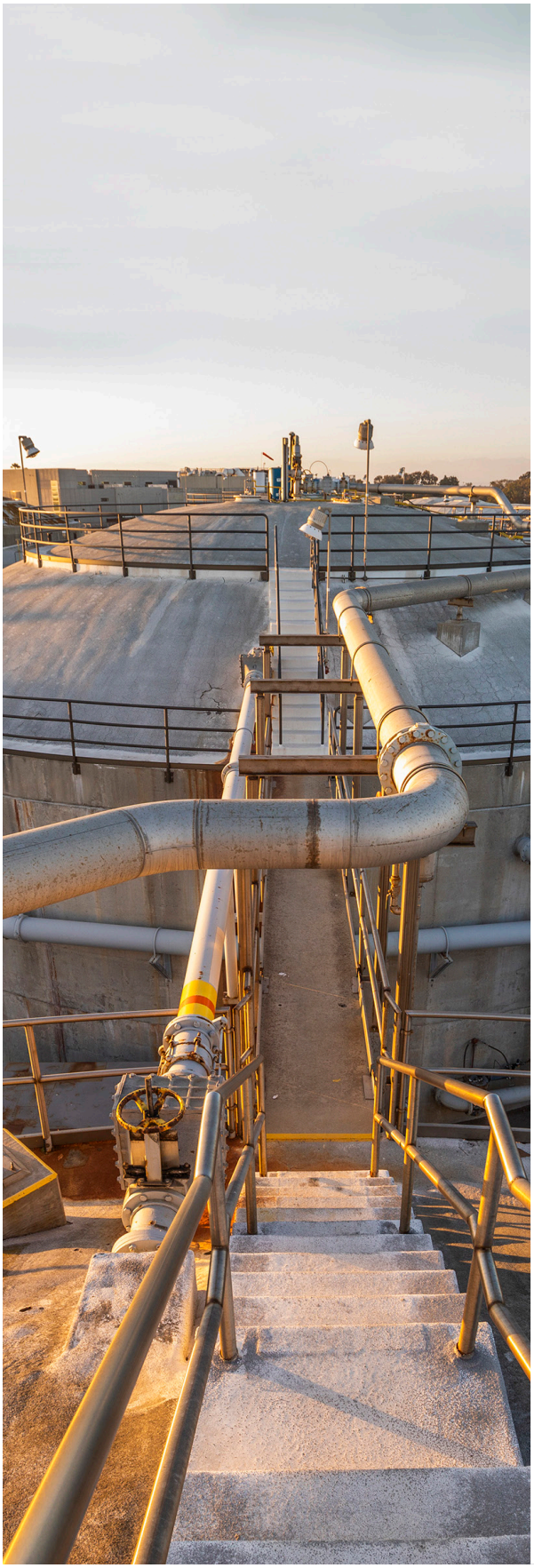

# 2020 Asset Management Plan

*Orange County Sanitation District, California*

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# Acronyms and Abbreviations

| Acronym or Abbreviation | Meaning |
|---|---|
| AM | Asset Management |
| AMP | Asset Management Plan |
| AS | Activated Sludge |
| AS1 | Activated Sludge 1 |
| AS2 | Activated Sludge 2 |
| BB | Blower Building |
| CCTV | Closed-circuit Television |
| Cen Gen | Central Generation |
| CIP | Capital Improvement Program |
| CM | Corrective Maintenance |
| CP | Control Panel |
| CS | Collection System |
| DAF | Dissolved Air Flotation |
| DAFT | Dissolved Air Flotation Thickener |
| DC | Distribution Center |
| DCJ | Distribution Center J |
| DIG | Digester |
| EBDB | East Basin Distribution Box |
| EJB | Effluent Junction Box |
| Elec. | Electrical |
| EPSA | Effluent Pump Station Annex |
| FE | Facilities Engineering |
| $FeCl_3$ | Ferric chloride |
| FY | Fiscal Year |
| GAP | Green Acres Project |
| GWRS | Groundwater Replenishment System |
| H2S | Hydrogen Sulfide |
| HCl | Hydrochloric Acid |
| HDPE | High-Density Polyethylene Resin |
| HP | Horsepower |
| HPU | Hydraulic Power Unit |

| Acronym or Abbreviation | Meaning |
|---|---|
| HVAC | Heating, Ventilation, and Air Conditioning |
| HW | Headworks |
| I&C | Instrumentation and Controls |
| IA | Instrument Air |
| Inst. | Instrument |
| JB | Junction Box |
| kV | Kilovolt |
| kW | Kilowatt |
| LEL | Lower Explosive Limit |
| LOFLO | Low Flow |
| LOS | Level of Service |
| LOX | Liquid Oxygen |
| M&D | Metering & Diversion |
| MCC | Motor Control Center |
| MES | Major Equipment Status |
| MGD | Million Gallons Per Day |
| MH | Manhole |
| ML | Mixed Liquor |
| MP | Maintenance Project |
| MSP | Main Sewage Pump |
| MTBF | Mean Time Between Failure |
| N/A | Not applicable |
| NaOH | Sodium Hydroxide |
| NASSCO | National Association of Sewer Service Companies |
| NFPA | National Fire Protection Association |
| No. | Number |
| NPDES | National Pollutant Discharge Elimination System |
| NSC | North Scrubber Complex |
| O&M | Operations and Maintenance |
| OCFCD | Orange County Flood Control District |
| OCSD | Orange County Sanitation District |
| OCWD | Orange County Water District |
| OEM | Original Equipment Manufacturer |

| Acronym or Abbreviation | Meaning |
|---|---|
| OOBS | Ocean Outfall Booster Station |
| OPT | Optimization |
| OXI | Oxidizer |
| P1 | Plant No. 1 |
| P2 | Plant No. 2 |
| PB | Power Building |
| PB | Primary Basin |
| PdM | Mature Predictive Maintenance |
| PDU | Power Distribution Unit |
| PE | Primary Effluent |
| PEDB | Primary Effluent Distribution Box |
| PEJB | Primary Effluent Junction Box |
| PEPS | Primary Effluent Pump Station |
| PISB | Primary Influent Splitter Box |
| PLC | Programmable Logic Controller |
| PM | Preventive Maintenance |
| PRN | Project Request Number |
| PS | Pump Station |
| psi | Pounds Per Square Inch |
| PVC | Polyvinyl chloride |
| PWPS | Plant Water Pump Station |
| RAS | Return Activated Sludge |
| RCP | Reinforced Concrete Pipe |
| Recirc. | Recirculation |
| RFID | Radio Frequency Identification |
| RSS | Return Secondary Sludge |
| RUL | Remaining Useful Life |
| RWQCB | Regional Water Quality Control Board |
| SALS | Steve Anderson Lift Station |
| SARI | Santa Ana River Interceptor |
| SC | Secondary Clarifier |
| SCADA | Supervisory Control and Data Acquisition |
| SCR | Selective Catalytic Reduction |

| Acronym or Abbreviation | Meaning |
|---|---|
| SE | Secondary Effluent |
| SEFE | Secondary Effluent Final Expansion |
| SEJB | Secondary Effluent Junction Box |
| SR | Secondary Return |
| SSC | South Scrubber Complex |
| T&D | Thickening & Dewatering |
| TF | Trickling Filter |
| TFPS | Trickling Filter Pump Station |
| TFSE | Trickling Filter Secondary Effluent |
| TL | Trunkline |
| TPAD | Temperature-phased Anaerobic Digester |
| UPS | Uninterruptible Power Supply |
| V | Voltage |
| VDC | Volts Direct Current |
| VFD | Variable Frequency Drive |
| WAS | Waste Activated Sludge |
| WSS | Waste Sidestream, Waste Secondary Sludge |
| WSSPS | Waste Sidestream Pump Station |
| Yr | Year |

# Executive Summary

## Asset Management Plan Purpose

The Orange County Sanitation District (OCSD) continues to make a concerted effort to establish a robust understanding of the condition and performance of all critical and major assets. Asset performance monitoring and tracking is how OCSD ensures our ability to meet the established levels of service. Performance monitoring also informs our maintenance and renewal programs and brings to light any corrective actions that need to be taken if performance or condition expectations are not being met. The Asset Management Plan is a tactical document that captures OCSD's operational strategies, maintenance plans, and capital improvement plan implementation on an annual basis. A primary characteristic of a successful Asset Management Program is continual improvement. OCSD strives to meet this challenge and, as such, we anticipate this document will continue to change in content and structure to reflect our efforts and to meet the needs of stakeholders.

## Overview of OCSD's Infrastructure

OCSD is responsible for providing wastewater collection, treatment, and recycling services to over 2.6 million people in central and northern Orange County, California. OCSD's two resource recovery and wastewater treatment facilities, located in Fountain Valley and Huntington Beach, treat an average daily wastewater flow of 189 million gallons per day (MGD) from three separate sources—residential, commercial, and industrial.


OCSD owns and operates wastewater collection system infrastructure, as well as resource recovery and wastewater treatment facilities. Our collection system infrastructure includes 388 miles of regional trunk sewer pipelines and 15 pump stations located throughout the OCSD service area. Wastewater is conveyed to Reclamation Plant No. 1 in Fountain Valley and Treatment Plant No. 2 in Huntington Beach, where resource recovery and wastewater treatment take place.

Figure ES-1 shows the facility valuation by asset system for OCSD's wastewater infrastructure. The valuation was prepared as part of the 2017 Facilities Master Plan.

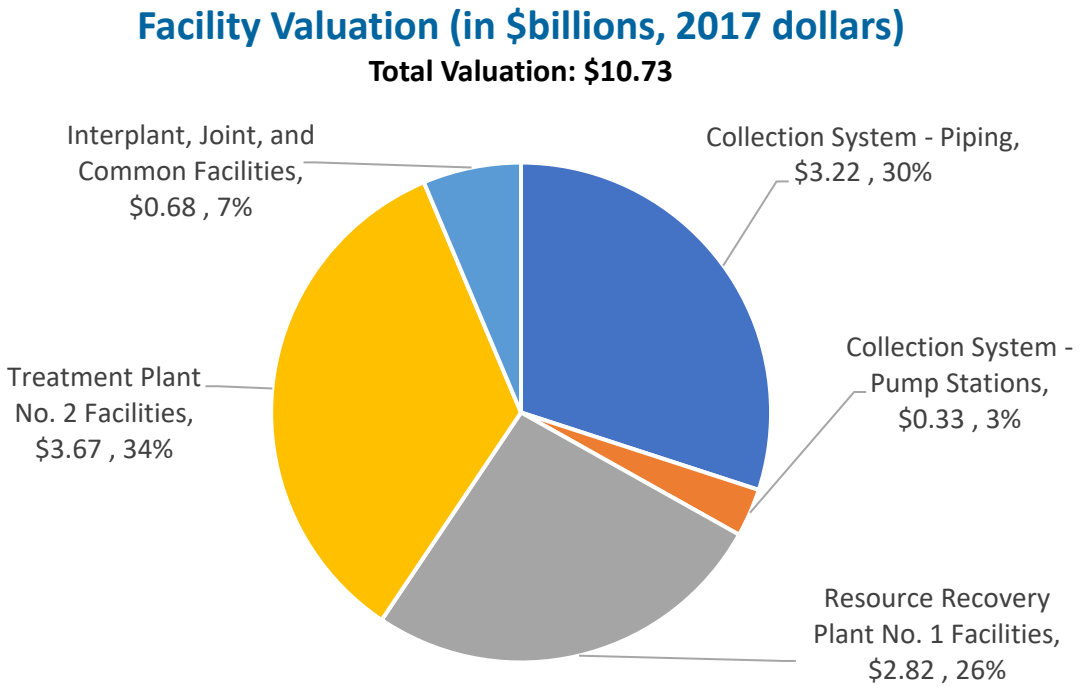


**Figure ES-1. Facility Valuation by Location**

## Asset Management Intent, Policy, and Initiatives

Safe and reliable infrastructure and process equipment are essential to providing industry leading wastewater collection and management, while achieving our mission and vision statements. We manage asset reliability, mitigate risk, and ensure the quality of our delivered services according to the following stated intent for our asset management program:

> ***"OCSD will know the condition of assets we own and will have a plan to operate and maintain these assets to deliver the required level of service, at the lowest life cycle cost, with an acceptable level of risk."***
>
> ***~ James D. Herberg, OCSD General Manager***

In November 2019, OCSD's strategic planning process resulted in the creation of an Asset Management Policy and Asset Management Initiatives.

### Asset Management Policy

*The Sanitation District will assess and manage the collection system and treatment plant systems and assets to improve resilience and reliability while lowering lifecycle costs. This will be accomplished through adaptive operation, coordinated maintenance and condition assessment, and planned capital investment. Staff will balance maintenance, refurbishment, and replacement strategies to maximize useful life, system availability and efficiency.*

### Asset Management Initiatives

- Create an annual Asset Management Plan documenting the condition of the collection system and treatment plants, and upcoming maintenance or capital projects.
- Coordinate the efforts of operations, collections, mechanical maintenance, electrical maintenance, instrument maintenance, and engineering through process teams to assure the Sanitation District's resources are focused on the high priority work functions.
- Maintain a 20-year forecast of all CIP projects needed to maintain or upgrade the Sanitation District's $10.7 billion in assets on a prioritized risk basis to establish rate structures.

## Asset Management Organization

As shown in Figure ES-2, every part of our organization is involved in some aspect of ensuring assets are designed, constructed, operated, and maintained to reliably deliver service to our customers.


**Figure ES-2. Roles in Asset Management**

To fulfill our commitment to our ratepayers, to provide safe and reliable services, and to better align with the Engineering and Operations and Maintenance (O&M) divisions, a dedicated Asset Management Group within the Engineering Planning Division consisting of Asset Engineers are responsible for understanding the key issues or deficiencies related to the condition, performance, and effectiveness of the assets; and, for developing and coordinating plans to ensure all of the assets operate safely and reliably.

## State of OCSD's Infrastructure

The following system-level summary tables provide a high-level overview of the Area Asset Management Summaries contained in Chapter 5**.** The system-level summaries are organized by:

- Plant No. 1 (Table ES.1-1)
- Plant No. 2 (Table ES.1-2)
- Collection System – Pump Stations (Table ES.1-3)
- Collection – Pipelines (Table ES.1-4)

The system-level summaries generally include the following fields:

- **Area No.**
- **Area Name**
- **Average Remaining Useful Life (RUL) Score**: Estimated average RUL score for each discipline (civil, structural, mechanical, electrical, and instrumentation) or area based on an average of the RUL scores provided by Asset Engineers in the detailed Area AM Summaries.
- **Percentage of RUL Scores with 4s or 5s** [1]: Percentage based on total number of RUL scores assigned to each area in the detailed Area AM Summaries. The percentage is an alternate metric for the overall condition of the area and equipment. A RUL score of 5 indicates less than 5 years of useful life remains for an asset or set of assets. A RUL score of 4 indicates 5 to 10 years of useful life remains for an asset or a set of assets.
- **Replacement Value ($ million)**: Process area replacement value from the facility valuation.

**Table ES.1-1. Plant No. 1 Overview**

| Area No. | Area Name | Average Remaining Useful Life Score | | | | | | Percentage of RUL Scores with 4s or 5s | Number of Projects to Address 4s & 5s | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Civil | Structural | Mechanical | Electrical | Instrumentation | All Assets | | | |
| 10 | Preliminary Treatment | 1 | 2 | 4 | 4 | 4 | 4 | 58% | 6 | $351.2 |
| 11 | Primary Treatment | 3 | 2 | 4 | 3 | 4 | 3 | 31% | 9 | $451.6 |
| 12 | Secondary Treatment - Activated Sludge | 3 | 2 | 3 | 3 | 4 | 3 | 32% | 10 | $887.3 |
| 12 | Secondary Treatment - Trickling Filter | 1 | 1 | 3 | 4 | 3 | 2 | 10% | 5 | $61.6 |
| 14 | Interplant | 2 | 2 | 3 | 2 | 2 | 2 | 18% | 4 | $683.1 |
| 15 | Solids Handling - Digesters | 2 | 1 | 2 | 2 | 2 | 2 | 3% | 8 | $231.2 |
| 15 | Solids Handling - Facilities | 2 | 1 | 2 | 2 | 2 | 2 | 13% | 6 | $206.5 |
| 16 | Central Generation[a] | | 3 | 3 | 4 | 4 | 4 | 46% | 12 | $154.8 |
| 17 | Utilities | 3 | 2 | 3 | 2 | 1 | 2 | 15% | 9 | $176.2 |
| 18 | Electrical Distribution[a] | | | | 3 | | 3 | 47% | 12 | $74.1 |
| 19 | Miscellaneous Structures & Grounds | *To Be Determined* | | | | | *TBD* | *TBD* | *TBD* | $226.0 |
| | **Plant No. 1 Total** | | | | | | | **31%** | **81** | **$3,503.7** |

**RUL Legend:**

**RUL <5 years** **RUL 5-10 years** **RUL 11-15 years** **RUL 16-20 years** **RUL >20 years**

[a] Gray box with diagonal line indicates there are no assets assigned to this discipline within this process area.

## Table ES.1-2. Plant No. 2 Overview

| Area No. | Area Name | Average Remaining Useful Life Score | | | | | | Percentage of RUL Scores with 4s or 5s | Number of Projects to Address 4s & 5s | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Civil | Structural | Mechanical | Electrical | Instrumentation | All Assets | | | |
| 20 | Preliminary Treatment | 3 | 1 | 2 | 2 | 2 | 2 | 0% | 11 | $324.6 |
| 21 | Primary Treatment | 4 | 4 | 3 | 3 | 3 | 3 | 27% | 6 | $454.3 |
| 22 | Secondary Treatment - Activated Sludge | 3 | 2 | 3 | 3 | 3 | 3 | 18% | 8 | $608.5 |
| 22 | Secondary Treatment - Trickling Filter | 2 | 1 | 2 | 3 | 3 | 2 | 5% | 8 | $310.8 |
| 24 | Effluent Disposal | 2 | 2 | 2 | 3 | 3 | 2 | 17% | 11 | $817.1 |
| 25 | Solids Handling - Digesters | 3 | 3 | 3 | 4 | 4 | 3 | 45% | 12 | $322.7 |
| 25 | Solids Handling - Facilities | 2 | 2 | 2 | 2 | 2 | 2 | 18% | 9 | $201.5 |
| 26 | Central Generation[a] | | 3 | 4 | 4 | 4 | 4 | 70% | 13 | $330.2 |
| 27 | Utilities | 3 | 3 | 3 | 2 | 1 | 2 | 5% | 7 | $98.3 |
| 28 | Electrical Distribution[a] | | | | 4 | | 3 | 62% | 10 | $72.7 |
| 29 | Miscellaneous Buildings & Grounds | *To Be Determined* | | | | | *TBD* | *TBD* | *TBD* | $132.7 |
| | **Plant No. 2 Total** | | | | | | | **33%** | **95** | **$3,673.4** |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

[a] Gray box with diagonal line indicates there are no assets assigned to this discipline within this process area.

**Table ES.1-3. Collection System – Pump Station Overview**

| Pump Station | Average Remaining Useful Life Score | | | | | | Percentage of RUL Scores with 4s or 5s | Number of Projects to Address 4s & 5s | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|
| | Civil | Structural | Mechanical | Electrical | Instrumentation | All Assets | | | |
| 15th Street | 3 | 4 | 3 | 2 | 3 | 3 | 25% | 1 | $13.5 |
| A Street | 3 | 4 | 3 | 3 | 3 | 3 | 25% | 1 | $11.7 |
| Bay Bridge | 4 | 4 | 4 | 4 | 5 | 4 | 85% | 2 | $34.0 |
| Bitter Point | 2 | 3 | 3 | 1 | 2 | 2 | 15% | 3 | $32.2 |
| College Avenue | 3 | 2 | 3 | 2 | 1 | 2 | 0% | 3 | $24.0 |
| Crystal Cove | 3 | 3 | 4 | 3 | 2 | 3 | 33% | 2 | $2.5 |
| Edinger | 4 | 3 | 3 | 3 | 3 | 3 | 27% | 2 | $12.9 |
| Lido | 1 | 4 | 4 | 4 | 4 | 3 | 50% | 3 | $20.1 |
| MacArthur | 4 | 3 | 4 | 3 | 1 | 3 | 55% | 2 | $16.3 |
| Main Street | 4 | 3 | 4 | 2 | 2 | 3 | 38% | 3 | $44.0 |
| Rocky Point | 1 | 3 | 2 | 2 | 2 | 2 | 8% | 4 | $16.0 |
| Seal Beach | 3 | 4 | 4 | 5 | 4 | 4 | 75% | 3 | $41.5 |
| Slater | 4 | 4 | 4 | 3 | 2 | 4 | 38% | 3 | $35.2 |
| Westside | 3 | 3 | 3 | 2 | 3 | 3 | 8% | 1 | $30.6 |
| Yorba Linda | 3 | 4 | 3 | 3 | 2 | 3 | 36% | 1 | Not Valued |
| **Total** | | | | | | | **34%** | **34+7[a]** | **$334.6** |

**RUL Legend:**

**RUL <5 years** **RUL 5-10 years** **RUL 11-15 years** **RUL 16-20 years** **RUL >20 years**

[a] 34 projects affect only one pump station. An additional 7 projects affect multiple pump stations.

**Table ES.1-4. Collection System – Pipeline Overview**

| Trunk | Miles of Pipe with Grade 4 Defects[a] | Miles of Pipe with Grade 5 Defects[a] | Total Miles with Grade 4 or Grade 5 Defects[a] | Total Miles | Percent of Length with Grade 4 and 5 Defects | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|
| Baker-Main | 2.94 | 0.38 | 3.32 | 42.6 | 7.79% | $275.5 |
| Bushard | 0.53 | 0.00 | 0.53 | 21.4 | 2.49% | $241.6 |
| Coast Hwy | 0.07 | 0.16 | 0.23 | 11.4 | 2.02% | $98.5 |
| Euclid | 1.69 | 0.10 | 1.79 | 34.4 | 5.20% | $269.9 |
| Interplant | 0.00 | 0.00 | 0.00 | 16.9 | 0.00% | $115.3 |
| Knott | 0.71 | 1.27 | 1.99 | 73.2 | 2.72% | $625.0 |
| Miller-Holder | 0.28 | 0.00 | 0.28 | 31.4 | 0.90% | $296.1 |
| Newhope-Placentia | 0.57 | 0.04 | 0.61 | 30.9 | 1.98% | $209.0 |
| Newport | 0.98 | 0.20 | 1.18 | 31.6 | 3.74% | $216.3 |
| Santa Ana River Interceptor (SARI) | 0.84 | 0.10 | 0.94 | 50.4 | 1.87% | $516.1 |
| Sunflower | 0.89 | 0.79 | 1.68 | 34.8 | 4.81% | $299.9 |
| Talbert | 0.03 | 0.14 | 0.17 | 8.4 | 2.04% | $57.6 |
| **Total[b]** | **9.53** | **3.18** | **12.71** | **387.4** | **3.28%** | **$3,220.8** |

[a] Grade 4 and 5 defects include both isolated (i.e., pipes that can be fixed by point repair) and non-isolated (i.e., pipes that need rehabilitation or replacement) type pipe.

[b] The abandoned pipelines at the Airbase ($6,366,516) and the Harvard Area Trunk Sewer ($191,784) areas are not included in the replacement value total.

## Budgetary Considerations

The AMP focuses on documenting short- to long-term planning of maintenance and capital improvement projects to support effective budget development and sustainable operations for robust planning purposes. OCSD has been striving to identify more accurately medium- to long-term capital cash flow requirements.

Fiscal Year (FY) 2020-2021 Budget Update, adopted on June 24, 2020, includes updates to the 20-year CIP outlay. Figure ES-3 includes current and projected CIP projects.

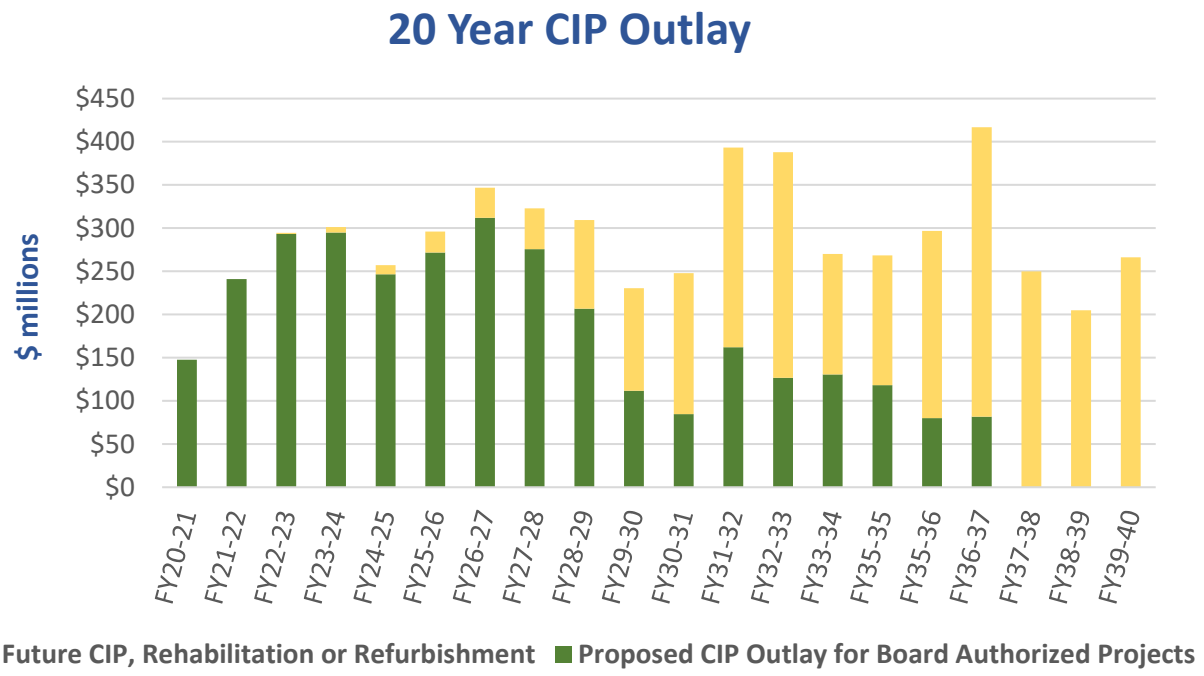


**Figure ES-3. 20-Year CIP Outlay**

# 1 Purpose

Orange County Sanitation District (OCSD) continues to make a concerted effort to establish a robust understanding of the condition and performance of all major assets. Asset performance monitoring is how OCSD demonstrates our ability to meet established levels of service. Performance monitoring and tracking also informs our maintenance and renewal programs and brings to light any corrective actions that need to be taken if performance or condition expectations are not being met.

The Asset Management Plan is a tactical document that coordinates with OCSD's operational strategies, maintenance plans, and capital improvement plan implementation on an annual basis. A primary characteristic of a successful Asset Management Program is continual improvement. OCSD strives to meet this challenge and as such we anticipate this document will continue to change in content and structure to reflect our efforts and to better meet the needs of stakeholders.

The current structure is organized into the following chapters:

- **Executive Summary:** Summarizes the purpose of the Asset Management Plan (AMP) and annual outcomes.
- **Chapter 1 Purpose**: Outlines the purpose and the organization of the Asset Management Plan.
- **Chapter 2 Overview of OCSD's Infrastructure**: Describes the major infrastructure that OCSD has ownership over and operates.
- **Chapter 3 Asset Management Alignment**: Defines organizational policies and initiatives driving the asset management program.
- **Chapter 4 Asset Management Organization**: Describes the asset management organizational structure and asset management strategies.
- **Chapter 5 State of OCSD's Infrastructure**: Summarizes the current state of OCSD's infrastructure and provides an overview of plans to address asset condition and performance issues.
- **Chapter 6 Program Monitoring and Improvements**: Documents metrics used to monitor the asset management program improvements and outlines future improvement opportunities.
- **Chapter 7 Budgetary Considerations**: Summarizes Capital Improvement Program (CIP) and maintenance expenditures, and planned maintenance projects.

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# 2 Overview of OCSD's Infrastructure

OCSD is responsible for providing wastewater collection, treatment, and recycling services to over 2.6 million people in central and northern Orange County, California. OCSD's two resource recovery and wastewater treatment facilities treat an average daily wastewater flow of 189 million gallons per day (MGD) from residential, commercial, and industrial sources.



In addition to our plant facilities, OCSD owns and operates wastewater collection system infrastructure. Our collection system infrastructure includes 388 miles of regional trunk sewer pipelines, and 15 pump stations, located throughout OCSD's service area (shown in Figure 2-1). Wastewater is conveyed via the collection system to Reclamation Plant No. 1 in Fountain Valley, and Treatment Plant No. 2 in Huntington Beach, where resource recovery and wastewater treatment take place.

OCSD's treatment plants currently operate under a regulatory permit from the Regional Water Quality Control Board (RWQCB). This authority is established through the National Pollutant Discharge Elimination System (NPDES) that permits the discharge of treated wastewater through an ocean outfall system to the Pacific Ocean. While some of this treated water is released five miles offshore through a deep-water ocean outfall system, most is recovered and delivered to the Orange County Water District (OCWD). OCWD further treats OCSD's effluent, using the Groundwater Replenishment System, which improves the effluent water quality, to drinking water standards for groundwater recharge and irrigation purposes. The following sections briefly describe the key systems under OCSD's management.

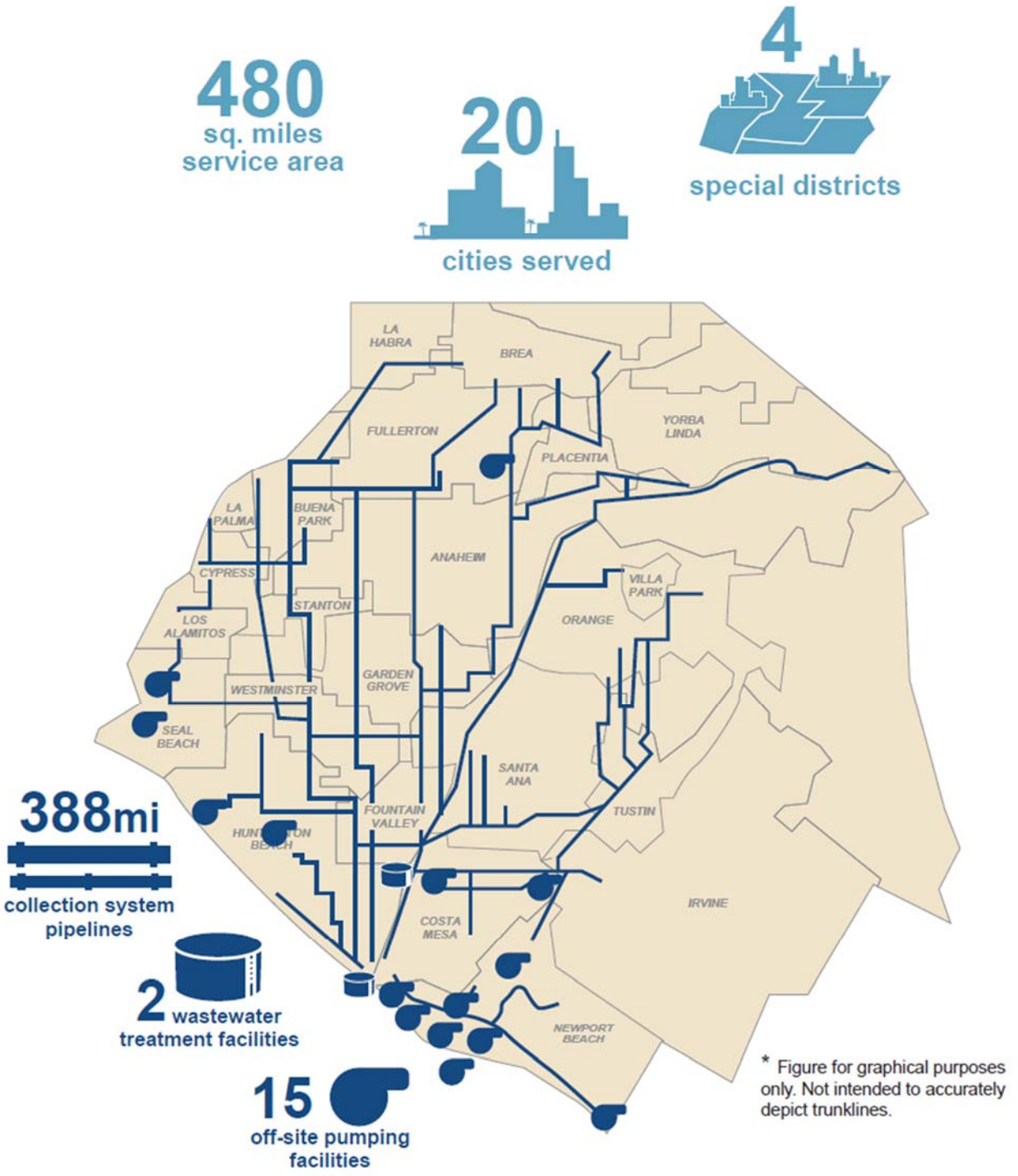
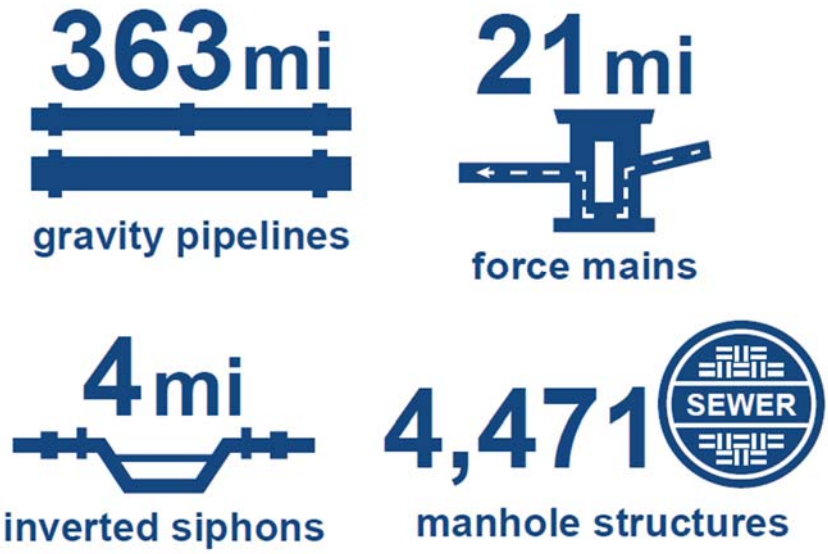



**Figure 2-1. OCSD Service Area**

## 2.1 Collection System

OCSD’s collection system serves as a regional conveyance system, collecting and conveying flows from 20 cities and four special districts. OCSD's 388 miles of collection system pipelines and 15 pump stations are spread throughout northern Orange County and include 363 miles of gravity pipelines, 21 miles of force mains, four miles of inverted siphons and 4,471 manholes structures.



## 2.2 Reclamation and Treatment Plant System

OCSD owns and operates two wastewater treatment plants, that serve two primary functions—treatment and reclamation. Reclamation Plant No. 1 (Plant No. 1) is located in the City of Fountain Valley, approximately four miles inland of the Pacific Ocean and adjacent to the Santa Ana River (shown in Figure 2-2). Influent wastewater entering Plant No. 1 passes through a flow metering and diversion structure, mechanical bar screens, grit chambers, and primary basins, before going to one of two air activated sludge processes, or trickling filters, and secondary basins. Up to 135 MGD of secondary effluent can be diverted to OCWD's facilities for tertiary treatment prior to reuse. For a more detailed understanding of how Reclamation Plant No. 1 processes work together, please see Appendix A.

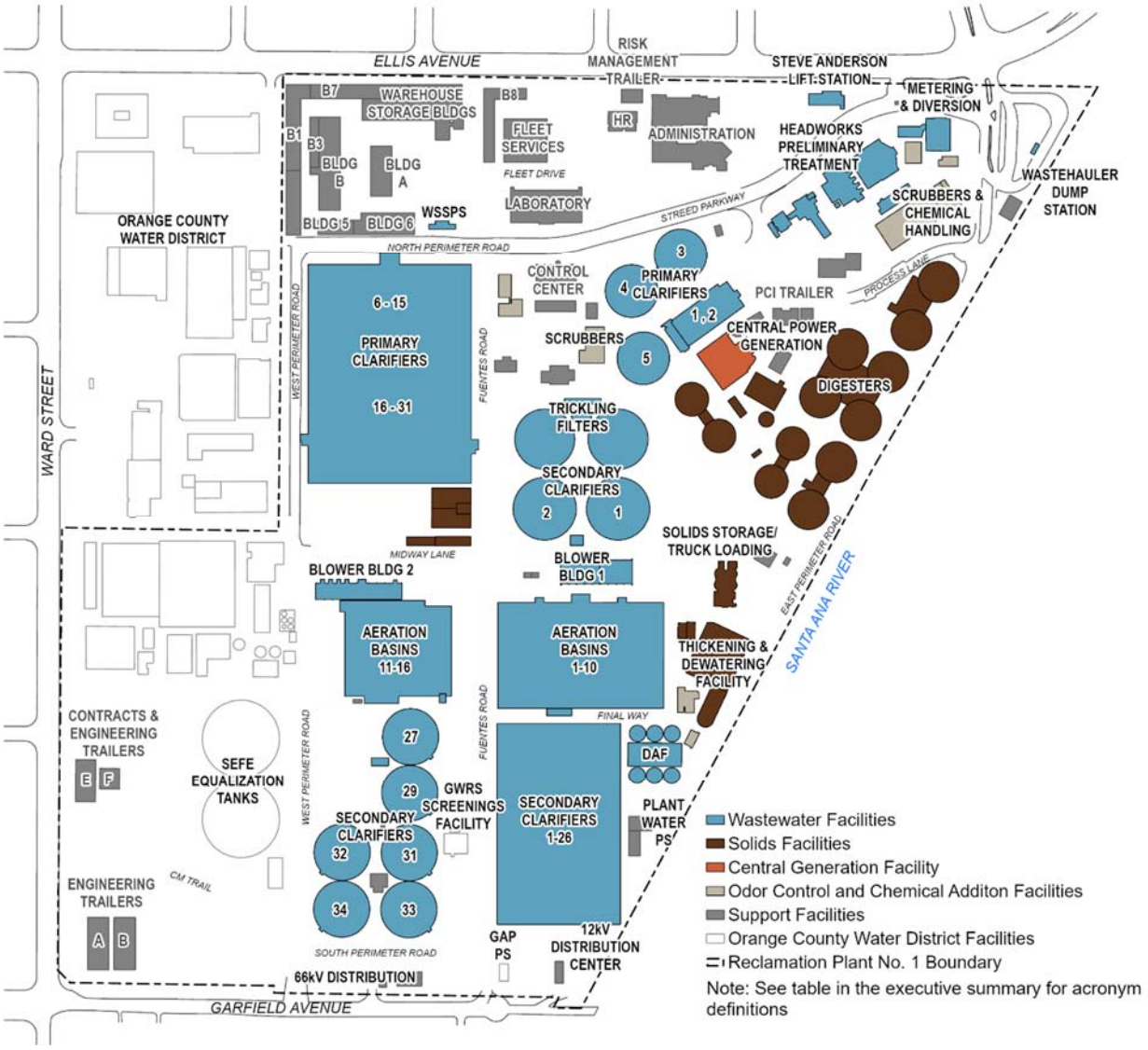



**Figure 2-2. Map of Reclamation Plant No. 1**

Solids treatment at Plant No. 1 includes co-thickening of primary and secondary sludge, followed by anaerobic digestion process and centrifuge dewatering of digested sludge to produce Class-B biosolids. Digester gas produced at Plant No. 1 is collected, cleaned, compressed, and transferred via a closed piping system, to the Central Power Generation

Facility, as a renewable fuel for energy generation. In addition, Plant No. 1 includes facilities for odor control and chemical addition to support the aforementioned

**Treatment Plant No. 2** is located in the City of Huntington Beach, adjacent to the Santa Ana River and east of Pacific Coast Highway (shown in Figure 2-3). Raw sewage flow entering Plant No. 2 passes through a flow metering structure, mechanical bar screens, and grit removal chambers. Flow then passes through primary basins before being split between the oxygen activated sludge secondary treatment facility or the trickling filters/solids contact basins, where it is finally discharged directly to the ocean via the outfall pumping system.

Solids treatment at Treatment Plant No. 2 includes in-basin thickening of primary sludge, dissolved air flotation thickening of waste activated sludge and secondary sludge, anaerobic sludge digestion, and centrifuge dewatering. Plant No. 2 also has facilities for odor control and chemical addition. Digester gas produced at Plant No. 2 is collected, compressed, cleaned, and distributed to a Central Power Generation System as a renewable fuel for energy generation. Currently, Plant No. 2 secondary effluent is discharged to the ocean through the outfall system. After the construction of OCWD's Groundwater Replenishment System (GWRS) final expansion and associated projects in 2023, Plant No. 2 reclaimable secondary effluent together with Plant No. 1 secondary effluent (a total of up to 175 MGD) will be diverted to OCWD for tertiary treatment and reuse. For a more detailed understanding of how Treatment Plant No. 2 processes work together, before and after the final expansion of GWRS, please see Appendices B and C, respectively.


**Figure 2-3. Map of Treatment Plant No. 2**

## 2.3 Outfall System

The ocean outfall system includes three discharge structures: Outfall No. 1, Outfall No. 2, and the Santa Ana River Emergency Overflow Weirs.

Outfall No. 2 serves as the primary ocean outfall, discharging treated wastewater approximately five miles offshore at a depth of approximately 200 feet. It began service in 1971 and is currently undergoing planned assessment and rehabilitation activities to ensure its reliability for many years to come.

### OUTFALL NO. 2 PRIMARY OCEAN OUTFALL


Outfall No. 1 serves as an emergency outfall. It was originally constructed in 1954 and was later modified in 1965. It is located over a mile offshore at a depth of approximately 65 feet and serves as a primary backup to Outfall No. 2. OCSD's NPDES permit specifies that this outfall can only be used in the case of an emergency or during planned maintenance activities.

### OUTFALL NO. 1 EMERGENCY OUTFALL


The Outfall System has two Santa Ana River Emergency Overflow Weirs at Plant No. 2, which discharge directly to the Santa Ana River. These weirs are for extreme emergency use only and serve as a secondary backup to the primary outfall facilities, ensuring the safety and welfare of the community at large.

## 2.4 Facility Valuation

As part of the 2017 Facilities Master Plan, OCSD commissioned an engineering study to determine the 2017 valuation of all OCSD capital facilities, including Plant No. 1, Plant No. 2, interplant and joint treatment facilities, and the collection system, including sewer pipelines and lift stations.

Figure 2-4 shows the valuation information, presented in five general sub-process areas:

- Collections Systems Piping
- Collection Systems Pump Stations
- Reclamation Plant No. 1 Facilities
- Treatment Plant No. 2 Facilities
- Interplant, Joint, and Common Facilities

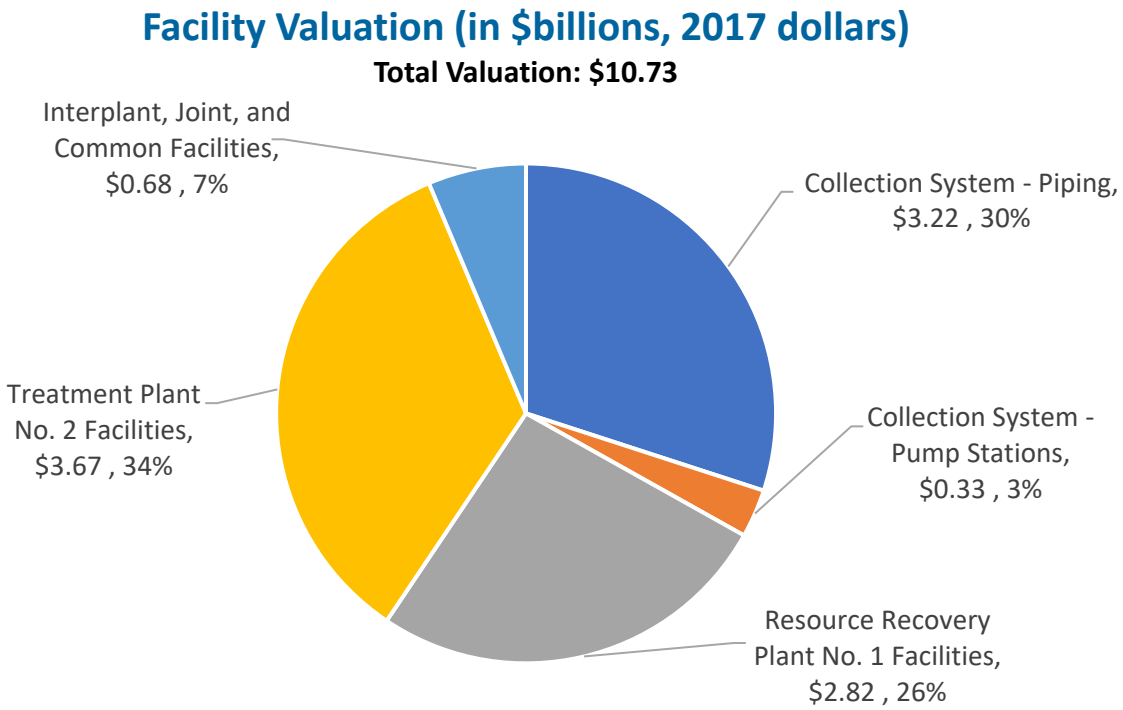
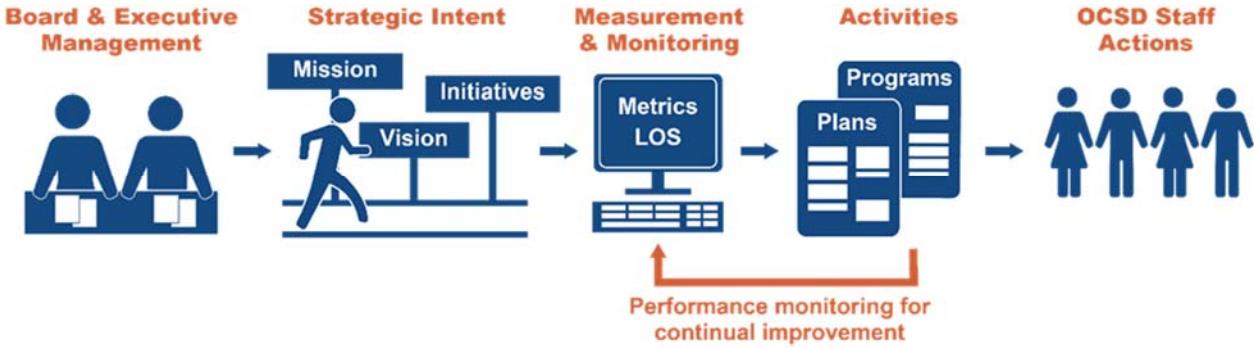



**Figure 2-4. Facility Valuation by Area**

# 3 Asset Management Alignment

OCSD's asset management policy and initiatives align with the OCSD mission, vision, and strategic business principles, as approved by the Board of Director's, and as described in the 2019 Strategic Plan. The policy outlines the principles and requirements for undertaking an asset management program across the organization in a well-planned and structured way. The initiatives are high level actions that if implemented will ensure the proactive management of the various assets that are currently installed and operating, as well as those that are in the design phase or still awaiting planning. The initiatives serve as a means for tracking progress towards meeting specific asset management objectives, and other performance metrics.




## 3.1 OCSD Mission and Vision Statements

OCSD's Board of Directors developed Mission and Vision statements to clearly communicate OCSD's purpose to our stakeholders and to articulate OCSD's organizational objectives. OCSD's Vision supports our Mission by expressing what we strive to achieve now and into the future.

### Our Mission

*To protect public health and the environment by providing effective wastewater collection, treatment, and recycling services.*

### Our Vision

*OCSD will be a leader in:*

- *Providing reliable, responsive, and affordable services in line with customer needs and expectations.*
- *Protecting public health and the environment utilizing all practical and effective means for wastewater, energy, and solids resource recovery.*
- *Continually seeking efficiencies to ensure that the public's money is well spent.*
- *Communicating our mission and strategies with those we serve and all other stakeholders.*
- *Partnering with others to benefit our customers, this region, and our industry.*
- *Creating the best possible workforce in terms of safety, productivity, customer service, and training.*

Through improved and robust asset management practices, we are better able to coordinate and plan actions to ensure our collection system, treatment and resource recovery infrastructure is safe and reliable, and meets the rigorous level of service embodied by our mission statement.

## 3.2 Strategic Plan – Asset Management Policy and Initiatives

The biennial strategic planning process is instrumental to aligning the activities OCSD's staff performs, with the strategic intent of the Board of Directors. The strategic planning process is designed to accomplish the following objectives:

1) Affirm the agency's mission and vision.
2) Adjust strategic goals and policies.
3) Set agency-wide prioritization of initiatives.
4) Provide a disciplined budgeting process.
5) Set operational goals at the operating level.
6) Hold individual units accountable for performance.

In November 2019, OCSD's strategic planning process resulted in the creation of an asset management policy and asset management initiatives. Collectively, the policy and initiatives make up OCSD's asset management strategy.

### Asset Management Policy

*The Sanitation District will assess and manage the collection system and treatment plant systems and assets to improve resilience and reliability while lowering lifecycle costs. This will be accomplished through adaptive operation, coordinated maintenance and condition assessment, and planned capital investment. Staff will balance maintenance, refurbishment, and replacement strategies to maximize useful life, system availability, and efficiency.*

### Asset Management Initiatives

- *Create an annual Asset Management Plan documenting the condition of the collection system and treatment plants, and upcoming maintenance or capital projects.*
- *Coordinate the efforts of operations, collections, mechanical maintenance, electrical maintenance, instrument maintenance, and engineering through process teams to assure the Sanitation District's resources are focused on the high priority work functions.*
- *Maintain a 20-year forecast of all CIP projects needed to maintain or upgrade the Sanitation District's $10.7 billion in assets on a prioritized risk basis to establish rate structures.*

The Asset Management Plan is a living document that describes constantly evolving operation strategies, maintenance and refurbishment plans and adaptations, and capital improvement plan implementation initially captured in the Facilities Master Plan and revised on an annual basis through the budgeting process. The information included in the Asset Management Plan encompasses the breadth of information needed to successfully align the capital and operational planning activities necessary to meet the asset management program objectives. The key objectives that are built into the asset management program include the following:

1) Proactive approach to repair, rehabilitation, and replacement.
2) Ensure assets are reliable and operating when needed.
3) Minimize unplanned outages and equipment downtime.
4) Manage risks associated with asset or service impairment through asset performance optimization.
5) Develop cost-effective management strategies for the long term.

6) Strive to implement world class asset management strategies through continual improvement in our asset management practices.


The Asset Management Plan is a key component of OCSD's overall planning activities. It aligns with the District's Strategic Plan, and the Facilities Master Plan and projects identified therein, while identifying potential and new opportunities that may require funding in the budget development process. Table 3-1 describes the relationship of the Asset Management Plan to the other planning activities.

**Table 3-1. Linkage between Asset Management Plan and Other Planning Activities**

| Planning Activity | Description | Planning Horizon | Update Cycle |
|---|---|---|---|
| **Strategic Plan** | Defines the strategic initiatives to be pursued by OCSD and provides a basis for long-term financial, capital, and operating planning. The Asset Management Plan aligns with Strategic Plan goals and objectives. | 5- to 10-year | Biennial |
| **Facilities Master Plan** | Identifies long-term capital improvement plans to address treatment and collection system infrastructure improvement needs. Projects identified in the Facilities Master Plan are incorporated into the Asset Management Plan and refined as appropriate. | 20-year | Varies |
| **Asset Management Plan** | Documents the overall condition of treatment and collection system assets and plans to address key condition and performance issues to ensure assets meet OCSD's levels of service. | 1-year<br>5-year<br>10-year | Annual |
| **Budget Document** | Lays out the framework of OCSD's activities and serves as a source of information for our Board of Directors, rate payers, and employees. It includes operational, capital, and debt service expenditures necessary to support our mission and to execute the Strategic Plan adopted by our Board of Directors. The Asset Management Plan identifies new operational, maintenance, and capital improvement activities for consideration during the budget development process. | 2-year | Annual |

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# 4 Asset Management Organization

Asset management is an essential part of OCSD, and our overall mission to deliver safe, economical, and reliable wastewater treatment services. Every part of our organization is involved in some aspect of asset management and ensuring that assets are designed, constructed, operated, and maintained to reliably deliver the required level of service to our customers. Through a very collaborative effort, each group plays an important role in ensuring that the individual asset management initiatives are properly executed.


**Figure 4-1. Roles in Asset Management**

- **Operations** operates and monitors assets and infrastructure that convey, treat, process, and recover resources.
- **Maintenance** performs proactive, corrective, and planned maintenance activities to maintain asset reliability.
- **Engineering Planning** provides engineering support for short- and long-term management of assets, while working towards asset management objectives.
- **Project Management** manages design and construction of new facilities and the rehabilitation of older facilities.
- **Engineering Design** ensures projects and assets are designed to meet stakeholder needs.
- **Construction Management** ensures assets are constructed in accordance with contract requirements.

To fulfill our commitment to our ratepayers for providing safe and reliable services, OCSD's asset management program is structured to align the Engineering, Operations, and Maintenance (O&M) departments. OCSD's Asset Management Group, within the Engineering

Planning Division, consists of nine Asset Engineers responsible for understanding the key issues or concerns related to the condition of OCSD's assets and for developing and coordinating plans or strategies to ensure that the assets operate reliably and are functioning properly. The Asset Engineers, assigned to their respective process or collection system area(s), work closely with the O&M Area Team members to maintain familiarity with all aspects that may impact the operational, condition, process, and maintenance related issues within their assigned areas. Collectively, the Area Teams work together to reach the goal of providing the required level of service to our customers, at the lowest lifecycle cost with an acceptable level of risk. This strategy involves a significant investment in internal coordination but ensures that we are properly assessing risks, solving problems and process deficiencies in a timely manner, and providing optimal water treatment services.

## 4.1 Asset Management Coordination and Solutions Development

The O&M Area Teams are the starting point for leveraging field data to define issues requiring remediation. Area Teams are made up of plant operators, mechanics, electricians, instrument technicians, and Asset Engineers. Figure 4-2 shows how field data are used to support coordination and solutions development for reporting issues to management and gaining project approval.

- Coordination: Asset Engineers coordinate with O&M staff to understand asset conditions and needs based on staff observations and knowledge, condition assessments (e.g., closed-circuit television [CCTV], corrosion assessments), and predictive maintenance data (e.g., vibration, ultrasound, infrared, oil quality). Asset Engineers update the area asset registries with important maintenance data, estimated remaining useful life, and relevant notes. Asset Engineers compile key issues, perform root cause analysis, and coordinate potential remediation activities, which are then presented to the Asset Management Council, consisting of managers from all divisions within OCSD, during monthly presentations.
- Solutions: Asset Engineers support solutions development and tracking. OCSD has developed SharePoint sites to track asset issues (i.e., Asset Issues Tracker) and to track solutions to asset issues executed by other divisions. Asset Engineers lead definition of the project, gather all necessary information, and prepare the potential work packages for the Clearinghouse review and approval with input and alignment with Operations and Maintenance, and/or Collections Divisions. The Clearinghouse consists of managers from all OCSD divisions who come to a common understanding of issues facing OCSD and prioritize resources necessary to address those issues. After the project is approved by the Clearinghouse, it is turned over to a project team for execution.

There are two sources of funding that may be used for projects approved by the Clearinghouse: Operating Budget and Capital Improvement Program.

- The two-year Operating Budget is adopted biennially with an annual update. This budget includes funding for all programmed maintenance work and repairs to the facilities and infrastructure.
- The Capital Improvement Program sets aside funds for projects that are planned to rehabilitate, replace, or extend the useful life of the facilities and infrastructure.


**Figure 4-2. Coordination and Solutions Development Processes**

The following subsections describe the groups involved in the coordination and solutions development process of asset management.

### 4.1.1 Operations and Maintenance

#### 4.1.1.1 Area Teams

The O&M Department has created Area Teams assigned to various process areas within the two wastewater treatment plants with the vision of being a top-notch, high-performing team that increases process efficiency and asset availability.

The Area Teams consist of staff from operations and maintenance covering mechanical, instrumentation, and electrical disciplines. Each Area Team is assigned an Area Champion (typically a supervisor) who assists the team through challenges, and aids in team collaboration and oversight. The Area Team is also assigned representatives from maintenance planning and an Asset Engineer from the Planning Asset Management Group (see Subsection 4.1.2).

The teams help streamline efforts and align resources within the current organizational structure to integrate the skills, knowledge, and insights from all levels of operations, maintenance, and engineering. O&M Area Team members provide the Asset Engineer with a direct line of communication to field staff operating within the process areas and serve as a central resource for information sharing and collaboration for solution development.

### 4.1.2 Engineering Planning

OCSD's Planning Division provides a comprehensive Capital Improvement Program (CIP) that considers projected capacity requirements, condition of current assets, projected regulatory, level of service changes, and business opportunities.

#### 4.1.2.1 Capital Improvement Program Planning

The Planning Division's CIP Planning Group develops and maintains the 20-year CIP plan consisting of capital improvement projects that maintain reliability, accommodate future growth, as well as meet future regulatory requirements, level of service goals, and strategic initiatives.

In 2017, the OCSD Board of Directors adopted the Facilities Master Plan which provides a 20-year roadmap setting forth OCSD's long term Capital Improvement Program. This roadmap provides a framework for infrastructure improvements needed at our treatment plant facilities, pump stations, and regional sewers. In the 2017 Facilities Master Plan, most of the projects identified are the result of the need to rehabilitate and replace aging infrastructure in the collection system and treatment plants.

#### 4.1.2.2 Asset Management

The Asset Management Group within the Planning Division consists of Asset Engineers who are responsible for OCSD's short- to long-term asset management goals. The primary responsibility of this group is to monitor the condition of assets, develop short- to long-term planning for asset maintenance, rehabilitation and replacement, and identification, packaging, and prioritization of projects.

Asset Engineers are assigned to one or more defined process or collection system areas. They work closely with O&M to maintain familiarity with operational, condition, and maintenance issues within their assigned areas. They also serve as "ambassadors" for each of their assigned areas to ensure that high priority issues are addressed in a timely fashion, and as the first point-of-contact for asset issues to drive root cause analysis and condition assessment. The Asset Management group plans and conducts condition assessments of critical assets utilizing corrosion consulting engineers, and CCTV contracts (Figure 4-3).


**Figure 4-3. CCTV Inspection**

Asset Engineers also engage with maintenance and capital improvement project delivery teams to monitor the scope of work and timing of planned projects to verify that the projects will address the identified objectives and issues in a timely manner. One of their key responsibilities

is to define the objectives, major project elements, justification, and appropriate timing and budget requirements of future maintenance and CIP projects, which are the basis for future project, operations, and maintenance budget development. Asset Engineers have the primary responsibility for submitting maintenance and small and large CIP projects for Clearinghouse approval.

Knowing the history, background information, and the future for each specific area, the Asset Engineers are in a unique position to coordinate asset maintenance and rehabilitation activities among various OCSD divisions. These coordination efforts support the goal of OCSD's Asset Management Program, which is to lower lifecycle costs of infrastructure, at an acceptable level of risk, while continuously delivering OCSD's established levels of service.

For Maintenance Led Projects, the Asset Engineer shall lead and be responsible for the scope of work and specification packages with Maintenance collaboration and approval, conduct scope coordination meetings and construction kick-off meetings if necessary. Asset Engineers work together with Maintenance Lead to determine inspection service requirements, monitor project schedule and progress, provide engineering support as needed, and serve as a gatekeeper for documents generated during construction and startup.

Figure 4-4 illustrates the role Asset Engineers have in gathering information and understanding needs to support coordination, planning, and communication of changes to the plans.

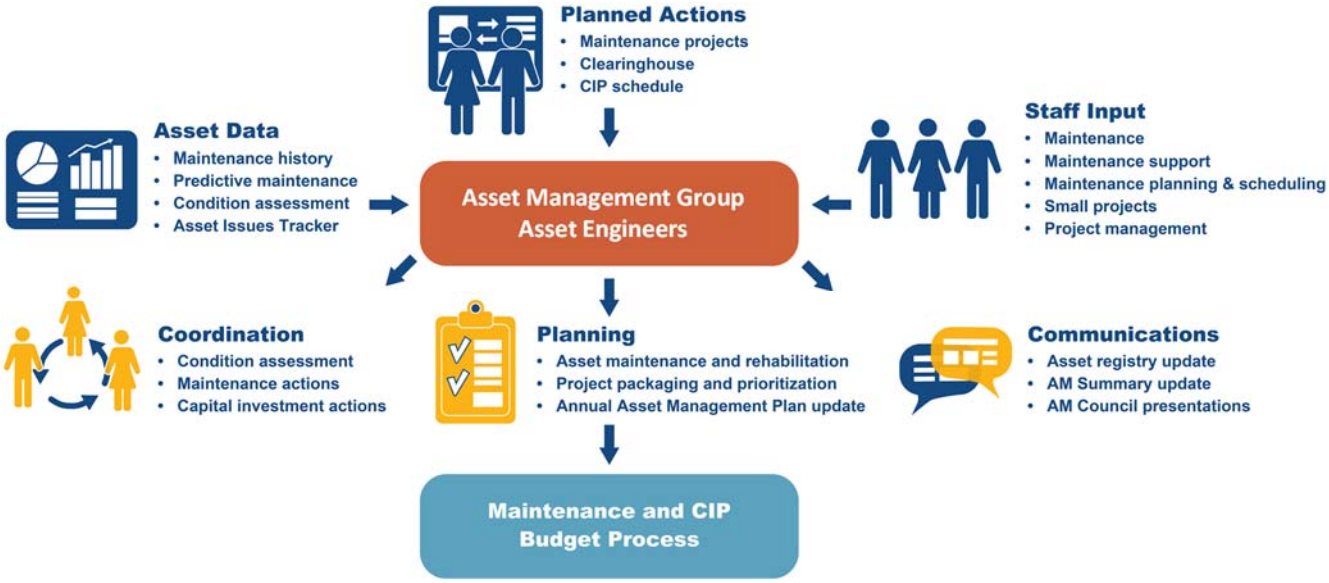


**Figure 4-4. Asset Engineer Role within Asset Management**

## 4.2 CIP Project Execution

### 4.2.1 Project Management Office

OCSD's Project Management Office Division manages the design and construction of new and rehabilitation projects for collection, treatment, and disposal facilities to ensure the safe, cost effective transport, and treatment of influent/effluent. This division is responsible for the delivery of projects from the project development stages through closeout of construction. The division provides standards, processes, and methodologies to improve project quality, cost, and timeliness.

#### 4.2.1.1 Small Project Delivery

The Small Projects Delivery team is a support arm of the Operations, Maintenance, and Engineering divisions and is responsible for the design and construction of maintenance projects. The purpose of this team is to deliver short-term projects to effectively manage life of existing assets and in doing so deferring construction of capital projects in the longer term.

Project Engineers in the Small Projects Delivery team complete scopes of work, perform project design (in-house or by consultant), bid projects in collaboration with Contracts or Purchasing, and manage construction, implementation, commissioning, change management, and closeout in collaboration with Construction Management and Design Engineering divisions.

#### 4.2.1.2 Project Management Group

The Project Management Group consists of engineers functioning as Project Managers for a range of CIP projects including design/construction projects, planning studies, California Environmental Quality Act studies, and research studies. This Group will also supplement the Small Project Delivery Group to deliver important short-term projects.

#### 4.2.1.3 Project Delivery Support

The Project Delivery Support group, which is part of the Financial Management Division, supports the CIP and small projects with reporting and monitoring tools for budgets, costs, schedules, cost estimates, amendments, change orders, and resource and cash forecasting for all projects.

### 4.2.2 Design

The Design division ensures that all projects are designed to be reliable, maintainable, and operable at optimum lifecycle costs in accordance with OCSD's Engineering Design Guidelines. and codes. The division provides process control SCADA system hardware, software, and data network support for collections and treatment plant processes that are highly reliable, safe, secure, online, and available to monitor, record, control, and operate our facilities. The division also leads the development of commissioning procedures during design and commissioning during construction.

The division includes the following groups:

- Civil, Mechanical, and Process
- Electrical and I&C
- Process Controls Integration
- Commissioning

### 4.2.3 Construction Management

The Construction Management Division ensures timely and quality construction and commissioning execution. This division's role is to provide construction management and inspection services for OCSD projects to ensure they are safely constructed and inspected in accordance with contract requirements and regulatory and legal codes while minimizing impacts to operations, maintenance, local agencies, and the public.

The division includes the following groups:

- Plant No. 1 and Pump Stations
- Plant No. 2 and Collections
- Civil Inspection – Plant No. 1 and Pump Stations
- Civil Inspection – Plant No. 2 and Collections
- Electrical and I&C Inspection

## 4.3 Asset Maintenance

The mission of the Maintenance Division is to protect public health and the environment by providing reliable power distribution, electrical and instrument maintenance, civil facilities and grounds maintenance, and mechanical maintenance to the treatment plant and associated pump stations in outer lying service areas. The Maintenance Division provides required predictive, preventive, and corrective maintenance and planning activities, collectively referred to as reliability centered maintenance (RCM). The goals of RCM involve implementing well-coordinated maintenance strategies to ensure OCSD's assets will operate at the required level of service.

### 4.3.1 Predictive Maintenance

#### 4.3.1.1 Maintenance Reliability Group

OCSD takes a proactive reliability centered maintenance approach emphasizing Predictive Maintenance (PdM). The Maintenance Reliability Group implements the PdM program, which collects data through condition-monitoring, enabling the real-time performance of assets. Methods of data collection are Insulation Resistance testing, Infrared Thermography, Structure Borne Ultrasound, Electrical Signal Analysis, Vibration Analysis, and Oil Analysis. The premise of PdM is a proactive approach to minimize unexpected breakdowns, reduce repair cost, extend the Mean Time Between Failure (MTBF), monitor the actual equipment health through quantifiable means, and perform advanced analysis and failure detection. In addition, when sudden changes or variations in the process manifest, they are often found during the regular Maintenance Reliability rounds as part of their everyday work—boots on the ground with finger on the pulse of the plant. The ability to monitor equipment lends itself to helping Maintenance to

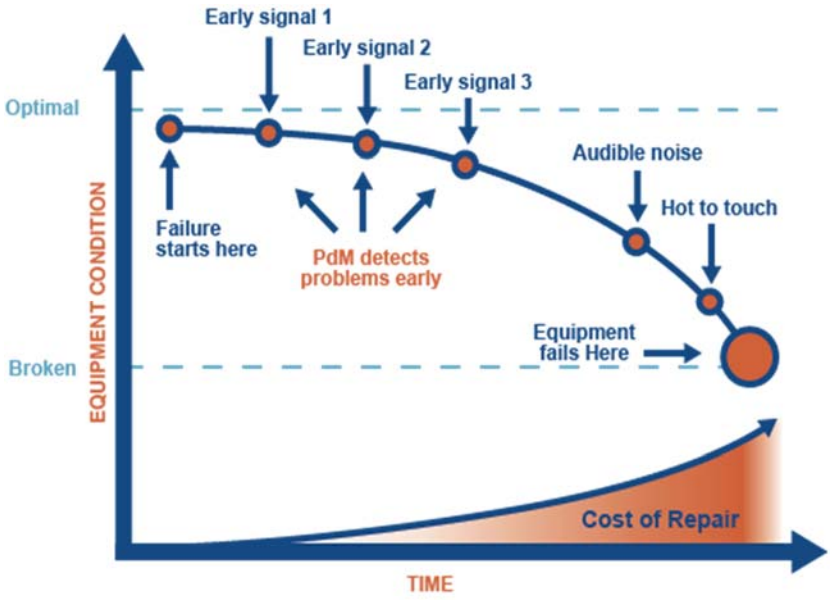


**Figure 4-5. PdM Summary**

optimize intervals between corrective repairs, minimizing the number and cost of unscheduled repairs created by machine-train failures, and improving the overall equipment reliability.

The Maintenance Specialists and Reliability Technicians in this group use various techniques such as:

- Vibration analysis to measure imbalance in rotating equipment.
- Thermography to measure excessive temperature rise.
- Oil and wear debris analysis to predict lubricant and equipment degradation.
- Ultrasound inspection of electrical power distribution equipment for detecting corona and other destructive conditions that pose a potential for arc flash incidents.
- Motor circuit analysis of de-energized motors, large or small, for diagnosing condition of the motor and its associated power circuits for determining motor stator health, broken rotor bars, deteriorating motor connections, and any impending failure trends.
- Motion Amplification amplifies a regular video frame of operating equipment, turning each camera pixel into a pseudo-accelerometer, which allows for an advanced analysis of machine faults. In addition, it augments other reliability analysis tools for troubleshooting purposes.

OCSD has a two-decade history of predictive maintenance as summarized in Table 4-1.

**Table 4-1. High-level Summary of OCSD's PdM Program**

| Year | Activity |
|---|---|
| **2002** | Baseline vibration monitoring with consultant assistance |
| **2006** | Comprehensive vibration analysis program implementation at both treatment plants and 15 pump stations |
| **2012** | Comprehensive predictive maintenance program implementation and establishment of Reliability Maintenance Team that includes engineers and four Reliability Maintenance Technicians |
| **2014** | Predictive maintenance program assessment conducted by Allied Reliability Inc. |
| **2018** | Machinery lubrication program assessment conducted by Noria Corporation Inc.; added ultrasound and thermography to test electrical equipment |
| **2019** | Motion Amplification equipment by RDI Technology added to the Predictive Maintenance Program |
| **2020** | Motor circuit analysis for large and small motors |

OCSD's predictive maintenance and monitoring program is staffed to address the high impact mechanical, and electrical disciplines.

#### 4.3.1.2 Mechanical Discipline

The mechanical discipline has the most mature PdM Program and involves variance trending of the PdM test results, which include:

- Vibration analysis
- Oil analysis
- Airborne Ultrasound
- Infrared thermography
- IRIS motion camera (measures deflection and displacement)

**Figure 4-6. Vibration Analysis Equipment**

In addition to PdM activities for mechanical equipment, OCSD also uses laser alignment techniques to enhance alignment rotating machinery accuracy to increase operating life span.

#### 4.3.1.3 Electrical Discipline

The electrical PdM Program continues to evolve and currently includes the following tests:

- Oil analysis for transformers
- Ultrasound to detect arcing
- Infrared thermography to detect hot spots
- Electrical power distribution equipment preventive maintenance
- Circuit breakers and protective relays preventive maintenance and testing
- Motor circuit analysis for large and small motors
- Medium voltage feeder cable testing to determine the health of cables and insulation

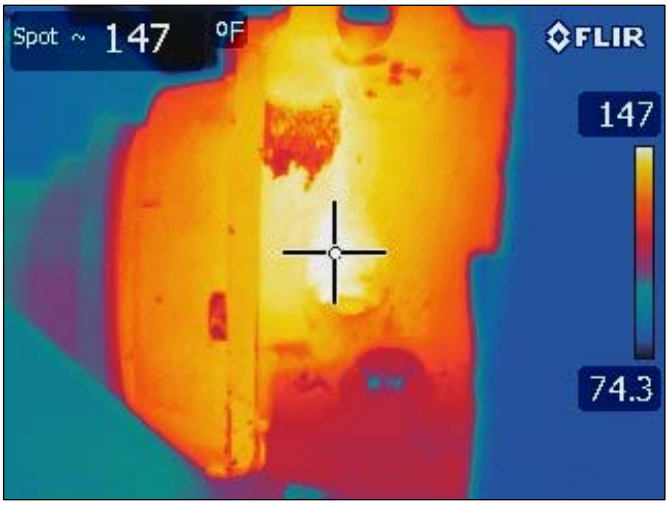


**Figure 4-7. Infrared Thermography**

### 4.3.2 Preventive and Corrective Maintenance

Beyond the advanced predictive maintenance strategies, OCSD also performs time and cycle-based preventive maintenance (PM) and corrective maintenance (CM) activities. It is these activities that, if well implemented, greatly extend the life of the assets. Recognizing the importance of these efforts, OCSD has dedicated two groups of skilled individuals to reinforce and sustain these activities.

#### 4.3.2.1 PM Optimization Group

OCSD has created a PM Optimization Group that is tasked with conducting an in-depth assessment to optimize preventive maintenance strategies for new and existing assets and to establish maintenance approaches and strategies for assets installed by capital improvement projects prior to beneficial occupancy. The PM Optimization Program tracks, maintains, and manages assets throughout their lifecycles from design, construction, commissioning, beneficial

occupancy, operations, and maintenance, to the eventual decommissioning or replacement of assets. This ensures that asset lifecycle is maximized with the lowest risk to process failure by achieving the intended reliability, at the lowest possible cost, and maximizing equipment availability.

#### 4.3.2.2 Maintenance Planning Group

The Maintenance Planning Group drives reliability and effectiveness in the craft-based maintenance work groups they support by ensuring that work groups have sufficient ready-to-execute work with appropriate resources such as tools, materials, labor, and job plans. Maintenance Specialists in this group are responsible for managing blanket maintenance service contracts, planning and scheduling maintenance activities, optimizing preventive maintenance activities within Maximo (which includes fine tuning job plans based on input received from field staff, leads, maintenance Supervisors and Engineers), and coordinating complex maintenance activities involving shutdowns and outages.

OCSD's preventive and corrective maintenance program is staffed to address the long-term reliable performance of civil, mechanical, electrical, and instrumentation assets. PM and CM activities specific to these disciplines are an integral part of OCSD's maintenance program. The following lists provide examples of tasks performed; however, they are not meant to be inclusive of all maintenance responsibilities. Often, OCSD staff get the job done by improvising in the field setting to meet the challenge.

#### 4.3.2.3 Civil Discipline

Preventative and corrective maintenance activities include:

1) Cleaning of civil facilities.
2) Chemical conditioning of the sewage to reduce corrosion and control odors.
3) Minor repairs.
4) Application and repair of coatings.
5) Maintenance and testing of cathodic protection systems.

#### 4.3.2.4 Mechanical, Electrical, and Instrumentation Disciplines

Preventative and corrective maintenance activities include:

1) Valve and gate exercising program comprising more than 264 preventive maintenance tasks for over 1,650 valves and gates in both plants and collection system.
2) Equipment rotation program to ensure equipment wear is predictable.
3) Adjustments and mechanical alignments.
4) Equipment rebuilding and regular testing.
5) Changing of lubricants and filters.
6) Electrical equipment cleaning and tightening.
7) Sensors and meters calibration.

# 5 State of OCSD's Infrastructure

The Area AM Summaries are intended to summarize the condition of major assets, identify key issues for further investigation, and summarize maintenance and CIP projects planned over the next ten years. The approach for developing the AM Summaries is to assemble a list of major assets, document key issues, define the average remaining useful lives of these assets, and identify OCSD's plan to address performance and reliability issues of these assets over the one, five-, and ten-year planning horizons. Each month, Asset Engineers present one or more of the AM Summaries to the AM Council; over the course of a year all the process areas are presented. The Area AM Summaries are updated as needed and incorporated into the AMP, which is published annually.

## 5.1 Asset Definition

The AM summaries consolidate the information contained in detailed asset registries. The asset registry (see Appendix G for examples) is the principal tool used by the Asset Engineers to facilitate their primary responsibilities; however, inconsistencies persist between the number of assets included in the registries and the comprehensive list of assets found in Maximo. The origin of the inconsistencies stem from how each group defines an asset and how each source is utilized. As the AM program matures, ideally, the definition of an asset used by the maintenance and operations groups, the Asset Engineers, and the Finance Division will align. In the interim, the Asset Engineers will use the methodology shown in Figure 5-1 to determine if an asset should be included in the registry. This methodology is informed by the asset definition and classification system developed when Maximo was implemented (Appendix D) and the recommended asset definition methodology that resulted from an in-depth analysis of the existing asset hierarchical data completed as part of the 2019 Asset Management Plan development effort (Appendix E).

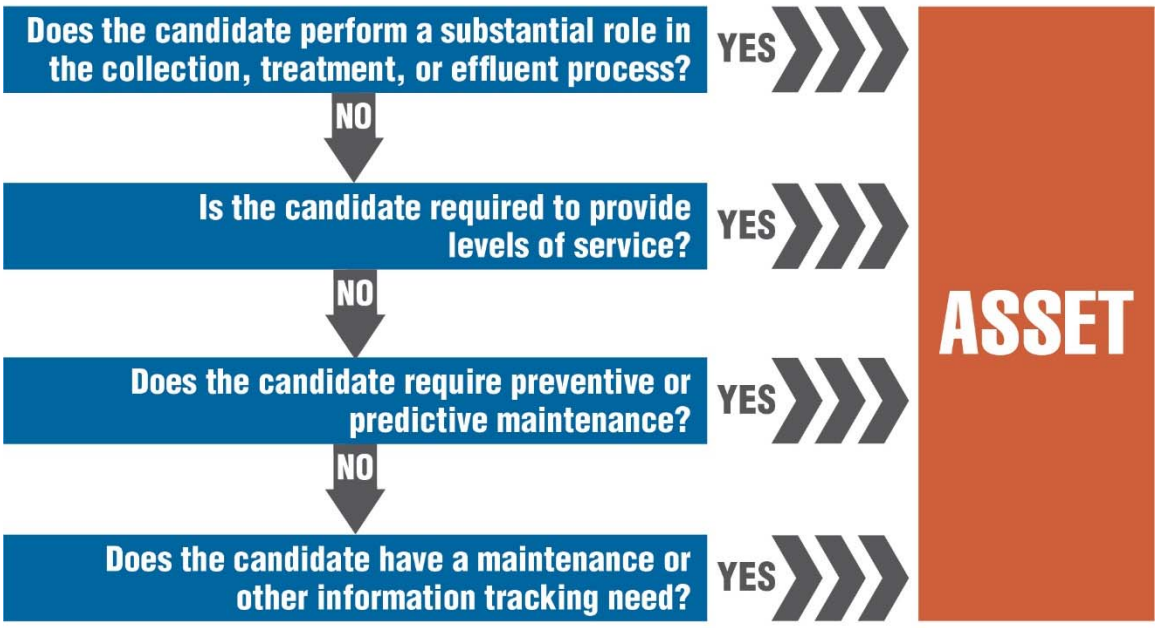


**Figure 5-1. Asset Definition Methodology**

## 5.2 Asset Registries

The Asset Engineers maintain a detailed asset registry which is a primary data source for the Area AM Summaries. The intention of the asset registry is to identify major assets, record the data required to adequately describe and categorize the asset, track the physical condition of the asset, and help determine the timing of upcoming maintenance, small and CIP projects. The asset registry field groupings, shown in Table 5-1, describe the information included in the registry to accomplish the objectives of the asset management group. A complete table of the asset registry fields is included in Appendix F and examples of asset registries for two different process areas are included in Appendix G. The asset registries are a work in progress and are expected to change as the functionality and level of detail necessary to perform the responsibilities of the asset engineer evolve.

**Table 5-1. General Description of Asset Registry Field Groupings**

| Field Groupings | Description | Purpose |
|---|---|---|
| **Identification** | Unique asset identifiers | Easily identify and track the asset |
| **Asset Information** | Data used to describe and categorize the asset | Facilitate data collection and analysis |
| **Condition and Performance** | Data used to determine the remaining useful life of the asset | Track physical condition and performance monitoring |
| **Timeline** | Projected year by which the asset will need to be replaced and upcoming project dates | Determine future rehabilitation/ replacement effort timing |

Condition and performance monitoring and tracking are crucial functions of the asset registry. The registry is the primary source of data used to determine maintenance and renewal efforts, keep management informed, and determine if corrective action is necessary. For now, the Asset Engineers tend to use various approaches to determine which assets need to be assessed and the level of confidence in the data required to decide the scope and timing of remediation efforts. A 1 to 5 rating system that loosely coincides with a remaining useful life designation is used for condition monitoring, as shown in Table 5-2. In determining the condition score, the asset engineers utilize a number of different sources of information that include (from quantitative to more qualitative methods) condition assessments, predictive maintenance data, data analysis, maintenance records, visual assessments, and discussions with operation and maintenance personnel. Of the methods listed, condition assessment, visual inspection, and discussions with operations and maintenance personnel are relied upon the most. The critical nature of the asset is also taken into consideration when assigning condition scores.

It is not realistic, or at times possible, to acquire even qualitative condition assessment information for assets included in the registry. The current organization of the asset registry supports the use of age, useful life and rehabilitation frequencies (as determined in SP-151, Asset Management Study; Appendix H), and rehabilitation or replacement date to derive a theoretical remaining useful life (in years) that can then be translated into a condition score. To standardize the determination of remaining useful life, condition score guidelines have been developed for civil, mechanical, and electrical assets (Appendix I). The condition score guidelines reflect the level of maturity of OCSD's program and, for the most part, use a combination of qualitative and quantitative descriptions to guide the assignment of condition scores.

**Table 5-2. Relationship between Condition Score and Remaining Useful Life Designation**

| Condition Score | Remaining Useful Life Designation |
|---|---|
| **1** | > 20 years |
| **2** | 15 – 20 years |
| **3** | 10 – 15 years |
| **4** | 5 – 10 years |
| **5** | < 5 years |

## 5.3 Asset System Summaries

The following system-level summaries provide a high-level overview of the Area AM Summaries contained in Section 5.4. The remaining useful life (RUL) scores are an average of the RUL scores for that discipline within that process area. Detailed condition scores are presented in the Area AM Summaries, included later in this chapter. The system-level summaries are organized by:

- Plant No. 1
- Plant No. 2
- Collection System – Pump Stations
- Collection System – Pipelines

The system-level summaries include an area map showing the general layout of the process areas or collection system, and a table with the following fields:

- **Area No.**
- **Area Name**
- **Average RUL Score**: Estimated average for each discipline (civil, structural, mechanical, electrical, and instrumentation) and area based on the detailed Area AM Summaries.
- **Average Remaining Useful Life (RUL) Score**: Estimated average RUL score for each discipline (civil, structural, mechanical, electrical, and instrumentation) or area based on an average of the RUL scores provided by Asset Engineers in the detailed Area AM Summaries.
- **Percentage of RUL Scores with 4s or 5s**[1]: Percentage based on total number of RUL scores assigned to each area by Asset Engineers in the detailed Area AM Summaries. The percentage is an alternate metric for the overall condition of the area. A RUL score of 5 indicates less than 5 years of useful life remains for an asset or set of assets. A RUL score of 4 indicates 5 to 10 years of useful life remains for an asset or a set of assets.
- **Replacement Value ($million)**: Process area replacement value from the facility valuation.

[1]RUL 5: <5 Years, RUL 4: 5 to 10 Years

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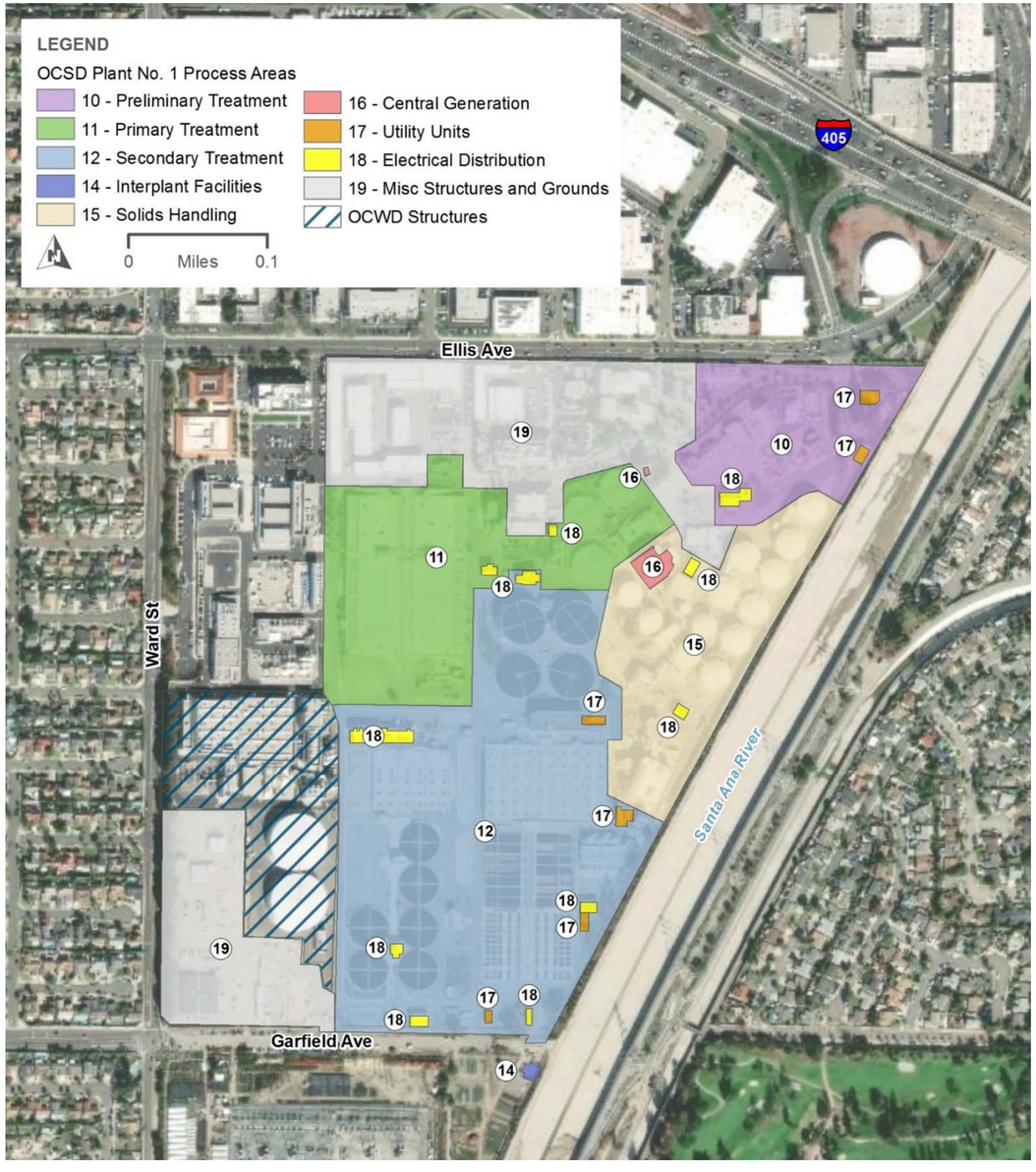
# ASSET MANAGEMENT SYSTEM SUMMARY – PLANT NO. 1 OVERVIEW

## Process Area Map




## Remaining Useful Life and Replacement Value Summary

| Area No. | Area Name | Average Remaining Useful Life Score | | | | | | Percentage of RUL Scores with 4s or 5s | Number of Projects to Address 4s & 5s | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Civil | Structural | Mechanical | Electrical | Instrumentation | All Assets | | | |
| 10 | Preliminary Treatment | 1 | 2 | 4 | 4 | 4 | 4 | 58% | 6 | $351.2 |
| 11 | Primary Treatment | 3 | 2 | 4 | 3 | 4 | 3 | 31% | 9 | $451.6 |
| 12 | Secondary Treatment - Activated Sludge | 3 | 2 | 3 | 3 | 4 | 3 | 32% | 10 | $887.3 |
| 12 | Secondary Treatment - Trickling Filter | 1 | 1 | 3 | 4 | 3 | 2 | 10% | 5 | $61.6 |
| 14 | Interplant | 2 | 2 | 3 | 2 | 2 | 2 | 18% | 4 | $683.1 |
| 15 | Solids Handling - Digesters | 2 | 1 | 2 | 2 | 2 | 2 | 3% | 8 | $231.2 |
| 15 | Solids Handling - Facilities | 2 | 1 | 2 | 2 | 2 | 2 | 13% | 6 | $206.5 |
| 16 | Central Generation[a] | | 3 | 3 | 4 | 4 | 4 | 46% | 12 | $154.8 |
| 17 | Utilities | 3 | 2 | 3 | 2 | 1 | 2 | 15% | 9 | $176.2 |
| 18 | Electrical Distribution[a] | | | | 3 | | 3 | 47% | 12 | $74.1 |
| 19 | Miscellaneous Structures & Grounds | *To Be Determined* | | | | | *TBD* | *TBD* | *TBD* | $226.0 |
| | **Plant No. 1 Total** | | | | | | | **31%** | **81** | **$3,503.7** |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

**Acronym Key:**

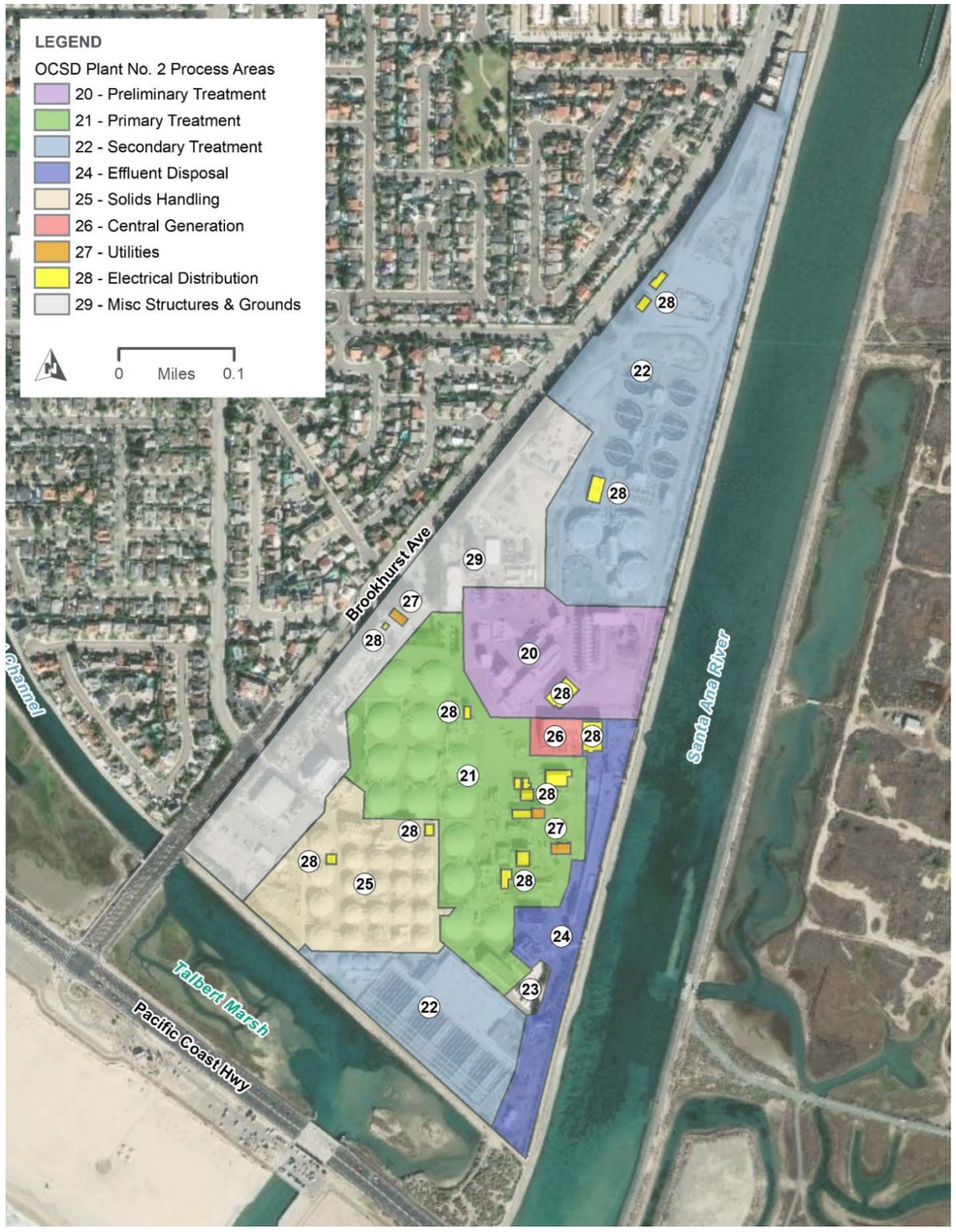
OCSD = Orange County Sanitation District; OCWD = Orange County Water District; RUL = Remaining Useful Life;

TBD = To Be Determined

[a] Gray box with diagonal line indicates there are no assets assigned to this discipline within this process area.

