Marco Island RWPF Advanced Wastewater Treatment Evaluation

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Purpose and Context

Purpose of the Advanced Wastewater Treatment (AWT) Evaluation

AWT Feasibility

City is interested in exploring options for upgrading the RWPF to AWT

Assessment of Current Facility

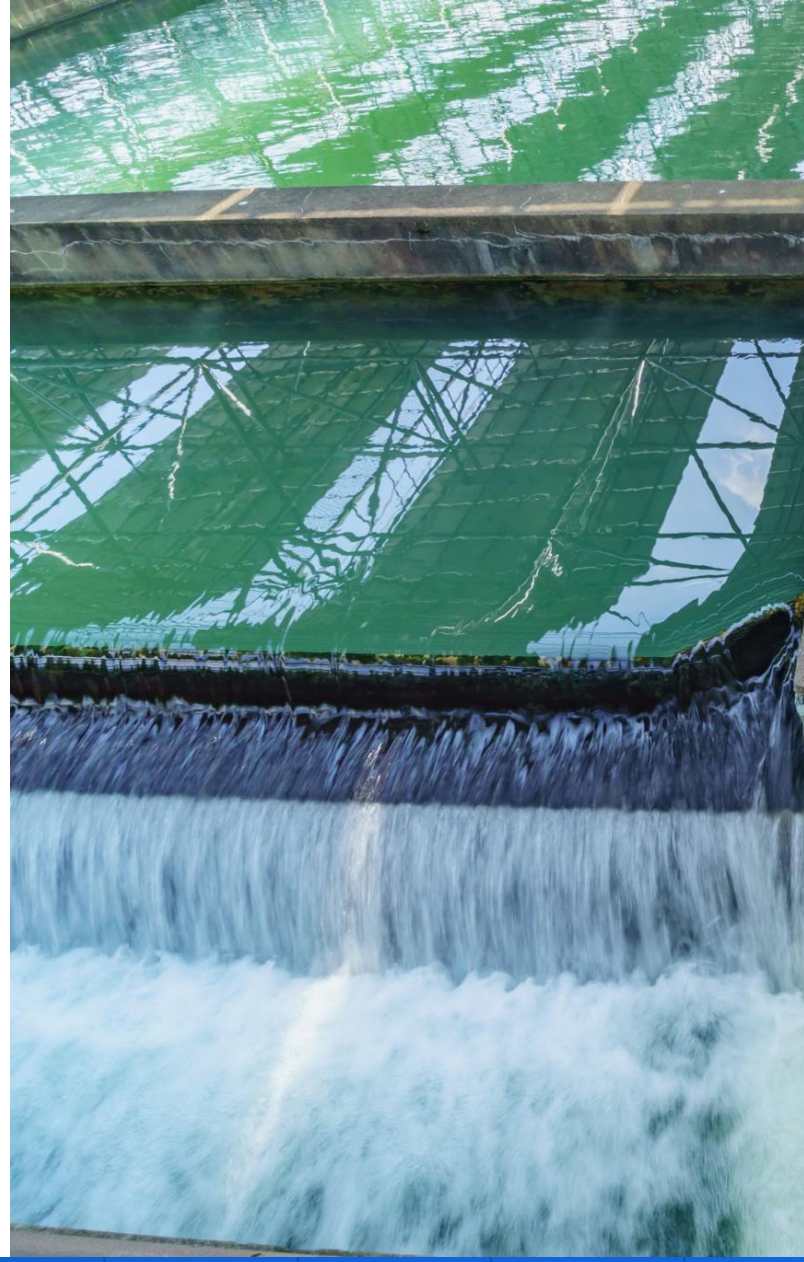
Study evaluates current RWPF performance and potential to meet upcoming Advanced Wastewater Treatment standards.

Balanced Upgrade Options

Identifies feasible upgrade alternatives balancing performance, cost, and operational efficiency for long-term benefits.

Community-Focused Outcomes

Findings focus on benefits, costs, and risks important to the community.



Existing Facility Performance

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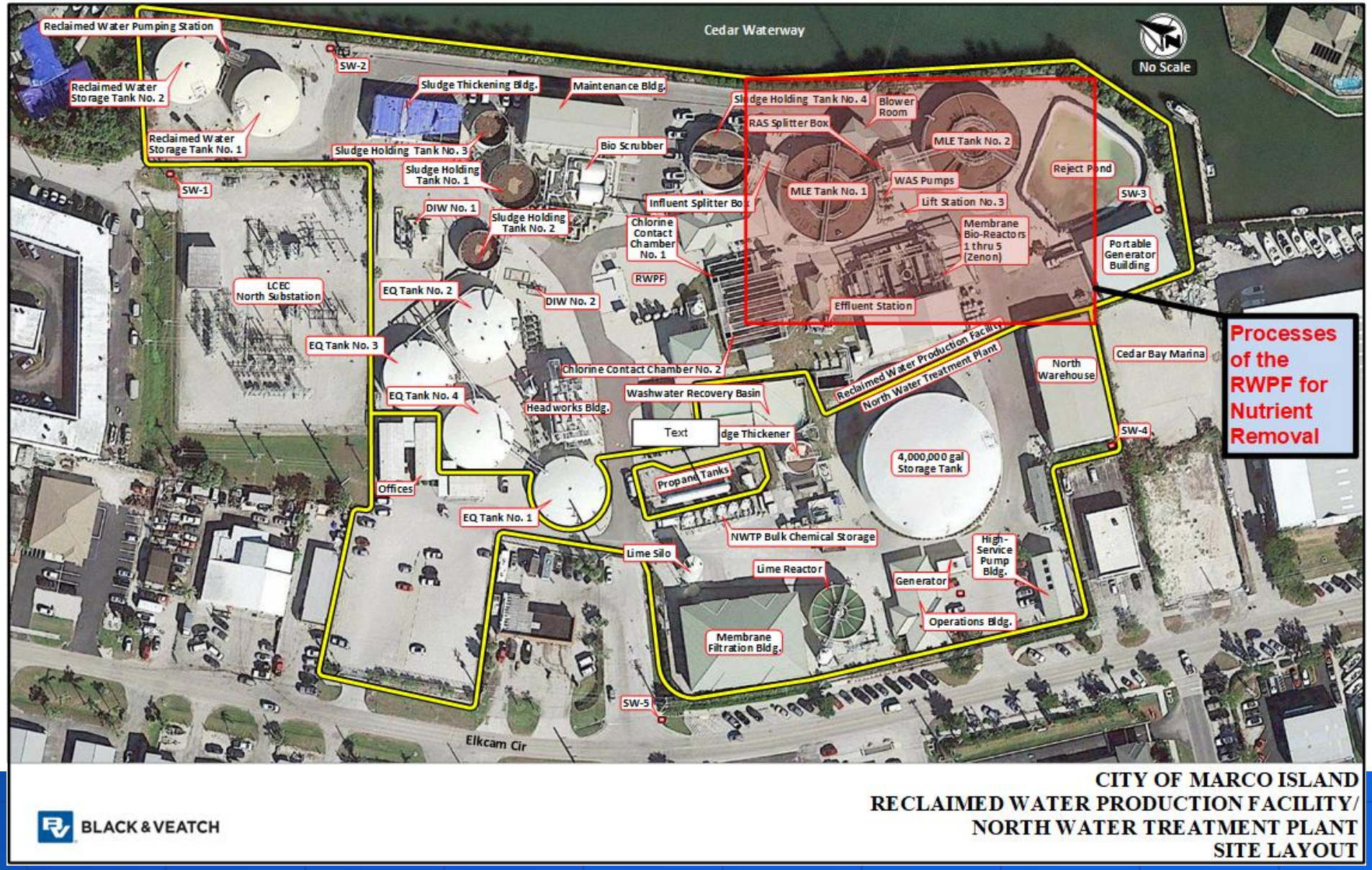
RWPF Site Plan



