
# Kline's Island Wastewater Treatment Plant Master Plan – 2024 Update

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# Agenda & Key Items

- Master Plan Overview
- KIWWTP Overview
- Master Plan Focus Areas
- Summary of CIP Recommendations

# Master Plan Overview

# Master Plan Overview

- Required by Concession and Lease Agreement between LCA and the City of Allentown every 5 years
  - 2019 = Previous Master Plan
  - 2024 = 5-year Master Plan Update

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# Master Plan Overview – Project Team

- Key LCA Project Team Members
  - Stephen Boone (PM)
  - Amy Rohrbach (Assistant PM)
  - Technical Support and Guidance:
    - Andrew Moore
    - AJ Capuzzi & Phil DePoe
    - Gary Saunders
    - Kevin Marx
    - Joe Thompson
    - Bryan Geissel
    - Chris Momose

- Key Consulting Partners
  - Black & Veatch (Prime Consultant)
    - Stephen Gitungo (PM)
    - Patrick Dunlap (Lead Engineer)
    - Ed Carpenetti (Asset Mgmnt.)
    - Ryan Townsend (Buildings)
    - Becca Chapa (Engineer)
  - Ongoing Related Studies / Projects
    - AECOM
    - Kleinfelder
- City of Allentown
  - Brian Chamberlain
  - Dan Koplish
  - Jennie McKenna

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# Master Plan Overview – Plan Drivers

- Several drivers define the needed work:
  - Age of facility / equipment
  - Physical condition
  - Regulatory standards and changes
  - Population growth
  - Future industrial loads
  - Emerging contaminants
  - Innovation / new technologies
- Bottom line objectives:
  - Ensure reliable regulatory compliance
  - Reduce operational risks

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# Master Plan Overview – Research and Collaboration (Lots!!)

- **Review of Existing Records**
  - Over 70 records/reports reviewed
- **Review of Ongoing Studies**
  - Solids Improvements (AECOM); Hydraulic Capacity Improvements (Kleinfelder); Disinfection Improvements (D'Huy & GF)
- **LCA Condition Assessment**
  - 2-Month exercise by LCA
- **Focused Meetings**
  - Over 12 meetings
- **Workshops**
  - Three workshops held
- **CIP Meetings**
  - Multiple discussions on immediate, near term, medium term and long- term projects.


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# KIWWTP Overview

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# KIWWTP Overview

- Two-stage trickling filter plant
  - Plastic Media
  - Rock Media
- Treats 32 MGD average flow
- Rated hydraulic capacity of 44.6 MGD
- Peak wet-weather flow capacity ~87 MGD
- Population served ~270,000

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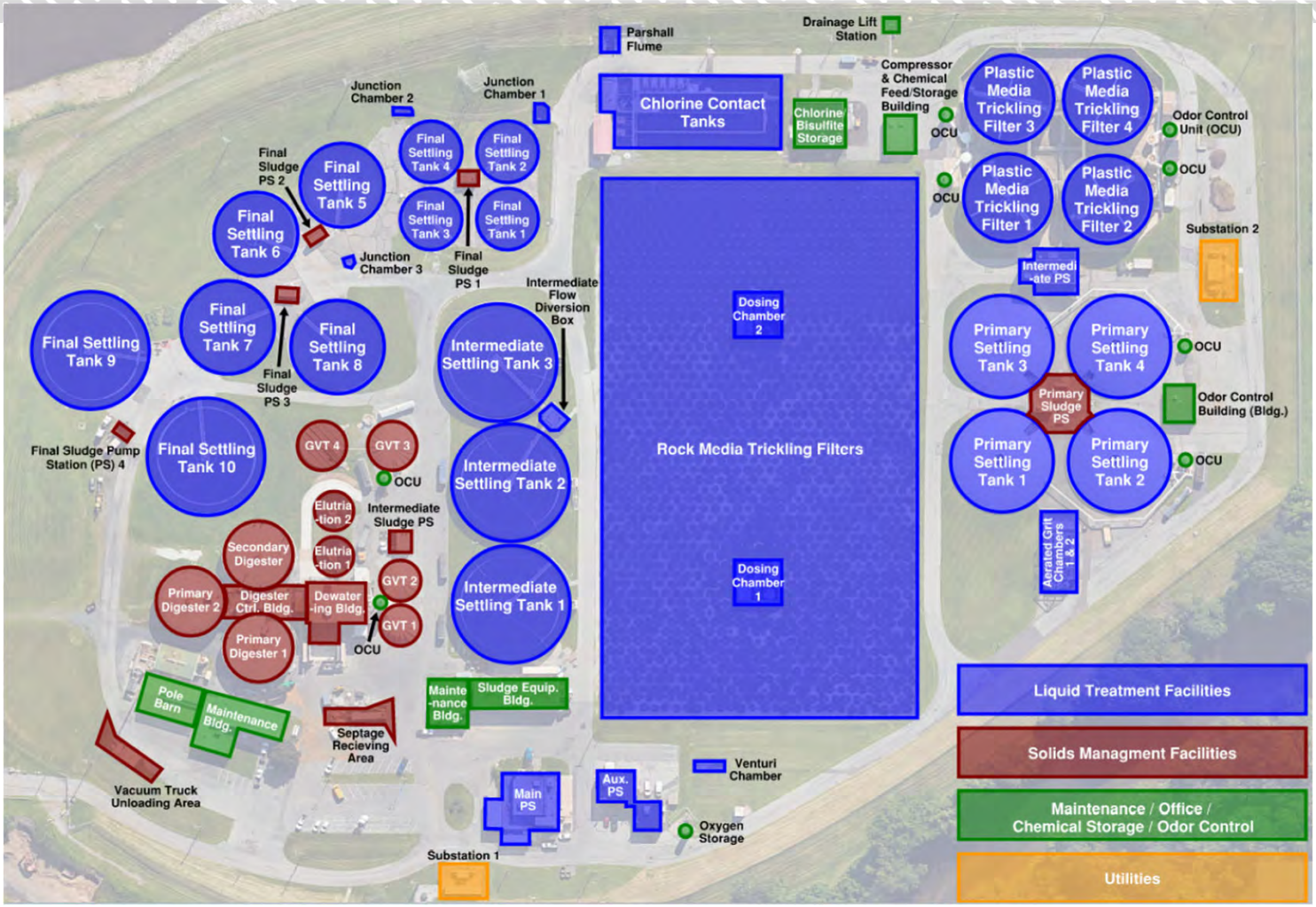
# KIWWTP Overview – Processes