# ASSET MANAGEMENT SYSTEM SUMMARY – PLANT NO. 2 OVERVIEW

## Process Area Map




## Remaining Useful Life and Replacement Value Summary

| Area No. | Area Name | Average Remaining Useful Life Score | | | | | | Percentage of RUL Scores with 4s or 5s | Number of Projects to Address 4s & 5s | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Civil | Structural | Mechanical | Electrical | Instrumentation | All Assets | | | |
| 20 | Preliminary Treatment | 3 | 1 | 2 | 2 | 2 | 2 | 0% | 11 | $324.6 |
| 21 | Primary Treatment | 4 | 4 | 3 | 3 | 3 | 3 | 27% | 6 | $454.3 |
| 22 | Secondary Treatment - Activated Sludge | 3 | 2 | 3 | 3 | 3 | 3 | 18% | 8 | $608.5 |
| 22 | Secondary Treatment - Trickling Filter | 2 | 1 | 2 | 3 | 3 | 2 | 5% | 8 | $310.8 |
| 24 | Effluent Disposal | 2 | 2 | 2 | 3 | 3 | 2 | 17% | 11 | $817.1 |
| 25 | Solids Handling - Digesters | 3 | 3 | 3 | 4 | 4 | 3 | 45% | 12 | $322.7 |
| 25 | Solids Handling - Facilities | 2 | 2 | 2 | 2 | 2 | 2 | 18% | 9 | $201.5 |
| 26 | Central Generation[a] | | 3 | 4 | 4 | 4 | 4 | 70% | 13 | $330.2 |
| 27 | Utilities | 3 | 3 | 3 | 2 | 1 | 2 | 5% | 7 | $198.3 |
| 28 | Electrical Distribution[a] | | | | 4 | | 3 | 62% | 10 | $72.7 |
| 29 | Miscellaneous Buildings & Grounds | *To Be Determined* | | | | | *TBD* | *TBD* | *TBD* | $132.7 |
| | **Plant No. 2 Total** | | | | | | | **33%** | **95** | **$3,673.4** |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

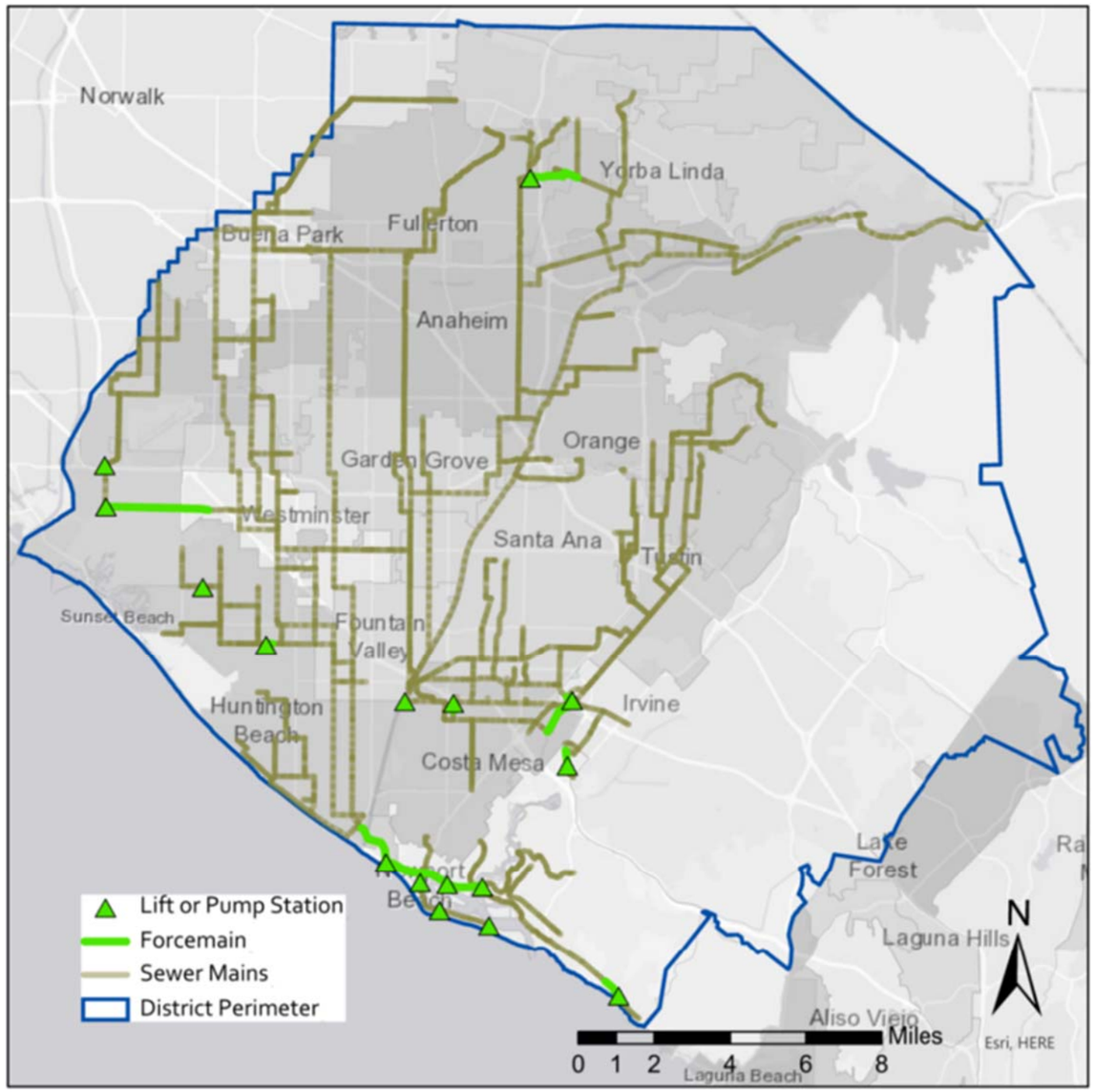
**Acronym Key:**

OCSD = Orange County Sanitation District; RUL = Remaining Useful Life; TBD = To Be Determined

[a] Gray box with diagonal line indicates there are no assets assigned to this discipline within this process area.

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM PUMP STATION OVERVIEW

### Collection System Pump Stations Location Map




### Remaining Useful Life and Replacement Value Summary

| Pump Station | Average Remaining Useful Life Score | | | | | | Percentage of RUL Scores with 4s or 5s | Number of Projects to Address 4s & 5s | Replacement Value ($millions, in 2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|
| | Civil | Structural | Mechanical | Electrical | Instrumentation | All Assets | | | |
| 15th Street | 3 | 4 | 3 | 2 | 2 | 3 | 25% | 1 | $13.5 |
| A Street | 3 | 4 | 3 | 3 | 2 | 3 | 25% | 1 | $11.7 |
| Bay Bridge | 4 | 4 | 4 | 4 | 5 | 4 | 85% | 2 | $34.0 |
| Bitter Point | 2 | 3 | 3 | 1 | 2 | 2 | 15% | 3 | $32.2 |
| College Avenue | 3 | 2 | 3 | 2 | 1 | 2 | 0% | 3 | $24.0 |
| Crystal Cove | 3 | 3 | 4 | 3 | 2 | 3 | 33% | 2 | $2.5 |
| Edinger | 4 | 3 | 3 | 3 | 3 | 3 | 27% | 2 | $12.9 |
| Lido | 1 | 4 | 4 | 4 | 4 | 3 | 50% | 3 | $20.1 |
| MacArthur | 4 | 3 | 4 | 3 | 1 | 3 | 55% | 2 | $16.3 |
| Main Street | 4 | 3 | 4 | 2 | 2 | 3 | 38% | 3 | $44.0 |
| Rocky Point | 1 | 3 | 2 | 2 | 2 | 2 | 8% | 4 | $16.0 |
| Seal Beach | 3 | 4 | 4 | 5 | 4 | 4 | 75% | 3 | $41.5 |
| Slater | 4 | 4 | 4 | 3 | 2 | 3 | 38% | 3 | $35.2 |
| Westside | 3 | 3 | 3 | 2 | 3 | 3 | 8% | 1 | $30.6 |
| Yorba Linda | 3 | 4 | 3 | 3 | 2 | 3 | 36% | 1 | Not Valued |
| **Totals** | | | | | | | **34%** | **34+7[a]** | **$334.6** |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

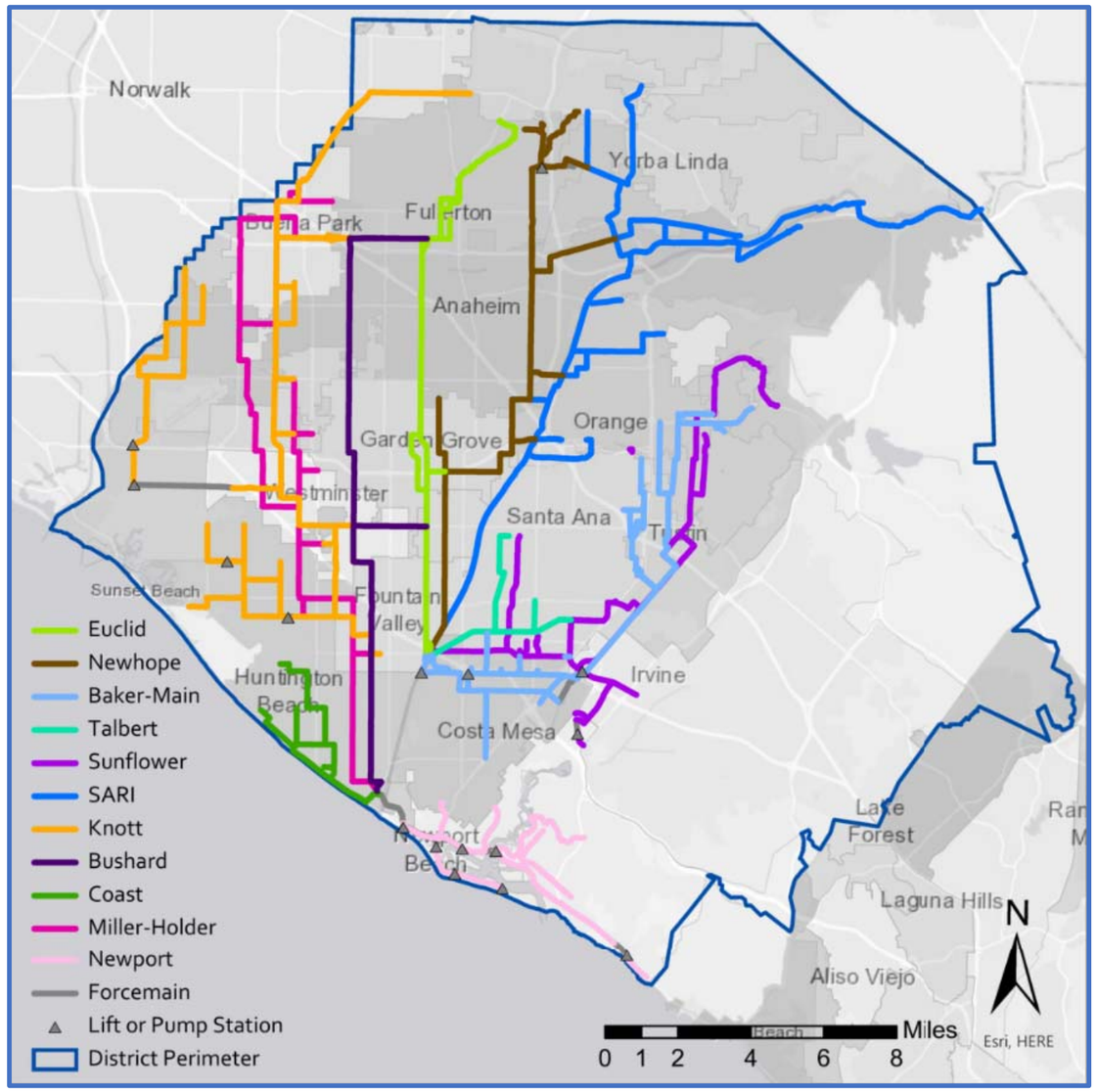
**Acronym Key:**

LS = Lift Station; OCSD = Orange County Sanitation District; PS = Pump Station; RUL = Remaining Useful Life

[a] 34 projects affect only one pump station. An additional 7 projects affect multiple pump stations.

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM PIPELINES OVERVIEW

## Collection System Pipelines – Service Area Map




## Pipeline Condition and Replacement Value Summary

| Trunk | No. of Structural Grade 4 or 5 Defects[a] | No. of Pipes with Structural Grade 4 or 5 Defects[a] | Total Number of Pipes | Percent of Pipe Segments with Grade 4 or Grade 5 Defects | Replacement Value ($millions, in 2017 Dollars) [b] |
|---|---|---|---|---|---|
| Baker-Main | 67 | 52 | 652 | 8.0% | $275.5 |
| Bushard | 3 | 3 | 192 | 1.6% | $241.6 |
| Coast Hwy | 1 | 1 | 146 | 0.7% | $98.5 |
| Euclid | 50 | 24 | 429 | 5.6% | $269.9 |
| Interplant | 0 | 0 | 67 | 0.0% | $115.3 |
| Knott | 49 | 35 | 852 | 4.1% | $625.0 |
| Miller-Holder | 6 | 2 | 266 | 0.8% | $296.1 |
| Newhope-Placentia | 13 | 9 | 330 | 2.7% | $209.0 |
| Newport | 37 | 22 | 561 | 3.9% | $216.3 |
| SARI | 20 | 14 | 576 | 2.4% | $516.1 |
| Sunflower | 39 | 20 | 488 | 4.1% | $299.9 |
| Talbert | 3 | 3 | 112 | 2.7% | $57.6 |
| **Total** | **288** | **185** | **4,671** | **4.0%** | **$3,220.8** |

[a] Grade 4 and 5 defects include both isolated (i.e., pipes that can be fixed by point repair) and non-isolated (i.e., pipes that needs rehabilitation or replacement) type pipe.

[b] The abandoned pipelines at the Airbase ($6,366,516) and the Harvard Area Trunk Sewer ($191,784) areas are not included in the total

| Trunk | Miles of Pipe with Grade 4 Defects[a] | Miles of Pipe with Grade 5 Defects[a] | Total Miles with Grade 4 or Grade 5 Defects | Total Miles | Percent of Length with 4s or 5s |
|---|---|---|---|---|---|
| Baker-Main | 2.94 | 0.38 | 3.32 | 42.6 | 7.79% |
| Bushard | 0.53 | 0.00 | 0.53 | 21.4 | 2.49% |
| Coast Hwy | 0.07 | 0.16 | 0.23 | 11.4 | 2.02% |
| Euclid | 1.69 | 0.10 | 1.79 | 34.4 | 5.20% |
| Interplant | 0.00 | 0.00 | 0.00 | 16.9 | 0.00% |
| Knott | 0.71 | 1.27 | 1.99 | 73.2 | 2.72% |
| Miller-Holder | 0.28 | 0.00 | 0.28 | 31.4 | 0.90% |
| Newhope-Placentia | 0.57 | 0.04 | 0.61 | 30.9 | 1.98% |
| Newport | 0.98 | 0.20 | 1.18 | 31.6 | 3.74% |
| SARI | 0.84 | 0.10 | 0.94 | 50.4 | 1.87% |
| Sunflower | 0.89 | 0.79 | 1.68 | 34.8 | 4.81% |
| Talbert | 0.03 | 0.14 | 0.17 | 8.4 | 2.04% |
| **Total** | **9.53** | **3.18** | **12.71** | **387.4** | **3.28%** |

[a] Grade 4 and 5 defects include both isolated (i.e., pipes that can be fixed by point repair) and non-isolated (i.e., pipes that need rehabilitation or replacement) type pipe.

## 5.4 Area Asset Management Summaries

The following AM Summaries document the current state of process areas in both plants and the collection system. The remainder of this section contains the AM Summaries organized as follows:

### Plant No. 1 Asset Management Summaries

- Preliminary Treatment
- Primary Treatment
- Secondary Treatment – Activated Sludge
- Secondary Treatment – Trickling Filters
- Interplant
- Solids Handling – Digesters
- Solids Handling – Facilities
- Central Power Generation
- Utilities
- Electrical Distribution

### Plant No. 2 Asset Management Summaries

- Preliminary Treatment
- Primary Treatment
- Secondary Treatment – Activated Sludge
- Secondary Treatment – Trickling Filters/Solids Contact
- Effluent Disposal
- Solids Handling – Digesters
- Solids Handling – Facilities
- Central Power Generation
- Utilities
- Electrical Distribution

### Collection System Asset Management Summaries

- Pump Stations
- Pipelines

The AM Summaries are built around a common structure. This structure provides a framework for continued use and development of the summaries. Key structure elements for AM Summaries are shown in Figure 5-2.


**Figure 5-2. Area Asset Management Summary Structure**

# Plant No. 1 Asset Management Summaries

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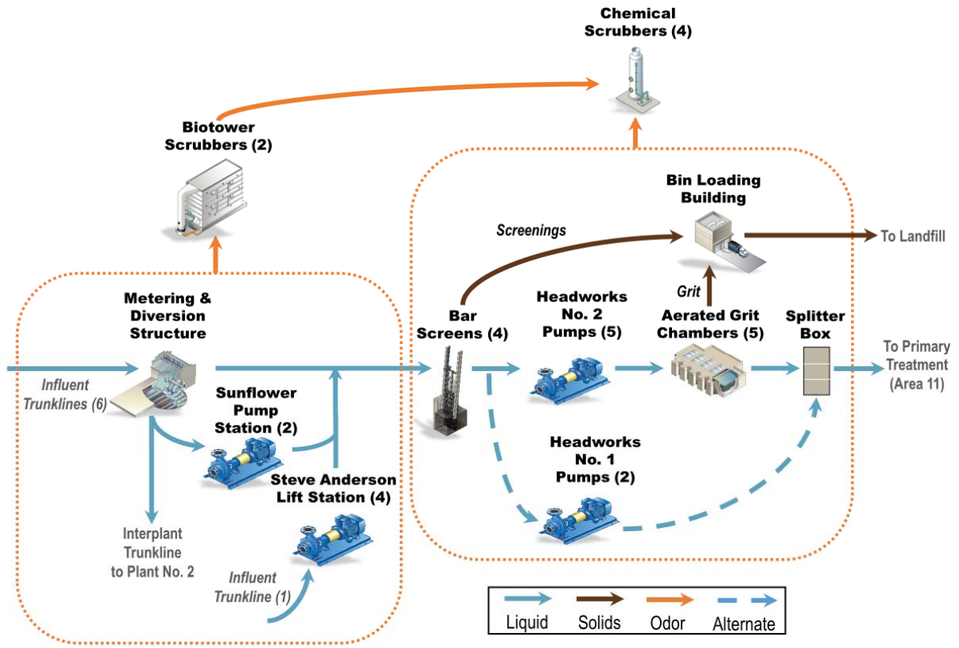
# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 10 – PLANT NO. 1 PRELIMINARY TREATMENT

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Metering & Diversion | Sunflower Pump Station | Steve Andersen Lift Station | Barscreens | Main Sewage Pumps | Grit Chamber | Splitter Box | Bin Loading | Odor Control |
|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | |
| Effluent Piping | - | - | - | - | - | - | 1 | - | - |
| **Structural** | | | | | | | | | |
| General | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| **Mechanical** | | | | | | | | | |
| Piping | 5 | - | 1 | - | 1 | - | - | - | - |
| Gates/Valves | 5 | 5 | 2 | 5 | 5 | 5 | 5 | - | 3 |
| Gearboxes | - | 2 | - | 1 | - | - | - | 4 | - |
| Screens | - | - | - | 4 | - | - | - | - | - |
| Pumps | - | 4 | 2 | - | 3 | - | - | - | 3 |
| Conveyors | - | - | - | 4 | - | - | - | 4 | - |
| Fans/Blowers | 4 | 3 | 1 | 5 | 5 | 5 | - | 5 | 5 |
| **Electrical** | | | | | | | | | |
| Operators | 5 | - | - | - | - | - | 5 | - | - |
| Motors | - | 3 | 3 | 2 | 5 | - | - | 5 | - |
| Variable Frequency Drives | - | - | 3 | - | 4 | - | - | - | 4 |
| Motor Control Centers | 5 | 5 | 2 | 5 | 5 | 5 | - | 5 | 5 |
| **Instrumentation** | | | | | | | | | |
| General | 4 | 4 | 3 | 4 | 4 | - | 4 | - | 5 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Metering & Diversion** | |
| Flowmeters | 7 |
| Gates | 26 |
| **Sunflower Pump Station** | |
| Screw Pumps | 2 |
| Motors | 2 |
| Gearboxes | 2 |
| Lube Oil Systems | 2 |
| Gates | 5 |

| Major Assets | Quantities |
|---|---|
| **Steve Anderson Lift Station** | |
| Pump/Motor/VFD | 4 |
| Flowmeter | 1 |
| **Barscreens** | |
| 5/8” Barscreens | 2 |
| 1” Barscreens | 2 |
| Gates | 22 |

| Major Assets | Quantities |
|---|---|
| **Main Sewage Pumps** | |
| Pump/Motor/VFD | 5 |
| Headworks #1 Pumps | 2 |
| Gates | 15 |
| **Splitter Box** | |
| Gates | 5 |
| Weir Gates | 15 |
| Flowmeters | 3 |

| Major Assets | Quantities |
|---|---|
| **Grit Chambers** | |
| Grit Chambers | 5 |
| Gates | 19 |
| Stop Plates | 10 |
| Flap Gates | 5 |
| Blowers | 3 |
| **Bin Loading** | |
| Paddle Conveyors | 2 |
| Belt Conveyor | 1 |

| Major Assets | Quantities |
|---|---|
| **Odor Control** | |
| Bioscrubbers | 2 |
| Chemical Scrubbers | 4 |

**Acronym Key:**

RUL = Remaining Useful Life;
VFD = Variable Frequency Drive

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 10 – PLANT NO. 1 PRELIMINARY TREATMENT

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **P1-105 Construction –** This project will rehabilitate most assets throughout the preliminary treatment area; however, the construction completion date is far in the future. Some assets have very little remaining life or have failed already and will need interim solutions before they are addressed by the project. | • Continue to actively monitor the condition of aging assets scheduled for repairs/replacement under P1-105 and develop temporary/minimal solutions as applicable until a permanent solution is provided by P1-105. In some instances, failed equipment may need to be replaced and removed from the P1-105 scope, but this approach should be minimized. |
| • **Foul Air Balance –** The foul air withdrawal system was found to be imbalanced with less air being pulled from the Headworks 2 area than designed. An air balance investigation is underway to resolve the issue that is likely caused by the newer equipment installed for Bioscrubbers 9 and 10 overpowering the aged equipment in the Headworks 2 area. | • Complete air balance investigation to determine what corrective actions can be taken to minimize the imbalance until P1-105 replaces the foul air system in this area. |
| • **Rags –** Rags have become an ongoing issue throughout the preliminary and primary process areas. The prevalence of rags is likely due to the rise in popularity of "flushable wipes". Rags passing the barscreens have caused failures and increased wear on various mechanical equipment. | • P1-105 will be replacing the existing 1-inch barscreens with 5/8-inch barscreens. This should reduce the number of rags passing the barscreens into the treatment process. |

## Current and Future Projects

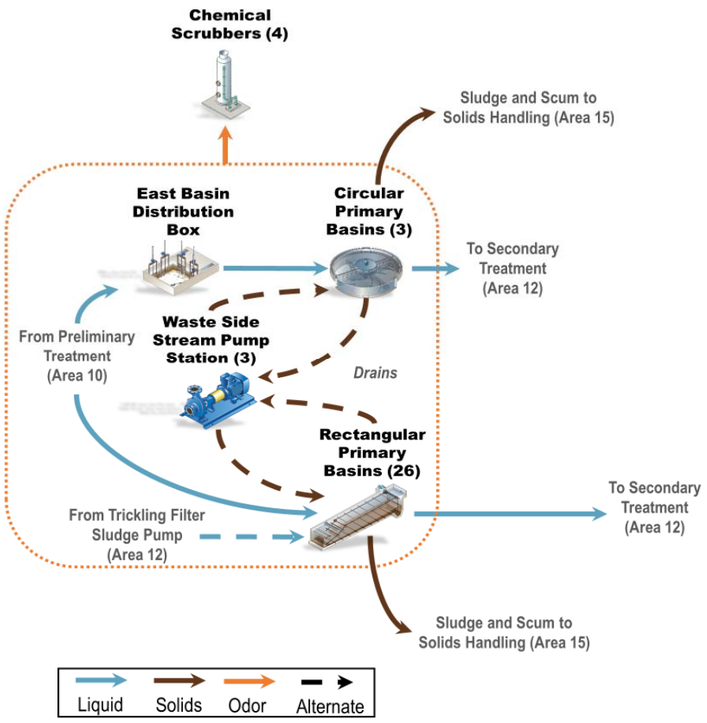
| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 | FY 34/35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P1-105** | Headworks Rehabilitation at Plant No. 1 | Metering & Diversion, Sunflower Pump Station, Barscreens, Main Sewage Pumps, Grit Chambers, Splitter Box, Bin Loading, Odor Control | • Rehabilitate structures of impacted facilities.<br>• Replace mechanical/electrical/instrumentation as-needed throughout impacted facilities.<br>• Improve grit handling. | | | | | | | | | | | | | | | |
| **FE19-04** | Sunflower Pump Station Repairs | Sunflower Pump Station | • Rehabilitate Sunflower Pump Station. | | | | | | | | | | | | | | | |
| **FE20-01** | Wastehauler Station Safety and Security Improvements | Wastehauler Station | • Install automatic samplers, RFID entrance system, and temporary office trailer. | | | | | | | | | | | | | | | |
| **FE18-11** | Headworks Explosive Gas Monitoring Systems at Plant No. 1 and No. 2 | Metering & Diversion, Odor Control | • Install Lower Explosive Limit monitoring system to detect explosive gas. | | | | | | | | | | | | | | | |
| **X-102** | Wastehauler Facility Improvements | Wastehauler Station | • Demolish abandoned wastehauler pump station and provide permanent building for staff. | | | | | | | | | | | | | | | |
| **X-044** | Steve Anderson Lift Station Rehabilitation | Steve Anderson Lift Station | • Rehabilitate mechanical, electrical, and instrumentation. | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** | **CIP – Design** | **CIP - Construction** | **Maintenance Project**

**Acronym Key:**
CIP = Capital Improvements Program;
RFID = Radio Frequency Identification; FY = Fiscal Year

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 11 – PLANT NO. 1 PRIMARY TREATMENT

## Process Schematic




Note: Primary Basins No. 1 and 2 are not shown. The facilities are available for emergency capacity during high flows and are scheduled to be demolished within the next 10 years.

## Major Assets Remaining Useful Life

| Asset Type | EBDB | PB 1 | PB 2 | PB 3 | PB 4 | PB 5 | WSSPS | PISB | Centerfeed Channels | PB 6-15 | PB 16-31 | Odor Control |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | | | | |
| Effluent Piping | 4 | 2 | 2 | 5 | 5 | 5 | 3 | - | - | 1 | 1 | - |
| **Structural** | | | | | | | | | | | | |
| Structures | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 2 | 3 | 2 | 2 |
| Cover | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | - |
| **Mechanical** | | | | | | | | | | | | |
| Piping | - | - | - | - | - | - | 3 | - | - | - | - | - |
| Gates/Valves | 3 | 5 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 2 |
| Sludge/Scum Collection System | - | 5 | 5 | 5 | 5 | 5 | - | - | - | 3 | 3 | - |
| Sludge Pumping System | - | 5 | 5 | 3 | 3 | 3 | - | - | - | 3 | 4 | - |
| Scum Pumping System | - | 5 | 5 | 3 | 3 | 3 | - | - | - | 4 | 4 | - |
| **Electrical** | | | | | | | | | | | | |
| General | 3 | 5 | 5 | 3 | 3 | 3 | 3 | 2 | - | 2 | 2 | 3 |
| **Instrumentation** | | | | | | | | | | | | |
| General | 3 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 5 |

**RUL Legend:**
**RUL <5 years** **RUL 5-10 years** **RUL 11-15 years** **RUL 16-20 years** **RUL >20 years**

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Rectangular Primary Basins** | |
| Basins | 26 |
| Thickened Sludge Pumps | 9 |
| Dilute Sludge Pumps | 4 |
| Dilute Sludge Sumps | 2 |
| Scum Pumps | 12 |
| Scum Pits | 6 |

| Major Assets | Quantities |
|---|---|
| **Circular Primary Basins** | |
| Basins[a] | 5 |
| Sludge Pumps | 4 |
| Scum Pumps | 3 |
| **Chemicals** | |
| Polymer Tanks | 4 |
| $FeCl_3$ Tanks | 1 |

[a] Primary basins No. 1 and 2 are included in this major asset category; they are rectangular in shape; however, process water is conveyed to them from the same source as the circular basins.

| Major Assets | Quantities |
|---|---|
| **Waste Sidestream Pump Station 1** | |
| Pumps | 3 |
| **Primary Odor Scrubber Complex** | |
| Chemical Scrubbers | 4 |
| HCl Tanks | 1 |
| HCl Pumps | 2 |
| NaOH Tanks | 1 |

| Major Assets | Quantities |
|---|---|
| NaOH Pumps | 5 |
| Bleach Tanks | 1 |
| Bleach Pumps | 8 |

**Acronym Key:**
EBDB: East Basin Distribution Box; $FeCl_3$= Ferric chloride; HCl= Hydrochloric acid; NaOH= Sodium hydroxide; PB = Primary Basin; PISB: Primary Influent Splitter Box; WSSPS: Waste Sidestream Pump Station

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 11 – PLANT NO. 1 PRIMARY TREATMENT

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Rectangular Primary Basin –** The rectangular primary basins experience relatively frequent issues that require maintenance. These issues require ongoing attention from maintenance and can affect Plant No. 1 treatment capacity. | • Several projects are planned to address rectangular primary basin issues and reliability including MP-462, P1-133, and X-017. However, these projects cannot make the rectangular basins maintenance free. OCSD should expect to dedicate a significant amount of maintenance and operations labor hours to these basins, especially during times when capacity is reduced by projects. Also, a planned Preventative Maintenance approach should be taken for continued maintenance on the mechanical parts within the basins after work is complete on MP-462. |
| • **Construction Sequencing –** There are many upcoming projects that will perform work on the Plant No. 1 primary treatment system. These projects are largely interdependent on one another and will temporarily impact the primary capacity at Plant No. 1. | • Continue to holistically assess the capacity/treatment consequences of the upcoming projects, especially if schedules change during design and construction. |
| • **Hydrogen Sulfide (H2S) Analyzer Plan –** The foul air scrubbers in the primary treatment area require continuous H2S monitoring by permit. The existing H2S technology is unreliable and requires attention from operations and maintenance. | • Develop a long-term H2S monitoring plan that could include testing of new equipment or exploring options to amend the permit to remove the continuous monitoring requirement. |
| • **GWRS Final Expansion –** The final expansion of OCWD's GWRS system is expected to be complete in 2023 and will produce 130 MGD of purified recycled water. This will require OCSD to provide more flow to OCWD. | • OCSD is executing several projects to prepare for the GWRS Final Expansion. The most directly applicable is P2-122, which will provide additional flow to OCWD from Plant No. 2 while also increasing OCSD's flexibility to route flows between Plant No. 1 and Plant No. 2. The optimization of flow routing will be an ongoing consideration for OCSD operations and should be periodically re-evaluated as operating conditions change. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRN-00563** | P1-33/37 Scum Study | Primary Basins 6-31 | • Perform a study to determine the best solution to the various scums system issues, such as issues for the scum pumping system. | | | | | | | | | | | | | | | |
| **MP-462** | Primary Basin Sludge Collections System Rehabilitation at Plant No. 1 (Phase 3) | Primary Basins 6-15 | • Replace mechanical parts in 9 rectangular basins. This is Phase 3 of a three-phased approach for the scum/sludge collection system. | | | | | | | | | | | | | | | |
| **PRN-00567** | Plant No. 1 Primary Basin Rebar Protection Blanket Contract | Primary Basins 6-15 | • Repair protect exposed rebar. | | | | | | | | | | | | | | | |
| **FE19-11** | Primary Clarifiers Nos. 6-31 Lighting and Alarm Improvements at Plant No. 1 | Primary Basins 6-31 | • Provide adequate lighting and ventilation alarm improvements to meet current codes. | | | | | | | | | | | | | | | |
| **P1-133** | Primary Sedimentation Basins No. 6-31 Reliability Improvements at Plant No. 1 | Primary Basins 6-31 | • Upgrade the sludge pumping system. Structural repair of launders in PISB. Repair of foul air system. | | | | | | | | | | | | | | | |
| **P1-126** | Primary Clarifiers Replacements and Improvements at Plant No. 1 | Primary Basins 3, 4, and 5 | • Replace Primary Basins 3, 4, and 5. Rehabilitate associated conveyance pipes and structures. Demolish Primary Basins 1-2. | | | | | | | | | | | | | | | |
| **X-017** | Plant No. 1 Primary Clarifiers 6-37 Rehabilitation | Primary Basins 6-31 | • Major rehabilitation of Primary Basins 6-31. | | | | | | | | | | | | | | | |
| **X-079** | Primary Scrubber Rehabilitation Project at Plant No. 1 | Odor Control | • Replace the Plant No. 1 primary basin air scrubbing system. | | | | | | | | | | | | | | | |
| **X-006** | Waste Sidestream Pump Station Upgrade | Waste Sidestream Pump Station | • Pump station rehabilitation and capacity increase. | | | | | | | | | | | | | | | |

**Types of Project Legend:**

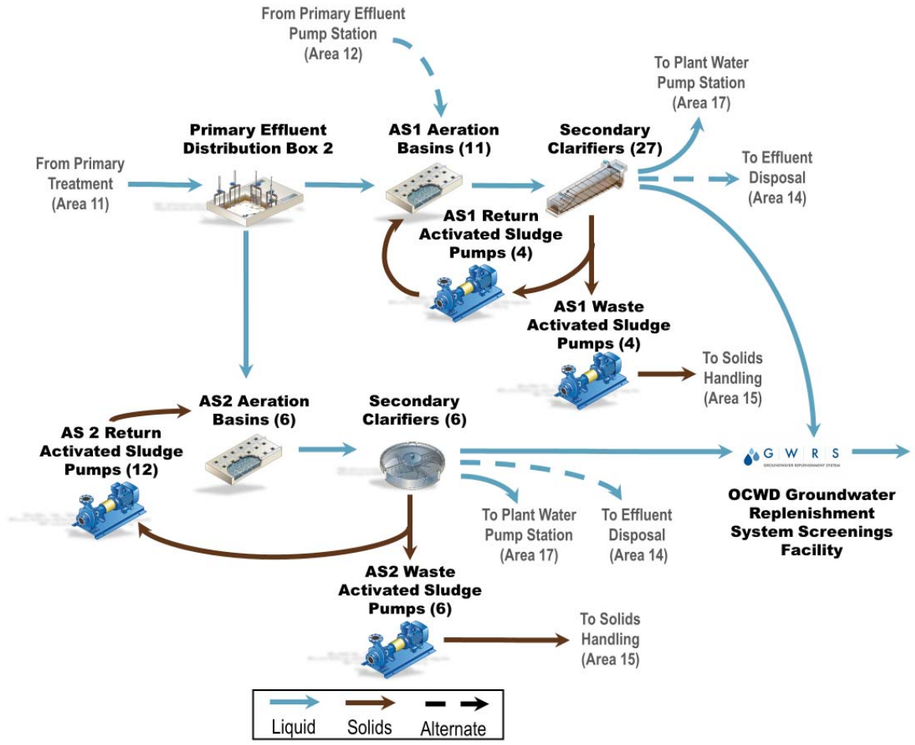
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP = Capital Improvements Program; FY = Fiscal Year; GWRS = Groundwater Replenishment System; MGD = Million Gallons per Day; OCSD = Orange County Sanitation District; OCWD = Orange County Water District; PISB = Primary Influent Splitter Box

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 12 – PLANT NO. 1 SECONDARY TREATMENT – ACTIVATED SLUDGE

## Process Schematic




## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Activated Sludge Plant No. 1 – AS1 is an aging facility.** | • Corrosion assessment in 2016 showed several locations of corrosion on the wall between reactors and steel re-bar support chairs missing. Baffle wall supports and vertical airpipes were damaged on some of the basins and are monitored on remaining basins.<br>• RAS piping has severe corrosion and will be replaced by FE20-03.<br>• Instrumentation is monitoring and replacing the equipment as needed. |
| • **Activated Sludge Basins Diffusers** | • Diffusers for activated sludge plants will be replaced in-house by Maintenance. |
| • **Primary Effluent Distribution Box 1** | • Will be demolished by P1-126. |
| • **Primary Effluent Pump Station** | • PEPS Pump 1 will be repaired in 2020 and the pump station will be demolished by a future project (P1-126). |

## Major Assets Remaining Useful Life

| Asset Type | PEDB1 | PEPS | Blower Building 1 | AS1 Aeration Basins | AS1 Clarifiers | AS1 RAS PS | AS1 WAS | AS2 PEPS 2 | AS2 Blowers | AS2 Aeration Basins | AS2 Clarifiers | AS2 RAS /WAS PS | WSSPS 2 | PEPS 2 | PEDB2 | AS1 & AS2 Junction Boxes | DAFTs | DAFTs Polymer System |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | | | | | | | | | | |
| Effluent Piping | 4 | - | 3 | 3 | 3 | 5 | - | - | - | - | - | - | - | 1 | 1 | 1 | 4 | - |
| **Structural** | | | | | | | | | | | | | | | | | | |
| Buildings | - | 2 | 2 | - | - | 2 | - | - | 1 | - | - | - | - | - | - | - | 4 | - |
| Structures | 4 | 3 | - | 2 | 3 | - | - | 1 | - | 1 | 1 | - | 1 | 1 | 1 | 1 | 4 | - |
| **Mechanical** | | | | | | | | | | | | | | | | | | |
| Piping | - | 3 | 2 | 3 | 3 | 5 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | 4 | 4 |
| Pumps | - | 5 | - | - | - | 3 | 3 | - | - | - | - | 3 | 3 | - | - | - | 5 | 5 |
| Diffusers | - | - | - | 4 | - | - | - | - | - | 4 | - | - | - | - | - | - | - | - |
| Mixers | - | - | - | 3 | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - |
| Clarifier/DAFT Moving Mechanism | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | 4 | - |
| Blowers | - | - | 3 | - | - | - | - | | 2 | - | - | - | - | - | - | - | - | - |
| Drain Gates & Inlet Gates | 4 | - | - | 3 | 3 | - | - | - | - | 2 | 2 | - | - | 1 | 2 | - | - | - |
| HVAC & Ventilation | - | 3 | | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - |
| Chemical/polymer Facility | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| **Electrical** | | | | | | | | | | | | | | | | | | |
| Variable Frequency Drives | - | 2 | - | 2 | 2 | 2 | 2 | - | - | 4 | 4 | 4 | 4 | - | - | - | 2 | 2 |
| Motor Control Centers | - | 4 | - | 4 | 4 | 4 | 4 | - | - | 2 | 2 | 2 | 2 | - | - | - | 3 | 3 |
| **Instrumentation-** | | | | | | | | | | | | | | | | | | |
| PLCs, Flow Meters | - | 5 | 5 | 5 | 5 | 5 | 5 | - | 2 | 2 | 2 | 2 | 2 | - | - | - | 5 | 5 |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

**Acronym Key:**
AS1 = Activated Sludge Plant No. 1; AS2 = Activated Sludge Plant No. 2; DAFT = Dissolved Air Flotation Thickener; HVAC=Heating, Ventilation, and Air Conditioning; OCWD=Orange County Water District; PEDB1 = Primary Effluent Distribution Box 1; PEDB2 = Primary Effluent Distribution Box 2; PEPS = Primary Effluent Pump Station; PEPS 2 =Primary Effluent Pump Station 2; PLC = Programmable Logic Controller; PS= Pump Station; RAS = Return Activated Sludge; RUL=Remaining Useful Life; WAS = Waste Activated Sludge; WSSPS2=Waste Sidestream Pump Station 2

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 12 – PLANT NO. 1 SECONDARY TREATMENT – ACTIVATED SLUDGE

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Primary Effluent Pump Station** | |
| Building | 1 |
| Wetwell | 1 |
| Pumps | 2 |
| Discharge Valves | 3 |
| **AS1 Aeration Basins** | |
| Aeration Basins | 10 |
| Inlet gates | 10 |
| **AS1 Blower Building 1** | |
| Blower Building | 1 |
| Blowers | 5 |

| Major Assets | Quantities |
|---|---|
| **AS1 Secondary Clarifiers** | |
| Secondary Clarifiers | 26 |
| Inlet gates | 78 |
| Sludge collectors | 52 |
| **AS1 RAS PS / WAS PS** | |
| RAS PS Building | 1 |
| RAS Pumps | 5 |
| WAS Pumps | 4 |
| **Primary Effluent Pump Station 2** | |
| Structure | 1 |
| Gate | 1 |

| Major Assets | Quantities |
|---|---|
| **AS2 Aeration Basins** | |
| Aeration Basins | 6 |
| Inlet gates | 6 |
| **AS2 Blower Building 2** | |
| Blower Building | 1 |
| Blowers | 4 |
| **AS2 Secondary Clarifiers** | |
| Secondary Clarifiers | 6 |
| Sludge collectors | 6 |
| **AS2 RAS PS / WAS PS** | |
| RAS Pumps | 12 |
| WAS Pumps | 6 |
| Surface Wasting Pumps | 6 |
| Scum Pumps | 6 |

| Major Assets | Quantities |
|---|---|
| **Waste Side Stream Pump Station 2** | |
| Pumps | 2 |
| Structure | 1 |
| **Primary Effluent Distribution Box 1** | |
| Structure | 1 |
| Gates | 1 |
| **Primary Effluent Distribution Box 2** | |
| Structure | 1 |
| Gates | 11 |
| **AS1 and AS2 Junction Boxes** | |
| Junction Box Structures | 8 |

| Major Assets | Quantities |
|---|---|
| **Dissolved Air Flotation Thickeners** | |
| Concrete Tanks | 6 |
| Mechanical Sweep | 6 |
| Recycle Pumps | 12 |
| Retention Tank | 6 |
| TWAS Pumps | 12 |
| **DAFTs Polymer System** | |
| Storage Tank | 2 |
| Mix Tank | 2 |
| Polymer Transfer Pumps | 2 |
| Feed Pumps | 6 |

**Acronym Key:**
AS1 = Activated Sludge Plant No. 1; AS2 = Activated Sludge Plant No. 2; DAFT = Dissolved Air Flotation Thickeners;
PEPS = Primary Effluent Pump Station; PS=Pump Station; RAS = Return Activated Sludge; WAS = Waste Activated Sludge;
TWAS = Thickened Waste Activated Sludge

## ASSET MANAGEMENT SYSTEM SUMMARY – AREA 12 – PLANT NO. 1 SECONDARY TREATMENT – ACTIVATED SLUDGE

### Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRN-00516** | PEPS Pump #1 Mechanical Repair | PEPS | • Repair of PEPS Pump #1. | | | | | | | | | | | | | | | | |
| **PRN-00478** | Plant No. 1 AS2 Clarifier #31 Catwalk - Coatings | AS2 Clarifier #31 | • Coating repair. | | | | | | | | | | | | | | | | |
| **PRN-00375** | Plant No. 1 AS2 blower silencer piping modification | AS2 blowers | • Provide access to service the blowers. | | | | | | | | | | | | | | | | |
| **PRN-00698** | Plant No. 1 activated sludge WAS pump replacement | AS1 WAS Pumps | • Replace 4 WAS pumps. | | | | | | | | | | | | | | | | |
| **MP-395** | AS1 Influent gate assessment and repair | AS1 Basins 3, 4, 5, 6 | • Modify the AS1 Basins 3 to 6 influent gates. | | | | | | | | | | | | | | | | |
| **P1-129** | Return Activated Sludge Piping Replacement at AS1 | AS1 RAS Pipes | • Replace the RAS pipes from the RAS pumps to the basins. | | | | | | | | | | | | | | | | |
| **FE20-03** | Return Activated Sludge Discharge Piping Replacement at Activated Sludge Plant No. 1 | AS1 RAS Pipe Discharge | • Replace the RAS discharge pipe located in Basins 3 and 8. | | | | | | | | | | | | | | | | |
| **X-113** | Blower Building 1 and Power Building 2 Power Connectors | Blower Building 1 | • Connect Blower Building 1 and Power Building 2 to the new centralized standby power building under P1-105 construction. | | | | | | | | | | | | | | | | |
| **X-043** | DAFT Demolition at Plant No. 1 | DAFTS | • Demolish DAFTS since the new thickening centrifuges are in service and DAFT is no longer needed. | | | | | | | | | | | | | | | | |
| **X-048** | AS1 Aeration Basin and Blower Rehabilitation | AS1 Aeration Basin and Blower | • Major rehabilitation of the basins and blowers. | | | | | | | | | | | | | | | | |
| **X-049** | AS1 Clarifier and RAS PS Rehabilitation at Plant No. 1 | AS1 Clarifier and RAS PS | • Major rehabilitation of the clarifiers and RAS pump station. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**
AS1 = Activated Sludge Plant No. 1; AS2 = Activated Sludge Plant No. 2; CIP=Capital Improvement Program; FY=Fiscal Year; DAFT = Dissolved Air Flotation Thickeners; PEPS = Primary Effluent Pump Station; PS=Pump Station; RAS = Return Activated Sludge; WAS = Waste Activated Sludge; TWAS = Thickened Waste Activated Sludge

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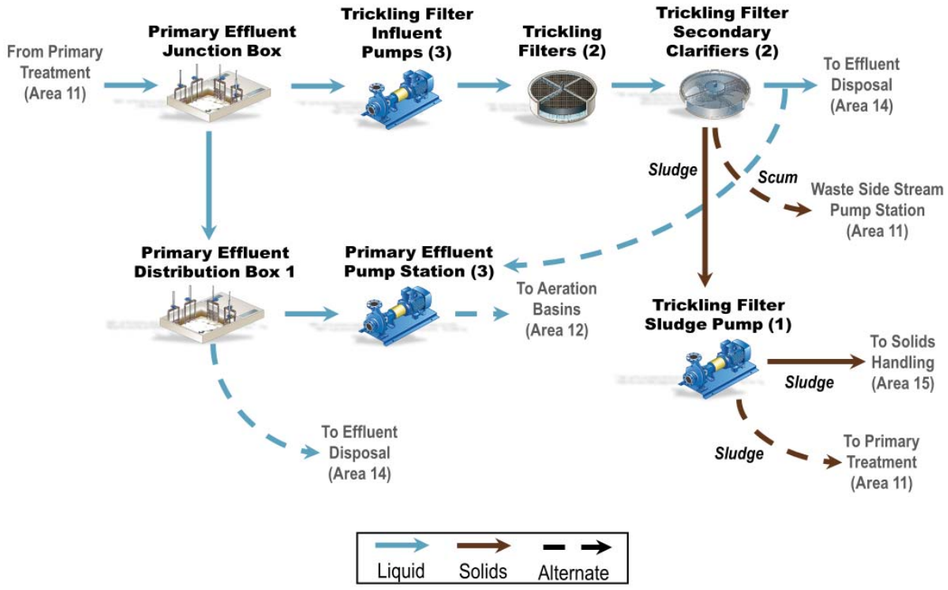
# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 12 – PLANT NO. 1 SECONDARY TREATMENT – TRICKLING FILTERS

## Process Schematic




## Major Assets

| Major Assets | Quantities |
|---|---|
| **Trickling Filter Pump Station** | |
| Structure | 1 |
| Trickling Filter Pumps | 3 |
| **Trickling Filters** | |
| Trickling Filter Basins | 2 |
| Rotary Distributor | 2 |
| Recirculation Fans | 8 |
| **Secondary Clarifiers** | |
| Circular Clarifiers | 2 |
| Sludge Collector | 2 |
| **Junction Boxes** | |
| Structure | 6 |

## Major Assets Remaining Useful Life

| Asset Type | Trickling Filter Pump Station | Trickling Filters | Secondary Clarifiers | Junction Boxes |
|---|---|---|---|---|
| **Civil** | | | | |
| Effluent Piping | 1 | 1 | 1 | 1 |
| **Structural** | | | | |
| Buildings | - | 1 | 1 | - |
| Structures | 1 | 1 | 1 | 1 |
| **Mechanical** | | | | |
| Piping | 2 | 2 | 2 | 2 |
| Pumps | 3 | - | 3 | - |
| Distributor Drive | - | 3 | - | - |
| Ventilation Fans | - | 3 | - | - |
| Trickling Filter Media | - | 4 | - | - |
| Clarifier Moving Mechanism | - | - | 3 | - |
| Valves, Gates | - | - | - | 2 |
| **Electrical** | | | | |
| Motor Control Centers | 3 | 3 | 3 | - |
| Variable Frequency Drives | 5 | 3 | 5 | - |
| **Instrumentation** | | | | |
| PLCs & Flow Meters | 3 | 3 | 3 | - |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

PLC = Programmable Logic Controller;

RUL = Remaining Useful Life

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 12 – PLANT NO. 1 SECONDARY TREATMENT – TRICKLING FILTERS

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Trickling Filter Sludge Pumps** – Currently, only one sludge pump is in service. | • Project FE19-03 will replace the trickling filter's sludge pump with two sludge pump and remove the scum pumps. |
| • **Trickling Filter Influent Pumps** – VFDs are obsolete and need to be replaced. Replacement parts are not available. | • Clearinghouse approved the replacement of the VFDs (PRN-00492) and adding a second source of power from SWGR-TFB bus to Drive #1. |
| • **Electrical** – Low voltage cable failure. | • Several damaged cables were replaced by Maintenance in the past, and Clearinghouse approved a project to assess the remaining low voltage cables and replace the damaged cables. (PRN-00409). FE19-03 will add new cables for the pumps. |

## Current and Future Projects

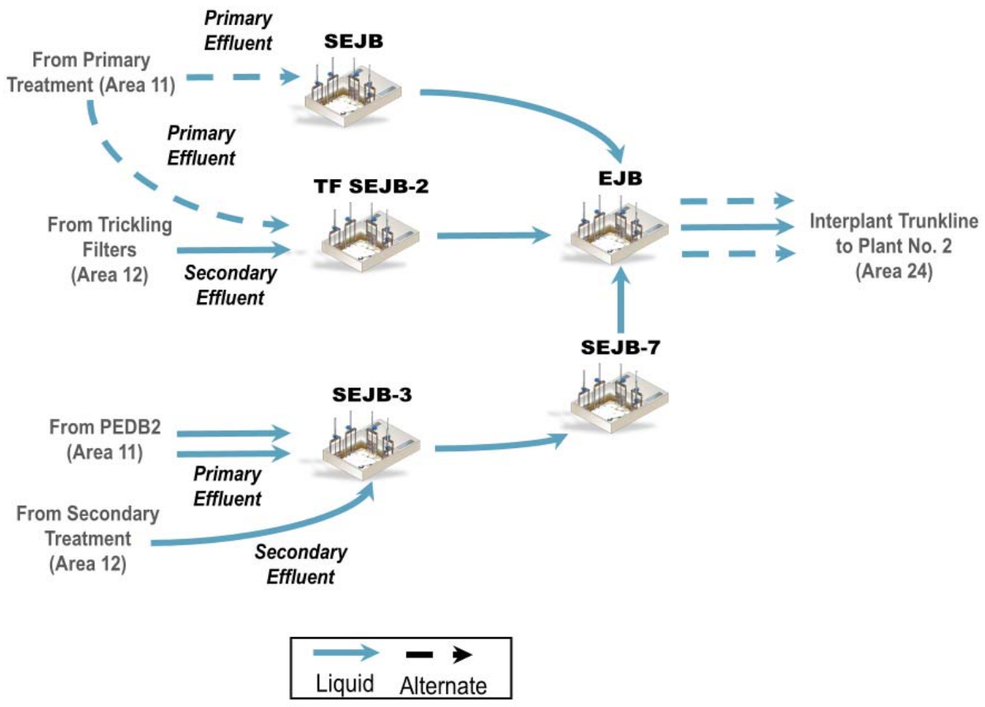
| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 | FY 34/35 | FY 35/36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE19-03** | FE19-03 Trickling Filter Sludge and Scum Pumps Replacement at Plant No. 1 | Sludge pumping | • Replace the sludge pump with two new pumps and remove 3 scum pumps. | | | | | | | | | | | | | | | | |
| **PRN-00414** | Snail Control at Plant No. 1 Trickling Filters | Trickling Filters | • Install permanent caustic dosing pumps and pipes to dose caustic to the Trickling Filters. Currently, Operations is using caustic totes. | | | | | | | | | | | | | | | | |
| **PRN-00492** | Plant No. 1 Trickling Filter Pumps VFD replacement (3 pumps) | Trickling Filters Pump Station | • Replace the obsolete VFDs on the Trickling Filter influent pumps. | | | | | | | | | | | | | | | | |
| **FR1-0008 PRN-00409** | Low Voltage Cable Assessment | Low voltage cables from Power Building 8 to the Trickling Filters | • Assess and replace the damaged cables. | | | | | | | | | | | | | | | | |
| **X-015** | Trickling Filters Facilities Rehabilitation at Plant No. 1 | Major rehabilitation project | • Replace the Trickling Filter Feed Pumps, distribution arms and media, and secondary clarifier mechanisms. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**
CIP = Capital Improvements Program; FY= Fiscal Year; VFD = Variable Frequency Drive

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 14 - PLANT NO. 1 INTERPLANT

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Plant No. 1 Facility | | | | | | | | | | Santa Ana Corridor | | | | Brookhurst Corridor | Ellis/Bushard Corridor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EJB | TFSEJB-2 | SEJB | SEJB3 | SEJB7 | PEJB1 | SEJB2 | 66" PE/SE | 84" PE/SE | 108" PE/SE | 66" PE/SE | 84" PE/SE | 120" PE/SE | 16" Gas | | |
| **Civil** | | | | | | | | | | | | | | | | |
| Pipeline | - | - | - | - | - | - | - | 4 | 3 | 3 | 4 | 1 | 1 | - | 1 | - |
| Gas | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **Structural** | | | | | | | | | | | | | | | | |
| Structure | 1 | 1 | 3 | 2 | 1 | 4 | 1 | - | - | - | - | - | - | - | - | - |
| **Mechanical** | | | | | | | | | | | | | | | | |
| Sluice Gates | 2 | - | - | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Butterfly Valves | 5 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Electrical** | | | | | | | | | | | | | | | | |
| Fiber Optic | - | | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 2 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

EJB = Effluent Junction Box; PE = Primary Effluent; PEDB2 = Primary Effluent Distribution Box 2; PEJB1 = Primary Effluent Junction Box 1; RUL= Remaining Useful Life; SE = Secondary Effluent; SEJB = Secondary Effluent Junction Box; SEJB2 = Secondary Effluent Junction Box 2; SEJB3 = Secondary Effluent Junction Box 3; SEJB7 = Secondary Effluent Junction Box 7; TFSEJB-2 = Trickling Filter Secondary Effluent Junction Box 2

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Plant No. 1 Facility** | |
| Junction Boxes | 6 |
| Gates | 17 |
| Butterfly Valves | 7 |
| Large Diameter Piping | 4 |

| Major Assets | Quantities |
|---|---|
| **Santa Ana Corridor** | |
| Large Diameter Piping | 3 |
| Fiber Optic Communication | 1 |
| Digester Gas Piping | 1 |

| Major Assets | Quantities |
|---|---|
| **Brookhurst Corridor** | |
| Large Diameter Piping | 1 |
| **Ellis/Bushard Corridor** | |
| Fiber Optic Communication | 1 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 14 – PLANT NO. 1 INTERPLANT

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • Exposed piping, valves, and supports in EJB have been submerged and exhibit significant corrosion based on March 2019 condition assessment. | • Coating Repair Project CTO-0018 will repair failed coatings. |
| • PEJB-1 and 66” and 84” pipelines between PEJB-1 and EJB are reaching the end of their useful life and some of these assets have not been assessed in the past 10 years. | • Complete condition assessment of PEJB-1 and CCTV of 66” and 84” pipelines within Plant No. 1. |
| • Soil Erosion along the Santa Ana River. | • Project MP-657 installed temporary erosion control and project FE18-12 will provide a permanent solution. |
| • Surface corrosion in vaults with 2-inch blow off valves on the interplant gas line. | • Project FRJ-0003 will repair coatings to the piping and valves in the vaults and install permanent drainage facilities to prevent future corrosion. |

## Current and Future Projects

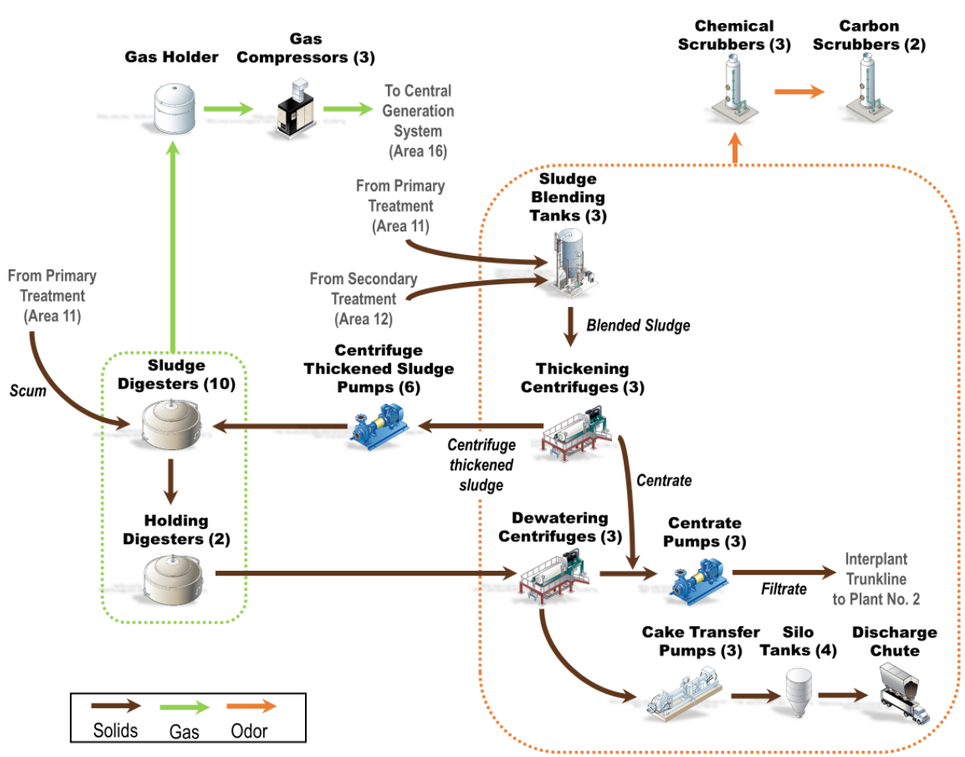
| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 | FY 34/35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **J-117A** | Interplant Effluent Pipeline Rehabilitation (Warranty) | 66” PE | • Perform warranty inspection of rehabilitated pipelines. | | | | | | | | | | | | | | | |
| **GWRS** | GWRS Pump Station | 66” PE | • Install new OCWD force main within existing 66” interplant pipe. | | | | | | | | | | | | | | | |
| **CTO-0018** | EJB Coating Repairs | EJB | • Replace and recoat various piping and supports. | | | | | | | | | | | | | | | |
| **MP-657** | Santa Ana River Erosion Control | Interplant Piping | • Correct existing earthen slope above the interplant pipes. | | | | | | | | | | | | | | | |
| **FE18-12** | Erosion Control at Santa Ana River and Hamilton | Interplant Piping | • Permanent erosion control of earthen slope above the interplant pipes. | | | | | | | | | | | | | | | |
| **X-XXX** | PEJB-1 & Piping Rehabilitation | PEJB-1 | • Rehabilitate the existing junction structure and associated piping. | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**
CIP = Capital Improvement Program; EJB = Effluent Junction Box; FY = Fiscal Year; GWRS = Groundwater Replenishment Program; OCWD = Orange County Water District; PE = Primary Effluent; PEJB = Primary Effluent Junction Box; SE = Secondary Effluent

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 15 – PLANT NO. 1 SOLIDS HANDLING – DIGESTERS

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Digester 5 | Digester 6 | Digester 7 | Digester 8 | Digester 9 | Digester 10 | Digester 11 | Digester 12 | Digester 13 | Digester 14 | Digester 15 | Digester 16 | Ferric System |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | | | | | |
| Effluent Piping | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Structural** | | | | | | | | | | | | | |
| Digester | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| **Mechanical** | | | | | | | | | | | | | |
| Piping | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4 |
| Chemical Pumps | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Ferric Control System | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Sludge Mixing Pumps | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - |
| Sludge Recirculation & Heating System | - | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - |
| Hot Water System | - | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - |
| Sludge Transfer Pumps | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | | - |
| **Electrical** | | | | | | | | | | | | | |
| Motor Control Centers | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Instrumentation** | | | | | | | | | | | | | |
| PLCs & Flow Meters | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**
PLC = Programmable Logic Controller;
RUL = Remaining Useful Life

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Anaerobic Digesters** | |
| Digesters (7-16) | 10 |
| Holding Digesters (5 & 6) | 2 |
| Sludge Mixing Pumps | 22 |
| Grinders | 10+3 |
| Sludge Recirculation Pumps | 10 |

| Major Assets | Quantities |
|---|---|
| **Anaerobic Digesters (Continued)** | |
| Hot Water Circulation Pumps | 10 |
| Heat Exchangers | 10 |
| Bottom Sludge Pumps | 5 |
| Digesters Transfer Pumps | 3 |
| **Ferric System** | |
| Storage Tanks | 2 |
| Feed Pumps | 2 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 15 – PLANT NO. 1 SOLIDS HANDLING – DIGESTERS

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **High Rate Mixing Pumps mechanical seals failure** – The high rate mixing pumps are experiencing higher than expected failures of the mechanical seals. | • There are several efforts by Maintenance and Engineering to reduce the failure rate including precision alignment of the pumps, studying sludge piping supports (PS19-01), and monitoring the vibrations. PS19-01 recommends adding expansion joints to the discharge of the pumps and pipe supports. |
| • **Structures** – Seismic risk. | • The PS15-06 Seismic Evaluation of Structures at Plant No. 1 and Plant No. 2 has identified lateral Spreading as the main seismic risk for the digesters. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P1-135** | Digester Ferric Chloride Piping Replacement at Plant No. 1 | Digesters, ferric dosing system | • This project will replace the digester ferric chloride piping, valves, and appurtenances to its point of connection with the digesters. | | | | | | | | | | | | | | | | |
| **PRN-00540** | Plant No. 1 digester 9 and 10 Pump Work Platform Replacement | Digesters 9 and 10 mixing pumps | • Add access platforms for maintenance activities. | | | | | | | | | | | | | | | | |
| **PRN- 00496** | Plant No. 1 Digesters 8 and 11 Area Lighting Installation | Digesters 8 and 11 | • Relocate existing warehouse. | | | | | | | | | | | | | | | | |
| **MP- 588** | Digester 7 and 8 Sludge Pipeline Improvements | Digester 7 and 8 sludge pipes | • Add flexibility in transferring sludge. | | | | | | | | | | | | | | | | |
| **MP- 610** | CP-DIG LEL Area Safety Monitoring Obsolescence | The LEL monitoring system in Digester 11 to 16 pump room and tunnels | • Upgrade the LEL monitors. | | | | | | | | | | | | | | | | |
| **RE20-04** | Holding Digester 6 Solids Shredder Trial | Holding Digester Mixing Pumps | • Reduce plugging. | | | | | | | | | | | | | | | | |
| **PRN-00613** | Add Plug Valves to Holding Digester Overflow Box | Holding Digester 5 & 6 Overflow | • Add plug valves will eliminate digester gas from overflow box. | | | | | | | | | | | | | | | | |
| **N/A** | Digester Cleaning | Ongoing maintenance activity | • Clean the digesters and performing preventive condition assessment every 5 to 7 years. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

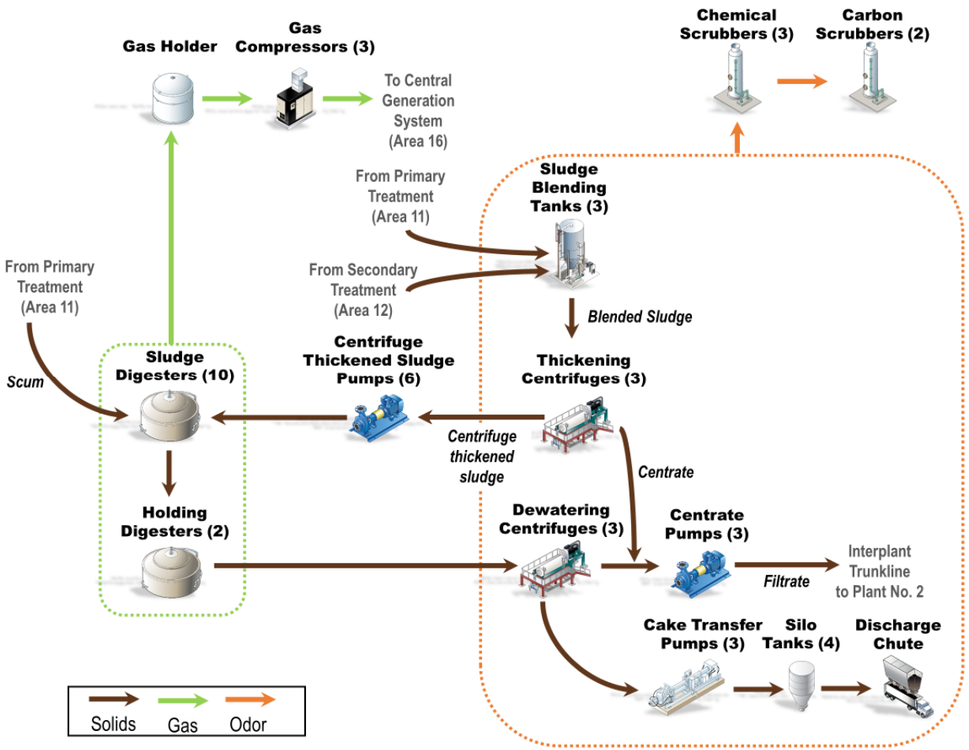
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; CP=Control Panel; DIG=Digester; FY=Fiscal Year;
LEL= Lower Explosive Level; N/A=Not Applicable

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 15 – PLANT NO. 1 SOLIDS HANDLING – FACILITIES

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Boiler System | Sludge Blending Facility | Thickening System | Dewatering System | Dewatering Odor Control | Truck Loading | Gas Handling | Gas Holder |
|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | |
| Effluent Piping | - | 1 | 1 | 1 | - | 1 | 3 | 3 |
| **Structural** | | | | | | | | |
| Structures | - | 1 | - | - | - | 1 | - | 3 |
| Buildings | - | - | 1 | 1 | - | 1 | 2 | - |
| **Mechanical** | | | | | | | | |
| Piping | 1 | - | 1 | 1 | 1 | 1 | 3 | - |
| Pumps-grinders | - | 1 | 1 | 1 | 1 | 1 | - | - |
| Boilers & Heat Exchangers | 2 | - | - | - | - | - | - | - |
| Centrifuges | - | - | 2 | 2 | - | - | - | - |
| Carbon Unit | - | - | - | - | 1 | - | - | - |
| Chemical/polymer System | - | - | 1 | 1 | 1 | - | - | - |
| Gas Compressors | - | - | - | - | - | - | 4 | - |
| Gas Dryer | - | - | - | - | - | - | 5 | - |
| Gas Flares | - | - | - | - | - | - | 4 | - |
| Silo Cake Conveyors | - | - | - | - | - | 1 | - | - |
| Silo Sliding Frames | - | - | - | - | - | 1 | - | - |
| **Electrical** | | | | | | | | |
| Variable Frequency Drives | - | 2 | 4 | 4 | - | 2 | - | - |
| Motor Control Centers | 2 | 1 | 1 | 1 | 1 | 1 | 4 | - |
| **Instrumentation** | | | | | | | | |
| PLCs & Flow Meters | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**
RUL= Remaining Useful Life;
PLC=Programmable Logic Controller

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 15 – PLANT NO. 1 SOLIDS HANDLING – FACILITIES

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Thickening System** | |
| Sludge Blending Tanks | 3 |
| Thickening Grinders | 3 |
| Centrifuge Feed Pumps | 3 |
| Thickening Centrifuges | 3 |
| Thickened Sludge Wet Wells | 3 |
| Thickened Sludge Pumps | 6 |

| Major Assets | Quantities |
|---|---|
| **Thickening System (Continued)** | |
| Centrate Wetwell | 1 |
| Centrate Pumps | 3 |
| **Chemical Equipment** | |
| Thickening Polymer Feed Pumps | 3 |
| Dewatering Polymer Feed Pumps | 3 |

| Major Assets | Quantities |
|---|---|
| **Chemical Equipment (Continued)** | |
| Polymer Mixing/Aging Tank | 6 |
| Polymer Make-Down Unit | 4 |
| **Dewatering System** | |
| Dewatering Grinders | 2 |
| Centrifuge Feed Pumps | 3 |
| Dewatering Centrifuges | 3 |
| Cake Transfer Pumps | 3 |

| Major Assets | Quantities |
|---|---|
| **Dewatering Odor Control** | |
| 3-Stage Packed Tower Scrubbers | 3 |
| Carbon Media | 2 |
| **Truck Loading** | |
| Cake Storage Silos | 4 |
| Cake Silo Transfer Pumps | 4 |
| Stand-by Truck Loading Bay | 1 |

| Major Assets | Quantities |
|---|---|
| **Gas Handling** | |
| Low Pressure Gas Holder | 1 |
| Gas Compressors | 3 |
| Gas Dryer | 1 |
| Gas Flares | 3 |
| Boiler | 1 |

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Maintainability of the Equipment** – There are several improvements that are needed for Thickening and Dewatering Area including lighting improvement, equipment access for maintenance, instrument air and power access and improving drains. | • Most of the improvements will be done by Maintenance.<br>• PRN-00505 small project for safety improvements.<br>• PRN-00540 small project regarding equipment access and platform installation. |
| • **Gas Handling System** – Gas compressor system is aging and needs replacement of major units. | • J-124 – Digester Gas Facilities rehabilitation in<br>• Gas compressors repair and gas compressor overhaul by Maintenance. |
| • **Gas Dryer** – Out of service. Currently, gas goes through a heat exchanger and condensate drop out. | • The gas dryer refrigerator system will be replaced by J-124 Project. |
| • **Boiler main control system is obsolete.** | • Replacement will be evaluated. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **J-124** | Digester Gas Facilities Rehabilitation | Gas compressors, dryers, and flares | • Replace the entire gas handling system including the gas compressor building. | | | | | | | | | | | | | | | | |
| **FE18-16** | New Floor and Equipment Drains for the Truckloading Basement | Truckloading Facility | • Improve the drainage in the basement. | | | | | | | | | | | | | | | | |
| **RE20-01** | CTS Sludge Density Meter Evaluation | Thickening centrifuges | • Evaluate two density meters. | | | | | | | | | | | | | | | | |
| **FE 16-06** | Fuel Cell Facilities Demolition | None | • Demolish concrete pads, pavement, and buried utilities. | | | | | | | | | | | | | | | | |
| **PRN-00505** | Safety Improvements at the Thickening and Dewatering Building | Thickening and Dewatering Building | • Improve safety outside of the thickening and dewatering building. | | | | | | | | | | | | | | | | |
| **PRN-00540** | Truckloading and silo's slide frame conveyor motor platform | Truckloading slide frame | • Improve access to the equipment for maintenance activities. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

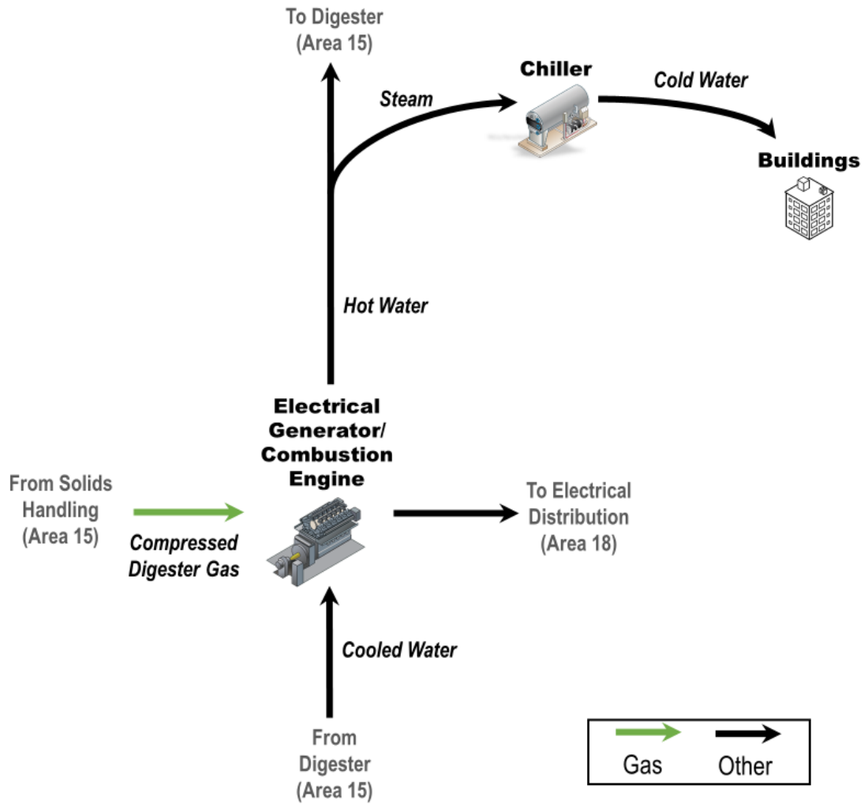
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 16 – PLANT NO. 1 CENTRAL GENERATION

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Engine Generator #1 | Engine Generator #2 | Engine Generator #3 | Absorption Chiller #1 | Absorption Chiller #2 | Deaerator Vessel | Heat Recovery Boiler #1 | Heat Recovery Boiler #2 | Heat Recovery Boiler #3 | OXI Catalyst | SCR Catalyst | Urea Injection System | Starting Air Compressor #1 | Starting Air Compressor #2 | Inst. Air Compressor #1 | Inst. Air Compressor #2 | Battery Backup | Building Elevator | Plant Water Piping | Miscellaneous |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Structural** | | | | | | | | | | | | | | | | | | | | |
| Buildings | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 1 |
| **Mechanical** | | | | | | | | | | | | | | | | | | | | |
| General | 5 | 5 | 5 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | - | 1 | - | - |
| HVAC | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Lube Oil System | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Electrical** | | | | | | | | | | | | | | | | | | | | |
| General | 4 | 4 | 4 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 5 | 5 | 5 | 1 | - | - |
| Switchgear | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | -- | - | - | - | - | - | - |
| **Instrumentation** | | | | | | | | | | | | | | | | | | | | |
| General | 5 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 1 | - | - |

**RUL Legend:**

RUL <5 years | RUL 5-10 years | RUL 11-15 years | RUL 16-20 years | RUL >20 years

**Acronym Key:**
HVAC=Heating, Ventilation, and Air Conditioning; Inst.=Instrument; OXI=Oxidizer; RUL=Remaining Useful Life;
SCR= Selective Catalytic Reduction

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Engine Generator** | |
| Gas Engine (12 Cylinder) | 3 |
| Electrical Generator | 3 |
| Engine Lube Oil System | 3 |
| **Cooling System** | |
| Absorption Chiller | 2 |
| Deaerator Vessel | 1 |

| Major Assets | Quantities |
|---|---|
| **Engine Emission Control** | |
| OXI Catalyst | 3 |
| SCR Catalyst | 3 |
| Urea Injection System | 3 |
| **Heat Recovery System** | |
| Heat Recovery Boiler | 3 |

| Major Assets | Quantities |
|---|---|
| **Building** | |
| Elevator | 1 |
| Piping | Various |
| **HVAC** | |
| Ventilation Exhaust Fans | 5 |
| **Air Compressors** | |
| Engine Starting Air | 2 |
| Instrument Air | 2 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 16 – PLANT NO. 1 CENTRAL GENERATION

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Gas Engine Generator Set Reliability –**Aging components and systems required to operate the Central Generation Engines are creating reliability issues and need to be addressed. | • Engine Overhauls (ongoing).<br>• Replace obsolete systems (i.e. Battery Backup, Switch Gear, Ignition System, PLC Upgrade, etc.). |
| • **Engine Lube Oil System –** The Lube Oil Centrifuges are no longer operational. | • Install new instrumentation and controls onto the existing 2 units. |
| • **Plant Water Piping –** The plant water (i.e., Cooling Water) piping has degraded and needs replacement. | • Replace all plant water piping in the basement of Central Generation. |
| • **Backup Battery System –** The batteries used to provide backup power for switching of the switch gear during loss of power events, has reached the end of its useful life. | • Replace the lead acid batteries and their respective battery chargers with a suitable backup battery system. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE17-03** | Battery Storage System | Plant Wide | • Install batteries for electricity storage purposes. | | | | | | | | | | | | | | | |
| **X-077** | Switch Gear Replacement | Engine Generator | • Install new Switch Gear for the engines. | | | | | | | | | | | | | | | |
| **FE19-02** | Plant Water Pipe Rehabilitation | Plant Water Piping | • Replace existing plant water piping with new. | | | | | | | | | | | | | | | |
| **PRN-00211** | Engine Lube Oil System Controls Upgrade | Engine Generator | • Install new instrumentation and controls onto the existing oil centrifuge units. | | | | | | | | | | | | | | | |
| **MP-227** | Starting Air Compressor System Rehabilitation | Starting Air Compressor System | • Rehabilitation of the Air Compressors. | | | | | | | | | | | | | | | |
| **J-135** | Engine Overhauls | Engine Generator | • Overhaul the engines as needed (ongoing). | | | | | | | | | | | | | | | |
| **SC17-03** | Lube Oil Filter Catwalk | Engine Generator | • Install Lube Oil Filter catwalks for maintenance purposes. | | | | | | | | | | | | | | | |
| **PRN-00627** | Engine Ignition Timing Sensor Obsolescence Repair | Engine Generator | • Replace and install new Hall Effect Sensors onto each engine. | | | | | | | | | | | | | | | |
| **FR1-0005** | Battery Backup Rehabilitation | Battery Backup | • Replace the existing backup batteries for the switch gear. | | | | | | | | | | | | | | | |
| **PRN-00697** | Engine Cylinder Pressure Sensing and Diagnostics | Engine Generator | • Install Pressure Sensors onto each Cylinder, incl. Software/HMI | | | | | | | | | | | | | | | |
| **TBD** | Engine Ignition System Obsolescence Repair | Engine Generator | • Replace and install new Ignition Systems onto each engine | | | | | | | | | | | | | | | |

**Types of Project Legend:**

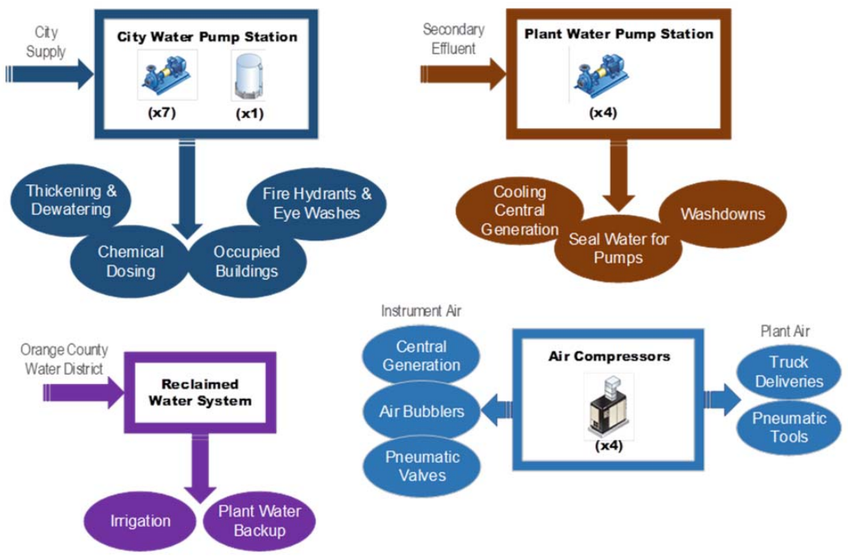
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 17 – PLANT NO. 1 UTILITIES

## Process Schematic




### Major Assets

| Major Assets | Quantities |
|---|---|
| **City Water** | |
| Pumps | 7 |
| Tanks | 3 |
| Piping | 10.6 Miles |
| **Plant Water** | |
| Pumps | 4 |
| Strainers | 3 |
| Piping | 12.5 Miles |
| **Reclaimed Water** | |
| Piping | 5.4 Miles |
| **Plant Air** | |
| Compressors | 4 |
| Plant Air Piping | 4 Miles |
| Instrument Air Piping | 3.5 Miles |

## Major Assets Remaining Useful Life

| Asset Type | City Water System | Plant Water System | Reclaimed Water Piping | Plant Air Systems |
|---|---|---|---|---|
| **Civil** | | | | |
| Piping | 3 | 3 | 2 | 3 |
| **Structural** | | | | |
| Pump Station | 1 | 3 | - | - |
| Tanks | 3 | - | - | - |
| **Mechanical** | | | | |
| Pumps | 5 | 3 | - | - |
| Strainers | - | 3 | - | - |
| Compressors | - | - | - | 4 |
| Ventilation System | 2 | 3 | - | - |
| **Electrical** | | | | |
| Motor Control Centers | 1 | 2 | - | - |
| Variable Frequency Drives | 3 | 1 | - | - |
| **Instrumentation** | | | | |
| PLCs, Flowmeters | 1 | 1 | - | 1 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**
RUL= Remaining Useful Life;
PLC=Programmable Logic Controller

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 17 – PLANT NO. 1 UTILITIES

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Plant/Instrument Air Lines –** Severe corrosion issues. | • Using on-call contractors to perform a condition assessment of the plant air system and identify any leaks or other deficiencies such as improper connections. Current plan is to use the information from the assessment to create larger CIP projects that can improve the piping network throughout the plant. Smaller repairs will be done using on-call contractors and maintenance/asset issues projects |
| • **City Water Pump Station** – Pumps are possibly undersized. | • The 3 medium pumps at the City Water Pump Station continuously run causing excessive wear. There are 1 smaller jockey pumps that run very infrequently. Study is needed to properly size the pumps at the station to meet the current needs of the plant. |
| • **Plant Water - Piping Failures** | • Due to the corrosive nature of the plant water, the current ductile iron pipes are corroding prematurely and causing failures throughout the plant. Current plan is to investigate other non-metallic piping material that is adequate to handle the plant water corrosivity and at the same time provide reliability and longevity to the piping system. A plan will be developed to estimate RUL more accurately on the piping system and confirm projects are in place to address before reliability issues and failures occur. |
| • **Reclaimed Water System** – This system needs a pressure regulating valve installed. | • Reclaimed water is meant to be a back up to plant water and to provide necessary support to Central Generation. When the pressure on the plant water side drops, the plant becomes in need of reclaimed water to compensate for the loss. Currently, the reclaimed water pressure varies between 100 pounds per square inch (psi) to 130 psi, depending on the operational conditions at OCWD. OCSD plant water is at 80 psi, so with the current valves, reclaimed water with the higher psi tends to replace plant water, even when we are not in need. This causes unnecessary reclaimed water charges. Installing a pressure regulating valve at the OCWD/OCSD reclaimed water connection point will help reduce unnecessary charges and better manage our reclaimed water usage. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY20/21 | FY21/22 | FY22/23 | FY23/24 | FY24/25 | FY25/26 | FY26/27 | FY27/28 | FY28/29 | FY29/30 | FY30/31 | FY31/32 | FY32/33 | FY33/34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE19-02** | Cen Gen Plant Water Pipe Replacement at Plant No. 1 | Central Generation | • Replace approximately 800 feet of plant water pipe within Cen Gen. | | | | | | | | | | | | | | |
| **FE18-06** | Instrument Air Compressors at Central Generation | Central Generation | • Replace Instrument Air compressors at Central Generation. | | | | | | | | | | | | | | |
| **P1-105** | Headworks Rehabilitation and Expansion | City Water Pump Station | • Refeed city water pumps from new power building and replace current compressor at headworks with 2 new compressors. | | | | | | | | | | | | | | |
| **FE18-20** | Blower Building Compressor Replacement | Blower Building | • Replace current compressor with 2 new compressors. | | | | | | | | | | | | | | |
| **P1-126** | Primary Clarifier Replacement and Improvement | Primary Clarifier | • Address plant water pipes near primary clarifiers. | | | | | | | | | | | | | | |
| **X-038** | City Water Pump Station Replacement | City Water Pump Station | • Rehabilitate City Water Pump Station. | | | | | | | | | | | | | | |
| **X-039** | Plant Water Pump Station Rehabilitation | Plant Water Pump Station | • Rehabilitate Plant Water Pump Station. | | | | | | | | | | | | | | |
| **PRN-00228** | Plant Water Piping Replacement at AS1 | Yard Piping around Aeration Basin | • Replace approximately 1,600 linear feet of buried ductile iron piping. | | | | | | | | | | | | | | |
| **PRN-00219** | DAFT Air Compressors Replacement | DAFT Pump Room | • Replace in kind compressor at the DAFT building. | | | | | | | | | | | | | | |

**Types of Project Legend:**

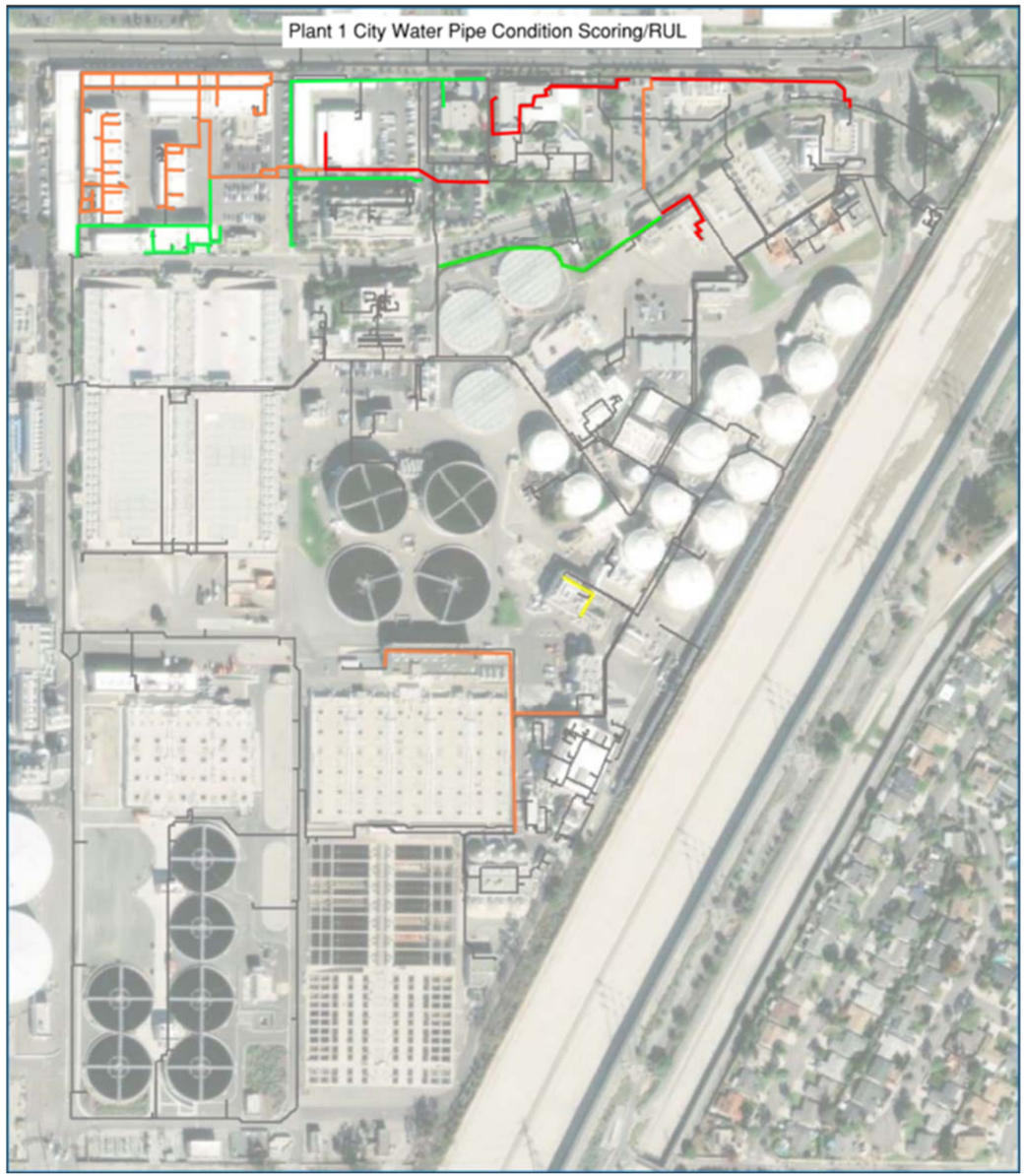
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

