced to maintain reliable operation.

Project Description: This project entails rehabilitating selected components of the existing landfill gas flare and booster system. The major support utility systems include:

- Replacement of landfill gas flare
- Replacement of miscellaneous mechanical equipment (e.g., valves) and piping

Project Implementation: These improvements should be implemented when a majority of the landfill gas flare and booster system facilities near the end of their useful life.

Permits Required: None

Special Considerations/Additional Notes: The condition assessment, proposed to be completed as part of the Existing Plant Rehabilitation Project, would include an assessment of the recycled water pump station (even though rehabilitation/replacement of these facilities would likely be completed as a standalone project). Depending upon the timing of these improvements, the recycled water pump station section of that condition assessment may need to be updated.

Project ID Number	9.4
Project Name:	Miscellaneous Civil Site/Support Utility Improvements
Process Area:	Support Utilities
Project Driver:	Condition (R&R)
Implementation Scenario:	General

Project Justification: Due to the age of the overall facilities as well as proposed process upgrades at the WPCP, key elements of the support utilities need to be rehabilitated or replaced to maintain reliable operation. These include the potable water, utility water, hot water, utility air, digester gas, landfill gas, natural gas, tank drain, sanitary drain, storm drain, and recycled water systems.

Project Description: This project entails rehabilitating selected components of the existing support utility systems. The major support utility systems include:

- Potable water, utility water, hot water, utility air
- Digester gas, landfill gas, natural gas
- Tank drains, sanitary drains, storm drains
- Recycled water

Project Implementation: These improvements are assumed to be packaged into one larger WPCP R&R project (as opposed to smaller individual projects).

Permits Required: None

Special Considerations/Additional Notes: The condition assessment, proposed to be completed as part of the Existing Plant Rehabilitation Project, would include an assessment of the support utility systems (even though rehabilitation/replacement of these facilities would likely be completed as a standalone project). Depending upon the timing of these improvements, the support utility systems section of that condition assessment may need to be updated.

APPENDIX E - FISCAL CASH FLOW SCENARIOS

Master Plan CIP Fiscal Scenarios - Conventional Activated Sludge (CAS) Split Flow

Total Program Costs (Escalated)

FINAL
5/16/2016

CIP Phase	Project Title (Descriptive)	Scenario 1 - Total CIP (Includes all potential projects)									Scenario 2				Scenario 3				Comments
		% of Project Incld.	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phases 1 - 3	Phases 4 - 5	Total (Ph. 1 - 5)	% of Project Incld.	Phases 1 - 3	Phases 4 - 5	Total (Ph. 1 - 5)	% of Project Incld.	Phases 1 - 3	Phases 4 - 5	Total (Ph. 1 - 5)	
	PRIMARY TREATMENT																		
1	Primary Treatment Facility	100%	$ 133,100,000	$ -	$ -	$ -	$ -	$ 133,100,000	$ -	$ 133,100,000	100%	$ 133,100,000	$ -	$ 133,100,000	100%	$ 133,100,000	$ -	$ 133,100,000	
1	Rehabilitation Primary Effluent Pipeline from Central Plant to Ponds	100%	$ 2,800,000	$ -	$ -	$ -	$ -	$ 2,800,000	$ -	$ 2,800,000	100%	$ 2,800,000	$ -	$ 2,800,000	100%	$ 2,800,000	$ -	$ 2,800,000	
1	Rehabilitation Influent Pipelines to WPCP	100%	$ 1,500,000	$ -	$ -	$ -	$ -	$ 1,500,000	$ -	$ 1,500,000	100%	$ 1,500,000	$ -	$ 1,500,000	100%	$ 1,500,000	$ -	$ 1,500,000	
	SECONDARY TREATMENT																		
1	Existing Plant Rehabilitation - Split Flow	100%	$ 43,300,000	$ -	$ -	$ -	$ -	$ 43,300,000	$ -	$ 43,300,000	100%	$ 43,300,000	$ -	$ 43,300,000	100%	$ 43,300,000	$ -	$ 43,300,000	
2	Secondary Treatment Improvements - Split Flow Stage 1	100%	$ -	$ 125,200,000	$ -	$ -	$ -	$ 125,200,000	$ -	$ 125,200,000	100%	$ 125,200,000	$ -	$ 125,200,000	100%	$ 125,200,000	$ -	$ 125,200,000	
4	Secondary Treatment Improvements - Split Flow Stage 2	100%	$ -	$ -	$ -	$ 86,600,000	$ -	$ -	$ 86,600,000	$ 86,600,000	100%	$ -	$ 86,600,000	$ 86,600,000	70%	$ -	$ 60,600,000	$ 60,600,000	Scenario 3 based on building 1 a. basin and 2 sec. clarifiers (instead of 2 a. basins and 3 sec. clarifiers) due to flows and loads.
4	Primary Effluent Diurnal Equalization and Emergency Storage	100%	$ -	$ -	$ -	$ 135,600,000	$ -	$ -	$ 135,600,000	$ 135,600,000	100%	$ -	$ 135,600,000	$ 135,600,000	94%	$ -	$ 126,800,000	$ 126,800,000	Scenario 3 based on building 1 day of emergency storage instead of 3.
4	Active Retirement of Ponds	100%	$ -	$ -	$ -	$ 10,600,000	$ -	$ -	$ 10,600,000	$ 10,600,000	100%	$ -	$ 10,600,000	$ 10,600,000	0%	$ -	$ -	$ -	
2	AFT Pump Station and Pipeline	100%	$ -	$ 7,200,000	$ -	$ -	$ -	$ 7,200,000	$ -	$ 7,200,000	100%	$ 7,200,000	$ -	$ 7,200,000	100%	$ 7,200,000	$ -	$ 7,200,000	Potential reduction in Phase 1 -3 Program.
5	Chemical Dosing (P-Removal)	100%	$ -	$ -	$ -	$ -	$ 2,200,000	$ -	$ 2,200,000	$ 2,200,000	0%	$ -	$ -	$ -	0%	$ -	$ -	$ -	
	TERTIARY TREATMENT																		
3	Filter Control Building (Includes Demolition of Existing)	100%	$ -	$ -	$ 5,900,000	$ -	$ -	$ 5,900,000	$ -	$ 5,900,000	100%	$ 5,900,000	$ -	$ 5,900,000	100%	$ 5,900,000	$ -	$ 5,900,000	
4	Filter Backwash Storage	100%	$ -	$ -	$ -	$ 11,800,000	$ -	$ -	$ 11,800,000	$ 11,800,000	100%	$ -	$ 11,800,000	$ 11,800,000	100%	$ -	$ 11,800,000	$ 11,800,000	
5	Denitrification Filters	100%	$ -	$ -	$ -	$ -	$ 63,600,000	$ -	$ 63,600,000	$ 63,600,000	0%	$ -	$ -	$ -	0%	$ -	$ -	$ -	
3	Chloramine Disinfection	100%	$ -	$ -	$ 3,500,000	$ -	$ -	$ 3,500,000	$ -	$ 3,500,000	100%	$ 3,500,000	$ -	$ 3,500,000	100%	$ 3,500,000	$ -	$ 3,500,000	
5	UV Disinfection	100%	$ -	$ -	$ -	$ -	$ 20,800,000	$ -	$ 20,800,000	$ 20,800,000	100%	$ -	$ 20,800,000	$ 20,800,000	100%	$ -	$ 20,800,000	$ 20,800,000	
5	Ozone Disinfection	100%	$ -	$ -	$ -	$ -	$ 45,800,000	$ -	$ 45,800,000	$ 45,800,000	0%	$ -	$ -	$ -	0%	$ -	$ -	$ -	
5	Membrane Filtration (MF) Improvements	100%	$ -	$ -	$ -	$ -	$ 35,200,000	$ -	$ 35,200,000	$ 35,200,000	0%	$ -	$ -	$ -	0%	$ -	$ -	$ -	
	SOLIDS FACILITIES																		
2	Digester Supernatant PS and Drainage Piping Upgrades	100%	$ -	$ 1,400,000	$ -	$ -	$ -	$ 1,400,000	$ -	$ 1,400,000	100%	$ 1,400,000	$ -	$ 1,400,000	100%	$ 1,400,000	$ -	$ 1,400,000	
2	Thickening and Dewatering Facility - Stage 1	100%	$ -	$ 52,100,000	$ -	$ -	$ -	$ 52,100,000	$ -	$ 52,100,000	100%	$ 52,100,000	$ -	$ 52,100,000	100%	$ 52,100,000	$ -	$ 52,100,000	
4	Thickening and Dewatering Facility - Stage 2	100%	$ -	$ -	$ -	$ 14,300,000	$ -	$ -	$ 14,300,000	$ 14,300,000	100%	$ -	$ 14,300,000	$ 14,300,000	100%	$ -	$ 14,300,000	$ 14,300,000	
3	Digester No. 5	100%	$ -	$ -	$ 10,900,000	$ -	$ -	$ 10,900,000	$ -	$ 10,900,000	100%	$ 10,900,000	$ -	$ 10,900,000	100%	$ 10,900,000	$ -	$ 10,900,000	
3	FOG/Food Waste Facility	100%	$ -	$ -	$ 2,100,000	$ -	$ -	$ 2,100,000	$ -	$ 2,100,000	100%	$ 2,100,000	$ -	$ 2,100,000	100%	$ 2,100,000	$ -	$ 2,100,000	Potential reduction in Phase 1 -3 Program.
4	Phosphorus Recovery Facility	100%	$ -	$ -	$ -	$ 10,900,000	$ -	$ -	$ 10,900,000	$ 10,900,000	0%	$ -	$ -	$ -	0%	$ -	$ -	$ -	
4	Biosolids Post-Processing	100%	$ -	$ -	$ -	$ 32,200,000	$ -	$ -	$ 32,200,000	$ 32,200,000	100%	$ -	$ 32,200,000	$ 32,200,000	0%	$ -	$ -	$ -	
	COMBINED HEAT AND POWER																		
3	Cogeneration Upgrade	100%	$ -	$ -	$ 21,200,000	$ -	$ -	$ 21,200,000	$ -	$ 21,200,000	100%	$ 21,200,000	$ -	$ 21,200,000	100%	$ 21,200,000	$ -	$ 21,200,000	
	SUPPORT FACILITIES																		
1	New Access to Bay Trails	100%	$ 600,000	$ -	$ -	$ -	$ -	$ 600,000	$ -	$ 600,000	100%	$ 600,000	$ -	$ 600,000	100%	$ 600,000	$ -	$ 600,000	
1	Household Hazardous Waste Demolition/ Solid Waste Removal	100%	$ 500,000	$ -	$ -	$ -	$ -	$ 500,000	$ -	$ 500,000	100%	$ 500,000	$ -	$ 500,000	100%	$ 500,000	$ -	$ 500,000	
2	Administration and Lab Building	100%	$ -	$ 26,300,000	$ -	$ -	$ -	$ 26,300,000	$ -	$ 26,300,000	100%	$ 26,300,000	$ -	$ 26,300,000	100%	$ 26,300,000	$ -	$ 26,300,000	
2	Maintenance Building	100%	$ -	$ 7,400,000	$ -	$ -	$ -	$ 7,400,000	$ -	$ 7,400,000	100%	$ 7,400,000	$ -	$ 7,400,000	100%	$ 7,400,000	$ -	$ 7,400,000	
	SUPPORT UTILITIES																		
2	Recycle Water Improvements (New Recycled Water PS)	100%	$ -	$ 4,200,000	$ -	$ -	$ -	$ 4,200,000	$ -	$ 4,200,000	100%	$ 4,200,000	$ -	$ 4,200,000	100%	$ 4,200,000	$ -	$ 4,200,000	
2	Community Improvements	100%	$ -	$ 700,000	$ -	$ -	$ -	$ 700,000	$ -	$ 700,000	100%	$ 700,000	$ -	$ 700,000	100%	$ 700,000	$ -	$ 700,000	
2	Landfill Gas Flare and Booster System Upgrades	100%	$ -	$ 400,000	$ -	$ -	$ -	$ 400,000	$ -	$ 400,000	100%	$ 400,000	$ -	$ 400,000	100%	$ 400,000	$ -	$ 400,000	
2	Miscellaneous Civil Site/Support Utility Improvements	100%	$ -	$ 700,000	$ -	$ -	$ -	$ 700,000	$ -	$ 700,000	100%	$ 700,000	$ -	$ 700,000	100%	$ 700,000	$ -	$ 700,000	
	DEMOLITION																		
4	Demolition Fixed Growth Reactor (FGR) Pump Station	100%	$ -	$ -	$ -	$ 2,600,000	$ -	$ -	$ 2,600,000	$ 2,600,000	100%	$ -	$ 2,600,000	$ 2,600,000	100%	$ -	$ 2,600,000	$ 2,600,000	
5	Demolition Fixed Growth Reactors (FGRs)	100%	$ -	$ -	$ -	$ -	$ 6,800,000	$ -	$ 6,800,000	$ 6,800,000	100%	$ -	$ 6,800,000	$ 6,800,000	100%	$ -	$ 6,800,000	$ 6,800,000	
	OPERATIONS AND MAINTENANCE																		
	Capital Replacement (1% of All New Construction)	100%	$ 1,360,000	$ 1,180,000	$ 1,960,000	$ 2,600,000	$ 3,450,000	$ 4,500,000	$ 6,050,000	$ 10,550,000	100%	$ 4,500,000	$ 6,050,000	$ 10,550,000	100%	$ 4,500,000	$ 6,050,000	$ 10,550,000	
	Total		**$ 183,160,000**	**$ 226,780,000**	**$ 45,560,000**	**$ 307,200,000**	**$ 177,850,000**	**$ 455,500,000**	**$ 485,050,000**	**$ 940,550,000**		**$ 455,500,000**	**$ 327,350,000**	**$ 782,850,000**		**$ 455,500,000**	**$ 249,750,000**	**$ 705,250,000**	