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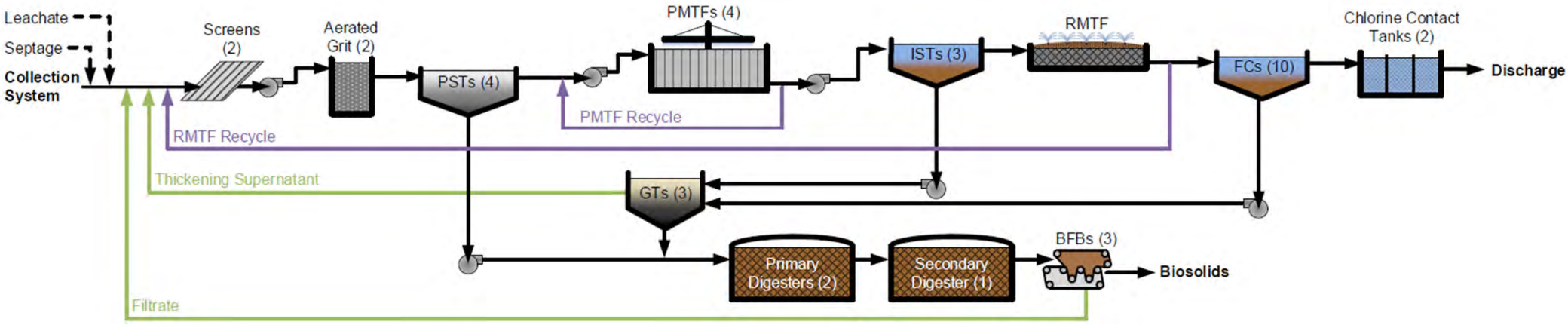
# KIWWTP Overview – Process Flow Diagram

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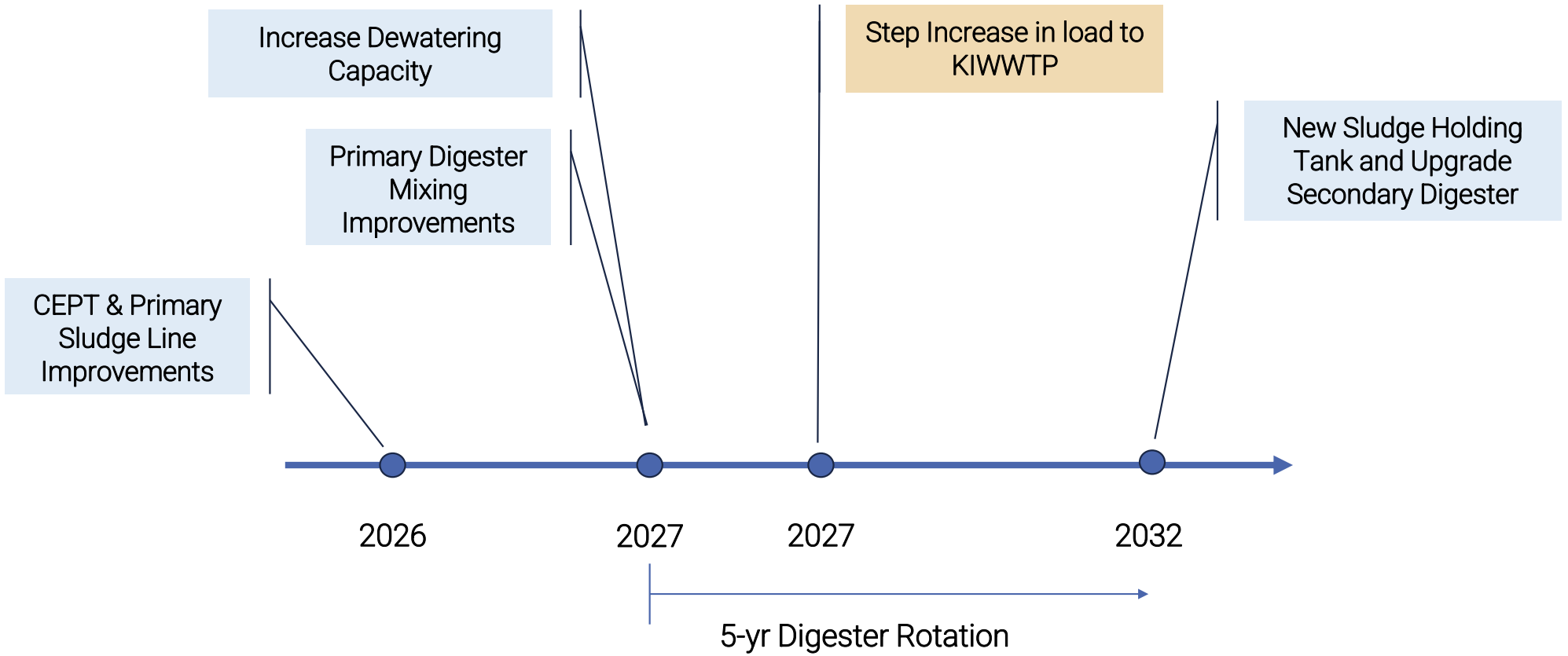
# Master Plan Focus Areas

# Focus – Future Loadings and Solids Handling

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# Focus – Load Capacity and Anaerobic Digesters

- Without 3rd digester converted to primary digester, **load shift and CEPT will overload digesters**.
- With **3 primary digesters** the **capacity is within acceptable ranges;** may require more operator attention to alkalinity, loading, etc.
- Supports need for sludge holding tank, digester mixing improvements, PS pipe improvements, repairs to GVT3 (complete).
- Recommend a digester capacity study.

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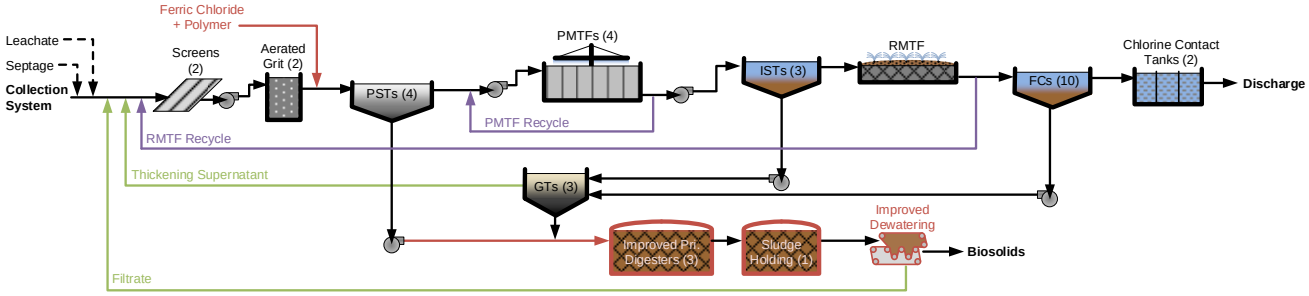
# Focus – Ongoing Work – CEPT & Solids Improvements Projects

