



A Plan
You Can
Act On



BROOMFIELD WASTEWATER RECLAMATION FACILITY

Total Inorganic Nitrogen Preliminary Optimization Study (PROJECT #14F0042)

ACES Group
August 14, 2023



Agenda

BWRF MASTER PLAN OVERVIEW

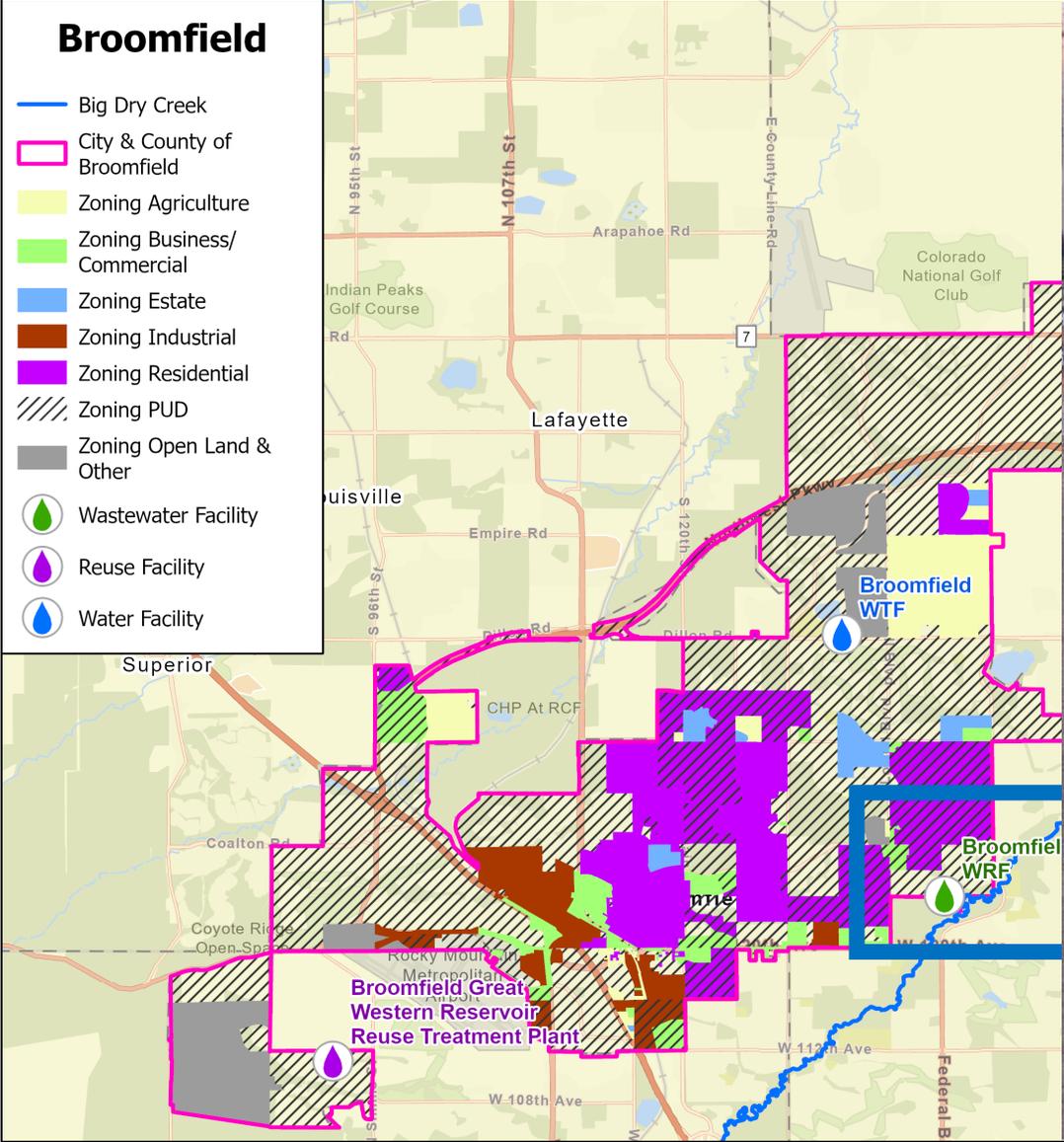
FUTURE NEEDS

CAPITAL IMPROVEMENT PROGRAM

SUSTAINABILITY

BWRF Master Plan Overview

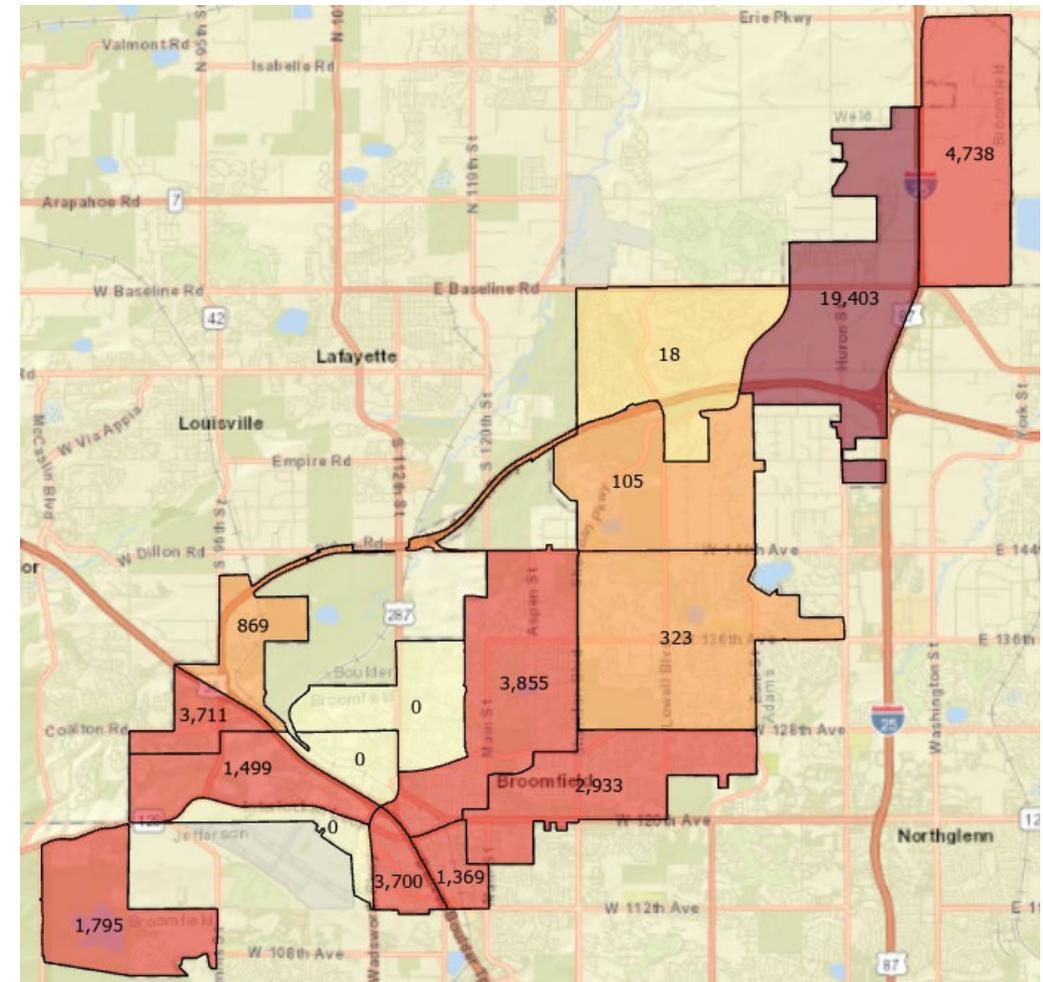
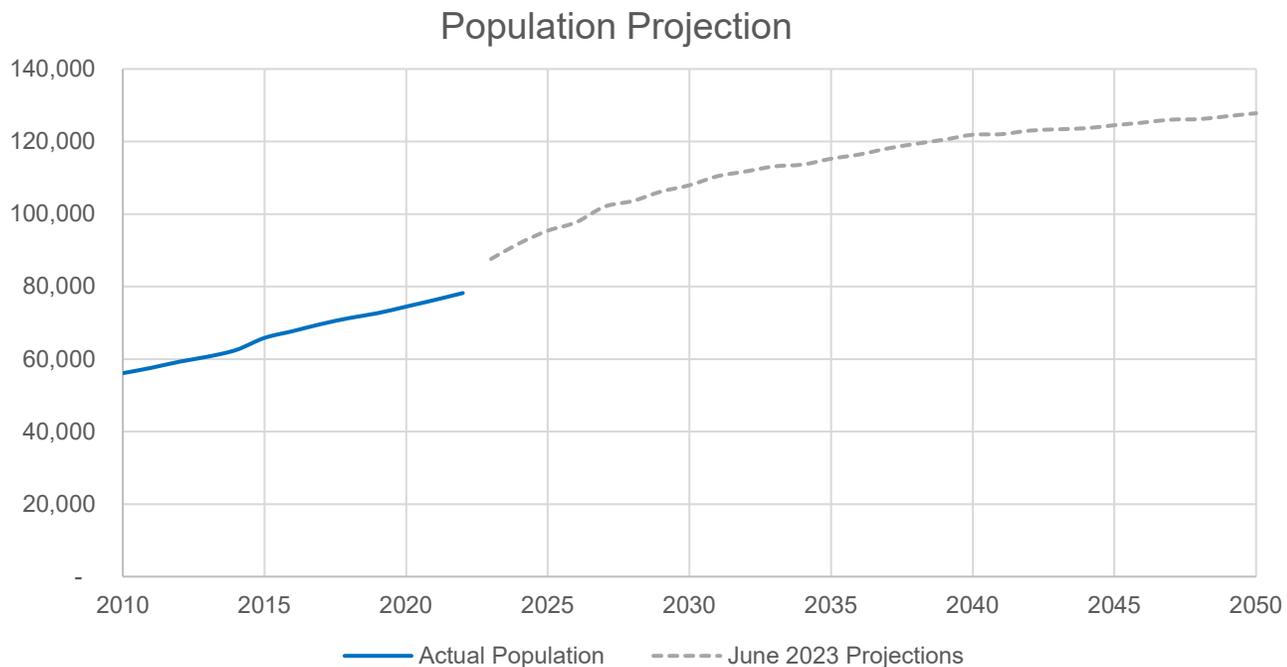
Broomfield Wastewater Reclamation Facility



