EAST BAY MUNICIPAL UTILITY DISTRICT

Nutrients Update

Board Workshop

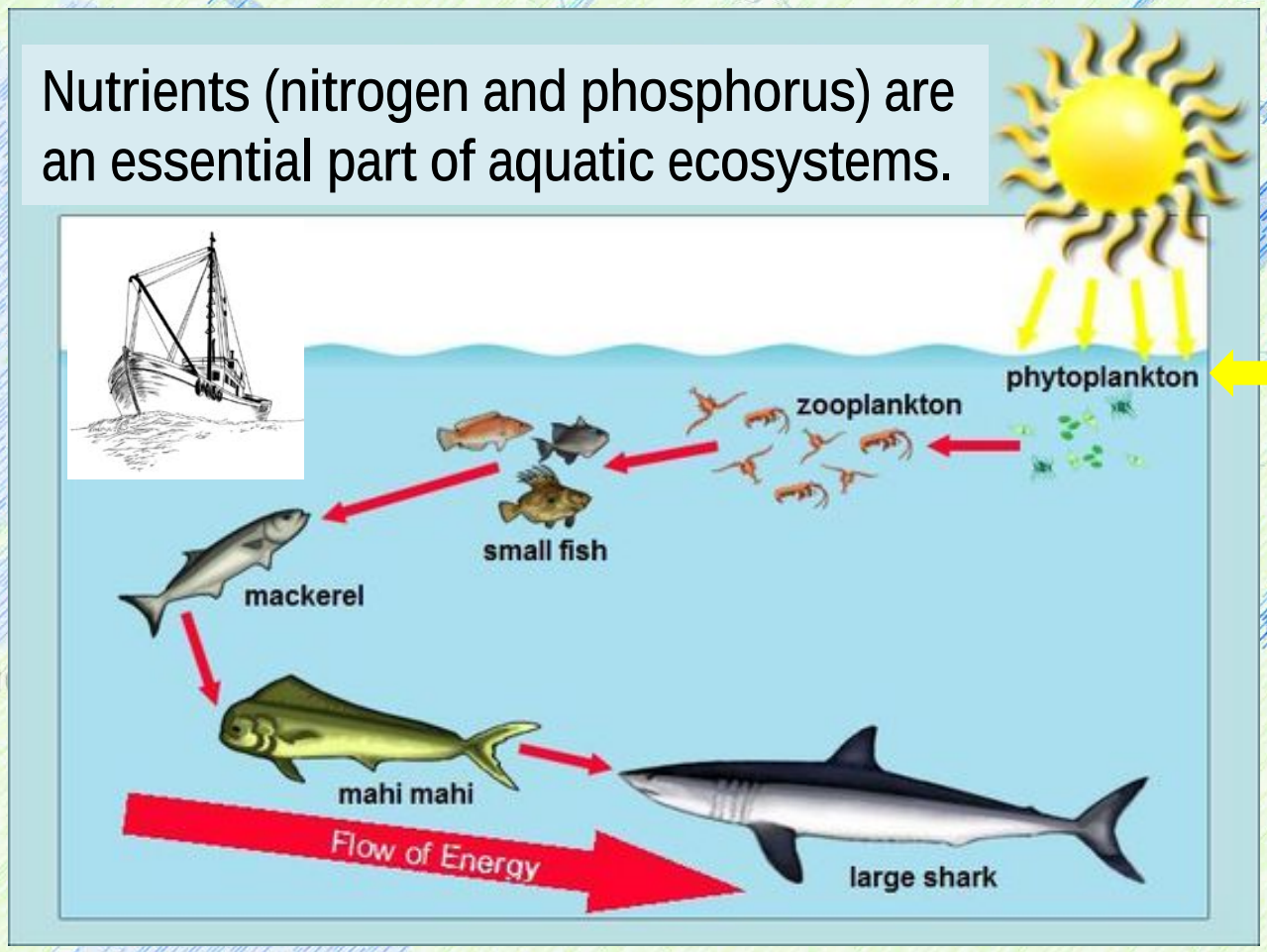
November 22, 2016

Outline

- Growing concerns of nutrient pollution
- Possible requirements in 2019 nutrient permit renewal
- District nutrient work plan
- Summary and next step

What are Nutrients?

Nutrients (nitrogen and phosphorus) are an essential part of aquatic ecosystems.