- Addition of **CEPT** to **handle load shift from pretreatment plant modifications** without a substantial increase in loading to secondary treatment
- **Solids improvements to manage increased load** including mixing improvements for digesters, sludge storage tank to operate all 3 digesters in parallel, and dewatering capacity improvements.
- **Primary sludge line piping improvements.**





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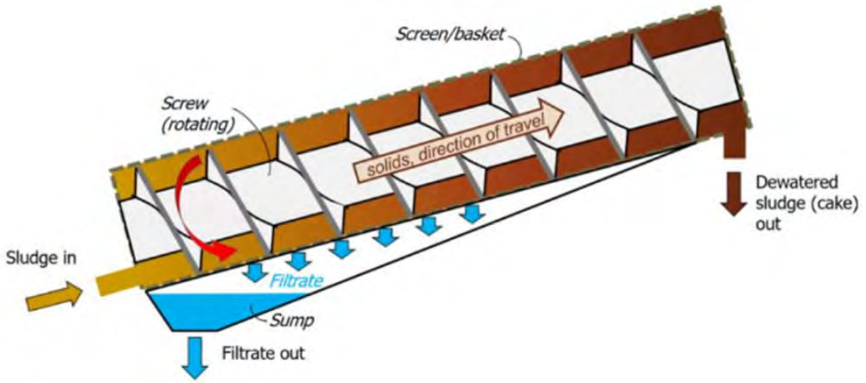
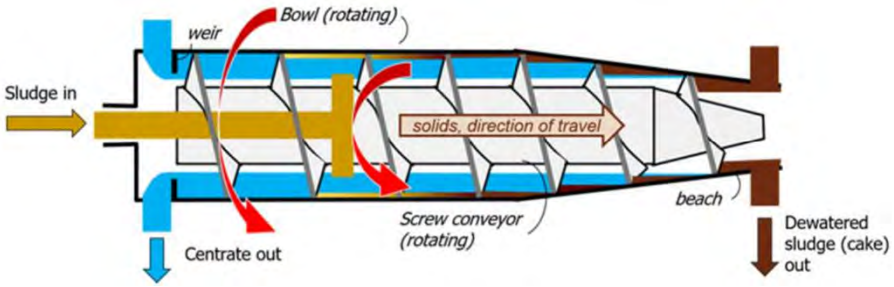
# Focus – Load Capacity and Residuals Equipment

- Current belt filter presses will **not have adequate capacity at future loadings** with load shift and CEPT.
- Need approximately **1 additional unit of equivalent capacity**.
- However, a **4th belt filter press will not fit** and alternative technologies with a lower footprint are being considered and piloted (centrifuges and rotary presses).

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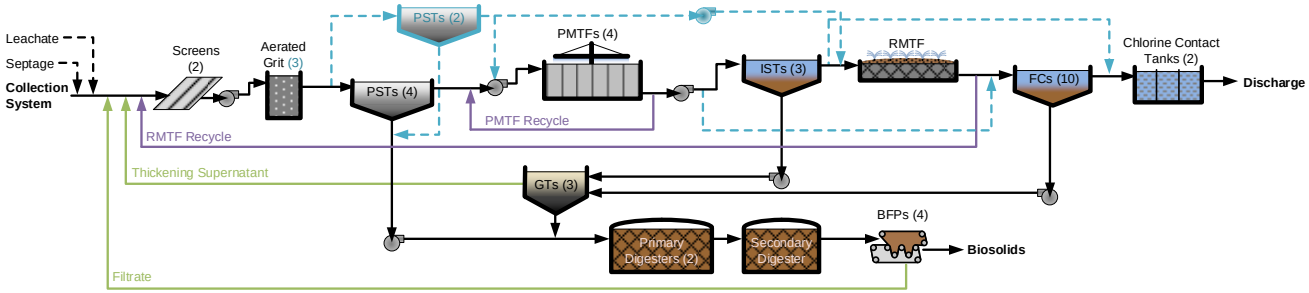
# Focus – Hydraulic / Wet Weather Improvements

- **100 mgd** project includes improvements at main/auxiliary pump stations, improvements to primary effluent pumps, and PMTF to FC bypass.
- **132 mgd** project includes addition of aerated grit chamber(s), auxiliary PSTs, auxiliary primary effluent pumping station, intermediate effluent to disinfection bypass, and additional final effluent pumps – **Note: pushed to 5-10+ year horizon as I&I removal is the main focus as part of the Act 537 Plan.**





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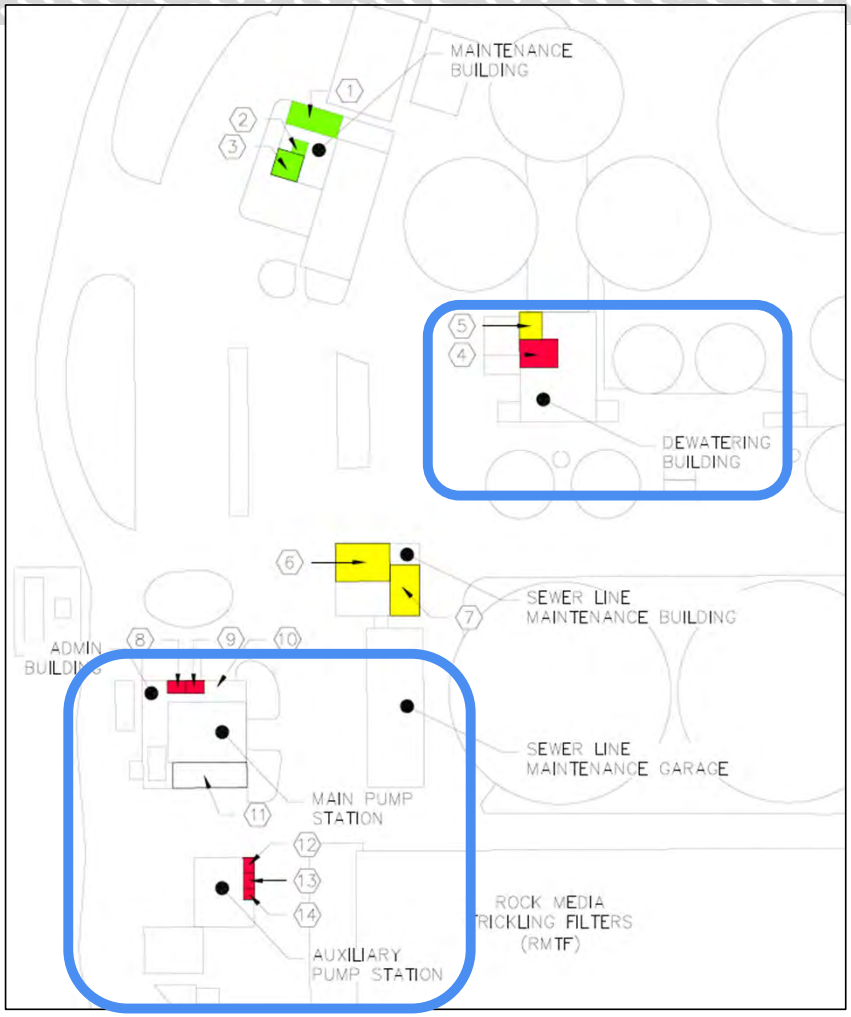
# Focus – Asset Management

