



Condition Assessments & Comprehensive Asset Evaluations

August 24, 2022

Central San
Central Contra Costa Sanitary District

- Serve over 480,000 residents a esses. Maintain ~1,500 miles of co
- Treatment Plant dry we ~32 Million Gallons pe
- Wet weather peak ho (stored in wet weathe
- Provide recycled water t customers.
- Operate residential household hazardous waste collection facility.

Liquid Treatment Process

CENTRAL SAN

Existing Solids Treatment Process

Secondary Clarifier

Dissolved Air Flotation Thickener

Sludge Blending Tank

Centrifuge

Multiple Hearth Furnace

Ash Handling System

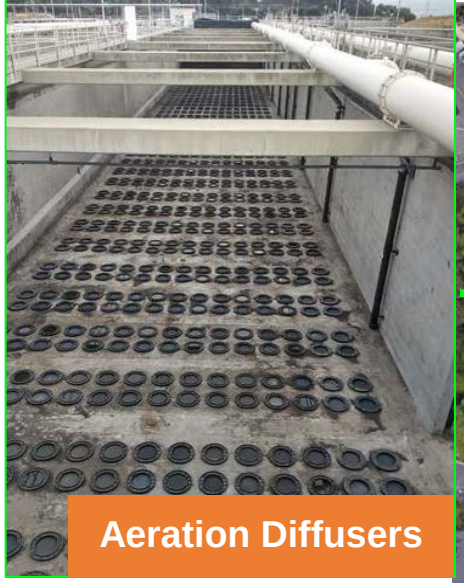
Central San's Challenge With Aging Infrastructure

- Much of Central San's equipment is from a major treatment plant expansion project completed in the 1970s.

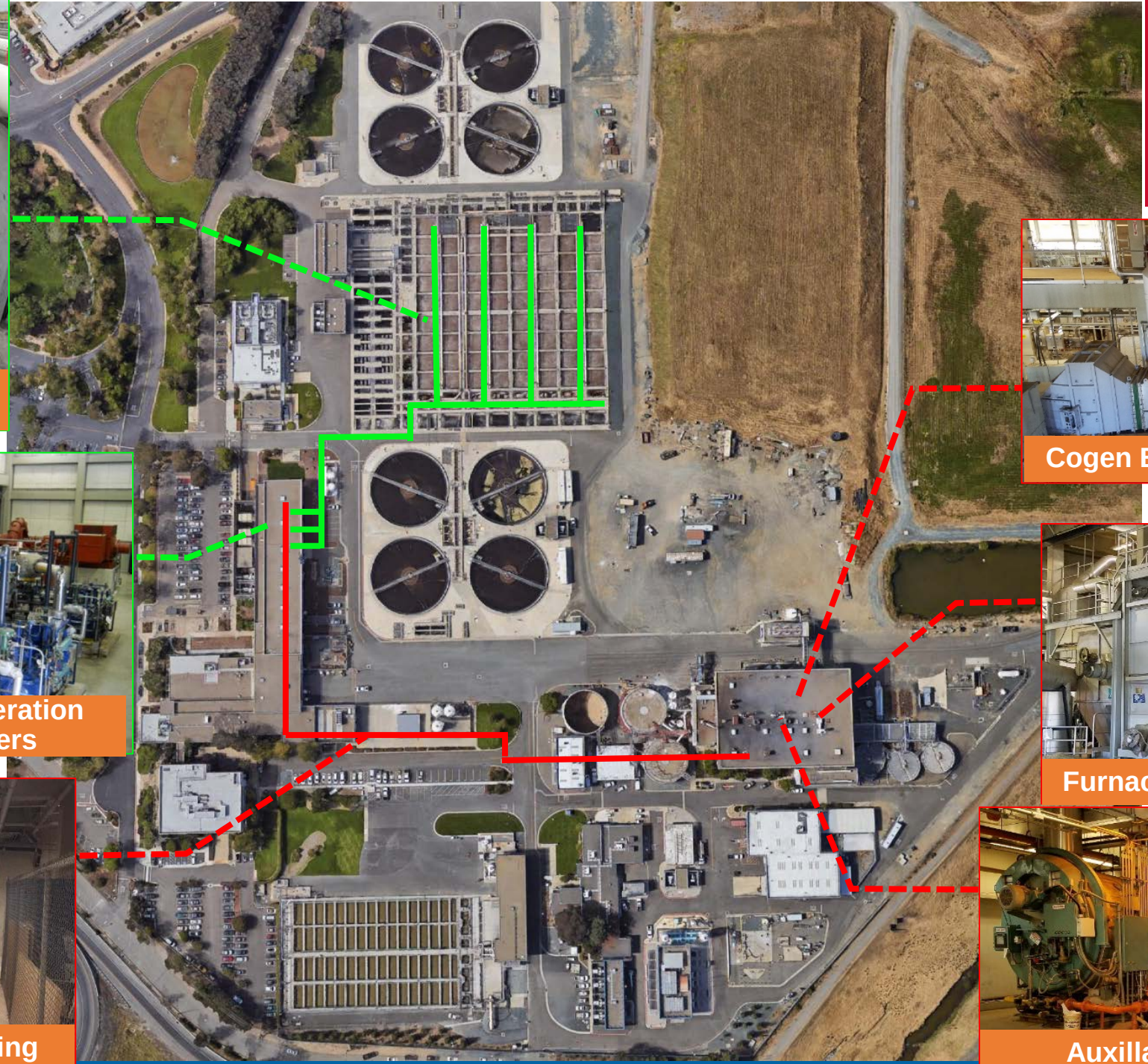
- While the treatment system has been reliable and serviceable for many years, operability and maintainability of the equipment is becoming more challenging over time (including access to spare parts) and more efficient equipment (often with higher standards of safety) has entered the marketplace.

