

HDR



Puget Sound Nutrient General Permit Advisory Committee

Nutrient Optimization Planning

David L. Clark, PE, WEF Fellow

dclark@hdrinc.com



August 20, 2020



Nutrient Optimization Planning

- Contents
- Monitoring Data
- Opportunities
- Preparation Time
- Strategic Formulation

OPTIMIZATION PLAN REFERENCES

- Water Research Foundation (WRF4973) Nutrient Removal Optimization Study
- San Francisco Bay and Bay Area Clean Water Association (BACWA)
- Montana
- Iowa
- Others

Optimization Objectives

Treatment Optimization

- Reduce Operational Costs
- Improve Effluent Performance
- Increase Treatment Capacity

Nutrient Optimization

- Secondary Treatment Facility
 - Remove Some Nutrients
- Nutrient Removal Facility
 - Improve Reliability
 - Reduce Effluent Concentration
- Nutrient Reduction by Other Means
 - New Technologies
 - Sidestream Treatment
 - Effluent Reuse
 - Restoration
 - Etc.

OPTIMIZATION PLAN CONTENTS

- 1. Optimization Scoping and Evaluation Plan**
- 2. Monitoring Plan**
- 3. Existing Facilities Assessment**
- 4. Site Specific Optimization Alternatives Development**
- 5. Alternatives Evaluation**
- 6. Implementation Plan**
- 7. Documentation and Reporting**

OPTIMIZATION PLAN CONTENTS

1. Optimization Scoping and Evaluation Plan

- Define Objectives

2. Monitoring Plan

- Establish Baseline for Current Performance
 - Quality Assurance Project Plan (QAPP) Focused on Nutrients
 - » Influent, Effluent, and Unit Processes

3. Existing Facilities Assessment

- Describe Facilities, Unit Processes, Service Area
 - Unique Nutrient Sources and Potential Source Control

4. Site Specific Optimization Alternatives Development

- Identify Operational Adjustments, Process Changes, Minor Upgrades, etc.
- Sidestream Treatment
- Potential New Technology Testing
- By Other Means (Reuse, Restoration, Offsets/Trades, etc.)

5. Alternatives Evaluation

- Quantify Potential Nutrient Discharge Load Reduction
- Economic Analysis and Non-Monetary Analysis
- Assess Operational Requirements Impacts
- Evaluate Beneficial and Adverse Impacts
 - Energy Use, Supplemental Carbon Requirements, Chemical Addition, Biosolids Production, Recycle Loadings, GHGs, etc.
- Assess Compliance Risks, Capacity Loss, etc.

6. Implementation Plan

- Select Preferred Option(s)
- Develop Implementation Schedule
- Prepare Backup Plans for Recovery

7. Documentation and Reporting

- Monitoring Plan
 - Tracking Nutrient Reduction and Trends Analysis
- Performance Assessment
- Modifications
 - Adaptive Management for Subsequent Optimization

MONITORING DATA AND SOUND FUNDAMENTALS FOR OPTIMIZATION PLANNING

- Existing Puget Sound Effluent Nitrogen Data
 - Limited to Monthly or Quarterly Samples
- Establish Baseline Conditions
 - Complete Effluent Characterization
 - Frequent Sampling to Quantify Variability
 - » Random Collection and Variable Days
 - If Known Loading Patterns, Capture Pattern
 - Capture All Design Conditions
 - » Seasonal Variations and Multiple Years
 - Dry Season, Wet Season, Peak Loads, Peak Flows & Low Temps, etc.
- Load Tracking and Trends Analysis
 - Individual Facilities
 - Aggregate Loadings to Puget Sound

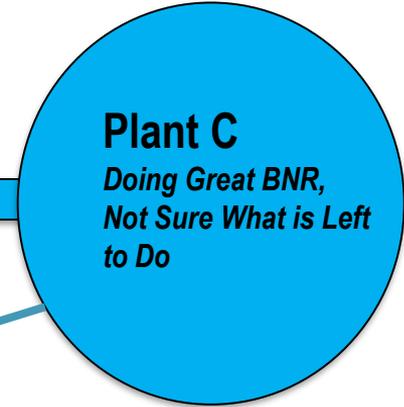
Data Needs Beyond Effluent Nitrogen to Support Optimization

- ***Influent***
 - *Source Control*
 - *Track Load Changes*
- ***Within Plant***
 - *Unit Processes, Recycles, etc.*
 - *Process Simulation Modeling*
- ***Multiple Parameters for Full Characterization***
 - *NH₃N, TKN, NO_x, TP, OP, BOD, TSS, Temp, Flow, etc.*

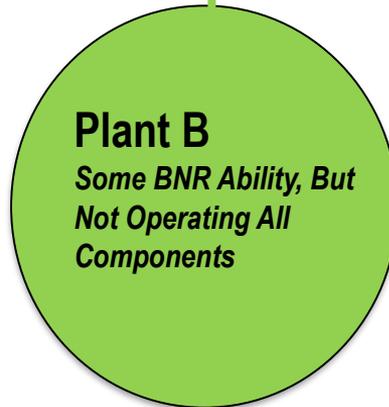
PUGET SOUND OPTIMIZATION OPPORTUNITIES



Challenge: Optimization has already been done in many ways; risk of backsliding and loss of capacity with a cap



