

# 20-Year Facility Planning Study

## Hanover Water Reclamation Facility

November 7, 2022



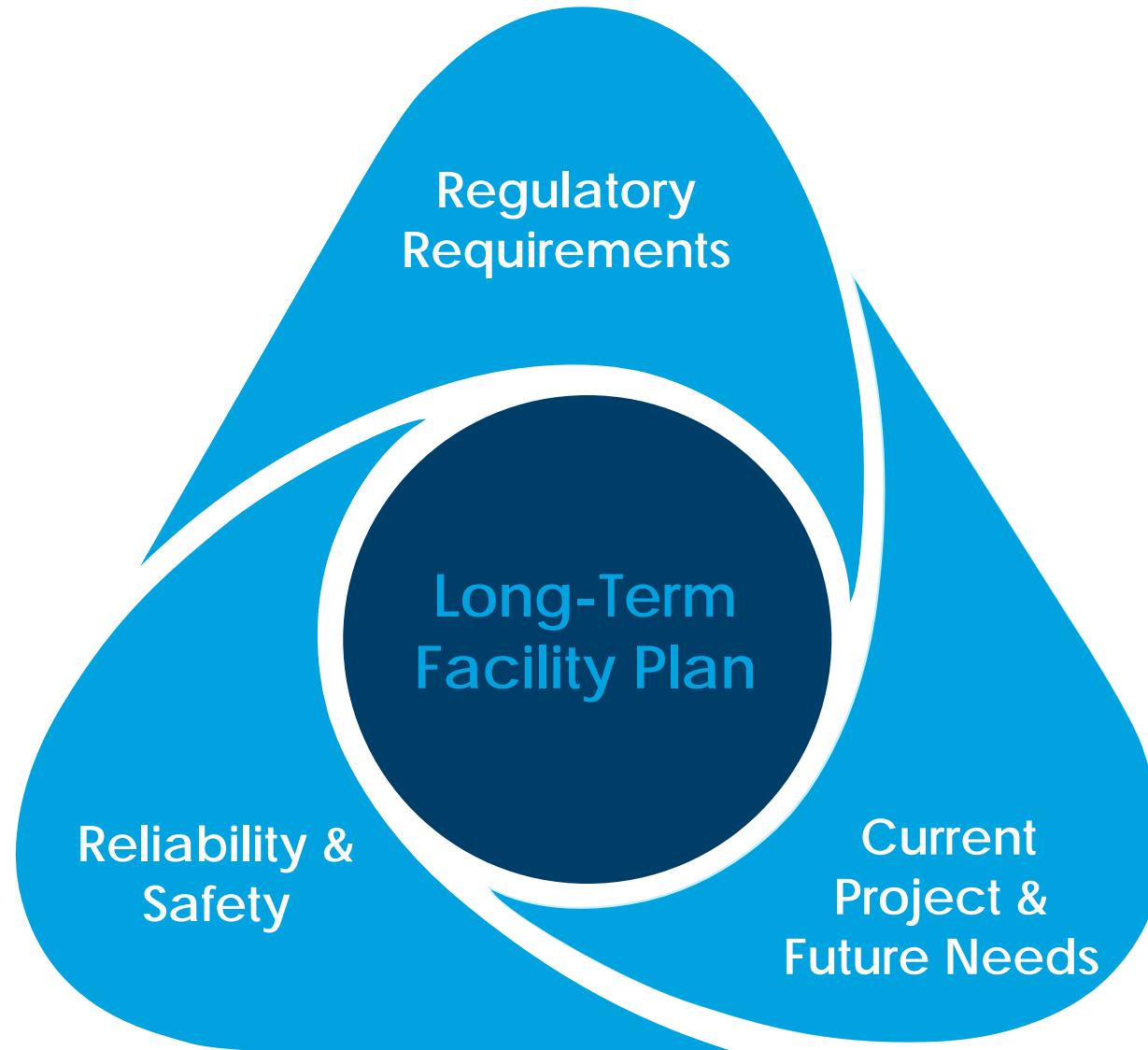
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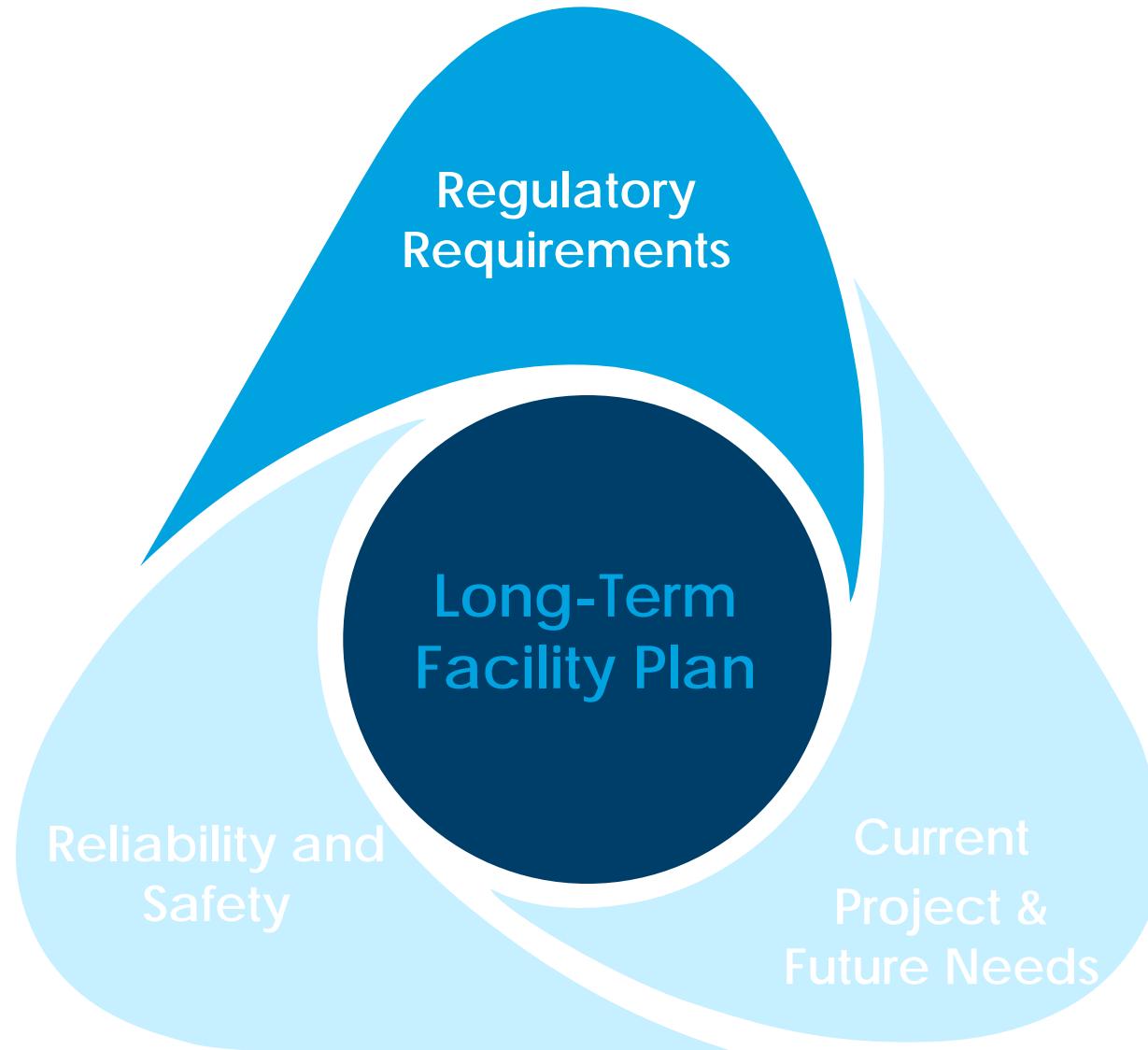
# Acronyms, Definitions