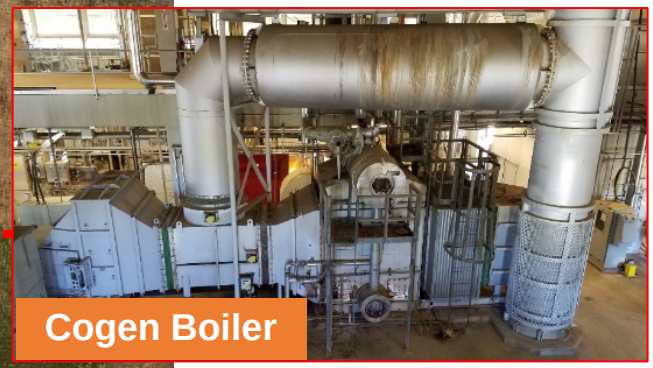
PROJECT OVERVIEW

Solids Handling and Steam System Currently Linked to Secondary Process



Aeration Diffusers



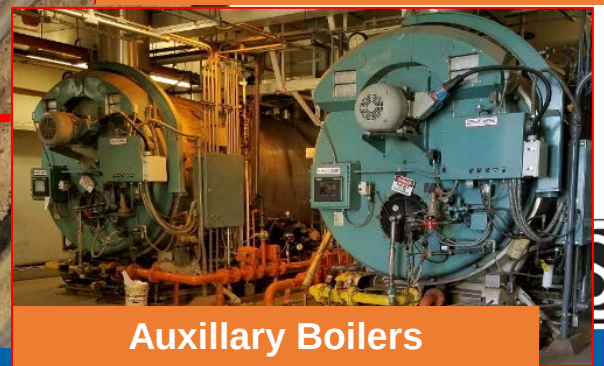


Cogen Boiler

Steam Aeration Blowers

Furnace Waste Heat Boiler

Steam Piping



Auxillary Boilers

Steam Project Drivers

Data collection, condition assessment, testing, business case evaluations, and pre-design to address:

- Employee safety
- Reliability of operation
- Meeting current and future demands
- Reliability of permit compliance
- Reduction of operation and maintenance cost