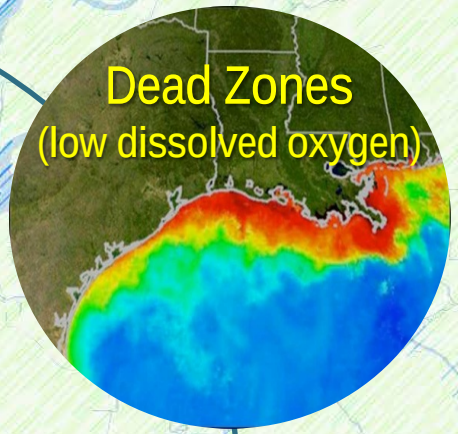


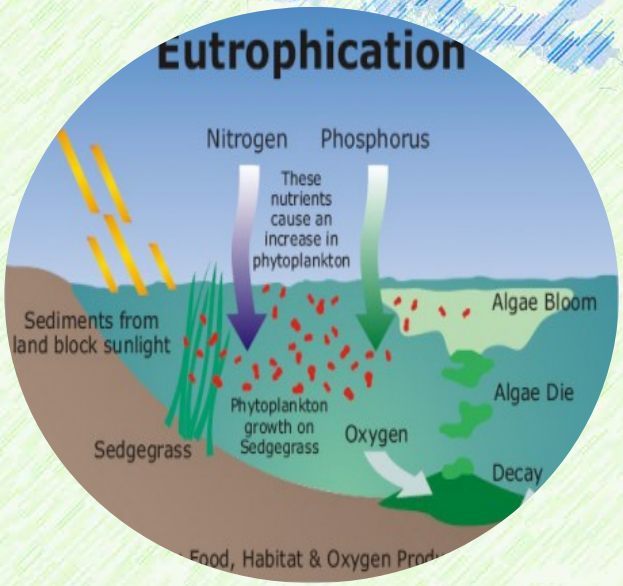
Nutrients (N+P)

Nitrogen and phosphorus support the growth of algae and aquatic plants, which provide food and habitat for aquatic animals.

Why Concern on Nutrient Pollution?

Excess nutrients — Too much of a good thing





Recent Local and National Nutrient Problems

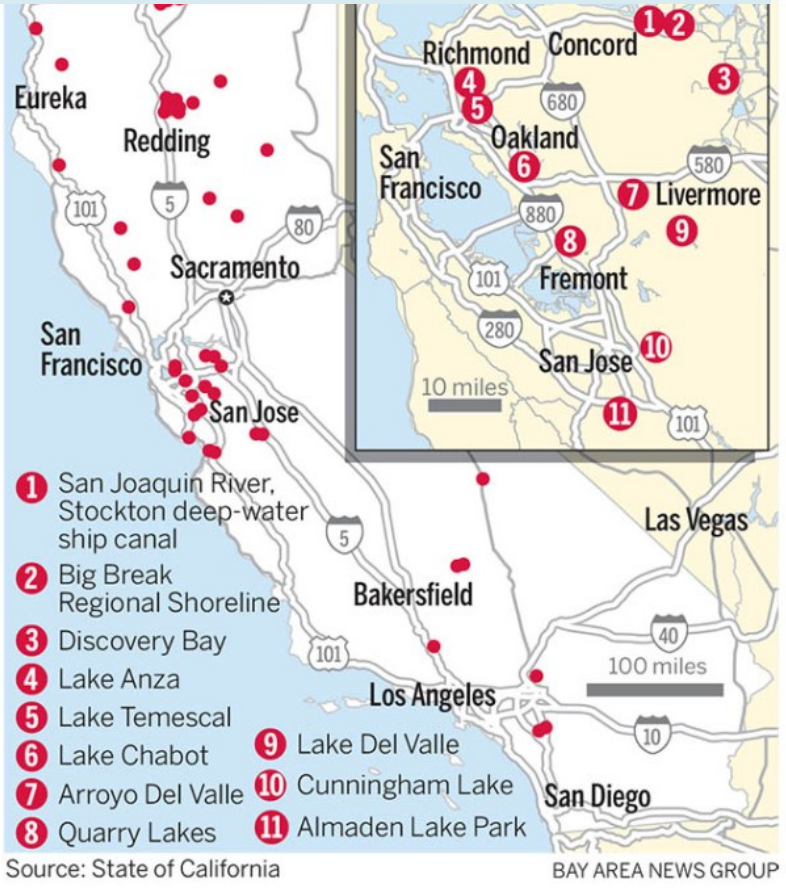
CBSNEWS Video | US | World | Politics | Entertainment | Health | MoneyWa