Future Needs

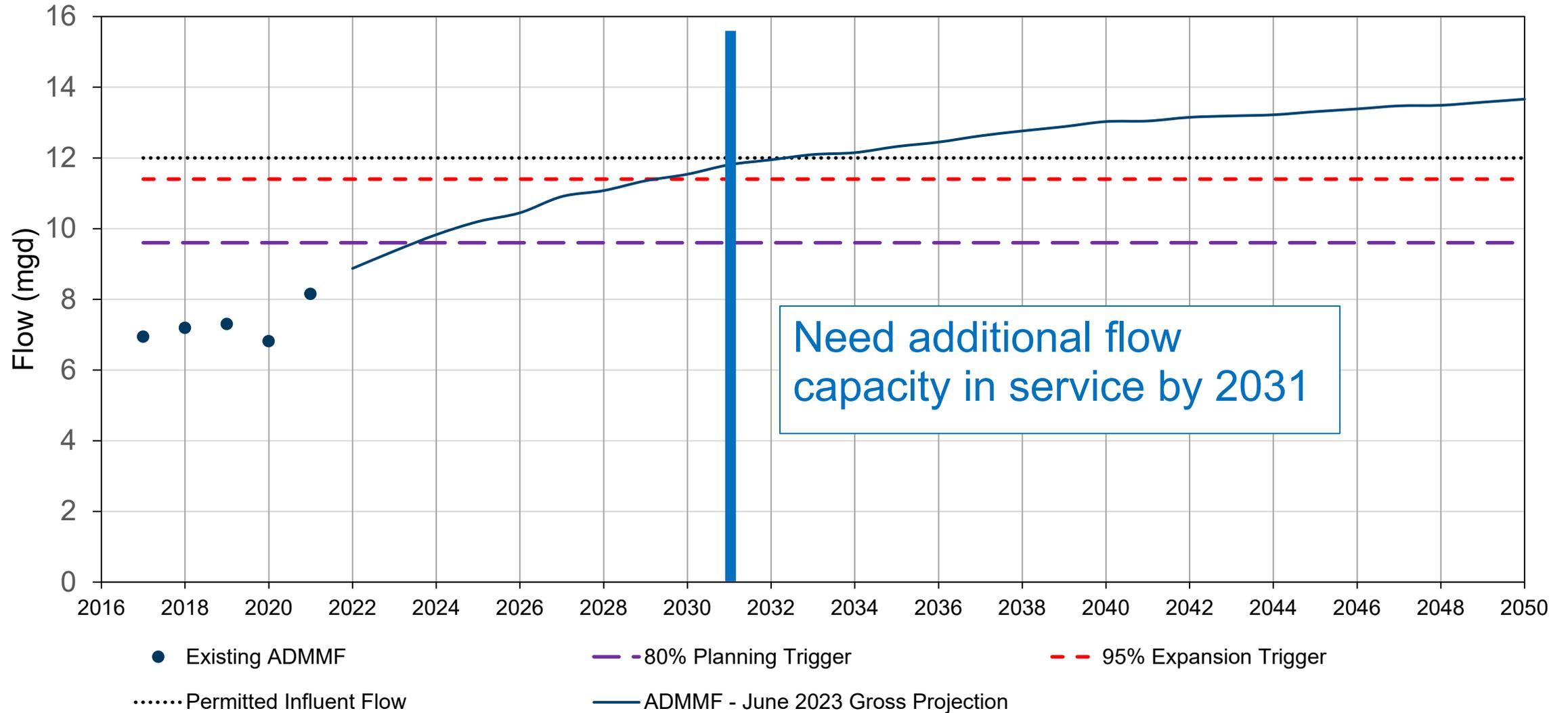
Drivers for the BWRF

- Growth and Capacity
- Facility Condition - Aging Assets
- Current and Future Regulations
- Water Resiliency