- Worked with professional engineering consultants from HDR and ArcSine

MHF Boiler Tubes

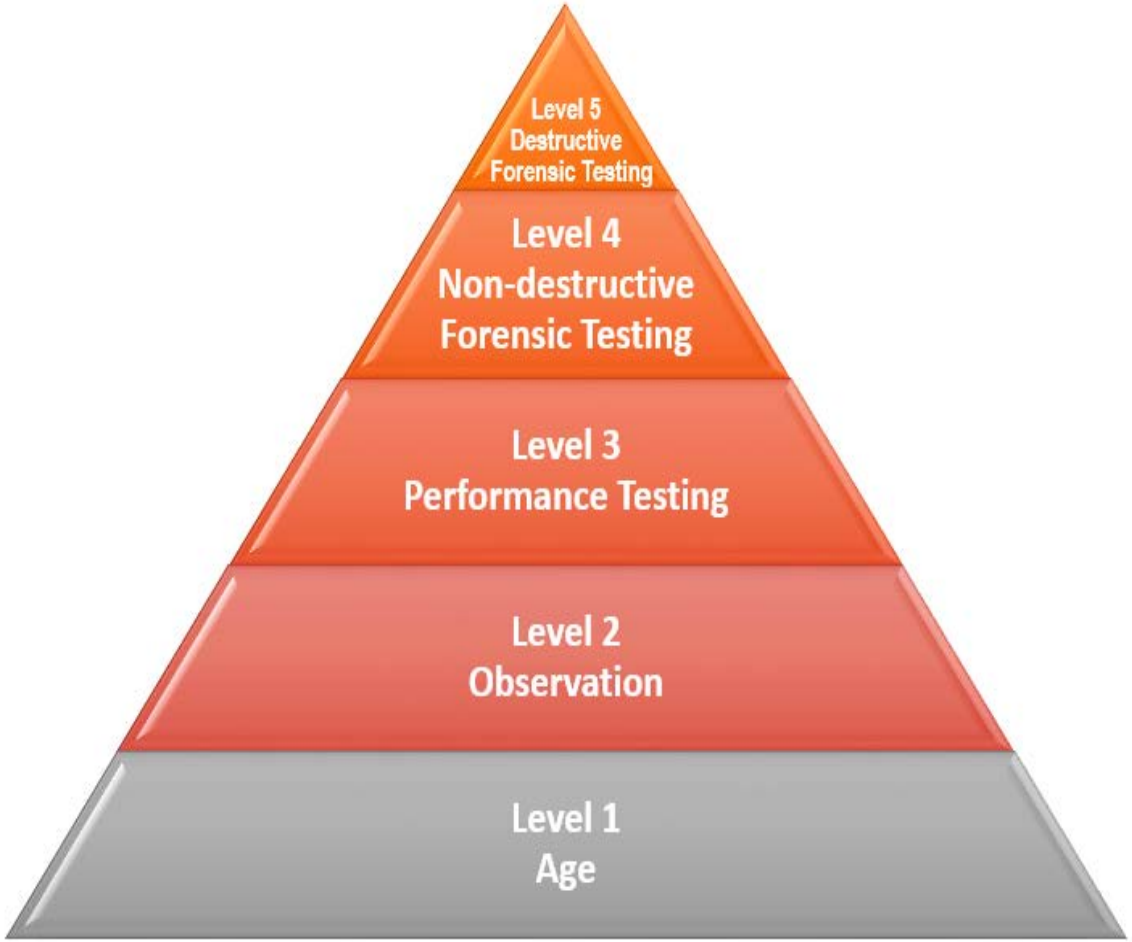
COMPLETED NUMEROUS CONDITION INSPECTIONS OF ASSETS

- Visual inspection, records/work order review, and non-destructive evaluation (NDE) completed as needed to estimate:
  - Remaining useful life of critical equipment
  - Lifecycle costs

Guided Wave Length Testing
Strength Length Steam Piping
Mistras ~100'

Planning and Initial Evaluation Phase

- Define Assets
- Establish Criticality Scoring System
- Request and Review Asset information
- Develop Condition Assessment Plans



Aggregate Condition Assessment Scoring

Condition Assessment Level	Levels 1 and 2 Aggregate Weight (%)	Levels 1, 2, and 3 Aggregate Weight (%)	Levels 1, 2, and 4 Aggregate Weight (%)	Levels 1, 2, 3, and 4 Aggregate Weight (%)
Level 1 - Review of Age and Expected Life	15%	15%	15%	15%
Level 2 - Visual Field Inspection	85%	42.5%	42.5%	30%
Level 3 - Performance Testing		42.5%		25%
Level 4 - Non-Destructive Testing			42.5%	30%
Total	100%	100%	100%	100%

Steam Driven Boiler Feedwater Pumps Condition Assessment

- Provides water to all 5 boilers. One duty and one stand-by.
- Overall pump condition was found to be good during visual inspection.

Asset Type	Aging Infrastructure (Years)
Steam Boiler Feed Pump	>20

Condition Assessment Take-aways

1) Planning and Initial Evaluation Phase
   - Important to identify a core team of Engineers, Operations and Maintenance
   - Getting records together is time consuming. Investing in effort to digitize records helps greatly.
2) Inspection Phase
   - Local team of consultants helps minimize shutdowns
3) Engineering Analysis Phase

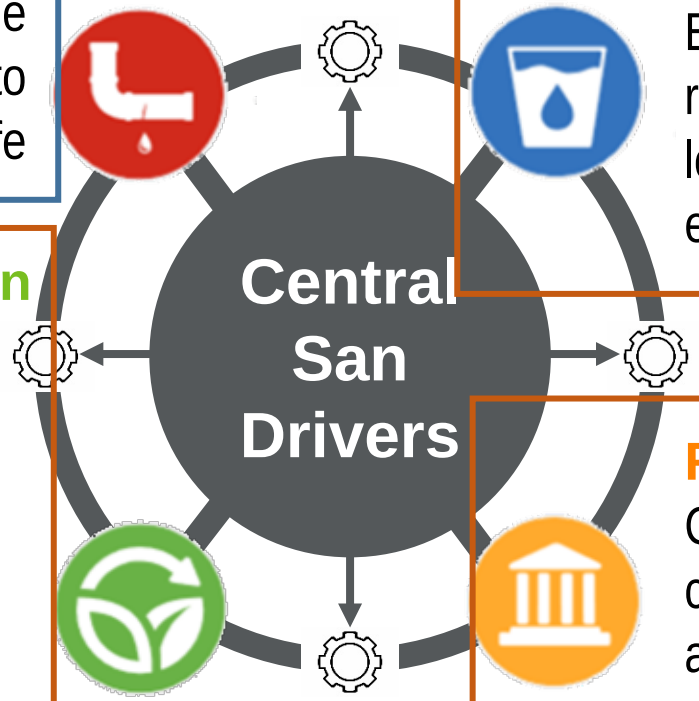
Systematically Capturing Multiple Drivers for Asset Replacement with Comprehensive Asset Evaluations (CAE)

Condition Inspection

CAE

Aging Infrastructure
Repair or replace some equipment and structures to extend their useful life

Capacity
Expand the capacity and redundancy (flows and loads) of some equipment and facilities



Sustainability/Optimization
- Safety
- Operating Ease
- Maintenance/Redundancy/ Reliability
- Long Term Flexibility

Regulations
Comply with regulations and continue to adhere to them as they evolve or become stricter in the future

CAE SEEKS TO SYSTEMATICALLY CAPTURE EVERYTHING GOING INTO ASSET REPLACEMENT DECISIONS

Criteria Development

- Capacity and Regulatory- Establish planning horizon and expected regulations
- Sustainability/Optimization- broad categories including access to spare parts, worker safety, system efficiency, etc.