Facts About the RWPF

- RWPF has advanced processes (MBR), pioneer in the State of Florida
- Influent Nutrient Loads to the plant –
  - ~380,000 lbs of nitrogen per year
  - ~41,000 lbs of phosphorus per year
- Current Removal of Nutrients
  - ~320,000 lbs of nitrogen removed per year (84%)
  - ~26,000 lbs of phosphorus removed per year (63%)

- City Reuse System
  - ~700 Million gallons per year
  - Consistent with the water reuse practice of the whole state of Florida
- City Monitors the groundwater nutrients as part of the reuse plan to ensure compliance with state and federal regulations

Nutrient Performance and Future AWT Gaps

Current Nutrient Removal Performance

The facility achieves effective nitrogen and phosphorus removal by conventional standards, with 84% and 63% average reductions, respectively.

Advanced Wastewater Treatment Standards

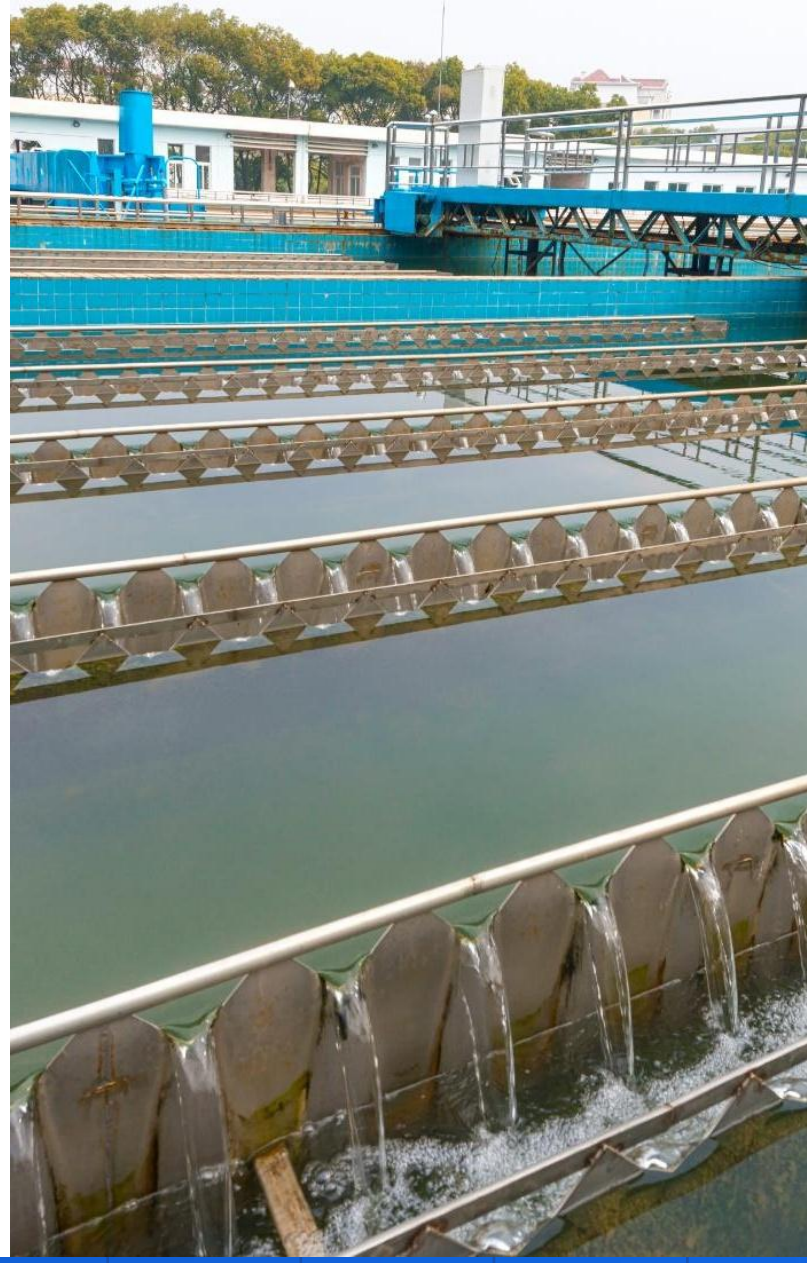
AWT requires lower nutrient limits: total nitrogen below 3 mg/L and total phosphorus below 1 mg/L.