AP / November 6, 2015, 12:53 PM

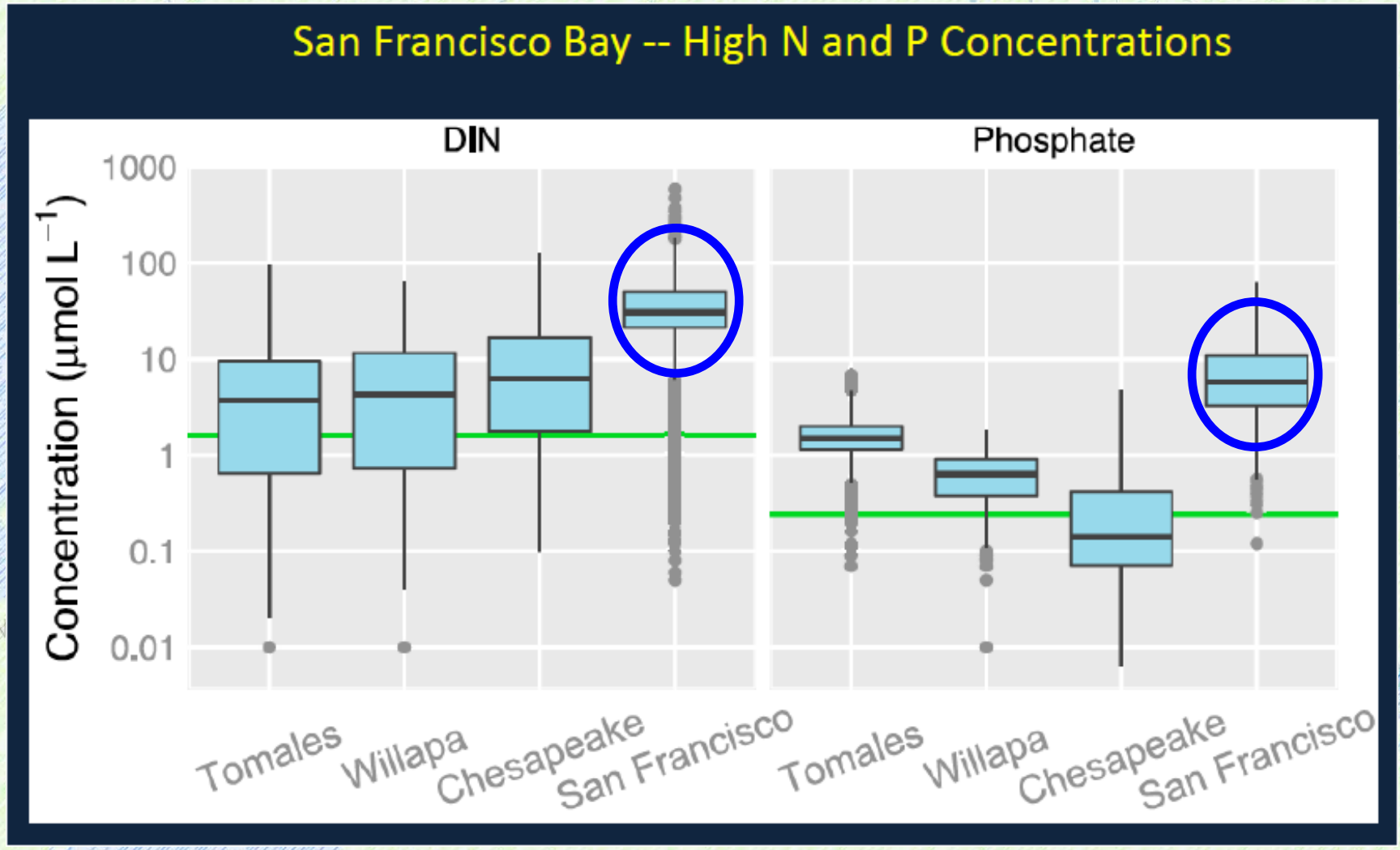
High toxin levels delay California crab season

Serious algae outbreaks have hit more than 20 states this summer

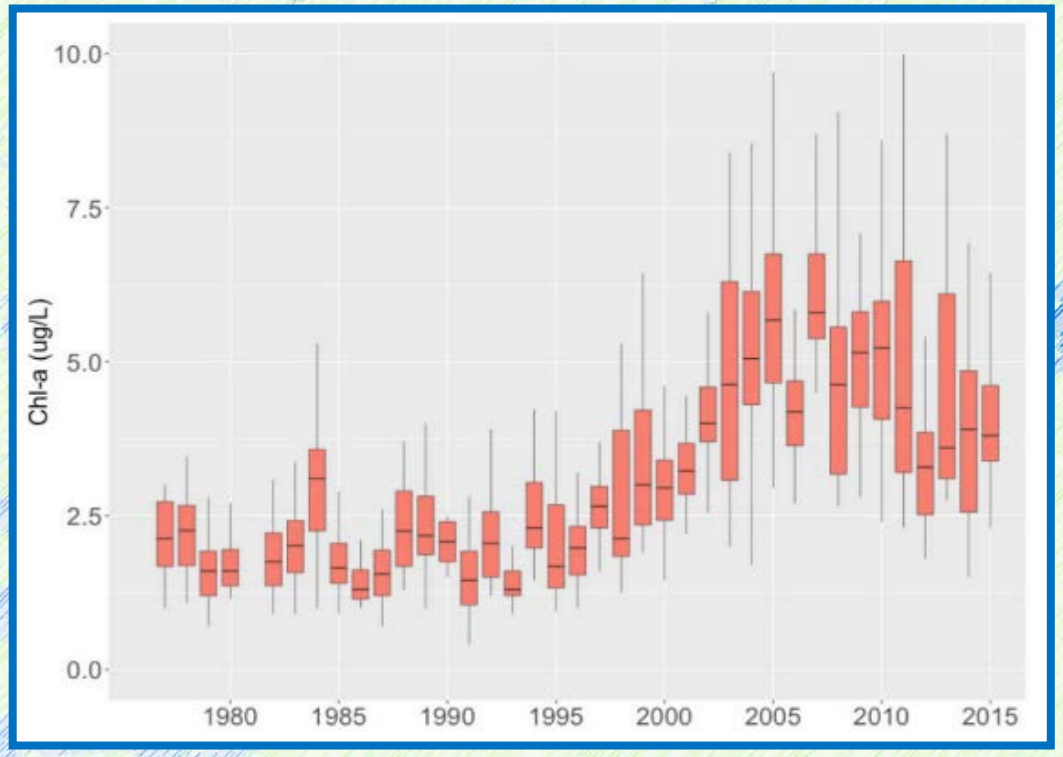
More than 40 CA lakes and waterways have suffered toxic blue-green algae blooms