APPENDIX F - CIP MODEL USER INFORMATION

User Information for WPCP Master Plan CIP Model (Excel Spreadsheet)
Master Plan
City of Sunnyvale

Input Tabs	Column	Input/ Calculated	Description of Key Inputs or Calculated Values
Program Factor Input			
	B	Input	Program cost factors for all Master Plan CIP projects, unless noted otherwise.
	C	Input	Program cost factors for Primary Treatment Facility
	D	Input	Program cost factors for Secondary Treatment Improvements Stage 1 and 2
Capital Replacement-Input			
	C	Input	Percentage of annual expenditure for capital replacement
HW-PST Detail			
	E	Input	Total construction cost for each phase of the project
	F	Input	Total cost of each phase of engineering services during construction (ESDC)
	G - M	Input	Custom s-curve to be used for each phase of the project
CAS CIP-Input			
MBR CIP-Input			
	A	Input	Project ID, a numerical assignment to facilitate cross reference with individual project descriptions.
	B	Input	Project phase (1 - 5), based on approximate time the project will take place.
	C	Input	Description of whether the project is the same as CAS. Enter one of the following: - On the CAS tab, enter "n/a" for all projects - On MBR tab, enter "No - Scope" if only the scope is different - On MBR tab, enter "No - Scope/Timing" if the scope and timing are different - On MBR tab, enter "No - Timing" if only the timing is different
	D	Input	Project title
	E	Input	Project category. Enter one of the following: - Enter "General" if the project is the same under Split Flow CAS, Full CAS, and MBR implementation - Enter "Split Flow" if the project applies to Split Flow implementation only - Enter "Full CAS" if the project applies to Full CAS implementation only. - Enter "MBR" if the project applies to MBR implementation only - Enter "Not Included" if the project is already underway and funded through previous CIP planning efforts
	F	Input	Construction cost of each project element (i.e., each line item on this tab).
	G	Input	Sum of all project elements included in the total project package. (Manually sum project elements included in the project package).
	H	Calculated	Years to midpoint of construction
	I	Calculated	Total escalated construction cost
	J	Calculated	Total escalated project cost
	K	Input	Project driver. Enter one of the following: - R&R - Regulatory - Flow and Load - Performance/Econ. - Policy
	L	Input	Project start date
	M	Calculated	Project start year
	N	Input	Duration of project planning/design phase (in months)
	O	Input	Duration of project permitting/CEQA phase (in months)
	P	Input	Duration of gaps in project schedule (if any) (in months)
	Q	Input	Duration of project construction phase (in months)
	R	Calculated	Total project duration (in months)
	S	Calculated	Total project duration (in years)
	T	Calculated	Fiscal year project is online (i.e. complete)

	U - Y	Calculated	Project cost for each phase of the master plan.
	Z - BE	Calculated	Fiscal year cash flow of project
CAS Fiscal Scenarios			
MBR Fiscal Scenarios			
	A	Calculated	Project phase (1 - 5), based on approximate time the project will take place.
	B	Calculated	Project title
	C	Fixed	Percentage of project included in Fiscal Planning Scenario 1. Fixed at 100% because this scenario includes all CIP projects.
	D - K	Calculated	Project cost for each phase of the master plan, under Fiscal Planning Scenario 1.
	L	Input	Percentage of project included in Fiscal Planning Scenario 2.
	M - O	Calculated	Project cost for each phase of the master plan, under Fiscal Planning Scenario 2.
	P	Input	Percentage of project included in Fiscal Planning Scenario 3.
	Q - S	Calculated	Project cost for each phase of the master plan, under Fiscal Planning Scenario 3.
	T	Input	Comments describing specific inputs. Enter as needed.
S-Curve - Standard	All	Fixed	Standard project cost breakdown by year depending on the duration of the project.
Output Tabs	**CAS Tab Name**	**MBR Tab Name**	**Description of Tab Contents**
CAS Output Tabs			
CAS Output Tabs			
	CAS TM Fig 1	MBR TM Fig 1	Figure showing the breakdown of the total CIP program cost by project driver. Figure is based on implementing Fiscal Planning Scenario 2.
	CAS TM Fig 2	MBR TM Fig 2	Figure showing the annual CIP program costs. Figure is based on implementing Fiscal Planning Scenario 1 (all CIP projects).
	CAS-Fig-Fiscal Scenarios	MBR-Fig-Fiscal Scenarios	Figure comparing the annual CIP program costs of each of the Fiscal Planning Scenarios.
	CAS FY Cash-Scn 1	MBR FY Cash-Scn 1	Table summarizing the annual program costs for Fiscal Planning Scenario 1.
	CAS FY Cash-Scn 2	MBR FY Cash-Scn 2	Table summarizing the annual program costs for Fiscal Planning Scenario 2.
	CAS FY Cash-Scn 3	MBR FY Cash-Scn 3	Table summarizing the annual program costs for Fiscal Planning Scenario 3.

APPENDIX G - PROGRAM O&M COSTS

O&M Costs for Split Flow Program Implementation Plan
WPCP Master Plan
City of Sunnyvale