Baseline Scores

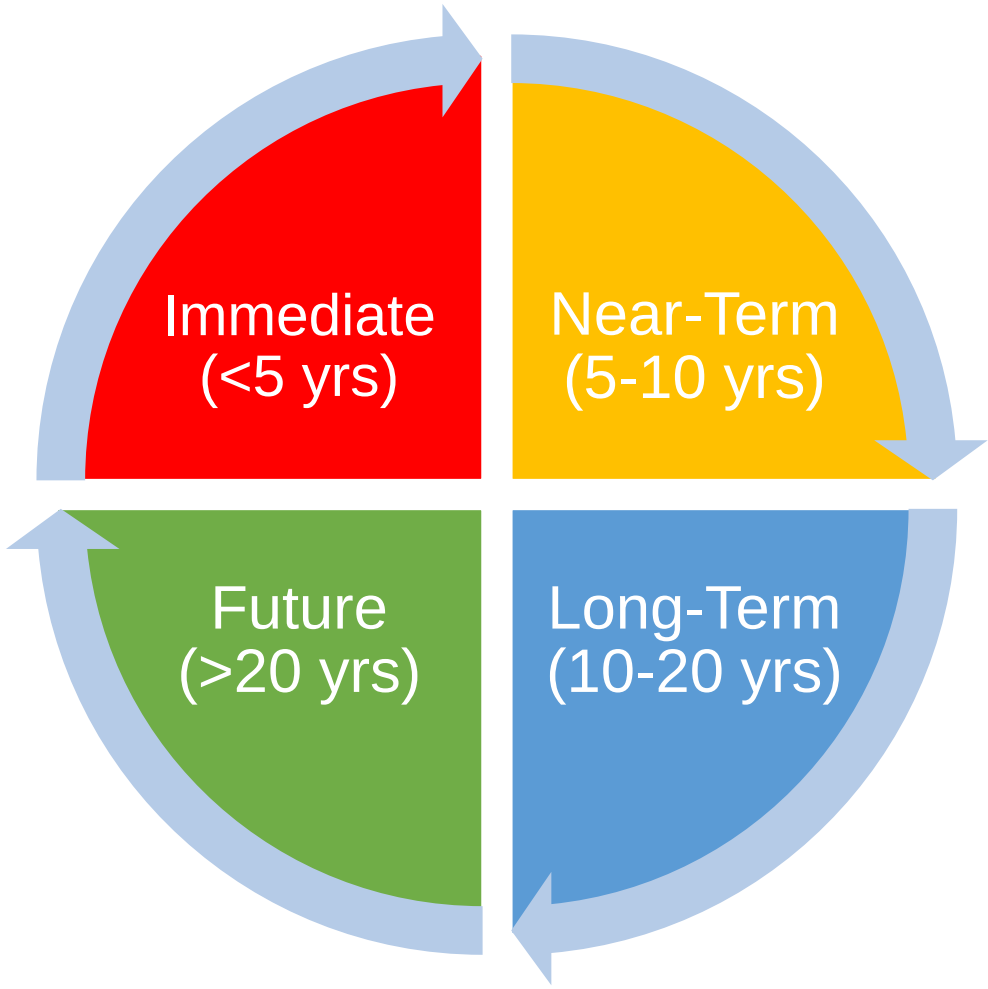
- Engineering staff complete evaluations to establish baseline scores for all categories

Workshop to Finalize Scores

- Operations, Maintenance and Engineering Staff to build consensus on scores

CAE Criteria Summary

- **Condition Assessment** RUL carried over from inspections, non-destructive testing, etc.
- **Capacity & Regulatory** RUL determined from data obtained during condition assessment work (operator interviews, design data, work order history, etc.) and additional research (0.75% growth increase/yr)
- **Sustainability/Optimization** RUL determined by consensus in workshops