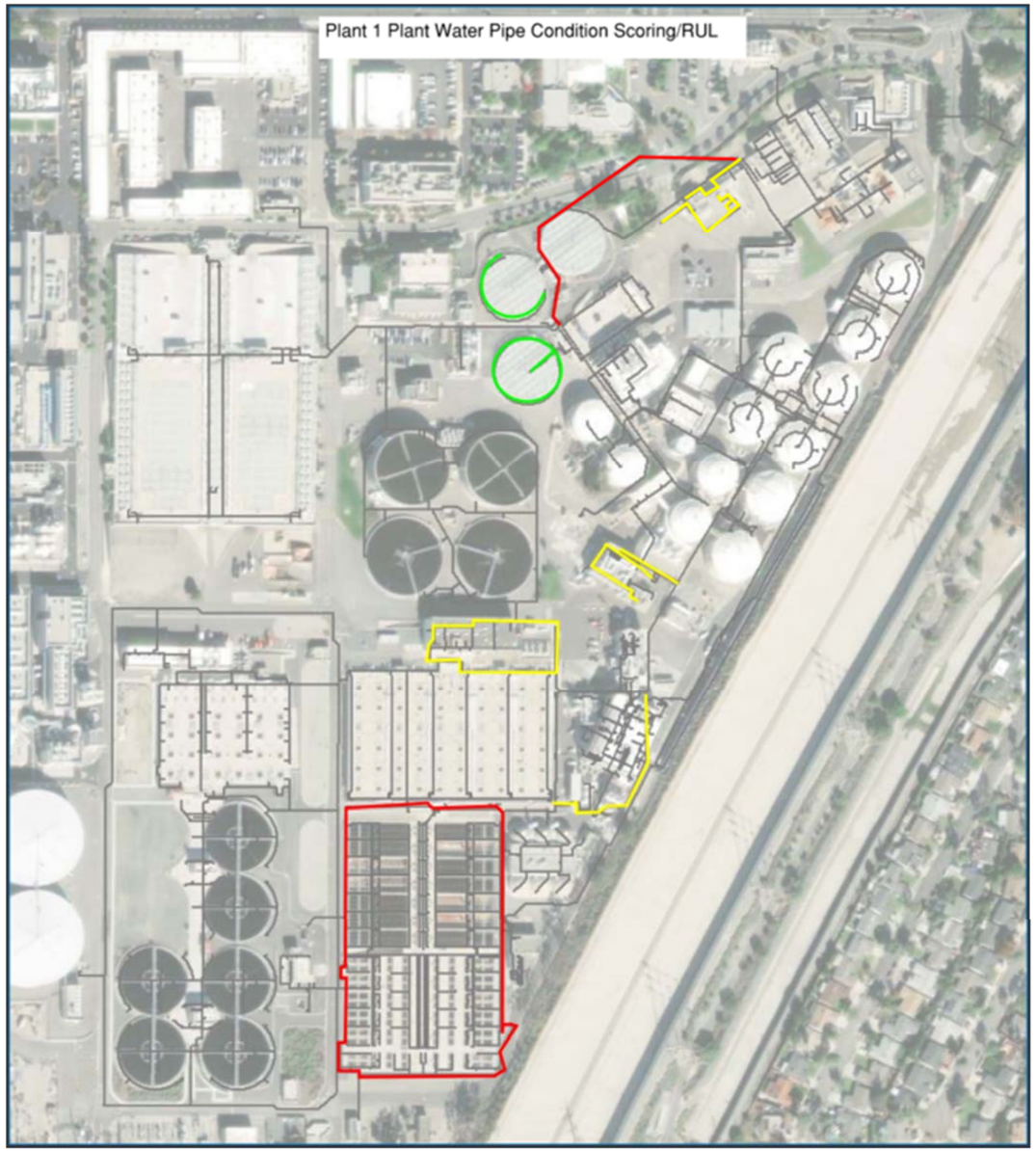
**Acronym Key:**

CIP=Capital Improvement Program; FE= Facilities Engineering; FY=Fiscal Year; HP=Horsepower; OCSD=Orange County Sanitation District; OCWD=Orange County Water District

## ASSET MANAGEMENT SYSTEM SUMMARY – AREA 17 – PLANT NO. 1 UTILITIES

**Remaining Useful Life of Utility Infrastructure**




**RUL Legend:**

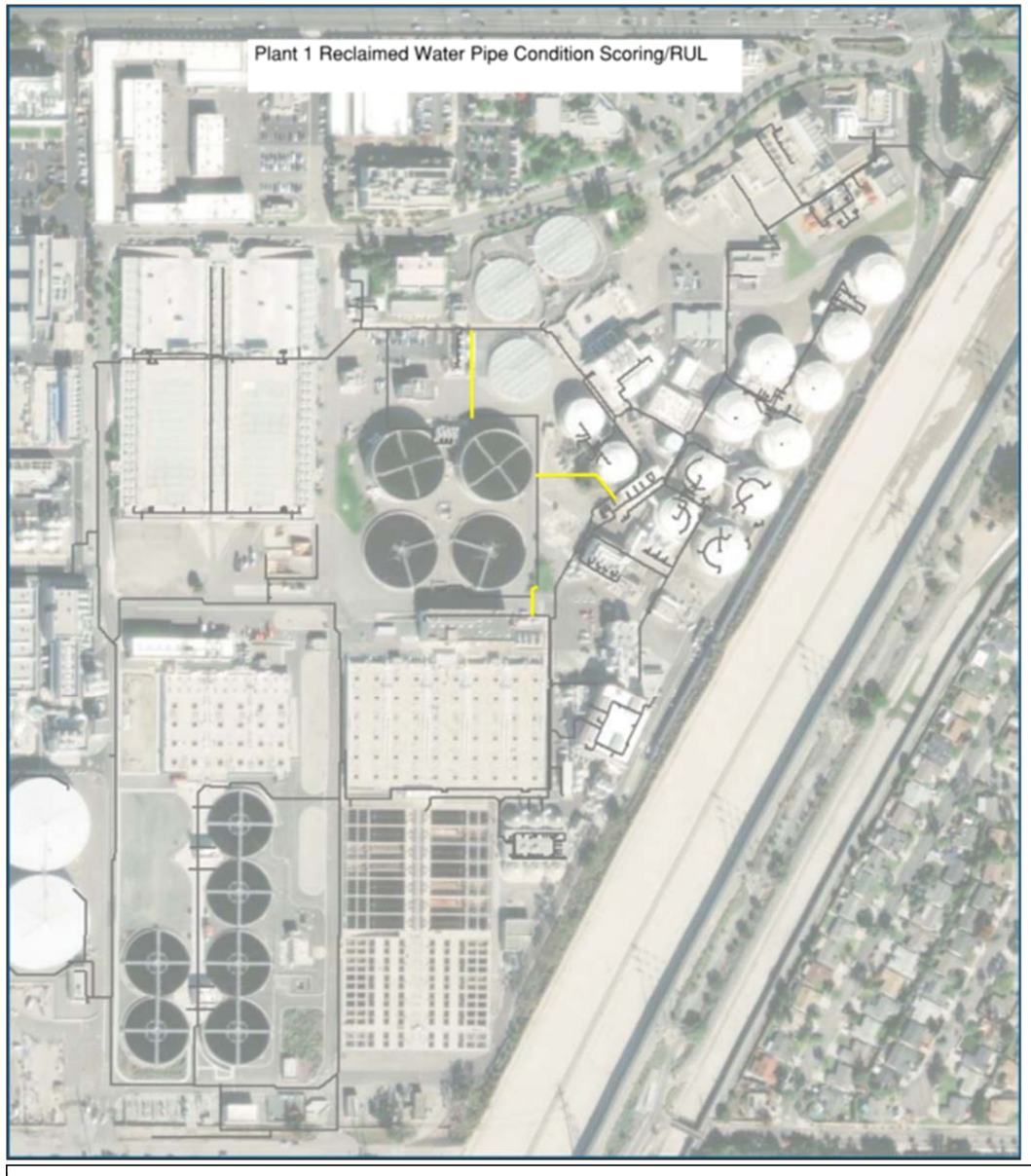
**RUL <5 years** **RUL 5-10 years** **RUL 11-15 years** **RUL 16-20 years** **RUL >20 years**

**Acronym Key:**

RUL=Remaining Useful Life

## ASSET MANAGEMENT SYSTEM SUMMARY – AREA 17 – PLANT NO. 1 UTILITIES

**Remaining Useful Life of Utility Infrastructure**




**RUL Legend:**

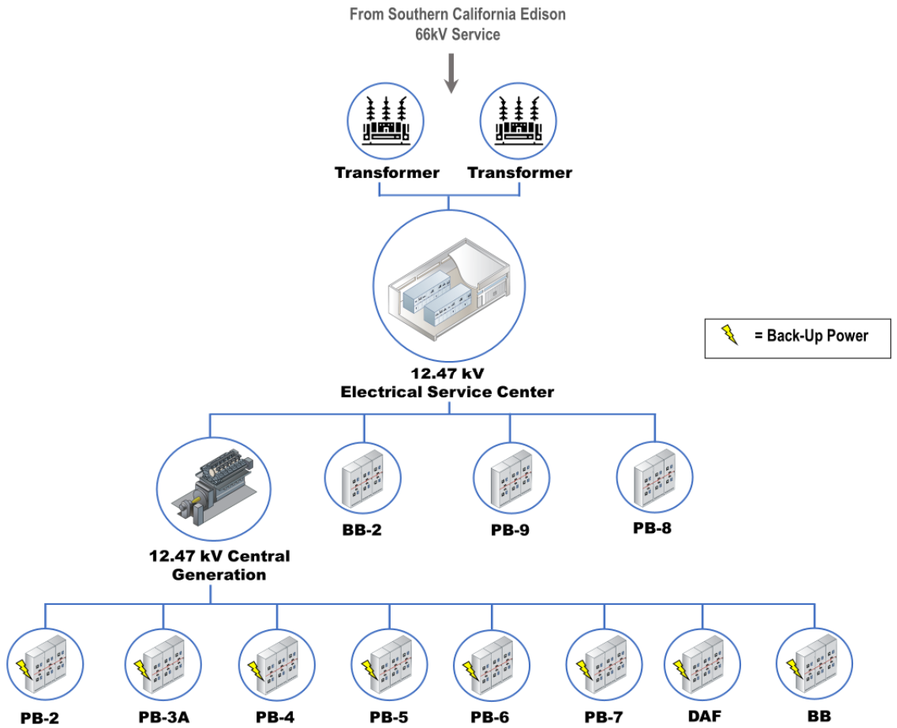
**RUL <5 years** **RUL 5-10 years** **RUL 11-15 years** **RUL 16-20 years** **RUL >20 years**

**Acronym Key:**

RUL=Remaining Useful Life

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 18 – PLANT NO. 1 ELECTRICAL DISTRIBUTION

## Process Schematic




## Major Assets

| Major Assets | Quantities |
|---|---|
| Transformers | 35 |
| Standby Generators | 8 |
| 12kV Switchgears | 19 |
| 480V Switchgears | 5 |
| 125VDC and 24VDC Battery Systems | 22 |
| UPS | 25 |

## Major Assets Remaining Useful Life

| Asset Type | Service Center | CENGEN | PB-2 | PB-3A | PB-4 | PB-5 | PB-6 | PB-7 | PB-8 | PB-9 | DAF | BB-1 | BB-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tier I – 12.47kV Primary Distribution Level** | | | | | | | | | | | | | |
| Transformers: 12.47/4.16kV | - | - | - | - | - | | - | - | - | - | | 4 | 1 |
| Transformers: 12.47/0.48kV | 4 | 4 | 2 | 2 | 4 | 1 | 4 | 1 | 1 | 1 | 3 | 4 | 1 |
| 12.47kV Switchgears | 3 | 4 | 4 | 4 | 4 | 4 | 4 | - | - | - | | - | 1 |
| 12.47kV Transfer Switchers | 3 | - | | - | | - | - | - | - | - | | - | |
| 12.47kV Load Interrupter Switches | 3 | - | 4 | 4 | 4 | - | - | 1 | 1 | 1 | 3 | 4 | |
| 12.47kV Feeders | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 4 | 4 | 1 |
| **Tier II – 4.16kV Distribution Level** | | | | | | | | | | | | | |
| 4.16kV Switchgears | - | - | - | - | - | - | - | - | - | - | - | 4 | 1 |
| 4.16kV Feeders | - | - | - | - | - | - | - | - | - | - | - | 4 | 1 |
| **Tier IV – 480V Distribution Level** | | | | | | | | | | | | | |
| 480V Switchgears | - | 4 | 2 | 2 | - | 2 | 4 | 1 | 1 | 1 | 3 | 4 | 1 |
| Transfer Switches | - | - | 2 | 2 | 4 | - | 2 | - | - | - | 4 | 4 | 1 |
| Generators | - | - | 5 | 5 | 5 | - | - | 1 | 1 | - | - | 5 | - |
| **Tier V – Uninterruptible Power Supply** | | | | | | | | | | | | | |
| UPSs Individual | - | 5 | - | 5 | - | | 3 | - | 3 | 2 | 3 | 3 | 3 |
| **Tier VI – 125 VDC and 24 VDC Battery Systems** | | | | | | | | | | | | | |
| 125VDC Chargers | 5 | 5 | 5 | 5 | | 3 | 3 | 3 | 3 | 2 | 3 | - | 3 |
| 125VDC Batteries | 5 | 5 | 5 | 5 | | 3 | 3 | 3 | 3 | 2 | 3 | - | 3 |
| 24VDC Chargers | - | 5 | 5 | 5 | 5 | - | - | 3 | 3 | - | - | 3 | - |
| 24VDC Batteries | - | 5 | 5 | 5 | 5 | - | - | 3 | 3 | - | - | 3 | - |
| **Generator Controls** | | | | | | | | | | | | | |
| Generator Controls | - | 5 | 5 | 5 | 5 | - | - | 1 | 1 | - | - | 5 | - |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

BB=Blower Building;
CENGEN=Central Generation;
kV=Kilovolt;
PB=Power Building;
RUL=Remaining Useful Life;
VDC=Volts of Direct Current;
UPS=Uninterruptible Power Supply

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 18 – PLANT NO. 1 ELECTRICAL DISTRIBUTION

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Standby Generators**<br>- Power Building 2, &3A: Overheating at 75%-80% loading.<br>- Power Building 4: Engine unable to drive the generator at 100% loading.<br>- Blower Building 1: Shut down on high temp. at 100%, cannot synchronize both generators. | • P1-105 will install centralized standby system with (4)-2500kW, 12kV diesel generators for Headworks Area, Power Building 2, 5 and Blower Building standby loads. P1-105 will demolish generators at Power Building 3A. P1-126 will demolish Power Building 4 Generator and re-feed standby loads from Power Building 8. Future Projects will design feeders from new generators to Power Building 2 and Blower Building 1 Standby Loads. |
| • **Battery Chargers and Batteries –** Aging. | • XPS0061 DC Battery Monitoring and Management Solutions: Study to develop technical solution to monitor existing battery life, develop path forward for replacing aged battery and charger systems. Project FR1-0005 will replace critical batteries and chargers at 12kV Service Center and Cen Gen |
| • **Cabling** – Aging medium voltage cabling infrastructure. | • MP-320: Service Contract in place for testing aging medium voltage cables to perform Condition Assessment and develop plan for preventive maintenance. |
| • **Variable Frequency Drive** – Obsolescence. | • Developed VFD Replacement Strategy. Plant No. 1 obsoleted VFDs will be addressed under FR1-011 Project and TOB-2020-1164 Project. |
| • **Power Building 2** –Seismic issues. | • P1-105 Project will transfer Power Building 2 Loads to T&D Building and eliminate the need for Power Building 2. |
| • Currently some secondary treatment processes do not have back-up power from generators. | • Evaluate the need to add equipment loads that currently do not have back up generation to the secondary generation system. |
| • Undervoltage Auto Transferring Scheme upgrades at Plant No. 1 Blower Building 2 and Power Building 9 (current auto transferring scheme does not work correctly; must switchover manually) | • PRN-00647/Future Project will upgrade Auto-Transferring Scheme and aging protective relays per latest OCSD Standards for Blower Building 2 and Power Building 9 12.47kV, 4.16kV and 480V Switchgears |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TOB-2020-1164** | P1 Polymer Pump VFD Replacement | Plant No. 1 Polymer Facility | • Replace existing obsolete Plant No. 1 Polymer Feed Pump VFDs with new VFDs. | | | | | | | | | | | | | | |
| **FR1-0005** | P1 Cen Gen and Service Center Battery and Charger Upgrade | Plant No. 1 Power Distribution | • Replace existing obsolete 125VDC and 24VDC batteries and battery chargers. | | | | | | | | | | | | | | |
| **MP-320** | On-call P1 and P2 Medium Voltage Cable Testing Services | Plant No. 1 and Plant No. 2 Power Distribution | • Medium voltage cables aging infrastructure assessment. | | | | | | | | | | | | | | |
| **FR1-0011** | P1 VFD Replacement at Plant No. 1 | CWPS, RAS, DAFT, WSS | • Replacement of existing obsolete Plant No. 1 CWPS, RAS, DAFT, WSS VFDs with new VFDs | | | | | | | | | | | | | | |
| **FR1-0008** | 480V Cable Replacement at Plant No. 1 Trickling Filters | Plant No. 1 Trickling Filters | • Trickling Filter 480V Equipment: Arm Drives, Gates, Pumps failed power and control cable replacement. | | | | | | | | | | | | | | |
| **P1-105** | Headworks Rehabilitation at Plant No. 1 | Plant No. 1 Headworks, Bars Screen, Metering Structure, Power Buildings | • Project will rehabilitate and upgrade Plant No. 1 Headworks. New structures to be constructed as part of this project include Grit Pump Station, Grit Handling Building, Headworks Odor Control Facility, Electrical Buildings, and other support systems. | | | | | | | | | | | | | | |
| **J-98** | Electrical Power Distribution System Improvements | Various Plant No. 1 and Plant No. 2 condition based electrical distribution systems | • Project will perform various Electrical Distribution System Improvements including replacing electrical equipment at the end of its useful life, modifying the electrical system configurations to improve reliability and support maintenance, replacing electrical cables and equipment that are not properly sized, and adding surge protection to protect equipment. Implementation of load shedding scheme at Plant No. 1 along with modifications for arc flash mitigation. | | | | | | | | | | | | | | |
| **P1-132** | Uninterruptable Power Supply Improvements at Plant No. 1 | Plant No. 1 multiple UPS Loads | • This project will provide a new regional UPS at Power Building 8 to provide critical power to facilities in the northwest region of Plant No. 1. | | | | | | | | | | | | | | |
| **PRN-00647** | Plant No. 1 Blower Building 2 and Power Building 9 auto transfer scheme and protection relay upgrade | 12.47kV, 4.16kV, 480V Switchgear at Blower Building 2 and 480V Switchgear at Power Building 9 | • Project will upgrade protection relays and undervoltage auto transferring scheme for 12.47kV, 4.16kV and 480V Switchgears to improve functionality and reliability | | | | | | | | | | | | | | |
| **XPS-0061** | Critical UPS and DC power back up battery condition monitoring and management solution | Plant No. 1 and Plant No. 2 125 VDC Battery Systems | • Project will develop automated approach to actively managing and maintaining battery systems to allow to view the status of battery line ups immediately and predict battery failures well in advance of an actual failures. Project will investigate replacing old batteries and chargers. | | | | | | | | | | | | | | |
| **P1-126** | Primary Sedimentation Basins No. 3-5 Replacement at Plant No. 1 | Plant No. 1 Power Distribution | • Demolish Power Building 4 Diesel Generator, re-feed standby loads from Power Building 8. | | | | | | | | | | | | | | |
| **P1-136** | 12.47kV Switchgear replacement at Plant No. 1 Central Generation | Plant No. 1 Power Distribution | • The project will be replacing existing 12.47kV electrical switchgear at the Plant No. 1 Central Generation facility. The project will also assess existing Central Generation 12.47kV feeders and replace ones that fail electric tests. | | | | | | | | | | | | | | |

**Types of Project Legend:**

**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FE= Facilities Engineering; FY=Fiscal Year; HVAC=Heating, Ventilation, and Air Conditioning; kV=Kilovolt; kW=Kilowatt; MCC=Motor Control Center; P1=Plant No. 1; P2=Plant No. 2; T&D=Thickening and Dewatering; VFD=Variable Frequency Drive; UPS=Uninterruptible Power Supply

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# Plant No. 2 Asset Management Summaries

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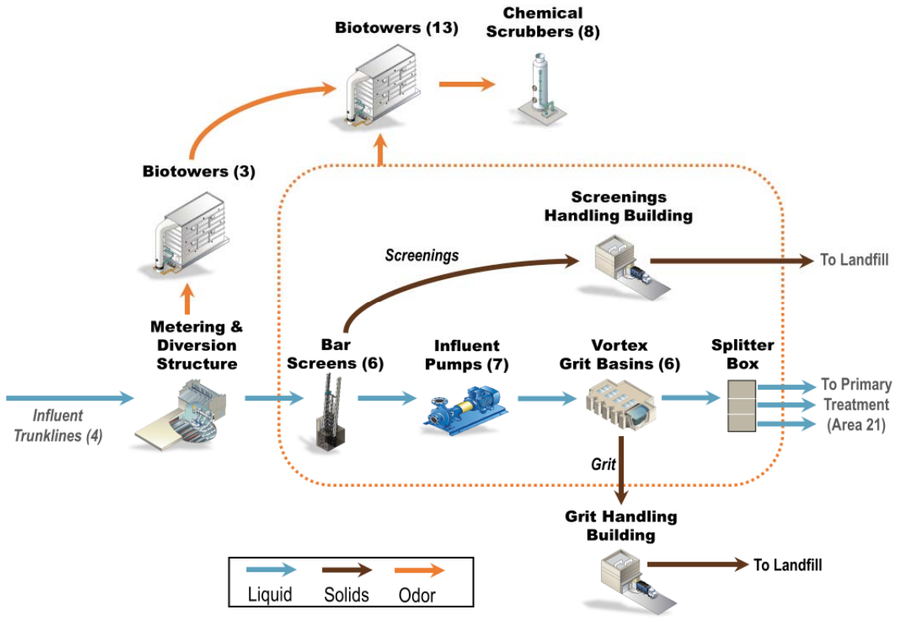
# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 20 – PLANT NO. 2 PRELIMINARY TREATMENT

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Headworks | | | | | Trunkline Odor Control | Headworks Odor Control |
|---|---|---|---|---|---|---|---|
| | Metering & Diversion | Bar Screens | Main Sewage Pump | Grit Basins | Splitter & Metering | | |
| **Civil** | | | | | | | |
| Effluent Piping | - | - | - | - | 1 | - | - |
| **Structural** | | | | | | | |
| Building | - | 1 | 1 | 1 | - | - | - |
| Concrete & Tanks | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Mechanical** | | | | | | | |
| Piping & Valve | 2 | 2 | 2 | 2 | 2 | - | - |
| Pump | - | - | 2 | 2 | - | 2 | 2 |
| Screening Washer Compactor | - | 3 | - | - | - | - | - |
| Grit Cyclone/ Classifier | - | - | - | 2 | - | - | - |
| Conveyor | - | 2 | - | 2 | - | - | - |
| Fans & Blower | - | - | - | - | - | 2 | 2 |
| Control Gate | 2 | 5 | 2 | 2 | 2 | - | - |
| Heating, Ventilation & Air Conditioning | - | 2 | 2 | 2 | - | - | - |
| Crane | - | 2 | 2 | - | - | - | - |
| **Electrical** | | | | | | | |
| Process – Motor, MCC, VFD | 2 | 2 | 4 | 2 | 2 | 2 | 2 |
| **Instrumentation** | | | | | | | |
| PLCs, Flow Meters | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

MCC=Motor Control Center;

PLC= Programmable Logic Controller;

RUL=Remaining Useful Life;

VFD=Variable Frequency Drive

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Metering & Diversion Structure** | |
| Influent Flow Meter | 4 |
| Control Gate | 7 |
| **Trunk Odor Control** | |
| Supply Fan | 3 |
| Biotower | 3 |
| Recirculation Pump | 6 |

| Major Assets | Quantities |
|---|---|
| **Bar Screens** | |
| Bar Screen | 6 |
| Screening Washer Compacter | 3 |
| Screenings Conveyor | 4 |
| Control Gate | 14 |

| Major Assets | Quantities |
|---|---|
| **Main Sewage Pump** | |
| Pump | 7 |
| Control Gate | 16 |
| **Splitter and Metering** | |
| Flow meter | 3 |
| Control Gate | 26 |

| Major Assets | Quantities |
|---|---|
| **Grit Basins** | |
| Grit Basins | 6 |
| Grit Slurry Pump | 6 |
| Grit Cyclone/ Classifier | 4 |
| Control Gate | 12 |

| Major Assets | Quantities |
|---|---|
| **Headworks Odor Control** | |
| Supply Fan | 21 |
| Biotower | 13 |
| Chemical Scrubber | 8 |
| Recirculation Pump | 42 |
| Bleach Tank | 1 |
| Bleach Pump | 16 |

| Major Assets | Quantities |
|---|---|
| **Headworks Odor Control (Continued)** | |
| Acid Tank | 1 |
| Acid Pump | 2 |
| Caustic Tank | 1 |

## ASSET MANAGEMENT SYSTEM SUMMARY – AREA 20 – PLANT NO. 2 PRELIMINARY TREATMENT

### Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Headworks Low Voltage Cable –** Many of Headworks 480 volts cables are failing, triggering ground faults on 480-volt equipment. Original MP-509 addressed identified grounded cables, but the project continued to discover additional grounded circuits | • FR2-0024 was created to address additional grounded circuits and potential future discoveries |
| • **Reclaimable Water Supply to Barscreens Sluiceways –** Based on the latest project schedule, GWRS Final Expansion (February 2013) would be completed before J-117B PWPS Beneficial Occupancy (November 2023). GWRS would not be able start immediately, because drain for Barscreen Sluiceways would end up in "Reclaimable Side". Barscreen sluiceways consume about 0.8 MGD of PW and PW contains SARI flow, which would make water not recyclable. | • OC San proposed a solution to temporarily feed GAP water to sluiceways and was approved by the GWRS Expansion Committees. The scope is now added to P2-122, and the project had a first design workshop on Nov 5th, 2020 |
| • **Reliability of Main Sewage Pump –** With P2-122 replacing 3 out of 7 pumps, area engineer evaluated the overall MSP system to identify assets that need to be overhauled to maintain the system's reliability for next 10 years. | • PRN-00528 P2 MSP VFD major preventative maintenance 100% complete. One of components in VFD #7 needs to be replaced and already scheduled. Internal UPS in the drives have been unreliable, so maintenance and engineering groups are working to come up with a more reliable solution.<br>• PRN-00529 P2 MSP Motor Overhaul is 100% complete. All 7 motors have been overhauled.<br>• Current vibration monitoring system is obsolete. The upgrade will be a part of an overall P1 and P2 procurement led by maintenance reliability group. |
| • **Headworks Condition Assessment –** Due to relatively new asset, no field condition assessment has been performed in the past. There is a need to perform assessments to build a condition baseline. | • Starting dry season of 2021, will be coordinating with O&M and P2-122 project team to schedule assessment of areas that will be down for P2-122 construction.<br>• P2-122 procured a structural engineer to certify some of the Headworks stop plates/ bulkheads for construction. PRN-00379 Validation of Process Area Stop Plates is in place to identify and certify the remaining plates in the Headworks. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P2-122** | Headworks Modifications at Plant No. 2 for GWRS Final Expansion | Headworks | • Modify headworks and sidestream routing to create reclaimable and non-reclaimable trains to support GWRS Final Expansion.<br>• Replace 3 of 7 MSPs with more efficient lower capacity pumps. | | | | | | | | | | | | | | | |
| **FR2-0024** | Plant No. 2 Headworks 480V Cable Replacement | Headworks | • In-house engineering design and bid for service contract for repairs on faulty cables | | | | | | | | | | | | | | | |
| **PRN-00528** | Plant No. 2 MSP VFD Year 10 PM | Influent Pump Station | • Refurbish all 7 MSP VFDs by performing Year 10 Preventative Maintenance program | | | | | | | | | | | | | | | |
| **PRN-00529** | Plant No. 2 MSP Motor Overhaul | Influent Pump Station | • Overhaul all 7 MSP motors in the motor shop. | | | | | | | | | | | | | | | |
| **FE18-11** | Headworks Explosive Gas Monitoring Systems at Plant No. 2 | TL & HW Odor Control | • Install an Early Warning System to provide early indication of combustible gas at the influent of the plant. | | | | | | | | | | | | | | | |
| **FE18-17** | Trunkline Sampler Power Feed at Plant No. 2 | Trunkline | • Provide 120V power for 4 automated samplers at 4 trunkline sample collection points. | | | | | | | | | | | | | | | |
| **MP-699** | Plant No. 2 Trunkline Biotower #3 Repair | TL Odor Control | • Repair internal mechanism of the Biotower #3 vessel. | | | | | | | | | | | | | | | |
| **N/A** | Plant No. 2 Scrubber Media Replacement | TL & HW Odor Control | • Replace scrubber media for both biotower and chemical scrubbers | | | | | | | | | | | | | | | |
| **X-030** | Plant No. 2 Headworks Rehabilitation | Headworks | • Rehabilitate any equipment, electrical, structures, or materials that cannot provide 25 years of useful life. | | | | | | | | | | | | | | | |

**Types of Project Legend:**

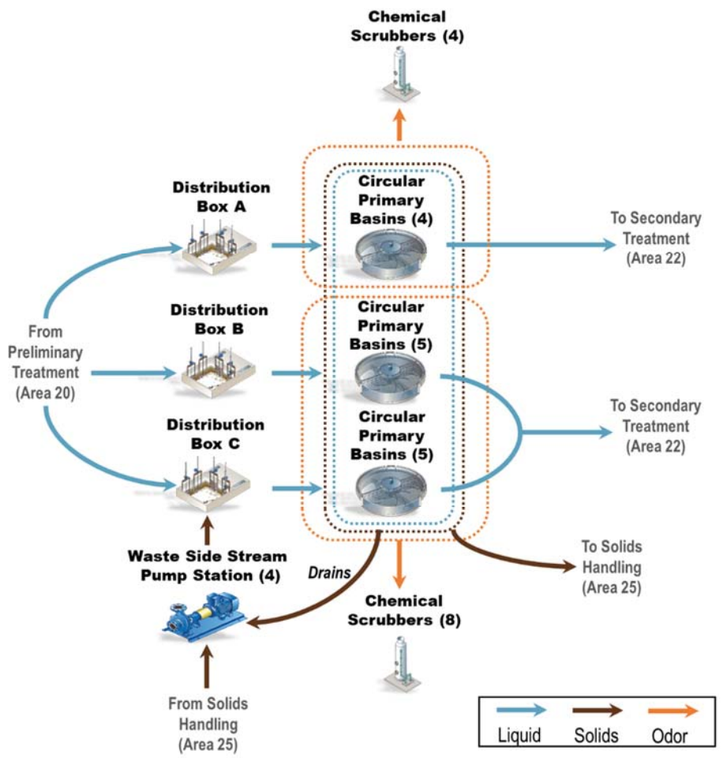
**CIP - Planning** | **CIP – Design** | **CIP - Construction** | **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year; GAP=Green Acres Project; GWRS=Groundwater Replenishment System; HW=Headworks; MSP=Main Sewage Pump; N/A= Not Applicable; OCWD=Orange County Water District; PM=Preventative Maintenance; PWPS=Plant Water Pump Station; SARI=Santa Ana River Interceptor; V=Volts; VFD=Variable Frequency Drive

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 21 – PLANT NO. 2 PRIMARY TREATMENT

## Process Schematic




**Acronym Key:**

HVAC=Heating, Ventilation, and Air Conditioning; MCC=Motor Control Center; NSC=North Scrubber Complex; PB=Power Building; RUL=Remaining Useful Life; SSC=South Scrubber Complex; VFD=Variable Frequency Drive; WSSPS=Waste Sidestream Pump Station

## Major Assets Remaining Useful Life

| Asset Type | A-Side | | | | B-Side | | | | | C-Side | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PB-D | PB-E | PB-F | PB-G | PB-H | PB-I | PB-J | PB-K | PB-L | PB-M | PB-N | PB-O | PB-P | PB-Q | NSC | SSC | Polymer System | Ferric System | Distribution Box | WSSPS-C |
| **Civil** | | | | | | | | | | | | | | | | | | | | |
| Effluent Piping | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | - | - | - | - | - | 3 |
| **Structural** | | | | | | | | | | | | | | | | | | | | |
| General | 5 | 5 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 2 | 4 | 1 |
| Dome | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 3 | - | - | - | - | - | - |
| **Mechanical** | | | | | | | | | | | | | | | | | | | | |
| Piping | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | - | 2 | 5 | 4 |
| Internal Mechanism | 3 | 3 | 5 | 5 | 3 | 3 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 3 | - | - | - | - | - | - |
| Fans & Pumps | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | 3 | 3 | 2 | - | 4 |
| HVAC & Ventilation | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | - | - | - | - | - | - |
| Gates | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | - |
| **Electrical** | | | | | | | | | | | | | | | | | | | | |
| Process – Motor, MCC, VFD | 3 | 3 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - | 3 |
| **Instrumentation** | | | | | | | | | | | | | | | | | | | | |
| PLC, Flow Meters | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 2 | - | 3 |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Primary Basin** | |
| Primary Basin | 4 |
| Sludge/ Scum Collectors | 4 |
| Sludge/ Scum Pump | 8 |
| Supply Fan | 6 |
| **B-Side** | |
| Primary Basin | 5 |
| Sludge/ Scum Collectors | 5 |
| Sludge/ Scum Pump | 10 |
| Supply Fan | 7 |

| Major Assets | Quantities |
|---|---|
| **C Side** | |
| Primary Basin | 5 |
| Sludge/ Scum Collectors | 5 |
| Sludge/ Scum Pump | 10 |
| Supply Fan | 8 |
| **North Scrubber Complex** | |
| Chemical Scrubber | 7 |
| Biofilter | 1 |
| Recirculation Pump | 16 |
| Supply Fan | 8 |
| Caustic Tank | 1 |

| Major Assets | Quantities |
|---|---|
| **North Scrubber Complex (Continued)** | |
| Acid Feed Pump | 2 |
| Bleach Tank | 1 |
| Bleach Feed Pump | 14 |
| Caustic Feed Pump | 16 |
| Acid Tank | 1 |
| **South Scrubber Complex** | |
| Supply Fan | 4 |
| Scrubbers | 4 |
| Recirculation Pump | 8 |
| Caustic Tank | 1 |

| Major Assets | Quantities |
|---|---|
| **South Scrubber Complex (Continued)** | |
| Caustic Feed Pump | 8 |
| Acid Tank | 1 |
| Acid Feed Pump | 2 |
| Bleach Tank | 1 |
| Bleach Feed Pump | 3 |
| **Polymer System** | |
| Polymer Bulk Tank | 3 |
| Polymer Bulk Transfer Pump | 4 |
| Polymer Mix Tank | 2 |

| Major Assets | Quantities |
|---|---|
| **Polymer System (Continued)** | |
| Polymer Feed Pump | 4 |
| **Ferric System** | |
| Ferric Bulk Tank | 2 |
| Ferric Feed Pump | 6 |
| **Distribution Boxes** | |
| Structure | 3 |
| Sluice Gates | 24 |
| **Waste Sidestream Pump Station C** | |
| Waste Sidestream Pump | 4 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 21 – PLANT NO. 2 PRIMARY TREATMENT

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Reliability of Primary Basins –** Basin F, M, N, O, P, and Q are not currently operational. With wet weather officially begins on October 15th, at least 3 basins need to be back in service, bringing the total available to 11 basins. With existing A-Side basins being demolished and replaced with new basins, B/ C side of basins need to be stay reliable for 10 years to support P2-98A construction. | • Basins M, N, O, P, and Q are down for repair through P2-98B B and C Side Interim Repair. Repairs for Basin D, E, H, I, N, O, and Q are complete. DS-C structure work and associated basins will be completed by the end of October. Basin F is down due to the sweep drive motor failure and will be replaced by 880E.<br>• P2-98A and P2-133 are in place to provide long term solutions to all A, B, and C side of primary clarifiers. |
| • **Reliability of Waste Sidestream Pump Station C** – Waste sidestream pumps and their associate equipment show accelerated corrosion issue due to the drains from the South Scrubber Complex. The SSC uses bleach for their scrubbers and the bleach pumps are oversized and do not have good turndown ratio. Excessive bleach goes to the drains that go to the WSSPS-C. The materials are not compatible with bleach, resulting accelerated corrosion. | • MP-420 Plant No. 2 South Scrubber Complex Bleach Pump is complete.<br>• Two failed pumps (5HP and 35HP) were sent out for root cause failure analysis and were replaced with improved design.<br>• Area engineer to assess the condition of the areas that are affected by SSC drain and rehabilitate.<br>• X-054 WSSPS-C Rehabilitation at Plant No. 2 was originally scheduled in 2024 due to accelerated corroded issues, but with multiple remediation plans, pushed the rehabilitation project to its end of useful life of 25 years. |
| • **Reliability of Polymer System –**The polymer system was built in 1988 and no major project was done since it was built. Replacement of the aged system is included in P2-133 scope, but the system may not last until the project. | • Expediate polymer station rehabilitation scope from P2-133. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P2-98A** | A-Side Primary Clarifiers Replacement at Plant No. 2 | A Side Primary Basins | • Demolish and replace 4 existing A-Side Primary Basins.<br>• Demolish and replace the South Scrubber Complex. | | | | | | | | | | | | | | | |
| **P2-98B** | B/C Side Primary Clarifiers Interim Repair at Plant No. 2 | B and C Side Primary Basins | • Repair the structural steel mechanism members of 12 primary basins.<br>• Interim repairs to make basins reliable for 10 years during P2-98A construction. | | | | | | | | | | | | | | | |
| **P2-133** | B/C Side Primary Clarifiers Rehabilitation at Plant No. 2 | B and C Side Primary Basins | • Long term repairs to extend remaining useful life of B and C side basins to 40 years or greater. | | | | | | | | | | | | | | | |
| **MP-420** | Plant No. 2 South Scrubber Complex Bleach Pump | South Scrubber Complex | • Replace existing bleach pumps with higher turndown capable pump to reduce excess bleach usage. | | | | | | | | | | | | | | | |
| **PRN-00629** | Plant No. 2 A-Side Primary Basin Launder Cover Repair | A Side Primary Basin | • Repair failed launder covers with new hinge bolts and replace warped covers | | | | | | | | | | | | | | | |
| **X-054** | Waste Sidestream Pump Station C Rehabilitation at Plant No. 2 | Waste Sidestream Pump Station C | • Replace pumps and associated equipment with chemical resistant material to provide reliable operation. | | | | | | | | | | | | | | | |

**Types of Project Legend:**

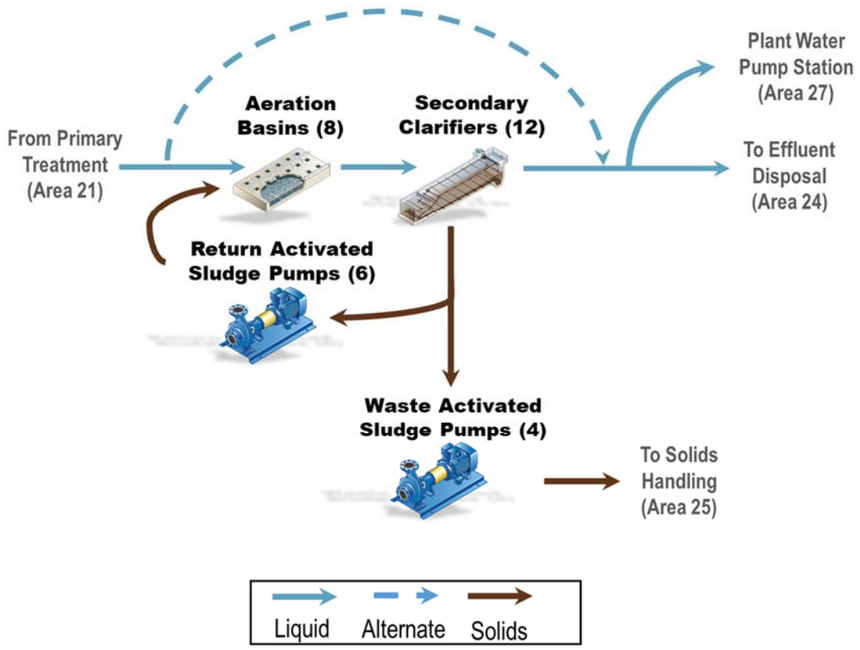
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year; HP=Horsepower; OEM=Original Equipment Manufacturer; WSSPS=Waste Sidestream Pump Station

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 22 – PLANT NO. 2 SECONDARY TREATMENT – ACTIVATED SLUDGE

## Process Schematic




**Acronym Key:**

DAFT=Dissolved Air Flotation Thickener; LOX=Liquid oxygen; MCC=Motor Control Center; PEPS=Primary Effluent Pump Station; PLC=Programmable Logic Controller; PS=Pump Station; RAS=Return Activated Sludge; RUL=Remaining Useful Life; SEJB=Secondary Effluent Junction Box; TWAS= Thickened Waste Activated Sludge; VFD=Variable Frequency Drive; WAS=Waste Activated Sludge; WSSPS=Waste Sidestream Pump Station

## Major Assets Remaining Useful Life

| Asset Type | PEPS | Aeration Basins | Secondary Clarifiers A-L | SEJB | East RAS /WAS PS | West RAS/WAS PS | Oxygen Facility | DAFTs A-D | DAFTs Polymer System | DAFTs Odor Control | WSSPS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | | | |
| Effluent Piping | 2 | - | 3 | 3 | 4 | 4 | - | - | - | - | 4 |
| **Structural** | | | | | | | | | | | |
| Building | 2 | - | - | - | 2 | 2 | - | 1 | - | - | - |
| Structure | 2 | 4 | 3 | 3 | - | - | - | 1 | 1 | 1 | - |
| **Mechanical** | | | | | | | | | | | |
| Pump | 2 | - | - | - | 3 | 3 | - | 2 | 2 | - | 3 |
| Aerator | - | 4 | - | - | - | - | - | - | - | - | - |
| Piping and Valve | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| Clarifier/DAFT Moving Mechanism | - | - | 5 | - | - | - | - | 2 | - | - | - |
| Channel Air Blower | - | - | - | - | - | 4 | - | - | - | - | - |
| Control Gate | - | 3 | 4 | 3 | - | - | - | - | - | 2 | 4 |
| LOX Facility | - | - | - | - | - | - | 3 | - | - | - | - |
| HVAC and Ventilation | 2 | - | - | - | 3 | 3 | - | - | - | - | - |
| Crane | 3 | - | - | - | - | - | - | - | - | - | - |
| **Electrical** | | | | | | | | | | | |
| MCC and VFD | 4 | 3 | 3 | - | 4 | 4 | - | 3 | 3 | 3 | 3 |
| **Instrumentation** | | | | | | | | | | | |
| PLC and Flow Meter | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | - | 3 |

**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

| Major Assets | Quantities |
|---|---|
| **Primary Effluent Pump Station** | |
| Building | 1 |
| Structure | 1 |
| Pumps | 4 |
| **Aeration Basins** | |
| Basins | 8 |
| Surface Aerators | 32 |
| Inlet gates | 8 |

| Major Assets | Quantities |
|---|---|
| **Secondary Clarifiers A-L** | |
| Basins | 12 |
| Inlet gates | 36 |
| Sludge collectors | 24 |
| **Secondary Effluent Junction Box** | |
| Structure | 1 |
| Control Gate | 1 |
| **East RAS/WAS PS** | |
| RAS/WAS Pumps | 5 |

| Major Assets | Quantities |
|---|---|
| **West RAS/WAS PS** | |
| RAS Pumps | 3 |
| WAS Pumps | 2 |
| Channel air blowers | 2 |
| Sliding Frames | 2 |
| **Oxygen Facility** | |
| LOX Storage Tanks | 2 |
| Vaporizer | 6 |
| Oxygen Purging Fan | 2 |

| Major Assets | Quantities |
|---|---|
| **DAFTs A-D** | |
| Concrete Tanks | 4 |
| Mechanical Sweep | 4 |
| Recycle Pumps | 6 |
| Saturation Tank | 4 |
| TWAS Pumps | 8 |
| **DAFTs Polymer System** | |
| Storage Tank | 1 |
| Aging Tank | 2 |

| Major Assets | Quantities |
|---|---|
| **DAFTs Polymer System (Continued)** | |
| Storage Tank Rec. Pumps | 2 |
| Blend Pumps | 2 |
| Feed Pumps | 6 |
| **DAFTs Odor Control** | |
| Biofilters | 3 |
| Foul Air Fans | 3 |
| **Waste Sidestream Pump Station** | |
| Pumps | 3 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 22 – PLANT NO. 2 SECONDARY TREATMENT – ACTIVATED SLUDGE

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **PEPS –** Obsolete VFD parts<br>• Missing flapper gates on the area drains inlets to the basins | • PRN-00573 (FE19-08) project will replace the PEPS VFDS.<br>• Condition assessment will be performed to determine the condition. |
| • **Aeration Basins –** Cracks and concrete spalling on aeration basins deck<br>• Aerator motor corrosion and vibration<br>• Inlet gates not totally sealed<br>• Oxygen leaking from aerator base and access manholes on top of the aeration deck | • P2-118 filled the cracks on west side, and the remaining work is included in P2-123 contract.<br>• Maintenance have been rebuilding the aerator gearbox, the motor base, and replacing the motor.<br>• Maintenance installed manual drop gates.<br>• Condition assessment scheduled and will make recommendation for short term repair to last until P2-136 construction. Maintenance will do urgent caulking of cracks.<br>• P2-136 will rehabilitate the aeration basins. |
| • **Clarifiers –** Broken clarifier mechanism need to be repaired or replaced<br>• Corroded Inlet gates need to be replaced<br>• Broken Area lights | • MP-248 is under construction to replace D, L, G, J, C, F), and the remaining 6 will be replaced by FR2-0018.<br>• MP-638 is under construction replace all the 36 inlet gates.<br>• P2-123 is under construction to replace all the lights. |
| • **RAS/WAS Pump Stations** – Obsolete VFDs<br>• Corroded RAS piping | • PRN-00573 (FE19-08) will replace the RAS and WAS VFDs.<br>• P2-123 will replace the RAS piping. |
| • **Oxygen Facility -** LOX Tank A out of service due to leaking flange | • Operation and maintenance of the LOX facility is part of the liquid oxygen supply contract. Small project delivery group is managing the repair. The repair work is scheduled to be performed and completed in October 2020. |
| • **WSSPS** – Wet well drain gate (draining to Coast Trunk) actuator difficult to operate<br>• Flooding of the pump dry well causing WSSPS pump motor damage | • P2-122 will bulkhead and plug the drain line to avoid the accident draining the flow from the non-reclaimable side to the reclaimable side.<br>• Maintenance is replacing the sump pump at the dry well to prevent the flooding. X-007 will replace the pumps with dry pit submersible type. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MP-248** | Plant No. 2 Secondary Clarifiers D, G, L, J, F, C Repairs | Secondary clarifiers | • Replace the 6 clarifiers moving mechanisms. | | | | | | | | | | | | | | | | |
| **MP-638** | Activated Sludge Plant Clarifier Inlet Gate Replacement at Plant No. 2 | Secondary clarifiers | • Replace all the 36 inlet gates with stainless steel gates. | | | | | | | | | | | | | | | | |
| **FR2-0018** | Activated Sludge Clarifier Repairs at Plant No. 2 | Secondary clarifiers | • Replace the remaining 6 clarifiers mechanisms left from MP-248 | | | | | | | | | | | | | | | | |
| **P2-122** | P2-122 - Headworks Modifications at Plant No. 2 for GWRS Final Expansion | AS plant, WSSPS | • Separate the reclaimable and non-reclaimable streams. AS Plant will treat non-reclaimable flow. WSSPS discharge piping to primary basins will be demolished and be directed to PEPS and drain gate will be plugged. | | | | | | | | | | | | | | | | |
| **P2-123** | Return Activated Sludge Piping Replacement at Plant No. 2 | RSS pump stations and secondary clarifiers | • Replace RAS piping, area lights and fix the concrete cracks and spalling on east aeration basin decks. | | | | | | | | | | | | | | | | |
| **FE19-08** | Plant No. 1, Plant No. 2, Collections VFD Drives Replacement | PEPS, RSS pump stations | • Replace PEPS, RAS and WAS VFDs | | | | | | | | | | | | | | | | |
| **P2-136** | Activated Sludge Aeration Basin Rehabilitation at Plant No. 2 | AS plant aeration basins | • Rehabilitate the AS process. | | | | | | | | | | | | | | | | |
| **X-52** | Activated Sludge RAS/WAS/PEPS/Vaporizers Rehabilitation at Plant No. 2 | AS plant | • Rehabilitate the RAS/WAS/PEPS/LOX vaporizers. | | | | | | | | | | | | | | | | |
| **FR2-0018** | Plant No. 2 AS Plant Clarifiers Rehabilitation - Phase 2 | Secondary clarifiers | • Replace Clarifiers A, B, E, G, H, and L moving mechanism. | | | | | | | | | | | | | | | | |
| **X-007** | Waste Sidestream Pump Station A Upgrade at Plant No. 2 | WSSPS A | • Replace the WSSPS pumps with dry pit submersible type. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

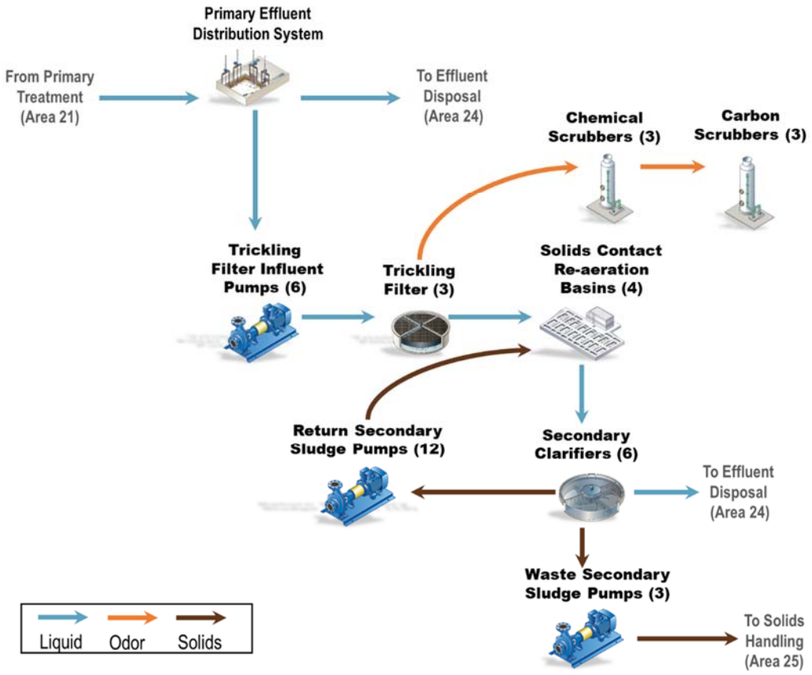
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

AS= Activated sludge; CIP=Capital Improvement Program; FY= Fiscal Year; GWRS=Groundwater Replenishment System; LOX=Liquid Oxygen; PEPS=Primary Effluent Pump Station; RAS=Return Activated Sludge; RSS=Return secondary sludge; VFD=Variable Frequency Drive; WAS=Waste Activated Sludge; WSSPS=Waste Sidestream Pump Station

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 22 - PLANT NO. 2 SECONDARY TREATMENT – TRICKLING FILTERS AND SOLIDS CONTACT

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | TFPS & Elec Room | Trickling Filters A-C | Solids Contact & ML Channel | Blower/ WSS PS Building | Secondary Clarifiers A-F | RSS PS A | RSS PS B | RSS PS C & Elec. Room | DCJ | Odor Control Facility | Chemical Facility |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | | | |
| Effluent Piping | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | 2 | 2 |
| **Structural** | | | | | | | | | | | |
| Building | 1 | - | - | 1 | - | 1 | 1 | 1 | - | - | |
| Structure | 1 | 1 | 1 | - | 1 | - | - | - | - | 2 | 2 |
| **Mechanical** | | | | | | | | | | | |
| Pump | 2 | - | - | 2 | 2 | 4 | 4 | 4 | - | 2 | 3 |
| TF Rotary Distributor | - | 4 | - | - | - | - | - | | - | - | - |
| TF Media | - | 3 | - | - | - | - | - | - | | - | - |
| Clarifier Sludge Collector | - | - | - | - | 3 | - | - | - | - | - | - |
| Blower & Fan | - | 2 | - | 2 | - | - | - | - | - | 2 | - |
| Control Gate | - | 3 | 3 | 3 | 3 | - | - | - | - | - | - |
| Piping and Valve | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | 2 | 2 |
| Diffusor | - | - | 2 | - | - | - | - | - | - | - | - |
| HVAC & Ventilation | 2 | - | - | 2 | - | 2 | 2 | 2 | 2 | - | - |
| Crane | 2 | - | - | 2 | - | 2 | 2 | 2 | - | - | - |
| **Electrical** | | | | | | | | | | | |
| MCC & VFD | 3 | 3 | - | 3 | 3 | - | - | 3 | 3 | 3 | 3 |
| **Instrumentation** | | | | | | | | | | | |
| PLCs & Flow Meters | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

HVAC=Heating, Ventilation, and Air Conditioning;
DCJ=Distribution Center J;
Elec.=Electrical;
RUL=Remaining Useful Life;
RSS=Return Secondary Sludge;
MCC=Motor Control Center;
ML=Mixed Liquor;
PLC= Programmable Logic Controller;
PS= Pump Station;
TF= Trickling Filter;
TFPS= Trickling Filter Pump Station;
VFD=Variable Frequency Drive;
WSS=Waste Secondary Sludge

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Trickling Filter Pump Station** | |
| Building | 1 |
| Pumps | 6 |
| **Trickling Filters A-C** | |
| Basins | 3 |
| Rotary Distributor | 3 |
| Recirculation Fans | 6 |

| Major Assets | Quantities |
|---|---|
| **Solids Contact & ML Channel** | |
| Structures | 2 |
| Control gates | multiple |
| Diffusors | multiple |
| **Blower/WSS PS Building** | |
| Building | 1 |
| SR Blowers | 3 |
| SC Blowers | 3 |
| WSS Pumps | 3 |

| Major Assets | Quantities |
|---|---|
| **Secondary Clarifiers A-F** | |
| SC Basins | 6 |
| Sludge Collector | 6 |
| Scum pumps | 6 |
| **RSS PS A** | |
| Buildings | 1 |
| RSS Pumps | 4 |

| Major Assets | Quantities |
|---|---|
| **RSS PS B** | |
| Buildings | 1 |
| RSS Pumps | 4 |
| **RSS PS C & Electrical Room** | |
| Buildings | 1 |
| RSS Pumps | 4 |
| **Distribution Center J** | |
| Building | 1 |

| Major Assets | Quantities |
|---|---|
| **Odor Control Facility** | |
| Foul Air Fans | 3 |
| Chemical scrubbers | 3 |
| Carbon Units | 3 |
| **Chemical System** | |
| Bleach Storage Tanks | 2 |
| Caustic Storage Tank | 1 |
| Bleach Pumps | 7 |
| Caustic Pumps | 6 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 22 - PLANT NO. 2 SECONDARY TREATMENT – TRICKLING FILTERS AND SOLIDS CONTACT

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **TFPS –** No backup power to TFPS; pump failure could result in primary effluent to ocean outfall and potential contaminating the future GWRS intake flow at P2<br>• Pumps seal water failure due to the seal tube corrosion | • J-117B will provide 2nd feed to DCJ from Central Generation and load shed for non-critical loads. AI-230 will investigate a solution on resetting and starting TFPS pumps from SCADA instead of locally at power loss as current.<br>• All TFPS had been refurbished by MP-551, seal tubes, shafts, and related parts were replaced with better material for corrosion resistance. Project completed in end of July 2020. |
| • **TFs –**TF-A distribution arm gears broke again after last year's repair. TF-A and TF-C center column seals leaking | • PRN-00643 (AI-155) Maintenance and asset engineer are working on a series of repairs to bringing TF-A back to service. The TF-A and TF-C seals were replaced with Ovivo's newer designed seals in September 2020. TF-A orifices were adjusted and tested to run TF-A hydraulically in October 2020. Ovivo provided a quotation for improved design of the gear and bearing for the distribution arm. Maintenance is in the process to procure the parts and will hire Ovivo's authorized installer to install the repair parts in Spring 2021 when wet season ends. |
| • **Secondary Clarifiers –**Scum pump cannot clear the scum pit | • Asset engineer will facilitate an investigation of the problem. |
| • **RSS Pumps** –RSS pump low seal water flow | • PRN-00634 approved to refurbish all the twelve RSS pumps, like the repair as the TFPS pumps. P.O. issued to Vaughan's Industrial Repair Co Inc. on May 1, 2020. All pumps will be refurbished by April 2021. |
| • **Snail control –** Signs of snail shell accumulation at process area and excessive wearing on RSS and WSS pipes | • Changed from 25% caustic injection to 50%.<br>• PS18-10 did the evaluation and recommended to change the injection the original design of flooding. Operation is doing the testing of flooding.<br>• Performed condition assessment of various pipes and replaced the bad pipes. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MP-551** | Plant No. 2 Trickling Filter Seal Tube Evaluation and Repair | TFPS | • Identify the cause, replace parts, and repair all the 6 pumps. | | | | | | | | | | | | | | | | |
| **PRN-00643** | Plant No. 2 TFSC RSS Pump Rehabilitation | RSS Pumps and SCs | • Refurbish all the twelve RSS pumps by replacing the seal tubes and other corroded parts to solve the low seal water problem and be better corrosion resistant. | | | | | | | | | | | | | | | | |
| **MP-509** | Headworks 480 Volts Cable Replacement at Plant No. 2 | WSS Pump #3 | • Access and replace cables that causing power supply issues including the bad cable for WSS Pump #3. | | | | | | | | | | | | | | | | |
| **PRN-00643** | TF-A Distribution Arm Repair for Low Seal Water Flow | TF-A | • Repair TF-A distribution arm and adjusting the orifices to run it with hydraulic power while waiting for parts. | | | | | | | | | | | | | | | | |
| **J-117B** | Outfall Low Flow Pump Station | DCJ, TFPS | • New PWPS to draw flow from TFSC secondary effluent<br>• Provide 2nd feed to DCJ from Central Generation and load shed for non-critical loads. | | | | | | | | | | | | | | | | |
| **P2-122** | Headworks Modifications at Plant No. 2 for GWRS Final Expansion | TFSC | • TFSC to treat the reclaimable stream. | | | | | | | | | | | | | | | | |
| **J-36-2** | GWRS Final Expansion Coordination | TFSC | • New diversion structure and weir box to divert the TFSC effluent to OCWD equalization tanks and pump station at P2. | | | | | | | | | | | | | | | | |
| **X-031** | Plant No. 2 TFSC Rehabilitation | TFSC facility | • Overall rehabilitation of TFSC. Replace the TF media. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

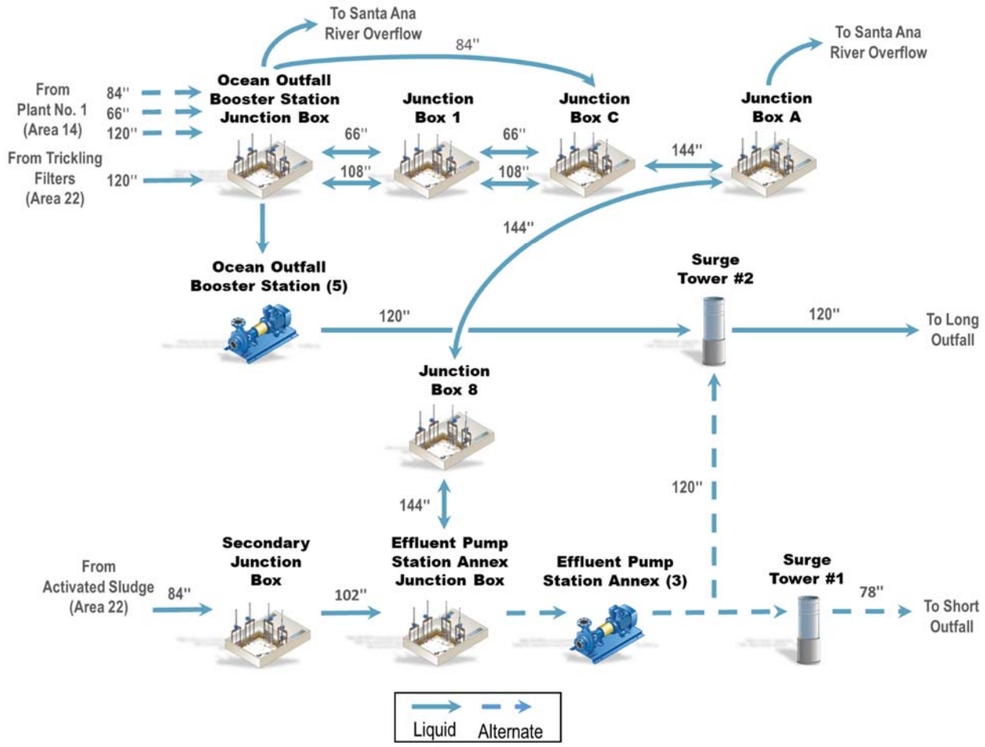
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; DCJ=Distribution Center J; FY=Fiscal Year; GWRS =Groundwater Replenishment System; OCWD= Orange County Water District; PWPS = Plant Water Pump Station; RSS=Return Secondary Sludge; SC=Secondary Clarifier; TF= Trickling Filter; TFPS= Trickling Filter Pump Station; TFSC= Trickling Filter Secondary Clarifier

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 24 – PLANT NO. 2 EFFLUENT DISPOSAL

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | OOBS | Junction Boxes | | | | EPSA | Disinfection System | Land Outfalls | | | | 120" Ocean Outfall | 78" Ocean Outfall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | JB-1 | JB-C | JB-A | JB-8 | | | Surge Tower #1 | Surge Tower #2 | Sample Building | Beach Box | | |
| **Civil** | | | | | | | | | | | | | |
| Effluent Piping | 4 | 1 | 2 | 2 | 2 | 4 | - | 1 | 2 | 1 | 2 | - | - |
| **Structural** | | | | | | | | | | | | | |
| Structures, Buildings | 4 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 |
| **Mechanical** | | | | | | | | | | | | | |
| Pumps, Fans | 3 | - | - | - | - | 2 | 4 | - | - | - | - | - | - |
| Gates | 2 | 1 | 2 | 2 | 2 | 5 | - | - | - | - | - | - | - |
| Valves | 2 | - | - | - | - | 2 | - | 5 | 2 | - | - | - | - |
| Pipes | 3 | 1 | 2 | 2 | 2 | 5 | 3 | 1 | 2 | 1 | 1 | - | - |
| Tank | - | - | - | - | - | - | 4 | - | - | - | - | - | - |
| Manhole Covers | - | - | - | - | - | - | - | - | - | - | - | ? | ? |
| Monel Parts | - | - | - | - | - | - | - | - | - | - | - | ? | ? |
| Ballast | - | - | - | - | - | - | - | - | - | - | - | ? | ? |
| **Electrical** | | | | | | | | | | | | | |
| Process – Motor, MCC, VFD | 5 | - | - | - | - | 3 | 3 | 2 | 2 | 2 | - | - | - |
| **Instrumentation** | | | | | | | | | | | | | |
| PLC, Flow Meters | 5 | - | - | - | - | 3 | 3 | 2 | 2 | 2 | - | - | - |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

EPSA=Effluent Pump Station Annex;

JB=Junction Box;

MCC=Motor Control Center;

OOBS=Ocean Outfall Booster Station;

PLC= Programmable Logic Controller;

RUL=Remaining Useful Life;

? = Unknown RUL;

VFD=Variable Frequency Drive

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Ocean Outfall Booster Station** | |
| Pump | 5 |
| Wingwall Structure | 1 |
| Gate | 3 |
| **Junction Boxes** | |
| Junction Boxes | 4 |
| Wingwall Structure | 1 |
| Gate | 13 |

| Major Assets | Quantities |
|---|---|
| **Effluent Pump Station Annex** | |
| Pump | 3 |
| Gate | 14 |
| **Disinfection Facility** | |
| Sodium Bisulfite Tank | 3 |
| Sodium Bisulfite Feed Pump | 6 |
| Bleach Tank | 6 |
| Bleach Feed Pump | 8 |

| Major Assets | Quantities |
|---|---|
| **Land Outfalls** | |
| Surge Tower | 2 |
| Valve | 2 |
| Sample Building | 1 |
| Flowmeters | 3 |
| Beach Box | 1 |
| **120" Ocean Outfall** | |
| Port hole | 500 |
| Manhole cover | 47 |

| Major Assets | Quantities |
|---|---|
| **78" Ocean Outfall** | |
| Port hole | 125 |
| Manhole cover | 14 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 24 – PLANT NO. 2 EFFLUENT DISPOSAL

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Reliability of EPSA System –** With J-117B rehabilitating OOBS pumps, up to 2 OOBS pumps may be down during the construction, which is scheduled to begin in April of 2021. By then, EPSA system needs to stay reliable to compensate outfall capacity loss from OOBS being down. There were 2 projects identified to improve EPSA reliability: VFD cells refurbishment, motor cooling improvement, and EPSA discharge line assessment and repair. | • VFD cells refurbishment and control modernization are complete.<br>• EPSA motors cooling issue has been approved by the Clearinghouse (PRN-00519) by modifying the motor cooling with additional internal fans. The project has been assigned as FE19-06 and is currently in a design phase.<br>• Earlier this year, performed a confined space entry of EPSA discharge pipe and identified areas that need to be repaired. The project has been approved by the Clearinghouse (PRN-00642) and is being executed through maintenance contract. |
| • **Reliability of Disinfection System–** The District no longer discharges primary effluent to the ocean, and in 2015, the District received an approval to stop disinfection for the Long Outfall. The Bleach Station is minimally used to disinfect plant water, but the Sodium Bisulfite Station was inactive since then. Both systems need to be available in case the Short Outfall is used during emergencies or planned maintenance. | • P2-98A will demolish the existing Bleach Station and build a new Bleach Station that primarily serves as an odor control for new primary sedimentation basins. The new station has a provision to disinfect effluent if needed.<br>• P2-135 Sodium Bisulfite Station Rehabilitation is in place to downsize the existing sodium bisulfite facility to address new design conditions, and rehabilitate structural, mechanical, electrical, and instrumentation to extend the useful life. The project is scheduled to start in 2021. |
| • **Reliability of Outfall Valve No. 8 and no. 9 –** 120” outfall valve No. 8 and No. 9 are located downstream of Surge Tower #1. They are critical to the operation to ensure that no effluent leaves through the short 78” Outfall. Recently, No. 8 failed due to sheared operating shaft. No. 9 is still operational but could be in a similar risk due to same design. | • No. 8 is going through an expediated process to have the valve back in service.<br>• Area engineer will take the lead on #9 to have it assessed and rehabilitated if needed to ensure its reliability. |
| • **Long Ocean Outfall Assessment –** With long outfall pipe approaching 50 years in service, need an extensive assessment to understand maintenance required to extend the useful life. Also, when the Final Expansion of the GWRS comes online in 2023, the outfall will observe a significant flow reduction. Need to evaluate the impact of reduced flow to a distribution of flow among the outfall diffuser ports. | • PS18-09 Ocean Outfall Condition Assessment and Scoping Study is in place to develop a detailed scope of work for the future X-053 project. All of field activities will be completed in 2021.<br>• X-053 is created to execute rehabilitation efforts per recommendations from PS18-09. |

## Current and Future Projects

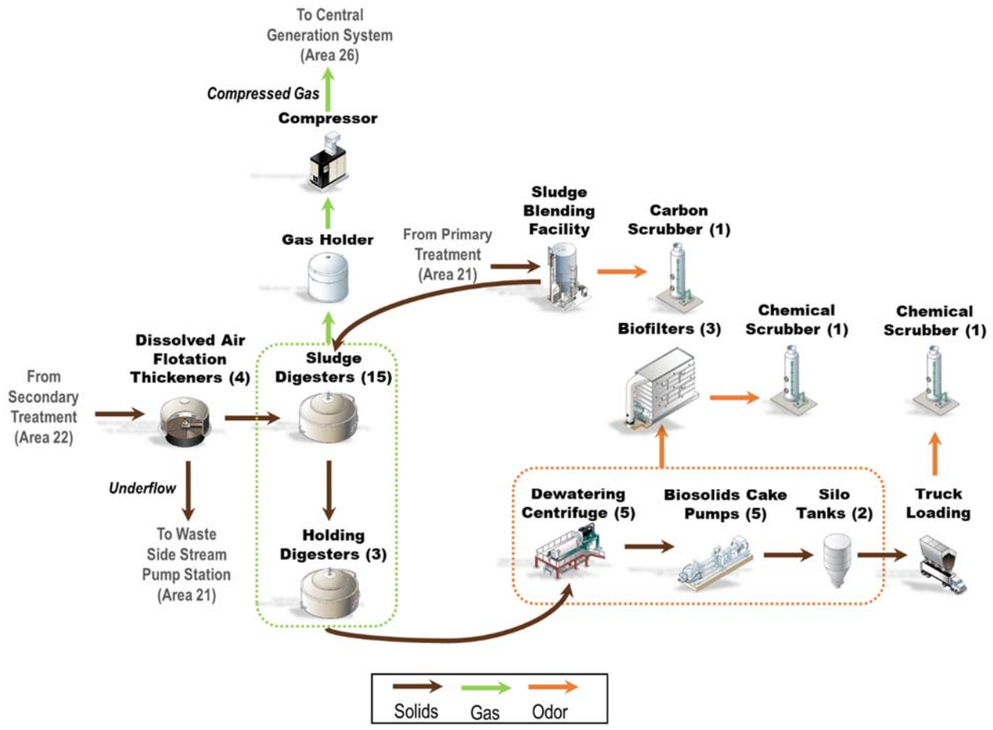
| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 | FY 34/35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PS18-09** | Ocean Outfall Condition Assessment | 120” Ocean Outfall | • Determine condition of Ocean Outfall and provide recommendations to extend its useful life. | | | | | | | | | | | | | | | |
| **J-117B** | Outfall Low Flow Pump Station | OOBS & New Low Flow Pump Station | • Rehabilitate the OOBS and construct a new Low Flow Pump Station.<br>• Replace the Plant Water Pump Station. | | | | | | | | | | | | | | | |
| **P2-135** | Sodium Bisulfite Station Rehabilitation | Sodium Bisulfite Station | • Downsize existing sodium bisulfite facility to address new design conditions and rehabilitate to extend the useful life. | | | | | | | | | | | | | | | |
| **X-053** | Long Ocean Outfall Rehabilitation | 120” Ocean Outfall | • Rehabilitate long ocean outfall per PS18-09 recommendations. | | | | | | | | | | | | | | | |
| **PRN-00591** | OOBS Elevator Modernization | OOBS | • Modernize one hydraulic service elevator and bring it up to the latest codes. | | | | | | | | | | | | | | | |
| **PRN-00710** | Junction Box A Overflow Pipe Repair | JB-A | • Rehabilitate 2 overflow pipe from JB-A per PS17-10 final report recommendation | | | | | | | | | | | | | | | |
| **FE19-06** | EPSA Motor Cooling Improvement | EPSA | • Modify motor cooling system to provide adequate cooling to the motor at a lower speed. | | | | | | | | | | | | | | | |
| **PRN-00642** | EPSA Discharge Pipe Repair | EPSA | • Use a 7-Pack TO repair items identified from the confined space entry assessment in January 2020. | | | | | | | | | | | | | | | |
| **X-0XX** | Santa Ana River Wingwall Rehabilitation | OOBS & JB-A | • Rehabilitate wingwalls by OOBS and JB-A per PS17-10 final report recommendations | | | | | | | | | | | | | | | |
| **N/A** | Outfall Valve No. 8 Repair | Surge Tower No. 1 | • Repair sheared operating shaft on Valve No. 8 and inspection Valve No. 9 | | | | | | | | | | | | | | | |
| **N/A** | Outfall External Inspection | 120” Ocean Outfall | • Ocean outfall external inspection every 2.5 years per lease agreement with the California State Lands Commission. | | | | | | | | | | | | | | | |
| **N/A** | Outfall Structural Integrity Report | 120” Ocean Outfall | • Ocean outfall structural integrity report every 5 years per the NPDES Permit. | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**
CIP=Capital Improvement Program; EPSA=Effluent Pump Station Annex; FY=Fiscal Year; JB=Junction Box; N/A=Not Applicable; NPDES=National Pollutant Discharge Elimination System; OOBS=Ocean Outfall Booster Station; TO=Task Order; VFD=Variable Frequency Drive

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 25 – PLANT NO. 2 SOLIDS HANDLING – DIGESTERS

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Digester C | Digester D | Digester E | Digester F | Digester G | Digester H | Digester I | Digester J | Digester K | Digester L | Digester M | Digester N | Digester O | Digester P | Digester Q | Digester R | Digester S | Digester T | Digester Ferric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | | | | | | | | | | | | |
| Effluent Piping | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **Structural** | | | | | | | | | | | | | | | | | | | |
| Structure | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Digester Dome | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | - |
| **Mechanical** | | | | | | | | | | | | | | | | | | | |
| Sludge Mixing Pumps/Jet Mixing | 4 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | - |
| Sludge Recirculation and Heating System | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - |
| Hot Water System | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | - |
| Sludge Transfer Pump | 4 | | | 4 | | | 2 | 2 | 4 | | 4 | | 4 | | 4 | | 4 | | - |
| Piping & Valve | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| Chemical Pump | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | 2 |
| **Electrical** | | | | | | | | | | | | | | | | | | | |
| MCC & VFD | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| **Instrumentation** | | | | | | | | | | | | | | | | | | | |
| PLC & Flow Meter | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |

**RUL Legend:**
**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Anaerobic Digesters (C-T)** | |
| Active Digesters | 15 |
| Active/Holding Digesters (I and J) | 2 |
| Holding Digesters (K) | 1 |
| Sludge Mixing Pumps | 15+1+4 (1 each Digester + 1 in Digester K+ 1 backup in each Digester L, M, N, & O) |

| Major Assets | Quantities |
|---|---|
| **Anaerobic Digesters (C-T) (Continued)** | |
| Jet Mixing Pumps | 4 (2 each in Digesters I and J) |
| Sludge Recirculation Pumps | 17 |
| Hot Water Circulation Pumps | 17 |
| Heat Exchangers | 17 |
| Bottom Sludge Pumps | 10 |

| Major Assets | Quantities |
|---|---|
| **Digester Ferric Facility** | |
| Digester Ferric Storage Tanks | 2 |
| Ferric Feed Pumps | 6 |

**Acronym Key:**
MCC=Motor Control Center;
RUL=Remaining Useful Life;
PLC= Programmable Logic Controller;
VFD=Variable Frequency Drive

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 25 – PLANT NO. 2 SOLIDS HANDLING – DIGESTERS

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Reliability of Digesters** – Keep the existing digesters in operable condition before the digesters being replaced by new TPAD digesters as planned by the Biosolids Master Plan | • Digester cleaning and repairs by Maintenance projects that need to be done while digester out of service after cleaning. Most finished. Remining projects are: FR2-0019, FR2-0022, and FE19-10<br>• FE20-02 Digester C, D, F & G Rehabilitation to replace high rate mixing pumps, heat exchangers, sludge recirculation pumps, bottom sludge transfer pumps, and hot water pumps and piping.<br>• P2-137 Digesters Rehabilitation at Plant No. 2 to repair domes, walking bridges, digester walls, handrails, and replace MCCs.<br>• PRN-00684 P2 Digester Maintenance Projects to replace heat exchangers, sludge recirculation pumps and bottom sludge transfer pumps. |
| • **Digester Replacement** – Building new digester complex as recommended by Biosolids Master Plan to replace the existing digesters | • Series of projects identified by Biosolids Master Plan and 2017 Facility Master Plan to replace the digesters with TPAD facility and improve the site, including, P2-128 TPAD Digester Facility; P2-129 - Digester P, Q, R, and S Replacement; XP2-131 - Digester I, J, and K Replacement; XP2-130 - Food Waste Receiving Facility; XP2-132 - Digester Demolition. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 | FY35/36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **N/A** | Digester Cleaning | Dig. D, J, K | • Maintenance is planning to clean Dig. D, J, and K in calendar year 2021 | | | | | | | | | | | | | | | | |
| **FR2-0019** | Digester O Repairs at Plant No. 2 | Dig. O | • Replace 15 penetration valves and other minor repairs. | | | | | | | | | | | | | | | | |
| **FR2-0022** | Digester O Structural Repairs | Dig. O | • Repair corroded penetration pipes, walkway, pipe supports and concrete spalling. | | | | | | | | | | | | | | | | |
| **FE19-10** | Digesters C, D, F, G, and I Gas Balance Lines Repl. | Dig. C, D, F, G, I | • Replaces digester gas balance lines from PVC to Stainless Steel (C to D, D to I, and F to G). | | | | | | | | | | | | | | | | |
| **PRN-00684** | P2 Digester Maintenance Projects | Dig. E, H, L, M, N, O, P, Q, R, S, T | • Replace major mechanical equipment including heat exchangers, sludge recirculation and transfer pumps. | | | | | | | | | | | | | | | | |
| **FE20-02** | Digester C, D, F, and G Rehabilitation | Dig. C, D, F, G | • Replace major mechanical equipment including high rate mixing pumps, heat exchangers, sludge recirculation, and transfer pumps, hot water pumps and piping. | | | | | | | | | | | | | | | | |
| **P2-137** | Digesters Rehabilitation at Plant No. 2 | Dig. C, D, F, G, H, L, M, N, O, P, Q, R, S, T | • Digester domes, walls, large pipe penetration, hot water piping, handrails, walking bridges and MCC rehabilitation. | | | | | | | | | | | | | | | | |
| **P2-124** | Interim Food Waste Receiving Facility | All Digesters, gas treatment facilities and Central Generation | • Receive 150 wet ton per day of source separated and processed organic food waste to digesters for Co-digestion. | | | | | | | | | | | | | | | | |
| **P2-128** | TPAD Digester Facility | New TPAD Digester Facility | • Build 6 new thermophilic digesters, batching and cooling facilities and use the existing digesters as the mesophilic phase to treat the sludge by TPAD process. | | | | | | | | | | | | | | | | |
| **P2-129** | Digester P, Q, R, and S Replacement | Digester P, Q, R, S | • Replace digester P, R, R, S as the new mesophilic digesters. | | | | | | | | | | | | | | | | |
| **XP2-130** | Food Waste Receiving Facility | All Digesters, gas treatment facilities and Central Generation | • 500 wet tons of preprocessed food waste receiving facility. | | | | | | | | | | | | | | | | |
| **XP2-131** | Digester I, J, and K Replacement | All digesters | • Final 3 new digesters in addition to the new digesters. | | | | | | | | | | | | | | | | |
| **XP2-132** | Digester Demolition | All digesters | • Demolish exiting digesters after 13 total new digesters built. | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

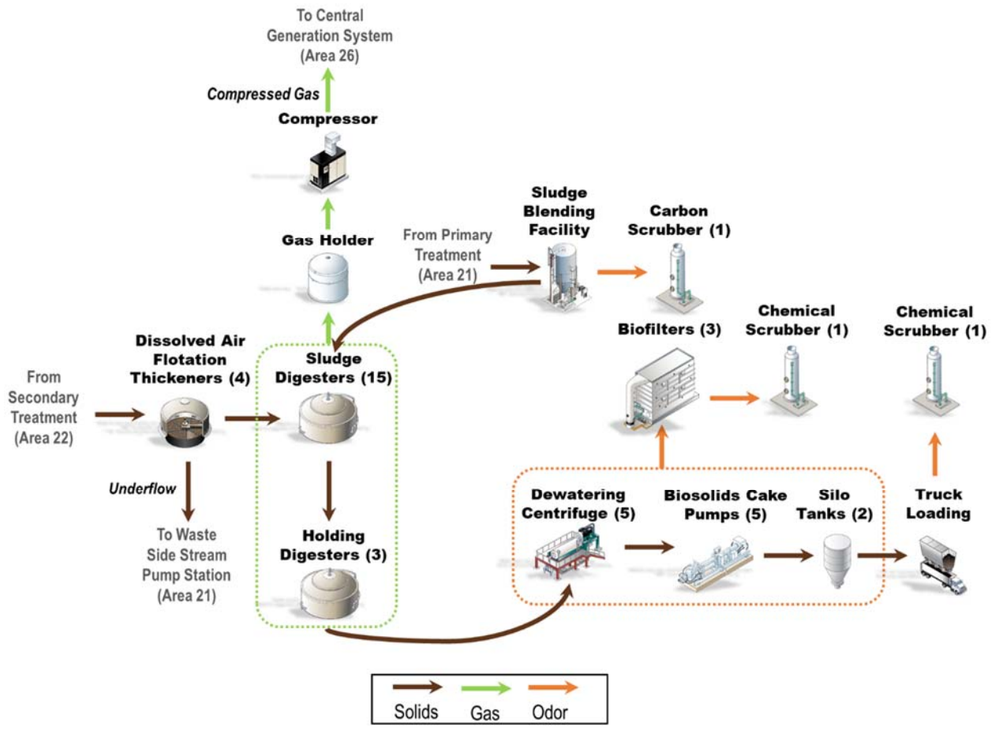
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year; N/A=Not Applicable; TPAD=Temperature Phased Anaerobic Digestion

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 25 – PLANT NO. 2 SOLIDS HANDLING – FACILITIES

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Sludge Blending Facility | Plant Boiler | Centrifuge Dewatering | Centrifuge Bldg. & Silos Odor Control | Truck Loading Bay Odor Control | Gas Handling | Gas Holder | Truck Loading |
|---|---|---|---|---|---|---|---|---|
| **Civil** | | | | | | | | |
| Effluent Piping | 2 | 4 | 1 | 1 | 1 | - | 3 | 1 |
| **Structural** | | | | | | | | |
| Structure | 2 | - | 1 | 1 | 1 | - | 3 | 1 |
| Building | 1 | 3 | 1 | - | - | 4 | - | - |
| **Mechanical** | | | | | | | | |
| Pump | 4 | - | 1 | 1 | 1 | - | - | - |
| Fan | - | - | - | 1 | 2 | - | - | - |
| Boiler & Heat Exchanger | - | 5 | - | - | - | - | - | - |
| Centrifuge | - | - | 1 | - | - | - | - | - |
| Polymer System | - | - | 1 | - | - | - | - | - |
| Biofilter | - | - | - | 1 | - | - | - | - |
| Chemical System | - | - | - | 1 | 1 | - | - | - |
| Gas Compressor | - | - | - | - | - | 4 | - | - |
| Gas Dryer | - | - | - | - | - | 2 | - | - |
| Gas Flare | - | - | - | - | - | 4 | - | - |
| Screw Conveyor | - | - | - | - | - | - | - | 4 |
| Sliding Frame | - | - | - | - | - | - | - | 4 |
| Piping & Valve | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 2 |
| **Electrical** | | | | | | | | |
| MCC & VFD | 2 | 2 | 1 | 1 | 1 | 4 | - | 3 |
| **Instrumentation** | | | | | | | | |
| PLC & Flow Meter | 2 | 2 | 1 | 1 | 1 | 4 | - | 3 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

MCC=Motor Control Center;

PLC= Programmable Logic Controller;

RUL=Remaining Useful Life;

VFD=Variable Frequency Drive

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Sludge Blending Facility** | |
| Sludge Blending Tanks | 2 |
| Digester Feed Pumps | 6 |
| Electrical Building | 1 |
| **Plant Boiler Facility** | |
| Building | 1 |

| Major Assets | Quantities |
|---|---|
| Boilers and Heat Exchangers | 2 |
| **Dewatering** | |
| Centrifuges | 5 |
| Sludge Feed Pumps | 5 |
| Cake Transfer Pumps | 5 |
| Polymer System | 1 |

| Major Assets | Quantities |
|---|---|
| **Centrifuge Building & Silos Odor Control** | |
| Biofilters | 3 |
| Ammonia Scrubber | 1 |
| **Gas Handling** | |
| Gas Compressors | 3 |
| Gas Dryer | 1 |

| Major Assets | Quantities |
|---|---|
| Gas Flares | 3 |
| **Gas Holder** | |
| Gas Holder Tank | 1 |
| **Truck Loading** | |
| Cake Storage Silos | 2 |
| Sliding Frames | 2 |
| Screw Conveyors | 12 |

| Major Assets | Quantities |
|---|---|
| **Truck Loading Bay Odor Control** | |
| 2-stage Chemical Scrubber | 2 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 25 – PLANT NO. 2 SOLIDS HANDLING – FACILITIES

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Boilers and Heat Exchangers –** Boiler tube leaking; boiler heat exchangers wearing out; no steam bypass outlet during boilers PM and AQMD required testing; boiler corrosion issues | • MP-271 – P2 Boiler Heat Exchangers Replacement (completed in 2020).<br>• FR2-003 – P2 Boiler Re-tubing.<br>• FE18-15 – Plant Boiler System Relief at Plant No. 2. |
| • **Gas Handling System –** Gas compressor system end of useful like and needs replacement | • J-124 – Digester Gas Facilities rehabilitation.<br>• Gas compressors repair and overhaul by Maintenance. |
| • **Truck Loading –** Auger No. 6 and No. 3 out of service due to age and wearing from higher solids content from centrifuge dewatered cake; difficult to lubricate the screw conveyors because of access issues<br>• Aged hydraulic power units<br>• Corroded sliding frame hydraulic cylinders<br>• Truck loading bay fugitive odors escaping<br>• Remaining mechanical and structural rehabilitation need | • PRN-00513 – P2 Truck Loading Screw Conveyors Replacement (replace all 12 augers and lubrication system). Six augers replacement on Silo B were completed in September 2020. Silo A six augers replacement SOW is currently out to bid, and the NTP date is scheduled in March 2021.<br>• Maintenance purchase order for manufacture to overhaul the HPUs.<br>• PRN-00619 P2 Truck Loading Sliding Frame Hydraulic Cylinders Replacement (AI-126).<br>• PRN-00689– Truckloading bay odor problem and improvements study.<br>• X-032 Truck Loading Rehabilitation. |
| • **Centrifuge –** Centrifuge #2 flight damaged and required factory refurbishment, and Centrifuge #1 rotating assembly damaged and is waiting for repair<br>• Sludge Feed Pump Seal Water Failure<br>• Lack of TSS analyzer at centrifuge feed and radar technology level sensing at cake hopper to replace the ultrasound level sensor | • PRN-00570 – Centrifuge #2 repair and spare rotating assembly purchase.<br>• Centrifuge #1 repair by P2-92 warranty or Maintenance to be determined.<br>• P2-92 team to design and replace seal water supply control valve.<br>• Instrumentation Maintenance to work with vendors to do trials first, and possible installation to improve the controls. |
| • **Sludge Blending Facility –** aged and poor performance of the digester feed pumps | • Maintenance is replacing all the 6 Vogelsang rotary lobe pumps with Boerger pumps. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 | FY35/36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE18-15** | Plant Boiler System Relief at Plant No. 2 | Boiler system | • Add steam by-pass to release the steam to the atmosphere at boiler building room level. | | | | | | | | | | | | | | | | |
| **FR2-003** | 2 Boiler Re-tubing | Boiler system | • Re-tube both boilers. | | | | | | | | | | | | | | | | |
| **PRN-00513 (MP-585)** | Truck Loading Screw Conveyor Replacement | Truck Loading Station | • Replace all twelve screw conveyors, and lubrication extension will be included in the new screw conveyor system. | | | | | | | | | | | | | | | | |
| **N/A** | HPU Overhaul | Truck Loading Station | • Overhaul the hydraulic power units and replace the hydraulic hose | | | | | | | | | | | | | | | | |
| **PRN-00619** | Truck Loading Sliding Frame Hydraulic Cylinders Replacement | Truck Loading Station | • Replace all the 4 cylinders driving the sliding frames at both silos | | | | | | | | | | | | | | | | |
| **N/A** | Gas Compressor Overhaul | Gas compressor facility | • Overhaul all gas compressors. | | | | | | | | | | | | | | | | |
| **N/A** | Digester Sludge Feed Pumps Replacement at SBF | Sludge Blending Facility | • Replace all 6 primary sludge feed pumps at SBF | | | | | | | | | | | | | | | | |
| **J-124** | Digester Gas Facilities Rehabilitation | Gas compressors, dryers, flare and holder system | • Replace the entire gas handling system including the gas compressor building. | | | | | | | | | | | | | | | | |
| **X-032** | Truck Loading Rehabilitation | Truck Loading Station | • Overall rehabilitation of the truck loading station | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

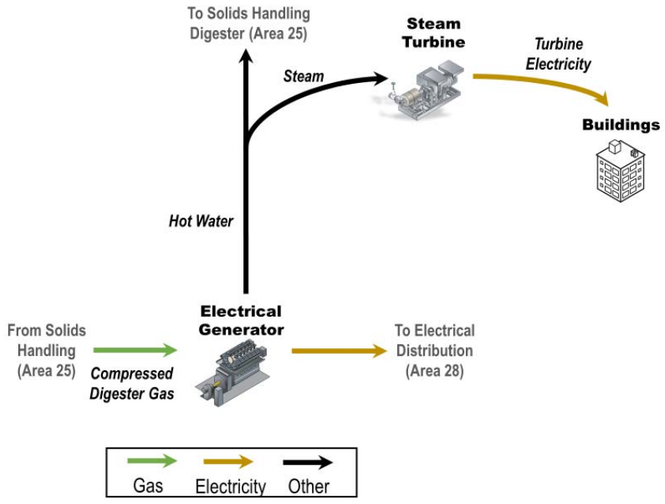
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

AQMD= Air Quality Management District; CIP=Capital Improvement Program; FY=Fiscal Year; HPU=Hydraulic Power Unit; N/A=Not Applicable; PM=Preventative Maintenance

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 26 – PLANT NO. 2 CENTRAL GENERATION