Phase		Phase 0				Phase 1					Phase 2	
	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19	FY 19/20	FY 20/21	FY 21/22	FY 22/23	FY 23/24	FY 24/25	FY 25/26
	6/14 - 7/15 2014	6/15 - 7/16 2015	6/16 - 7/17 2016	6/17 - 7/18 2017	6/18 - 7/19 2018	6/19 - 7/20 2019	6/20 - 7/21 2020	6/21 - 7/22 2021	6/22 - 7/23 2022	6/23 - 7/24 2023	6/24 - 7/25 2024	6/25 - 7/26 2025
Average Annual Flow												
Flow, mgd	15.2	15.2	15.5	15.7	16.0	16.2	16.5	16.8	17.0	17.3	17.5	17.8
Recycled Water, mgd		1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Bay Discharge, mgd		13.5	13.8	14.0	14.3	14.5	14.8	15.1	15.3	15.6	15.8	16.1
Labor Costs												
UNESCALATED Total Annual Labor Cost, $	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000
ESCALATED Total Annual Labor Cost, $	$ 9,100,000	$ 9,100,000	$ 9,400,000	$ 9,700,000	$ 9,900,000	$ 10,200,000	$ 10,500,000	$ 10,900,000	$ 11,200,000	$ 11,500,000	$ 11,900,000	$ 12,200,000
	Note: same value each year											
Power Costs												
Average Power Demand, kW						1,520	1,545	1,569	1,593	2,533	2,571	2,609
Average Power Production, kW						1,000	1,000	1,000	1,000	1,000	1,000	1,000
Net Power Demand (Usage), kW						520	545	569	593	1,533	1,571	1,609
Average Annual Power Demand, kWh						4,557,446	4,770,656	4,983,867	5,197,077	13,425,723	13,759,536	14,093,349
Average Cost of Power, $/kWh						$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20
UNESCALATED Annual Power Cost, $	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 900,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 2,700,000	$ 2,800,000	$ 2,800,000
ESCALATED Annual Power Cost, $	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 1,100,000	$ 1,300,000	$ 1,300,000	$ 1,400,000	$ 4,000,000	$ 4,300,000	$ 4,600,000
Chemical Costs												
Polymer - CEPT												
Dose, mg/L		0	0	0	0	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Usage, pounds per day		0	0	0	0	28	28	28	29	29	30	30
Activation, %		30	30	30	30	30	30	30	30	30	30	30
Density, SG		1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Months of Operation per Year		0	0	0	0	2	2	2	2	2	2	2
Usage, gallons per year		0	0	0	0	668	668	668	692	692	717	717
Usage, pounds per year		0	0	0	0	1,703	1,703	1,703	1,764	1,764	1,825	1,825
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ 1,908	$ 1,908	$ 1,908	$ 1,976	$ 1,976	$ 2,044	$ 2,044
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ 2,147	$ 2,212	$ 2,278	$ 2,430	$ 2,503	$ 2,667	$ 2,747
Polymer - AFT												
Dose, mg/L		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Usage, pounds per day (based on treating 1/3 the influent flow)		233	237	241	245	249	253	257	261	265	269	273
Activation, %		27	27	27	27	27	27	27	27	27	27	27
Density, SG		1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Percentage of Flow Treated by AFTs		100%	100%	100%	100%	100%	100%	100%	100%	100%	40%	40%
Usage, gallons per year		37,030	37,670	38,300	38,940	39,570	40,210	40,850	41,480	42,120	17,100	17,360
Usage, pounds per year		85,045	86,505	87,965	89,425	90,885	92,345	93,805	95,265	96,725	98,185	99,645
UNESCALATED Annual Cost, $		$ 95,250	$ 96,886	$ 98,521	$ 100,156	$ 101,791	$ 103,426	$ 105,062	$ 106,697	$ 108,332	$ 109,967	$ 111,602
ESCALATED Annual Cost, $		$ 95,250	$ 99,792	$ 104,521	$ 109,443	$ 114,567	$ 119,900	$ 125,449	$ 131,224	$ 137,232	$ 143,482	$ 149,984
Polymer - DMF												
Dose, mg/L		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.5	0.50
Usage, pounds per day		127	129	132	134	136	138	140	142	145	74	75
Activation, %		27	27	27	27	27	27	27	27	27	27	27
Density, SG		1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Usage, gallons per year		20,190	20,500	20,980	21,300	21,620	21,940	22,250	22,570	23,050	11,760	11,920
Usage, pounds per year		46,355	47,085	48,180	48,910	49,640	50,370	51,100	51,830	52,925	27,010	27,375
UNESCALATED Annual Cost, $		$ 51,918	$ 52,735	$ 53,962	$ 54,779	$ 55,597	$ 56,414	$ 57,232	$ 58,050	$ 59,276	$ 30,251	$ 30,660
ESCALATED Annual Cost, $		$ 51,918	$ 54,317	$ 57,248	$ 59,859	$ 62,575	$ 65,400	$ 68,338	$ 71,394	$ 75,089	$ 39,471	$ 41,204
Polymer - Thickening												
Sludge, pounds per day		0	0	0	0	0	0	0	0	0	11900	12182
Dose, lb/dry ton		15	15	15	15	15	15	15	15	15	15	15
Usage, pounds per day		0	0	0	0	0	0	0	0	0	90	92
Activation, %		30	30	30	30	30	30	30	30	30	30	30
Density, SG		1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

O&M Costs for Split Flow Program Implementation Plan
WPCP Master Plan
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Phase			Phase 3							Phase 4		
	FY 26/27	FY 27/28	FY 28/29	FY 29/30	FY 30/31	FY 31/32	FY 32/33	FY 33/34	FY 34/35	FY 35/36	FY 36/37	FY 37/38
	6/26 - 7/27	6/27 - 7/28	6/28 - 7/29	6/29 - 7/30	6/30 - 7/31	6/31 - 7/32	6/32 - 7/33	6/33 - 7/34	6/34 - 7/35	6/35 - 7/36	6/36 - 7/37	6/37 - 7/38
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Average Annual Flow												
Flow, mgd	18.1	18.3	18.6	18.8	19.1	19.4	19.6	19.9	20.1	20.4	20.4	20.4
Recycled Water, mgd	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	3.6	3.6	3.6
Bay Discharge, mgd	16.4	16.6	16.9	17.1	17.4	17.7	17.9	18.2	18.4	16.8	16.8	16.8
Labor Costs												
UNESCALATED Total Annual Labor Cost, $	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000
ESCALATED Total Annual Labor Cost, $	$ 12,600,000	$ 13,000,000	$ 13,400,000	$ 13,800,000	$ 14,200,000	$ 14,600,000	$ 15,000,000	$ 15,500,000	$ 16,000,000	$ 16,400,000	$ 16,900,000	$ 17,400,000
Power Costs												
Average Power Demand, kW	2,647	2,681	2,719	2,757	2,795	2,833	2,871	2,909	2,947	3,055	3,055	3,055
Average Power Production, kW	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Net Power Demand (Usage), kW	1,647	1,681	1,719	1,757	1,795	1,833	1,871	1,909	1,947	2,055	2,055	2,055
Average Annual Power Demand, kWh	14,427,162	14,723,850	15,057,136	15,390,422	15,723,708	16,056,994	16,390,280	16,723,567	17,056,853	18,005,907	18,005,907	18,005,907
Average Cost of Power, $/kWh	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20
UNESCALATED Annual Power Cost, $	$ 2,900,000	$ 2,900,000	$ 3,000,000	$ 3,100,000	$ 3,100,000	$ 3,200,000	$ 3,300,000	$ 3,300,000	$ 3,400,000	$ 3,600,000	$ 3,600,000	$ 3,600,000
ESCALATED Annual Power Cost, $	$ 5,000,000	$ 5,200,000	$ 5,700,000	$ 6,100,000	$ 6,400,000	$ 7,000,000	$ 7,600,000	$ 7,900,000	$ 8,600,000	$ 9,600,000	$ 10,000,000	$ 10,500,000
Chemical Costs												
Polymer - CEPT												
Dose, mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Usage, pounds per day	31	31	31	32	32	33	33	34	34	35	35	35
Activation, %	30	30	30	30	30	30	30	30	30	30	30	30
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Months of Operation per Year	2	2	2	2	2	2	2	2	2	2	2	2
Usage, gallons per year	740	740	740	763	763	787	787	812	812	835	835	835
Usage, pounds per year	1,886	1,886	1,886	1,947	1,947	2,008	2,008	2,068	2,068	2,129	2,129	2,129
UNESCALATED Annual Cost, $	$ 2,112	$ 2,112	$ 2,112	$ 2,180	$ 2,180	$ 2,248	$ 2,248	$ 2,317	$ 2,317	$ 2,385	$ 2,385	$ 2,385
ESCALATED Annual Cost, $	$ 2,924	$ 3,011	$ 3,102	$ 3,298	$ 3,397	$ 3,608	$ 3,716	$ 3,944	$ 4,062	$ 4,307	$ 4,436	$ 4,569
Polymer - AFT												
Dose, mg/L	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0	0	0
Usage, pounds per day (based on treating 1/3 the influ	277	281	285	289	293	297	300	304	308	0	0	0
Activation, %	27	27	27	27	27	27	27	27	27	27	27	27
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Percentage of Flow Treated by AFTs	40%	40%	40%	40%	40%	40%	40%	40%	40%	0%	0%	0%
Usage, gallons per year	17,610	17,870	18,120	18,380	18,630	18,880	19,070	19,330	19,580	0	0	0
Usage, pounds per year	101,105	102,565	104,025	105,485	106,945	108,405	109,500	110,960	112,420	0	0	0
UNESCALATED Annual Cost, $	$ 113,238	$ 114,873	$ 116,508	$ 118,143	$ 119,778	$ 121,414	$ 122,640	$ 124,275	$ 125,910	$ -	$ -	$ -
ESCALATED Annual Cost, $	$ 156,747	$ 163,781	$ 171,096	$ 178,702	$ 186,611	$ 194,833	$ 202,705	$ 211,570	$ 220,785	$ -	$ -	$ -
Polymer - DMF												
Dose, mg/L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Usage, pounds per day	76	77	78	79	80	81	82	83	84	86	86	86
Activation, %	27	27	27	27	27	27	27	27	27	27	27	27
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Usage, gallons per year	12,080	12,240	12,400	12,560	12,720	12,880	13,040	13,190	13,350	13,670	13,670	13,670
Usage, pounds per year	27,740	28,105	28,470	28,835	29,200	29,565	29,930	30,295	30,660	31,390	31,390	31,390
UNESCALATED Annual Cost, $	$ 31,069	$ 31,478	$ 31,886	$ 32,295	$ 32,704	$ 33,113	$ 33,522	$ 33,930	$ 34,339	$ 35,157	$ 35,157	$ 35,157
ESCALATED Annual Cost, $	$ 43,006	$ 44,880	$ 46,826	$ 48,849	$ 50,952	$ 53,136	$ 55,406	$ 57,764	$ 60,214	$ 63,497	$ 65,402	$ 67,364
Polymer - Thickening												
Sludge, pounds per day	12464	12745	13027	13309	13591	13873	14155	14436	14718	15000	15000	15000
Dose, lb/dry ton	15	15	15	15	15	15	15	15	15	15	15	15
Usage, pounds per day	94	96	98	100	102	105	107	109	111	113	113	113
Activation, %	30	30	30	30	30	30	30	30	30	30	30	30
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