DATA



Challenge: Optimization is much harder to achieve without a sizable capital investment (at first glance)

Challenge: Integrate optimization while maintaining capacity for growth; choosing high value (\$/BNR) modifications

PREPARATION TIME - SAN FRANCISCO BAY WATERSHED PERMIT

- BACWA Permit Included a Series of Optimization Reports Delivered Over 4 Years
 - 6 months to submit an Optimization Scoping Plan as a group or individually
 - 1 year to submit an Evaluation Plan
 - 2 years to submit Status Report
 - 3 years to submit Status Report
 - 4 years to submit Final Report with planning level cost estimates for each option

Dischargers that have recently completed optimization evaluations may use previously completed reports.

a. Submit and Implement Scoping and Evaluation Plans

By December 1, 2014, the major Dischargers listed in Table 1 shall, individually or in collaboration with other Dischargers, submit a Scoping Plan that defines the level of work for the proposed optimization evaluation. The Scoping Plan shall be acceptable to the Executive Officer.

By July 1, 2015, the major Dischargers listed in Table 1 shall, individually or in collaboration with other Dischargers, submit an Evaluation Plan that includes a schedule describing how they will conduct the evaluation of potential nutrient discharge reduction by treatment optimization. The Evaluation Plan shall include sampling, as necessary, to support proposed optimization studies. The Evaluation Plan shall be acceptable to the Executive Officer.

The Dischargers shall proceed with implementation of the Evaluation Plan within 45 days of submittal.

b. Submit Status Report

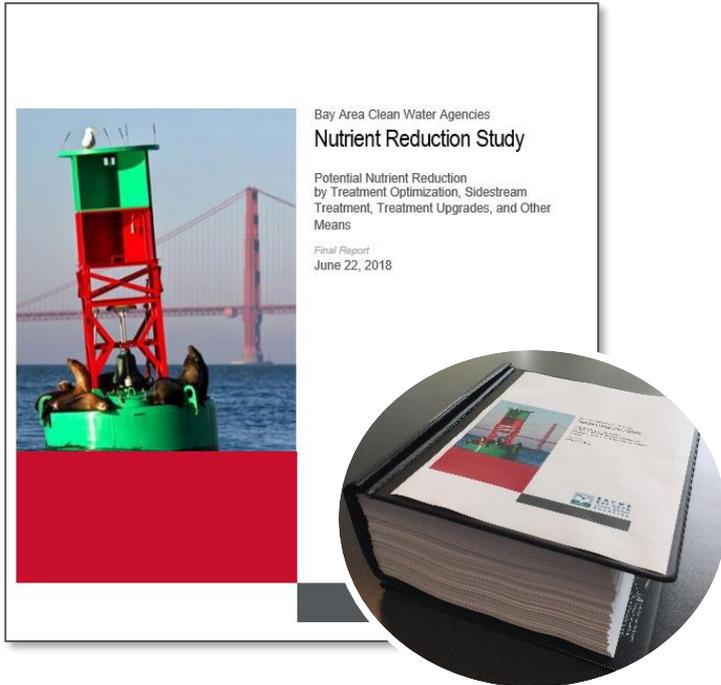
By July 1, 2016, and subsequently by July 1, 2017, major Dischargers listed in Table 1 shall submit, or cause to be submitted, a report describing the tasks completed, preliminary findings, and tasks to be completed, highlighting any adaptive changes to be made to the Evaluation Plan submitted in accordance with task a, above.

c. Submit Final Report

By July 1, 2018, the major Dischargers listed in Table 1 shall submit, or cause to be submitted, the results of their evaluations with planning level cost estimates for each optimization option studied.

Nutrient Optimization Expectations

BACWA Regional Nutrient Reduction Study



Strategy	TIN Load Reduction to the Bay	TP Load Reduction to the Bay	Total Present Value
Optimization	7%	34%	\$266 M
Sidestream Treatment	19%	12%	\$766 M
Upgrade Level 2 (TN 15 mg/L TP 1 mg/L)	57%	59%	\$9.4 B
Upgrade Level 3 (TN 6 mg/L TP 0.3 mg/L)	82%	88%	\$12.4 B

STRATEGIC PREPARATION

- Advance Preparation
 - Opportunity Time in Advance of Permitting
- Sound Fundamentals
 - Monitoring Data
 - Establish Baseline & Accounting
- Opportunities
 - Consider All Utility Obligations and Objectives
 - Consider New Technologies, Development Needs, and Time Required
 - Find the Sweet Spot



Puget Sound Nutrient General Permit Advisory Committee

Nutrient Optimization Planning

David L. Clark, PE, WEF Fellow

dclark@hdrinc.com



August 20, 2020