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | Engine Generator #1 | Engine Generator #2 | Engine Generator #3 | Engine Generator #4 | Engine Generator #5 | Steam Turbine Generator | Steam Condenser | Deaerator Vessel | Heat Recovery Boiler #1 | Heat Recovery Boiler #2 | Heat Recovery Boiler #3 | Heat Recovery Boiler #4 | Heat Recovery Boiler #5 | OXI Catalyst | SCR Catalyst | Urea Injection System | Starting Air Compressor #1 | Starting Air Compressor #2 | Starting Air Compressor #3 | Inst. Air Compressor #1 | Inst. Air Compressor #2 | Battery Backup | Plant Water Piping | Miscellaneous |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Structural** | | | | | | | | | | | | | | | | | | | | | | | | |
| Building | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 1 |
| **Mechanical** | | | | | | | | | | | | | | | | | | | | | | | | |
| General | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | - | - | - |
| HVAC | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Lube Oil System | 3 | 3 | 3 | 3 | 3 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Electrical** | | | | | | | | | | | | | | | | | | | | | | | | |
| General | 4 | 4 | 4 | 4 | 4 | 5 | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 | 5 | 5 | 5 | - | - |
| Switchgear | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Instrumentation** | | | | | | | | | | | | | | | | | | | | | | | | |
| General | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | - | - |

**RUL Legend:**

RUL <5 years | RUL 5-10 years | RUL 11-15 years | RUL 16-20 years | RUL >20 years

**Acronym Key:**

HVAC=Heating, Ventilation, and Air Conditioning; Inst.=Instrument; OXI=Oxidizer; RUL=Remaining Useful Life;
SCR= Selective Catalytic Reduction

## Major Assets

| Major Assets | Quantities |
|---|---|
| **Engine Generator** | |
| Gas Engine (16 Cylinder) | 5 |
| Electrical Generator | 5 |
| Engine Lube Oil System | 5 |
| **Steam Turbine Generator** | |
| Steam Turbine | 1 |
| Electrical Generator | 1 |
| Steam Condenser | 1 |
| Deaerator Vessel | 1 |

| Major Assets | Quantities |
|---|---|
| **Heat Recovery System** | |
| Heat Recovery Boiler | 5 |
| **Building** | |
| Building | 1 |
| Piping | Various |
| **Engine Emission Control** | |
| OXI Catalyst | 5 |
| SCR Catalyst | 5 |
| UREA Injection System | 5 |

| Major Assets | Quantities |
|---|---|
| **HVAC** | |
| Ventilation Supply Fans | 5 |
| Ventilation Exhaust Fans | 6 |
| **Air Compressors** | |
| Engine Starting Air | 3 |
| Instrument Air | 2 |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 26 – PLANT NO. 2 CENTRAL GENERATION

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • **Gas Engine Generator Set Reliability –**Aging components and systems required to operate the 5 Central Generation Engines are creating reliability issues and need to be addressed | • Overhaul engines (ongoing).<br>• Replace obsolete systems (i.e., Battery Backup, Switch Gear, Ignition System, PLC Upgrade, etc.). |
| • **Engine Lube Oil System –**Lube Oil Centrifuges are no longer operational | • Install new instrumentation and controls onto the existing 2 units. |
| • **Steam Turbine System Rehabilitation –**Steam Turbine has degraded and needs rehabilitation | • Overhaul the Steam Turbine and Steam Condenser. |
| • **Plant Water Piping –**Plant water (i.e., Cooling Water) piping has degraded and needs replacement | • Replace all plant water piping in the basement of Central Generation. |
| • **Emission Control System –**Housings on the Oxidizer Catalysts are failing prematurely | • Analyze and design new Catalyst Housings. |
| • **Instrument Air Compressors –** are no longer operational | • Replace the entire Instrument Air System, installing new compressors and appurtenances. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRN-00536** | Instrument Air Compressor Replacement | Instrument Air Compressor System, Urea Injection System | Install 2 new Instrument Air Compressors. | | | | | | | | | | | | | | | |
| **PRN-00262** | Steam Turbine Rehabilitation | Steam Turbine Generator | Rehabilitation of the Steam Turbine. | | | | | | | | | | | | | | | |
| **PRN-00211** | Engine Lube Oil System Controls Upgrade | Engine Generator | Install new instrumentation and controls onto the existing units. | | | | | | | | | | | | | | | |
| **MP-227** | Starting Air Compressor System Rehabilitation | Starting Air Compressor System | Rehabilitation of the Air Compressors. | | | | | | | | | | | | | | | |
| **PRN-00427** | Engine Emission Control Redesign | OXI/SCR Catalyst | Analyze and design new Catalyst Housings. | | | | | | | | | | | | | | | |
| **J-135** | Engine Overhauls | Engine Generator | Overhaul the engines as needed (ongoing). | | | | | | | | | | | | | | | |
| **PRN-00314** | Ventilation Supply Fan Rehabilitation | HVAC | Replace one fan and rehabilitation the fan support structures. | | | | | | | | | | | | | | | |
| **SC17-03** | Lube Oil Filter Catwalk | Engine Generator | Install Lube Oil Filter catwalks for maintenance purposes. | | | | | | | | | | | | | | | |
| **FE20-04** | Plant Water Pipe Rehabilitation | Plant Water Piping | Replace existing plant water piping with new. | | | | | | | | | | | | | | | |
| **PRN-00627** | Engine Ignition Timing Sensor Obsolescence Repair | Engine Generator | Replace and install new Hall Effect Sensors onto each engine. | | | | | | | | | | | | | | | |
| **PRN-00697** | Engine Cylinder Pressure Sensing and Diagnostics | Engine Generator | Install Pressure Sensors onto each Cylinder, incl. Software/HMI | | | | | | | | | | | | | | | |
| **TBD** | Engine Ignition System Obsolescence Repair | Engine Generator | Replace and install new Ignition Systems onto each engine | | | | | | | | | | | | | | | |

**Types of Project Legend:**

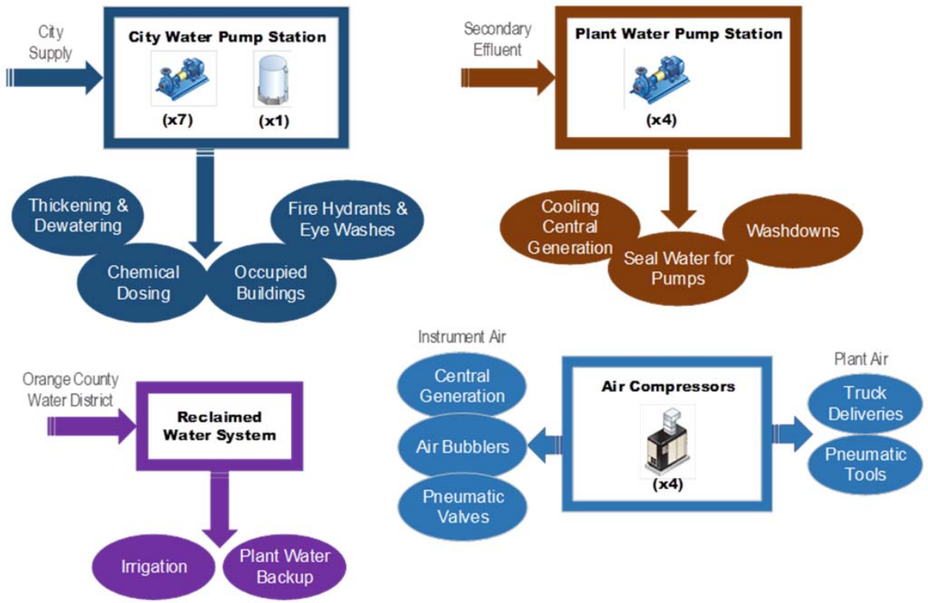
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year; HVAC=Heating, Ventilation, and Air Conditioning; OXI=Oxidizer; RUL=Remaining Useful Life; SCR= Selective Catalytic Reduction

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 27 – PLANT NO. 2 UTILITIES

## Process Schematic




## Major Assets Remaining Useful Life

| Asset Type | City Water System | Plant Water System | Reclaimed Water Piping | Plant Air Systems |
|---|---|---|---|---|
| **Civil** | | | | |
| Pipes | 2 | 3 | 2 | 3 |
| **Structural** | | | | |
| Pump Station | 3 | 3 | - | - |
| Tanks | 3 | - | - | - |
| **Mechanical** | | | | |
| Pumps | 3 | 3 | - | - |
| Strainers | - | 3 | - | - |
| Compressors | - | - | - | 4 |
| Ventilation System | 2 | 2 | - | - |
| **Electrical** | | | | |
| MCC | 1 | 1 | - | - |
| VFD | 3 | 3 | - | - |
| **Instrumentation** | | | | |
| PLC, Flowmeter | 1 | 1 | - | 1 |

**Asset RUL Legend:**

- RUL <5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL >20 years

**Acronym Key:**

MCC=Motor Control Center;

RUL=Remaining Useful Life;

PLC= Programmable Logic Controller;

VFD=Variable Frequency Drive

## Major Assets

| Major Assets | Quantities |
|---|---|
| **City Water** | |
| Pumps | 7 |
| Tanks | 4 |
| Piping | 8.9 Miles |

| Major Assets | Quantities |
|---|---|
| **Plant Water** | |
| Pumps | 4 |
| Strainers | 4 |
| Piping | 10.6 Miles |

| Major Assets | Quantities |
|---|---|
| **Reclaimed Water** | |
| Piping | 6 Miles |

| Major Assets | Quantities |
|---|---|
| **Plant Air** | |
| Compressors | 3 |
| Plant Air Piping | 6.7 Miles |
| Instrument Air Piping | 1.6 Miles |

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 27 – PLANT NO. 2 UTILITIES

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| • Plant/Instrument Air Lines have severe corrosion issues | • Using on-call contractors to perform a condition assessment of the plant air system and identify any leaks or other deficiencies such as improper connections. Current plan is to use the information from the assessment to create larger CIP projects that can improve the piping network throughout the plant. Smaller repairs will be done using on-call contractors and maintenance/asset issues projects. |
| • Plant Water Pipe Failures Throughout | • Due to the corrosive nature of the plant water, the current ductile iron pipes are corroding prematurely and causing failures throughout the plant. Current plan is to investigate other non-metallic piping material that is adequate to handle the plant water corrosivity and at the same time provide reliability and longevity to the piping system. A plan will be developed to estimate RUL more accurately on the piping system and confirm projects are in place to address before reliability issues and failures occur. |

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY20/21 | FY21/22 | FY22/23 | FY23/24 | FY24/25 | FY25/26 | FY26/27 | FY27/28 | FY28/29 | FY29/30 | FY30/31 | FY31/32 | FY32/33 | FY33/34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE18-14** | Plant Water Pipeline Rehabilitation | Piping in tunnels | • 1600 feet of piping in the tunnels. | | | | | | | | | | | | | | |
| **J-117B** | Outfall Low Flow Pump Station | Plant Water Pump Station | • Replace Plant Water Pump Station and plant water piping near project. | | | | | | | | | | | | | | |
| **P2-133** | B/C Side Primary Clarifiers Rehabilitation | Primary Clarifiers | • Replace City water piping near project. | | | | | | | | | | | | | | |
| **P2-98A** | Primary Treatment Rehabilitation | City Water Pump Station | • Refeed City Water Pump Station directly from DC-F 480 switchgear. | | | | | | | | | | | | | | |
| **X-036** | Plant No. 2 City Water Pump Station | City Water Pump Station | • Rehabilitation of City Water Pump Station. | | | | | | | | | | | | | | |
| **X-037** | Plant No. 2 Plant Water Pump Station Demolition | Plant Water Pump Station | • Demo Plant Water Pump Station. | | | | | | | | | | | | | | |
| **PRN-00510** | Repair Reclaimed Pipe Leaks | Piping in tunnels | • Repair and re-route portions of reclaimed water line near Primary Clarifiers and Bar Screen. | | | | | | | | | | | | | | |

**Types of Project Legend:**

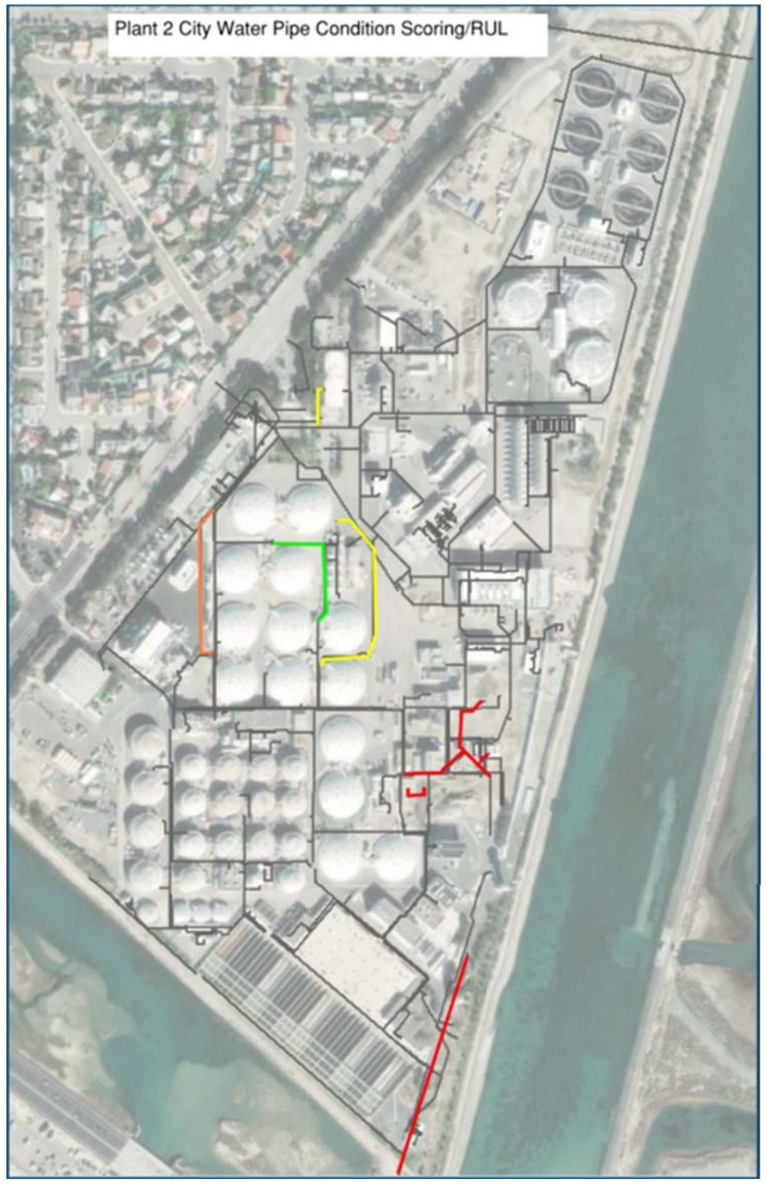
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

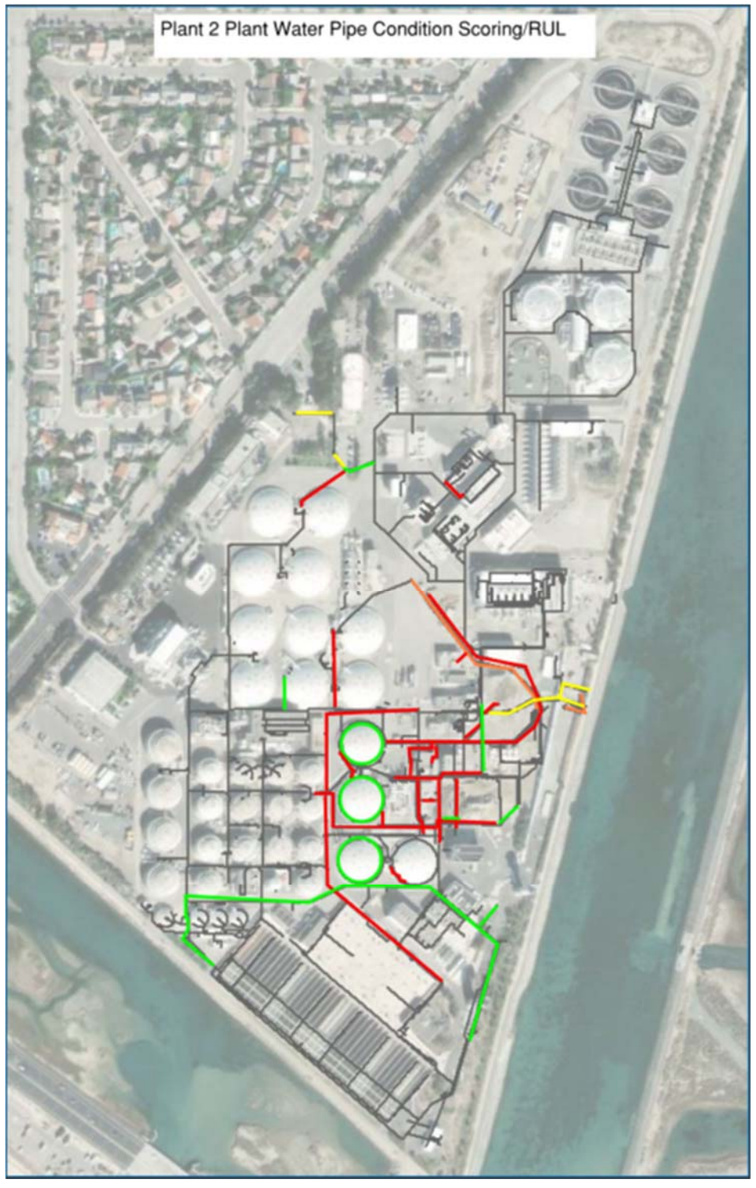
**Acronym Key:**

CIP=Capital Improvement Program; FY=Fiscal Year; HP=Horsepower; OOBS= Ocean Outfall Booster Station

## ASSET MANAGEMENT SYSTEM SUMMARY – AREA 27 – PLANT NO. 2 UTILITIES

**Remaining Useful Life of Utility Infrastructure**




**RUL Legend:**

**RUL <5 years** | **RUL 5-10 years** | **RUL 11-15 years** | **RUL 16-20 years** | **RUL >20 years**

**Acronym Key:**

RUL=Remaining Useful Life

## ASSET MANAGEMENT SYSTEM SUMMARY – AREA 27 – PLANT NO. 2 UTILITIES

### Remaining Useful Life of Utility Infrastructure


**RUL Legend:**

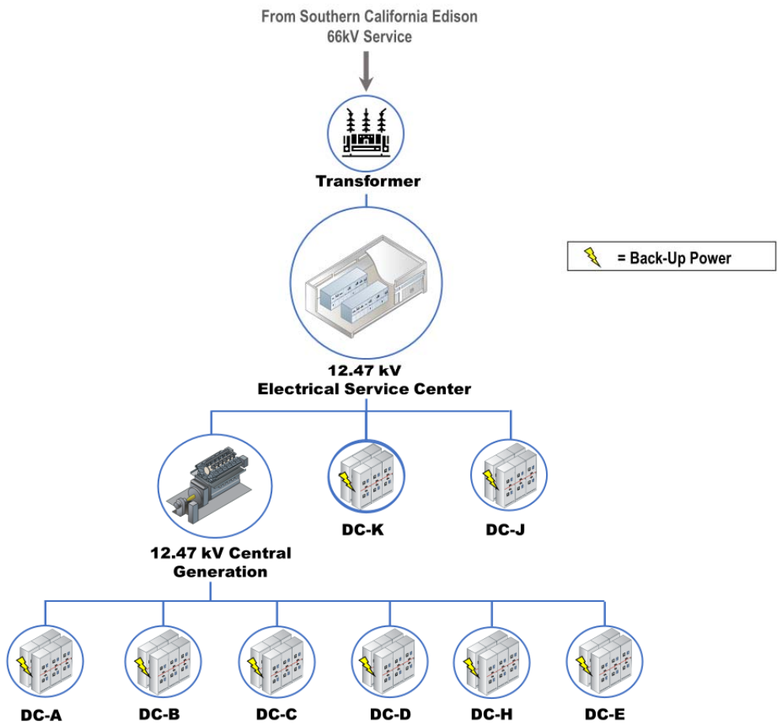
RUL <5 years | RUL 5-10 years | RUL 11-15 years | RUL 16-20 years | RUL >20 years

**Acronym Key:**

RUL=Remaining Useful Life

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 28 – PLANT NO. 2 ELECTRICAL DISTRIBUTION

## Process Schematic




## Major Assets

| Major Assets | Quantities |
|---|---|
| Transformers | 58 |
| Standby Generators | 9 |
| 12kV Switchgears | 27 |
| 480V Switchgears | 32 |
| 125VDC and 24VDC Battery Systems | 38 |
| UPS | 27 |

**Acronym Key:**
CENGEN=Central Generation;
DC=Distribution Center;
kV=Kilovolt;
PB=Power Building;
RUL=Remaining Useful Life;
VDC=Volts of Direct Current;
UPS=Uninterruptible Power Supply

## Major Assets Remaining Useful Life

| Asset Type | Service Center | CENGEN | DC-A | DC-B | DC-C | DC-D | DC-E (EPSA) | EPSA SPF | DC-H (Headworks) | Headworks Standby Building | DC-J | DC-K | PB-A | PB-B | PB-C | PB-D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tier I – 12.47KV Primary Distribution Level** | | | | | | | | | | | | | | | | |
| Transformers: 12.47/2.4kV | - | - | - | | 4 | - | - | - | - | - | - | - | - | - | - | |
| Transformers: 12.47/0.48kV | 3 | 4 | 3 | 3 | 4 | 4 | 3 | - | 2 | - | 2 | 1 | 4 | 4 | 4 | 4 |
| 12.47kV Switchgears | 3 | 5 | 3 | 3 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | 1 | - | - | - | - |
| 12.47kV Level Indicator Switches | - | - | - | 3 | - | - | - | - | - | - | - | 1 | 1 | 3 | 3 | 4 |
| 12.47kV Feeders | 4 | 4 | 1 | 1 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 4 | 4 |
| 12.47kV Generators | - | - | - | - | - | - | - | 3 | - | 3 | - | - | - | - | - | - |
| **Tier II – 4.16kV Distribution Level** | | | | | | | | | | | | | | | | |
| 4.16kV Feeders | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| **Tier III – 2.4kV Distribution Level** | | | | | | | | | | | | | | | | |
| 2.4kV Feeders | - | - | - | - | 4 | - | - | - | - | - | - | - | - | - | - | - |
| **Tier IV – 480V Distribution Level** | | | | | | | | | | | | | | | | |
| 480V Switchgears | - | - | 3 | 3 | - | 4 | - | - | 2 | - | 2 | 1 | 4 | 4 | 4 | 4 |
| Transfer Switches | - | - | - | - | - | - | - | - | - | - | - | - | 4 | 4 | 4 | 4 |
| Generators | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 | 4 |
| **Tier V – UPS** | | | | | | | | | | | | | | | | |
| UPSs Individual | - | 5 | - | - | 5 | 4 | - | - | 4 | - | - | 4 | - | 4 | - | - |
| UPSs Regional | - | - | - | 1 | - | - | 1 | - | - | - | 4 | - | - | - | - | - |
| **Tier VI – 125 VDC and 24 VDC Battery Systems** | | | | | | | | | | | | | | | | |
| 125VDC Chargers | 4 | 5 | 5 | 5 | - | - | - | 4 | - | 4 | 4 | 1 | 4 | 4 | - | - |
| 125VDC Batteries | 4 | 5 | 5 | 5 | - | - | - | 4 | - | 4 | 4 | 1 | 4 | 4 | - | - |
| 24VDC Chargers | - | 5 | - | - | - | - | - | 4 | - | 4 | - | - | - | - | 4 | 4 |
| 24VDC Batteries | - | 5 | - | - | - | - | - | 4 | - | 4 | - | - | - | - | 4 | 4 |
| **Generator Controls** | | | | | | | | | | | | | | | | |
| Generator Controls | - | 5 | - | - | - | - | - | 3 | | 3 | - | - | - | - | 4 | 4 |

**RUL Legend:**
**RUL <5 years** **RUL 5-10 years** **RUL 11-15 years** **RUL 16-20 years** **RUL >20 years**

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 28 – PLANT NO. 2 ELECTRICAL DISTRIBUTION

## Key Issues

| Key Issues | Actions and Recommendations |
|---|---|
| 1. Southern California Edison is currently a single 66kV Feeder Service | 1. P2-126 Project will install new 66kV Switchyard; Additional 66kV Line; Additional Transformer with automatic Load tap changes, new Electrical Service Center. |
| 2. Aging Battery Chargers and Batteries | 2. XPS0061 DC Battery Monitoring and Management Solutions: Study to develop technical solution to monitor existing battery life, develop path forward for replacing aged battery and charger systems. |
| 3. Plant No. 2 Cabling: Aging Medium Voltage Cabling Infrastructure | 3. MP-320 Service Contract in place for testing aging medium voltage cables to perform Condition Assessment and develop plan for preventive maintenance. |
| 4. Plant No. 2 Cabling: 480V (Headworks) failing cables | 4. MP-509 will address repairs of Plant No. 2 480V (Headworks) failing cables. |
| 5. Currently, some secondary treatment processes do not have back up power from generators. | 5. Evaluate the need to add equipment loads that currently do not have back up generation to secondary generation system. |

**Acronym Key:**

kV=Kilovolt; PEPS=Primary Effluent Pump Station; V=Volt

# ASSET MANAGEMENT SYSTEM SUMMARY – AREA 28 – PLANT NO. 2 ELECTRICAL DISTRIBUTION

## Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MP-509** | P2 Headworks Low Voltage Cable Assessment | Plant No. 2 Power Distribution/Headworks | • Plant No. 2 Headworks 480V Cable Repairs | | | | | | | | | | | | | | |
| **MP-233/ XPS0061** | Critical UPS and DC Power Back Up Battery Condition Monitoring and Management Solutions | Plant No. 1 and Plant No. 2 Power Distribution | • Develop automated approach to monitor and test existing batteries. Develop path forward for replacing aged battery and charger systems. | | | | | | | | | | | | | | |
| **MP-320/S-2019-1107B** | On-Call Plant No. 1 and Plant No. 2 Medium Voltage Cable Testing Services | Plant No. 1 and Plant No. 2 Power Distribution and Cabling Infrastructure | • Condition assessment and Testing of Plant No. 1 and Plant No. 2 Medium Voltage Cabling Infrastructure. | | | | | | | | | | | | | | |
| **P2-126** | Outfall Low Flow Pump Station | Plant No. 2 Outfall Booster Station | • Rehabilitation of Mechanical, electrical and Civil Systems at the Ocean Outfall Booster Station at Plant No. 2 that includes 12.47kV switchgear replacement, VFD motors, and feeder cable replacement. | | | | | | | | | | | | | | |
| **P2-107/J-117B** | Outfall Low Flow PS | Power Distribution, OOBS, LOFLO | • This project will rehabilitate the mechanical, electrical, and civil systems at the Ocean Outfall Booster Station at Plant No. 2, which is the primary pumping station for the discharge of secondary effluent to the ocean outfall system. Project will replace LOFLO/PWPS 480V Switchgear, 12.47kV Switchgears (Main and Generators) at Cen Gen, OOBs/DC-C 12.47kV and 480V Switchgear, replace electromechanical relays with solid state relays for Service Center and Distribution Center B, add new SCADA Points and Load Shedding System. | | | | | | | | | | | | | | |
| **FE19-08** | Secondary Treatment VFD Replacements at Plant No. 2 | Power Distribution | • This project will replace six 125HP Return Activated Sludge VFDs, four 50HP Waste Activated Sludge VFDs, four 300HP Primary Effluent Pump Station VFDs, and associated cables and conductors at Plant No. 2. | | | | | | | | | | | | | | |
| **SC19-06** | EPSA Standby Power Generator Control Upgrades at Plant No. 2 | Plant No. 2 Power Distribution | • This project will upgrade 12.47kV ESPA Generator Switchgear and Generator controls to ensure successful operation, paralleling and load sharing suitable for addition of fourth generator under J-117B Project. | | | | | | | | | | | | | | |
| **P2-98A** | A-Side Primary Clarifiers Replacement at Plant No. 2 | Plant No. 2 Clarifiers, Power Distribution System | • This project will demolish and replace 4 existing A-Side Primary Clarifiers, replace the South Scrubber Complex with a dual stage chemical scrubbing odor control treatment system, replace existing utilities, demolish power buildings, and install a new Power Building F. | | | | | | | | | | | | | | |
| **J-124** | Digesters Gas Facility Replacement | Plants No. 1 and Plant No. 2 Compressors, Flares, Power Distribution. | • This project will replace the low- and high-pressure digester gas facilities at Plant No. 1 and Plant No. 2 to meet current and future needs such as projected gas production and Air Quality. The Plant No. 2 work includes construction of a new gas compressor building and Distribution Center L Building, and replacement of the flares and gas compressors. | | | | | | | | | | | | | | |
| **P2-128** | TPAD Digester Facility at Plant No. 2 | Plant No. 2 Digesters, Electrical and Mechanical Systems | • This project will build 6 new thermophilic digesters; Class A batch tanks; sludge heating and cooling facilities; associated sludge pumping; digester mixing; gas conveyance and cooling facilities; odor control; power distribution; and controls, including 2-story Electrical Power Building. The project will decommission Power Building C. | | | | | | | | | | | | | | |
| **P2-133** | Plant No. 2- B/C-Side Clarifiers Rehabilitation | Plant No. 2 Primary Clarifiers, Mechanical and Electrical Systems | • Extensively rehabilitate the C-Side primary clarifiers at Plant No. 2. The work is expected to include demolition of Power Building D, including backup generator and installation of new electrical systems. | | | | | | | | | | | | | | |

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **X-103** | UPS System Upgrades | Plant No. 2 Power Distribution System | • New 150kV-ampere Regional UPS addition at Plant No. 2. | | | | | | | | | | | | | | |

**Types of Project Legend:**

**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvements Program; FY=Fiscal Year; kV=Kilovolt; LOFLO = Low Flow; NFPA= National Fire Protection Association; OCSD=Orange County Sanitation District; SCADA=Supervisory Control and Data Acquisition; TPAD=Temperature-Phased Anaerobic Digester; UPS=Uninterruptible Power Supply; V=Volt; VFD=Variable Frequency Drive

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# Collection System Pump Station Asset Management Summaries

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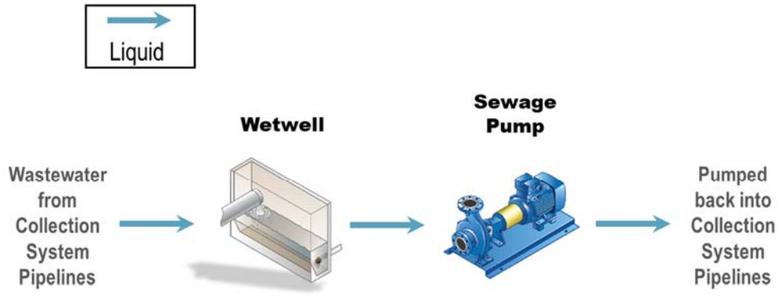
# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – PUMP STATIONS

## Process Schematic




| Pump Station | Major Assets – Quantities | | | | |
|---|---|---|---|---|---|
| | Wet Wells | Pumps | Force Mains | Valves | Emergency Generators (Y/N) |
| 15th Street | 1 | 3 | 2 | 22 | N |
| A Street | 1 | 3 | 2 | 19 | N |
| Bay Bridge | 1 | 5 | 2 | 17 | Y |
| Bitter Point | 1 | 5 | 2 | 23 | Y |
| College | 1 | 3 | 2 | 18 | N |
| Crystal Cove | 1 | 2 | 2 | 13 | Y |
| Edinger | 1 | 2 | 1 | 8 | N |
| Lido | 1 | 3 | 2 | 17 | N |
| MacArthur | 1 | 2 | 1 | 8 | N |
| Main Street | 2 | 10 | 3 | 38 | Y |
| Rocky Point | 1 | 4 | 2 | 18 | Y |
| Slater | 1 | 5 | 2 | 17 | Y |
| Seal Beach | 2 | 8 | 2 | 24 | N |
| Westside | 1 | 4 | 1 | 16 | Y |
| Yorba Linda | 1 | 3 | 1 | 11 | N |
| **Total** | **17** | **62** | **27** | **269** | **--** |

## Major Assets Remaining Useful Life

| Asset Type | 15th Street | A Street | Bay Bridge | Bitter Point | College | Crystal Cove | Edinger | Lido | MacArthur | Main Street | Rocky Point | Slater | Seal Beach | Westside | Yorba Linda |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Civil - Piping** | | | | | | | | | | | | | | | |
| Force Mains | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 1 | 4 | 4 | 1 | 4 | 3 | 3 | 3 |
| **Structural** | | | | | | | | | | | | | | | |
| Pump Station | 4 | 4 | 3 | 4 | 1 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 4 |
| Wet Well | 4 | 4 | 4 | 1 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 3 |
| **Mechanical** | | | | | | | | | | | | | | | |
| Pumps | 2 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 2 | 4 | 4 | 4 | 4 |
| Valves | 4 | 4 | 4 | 2 | 3 | 5 | 3 | 4 | 4 | 5 | 3 | 5 | 5 | 3 | 4 |
| Ventilation System | 3 | 3 | 4 | 3 | 2 | 4 | 3 | 4 | 4 | 3 | 2 | 3 | 4 | 3 | 2 |
| Emergency Generator | -- | -- | 3 | 5 | -- | 3 | -- | -- | -- | 2 | 2 | 3 | -- | 2 | -- |
| **Electrical** | | | | | | | | | | | | | | | |
| Motor Control Center | 1 | 2 | 4 | 1 | 1 | 4 | 4 | 3 | 4 | 2 | 2 | 2 | 5 | 2 | 4 |
| Variable Frequency Drive | 2 | 3 | 5 | 2 | 2 | -- | -- | 4 | 3 | 4 | 2 | 4 | 5 | 2 | -- |
| Motors | 3 | 3 | 4 | 1 | 2 | 3 | 3 | 4 | 2 | 2 | 2 | 3 | 4 | 3 | 3 |
| Transformer | 2 | 2 | 4 | 1 | 1 | 3 | 2 | 3 | 4 | 1 | 2 | 2 | 4 | 2 | 3 |
| **Instrumentation** | | | | | | | | | | | | | | | |
| Programmable Logic Controller | 1 | 1 | 4 | 2 | 1 | 1 | 1 | 5 | 1 | 1 | 1 | 1 | 3 | 3 | 1 |
| Flowmeter | 3 | 3 | 5 | 2 | 1 | 3 | 4 | 2 | -- | 3 | 2 | 3 | 4 | 3 | 3 |

**Asset RUL Legend:**

- RUL < 5 years
- RUL 5-10 years
- RUL 11-15 years
- RUL 16-20 years
- RUL > 20 years

**Acronym Key:**

RUL=Remaining Useful Life

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – PUMP STATIONS

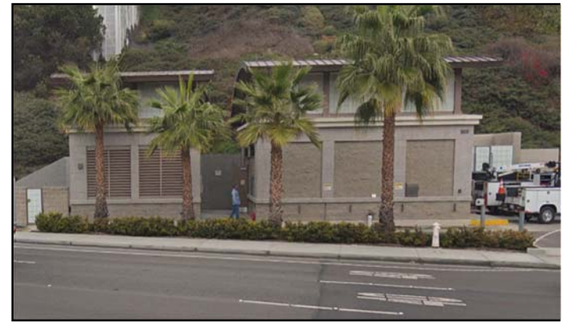
| Key Issues | Actions and Recommendations |
|---|---|
| • **Safety –** Currently, 4 OCSD's older pump stations do not have atmospheric monitoring (for hydrogen sulfide gases) or standard safety indication lighting. Also, pump station infrastructure is often located in the public right of way making safe access to these facilities an ongoing issue. | • A planning study has been established to review and interpret electrical code and establish OCSD design standards to address this issue. Practicing ongoing safety measures and traffic control when working in the public right of way will continue to be of the utmost importance. |
| • **Natural Phenomenon –** Edinger pump station is located immediately adjacent to an undersized flood control channel. Crystal Cove pump station is experiencing gradual site settlement. Both natural hazards present a risk to normal operation of the pump stations. | • Siting analysis has identified an area farther away from the active flood control channel to which Edinger pump station may be moved. Also, the County of Orange is planning to increase the capacity of the channel to accommodate future planned flows. A planning study has been established to determine the necessary mitigation measures to remediate site settlement at Crystal Cove pump station. |
| • **Increased Methane Gas Levels** – Methane gas accumulation has become a safety concern at some pump stations. The amount of gas seems to increase during summer months and presents a unique challenge because of the short response time necessary to address the safety concerns of increased ignition risk. | • OCSD crews respond to alarms that indicate increased levels of methane gas. A multi-division task force has been established to address this issue. The effort includes in-depth liquid and air sampling, installation of a two-stage unit to treat odorous air pulled from Bitter Pt. pump station, and finally establishing an operation strategy for the force main system. |
| • **Corrosion** – Corrosion is an ongoing problem in this very harsh environment. In places were the system has been kept from venting and mixing of wastewater is prevalent, such as wet wells, the degree of corrosion has (or will soon) require the replacement/rehabilitation of the assets. | • Visual assessments of known corrosion issues are performed on an on-going basis. When necessary, cameras are used to evaluate the spreading of corrosion impacts and confined space entry may be performed to gather additional information to determine when the facility needs to be rehabilitated. |
| • **Groundwater Intrusion** – Groundwater has penetrated 4 of the newly constructed pump stations in the coastal region of the service area. Groundwater is notoriously corrosive and may compromise the strength of the rebar within the concrete structure walls. | • Execute a planning study to identify possible mitigation measures. |
| • **Maintenance Access** – In some cases, such as venting of the Newport Beach force main system, access to critical facilities is limited by safety and public impact concerns. In other cases, such as MacArthur Pump Station force main, access to critical facilities is not possible because redundancy was not considered when the pump station was designed. | • OCSD continues to improve planned maintenance processes and inter-agency coordination that allow crews to minimize impacts to the community during necessary maintenance operations. A capital project has been established to construct a redundant force main to serve MacArthur Pump Station. |

**Acronym Key:**

OCSD=Orange County Sanitation District

College Pump Station

Main Street Pump Station



Rocky Point Pump Station

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – PUMP STATIONS

### Current and Future Projects

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **General – Projects that affect more than one pump station** | | | | | | | | | | | | | | | | | | | |
| **5-68** | Newport Beach Pump Station Odor Control Improvements | Multiple Pump Stations in Newport Beach Area | • Installation of venting equipment; phased implementation of chemical use | | | | | | | | | | | | | | | | |
| **FE19-01** | Portable Generator Connectors at Pump Stations | Multiple Pump Stations | • Installation of standard portable generator connectors | | | | | | | | | | | | | | | | |
| **PS18-06** | Go/No-Go Lights and Signage | All Pump Stations | • Standardize Safety Lights and Signage | | | | | | | | | | | | | | | | |
| **PRN-00527** | A St. and 15th St. PS Valve Replacement Project | Multiple Pump Stations | • Replacement of multiple valves at each station | | | | | | | | | | | | | | | | |
| **XPS0065** | Pump Station Groundwater Intrusion Study | Multiple Pump Stations | • Comprehensive study of groundwater management solutions | | | | | | | | | | | | | | | | |
| **XPS0009** | A Street and 15th Street Pump Station and Force Main Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |
| **15th Street Pump Station** | | | | | | | | | | | | | | | | | | | |
| **X-022** | 15th Street Pump Station and Force Main Project | Entire Pump Station | • Comprehensive rehabilitation of pump station and force mains | | | | | | | | | | | | | | | | |
| **A Street Pump Station** | | | | | | | | | | | | | | | | | | | |
| **X-041** | A Street Pump Station and Force Main Project | Entire Pump Station | • Comprehensive rehabilitation of pump station and force mains | | | | | | | | | | | | | | | | |
| **Bay Bridge Pump Station** | | | | | | | | | | | | | | | | | | | |
| **5-67** | Bay Bridge Pump Station Force Main Replacement | Pump Station Force Main | • Comprehensive rehabilitation of pump station and force mains | | | | | | | | | | | | | | | | |
| **FRC-0002** | Bay Bridge Pump Station Valve Replacement Project | Pump Station Isolation Valves | • Replacement of pump suction and discharge valves | | | | | | | | | | | | | | | | |
| **Bitter Point Pump Station** | | | | | | | | | | | | | | | | | | | |
| **PRN-00636** | Generator Enclosure Roof Repair | Generator Enclosure Roof | • Repair the stand-by generator enclosure roof | | | | | | | | | | | | | | | | |
| **XPS0004** | Bitter Point Pump Station Rehabilitation Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |
| **X-025** | Bitter Point Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **College Pump Station** | | | | | | | | | | | | | | | | | | | |
| **XPS0010** | College Pump Station Rehabilitation Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **X-026** | College Avenue Force Main Rehabilitation Project | Pump Station Force Main | • Comprehensive rehabilitation of force mains | | | | | | | | | | | | | | | | |
| **X-040** | College Pump Station Replacement | Entire Pump Station | • Reconstruction of pump station | | | | | | | | | | | | | | | | |
| **Crystal Cove Pump Station** | | | | | | | | | | | | | | | | | | | |
| **XPS0049** | Crystal Cove Pump Station Rehabilitation Study | Entire pump station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |
| **5-66** | Crystal Cove Pump Station Upgrade and Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **Edinger Pump Station** | | | | | | | | | | | | | | | | | | | |
| **11-33** | Edinger Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive relocation of pump station | | | | | | | | | | | | | | | | |
| **PS15-02** | Edinger Pump Station Rehabilitation Study | Entire Pump Station | • Determine extent of pump station replacement or rehabilitation | | | | | | | | | | | | | | | | |
| **Lido Pump Station** | | | | | | | | | | | | | | | | | | | |
| **PRN-00549** | Lido Pump Station UPS Replacement | Pump Station UPS | • Replacement of pump station UPS | | | | | | | | | | | | | | | | |
| **X-023** | Lido Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **XPS0017** | Lido Pump Station Rehabilitation Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |
| **MacArthur Pump Station** | | | | | | | | | | | | | | | | | | | |
| **7-63** | MacArthur Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **7-68** | MacArthur Force Main Improvements | Pump Station Force Main | • Installation of second force main and rehabilitation of existing force main | | | | | | | | | | | | | | | | |
| **Main Street Pump Station** | | | | | | | | | | | | | | | | | | | |
| **7-64** | Main Street Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **7-65** | Gisler-Redhill Interceptor Rehabilitation | Pump Station Force Mains | • Rehabilitation of pump station force mains | | | | | | | | | | | | | | | | |
| **XPS0048** | Main Street Pump Station Rehabilitation Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |
| **Rocky Point Pump Station** | | | | | | | | | | | | | | | | | | | |
| **XPS0005** | Rocky Point Pump Station Rehabilitation Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |

| Project No. | Project Title | Impacted Facilities | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FRC-0006** | 480V Feeder Replacement at Rocky Point Pump Station | Electrical Equipment | • Replacement of electrical equipment | | | | | | | | | | | | | | | | |
| **X-024** | Rocky Point Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **Slater Pump Station** | | | | | | | | | | | | | | | | | | | |
| **11-34** | Slater Pump Station Rehabilitation Project | Entire Pump Station | • Comprehensive rehabilitation of pump station | | | | | | | | | | | | | | | | |
| **MP-207** | Slater Pump Station Link Seal Repair | Pump Station Dry Well Wall | • Replace leaking link seal | | | | | | | | | | | | | | | | |
| **XPS0044[a]** | Slater Pump Station Rehabilitation Study | Entire Pump Station | • Comprehensive study of pump station condition and capacity | | | | | | | | | | | | | | | | |
| **Seal Beach Pump Station** | | | | | | | | | | | | | | | | | | | |
| **3-67** | Seal Beach Pump Station Replacement | Entire Pump Station | • Reconstruction of pump station | | | | | | | | | | | | | | | | |
| **PRN-00550** | Seal Beach Pump Station – Fan No. 3 Relocation | Fan No. 3 | • Procure portable table to allow access to the fan for maintenance | | | | | | | | | | | | | | | | |
| **3-62** | Westminster Boulevard Force Main Replacement | Seal Beach Pump Station force main | • Replacement of force mains | | | | | | | | | | | | | | | | |
| **Westside Pump Station** | | | | | | | | | | | | | | | | | | | |
| **3-68** | Los Alamitos Subtrunk Extension | Westside Pump Station | • Demolition of pump station | | | | | | | | | | | | | | | | |
| **Yorba Linda Pump Station** | | | | | | | | | | | | | | | | | | | |
| **2-73** | Yorba Linda Pump Station Abandonment Project | Entire Pump Station and Force Main | • Abandonment of pump station and force main | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

**CIP - Planning** | **CIP – Design** | **CIP - Construction** | **Maintenance Project**

**Acronym Key:**

CIP=Capital Improvement Project; FY=Fiscal Year; N/A=Not Applicable;
UPS = Uninterruptable Power Source

[a] Pending the outcome of potential property negotiations this study may be needed to determine conceptual design of future pump station; however, as of this writing Slater PS is scheduled as a rehabilitation project starting in FY21/22.

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# Collection System Pipeline Asset Management Summaries

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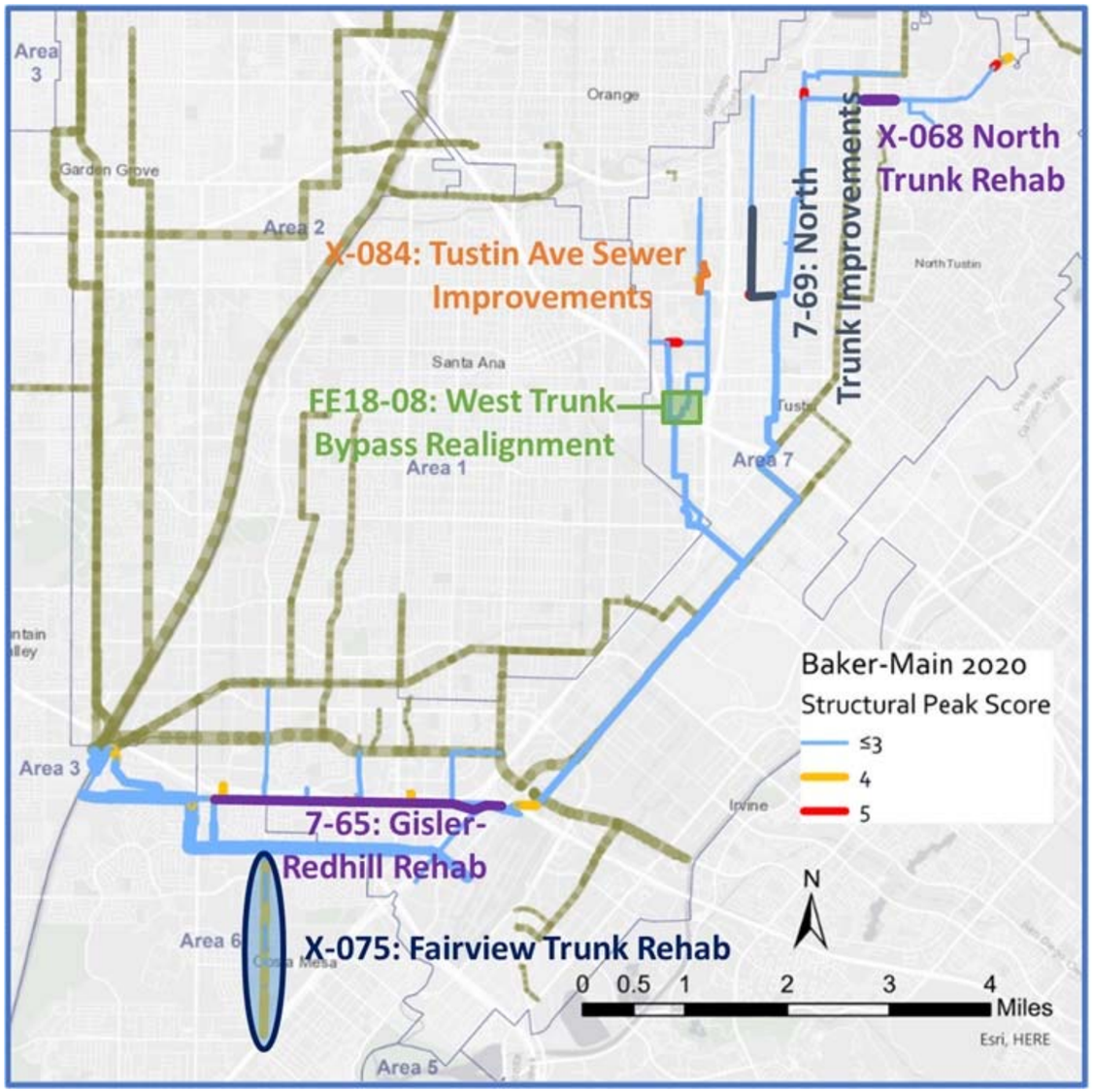
## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – BAKER-MAIN TRUNK

### System Overview




### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 18.8 | 342 | 53 | 5 | 17 |
| 21” - 33” Ø | 15.7 | 246 | 38 | 1 | 29 |
| **Reinforced Concrete** | | | | | |
| 48” - 66” Ø | 1.2 | 16 | 28 | - | - |
| ≥ 72” Ø | 3.7 | 35 | 26 | - | - |
| **Ductile Iron** | | | | | |
| 42” Ø | 0.5 | 2 | 29 | - | - |
| **Polyvinyl Chloride** | | | | | |
| 19” - 36” Ø | 0.0 | 1 | 13 | - | - |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – BAKER-MAIN TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Capacity** – The Collections Capacity Evaluation Study completed in 2019 conducted a detailed capacity analysis to identify the location of capacity deficiencies during dry and peak wet weather flows. | • Develop and complete CIPs identified by the Collections Capacity Evaluation Study to address capacity issues. Implement planning study to monitor potential spill locations associated with capacity deficiencies not identified as near-term CIPs. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE18-08** | West Trunk Bypass Sewer Realignment | • Realignment of sewer facilities in the city of Santa Ana | | | | | | | | | | | | | | | | |
| **7-65** | Gisler-Redhill Interceptor Rehabilitation | • Rehabilitation of sewer facilities in the city of Costa Mesa | | | | | | | | | | | | | | | | |
| **7-69** | North Trunk Improvements | • Upsizing of pipe segments to increase capacity in the city of Tustin | | | | | | | | | | | | | | | | |
| **X-075** | Fairview Trunk Sewer Rehabilitation | • Rehabilitation of sewer facilities in the city of Costa Mesa | | | | | | | | | | | | | | | | |
| **X-084** | Tustin Avenue Sewer Improvements | • Upsizing of pipe segments to increase capacity in the city of Santa Ana | | | | | | | | | | | | | | | | |
| **X-068** | North Trunk Rehabilitation | • Rehabilitation of sewer facilities in the city of Orange | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

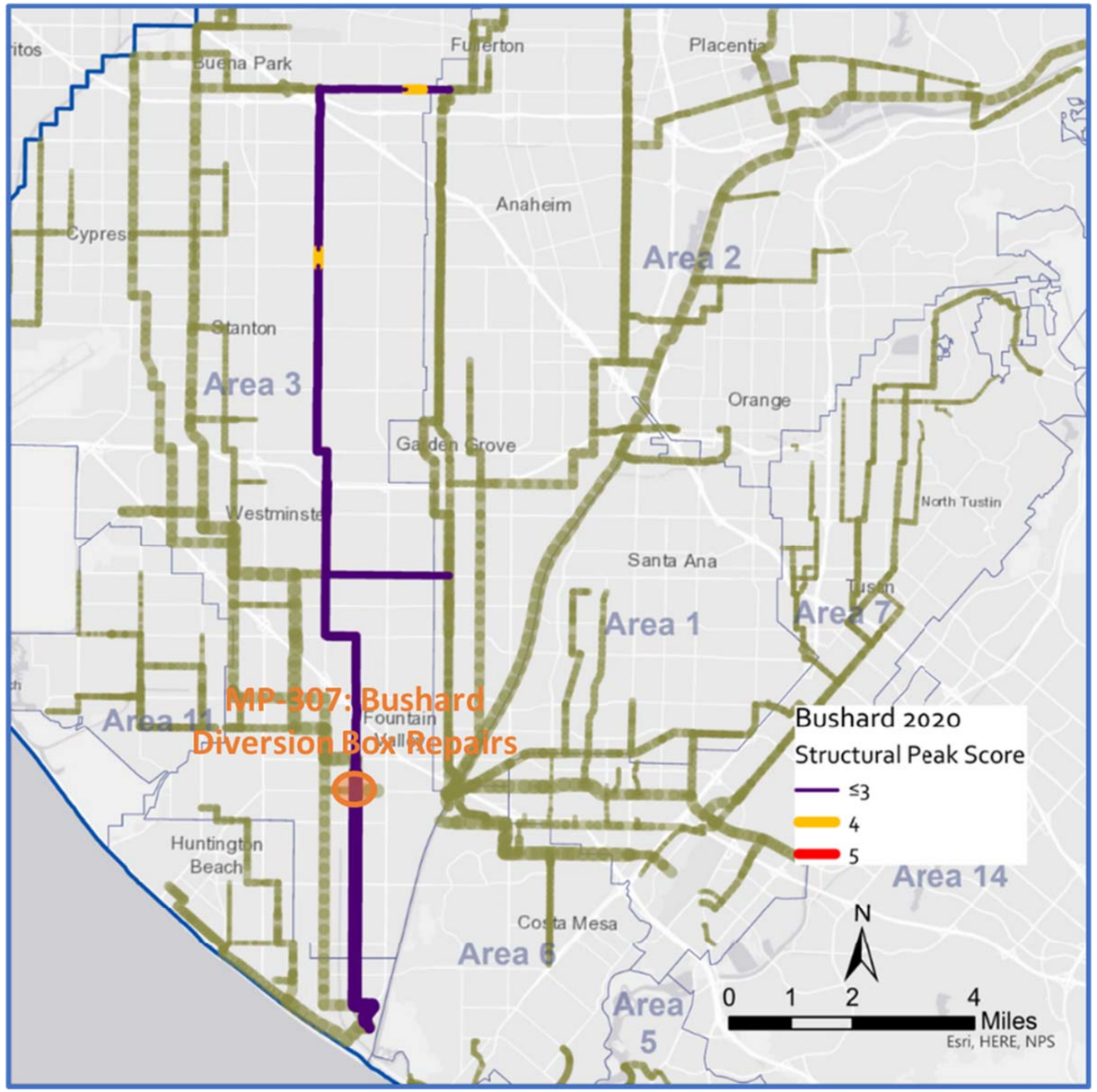
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – BUSHARD TRUNK

## System Overview




## Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 0.03 | 2 | 33 | - | - |
| 24” - 27” Ø | 5.1 | 73 | 48 | - | 2 |
| 39” Ø | 3.6 | 25 | 46 | - | 1 |
| **Reinforced Concrete** | | | | | |
| 39” - 42” Ø | 2.4 | 14 | 56 | - | - |
| 60” - 66” Ø | 0.2 | 7 | 18 | - | - |
| ≥ 72” Ø | 4.2 | 32 | 20 | - | - |
| **Fiberglass** | | | | | |
| 36” - 42” Ø | 4.4 | 26 | 55 | - | - |
| 48” Ø | 0.3 | 1 | 70 | - | - |
| **Unreinforced Concrete** | | | | | |
| 42” - 48” Ø | 1.0 | 10 | 37 | - | - |
| **HDPE** | | | | | |
| 22” Ø | 0.1 | 2 | 22 | - | - |

**Acronym Key:**

HDPE=High-Density Polyethylene Resin;

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – BUSHARD TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Bushard Diversion Box** - the Bushard Diversion Box is not able to operate as originally intended (flow modulation between Plant No. 1 and Plant No. 2 based on flows). | • A planning study was completed that recommended immediate repairs that will be completed under MP-307, as well as future improvements that are included in project X-096. |
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MP-307** | Bushard Diversion Structure Repairs | • Repair of structural assets and replacement of electrical and instrumentation and control components | | | | | | | | | | | | | | | | |
| **X-096** | Bushard Diversion Structure Improvements | • Replacement of mechanical equipment | | | | | | | | | | | | | | | | |

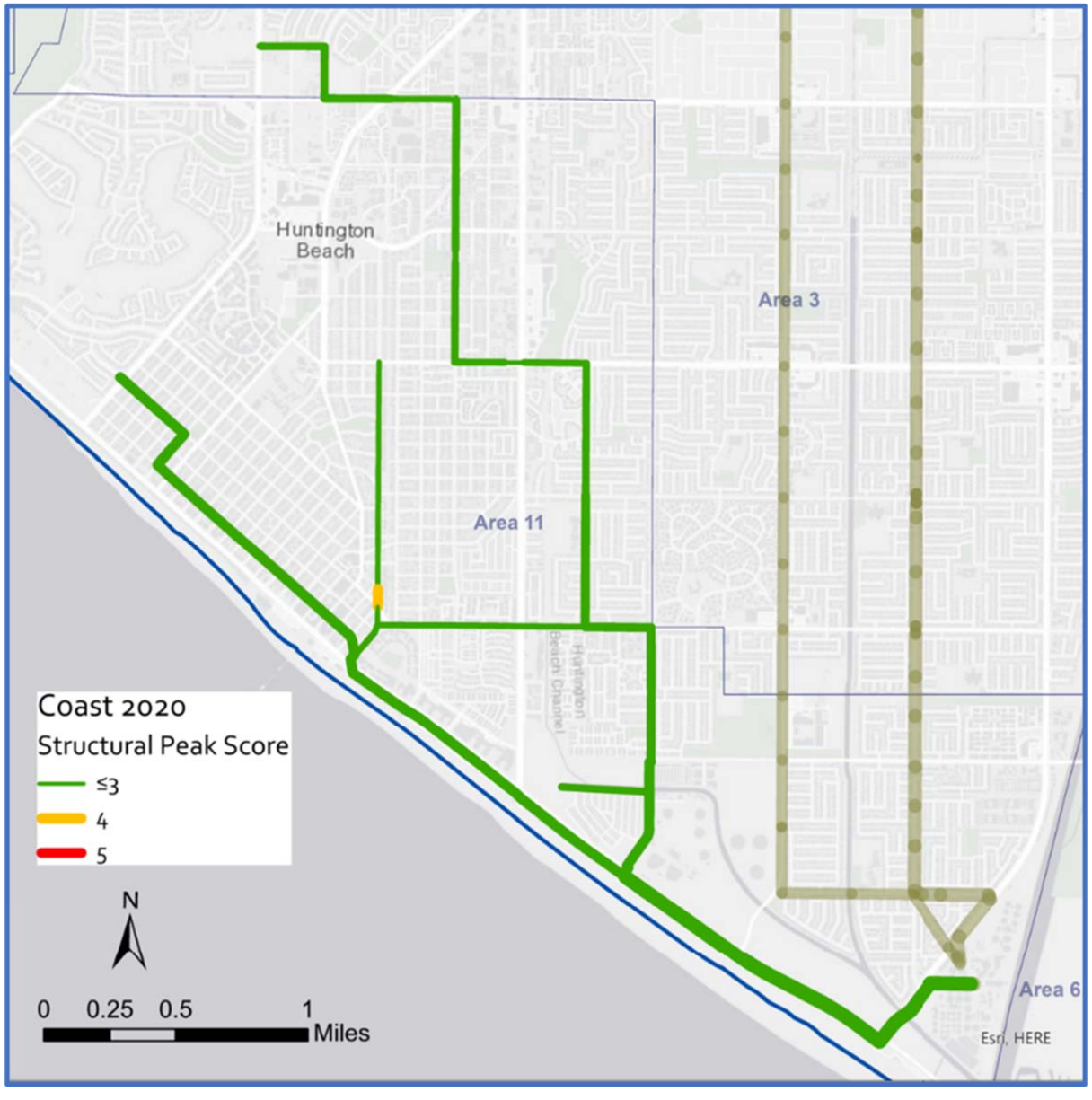
**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Project; FY=Fiscal Year; OCSD=Orange County Sanitation District

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – COAST TRUNK

### System Overview




### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 2.1 | 32 | 61 | - | 1 |
| 21” - 36” Ø | 4.4 | 58 | 59 | - | - |
| **Reinforced Concrete** | | | | | |
| 48” - 54” Ø | 3.3 | 43 | 38 | - | - |
| ≥ 72” Ø | 1.6 | 11 | 39 | - | - |
| **Polyvinyl Chloride** | | | | | |
| 54” Ø | 0.05 | 1 | 38 | - | - |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – COAST TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| None | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Types of Project Legend:**

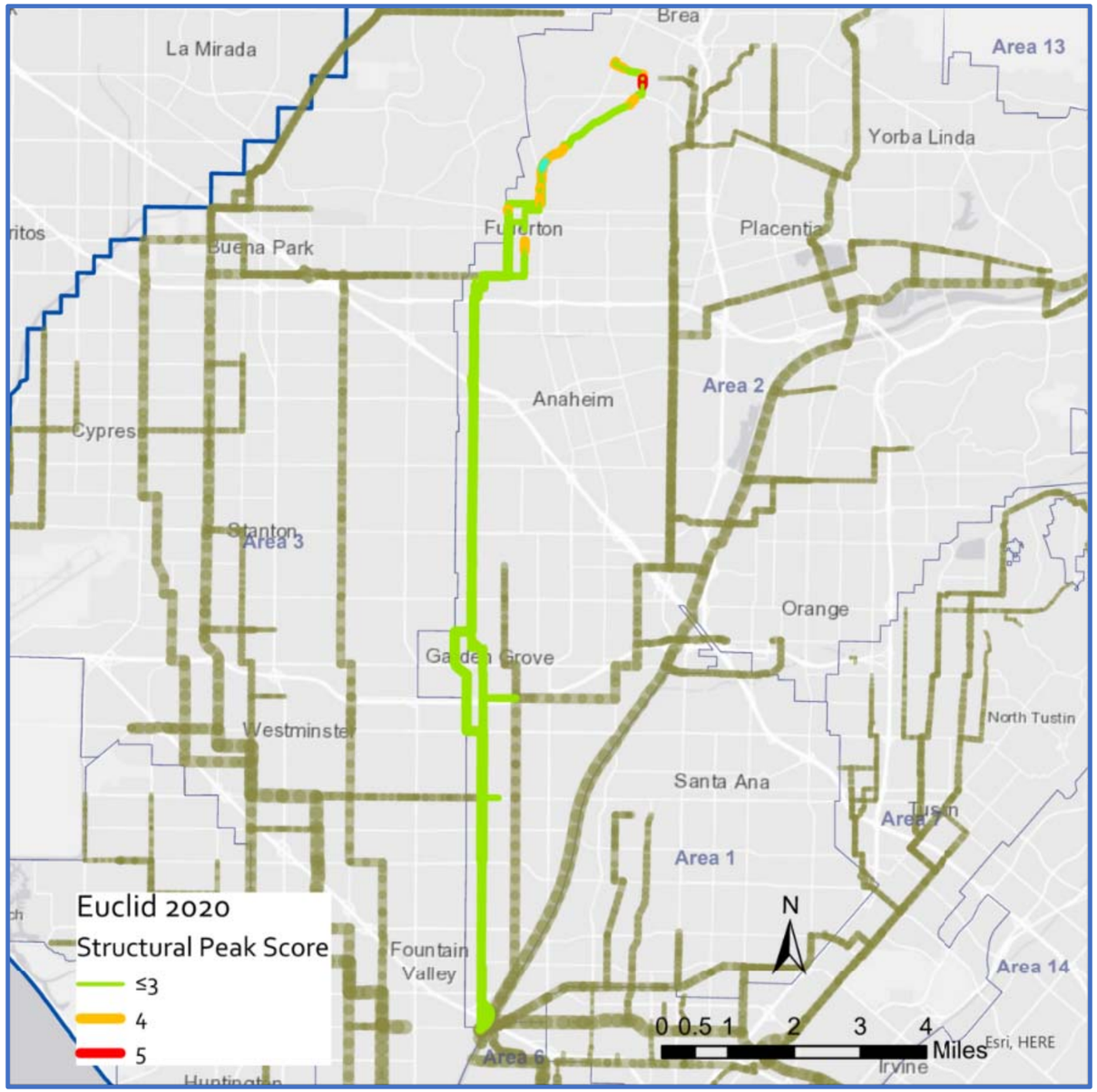
CIP - Planning | CIP – Design | CIP - Construction | Maintenance Project

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – EUCLID TRUNK

## System Overview




## Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 4.4 | 76 | 56 | 1 | 14 |
| 21” - 27” Ø | 3.9 | 52 | 37 | - | 3 |
| ≥ 30” Ø | 12.1 | 153 | 48 | - | 6 |
| **Reinforced Concrete** | | | | | |
| 30” - 45” Ø | 2.7 | 21 | 41 | - | - |
| 48” - 60” Ø | 11.4 | 127 | 31 | - | - |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – EUCLID TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Capacity** – The Collections Capacity Evaluation Study completed in 2019 conducted a detailed capacity analysis to identify the location of capacity deficiencies during dry and peak wet weather flows. | • Develop and complete CIPs identified by the Collections Capacity Evaluation Study to address capacity issues. Implement planning study to monitor potential spill locations associated with capacity deficiencies not identified as near-term CIPs. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| None | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Types of Project Legend:**

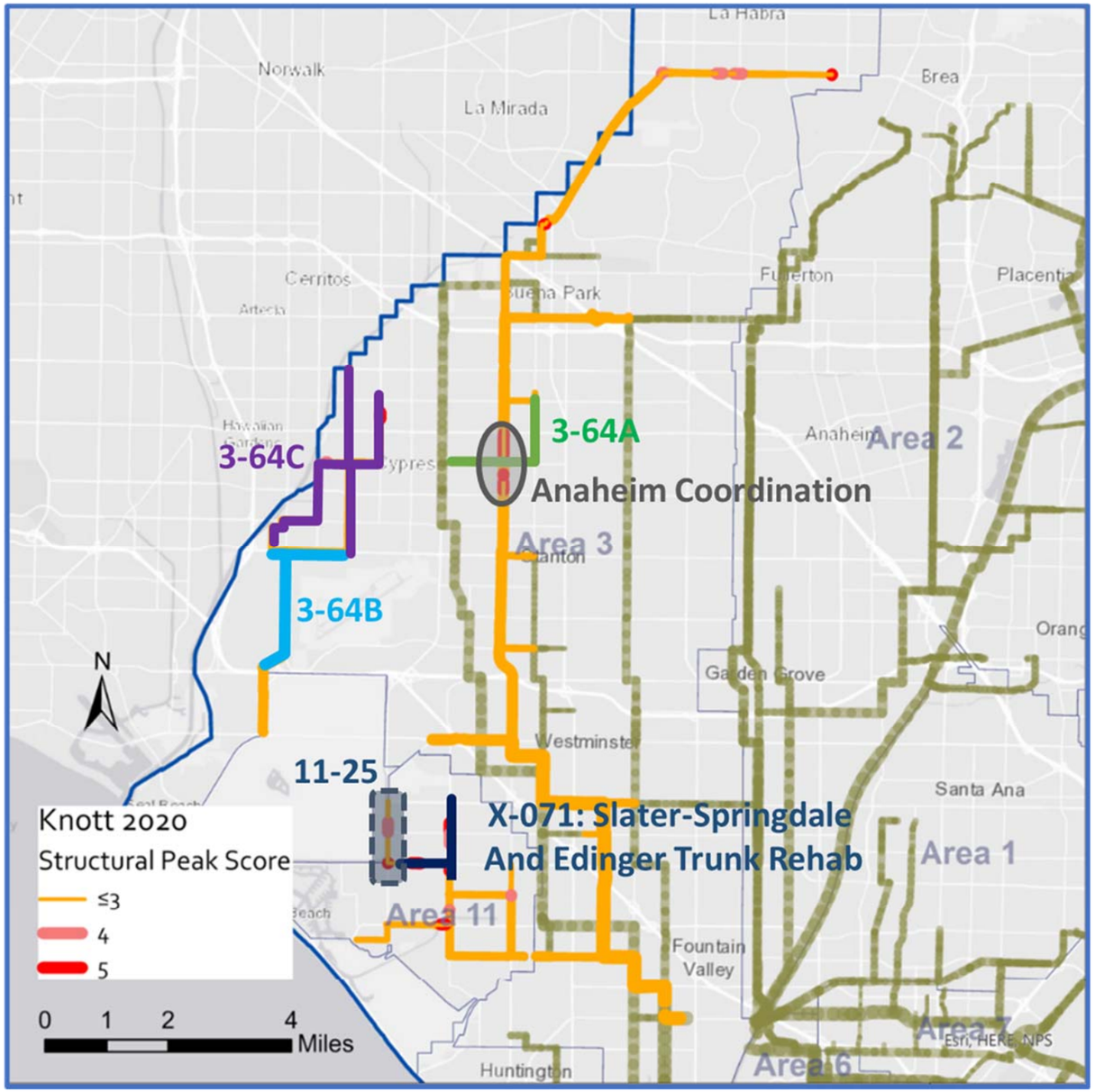
CIP - Planning | CIP – Design | CIP - Construction | Maintenance Project

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – KNOTT TRUNK

### System Overview




### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 9.0 | 127 | 52 | 19 | 8 |
| 21” - 27” Ø | 20.5 | 300 | 48 | 5 | 2 |
| ≥ 30” Ø | 17.1 | 222 | 40 | 0 | 1 |
| **Reinforced Concrete** | | | | | |
| ≤ 48” Ø | 0.02 | 2 | 47 | | |
| 51” - 66” Ø | 7.7 | 70 | 43 | | |
| ≥ 72” Ø | 9.7 | 68 | 46 | | |
| **Polyvinyl Chloride** | | | | | |
| 18” Ø | 1.1 | 12 | 16 | | |
| **Ductile Iron** | | | | | |
| 20” Ø | 0.0 | 1 | 61 | | |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – KNOTT TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Anaheim Coordination** – The city of Anaheim owns and operates various small diameter pipelines and diversions throughout the northern central area of the trunk. | • Coordinate with the City of Anaheim pertaining to operation and maintenance of these pipelines and diversions. |
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3-66** | Interstate 405 Widening Project Impact on OCSD Sewers | • OCSD staff support for the realignment/conflicts of District facilities as part of Orange County Transportation's proposed widening of the I-405 | | | | | | | | | | | | | | | | |
| **3-64A** | Orange Western Sub-Trunk Rehabilitation | • Rehabilitate sewer facilities in the cities of Cypress, Anaheim, and Buena Park | | | | | | | | | | | | | | | | |
| **3-64B** | Los Alamitos Trunk Sewer Rehabilitation | • Rehabilitate sewer facilities in the cities of Seal Beach, Los Alamitos, and the community of Rossmoor | | | | | | | | | | | | | | | | |
| **3-64C** | Cypress Trunk Sewer Rehabilitation - West | • Rehabilitate sewer facilities in the cities of Los Alamitos, Cypress and La Palma | | | | | | | | | | | | | | | | |
| **X-071** | Bolsa Chica / Edinger / Springdale Rehabilitation | • Rehabilitation of sewer facilities in the City of Huntington Beach | | | | | | | | | | | | | | | | |
| **3-68** | Los Alamitos Sub-Trunk Extension | • Extension of the Los Alamitos Sub-Trunk to facilitate abandonment of Westside Pump Station | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

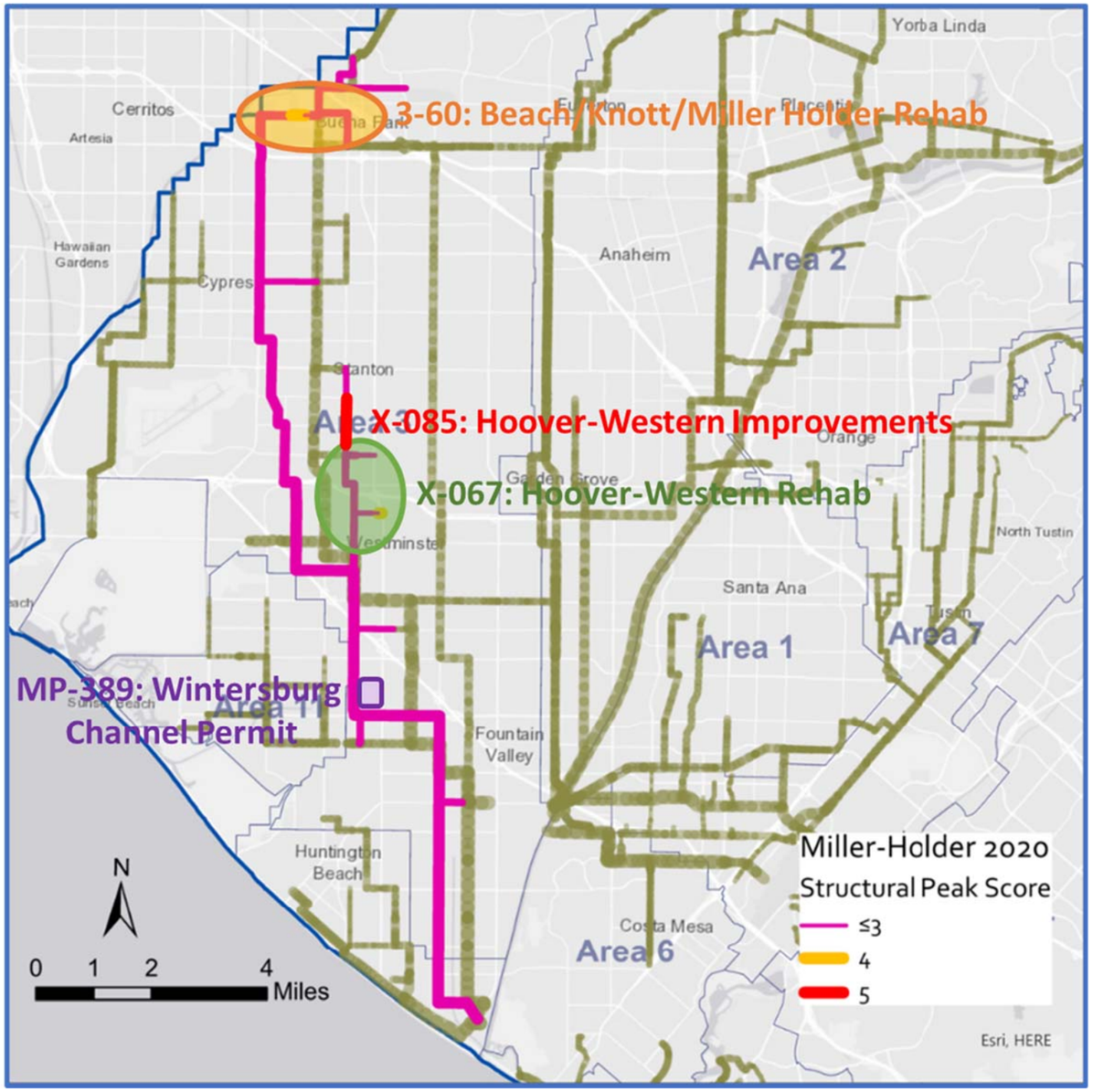
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – MILLER-HOLDER TRUNK

### System Overview




### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 2.9 | 51 | 60 | - | 1 |
| 21” - 27” Ø | 6.9 | 87 | 59 | - | - |
| ≥ 30” Ø | 2.4 | 26 | 55 | - | 1 |
| **Reinforced Concrete** | | | | | |
| 45” Ø | 1.8 | 12 | 61 | - | - |
| 48” - 69” Ø | 11.5 | 64 | 61 | - | - |
| ≥ 72” Ø | 5.8 | 24 | 70 | - | - |
| **Ductile Iron** | | | | | |
| 12” Ø | 0.03 | 2 | 61 | - | - |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – MILLER-HOLDER TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Capacity** – The Collections Capacity Evaluation Study completed in 2019 conducted a detailed capacity analysis to identify the location of capacity deficiencies during dry and peak wet weather flows. | • Develop and complete CIPs identified by the Collections Capacity Evaluation Study to address capacity issues. Implement planning study to monitor potential spill locations associated with capacity deficiencies not identified as near-term CIPs. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MP-389** | Wintersburg Channel Permit | • Easement coordination to improve existing manhole access | | | | | | | | | | | | | | | | |
| **3-60** | Beach Relief Trunk/Knott Interceptor/Miller Holder Trunk Rehabilitation | • Rehabilitation of sewer facilities in the city of Buena Park | | | | | | | | | | | | | | | | |
| **X-067** | Western Avenue / Hoover Street Trunk Sewer Rehabilitation | • Rehabilitation of sewer facilities in the city of Westminster | | | | | | | | | | | | | | | | |
| **X-085** | Hoover-Western Sub-Trunk Improvements | • Upsizing of sewer segments to increase capacity | | | | | | | | | | | | | | | | |
| **X-061** | Imperial Relief Interceptor / Miller Holder Trunk Rehabilitation | • Rehabilitation of sewer facilities in the city of La Habra | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

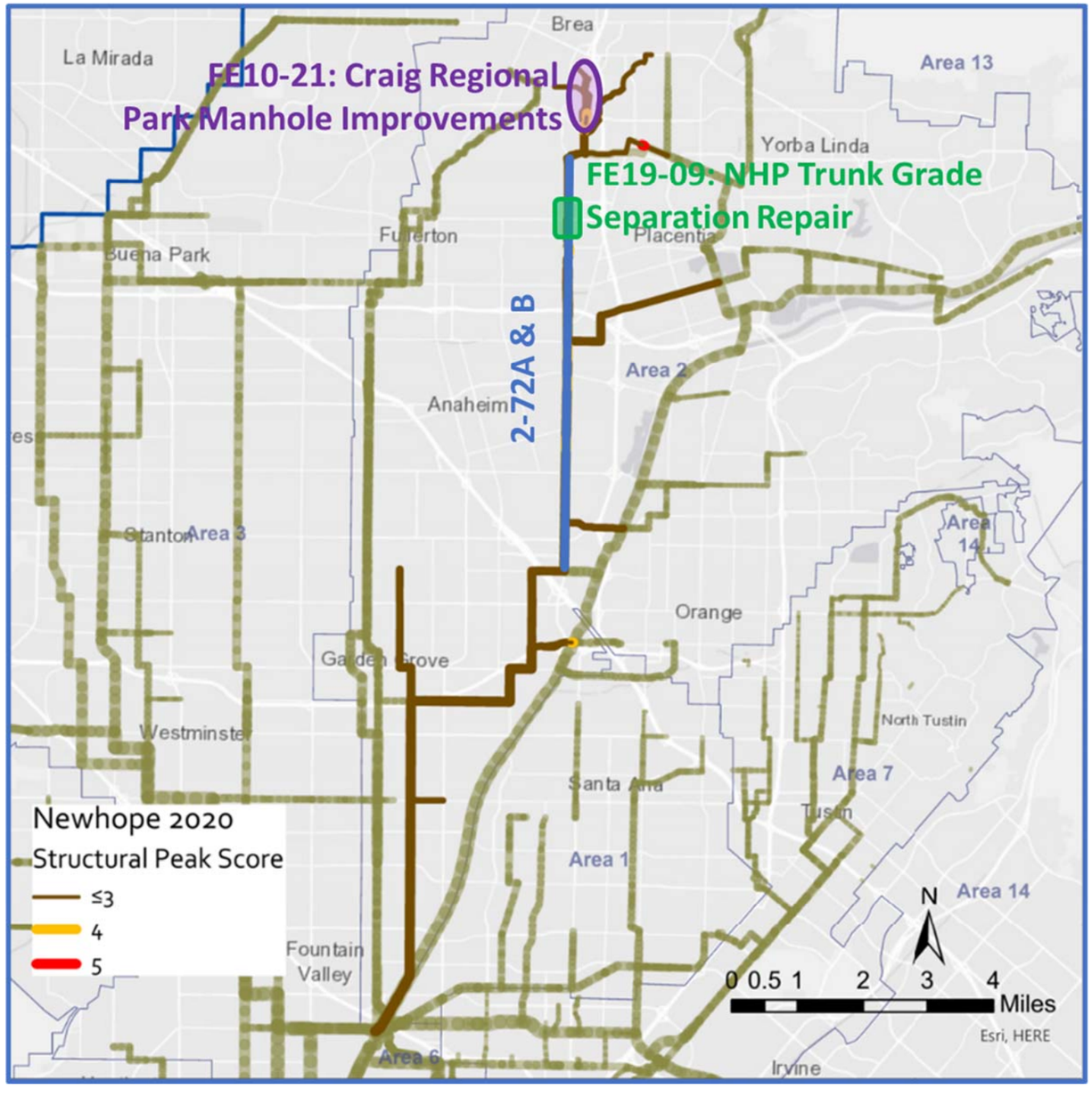
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – NEWHOPE TRUNK

### System Overview




### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 4.0 | 68 | 49 | 1 | 2 |
| 21” - 27” Ø | 2.7 | 39 | 52 | - | 3 |
| ≥ 30” Ø | 13.1 | 159 | 42 | - | 3 |
| **Reinforced Concrete** | | | | | |
| ≤ 45” Ø | 2.2 | 14 | 60 | - | - |
| 48” - 54” Ø | 6.1 | 35 | 47 | - | - |
| **Polyvinyl Chloride** | | | | | |
| 24” Ø | 0.01 | 1 | 25 | - | - |
| **Fiberglass** | | | | | |
| 48” Ø | 0.03 | 1 | 3 | - | - |
| **Ductile Iron** | | | | | |
| ≤ 18” Ø | 0.93 | 18 | 27 | - | - |
| 20” - 24” Ø | 0.3 | 5 | 46 | - | - |
| 30” - 36” Ø | 0.1 | 2 | 35 | - | - |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – NEWHOPE TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2-72B** | Newhope Placentia Trunk Sewer Replacement | • Upsizing of segments of sewer to increase capacity | | | | | | | | | | | | | | | | |
| **FE10-21** | Craig Regional Park Manhole Improvements | • Manhole access improvements throughout Craig Regional Park | | | | | | | | | | | | | | | | |
| **FE19-09** | Newhope - Placentia Trunk Grade Separation Replacement Repairs | • Rehabilitation of sewer facilities in the city of Fullerton | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – NEWPORT TRUNK

### System Overview


### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 6.0 | 127 | 43 | 3 | 11 |
| 21” - 27” Ø | 4.5 | 101 | 36 | 1 | 5 |
| ≥ 30” Ø | 3.8 | 76 | 33 | - | 2 |
| **Ductile & Cast Iron** | | | | | |
| 8” - 30” Ø | 2.9 | 43 | 29 | - | - |
| **Polyvinyl Chloride** | | | | | |
| ≤ 18” Ø | 0.1 | 2 | 7 | - | - |
| 30” - 36” Ø | 2.6 | 36 | 20 | - | - |
| **Cured-in-Place** | | | | | |
| 24” Ø | 1.1 | 13 | 22 | - | - |
| **HDPE** | | | | | |
| ≤ 20” Ø | 0.8 | 14 | 27 | - | - |
| 30” - 42" Ø | 0.02 | 2 | 22 | 1 | - |

**Acronym Key:**

HDPE=High-Density Polyethylene Resin;

NASSCO=National Association of Sewer Service Companies

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – NEWPORT TRUNK

### Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Tuberculation** – Some portions of the existing metal pipes have tuberculation which poses a risk. Several of these segments have been lined; however, some work remains to complete these repairs. | • Review condition of unlined metal pipes and rehabilitate pipes subject to tuberculation as needed. Project FRC-0005 is addressing a high priority segment with significant tuberculation. |
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Local Sewers –** A portion of gravity collection system that was local service was transferred to Newport Beach. | • None. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. In addition, coordination of CCTV assessments along Pacific Coast Highway is challenging due to Caltrans permitting. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |

### Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FRC-0005** | East Coast Highway Trunk Repair | • Rehabilitation of sewer facilities in the city of Newport Beach | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

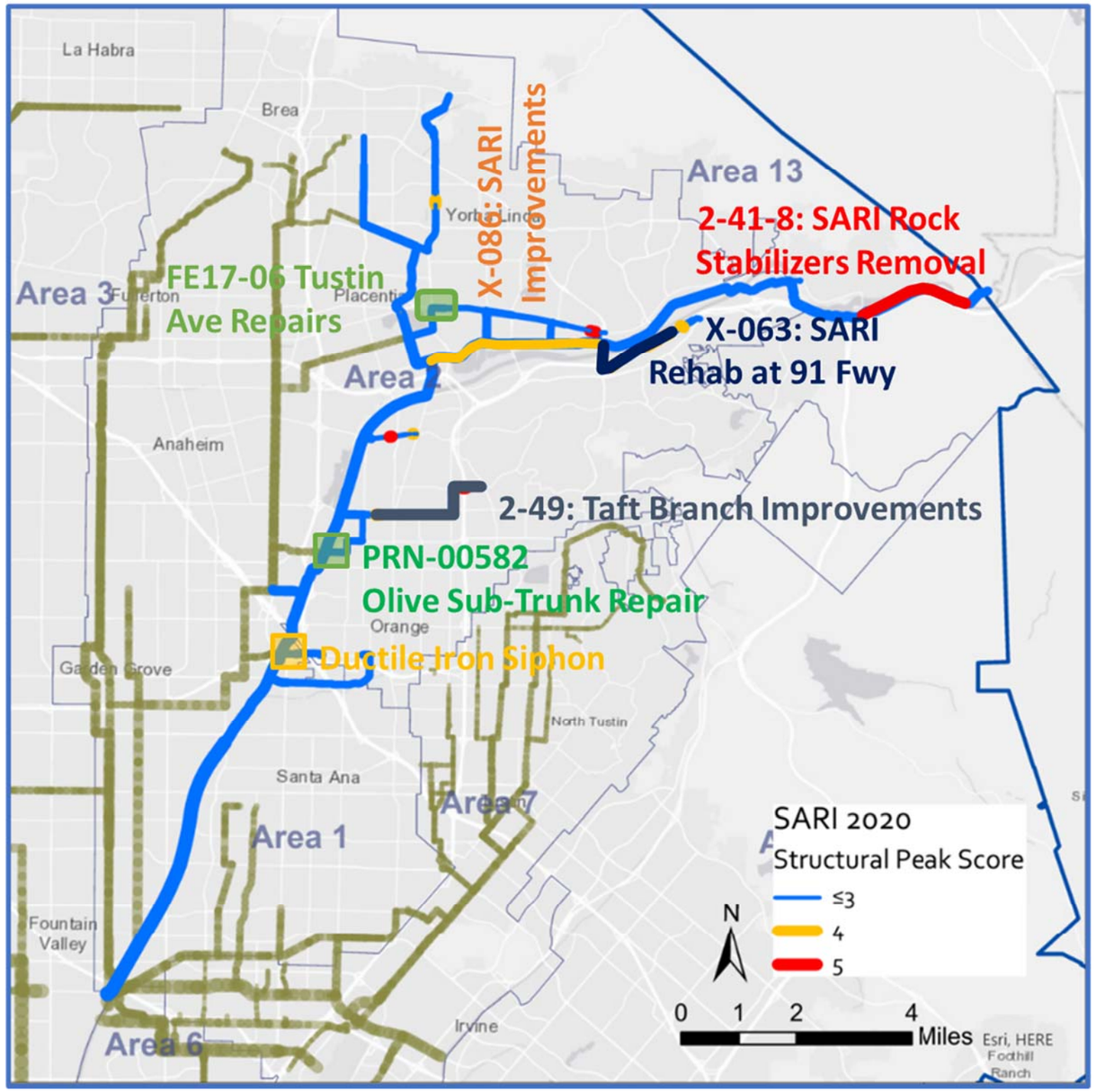
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

## ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – SARI TRUNK

### System Overview




### Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 5.0 | 116 | 54 | 3 | 2 |
| 21” - 27” Ø | 11.3 | 179 | 45 | - | 6 |
| 30” - 42” Ø | 5.7 | 79 | 35 | - | 3 |
| 51” - 66” Ø | 1.1 | 7 | 46 | - | - |
| **Reinforced Concrete** | | | | | |
| 42” - 45” Ø | 2.4 | 26 | 36 | - | - |
| 48” - 66” Ø | 8.1 | 54 | 42 | - | - |
| ≥ 72” Ø | 10.0 | 50 | 45 | - | - |
| **Fiberglass** | | | | | |
| 36” Ø | 0.3 | 2 | 11 | - | - |
| 54” Ø | 3.65 | 38 | 9 | - | - |
| **HDPE** | | | | | |
| ≤ 18” Ø | 0.5 | 4 | 6 | - | - |
| 30” Ø | 0.7 | 3 | 9 | - | - |
| **Ductile Iron** | | | | | |
| 24” Ø | 0.4 | 5 | 38 | - | - |
| 30” Ø | 0.4 | 5 | 27 | - | - |
| 48” Ø | 0.4 | 2 | 46 | - | - |
| **Steel** | | | | | |
| 24” - 48” Ø | 0.03 | 2 | 9 | - | - |

**Acronym Key:**

HDPE=High-Density Polyethylene Resin

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – SARI TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Ductile Iron Siphon Condition** – Recent condition assessment showed that a ductile iron siphon on Katella Avenue at the Santa Ana River had failed. This line is not essential to operations; however, having it offline diverts water away from Plant No. 1 and the GWRS. Another ductile iron siphon about 2 miles south along the river trail is of similar age and the condition is unknown. | • OCSD to repair the failed pipeline on Katella through a small project currently approved by Clearinghouse (PRN-00582). A condition assessment of the ductile iron pipeline to the south is recommended. |
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42”) are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Capacity** – The Collections Capacity Evaluation Study completed in 2019 conducted a detailed capacity analysis to identify the location of capacity deficiencies during dry and peak wet weather flows. | • Develop and complete CIPs identified by the Collections Capacity Evaluation Study to address capacity issues. Implement planning study to monitor potential spill locations associated with capacity deficiencies not identified as near-term CIPs. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