O&M Costs for Split Flow Program Implementation Plan
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Phase	Phase 5							
	FY 38/39	**FY 39/40**	**FY 40/41**	**FY 41/42**	**FY 42/43**	**FY 43/44**	**FY 44/45**	**Total**
	6/38 - 7/39	**6/39 - 7/40**	**6/40 - 7/41**	**6/41 - 7/42**	**6/42 - 7/43**	**6/43 - 7/44**	**6/44 - 7/45**	
	2038	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	
Average Annual Flow								
Flow, mgd	20.4	20.4	20.4	20.4	20.4	20.4	20.4	
Recycled Water, mgd	3.6	3.6	3.6	3.6	3.6	3.6	3.6	
Bay Discharge, mgd	16.8	16.8	16.8	16.8	16.8	16.8	16.8	
Labor Costs								
UNESCALATED Total Annual Labor Cost, $	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	$ 9,100,000	**$ 282,100,000**
ESCALATED Total Annual Labor Cost, $	$ 18,000,000	$ 18,500,000	$ 19,100,000	$ 19,600,000	$ 20,200,000	$ 20,800,000	$ 21,400,000	**$ 442,000,000**
Power Costs								
Average Power Demand, kW	3,721	3,721	3,721	3,721	3,721	3,721	3,721	
Average Power Production, kW	1,000	1,000	1,000	1,000	1,000	1,000	1,000	
Net Power Demand (Usage), kW	2,721	2,721	2,721	2,721	2,721	2,721	2,721	
Average Annual Power Demand, kWh	23,835,231	23,835,231	23,835,231	23,835,231	23,835,231	23,835,231	23,835,231	
Average Cost of Power, $/kWh	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	
UNESCALATED Annual Power Cost, $	$ 4,800,000	$ 4,800,000	$ 4,800,000	$ 4,800,000	$ 4,800,000	$ 4,800,000	$ 4,800,000	**$ 86,300,000**
ESCALATED Annual Power Cost, $	$ 14,700,000	$ 15,500,000	$ 16,300,000	$ 17,100,000	$ 17,900,000	$ 18,800,000	$ 19,800,000	**$ 229,200,000**
Chemical Costs								
Polymer - CEPT								
Dose, mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Usage, pounds per day	35	35	35	35	35	35	35	
Activation, %	30	30	30	30	30	30	30	
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
Months of Operation per Year	2	2	2	2	2	2	2	
Usage, gallons per year	835	835	835	835	835	835	835	
Usage, pounds per year	2,129	2,129	2,129	2,129	2,129	2,129	2,129	
UNESCALATED Annual Cost, $	$ 2,385	$ 2,385	$ 2,385	$ 2,385	$ 2,385	$ 2,385	$ 2,385	**$ 57,436**
ESCALATED Annual Cost, $	$ 4,706	$ 4,848	$ 4,993	$ 5,143	$ 5,297	$ 5,456	$ 5,620	**$ 97,420**
Polymer - AFT								
Dose, mg/L	0	0	0	0	0	0	0	
Usage, pounds per day (based on treating 1/3 the influ	0	0	0	0	0	0	0	
Activation, %	27	27	27	27	27	27	27	
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
Percentage of Flow Treated by AFTs	0%	0%	0%	0%	0%	0%	0%	
Usage, gallons per year	0	0	0	0	0	0	0	
Usage, pounds per year	0	0	0	0	0	0	0	
UNESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 2,214,470**
ESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 3,017,675**
Polymer - DMF								
Dose, mg/L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Usage, pounds per day	86	86	86	86	86	86	86	
Activation, %	27	27	27	27	27	27	27	
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
Usage, gallons per year	13,670	13,670	13,670	13,670	13,670	13,670	13,670	
Usage, pounds per year	31,390	31,390	31,390	31,390	31,390	31,390	31,390	
UNESCALATED Annual Cost, $	$ 35,157	$ 35,157	$ 35,157	$ 35,157	$ 35,157	$ 35,157	$ 35,157	**$ 1,206,778**
ESCALATED Annual Cost, $	$ 69,385	$ 71,467	$ 73,611	$ 75,819	$ 78,093	$ 80,436	$ 82,849	**$ 1,835,769**
Polymer - Thickening								
Sludge, pounds per day	15000	15000	15000	15000	15000	15000	15000	
Dose, lb/dry ton	15	15	15	15	15	15	15	
Usage, pounds per day	113	113	113	113	113	113	113	
Activation, %	30	30	30	30	30	30	30	
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

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Phase		Phase 0				Phase 1					Phase 2	
	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19	FY 19/20	FY 20/21	FY 21/22	FY 22/23	FY 23/24	FY 24/25	FY 25/26
	6/14 - 7/15	6/15 - 7/16	6/16 - 7/17	6/17 - 7/18	6/18 - 7/19	6/19 - 7/20	6/20 - 7/21	6/21 - 7/22	6/22 - 7/23	6/23 - 7/24	6/24 - 7/25	6/25 - 7/26
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Usage, gallons per year		0	0	0	0	0	0	0	0	0	12,880	13,160
Usage, pounds per year		0	0	0	0	0	0	0	0	0	32,850	33,580
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,792	$ 37,610
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 48,005	$ 50,544
Polymer - Dewatering												
Sludge, pounds per day		0	0	0	0	0	0	0	0	0	18400	18664
Dose, lb/dry ton		34	34	34	34	34	34	34	34	34	34	34
Usage, pounds per day		0	0	0	0	0	0	0	0	0	313	318
Activation, %		30	30	30	30	30	30	30	30	30	30	30
Density, SG		1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Usage, gallons per year		0	0	0	0	0	0	0	0	0	44,770	45,490
Usage, pounds per year		0	0	0	0	0	0	0	0	0	114,245	116,070
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 127,954	$ 129,998
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 166,951	$ 174,707
Ferric Chloride ($FeCl_3$) - CEPT												
Dose, mg/L		0	0	0	0	20	20	20	20	20	20	20
Usage, pounds per day		0	0	0	0	2709	2753	2796	2839	2883	2926	2970
Solution, %		39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Density, SG		1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Months of Operation per Year		0	0	0	0	2	2	2	2	2	2	2
Usage, gallons per year		0	0	0	0	38,482	39,107	39,717	40,328	40,953	41,563	42,188
Usage, pounds per year		0	0	0	0	164,798	167,474	170,090	172,706	175,383	177,998	180,675
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ 55,798	$ 56,705	$ 57,589	$ 58,476	$ 59,382	$ 60,267	$ 61,173
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ 62,802	$ 65,736	$ 68,764	$ 71,918	$ 75,224	$ 78,635	$ 82,212
Ferric Chloride ($FeCl_3$) - Chemical Phosphorous Removal[(1)]												
Dose, mg/L		0	0	0	0	0	0	0	0	0	0	0
Usage, pounds per day		0	0	0	0	0	0	0	0	0	0	0
Solution, %		39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Density, SG		1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Months of Operation per Year		0	0	0	0	0	0	0	0	0	0	0
Usage, gallons per year		0	0	0	0	0	0	0	0	0	0	0
Usage, pounds per year		0	0	0	0	0	0	0	0	0	0	0
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Methanol - Nitrogen Removal (Required if Chemical Phosphorous Removal is implemented)[(1)]												
Dose, mg/L		0	0	0	0	0	0	0	0	0	0	0
Usage, pounds per day		0	0	0	0	0	0	0	0	0	0	0
Density, SG		0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Usage, gallons per day		0	0	0	0	0	0	0	0	0	0	0
Usage, gallons per year		0	0	0	0	0	0	0	0	0	0	0
Usage, pounds per year		0	0	0	0	0	0	0	0	0	0	0
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sodium Hypochlorite (NaOCl) - Chlorination												
Dose, mg/L Cl2		11	11	11	11	11	11	11	11	11	11	11
Usage, pounds per day Cl2		1395	1419	1443	1467	1490	1514	1538	1562	1586	1610	1633
NaOCl/Cl2 Ratio		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
NaOCl Concentration, %		12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Density, SG		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Usage, pounds per day NaOCl		1,465	1,490	1,516	1,541	1,565	1,590	1,615	1,641	1,666	1,691	1,715
Usage, gallons per year NaOCl		420,440	427,610	435,070	442,250	449,130	456,310	463,480	470,940	478,120	485,290	492,180
Usage, pounds per year NaOCl		534,725	543,850	553,340	562,465	571,225	580,350	589,475	598,965	608,090	617,215	625,975
UNESCALATED Annual Cost, $		$ 420,440	$ 427,610	$ 435,070	$ 442,250	$ 449,130	$ 456,310	$ 463,480	$ 470,940	$ 478,120	$ 485,290	$ 492,180
ESCALATED Annual Cost, $		$ 420,440	$ 440,438	$ 461,566	$ 483,259	$ 505,500	$ 528,988	$ 553,419	$ 579,197	$ 605,668	$ 633,193	$ 661,449

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Phase			Phase 3							Phase 4		
	FY 26/27	FY 27/28	FY 28/29	FY 29/30	FY 30/31	FY 31/32	FY 32/33	FY 33/34	FY 34/35	FY 35/36	FY 36/37	FY 37/38
	6/26 - 7/27	6/27 - 7/28	6/28 - 7/29	6/29 - 7/30	6/30 - 7/31	6/31 - 7/32	6/32 - 7/33	6/33 - 7/34	6/34 - 7/35	6/35 - 7/36	6/36 - 7/37	6/37 - 7/38
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Usage, gallons per year	13,450	13,740	14,020	14,310	14,590	15,020	15,310	15,590	15,880	16,170	16,170	16,170
Usage, pounds per year	34,310	35,040	35,770	36,500	37,230	38,325	39,055	39,785	40,515	41,245	41,245	41,245
UNESCALATED Annual Cost, $	$ 38,427	$ 39,245	$ 40,062	$ 40,880	$ 41,698	$ 42,924	$ 43,742	$ 44,559	$ 45,377	$ 46,194	$ 46,194	$ 46,194
ESCALATED Annual Cost, $	$ 53,192	$ 55,954	$ 58,833	$ 61,835	$ 64,964	$ 68,880	$ 72,298	$ 75,859	$ 79,568	$ 83,432	$ 85,935	$ 88,513
Polymer - Dewatering												
Sludge, pounds per day	18927	19191	19455	19718	19982	20245	20509	20773	21036	21300	21300	21300
Dose, lb/dry ton	34	34	34	34	34	34	34	34	34	34	34	34
Usage, pounds per day	322	327	331	336	340	345	349	354	358	363	363	363
Activation, %	30	30	30	30	30	30	30	30	30	30	30	30
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Usage, gallons per year	46,060	46,770	47,350	48,060	48,630	49,350	49,920	50,640	51,210	51,920	51,920	51,920
Usage, pounds per year	117,530	119,355	120,815	122,640	124,100	125,925	127,385	129,210	130,670	132,495	132,495	132,495
UNESCALATED Annual Cost, $	$ 131,634	$ 133,678	$ 135,313	$ 137,357	$ 138,992	$ 141,036	$ 142,671	$ 144,715	$ 146,350	$ 148,394	$ 148,394	$ 148,394
ESCALATED Annual Cost, $	$ 182,212	$ 190,592	$ 198,711	$ 207,764	$ 216,545	$ 226,321	$ 235,814	$ 246,368	$ 256,626	$ 268,017	$ 276,057	$ 284,339
Ferric Chloride ($FeCl_3$) - CEPT												
Dose, mg/L	20	20	20	20	20	20	20	20	20	0	-	-
Usage, pounds per day	3013	3056	3100	3143	3186	3230	3273	3316	3360	0	0	0
Solution, %	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Density, SG	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Months of Operation per Year	2	2	2	2	2	2	2	2	2	2	2	2
Usage, gallons per year	42,800	43,410	44,035	44,647	45,257	45,882	46,493	47,103	47,728	0	0	0
Usage, pounds per year	183,291	185,907	188,583	191,199	193,815	196,492	199,108	201,723	204,400	0	0	0
UNESCALATED Annual Cost, $	$ 62,060	$ 62,945	$ 63,851	$ 64,738	$ 65,622	$ 66,528	$ 67,415	$ 68,300	$ 69,206	$ -	$ -	$ -
ESCALATED Annual Cost, $	$ 85,906	$ 89,744	$ 93,767	$ 97,922	$ 102,237	$ 106,759	$ 111,427	$ 116,276	$ 121,353	$ -	$ -	$ -
Ferric Chloride ($FeCl_3$) - Chemical Phosphorous Removal[1,												
Dose, mg/L	0	0	0	0	0	0	0	0	0	54	54	54
Usage, pounds per day	0	0	0	0	0	0	0	0	0	9188	9188	9188
Solution, %	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Density, SG	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Months of Operation per Year	0	0	0	0	0	0	0	0	0	12	12	12
Usage, gallons per year	0	0	0	0	0	0	0	0	0	783,090	783,090	783,090
Usage, pounds per year	0	0	0	0	0	0	0	0	0	3,353,620	3,353,620	3,353,620
UNESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,135,481	$ 1,135,481	$ 1,135,481
ESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,050,804	$ 2,112,328	$ 2,175,698
Methanol - Nitrogen Removal (Required if Chemical Phosp												
Dose, mg/L	0	0	0	0	0	0	0	0	0	6.64	6.64	6.64
Usage, pounds per day	0	0	0	0	0	0	0	0	0	1130	1130	1130
Density, SG	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Usage, gallons per day	0	0	0	0	0	0	0	0	0	171	171	171
Usage, gallons per year	0	0	0	0	0	0	0	0	0	62,565	62,565	62,565
Usage, pounds per year	0	0	0	0	0	0	0	0	0	412,476	412,476	412,476
UNESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 125,130	$ 125,130	$ 125,130
ESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 225,999	$ 232,779	$ 239,762
Sodium Hypochlorite (NaOCl) - Chlorination												
Dose, mg/L Cl2	11	11	11	11	11	11	11	11	11	11	11	11
Usage, pounds per day Cl2	1657	1681	1705	1729	1753	1777	1800	1824	1848	1872	1872	1872
NaOCl/Cl2 Ratio	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
NaOCl Concentration, %	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Density, SG	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Usage, pounds per day NaOCl	1,740	1,766	1,791	1,816	1,841	1,866	1,890	1,916	1,941	1,966	1,966	1,966
Usage, gallons per year NaOCl	499,360	506,820	513,990	521,170	528,340	535,520	542,400	549,870	557,040	564,210	564,210	564,210
Usage, pounds per year NaOCl	635,100	644,590	653,715	662,840	671,965	681,090	689,850	699,340	708,465	717,590	717,590	717,590
UNESCALATED Annual Cost, $	$ 499,360	$ 506,820	$ 513,990	$ 521,170	$ 528,340	$ 535,520	$ 542,400	$ 549,870	$ 557,040	$ 564,210	$ 564,210	$ 564,210
ESCALATED Annual Cost, $	$ 691,231	$ 722,604	$ 754,812	$ 788,316	$ 823,137	$ 859,352	$ 896,505	$ 936,117	$ 976,773	$ 1,019,026	$ 1,049,597	$ 1,081,085