Environmental Protection and Monitoring

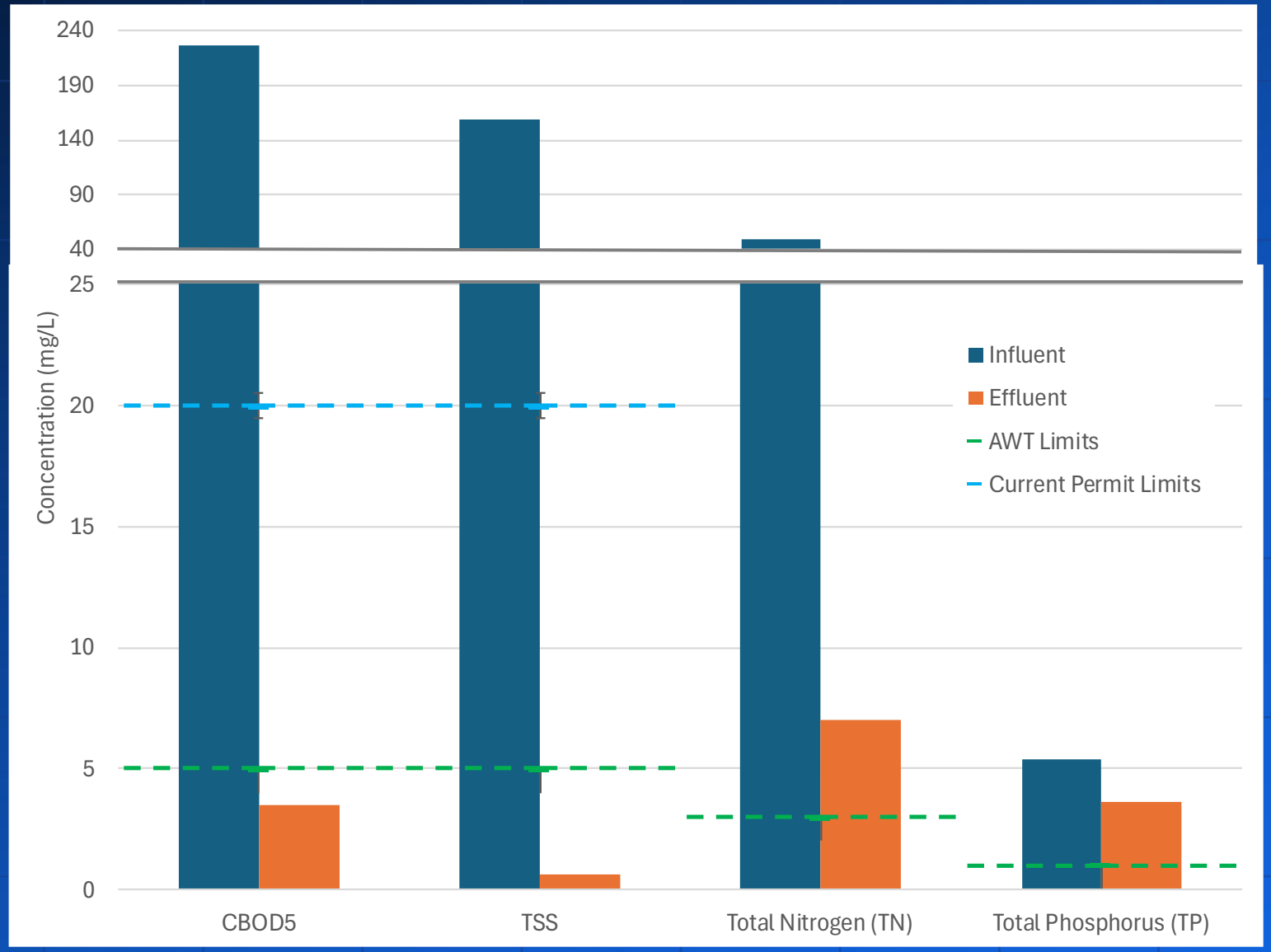
Current groundwater quality is protected, with nitrogen levels well below drinking water standards, confirming environmental safety.

Focus on Future Improvements

Evaluation targets enhanced nitrogen and phosphorus removal to meet AWT while preserving existing system strengths.



Current Plant Performance Vs. AWT Limits



AWT Alternatives and Recommendations

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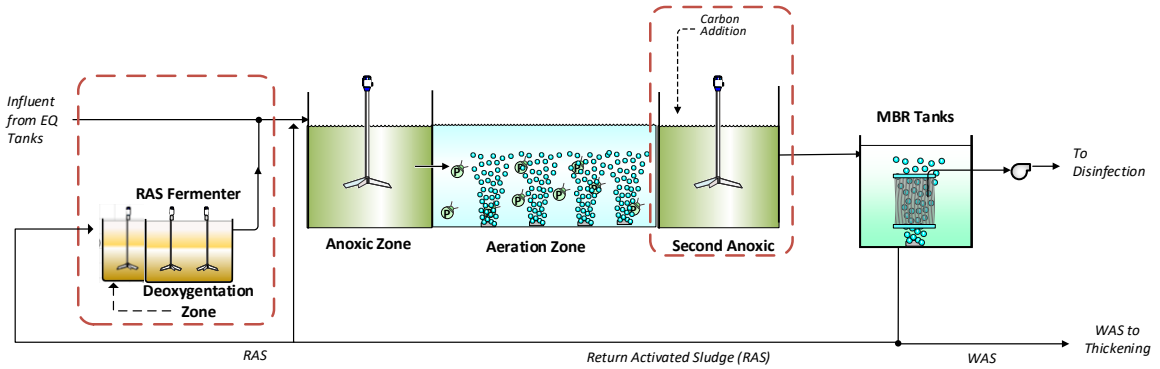
AWT Alternatives Considered

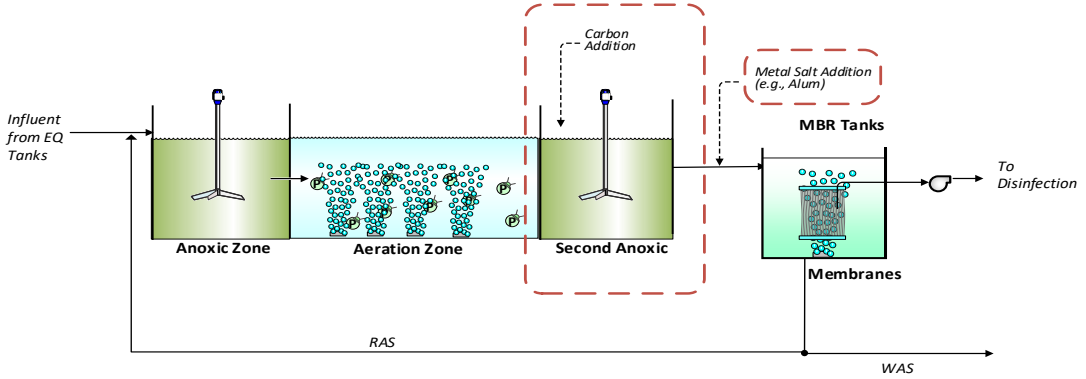
AWT Alternative 1 - Biological Treatment Alternative

Uses four-stage Bardenpho and innovative sidestream biological phosphorus removal relying on natural biological processes.