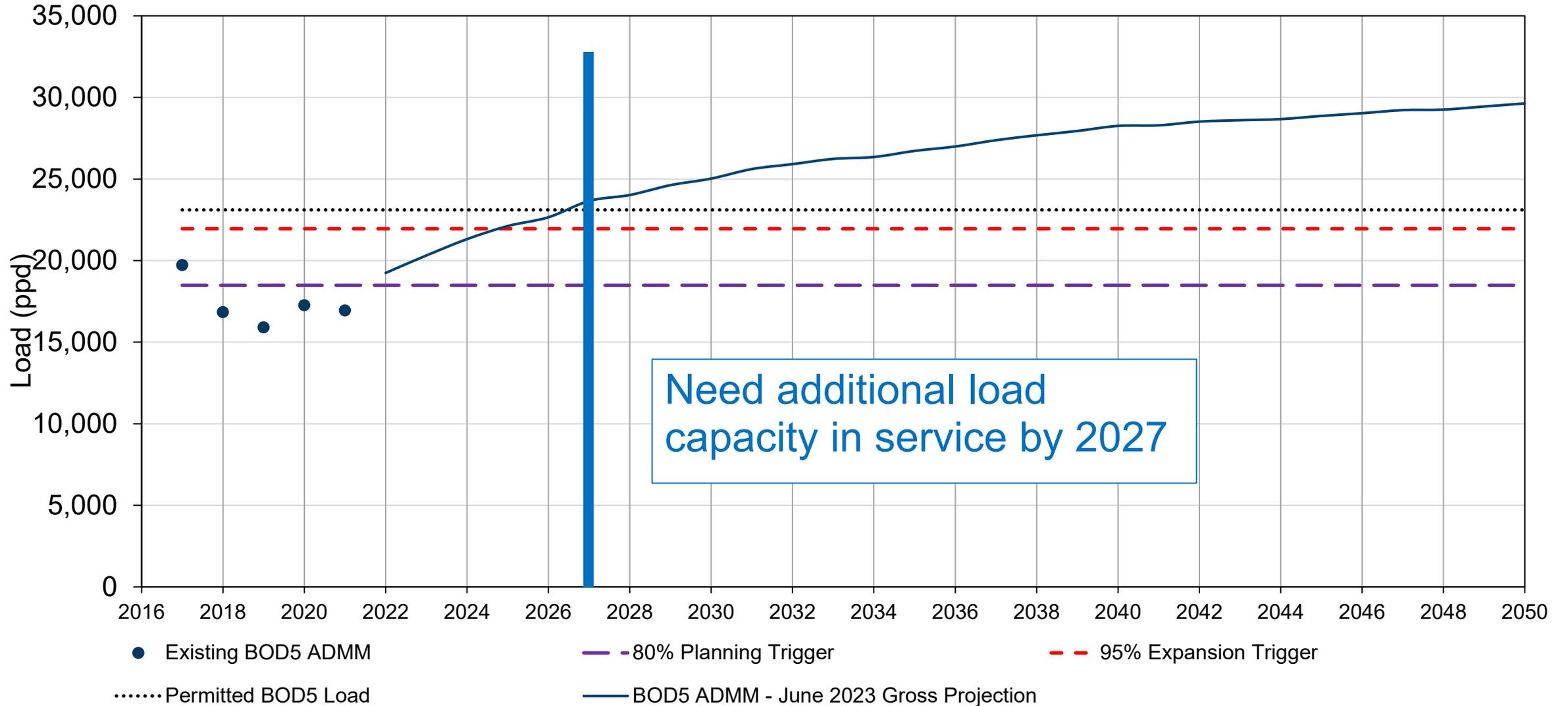


Expected growth by 2050

BWRF Flows – Historical and Projected



BWRF Loads – Historical and Projected



Facility Assessment Site Plan



Most significant work: Digestion replacement and equalization system

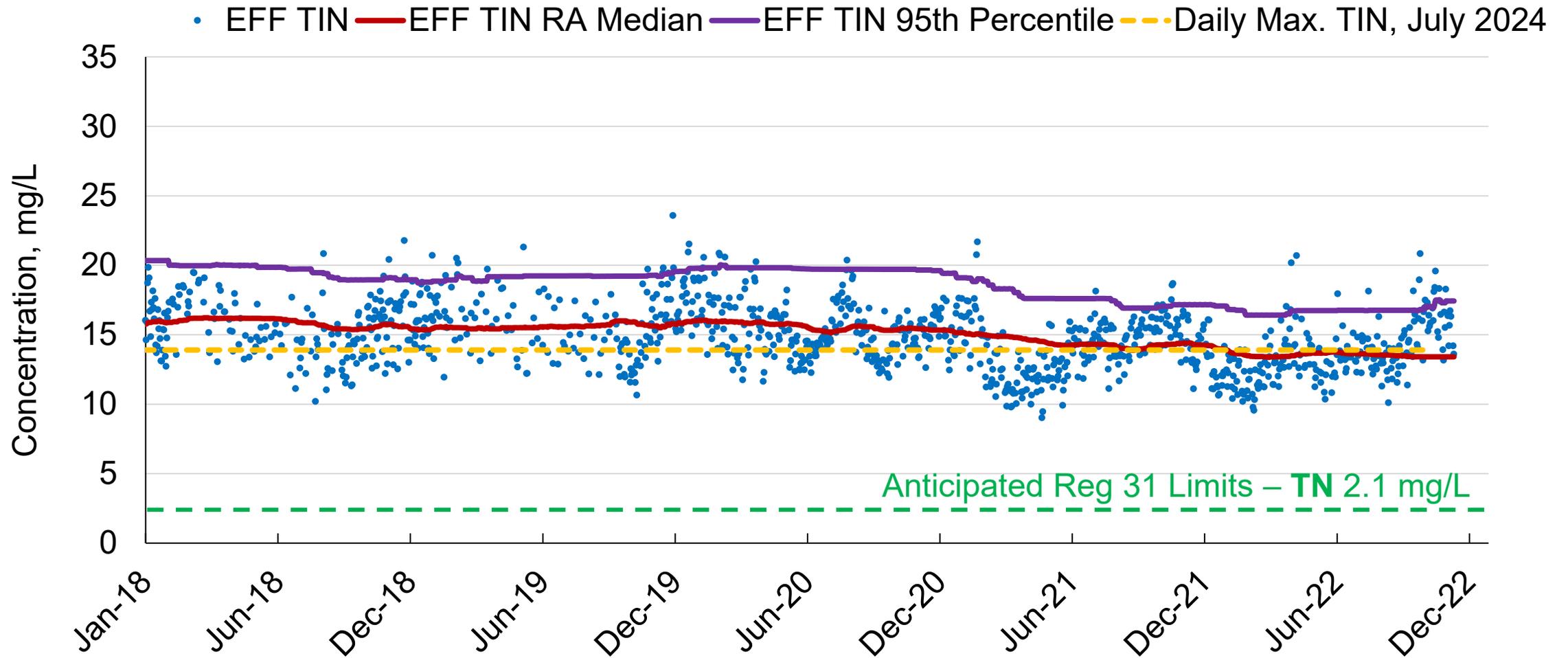
- 1 PRIMARY TREATMENT**
 - Replace flow equalization basin and pumping, primary sludge pumping, and primary clarifier mechanisms.
 - Evaluate primary clarifier concrete and mechanism condition.
- 2 PRELIMINARY TREATMENT**
 - Upgrade HVAC and odor control air flows.
 - Plan rebuild of influent pumps.
 - Consider influent flow measurement improvements, address metals corrosion in girl room, and evaluate hydraulic capacity and limitations in channels for peak flow.
- 3 SITE ELECTRICAL**
 - Recommend a full plant one-line diagram.
 - Update arc-flash study and provide equipment labeling.
 - Replace switchboard in West Generator Building.
 - Replace site lighting.
- 4 SECONDARY TREATMENT**
 - Replace South Train capacity with new treatment train.
 - Replace Middle Train IR, RAS, and WAS pumps and associated electrical, and IFAS system.
 - Replace old North Train blowers- Replace secondary clarifier mechanisms for SC 3 and 4.
- 5 I&C SYSTEMS**
 - Improve aeration/DO control.
 - Plan PLC and instrumentation upgrades in parallel with project work.
- 6 SOLIDS THICKENING**
 - DAF redundancy for WAS thickening.
- 7 ODOR CONTROL**
 - Complete odor control study.
 - Construct new odor control system at new EQ facility and combine nearby existing foul air flows.
 - Replace odor control fans, associated ductwork, and metal building.
- 8 DIGESTION**
 - Construct new digestion complex, including digesters, dewatering feed pumps, and pre-dewatering sludge storage.
 - Consider capacity and desire to achieve Class B biosolids and beneficial reuse of biogas.
- 9 TERTIARY TREATMENT**
 - Replace filter backwash pumps and HVAC in chemical rooms.
 - Evaluate UV disinfection hydraulics and update, if necessary.
 - Consider logical approach to reuse system expansion.
 - Add jockey reuse pump in fourth pump bay.
- 10 DEWATERING**
 - Replace conveyors.
 - Increase centrate storage/consider treatment.
 - Replace centrifuges with larger capacity units or 3 centrifuges if mechanical connections and access can be defined.
 - Plan for sludge storage volume and replace dewatering feed pumps

Facility Overview
currently in good condition
compliance with current
regulation aging and
sal/beneficial reuse
is limited