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Phase	Phase 5							
	FY 38/39	FY 39/40	FY 40/41	FY 41/42	FY 42/43	FY 43/44	FY 44/45	Total
	6/38 - 7/39	6/39 - 7/40	6/40 - 7/41	6/41 - 7/42	6/42 - 7/43	6/43 - 7/44	6/44 - 7/45	
	2038	2039	2040	2041	2042	2043	2044	
Usage, gallons per year	16,170	16,170	16,170	16,170	16,170	16,170	16,170	
Usage, pounds per year	41,245	41,245	41,245	41,245	41,245	41,245	41,245	
UNESCALATED Annual Cost, $	$ 46,194	$ 46,194	$ 46,194	$ 46,194	$ 46,194	$ 46,194	$ 46,194	**$ 913,259**
ESCALATED Annual Cost, $	$ 91,169	$ 93,904	$ 96,721	$ 99,622	$ 102,611	$ 105,689	$ 108,860	**$ 1,646,390**
Polymer - Dewatering								
Sludge, pounds per day	21300	21300	21300	21300	21300	21300	21300	
Dose, lb/dry ton	34	34	34	34	34	34	34	
Usage, pounds per day	363	363	363	363	363	363	363	
Activation, %	30	30	30	30	30	30	30	
Density, SG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
Usage, gallons per year	51,920	51,920	51,920	51,920	51,920	51,920	51,920	
Usage, pounds per year	132,495	132,495	132,495	132,495	132,495	132,495	132,495	
UNESCALATED Annual Cost, $	$ 148,394	$ 148,394	$ 148,394	$ 148,394	$ 148,394	$ 148,394	$ 148,394	**$ 2,993,642**
ESCALATED Annual Cost, $	$ 292,869	$ 301,655	$ 310,705	$ 320,026	$ 329,627	$ 339,516	$ 349,701	**$ 5,375,125**
Ferric Chloride ($FeCl_3$) - CEPT								
Dose, mg/L	-	-	-	-	-	-	-	
Usage, pounds per day	0	0	0	0	0	0	0	
Solution, %	39.5	39.5	39.5	39.5	39.5	39.5	39.5	
Density, SG	1.3	1.3	1.3	1.3	1.3	1.3	1.3	
Months of Operation per Year	2	2	2	2	2	2	2	
Usage, gallons per year	0	0	0	0	0	0	0	**689,693**
Usage, pounds per year	0	0	0	0	0	0	0	**2,953,641**
UNESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 1,000,055**
ESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 1,430,680**
Ferric Chloride ($FeCl_3$) - Chemical Phosphorous Removal [(1)]								
Dose, mg/L	54	54	54	54	54	54	54	
Usage, pounds per day	9188	9188	9188	9188	9188	9188	9188	
Solution, %	39.5	39.5	39.5	39.5	39.5	39.5	39.5	
Density, SG	1.3	1.3	1.3	1.3	1.3	1.3	1.3	
Months of Operation per Year	12	12	12	12	12	12	12	
Usage, gallons per year	783,090	783,090	783,090	783,090	783,090	783,090	783,090	**7,830,900**
Usage, pounds per year	3,353,620	3,353,620	3,353,620	3,353,620	3,353,620	3,353,620	3,353,620	**33,536,200**
UNESCALATED Annual Cost, $	$ 1,135,481	$ 1,135,481	$ 1,135,481	$ 1,135,481	$ 1,135,481	$ 1,135,481	$ 1,135,481	**$ 11,354,805**
ESCALATED Annual Cost, $	$ 2,240,969	$ 2,308,198	$ 2,377,444	$ 2,448,767	$ 2,522,230	$ 2,597,897	$ 2,675,834	**$ 23,510,171**
Methanol - Nitrogen Removal (Required if Chemical Phosp								
Dose, mg/L	6.64	6.64	6.64	6.64	6.64	6.64	6.64	
Usage, pounds per day	1130	1130	1130	1130	1130	1130	1130	
Density, SG	0.79	0.79	0.79	0.79	0.79	0.79	0.79	
Usage, gallons per day	171	171	171	171	171	171	171	
Usage, gallons per year	62,565	62,565	62,565	62,565	62,565	62,565	62,565	**625,651**
Usage, pounds per year	412,476	412,476	412,476	412,476	412,476	412,476	412,476	**4,124,763**
UNESCALATED Annual Cost, $	$ 125,130	$ 125,130	$ 125,130	$ 125,130	$ 125,130	$ 125,130	$ 125,130	**$ 1,251,302**
ESCALATED Annual Cost, $	$ 246,955	$ 254,364	$ 261,995	$ 269,855	$ 277,950	$ 286,289	$ 294,877	**$ 2,590,825**
Sodium Hypochlorite (NaOCl) - Chlorination								
Dose, mg/L Cl2	11	11	11	11	11	11	11	
Usage, pounds per day Cl2	1872	1872	1872	1872	1872	1872	1872	
NaOCl/Cl2 Ratio	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
NaOCl Concentration, %	12.5	12.5	12.5	12.5	12.5	12.5	12.5	
Density, SG	1.22	1.22	1.22	1.22	1.22	1.22	1.22	
Usage, pounds per day NaOCl	1,966	1,966	1,966	1,966	1,966	1,966	1,966	
Usage, gallons per year NaOCl	564,210	564,210	564,210	564,210	564,210	564,210	564,210	**15,417,430**
Usage, pounds per year NaOCl	717,590	717,590	717,590	717,590	717,590	717,590	717,590	**19,608,530**
UNESCALATED Annual Cost, $	$ 564,210	$ 564,210	$ 564,210	$ 564,210	$ 564,210	$ 564,210	$ 564,210	**$ 15,417,430**
ESCALATED Annual Cost, $	$ 1,113,517	$ 1,146,923	$ 1,181,330	$ 1,216,770	$ 1,253,273	$ 1,290,872	$ 1,329,598	**$ 25,003,955**

O&M Costs for Split Flow Program Implementation Plan
WPCP Master Plan
City of Sunnyvale