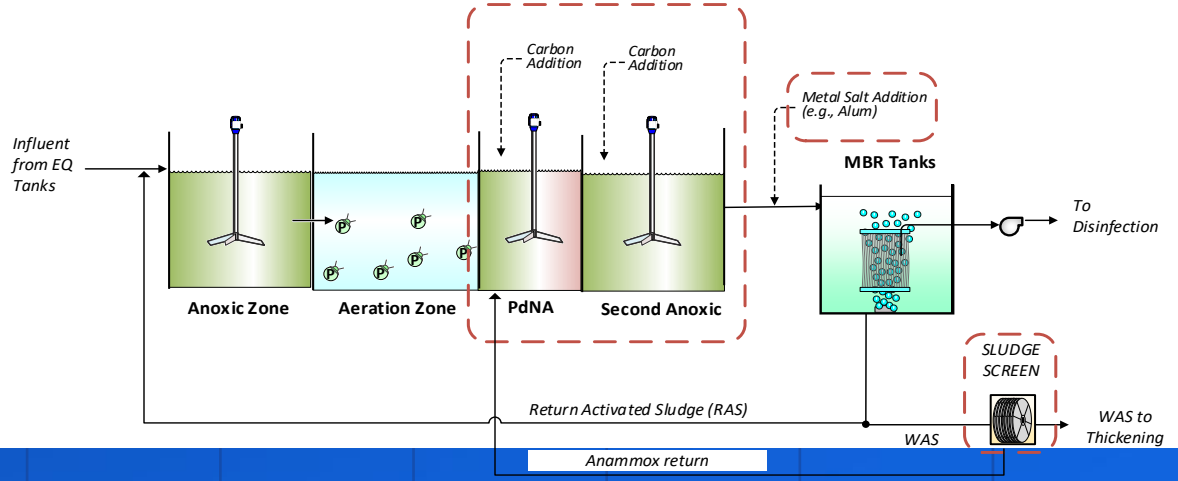
AWT Alternative 2 - Chemical Phosphorus Removal Alternative

Combines four-stage Bardenpho for nitrogen removal with chemical addition for phosphorus removal, easier to operate but requires chemicals.



AWT Alternative 3 -Advanced Nitrogen Removal Alternative

Features newer nitrogen removal technology paired with chemical phosphorus removal, offering high performance with increased operational complexity.



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Evaluation focuses on prioritizing proven, reliable solutions that balance complexity, cost, and long-term performance

How the Alternatives Were Evaluated

Comprehensive Evaluation Criteria

Alternatives were assessed on nutrient limits, reliability, operation ease, facility compatibility, treatment performance, expandability, public perception, and cost alignment with City priorities.

Total Cost Consideration

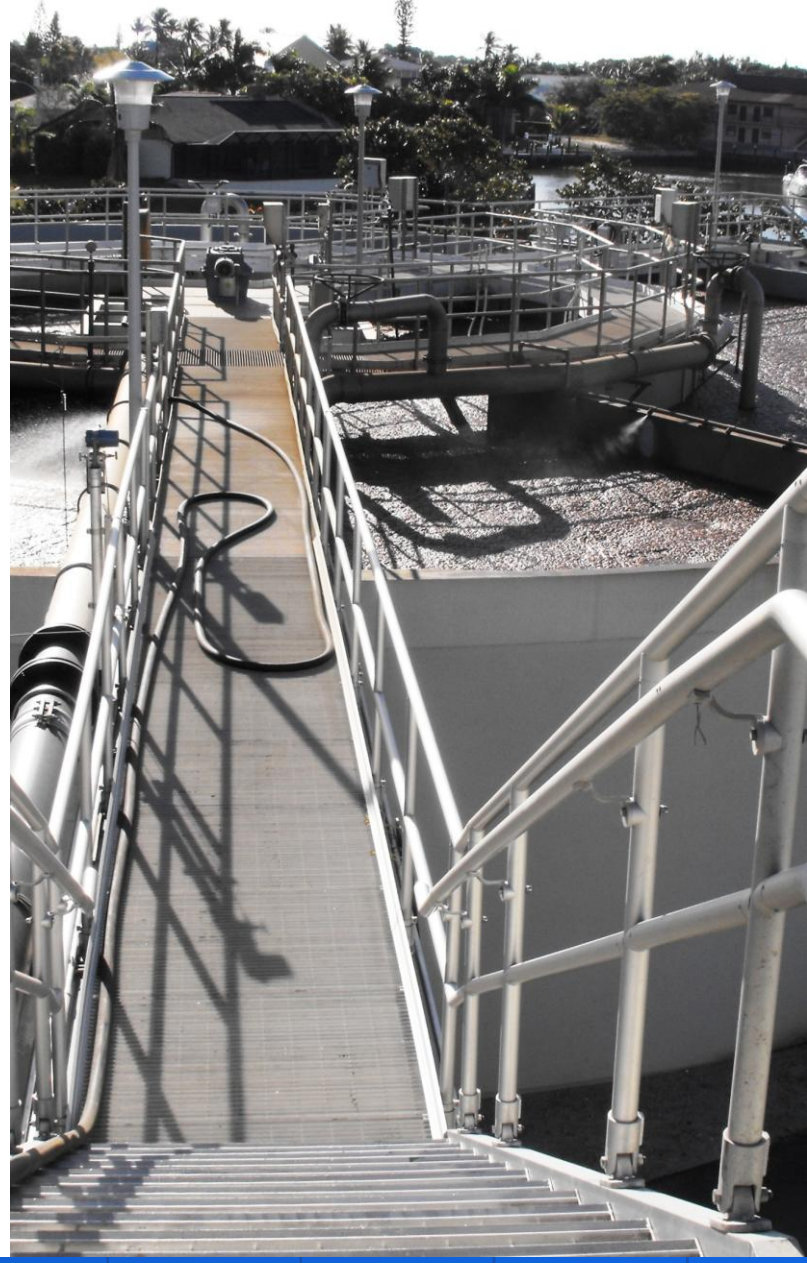
Costs included initial capital and long-term operations like energy consumption, chemicals, and residuals to reflect true financial impact.

Operational Simplicity and Flexibility

Operational complexity was minimized to reduce risk, with flexibility for future regulatory or community changes ensured.