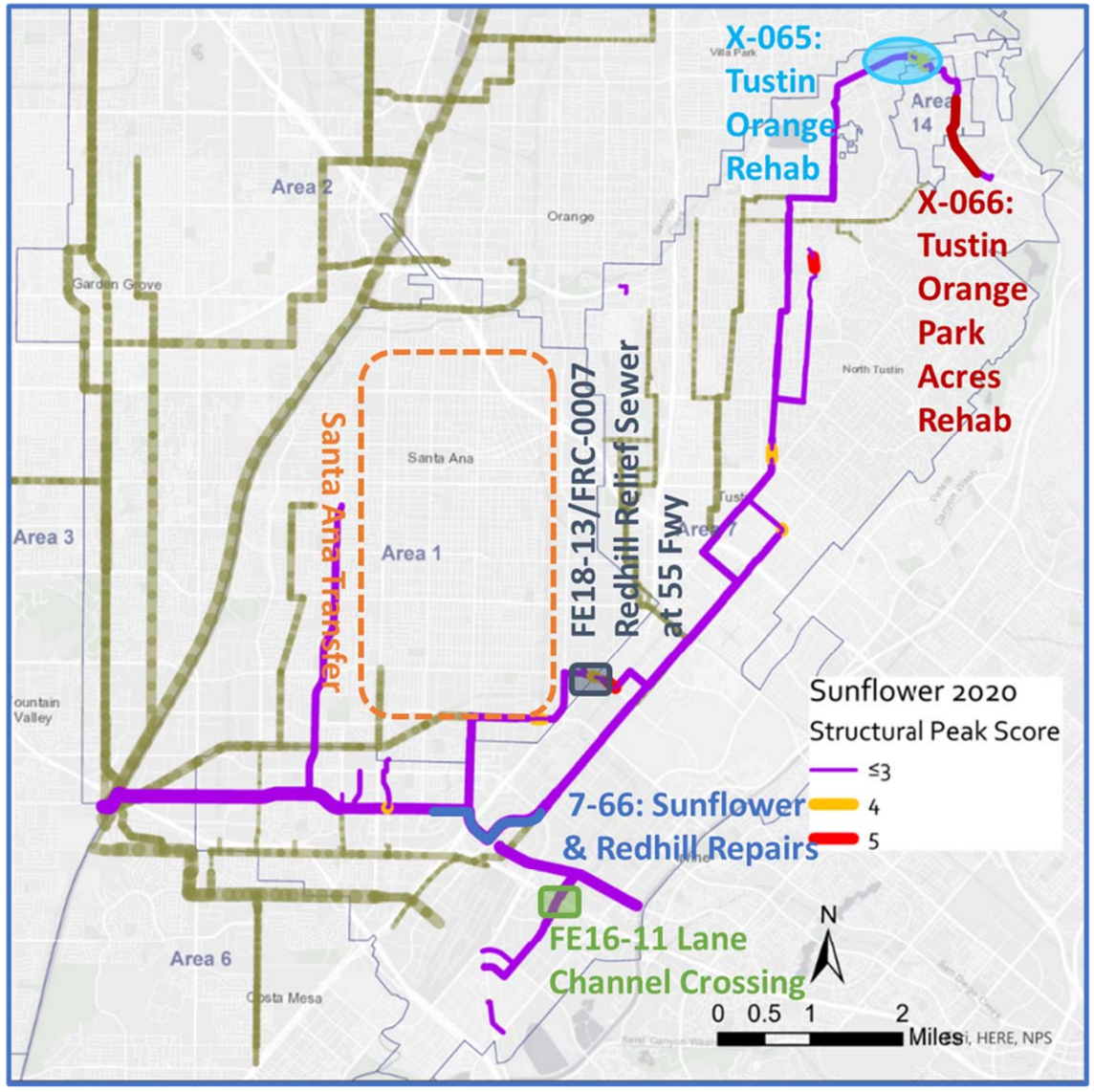
| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | FY 26/27 | FY 27/28 | FY 28/29 | FY 29/30 | FY 30/31 | FY 31/32 | FY 32/33 | FY 33/34 | FY 34/35 | FY 35/36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2-41-8** | SARI Rock Stabilizers Removal | • Removal of riprap and restoration of access roads | | | | | | | | | | | | | | | | |
| **FE17-06** | Tustin Avenue Manhole and Pipe Repair | • Rehabilitation of sewer facilities in the cities of Anaheim and Placentia | | | | | | | | | | | | | | | | |
| **FEXX-XX (PRN-00582)** | Olive Sub-Trunk Repair | • Rehabilitation of an inverted siphon in the cities of Anaheim and Orange | | | | | | | | | | | | | | | | |
| **2-49** | Taft Branch Improvements | • Upsizing of sewer segments to increase capacity | | | | | | | | | | | | | | | | |
| **X-063** | Santa Ana River Interceptor Rehabilitation at Imperial Highway / 91 Freeway | • Rehabilitation of sewer facilities in the city of Anaheim | | | | | | | | | | | | | | | | |
| **X-086** | Santa Ana River Interceptor Improvements | • Upsizing of sewer segments to increase capacity | | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**
CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; PVC=Polyvinyl Chloride; OCFCD=Orange County Flood Control District; OCSD=Orange County Sanitation District

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – SUNFLOWER TRUNK

## System Overview




## Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 7.1 | 139 | 43 | 1 | 4 |
| 21” - 27” Ø | 13.5 | 203 | 49 | 7 | 4 |
| ≥ 30” Ø | 4.8 | 56 | 43 | - | 2 |
| **Reinforced Concrete** | | | | | |
| 42” Ø | 1.3 | 9 | 49 | - | - |
| 48” - 66” Ø | 3.4 | 40 | 38 | - | - |
| ≥ 72” Ø | 3.7 | 25 | 32 | - | - |
| **Ductile Iron** | | | | | |
| 20” Ø | 0.5 | 11 | 21 | 1 | 1 |
| **Polyvinyl Chloride** | | | | | |
| 30” Ø | 0.01 | 1 | 13 | - | - |

**Acronym Key:**

NASSCO=National Association of Sewer Service Companies

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – SUNFLOWER TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Point Repairs** – There are isolated pipe segments with structural defects that are not part of a current project. | • OCSD staff will evaluate the extent of the necessary repairs in these locations and recommend small projects to address the most significant defects. |
| • **Sewer Transfer** – Approximately 7.8 miles of gravity sewer were transferred to the City of Santa Ana. | • None. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |
| • **Manhole Access** – OCSD staff has identified specific locations where manholes are difficult to access for maintenance. | • OCSD staff will track and prioritize access issues to address key concerns. High priority access improvements will be recommended as a small project or addition to an existing project. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FE16-11** | Lane Channel Crossing | • OCSD support of Orange County Flood Control District's Lane Channel Project | | | | | | | | | | | | | | | | |
| **FE18-13** | Redhill Relief Sewer Relocation at State Route 55 | • Relocate sewer facilities in the city of Santa Ana | | | | | | | | | | | | | | | | |
| **FRC-0007** | Redhill Relief Sewer Liner Repair at State Route 55 | • Rehabilitation of sewer facilities in the city of Santa Ana | | | | | | | | | | | | | | | | |
| **7-66** | Sunflower and Red Hill Interceptor Repairs | • Rehabilitation of sewer facilities in the cities of Santa Ana and Costa Mesa | | | | | | | | | | | | | | | | |
| **X-065** | Tustin-Orange Interceptor Rehabilitation | • Rehabilitation of sewer facilities in the city of Orange | | | | | | | | | | | | | | | | |
| **X-066** | Tustin-Orange Interceptor / Orange Park Acres Trunk Rehabilitation | • Rehabilitation of sewer facilities in the city of Orange | | | | | | | | | | | | | | | | |

**Types of Project Legend:**

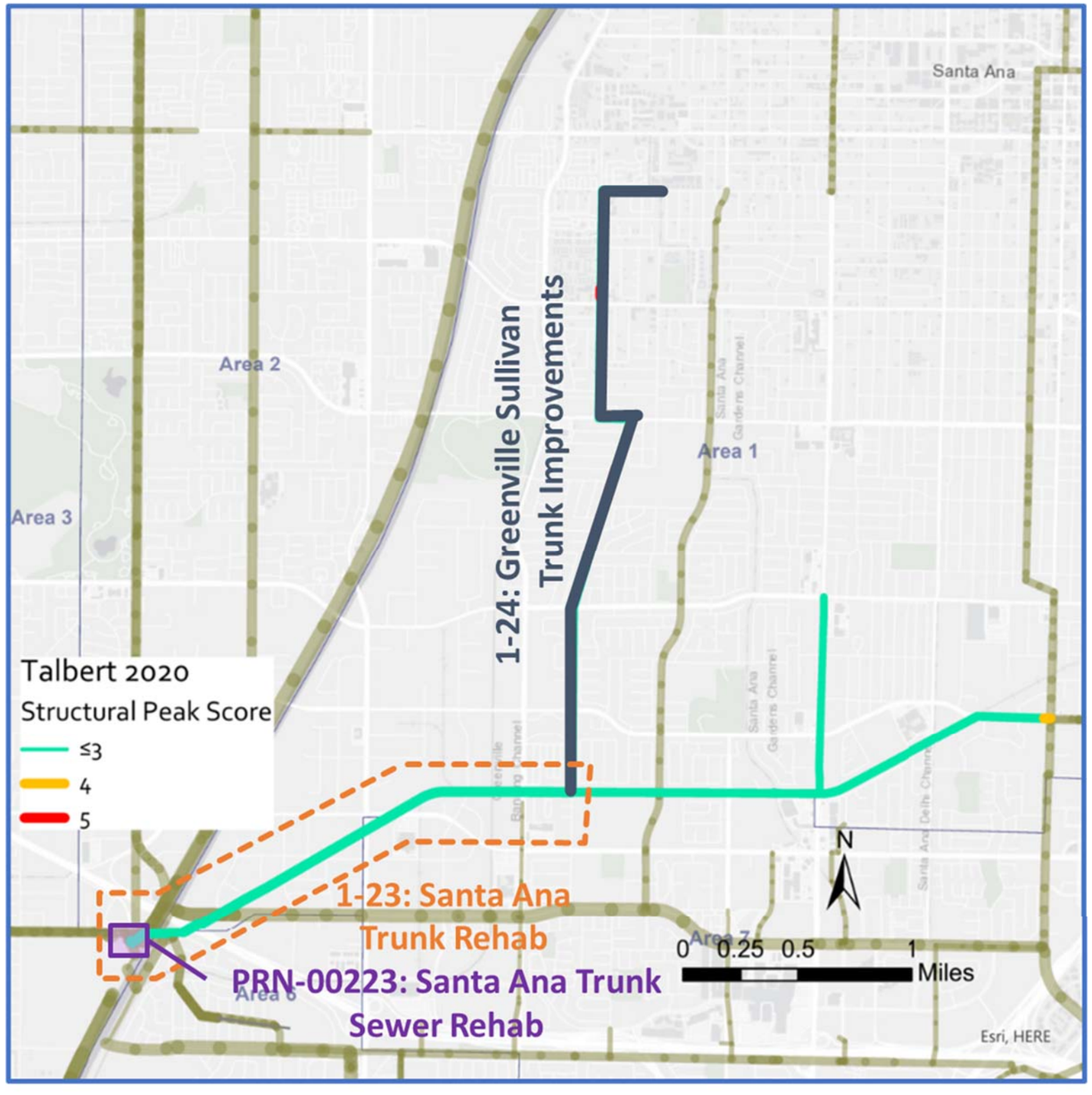
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**

CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – TALBERT TRUNK

## System Overview




## Major Assets and Condition Information

| Asset Type | Total Length (miles) | # of Pipes | Average Age (years) | # of Pipes with NASSCO Structural 5 | # of Pipes with NASSCO Structural 4 |
|---|---|---|---|---|---|
| **Vitrified Clay** | | | | | |
| ≤ 18” Ø | 0.03 | 3 | 63 | - | - |
| 21” - 27” Ø | 3.4 | 46 | 67 | - | 2 |
| ≥ 30” Ø | 1.7 | 23 | 67 | - | 1 |
| **Reinforced Concrete** | | | | | |
| ≤42” Ø | 1.0 | 10 | 51 | - | - |
| 48” - 60” Ø | 2.3 | 30 | 49 | - | - |


Santa Ana Trunk Sewer

# ASSET MANAGEMENT SYSTEM SUMMARY – COLLECTION SYSTEM – TALBERT TRUNK

## Key Issues

| Key Issues | Actions & Recommendations |
|---|---|
| • **Unlined Reinforced Concrete Pipelines** – The lower portions of the Santa Ana trunk are unlined reinforced concrete pipe that has been routinely evaluated and is currently in acceptable condition. These segments are more prone to corrosion related issues than typical pipe materials utilized within the collection system. | • Continue frequent monitoring of the pipeline condition to provide routine updates from which the scheduling of a future rehabilitation project (X-076) can be determined. |
| • **Sewer Transfer** – Approximately 7.8 miles of gravity sewer were transferred to the City of Santa Ana. | • None. |
| • **Condition Assessment of Gravity Pipelines** - Many factors impact the accuracy of the coding system used to identify the type and severity of condition issues within the collection system. Video quality, operator experience, and field conditions often make correct and consistent coding of defects difficult. For this reason, defects that have been identified may not illicit an immediate response. | • OCSD staff reviews condition reports on a regular basis and if necessary, marks the defect for monitoring or repair. It is recommended that the frequency of monitoring of grade 4 and grade 5 NASSCO structural defects be increased. |
| • **Cleaning and Condition Assessment of Siphons and Large Diameter Pipelines** – Siphons are regularly cleaned but are not inspected because they are inaccessible using CCTV equipment. Large diameter pipe (> 42") are not cleaned and CCTV footage does not identify sediment or debris below the waterline. | • OCSD staff will review recent sonar inspection data that identifies amount of debris in select large diameter pipelines. Based on the results, OCSD staff will recommend additional sonar inspection or large diameter cleaning where necessary. |
| • **Capacity** – The Collections Capacity Evaluation Study completed in 2019 conducted a detailed capacity analysis to identify the location of capacity deficiencies during dry and peak wet weather flows. | • Develop and complete CIPs identified by the Collections Capacity Evaluation Study to address capacity issues. Implement planning study to monitor potential spill locations associated with capacity deficiencies not identified as near-term CIPs. |
| • **T-lock** – The T-Lock PVC sheet lining system use to line manholes and concrete structures throughout the collection system will be discontinued. | • OCSD staff will investigate alternative liner technologies and methods to repair existing lined structures. |

## Current and Future Projects

| Project No. | Project Title | Description of Work | FY 20/21 | FY 21/22 | FY 22/23 | FY 23/24 | FY 24/25 | FY 25/26 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FEXX-XX (PRN-00223)** | Plant No. 1 Influent Trunk Sewer Rehabilitation | • Rehabilitation of influent trunk line in the city of Fountain Valley | | | | | | | | | | | | | | | | |
| **1-23** | Santa Ana Trunk Sewer Rehabilitation | • Rehabilitation of sewer facilities in the cities of Santa Ana and Costa Mesa | | | | | | | | | | | | | | | | |
| **1-24** | Greenville Trunk Improvements | • Upsizing of sewer segments to increase capacity in the City of Santa Ana | | | | | | | | | | | | | | | | |

**Types of Project Legend:**
**CIP - Planning** **CIP – Design** **CIP - Construction** **Maintenance Project**

**Acronym Key:**
CCTV=Closed-Circuit Television; CIP=Capital Improvement Program; FY=Fiscal Year; OCSD=Orange County Sanitation District; PVC=Polyvinyl chloride

# 6 Program Monitoring and Improvements

## 6.1 Program Monitoring

OCSD is continually evaluating AM Program progress and realized benefits. To support the evaluation, OCSD is in the early stages (first year) of developing metrics for monitoring. The metrics described below have been carefully chosen to directly relate to the Asset Management program objectives. As stated in Chapter 3, the key objectives OCSD is building into the asset management program are as follows:

1) Proactive approach to repair, rehabilitation, and replacement.
2) Ensure assets are reliable and operating when needed.
3) Minimize unplanned outages and equipment downtime.
4) Manage risks associated with asset or service impairment through asset performance optimization.
5) Develop cost-effective management strategies for the long term.
6) Strive to implement world class asset management strategies through continual improvement in our asset management practices.

This year, OCSD has chosen to focus on the first three objectives and in so doing, has also met the intention of objective number six, continual improvement. The following metrics were chosen not only to demonstrate the effectiveness of the AM Program but also to establish a baseline for which to gauge future performance. It is expected that the AM Council will meet and after reviewing the information in this report, will discuss AM Program metrics in greater length including the utility of the metrics chosen for the 2020 AMP and the possibility of setting agency goals.

*The proactive maintenance percent*, the percent of preventive maintenance as a total of all maintenance, demonstrates the effectiveness of the maintenance program (proactive vs. reactive). It also may reflect the condition (including age) of the assets. *Availability percent* demonstrates the average asset availability by process area and speaks to whether the assets are operating when needed. It is implied that when the assets are available, they are also reliable; however, this may or may not be the case. OCSD staff tried diligently to develop a metric that measures reliability; however, current data capture processes limit how the data can be used and the nature of the chosen reliability metric was not appropriate for the level at which the data are being reported. For now, availability is our best measure of objective number two. *Break-In percent* illustrates the amount of emergency work (or reactive work) as a percent of total work in the process area. The break-in percent metric will give OCSD personnel a better understanding of unplanned outages and the causes of equipment downtime. Finally, *maintenance costs and labor hours* are presented by process area to illustrate the total resources devoted to maintaining the process areas. The methods used to calculate each metric are included in Appendix J.

### 6.1.1 Data

The data used for the following analysis comes from two different sources. The data used for asset availability were sourced from the OCSD Major Equipment Status (MES) Dashboard database. The original intent of the major equipment status dashboard was to provide a targeted overview of critical asset availability allowing management to gauge if the area can meet OCSD level of service commitments. The primary strength of this data source is the relevance of the asset population utilized for this original intent. Specifically, using the MES as a data source provides a narrow and targeted group of major assets that are critical to the

operation of the process areas. A weakness of the MES is the fidelity of the data. Each piece of equipment is placed 'in' or 'out' of service by staff. Dates, which are recorded when an entry is made, may not be precise, or overlap if duplicate entries are made.

All other metric data were sourced from the computerized maintenance management system of record, Maximo. In contrast to the availability metric, the other metrics presented include most assets in each process area, some of which are not as critical to the successful operation of the process area. A mitigation to using this larger subset of assets exists in the break-in (reactive work) metric, which includes work that is deemed "emergency" or "urgent" by staff. By implication, this population of assets includes higher risk assets. The data from each database is from FY2018-19 and 2019-20 and is included in Appendix J for reference.

## 6.2 Program Metrics

### 6.2.1 Proactive Maintenance Percent

As stated above, the proactive maintenance percent has been chosen as the metric that, if increasing, will represent a shift from reactive to proactive maintenance routines. *The Proactive Maintenance Percent*, the percent of preventive maintenance as a total of all maintenance, demonstrates the effectiveness of the maintenance program. As shown in Tables 6-1 and 6-2, the proactive maintenance percent for both Reclamation Plant No. 1 and Treatment Plant No. 2 is very consistent and does not show any remarkable increase or decrease for either facility between FY2018-19 and FY2019-20 (a slightly elevated percentage for Plant No. 1 central generation area is noted and indicates that the maintenance program for this area is successfully being implemented). The electrical distribution area at Plant No. 2 began FY2018-19 above the 80% best in class value (SMRP, 2013) and the interplant area teams at Plant No. 1 were successful in raising the proactive maintenance percent above this threshold by the end of FY2019-20. Although, OCSD recognizes that industry standards, often developed for the manufacturing industry, may not be the best measure by which our asset management program is compared, it is helpful to have as a guideline. Many of the areas at both plants were at or below 60% indicating that improvement in this area is likely over time as proactive maintenance programs are implemented and older facilities are replaced.

**Table 6-1. Proactive Maintenance Percent for Reclamation Plant No. 1**

| Process Area | Fiscal Year 2018-19 Proactive Maintenance Percent | Fiscal Year 2019-20 Proactive Maintenance Percent |
|---|---|---|
| **Preliminary** | 25% | 39% |
| **Primary** | 29% | 39% |
| **Interplant** | 69% | 84% |
| **Activated Sludge** | 58% | 53% |
| **Trickling Filters** | 55% | 56% |
| **Digesters** | 34% | 46% |
| **Solids Handling - Facilities** | 31% | 34% |
| **Central Power Generation** | 40% | 64% |
| **Electrical Distribution** | 75% | 66% |
| **Utilities** | 39% | 30% |

**Table 6-2. Proactive Maintenance Percent for Treatment Plant No. 2**

| Process Area | Fiscal Year 2018-19 Proactive Maintenance Percent | Fiscal Year 2019-20 Proactive Maintenance Percent |
|---|---|---|
| **Preliminary** | 53% | 63% |
| **Primary** | 36% | 26% |
| **Effluent Disposal** | 60% | 55% |
| **Activated Sludge** | 54% | 48% |
| **Trickling Filters** | 64% | 66% |
| **Digesters** | 39% | 40% |
| **Solids Handling - Facilities** | 34% | 42% |
| **Central Power Generation** | 56% | 43% |
| **Electrical Distribution** | 84% | 69% |
| **Utilities** | 32% | 38% |

Although the pump stations have proactive maintenance percentages over 60%, the amount of percent change is the defining characteristic of the data. For instance, Lido, Slater, and Main Street pump stations increases were greater than 20%. The increase in proactive maintenance from FY2018-19 to FY2019-20 at Main Street pump station is due to a failed piping connection in the valve vault (February 2019) which caused a spill and resulted in over 650 labor hours being assigned an emergency corrective maintenance priority level. Figure 6.1 is included here as an example of a proactive maintenance percent chart. In addition to showing Main Street pump station the chart includes the metrics for MacArthur and Crystal Cove pump station, both of which show a decrease in proactive maintenance percent of over 20%. These pump stations are some of OCSD's older pump stations and this is reflected in the data. Common corrective maintenance work orders include replacing leaking valves, increase in the replacement of pump packing, and attending to equipment that is making excessive noise when operating. Appendix J contains graphs for the remaining process areas as well as the source data and methods.

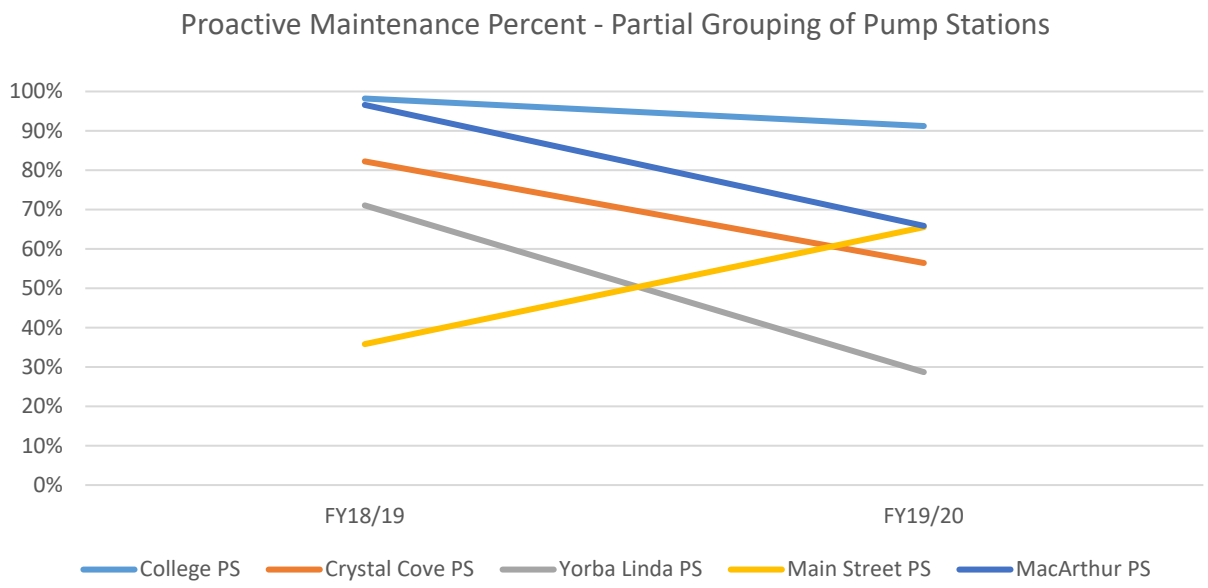



**Figure 6-1. Representative Graph of Proactive Maintenance Percent**

### 6.2.2 Availability Percent

The *Availability Percent* demonstrates the average asset availability by process area and speaks to whether the assets are operating when needed. In general, the major equipment for Reclamation Plant No. 1 was available over 90% of the time. Notable exceptions include Plant No. 1 electrical distribution and utility assets. For a list of availability percent by process area, see Table 6-3.

**Table 6-3. Availability Percent for Reclamation Plant No. 1**

| Process Area | Fiscal Year 2018-19 Availability Percent | Fiscal Year 2019-20 Availability Percent | Major Equipment |
|---|---|---|---|
| **Preliminary** | 91% | 95% | |
| **Primary** | 88% | 95% | |
| **Interplant** | 100% | 100% | |
| **Activated Sludge** | 94% | 92% | PEPS Pumps No. 2 and 3, Clarifier No. 11 |
| **Trickling Filters** | 97% | 100% | |
| **Digesters** | 99% | 98% | |
| **Solids Handling - Facilities** | 99% | 99% | |
| **Central Power Generation** | 97% | 100% | |
| **Electrical** | 85% | 89% | Power Building No. 2 Generator, Turbine Generator No. 3 |
| **Utilities** | 82% | 88% | |

The data shows that the Power Building 2 generator, Turbine Generator No. 3, and related electrical equipment were out for most of both years due to safety and performance concerns. With that said, both areas are showing an increase in availability when compared to the prior year. Other areas also showing an increase in availability include preliminary treatment, primary treatment, secondary treatment (trickling filters), and central generation. This is shown in Figure 6.2, a representative graph of the availability percent metric for some process areas at Reclamation Plant No. 1. Slight decreases in availability were seen in solids handling areas (digesters); however, this metric does not capture the heighten amount of maintenance that was completed at the time the digesters were cleaned thus preventing many hours of future downtime. A greater decrease in the secondary treatment area is evident due to the Primary Effluent Pump Station (PEPS) Pumps No. 2 and 3 and Secondary Clarifier No. 11 being taken out of service. All the critical interplant facilities were available in both fiscal years. The source data, methods, and graphs for all the process areas can be found in Appendix J.

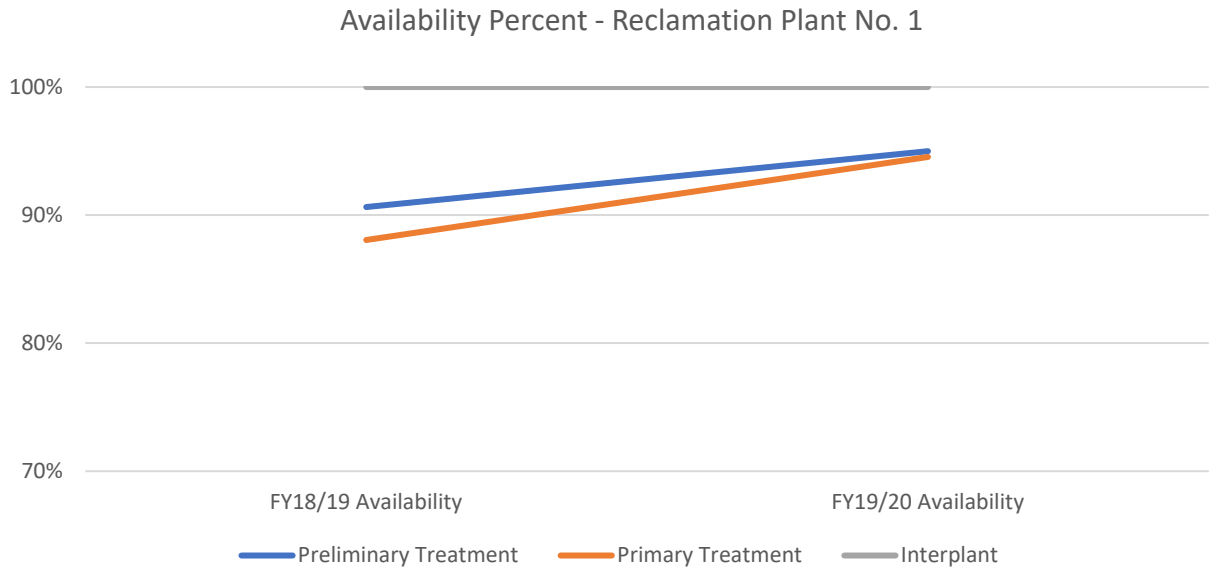



**Figure 6-2. Representative Graph of Availability Percent – Reclamation Plant No. 1**

Unfortunately, the predominant trend for Treatment Plant No. 2 is a decrease in the availability of the major equipment. For a list of availability percent by process area, see Table 6-4.

**Table 6-4. Availability Percent for Treatment Plant No. 2**

| Process Area | Fiscal Year 2018-19 Availability Percent | Fiscal Year 2019-20 Availability Percent | Major Equipment |
|---|---|---|---|
| **Preliminary** | 92% | 94% | |
| **Primary** | 94% | 84% | |
| **Effluent Disposal** | 72% | 71% | |
| **Activated Sludge** | 91% | 86% | |
| **Trickling Filters** | 93% | 92% | |

**Table 6-4. Availability Percent for Treatment Plant No. 2**

| Process Area | Fiscal Year 2018-19 Availability Percent | Fiscal Year 2019-20 Availability Percent | Major Equipment |
|---|---|---|---|
| **Digesters** | 98% | 82% | Digester F, I, O, and S |
| **Solids Handling - Facilities** | 100% | 98% | |
| **Central Power Generation** | 74% | 79% | |
| **Electrical** | 100% | 98% | |
| **Utilities (Plant Water)** | 88% | 79% | Inline Strainer No. 1 and 3; Pump No. 2 |

Although the percentages above represent the data as OCSD has chosen to utilize it, simply listing the percentages does not provide the entire picture. In the primary treatment area, the dramatic decrease in availability was due to an increase in the number of major equipment components needed during the wet weather season, not because the equipment was taken out of service. In the utilities area, Plant Water Inline Strainer No. 1 and No. 3 were out of service due to normal wear and valve failure. Plant Water Pump No. 2 was out of service because the shaft broke and the parts have a long lead time. Currently the equipment is back in service and working reliably. Finally, the digesters at Treatment Plant No. 2 saw the most dramatic decrease because Digester F, I, O, and S were intentionally removed from service for cleaning and repairs. This is an extensive effort to make the digesters more reliable with the implementation of several maintenance rehabilitation projects over the next six years.

The major equipment in the effluent disposal area is presenting as the least available, hovering just above 70% (shown in Figure 6.3). Major equipment in this area include the bleach and bisulfite pumps that were used to disinfect the primary effluent discharged through the long outfall. OCSD no longer discharges primary effluent to the ocean; however, the facilities are needed if OCSD discharges through the short outfall during emergency operations. Currently, the number of pumps necessary to meet reduced usage capacity are available. A capital improvement project that will reconstruct the Bleach Station to meet OCSD's current needs is underway. A capital improvement project that will rehabilitate the Sodium Bisulfite Station is schedule to begin soon (2021).

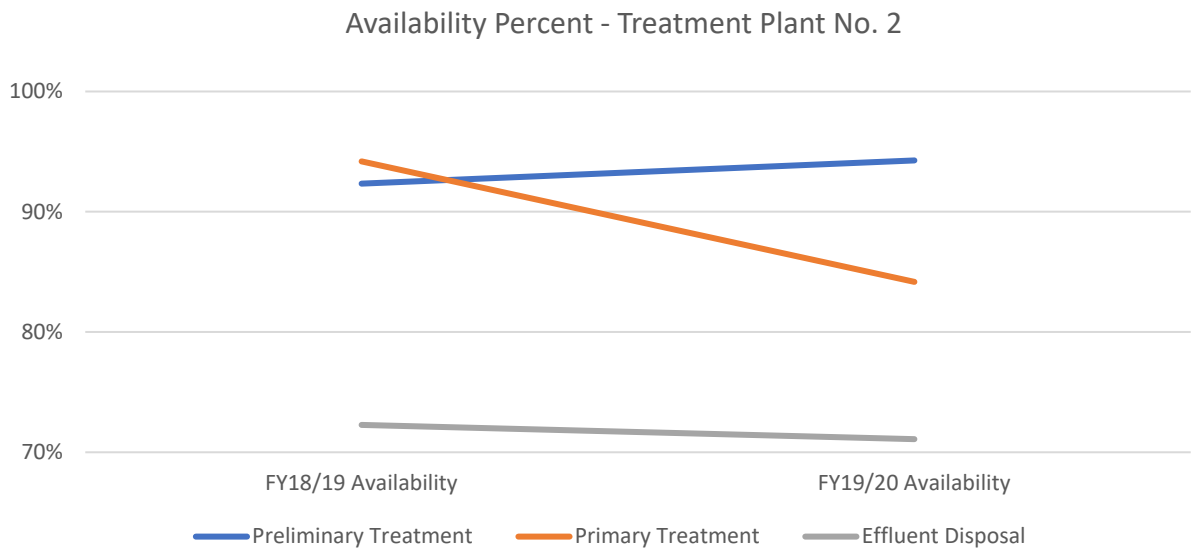



**Figure 6-3. Representative Graph of Availability Percent – Treatment Plant No. 2**

Major equipment was predominately available at the pump stations, with only Bay Bridge Pump Station and Yorba Linda Pump Station ending the 2019-20 fiscal year below 90% and 15th Street, Bay Bridge, and MacArthur Pump Stations trending downward (Table 6-5). The slight decrease in availability at MacArthur is due to Pump No. 1 being out of service for approximately a month in fiscal year 2019-20 and the dramatic decrease at Bay Bridge is due to Pumps No. 2, 3, and 5 being out of service for the majority of FY2019-20. The Collections Division has worked hard and as of this writing Pumps No. 4 and 5 are currently back in service and Pump No. 2 has partial operability. The pump station is near the end of its useful life and a decrease in availability would be expected. The Bay Bridge Pump Station Replacement Project (Project No. 5-67) is currently in the public review period for the environmental documents. The new pump station is scheduled to be complete in FY2026-27. Availability of major equipment was either increasing or consistent for all other pump stations.

**Table 6-5. Availability Percent for the Pump Stations**

| Process Area | Fiscal Year 2018-19 Availability Percent | Fiscal Year 2019-20 Availability Percent |
|---|---|---|
| **A Street** | 99% | 100% |
| **15th Street** | 100% | 97% |
| **Lido** | 98% | 98% |
| **Bay Bridge** | 94% | 86% |
| **Rocky Point** | 94% | 96% |
| **Bitter Point** | 100% | 100% |
| **Seal Beach** | 88% | 90% |
| **Westside** | 88% | 94% |
| **Edinger** | 100% | 100% |
| **Slater** | 94% | 98% |

**Table 6-5. Availability Percent for the Pump Stations**

| Process Area | Fiscal Year 2018-19 Availability Percent | Fiscal Year 2019-20 Availability Percent |
|---|---|---|
| **College** | 100% | 100% |
| **Crystal Cove** | 100% | 100% |
| **Yorba Linda** | 76% | 86% |
| **Main Street** | 92% | 95% |
| **MacArthur** | 100% | 99% |

#### 6.2.2.1 Availability vs. Reliability

Ideally, to gauge asset management performance, a metric reporting on asset reliability would be included. Examples include such metrics as MTBF or Mean Time to Repair. OCSD staff was unable to develop similar metrics due to data capture functionality and diminished relevance of the result. To develop reliability metrics, functional data that (1) identifies critical assets and (2) records asset failure and successful repair dates must be available. Currently, Maximo does not assign criticality to assets. Also, granularity of detailed data is not available. For example, if a Maximo work order for a failure of a sub-component on a clarifier is recorded, there is no way to know if the clarifier itself has been taken out of service. The MES includes what could be considered a 'starting point' for a group of critical assets but does not capture the discrete dates ("in service") needed for these metrics in a usable way.

The development of reliability metrics also requires that the result remain relevant for the intended use once the data has been synthesized. Generally, a metric such as MTBF would be useful in gauging reliability of individual major assets. Assuming MTBF was feasible, summarizing many assets by area in the manner used for other metrics included thus far in the AMP is not meaningful. In the future, given a precise definition of criticality, established parent child relationships between major equipment and sub-components, and processes to ensure data integrity, meaningful reliability metrics can be developed. The feasibility of these steps and identification of other steps necessary for the development of reliability metrics has been identified as an opportunity for improvement and is included in Table 6-7.

### 6.2.3 Break-In Percent

*Break-In Percent* illustrates the amount of emergency work (or reactive work) as a percent of total work in the process area. Typically, the Break-In Percent metric should track closely with the inverse of the proactive maintenance percent as one is a measure of proactive maintenance program and the other a measure of unplanned outages or a reactive maintenance response. However, at both Edinger Pump Station and Plant No. 1 - Interplant Area, there was an increase in both the proactive maintenance percent and the break-in percent for the interplant area. The data indicate that this is an anomaly due to the low number of work orders for the area. At Plant No. 2, the data show an increase in both metrics in the solids handling facilities. This is simply a reminder that corrective maintenance work orders that are assigned a high priority are in fact a small percentage of total corrective maintenance work orders and it is entirely possible to have an increase in both data populations. Literature for the manufacturing industry (SMRP, 2013) indicates that high performers can expect a Break-In Percent of less than 10%. A list of facilities with decreasing Break-In percent is summarized in Table 6-6. This metric, even more so than the others, is best interpreted as a trend over many years, as the percentage from year to year is expected to change dramatically (see Main Street Pump Station, Solids Handling Facilities,

and Central Generation for examples). Success is measured as a consistent trend downward overtime.

**Table 6-6. Process Areas with Decreasing Break-In Percent**

| Process Area | Fiscal Year 2018-19 Break-In Percent | Fiscal Year 2019-20 Break-In Percent | Percent Change |
|---|---|---|---|
| Main Street PS | 59% | 4% | 55% |
| P1 Solids Handling - Digesters | 38% | 19% | 19% |
| P1 Central Power Generation | 28% | 10% | 18% |
| P1 Solids Handling - Facilities | 37% | 23% | 14% |
| Seal Beach PS | 26% | 14% | 12% |
| Rocky Point PS | 19% | 7% | 12% |
| P2 Preliminary Treatment | 19% | 8% | 11% |
| Lido PS | 36% | 26% | 10% |
| Slater PS | 18% | 8% | 10% |
| A Street PS | 12% | 4% | 8% |
| P2 Electrical Distribution | 13% | 7% | 6% |
| P1 Utilities | 24% | 19% | 5% |
| P2 Solids Handling - Digesters | 20% | 15% | 5% |
| P1 Primary Treatment | 30% | 27% | 3% |
| P2 Primary Treatment | 19% | 17% | 2% |
| P2 Central Power Generation | 21% | 20% | 1% |

### 6.2.4 Maintenance Costs and Labor Hours

OCSD plans on using the maintenance costs and number of labor hours over time as trend indicators to indicate the amount of resources devoted to reliably maintaining the process areas; consequently, it is difficult to utilize two years of data for a baseline let alone as intended until more data can be gathered in a systematic way. Simply calculating the percent change for each area is not useful toward our goal of measuring the improvement of the AM Program; however, several interesting developments are prevalent when comparing the degree to which the maintenance cost and labor hours change in this short period of time. First, the data indicate that there has been a slight increase in maintenance costs accompanied by a dramatic increase in maintenance labor hours in the Treatment Plant No. 2 Central Generation process area (Figure 6.4 and Figure 6.5). This is due to increased focus and dedication to maintaining the central generation facilities in-house, through a centralized team of specialists.

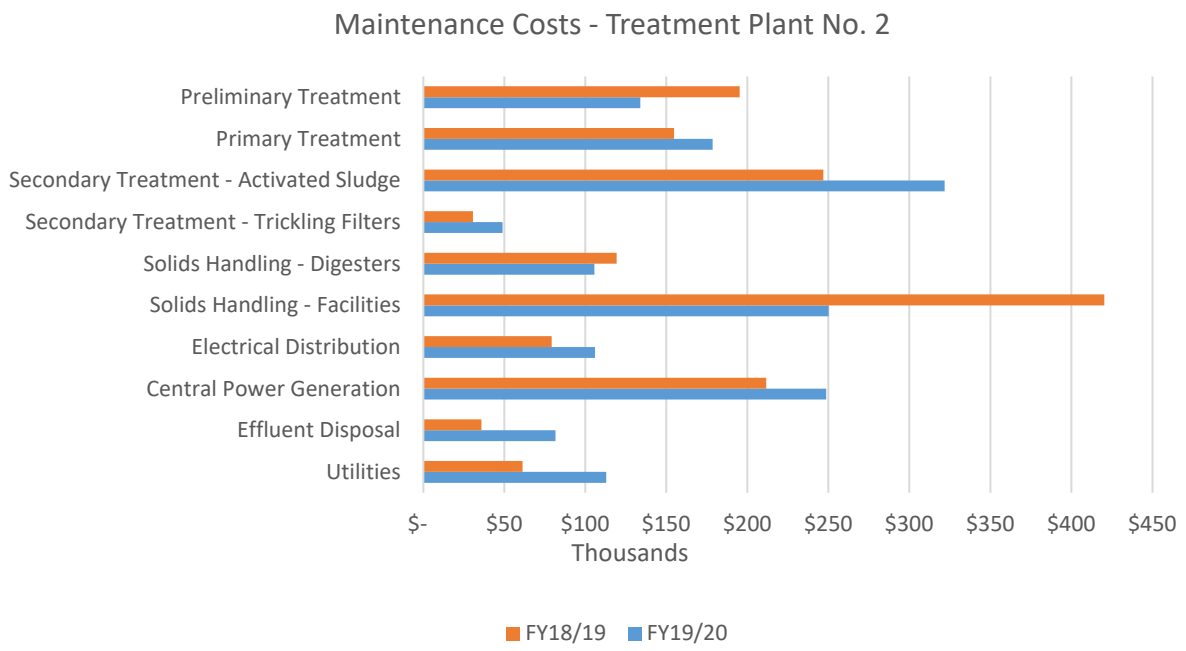



**Figure 6-4. Representative Graph of Maintenance Costs (Materials and Services)**

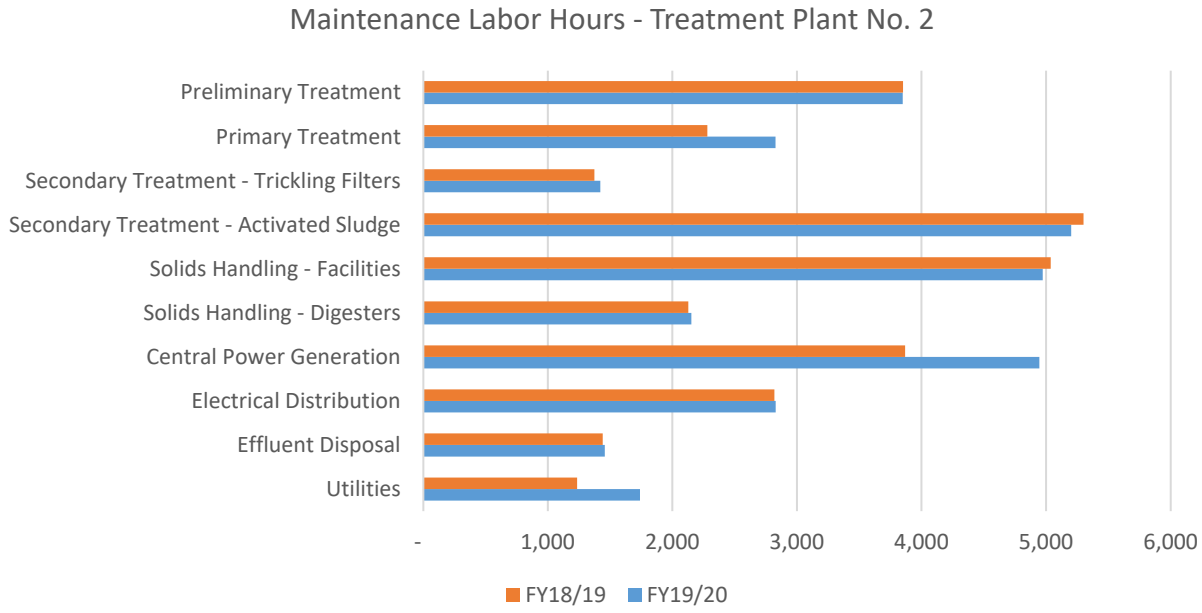



**Figure 6-5. Representative Graph of Maintenance Labor Hours**

Although not shown here, the data also show large increases in both maintenance costs and labor hours at Yorba Linda, Seal Beach, Bay Bridge, and Crystal Cove pump stations. These pump stations are some of OCSD's oldest; the first three pump stations will be abandoned or rebuilt in the next six years and are approaching the end of their useful lives. Crystal Cove Pump Station is scheduled for rehabilitated within nine years. It is expected that both maintenance and labor costs will continue to increase as these pump stations age and need increased efforts to remain reliable. Appendix J contains the source data and charts for all the process areas.

## 6.3 AM Program Improvement Opportunities

Key Objective No. 6 cites the need for continuous improvement of the AM Program. The general long-term approach of the program is to utilize risk assessment methods to identify which assets should be included in a condition monitoring program. Also, as condition assessment technology advances, methods will depend more on the criticality of the asset and less upon the asset accessibility. Another example of an improvement opportunity is to track asset life-cycle costs to determine if the AM program is truly trending toward minimizing asset life-cycle costs. Integrating multiple software systems such as Maximo and geographic information system will improve efficiency in data capture and utilization as the AM program evolves. The specific improvement opportunities and reasonable timeframes for implementing these improvements are defined in Table 6-7. Future AMP updates will summarize the implementation progress.

**Table 6-7. AM Program Improvement Opportunities**

| Improvement Opportunity | Description | Timeframe (Years) | Success Measures |
|---|---|---|---|
| Performance Management Framework and Metrics | Further develop metrics, for tracking and trending the AM program performance and progress towards meeting the GM's intent. | Ongoing | • Defined metrics<br>• Documented reporting processes |
| Collection of Condition Data | The actual condition of several assets is not known and applying a theoretical condition and remaining useful life is not accurate. | Ongoing | • We know the condition of our most important assets<br>• Every critical asset has a condition assessment plan that is being tracked in Maximo |
| Asset Registries | Standardize the asset registries, assure pertinent information is included and update on a regular basis. | Ongoing | • All "assets" are being tracked.<br>• Latest available asset data are in the registry |
| Remaining Useful Life | Develop a standard approach to determining remaining useful life that is based on condition, performance, and risk. | 1-2 | • Updated RUL scores are more accurate and defensible<br>• Corrective maintenance and break-ins decrease over time |
| Asset Hierarchy | Establish a hierarchy of all assets within Maximo to allow easier tracking on a higher level. | 1-2 | • Assets within Maximo are easily linked to the assets in the asset registry<br>• Transfer of maintenance data into the asset registries is more efficient |
| Risk Assessment | Expand existing risk assessment process and update likelihood and consequence of failure criteria. Score each major asset using the criteria. | 2-4 | • Risk score for each major asset |

**Table 6-7. AM Program Improvement Opportunities**

| Improvement Opportunity | Description | Timeframe (Years) | Success Measures |
|---|---|---|---|
| Integrated Use of Maximo | Transition asset hierarchy and inventory, replacement costs, risk scores, and RUL estimates to Maximo to make it the system of record.<br>Transition the asset issue tracking system to Maximo. | 2-5 | • Maximo used as system of record for the asset registry and to address asset issues<br>• Elimination of Asset Engineer asset registry spreadsheets and SharePoint Asset Issue Tracker |
| Life Cycle Costing | Continue refining processes to track asset-level life cycle cost data. | 2-5 | • Documented processes for conducting life cycle cost analyses<br>• Formalized templates<br>• Staff trained on processes and templates |

## 6.4 Reference

Society for Maintenance and Reliability Professionals (SMRP). 2013. *Maintenance and Reliability Best Practices.* 4th Edition.

# 7 Budgetary Considerations

The AMP focuses on documenting short- to long-term planning of maintenance and capital improvement projects to support effective budget development and sustainable operations. OCSD has been striving to identify more accurately medium- to long-term capital cash flow requirements. Specifically, the Planning Division has been working on developing a 20-year CIP by creating project plans for forecasted rehabilitation, replacement, improvements and expansion for the collection system and treatment plants. The CIP budget is evaluated and updated on an on-going basis as new information becomes available.

## 7.1 Capital Improvement Expenditures

FY2020-21 Budget Update, adopted on June 24, 2020, includes updates to the 20-year CIP outlay. Figure 7-1 shows the 20-year CIP outlay, which includes current and projected future Capital Improvement Program projects. FY2020-2021 CIP outlay is further divided into process categories shown in Figure 7-2.

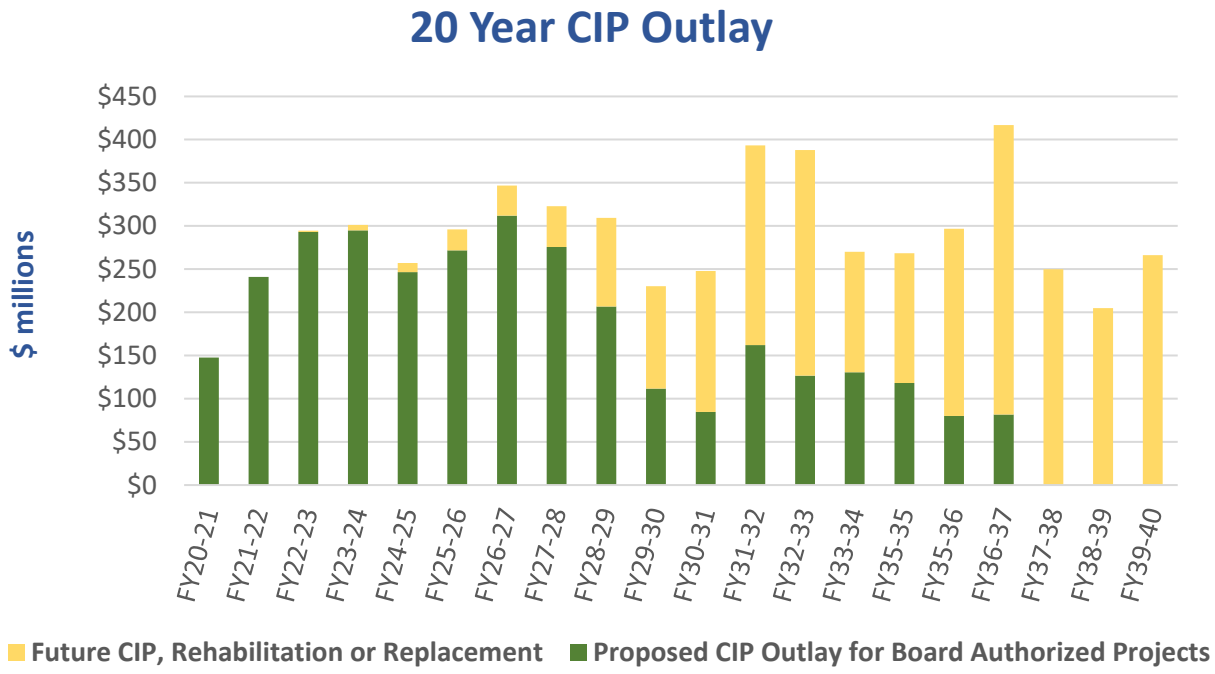



**Figure 7-1. 20-Year CIP Outlay**

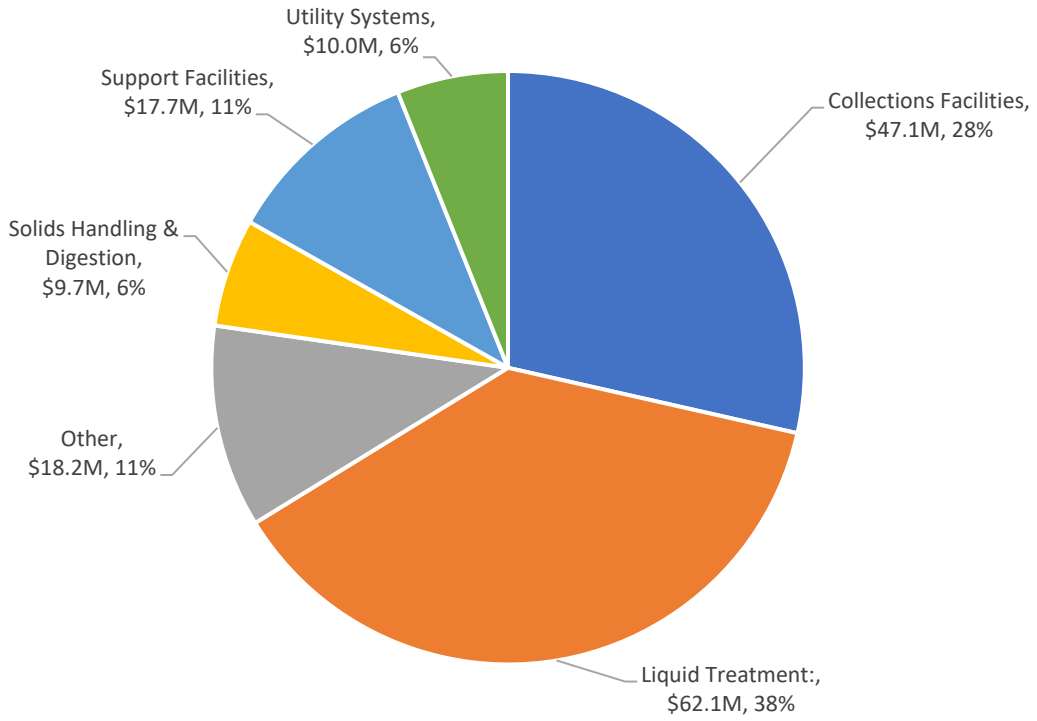



**Figure 7-2. FY 2020-21 CIP Outlay by Process - $164.8 Million**

## 7.2 Maintenance Expenditures

### 7.2.1 Five-Year Historical Maintenance Expenditures

Figure 7-3 and Figure 7-4 show the historical actual spent versus budgeted operational and maintenance expenditures for the treatment plants and collection system, respectively.

- The treatment plant expenditures include maintenance services and materials (budget objects 54010, 54020).
- The collection system expenditures include maintenance services and materials (budget objects 54010, 54020, 53180).
- These costs represent the operations and maintenance costs of fixed assets, including operationally funded repair/replacement projects.

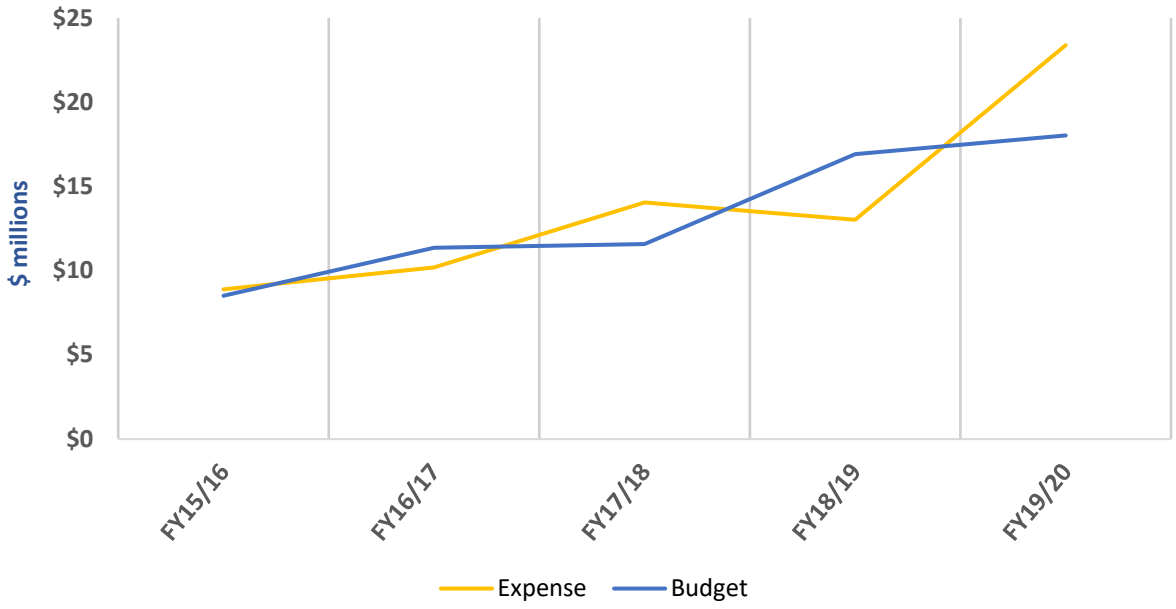



**Figure 7-3. Five-Year Historical Maintenance Costs for Treatment Plants**

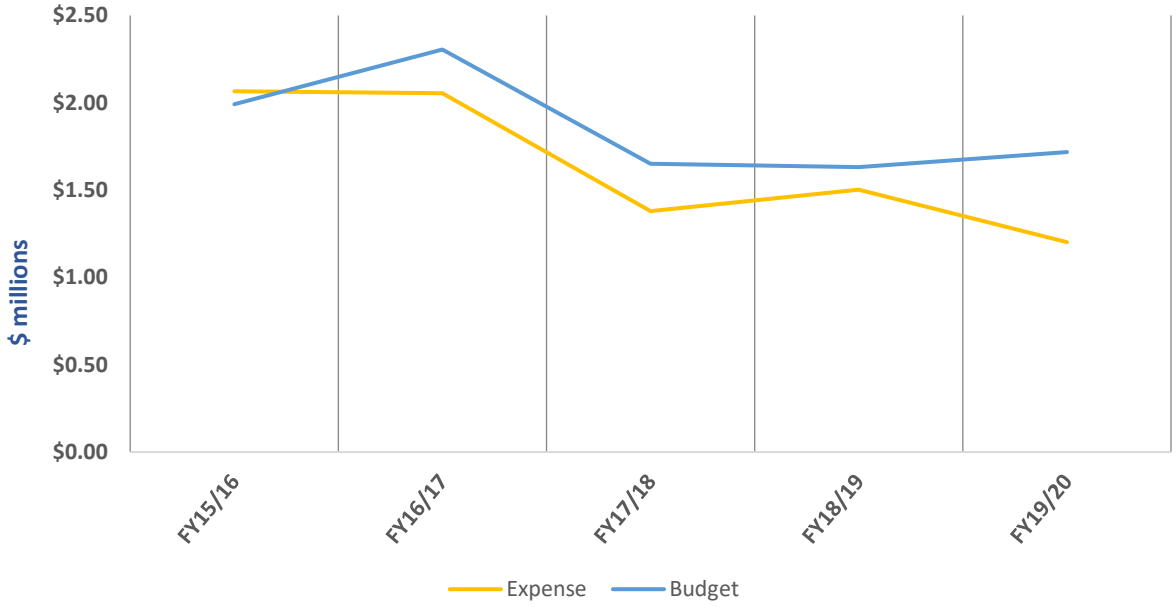



**Figure 7-4. Five-Year Historical Maintenance Costs for Collection System**

### 7.2.2 Three-Year Look-Ahead Maintenance Expenditures

Table 7-1 shows operational-funded projects identified to-date and includes the projected annual expenditures. The projects are grouped by location (Plant No. 1, Plant No. 2, Joint, and Collection System), and then sorted by the project start fiscal year. The list encompasses projects identified thus far. It is likely FY21-22 and beyond will fluctuate based on the condition of assets as they age. Additionally, projects in the following list represent expenditures that are operationally funded and capital in nature.

**Table 7-1. Planned Operational-Funded Maintenance Projects in FY2020-21 through FY2022-23 (as of October 5, 2020)**

| PRN No. | Alt Project No. | Project Title | FY20-21 | FY21-22 | FY22-23 | Three-Year Total Cost |
|---|---|---|---|---|---|---|
| **Collection System Projects** | | | | | | |
| PRN-00159 | MP-307 | Bushard Diversion Structure Repair | $0 | $1,456,000 | | $1,456,000 |
| PRN-00449 | FRC-0002 | Bay Bridge Pump Station Valve Replacement | $945,000 | | | $945,000 |
| PRN-00527 | | A Street and 15th Street Pump Station Valve Replacement and Assessment (Construction Costs) | $0 | $247,500 | $247,500 | $495,000 |
| PRN-00584 | FRC-0004 | Seal Beach suction and isolation valve Replacement | $843,000 | | | $843,000 |
| PRN-00589 | | Olive Sub Trunk Siphon Assessment | $97,750 | | | $97,750 |
| PRN-00592 | FRC-0007 | Redhill Relief Sewer Liner Repair at SR-55 | $0 | | $245,000 | $245,000 |
| PRN-00599 | FRC-0005 | East Coast Highway Trunk Line Repair | $300,000 | | | $300,000 |
| PRN-00610 | FRC-0006 | Rocky Point PS 480V Feeder Cable Replacement | $480,000 | | | $480,000 |
| PRN-00639 | | Warner Avenue Vault Cover Repairs | $50,000 | | | $50,000 |
| PRN-00677 | | Removal of Yorba Linda Spur Biofilter Odor Control | $75,000 | | | $75,000 |
| PRN-00694 | | Manhole Abandonment Near Slater Pump Station | $70,756 | | | $70,756 |
| PRN-00695 | | Valve Abandonment Near Slater Pump Station | $29,000 | | | $29,000 |
| | 7-66 | Sunflower Trunkline Liner Repairs | $0 | $2,350,000 | $0 | $2,350,000 |
| | FE17-06 | Tustin Manhole Repairs | $526,000 | | | $526,000 |

**Table 7-1. Planned Operational-Funded Maintenance Projects in FY2020-21 through FY2022-23 (as of October 5, 2020)**

| PRN No. | Alt Project No. | Project Title | FY20-21 | FY21-22 | FY22-23 | Three-Year Total Cost |
|---|---|---|---|---|---|---|
| **Joint Projects** | | | | | | |
| PRN-00630 | | Interplant Gas Line Blow Off Vaults | | $75,000 | | $75,000 |
| **Plant No. 1 Projects** | | | | | | |
| PRN-00385 | MP-462 | Primary Clarifier Maintenance (16-31) | $1,432,000 | | | $1,432,000 |
| PRN-00402 | MP-432 | P1 AS Clarifier Lighting Replacement | $130,000 | | | $130,000 |
| PRN-00480 | | OOBS 120-inch Pipe Plinths - Coatings | $90,000 | | | $90,000 |
| PRN-00491 | | Repair Storm Drains Throughout Plant No. 1 (MP 584) | $40,000 | | | $40,000 |
| PRN-00492 | FR1-011 | P1 TF Pump VFD (3) Replacement | $220,000 | $150,000 | $700,000 | 1,070,000 |
| PRN-00516 | | PEPS Pump #1 Mechanical Repair | $52,017 | | | $52,017 |
| PRN-00517 | | PB-7 Generator Radiator Repair | $100,000 | | | $100,000 |
| PRN-00520 | MP-493 | P1 AS1 Blower Flowmeter Replacement | $76,500 | | | $76,500 |
| PRN-00522 | | P1 EJB Piping - Coatings | $135,732 | | | $135,732 |
| PRN-00523 | FR1-0005 | P1 12kV Service Center 125VDC System replacement and upgrades | $0 | $0 | $500,000 | $500,000 |
| PRN-00525 | FR1-0005 | P1 Cen Gen 125VDC and 24DC Battery System | $85,000 | | | $85,000 |
| PRN-00540 | MP-669 | Truckloading, Digesters 9 and 10, and Silo Cake Pumps Platform Request | $30,000 | $150,000 | $0 | $180,000 |
| PRN-00569 | MP-648 | P1 Emergency Generator Relay Upgrade | $190,000 | $0 | $0 | $190,000 |
| PRN-00632 | | Rebuild Shop Wood Floor Replacement | $70,000 | | | $70,000 |
| PRN-00647 | | P1 BB2 4.16V Switchgear Auto Transfer Scheme & Protection Upgrade | $900,000 | | | $900,000 |
| PRN-00662 | | AS1 Aeration Basin Cart Ramp Repair | $57,700 | | | $57,700 |
| PRN-00676 | | Digester Ferric Injection Pipe | $65,000 | | | $65,000 |

**Table 7-1. Planned Operational-Funded Maintenance Projects in FY2020-21 through FY2022-23 (as of October 5, 2020)**

| PRN No. | Alt Project No. | Project Title | FY20-21 | FY21-22 | FY22-23 | Three-Year Total Cost |
|---|---|---|---|---|---|---|
| PRN-00683 | | Centrifuge Bridge Crane Hoist Length Replacement | $55,000 | | | $55,000 |
| PRN-00698 | | AS1 Waste Activated Sludge Pump Capacity | | | $500,000 | $500,000 |
| | MP-320 | Med. Voltage Cable Testing Services | $206,655 | $160,000 | $125,000 | $491,655 |
| | | P1 Centrifuge Overhaul (4k hour) (Three per year; Annual Costs) | $1,000,000 | $1,000,000 | $1,000,000 | $3,000,000 |
| | | P1 Digester Cleaning (Annual Costs) | $300,000 | $300,000 | $300,000 | $900,000 |
| | | P1 Gas Compressor Overhaul (One per year; Annual Costs) | $100,000 | $100,000 | $100,000 | $300,000 |
| **Joint Projects (Plant No. 1 and Plant No. 2 Projects)** | | | | | | |
| PRN-00398 | MP-326 | P1 Power Bldg 3A, P2-3C Prot. Relay Replacement | $210,000 | | | $210,000 |
| PRN-00537 | | P2 and P1 Office Space for Heavy Mechanics Group | $15,000 | $0 | $0 | $15,000 |
| PRN-00573 | | P1, P2, Collections Variable Frequency Drives | $2,000,000 | $1,000,000 | | $3,000,000 |
| PRN-00627 | | P1/P2 Cen Gen Engine Ignition Control System Obsolescence Repair | $250,000 | | | $250,000 |
| | MP-302 | On-call HVAC Services | $150,000 | $150,000 | | $300,000 |
| **Plant No. 2 Projects** | | | | | | |
| PRN-00262 | MP-105 | P2 Cen Gen Steam Turbine Rehabilitation | $530,000 | | | $530,000 |
| PRN-00314 | MP-305 | P2 Cen Gen Supply Fan Rehabilitation | $0 | $550,000 | | $550,000 |
| PRN-00394 | MP-257 | P2 Cen Gen Steam Turbine Condenser Repair | $360,000 | | | $360,000 |
| PRN-00409 | MP-509 | P2 Headworks Low Voltage Cable Assessment | $400,000 | | | $400,000 |
| PRN-00438 | FR2-0013 | Trickling Filter Waste Sludge Pump Room Exhaust Fan Relocation at Plant No. 2 | | $370,000 | | $370,000 |

**Table 7-1. Planned Operational-Funded Maintenance Projects in FY2020-21 through FY2022-23 (as of October 5, 2020)**

| PRN No. | Alt Project No. | Project Title | FY20-21 | FY21-22 | FY22-23 | Three-Year Total Cost |
|---|---|---|---|---|---|---|
| PRN-00451 | MP-248 | P2 Secondary Clarifier Repairs | $1,027,153 | | | $1,027,153 |
| PRN-00455 | FR2-0021 | P2 Plant Boiler Re-tube | $0 | $207,000 | | $207,000 |
| PRN-00457 | MP-638 | P2 AS Plant Inlet Gate Replacement | $990,000 | | | $990,000 |
| PRN-00493 | MP-551 | P2 TF Pump Overhaul / Seal Tube Eval | $221,727 | | | $221,727 |
| PRN-00499 | | P2 EPSA VFD Upgrades | $80,671 | | | $80,671 |
| PRN-00512 | | Plant No. 2 Steam Pipe Repairs | $25,000 | | $0 | $25,000 |
| PRN-00513 | MP-585 | P2 Truck Loading Auger Replacement | $266,213 | | | $266,213 |
| PRN-00528 | | P2 MSP VFD 10-year PM | $275,360 | $0 | | $275,360 |
| PRN-00529 | | P2 MSP Motor Overhaul | $253,088 | $0 | | $253,088 |
| PRN-00566 | | P2 EPSA suction piping Coating | $68,000 | | | $68,000 |
| PRN-00570 | | P2 Centrifuge Spare Parts/Damage | $457,465 | | | $457,465 |
| PRN-00571 | FR2-0019/ FR2-0022 | P2 Digester 'O' Valve Replacement / Repairs | $320,000 | $260,000 | | $580,000 |
| PRN-00572 | FR2-0018 | P2 AS Plant Clarifier Rehabilitation (6) – Phase II | $0 | $2,500,000 | $2,500,000 | $5,000,000 |
| PRN-00606 | | Digester Pump Room Roof Repair (P, Q, T) | $227,775 | | | $227,775 |
| PRN-00616 | | Cen Gen Generator #5 Electrical Service and Repair | $85,000 | | | $85,000 |
| PRN-00619 | | P2 Truck Loading Sliding Frame Hydraulic Cylinders Replacement | $420,000 | | | $420,000 |
| PRN-00629 | | P2 A Side Primary Basin Launder Cover Repair | $84,175 | | | $84,175 |
| PRN-00633 | FR2-0023 | P2 AS Plant Secondary Clarifier Safety Entry Improvements | $0 | $161,850 | | $161,850 |
| PRN-00634 | | P2 TFSC RSS Pumps Repair for Low Seal Water Flow | $190,000 | | | $190,000 |

**Table 7-1. Planned Operational-Funded Maintenance Projects in FY2020-21 through FY2022-23 (as of October 5, 2020)**

| PRN No. | Alt Project No. | Project Title | FY20-21 | FY21-22 | FY22-23 | Three-Year Total Cost |
|---|---|---|---|---|---|---|
| PRN-00642 | | EPSA Discharge Piping Repair | $100,775 | | | $100,775 |
| PRN-00643 | | P2 TF-A Rotary Distributor Damage Evaluation and Repair | $50,000 | | | $50,000 |
| PRN-00680 | | P2 Distribution Center H: 480V Switchgear Relay Replacement & Auto Transferring | $630,000 | | | $630,000 |
| PRN-00684 | | P2 Digester Maintenance Projects (AI-207) | $280,000 | $1,250,000 | $700,000 | $2,230,000 |
| PRN-00690 | | 480V Cable Replacement at P2 Headworks | $130,000 | | | $130,000 |
| | | P2 Centrifuge Overhaul (4k hour) (Three per year; Annual Costs) | $1,000,000 | $1,000,000 | $1,000,000 | $3,000,000 |
| | | P2 Digester Cleaning (Annual Costs) | $500,000 | $500,000 | $500,000 | $1,500,000 |
| | | Cathodic Protection/ Ground rod replacement (Annual Costs) | $150,000 | $150,000 | $150,000 | $450,000 |
| | | P2 Gas Compressor Overhaul (One per year; Annual Costs) | $100,000 | $100,000 | $100,000 | $300,000 |
| | | Primary Treatment Rehabilitation - B/C Side Primary Clarifiers | $275,000 | | | $275,000 |
| | | Cake Transfer Pumps Overhaul (Annual Costs) | $60,000 | $60,000 | $60,000 | $180,000 |

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# Appendix A
# Reclamation Plant No. 1 Process Diagram

# Unit Process Schematic

## OCSD Reclamation Plant No. 1

rev. 11/06/19

ORANGE COUNTY SANITATION DISTRICT • PROTECTING THE ENVIRONMENT •

Caustic
Bleach
Scrubbers 1,2,3,4
Grit to Landfill
Scrubbers 5–8
Caustic
Bleach
Headworks No. 1 Pumps (2)
Gravity Grit Chambers (2)
Dilution Water
Polymer
East Basin Distribution Structure
Primary Clarifiers 1–5
Primary Effluent Junction Box (PEJB)
(recirculation line)
Trickling Filter Influent Pumps (3)
Trickling Filters (2)
TFE Box
Trickling Filter Secondary Clarifiers (2)
TFSE Junction Box 1
TFSE Junction Box 3
TFSE Junction Box 4
TFSE Junction Box 5
Bleach
Sludge
Drain
Scum
78-Inch Interplant Trunkline to Plant No. 2
Waste Side Stream Pump Station (WSSPS) (3 pumps)
(overflow only)
TF Sludge
Trickling Filter Sludge Pumps (4)
Redwood Weir (PEDB1)
Primary Effluent Pump Station (PEPS) (3)
Facility Use
Plant 1 Water Pump Station
Wastehauler Station
Ferric Chloride & Hydrogen Peroxide
(separate lines to each box)
84-inch line
66-inch line
SEJB
Interplant Line
Hydrogen Peroxide
Splitter Box
Sludge & Scum Decant
GAP Backwash
Junction Box A
SE Junction Box 1
Scrubber 9
Scrubber 10 (Biotower)
Ferric Chloride
Dilution Water
Polymer
Primary Effluent Distribution Box (PEDB2)
Bleach
Scum
SE Junction Box 5
OCWD-owned Pump Station for GAP Water
TFSE Junction Box 2
Effluent Junction Box (EJB)
Hydrogen Peroxide
Hydrogen Peroxide
Bar Screens 1,2,5,6
Headworks No. 2 Pumps (5)
Aerated Grit Chambers 1,2,3,4,5
Aeration Basins 1-10
Secondary Clarifiers 1-26
SE Junction Box 4
GAP Backwash
84-inch
120-inch
66-inch
Interplant Trunkline to Plant No. 2 Outfall
6 Influent Trunklines
Metering & Diversion (M&D) Structure
Sunflower Pump Station
Steve Anderson Lift Station
Screenings to Landfill
Grit to Landfill
Influent
Primary Clarifiers 6–31
GWR Backwash (BWW)
GWRS Wastestreams (42"ROC) (24"Brine)
RAS Pumps (5)
WAS Pumps (4)
(2) 108-inch lines
SE Junction Box 2
SE Junction Box 3
SE Junction Box 7
Bleach
to OCSD WSSPS
GWRS Water (emergency flow)
to Santa Ana River
Gas Flares (3)
Boiler 2 (Hot Water Boiler)
Gas Compressor Bldg
Interplant High Pressure Digester Gas Line
to Plant No. 2 CenGen
Carbon Scrubbers (2)
Ferric Chloride (as required)
to Plant No. 2 interplant line
Aeration Basins 11-16
Secondary Clarifiers 27-34
(weir overflow)
OCWD-owned GWR System Facilities
Sump Waste (SW)
Lime Waste (2 lines)
to OCSD 78-inch Interplant Trunkline to Plant No. 2 Influent
Central Power Generation System (3 engines, 3 boilers)
Hot Water (to Heat Exchanger)
Cold Water
Hot Water
to Cooling/Heating Admin. Bldg, Lab, Control Center
Sulfuric Acid
Caustic Soda
Bleach
Thickening and Dewatering Scrubbers 1, 2, 3
Holding Digesters No. 5 & 6
Sludge Digesters 7–16
Return-Activated Sludge (RAS) Pumps (12)
Waste-Activated Sludge (WAS) Pumps (6)
SE Junction Box 6
OCWD-owned GWR System Screenings Facility
GWRS Wastestreams (42"ROC) (24"Brine)
Backwash (BWW)
to OCSD PEDB2 (effluent 108-inch)
to OCSD Primary Clarifiers 6-31
Float
Thickened Waste-Activated Sludge (TWAS)
Underflows
Dissolved Air Flotation Thickners (DAFTS) (6)
Junction Box C
Junction Box B
Centrifuge Thickened Sludge
Polymer
Centrate Pumps Station (3)
Centrate
Dewatering Centrifuges (3)
Dewatered Cake
Cake Transfer Station (3 pumps)
Truckloading Hopper (1)
Storage Silos 1,2,3,4
Pumps (4)
Interplant Trunkline to Plant No. 2
Trickling Filters
Aeration Basins (AS2)
Sludge Blend Tanks (3)
Polymer
Thickening Centrifuges (3)
Centrifuge Thickened Sludge
Biosolids Recycle

LEGEND

- Plant Influent
- Primary Influent
- Primary Effluent
- Secondary Effluent
- Plant Discharge
- Alternate Routing
- Solids
- Chemical Addition
- Foul Air
- Digester Gas
- from OCWD

NOTE: Thicker lines denote main flow direction.

# Appendix B
# Treatment Plant No. 2 Process Diagram – Before GWRS Expansion

ORANGE COUNTY SANITATION DISTRICT
PROTECTING THE ENVIRONMENT

Caustic
Bleach
Headworks Odor Control
(8 Chemical Scrubbers
& 13 Biotowers)
Rag Handling
& Loading (4)
Grit Handling
& Loading (4)
Splitter
Box
A
B
C
Ferric Chloride
& Bleach
(separate lines
to each box)
Polymer
Dilution
Water
Distribution
System
Primary
Metering
Caustic
Bleach
South
Scrubber
Complex U–Z
Primary
Clarifiers
D–G
Primary
Clarifiers
H–L
Primary
Clarifiers
M–Q
Junction
Box 4
Facility
Use
Plant Water
Pump Station
Bleach
High Purity Oxygen
Aeration
Basins (8)
Secondary
Clarifiers
A–L
Bleach
Santa Ana River
Overflow (SARO)
(Serial Port 003)
Emergency
78-inch
Outfall
(Serial Port 002)
Surge
Tower
No. 1
Sodium
Bisulfite
Primary Effluent
Pump Station
(PEPS) (4)
Return-
Activated
Sludge (RAS)
Pumps (6)
Bleach
Junction
Box 8
(JB8)
Effluent
Pump
Station
Annex
(EPSA)
(3 pumps)
Hydrogen
Peroxide
Trunkline
Odor Control
(3 Biotowers)
Wetwell
Vortex
Grit
Basins
(6)
**5 Influent Trunklines**
**including 78-Inch Interplant Trunkline**
(Raw Sewage from Plant No. 1 M&D and GWRS wastestreams)
Diversion
Struture
Metering
Structure
Bar
Screens
(6)
Headworks D
Pumps (7)
Primary Effluent
Distribution
Structure (PEDS)
Junction Box 1
*(closed)*
Junction
Box A
(JBA)
Sodium
Bisulfite
Final Sampler
Bldg.
Wetwell
120-inch
Outfall
(Serial Port 001)
Surge
Tower
No. 2
*Emergency Overflow*
Chemical
Scrubber &
Carbon
Scrubbers
(A-C)
Solids Contact
Re-aeration
Basins (A-D)
Ocean Outfall
Booster Station
(OOBS) (5 pumps)
Trickling
Filters (A,B,C)
*120-inch line*
*66-inch line*
*84-inch line*
Interplant
Trunklines (from
Plant No.1 EJB)
Trickling Filter
Influent Pumps
(6)
Return Secondary
Sludge (RSS)
Pumps (12)
Central Power
Generation System
(5 engines, 5 boilers,
1 steam turbine)
Gas
Flares (3)
Interplant High Pressure
Digester Gas Line from
Plant No. 1
Gas
Compressor
Bldg.
Carbon
Scrubbers
(3)
*(to Heat Exchanger)*
*Hot Water*
*Centrate*
Waste
Stream
Pump
Station
*Sludge & Scum*
Caustic
Bleach
North Scrubber
Complex M–T
(Q Biotower)
*A through C DAFTS (underflow)*
Scrubbers G
(Biotower)
Polymer
Dilution
Water
*Sludge and Scum Decant*
Secondary
Settling
Clarifiers
(A-F)
Bleach
Dewatering
Scrubbers
Biofilter
Carbon
Scrubber
Sludge Blending
Facility
Sludge
Digesters
Ferric
Chloride
A
Segment
(F,G,H,
N,O,T)
B
Segment
(P,Q,R,S)
C
Segment
(C,D,E,
L,M)
*Float*
*Thickened Waste-Activated Sludge (TWAS)*
*DAFT D (underflow)*
Waste Secondary
Sludge (WSS)
Pumps (3)
Centrifuge (5)
Polymer
Dilution
Water
Cake
Transfer
(5 pumps)
Holding
Digesters
(I,J,K)
Dissolved Air Flotation
Thickners (DAFTs)
A–D
Waste-Activated
Sludge (WAS)
Pumps (4)
Hoppers
A, B
and
Truckloading
Truckloading
Odor Scrubber
Biosolids
Recycle

LEGEND

Alternate Routing

- Plant Influent
- Primary Influent
- Primary Effluent
- Secondary Effluent
- Plant Discharge
- Solids
- Chemical Addition
- Foul Air
- Digester Gas
- Grit and Screenings

*NOTE: Thicker lines denote main flow direction.*

# Unit Process Schematic

## OCSD Treatment Plant No. 2

rev. 11/06/19

# Appendix C
# Treatment Plant No. 2 Process Diagram – After GWRS Expansion

# Unit Process Schematic — OCSD Treatment Plant No. 2

Future Process after GWRS Final Expansion in 2023

78-interplant line containing SARI, P1 recycle flow, and GWRS wastestreams (Non-Reclaimable)

4 Influent Trunklines (Reclaimable)

Hydrogen Peroxide

Trunkline Odor Control (3 Biotowers)

Headworks Odor Control (8 Chemical Scrubbers & 13 Biotowers)

Caustic Bleach

Diversion Structure — 1 Non-Reclaimable, 3 Reclaimable

Metering Structure — 3 Reclaimable

Rag Handling & Loading (4)

Bar Screens (6) — 3 Non-Reclaimable, 3 Reclaimable

Wetwell

Headworks D Pumps (7) — 3 Non-Reclaimable, 4 Reclaimable

Grit Handling & Loading (4)

Vortex Grit Basins (6) — 3 Non-Reclaimable, 3 Reclaimable

Splitter Box (A, B, C)

Ferric Chloride & Bleach (separate lines to each box)

Primary Metering

Polymer

Dilution Water

Distribution System (A, B, C)

*Primary Clarifiers D–G

Primary Clarifiers H–L

Primary Clarifiers M–Q

Caustic Bleach

South Scrubber Complex U–Z

Caustic Bleach

North Scrubber Complex M–T (Q Biotower)

Junction Box 4

Primary Effluent Pump Station (PEPS) (4)

Primary Effluent Distribution Structure (PEDS)

High Purity Oxygen

*Aeration Basins (8)

Return-Activated Sludge (RAS) Pumps (6)

*Secondary Clarifiers A–L

Facility Use

Plant Water Pump Station

Bleach

Bleach

Santa Ana River Overflow (SARO) (Serial Port 003)

Emergency 78-inch Outfall (Serial Port 002)

Surge Tower No. 1

Sodium Bisulfite

Effluent Pump Station Annex (EPSA) (3 pumps)

Bleach

Junction Box 8 (JB8)

Junction Box A (JBA)

Sodium Bisulfite

Final Sampler Bldg.

120-inch Outfall (Serial Port 001)

Surge Tower No. 2

Wetwell

Ocean Outfall Booster Station (OOBS) (5 pumps)

120-inch line

66-inch line

84-inch line

Overview Weir Box

Interplant Trunklines (from Plant No.1 EJB)

Diversion Structure

OCWD EQ Tank and Pumps

To GWRS through the existing 66-inch Interplant Line

To GWRS intake at Plant No. 1

Emergency Overflow

Chemical Scrubber & Carbon Scrubbers (A-C)

Trickling Filters (A,B,C)

Trickling Filter Influent Pumps (6)

Solids Contact Re-aeration Basins (A-D)

Return Secondary Sludge (RSS) Pumps (12)

Secondary Settling Clarifiers (A-F)

Bleach

Waste Secondary Sludge (WSS) Pumps (3)

Waste-Activated Sludge (WAS) Pumps (4)

Scrubbers G (Biotower)

Polymer

Dilution Water

Sludge and Scum Decant

Dissolved Air Flotation Thickners (DAFTs) A–D

Float

Thickened Waste-Activated Sludge (TWAS)

DAFT D (underflow) & AS Plant Process Drainage

A through C DAFTS (underflow)

Sludge & Scum

Waste Stream Pump Station

Sludge Blending Facility

Carbon Scrubber

Central Power Generation System (5 engines, 5 boilers, 1 steam turbine)

Gas Flares (3)

Gas Compressor Cooling Water

Interplant High Pressure Digester Gas Line from Plant No. 1

Gas Compressor Bldg.

Carbon Scrubbers (3)

(to Heat Exchanger)

Hot Water

Centrate

Dewatering Scrubbers Biofilter

Sludge Digesters

Ferric Chloride

A Segment (F,G,H,N,O,T)

B Segment (P,Q,R,S)

C Segment (C,D,E,L,M)

Holding Digesters (I,J,K)

Centrifuge (5)

Polymer

Dilution Water

Cake Transfer (5 pumps)

Hoppers A, B and Truckloading

Truckloading Odor Scrubber

Biosolids Recycle

After 2023, A-side primary clarifiers and AS Plant will treat the non-reclaimable flow, and B&C-sides primary clarifiers and TF/SC will treat the reclaimable flow to GWRS.

* Major non-reclaimable flow treatment process units

**LEGEND**

- Plant Influent
- Primary Influent
- Primary Effluent
- Secondary Effluent
- Plant Discharge
- Solids
- Chemical Addition
- Foul Air
- Digester Gas
- Grit and Screenings
- GWRS
- Alternate Routing

NOTE: Thicker lines denote main flow direction.

rev. 07/15/20

# Appendix D
# Maximo Asset Classification Strategy

# OCSD Asset Definition, Classification and Mapping Strategy for Maximo

Introduction: Implementing a well thought out and well-constructed location/asset hierarchy is one of the most important steps in building an effective asset management program at OCSD. The Location/Asset hierarchy provides both context and organization to the asset registry, allowing tracking and reporting from a multitude of perspectives. The asset hierarchy itself is the fundamental building block for asset management. In the hierarchy, every asset is recorded according to a unique identification string ("number") against which certain asset attributes are recorded. A registry organized in hierarchical order is the vehicle by which the information system most effectively enables the assessment of the assets as individual components, composite assets, or groups of assets.

## Locations:

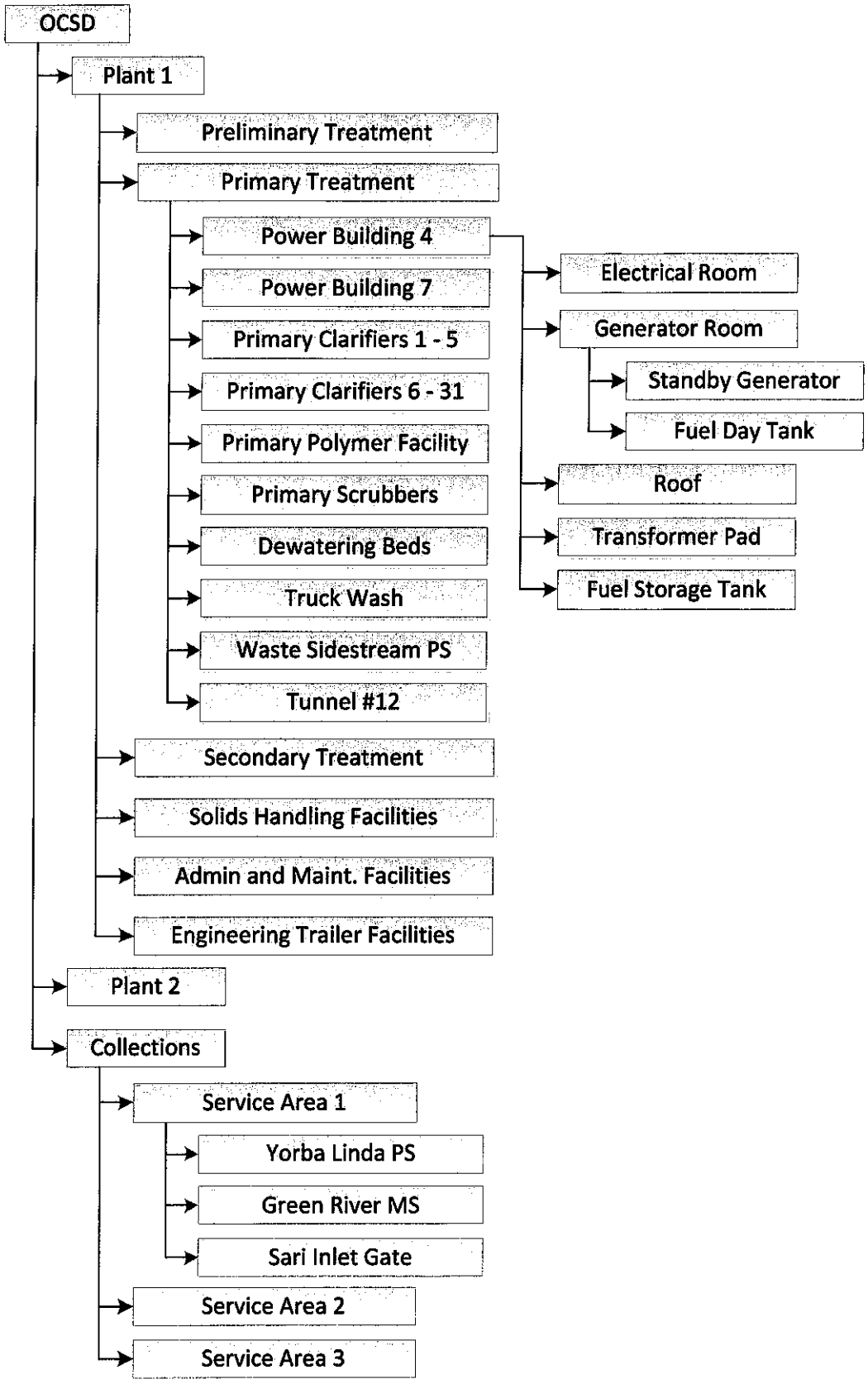
Locations are defined as the physical or virtual collection areas where assets may reside. Locations are recommended to be grouped into a logical hierarchy or hierarchies based on the organizational needs to collect, report, and roll up information.

System Hierarchies are physical or virtual associations of locations and/or assets that provide for modeling relationships between assets that work in conjunction with others to provide an operational function. While the primary system in geographic in nature, additional systems may be added for high voltage, air, potable water, chemical systems etc. over time.