AADF	Annual average daily flow	NPDES	National pollutant discharge elimination system
BOD	Biochemical Oxygen Demand	PLC	Programmable Logic Controller
CIP	Capital improvement plan	POTW	Publicly Owned Treatment Wastewater
CWA	Clean Water Act	Ppt	Parts per trillion
DO	Dissolved oxygen	Q	Flow
EPA	Environmental Protection Agency	RAS	Return activated sludge
FY	Fiscal Year	RPM	Rotations per minute
GPD	Gallons per day	SCADA	Supervisory Control and Data Acquisition
GPM	Gallons per minute	TKN	Total Kjeldahl Nitrogen
HP	Horsepower	TMDL	Total Maximum Daily Load
HVAC	Heating, ventilation, and air conditioning	TN	Total nitrogen
IND	Individually Owned Wastewater Treatment	TSS	Total suspended solids
I/I	Infiltration and inflow	TWAS	Thickened waste activated sludge
IMA	Inter-municipal agreement	Ug/day	Micrograms per day
kW	Kilowatt	Ug/L	Micrograms per liter
MCC	Motor control center	VFD	Variable frequency drive
Mg/L	Milligrams per liter	WAS	Waste activated sludge
MGD	Million gallons per day	WRF	Water reclamation facility
NHDES	NH Department of Environmental Services		

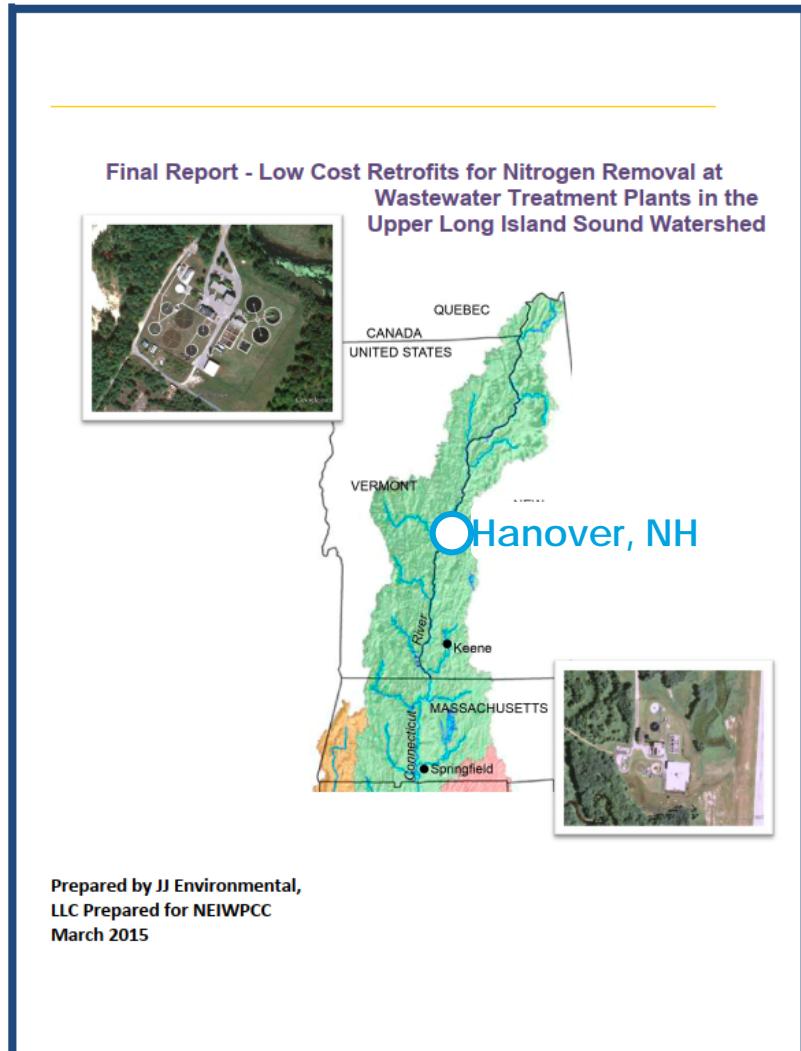
## Background: Drivers



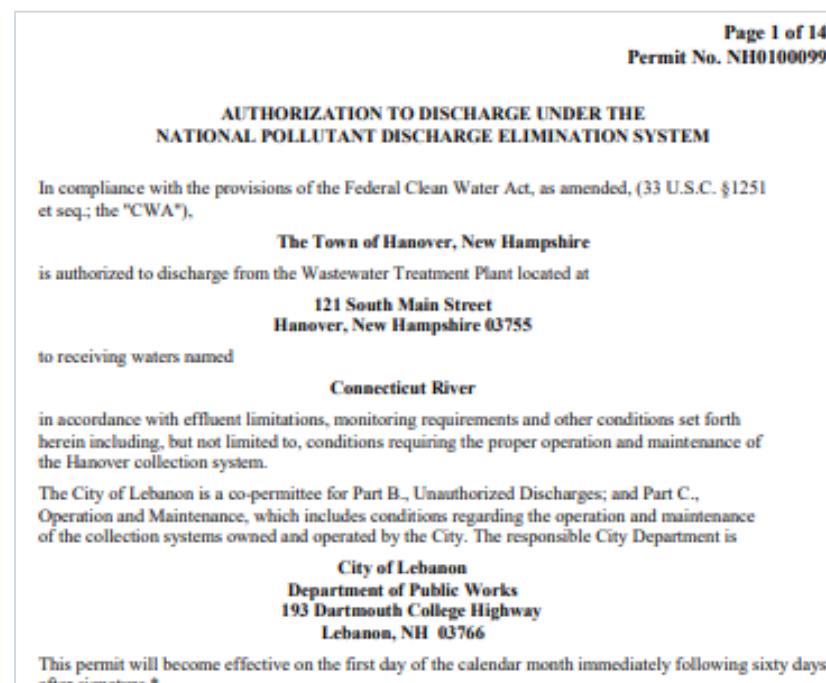
## Background: Drivers



# EPA: Connecticut River Valley



- 2000-2001 Long Island Sound Study, TMDL
- 2007-2015 WWTF Optimization Study
- 2015 Hanover NPDES Permit
  - Current Nitrogen Optimization Goal
  - Future Nitrogen “Optimization” Limit



# EPA: Connecticut River Valley

Summary of New Hampshire Out-Of-Basin Wastewater Treatment Plant and Industrial Discharger Total Nitrogen Effluent Data

