Nutrients Update
Planning Committee
July 10, 2018
Major Nutrient Sources to San Francisco Bay

Nutrient Sources to the San Francisco Bay*

21% by Publicly Owned Treatment Works (POTWs)
- Rest by Delta and storm water
- Large seasonal variability

24% by POTWs
- Rest by Delta and storm water
- Large seasonal variability

> 90% by POTWs
- Rest by storm water
- Minimal seasonal variability

* Source: San Francisco Estuary Institute (SFEI, 2014)
Bay Area Wastewater Treatment Plants

- Various treatment processes
- Plant size ranges from 1–167 MGD

WWTP Size (by permitted average dry weather flow)

- ~450 MGD
- 7+ million

<table>
<thead>
<tr>
<th>WWTP Size</th>
<th># of WWTPs</th>
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</thead>
<tbody>
<tr>
<td>&lt;10 MGD</td>
<td>17</td>
</tr>
<tr>
<td>10-20 MGD</td>
<td>9</td>
</tr>
<tr>
<td>20-30 MGD</td>
<td>5</td>
</tr>
<tr>
<td>&gt;30 MGD</td>
<td>6</td>
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</tbody>
</table>
Dissolved Inorganic Nitrogen (DIN) Discharge (kg-N/day)
(DIN = ammonium + nitrite + nitrate)

Treated wastewater to the Bay

Total Nitrogen Discharge
(70% by the top five dischargers)

~450 MGD

12,200 lbs/day
(55,600 kg/d)

8,600 lbs/day
(3,900 kg/d)

EBMUD, 19%

SFPUC, 18%

EBDA, 16%

San Jose, 10%

CCCSD, 8%

Other POTWs, 30%

Data by BACWA/HDR (2016 average), graph by SFEI. CCCSD = Central Contra Costa Sanitary District; EBDA = East Bay Dischargers Authority (joint power of five local agencies); SFPUC = San Francisco Public Utilities Commission Southeast Plant; San Jose = San Jose-Santa Clara Regional Wastewater Facility
Current Nutrient Watershed Permit

**Nutrient Management Strategy (NMS)**

To develop the best science-supported nutrient management solutions for San Francisco Bay

<table>
<thead>
<tr>
<th>Action</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Investigate nutrients impact to the Bay through scientific studies</td>
<td>In Progress</td>
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<tr>
<td>Understand potential nutrient load reduction and costs at WWTPs</td>
<td>✓</td>
</tr>
<tr>
<td>Explore non-WWTPs solutions (wetland, water recycling etc.)</td>
<td>Next</td>
</tr>
</tbody>
</table>

**Current Watershed Permit Requirements (2014‒2019)**

- **Monitor**: Nutrients in effluent
- **Study**: Nutrient reduction at WWTPs (by July 1, 2018)
- **Analyze**: Nutrient load trend in effluent
- **Support**: Regional Science Program
Nutrient Reduction Study Approach

Contract Management Group
& Representatives from other POTWs

Consulting Team

- Scoping Plan 2014
- Evaluation Plan
- Data Collection and Analysis
- Synthesis and Review
- Nutrient Reduction Report June 2018
**Study Assumptions**

**Conceptual-level Study**

- **Influent**
  - ~50 mg-N/l
  - ~6 mg-P/l

- **37 Bay Area WWTPs**

- **Current Effluent Concentration**
  - ~35 mg-N/l; ~2–3 mg-P/l
  - (~⅓ N removal, ~⅔ P removal)

- **Optimization** (10-y project life, no eff. target)

- **Sidestream** (30-y project life, no eff. target)

- **Upgrades** (30-y project life, yes eff. targets)
  - **Level 2**
    - 15 mg-N/l; 1.0 mg-P/l
  - **Level 3**
    - 6 mg-N/l; 0.3 mg-P/l

* Source: BACWA/HDR, based on limited data available
Study Findings for EBMUD MWWTP