- Asset Count by Risk Scoring — Percentage
  - 19 critical assets require immediate attention — 1.0%
  - 69 critical assets require near-term attention — 3.5%
  - 71 critical assets require mid-term attention — 3.6%
  - 667 critical assets are in sound condition
  - 205 critical assets require maintenance to maximize their useful life

| STRUCT_1 * | Process | EQUIPMENT_DESCRIPTION | Risk Score | Term | CIP Years | Action |
|---|---|---|---|---|---|---|
| WWFIN0068 | FIN | MOTOR CONTROL CENTER #7A | 21.13 | Immediate | 0-2 Years | Replace |
| WWUTL0189 | UTL | MAINT SHOP SECURITY SYSTEM | 20.00 | Immediate | 0-2 Years | Upgrade |
| WWUTL0191 | UTL | MAIN PUMP HOUSE SECURITY SYSTEM | 20.00 | Immediate | 0-2 Years | Upgrade |
| WWUTL0190 | UTL | INTERMEDIATE PUMP STATION SECURITY SYSTEM | 20.00 | Immediate | 0-2 Years | Upgrade |
| WWUTL0188 | UTL | CHLORINE BUILDING SECURITY SYSTEM | 20.00 | Immediate | 0-2 Years | Upgrade |
| WWUTL0187 | UTL | EFFLUENT PUMP STATION SECURITY SYSTEM | 20.00 | Immediate | 0-2 Years | Upgrade |
| WWUTL0186 | UTL | LAB/AUX PUMP STATION SECURITY SYSTEM | 20.00 | Immediate | 0-2 Years | Upgrade |
| WWSOL0147 | SOL | BUILDING DEWATERING | 19.13 | Near-Term | 2-5 Years | Upgrade |
| WWNIT0002 | NIT | DOSING CHAMBER #1 | 18.37 | Near-Term | 2-5 Years | Repair/Refurbish |
| WWNIT0003 | NIT | DOSING CHAMBER #2 | 18.37 | Near-Term | 2-5 Years | Repair/Refurbish |
| WWNIT0004 | NIT | DOSING CHAMBER #3 | 18.37 | Near-Term | 2-5 Years | Repair/Refurbish |

# Focus – Building Condition

- All buildings housing staff workspaces (offices, locker rooms, meeting rooms, laboratory, etc.) were evaluated
- Notable building deficiencies at:
  - Dewatering Building
  - Main Pump House
  - Auxiliary Pump Station

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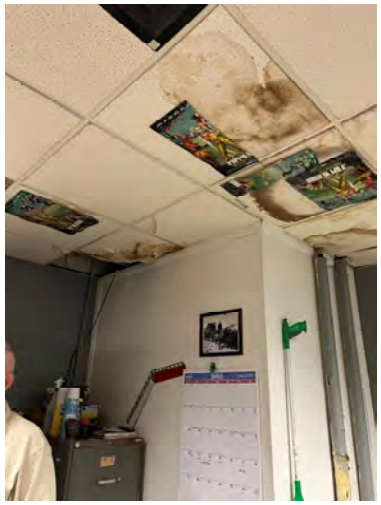
# Focus – Building Condition – Dewatering Building

- Interior paint needed to stop progression of rust.
- Existing quarry tile flooring is in poor condition.
- Locker room has been repurposed as office and break space – plumbing is not working, ceiling tiles have water damage and probable mold.
- Significant exterior rust.
- Leakage from Press Room is coming through the floor to damage spaces below.



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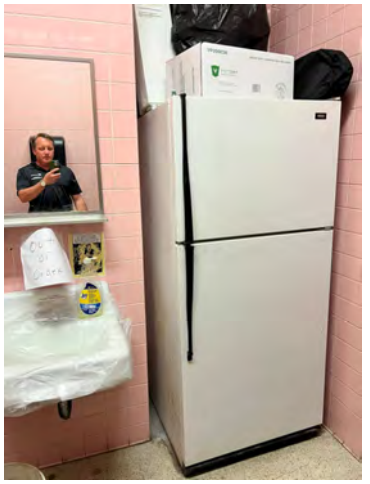
# Focus – Building Condition – Main Pump House

- Restrooms have significant plumbing issues .
- Interior finishes are in poor condition.
- The SCADA server rack is located near a heater and frequently overheats.
- Multiple rooms in the building have air circulation issues.
- Frequent odor possibly caused by certain types of black mold, freon gas, or a sewer gas.
- Lower level locker rooms are not used and prone to flooding.
- Windows have broken seals
- Entrance is not ADA compliant.
- Kitchen located in SCADA room.
- SCADA closet houses abandoned utilities.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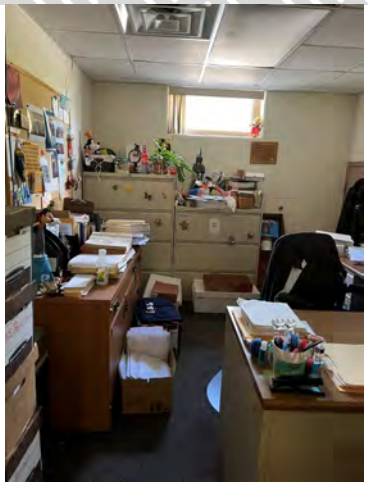
# Focus – Building Condition – Auxiliary Pump Station

- Lab has no break/lunch room. Lab technicians eat lunch at their desks, their food inches away from samples. This is a contamination risk and a health risk.
- Lab does not have enough ventilation, which is a safety concern for all staff.
- Building does not meet ADA. One staff member with a lower level office in this building has mobility issues.
- The lower level offices are prone to flooding.