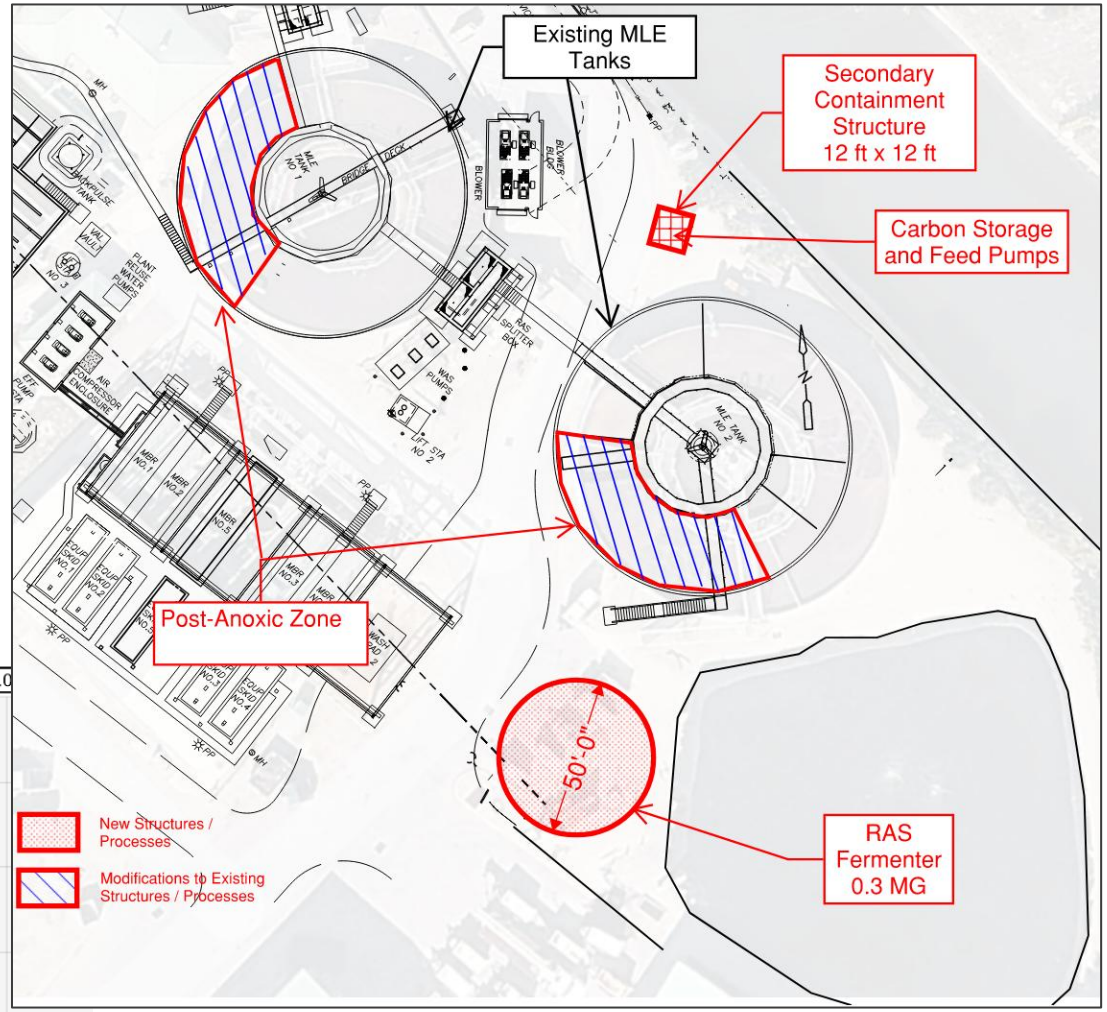
Environmental and Health Priorities

Public health and groundwater protection were integral to the evaluation to support sustainable and safe community outcomes.

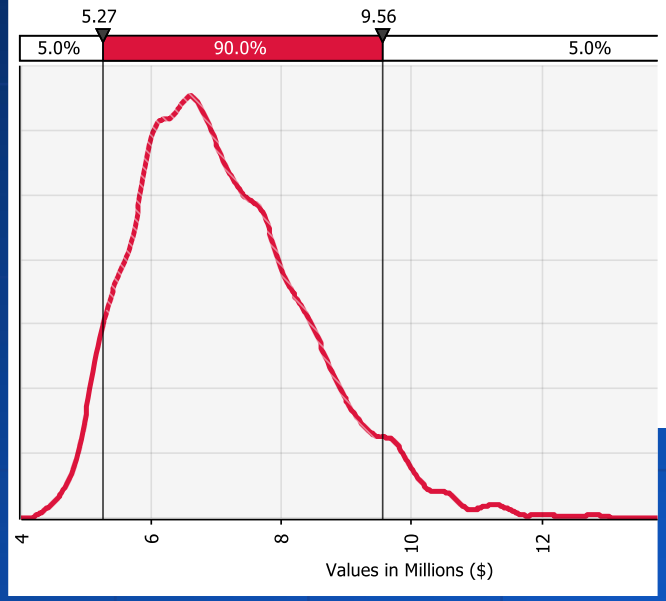


Alternative 1 – Four Stage Bardenpho + S2EBPR

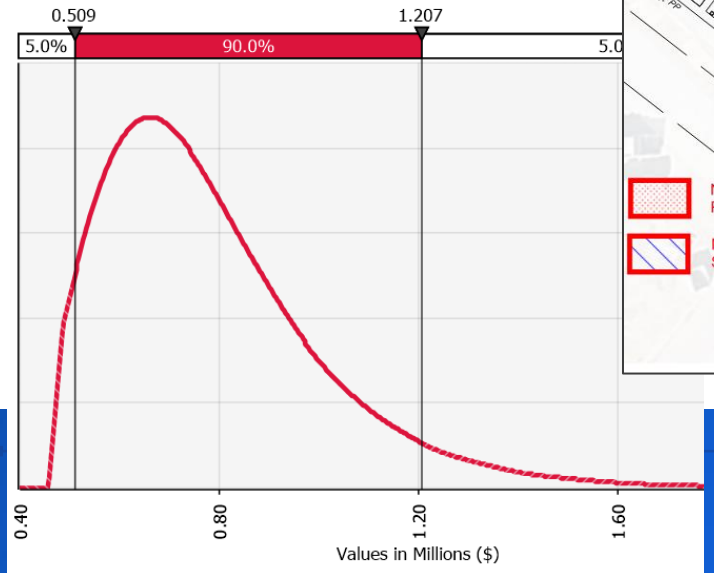
- Biological N and P removal
- Reconfigure a portion of existing MLE basin to include a second anoxic zone
- Supplemental carbon addition required approx. 220 gal/day
- Additional infrastructure required:
  - RAS fermenter
  - Carbon dosing and storage
  - New second anoxic zones with baffles and mixers



CAPEX M$ (2026 US$)