Phase		Phase 0				Phase 1					Phase 2	
	FY 14/15	**FY 15/16**	**FY 16/17**	**FY 17/18**	**FY 18/19**	**FY 19/20**	**FY 20/21**	**FY 21/22**	**FY 22/23**	**FY 23/24**	**FY 24/25**	**FY 25/26**
	6/14 - 7/15	**6/15 - 7/16**	**6/16 - 7/17**	**6/17 - 7/18**	**6/18 - 7/19**	**6/19 - 7/20**	**6/20 - 7/21**	**6/21 - 7/22**	**6/22 - 7/23**	**6/23 - 7/24**	**6/24 - 7/25**	**6/25 - 7/26**
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Sodium Bisulfilte ($NaHSO_3$) - Dechlorination												
Dose, mg/L Cl2		11	11	11	11	11	11	11	11	11	11	11
Consumed, mg/L Cl2		5	5	5	5	5	5	5	5	5	5	5
Residual, mg/L Cl2		6	6	6	6	6	6	6	6	6	6	6
Usage, pounds per day Cl2		676	689	702	715	728	741	754	767	780	793	806
NaHSO3/Cl2 Ratio		1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
NaHSO3 Concentration, %		25	25	25	25	25	25	25	25	25	25	25
Density, SG		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Usage, pounds per day NaHSO3		987	1,006	1,025	1,044	1,063	1,082	1,101	1,120	1,139	1,158	1,177
Usage, gallons per year NaHSO3		141,630	144,360	147,080	149,810	152,540	155,260	157,990	160,720	163,440	166,170	168,890
Usage, pounds per year NaHSO3		360,255	367,190	374,125	381,060	387,995	394,930	401,865	408,800	415,735	422,670	429,605
UNESCALATED Annual Cost, $		$ 141,630	$ 144,360	$ 147,080	$ 149,810	$ 152,540	$ 155,260	$ 157,990	$ 160,720	$ 163,440	$ 166,170	$ 168,890
ESCALATED Annual Cost, $		$ 141,630	$ 148,691	$ 156,037	$ 163,701	$ 171,685	$ 179,989	$ 188,648	$ 197,665	$ 207,041	$ 216,814	$ 226,974
Membrane Filtration - Chemicals (2)												
Chemical Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
UNESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
ESCALATED Annual Cost, $		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
UNESCALATED Total Annual Chemical Cost(1)(2), $	$ 1,100,000	$ 700,000	$ 700,000	$ 700,000	$ 700,000	$ 800,000	$ 800,000	$ 800,000	$ 900,000	$ 900,000	$ 1,000,000	$ 1,000,000
ESCALATED Total Annual Chemical Cost(1)(2), $	$ 1,100,000	$ 700,000	$ 700,000	$ 800,000	$ 800,000	$ 900,000	$ 1,000,000	$ 1,000,000	$ 1,100,000	$ 1,100,000	$ 1,300,000	$ 1,400,000
TOTAL												
UNESCALATED Total O&M Cost		$ 10,100,000	$ 10,100,000	$ 10,100,000	$ 10,100,000	$ 10,800,000	$ 10,900,000	$ 10,900,000	$ 11,000,000	$ 12,700,000	$ 12,900,000	$ 12,900,000
ESCALATED Total O&M Cost		$ 10,100,000	$ 10,400,000	$ 10,800,000	$ 11,000,000	$ 12,200,000	$ 12,800,000	$ 13,200,000	$ 13,700,000	$ 16,600,000	$ 17,500,000	$ 18,200,000

Notes:

(1) It is assumed chemical phosphorous removal will be implemented. As a result, total chemical costs include the cost for ferric and methanol required for chemical phosphorous removal.

(2) Membrane Filtration chemical costs are not included in the total chemical costs because it is assumed it is unlikely this project will be implemented.

LEGEND

Major process change

Inputs

O&M Costs for Split Flow Program Implementation Plan
WPCP Master Plan
City of Sunnyvale

Phase			Phase 3							Phase 4		
	FY 26/27	FY 27/28	FY 28/29	FY 29/30	FY 30/31	FY 31/32	FY 32/33	FY 33/34	FY 34/35	FY 35/36	FY 36/37	FY 37/38
	6/26 - 7/27	6/27 - 7/28	6/28 - 7/29	6/29 - 7/30	6/30 - 7/31	6/31 - 7/32	6/32 - 7/33	6/33 - 7/34	6/34 - 7/35	6/35 - 7/36	6/36 - 7/37	6/37 - 7/38
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Sodium Bisulfilte ($NaHSO_3$) - Dechlorination												
Dose, mg/L Cl2	11	11	11	11	11	11	11	11	11	11	11	11
Consumed, mg/L Cl2	5	5	5	5	5	5	5	5	5	5	5	5
Residual, mg/L Cl2	6	6	6	6	6	6	6	6	6	6	6	6
Usage, pounds per day Cl2	819	832	845	858	871	884	897	910	923	841	841	841
NaHSO3/Cl2 Ratio	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
NaHSO3 Concentration, %	25	25	25	25	25	25	25	25	25	25	25	25
Density, SG	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Usage, pounds per day NaHSO3	1,196	1,215	1,234	1,253	1,272	1,291	1,310	1,329	1,348	1,228	1,228	1,228
Usage, gallons per year NaHSO3	171,620	174,350	177,070	179,800	182,530	185,250	187,980	190,710	193,430	176,210	176,210	176,210
Usage, pounds per year NaHSO3	436,540	443,475	450,410	457,345	464,280	471,215	478,150	485,085	492,020	448,220	448,220	448,220
UNESCALATED Annual Cost, $	$ 171,620	$ 174,350	$ 177,070	$ 179,800	$ 182,530	$ 185,250	$ 187,980	$ 190,710	$ 193,430	$ 176,210	$ 176,210	$ 176,210
ESCALATED Annual Cost, $	$ 237,562	$ 248,581	$ 260,033	$ 271,964	$ 284,376	$ 297,272	$ 310,702	$ 324,671	$ 339,181	$ 318,255	$ 327,803	$ 337,637
Membrane Filtration - Chemicals [(2)]												
Chemical Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
UNESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
ESCALATED Annual Cost, $	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
UNESCALATED Total Annual Chemical Cost[(1)(2)], $	$ 1,000,000	$ 1,100,000	$ 1,100,000	$ 1,100,000	$ 1,100,000	$ 1,100,000	$ 1,100,000	$ 1,200,000	$ 1,200,000	$ 2,200,000	$ 2,200,000	$ 2,200,000
ESCALATED Total Annual Chemical Cost[(1)(2)], $	$ 1,500,000	$ 1,500,000	$ 1,600,000	$ 1,700,000	$ 1,700,000	$ 1,800,000	$ 1,900,000	$ 2,000,000	$ 2,100,000	$ 4,000,000	$ 4,200,000	$ 4,300,000
TOTAL												
UNESCALATED Total O&M Cost	$ 13,000,000	$ 13,100,000	$ 13,200,000	$ 13,300,000	$ 13,300,000	$ 13,400,000	$ 13,500,000	$ 13,600,000	$ 13,700,000	$ 14,900,000	$ 14,900,000	$ 14,900,000
ESCALATED Total O&M Cost	$ 19,100,000	$ 19,700,000	$ 20,700,000	$ 21,600,000	$ 22,300,000	$ 23,400,000	$ 24,500,000	$ 25,400,000	$ 26,700,000	$ 30,000,000	$ 31,100,000	$ 32,200,000

Notes:

(1) It is assumed chemical phosphorous removal will be implemented. As a result, total chemical costs include the cost for ferric and methanol required for chemical phosphorous removal.

(2) Membrane Filtration chemical costs are not included in the total chemical costs because it is assumed it is unlikely this project will be implemented.

LEGEND

Major process change

Inputs

O&M Costs for Split Flow Program Implementation Plan
WPCP Master Plan
City of Sunnyvale

Phase	Phase 5							
	FY 38/39	FY 39/40	FY 40/41	FY 41/42	FY 42/43	FY 43/44	FY 44/45	Total
	6/38 - 7/39	6/39 - 7/40	6/40 - 7/41	6/41 - 7/42	6/42 - 7/43	6/43 - 7/44	6/44 - 7/45	
	2038	2039	2040	2041	2042	2043	2044	
Sodium Bisulfilte ($NaHSO_3$) - Dechlorination								
Dose, mg/L Cl2	11	11	11	11	11	11	11	
Consumed, mg/L Cl2	5	5	5	5	5	5	5	
Residual, mg/L Cl2	6	6	6	6	6	6	6	
Usage, pounds per day Cl2	841	841	841	841	841	841	841	
NaHSO3/Cl2 Ratio	1.46	1.46	1.46	1.46	1.46	1.46	1.46	
NaHSO3 Concentration, %	25	25	25	25	25	25	25	
Density, SG	1.22	1.22	1.22	1.22	1.22	1.22	1.22	
Usage, pounds per day NaHSO3	1,228	1,228	1,228	1,228	1,228	1,228	1,228	**35,630**
Usage, gallons per year NaHSO3	176,210	176,210	176,210	176,210	176,210	176,210	176,210	**5,112,730**
Usage, pounds per year NaHSO3	448,220	448,220	448,220	448,220	448,220	448,220	448,220	**13,004,950**
UNESCALATED Annual Cost, $	$ 176,210	$ 176,210	$ 176,210	$ 176,210	$ 176,210	$ 176,210	$ 176,210	**$ 5,112,730**
ESCALATED Annual Cost, $	$ 347,766	$ 358,199	$ 368,945	$ 380,013	$ 391,413	$ 403,156	$ 415,250	**$ 8,221,654**
Membrane Filtration - Chemicals [(2)]								
Chemical Cost, $	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	
UNESCALATED Annual Cost, $	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	**$ 225,000**
ESCALATED Annual Cost, $	$ -	$ -	$ 94,220	$ 97,047	$ 99,958	$ 102,957	$ 106,045	**$ 500,227**
UNESCALATED Total Annual Chemical Cost[(1)(2)], $	$ 2,200,000	$ 2,200,000	$ 2,200,000	$ 2,200,000	$ 2,200,000	$ 2,200,000	$ 2,200,000	**$ 42,100,000**
ESCALATED Total Annual Chemical Cost[(1)(2)], $	$ 4,400,000	$ 4,500,000	$ 4,700,000	$ 4,800,000	$ 5,000,000	$ 5,100,000	$ 5,300,000	**$ 74,000,000**
TOTAL								
UNESCALATED Total O&M Cost	$ 16,100,000	$ 16,100,000	$ 16,100,000	$ 16,100,000	$ 16,100,000	$ 16,100,000	$ 16,100,000	**$ 400,000,000**
ESCALATED Total O&M Cost	$ 37,100,000	$ 38,500,000	$ 40,100,000	$ 41,500,000	$ 43,100,000	$ 44,700,000	$ 46,500,000	**$ 734,700,000**

Notes:

(1) It is assumed chemical phosphorous removal will be implemented. As a result, total chemical costs include the cost for ferric and methanol required for chemical phosphorous removal.

(2) Membrane Filtration chemical costs are not included in the total chemical costs because it is assumed it is unlikely this project will be implemented.