#2 NH Loading



Permit #	Name	Type	Design Flow (MGD)	2014-2018 Avg Flow (MGD)	2014 Average Load (lb/day)	2015 Average Load (lb/day)	2016 Average Load (lb/day)	2017 Average Load (lb/day)	2018 Average Load (lb/day)	2014-2018 Avg Load (lb/day)
<b>Total New Hampshire Out-of-Basin Load</b>			<b>31.5</b>	<b>18.6</b>	<b>1,662</b>	<b>1,457</b>	<b>1,370</b>	<b>1,555</b>	<b>1,154</b>	<b>1,440</b>
NH0000621	BERLIN STATE FISH HATCHERY	IND	6.1	6.30	8.8	13	13	15	8.7	12
NH0000744	NH DES (TWIN MTN STATE FISH HATCHERY)	IND	1.0	0.78	2.0	5.8	6.2	5.5	5.1	4.9
NH0100099	HANOVER WWTF	POTW	2.3	1.30	<u>341</u>	<u>341</u>	313	350	361	341
NH0100145	LANCASTER WWTF	POTW	1.2	0.79	84	78	45	72	63	68
NH0100153	LITTLETON WWTP	POTW	1.5	0.69	32	36	24	31	45	34
NH0100200	NEWPORT WWTF	POTW	1.3	0.59	97	63	80	80	79	80
NH0100366	LEBANON WWTF	POTW	3.2	1.49	<u>136</u>	<u>136</u>	132	127	152	137
NH0100382	HINSDALE WWTP	POTW	0.3	0.19	<u>18</u>	17	11	20	16	16
NH0100510	WHITEFIELD WWTF	POTW	0.2	0.08	35	22	15	18	24	23
NH0100544	SUNAPEE WWTF	POTW	0.6	0.40	<u>32</u>	<u>32</u>	<u>32</u>	50	33	35
NH0100765	CHARLESTOWN WWTP	POTW	1.1	0.28	22	13	12	19	22	17
NH0100790	KEENE WWTF	POTW	6.0	2.89	<u>533</u>	<u>397</u>	<u>394</u>	<u>452</u>	40	363
NH0101052	TROY WWTF	POTW	0.3	0.08	23	15	12	13	25	18
NH0101150	WEST SWANZEY WWTP	POTW	0.2	0.07	6.1	6.4	7.8	7.8	15	8.7
NH0101168	MERIDEN VILLAGE WATER DISTRICT	POTW	0.1	0.03	0.53	2.5	1.4	2.9	1.3	1.7
NH0101257	CLAREMONT WWTF	POTW	3.9	1.51	<u>161</u>	<u>161</u>	<u>161</u>	163	146	158
NH0101392	BETHLEHEM VILLAGE WWTP (1)	POTW	0.3	0.21	25	26	25	29	25	26
NHG580226	GROVETON WWTP	POTW	0.4	0.12	18	13	10	12	14	13
NHG580315	COLEBROOK WWTP	POTW	0.5	0.22	26	23	21	31	31	26
NHG580391	CHESHIRE COUNTY MAPLEWOOD NURSING HOME	POTW	0.040	0.02	2.1	1.6	1.3	1.5	1.3	1.5
NHG580404	WINCHESTER WWTP	POTW	0.28	0.14	6.1	11	3.9	13	8.3	8.3
NHG580421	LISBON WWTF	POTW	0.3	0.12	26	23	19	17	17	20
NHG580536	STRATFORD VILLAGE SYSTEM	POTW	0.1	0.01	2.2	1.9	3.9	2.5	2.8	2.7
NHG580978	WOODSVILLE WWTF	POTW	0.3	0.19	22	15	19	19	13	18
NHG581206	NORTHUMBERLAND VILLAGE WPCF	POTW	0.1	0.04	2.7	3.3	3.5	2.6	3.1	3.0
NHG581214	STRATFORD-MILL HOUSE	POTW	0.0	0.01	1.4	1.5	2.2	1.8	2.3	1.8
NHG581249	LANCASTER GRANGE WWTP	POTW	0.0	0.00	0.45	0.53	0.45	0.49	0.44	0.47

# EPA: Connecticut River Valley

- 2021 Town & EPA Meeting
  - Spring 2023 Permit Issuance Likely
  - Nitrogen Limit likely:  
10 mg/L, 192 lbs/day
    - Keene (2021)
    - Small General Permit NH (2021)
- 2015-2019 Hanover TN Effluent:
  - 29 mg/L TN avg
  - 332 lbs/day TN avg
  - 576 lbs/day TN peak month

- 2021 Small General Permit

Table 1 - Annual Average Total Nitrogen Limits for Massachusetts WWTF Dischargers to the Long Island Sound Watershed

Facility Design Flow, $Q_D$ (MGD)	Annual Average TN Limit (lb/day)
$Q_D > 10$	$Q_D$ (MGD) * 5 mg/L * 8.34 + optimize
$5 < Q_D \leq 10$	$Q_D$ (MGD) * 8 mg/L * 8.34 + optimize
$1 \leq Q_D \leq 5$	$Q_D$ (MGD) * 10 mg/L * 8.34 + optimize
$0.1 \leq Q_D < 1$	Optimize
$Q_D < 0.1$	TN monitoring only

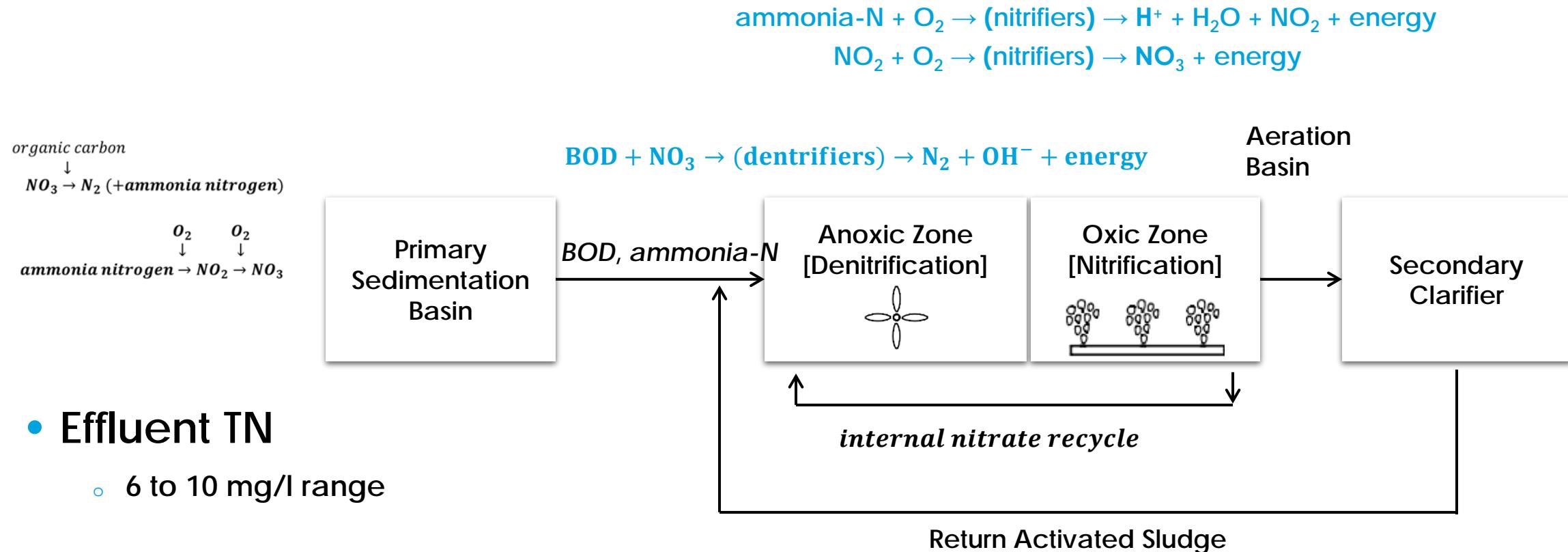
Table 2 - Annual Average Total Nitrogen Limits for New Hampshire WWTF Dischargers to the Long Island Sound Watershed