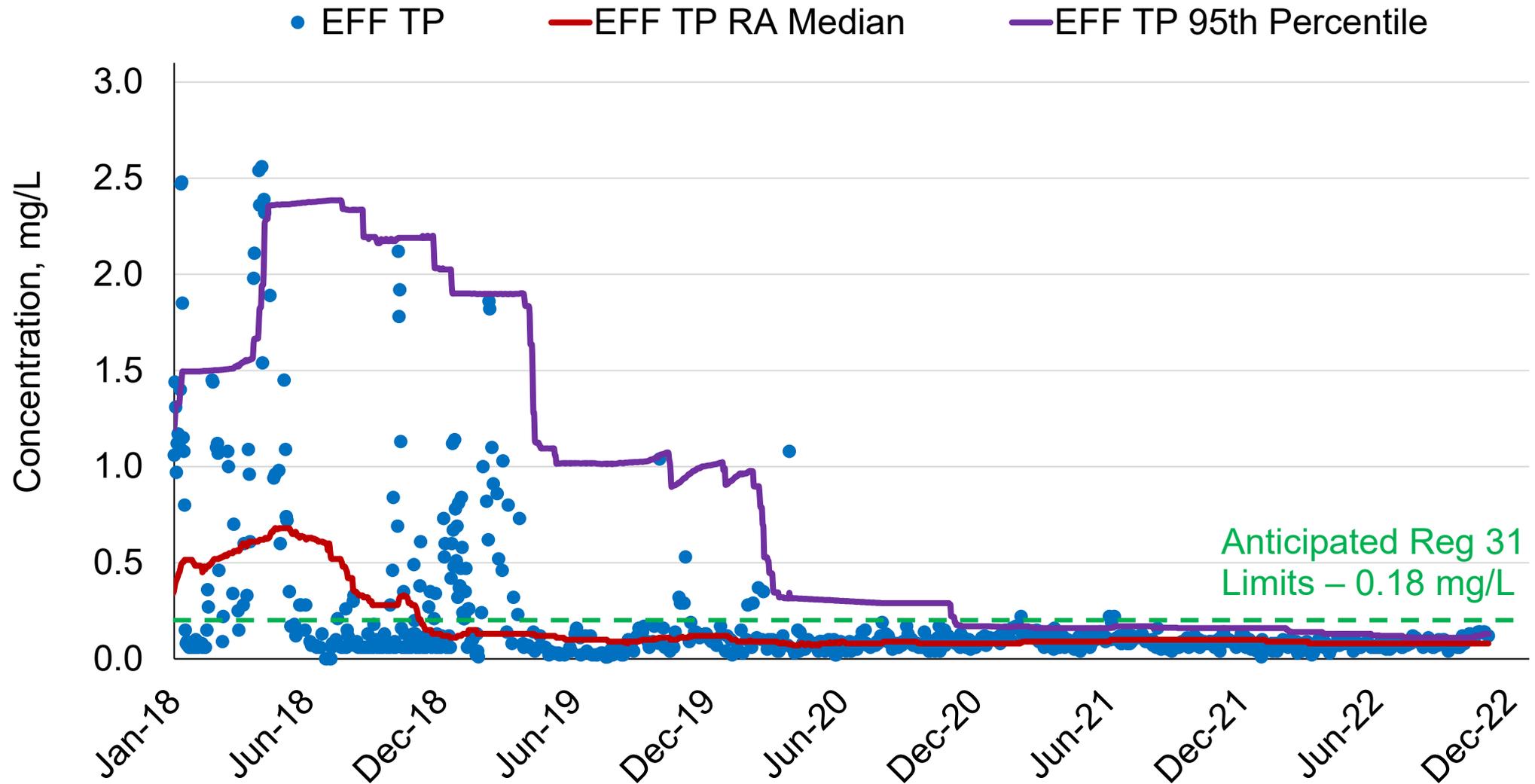
Regulations – Near-term and Future

- Nutrients
 - Ammonia
 - Total Inorganic Nitrogen
 - Total Phosphorus
- Temperature
- Regulation 31 Nutrients
- PFAS

Historical Effluent TIN



Historical Effluent TP



PFAS Regulations – Wastewater Effluent and Biosolids

Legend	
■	Enforceable
■	Enforceable Proposed
■	Monitoring

Michigan
Enforceable Surface Water Quality Standards:

- Drinking water source: PFOS 11 ng/L, PFOA 420 ng/L
- Non-drinking water source: **PFOS 12 ng/L, PFOA 12,000 ng/L**

Also: Evaluation of WW biosolids

Maine –
Moratorium on land application; Enforceable biosolids screening levels:
 PFOA – 0.0025 mg/kg
 PFOS – 0.0052 mg/kg
 PFBS – 1.9 mg/kg

Wisconsin
 Surface water standards under development

Minnesota
 Site specific surface water standards

Vermont-
 Surface water standards under development.

New Hampshire -
 Surface water standards under development.

Washington –
 PFOS in biosolids as topic emerging
 Wastewater survey

New York
 Biosolids screening required.

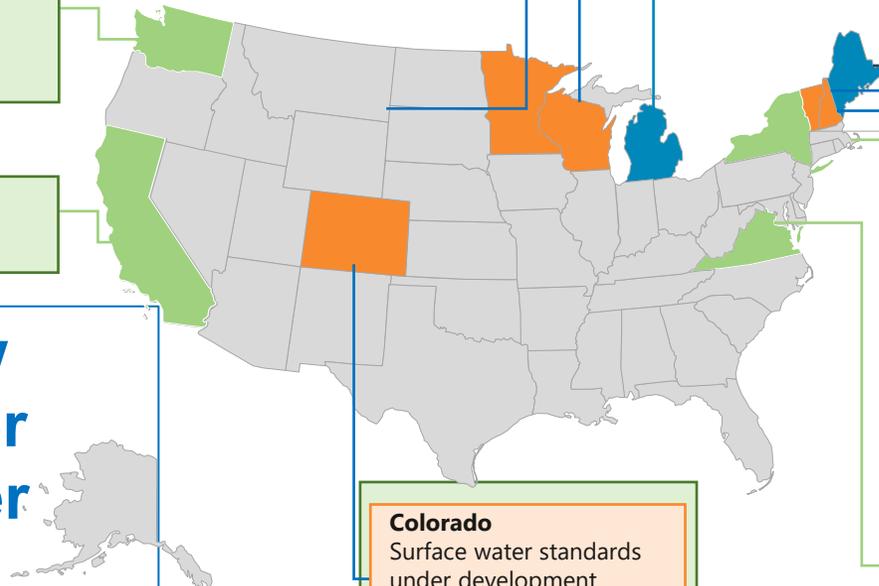
California –
 Monitoring of biosolids and wastewater

Massachusetts –
 PFAS testing required for biosolids in permit renewal process.