SF Bay Nutrient Concern: Nutrient Enriched

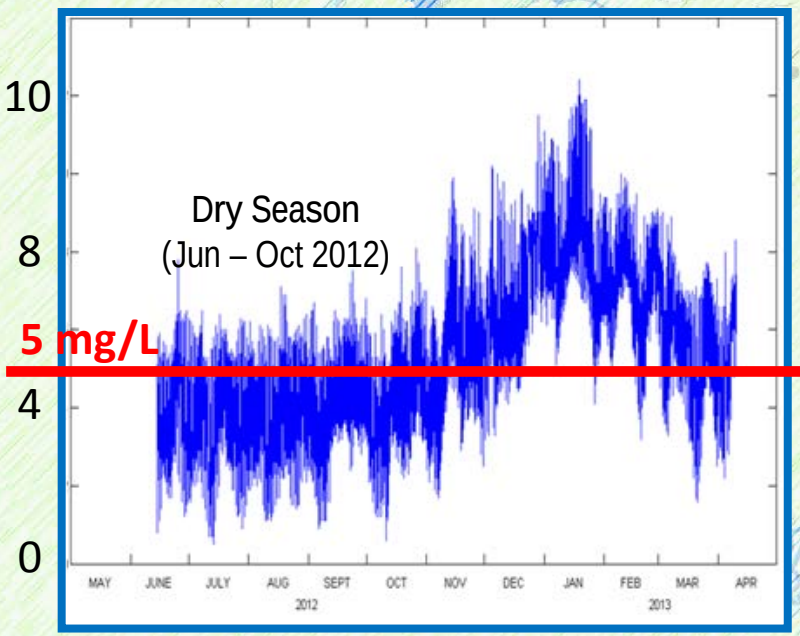


SF Bay Nutrient Concern: Early Signs of Possible Nutrient Impact

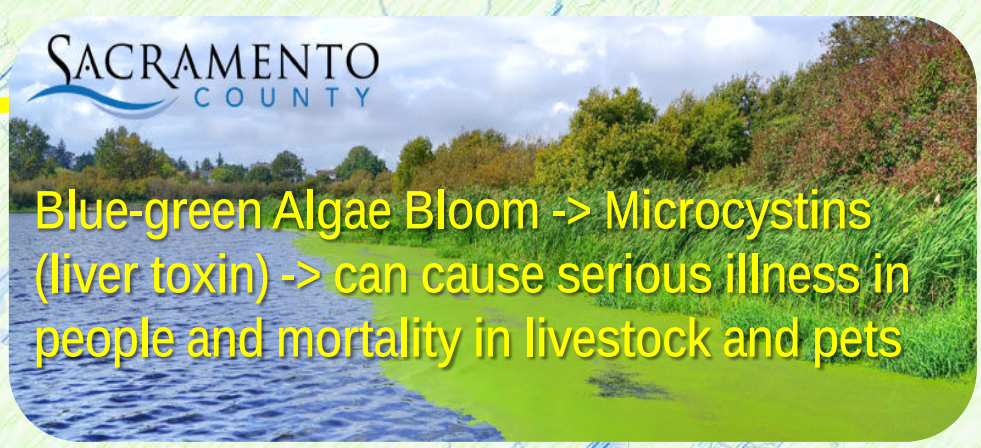


Increased Fall Phytoplankton Biomass in South Bay

Low Dissolved Oxygen in Sloughs and Creeks