Facility Design Flow, $Q_D$ (MGD)	Annual Average TN Limit (lb/day)
$1.5 \leq Q_D$	$Q_D$ (MGD) * 10 mg/L * 8.34 + optimize
$0.1 \leq Q_D < 1.5$	Optimize
$Q_D < 0.1$	TN monitoring only

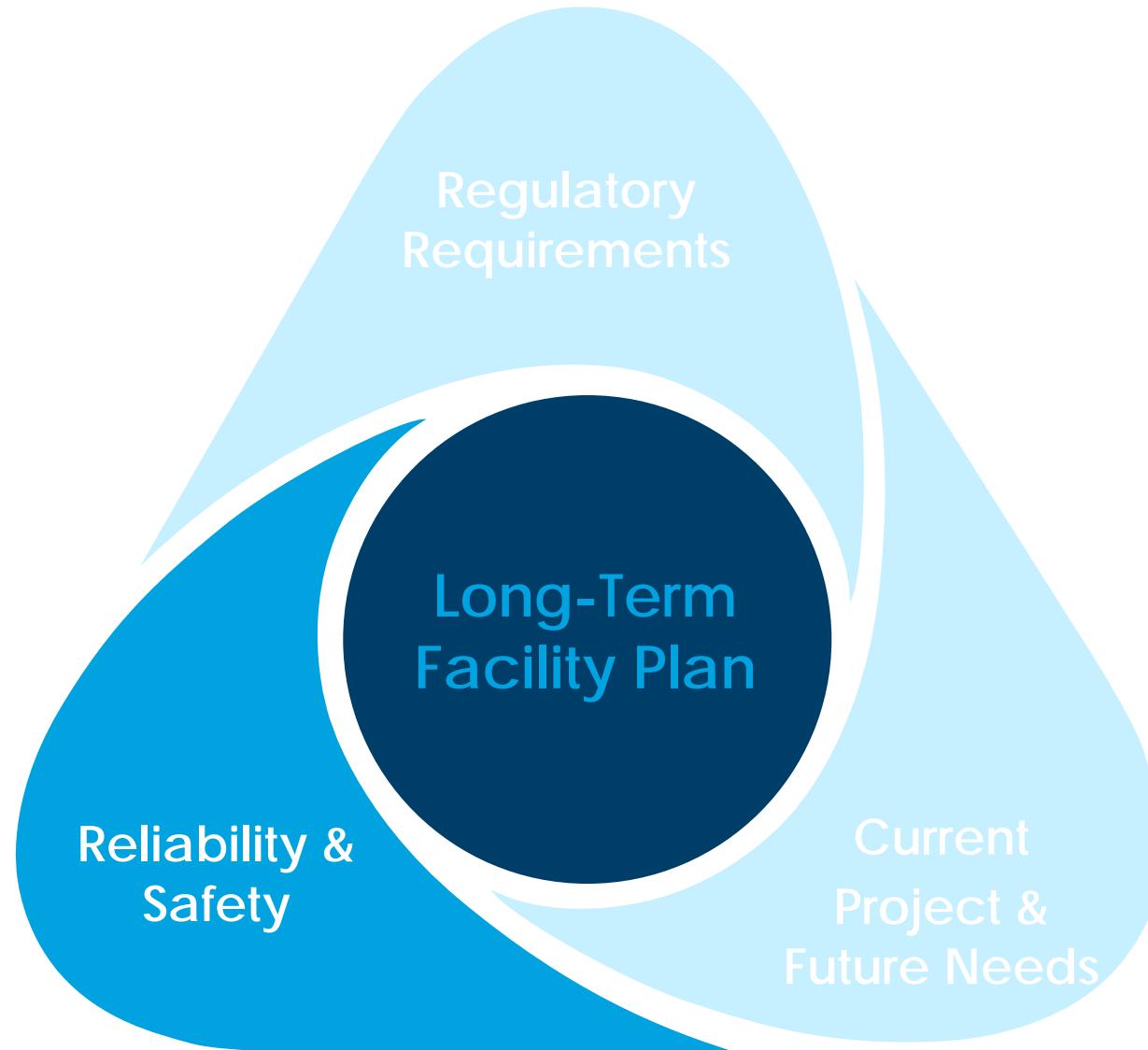
CURRENT FACILITY CANNOT RELIABLY MEET FUTURE TOTAL NITROGEN LIMIT WITHOUT A SIGNIFICANT UPGRADE

REDUCTION OF MORE THAN 2/3 NITROGEN NEEDS TO BE ACHIEVED

# Process Detail - Total Nitrogen Removal: Modified Ludzak-Ettinger



# Project Foundations



# Reliability and Safety

- Headworks Building (1988)



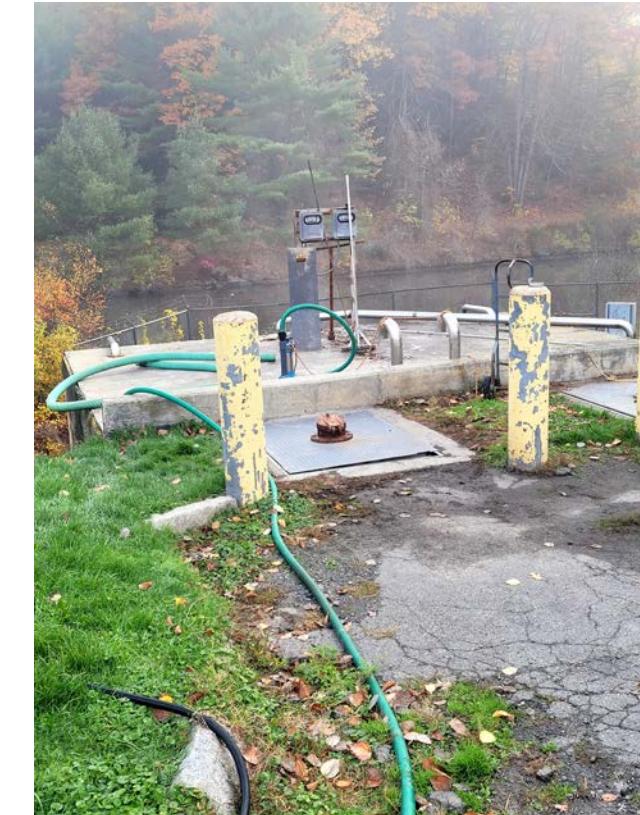
# Reliability and Safety

- Headworks Building (1988)



# Reliability and Safety

- Septage Receiving (1988)