LEGEND

Major process change

Inputs

O&M Cost Assumptions - Split Flow
WPCP Master Plan
City of Sunnyvale

Legend

Highlight yellow - Input from Master Plan TMs
Input
Black - Calculated

Assumptions

Annual Escalation Rate for Labor and Chemical Costs	3%
Annual Escalation Rate for Power Costs	5%

Unit Costs

Current Unit Cost for Power, $/kWh	$ 0.30
Future Unit Cost for Power, $/kWh	$ 0.20
Polymer, $/lb	$ 1.12
Sodium Bisulfilte ($NaHSO_3$), $/gal	$ 1.00
Ferric Chloride ($FeCl_3$), $/gal	$ 1.45
Sodium Hypochlorite (NaOCl), $/gal	$ 1.00
Methanol, $/gal	$ 2.00

Source:
Master Plan Basis of Cost TM

Flow and Loads

	(current)							
Year from Flow and Loads TM	2010	2015	2019	2023	2025	2028	2035	> 2035
Average annual flow, mgd	13.8	15.2	16.2	17.3	17.8	18.6	20.4	20.4
Maximum month flow, mgd	17.8	19.5	20.9	22.2	22.9	23.9	26.2	26.2

Source:
Master Plan Flow and Loads TM

Power Demand

		Phase 0	**Phase 1**	**Phase 2**		**Phase 3**	**Phase 4**	**Phase 5**
Year		Current (2015)	2019	2023		2028	2035	> 2035 (most on in 2038)
Duty Power Demand (all duty units in service), hp		1529	2719	4529		4794	5464	6654
Estimated Ratio Average Power Demand/Duty Power Demand, %	75%							
Estimated Average Power Demand, hp		1529	2039	3397		3596	4098	4991
Estimated Average Power Demand, kW		1140	1520	2533		2681	3055	3721
Power Production, kW		1000	1000	1000		1000	1000	1000
Annual Power Cost, $/year		$ 306,000						

O&M Cost Assumptions - Split Flow
WPCP Master Plan
City of Sunnyvale

Notes:
WPCP is a net energy producer due to Congen Units. Power production averages 1,200 kW. Power demand averages 1,050 - 1,150 kW. (Per Sorrick email 2015-03-26)

Source:
Master Plan Basis of Design - Summary of Equipment Loads
WPCP Level 4 Annual Fiscal Report

Chemical Use

Year	**2014**			
Chemical Cost from WPCP Level 4 Annual Fiscal Report	$ 1,067,873			
Polymer - CEPT				
Dose, mg/L	0.2			
Activation, %	30			
Density, SG	1.02			
Months of Operation per Year	2			
Polymer - Thickening				
Year		Current	2024	2035
Dose, lb/dry ton	15			
Activation, %	30			
Density, SG	1.02			
Sludge, pounds per day		0	11900	15000
Polymer - DMF				
Year		Current	2024	
Dose, mg/L		1	0.5	
Activation, %	27			
Density, SG	1.02			
Polymer - Dewatering				
Year		Current	2024	2035
Dose, lb/dry ton	34			
Activation, %	30			
Density, SG	1.02			
Sludge, pounds per day		0	18400	21300
Polymer - AFT				
Year		Current	2024	2035
Dose, mg/L	5.5			
Activation, %	27			
Density, SG	1.02			
Percentage of Flow Treated by AFTs		100%	40%	0%

O&M Cost Assumptions - Split Flow
WPCP Master Plan
City of Sunnyvale

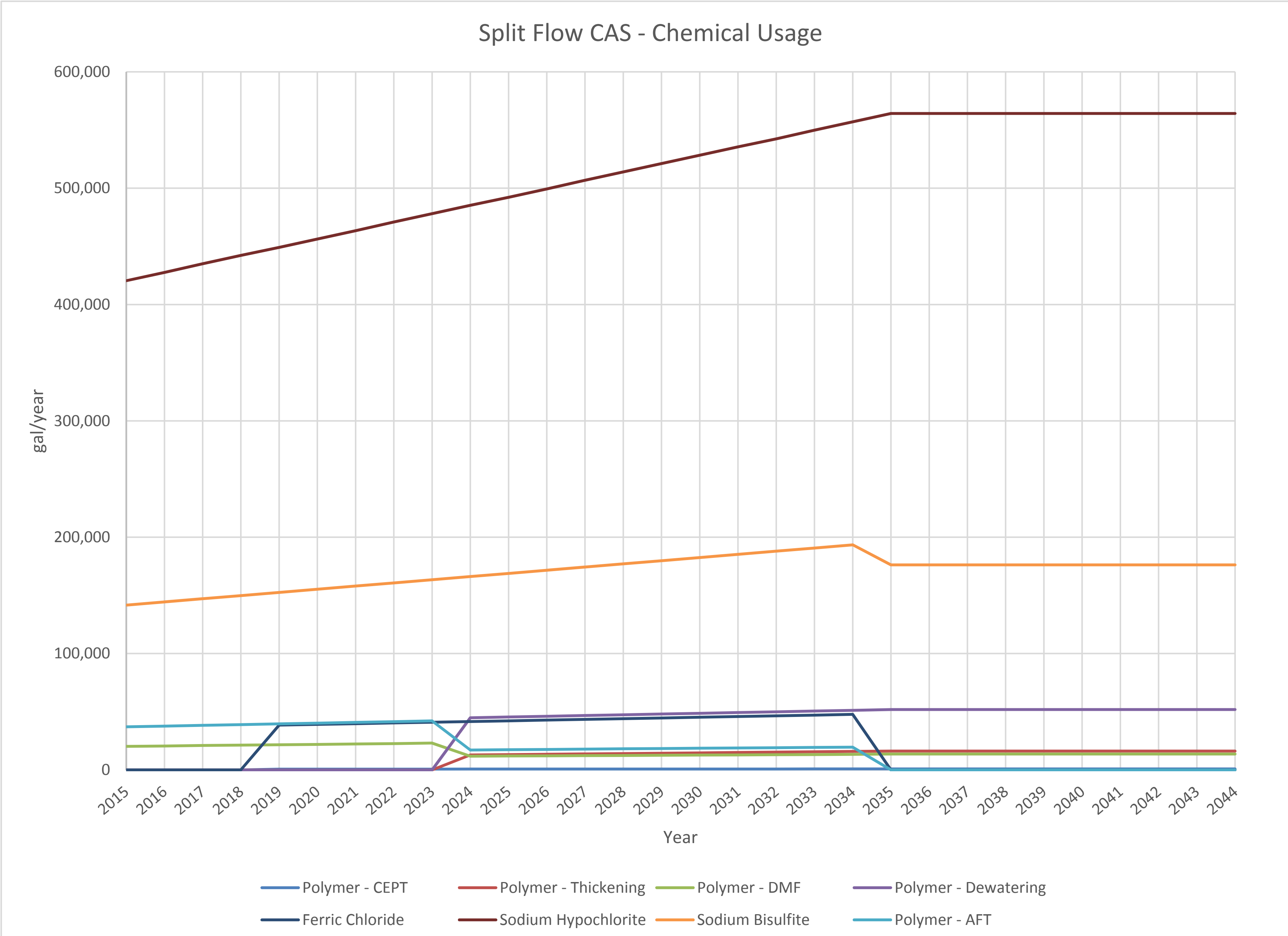
Sodium Bisulfilte ($NaHSO_3$) - Dechlorination			
Dose, mg/L Cl2	11		
Consumed, mg/L Cl2	5		
NaHSO3/Cl2 Ratio	1.46		
NaHSO3 Concentration, %	25		
Density, SG	1.22		
Ferric Chloride ($FeCl_3$) - CEPT			
Year		2019	2035
Dose, mg/L		20	0
Solution, %	39.5		
Density, SG	1.3		
Months of Operation per Year		2	2
Ferric Chloride ($FeCl_3$) - Chemical Phosphorous Removal			
Year		2019	2035
Dose, mg/L		*0*	*54*
Solution, %	*39.5*		
Density, SG	*1.3*		
Months of Operation per Year		*0*	*12*
Methanol			
Year		2015	2035
Specific Gravity, g/mL	0.79		
Chemical Usage at maximum month, ppd as COD	2310		
Chemical Usage at maximum month, ppd as methanol	1540		
Flow basis for chemical usage at maximum month, mgd	27.8		
Chemical Usage, mg/L as methanol		0	6.6
Sodium Hypochlorite (NaOCl) - Chlorination			
Dose, mg/L Cl2	11		
NaOCl/Cl2 Ratio	1.05		
NaOCl Concentration, %	12.5		
Density, SG	1.22		
Membrane Filtration Chemical Cost*			
Annual Costs, $/year (2015)	$45,000		

*Includes costs for sodium hypochlorite, aqua ammonia, caustic soda, sodium bisulite, and citric acid
CIP Cost-Membrane Filtration (MF) Improvements

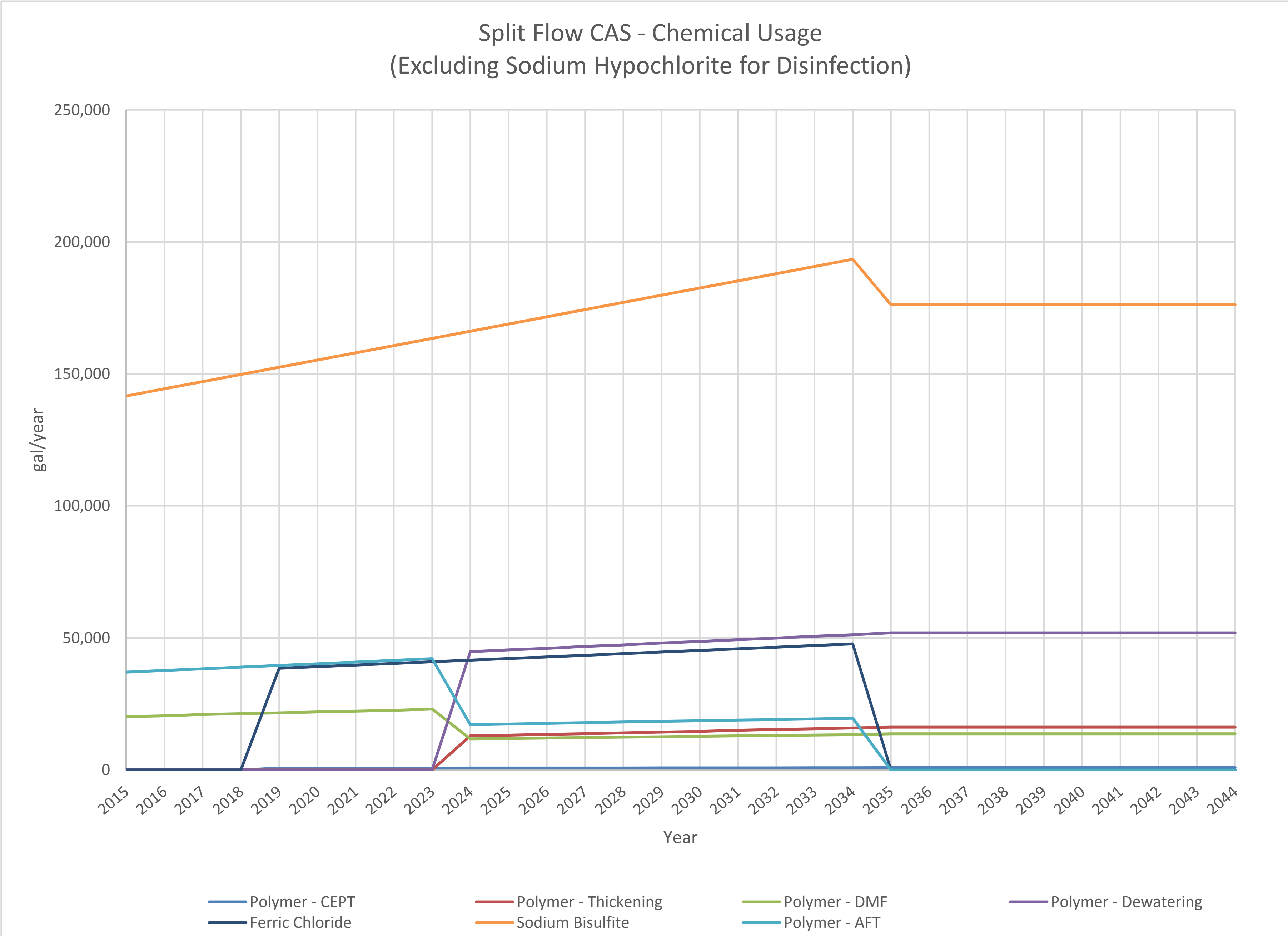
Source:
Master Plan Treatment Alternatives TMs and Site Plan TM