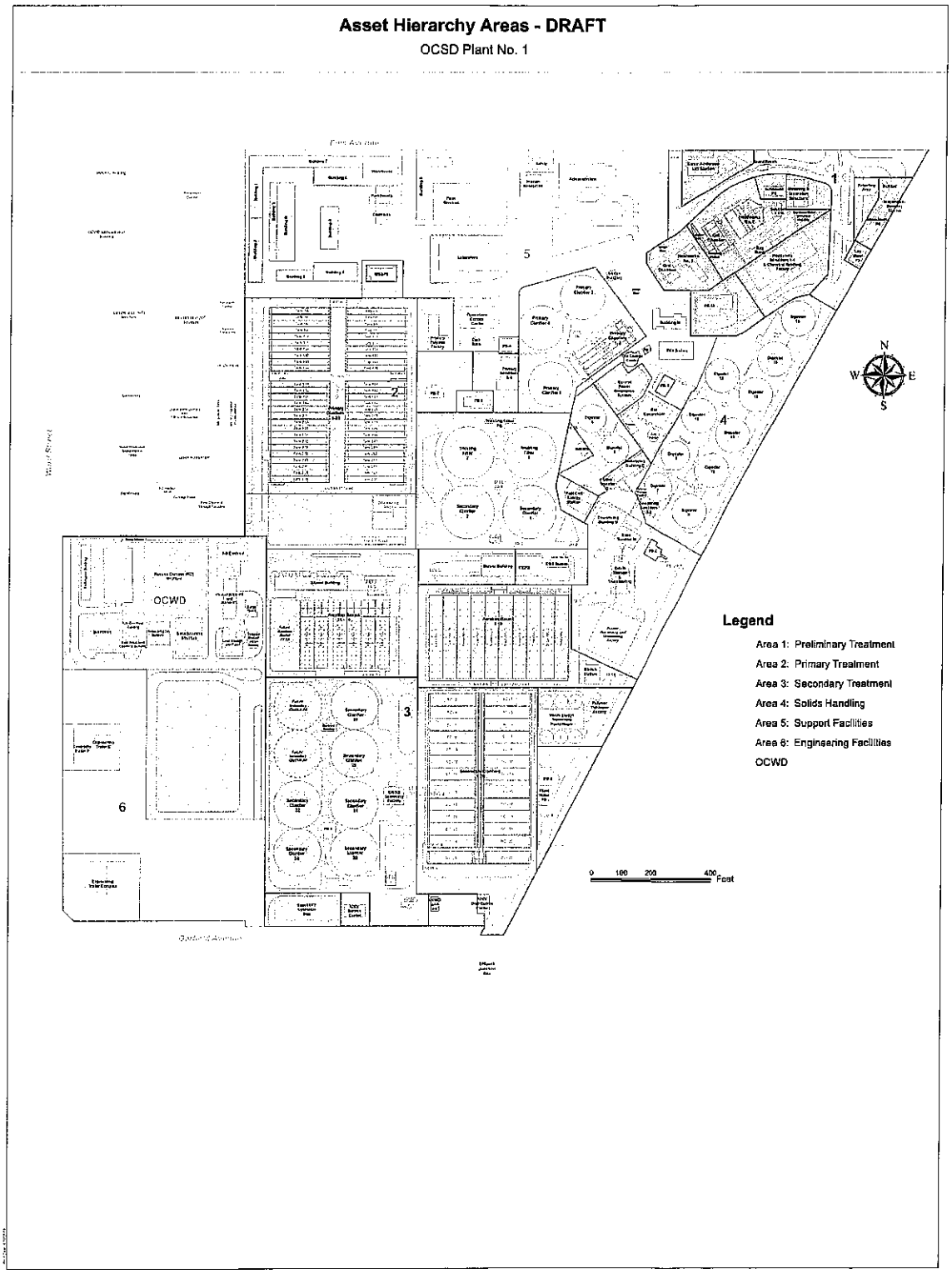
OCSD has initially built a geographically based location hierarchy, with three top level locations, Plant 1, Plant 2, and the Collections area. Lower locations split each of these into bounded areas intended to be easily identifiable by both process and non-process staff. Buildings are broken down by floor level, then rooms. Major equipment items have been identified as locations to resolve issues associated with moving components through the asset rotation process.

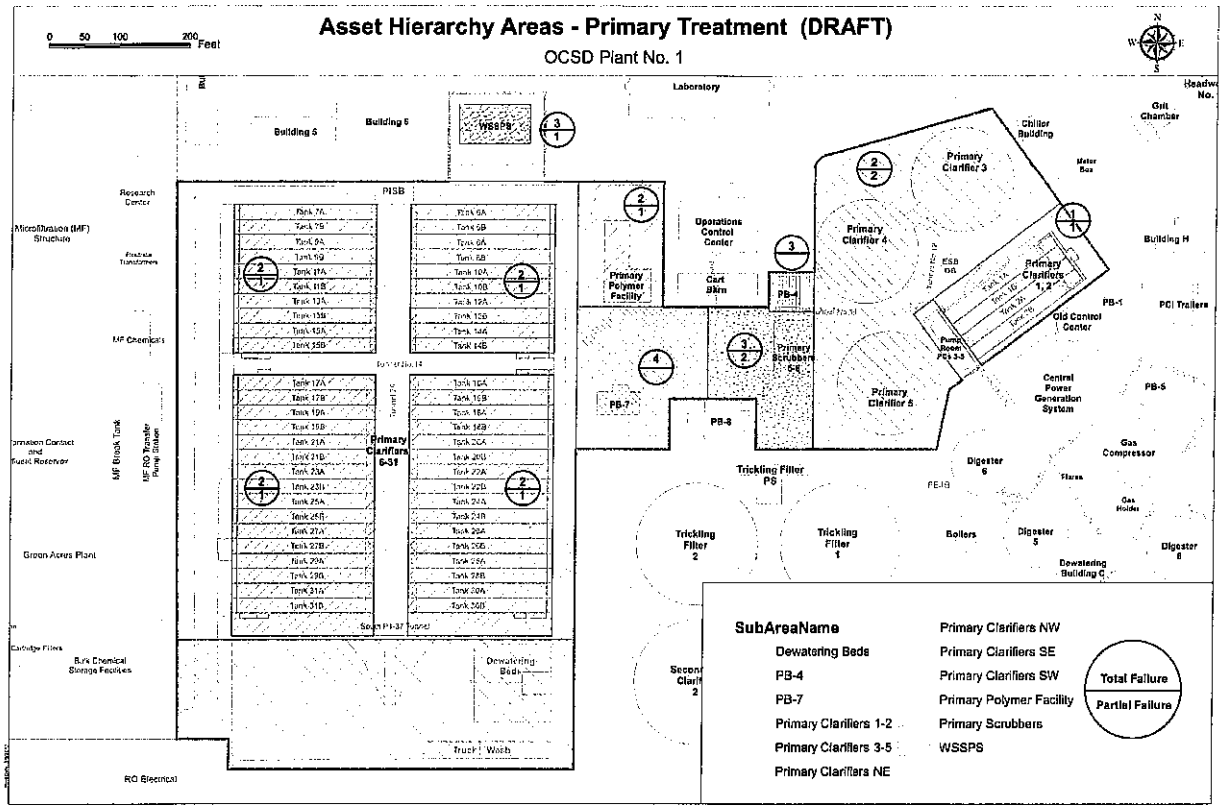
Locations are defined as the physical or virtual collection areas where assets may reside. Locations are recommended to be grouped into a logical hierarchy or hierarchies based on the organizational needs to collect, report, and roll up information.

# Orange County Sanitation District Sample Location Layout



# Locations are being mapped in GIS for future spatial use.




Asset Hierarchy Areas - Primary Treatment (DRAFT)
OCSD Plant No. 1
0 50 100 200 Feet
N
W
E
S
Laboratory
Building 5
Building 6
WSSPS
Chiller Building
Grit Chamber
Primary Clarifier 3
Meter Box
Research Center
PISB
Operations Control Center
Primary Clarifier 4
Building H
Primary Polymer Facility
Cart Barn
PB-4
ESD 66
Primary Clarifiers 1,2
PB-1
PCI Trailers
Old Control Center
Primary Scrubbers 6-8
Primary Clarifier 5
Central Power Generation System
PB-5
PB-7
PB-8
Primary Clarifiers 6-31
Trickling Filter PS
PEHB
Digester 6
Gas Compressor
Flares
Gas Holder
Trickling Filter 2
Trickling Filter 1
Boilers
Digester 5
Digester 8
Dewatering Building C
MF Chemicals
MF Break Tank
MF RO Transfer Pump Station
Green Acres Plant
Cartridge Filters
Bulk Chemical Storage Facilities
Dewatering Beds
Truck Wash
RO Electrical
SubAreaName
Dewatering Beds
PB-4
PB-7
Primary Clarifiers 1-2
Primary Clarifiers 3-5
Primary Clarifiers NE
Primary Clarifiers NW
Primary Clarifiers SE
Primary Clarifiers SW
Primary Polymer Facility
Primary Scrubbers
WSSPS
Total Failure
Partial Failure

## Assets:

Assets are typically defined as any item of organizational property that meets at a minimum the following criteria, (1) Exists as a physical object or entity, they "can be touched", and (2) is desired to have institutional information stored or tracked against or in reference to. Examples of Assets include vehicles, boilers, pumps, motors, electrical panels, generators, HVAC units, air handlers, etc. Some assets may be classified as linear based on the nature of existing over significant distances. Examples of linear asset include pipes, power lines, roads, rail, etc. Large or complex assets may be broken into asset hierarchies. These are logical relationships of unique assets that work together to provide asset function. Recommended asset hierarchies take the form of main asset-assembly-subassembly. For example, a large HVAC Unit may be broken down into HVAC Unit-Compressor-Motor.

OCSD has defined an asset as a piece of equipment that performs a substantial role in the treatment, collection or effluent processes, has defined boundaries, and is not consumable in nature. Items that do not meet this definition may be included in the asset catalog if they have a specific maintenance tracking need (ie. back flow devices), such as regulatory compliance, or are routinely maintained by contracted support independently of major assets.

In phase three linear assets will be limited to inclusion in the collections service areas, as gravity manholes and line segments or force main lines. Future phases of the project may include various process, utility and chemical linear assets within the reclamation plant locations.

**History:**

OCSD has historically used the Equipment & Instrumentation Datasheet (EID) as a data collection tool to gather information on all components listed on P&ID and single line drawings. Several drawbacks to this approach have been identified in the current CMMS system, with some improvements made subject to system limitations. As of 2008 the RJN Cassworks system had roughly 140,000 pieces of equipment identified as assets. Many of these do not meet the asset definition above, and either do not require any tracking in Maximo or will fall into the category of parts. Major structures and assets have been excluded through the EID process, as they either do not appear on P&ID drawings, or appear as groupings of components rather than as complete assets. Currently the CMMS system has been reduced to approximately 30,000 discrete assets.

**Migration approach:** In the future OCSD anticipates four primary sources of asset data, Maximo, ESRI GIS, SQL Server bases Autocad P&ID, and SQL Server based Autocad Electrical. The following chart contains a listing of the District's current discreet asset classifications, determination of Maximo usability, and the intended record source of the data. For existing

assets the asset numbers will be grandfathered from the RJN CMMS system. All new asset numbers will be auto generated in Maximo and copied back to the source system for cross reference and updating purposes. Buildings and rooms are being created in Maximo, along with any other required geographic locations. Linear assets (collections system) will be picked up from the GIS integration.

| Classification | Description | Asset Count | Location | Asset | Source |
|---|---|---|---|---|---|
| AERBAS | Aeration Basin | 13 | Y | | Maximo |
| AC | Air Conditioner | 276 | | Y | PNID |
| AHU | Air Handler | 55 | | Y | PNID |
| ANA | Analyzer | 626 | | Y | PNID |
| BFD | Back Flow Device | 213 | | Y | PNID |
| BRSC | Barscreen | 10 | Y | Y | PNID |
| BLTP | Beltpress | 23 | Y | Y | PNID |
| BLWR | Blower | 28 | Y | Y | PNID |
| BLR | Boiler | 19 | Y | Y | PNID |
| BKR | Breaker | 3151 | | Y | SLD |
| CAN | Canister (Oxidyzer) | 3 | | Y | PNID |
| CEN | Centrifuge | 6 | Y | Y | PNID |
| CHR | Charger, Battery | 69 | | Y | SLD |
| CHIL | Chiller | 9 | | Y | PNID |
| CLAR | Clarifiers | 82 | Y | | MAXIMO |
| COLL | Collector (Sludge and Scum) | 112 | | Y | PNID |
| CMD | Compressor | 63 | Y | Y | PNID |
| CND | Condenser | 72 | Y | Y | PNID |
| CNVR | Conveyor | 46 | Y | Y | PNID |
| CTW | Cooling Tower | 1 | Y | Y | PNID |
| CRN | Crane | 49 | | Y | PNID |
| DIGEST | Digester | 32 | Y | | MAXIMO |
| DAFT | Dissolved Air Flotation Thickener | 10 | Y | | MAXIMO |
| DOR | Doors | 156 | | Y | MAXIMO |
| DRV | Drive, Variable Speed | 294 | | Y | SLD |
| DRYR | Dryer | 55 | | Y | PNID |
| ELV | Elevator | 11 | | Y | MAXIMO |
| ENG | Engine | 37 | | Y | PNID |
| ENTRY | Entry Gates | 31 | Y | Y | MAXIMO |
| EXCH | Exchanger | 138 | Y | Y | PNID |
| FAN | Fans | 650 | | Y | PNID |
| FLTR | Filter | 209 | | Y | PNID |
| FH | Fire Hydrant | 84 | | Y | PNID |
| POLE | Flag Pole | 3 | | Y | MAXMIO |

| | | | | | |
|---|---|---|---|---|---|
| FLMA | Flame Arrestor | 98 | | Y | PNID |
| FLA | Flare | 6 | Y | Y | PNID |
| FLWM | Flow Meter | 1037 | | Y | PNID |
| GATE | Gate, Slide, Sluice or Weir * | 1566 | | Y | PNID |
| GBX | Gearbox | 360 | | Y | PNID |
| GEN | Generator | 85 | Y | Y | PNID |
| GRNDR | Grinder | 45 | Y | Y | PNID |
| HTR | Heater | 123 | Y | Y | PNID |
| HMD | Humidifier | 2 | Y | Y | PNID |
| HMTR | Hydraulic Motor | 7 | Y | Y | PNID |
| MXR | Mixer | 106 | Y | Y | PNID |
| MTR | Motor | 2364 | | Y | PNID |
| MCC | Motor Control Center | 205 | | Y | SLD |
| PLC | Programmable Logic Controller | 176 | | Y | PNID |
| PRODEV | Protective Device | 1069 | | Y | SLD |
| PMP | Pump | 1234 | Y | Y | PNID |
| REFG | Refrigerated Equipment | 65 | | Y | MAXIMO |
| SFS | Safety Shower/Eyewash | 177 | | Y | PNID |
| SAMP | Sampler | 26 | | Y | PNID |
| SCLE | Scale | 3 | | Y | PNID |
| SCRUB | Scrubber | 56 | Y | Y | PNID |
| STR | Strainer | 744 | | Y | PNID |
| SUMP | Sump Pit | 17 | Y | | MAXIMO |
| SWP | Sweep | 2 | | Y | PNID |
| SWGR | Switchgear | 8 | | Y | SLD |
| TANK | Tank | 306 | Y | Y | PNID |
| XFMR | Transformer | 381 | | Y | SLD |
| TRFL | Trickling Filter | 5 | Y | | MAXIMO |
| TUR | Turbine | 3 | Y | Y | PNID |
| TBC | Turbocharger | 7 | | Y | PNID |
| UPS | Uninterruptible Power Supply | 103 | | Y | SLD |
| VLV | Valve * | 46840 | | Y | PNID |
| WCP | Washer Compactor | 3 | | Y | PNID |

* Valves and Gates 6" or larger (Exceptions made for directly maintained valves/gates)

PNID – Piping and Instrument Diagram (SQL2012-MAXIMO)

SLD – Single Line Diagram

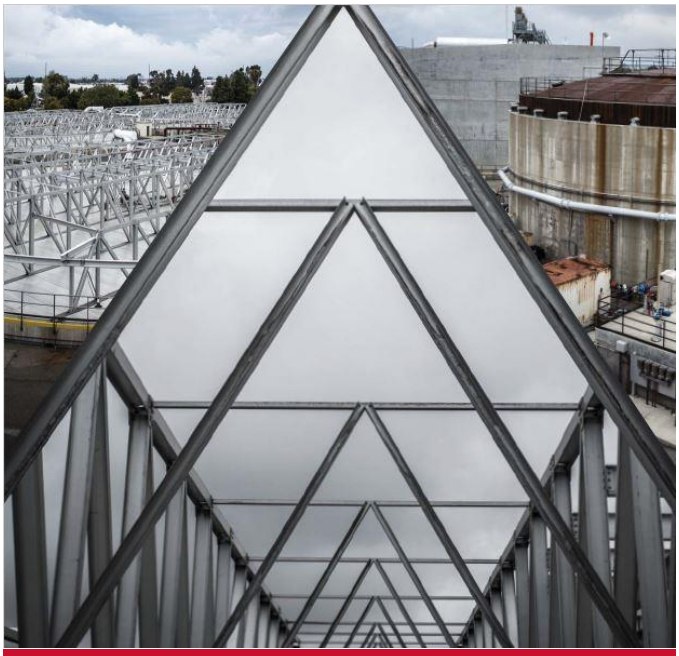
Additional classifications will be required to identify locations for distribution structures, channels, in plant large pipe sections, wet wells and other similar process locations.

The following are asset classifications originally identified in the RJN Cassworks program that do not meet the districts revised asset definition.

| Asset Type Code | Description | # of Assets |
|---|---|---|
| LRM | ALARMS, AUDIBLE | 299 |
| APR | ASPIRATOR | 3 |
| ATMZ | ATOMIZER | 1 |
| BAT | BATTERIES | 54 |
| CAP | CAPACITORS | 10 |
| CON | CONTROLLER | 1300 |
| CVR | CONVERTER | 1019 |
| CUB | CUBICLE (12KV CONTROLS OR NO BREAKER INSTALLED) | 9 |
| DPR | DAMPER | 149 |
| DETC | DETECTOR | 233 |
| DIS | DISPLAY, ANALOG / DIGITAL | 2845 |
| ESWI | ELECTRICAL SWITCH | 2230 |
| EXCT | EXCITER, GENERATOR (12KV) | 9 |
| FLEET | FLEET EQUIPMENT | 486 |
| GAUGE | GAUGE, MECHANICAL | 6088 |
| GRND | GROUNDS | 7 |
| HFLTR | HARMONIC FILTER | 4 |
| INJ | INJECTOR, CHEMICAL | 8 |
| INFACE | INTERFACE (HMI) | 111 |
| LABEQ | LAB EQUIPMENT | 14 |
| LIGHT | LIGHT, ALARM OR STATUS INDICATOR | 14470 |
| LTG | LIGHTING, STRUCTURE | 12 |
| OPRE | OPERATORS/ACTUATORS ELECTRICAL OR MECHANICAL | 967 |
| PNL | PANEL | 483 |
| PIPG | PIPING | 1 |
| PTEQ | PORTABLE EQUIPMENT | 1 |
| POS | POSITIONER | 56 |
| PWR | POWER SUPPLY | 104 |
| PUR | PURIFIER, AIR | 2 |
| RECP | RECEPTACLE | 21 |
| RCDR | RECORDER | 15 |
| REG | REGULATOR, PRESSURE | 64 |
| RLY | RELAY | 162 |
| SENS | SENSOR | 3512 |
| STRT | STARTER, COMB | 1928 |
| SWI | SWITCH | 23873 |

| | | |
|---|---|---|
| TSPT | TEST POINT | 26 |
| TOOL | TOOLS, MACHINERY AND PORTABLE EQUIPMENT | 93 |
| XDCR | TRANSDUCER | 1 |
| XMTR | TRANSMITTER | 2410 |
| TRAP | TRAP | 3 |
| VAV | VARIABLE AIR VOLUME CONTROLLER | 28 |

# Appendix E
# Asset Hierarchy Review



# Asset Hierarchy Review

PS18-01 Asset Management Plan Update

Task 2 – Develop Asset Hierarchy

*Fountain Valley, CA*
April 20, 2020

# Contents



# Tables



# Figures



# Attachments

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# 1 Introduction

OCSD has formed an Asset Management Team with Asset Engineers who work with OCSD's O&M Area Teams to investigate issues, assess asset condition, evaluate alternatives and develop short-term and long-term maintenance and CIP plans for these assets. The main deliverable for the Asset Management Team is an annual Asset Management Plan. As Asset Engineers collect data and make decisions, it has become clear that an asset hierarchy to support asset management data collection, evaluation and decision-making does not exist. This task reviewed OCSD's existing asset hierarchy data and documents observations gathered over the course of the project.

# 2 Overview

OCSD owns and operates wastewater collection system infrastructure as well as resource recovery and wastewater treatment facilities. The collection system infrastructure includes 389 miles of regional trunk sewer pipelines and fifteen pump stations located throughout OCSD's service area. This wastewater is conveyed to Reclamation Plant No. 1 in Fountain Valley and Treatment Plant No. 2 in Huntington Beach, where resource recovery and wastewater treatment take place.

OCSD has augmented and solidified their asset management program and restructured the organization to better align the Engineering and Operations and Maintenance (O&M) departments. Through this restructuring, OCSD has established an Asset Management Team within the Planning Division consisting of nine Asset Engineers responsible for working with O&M Area Teams to understand the key issues or concerns related to the condition of OCSD's assets and for developing and coordinating plans to ensure these assets operate reliably. The areas managed by the nine Asset Engineers are grouped into Collection (pump stations and collection system), Plant 1, and Plant 2. During the course of the project, HDR conducted interviews, analyzed data and conducted workshops to support development of an updated Asset Management Plan. These activities also provided insights into the current state of asset hierarchical data. This memorandum documents those insights.

# 3 Data Review

### 3.1.1 Interviews with OCSD Staff

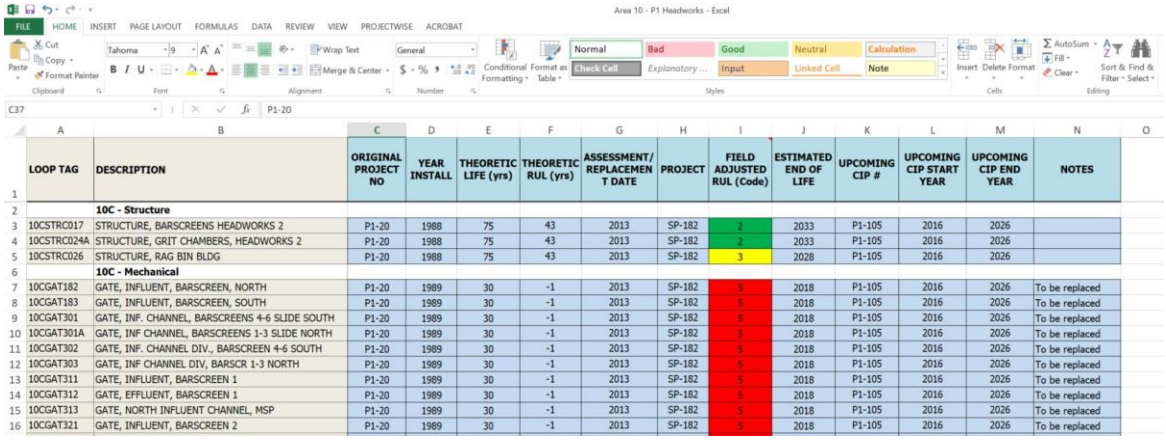
HDR conducted a series of workshops with Asset Engineers to discuss current practices and documentation of existing assets throughout OCSD's system. Key findings from those interviews include:

- Asset Management Team is documenting asset condition health on a set of Asset Registries developed over several years.
    - Asset Registries are documented in Microsoft (MS) Excel spreadsheets.

- Treatment plants are divided into MS Excel workbooks for each process area and separate MS Excel tabs within workbooks for assets within sub-areas or systems within process areas.
- In some cases, assets are linked back to specific assets defined in Maximo. In other cases, assets are defined in the Asset Registry and not linked to a corresponding asset in Maximo.

**Figure 1** includes an example portion of an asset registry. A hierarchy is built into each registry breaking the process area down into systems, disciplines such as structural, mechanical, electrical, and instrumentation and controls (I&C) and major asset types.

## Figure 1: Example Asset Registry



| | LOOP TAG | DESCRIPTION | ORIGINAL PROJECT NO | YEAR INSTALL | THEORETIC LIFE (yrs) | THEORETIC RUL (yrs) | ASSESSMENT/ REPLACEMENT DATE | PROJECT | FIELD ADJUSTED RUL (Code) | ESTIMATED END OF LIFE | UPCOMING CIP # | UPCOMING CIP START YEAR | UPCOMING CIP END YEAR | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | **10C - Structure** | | | | | | | | | | | | |
| 3 | 10CSTRC017 | STRUCTURE, BARSCREENS HEADWORKS 2 | P1-20 | 1988 | 75 | 43 | 2013 | SP-182 | 2 | 2033 | P1-105 | 2016 | 2026 | |
| 4 | 10CSTRC024A | STRUCTURE, GRIT CHAMBERS, HEADWORKS 2 | P1-20 | 1988 | 75 | 43 | 2013 | SP-182 | 2 | 2033 | P1-105 | 2016 | 2026 | |
| 5 | 10CSTRC026 | STRUCTURE, RAG BIN BLDG | P1-20 | 1988 | 75 | 43 | 2013 | SP-182 | 3 | 2028 | P1-105 | 2016 | 2026 | |
| 6 | | **10C - Mechanical** | | | | | | | | | | | | |
| 7 | 10CGAT182 | GATE, INFLUENT, BARSCREEN, NORTH | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 8 | 10CGAT183 | GATE, INFLUENT, BARSCREEN, SOUTH | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 9 | 10CGAT301 | GATE, INF. CHANNEL, BARSCREENS 4-6 SLIDE SOUTH | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 10 | 10CGAT301A | GATE, INF CHANNEL, BARSCREENS 1-3 SLIDE NORTH | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 11 | 10CGAT302 | GATE, INF. CHANNEL DIV., BARSCREEN 4-6 SOUTH | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 12 | 10CGAT303 | GATE, INF CHANNEL DIV, BARSCR 1-3 NORTH | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 13 | 10CGAT311 | GATE, INFLUENT, BARSCREEN 1 | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 14 | 10CGAT312 | GATE, EFFLUENT, BARSCREEN 1 | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 15 | 10CGAT313 | GATE, NORTH INFLUENT CHANNEL, MSP | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |
| 16 | 10CGAT321 | GATE, INFLUENT, BARSCREEN 2 | P1-20 | 1989 | 30 | -1 | 2013 | SP-182 | 5 | 2018 | P1-105 | 2016 | 2026 | To be replaced |

Asset Engineers can use the asset registry to document the condition and overall remaining useful life (RUL) of major assets and can use this data to inform the development of a Condition Scoring/Remaining Useful Life matrix included within a PowerPoint presentation that is given annually at an Asset Management Council (AMC) meeting.

The Condition Scoring/Remaining Useful Life matrix provides insight into the asset hierarchy the Asset Management Team is using to organize assets and appears to follow an asset hierarchy similar to an example included in Chapter 5, Exhibit 5.7, Example 1 of *Implementing Asset Management, A Practice Guide* published in 2007 by National Association of Clean Water Agencies. **Figure 2** provides the partial example of the hierarchy from Implementing Asset Management. **Figure 3** provides an example of the Condition Scoring/Remaining Useful Life Matrix included in AMC presentations.

## Figure 2: Partial Hierarchy Example

| Hierarchy Level | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Wastewater System | | | | |
| | Treatment Plant 1 | | | |
| | | Unit Process A | | |
| | | | Structural | |
| | | | | Tank 1 |
| | | | | Tank 2 |
| | | | Mechanical | |
| | | | | Tank 1 |
| | | | | Tank 2 |
| | | | Electrical | |
| | | | | Tank 1 |
| | | | | Tank 2 |
| | | | Instrumentation | |
| | | | | Tank 1 |
| | | | | Tank 2 |

## Figure 3: Example Area Condition Scoring/Remaining Useful Life Matrix

**Condition Scoring/Remaining Useful Life**

5 • RUL: < 5 years
4 • RUL: 5 – 10 years
3 • RUL: 11 – 15 years
2 • RUL: 16 – 20 years
1 • RUL: > 20 years

| | M&D | Sunflower | SALS | Barscreens | MSPs | Grit Chamber | Splitter Boxes | Rag & Grit | Odor Control |
|---|---|---|---|---|---|---|---|---|---|
| Structural | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 1 3 |
| Pipes (72", 2x90") | | | | | | | 3 2 | | |
| Mechanical | | | | | | | | | |
| *Gates/Valves* | 5 | 5 | 2 | 5 | 5 | 5 | 5 | - | 1 3 |
| *Gearboxes* | - | 5 | - | 5 | - | - | - | 4 | - |
| *Screens* | - | - | - | 4 | - | - | - | - | - |
| Pumps | - | 3 | 5 | - | 3 | - | - | - | 1 3 |
| Conveyors | - | - | - | 4 | - | - | - | 4 | - |
| Fans/Blowers | 4 | 4 | 4 | 4 | 4 | 3 | - | 4 | 1 3 |
| I&C – Process | 4 | 4 | 3 | 4 | 4 | - | 4 | - | 1 5 |
| Electrical | | | | | | | | | |
| *Operators* | 5 | - | - | - | - | - | 5 | - | - |
| *Motors* | - | 3 | 5 | 4 | 5 | - | - | 5 | - |
| *VFDs* | - | - | 3 | - | 4 | - | - | - | 3 4 |
| *Switchgears/MCCs* | 5 | 5 | 2 | - | - | - | - | - | 1 5 |
| *Transformers* | | | 2* | 4 | | | | | |

* 2 medium voltage Transformers fed by 2 load interrupter switches that feed 2 MCCs

Over time, each Asset Engineer has made changes to their respective registries such that asset registries are inconsistent with each other in terms of data fields and data field names. Furthermore, all Asset Engineers acknowledged the data stored within the registries is difficult to keep up-to-date and aligned with the Condition Scoring/Remaining Useful Life matrices presented to the AMC. The most current information regarding asset condition health generally resides in the AMC presentations.

### 3.1.2 Subledger Location Numbers

OCSD maintains a listing of Plant Area Locations identifying Plants Areas associated with Subledger Location Numbers. Subledger Location Numbers are associated with Location Codes built into Maximo Loop Codes and Loop Tag Numbers. In this way, the Maximo Assets are linked to OCSD's Fixed Asset Register.

**Figure 4: Portion of Subledger Listing Plant Area Locations**

| OCSD | | |
|---|---|---|
| **Listing of Plant Area Locations** | | |
| **(First four digits of Subledger Number)** | | |
| Updated: 7/1/16 | | |
| **Subledger Location Number (1st 4 digits)** | | **Description** |
| | | **PLANT NO. 1** |
| | | **PRELIMINARY TREATMENT - Plant #1** |
| 1001 | 10A | General |
| | * | Plant Influent Diversion and Metering Facility (IFMS) |
| | * | Wastehauler Station |
| 1002 | 10B | Headworks #1 |
| | * | Influent Channel |
| | * | Lift Station |
| | * | Grit System |
| | * | Splitter Box |
| | * | Effluent Metering |
| 1003 | 10C | Headworks #2 |
| | * | Influent Channel |
| | * | Screening Station |
| | * | Lift Station |
| | * | Grit System |
| | * | Splitter Box |
| | * | Effluent Metering |
| 1004 | 10D | Sunflower Pump Station |
| 1005 | 10E | Ellis Pump Station |
| 1008 | 10H | Preliminary Treatment Chemicals: Hydrogen Peroxide |
| 1009 | 10I | Preliminary Treatment and Environmental Facilities |
| | * | Chemical Injection (P1-20) |

### 3.1.3 Maximo Asset List

OCSD maintains an extensive list of treatment plant, offsite pump station and interplant assets within the Maximo database. OCSD provided a set of spreadsheets with assets associated with the Interplant Line, Revenue Areas (i.e. offsite pump stations), and Treatment Plant areas.

Together, these tables combined to include 124,782 assets. The list is comprehensive and includes everything from primary equipment such as pumps, centrifuges, and blowers to smaller items such as sensors, switches, relays and breakers. Assets in Maximo are assigned a Loop Code and a Loop Tag Number defined as follows:

- **Loop Code**: The Loop Code identifies equipment at the sub-system level. Each Loop Code (Block) can encompass numerous pieces of equipment which are interdependent on each other. The Loop Code number is made up of two components (e.g. 27B-040):
  - Location Code: **27B**-040
  - Loop Block. 27B-**040**
- **Loop Tag Number (LTN)**: The Loop Tag Number identifies specific equipment within a Loop Number's group of equipment. The Loop Tag Number consists of three components (e.g. 27BFBK040).
  - Location Code: **27B**FBK040
  - Function Code: 27B**FBK**040
  - Loop Block. 27BFBK**040**

OCSD requires consultants and contractors to document new assets being designed and built into OCSD's infrastructure using guidance OCSD provides on equipment identification (i.e. *EID SAMPLE (ver_5.4 (2019).xlsx*). This guidance includes a list of equipment OCSD considers to be Primary Equipment and Electrical Parent Equipment shown in **Table 1** and **Table 2**.

## Table 1: Primary Equipment Function Codes

| PRIMARY EQUIPMENT | FUNCTION CODE |
|---|---|
| AIR CONDITIONER | AC |
| AIR HANDLER UNIT | AHU |
| BARSCREEN | BSR |
| BELTPRESS | BFP |
| BLOWER | BWR |
| BOILER | BOL |
| CENTRIFUGE | CEN |
| CHILLER | CHR |
| COLLECTOR (SLUDGE or SCUM) | CLR |
| COMPRESSOR (AIR) | CMP |
| CONVEYOR | CVY |
| COOLING TOWER | CTW |
| CRANE | CRN |
| DRYER | DRY |
| ELEVATOR | ELV |
| EXCHANGER | EXR |
| FAN | FAN |
| FLARE | FLR |
| GENERATOR | GEN |
| GRINDER, SLUDGE | GDR |
| HEATER | HTR |
| MIXER, CHEMICAL | MXR |
| OPERATOR (VALVE or GATE) | MOV |
| OXIDIZER, CATALYST | CLST |
| PUMP | PMP |
| SAMPLER | SAM |
| SCRUBBER | SBR |
| SEPARATOR | SPR |
| SUBMERSIBLE PUMP W/INTEGRAL MOTOR | SPMP |
| SWEEP ARM, TRICKLING FILTER | SWP |
| TANK | TNK |
| TRANSFORMER | XFMR |
| TURBINE | TUR |
| UPS | UPS |
| VAPORIZER, OXYGEN FACILITY | EVP |
| WASHER COMPACTOR | WCP |

### Table 2: Electrical Parent Equipment Function Codes

| ELECTRICAL PARENT EQUIPMENT | FUNCTION CODE |
|---|---|
| DISTRIBUTION PANEL | DPN |
| MOTOR CONTROL CENTER | MCC |
| SWITCHBOARD | SWBD |
| SWITCHGEAR | SWGR |
| BRANCH CIRCUIT PANEL | BCP |
| DISTRIBUTION POWER UNIT | DPN |

Assets with Primary Equipment Function Codes and Electrical Parent Equipment Function Codes comprise 7,091 assets out of the 124,782 assets included in the compiled Maximo Asset List. These 7,091 primary assets are located on 6,047 Loop Blocks as shown in **Table 3**. **Attachment A** shows the count of different types of primary equipment by area.

### Table 3: Number of Loop Blocks with Primary Equipment by Area

| AREA | Count of Loop Blocks with Primary Equipment | Count of Primary Equipment |
|---|---|---|
| **COLLECTIONS** | **338** | **428** |
| **PLANT 1 TOTAL** | **2,683** | **3,219** |
| 10 | 231 | 255 |
| 11 | 429 | 472 |
| 12 | 456 | 490 |
| 15 | 634 | 865 |
| 16 | 180 | 195 |
| 17 | 114 | 139 |
| 18 | 201 | 241 |
| 19 | 438 | 562 |
| **PLANT 2 TOTAL** | **3,026** | **3,444** |
| 20 | 400 | 422 |
| 21 | 312 | 343 |
| 22 | 606 | 644 |
| 23 | 35 | 36 |
| 24 | 131 | 149 |
| 25 | 694 | 882 |
| 26 | 232 | 254 |
| 27 | 192 | 214 |
| 28 | 303 | 349 |
| 29 | 121 | 151 |
| **GRAND TOTAL** | **6,047** | **7,091** |

### 3.1.4 2019 Asset Management Plan Update

The 2019 Asset Management Plan Update included Asset Management Summaries for facility areas. The Asset Management Summaries for treatment plants and pump stations included a table listing the major assets. Compiled together, the tables with Major Assets in the Asset Management Summaries include a count of 3,331 major assets, summarized in **Table 4**. The location and asset nomenclature in the Asset Registries and Asset Management Summaries is inconsistent with the location and asset nomenclature in the Maximo Asset List and Financial Ledger.

## Table 4: Count of Major Assets from AMP Asset Management Summaries

| Facility | Area | Area Name | Major Asset Count |
|---|---|---|---|
| **Plant 1** | 10 | Preliminary Treatment | 173 |
| | 11 | Primary Treatment | 99 |
| | 12-AS | Secondary Treatment - Activated Sludge | 339 |
| | 12-TF | Secondary Treatment - Trickling Filter | 26 |
| | 14 | Interplant | 37 |
| | 15-DIG | Solids Handling - Digesters | 89 |
| | 15-FAC | Solids Handling - Facilities | 75 |
| | 16 | Central Generation | 34 |
| | 17 | Utilities | 21 |
| | 18 | Electrical Distribution | 114 |
| **Plant 2** | 20 | Preliminary Treatment | 235 |
| | 21 | Primary Treatment | 227 |
| | 22-AS | Secondary Treatment - Activated Sludge | 200 |
| | 22-TF | Secondary Treatment - Trickling Filter | 90 |
| | 24 | Interplant | 760 |
| | 25-DIG | Solids Handling - Digesters | 110 |
| | 25-FAC | Solids Handling - Facilities | 58 |
| | 26 | Central Generation | 56 |
| | 27 | Utilities | 22 |
| | 28 | Electrical Distribution | 191 |
| **Collection System** | Pump Stations | 15th Street | 28 |
| | | A Street | 25 |
| | | Bay Bridge | 25 |
| | | Bitter Point | 31 |
| | | College | 24 |
| | | Crystal Cove | 18 |
| | | Edinger | 12 |
| | | Lido | 23 |
| | | MacArthur | 12 |

**Table 4: Count of Major Assets from AMP Asset Management Summaries (Cont'd)**

| | | | |
|---|---|---|---|
| | | Main Street | 53 |
| | | Rocky Point | 25 |
| | | Slater | 25 |
| | | Seal Beach | 36 |
| | | Westside | 22 |
| | | Yorba Linda | 16 |
| **Grand Total** | | | **3,331** |

# 4 Asset Definition Work Session

## 4.1 Asset Definition

An organization typically defines an asset, for each asset class, by determining the lowest level at which an asset is maintained or at which decisions are made to repair, refurbish or replace assets. Ideally, the maintenance organization and the asset management team are aligned on asset definition. At OCSD, the level at which the Asset Management Team desires to collect, track and manage assets is at a higher level than the maintenance organization is choosing to manage and collect data on equipment. This is clearly indicated in the difference between the number of assets in the compiled Maximo Asset List (124,782 assets) versus the number of Major Assets the Asset Engineers are tracking in the Asset Management Plan (3,331 major assets). The number of major assets the Asset Engineers are tracking is roughly equivalent to the number of assets the maintenance organization identifies as Primary Equipment (approximately 7,000 primary assets).

The difference between how the maintenance organization defines an asset (i.e. the level at which maintenance is planned) is not going to be the same as the level the Asset Management Team defines as asset, since the Asset Engineers are largely focused on the asset issues and remediation actions requiring capital improvements. These are mainly larger assets, with solutions requiring capital investment and delivery pathways. Smaller assets are largely handled using operational expenditures with decisions to repair and replace occurring within the maintenance organization.

In June 2019, HDR presented a set of six questions an organization can ask and answer to define an asset shown in **Figure 5**. The six questions include:

1. Does the candidate value exceed agency cost threshold?
2. Is the candidate critical? In other words, will failure cause a significant environmental, safety or economic impact?
3. Does the candidate require preventive or predictive maintenance?
4. Does the candidate require tracking of maintenance cost?
5. Is the candidate required to provide Level of Service to customer?

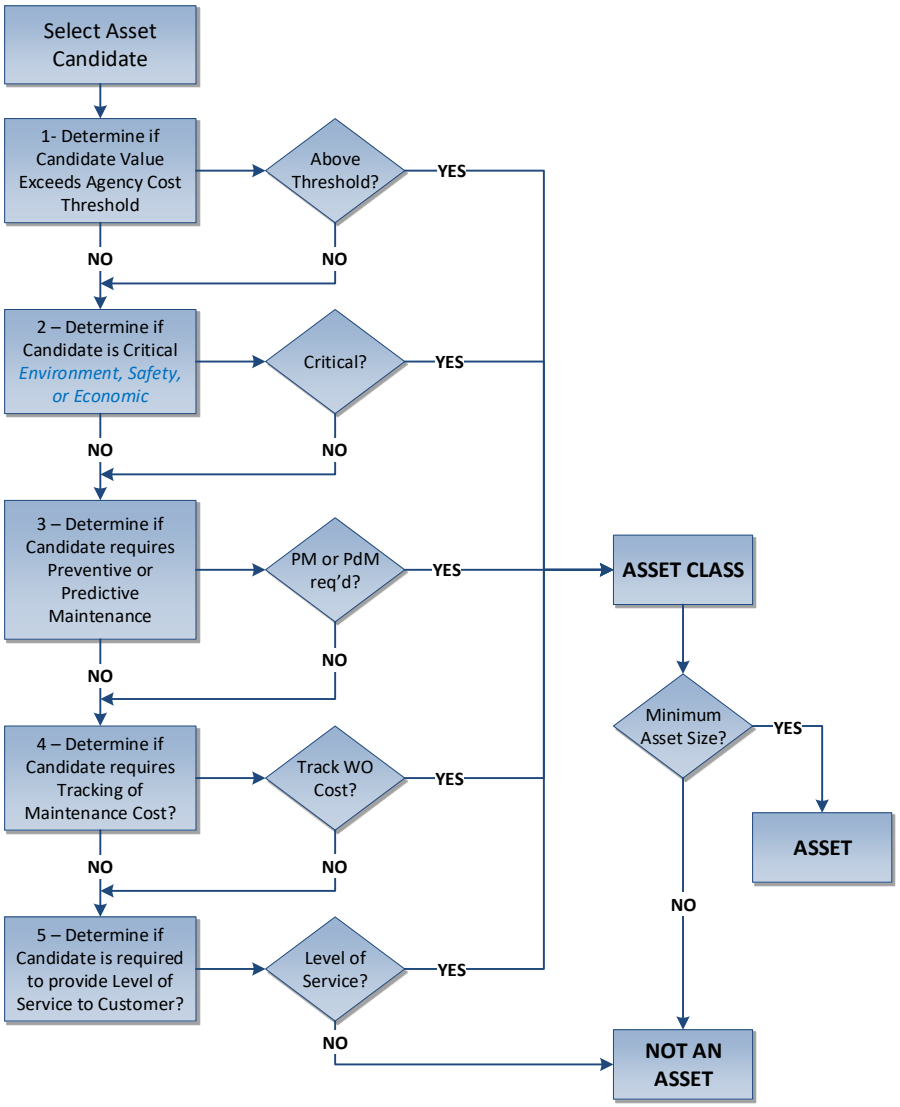
If the answer to any of the above questions is “Yes”, then the candidate is an Asset Class. If the answer to all of the above questions is no, then the candidate is not part of an Asset Class and is not and Asset. The last question is:

6. If the candidate is part of an established Asset Class, is the candidate above the minimum asset size?

If the answer to the last question is “Yes”, then the candidate is an Asset. If no, then the candidate is not an Asset.

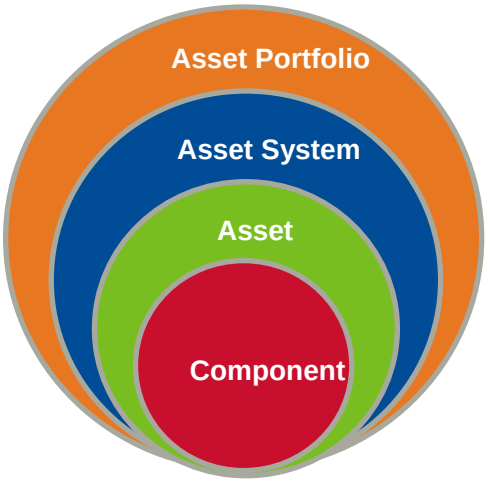
These questions are primarily aimed at determining the asset classes and assets an agency should build into their maintenance management system. These assets are typically referred to as “Maintenance-Managed Items”. The Asset Management Team is mainly focused on subset of Maintenance-Managed Items requiring capital investment to rehabilitate or replace assets. The Asset Management Team is also focused on a whole class of assets the maintenance organization has not built into Maximo, including many structural and civil assets.

**Figure 5: Asset Definition Methodology**



## 4.2 Asset Hierarchy Definitions

- **Asset Portfolio**: A grouping of assets and facilities for which an organization is responsible that is within the same Asset Management System or program scope. These are typically grouped by major business lines where management authority and funding sources may be separated (e.g., Generation versus Power Delivery). [ISO 55001:2014]
- **Asset System**: A group of assets that work together to deliver a required business function or purpose (e.g., Generator). [PAS 55: 2008]
- **Asset:** At the most detailed level, assets will typically be broken down to the "maintenance-managed item (MMI)" level (i.e., the level at which maintenance is planned). [International Infrastructure Management Manual 2015]
- **Component**: The group of parts of the asset that are commonly maintained (repaired / restored) as a whole. [ISO 14224]




**Note:** Asset Class may be defined at the Asset System or Asset Level of the hierarchy.

### 4.2.1 Definitions of Related Terms

- **Asset Class**: A logical grouping of similar assets or equipment types used to categorize, organize and manage the Asset Portfolio. Grouping of assets having common functions and characteristics that distinguish those assets as a group or class (e.g., transformer, pump, valve). Also termed "asset type" in ISO 55000.
- **Asset Sub-class**: Distinctive group of Assets within an Asset Class (e.g., $SF_6$, oil, and vacuum circuit breakers).
- **Asset Cohort**: A group of Assets within one Asset Class having similar characteristics, such as useful life. Assets of the same cohort typically have the same maintenance and renewal plans, even with respect to timing of those activities.

# 5 Recommendations for Future Improvements

### 5.1.1 Align Asset Registries with the Maximo Asset List

The majority of assets defined as Major Assets in the 2019 Asset Management Plan are pieces of equipment likely managed within the Maximo Asset List.

- Review Maximo Function Codes to identify the asset types that meet the definition of an Asset Class from the Asset Engineer perspective (i.e. above cost threshold; is

critical; requires capital investment to rehabilitation or replace; requires tracking of capital investment costs; and, is required to deliver levels of service).

- Start by looking at all of the asset types identified in the Asset Management Plan as Major Assets and identify the Function Codes for those asset types.
- Isolate Maximo assets with Major Asset Function Codes and create Pareto charts for these asset types by size. A Pareto chart is a type of chart that contains both bars and a line graph, where individual values are represented in descending order by bars, and the cumulative total is represented by the line. Use Pareto analysis to "draw the line" on asset size containing the majority of the overall replacement value and risk associated with the asset class. This can be done for each asset class of Major Assets. The goal is to remove the smaller assets where decisions to replace are made by the maintenance organization and funded by the operational budget. Asset Engineers can draw an initial "line" to focus on the larger Major Assets and can modify the criteria to include more assets as the larger assets are identified and linked between the Asset Registry and Maximo Asset List.
- The Maximo Asset List provided to HDR did not have an engineering discipline data field. The Maximo Function Codes could easily be associated with engineering discipline. It is likely that most of the Maximo Function Codes will be associated with mechanical, electrical, instrumentation and civil (i.e. piping) assets. This field could be incorporated into the Maximo database or be managed separately as a lookup table.
- A key activity is to create alignment, or at least linkage, between the Maximo Location Codes and Loop Blocks and the process area/system breakdowns Asset Engineers are using in the Condition Scoring/Remaining Useful Life matrices and the Major Asset Lists included on the Asset Management Summaries. This will be an essential step towards tracking asset condition and remaining useful life data in Maximo.

### 5.1.2 Define Consistent and Standardized Asset Nomenclature for Assets Not in Maximo

The remaining assets included in the Asset Management Plan either as Major Assets or included as part of the Condition Scoring/Remaining Useful Life matrices (i.e. structural and civil assets), yet not included in the Maximo Asset List would need to be defined with a consistent and standardized asset nomenclature. A solution will need to be developed to address how these assets would be defined in Maximo. The current approach for asset nomenclature in Maximo appears to focus on naming and organizing mechanical, electrical, instrumentation and piping assets. OCSD may be able to associate structures with Location Codes already existing in Maximo. OCSD could assign a new set of Location Sub-Codes assigned to structures and could even link specific structures with the sets of Loop Blocks the structures support or impact.

## Attachment A: Count of Primary Equipment Types by Area

| PRIMARY EQUIPMENT NAME | COLLECTIONS | PLANT 1 AREAS | | | | | | | | PLANT 1 TOTAL | PLANT 2 AREAS | | | | | | | | | | PLANT 2 TOTAL | GRAND TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 11 | 12 | 15 | 16 | 17 | 18 | 19 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| AIR CONDITIONER | 10 | 6 | 2 | 13 | 25 | | 4 | 12 | 88 | 150 | 1 | 5 | 5 | | 6 | 26 | 2 | 3 | 27 | 29 | 104 | 264 |
| AIR HANDLER UNIT | 3 | | 2 | 3 | 12 | 5 | | 2 | 14 | 38 | | 4 | 10 | | 6 | 10 | | | 8 | 1 | 39 | 80 |
| BARSCREEN | | 4 | | | | | | | | 4 | 6 | | | | | | | | | | 6 | 10 |
| BELTPRESS | | | | | 8 | | | | | 8 | | | | | | 15 | | | | | 15 | 23 |
| BLOWER | | 7 | 7 | 9 | 2 | | | | | 25 | | | 8 | | | 6 | | | | | 14 | 39 |
| BOILER | | | | | 2 | 3 | | | 12 | 17 | | | | | | 2 | 5 | | | 4 | 11 | 28 |
| BRANCH CIRCUIT PANEL | 24 | 16 | 20 | 25 | 44 | 7 | 6 | 20 | 51 | 189 | 15 | 14 | 32 | 1 | 11 | 32 | 6 | 7 | 42 | 25 | 185 | 398 |
| CENTRIFUGE | | | | 2 | 12 | 2 | | | | 16 | | | | | | 10 | 3 | | | | 13 | 29 |
| CHILLER | | | | | 2 | 2 | | | 5 | 9 | | | | | 3 | | | | | | 3 | 12 |
| COLLECTOR (SLUDGE or SCUM) | | | 85 | 40 | | | | | | 125 | | 14 | 35 | | | | | | | | 49 | 174 |
| COMPRESSOR (AIR) | 33 | 1 | | | 3 | 4 | 5 | | 31 | 44 | | | | 4 | | 3 | 7 | 10 | | | 24 | 101 |
| CONVEYOR | | 3 | | | 40 | | | | | 43 | 4 | | | | | 89 | | | | | 93 | 136 |
| COOLING TOWER | | | | | | | | | 1 | 1 | | | | | | | | | | | | 1 |
| CRANE | 16 | 3 | | 4 | 2 | | | | 3 | 12 | 7 | | 2 | | 1 | 2 | | 1 | | | 13 | 41 |
| DISTRIBUTION PANEL | 17 | 3 | 12 | 3 | | 1 | 1 | 4 | 31 | 55 | 2 | 4 | 14 | | 3 | 2 | | 2 | 12 | 7 | 46 | 118 |
| DRYER | | | 2 | | 2 | 4 | 16 | 2 | 7 | 33 | 1 | | 3 | | | 4 | 7 | 30 | | | 45 | 78 |
| ELEVATOR | | | | | 2 | 1 | | | 4 | 7 | | | 2 | | 1 | | | | | 1 | 4 | 11 |
| EXCHANGER | 3 | 2 | | 9 | 65 | 20 | | 1 | 4 | 101 | | | | | 8 | 30 | 36 | | 3 | | 77 | 181 |
| FAN | 63 | 55 | 43 | 61 | 84 | 10 | 3 | 14 | 67 | 337 | 86 | 38 | 91 | | 16 | 107 | 18 | 6 | 27 | 14 | 403 | 803 |
| FLARE | | | | | 3 | | | | | 3 | | | | | | 3 | | | | | 3 | 6 |
| GENERATOR | 13 | | | | | 4 | | 14 | 49 | 67 | | | | | | | 6 | | 20 | | 26 | 106 |
| GRINDER, SLUDGE | | | 1 | | 31 | | | | | 32 | | 21 | | | | 18 | | | | | 39 | 71 |
| HEATER | 14 | 4 | | 4 | 10 | 4 | | 1 | 86 | 109 | 18 | | | 12 | 5 | 4 | 6 | 3 | 5 | 25 | 78 | 201 |
| MIXER, CHEMICAL | 1 | | 5 | 43 | 41 | 4 | | | | 93 | 12 | 2 | 44 | | | 19 | 8 | | | | 85 | 179 |
| MOTOR CONTROL CENTER | 23 | 9 | 17 | 19 | 21 | 4 | 6 | 18 | 4 | 98 | 1 | 15 | 24 | 1 | 2 | 23 | 4 | 5 | 28 | 2 | 105 | 226 |
| OPERATOR (VALVE or GATE) | 1 | 13 | 96 | 29 | | 4 | | | | 142 | 87 | 5 | 111 | | 3 | 4 | 5 | 6 | | | 221 | 364 |
| OXIDIZER, CATALYST | | | | | | 6 | | | | 6 | | | | | | | 10 | | | | 10 | 16 |
| PUMP | 109 | 77 | 110 | 166 | 304 | 53 | 44 | 3 | 58 | 815 | 140 | 167 | 149 | 5 | 30 | 318 | 68 | 56 | 13 | 14 | 960 | 1884 |
| SAMPLER | 1 | 2 | 4 | 3 | | | | | | 9 | 2 | 5 | 8 | | 12 | 1 | | | | | 28 | 38 |
| SCRUBBER | | 10 | 4 | 2 | 9 | | | | | 25 | 12 | 10 | 5 | | | 12 | | | | | 39 | 64 |
| SEPARATOR | | | | | 13 | 3 | 5 | | | 21 | | | | | 1 | 2 | 6 | 3 | | | 12 | 33 |
| SUBMERSIBLE PUMP W/INTEGRAL MOTOR | 32 | 13 | 28 | 7 | 19 | 2 | 22 | | 3 | 94 | 3 | 11 | 21 | | 16 | 16 | 2 | 39 | | 6 | 114 | 240 |
| SWEEP ARM, TRICKLING FILTER | | | | 2 | | | | | | 2 | | | 3 | | | | | | | | 3 | 5 |
| SWITCHBOARD | | | | | | | | | | | | | | | | 5 | | | | | 5 | 5 |
| SWITCHGEAR | 6 | 2 | | 11 | 6 | 4 | | 32 | | 55 | | | 7 | | | 3 | 4 | 3 | 52 | 1 | 70 | 131 |
| TANK | 13 | 8 | 12 | 11 | 70 | 36 | 20 | 26 | 20 | 203 | 11 | 13 | 32 | 2 | 9 | 83 | 36 | 28 | 18 | | 232 | 448 |

| PRIMARY EQUIPMENT NAME | COLLECTIONS | PLANT 1 AREAS | | | | | | | | PLANT 1 TOTAL | PLANT 2 AREAS | | | | | | | | | | PLANT 2 TOTAL | GRAND TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 11 | 12 | 15 | 16 | 17 | 18 | 19 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| TRANSFORMER | 28 | 13 | 15 | 21 | 32 | 8 | 5 | 42 | 19 | 155 | 11 | 13 | 29 | 1 | 15 | 31 | 11 | 11 | 68 | 16 | 206 | 389 |
| TURBINE | | | | | | | | 4 | | 4 | | | | | | | 1 | | | | 1 | 5 |
| UPS | 18 | 4 | 7 | 3 | 1 | 4 | 2 | 46 | 4 | 71 | | 2 | 9 | | 1 | 2 | 2 | 1 | 26 | 3 | 46 | 135 |
| VAPORIZER, OXYGEN FACILITY | | | | | | | | | 1 | 1 | | | | 10 | | | 1 | | | 3 | 14 | 15 |
| WASHER COMPACTOR | | | | | | | | | | | 3 | | | | | | | | | | 3 | 3 |
| **GRAND TOTAL** | **428** | **255** | **472** | **490** | **865** | **195** | **139** | **241** | **562** | **3219** | **422** | **343** | **644** | **36** | **149** | **882** | **254** | **214** | **349** | **151** | **3444** | **7091** |

# Appendix F
# Asset Registry Field Descriptions

# Asset Registry Fields

| Column | Field | Description (Example) |
|---|---|---|
| A | Area No. | Numerical designation of process area (22; Plant No. 2 – Trickling Filters) |
| B | Sub-Area No. | Letter assigned to further classify process areas (22N; Trickling Filters Clarifiers) |
| C | Facility | Facility the asset belongs to (Plant No. 1, Plant No. 2, or Collection System) |
| D | Process | Name of the process area (Secondary Treatment – Trickling Filters) |
| E | Sub-Process | Name of treatment process within the process area (Trickling Filter Clarifiers) |
| F | Discipline | Type of expertise needed to maintain asset (Mechanical) |
| G | Sub-Discipline | Categorization of function and criticality (Distribution, Process, Non-process) |
| H | Asset | Name of the Asset (Pump, Valve) |
| I | Loop Tag Number | Location based asset unique identifier (22KPMP060) |
| J | Asset Type | Type of asset (Valve: gate, ball, globe) |
| K | Attribute1 | Identifying feature of the asset (manufacturer) |
| L | Attribute2 | Identifying feature of the asset (model) |
| M | Attribute3 | Identifying feature of asset (size) |
| N | Description | Information used to locate/identify the asset in the field (MSP No. 3 suction side isolation valve) |
| O | Year Built/Installed | Year the asset was constructed of installed |
| P | Original Project No. | OCSD Project Number the asset was created (P2-90) |

| Column | Field | Description (Example) |
|---|---|---|
| Q | Theoretical Useful Life (SP-151) | Number of years the asset is expected to be useful according to SP-151 |
| R | Rehab Cycle (SP-151) | Number of years between rehabilitation cycles according to SP-151 |
| S | Rehab/Replacement Project No. | OCSD Project Number for rehabilitation effort (FRC-0004, FR1-0008) |
| T | Rehab/Replacement Date | Date of the rehabilitation/replacement effort |
| U | Years Since Last Rehab | No. of years since the asset has been rehabilitated or replaced |
| V | Theoretical Remaining Useful Life | Remaining number of years the asset is expected to be useful based on desktop analysis |
| W | Field Adjusted Remaining Useful Life | Remaining number of years the asset is expected to be useful based on field data or condition assessment |
| X | Data Year | Year the field assessment or condition assessment was completed |
| Y | Estimated End of Life | Approximate year the asset will need to be replaced by |
| Z | Future Project No. | OCSD project number for future project |
| AA | Construction Start Date | Construction start date for future project |
| AB | Construction End Date | Construction end date for future project |
| AC | Notes | Pertinent information about asset performance, part lead time, etc. |

# Appendix G
# Example Asset Registries

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Blower Room Supply Fan | Mechanical | Fan | 22MFAN350 | Blower Room Supply Fan | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Blower Room Exhaust Fan No. 1 | Mechanical | Fan | 22MFAN355 | Blower Room Exhaust Fan No. 1 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Blower Room Exhaust Fan No. 2 | Mechanical | Fan | 22MFAN360 | Blower Room Exhaust Fan No. 2 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Blower Room Exhaust Fan No. 3 | Mechanical | Fan | 22MFAN365 | Blower Room Exhaust Fan No. 3 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Waste Sludge Pump Room Exhaust Fan No. 4 | Mechanical | Fan | 22MFAN370 | Waste Sludge Pump Room Exhaust Fan No. 4 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Structural | Wet Well | -- | Trickling Filter Pump Station Wet Well | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Structural | Building | 22KSTRC145 | Trickling Filter Pump Station Building | 2012 | P2-90 | 60 | 20 | None | None | 52 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Civil | Piping | -- | Trickling Filter Pump Station Piping | 2012 | P2-90 | 75 | 20 | None | None | 67 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Distribution Panel | 22KDPN003 | PNL-STA2 | 2012 | P2-90 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Distribution Panel | 22KDPN004 | PNL-UPSA | 2012 | P2-90 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Distribution Panel | 22KDPN203 | PNL-STC2 | 2012 | P2-90 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Motor Control Center | 22KMCC001 | MCC STA | 2012 | P2-90 | 40 | 20 | None | None | 32 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Motor Control Center | 22KMCC101 | MCC STB | 2012 | P2-90 | 40 | 20 | None | None | 32 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Motor Control Center | 22KMCC101 | MCC STB | 2012 | P2-90 | 40 | 20 | None | None | 32 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Motor Control Center | 22KMCC201 | MCC STC | 2012 | P2-90 | 40 | 20 | None | None | 32 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump A1 | Mechanical | Pump | 22KPMP020 | Pump A1 | 2012 | P2-90 | 40 | 20 | 2020 | 0 | 20 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump A2 | Mechanical | Pump | 22KPMP040 | Pump A2 | 2012 | P2-90 | 40 | 20 | 2019 | 1 | 19 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump B1 | Mechanical | Pump | 22KPMP060 | Pump B1 | 2012 | P2-90 | 40 | 20 | 2020 | 0 | 20 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump B2 | Mechanical | Pump | 22KPMP080 | Pump B2 | 2012 | P2-90 | 40 | 20 | 2019 | 1 | 19 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump C1 | Mechanical | Pump | 22KPMP100 | Pump C1 | 2012 | P2-90 | 40 | 20 | 2020 | 0 | 20 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump C2 | Mechanical | Pump | 22KPMP120 | Pump C2 | 2012 | P2-90 | 40 | 20 | 2019 | 1 | 19 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | UPS | 22KUPS004 | Uninterruptible Power Supply, UPS-STA | 2012 | P2-90 | 10 | 5 | None | None | 2 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump A1 | Electrical | VFD | 22KVFD020 | Pump A1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump A2 | Electrical | VFD | 22KVFD040 | Pump A2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump B1 | Electrical | VFD | 22KVFD060 | Pump B1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump B2 | Electrical | VFD | 22KVFD080 | Pump B2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump C1 | Electrical | VFD | 22KVFD100 | Pump C1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | Pump C2 | Electrical | VFD | 22KVFD120 | Pump C2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Transformer | 22KXFMR003 | Transformer PNL-STA | 2012 | P2-90 | 50 | No Data | None | None | 42 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Transformer | 22KXFMR004 | Transformer PNL-UPSA | 2012 | P2-90 | 50 | No Data | None | None | 42 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Transformer | 22KXFMR203 | Transformer PNL-STC2 | 2012 | P2-90 | 50 | No Data | None | None | 42 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Structural | Tank | -- | Trickling Filter A Concrete Structure | 2012 | P2-90 | 60 | 20 | None | None | 52 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Structural | Media | -- | Trickling Filter A Plastic Media | 2012 | P2-90 | 30 | 30 | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Mechanical | Fan | 22LFAN040 | Recirculation Fan No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Mechanical | Fan | 22LFAN045 | Recirculation Fan No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Mechanical | Fan | 22LFAN140 | Foul Air Fan No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Structural | Tank | -- | Trickling Filter B Concrete Structure | 2012 | P2-90 | 60 | 20 | None | None | 52 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Structural | Media | -- | Trickling Filter B Plastic Media | 2012 | P2-90 | 30 | 30 | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Mechanical | Fan | 22LFAN170 | Recirculation Fan No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Mechanical | Fan | 22LFAN175 | Recirculation Fan No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Mechanical | Fan | 22LFAN240 | Foul Air Fan No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Mechanical | Fan | 22LFAN270 | Foul Air Fan No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Structural | Tank | -- | Trickling Filter C Concrete Structure | 2012 | P2-90 | 60 | 20 | None | None | 52 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Structural | Media | -- | Trickling Filter C Plastic Media | 2012 | P2-90 | 30 | 30 | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Mechanical | Fan | 22LFAN290 | Recirculation Fan No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Mechanical | Fan | 22LFAN295 | Recirculation Fan No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | -- | Instrumentation | Flowmeter | 22LFE340 | Caustic Pump Discharge Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Structural | Carbon Filter | 22LFLT060 | Trickling Filter A Carbon Filter | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Structural | Carbon FIlter | 22LFLT160 | Trickling Filter B Carbon Filter | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Structural | Carbon FIlter | 22LFLT260 | Trickling Filter C Carbon Filter | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Mechanical | Gate | 22LGAT036 | Effluent Gate | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Mechanical | Gate | 22LGAT136 | Effluent Gate | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Mechanical | Gate | 22LGAT236 | Effluent Gate | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Pump No. 3 | Mechanical | Pump | 22LPMP015 | Serves Trickling Filter A Scrubber | 2017 | FE13-04 | 20 | 10 | 2013 | 7 | 3 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Pump No. 4 | Mechanical | Pump | 22LPMP015 | Serves Trickling Filter A Scrubber | 2017 | FE13-04 | 20 | 10 | 2013 | 7 | 3 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Pump No. 5 | Mechanical | Pump | 22LPMP020 | Serves Trickling Filter B Scrubber | 2017 | FE13-04 | 20 | 10 | 2013 | 7 | 3 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Pump No. 6 | Mechanical | Pump | 22LPMP025 | Serves Trickling Filter C Scrubber | 2017 | FE13-04 | 20 | 10 | 2013 | 7 | 3 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Pump No. 7 | Mechanical | Pump | 22LPMP055 | Serves All Trickling Filter Scrubbers | 2017 | FE13-04 | 20 | 10 | 2013 | 7 | 3 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Caustic Soda Pump No. 1 | Mechanical | Pump | 22LPMP330 | Serves Trickling Filters | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Caustic Soda Pump No. 2 | Mechanical | Pump | 22LPMP335 | Serves Trickling Filters | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Structural | Scrubber | 22LSBR150 | Scrubber | 2017 | FE13-04 | 20 | 10 | 2017 | 3 | 7 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Structural | Scrubber | 22LSBR250 | Scrubber | 2017 | FE13-04 | 20 | 10 | 2017 | 3 | 7 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Structural | Scrubber | 22LSBR280 | Scrubber | 2017 | FE13-04 | 20 | 10 | 2017 | 3 | 7 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Mechanical | Rotary Arm | 22LSWP006 | Rotary Distributor Motor | 2012 | P2-90 | 40 | 20 | 2019 | 1 | 19 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Mechanical | Rotary Arm | 22LSWP106 | Rotary Distributor Motor | 2012 | P2-90 | 40 | 20 | None | None | 32 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Mechanical | Rotary Arm | 22LSWP206 | Rotary Distributor Motor | 2012 | P2-90 | 40 | 20 | None | None | 32 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Caustic Soda Tank | Structural | Storage Tank | 22LTNK310 | Caustic Soda Tank | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter A | Electrical | VFD | 22LVFD006 | Trickling Filter A VFD,  MCC-STA | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Electrical | VFD | 22LVFD106 | Trickling Filter B VFD, MCC-STB | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Electrical | VFD | 22LVFD206 | Trickling Filter C VFD, MCC-STC | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter B | Electrical | VFD | 22LVFD240 | Foul Air Fan No. 1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22L | Plant No. 2 | Secondary - Trickling Filters | Trickling Filter C | Electrical | VFD | 22LVFD270 | Foul Air Fan No. 1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Air Control Valves | Mechanical | Air Control Valves | -- | Air Control Valves | 2012 | P2-90 | 25 | 5 | None | None | 17 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | SCR Blower No.1 | Mechanical | Blower | 22MBWR250 | SCR Blower No. 1 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | SCR Blower No. 2 | Mechanical | Blower | 22MBWR260 | SCR Blower No. 2 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | SCR Blower No. 3 | Mechanical | Blower | 22MBWR270 | SCR Blower No. 3 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | SRR Blower No. 1 | Mechanical | Blower | 22MBWR280 | SRR Blower No. 1 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | SRR Blower No. 2 | Mechanical | Blower | 22MBWR290 | SRR Blower No. 2 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | SRR Blower No. 3 | Mechanical | Blower | 22MBWR300 | SRR Blower No. 3 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Distribution Panel | 22MDPN002 | Blower Room Distribution Panel, PNL-UPSG2 | 2012 | P2-90 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Waste Sludge Pump | Instrumentation | Flowmeter | 22MFE239 | Waste Sludge Pump Discharge Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor A | Mechanical | Gate | 22MGAT010 | Solids Contact Reactor A - Inlet Gate No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor A | Mechanical | Gate | 22MGAT011 | Solids Contact Reator A - Inlet Gate No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor A | Mechanical | Gate | 22MGAT012 | Solids Contact Reactor A - Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor A | Mechanical | Gate | 22MGAT018 | Solids ContactReactor A - Outlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor B | Mechanical | Gate | 22MGAT025 | Solids Contact Reactor B - Inlet Gate No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor B | Mechanical | Gate | 22MGAT026 | Solids Contact Reactor B - Inlet Gate No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor B | Mechanical | Gate | 22MGAT027 | Solids Contact Reactor B - Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor B | Mechanical | Gate | 22MGAT033 | Solids Contact Reactor B - Outlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor A | Mechanical | Gate | 22MGAT040 | Sludge Rearation Reactor A - Outlet Gate No. | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor A | Mechanical | Gate | 22MGAT041 | Sludge Rearation Reactor A - WS Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor A | Mechanical | Gate | 22MGAT042 | Sludge Rearation Reactor A - Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor A | Mechanical | Gate | 22MGAT047 | Sludge Rearation Reactor A - Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor B | Mechanical | Gate | 22MGAT055 | Sludge Rearation Reactor B - Outlet Gate No. | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor B | Mechanical | Gate | 22MGAT056 | Sludge Rearation Reactor B - WS Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor B | Mechanical | Gate | 22MGAT057 | Sludge Rearation Reactor B - Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor B | Mechanical | Gate | 22MGAT062 | Sludge Rearation Reactor B - Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | West Mixed Liquor Channel | Mechanical | Gate | 22MGAT066 | Drain Gate No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | West Mixed Liquor Channel | Mechanical | Gate | 22MGAT067 | Drain Gate No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | West Mixed Liquor Channel | Mechanical | Gate | 22MGAT081 | Drain Gate No. 4 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | West Mixed Liquor Channel | Mechanical | Gate | 22MGAT082 | Drain Gate No. 3 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor C | Mechanical | Gate | 22MGAT110 | Inlet Gate No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor C | Mechanical | Gate | 22MGAT111 | Inlet Gate No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor C | Mechanical | Gate | 22MGAT112 | Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor C | Mechanical | Gate | 22MGAT118 | Outlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor D | Mechanical | Gate | 22MGAT125 | Inlet Gate No. 1 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor D | Mechanical | Gate | 22MGAT126 | Inlet Gate No. 2 | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor D | Mechanical | Gate | 22MGAT127 | Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor D | Mechanical | Gate | 22MGAT133 | Outlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor C | Mechanical | Gate | 22MGAT140 | Outlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor C | Mechanical | Gate | 22MGAT141 | WS Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor C | Mechanical | Gate | 22MGAT142 | Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor C | Mechanical | Gate | 22MGAT147 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | East Mixed Liquor Channel | Mechanical | Gate | 22MGAT149 | Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor D | Mechanical | Gate | 22MGAT155 | Outlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor D | Mechanical | Gate | 22MGAT156 | WS Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor D | Mechanical | Gate | 22MGAT157 | Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor D | Mechanical | Gate | 22MGAT162 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | East Mixed Liquor Channel | Mechanical | Gate | 22MGAT181 | Drain Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | East Mixed Liquor Channel | Mechanical | Gate | 22MGAT186 | East/West ML Channel Isolation Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | East Mixed Liquor Channel | Mechanical | Gate | 22MGAT197 | East ML Channel Scum Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | East Mixed Liquor Channel | Mechanical | Gate | 22MGAT198 | East ML Channel Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Waste Sludge Pump No. 1 | Mechanical | Pump | 22MPMP210 | WS Pump No. 1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Waste Sludge Pump No. 2 | Mechanical | Pump | 22MPMP220 | WS Pump No. 2 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Waste Sludge Pump No. 3 | Mechanical | Pump | 22MPMP230 | WS Pump No. 3 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | UPS | 22MUPS006 | ML Channel RIO UPS | 2012 | P2-90 | 10 | 5 | None | None | 2 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | UPS | 22MUPS007 | SC Utility/HVAC RIO UPS | 2012 | P2-90 | 10 | 5 | None | None | 2 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | WS Pump No. 1 | Electrical | VFD | 22MVFD210 | WS Pump No. 1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | WS Pump No. 2 | Electrical | VFD | 22MVFD220 | WS Pump No. 2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | WS Pump No. 3 | Electrical | VFD | 22MVFD230 | WS Pump No. 3 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Panel | 22NDPN003 | Distribution Panel, PNL-STE2 | 2012 | P2-90 | 30 | No Data | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Panel | 22NDPN004 | Distribution Panel, PNL-UPSF | 2012 | P2-90 | 30 | No Data | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Electrical | Panel | 22NDPN005 | Distribution Panel, PNL-STE3 | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station A | Mechanical | Fan | 22NFAN400 | Supply Fan | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station B | Mechanical | Fan | 22NFAN405 | Supply Fan | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station A | Mechanical | Fan | 22NFAN410 | Exhaust Fan No. 1 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station A | Mechanical | Fan | 22NFAN415 | Exhaust Fan No. 2 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station B | Mechanical | Fan | 22NFAN420 | Exhaust Fan No. 1 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station B | Mechanical | Fan | 22NFAN425 | Exhaust Fan No. 2 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Mechanical | Fan | 22NFAN435 | Supply Fan | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Mechanical | Fan | 22NFAN440 | Exhaust Fan No. 1 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Mechanical | Fan | 22NFAN445 | Exhaust Fan No. 2 | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Instrumentation | Flowmeter | 22NFE006 | Scum Pump A Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Instrumentation | Flowmeter | 22NFE049 | RSS Pumps A1 and A2 Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Instrumentation | Flowmeter | 22NFE089 | RSS Pumps B1 and B2 Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Instrumentation | Flowmeter | 22NFE129 | RSS Pumps C1 and C2 Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Instrumentation | Flowmeter | 22NFE169 | RSS Pumps D1 and D2 Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Instrumentation | Flowmeter | 22NFE209 | RSS Pumps E1 and E2 Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Instrumentation | Flowmeter | 22NFE250 | RSS Pumps F1 and F2 Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Sodium Hypochlorite Pump | Instrumentation | Flowmeter | 22NFE350 | Sodium Hypochlorite Pump Flowmeter | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Mechanical | Gate | 22NGAT025 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Mechanical | Gate | 22NGAT065 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Mechanical | Gate | 22NGAT105 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Mechanical | Gate | 22NGAT145 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Mechanical | Gate | 22NGAT185 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Mechanical | Gate | 22NGAT225 | Inlet Gate | 2012 | P2-90 | 20 | 5 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | MCC | 22NMCC001 | Motor Control Center | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | MCC | 22NMCC101 | Motor Control Center | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Mechanical | Pump | 22NPMP010 | Scum Pump A | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Mechanical | Pump | 22NPMP030 | RSS Pump A1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Mechanical | Pump | 22NPMP040 | RSS Pump A2 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Mechanical | Pump | 22NPMP050 | Scum Pump B | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Mechanical | Pump | 22NPMP070 | RSS Pump B1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Mechanical | Pump | 22NPMP080 | RSS Pump B2 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Mechanical | Pump | 22NPMP090 | Scum Pump C | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Mechanical | Pump | 22NPMP110 | RSS Pump C1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Mechanical | Pump | 22NPMP120 | RSS Pump C2 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Mechanical | Pump | 22NPMP130 | Scum Pump D | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Mechanical | Pump | 22NPMP150 | RSS Pump D1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Mechanical | Pump | 22NPMP160 | RSS Pump D2 | 2012 | P2-90 | 40 | 20 | 2020 | 0 | 20 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Mechanical | Pump | 22NPMP170 | Scum Pump E | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Mechanical | Pump | 22NPMP190 | RSS Pump E1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Mechanical | Pump | 22NPMP200 | RSS Pump E2 | 2012 | P2-90 | 40 | 20 | 2020 | 0 | 20 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Mechanical | Pump | 22NPMP210 | Scum Pump F | 2012 | P2-90 | 40 | 20 | None | None | 32 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Mechanical | Pump | 22NPMP230 | Rss Pump F1 | 2012 | P2-90 | 40 | 20 | None | None | 32 | 4 | 2020 | 2030 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Mechanical | Pump | 22NPMP240 | RSS Pump F2 | 2012 | P2-90 | 40 | 20 | 2020 | 0 | 20 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Sodium Hypochlorite Pump No. 1 | Mechanical | Pump | 22NPMP335 | Serves Trickling Filter A | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Sodium Hypochlorite Pump No. 2 | Mechanical | Pump | 22NPMP340 | Serves Trickling Filter B | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Sodium Hypochlorite Pump No. 3 | Mechanical | Pump | 22NPMP345 | Serves Trickling Filter C | 2012 | P2-90 | 20 | 10 | None | None | 12 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Tank No. 1 | Structural | Storage Tank | 22NTNK310 | Hypochlorite Tank No. 1 | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Hypochlorite Tank No. 2 | Structural | Storage Tank | 22NTNK320 | Hypochlorite Tank No. 2 | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Instrumentation | PLC Controller | 22NU540 | PLC Controller | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | UPS | 22NUPS003 | Clarifier B RIO UPS | 2012 | P2-90 | 10 | 5 | None | None | 2 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | UPS | 22NUPS004 | UPS-STF | 2012 | P2-90 | 10 | 5 | None | None | 2 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD030 | RSS Pump A1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD040 | RSS Pump A2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD070 | RSS Pump B1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD080 | RSS Pump B2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD110 | RSS Pump C1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD120 | RSS Pump C2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD150 | RSS Pump D1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD160 | RSS Pump D2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD190 | RSS Pump E1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD200 | RSS Pump E2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD230 | RSS Pump F1 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | VFD | 22NVFD240 | RSS Pump F2 VFD | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | Transformer | 22NXFMR003 | TRANSFORMER, PNL-STE2 | 2012 | P2-90 | 50 | No Data | None | None | 42 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Electrical | Transformer | 22NXFMR004 | TRANSFORMER, PNL-UPSF | 2012 | P2-90 | 50 | No Data | None | None | 42 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Instrumentation | PLC Controller | -- | PLC | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Instrumentation | Flowmeter | -- | Flowmeters | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22K | Plant No. 2 | Secondary - Trickling Filters | -- | Civil | Piping | -- | Trickling Filters Piping | 2012 | P2-90 | 75 | 20 | None | None | 67 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Instrumentation | PLC | -- | PLC | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Instrumentation | Flowmeter | -- | Flowmeters | 2012 | P2-90 | 30 | No Data | None | None | 22 | 3 | 2020 | 2035 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor A | Structural | Concrete Tank | -- | Solids Contact Reactor A Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor B | Structural | Concrete Tank | -- | Solids Contact Reactor B Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor C | Structural | Concrete Tank | -- | Solids Contact Reactor C Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Solids Contact Reactor D | Structural | Concrete Tank | -- | Solids Contact Reactor D Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor A | Structural | Concrete Tank | -- | Reaeration Reactor A Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor B | Structural | Concrete Tank | -- | Reaeration Reactor B Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor C | Structural | Concrete Tank | -- | Reaeration Reactor C Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Sludge Reaeration Reactor D | Structural | Concrete Tank | -- | Reaeration Reactor D Tank | 2012 | P2-90 | 100 | 50 | None | None | 92 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | Blower/WSS Building | Structural | Building | -- | Blower/WSS Building | 2012 | P2-90 | 60 | 20 | None | None | 52 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22M | Plant No. 2 | Secondary - Trickling Filters | -- | Civil | Piping | -- | -- | 2012 | P2-90 | 75 | 20 | None | None | 67 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Structural | Clarifier | -- | Circular Clarifier A | 2012 | P2-90 | 75 | 20 | None | None | 67 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Structural | Clarifier | -- | Circular Clarifier B | 2012 | P2-90 | 75 | 20 | None | None | 67 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Structural | Clarifier | -- | Circular Clarifier C | 2012 | P2-90 | 75 | 20 | None | None | 67 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |

| Area | Sub-Area | Facility | Process | Unit | Discipline | Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Structural | Clarifier | -- | Circular Clarifier D | 2012 | P2-90 | 75 | 20 | None | None | 67 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Structural | Clarifier | -- | Circular Clarifier E | 2012 | P2-90 | 75 | 20 | None | None | 67 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Structural | Clarifier | -- | Circular Clarifier F | 2012 | P2-90 | 75 | 20 | None | None | 67 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station A | Structural | Building | -- | RSS Pump Station A Building | 2012 | P2-90 | 60 | 20 | None | None | 52 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station B | Structural | Building | -- | RSS Pump Station B Building | 2013 | P2-91 | 60 | 20 | 2013 | 7 | 13 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | RSS Pump Station C | Structural | Building | -- | RSS Pump Station C Building | 2014 | P2-92 | 60 | 20 | 2014 | 6 | 14 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier A | Mechanical | Collector Drive | 22NCLR020 | Clarifier A Sludge Collector | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier B | Mechanical | Collector Drive | 22NCLR060 | Clarifier B Sludge Collector | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier C | Mechanical | Collector Drive | 22NCLR100 | Clarifier C Sludge Collector | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier D | Mechanical | Collector Drive | 22NCLR140 | Clarifier D Sludge Collector | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier E | Mechanical | Collector Drive | 22NCLR180 | Clarifier E Sludge Collector | 2012 | P2-90 | 20 | 10 | 2019 | 1 | 9 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | Clarifier F | Mechanical | Collector Drive | 22NCLR220 | Clarifier F Sludge Collector | 2012 | P2-90 | 20 | 10 | None | None | 12 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Structural | Building | -- | Distribution Center Building | 2012 | P2-90 | 60 | 20 | None | None | 52 | 1 | 2020 | 2045 | X-031 | 2036 | 2040 |
| 22 | 22N | Plant No. 2 | Secondary - Trickling Filters | -- | Mechanical | Ventilation | -- | Distribution Center J HVAC | 2012 | P2-90 | 30 | 15 | None | None | 22 | 2 | 2020 | 2040 | X-031 | 2036 | 2040 |

| Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Force Main | -- | Ductile Iron Force Main | 1975 | 2-16-2 | 50 | 30 | None | None | 5 | 3 | 2015 | 2030 | 2-73 | 2023 | 2028 |
| Pump Room | 52BROOM321 | Pump Room Structure | 1974 | 2-15 | 75 | No Data | None | None | 29 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Electrical Room | 52BROOM322 | Electrical Room Structure | 1974 | 2-15 | 75 | No Data | None | None | 29 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Pump Station | 52BSTRC001 | Pump Station Structure | 1974 | 2-15 | 75 | No Data | None | None | 29 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Wet Well | 52BSTRC326 | Wet Well | 1974 | 2-15 | 75 | 20 | None | None | 29 | 3 | 2018 | 2033 | 2-73 | 2023 | 2028 |
| Valve Pit | 52BSTRC327 | Valve Pit | 1974 | 2-15 | 75 | No Data | None | None | 29 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| MCC | 52BMCC129 | Motor Control Center | 1974 | 2-15 | 40 | 5 | 2020 | 0 | 5 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Motor | 52BMTR051 | Exhaust Fan Motor | 1974 | 2-15 | No Data | No Data | 2003 | 17 | No Data | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Motor | 52BMTR053 | Supply Fan Motor | 1974 | 2-15 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Motor | 52BMTR300 | Main Sewage Pump No. 3 Motor | 1974 | 2-15 | No Data | No Data | 2016 | 4 | No Data | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Motor | 52BMTR400 | Main Sewage Pump No. 4 Motor | 1974 | 2-15 | No Data | No Data | 2014 | 6 | No Data | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Motor | 52BMTR500 | Main Sewage Pump No. 5 Motor | 1974 | 2-15 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Receptacle | 52BREC125 | Portable Engine Generator Plug | 1974 | 2-15 | 10 | No Data | None | None | -36 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Switchgear | 52BSWGR125 | Switchgear | 1974 | 2-15 | 40 | 5 | 2020 | 0 | 5 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| UPS | 52BUPS060 | Uninterruptable Power Supply | 1974 | 2-15 | 10 | 5 | 2015 | 5 | 0 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Transformer | 52BXFMR134 | Transformer | 1974 | 2-15 | 50 | No Data | None | None | 4 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Flowmeter | 52BFE075 | Magnetic Flowmeter | 1974 | 2-15 | 30 | No Data | None | None | -16 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| PLC | 52BU036 | PLC | 1974 | 2-15 | 30 | No Data | 2013 | 7 | No Data | 1 | 2020 | 2045 | 2-73 | 2023 | 2028 |
| Crane | 52BCRN261A | Manual Hoist Crane; Pumps | 1974 | 2-15 | No Data | No Data | None | None | No Data | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Fan | 52BFAN051 | Exhaust Fan | 1974 | 2-15 | 20 | 5 | 2016 | 4 | 1 | 2 | 2020 | 2040 | 2-73 | 2023 | 2028 |
| Fan | 52BFAN053 | Supply Fan | 1974 | 2-15 | 20 | 5 | 2016 | 4 | 1 | 2 | 2020 | 2040 | 2-73 | 2023 | 2028 |
| Valve | 52BGV078 | Force Main Isolation Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Valve | 52BGV078A | Emergency Pumping Bypass Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Valve | 52BGV300 | MSP No. 3 Suction Side Isolation Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Valve | 52BGV300A | MSP No. 3 Discharge Side Isolation Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Valve | 52BGV400 | MSP No. 4 Suction Side Isolation Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Valve | 52BGV400A | MSP No. 4 Discharge Side Isolation Valve | 1974 | 2-15 | 40 | 10 | 2001 | 19 | -9 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |

| Asset | Loop Tag No. | Description | Year Built/ Installed | Original Project No. | Theoretical Useful Life (SP-151) | Rehab Cycle (SP-151) | Rehab/Replace-ment Date | Years Since Last Rehab | Theoretical Remaining Useful Life (years) | Field Adjusted Remaining Useful Life | Data Year | Estimated End of Life | Upcoming Project | Upcoming Construction Start | Upcoming Construction End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Valve | 52BGV500 | MSP No. 5 Suction Side Isolation Valve | 1974 | 2-15 | 40 | 10 | 2018 | 2 | 8 | 1 | 2020 | 2045 | 2-73 | 2023 | 2028 |
| Valve | 52BGV500A | MSP No. 5 Discharge Side Isolation Valve | 1974 | 2-15 | 40 | 10 | 2001 | 19 | -9 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Valve | 52BCV305 | MSP No. 3 Check Valve | 1974 | 2-15 | 40 | 10 | 2013 | 7 | 3 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Valve | 52BCV405 | MSP No. 4 Check Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Valve | 52BCV505 | MSP No. 5 Check Valve | 1974 | 2-15 | 40 | 10 | None | None | -6 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Pump | 52BPMP300 | Main Sewage Pump No. 3 | 1974 | 2-15 | 40 | 20 | 2020 | 0 | 20 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |
| Pump | 52BPMP400 | Main Sewage Pump No. 4 | 1974 | 2-15 | 40 | 20 | 2014 | 6 | 14 | 3 | 2020 | 2035 | 2-73 | 2023 | 2028 |
| Pump | 52BPMP500 | Main Sewage Pump No. 5 | 1974 | 2-15 | 40 | 20 | 2020 | 0 | 20 | 4 | 2020 | 2030 | 2-73 | 2023 | 2028 |

# Appendix H
# Asset Management Study (SP-151)

# SP-151
# Asset Management Study

Prepared for

Orange County Sanitation OCSD
Fountain Valley, California

April 3, 2012

# SP-151 Asset Management Study
# Project Report: Asset Class Useful Lives, Rehabilitation and Key Maintenance Activities

Prepared for
Orange County Sanitation OCSD
Fountain Valley, California
April 3, 2012

Project No. 142241

Brown AND Caldwell
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Irvine, California 92612

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# List of Acronyms

| | |
|---|---|
| AQMD | Air Quality Management District |
| BC | Brown and Caldwell |
| CCTV | closed-circuit television |
| CIPP | cured-in-place pipe |
| DIP | ductile iron pipe |
| FRP | fiberglass reinforced plastic |
| GHD | Consulting firm which developed TEAMPlan model |
| HDPE | high density polyethylene pipe |
| $H_2S$ | Hydrogen Sulfide |
| I&C | Instrumentation and Controls |
| I/I | infiltration/inflow |
| IR | Infrared |
| MCC | Motor Control Center |
| OCSD | Orange County Sanitation District |
| OOBS | Ocean Outfall Booster Station |
| OIT | Operator Interface Terminal |
| PLC | programmable logic controller |
| PM | preventative maintenance |
| PVC | polyvinyl chloride |
| R&R | rehabilitation and replacement |
| RCB | reinforced concrete box |
| RCP | reinforced concrete pipe |
| RIO | reconfigurable input/output |
| SSO | sanitary sewer overflow |
| TEAMPlan | Asset management model used by GHD to forecast replacement and rehabilitation costs |
| UPS | Uninterruptable Power Supply |
| VAC | Volts Alternating Current |
| VCP | vitrified clay pipe |
| WWTP | wastewater treatment plant |

## SP-151 Asset Management Study

# Project Report: Asset Class Useful Lives, Rehabilitation and Key Maintenance Activities

# 1 Background of Project

## 1.1 Project Objective and Scope

Orange County Sanitation District (OCSD) uses the TEAMPlan model to forecast renewal (rehabilitation and replacement [R&R]) capital funding needs. The TEAMPlan model was prepared for OCSD by GHD and is currently being updated. The model includes a broad listing of OCSD asset classes which are maintained by OCSD. For each asset class, the model includes the count of the particular asset class, the value assigned to the class, the expected useful life, and the rehabilitation frequency before the asset reaches the end of its life.

Under the SP-151 project, Brown and Caldwell (BC) was engaged by OCSD to review and validate the data in the TEAMPlan model and provide recommended updates where appropriate. The primary objective of this work was to provide OCSD with a higher level of confidence in the useful life and rehabilitation frequencies which are key inputs to the model.

The TEAMPlan model includes over 300 asset classes; however, the bulk of the value in the model is concentrated on a limited number of very high value assets. For the purposes of the SP-151 project, OCSD and BC identified 110 asset classes which would be reviewed under the SP-151 project. These 110 classes represented over 98 percent of the total value of OCSD assets within the model. This group of reviewed assets were referred to as the "in list;" those asset classes not reviewed were referred to the as the "out list."

A summary of the "in list" asset classes which were evaluated as part of the project are listed in the tables provided in Appendix A. Additional asset classes which were added as a result of discussions and recommendations made during the workshops are also provided in Appendix A.

BC's review of the asset classes were focused on the following asset class areas:

- Civil Structures
  - Process and non-process civil structures
  - Collection system piping
- Mechanical
- Electrical
- Instrumentation & Controls

For each asset class area, a BC subject matter expert reviewed the data in the model and then facilitated a workshop with OCSD staff to make recommendations to values used in the model. For each asset class, the following key elements were discussed and reviewed within the workshop:

- Asset class appropriateness
- Asset useful life
- Rehabilitation interval (if any)
- Number of rehabilitation activities
- Maintenance activities required to achieve useful life
- Valuation

## 1.2 Workshops Conducted

Table 1-1 below lists the workshops which were conducted by BC subject matter experts and OCSD staff to discuss each of the assets on the in list.

**Table 1-1. Workshops Conducted**

| Workshop | Date | Location |
|---|---|---|
| SP-151 Kickoff Meeting | 1/16/12 | BC Irvine Conference Room 1 |
| Civil / Structural | 1/24/12 | BC Irvine Conference Room 1 |
| Civil/Collection System | 1/25/12 | Plant 1 - Administration building - Conference Room C |
| Electrical | 1/30/12 | Plant 1 - Eng. & Const. Conference Room 2 |
| Mechanical | 1/30/12 | Plant 1 - Administration building - Conference Room A |
| Instrumentation | 1/31/12 | Plant 1 - Administration building - Conference Room C |

## 1.3 Project Findings & Recommendations

As result of the review by BC staff, and the discussions during the workshop, BC provided recommended updates to the values in the GHD TEAMPlan model. These recommended updates were provided as new entries into a GHD-provided spreadsheet. BC's recommended values are provided in Appendix A.