# Reliability and Safety

- Septage Receiving (1988)



# Reliability and Safety

## Treatment: Secondary Clarifiers (1988)



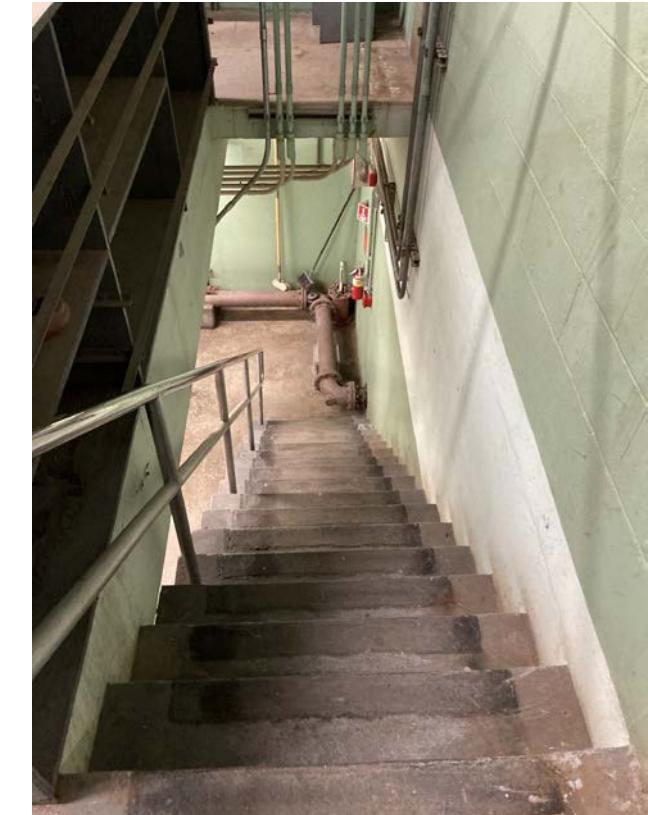
# Reliability and Safety

- Sludge Thickening (1988)
- Influent Screening



# Reliability and Safety

## Safety and Access



# Reliability and Safety

## Yard Electrical Distribution



# Reliability and Safety

## Motor Control Center (1988)



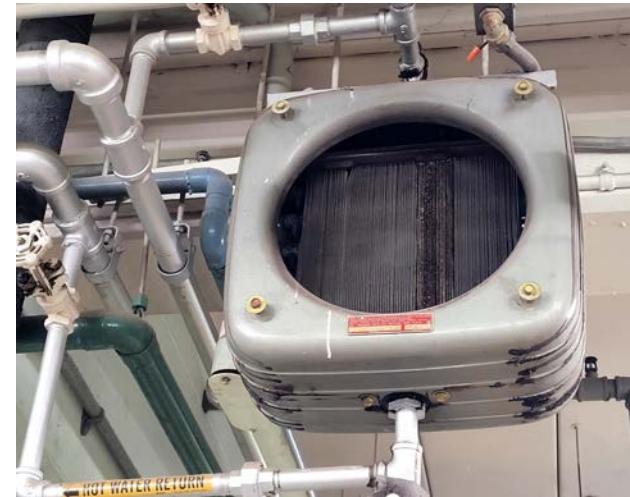
# Reliability and Safety

## HVAC Systems



# Reliability and Safety

## HVAC Systems

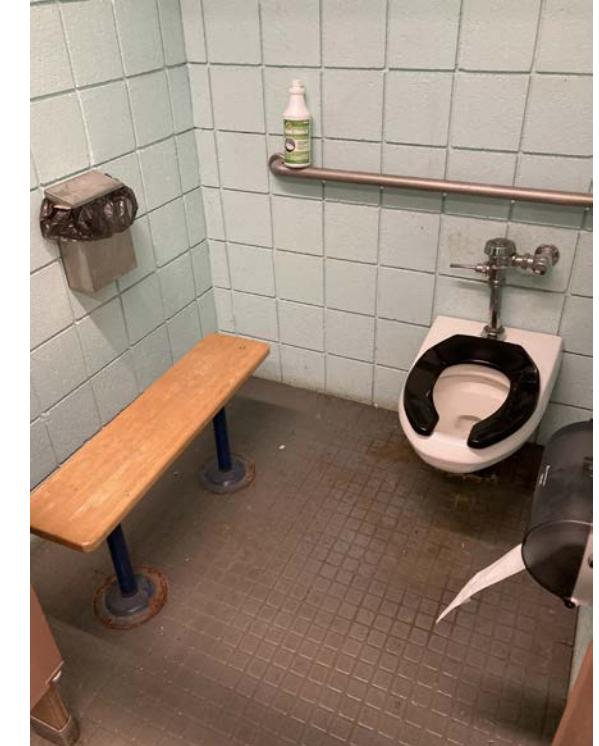