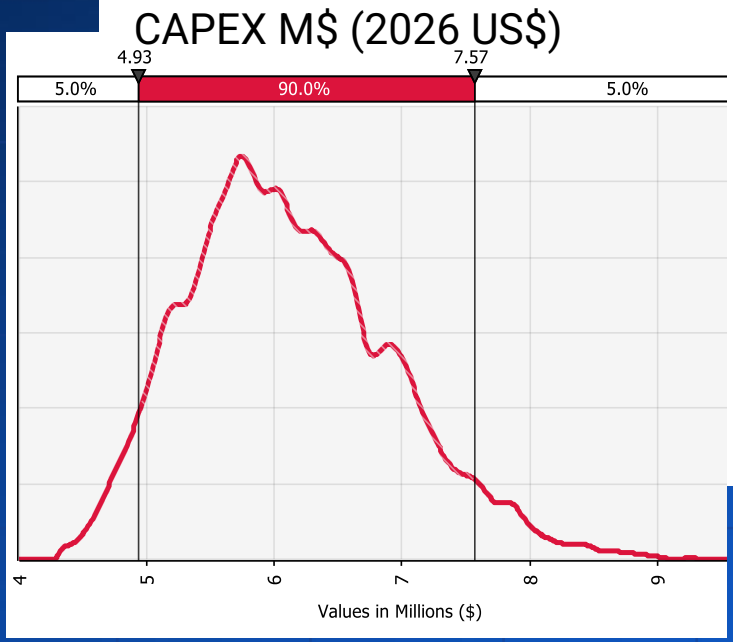


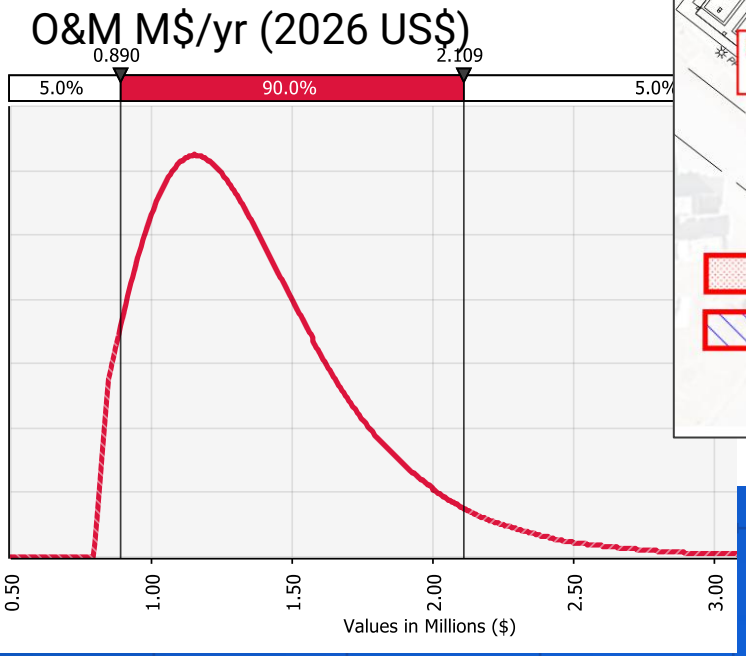
O&M M$/yr (2026 US$)

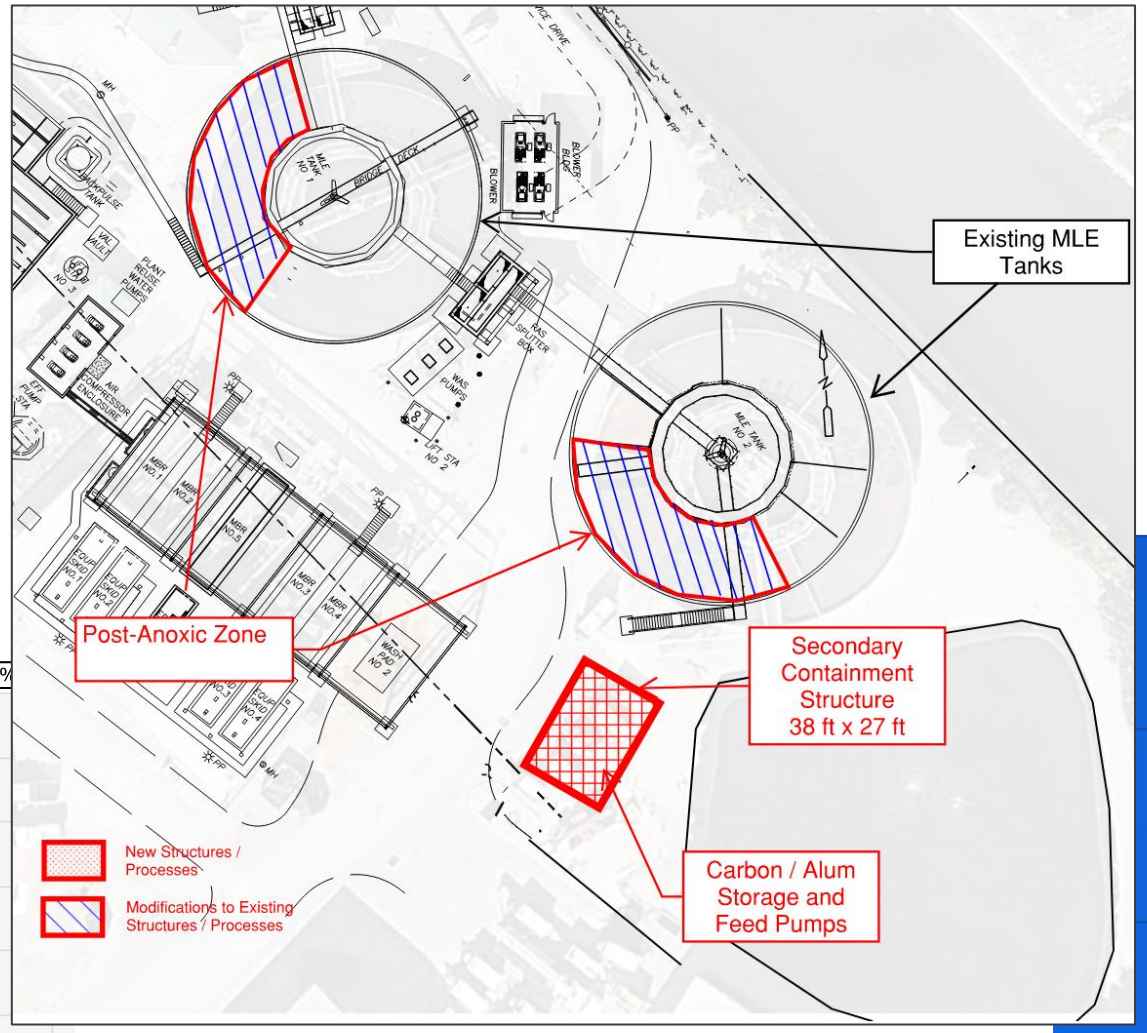


Alternative 2 – Four Stage Bardenpho + Chemical P Removal

- Biological N removal, Chemical P removal
- Reconfigure a portion of existing MLE basin to include a second anoxic zone
- Supplemental carbon required approx. 200 gpd
- Alum required approx. 125 gpd
- Additional infrastructure required:
  - Alum dosing equipment and storage
  - Carbon dosing equipment and storage
  - New second anoxic zones with baffles and mixers