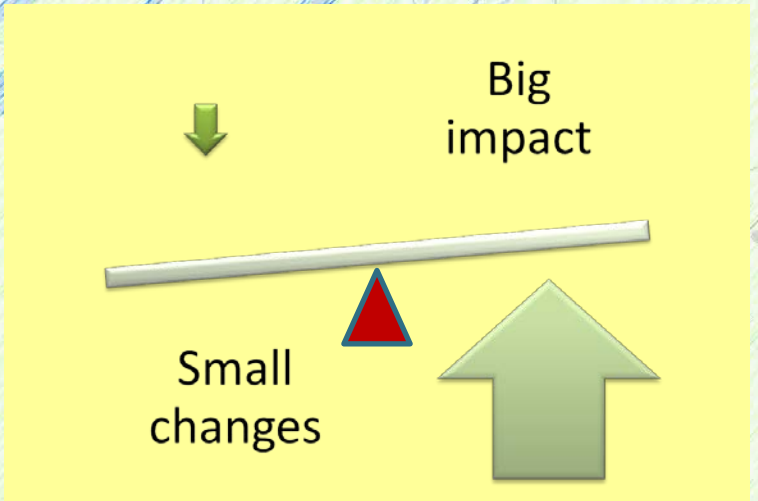
SF Bay Nutrient Concern: Algal Toxins



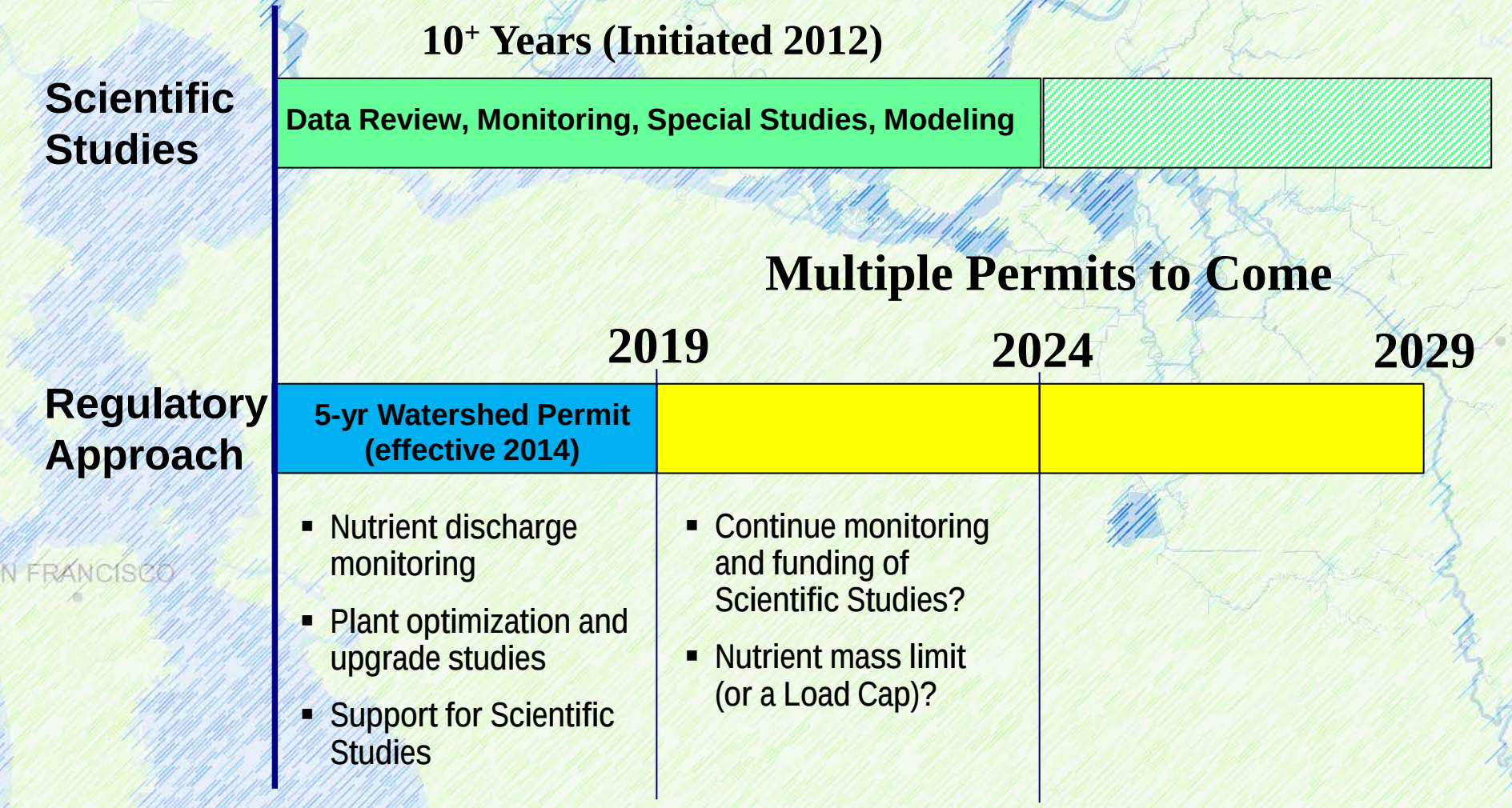
- Low levels of algal toxins detected Bay-wide
- One toxin (microcystins) has at times exceeded the fish consumption guideline