Where appropriate, discussions and recommendations surrounding a particular asset class are summarized in this report.

There were some asset classes which were identified as too broad. In these cases, a recommended approach to a more narrow set of classes was provided during the workshop.

## 1.4 Cost Estimator Review

During the review process, some of the asset classes were identified as clear outliers with respect to the expected reasonable unit cost for the asset. Some of these asset classes were reviewed by BC cost estimating staff, which provided a recommended range of expected values for these classes. The estimator's data is summarized later in this report. At the time of BC's review of the data output from the TEAMPlan model, there were still many assets which had no counts or values. Estimating the quantity or costs of these assets was not part of the scope of this project.

# 2 Civil Collection System Workshop

The Collection System Asset Class Review workshop was conducted on January 25, 2012 from 8 a.m. to 4 p.m. The workshop started by reviewing the purpose of the workshops, as identified at the beginning of this document, then reviewing the asset classes that were previously targeted to be discussed as a group. Initial discussions of the workshop are described below in Section 2.1, and included an overall state of the collection system, and current maintenance practices. The majority of the discussion during the workshop was related to specific asset classes, as described in the following sections.

## 2.1 Overall Sewer Collection System

### 2.1.1 Appropriateness of Asset Class

Collection system pipes and manholes have several failure methods which impact their useful lives. Failure of a collection system is typically related to sanitary sewer overflows (SSOs). SSO causes can be grouped into three basic categories: structural, maintenance, and capacity. This analysis focuses on structural failure caused by deterioration of the structural capacity of a pipeline which can result in a collapse that results in an SSO.

Maintenance failures are typically caused by roots, grease, or other debris that blocks all or part of the pipe resulting in an SSO. OCSD mitigates and prevents maintenance failures with its maintenance program. The pipes typically do not require replacement or rehabilitation to address maintenance issues. Consequently, maintenance-related failures will not be considered in this analysis.

Capacity failures occur when peak flows exceed the hydraulic capacity of the pipes. Capacity problems can occur because of growth in the tributary area of a pipe or upstream infiltration and inflow (I/I). OCSD has performed extensive hydraulic modeling of the collection system and has identified pipes with current or future hydraulic capacity issues. OCSD uses this information to prevent hydraulic capacity failures. OCSD has also determined that I/I rates are low. Capacity related failures will not be considered in this analysis.

Obsolescence is a failure mode that can apply to electronic and mechanical equipment. It does not apply to collection systems.

With the focus of this analysis on structural condition, collection system assets are divided into subclasses by pipe material. Pipes made of materials that corrode can be further divided into being located in corrosive or non-corrosive environments.

Collection systems are often evaluated from several perspectives, including individual pipe reaches, pipelines, or areas. Individual pipe reach condition assessments are based on closed-circuit television (CCTV) and other inspection methods. Rehabilitation is based on the results of the inspections and is performed on an individual pipe reach basis.

Corrosion often occurs on a pipeline basis. Trunk sewer pipelines can convey septic wastewater that generates sulfides which leads to corrosion. Pipelines are also typically constructed of a single material during a project (for a specific reach) such as a reinforced concrete pipe (RCP) gravity sewer or ductile iron pipe (DIP) force main. This combination of corrosion potential and pipe material make pipelines a useful perspective for remaining life analysis.

Area analysis is typically used to evaluate I/I and legacy issues resulting from the initial construction of the collection system. The collection system has minor I/I which is not a factor in the remaining life analysis. No legacy issues such as undersized (6-inch) pipe or areas with very flat slopes have been identified.

### 2.1.2 Rehabilitation

Collection system rehabilitation approaches depend on the pipe material and diameter and on the nature of the failure. Rehabilitation typically consists of lining the existing pipe with a plastic or polymer liner. Various construction techniques and materials are available for lining and the liner pipe is typically designed to resist the failure mechanism. For example, a pipeline that is corroded is lined with corrosion resistant material. This precludes the need to rehabilitate the pipe at another time in future. If the liner or rehabilitated pipe does fail in the future, it would be replaced.

The useful life of liners is estimated to be 50 years. This is based on the long-term modulus of the material which is a key factor in resisting groundwater and other loads on the liner.

### 2.1.3 Key Maintenance

OCSD performs a variety of maintenance activities on the collection system to ensure proper operation and long useful lives of its assets. The key maintenance activities related to useful life for this analysis are:

- **Root control.** Roots can cause cracks in pipe which can lead to structural failure.
- **Inspection.** CCTV inspection is used to identify pipes that are corroding or have structural problems. Early detection of these problems allows pipes to be rehabilitated instead of failing and being replaced. Inspections occur on about a 7-year cycle.
- **Spot repairs.** Spot repairs are typically performed at specific locations to address isolated structural problems. Repairing pipes lets the timing of full rehabilitation be extended. The primary spot repair is related to manhole frames and covers.
- **Chemical addition.** Chemicals can be added to the collection system to control sulfides, which are the principle source of interior corrosion of reinforced concrete pipe and manholes.
- **Cathodic protection.** Cathodic protection systems protect metallic pipe from corrosive soils.
- **Plastic liner repairs.** T-lock and other plastic liner systems need periodic repairs to address failing weld strips and loose plastic sheets.

Other maintenance activities that are not as directly related to remaining life include:

- Maintenance of easements to maintain easements to be clear and accessible.
- Cleaning frequency is 5 years for pipe 42 inches and smaller.
- Manhole inspections are scheduled at 5-year intervals.

## 2.2 Vitrified Clay Pipe

### 2.2.1 Background

Vitrified clay pipe (VCP) is a typical material for constructing smaller and medium sized portions of collection systems. While VCP has been manufactured for many decades, a significant improvement in its joints occurred around 1960. Nationally, the improved joints have typically resulted in pipelines with less infiltration of groundwater and fewer root problems. For this analysis, VCP can be divided into pre-1960 and post-1960; with post-1960 pipe further divided by diameter into less than or equal to 8-inch and greater than 8-inch. The VCP asset class is divided by diameter because 8-inch-diameter pipe is

considered the minimum acceptable diameter and existing 6-inch and 8-inch VCP should consequently by replaced and not rehabilitated because of the resulting reduction in diameter caused by rehabilitation.

### 2.2.2 Maintenance

The primary maintenance activities associated with VCP are cleaning and CCTV inspections. Cleaning that controls roots is important in maintaining the useful life of the pipe reaches. CCTV inspection is typically on a 7-year cycle and is used to catalog and track defects and identify where spot repairs or pipe reach rehabilitation is needed.

### 2.2.3 Expected Useful Life and Rehabilitation Interval

The useful life of pre-1960 VCP is estimated at 50 years while post-1960 VCP useful life is estimated at 75 years. While smaller diameter pipes are typically replaced, larger diameter pipes can be rehabilitated by lining pipe reaches. Lining can address excessive infiltration and structural problems, such as cracks. Rehabilitation of VCP is expected to extend the total life of the pipe an additional 50 years.

## 2.3 RCP Pipe

### 2.3.1 Background

RCP is typically used for medium and large diameter pipelines. RCP is subject to interior corrosion related to hydrogen sulfide ($H_2S$) and can be manufactured with a polyvinyl chloride (PVC) liner (T-lock) cast into the pipe. For this analysis, RCP is divided into three asset groups: RCP with PVC lining; RCP without PVC lining in areas with low corrosion potential; and RCP without PVC lining in areas with high corrosion potential.

OCSD has been installing RCP with T-lock lining for many years. OCSD was one of the first agencies to require PVC lining and has some of the very early black PVC liner which predated T-lock and was attached by adhesive strips. T-lock typically covers the top 270 to 300 degrees of the pipe since low flows are assumed to keep the unprotected bottom of the submerged and therefore protected from corrosion. If initial flows in the pipeline are too small, the pipe wall below the T-lock is exposed and subject to corrosion. The primary problems with RCP with T-lock are blisters and weld strip failures. Occasionally blisters form because of small pinholes and $H_2S$ contamination and some pipes have multiple blisters per joint; however, weld seams are a larger problem than pinholes.

### 2.3.2 Maintenance

The primary maintenance activity associated with RCP is CCTV inspections. Corrosion and defects in T-lock liners are catalogued, tracked and corrected as needed to maintain the function of the system. Weld strips should be monitored every 5 years with any failures repaired. Repairs are made on RCP with T-lock that is 48-inch and larger in diameter. The repairs to the T-lock are made manually. Man-entry and repairs in smaller diameter RCP is considered impractical. The maintenance strategy for RCP that does not have T-lock and for smaller RCP with T-lock is to monitor until rehabilitation is needed. Rehabilitation is typically needed when rebar is exposed (condition ratings of 4 or 5), although rehabilitation prior to exposing rebar may reduce preparation work required for rehabilitation.

Another maintenance activity used by OCSD is chemical addition to reduce sulfides and $H_2S$ levels in the pipelines. OCSD adds Magnesium Hydroxide to several RCP pipelines and is considering expanding this program.

### 2.3.3 Expected Useful Life and Rehabilitation Interval

The expected life of RCP depends on whether it has T-lock lining and the sulfide levels in the wastewater. RCP without T-lock in high $H_2S$ areas is expected to last 40 years in this environment. If the RCP has T-lock, it would be expected to last approximately 75 years before needing rehabilitation. RCP without T-lock in low $H_2S$ areas are also expected to last approximately 75 years. Rehabilitation would consist of adding a cured-in-place pipe (CIPP) or slipliner that would prevent future corrosion and can be designed to address structural problems also. During maintenance, the liner should be inspected and the pipes should be repaired as needed.

Rehabilitation of a solution would expect to extend the life of the pipe an additional 50 years. Pipe reaches are anticipated to be rehabilitated once before being replaced. Replacement RCP would be T-lock lined.

## 2.4 Manholes (Trunk Sewers Only)

### 2.4.1 Background

Manholes are divided by location as trunk sewer manholes and other manholes (see below). Most manhole failures are corrected with frame and cover replacement. Manholes on trunk sewers are also subject to $H_2S$ corrosion. T-lock lining of manholes walls started in the 1970s, which left the benches and channels subject to corrosion. Beginning in the 1990s, lining was extended to include the benches and channels. As with T-lock RCP, manholes are subject to weld strip failures. The liners for the benches and channels are more prone to failure.

### 2.4.2 Maintenance

Manholes are periodically inspected. OCSD replaces frames and covers as needed and repairs defects in the T-lock lining. Inspected

### 2.4.3 Expected Useful Life and Rehabilitation Interval

The expected useful life for manholes is 50 years. Rehabilitation consists of installing a new liner or applying a coating in the manhole. The new lining is expected to last 25 years and can be replaced once after 25 years. The total useful life of a manhole with the two anticipated rehabilitations is 100 years.

## 2.5 Manholes (Non-trunk Sewers Only)

### 2.5.1 Background

Non-trunk sewer manholes are subject to frame and cover failures and corrosion, although corrosion potential is much lower than with trunk sewer manholes. Frame and covers are replaced. Non-trunk sewer manholes typically do not have lining since the corrosion potential is reduced. Consequently, there is no need for liner repairs.

### 2.5.2 Maintenance

Manholes are inspected periodically and frames and covers are replaced as needed.

### 2.5.3 Expected Useful Life and Rehabilitation Interval

The expected useful life of non-trunk sewer manholes is 75 years. At that time, it is expected that the manholes are rehabilitated and the rehabilitation will extend their useful lives by another 50 years.

## 2.6 Gravity Ductile Iron Pipe

### 2.6.1 Background

Gravity DIP in OCSD typically has a short life because of exterior and interior corrosion. Exterior corrosion is due to aggressive soils and no cathodic protection or other effective systems to control exterior corrosion. All but a short section of DIP pipeline in Newport Beach is already rehabilitated with a structural CIPP solution because of exterior corrosion. OCSD has experienced some interior corrosion which can be caused by galvanic corrosion or high $H_2S$. Galvanic corrosion leads to a decrease in pipe diameter.

### 2.6.2 Maintenance

DIP is inspected using CCTV and the results are used to track interior corrosion. Exterior corrosion is not tracked because the pipelines typically are not bonded and do not have test cells to measure corrosion potential.

OCSD is using magnesium hydroxide to control sulfides and $H_2S$ levels in some pipelines. This program could be extended to include DIP pipelines if appropriate.

### 2.6.3 Expected Useful Life and Rehabilitation Interval

The expected useful life for DIP is 30 years because of exterior and interior corrosion. Most DIP subject to exterior corrosion is already rehabilitated by CIPP. The remaining DIP is primarily subject to interior corrosion. Interior galvanic corrosion byproducts choke down the diameter of the pipeline reducing its hydraulic capacity. These byproducts are very difficult to remove, which makes rehabilitation infeasible.

## 2.7 Force (Pressure) DIP

### 2.7.1 Background

Force mains constructed of DIP typically have short lives due to exterior corrosion. Exterior corrosion is due to aggressive soils and no cathodic protection or other effective systems to control exterior corrosion. OCSD has several DIP force mains including a 42-inch force main at Seal Beach Pump Station, a ½-mile force main at the Yorba Linda Pump Station, and a dual barrel force main at the Main St. Pump Station for a total of 2 miles. However the majority of the DIP force main is within the Newport Force main which is under study and design for rehabilitation.

### 2.7.2 Maintenance

Inspection is completed using remote sensing equipment. This process requires access ways.

### 2.7.3 Expected Useful Life and Rehabilitation Interval

The expected useful life is 30 years because of aggressive soils. Force mains can be rehabilitated although bends and fittings can make rehabilitation difficult. Rehabilitation is by installing a lining that is designed to withstand the internal and external forces as the DIP corrodes. The lining is expected to extend the useful life of the pipeline by 50 years.

## 2.8 PVC Pipe Gravity

### 2.8.1 Background

PVC is a common material for small sewer pipes. PVC pipe has been available for a relatively short period of time and has performed very well. Typically, PVC sewers have very few structural issues since PVC does not crack while VCP does. Since PVC pipe is still relatively new and still performing well, its useful life has not been firmly established.

### 2.8.2 Maintenance

The primary maintenance activities associated with PVC pipe are cleaning and CCTV inspections. Cleaning that controls roots is important in extending the useful life of the pipe reaches. CCTV inspection is typically on a 7-year cycle and is used to catalog and track defects and identify where spot repairs or pipe reach rehabilitation is needed. As noted above, spot repairs are rare and rehabilitation is typically not needed.

### 2.8.3 Expected Useful Life and Rehabilitation Interval

The useful life for PVC pipe is projected to be 100 years. This projection is based on the performance of PVC pipe over the last several decades since no PVC pipe is 100 years old and the fact that almost all PVC pipe is still performing well. The principle anticipated failure mode for PVC pipe is deformation due to long term creep of the PVC material. Rehabilitation methods would not reduce the existing deformation and therefore would likely not be effective in extending the useful life of a PVC pipe. Therefore, rehabilitation of PVC pipe is not anticipated as a method to extend the pipe life.

## 2.9 PVC Pipe Force Main

### 2.9.1 Background

PVC pipe can be used for force mains. OCSD has two parallel PVC pipe encase in concrete to protect from live loads because of their shallow depths. The pipelines pressurizes during high flow conditions. Force mains are subject to cyclic changes in internal pressure due to the operation of the upstream pumps. The cyclic pressure changes can cause fatigue failures in PVC pipe.

PVC pipelines typically have metallic fittings and joint restraints which are subject to exterior corrosion. As noted above, OCSD typically does not have cathodic protection systems which would protect metallic fittings and joint restraints.

### 2.9.2 Maintenance

Inspection is completed using remote sensing equipment. This process requires access ways. Inspection does not evaluate the cyclic loading of the force main.

### 2.9.3 Expected Useful Life and Rehabilitation Interval

The expected useful life of a PVC force main is 50 years. This is less than gravity PVC pipe due to cyclic loading. This is the assumed criteria used when designing the force mains. At the end of its useful life, a force main will be replaced.

## 2.10 Reinforced Concrete Boxes

### 2.10.1 Background

Reinforced concrete boxes (RCBs) are used to convey gravity flows like large diameter pipelines. The boxes have T-lock lining similar to RCP for corrosion protection. Also similar to RCP, the T-lock requires periodic repairs to address weld strips and other problems.

### 2.10.2 Maintenance

The primary maintenance activity associated with RCB is CCTV or manned inspections. Corrosion and defects in T-lock liners are catalogued, tracked and corrected as needed to maintain the function of the system. The repairs to the T-lock are made manually.

Another maintenance activity used by OCSD is chemical addition to reduce sulfides and $H_2S$ levels in the pipelines and RCBs. OCSD adds Magnesium Hydroxide to several pipelines and is considering expanding this program.

### 2.10.3 Expected Useful Life and Rehabilitation Interval

The expected useful life for RCB is 100 years. Rehabilitation is typically not an option because of the shape of the boxes and reduction in cross sectional diameter resulting from lining. In some instances, however, rehabilitation may be the best solution (e.g., Project 1-17).

## 2.11 High Density Polyethylene Pipe Force Main

### 2.11.1 Background

High density polyethylene pipe (HDPE) can be used for force mains. Force mains are subject to cyclic changes in internal pressure due to the operation of the upstream pumps. The cyclic pressure changes cause fatigue failures in HDPE.

HDPE pipelines typically have metallic fittings, which are subject to exterior corrosion. As noted above, OCSD typically does not have cathodic protection systems which would protect metallic fittings.

### 2.11.2 Maintenance

Inspection is completed using remote sensing equipment. Inspection technologies require access ways or launch areas. Inspection does not evaluate the cyclic loading of the force main.

### 2.11.3 Expected Useful Life and Rehabilitation Interval

The expected useful life of a HDPE force main is 50 years with failure caused by cyclic loading. This is typically the assumed criteria used when designing the force mains. At the end of its useful life, a HDPE force main will be replaced rather than rehabilitated.

## 2.12 Gravity CIPP

### 2.12.1 Background

CIPP is used to rehabilitate existing pipe that is corroded or experiencing other problems. CIPP results in a new resin pipe inside the existing pipe and can be designed to withstand the full loading on the existing pipe. CIPP is highly corrosion resistant and does not deteriorate even in areas with high $H_2S$ levels. CIPP is typically designed assuming a 50 year useful life.

### 2.12.2 Maintenance

The primary maintenance activities associated with CIPP are cleaning and CCTV inspections. Roots are not an issue with CIPP since the CIPP does not have joints. CCTV inspection is typically on a 7-year cycle and is used to catalog and track defects and identify where spot repairs are needed. As noted above, spot repairs are rare.

### 2.12.3 Expected Useful Life and Rehabilitation Interval

The expected useful life for CIPP is 50 years as discussed above. Rehabilitation of CIPP is not anticipated because of the reduction in pipe cross section area.

## 2.13 Wet Wells and Pits (Collection System)

Collection system wet wells and pits should be modeled after plant wet well components in the plant structures area.

# 3 Civil Structures Workshop

The asset classes in the civil structures area workshop was conducted on January 24, 2102. Below is a summary of signification discussions and recommendations related to those assets in this area. BC suggested values for asset life, rehabilitation interval and frequency are provided in Appendix A.

## 3.1 Structures

### 3.1.1 Appropriateness of Asset Class

Structures was broken into two groups, “Process Structures” and “Non-Process Structures.” For many process structures, the overall recommendations described below for “Structures - Process” applies.

### 3.1.2 Structures - Processes

It is suggested that process structures includes the following, Preliminary Treatment related structures

- Primary Treatment related structures
- Secondary Treatment related structures
- Electrical Distribution Structures

It was agreed during the workshop that all of these process structures will have similar expected useful life of 75 years. Suggested refurbishment and inspection actives for Process Structures are provided below.

**Rehabilitation:**

1. Roof replacement and minor repair (repair of spalling, cracking, etc.) every 20 years.
2. Rehabilitation of wet wells every 20 years. The group discussed the need to consider full bypass for inspection costs.

**Inspection Activities:**

- Inspection activities every 10 years for substantial structure (maintenance, non-refurbishment).
- Full inspection of wet wells every 10 years, may consider partial inspection every 5 years.

**Other Changes:** Process changes, code changes, or other functional requirements may affect structures’ expected lives.

### 3.1.3 Structures - Non-Process

Non-process have an expected useful life of 40 years, based on OCSD needs. The driver for this class expected useful life would be expected to be obsolescence.

**Rehabilitation:** Major refurbishment including roof replacement and major rehabilitation to the interior of the structure, including electrical, HVAC, plumbing expected after 20 years of original construction. This refurbishment cost may be on the order of 50 percent of replacement value.

**Inspections:** Inspection activities every 10 years (maintenance, non-refurbishment) would be anticipated.

## 3.2 Outfall

### 3.2.1 Appropriateness of Asset Class

The outfall class should be divided into two sections: (1) the RCP ocean outfall section; and (2) the steel land section of the outfall piping. Each section has different related rehabilitation activities.

## 3.3 RCP (Ocean) Section of Outfall

The ocean portion of the outfall is constructed of RCP and ballasted with rock.

### 3.3.1 Key Maintenance/Rehabilitation Activities

Specific planned rehabilitation to include:

- Replacement of Flap Gate every 50 years. Note that the flap gate had been repaired in 1992 (approximately).
- Inspection and replacement of Ballast every 50 years.
- The intervals between inspections/assessments will likely shorten as the asset ages. The current intervals for inspection of the interior of the pipe is expected every 20 to 25 years.

## 3.4 Steel (Land) Section of Outfall

The land section of this class includes the steel which flows to the concrete ocean section of the outfall.

### 3.4.1 Key Maintenance/Rehabilitation Activities

At a 60-year expected useful life, refurbishments on the coated steel section of the outfall should be anticipated at 20-year rehabilitation interval. BC suggests breaking rehabilitation/maintenance activities for this class into two groups:

1. Specific planned rehabilitation to include:
   - Recoating every 20 years (based on recoating of pipe this year)
2. Inspection/assessment (maintenance activities) will likely shorten interval as the asset ages:
   - Inspection of interior every 10 years and touch up, as necessary
   - Maintaining external corrosion system (cathodic protection)

## 3.5 Digesters

### 3.5.1 Appropriateness of Asset Class

It is recommended that this class be split into two subclasses to model the refurbishment and replacement activities and intervals. The first class is the Digester tank itself and the second is the digester domes.

### 3.5.2 Key Maintenance/Rehabilitation Activities

Recommended activities include:

- **Digester Tanks:** Digester tanks would fall under the same recommended expected useful life as the Process Structure class described above.
- **Digester Domes:** All digesters are steel and concrete fixed covers. The limiting factor on steel is the integrity of the coatings, therefore:
  - Replacement of the bare (sub asset class) digester domes with T-lock roof system would be anticipated every 50 years. This starts with the next rehabilitation cycle. One interval of this type until the end of the digester's useful life would be expected. This work effectively renews the digester back to like-new condition (based on OCSD's inspection of great shape of floor and walls).
  - Rehabilitation: The rehabilitation interval is expected to be 20 year intervals. Rehabilitation consists of coating on manways and other steel components.
  - Maintenance/Inspection: Inspection intervals every 5 to 10 years coincide with the digester cleaning program would be expected. (Note: they are currently planned for 5-year intervals). Inspect and repair T-lock. Replacement of insulating foam every 20 years.

## 3.6 Tunnel

Tunnels are very sound, but the lids have issues. Therefore, refurbishment of the lids with increased loading criteria will be needed. Note that pipe replacement might coincide with the tunnel rehabilitation. It was noted that not all tunnels are covered and an estimate of percent covered tunnels and traffic loaded tunnels will need to be factored into the refurbishment costs. Some settlement has been encountered within some tunnels (differential settlement with pipes, etc.).

### 3.6.1 Appropriateness of Asset Class

This class is appropriate.

### 3.6.2 Key Maintenance/Rehabilitation Activities

Recommended activities include:

- A tunnel walk to inspect lids is recommended every 5 years.
- Rehabilitation interval is planned at 50 years which might include minor concrete repair.
- Rehabilitation for this class will consist of minor concrete repair and possible replacement of the tunnel lids. Minor asphalt maintenance may be needed.

## 3.7 Secondary Clarifier

### 3.7.1 Appropriateness of Asset Class

This class is appropriate.

### 3.7.2 Key Maintenance/Rehabilitation Activities

Recommended maintenance for the Secondary Clarifier class is as follows:

- Inspect 2- to 10-year intervals; minor touch up of concrete, handrails, etc.
- Inspection on joints and cover near the sludge removal gear and concrete near gate actuators.
- Inspection and maintenance/repair of handrail and gate fasteners due to corrosion of concrete at base.
- Rehabilitation every 20 years.

## 3.8 Thickeners

### 3.8.1 Appropriateness of Asset Class

This class is appropriate.

### 3.8.2 Key Maintenance/Rehabilitation Activities

Thickeners are the four DAFTs at Plant 2. A 100-year life overall can be expected, with inspections and rehabilitations as follows:

- Inspection at 10 years.
- Minor structural rehabilitation for spalling, minor crack repair, joints.
- Rehabilitation should be a small capital requirement for rehabilitation, can be expected to be 10 to 20 percent of replacement value.

## 3.9 Tanks

This class includes several types of tanks. BC suggests using 20-year life as an appropriate planning value.

### 3.9.1 Appropriateness of Asset Class

OCSD may consider breaking tanks into material or service types; however, variability of cost and life for different services and materials may not warrant adding this complexity to the model.

### 3.9.2 Key Maintenance/Rehabilitation Activities

See Appendix A for suggested rehabilitation interval values.

## 3.10 Grit Chamber

### 3.10.1 Appropriateness of Asset Class

This class is appropriate. The general recommendation for “Process Structures” apply to the Grit Chambers. This class includes the Grit Classifiers (one structure at each plant). These structures are T-locked which would suggest a 100-year life.

### 3.10.2 Key Maintenance/Rehabilitation Activities

Recommended activities include:

- Inspection every 10 years.
- Minor repair to structures (repair cracks, spalling, etc) every 20 years.

## 3.11 Surge Tower

The Surge Tower is a steel structure with a concrete base. This structure is approximately 50 years old and in good condition. Current conditions indicate that the a remaining life of 50 years with the maintenance and rehabilitation below is reasonable.

### 3.11.1 Appropriateness of Asset Class

This class is appropriate.

### 3.11.2 Key Maintenance/Rehabilitation Activities

Recommended activities include:

- Inspect and minor coating every 10 years.
- Full recoat every 20 years.

### 3.11.3 Valuation

During BC's work on this project, OCSD indicated that internally they had estimated the valuation of the surge tower to be between $5 and $6 million. This information was provided to GHD during this project for incorporation into the model.

## 3.12 Aeration Tanks

Plant 1 aeration tanks use air, while the Plant 2 aeration tanks use pure oxygen. This process difference between causes the wear characteristics to be quite different at the two plants. None of the aeration tanks are T-locked.

Plant 2 has an aeration tank project in which OCSD will be blasting carbonated concrete and recoating and identifying corroded rebar. A significant amount of cracking was described by OCSD staff. OCSD staff mentioned that a corrosion engineer has inspected the roof and determined that the cracking is shrinkage cracking.

### 3.12.1 Appropriateness of Asset Class

It is suggested that the aeration tanks be split into two separate asset classes: Plant 1 Aeration Tanks and Plant 2 Aeration Tanks. The aeration tanks at Plant 1 use air, while the aeration tanks at Plant 2 use oxygen. This causes the rehabilitation intervals to be significantly different between aeration tanks at Plant 1 and at Plant 2. The table in Appendix A provides suggested useful live for the two classes.

### 3.12.2 Key Maintenance/ Rehabilitation Activities

Recommended activities include:

- **Plant 1 Aeration Tanks:**
  - Plant 1 Aeration Tanks requires an inspection every 5 to 10 years. Diffusers are inspected every 5 years.
  - Minor rehabilitation every 20 years.
  - Medium rehabilitation in 50-year interval, but may need to be adjusted based on the results of the next inspection.
- **Plant 2 Aeration Tanks:** Current age of the Plant 2 facility is 30 years old. Once coated, it was determined that the following activities will be done:
  - Inspection 5 years after this next rehabilitation and then every 10 years thereafter.

- Major rehabilitation now; then rehabilitation, including recoating frequency should be every 20 years, but may require more major rehabilitation in 10 years.
- Major rehabilitation at age 50 (approximately 2030) to replace roof completely.

## 3.13 Primary Clarifiers

It is expected that useful life of a clarifier will be 100 years. There is currently a need to replace the Plant 1 circular clarifiers and raise the level 4 feet. Plant 1 clarifier replacement is scheduled for 2016.

### 3.13.1 Appropriateness of Asset Class

This class is appropriate.

### 3.13.2 Key Maintenance/ Rehabilitation Activities

Recommended activities include:

- Expected maintenance/rehabilitation activities for primarily clarifiers is described below; 10-year inspection.
- Twenty-year recoat.
- Major rehabilitation includes replacement of outer launder walls and replacement of covers at 50 years.

## 3.14 Trickling Filters

It is expected that useful life of a trickling filter will be 100 years.

### 3.14.1 Appropriateness of Asset Class

This class is appropriate.

### 3.14.2 Key Maintenance/ Rehabilitation Activities

Expected maintenance and rehabilitation activities for primary clarifiers is described below:

- Ten-year inspection, including media.
- Twenty-year recoat.
- Replacement of media every 50 years.
- Major rehabilitation including replacement of outer launder walls and replacement of covers at 50 years.

## 3.15 Junction Box

It was discussed in the workshop that that there are approximately 30 junction boxes. All junction boxes are coated (T-locked) concrete boxes.

### 3.15.1 Appropriateness of Asset Class

This class is appropriate.

### 3.15.2 Key Maintenance/ Rehabilitation Activities

Recommended activities include:

- Full inspection of wet wells every 10 years.
- May consider partial inspection every 5 years.

- Rehabilitation consisting of minor repair at junction box every 20 years.

## 3.16 Plant Piping

It is suggested that different useful live and inspection frequencies be used based on pipe service, material and installation details. Key drivers for plant piping life and inspection intervals are

- Capacity;
- Process Changes;
- Condition;
- Insulation (typically shorter lives are seen on insulated pipe); and
- In general, Utility and Plant piping should be considered to have a 15 year useful life:
  - Fiberglass reinforced plastic (FRP) piping should be considered to have a 50 year expected useful life with a 25-year inspection interval, with no rehabilitation.

### 3.16.1 Appropriateness of Asset Class

Appendix A provides the updated asset classes related to plant piping.

## 3.17 Easements

During the workshop, the group discussed OCSD interest in gathering cost of easements and grounds. It is suggested that GHD add these new asset classes and OCSD will provide value to use in the model for easements.

## 3.18 Sludge Drying Bed

Sludge drying beds should not be rehabilitated but replaced. Their useful life is approximately 50 years.

# 4 Electrical System Workshop

The workshop to review the asset classes in the electrical category was conducted on January 30, 2102. Below is a summary of signification discussions and recommendations related to those assets in this area. BC suggested values for asset life, rehabilitation interval and frequency are provided in Appendix A.

## 4.1 Motor Control Center

The definition of a Motor Control Center (MCC) count unit value in the model was unclear. The definition of one count unit in this class should be defined and then verified in the model.

It is unclear if high voltage starters for the 4160V blowers are included in this class with the more common 480VAC starter hardware. The unit cost for these devices are significantly different than those for 480VAC hardware.

Future arc flash study results, or code changes, may drive upgrade/rehabilitation based on results of studies in advance of a condition or obsolescence based end of life of MCCs.

Frequently, the need to replace MCCs is driven by an inability to get parts for the unit.

### 4.1.1 Appropriateness of Asset Class

Consider a separate class for 4160 VAC starters as the unit cost for these devices are significantly different than those for 480VAC hardware.

It should be confirmed that automatic transfer switches are indeed separate from the MCC count in the model.

### 4.1.2 Key Maintenance

OCSD currently performs cleaning, infrared and ultrasound inspections of the MCCs every other year, depending on where it is located. MCCs in outdoor locations, or dirty areas get more frequent attention (once per year). This level of maintenance is appropriate for this hardware and the expected useful life planned for MCCs.

## 4.2 Generator

### 4.2.1 Appropriateness of Asset Class

This class is too broad. Small portables and larger fixed generators appear to be lumped together in this single class. In particular, the following should be separated and/or classed individually:

- "Vehicle" generators (separated)
- Mobile generator units (separated)
- CEN-GEN generators (classed individually)
- Two turbine-driven generators at Plant 1 (classed individually)

BC suggests a breakdown of classes based upon different modes of operation—backup infrequent operations versus longer running generators. BC also suggests further categorizing generators by voltage (120v, 480v, 12kv) and fuel type.

For the CEN-GEN generators, the engine and generator components should be separated into different classes. The engine is on a different maintenance cycle than the generator side. The engine maintenance and rehabilitation schedule is driven by runtime with the electrical generator side is driven by condition.

### 4.2.2 Key Maintenance

In addition to existing maintenance activities performed by OCSD, BC suggests the following enhancements to the predictive/preventative maintenance procedures:

- **Oil testing prior to usage.** There is a variability in oil supply quality control. Some oils may not meet specs or have contaminants upon delivery. Catching this before usage and ensuring only "clean" spec oil is used may result in an increase in reliability and generator life.
- **Predictive efforts increase life.** The following predictive tools may catch items before signs of failure:
  - Oil analysis
  - Vibration testing/monitoring
  - Insulation testing
  - Meggering
  - Motor current signature checking

## 4.3 Cable and Cable Trays

There is a significant amount of cable tray that is not compliant and will need to be rehabilitated or replaced. The model currently has a placeholder value of $1.3 million for cable tray. BC believes this value is extremely low. The asset should be tracked by feet or number of conductors or other metric which might allow a more accurate valuation of the asset.

Cable tray/cable rehabilitation or replacement work is typically not done unless related process equipment or area is replaced/rehabilitated. It may be appropriate to assign sections of cable tray to a parent process. The cable tray rehabilitation costs could then be related to the parent process area rehabilitation project.

It was noted that the J-47 project did an accounting of cable tray. This could be broken out by process area, and possibly used to more accurately value the cable tray and also help assign cable tray rehabilitation costs to a parent process.

### 4.3.1 Appropriateness of Asset Class

There is no class for high voltage feeders; this should be added as they are high value items with a finite life.

### 4.3.2 Key Maintenance

This is not closely monitored and is too broad a task. Typically, a cable tray is a run to failure item.

Failure mode is typically insulation failure leading to ground fault. This does not occur frequently, typically triggered by installation issues rather than wear or age.

BC suggested that OCSD could use additional preventative maintenance tasks described below to help identify cable tray issues before a fault occurs:

- Motor current signature analysis performed may provide data indicating condition of cable.
- Infrared scanning of cable tray do identify hot spots and potential cable issues prior to faults.

## 4.4 Switchgear

It was unclear what a unit of switchgear in the model represents. OCSD should define a unit count and verify the count value in the model. BC suggests using a count of vertical sections for a count value of switchgear. Most units in OCSD are double ended. Again, this should be appropriately accounted for in the method for determining switchgear count. BC noted that the unit cost appeared low for switchgear. More input on these devices, as provided by BC estimators, is described later in this report. The costs for the recently installed P2-90 switchgear could also be a good data point for costing of these units as well as a methodology for unit counts.

Typically, switchgear is not rehabilitated; however, the replacement of the associated microprocessor relays will have a R&R cycle of approximately 15 years. Relay replacement approximately every 5 years should be considered a rehabilitation for switchgear, or included in the “parts” category for the purposes of the model.

### 4.4.1 Appropriateness of Asset Class

The class is too broad as it may cover switchgear ranging from 480VAC 12kv. BC suggests breaking out the switchgear into at least two possibly three classes based on voltage range. Items categorized as “breaker” should be considered for moving into the switchgear valuation.

**Table 4-1. Suggested Refined Asset Classes which would Allow Narrowing the Cost Values**

| Suggested Refined Asset Class Code | Suggested Refined Asset Class Name | BC Estimator Recommended Unit Cost Value |
|---|---|---|
| SWGR - MV | SWITCHGEAR – MV, 600A(Per Section) | $75,000 |
| SWGR – 480V | SWITCHGEAR – 480V, 3200A(Per Section) | $25,000 |

### 4.4.2 Key Maintenance

OCSD current regularly performs an infrared inspection, cleaning, ultrasound, exercise and testing of the switch gear every other year for most units. For switchgear installed in dirty areas, these procedures are performed yearly. This level of maintenance activity is appropriate for this class.

A rehabilitation of switchgear would require replacement of relays; however, relays are likely covered under “parts” in the current model.

## 4.5 Breaker

All breakers would be associated with switchgear or MCC. BC suggests that this class be eliminated. Breakers should be associated with the parent switchgear or MCC.

Count and costs for this class should be re-allocated to the appropriate parent. The number and count should be reviewed to verify breakers are appropriately captured.

## 4.6 Panel

This class covers a wide range of panel types, including programmable logic controller (PLC) and reconfigurable input/out (RIO) panels.

PLC/RIO should be their own class as the valuation is very different for a PLC or RIO panel when compared to a more common small panel. OCSD may want to consider moving the PLC /RIO panels to the INSTRUMENTATION category.

Preventative maintenance (PM) activities is typically similar for all panels types.

There is a related asset class for “PLC CPU” in which the count appears to be incorrect. OCSD should verify this count.

### 4.6.1 Appropriateness of Asset Class

This asset class is too broad. PLC/RIO should broken into their own class as the valuation is very different for a PLC or RIO panel when compared to a more common small panel. Other suggestions include:

- OCSD considering moving the PLC /RIO panels to the INSTRUMENTATION category;
- Moving lighting panels into a dedicated class; and
- Moving control panels to a dedicated asset class.

### 4.6.2 Key Maintenance

OCSD currently performs cleaning and an IR scan, every two years. This is appropriate for this class.

## 4.7 Switch

There is no rehabilitation associated with switches.

### 4.7.1 Appropriateness of Asset Class

This class is too broad.

Classes should be refined to breakout 480VAC field disconnects as they have a shorter life than other assets in class. Typically, weather/corrosion will shorten the life of field disconnects. Below are notes on suggested classes and useful life information.

- **480VAC field disconnects—**nothing to do, clean only. 480 VAC outdoor switches corrode faster than others; life only 15 years.
- **Medium voltage—**maintained with switchgear, same PM schedule but its own class, same life as switchgear.
- **Automatic transfer switches—**maintained with switchgear, same PM schedule but its own class, same life as switchgear.

Asset class code is "SWI." Need to verify if this class does not also capture the small SWI tagged 120VAC toggle switches associated with instruments. These are very low value items which should not be tracked in this class.

## 4.8 Transformer

### 4.8.1 Appropriateness of Asset Class

This asset class is too broad. It should be split into dry type/oil filled and further refined by KVA rating:

- The dry type typically run to fail, no rehabilitations, PM limited, clean, and IR scan.
- Maintenance requirements are different for oil/dry type.

### 4.8.2 Key Maintenance

Maintenance should be broken down as follows:

- **Dry type:** This type requires little maintenance, asset life 30 years, and is typically replaced with process area rehabilitations. The cost is to be evaluated.
- **Oil type:** OCSD completes oil analysis, IR, and cleaning outside (every year). Paint is required as needed, determined by condition. OCSD may also provide headspace gases analysis. This type has 50-year life with no rehabilitation.
- **OCSD completes:** cleaning, IR; every two years.

### 4.8.3 Estimator Input

The transformer class was too broad and the unit costs appeared to be inaccurate. BC Estimators have suggested a breakout of transfer asset classes along with suggested values for each as summarized in the Table 4-2.

**Table 4-2. Suggested Refined Asset Classes which would Allow Narrowing the Cost Values**

| Suggested Refined Asset Class Code | Suggested Refined Asset Class Name | BC Estimator Recommended Unit Cost Value |
|---|---|---|
| XFMR-A-50KVA | TRANSFORMER – Dry – 50KVA | 6,000 |
| XFMR-A-500KVA | TRANSFORMER – Dry – 500KVA | 27,000 |
| XFMR-B-500KVA | TRANSFORMER – Oil – 500KVA | 41,000 |
| XFMR-B-3000KVA | TRANSFORMER – Oil – 3000KVA | 116,000 |

## 4.9 Power Supply

Members of this class should be moved to the parent panel. Any Uninterruptable Power Supply (UPS) items should be moved to UPS class.

## 4.10 UPS

The regional UPS systems planned for both Plant 1 and Plant 2 under J-102 will result in most UPS' being replaced by a feed from a new regional UPS.

The valuation of switchgear battery appears low, should be verified by OCSD.

# 5 Mechanical Workshop

The asset classes in the mechanical category was conducted on January 30, 2102. Below is a summary of signification discussions and recommendation related to those assets in this area. BC suggested values for asset life, rehabilitation interval and frequency are provided in Appendix A.

## 5.1 Valve

### 5.1.1 Background

The valve class covers a wide range of valve sizes and services. New classes are recommended based upon size (6 to 48 inches and 48 inches and above). For the larger valves, wear items are replaced as part of maintenance procedures.

Digester plug valves typically only last 10 years. These valves are commonly eroded by process fluid and corrosive environment. Plug valves are replaced whenever the digester is down for maintenance or rehabilitation. A more refined breakout of valves by process fluid was discussed but discounted in favor of simplicity in the TEAMPlan model. There would be little gained in the model to justify the added complexity of tracking valves by process.

Under 6-inch valves are run to failure items replaced using maintenance dollars; therefore, they do not need to be tracked as a separate asset.

## 5.2 Pumps

### 5.2.1 Background

This class is too broad. Individual categories for large unique pumps should be considered. These large pumps would be as follows:

- Larger pumps would be expected to have a useful life of 40 years with one rehabilitation during their service life
  - Headworks
  - Primary Effluent Pump Station (PEPS)
  - Outfall Ocean Booster Station (OOBS)
  - Trickling Filter Pump Station pumps
- Smaller pumps have a useful life of 20 years; rehabilitation at 10
  - Primaries
  - Digesters

It was noted during the workshop that the OOBS pumps were recently rehabilitated for $250,000 for one pump after more than 20 years of service.

OCSD staff noted that sludge pumps historically have had a have life of 20 years maximum, with rehabilitation of the stator and rotor approximately every 6 years.

The pumps in the model do not have size or horsepower information associated with them. This could be useful in refining unit cost/valuation for pumps.

### 5.2.2 Key Maintenance

OCSD staff indicated that the rehabilitation of a pump includes, bearings, wear rings, spray shafts, and replacing wear parts.

OCSD does not have a lot of history on dry pit submersibles failure modes as they have only been installed in the last 5 years.

For all pumps, BC suggested that OCSD complete a root cause analysis on failures when they start to occur and see if failure modes can be avoided or planned for.

## 5.3 Sump Pumps

All submersibles are grouped together (small and large pump station submersibles). BC recommends that these should be separated into different classes.

## 5.4 Gate, Slide or Entrance

OCSD staff indicated that the gate life is typically longer than 20 years. Newer gates are 316 stainless steel and should have an even longer life.

Headworks gates were installed in 1989. These were the older cast-iron style and are now being replaced (after 22 years).

A gate is replaced at end of life (i.e., no rehabilitation). However, new strips and packing can be used to repair the gates. Otherwise, no regular maintenance is required. Key gates should be considered for regular scheduled exercise.

## 5.5 Blower

### 5.5.1 Background

OCSD staff indicate that they expect a 30-year life with one rehabilitation at 15 years for turbelex blowers.

Plant 2 has a main air compressor and a screw type compressor for oxygen.

It is not clear if BLOWER category is also picking up fans for foul air (quantity of 53 seems high). Items in this class may be fans but requires verification. This class needs a clear definition of what assets are included.

### 5.5.2 Key Maintenance

OCSD currently does vibration monitoring on compressors.

BC recommends that a motor current analysis also be used as a monitoring diagnostic. Additionally, BC suggested OCSD could review failure modes, identify method to prevent future failures.

## 5.6 Tower

The definition of asset is unclear. It is believed this asset class may likely be scrubber towers. The assumption is that it is just the FRP tower packing and internals and is similar to chemical tanks in service-like expectations.

OCSD has not experienced any significant wear, nor is there a history of failure or repair on these devices.

Media change out is required every 3 to 5 years for scrubber towers with media.

Windows and internals will occasionally need to be changed.

A 10-year rehabilitation cycle is appropriate. OCSD staff indicated that the cost per rehabilitation should be reduced to approximately 20 percent of capital value.

## 5.7 Conveyor

### 5.7.1 Background

Conveyor quantity appears to be high. The count value for this asset needs verification. In particular, OCSD staff noted in the workshop the count of conveyers noted as"P2-60" may be incorrect.

Screws, belts, and paddles are also in the asset list, so there may be some overlap in these assets.

BC suggests grouping of conveyer assets by unit process rather than individual parts as it appeared to be done in the model output reviewed in the workshops. Possible unit process break outs could include:

- Plant 1 headworks
- Plant 2 headworks
- Plant 2 truck loading
- Dewatering

### 5.7.2 Key Maintenance

OCSD staff indicated that preventative maintenance for the conveyors included lube and cleaning. This is appropriate.

## 5.8 Motor

### 5.8.1 Background

At the time of the workshop, motors were categorized as a mechanical asset. During the workshops OCSD staff indicated that these devices should be categorized at electrical asset.

Class should be broken into horsepower classes. Lower horsepower motors are run to fail assets while larger horsepower motors (>200 horsepower) may be rehabilitated.

OCSD Electrical staff may choose to review recent motor history and refine break point for large and small motors.

### 5.8.2 Key Maintenance

BC suggests OCSD perform a motor current signature analysis on the larger motors to detect issues with the motors before they result in a fault or failure.

## 5.9 Operator, Electrical, Mechanical

This category was too broad and should be separated as follows:

- **Motor Actuator:** 30 years, or gate/valve life whichever comes first, no rehabilitation activity, PM is lube
- **Pneumatic Actuator:** 20 years, rehabilitate at 10, rehabilitation is new cylinders/seals
- **Manual/Chain Fall Actuator:** 30 year life, no rehabilitation

### 5.9.1 Key Maintenance

Maintenance activities are as follows:

- **Motor Actuator:** lube PM, adjust torque limit switch, testing of switches, exercise
- **Pneumatic Actuator**: cleaner/dryer air
- **Manual/Chain Fall Actuator:** lube

## 5.10 Barscreen

All screens are stainless and a 50-year life is reasonable. Only wear parts are replaced.

There is no rehabilitation; motor and gearbox picked are assumed to be carried under these classes separately.

### 5.10.1 Key Maintenance

Maintenance activities are as follows:

- **Key PM:** inspection and adjustment, lube.
- **Bar Screen:** Isolate, pump out and perform detailed inspection, along with structure (an approximate 10-year cycle)

## 5.11 Turbocharger

The count should be verified. OCSD staff indicated correct count is likely 10 units. It appears some in count could be spare parts.

Rehabilitation is expected at approximately 10k to 15k run hours, equivalent to one rehabilitation at 15 years. However, overhaul frequency is dependent on run time, which can be variable.

## 5.12 Gearbox

Gearboxes typically outlive the parent pump or driven device. Gearboxes could last 30 years, therefore, life and rehabilitation frequency can be synchronized to the parent device.

### 5.12.1 Key Maintenance

OCSD currently performs oil analysis on larger gearboxes. Periodic oil changes and vibration analysis are also performed. This level of maintenance is appropriate.

## 5.13 Exchanger

This asset class too large. Lube exchangers should be separated out into a separate class.

In addition, life is in question—almost all in service are currently older than 25 years.

Typical life is 25 years with run to failure and no rehabilitation.

Plant water is aggressive. Where plant water is used, life is shortened. Consider separating these out as life will be reduced.

## 5.14 Turbine

Diesel turbines are standby generators. Steam turbines run at all times. These should be separated as they are different devices.

One steam turbine is near the end of life as it has been in service 20 years (steam turbine run to loss in performance/efficiency typically occurs at approximately 20 years).

Diesels will likely be obsolete by Air Quality Management District (AQMD) rules rather than functionality. Standby units run less than 200 hours per year.

### 5.14.1 Key Maintenance

Maintenance activities are as follows:

- **Steam turbine PM:** OCSD completes oil, water conditioning, vibration analysis. BC suggests the recommended the steam turbines de-scaling be performed every 5 years.
- **Diesel Turbine PM:** OCSD completes oil changes based on hours (oil filter changes as required, turbines kept heated). This level of maintenance is appropriate.

## 5.15 Collector, Clarifier Sweep Unit

### 5.15.1 Background

Life is approximately 20 years replacement, in sync with clarifier rehabilitation cycle. Rectangular units are all fiberglass now which are expected to provide even longer life.

### 5.15.2 Key Maintenance

Maintenance activities are as follows:

- **Rectangles:** OCSD currently flips shoes, tightening every 2 years.
- **Circular:** Verification that metal is intact and coating is inspected (every 2 years).

In both cases of rectangular and circular clarifiers, the maintenance activities are appropriate.

## 5.16 Centrifuge

These are associated with the engine generators which run a limited amount of time.

## 5.17 Gauge Mechanical

Run to failure (no discussion); most items in this class have been removed from the model.

## 5.18 Engines

CEN-GEN type engines (eight) should be separated as its own class. The value seems low and should be verified. AQMD rules will likely make these obsolete before mechanical issues arise. Assume a 50-year life, 40k hour overhauls, and run at approximately 40-percent utilization.

Combustion engines, backup generators, and class definition should be verified. OCSD staff indicated that they were uncertain where the source of the count on these items is coming from. Therefore, this class needs refinement and verification of counts.

## 5.19 Filter

This class is air filter, water filter and fuel filter. It may be combined with strainers for the plant water pump station. This class may need refinement, separating larger items from smaller disposable items.

## 5.20 Cooling Tower (AC)

This class definition needs to be verified. Model data indicates this class is related to the chiller building (i.e., most likely a chiller).

## 5.21 Chiller

Categorized under HVAC. These units typically last 30 years and they are closely monitored. Expect one rehabilitation at 15 years.

## 5.22 Condenser

Class includes steam and refrigerant condensers. These should be classed separately.

## 5.23 Flare

Value should be verified as they appear low. When rehabilitated they will need to be rehabilitated to new standards.

Life is 50 years with rehabilitation at 6.5 years. Burners, controls, and PRV see significant corrosion and condensation which drives the frequent need for rehabilitation.

Future AQMD requirements may necessitate additional changes to procedures related to these units.

## 5.24 Fans

This class needs to be separated by size, CFM or horsepower.

BC suggests removing small direct drive units from the list (over 300 items). Many of these assets may be small throw-away type fans. For these smaller devices, assume a 10-year life and replace.

## 5.25 Flame Arrestors

Changing flame arrestor inserts should be categorized as maintenance activity. No rehabilitation is required. BC suggests replacing the flame arrestor with the pipe.

## 5.26 Compressors

Class needs to be separated. Gas compressors should be in their own class (six) with 50-year life and three rehabilitations. Limited availability of parts may shorten life.

Existing compressors are 20 years old and parts are not available.

Plant air compressors have a 20-year life, then are thrown away.

## 5.27 Boiler

Large process boilers are AQMD-limited to 10 more years of life and are then obsolete. The value is certainly too low.

Recommendations include:

- Separating out the three large process boilers (10-year AQMD limited).
- Separating CEN-GEN boilers (these recover waste heat from engines); plan for 30-year life with two rehabilitations. They are currently at 22 years now, with one rehabilitation.
- Separating out building boilers to smaller building heating units (15 years, no rehabilitation).

# 6 Instrumentation and Control Workshop 1/31/2012

The asset Instrumentation and Control (I&C) workshop area workshop was conducted on January 31, 2102. Below is a summary of signification discussions and recommendations related to those assets in this area. BC suggested values for asset life, rehabilitation interval and frequency are provided in Appendix A.

## 6.1 Flowmeters

This asset class is too broad and should be refined by flowmeter type. Below is the suggested breakout of meters, along with notes on each type from the workshop discussions.

### 6.1.1 Rotameter

No rehabilitation. The 30-year life coincides with the parent process.

### 6.1.2 Magmeter

No rehabilitation. The 30-years life coincides with the parent process. Critical “money meters” may be replaced pre-emptively on obsolescence of the meter.

### 6.1.3 Ultrasonic

The typical failure mode on the ultrasonic flowmeter is a failure of the sensor itself. Based on historical experience of OCSD staff, and the experience of BC technical staff, a 30-year life with an expectation of three rehabilitations on sensor death every 7 to 8 years is appropriate.

### 6.1.4 Venturi

The group discussed and agreed a 100-year life with no rehabilitation was appropriate.

### 6.1.5 Thermal

The group discussed and agreed a 20-year life with no rehabilitation was appropriate. It was noted that this device classification did not appear in the TEAMPlan model at the time of this report.

### 6.1.6 General

For any flowmeters which did not fall into any of the specific categories above, the group discussed and agreed a 20-year life with no rehabilitation was appropriate.

## 6.2 Transmitters

Most transmitters are run to failure items. Transmitters are being moved to “part” classification in the model. Bubblers are also counted in the model, which would include the transmitter. However, bubbler count appears low and should be verified if transmitters located in bubblers are counted separately from bubbler panels.

It appears the bubbler panel count may be low, therefore, count should be verified.

## 6.3 Monitor, Display

All items previously in this class have been moved out of the model (likely moved to “part” classification).

## 6.4 Analyzer

BC suggests adding breaking analyzer into the following classes:

- ANALYZER SAFETY,  15 year life, driven by parent process life. Sensors and calibrations are consumables covered under the maintenance budget.
- ANALYZER COMPLIANCE, 15 year life, driven by parent process life. Sensors and calibrations are consumables covered under the maintenance budget.
- ANALYZER PROCESS, 15 year life, driven by parent process life. Sensors and calibrations are consumables covered under the maintenance budget.

The sub classes related to analyzers appear to be incomplete. Analyzers should be noted to indicate service. It is expected that the following analyzer types would be in the model:

- $H_2S$
- O2
- O3
- DO
- CL2
- ORP
- LEL
- Methane
- Density
- TSS
- Sludge Blanket
- Percent Solids
- NOX
- CO

## 6.5 Sensor

This class has moved out of CMMS, likely reclassified as parts.

## 6.6 Controller

A new class has been created; however, this seems to be capturing items such as panel mounted potentiometer. This may need further refinement.

## 6.7 OITs (not in list or accounted for)

This class is missing and should be added. Small panel view type OITs are numerous at both plants. BC suggests verifying the count of OITs for inclusion in the model.

## 6.8 Landscaped Areas (not in list or accounted for)

During the workshop it was discussed that this class is missing and should be added. It was further noted by OCSD staff that Plant 1 has approximately 10 acres of landscaped areas, while Plant 2 has 9 acres.

## 6.9 Pump Station Appurtenances (not in list or accounted for)

It was noted during the workshop that this class is missing and should be added. Value should be captured for items such as buildings and houses, etc.

## 6.10 Fiber /IT Assets/Software (not in list or accounted for)

Fiber is an asset that is not currently in the model, nor is it in CMMS. This is a high value item that should be included in the model. OCSD IT staff should review this item to help determine an appropriate value and count for these assets.

# 7 Estimator Input

As part of the SP-151 project OCSD and BC identified a limited number of asset classes for the attention of the BC estimators. Table 7-1 provides a list of those items selected with suggested costs from our estimators. Costs are based on what the estimators typically see at wastewater treatment plant of the size of OCSD Plants 1 and 2. The estimated costs are installed, with all markups, and 30 percent contingency included.

**Table 7-1. Summary of Range of Values**

| Asset Class Code | Asset Class Name | BC Estimator Recommended Unit Cost Value |
|---|---|---|
| ATS | Automatic Transfer Switch | $6k to $69k |
| MCC | MOTOR CONTROL CENTER | $7k to 15k |
| SWGR | SWITCHGEAR | $25k to $75k |
| XFMR-A | TRANSFORMER - Dry | $6k to $27k |
| XFMR-B | TRANSFORMER - Oil | $41k to $116k |
| PLC/PNL | PLC Panel / Remote IO Panel | $22k to $148k |
| GRNDR | GRINDER, SLUDGE | $32k |
| VLV-B | VALVE – 48"+ | $77k |
| SCADA NETWORK | SCADA NETWORK | 3 - 4.5M |

The table provides a range of values for those items which may have some wide variability within the asset class. In cases where there was a wide range of possible values, a suggestion on how the asset classes might be further refined to help narrow the range of values for a class has been provided. This is detailed in Table 7-2.

**Table 7-2. Suggested Refined Asset Classes which would Allow Narrowing the Cost Values**

| Suggested Refined Asset Class Code | Suggested Refined Asset Class Name | BC Estimator Recommended Unit Cost Value |
|---|---|---|
| ATS – 100A | AUTOMATIC TRANSFER SWITCH | 6,000 |
| ATS – 3000A | AUTOMATIC TRANSFER SWITCH | 69,000 |
| MCC – 600A | MOTOR CONTROL CENTER – 600A(Per Section) | 7,000 |
| MCC – 2000A | MOTOR CONTROL CENTER – 2000A(Per Section) | 15,000 |
| SWGR – MV | SWITCHGEAR – MV, 600A(Per Section) | 75,000 |
| SWGR – 480V | SWITCHGEAR – 480V, 3200A(Per Section) | 25,000 |
| XFMR-A-50KVA | TRANSFORMER – Dry – 50KVA | 6,000 |
| XFMR-A-500KVA | TRANSFORMER – Dry – 500KVA | 27,000 |
| XFMR-B-500KVA | TRANSFORMER – Oil – 500KVA | 41,000 |
| XFMR-B-3000KVA | TRANSFORMER – Oil – 3000KVA | 116,000 |
| PLC/PNL-LARGE | PLC PANEL -LARGE | 68,000 |
| PLC/PNL-SMALL | PLC PANEL-SMALL | 22,000 |
| RIO PNL-LARGE | REMOTE IO PANEL-LARGE | 148,000 |
| RIO PNL-SMALL | REMOTE IO PANEL-SMALL | 15,000 |

Note that the unit costs for the MCCs and switchgear are for a typical section of gear. It should be verified that the count values in the model for this asset class are similarly broken out.

## 7.1 Fiber Network Valuation

It was noted during the workshops that the TEAMPlan model had no value assigned to the fiber network. Each plant has an extensive fiber network, as well as fiber connections between plants and to portions of the collection system. The fiber network is a significant high value item that should be accounted for.

In order to properly estimate the value of the fiber network, an accurate count of miles of fiber, number of network switches, fiber patch panels, tube distribution units, and other key details would be required. It would not be unreasonable when a detailed estimate was performed that the value of the Fiber Network(s) may be in excess of $5 million.

Therefore, the zero value currently assigned is inadequate for this significant asset. BC suggests as a minimum using a placeholder value in the $5 million range for the fiber network until a more accurate accounting of this asset can be performed.

## 7.2 SCADA Network Valuation

It was noted during the workshops that the TEAMPlan model had no value assigned to the SCADA networks. Based on plants of similar size, the Estimator has suggested a possible value of $3.5 to $4 million for the SCADA systems at each plant. However, this is a very rough estimate.

To more accurately estimate the value of the SCADA network, the estimators would require a count of servers, workstation network switches, Modbus plus network hardware, software licenses, monitors and displays, printers and other devices.

PCI staff in attendance at the I&C workshop indicated that OCSD may have an inventory of SCADA assets that could be used to help refine this very rough estimate.

# Appendix A:
# Asset Classes Useful Life and Rehabilitation Recommended Values

*Tables which follow provided recommended values for asset expected useful life, rehabilitation count, and rehabilitation interval for all asset classes evaluated under SP-151 and those asset classes added as a result of the workshop activities.*

## Appendix A

# Asset Classes Useful Life and Rehabilitation Recommended Values

### BC Recommended Values: Civil, Piping, Mechanical, Electrical, Instrumentation

| Asset Class Info / Output from TEAMPlan Model | | | | BC Recommended Values | | | | |
|---|---|---|---|---|---|---|---|---|
| Asset Class Code | Asset Class Name | Area | Source Tab (Data from GHD) | Rehab the Assets? | How many Rehabs? | Rehab Interval | Asset Useful Life | Notes |
| OUTFAL | OUTFALL | CIVIL | CIVIL | TRUE | 2 | 50 | 150 | |
| OUTFAL-A | OUTFALL - Steel Sections | CIVIL | CIVIL | TRUE | 2 | 20 | 60 | |
| PPIPE-CI-B | Cast Iron - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-CI-T | Cast Iron - Tunnel | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-DI-B | Ductile Iron - Buried | CIVIL | PIPING | N | | | 75 | |
| PPIPE-DIP-B | Ductile Iron Pipe - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-FRP-A | Fiber(glass) Reinforced - Above Ground | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-FRP-T | Fiber(glass) Reinforced - Tunnel | CIVIL | PIPING | N | | | | Not discussed in workshop |
| PPIPE-HDPE-B | High Density Polyethylene (SDR 26) - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-PVC-B | Polyvinyl Chloride - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-PVC-T | Polyvinyl Chloride - Tunnel | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-RCP-B | Reinforced Concrete - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-STL-B | Steel - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-STL-T | Steel - Tunnel | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-UK-B | Unknown - Buried | CIVIL | PIPING | TRUE | 3 | 20 | 75 | |
| PPIPE-UK-T | Unknown - Tunnel | CIVIL | PIPING | N | | | | Not discussed in workshop |
| PPIPE-VCP-B | Vitrified Clay - Buried | CIVIL | PIPING | N | | | 75 | |
| STRC-DIGEST | DIGESTER | CIVIL | CIVIL | TRUE | 3 | 20 | 75 | |
| STRC-DIGEST-A | DIGESTER - DOME | CIVIL | CIVIL | TRUE | 1 | 20 | 50 | |
| STRC-DISBOX | DISTRIBUTION BOX / Junction Box | CIVIL | CIVIL | TRUE | 1 | 20 | 50 | |
| STRC-DRYBED | SLUDGE DRYING BED | CIVIL | CIVIL | N | | | 50 | |
| STRC-GRIT | GRIT CHAMBER | CIVIL | CIVIL | TRUE | 4 | 20 | 100 | |
| STRC-NONPROCESS | BUILDING - Non-Process Structure | CIVIL | CIVIL | TRUE | 1 | 20 | 40 | |
| STRC-PIT | VALVE PIT/VAULT | CIVIL | CIVIL | N | | | | Not discussed in workshop |
| STRC-PROCESS | BUILDING - Process Structure | CIVIL | CIVIL | TRUE | 3 | 20 | 75 | |
| STRC-PUMPST | PUMP STATION/ROOM | CIVIL | CIVIL' | N | | | 75 | |
| STRC-SECCLR | SECONDARY CLARIFIER | CIVIL | CIVIL | TRUE | 3 | 20 | 75 | |
| STRC-SURGE | SURGE TOWER | CIVIL | CIVIL | TRUE | 4 | 20 | 100 | |
| STRC-THICK | THICKENER / DAF | CIVIL | CIVIL | TRUE | 3 | 25 | 100 | |
| STRC-TRAIL | TRAILER | CIVIL | CIVIL' | N | | | NA, see notes | Not discussed in workshop |
| STRC-TRKFLT | Trickling Filter (use numbers from secondary clarifier) | CIVIL | CIVIL | TRUE | 4 | 20 | 100 | |
| STRC-TUNNEL | TUNNEL | CIVIL | CIVIL | TRUE | 1 | 50 | 100 | |
| STRC-TUNNEL-A | TUNNEL - No Lids | CIVIL | CIVIL | N | | | 100 | |
| TANK | TANKS | CIVIL | CIVIL | N | | | 20 | |

## BC Recommended Values: Civil, Piping, Mechanical, Electrical, Instrumentation

| Asset Class Info / Output from TEAMPlan Model | | | | BC Recommended Values | | | | |
|---|---|---|---|---|---|---|---|---|
| Asset Class Code | Asset Class Name | Area | Source Tab (Data from GHD) | Rehab the Assets? | How many Rehabs? | Rehab Interval | Asset Useful Life | Notes |
| ATS | Automatic Transfer Switch | ELECTRICAL | ELECTRICAL | TRUE | 7 | 5 | 40 | |
| CBL | CABLE AND CABLE TRAYS | ELECTRICAL | ELECTRICAL | N | | | 40 | |
| CENGEN | CENGEN Generators | ELECTRICAL | ELECTRICAL | | 2 | 20 | 60 | |
| DRV | VFD | ELECTRICAL | ELECTRICAL | N | | | 30 | |
| DRV-A | VFD > 100 HP | ELECTRICAL | ELECTRICAL | N | | | 30 | |
| GEN | GENERATOR | ELECTRICAL | ELECTRICAL | TRUE | 9 | 5 | 50 | |
| GEN-A | Fleet or Portable GENERATOR | ELECTRICAL | ELECTRICAL | N | | | NA, see notes | Not discussed in workshop |
| MCC | MOTOR CONTROL CENTER | ELECTRICAL | ELECTRICAL | TRUE | 7 | 5 | 40 | |
| MTS | Manual Transfer Switch | ELECTRICAL | ELECTRICAL | N | | | NA, see notes | Not discussed in workshop |
| SWGR | SWITCHGEAR | ELECTRICAL | ELECTRICAL | TRUE | 7 | 5 | 40 | |
| SWI | SWITCH | ELECTRICAL | ELECTRICAL | N | | | 15 | Class is too broad see sub categories and report recommendations |
| SWI-A | SWITCH - Medium Voltage | ELECTRICAL | ELECTRICAL | N | | | 40 | |
| UPS | UNINTERRUPTABLE POWER SUPPLY | ELECTRICAL | ELECTRICAL | TRUE | 1 | 5 | 10 | |
| XFMR | TRANSFORMER | ELECTRICAL | ELECTRICAL | | | | | See XFMR-A and XFMR-B for updates |
| XFMR-A | TRANSFORMER - Dry | ELECTRICAL | ELECTRICAL | N | | | 30 | |
| XFMR-B | TRANSFORMER - Oil | ELECTRICAL | ELECTRICAL | N | | | 50 | |
| ANA | ANALYZER | INSTRUMENTATION | INSTRUMENTATION | N | | | 15 | |
| ANA-A | ANALYZER - Safety | INSTRUMENTATION | INSTRUMENTATION | N | | | 15 | |
| ANA-B | ANALYZER - Complience | INSTRUMENTATION | INSTRUMENTATION | N | | | 15 | |
| FBR | Fiber Optic Network | INSTRUMENTATION | INSTRUMENTATION | N | | | 30 | |
| FLWM | FLOWMETER | INSTRUMENTATION | INSTRUMENTATION | N | | | 20 | |
| FLWM-A | Flowmeter - Rotameter | INSTRUMENTATION | INSTRUMENTATION | N | | | 30 | |
| FLWM-B | Flowmeter - Ultra sonic | INSTRUMENTATION | INSTRUMENTATION | TRUE | 3 | 7.5 | 30 | |
| FLWM-C | Flowmeter - Venturi | INSTRUMENTATION | INSTRUMENTATION | N | | | 100 | |
| FLWM-D | Flowmeter - Magmeter | INSTRUMENTATION | INSTRUMENTATION | N | | | 30 | |
| FLWM-E | Flowmeter - Magmeter, money meters | INSTRUMENTATION | INSTRUMENTATION | N | | | 20 | |
| PLC/PNL | PLC / Remote I/O Processor Module | INSTRUMENTATION | INSTRUMENTATION | N | | | 30 | |
| SENS | SENSOR | INSTRUMENTATION | INSTRUMENTATION | N | | | NA, see notes | Per workshops reclassified as "parts" |
| AHU | AIR HANDLER UNIT | MECHANICAL | MECHANICAL | TRUE | 1 | 10 | 20 | |
| BLR | BOILER | MECHANICAL | MECHANICAL | N | | | 15 | |
| BLR-A | BOILER - CENGEN | MECHANICAL | MECHANICAL | TRUE | 2 | 10 | 30 | |
| BLR-B | BOILER - Process Heaters | MECHANICAL | MECHANICAL | N | | | 10 | |
| BLWR | BLOWER | MECHANICAL | MECHANICAL | TRUE | 1 | 15 | 30 | |
| BLWR-A | BLOWER - Aerator | MECHANICAL | MECHANICAL | N | | | | No changes recommended |
| BRSC | BARSCREEN | MECHANICAL | MECHANICAL | N | | | 50 | Motor and gearbox rehab covered in other classes |
| CEN | CENTRIFUGE | MECHANICAL | MECHANICAL | TRUE | 5 | 5 | 30 | |
| CHIL | CHILLER | MECHANICAL | MECHANICAL | TRUE | 1 | 15 | 30 | |
| CMP | COMPRESSOR | MECHANICAL | MECHANICAL | N | | | 20 | |
| CMP-A | COMPRESSOR - PNS / Gas | MECHANICAL | MECHANICAL | TRUE | 3 | 12.5 | 50 | |

## BC Recommended Values: Civil, Piping, Mechanical, Electrical, Instrumentation

| Asset Class Info / Output from TEAMPlan Model | | | | BC Recommended Values | | | | |
|---|---|---|---|---|---|---|---|---|
| Asset Class Code | Asset Class Name | Area | Source Tab (Data from GHD) | Rehab the Assets? | How many Rehabs? | Rehab Interval | Asset Useful Life | Notes |
| CND | CONDENSER | MECHANICAL | MECHANICAL | TRUE | 1 | 15 | 30 | |
| CNVR | CONVEYOR - Does not include conveyor parts | MECHANICAL | MECHANICAL | TRUE | 2 | 8.3333 | 25 | |
| COLLECTOR | COLLECTOR | MECHANICAL | MECHANICAL | N | | | 20 | |
| STRC-AERBAS | AERATION BASINS | | CIVIL | TRUE | P2:4/P1:1 | P2: 20/P1:50 | 100 | Recommend split into two classes: P1 uses Air. P2 uses Oxygen |
| STRC-BLDG | BUILDING | | CIVIL | TRUE | 1 | 20 | 40 | |
| STRC-PRIMCLR | PRIMARY CLARIFIER | | CIVIL | TRUE | 4/1 | 20/50 | 100 | Recoat at 20 yrs/Major rehab at 50 yrs |
| ROOM | ROOMS, INTERIOR | | CIVIL | | | | | Not discussed in workshop |
| STP | STANDPIPE | | CIVIL | | | | | Not discussed in workshop |
| STRC | STRUCTURES | | CIVIL | | | | | Included in STRC-Process or STRC-Non-process |
| CTW | COOLING TOWER (AC) | MECHANICAL | MECHANICAL | N | | | NA, see notes | Class definition to be verified, most likely a chiller |
| ENG | ENGINE | MECHANICAL | MECHANICAL | TRUE | 4 | 10 | 50 | |
| ENG-A | ENGINE - CENGEN | MECHANICAL | MECHANICAL | TRUE | 4 | 10 | 50 | |
| EXCH | EXCHANGER | MECHANICAL | MECHANICAL | N | | | 30 | |
| EXCH-A | EXCHANGER - Tube | MECHANICAL | MECHANICAL | N | | | 25 | |
| FAN | FANS | MECHANICAL | MECHANICAL | TRUE | 3 | 5 | 20 | |
| FAN-A | FANS - Small / Direct Drive | MECHANICAL | MECHANICAL | N | | | 10 | |
| FLA | FLARE | MECHANICAL | MECHANICAL | TRUE | 8 | 6.25 | 50 | |
| FLMA | FLAME ARRESTER | MECHANICAL | MECHANICAL | N | | | 20 | |
| GATE | GATE, SLIDE OR ENTRANCE | MECHANICAL | MECHANICAL | TRUE | 3 | 5 | 20 | |
| GBX | GEARBOX | MECHANICAL | MECHANICAL | TRUE | 1 | 15 | 30 | |
| GRNDR | GRINDER, SLUDGE | MECHANICAL | MECHANICAL | TRUE | 9 | 1 | 10 | |
| MTR-A | MOTOR - Large (>=200HP) | MECHANICAL | MECHANICAL' | N | | | | No changes recommended |
| MXR | MIXER, CHEMICAL | MECHANICAL | MECHANICAL | N | | | | No changes recommended |
| OPRE | OPERATOR, ELECTRICAL/MECHANICAL | MECHANICAL | MECHANICAL | TRUE | 3 | 5 | 20 | |
| PMP | PUMP | MECHANICAL | MECHANICAL | TRUE | 4 | 7.5 | 40 | See PUMP-A,B,C,D |
| PMP-A | PUMP - Large | MECHANICAL | MECHANICAL | TRUE | 1 | 20 | 40 | |
| PMP-B | PUMP - Small | MECHANICAL | MECHANICAL | TRUE | 1 | 10 | 20 | |
| PMP-C | PUMP - Sump | MECHANICAL | MECHANICAL | N | | | 10 | |
| PMP-D | PUMP - Large Submersible | MECHANICAL | MECHANICAL | TRUE | 1 | 20 | 40 | |
| SCRUBBER | SCRUBBER | MECHANICAL | MECHANICAL | N | | | | No changes recommended |
| TBC | TURBOCHARGER | MECHANICAL | MECHANICAL | TRUE | 1 | 15 | 30 | |
| TUR | TURBINE | MECHANICAL | MECHANICAL | TRUE | 5 | 5 | 30 | |
| TUR-A | TURBINE - Steam | MECHANICAL | MECHANICAL | N | | | 20 | |
| VLV | VALVE | MECHANICAL | MECHANICAL | N | | | 40 | See VLV-A and VLV-B recommendations |
| VLV-A | VALVE - 6 to 48'' | MECHANICAL | MECHANICAL | TRUE | 3 | 10 | 40 | |
| VLV-B | VALVE - 48''+ | MECHANICAL | MECHANICAL | TRUE | 1 | 10 | 20 | |

## BC Recommended Values: Collection Only

| Asset Class Info / Output from TEAMPlan Model | | | BC Recommended Values | | | | | |
|---|---|---|---|---|---|---|---|---|
| Asset Class Code | Asset Class Name | Area | Asset Class Appropriate? Y/N | Rehab the Assets? | How many Rehabs? | Rehab Interval | Asset Useful Life | Notes |
| FORCE-DIP | Force Main - DUCTILE IRON PIPE | COLLECTION | Y | N | 1 | 30 | 50 | |
| GRAVTY-CIPP | Gravity - CURED IN PLACE PIPE | COLLECTION | Y | N | | | 50 | |
| GRAVTY-DIP | Gravity - DUCTILE IRON PIPE | COLLECTION | Y | N | | | 30 | |
| GRAVITY-PVC | Gravity - POLYVINYL CHLORIDE | COLLECTION | N | N | | | 100 | |
| GRAVTY-RCP | Gravity - RCP (Tlocked) | COLLECTION | N | See notes | | | | See gravity sub-classes below |
| GRAVITY - RCP T-LOCK | TBD BY GHD/OCSD | COLLECTION | Y | TRUE | 1 | 75 | 125 | |
| GRAVTY-CONPVC | Gravity - CONCRETE PIPE WITH PVC LINER | COLLECTION | N | See notes | | | | Treat same as RCP t-lock |
| GRAVITY-RCP LOW H2S | TBD BY GHD/OCSD | COLLECTION | Y | TRUE | 1 | 75 | 125 | |
| GRAVITY -RCP HIGH H2S | GRAVTY-RCP high$H_2S$ | COLLECTION | Y | TRUE | 1 | 40 | 90 | |
| GRAVTY-RCB | Gravity - REINFORCED CONCRETE BOX - Lined | COLLECTION | Y | N | | | 100 | |
| GRAVTY-VCP | Gravity - VITRIFIED CLAY PIPE | COLLECTION | N | See notes | | | | See VCP sub-classes below |
| GRAVITY-VCP (Pre 1960) | TBD BY GHD/OCSD | COLLECTION | Y | TRUE | 1 | 50 | 100 | |
| GRAVITY-VCP (>8") | TBD BY GHD/OCSD | COLLECTION | Y | TRUE | 1 | 75 | 125 | |
| GRAVITY-VCP (<8") | TBD BY GHD/OCSD | COLLECTION | Y | N | | | 50 | |
| MH | MANHOLES | COLLECTION | N | See notes | | | | See MH-trunk<br>See MH-other |
| MH-TRUNK | TBD BY GHD/OCSD | COLLECTION | Y | TRUE | 2 | 50 (1st interval) + 25 (2nd Interval) | 100 | |
| MH-OTHER | TBD BY GHD/OCSD | COLLECTION | Y | TRUE | 1 | 75 | 125 | |
| FORCE-PVC | TBD BY GHD/OCSD | COLLECTION | Y | N | | | 50 | |
| FORCE-HDPE | TBD BY GHD/OCSD | COLLECTION | Y | N | | | 50 | |

## BC Recommended Values: Collection Only

BC recommends eliminating the asset classifications. It is recommended that assets in these classes roll up into other classifications.

| Asset Class Code | Asset Class Name | Area | Asset Class Appropriate? Y/N |
|---|---|---|---|
| GRAVTY | GRAVITY PIPES | COLLECTION | N |
| GRAVTY-VCP-HH2S | Gravity - VITRIFIED CLAY PIPE - High $H_2S$ | COLLECTION | N |
| GRAVTY-VCP-LH2S | Gravity - VITRIFIED CLAY PIPE - Low $H_2S$ | COLLECTION | N |
| GRAVTY-DIP-LH2S | GRAVTY-DIP Low $H_2S$ | COLLECTION | N |

The following were not discussed at the workshop; however, BC recommendations are provided on each class should they be required.

| Asset Class Code | Asset Class Name | Area | Rehab the Assets? | Asset Useful Life |
|---|---|---|---|---|
| FORCE-SIPH-RCP | Force Main - SIPHON - REINFORCED CONCRETE PIPE | COLLECTION | N | 50 |
| GRAVTY-CIP | Gravity - CAST IRON PIPE | COLLECTION | N | 30 |
| GRAVTY-CCFRPM | Gravity - CNTRFGL CST FBRGLS RENFRCD PLY | COLLECTION | N | 50 |

# Appendix I
# Condition Score Guidelines for Civil, Mechanical, and Electrical Assets

# Civil Assets – Condition Score Guidelines

| Condition Score | Performance | Non-Destructive Condition Assessment | | | Destructive Condition Assessment (Core Samples) | | Presence of Rebar Corrosion Activity | |
|---|---|---|---|---|---|---|---|---|
| | | Visual Assessment and/or O&M description | Sounding | Surface Penetrating Radar | pH | Depth of Carbonation | Half-cell Potential Survey | Galvanostatic Pulse Testing |
| 1 | Sufficient capacity to meet average and peak flow requirements; appropriate utilization and function | New Concrete/No damage | Sharp Ping | More than 1.0 inches over required design cover | Greater than 11 | Within 2.0 inches of the rebar zone | Corrosion is not occurring at the time of measurement | Negligible |
| 2 | Under-utilized or oversized; may be causing O&M issues | Minimal Damage to Concrete | -- | 0.5 – 1.0 inches greater than required rebar cover | 9 - 11 | Within 1.0 inch of the rebar zone | -- | Negligible |
| 3 | Sufficient capacity but unable to meet functional requirements | Damage to Concrete Mortar | Hollow Sound | Meets rebar cover requirements | 7 - 9 | Adjacent to the rebar zone | Uncertain if corrosion is occurring at the time of measurement | Low Activity |
| 4 | Able to meet average capacity needs but not peak capacity needs | Loss of Concrete Mortar/Damage to Rebar | -- | 0.5 – 1.0 inches less than required rebar cover | < 7 | Compromised the rebar zone | -- | Moderate Activity |
| 5 | Unable to meet average capacity Needs | Significant Damage to Structure/Rebar Severely Corroded | Soft Thud | More than 1.0 inches deficient in rebar cover | < 7 | Encompassed the rebar zone | Corrosion is occurring at the time of measurement | High Activity |

# Mechanical and Electrical Assets – Condition Score Guidelines

| Condition Score | Performance | Visual Assessment and/or O&M Description | Reliability Percent[1] | PdM Program - Vibration Analysis, Infrared Thermography, Ultra-sound, Oil Analysis |
|---|---|---|---|---|
| 1 | Sufficient capacity to meet average and peak flow requirements; appropriate utilization and function | Asset is in very good physical condition, is operable, and well maintained. Asset likely to perform reliably with routine preventative maintenance. No work is required. | > 90% | Analysis values within normal range; no action necessary (Good) |
| 2 | Under-utilized or oversized; may be causing O&M issues | Asset is in good physical condition with some minor wear. Deterioration has little to no impact on asset performance. Minor work required to maintain reliable functionality. | 80% - 90% | Continue monitoring routine; potential failure mode identified |
| 3 | Sufficient capacity but unable to meet functional requirements | Asset is in adequate physical condition with moderate wear. Moderate work is required to maintain reliable functionality (i.e. components need repair or parts need replacement). Wear is beginning to be reflected in the performance of the asset and increased maintenance is necessary; however, the asset is serviceable. | 65% - 79% | Monitoring necessary; additional analysis may be utilized; failure mode identified |
| 4 | Able to meet average capacity needs but not peak capacity needs; asset is obsolete | Asset is in less than adequate condition with major wear. A high level of maintenance is required to maintain reliable functionality (asset needs to be rebuilt, possibly more than once). Marked deterioration in performance resulting in decreased operational flexibility. | 50 – 64% | Action necessary to prevent failure; (Alert); work order submitted |
| 5 | Unable to meet average capacity needs | Asset failure is imminent. Excessive maintenance is required to maintain functionality, if even possible. Asset performance continues to deteriorate with an increased risk of failure. No immediate risk to health or safety. | < 50% | Pending failure imminent; (Fault); work order is urgent and needs to be actioned |

1 – $R(t)= e^{-t/\vartheta}$ , where R(t) represents the reliability, as a probability of an asset not breaking down, during a period of 't' (time span in hours) with the mean time between failure (MTBF) of '$\vartheta$', where MTBF is defined as the average failure rate during the span of time 't' above (MTBF=Total number of equipment operating hours examined / Total number of failures within the time of operation examined).

# Appendix J
# AM Program Metrics Methods, Data, and Charts

# AM Program Metrics Methodology

Data Source:

Availability Percent

The data used to derive the asset availability percent was sourced from the OCSD Major Equipment Status (MES) Dashboard.

Proactive Maintenance Percent, Break-In Percent, Maintenance Costs and Labor Hours

The data used to derive all other AM program metrics was sourced from the Computerized Maintenance Management System (CMMS) of record, Maximo.

Methodology:

Availability Percent

The bullet point list below details the steps taken to derive at the availability percent metric for each process area. As detailed below the data extant in the MES is not readily captured in a way that provides easy summarization. The data must be manipulated (grouped, re-written, etc.) to make it usable for the purposes of assessing availability. To improve efficiency, and accuracy data capture methods need to be modified.

- The MES includes a report for those assets still unavailable ("Open Out of Service" - or "OOS" Report - Open) and those which were unavailable in the past but since returned to service ("OOS" Report – Closed). The former records the number of days the asset(s) has been out of service. This can be used directly to derive availability. The Closed option does not record the number of days the asset was out of service. This date is included in the "operator comments" section of the report and must be separated from the other text included there to use as a date field. These two groups of data must then be combined.
- The OOS report includes a column for the Operator to designate a category for the outage (example, "CIP", Equipment Failure", etc.). For this metric, only "maintenance failure", maintenance-unplanned", and "operations planned" are included. The "operations planned" has been used in the past as a 'catch-all' and must be examined individually to include only the desired type of outages. Efforts have been made to ensure this category is not used as a 'catch-all' in the future.
- To assign unique asset names to each piece of equipment, the "Plant", "Area", "Sub-Area", and "Equipment" columns must be concatenated. This is a necessary step for later compilation of the data.
- The areas listed in the MES report do not correspond to the areas used in the AMP. They must be manually adjusted/re-written into a new column.
- "Days out" for each asset must be divided into appropriate fiscal years if they overlap fiscal years.
- To assess availability, it is important to capture how many assets of each type are required. This data is included in the MES ("Area Limits" report) for wet (October 15$^{th}$- April 15$^{th}$) and dry seasons. Outages during dry weather may not affect the true Availability of assets in the process area. To capture wet/dry thresholds (i.e., the number of assets required in the area

to meet levels of service or permit requirements), if an outage overlapped the wet season, the wet season threshold ("Normal") was used. Conversely, if the outage did not overlap the wet season, the dry threshold ("Normal") was used. Outages (counted in 'days') for each asset were then deducted from a total of 365 days for each fiscal year to derive a "Days IN" factor.

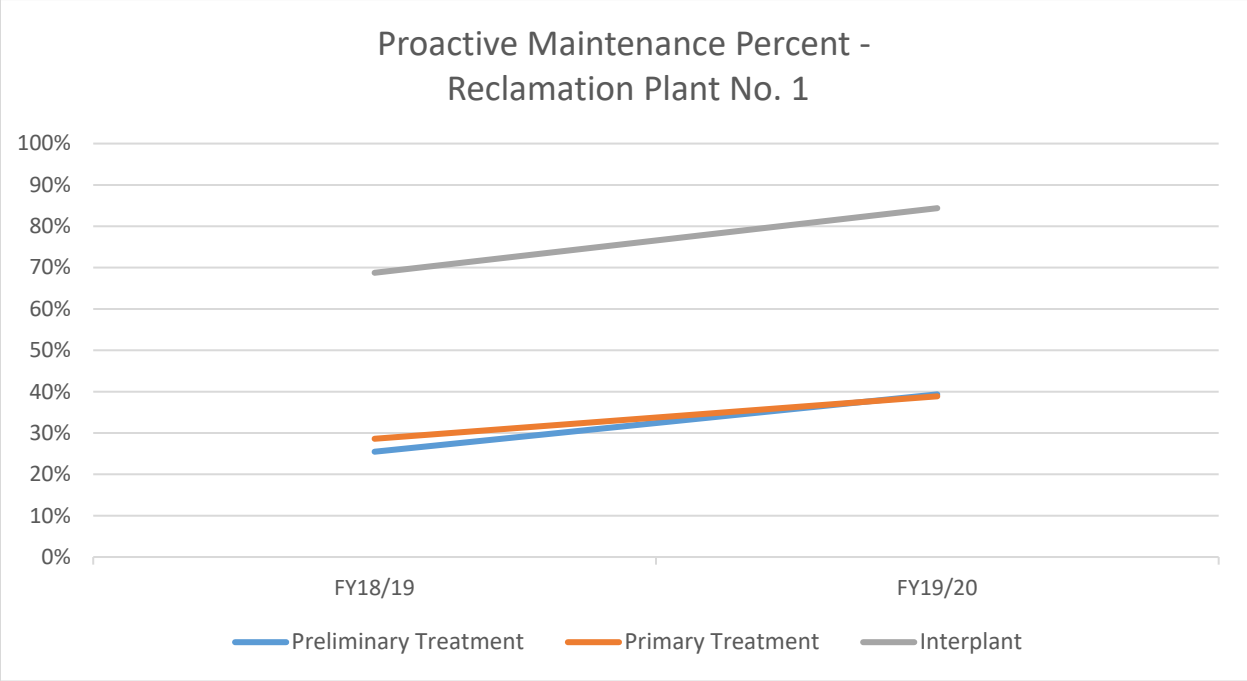
- To reach availability for each area, the total days "In" was divided by the total days (365 multiplied by the total number of assets in the area) to reach an overall area percentage.

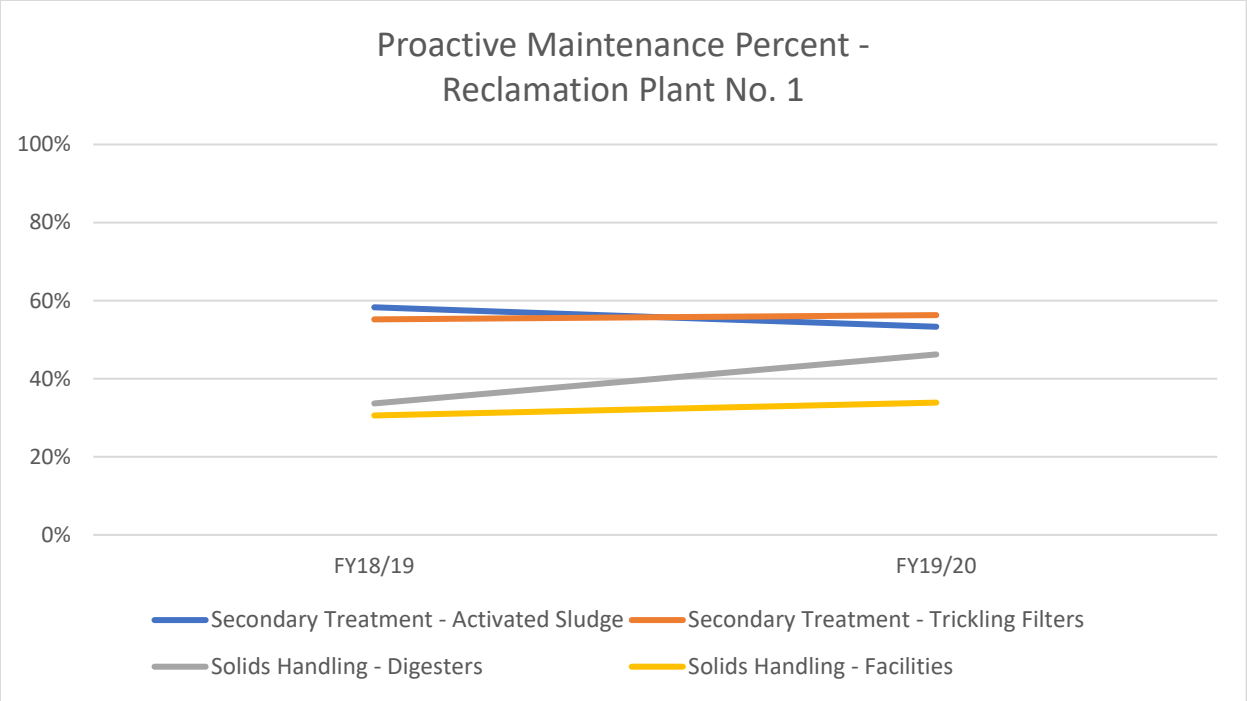
Proactive Maintenance Percent, Break-In Percent, Maintenance Costs and Labor Hours

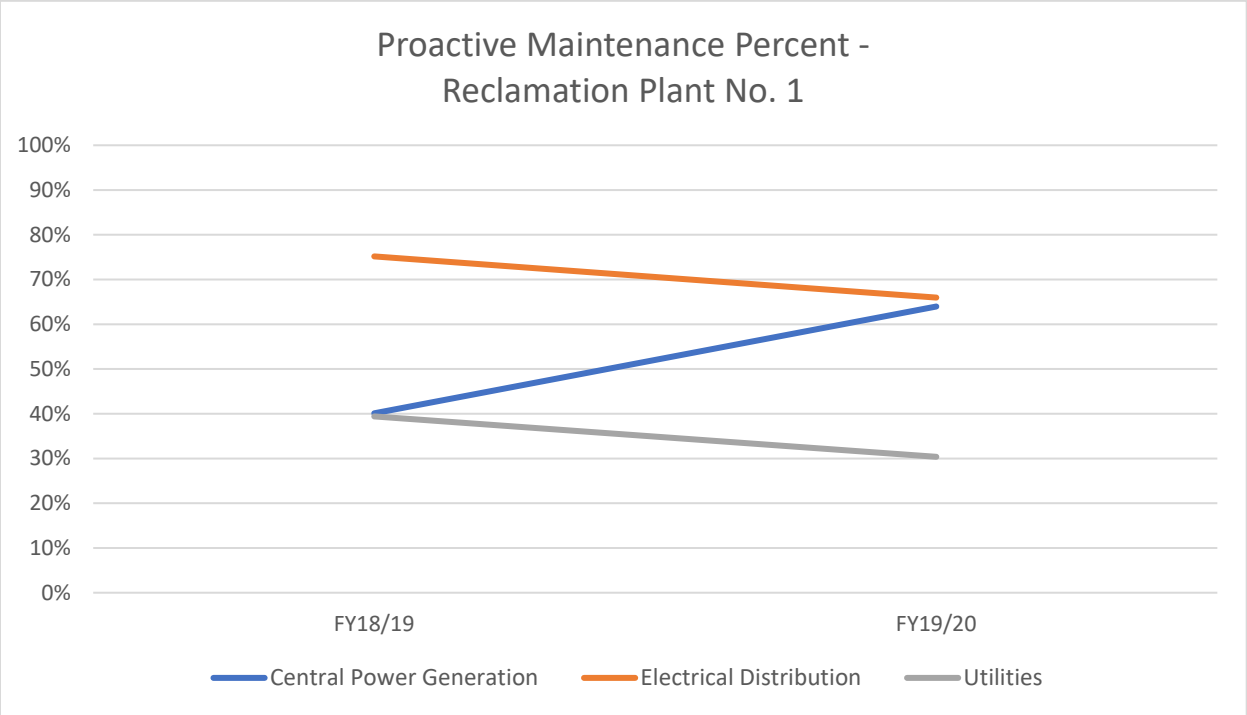
The bullet point list below details the steps taken to derive the listed metric for each process area:

- Data was extracted using the work order completion ("RTN" date) for work orders completed during FY18/19 and 19/20.
- Only maintenance, electrical, and reliability group work orders were included.
- Only process areas were included (no administrative buildings, non-process facilities, etc.).
- Lighting and HVAC work orders were excluded.
- Only 'CM','PM' and 'PD' work orders were included.
  - Proactive Maintenance Percent: Displayed as percent calculated as total 'PM' and 'PD' hours divided by all hours by area, by fiscal year.
  - Break-In Percent: Displayed as percent calculated as total priority '40' and '50' work order hours divided by total work order hours by area, by fiscal year.
  - Maintenance Costs / Labor Hours: Displayed as total costs (materials and services) or labor hours by area, by fiscal year.