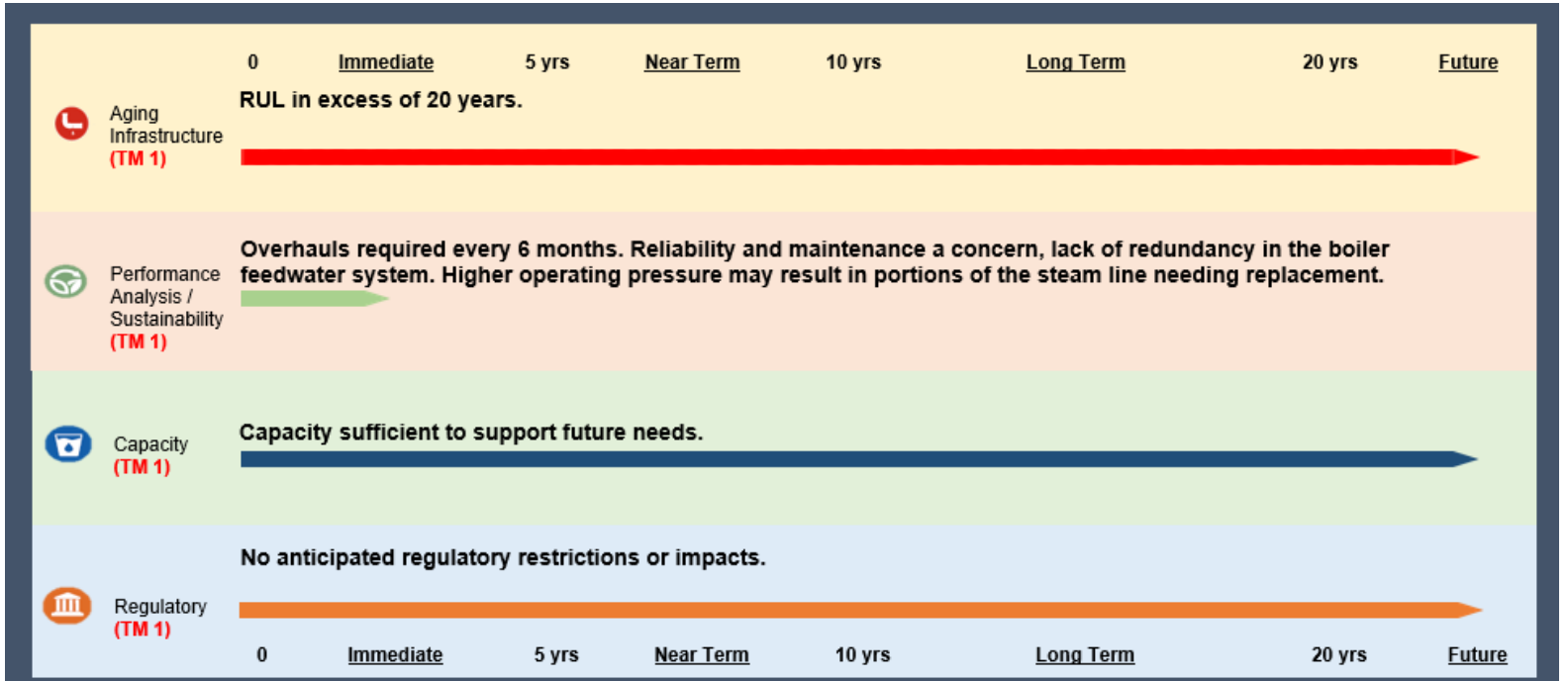
Sustainability and Optimization Drivers Differ for Electrical and Other Assets

Non-Electrical Assets (25% Each)

- Safety
- Operating Ease
- Maintenance, Redundancy, and Reliability
- Long Term Flexibility