**TBD impact of new
 EPA Drinking Water
 MCL on wastewater
 discharges**

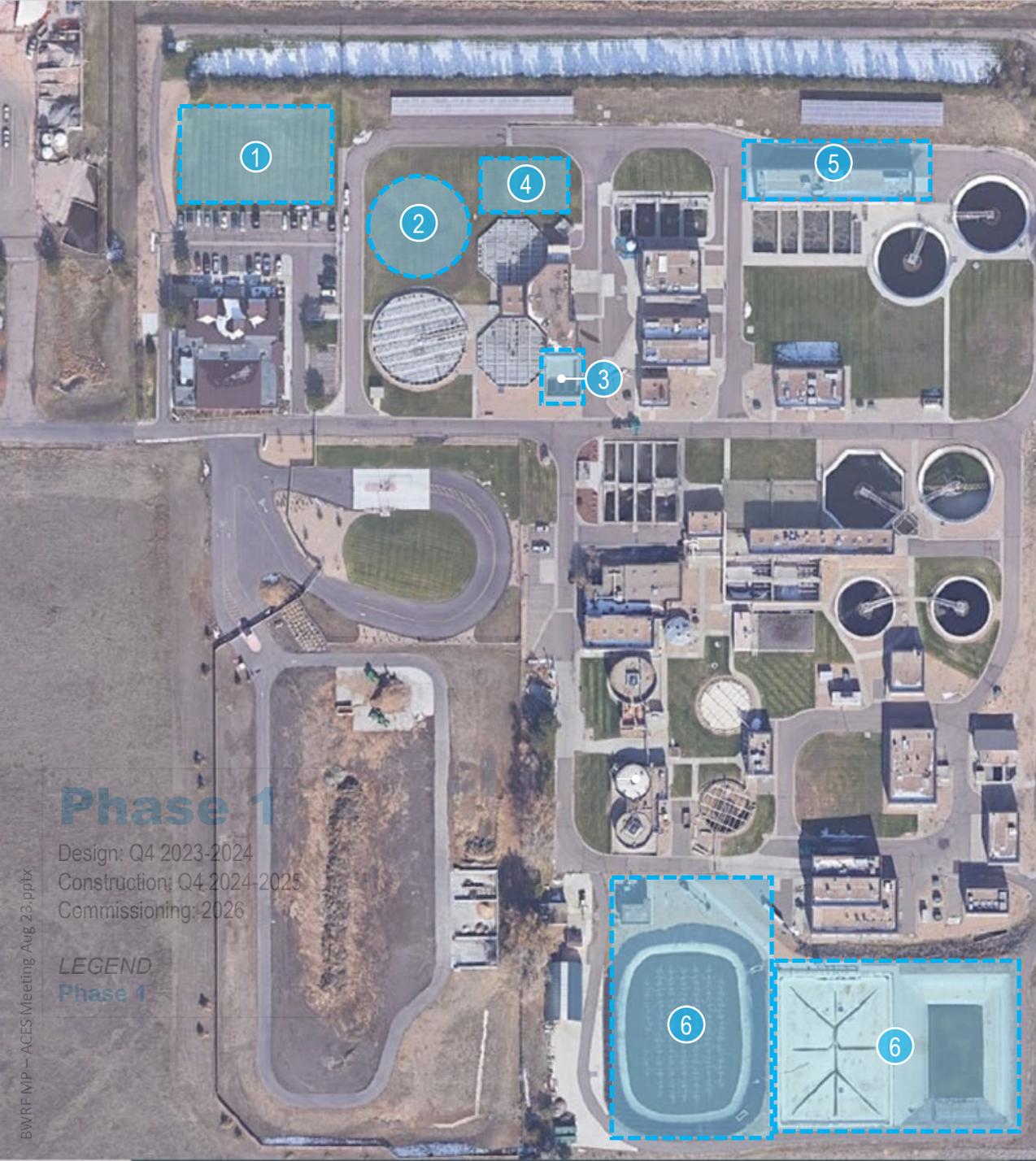
Colorado
 Surface water standards
 under development
 Monitoring of biosolids
 and wastewater