Growing SF Bay Nutrient Concerns

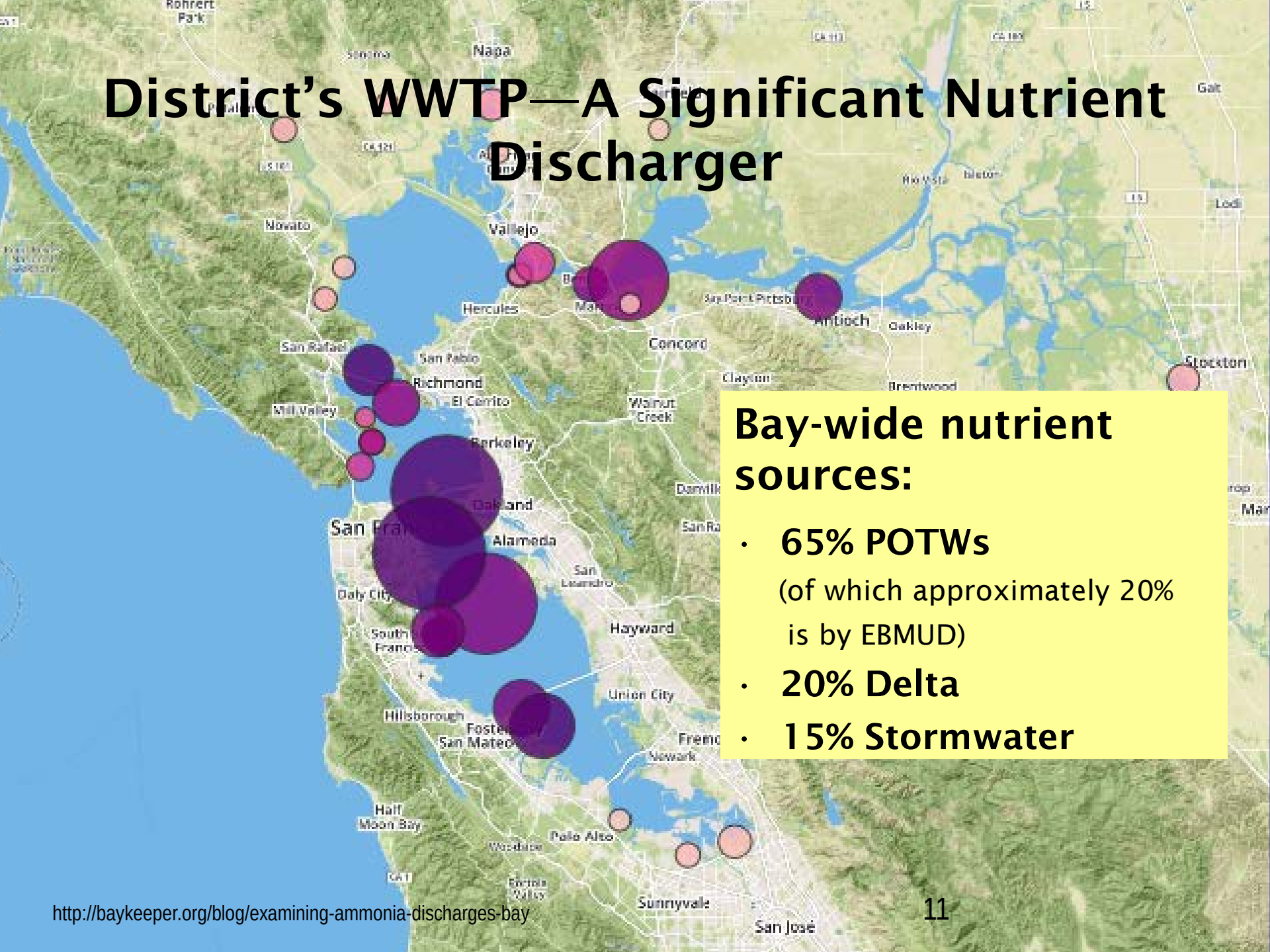
- Is the Bay currently impaired by nutrients?
- Is there a tipping point?
- What management actions, if any, are needed?



Possible Requirements of 2019 Permit Renewal



District's WWTP—A Significant Nutrient Discharger



Bay-wide nutrient sources:

- **65% POTWs**
  (of which approximately 20% is by EBMUD)
- **20% Delta**
- **15% Stormwater**

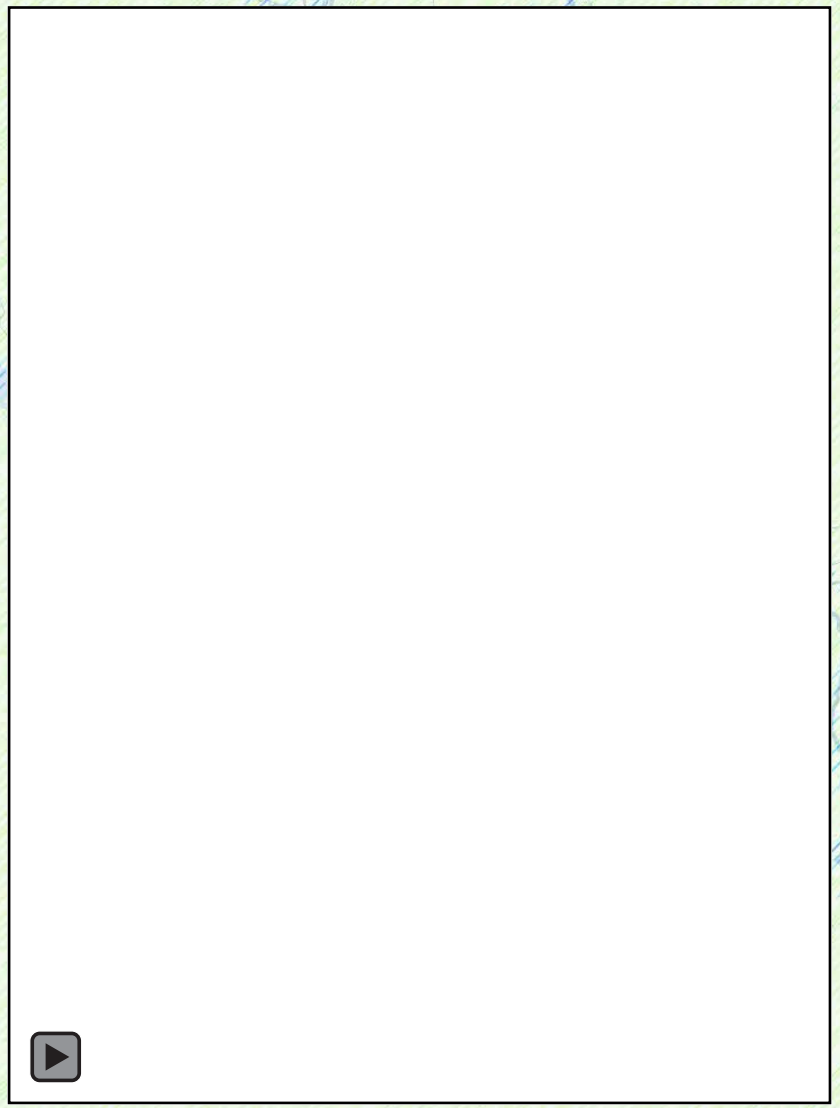
http://baykeeper.org/blog/examining-ammonia-discharges-bay