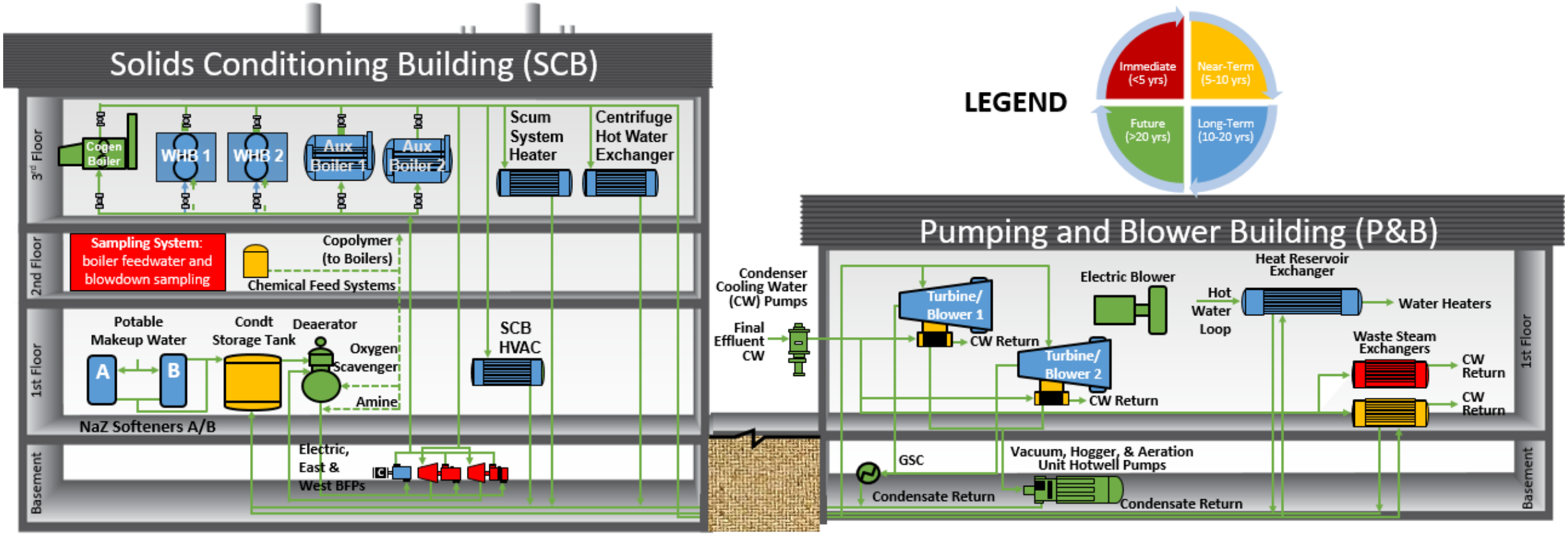
Electrical Assets

- Safety (25%)
- Physical Access (25%)
- Redundancy/Reliability (25%)
- Staff Interaction (5%)
- Standardization (10%)
- Documentation & Troubleshooting (10%)



Asset Type	Aging Infrastructure (Years)	Regulatory (Years)	Capacity (Years)	Sustainability/ Optimization (Years)
Steam Boiler Feed Pump	>20	>20	>20	<5

CAE Results Easily Communicated

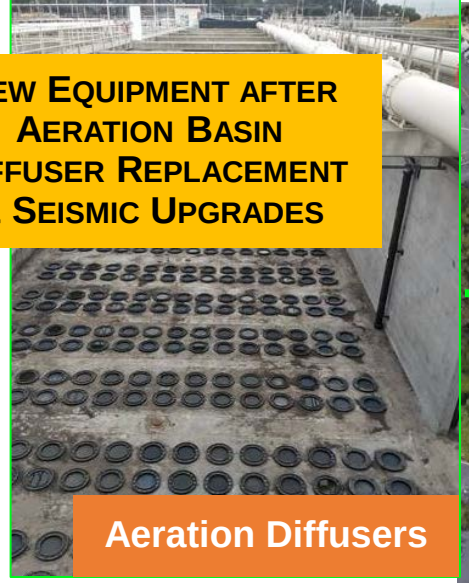


CAE and Condition Assessment Results to Date

- Accelerated spin-off projects
  - Installation of 3 new electric blowers for full redundancy and replacement of inlet air filters
  - Aeration diffuser replacement

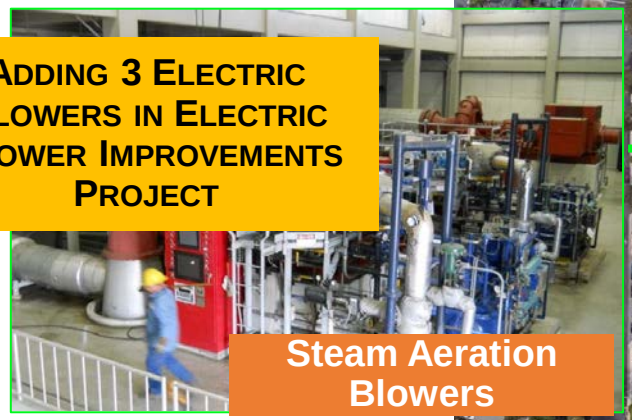
- CAE process will help identify key support equipment to replace to keep system operational for 10+ years