Labor Cost	
Year	**2014**
Labor Cost	$ 9,124,677

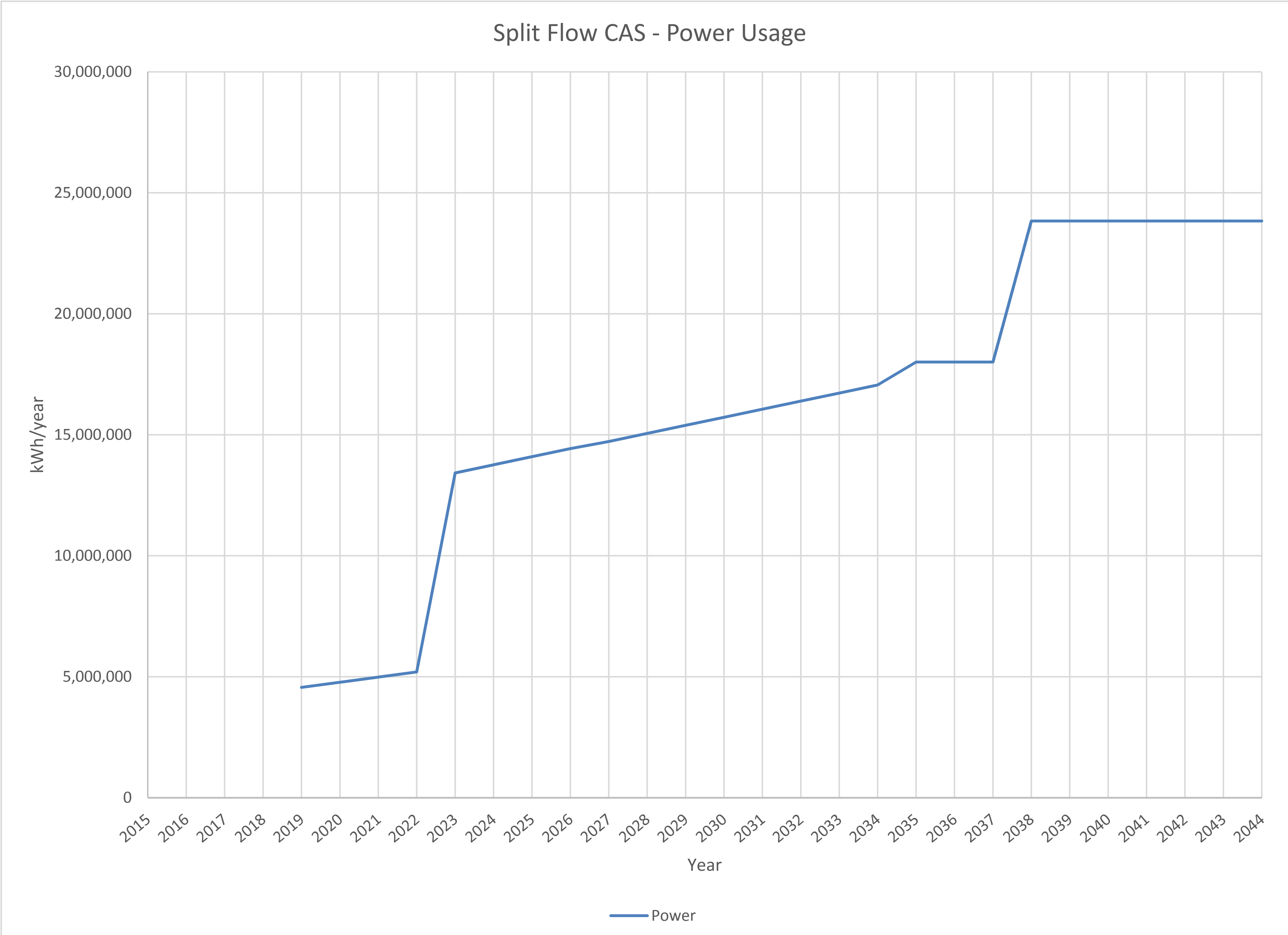
Source:
WPCP Level 4 Annual Fiscal Report



Split Flow CAS - Chemical Usage
600,000
500,000
400,000
300,000
200,000
100,000
0
gal/year
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
Year
Polymer - CEPT
Polymer - Thickening
Polymer - DMF
Polymer - Dewatering
Ferric Chloride
Sodium Hypochlorite
Sodium Bisulfite
Polymer - AFT



Split Flow CAS - Chemical Usage
(Excluding Sodium Hypochlorite for Disinfection)
250,000
200,000
150,000
100,000
50,000
0
gal/year
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
Year
Polymer - CEPT
Polymer - Thickening
Polymer - DMF
Polymer - Dewatering
Ferric Chloride
Sodium Bisulfite
Polymer - AFT



Split Flow CAS - Power Usage
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
kWh/year
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
Year
Power

PROJECT: 3 MGD Microfiltration (MF) Facility O&M Cost Estimate
CLIENT: City of Sunnyvale
DATE: 9/15/2014
BY: DWW

Operations and Maintenance Cost Estimate			
Costs By System	**Annual Cost**		**Percent of Costs**
MF Feed Pumping	$	74,000	21%
Backwash Pumps	$	2,000	1%
CIP Energy	$	3,000	1%
Backwash Waste Pumps	$	3,000	1%
Blowers/Compressors	$	4,000	1%
Electrical Costs	$	86,000	**24%**
Cost per 1,000 gallons	$	0.08	
Aqua Ammonia	$	10,000	3%
Citric Acid	$	4,000	1%
Sodium Bi-Sulfite	$	5,000	1%
Sodium Hydroxide	$	1,000	0%
Sodium Hypochlorite	$	25,000	7%
Chemical Operating Costs	$	45,000	**13%**
Cost per 1,000 gallons	$	0.04	
Annualized Membrane Replacement Cost [1]	$	76,000	21%
Plant Maintenance[2]	$	150,000	42%
Indirect Operating Costs	$	226,000	**63%**
Cost per 1,000 gallons	$	0.21	
Total	**$**	**360,000**	**99%**
Cost per 1,000 gallons	$	0.33	

Notes:
1. Annualized membrane replacementr cost assumes a membrane replacement cost of $2,400 at 7 years.
2. Based upon 1% of 100% construction cost, for mechanical, electrical, and instrumentation to cover equipment maintenance, including tools, building maintenance, electrical, mechanical and instrumentation equipment.

Raw Water Pumping Costs

	Raw Water Flow (MGD)	Production (MGD)	Days of operation
Average Daily Flow Production (MGD)			Days of operation
Flow Rate	3.20	3	365

Membrane Plant Pre-treatment Chemical Costs
Chemical Costs

Chemicals	Dose (mg/L active chemical)	Chemical use (dry lb/yr)	Gallons /yr	Cost ($/yr)
Hypochlorite	5	389671	38298	$21,948.20
Aqua ammonia	1.3	12664	8880	$9,231.83
			Pre Treatment Chemical costs	**$31,180**

CIP Costs Page 1 of 2

Chemical Handling and Neutralization

	cost per year[1]	cost per CIP
Number of Trains	4	
Gallons/CIP	1300	
Liters/CIP	4920.5	

Hypochlorite Maintenance Wash (MW-1)

Hypochlorite (mg/L)	300	
Sodium bi-sulfite (mg/l) (neutralization)	441	
Hypochlorite use/ MW-1 (bulk-lbs)/Gallons	26.0	2.6
Sodium bi-sulfite/ MW-1 (gallons)	1.1	

Cost for Each MW-1

Hypochlorite	$1
Sodium bi-sulfite	$3
Total	**$4**

Hypochlorite CIP (CIP-1)

Hypochlorite (mg/L)	3000	
Sodium bi-sulfite (mg/l) (neutralization)	4410	
Hypochlorite use/ CIP-1 (bulk-lbs)/Gallons	260.2	25.6
Sodium bi-sulfite/ CIP-1 (gallons)	11.3	

Cost for Each MW-1

Hypochlorite	$15	
Sodium bi-sulfite	$25	
Total	**$40**	
Citric Acid CIP (CIP-2)		
Citric Acid dose (mg/L)	5000	
Caustic Soda (pounds per pound of CA)	0.82	
Citric Acid Used/CIP-2 (lbs/gallons)	54.2	10.7
Caustic Soda/CIP-2 (Pounds/Gallons)	44.45	7.0

Cost for Each MW2

Citric Acid	$ 67.13
Caustic soda	$ 17.23
Total	**$ 84**

CIP Costs Page 2 of 2

Energy to heat tank 20-38

E=M*Cp*∆T (KJ)	514192
Cp (KJ/Kg*K)	4.18
M (Kg)	4920.5
∆T	20
Efficiency	80%
KJ to Kw-hr	3600

Total Number of CIPs and MWs

MW1/yr	1412
CIP-1/yr	48
CIP-2/yr	48

Annual CIP Costs

Sodium Hypochlorite	$2,773
Caustic Soda	$827
Sodium bi-sulfite	$4,793
Citric Acid	$3,222
Energy Costs	$2,364
Total	**$13,979**

Annual Chemical Usage

Sodium Hypochlorite (gallons)	4839
Caustic Soda (gallons)	334
Citric Acid (gallons)	511
Sodium bi-sulfite (gallons)	1644

CIP Pumping

Sodium bi-sulfite $4,793
Citric Acid $3,222
Energy Costs $2,364
Total **$13,979**

Annual Chemical Usage
Sodium Hypochlorite (gallons) 4839
Caustic Soda (gallons) 334
Citric Acid (gallons) 511
Sodium bi-sulfite (gallons) 1644

CIP Pumping

MW pumping Duration	minutes	1
CIP Pumping Duration	minuts	180
Pump TDH	Ft	60