District's WWTP Effluent Impact to the Bay

- Despite high loads, District benefits from discharge location

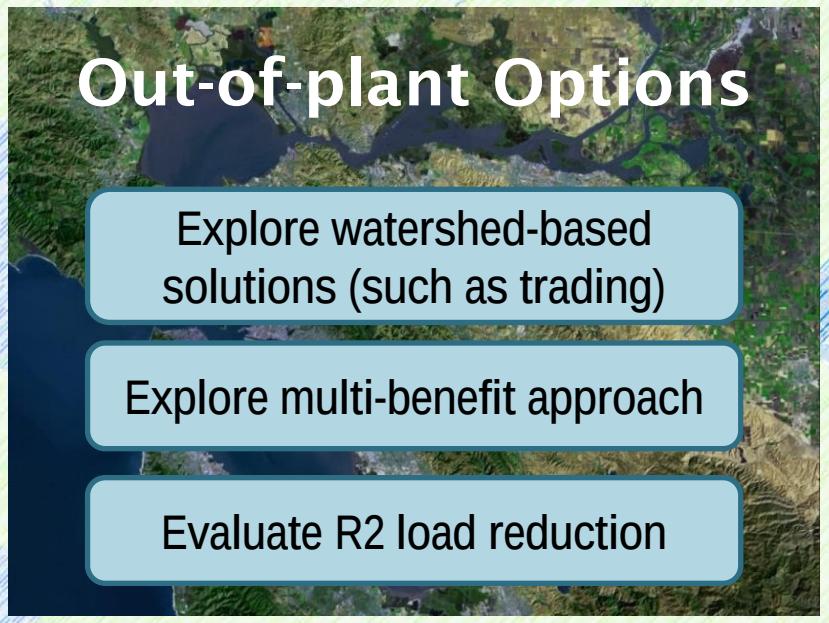
However,

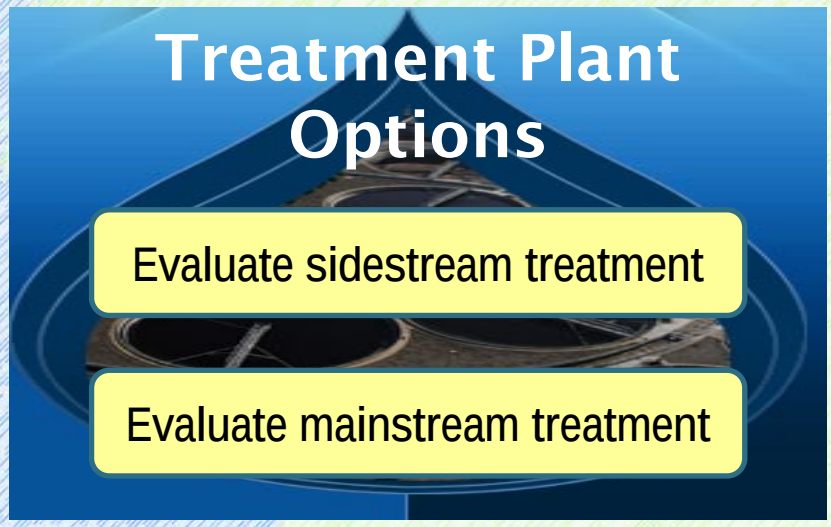
- Emerging concerns of coastal impact



Ongoing Water Quality Modeling by SFEI

District Nutrient Work Plan





Select best option(s)

Sidestream At District's WWTP

Influent

Nutrients

Mainstream

Wastewater Treatment

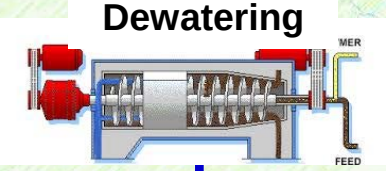
SF Bay

Sludges

Nutrients

Anaerobic Digesters

Dewatering



Biosolids

Sidestream (dewatering centrate)