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# Summary of CIP Recommendations

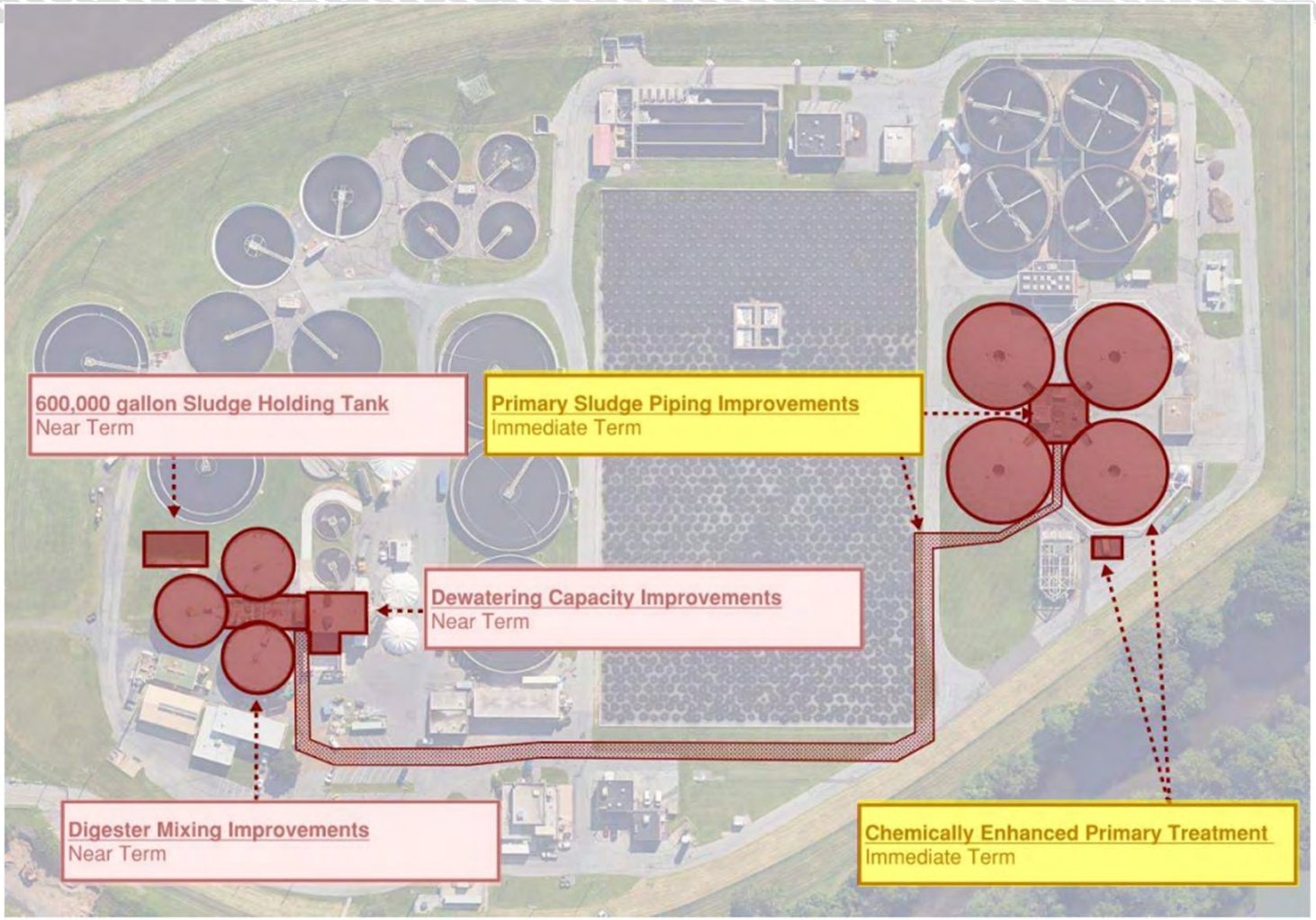
# Immediate Term Projects (0-2 Years)

| Project Name / Description | Cost (Million $) | Source / Type |
|---|---|---|
| Chemically Enhanced Primary Treatment (CEPT) | 2.5 | Solids Capacity |
| Primary Sludge Piping | 2.3 | Solids Capacity |
| 100 MGD Improvements - Treatment Processes, Primary Effluent Pumps, IPS, MPH, APS | 29.1 | Hydraulics |
| FSTs 1-4 Rehabilitation | 4.0 | 2019 Master Plan |
| Architectural Upgrades - Pole Barn, Maintenance Building, Dewatering Building, MPH | 0.5 | New |
| OCU 24 Building Replacement | 0.5 | 2019 Master Plan |
| Masonry Restoration | 2.1 | 2019 Master Plan |
| HVAC Equipment Replacement | 1.6 | 2019 Master Plan |
| Concrete Restoration | 0.4 | 2019 Master Plan |
| PMTF 4 Improvements | 5.6 | 2019 Master Plan |
| Total Immediate-Term Project Costs | 48.6 | |

# Near Term Projects (2-5 Years)

| Project Name / Description | Cost (Million $) | Source / Type |
|---|---|---|
| Mixing Improvements to Digesters | 4.1 | Solids Capacity |
| Dewatering Capacity Improvements | 7.3 | Solids Capacity |
| Architectural Upgrades - Dewatering Building, SLM Building, MPH | 1.3 | New |
| SCADA Upgrades | 1.8 | New |
| 480V MCC Replacement | 4.5 | 2019 Master Plan |
| Unit Process Equipment Painting | 2.7 | 2019 Master Plan |
| Drainage Lift Station Rehabilitation | 0.9 | 2019 Master Plan |
| RMTF Improvements | 5.4 | 2019 Master Plan |
| FSTs 7 - 10 Improvements | 3.4 | 2019 Master Plan |
| Thickening Tanks 1, 2, 4 Improvements | 0.2 | 2019 Master Plan |
| Sludge Transfer and Feed Pumps Improvements | 0.1 | 2019 Master Plan |
| Elutriation Tanks 1 and 2 Improvements | 0.1 | 2019 Master Plan |
| PMTFs 1, 2, and 3 Improvements | 19.0 | 2019 Master Plan |
| RMTF - Venturi Improvements | 0.1 | 2019 Master Plan |
| FSTs 5 and 6 Improvements | 1.2 | 2019 Master Plan |
| Total Near-Term Project Costs | 52.1 | |