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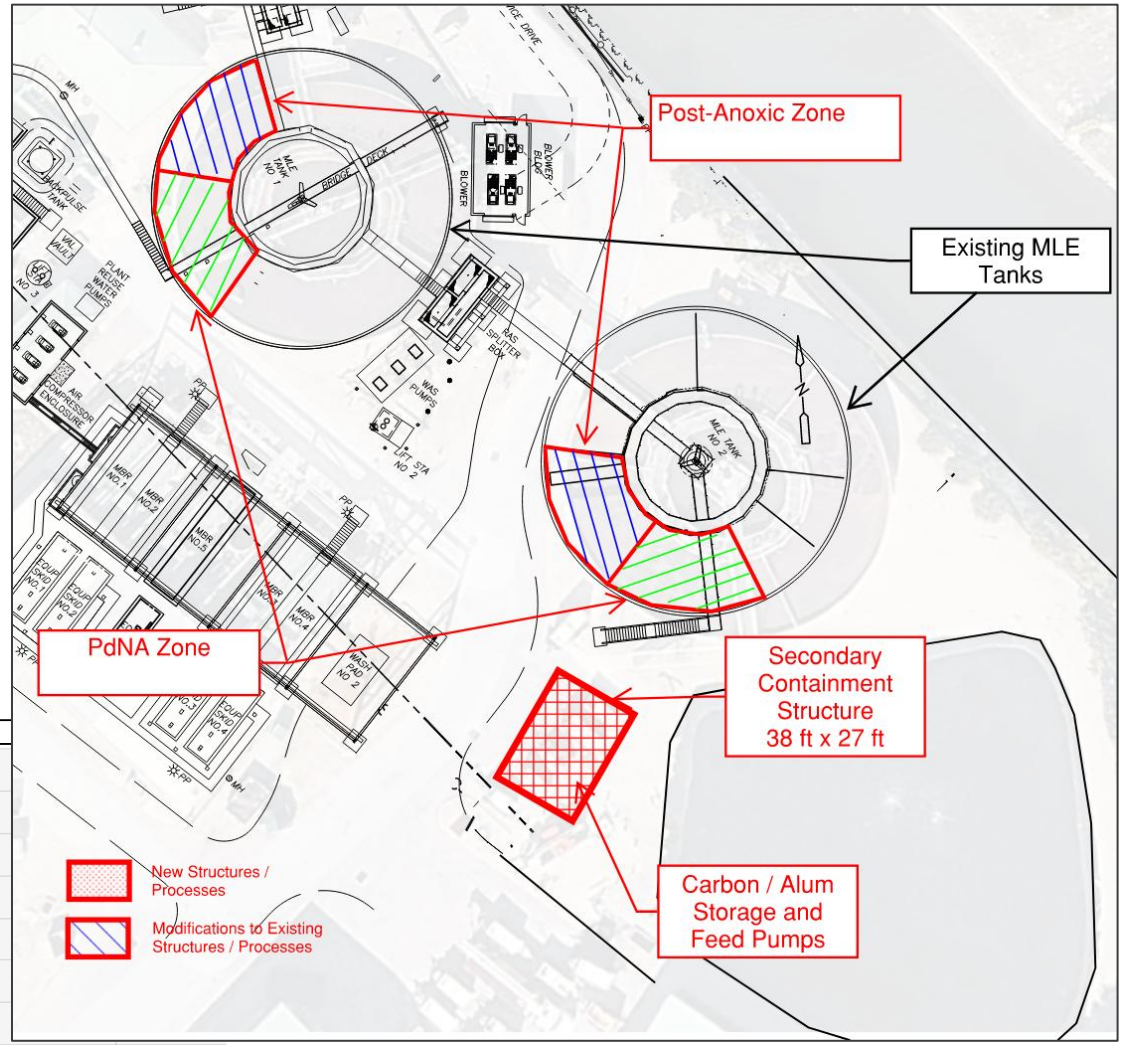
Alternative 3 – PdNA + Chemical P Removal

- Biological N removal, Chemical P removal
- Reconfigure a portion of existing MLE basin to include a second anoxic zone and a PdNA zone
- Supplemental carbon addition required approx. 50 gpd
- Alum addition required approx. 125 gpd
- Additional infrastructure required:
  - RAS fermenter
  - Carbon addition and storage
  - New second anoxic zones with baffles and mixers