New Equipment after Aeration Basin Diffuser Replacement & Seismic Upgrades



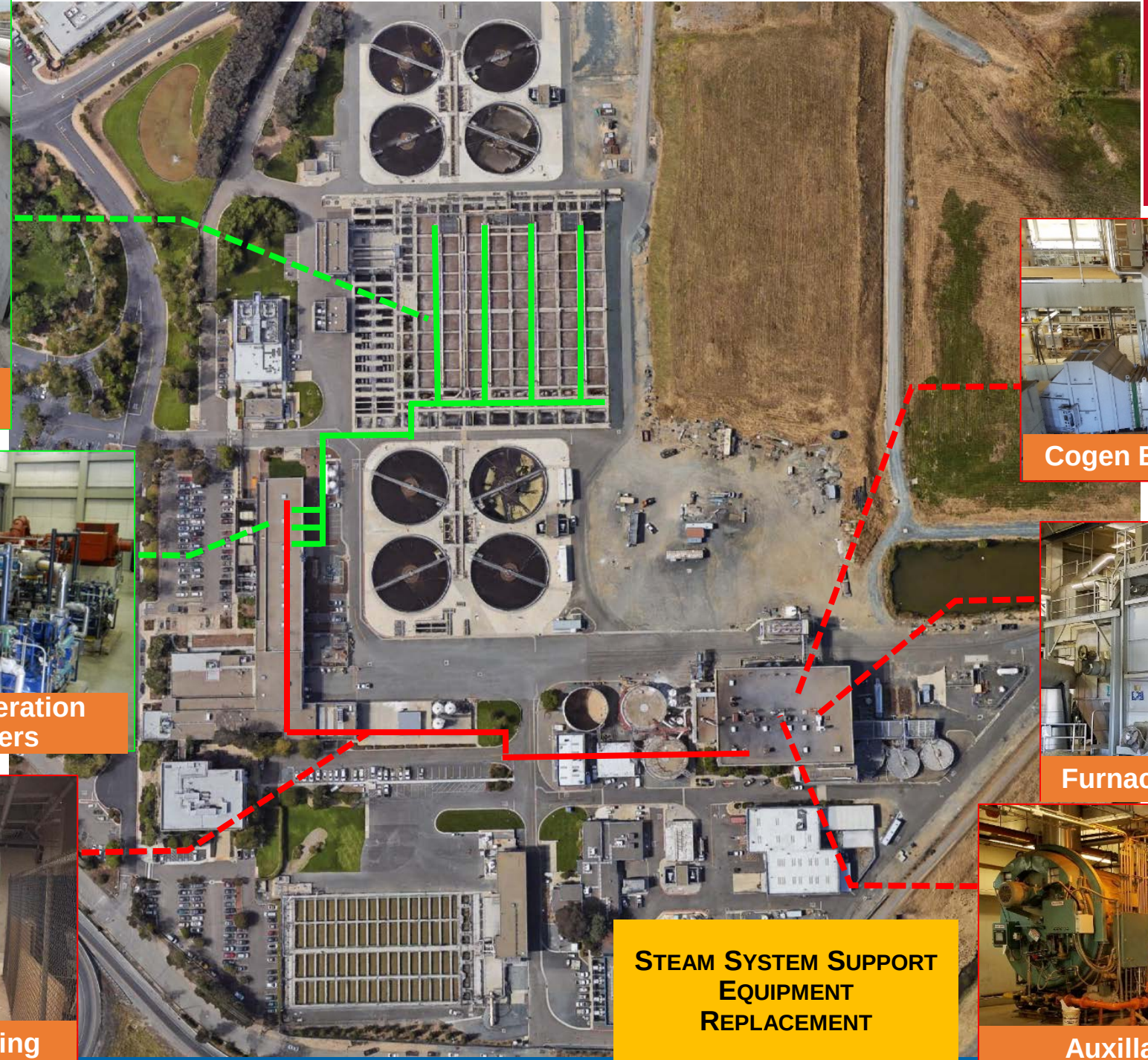
Aeration Diffusers

Adding 3 Electric Blowers in Electric Blower Improvements Project



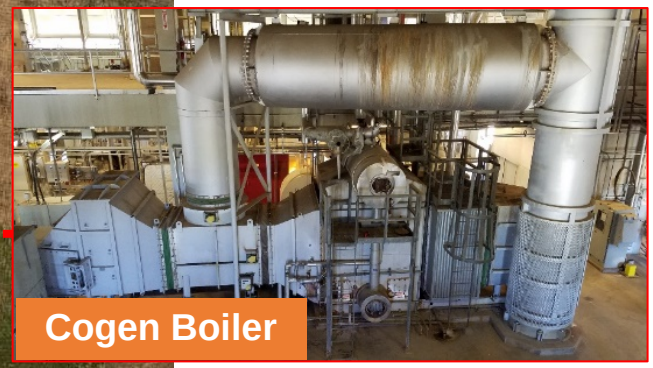
Steam Aeration Blowers

Steam Piping



Steam System Support Equipment Replacement

Solids Handling and Steam System Currently Linked to Secondary Process



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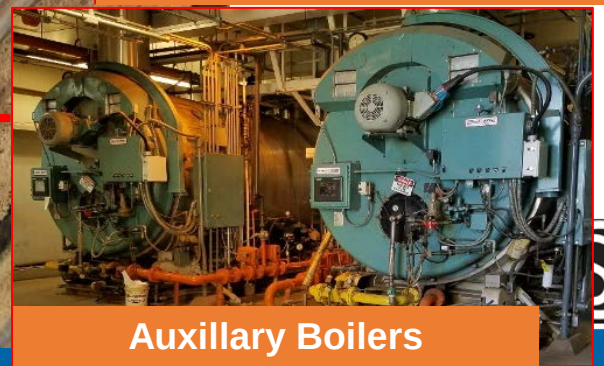
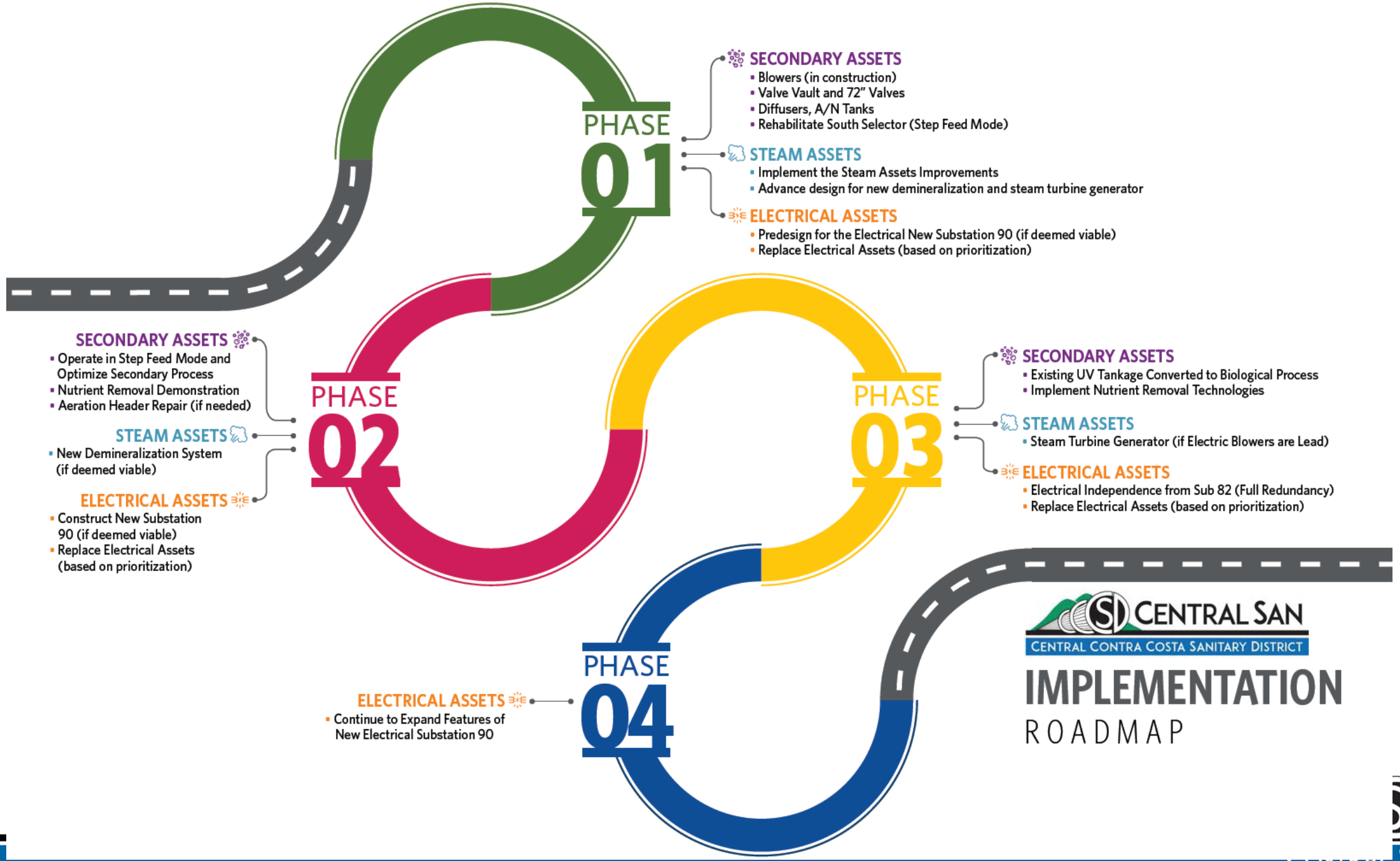


Auxillary Boilers

CONCLUSIONS

- This case study can serve as a template for others to make informed business decisions regarding aging infrastructure.
- CAE builds upon condition assessment results to systematically capture other drivers (capacity, regulatory, and sustainability/optimization).
- The CAE process can ideally help a treatment plant fast track optimization efforts, identify opportunities to extend RUL of major assets when cost effective, and define near and long-term capital improvement projects in a simple and easy to communicate way.


PHASE 01
SECONDARY ASSETS
Blowers (in construction)
Valve Vault and 72" Valves