# CIP Project Locations – Solids Improvements

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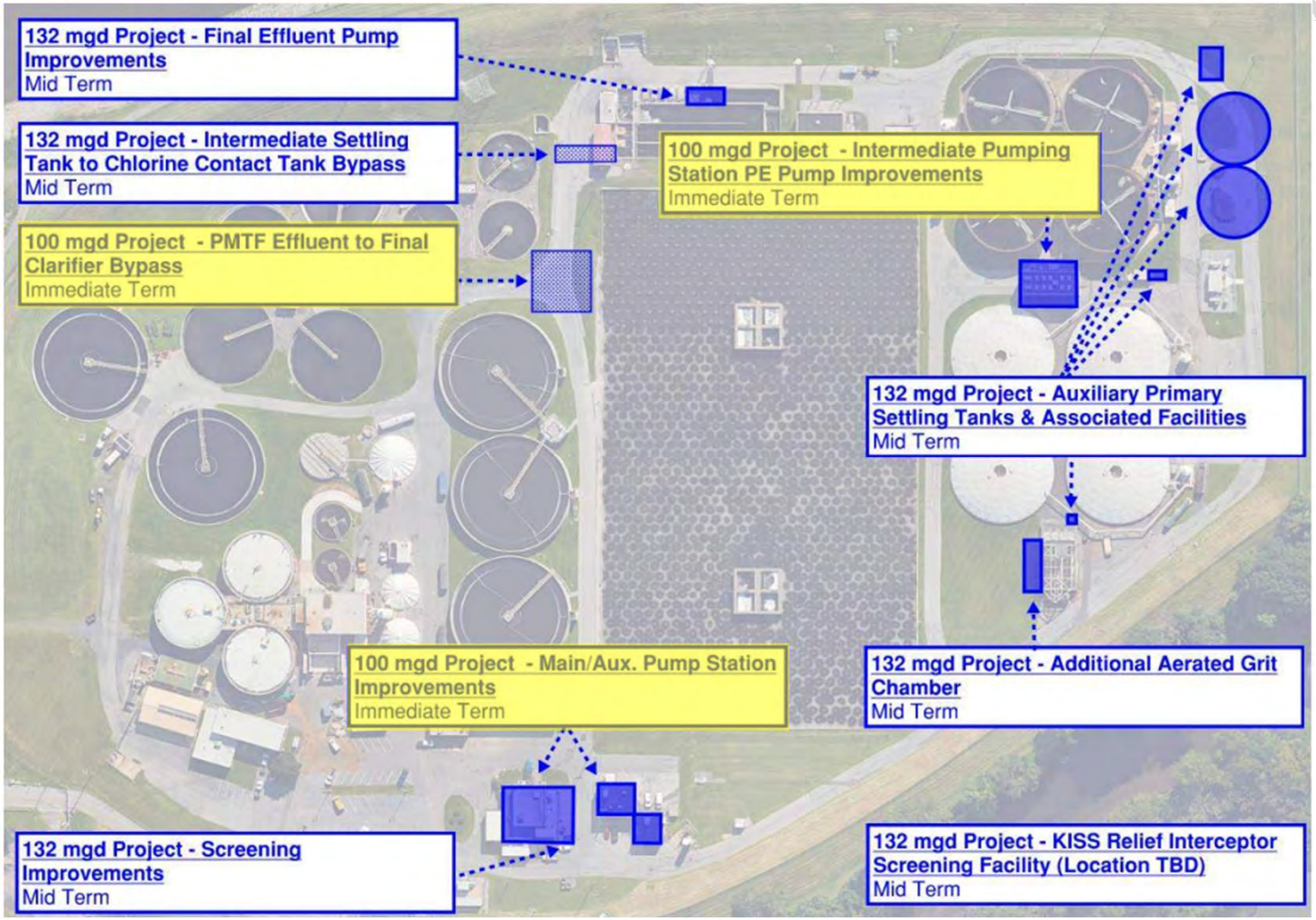
# CIP Project Locations – Hydraulic Improvements

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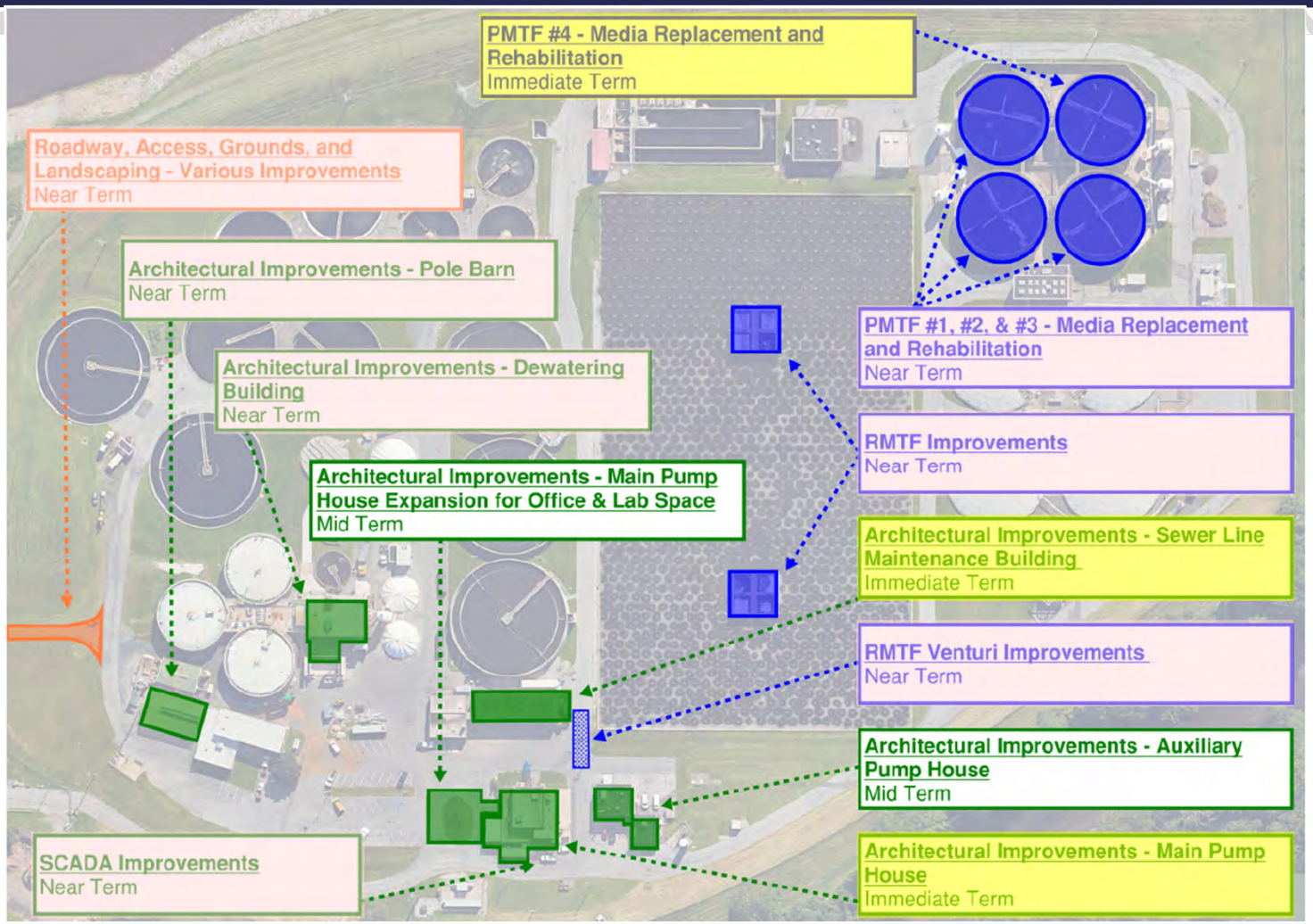
# CIP Project Locations – Facility Functional Improvements