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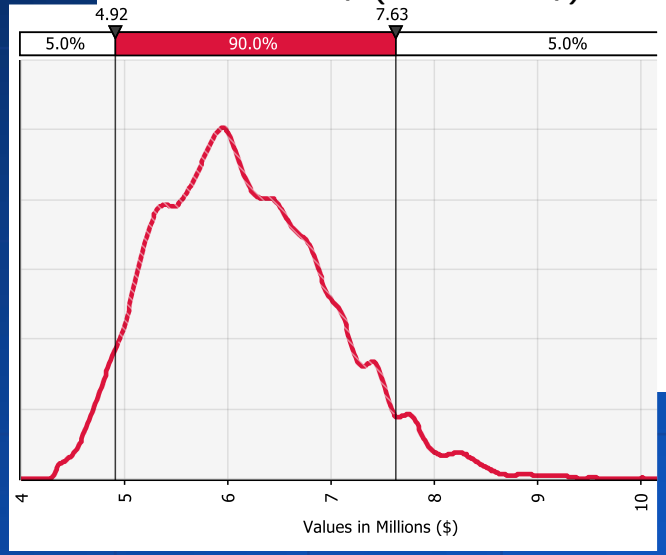
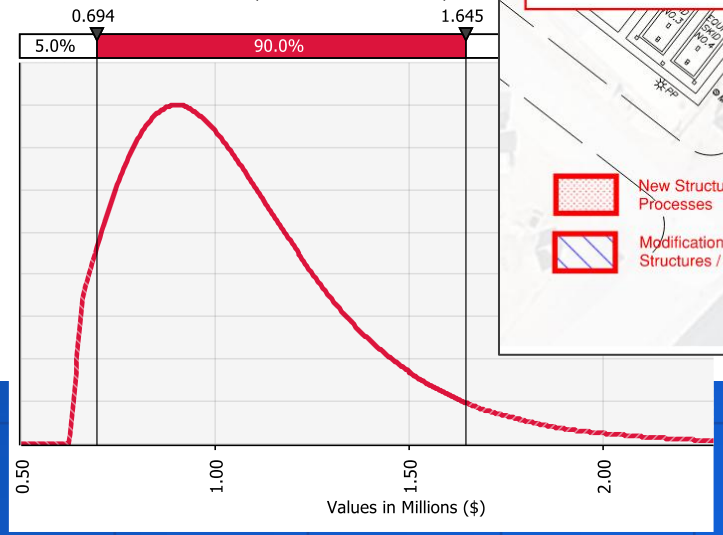
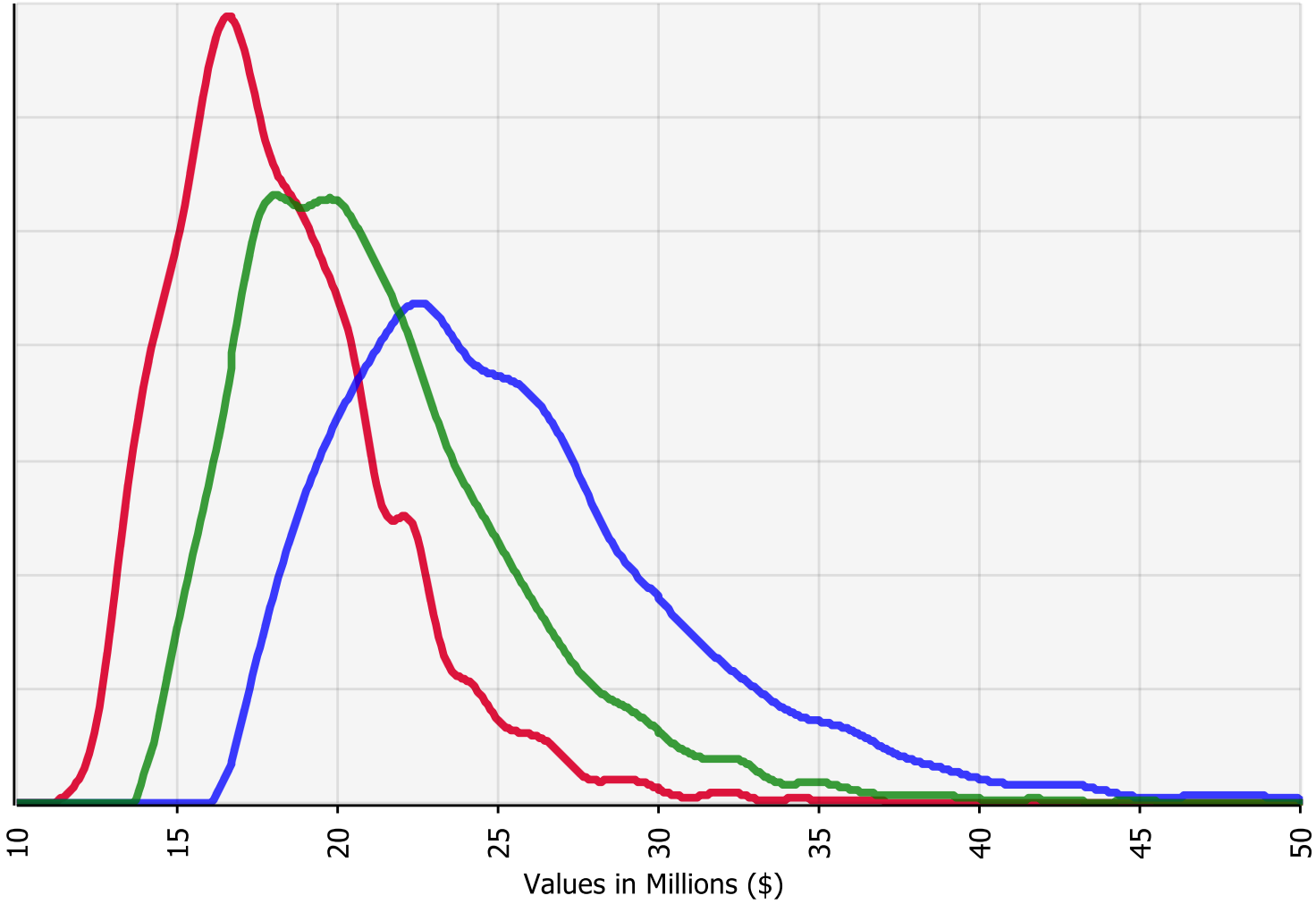


O&M M$/yr (2026 US$)



Summary of AWT Alternatives

- All three AWT alternatives are feasible for the RWPF.
- Alternative 1 has the lowest life cycle cost (TOTEX), similar operation compared to existing process, and less chemicals required.
- Alternative 2 is the easiest to implement but has the highest TOTEX.
- Alternative 3 is an emerging treatment technique with a few full-scale installations.



TOTEX Alt 1

Minimum	$11,173,782.83
Maximum	$43,328,168.51
Mean	$18,241,647.21
Std Dev	$3,473,143.20
Values	5000

TOTEX Alt 2

Minimum	$16,028,567.45
Maximum	$68,911,436.73
Mean	$25,571,009.76
Std Dev	$5,632,444.81
Values	5000

TOTEX Alt 3

Minimum	$13,649,333.73
Maximum	$54,826,272.39
Mean	$21,328,641.27
Std Dev	$4,418,552.50
Values	5000

TOTEX evaluated for 20 years on all alternatives

Recommended AWT Path Forward

Preferred Treatment Alternative

The four-stage Bardenpho process with sidestream enhanced phosphorus removal (S2EBPR) (**Alternative 1**) is the preferred biological treatment option for reasons including costs, reliability, and operability.

Cost and Reliability Benefits

This alternative balances capital and operating costs while ensuring long-term reliability and minimal chemical dependency.

Alignment with Existing Infrastructure

The option leverages current staff expertise and infrastructure, reducing project risks and allowing efficient upgrades.

Strategic Planning Advantage

Provides a defensible, well-documented foundation for future planning without committing to immediate construction.

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Discussion