North Carolina –
 PFOS biosolids testing required





Capital Improvement Program

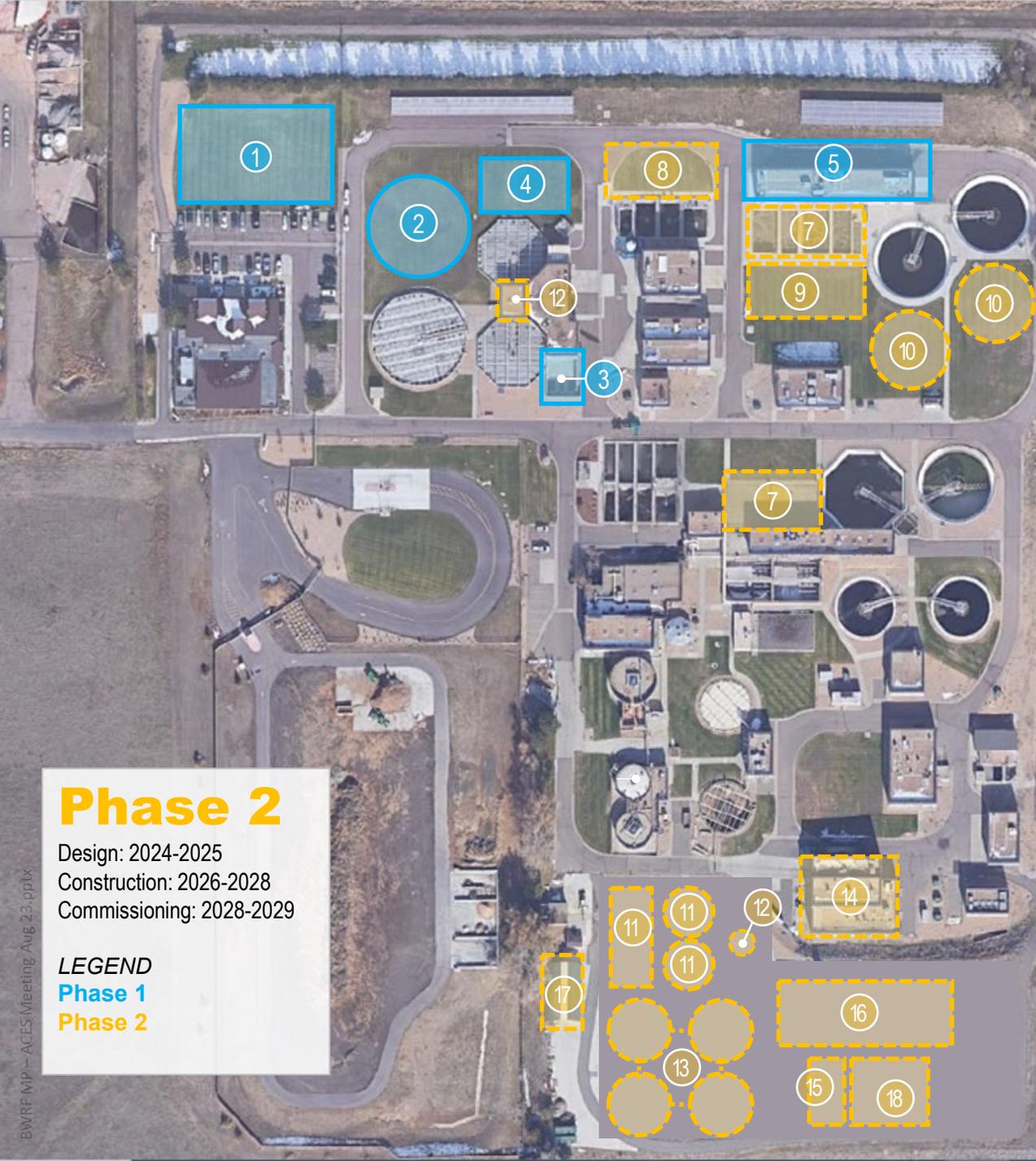


- 1 DIURNAL EQUALIZATION BASIN
- 2 EQUALIZATION BASIN / 4TH PRIMARY CLARIFIER
- 3 EQUALIZATION PUMP STATION
- 4 LIQUIDS ODOR CONTROL
- 5 BLOWER OPTIMIZATION
- 6 SITE PREP FOR PHASE 2

Phase 1

Design: Q4 2023-2024
Construction: Q4 2024-2025
Commissioning: 2026

LEGEND
Phase 1



Phase 2

Design: 2024-2025
Construction: 2026-2028
Commissioning: 2028-2029

LEGEND
Phase 1
Phase 2

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- 9 TRAIN 4 AERATION BASINS
- 10 TRAIN 4 SECONDARY CLARIFIERS
- 11 DAF MECHANICAL FACILITY AND TANKS
- 12 SLUDGE PUMPING AND BLEND TANK
- 13 DIGESTER COMPLEX
- 14 DEWATERING CENTRIFUGE UPGRADE
- 15 CENTRATE EQUALIZATION
- 16 BENEFICIAL BIOGAS USE SYSTEM
- 17 SOLIDS ODOR CONTROL
- 18 SIDESTREAM NITROGEN TREATMENT



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- 20 DEMO AND REPLACEMENT OF SOUTH TRAIN AERATION BASINS AND SECONDARY CLARIFIERS
- 21 MIDDLE/SOUTH IR PUMP STATION & DEMO OF EXISTING IR PUMPS
- 23 UV EXPANSION
- 24 REUSE FILTRATION EXPANSION
- 25 SIDESTREAM PHOSPHORUS TREATMENT
- 26 PFAS TREATMENT

Phase 3
 Design: 2027-2028
 Construction: 2029-2030
 Commissioning: 2031

LEGEND
 Phase 1
 Phase 2
 Phase 3



Phase 4

Design: 2029-2030
 Construction: 2031-2032
 Commissioning: 2033

LEGEND
 Phase 1
 Phase 2
 Phase 3
 Phase 4

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- 27 PLANT-WIDE ROAD REPLACEMENT
- 28 SOLIDS LOADOUT
- 29 COOLING TOWERS
- 30 HYDRAULIC CAPACITY AND ASSET IMPROVEMENTS

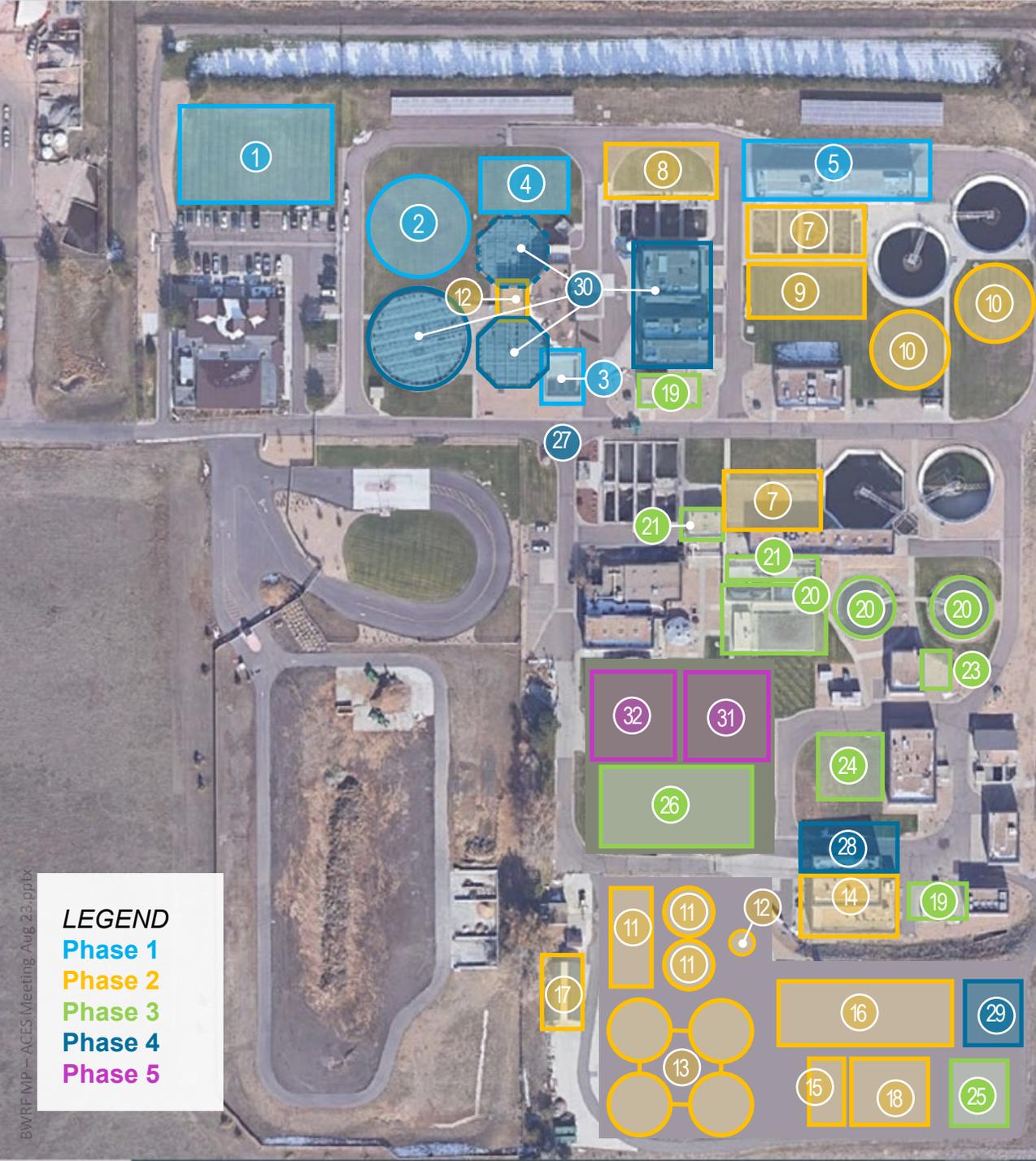


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- 31 TERTIARY DENITRIFICATION FILTERS
- 32 TERTIARY PHOSPHORUS FILTERS