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# Medium Term Projects (5-10 Years)

| Project Name / Description | Cost (Million $) | Source / Type |
|---|---|---|
| 0.6 MG Sludge Holding Tank | 6.1 | Solids Capacity |
| 132 MGD Wet Weather System | 54.8 | Hydraulics |
| KRI Screening | TBD | Hydraulics |
| Architectural Upgrades - MPH Additions, APS Improvements, SLM Improvements | 7.5 | New |
| Headworks Improvements | 0.8 | 2019 Master Plan |
| Plastic Media Trickling Filters (PMTF) Rotary Distributor Improvements | 1.4 | 2019 Master Plan |
| PMTF Odor Control System 24 Improvements | 0.9 | 2019 Master Plan |
| Aerated Grit Chamber Improvements | 0.5 | 2019 Master Plan |
| PSTs Cover Replacement | 3.6 | 2019 Master Plan |
| PST Odor Control System Improvements | 1.0 | 2019 Master Plan |
| PMTF Odor Control System 13 Improvements | 1.4 | 2019 Master Plan |
| ISTs Clarifier Mechanisms Improvements | 0.3 | 2019 Master Plan |
| Intermediate Sludge Pumping Station Improvements | 0.2 | 2019 Master Plan |
| Thickening Tank Odor Control Systems Improvements | 1.0 | 2019 Master Plan |
| Final Sludge Pumping Station 4 Improvements | 0.3 | 2019 Master Plan |
| **Total Medium-Term Project Costs** | **79.8** | |

# Long Term Projects (10-20+ Years)

| Project Name / Description | Cost (Million $) | Source / Type |
|---|---|---|
| Main Flow Venturi Meter Improvements | 0.1 | 2019 Master Plan |
| Primary Settling Tanks (PSTs) Improvements | 5.2 | 2019 Master Plan |
| PST Odor Control System Improvements | 1.3 | 2019 Master Plan |
| Primary Sludge Pumping Station Improvements | 1.7 | 2019 Master Plan |
| Intermediate Pumping Station (PE Pumps) Improvements | 0.9 | 2019 Master Plan |
| Intermediate Pumping Station (PMTF Pumps) Improvements | 0.9 | 2019 Master Plan |
| PMTF Odor Control System 13 Improvements | 0.6 | 2019 Master Plan |
| PMTF Odor Control System 24 Improvements | 1.2 | 2019 Master Plan |
| ISTs Clarifier Mechanisms and Flow Distribution Chamber Improvements | 4.0 | 2019 Master Plan |
| Final Settling Tanks 1-4 Improvements | 3.3 | 2019 Master Plan |
| Final Settling Tanks 7 and 8 Improvements | 2.4 | 2019 Master Plan |
| Final Settling Tanks 9 and 10 Improvements | 2.8 | 2019 Master Plan |
| Final Sludge Pumping Station 1 Improvements | 0.4 | 2019 Master Plan |
| Final Sludge Pumping Station 2 Improvements | 0.4 | 2019 Master Plan |
| Final Sludge Pumping Station 3 Improvements | 0.4 | 2019 Master Plan |
| Chlorine Contact Tank Improvements | 0.4 | 2019 Master Plan |
| Thickening Tank 1 Improvements | 0.6 | 2019 Master Plan |
| Thickening Tank 2 Improvements | 0.6 | 2019 Master Plan |
| Thickening Tank 3 Improvements | 0.6 | 2019 Master Plan |
| Thickening Tank 4 Improvements | 0.6 | 2019 Master Plan |
| Sludge Transfer and Feed Pumps Improvements | 0.1 | 2019 Master Plan |
| Polymer System Improvements | 0.3 | 2019 Master Plan |
| Elutriation Tanks Improvements | 1.0 | 2019 Master Plan |
| Anaerobic Digester 1 Improvements | 3.5 | 2019 Master Plan |
| Anaerobic Digester 2 Improvements | 3.5 | 2019 Master Plan |
| Anaerobic Digester 3 Improvements | 3.5 | 2019 Master Plan |
| **Total Long-Term Project Costs** | **40.3** | |

# Event Driven Projects

| Project Name / Description | Cost (Million $) | Source / Type |
|---|---|---|
| Denitrification Filters | 54.4 | New |
| Side Stream Deammonification | 15.7 | New |
| Final Clarifiers 1 - 4 | 11.1 | 2019 Master Plan |
| New Leachate Tank | 3.2 | 2019 Master Plan |
| Biosolids Drying and Thermal Treatment for PFAS Removal | 50 | New |
| Total Event Driven Project Costs | 134.4 | |

- "Event Driven" projects result from changes to effluent limits
  - Delaware River Basin Commission
    - New TN and TP limits
    - Stricter NHx-N limits