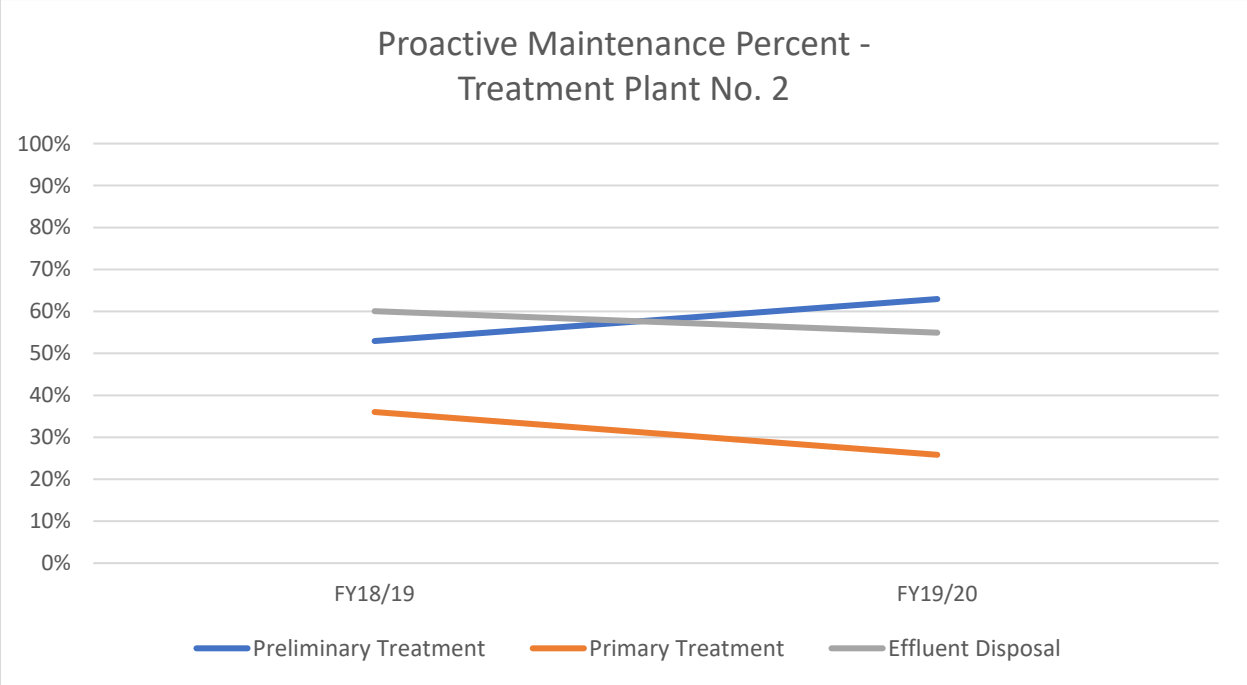
| Proactive Maintenance Percent – Reclamation Plant No. 1 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 25% | 39% |
| Primary Treatment | 29% | 39% |
| Interplant | 69% | 84% |
| Activated Sludge | 58% | 53% |
| Trickling Filters | 55% | 56% |
| Digesters | 34% | 46% |
| Solids Handling Facilities | 31% | 34% |
| Central Power Generation | 40% | 64% |
| Electrical Distribution | 75% | 66% |
| Utilities | 39% | 30% |

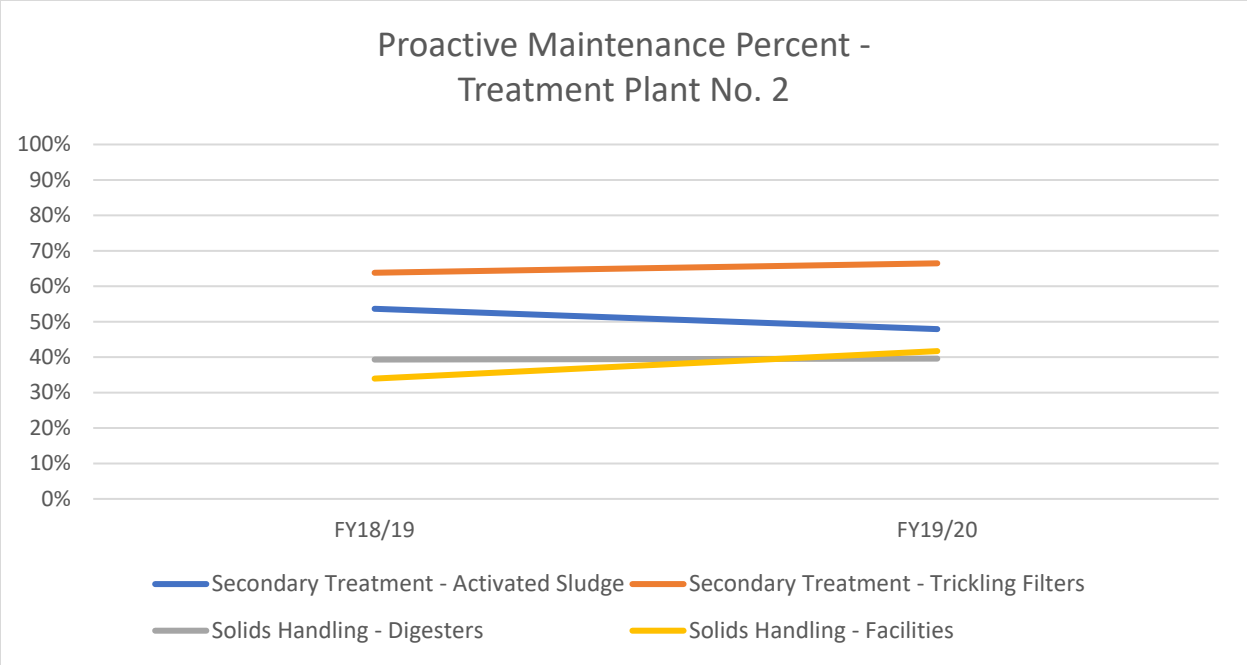


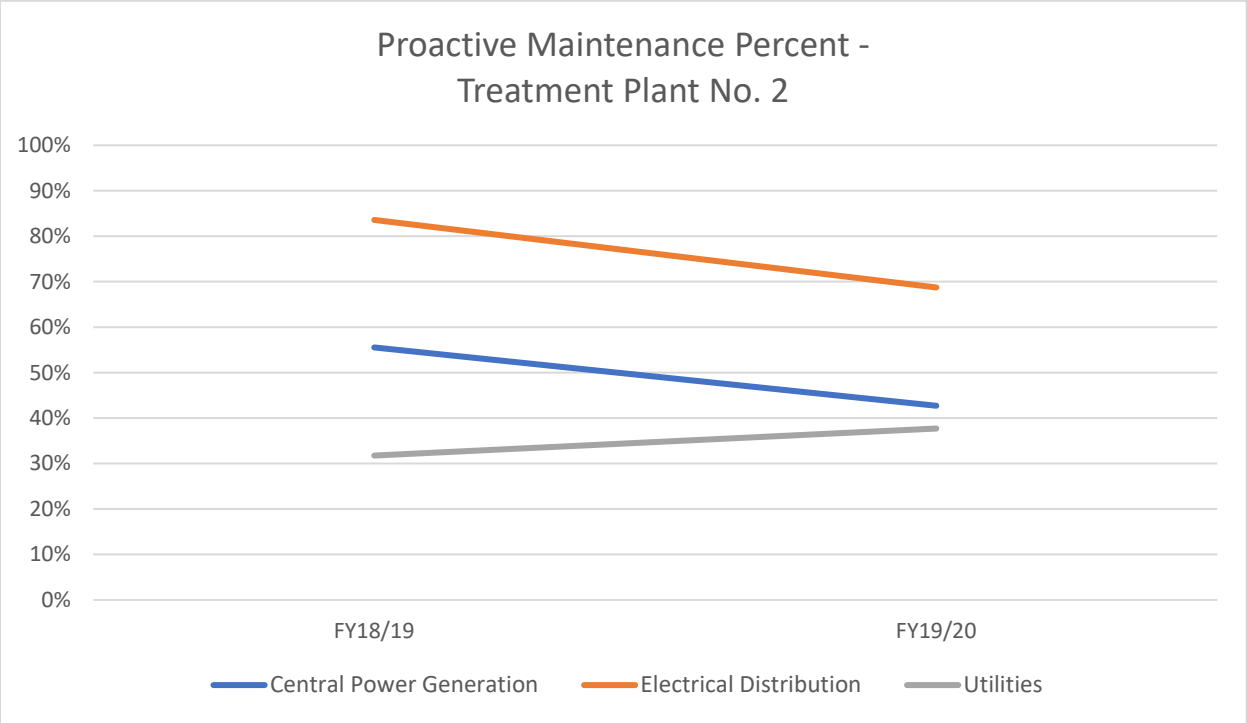

Proactive Maintenance Percent - Reclamation Plant No. 1
100%
80%
60%
40%
20%
0%
FY18/19
FY19/20
Secondary Treatment - Activated Sludge
Secondary Treatment - Trickling Filters
Solids Handling - Digesters
Solids Handling - Facilities


Proactive Maintenance Percent - Reclamation Plant No. 1
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
FY18/19
FY19/20
Central Power Generation
Electrical Distribution
Utilities

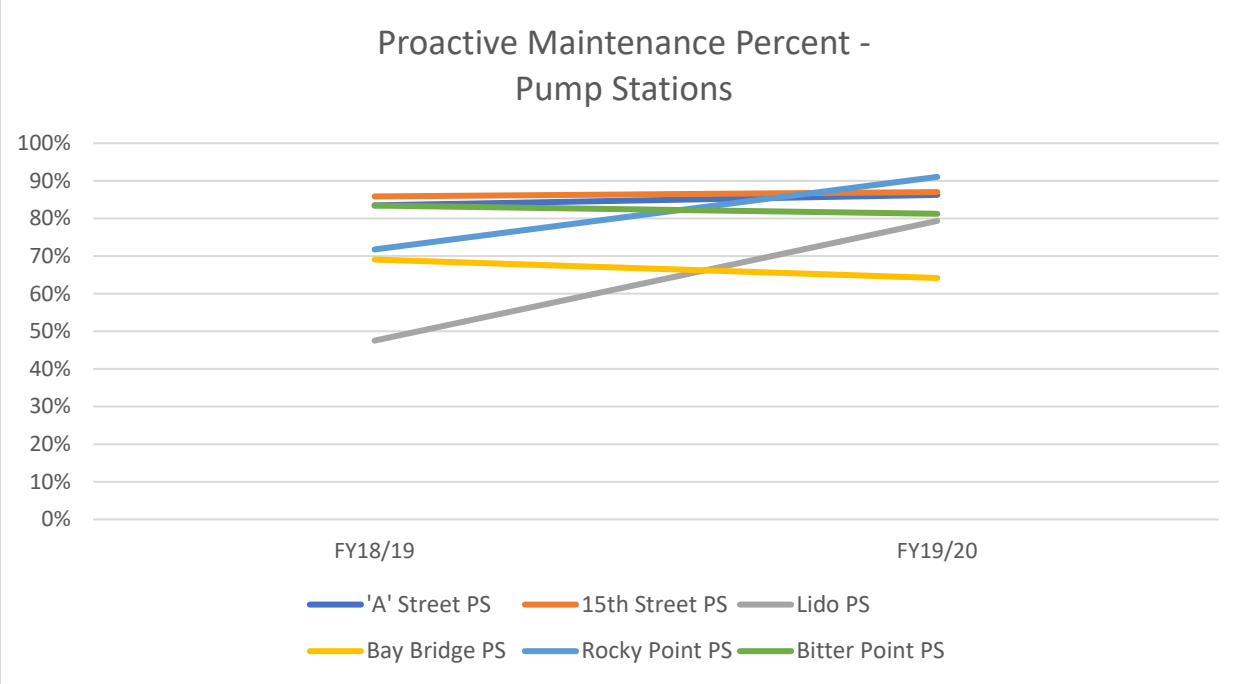
| Proactive Maintenance Percent – Treatment Plant No. 2 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 53% | 63% |
| Primary Treatment | 36% | 26% |
| Effluent Disposal | 60% | 55% |
| Activated Sludge | 54% | 48% |
| Trickling Filters | 64% | 66% |
| Digesters | 39% | 40% |
| Solids Handling Facilities | 34% | 42% |
| Central Power Generation | 56% | 43% |
| Electrical Distribution | 84% | 69% |
| Utilities | 32% | 38% |

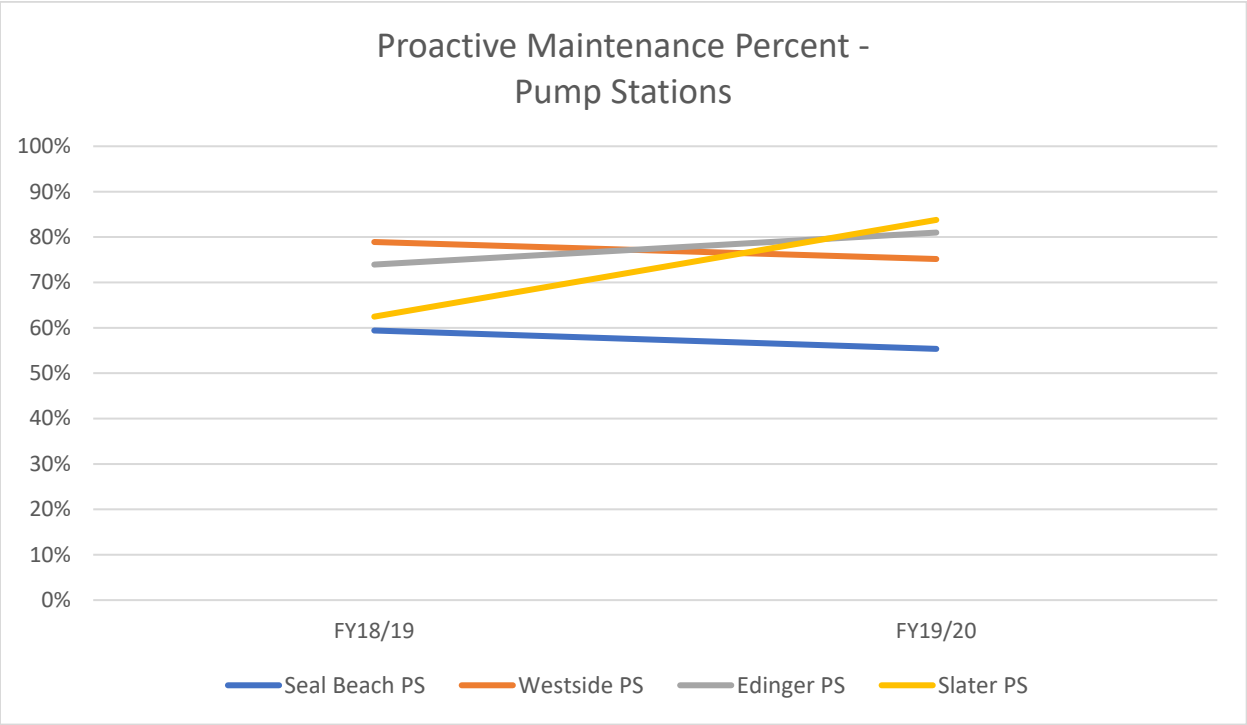


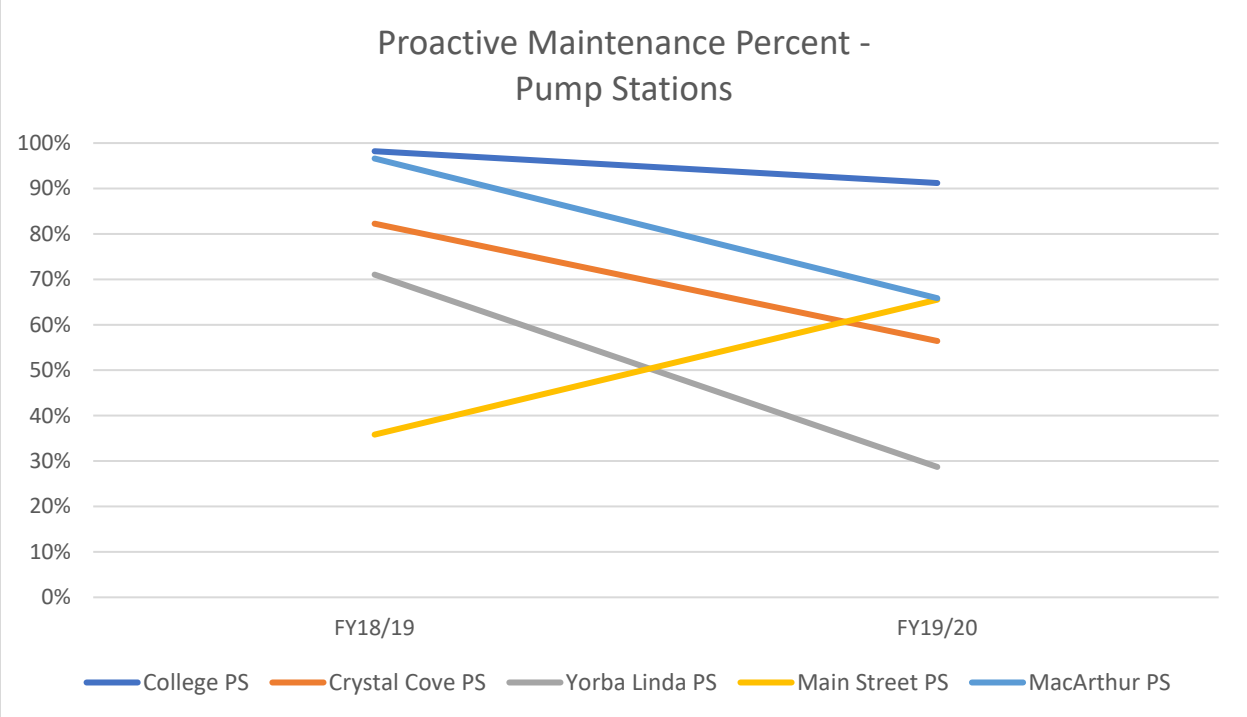

Proactive Maintenance Percent - Treatment Plant No. 2
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
FY18/19
FY19/20
Secondary Treatment - Activated Sludge
Secondary Treatment - Trickling Filters
Solids Handling - Digesters
Solids Handling - Facilities


Proactive Maintenance Percent - Treatment Plant No. 2
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
FY18/19
FY19/20
Central Power Generation
Electrical Distribution
Utilities

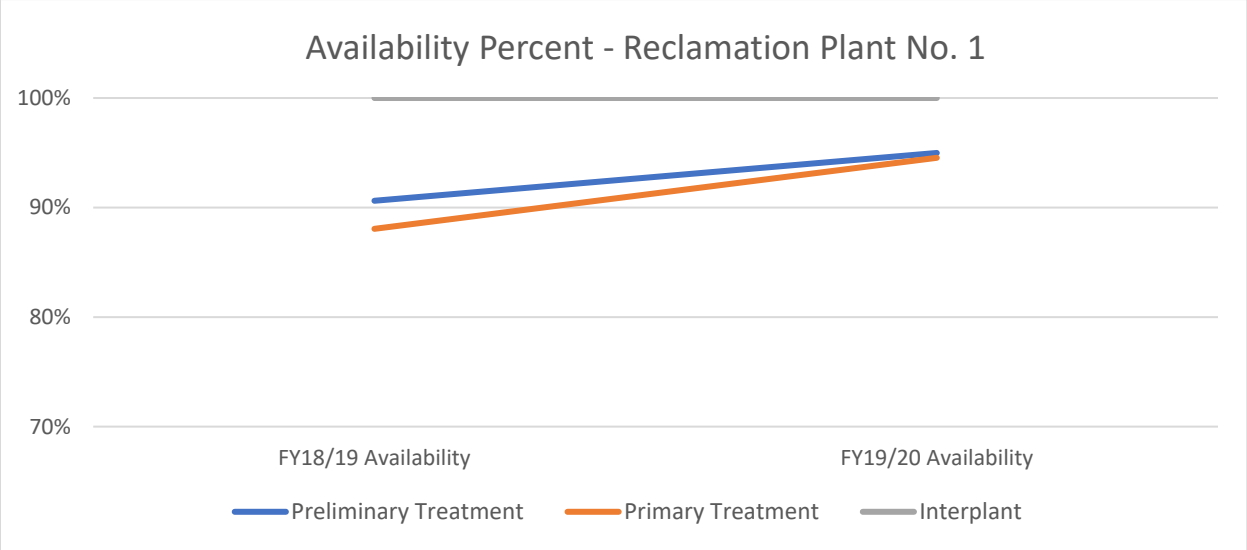
| Proactive Maintenance Percent – Pump Stations | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| A Street | 83% | 86% |
| 15th Street | 86% | 87% |
| Lido | 48% | 79% |
| Bay Bridge | 69% | 64% |
| Rocky Point | 72% | 91% |
| Bitter Point | 83% | 81% |
| Seal Beach | 59% | 55% |
| Westside | 79% | 75% |
| Edinger | 74% | 81% |
| Slater | 62% | 84% |
| College | 98% | 91% |
| Crystal Cove | 82% | 56% |
| Yorba Linda | 71% | 29% |
| Main Street | 36% | 66% |
| MacArthur | 97% | 66% |

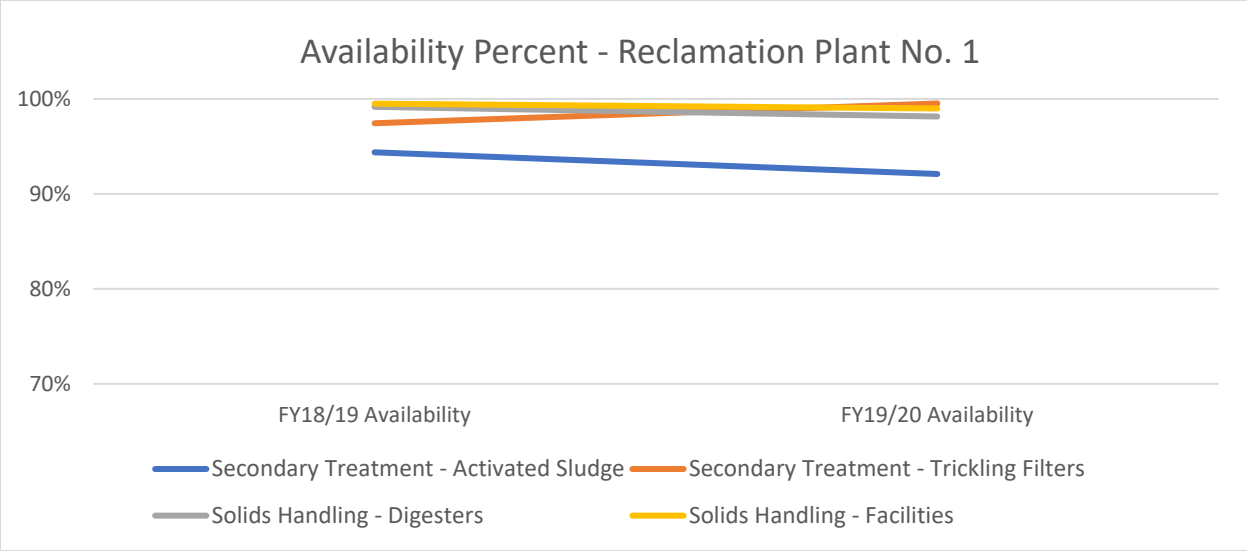


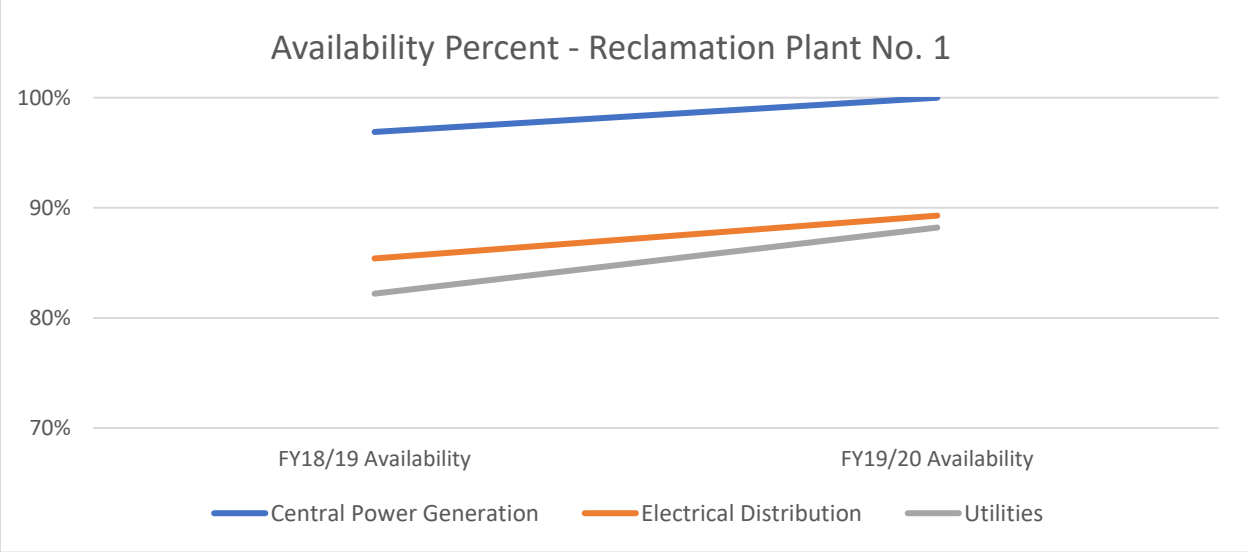

Proactive Maintenance Percent - Pump Stations
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
FY18/19
FY19/20
Seal Beach PS
Westside PS
Edinger PS
Slater PS


Proactive Maintenance Percent - Pump Stations
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
FY18/19
FY19/20
College PS
Crystal Cove PS
Yorba Linda PS
Main Street PS
MacArthur PS

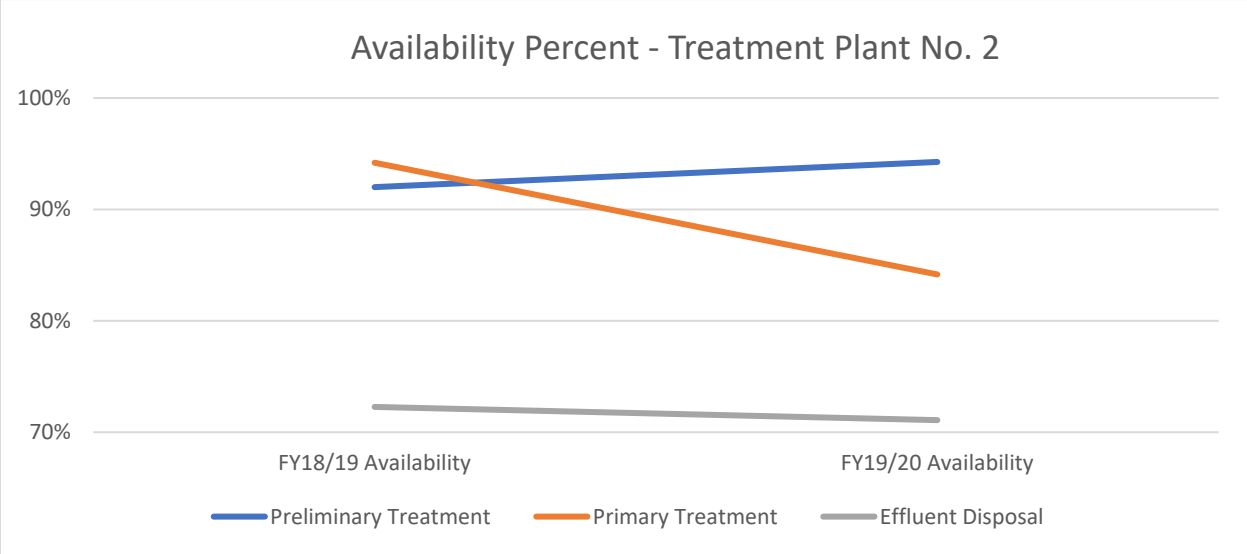
| Availability Percent – Reclamation Plant No. 1 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 91% | 95% |
| Primary Treatment | 88% | 95% |
| Interplant | 100% | 100% |
| Activated Sludge | 94% | 92% |
| Trickling Filters | 97% | 100% |
| Digesters | 99% | 98% |
| Solids Handling Facilities | 99% | 99% |
| Central Power Generation | 97% | 100% |
| Electrical Distribution | 85% | 89% |
| Utilities | 82% | 88% |

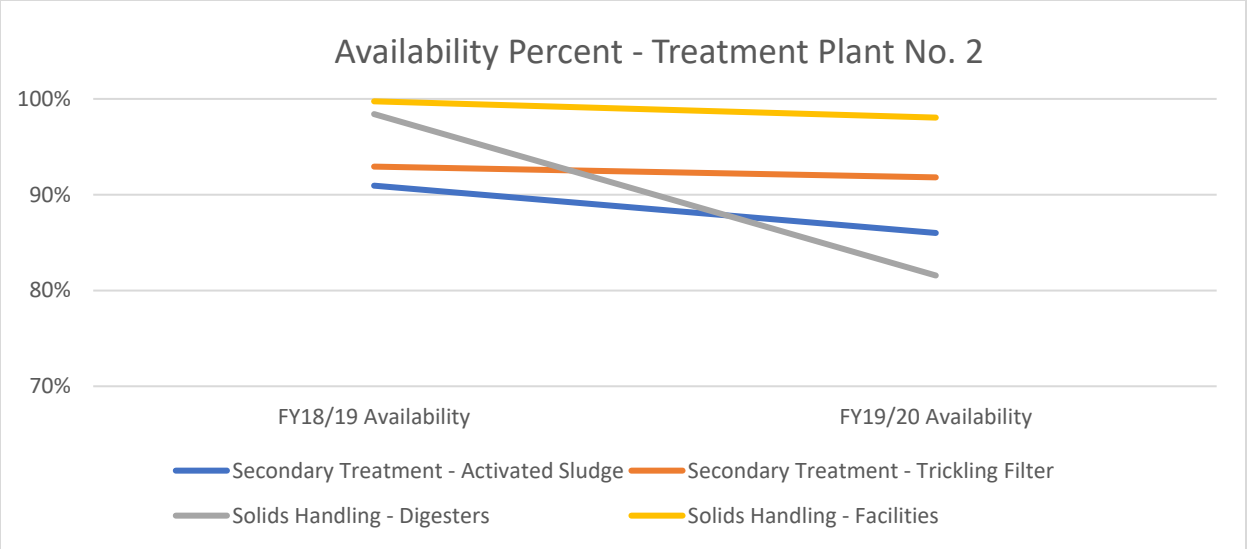


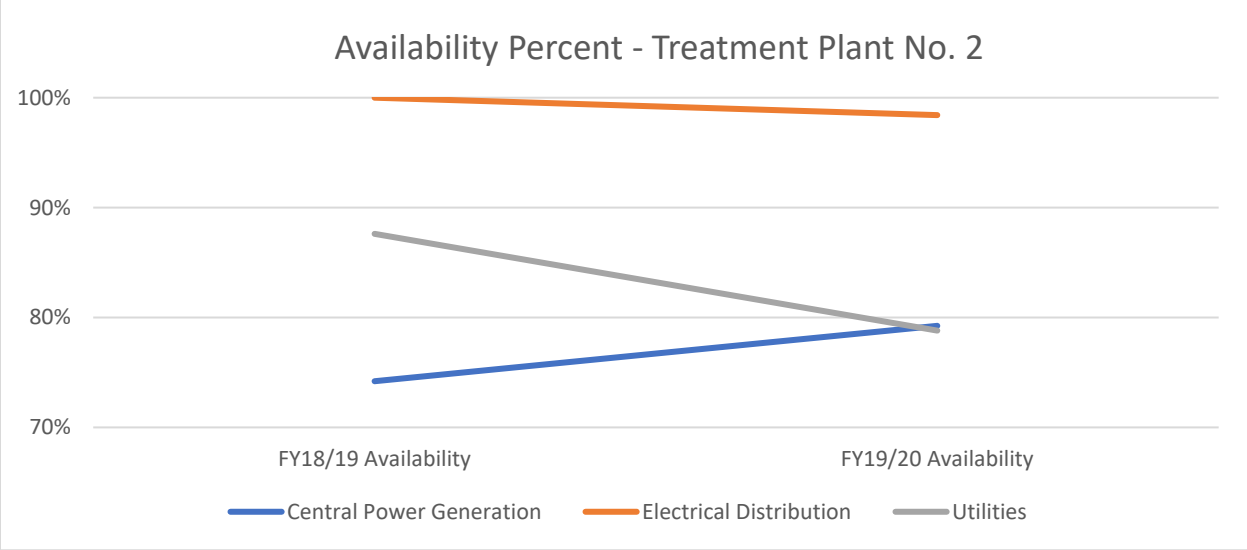

Availability Percent - Reclamation Plant No. 1
100%
90%
80%
70%
FY18/19 Availability
FY19/20 Availability
Secondary Treatment - Activated Sludge
Secondary Treatment - Trickling Filters
Solids Handling - Digesters
Solids Handling - Facilities


Availability Percent - Reclamation Plant No. 1
100%
90%
80%
70%
FY18/19 Availability
FY19/20 Availability
Central Power Generation
Electrical Distribution
Utilities

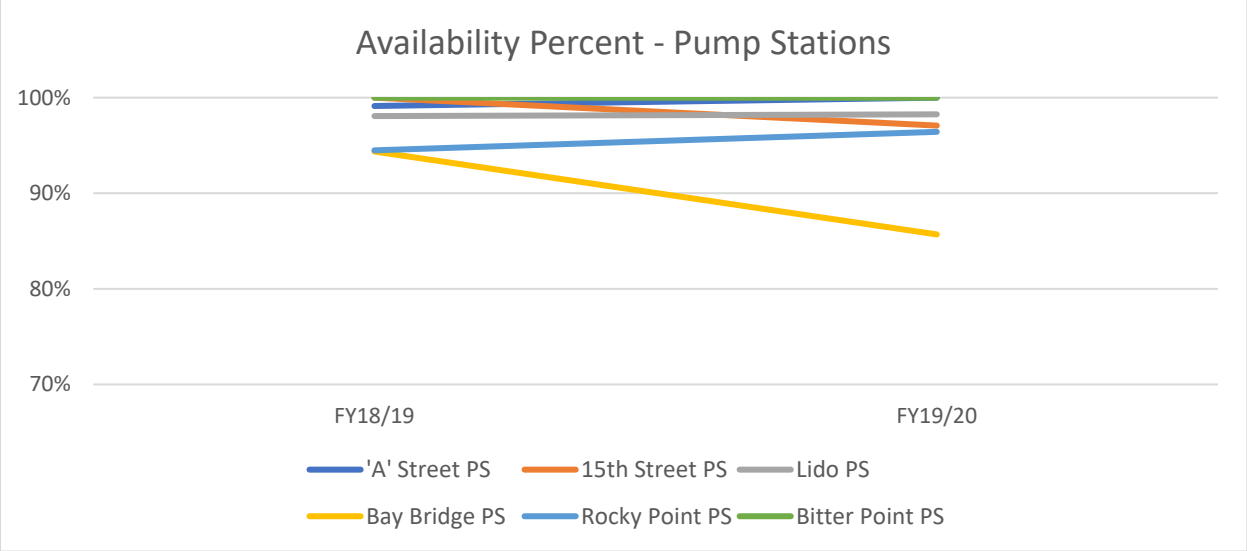
| Availability Percent – Treatment Plant No. 2 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 92% | 94% |
| Primary Treatment | 94% | 84% |
| Effluent Disposal | 72% | 71% |
| Activated Sludge | 91% | 86% |
| Trickling Filters | 93% | 92% |
| Digesters | 98% | 82% |
| Solids Handling Facilities | 100% | 98% |
| Central Power Generation | 74% | 79% |
| Electrical Distribution | 100% | 98% |
| Utilities | 88% | 79% |

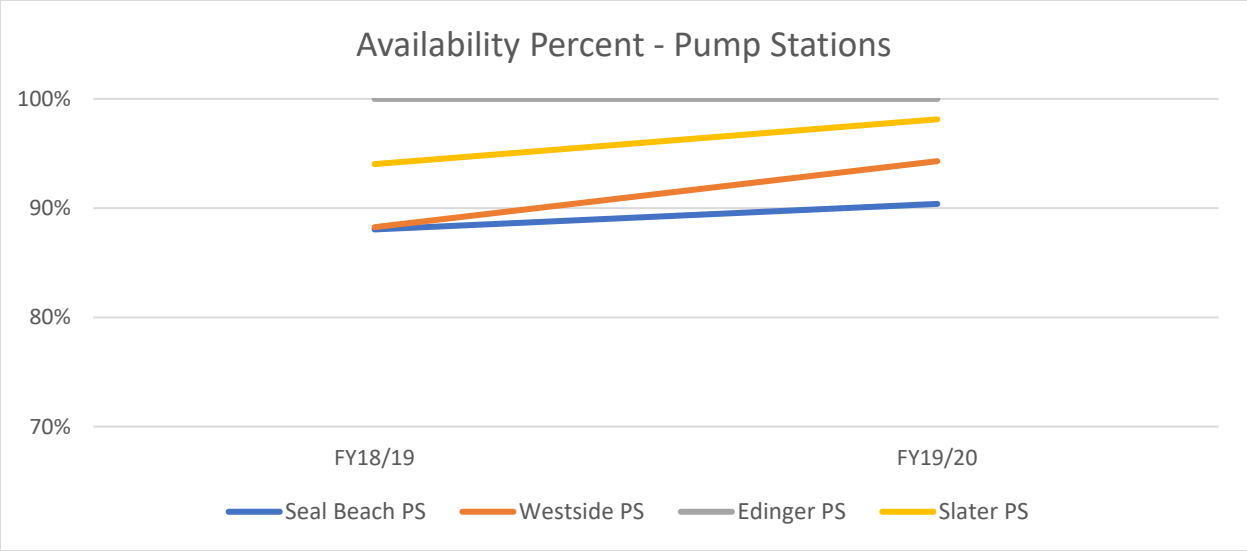


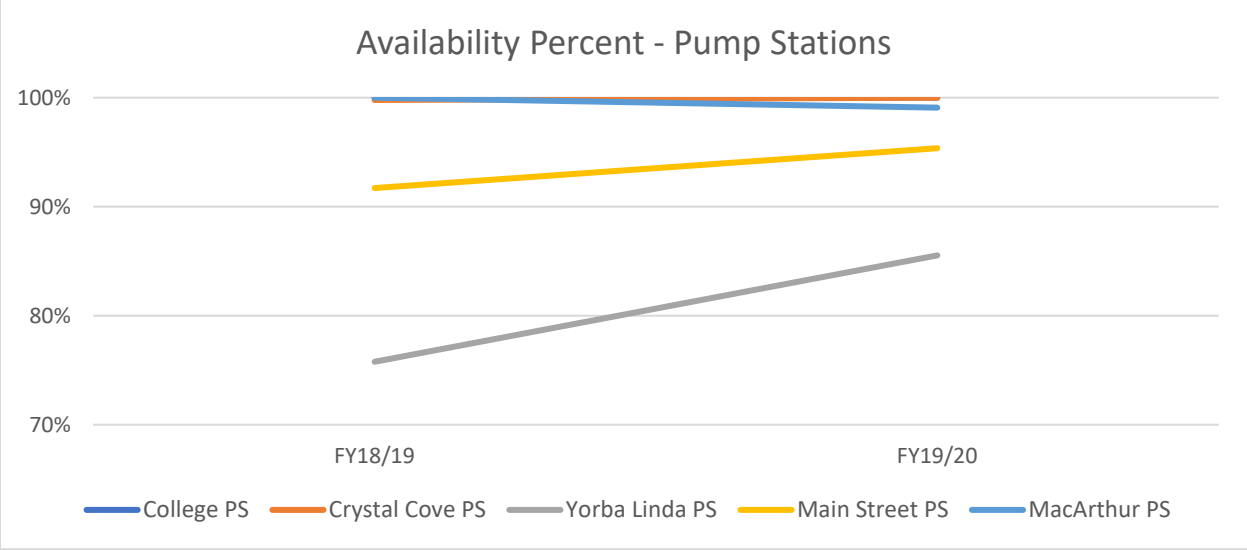

Availability Percent - Treatment Plant No. 2
100%
90%
80%
70%
FY18/19 Availability
FY19/20 Availability
Secondary Treatment - Activated Sludge
Secondary Treatment - Trickling Filter
Solids Handling - Digesters
Solids Handling - Facilities


Availability Percent - Treatment Plant No. 2
100%
90%
80%
70%
FY18/19 Availability
FY19/20 Availability
Central Power Generation
Electrical Distribution
Utilities

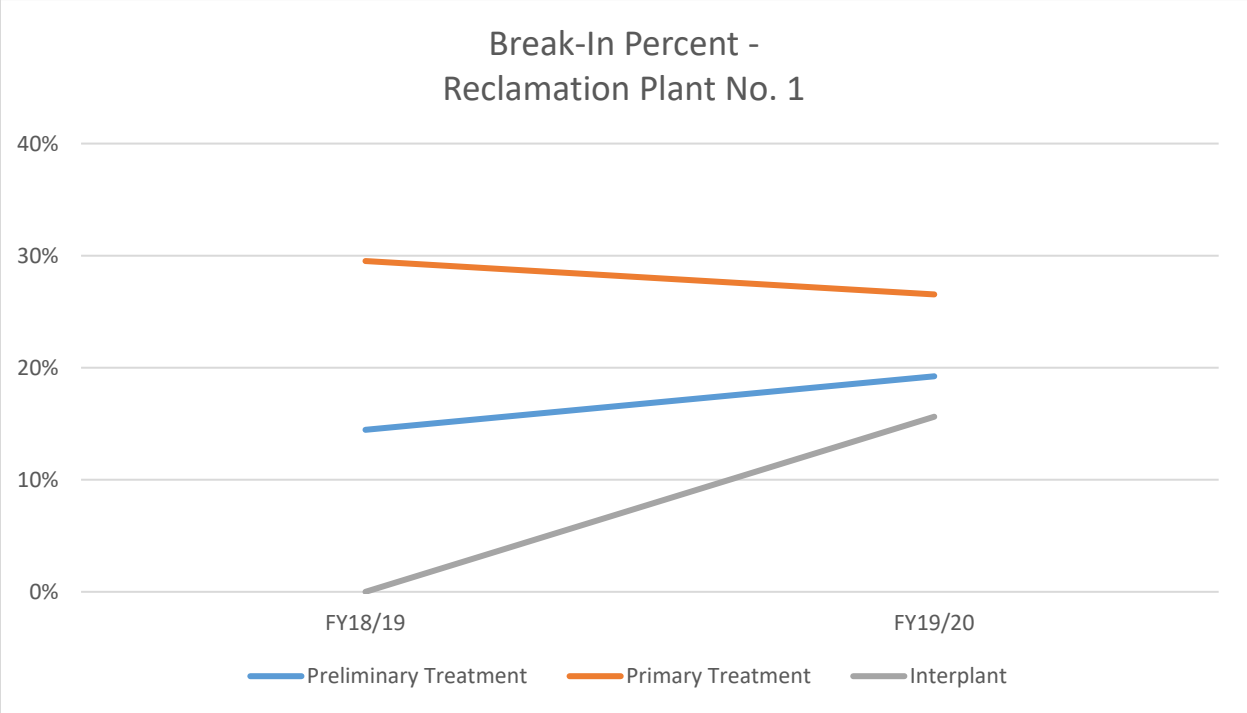
| Availability Percent – Pump Stations | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| A Street | 99% | 100% |
| 15th Street | 100% | 97% |
| Lido | 98% | 98% |
| Bay Bridge | 94% | 86% |
| Rocky Point | 94% | 96% |
| Bitter Point | 100% | 100% |
| Seal Beach | 88% | 90% |
| Westside | 88% | 94% |
| Edinger | 100% | 100% |
| Slater | 94% | 98% |
| College | 100% | 100% |
| Crystal Cove | 100% | 100% |
| Yorba Linda | 76% | 86% |
| Main Street | 92% | 95% |
| MacArthur | 100% | 99% |

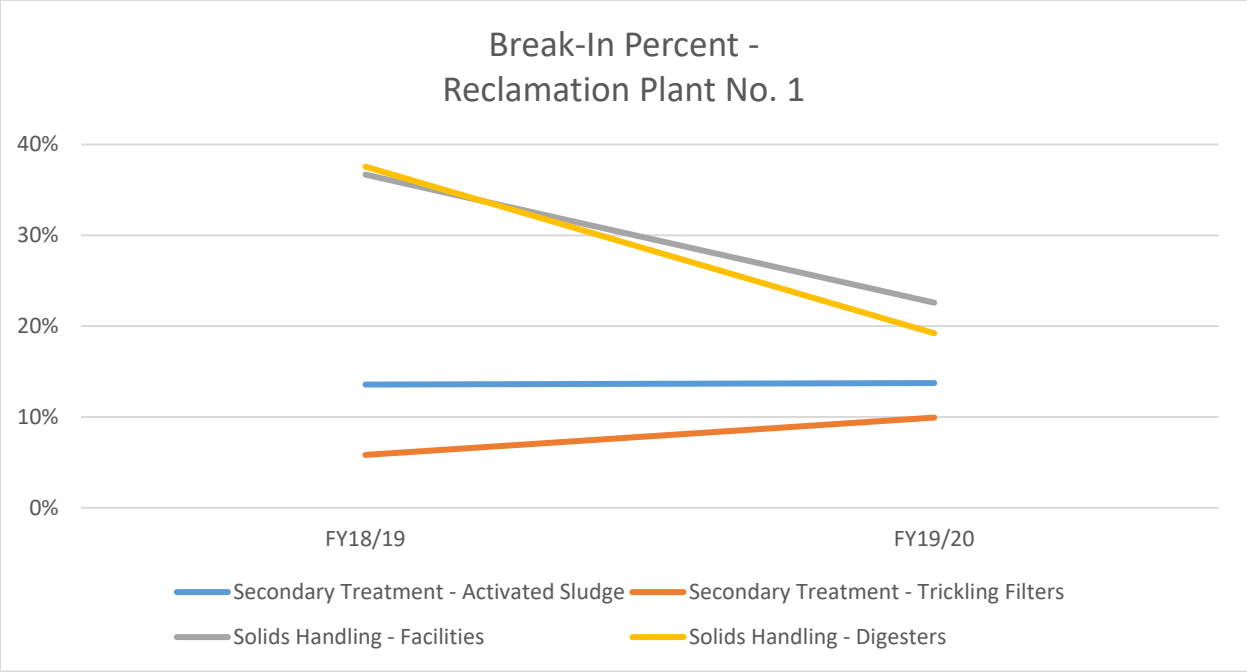


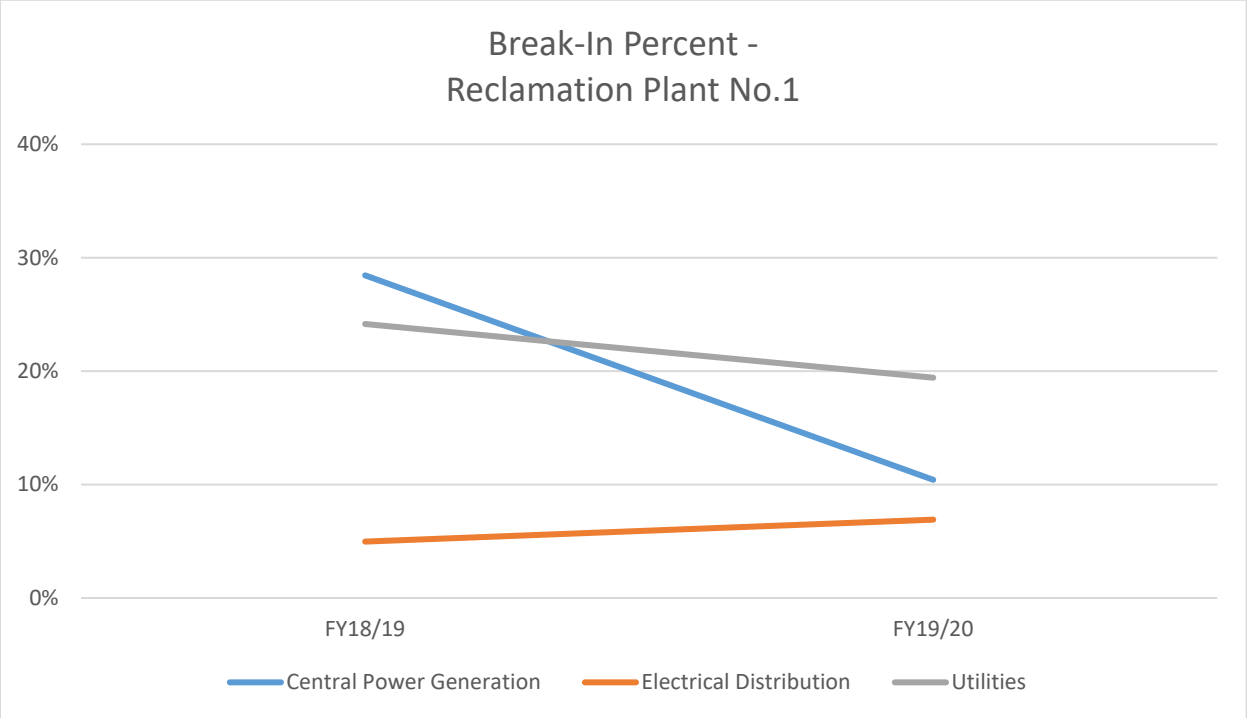

Availability Percent - Pump Stations
100%
90%
80%
70%
FY18/19
FY19/20
Seal Beach PS
Westside PS
Edinger PS
Slater PS


Availability Percent - Pump Stations
100%
90%
80%
70%
FY18/19
FY19/20
College PS
Crystal Cove PS
Yorba Linda PS
Main Street PS
MacArthur PS

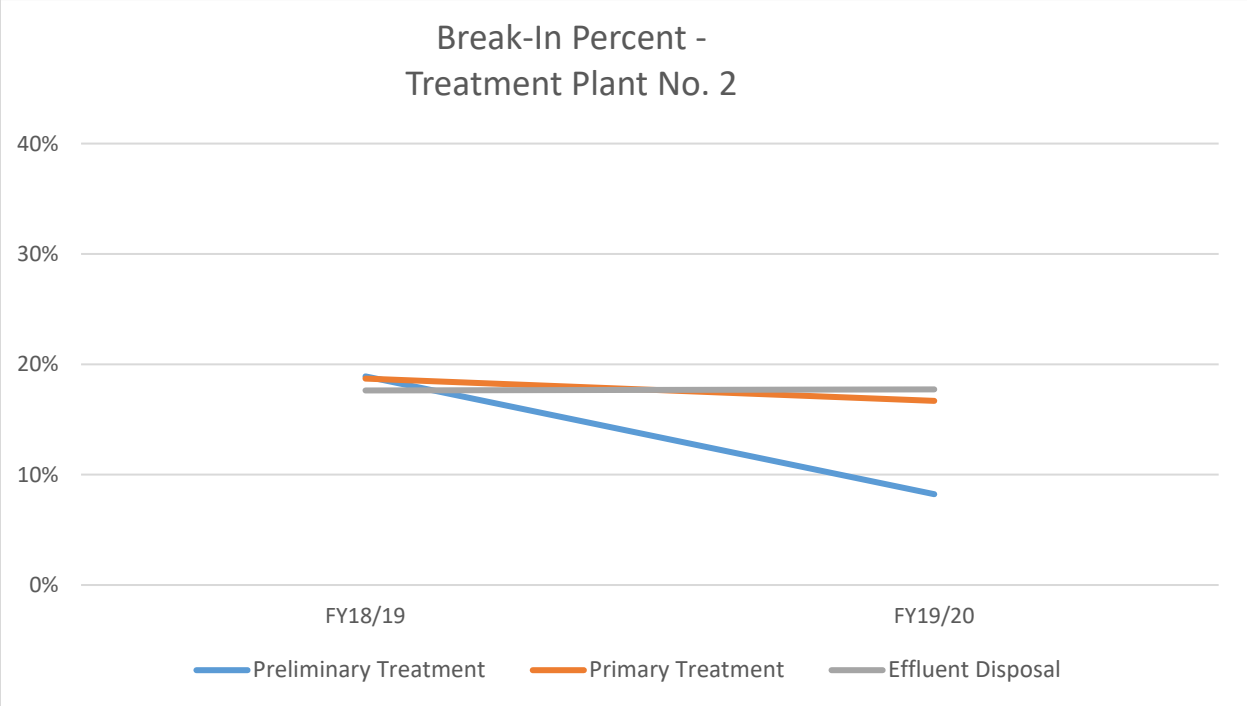
| Break-In Percent – Reclamation Plant No. 1 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 14% | 19% |
| Primary Treatment | 30% | 27% |
| Interplant | 0% | 16% |
| Activated Sludge | 14% | 14% |
| Trickling Filters | 6% | 10% |
| Digesters | 38% | 19% |
| Solids Handling Facilities | 37% | 23% |
| Central Power Generation | 28% | 10% |
| Electrical Distribution | 5% | 7% |
| Utilities | 24% | 19% |

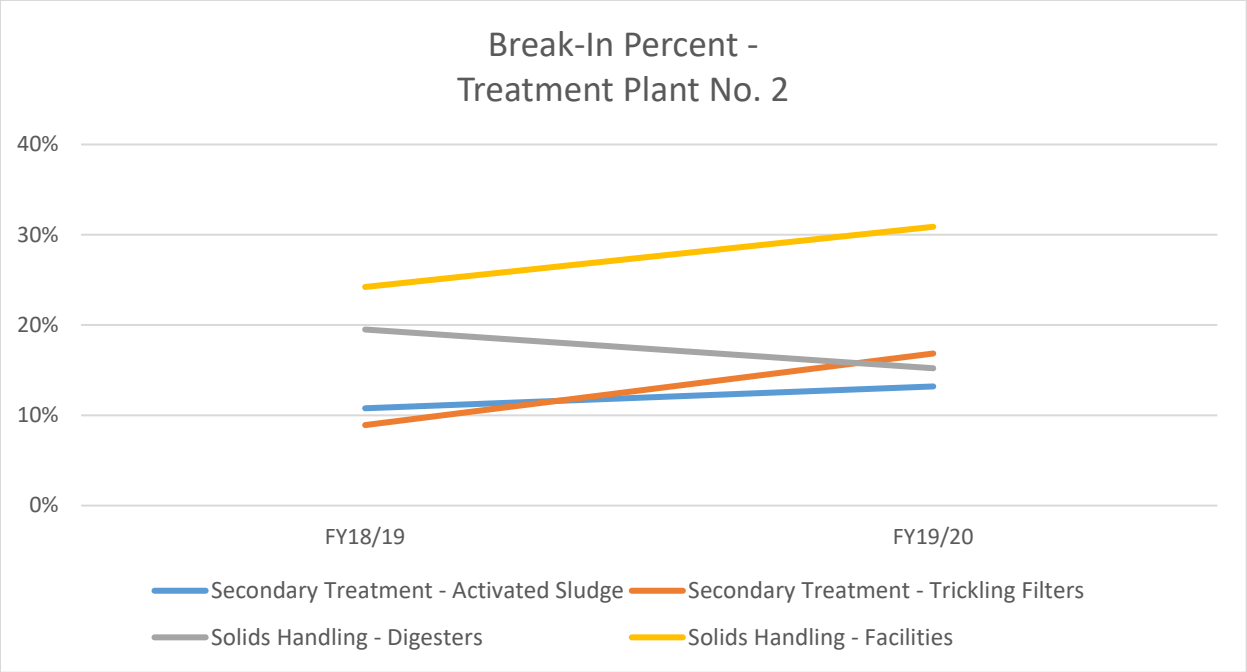


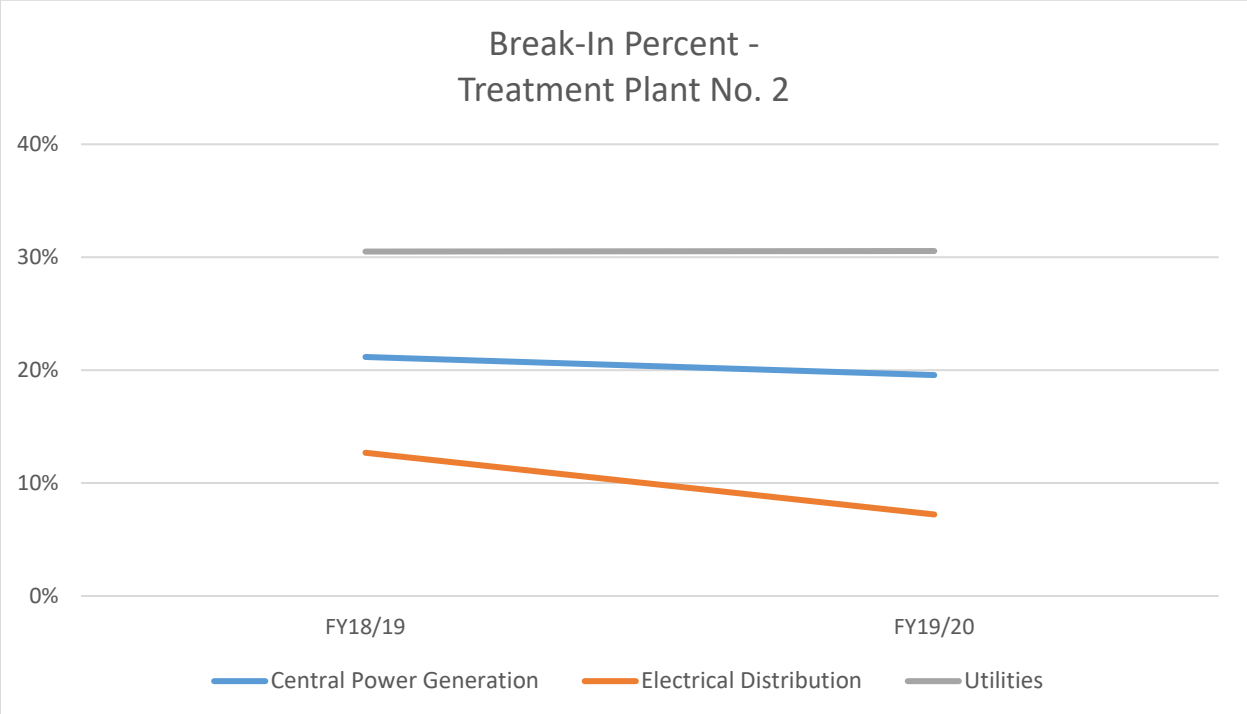

Break-In Percent -
Reclamation Plant No. 1
40%
30%
20%
10%
0%
FY18/19
FY19/20
Secondary Treatment - Activated Sludge
Secondary Treatment - Trickling Filters
Solids Handling - Facilities
Solids Handling - Digesters


Break-In Percent -
Reclamation Plant No.1
40%
30%
20%
10%
0%
FY18/19
FY19/20
Central Power Generation
Electrical Distribution
Utilities

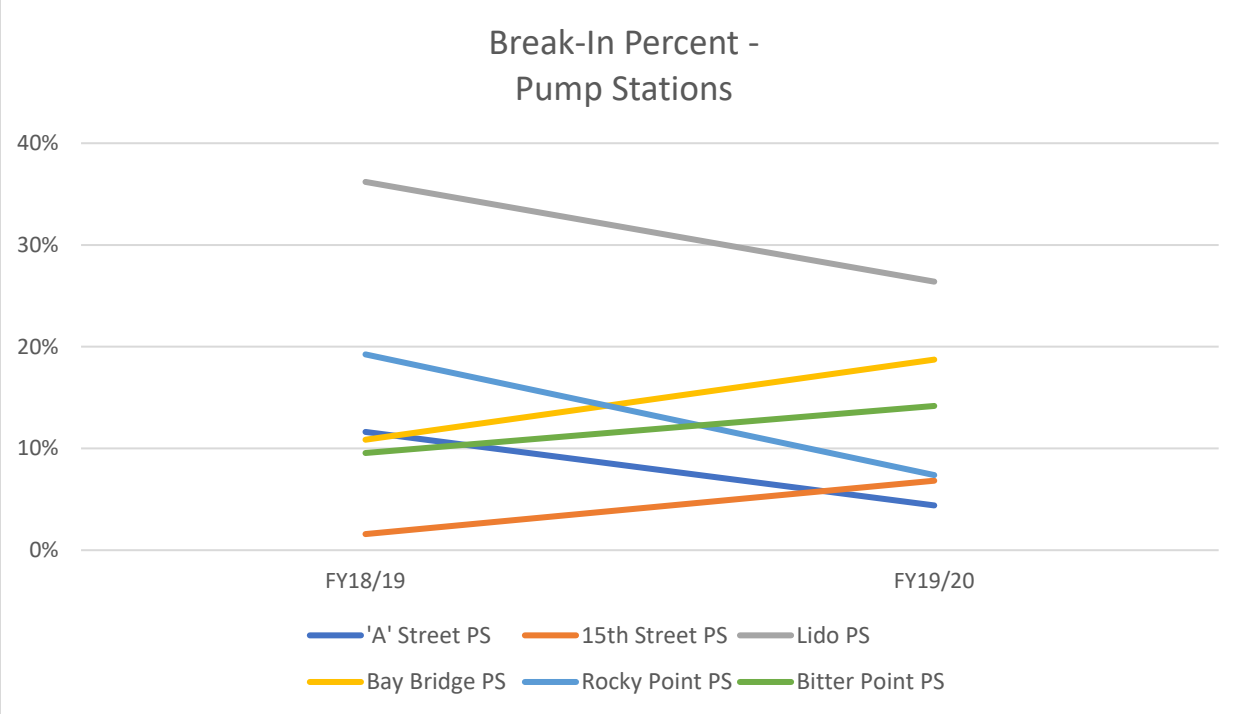
| Break-In Percent – Treatment Plant No. 2 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 19% | 8% |
| Primary Treatment | 19% | 17% |
| Effluent Disposal | 18% | 18% |
| Activated Sludge | 11% | 13% |
| Trickling Filters | 9% | 17% |
| Digesters | 20% | 15% |
| Solids Handling Facilities | 24% | 31% |
| Central Power Generation | 21% | 20% |
| Electrical Distribution | 13% | 7% |
| Utilities | 30% | 31% |

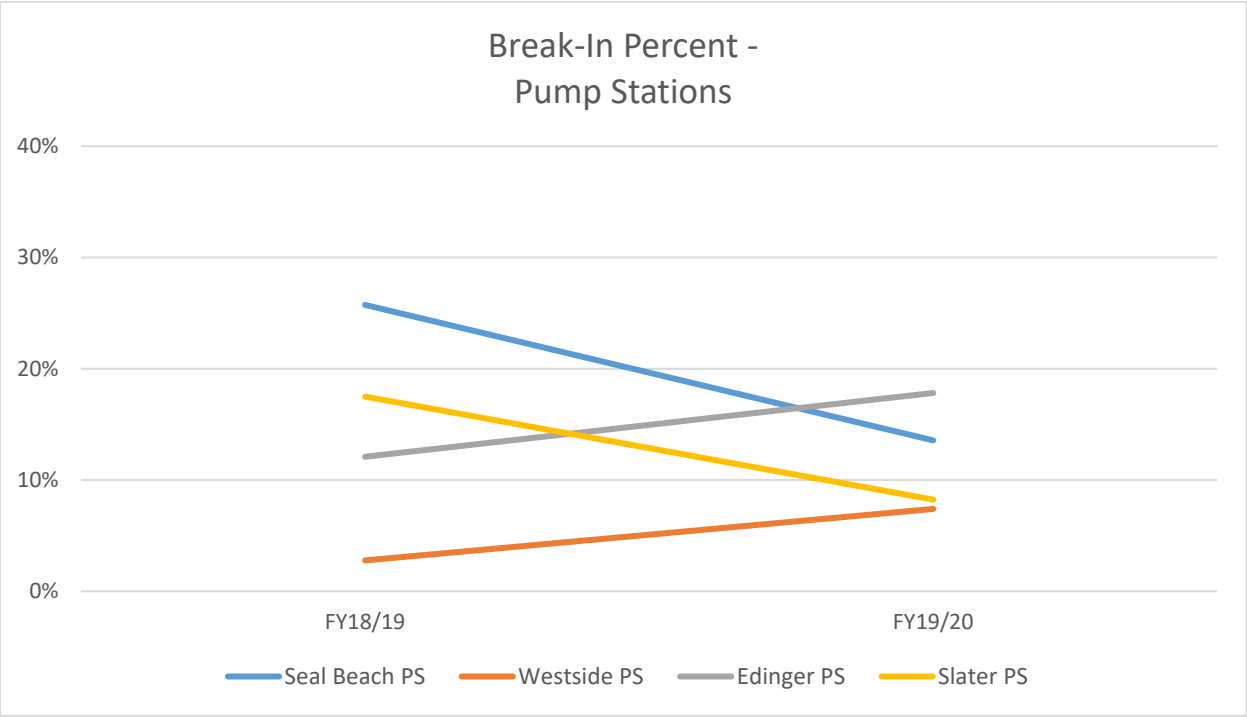


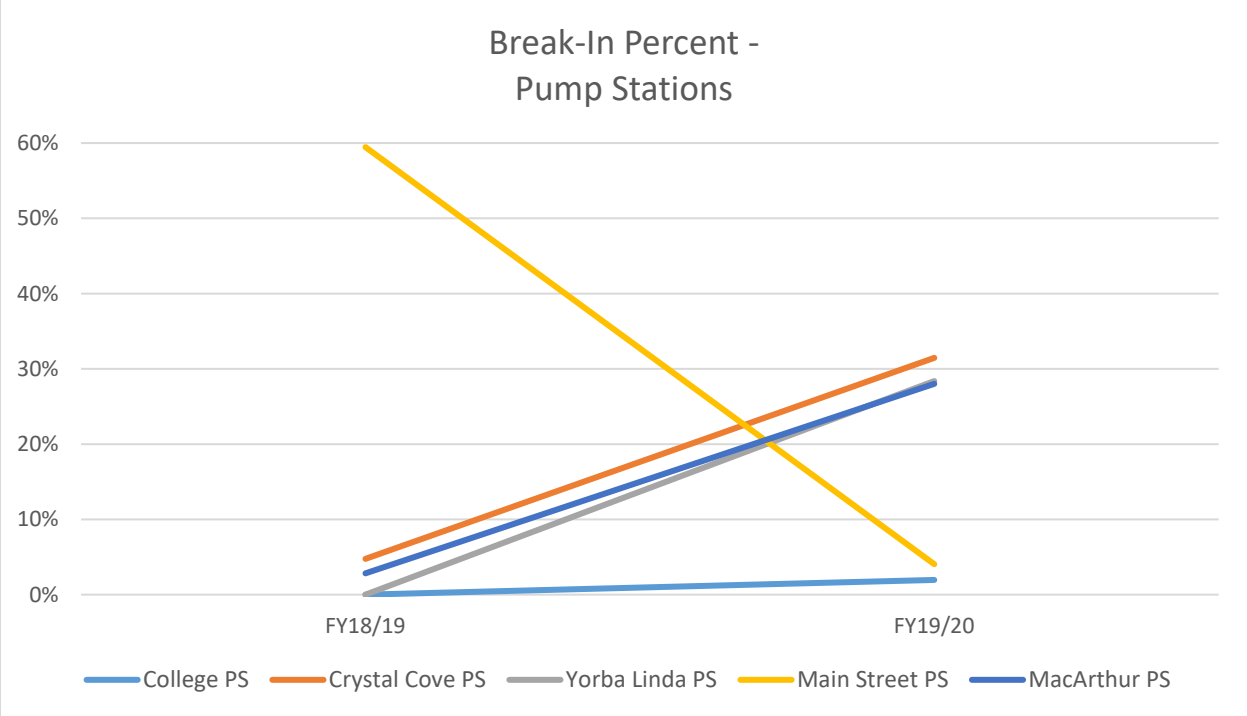

Break-In Percent -
Treatment Plant No. 2
40%
30%
20%
10%
0%
FY18/19
FY19/20
Secondary Treatment - Activated Sludge
Secondary Treatment - Trickling Filters
Solids Handling - Digesters
Solids Handling - Facilities


Break-In Percent -
Treatment Plant No. 2
40%
30%
20%
10%
0%
FY18/19
FY19/20
Central Power Generation
Electrical Distribution
Utilities

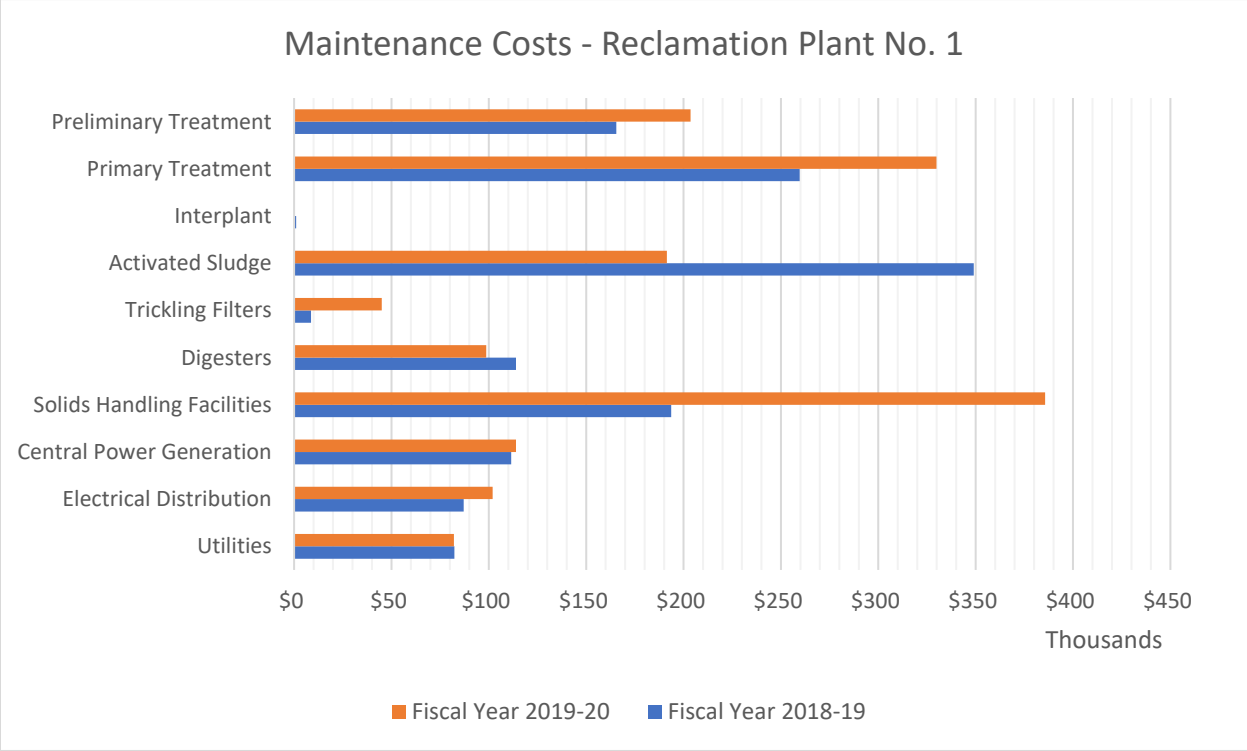
| Break-In Percent – Pump Stations | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| A Street | 12% | 4% |
| 15th Street | 2% | 7% |
| Lido | 36% | 26% |
| Bay Bridge | 11% | 19% |
| Rocky Point | 19% | 7% |
| Bitter Point | 10% | 14% |
| Seal Beach | 26% | 14% |
| Westside | 3% | 7% |
| Edinger | 12% | 18% |
| Slater | 18% | 8% |
| College | 0% | 2% |
| Crystal Cove | 5% | 31% |
| Yorba Linda | 0% | 28% |
| Main Street | 59% | 4% |
| MacArthur | 3% | 28% |



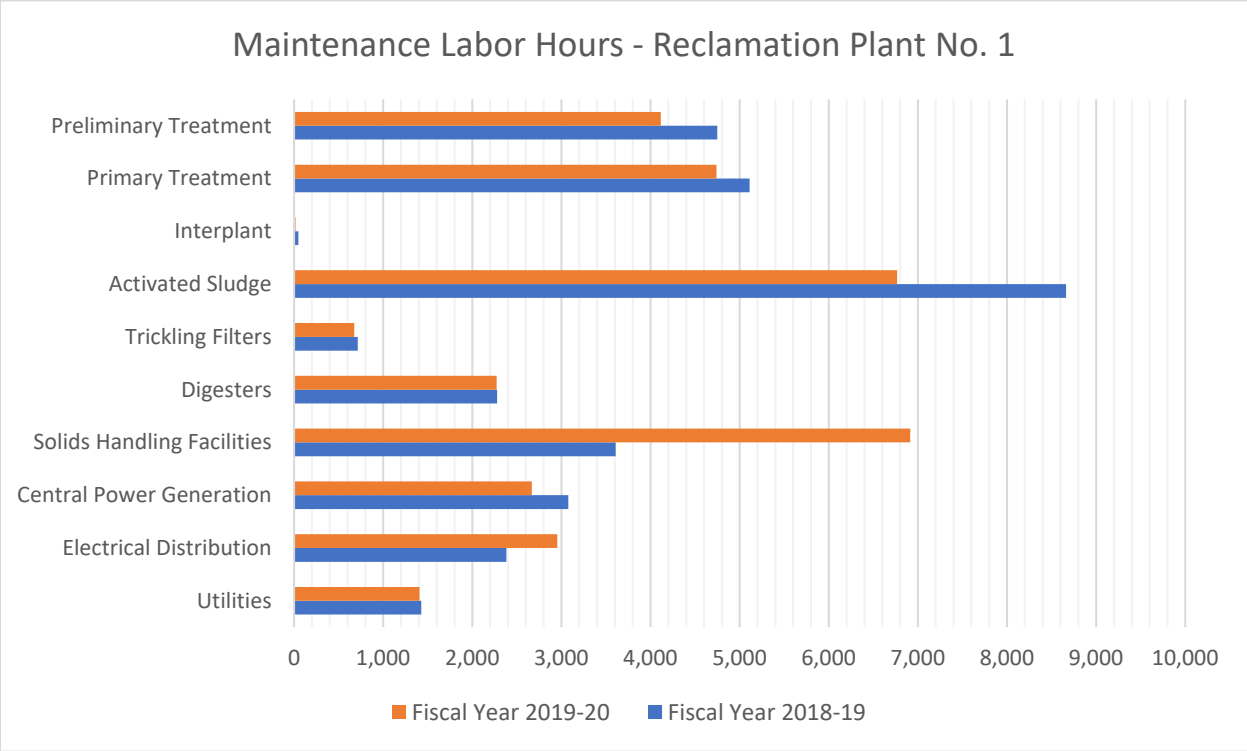

Break-In Percent -
Pump Stations
40%
30%
20%
10%
0%
FY18/19
FY19/20
Seal Beach PS
Westside PS
Edinger PS
Slater PS


Break-In Percent -
Pump Stations
60%
50%
40%
30%
20%
10%
0%
FY18/19
FY19/20
College PS
Crystal Cove PS
Yorba Linda PS
Main Street PS
MacArthur PS

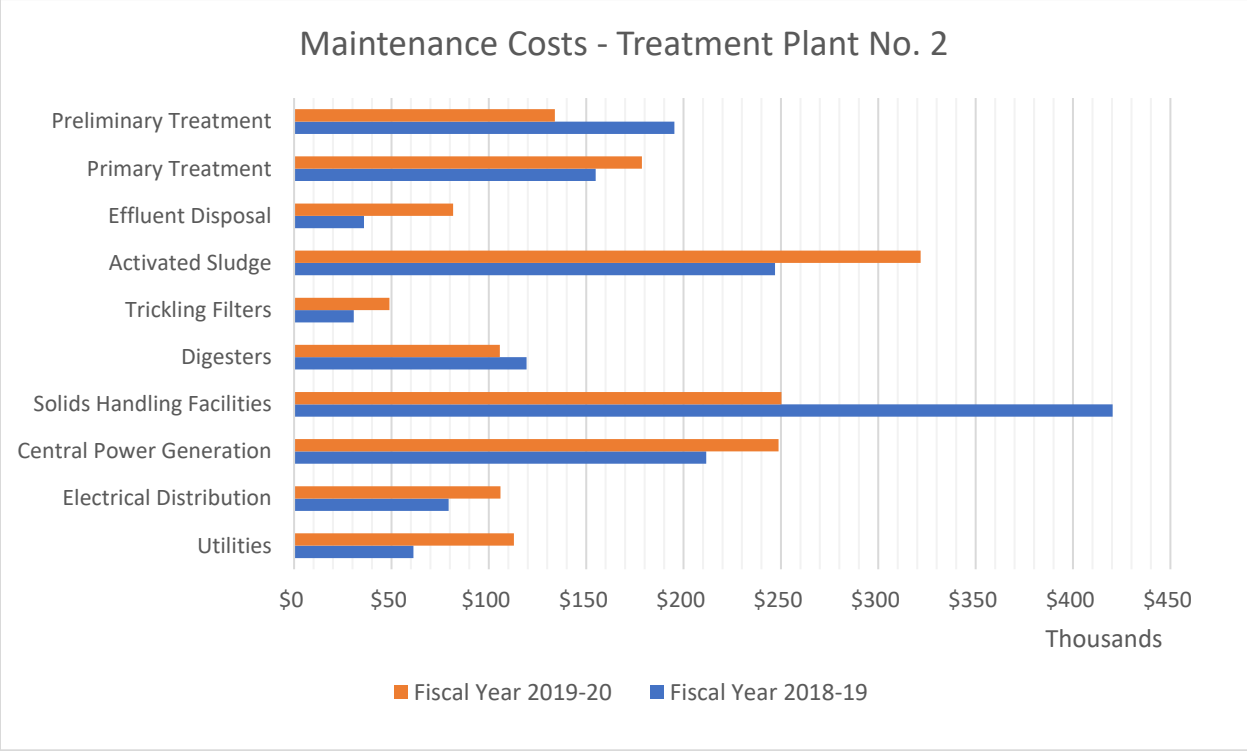
| Maintenance Costs – Reclamation Plant No. 1 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | $165,488 | $203,570 |
| Primary Treatment | $259,648 | $329,854 |
| Interplant | $1,036 | $129 |
| Activated Sludge | $348,991 | $191,435 |
| Trickling Filters | $8,680 | $45,031 |
| Digesters | $113,916 | $98,690 |
| Solids Handling Facilities | $193,670 | $385,627 |
| Central Power Generation | $111,462 | $113,983 |
| Electrical Distribution | $87,059 | $101,982 |
| Utilities | $82,326 | $82,080 |



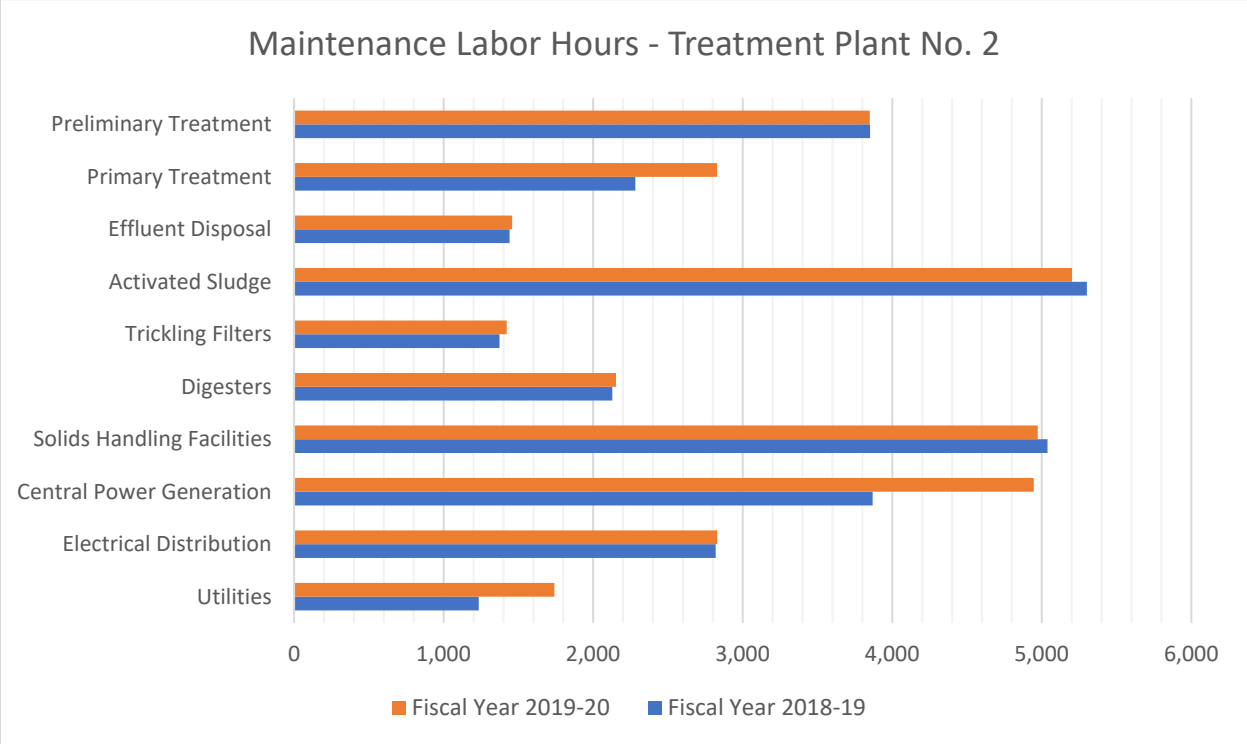
| Maintenance Labor Hours – Reclamation Plant No. 1 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 4,748 | 4,115 |
| Primary Treatment | 5,111 | 4,740 |
| Interplant | 48 | 16 |
| Activated Sludge | 8,662 | 6,767 |
| Trickling Filters | 714 | 675 |
| Digesters | 2,279 | 2,273 |
| Solids Handling Facilities | 3,608 | 6,913 |
| Central Power Generation | 3,077 | 2,668 |
| Electrical Distribution | 2,383 | 2,954 |
| Utilities | 1,428 | 1,408 |



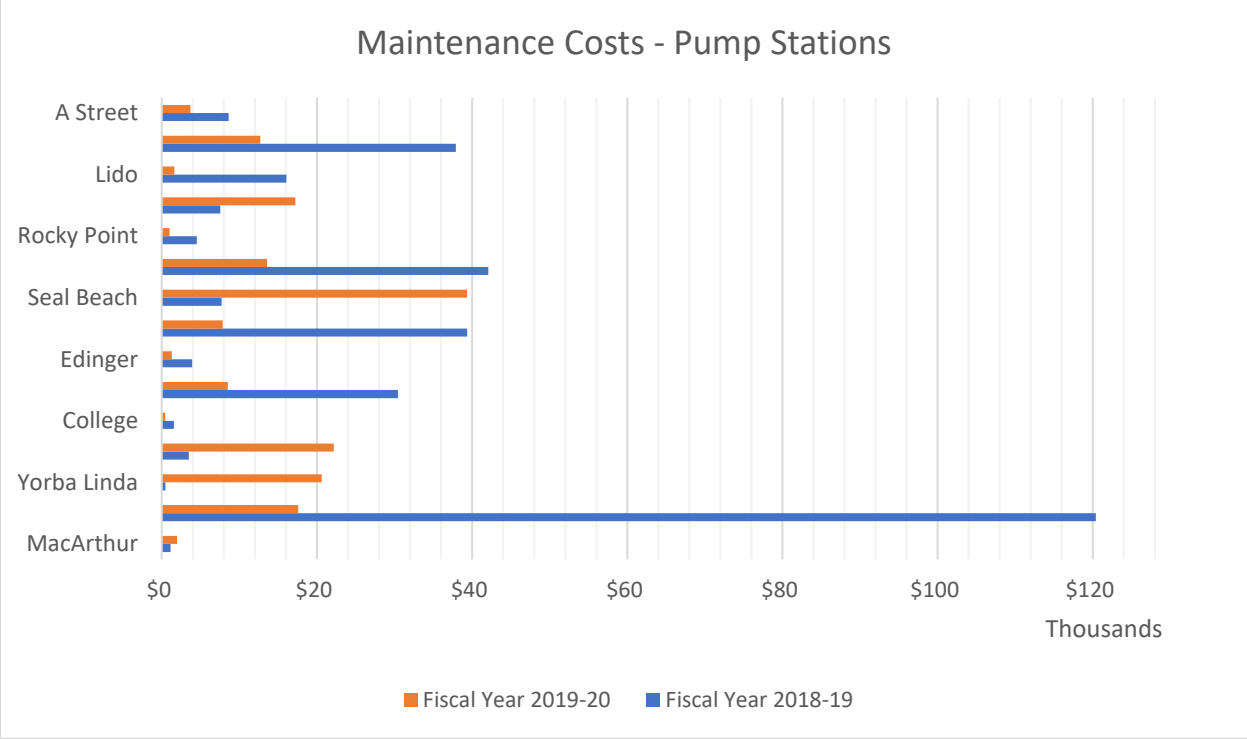
| Maintenance Costs – Treatment Plant No. 2 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | $195,308 | $133,945 |
| Primary Treatment | $154,861 | $178,630 |
| Effluent Disposal | $35,917 | $81,641 |
| Activated Sludge | $246,962 | $321,769 |
| Trickling Filters | $30,648 | $49,001 |
| Digesters | $119,396 | $105,654 |
| Solids Handling Facilities | $420,324 | $250,255 |
| Central Power Generation | $211,670 | $248,771 |
| Electrical Distribution | $79,327 | $106,000 |
| Utilities | $61,275 | $112,913 |



| Maintenance Labor Hours – Treatment Plant No. 2 | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| Preliminary Treatment | 3,852 | 3,849 |
| Primary Treatment | 2,282 | 2,829 |
| Effluent Disposal | 1,441 | 1,458 |
| Activated Sludge | 5,301 | 5,202 |
| Trickling Filters | 1,374 | 1,422 |
| Digesters | 2,128 | 2,153 |
| Solids Handling Facilities | 5,038 | 4,973 |
| Central Power Generation | 3,869 | 4,946 |
| Electrical Distribution | 2,819 | 2,830 |
| Utilities | 3,852 | 3,849 |



| Maintenance Costs – Pump Stations | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| A Street | $8,613 | $3,683 |
| 15th Street | $37,904 | $12,704 |
| Lido | $16,070 | $1,629 |
| Bay Bridge | $7,558 | $17,214 |
| Rocky Point | $4,516 | $1,016 |
| Bitter Point | $42,090 | $13,573 |
| Seal Beach | $7,707 | $39,357 |
| Westside | $39,372 | $7,862 |
| Edinger | $3,915 | $1,303 |
| Slater | $30,446 | $8,510 |
| College | $1,578 | $461 |
| Crystal Cove | $3,489 | $22,171 |
| Yorba Linda | $467 | $20,626 |
| Main Street | $120,387 | $17,597 |
| MacArthur | $1,144 | $1,974 |



| Maintenance Labor Hours – Pump Stations | | |
|---|---|---|
| **Process Area** | **Fiscal Year 2018-19** | **Fiscal Year 2019-20** |
| A Street | 286 | 330 |
| 15th Street | 458 | 520 |
| Lido | 439 | 300 |
| Bay Bridge | 408 | 442 |
| Rocky Point | 278 | 224 |
| Bitter Point | 560 | 693 |
| Seal Beach | 574 | 905 |
| Westside | 288 | 314 |
| Edinger | 147 | 147 |
| Slater | 640 | 677 |
| College | 195 | 256 |
| Crystal Cove | 410 | 681 |
| Yorba Linda | 194 | 463 |
| Main Street | 1324 | 915 |
| MacArthur | 177 | 204 |