# Reliability and Safety

Uncompleted Projects from 2002-2011

Operations Building – Architectural, Plumbing, HVAC

Replace Temporary Projects, Aeration Selectors



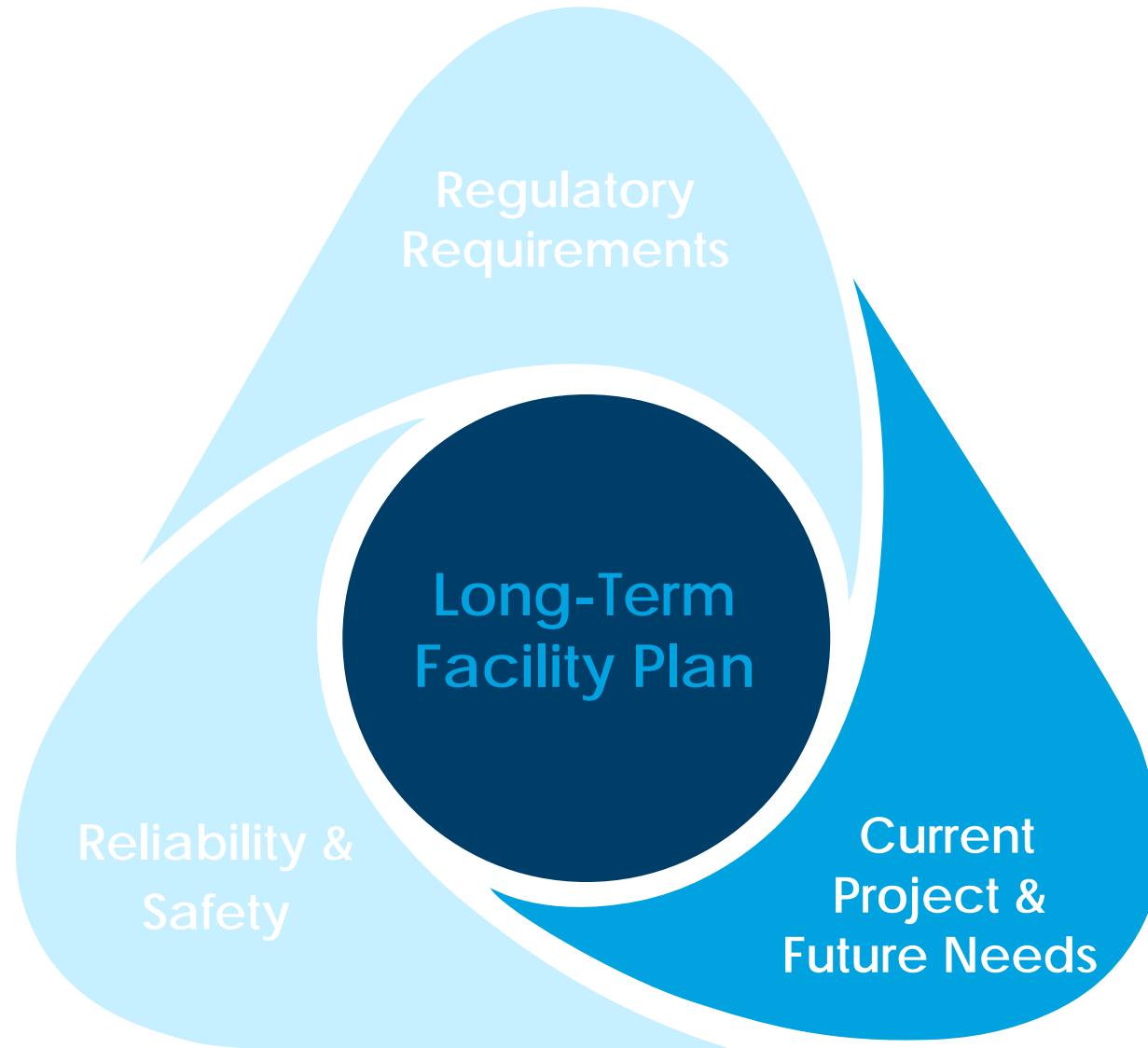
# Reliability and Safety

## Operations Building

### Architectural, Plumbing, HVAC, Electrical



# Improvements Foundations

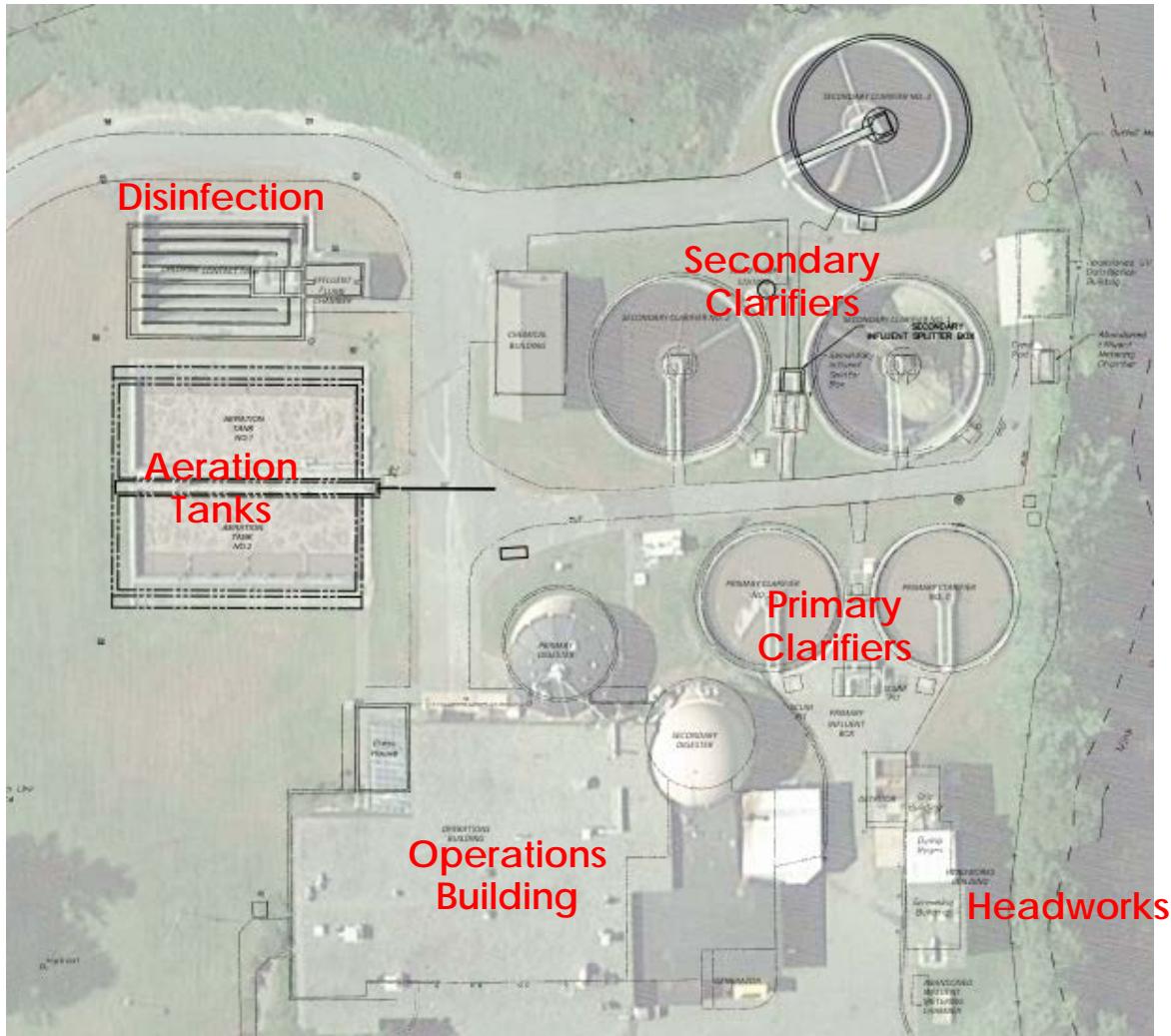


# Current and Future Needs

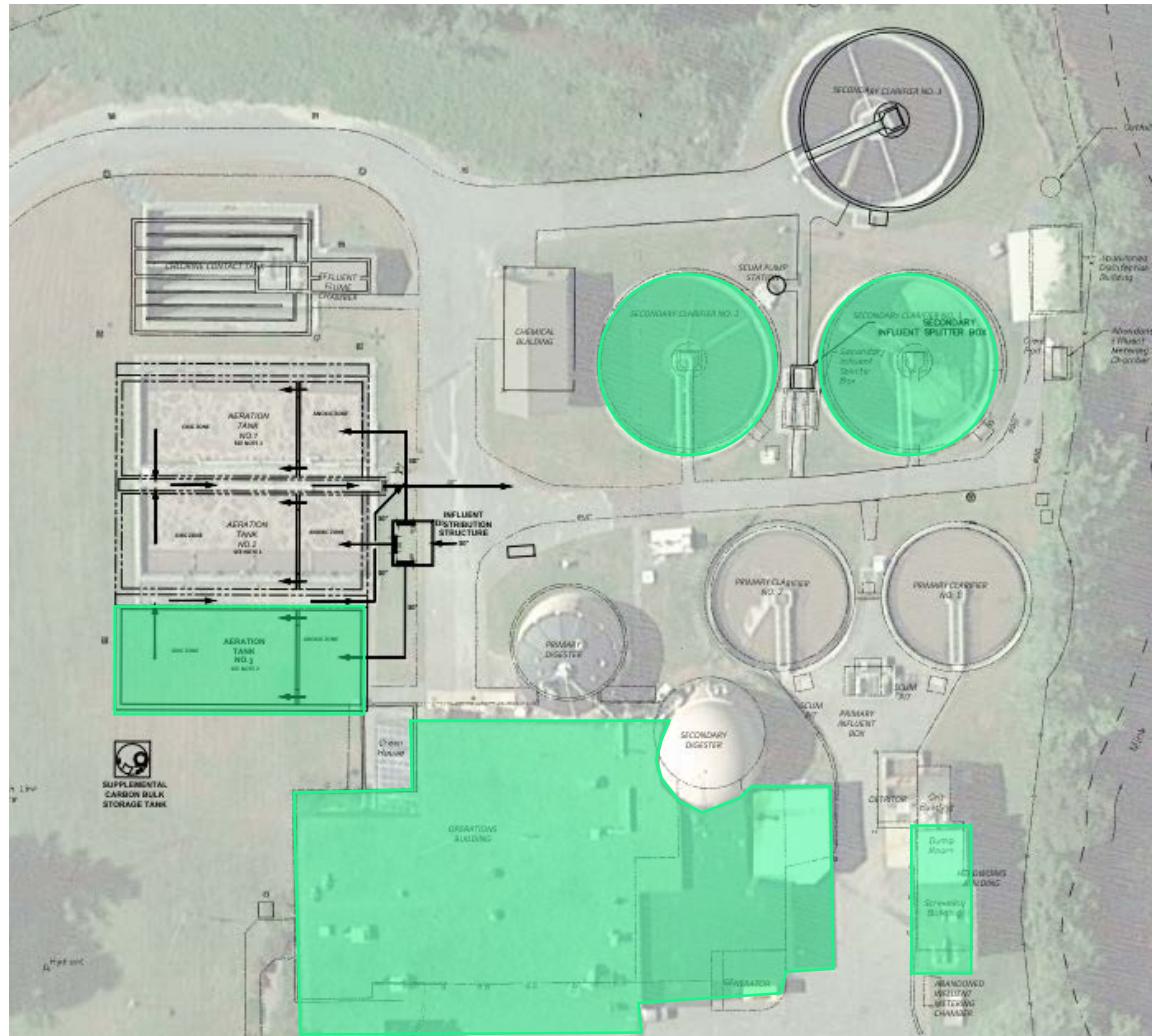
- Current Needs – 2023 - \$22M
  - Highest Priority
  - 2023 NPDES Permit Requirements