Phase 5

Design: 2035-2036
 Construction: 2037-2038
 Commissioning: 2039

- LEGEND**
- Phase 1
 - Phase 2
 - Phase 3
 - Phase 4



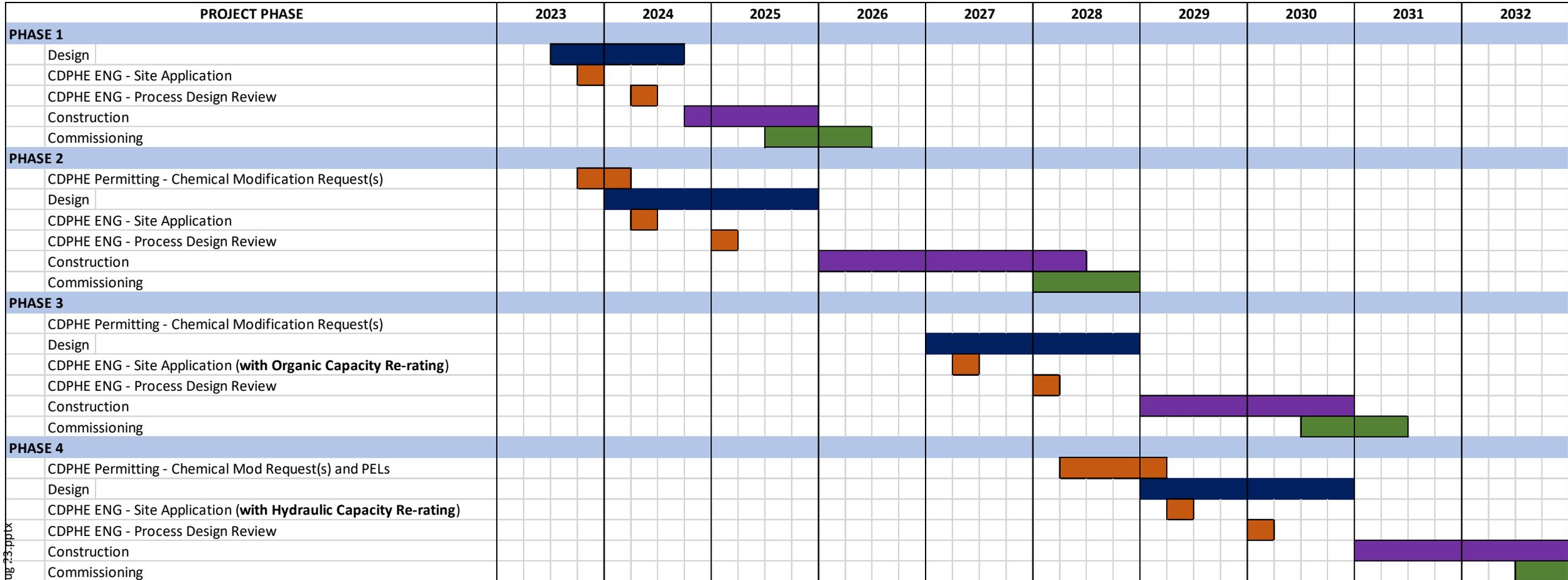
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LEGEND
 Phase 1
 Phase 2
 Phase 3
 Phase 4
 Phase 5

CIP Schedule

	Phase	Design	Construction	Commissioning	Key Considerations
	1	Q4 2023-2024	Q4 2024-2025	2026	Site Preparation for Solids
	2	2024-2025	2026-2028	2028-2029	Capacity Drivers, Performance, Resource Recovery
	3	2027-2028	2029-2030	2031	Timing of Load Growth, Asset Upgrades, Reuse Approach, Timing of PFAS Limits
	4	2029-2030	2031-2032	2033	Timing of Flow Growth, Treatment Approach, Temperature Limits
	5	2035-2036	2037-2038	2039	Timing of Regulation 31 Limits and Approach to Treatment/Reuse

Permitting and Near-term Schedule



Cost Estimates as of March 2023

Phase	Construction Cost Estimate	Design and Permitting Cost Estimate	Construction Management and Engineering Services During Construction Cost Estimate	Project Cost Estimate
1	\$31,278,000	\$2,750,000	\$2,815,000	\$36,843,000
2	\$149,464,000	\$13,452,000	\$13,452,000	\$176,368,000
3	\$100,556,000	\$9,050,000	\$9,050,000	\$118,656,000
4	\$53,826,000	\$4,844,000	\$4,844,000	\$63,514,000
5	\$108,569,000	\$9,771,000	\$9,771,000	\$128,111,000



Sustainability

Key Sustainability Components of BWRF CIP

- Improved treatment in line with new standards
- Treatment processes selected to minimize need for chemical addition
- Flexibility in beneficial reuse of biosolids
- Beneficial energy recovery from digester biogas

GHG Terminology

Scope 1*

- Direct emissions
 - Onsite stationary combustion



Scope 2

- Indirect emissions
 - Purchased electricity, heat, or steam



Scope 3

- Indirect emissions
 - Purchased materials & uses of end products



*Regulated emissions include combustion of natural gas and biogas (not including biogenic CO₂)

GHG Emissions at the BWRF

Period	Annual Treated Wastewater (MG/yr)	Annual Scope 1, 2, and 3 GHG Emissions (MT CO2e/yr)	Unit GHG Emissions (MT CO2e/yr/MG)
2021	2,369	7,332	3.1
2028 After Phase 2 with Cogeneration	3,289	9,557	2.9

- 6% reduction in unit GHG emissions, despite:
 - More stringent limits
 - Increased chemical demands



Next Steps