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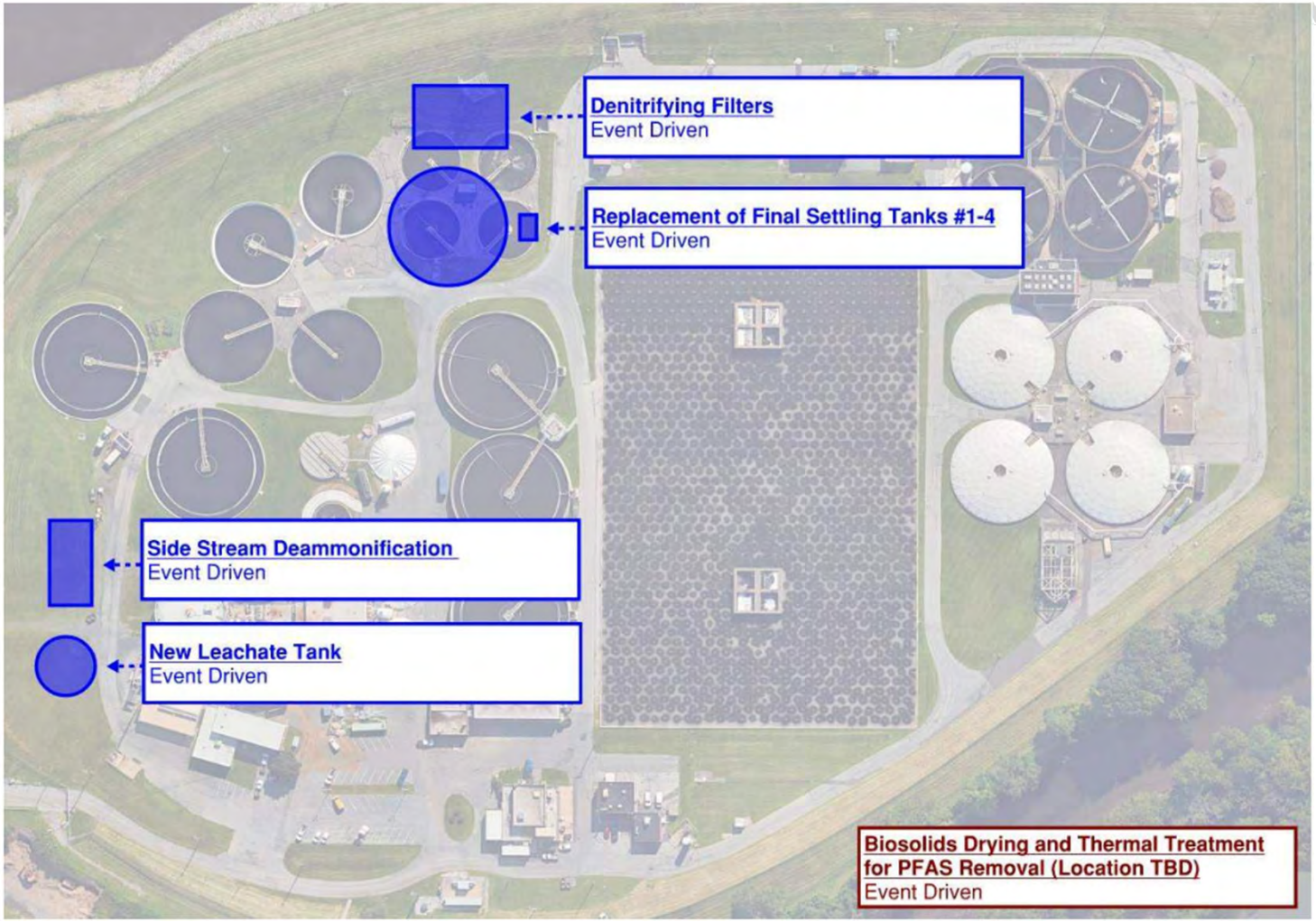
# CIP Project Locations – Event Driven Projects

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# Recommended Process Studies

| Study Name | Recommended Scope | Timeframe or Trigger |
|---|---|---|
| **PFAS Sampling** | Implement regular sampling and analysis of PFAS at plant and of industries through new pretreatment regulations. Will help identify which industries are contributing to PFAS loads and assist in identifying sources for and potential impact of source reduction. | Immediate triggered by need to understand PFAS levels and sources due to fast moving regulatory environment. |
| **Dewatering Alternatives Evaluation** | Dewatering upgrade options need to be explored since there is no space to add an additional BFP unit in the dewatering building. Considerations should be given to odor containment of the different technologies. | Immediate triggered by the design of CEPT. |
| **Nitrification Stress Testing** | Additional sampling, modeling, and testing of RMTFs to better understand current nitrification dynamics, causes of nitrification instability, the impact of load shifting on nitrification stability, and potential operational or capital improvements to address issues. | Near-Term triggered by increased loading associated with load shift. |
| **Leachate Receiving and Odor Control Study** | The evaluation should include tank cover options, odor treatment alternatives, odor treatment preliminary design, and feasibility of leachate treatment for reduction of odorous and potentially inhibitory compounds, and improved unloading facilities. | Near- to Mid-Term based on concern over odor complaints and operational issues. |
| **Primary Settling Tank Hydraulics** | Check with Kleinfelder about high level feasibility of increasing the hydraulic capacity through PSTs to 132 mgd. With CEPT the two auxiliary PSTs are not needed to limit PST overflow rate as PSTs with CEPT can manage high overflow rates for sustained periods. | Near- to Mid-Term triggered by hydraulic capacity improvements to 100 mgd. |

# Recommended Process Studies

| Study Name | Recommended Scope | Timeframe or Trigger |
|---|---|---|
| **Chlorine Contact Tank Investigation** | Due to short term issues with chlorination and longer-term concerns about the increase in hydraulic capacity to 132 mgd and the potential for chlorine limits in the future, it is recommended that a study to identify issues and alternatives analysis of solutions be undertaken. | Near to Mid-Term to prepare for hydraulic capacity improvements and potential future chlorine limits. |
| **Wholistic Roadmap for Biosolids in PFAS, Digester Capacity, and Leachate Management** | Solutions to PFAS issues relate to other topics.<br>• Leachate is possibly a significant source of PFAS and treatment for PFAS may reduce odorous and inhibitory compounds as well.<br>• Landfills could be considered a partner in wholistic PFAS management.<br>• Digester capacity is related because many of the PFAS removal and end use options will change the digester rating criteria. | Near to Mid-Term. Triggered by acquisition of more PFAS data, regulatory developments in the next several years, and observed impact of load shift on solids processing. |
| **Long Term Nutrient Removal and Sustainability Study** | Assess options to meet future nutrient removal options sustainably. Potential future total nitrogen limits can be met with dentrification filters and potential future ammonia limits can likely be met with by doing PdNA at those filters, as included in the event driven capital projects below. However, more sustainable options such as integrating MABR into the existing trickling filter process may be viable and should be further explored for long term planning. Additionally, related energy efficiency and resource recovery goals could be evaluated to address long term sustainability goals. | Mid- to Long-Term to prepare for potential future nutrient limits and consider alternatives that may address long term sustainability goals |

# Discussion