  - Criticality & Risk of Failing Equipment
  - Safety
  - Operations Building
- Future Needs
- 2033 - \$16M
  - Critical Equipment Replacement
- 2043 - \$17M
  - Facility expansion
  - More stringent NPDES Permit



# Proposed Project: Existing Conditions

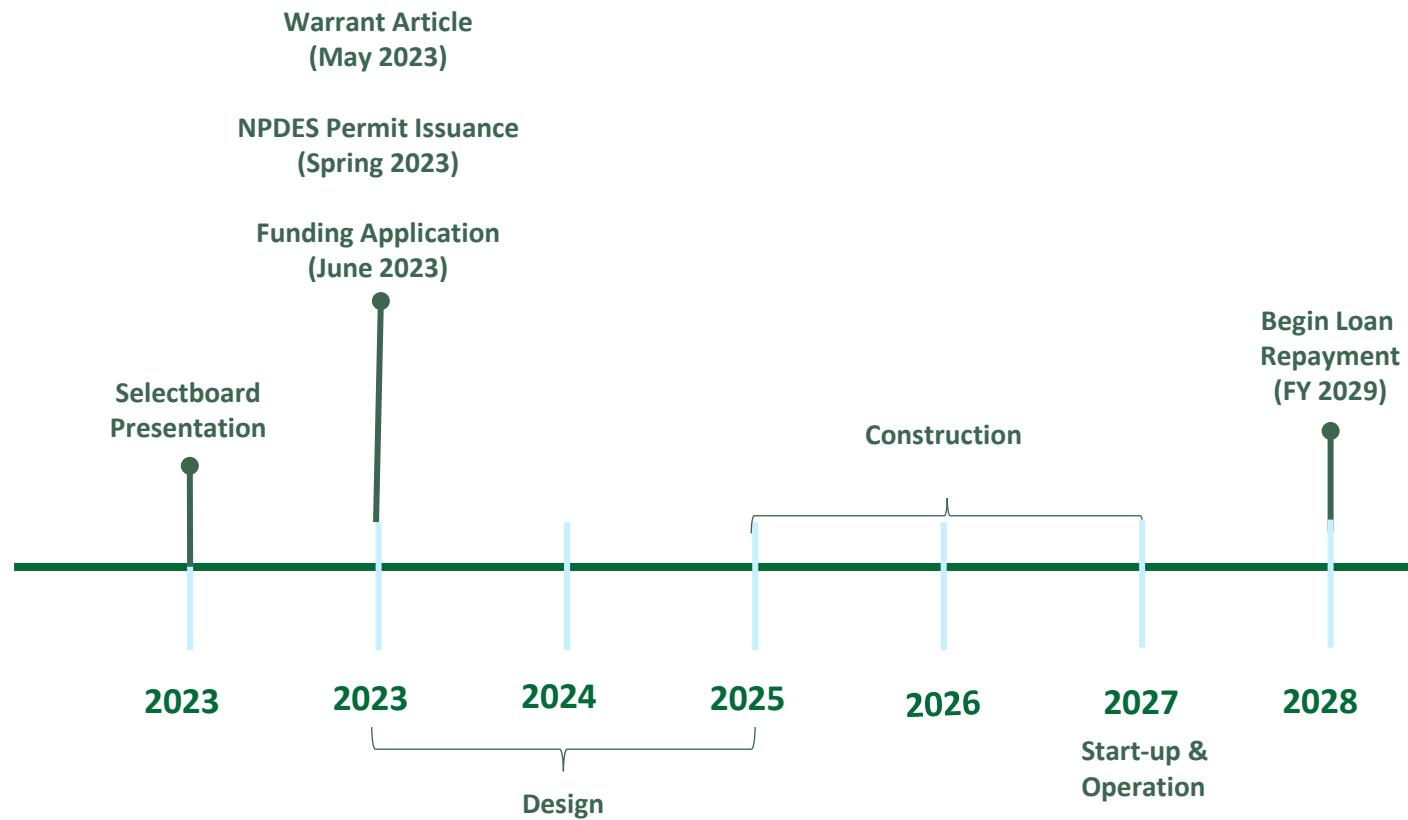


# Proposed Project:



- Aeration Tank Expansion
  - 3 Trains
- Secondary Clarifiers
- Headworks Building
- Operations Building
  - Equipment
  - Building Systems:
    - Architectural
    - Electrical
    - Plumbing, HVAC
- Site: Electrical