Diffusers, A/N Tanks
Rehabilitate South Selector (Step Feed Mode)
STEAM ASSETS
Implement the Steam Assets Improvements
Advance design for new demineralization and steam turbine generator
ELECTRICAL ASSETS
Predesign for the Electrical New Substation 90 (if deemed viable)
Replace Electrical Assets (based on prioritization)
PHASE 02
SECONDARY ASSETS
Operate in Step Feed Mode and Optimize Secondary Process
Nutrient Removal Demonstration
Aeration Header Repair (if needed)
STEAM ASSETS
New Demineralization System (if deemed viable)
ELECTRICAL ASSETS
Construct New Substation 90 (if deemed viable)
Replace Electrical Assets (based on prioritization)
PHASE 03
SECONDARY ASSETS
Existing UV Tankage Converted to Biological Process
Implement Nutrient Removal Technologies
STEAM ASSETS
Steam Turbine Generator (if Electric Blowers are Lead)
ELECTRICAL ASSETS
Electrical Independence from Sub 82 (Full Redundancy)
Replace Electrical Assets (based on prioritization)
PHASE 04
ELECTRICAL ASSETS
Continue to Expand Features of New Electrical Substation 90
CENTRAL SAN
CENTRAL CONTRA COSTA SANITARY DISTRICT
IMPLEMENTATION
ROADMAP

THANK YOU

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