Not a candidate for Optimization — difficult for pure oxygen plant with limited reactor volume

A candidate for sidestream treatment

If upgrade to

- Treat 120 MGD permitted dry weather flow (current ~50 MGD)
- Build new secondary treatment
- Build new sidestream treatment $164M ($75M capital)

$2.6B for Level 2 $2.9B for Level 3
($2.3B capital) ($2.4B capital)

$2.4B Level 3 Upgrade Details

- Demolish/relocate Maintenance Facility
- Construct membrane bioreactor
- Construct aeration system
- Demolish Reactors, O2 Plant, Secondary Clarifiers, and Old Maintenance Building
- Construct Sidestream Treatment Reactor
- Construct Fermenter to treat primary solids (to produce carbon needed)
- Construct chemical addition facility (external carbon source)
- Construct chemical addition facility (metal salts)
### Region-wide Study Findings

#### Candidate WWTPs for TN Removal

**Data by BACWA/HDR; graph by SFEI**

#### Region-wide Summary

<table>
<thead>
<tr>
<th>Strategy</th>
<th>TN Load Reduction to the Bay</th>
<th>Standalone Life-cycle Cost* (Capital cost)</th>
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</thead>
<tbody>
<tr>
<td>Optimization</td>
<td>7%</td>
<td>$266M ($119M)</td>
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<tr>
<td>Sidestream Treatment</td>
<td>19%</td>
<td>$736M ($391M)</td>
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<tr>
<td>Upgrade Level 2</td>
<td>57%</td>
<td>$9.4B ($7B)</td>
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<tr>
<td>Upgrade Level 3</td>
<td>82%</td>
<td>$12.4B ($8.5B)</td>
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</tbody>
</table>

* Costs for both TN and TP reductions
Nutrient Upgrade Costs for WWTPs (with ≥10 MGD permitted flow)

Level 3 Nutrient Upgrade Life-cycle Cost (in million)

- EBMUD
- SFPUC Southeast
- CCCSD
- Palo Alto
- Union San
- Sunnyvale
- SVCW
- DSRSD
- FSSD
- OLSD
- Delta Diablo
- Hayward
- Richmond
- San Mateo
- Vallejo
- Napa
- South SF
- West Co WCSD
- CMSA

- ≥ 30 MGD WWTPs
- 20–30 MGD WWTPs
- 10–20 MGD WWTPs

Capital cost
Operation & Maintenance cost
Develop Integrated Master Plan for the MWWTP

- Site Use
- Infrastructure Renewal
- Power Supply
- Technology Innovation
- Resource Recovery
- Nutrient Removal
- Climate Change Adaption
- Biosolids Management

EBMUD
Possible Requirements for 2019 Nutrient Watershed Permit

2014

**Monitor**
- Nutrients in effluent

**Analyze**
- Nutrient load trend in effluent

**Study**
- Nutrient reduction at WWTPs

**Support**
- Regional Science Program

$880K/year
(~13% by EBMUD)

2019

**Continue**

**Study**
- Non-WWTP nutrient reduction
  (wetland, water recycling etc.)

2024

**Increase Support**
- Regional Science Program

$2.2M/year
(~19% by EBMUD)

Regional Science Program
(led by SFEI, governed by the Nutrient Management Strategy)
Summary and Next Steps

- Costs for nutrient upgrades at WWTPs will be substantial
- Science is critical to inform future nutrient management decisions
- Regional collaboration is important to develop the best nutrient management decisions

EBMUD Actions

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<tbody>
<tr>
<td>Continue support</td>
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<td>strategy development</td>
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<tr>
<td>Develop MWWTP Master</td>
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<td>Plan</td>
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<tr>
<td>Continue regional</td>
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<tr>
<td>collaboration</td>
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<td>Provide ongoing Board</td>
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**$12.4B**

Nutrient upgrade costs for 37 Bay Area WWTPs

Water Quality Benefits to the Bay

Nutrient Management Strategy (NMS)