University of New Hampshire
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Mt. Washington Extreme Sewage Treatment Plant Upgrade

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Acknowledgements

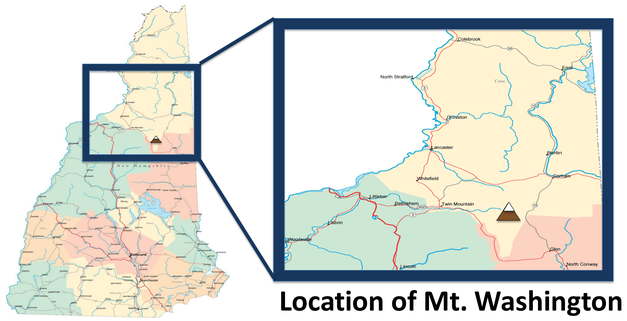
Client: Michael Pelchat
NHDES Advisor: Kenneth Kessler
Reference Report Provided by: Underwood Engineers
Designer of Extreme Sewage Treatment Plant (ESTP) : Lifewater Engineering

Background Information

State Park Area: 60 acres
Visitors: 600,000 Annually (May to October)
Transportation to the Summit: Auto Road, Cog Railway & hiking trails
Funded Solely by: Sales of merchandise, concessions, radio operation

ESTP Design Constraints

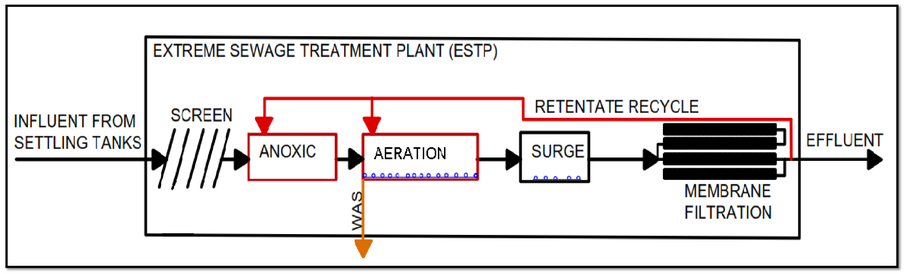
Low Visual Impact: Requires a small footprint
Nutrient Removal: Total suspended solids, organic carbon & nitrogen
Extreme Weather: Accessible in winter & summer conditions
Limited Historical Data: Created challenges when modeling the plant



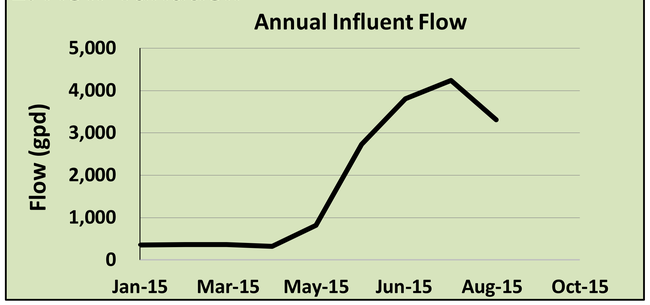
Location of Mt. Washington in Sargent's Purchase, NH

Contaminant Type	Influent (mg/L)	Effluent (mg/L)	Permit Requirements
BOD_5	**450**	5.2	<10 mg/L
Nitrogen (TKN)	**180**	48	
Nitrate-Nitrogen (NO_3-N)		**17**	< 10 mg/L
Ammonia-Nitrogen (NH_3-N)		**28**	< 10 mg/L

Existing Treatment Plant Schematic



1. Flow Variation



2. Insufficient Aeration

Parameters	Existing	Design	Aeration Deficit
Average (cfm)	125	207	**82**
Maximum (cfm)	125	383	**258**

Critical Plant Challenges

1. Flow Variation
2. Insufficient Aeration
3. Intermittent Hydraulics
4. "After the Fact" Chemical Addition

3. Intermittent Hydraulics

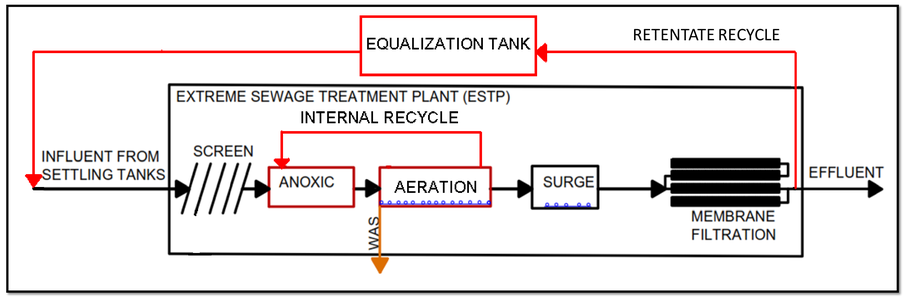
- **Daily Influent Flow:** Occurs over 8 hour period
- **Flooding Occurs within:** The anoxic & aeration tanks
- **Lower Efficiency:** Flooding decreases retention time such that fewer nutrients can be removed

4. "After the Fact" Chemical Addition

Organic Carbon + Nitrate → N_2 gas

Ammonia + Oxygen → Nitrate + Acid

Short-Term Pilot Study: Summer 2016 (Proposed)



Equalization Tank: Dampen flow variation and increase cell residence time
Internal Recycle: Maintain biomass and increase retention time in the system
Attention to Sampling: Increase the frequency, consistency, and location

Long-Term Plant Enhancements

Improve Aeration

- Change location of aeration input to aeration tank only
- Increase capacity by installing a new blower
- Replace diffusers to increase oxygen transfer efficiency and mitigate clogging

Alkalinity & Carbon Source

- Furnish system with automated monitoring and adjustment system to proactively balance water chemistry
- Addition of food sources will optimize denitrification and nitrification processes

Increase Sampling Frequency

- Knowing the water characteristics allows more accurate modeling
- Promotes early identification of inhibitory conditions
- Facilitate the transition for future modifications and upgrades

Establish BOD:COD Ratio

- Organic carbon (BOD) removal is essential for nitrification
- BOD_5 testing is done off-site
- COD is an on-site surrogate for BOD_5
- Ratio is critical for ESTP operability and performance