# Proposed Project: Project Schedule



# Proposed Project: Cost

Priority	Capital Upgrade Item	Total Project Cost
1	Three-Train Modified Ludzak-Ettinger (MLE) Process Nutrient Removal Upgrade	\$7.30 M
2	Aged Wastewater Equipment Replacement	\$4.55 M
3	Operations Building – Administration Area Improvements	\$1.26 M
4	Purchase Spare Parts for Redundancy and Purchase/Replace Sodium Bisulfite Submersible Mixer	\$0.25 M
5	Electrical and Instrumentation WRF Site Improvements	\$0.47 M
6	Modify Influent Flow Meter Vault and Install Magnetic Flow Meter	\$0.12 M
7	Headworks Building Upgrades	\$4.17 M
8	Operations Building – Process Equipment Areas, Garage, Maintenance Shop Space Improvements (Critical Needs)	\$1.73 M
9	Pipe Thickness Testing and Valve Replacement for Solids Piping	\$0.09 M
	Contingency	\$2.09 M
<b>TOTAL PHASE I</b>		<b>\$22 M</b>

# Funding

- NHDES State Revolving Loan Fund
  - 2022 Priority List
    - 15 projects offered funding as of August 2022
  - \$22M Total Project Cost
  - \$2.2 M Principal Forgiveness (10%)
  - SRF rates 2.536% interest for 20-year loan
- NHDES State Aid Grant eligible
  - \$4.4M
  - (deferred grant funding)



## Existing Debt

• Loans	Principal	Interest	Total	Matures	FY
• 2008 SRF \$2.9 M	\$148,198	\$36,184	\$189,551	12/1/2027	2028
• 2013 ARRA Ln \$1.7 M	\$63,393	\$11,718	\$74,111	12/1/2026	2027
• 2013 SRF \$4.235 M	\$287,827	\$55,479	\$343,305	7/1/2026	2027
• Current total annual payment \$606,967					
• With our current user rate-repayment-retiring approx. \$7.4 M in loans by Fiscal 2028					

# Proposed Project Debt

• Loans	Principal	Int. Rate	Yearly Payment	Matures
• 2023 SRF \$22 M	\$19.8 M	2.536%	~\$1.268 M	2048
• 10% principal forgiveness				
• Potential Rate Impact				

	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Rate Increase from FY 2023	0%	3.8%	7.6%	11.4%	15.2%	19.0%	22.8%
Average Domestic User (185 gal/day)	\$475.00	\$493.07	\$511.14	\$529.20	\$547.27	\$565.34	\$583.41

# Future Improvements (2033-2043)

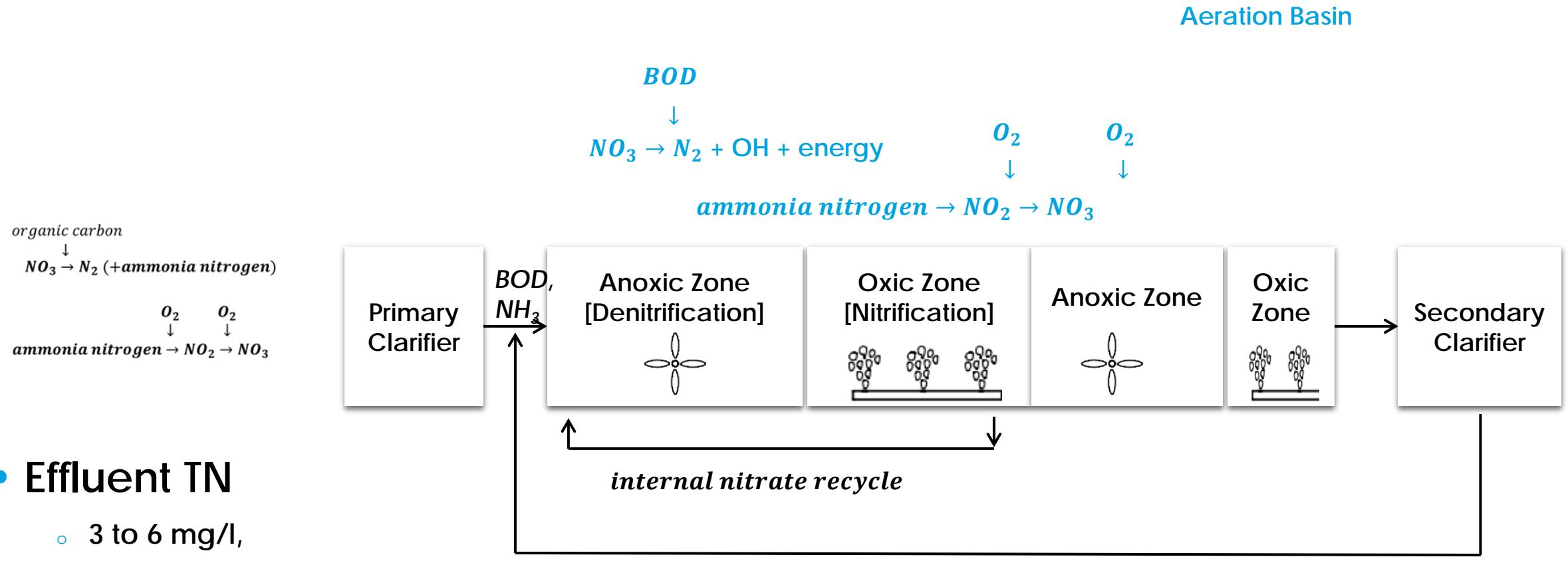
# Future Project Cost (2033) - Equipment Replacement

Capital Upgrade Item	Total Project Cost
WRF Electric Service	\$1.87 M
Dewatering Feed Pumps, Centrifuges, and Conveyors Replacement	\$3.6 M
Secondary Clarifier No. 3 Mechanism and Secondary Scum Pump (With Mixing Valve) Replacement	\$1.41 M
Pump Replacement and Select Pipe and Valve Replacement – Grit Pump, Plant Water Pumps and Equipment, Primary Sludge Pumps and Motor Actuators/Valves, TWAS Pump, RAS & WAS Pumps, and Primary Sludge/RAS/WAS Piping and Valves	\$1.86 M
Disinfection Chemical Feed Storage Tanks Replacement	\$0.25 M
PLC/SCADA System Upgrade	\$1.21 M
Operations Building – Process Equipment Areas, Garage, and Maintenance Shop Space Electrical and HVAC Improvements (items not upgraded in Phase I)	\$1.02 M
WRF Generator Replacement	\$0.76 M
Anaerobic Digester Conversion to Sludge Storage Tanks and Demolition of TWAS Storage Tank	\$2.32 M
Chemical Building HVAC Improvements	\$0.34 M
Contingency	\$1.45 M
<b>TOTAL PHASE II</b>	<b>\$16 M</b>

## Future Project (2043) - Capacity & Enhanced Permit Requirements

Capital Upgrade Item	Total Project Cost
Four-Stage Bardenpho Process Nutrient Removal Upgrade	\$9.37 M
Grit System Replacement <sup>1</sup>	\$2.02 M
Primary Clarifier No. 1 and No. 2 Mechanism Replacement <sup>2</sup>	\$2.86 M
Secondary Clarifier Influent Splitter Box Structure Gate Replacement	\$0.11 M
Chlorine Contact Tanks Gate Replacement	\$0.11 M
Electrical Improvements in Chemical Building	\$0.95 M
Contingency	\$1.58 M
<b>TOTAL PHASE II</b>	<b>\$17 M</b>

# Future/Enhanced Total Nitrogen Removal: 4-Stage Bardenpho



- **Effluent TN**

- 3 to 6 mg/l,
- Depending on anoxic zone volume and carbon addition levels