- **<2% of Plant Flow**
- **~50% of Plant N Discharge**
- **~70% of Plant P Discharge**

Where Sidestream Fits In

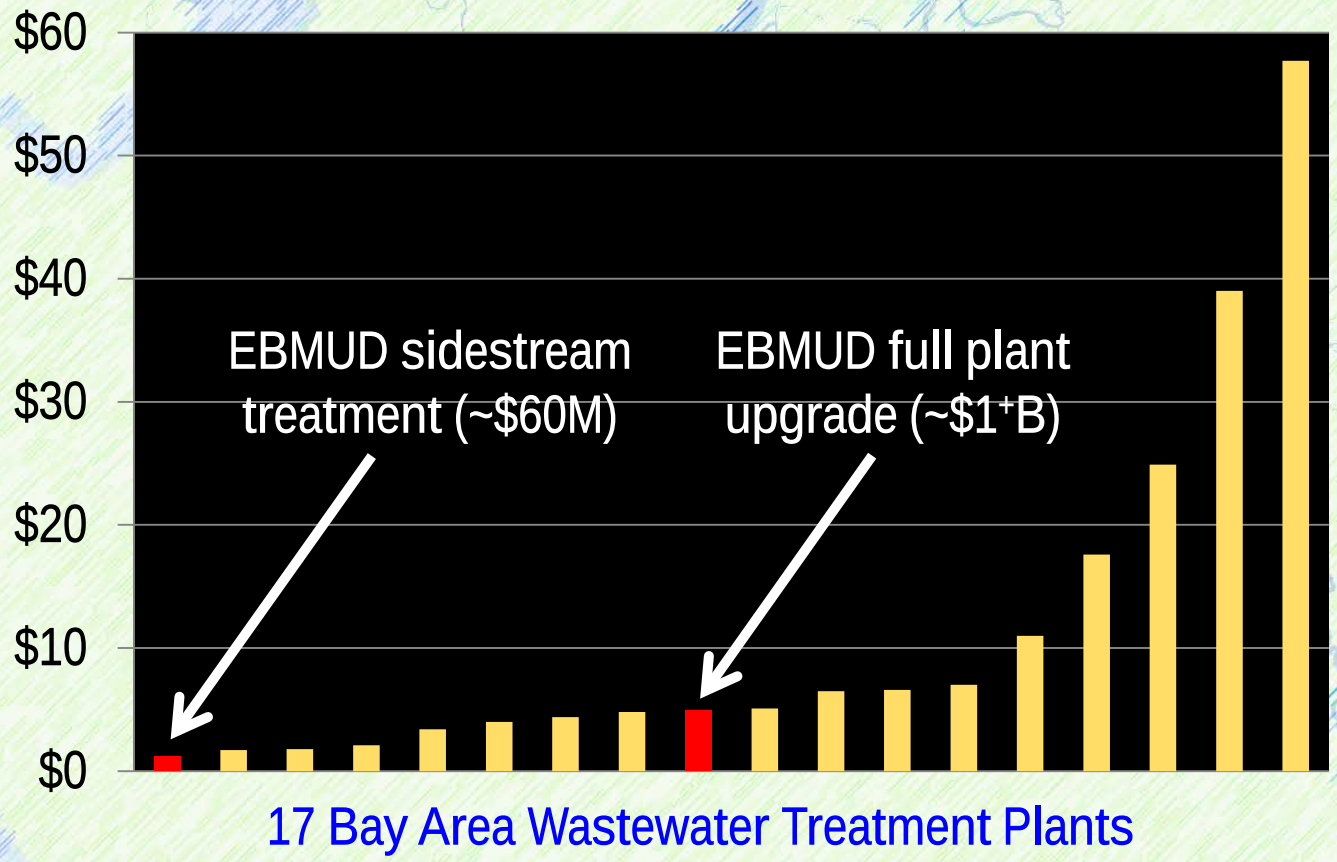
- **Sidestream treatment may be cost effective:**
  - **As part of an adaptive management stepwise approach**

  and/or

  - **In conjunction with a full facility upgrade**

Preliminary Nutrient Removal Cost Comparison
(Estimated under Watershed Permit Effort)

Preliminary Life-cycle Cost for Full Plant Nutrient Upgrades ($/lb TN Removal)



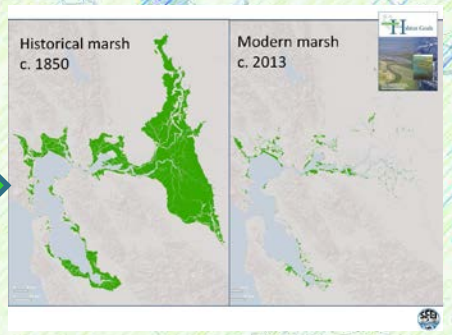
Source: Preliminary Level 3 full plant upgrade costs for dry weather TN removal at 17 WWTPs. Costs are in present value.

Explore Multi-benefit Opportunities

- Investigate recovering nutrients in sidestream for fertilizer market
- Explore use of nutrients in effluent for wetland restoration
- Evaluate nutrient upgrades and water recycling synergy

Use of Wastewater-derived Fertilizers

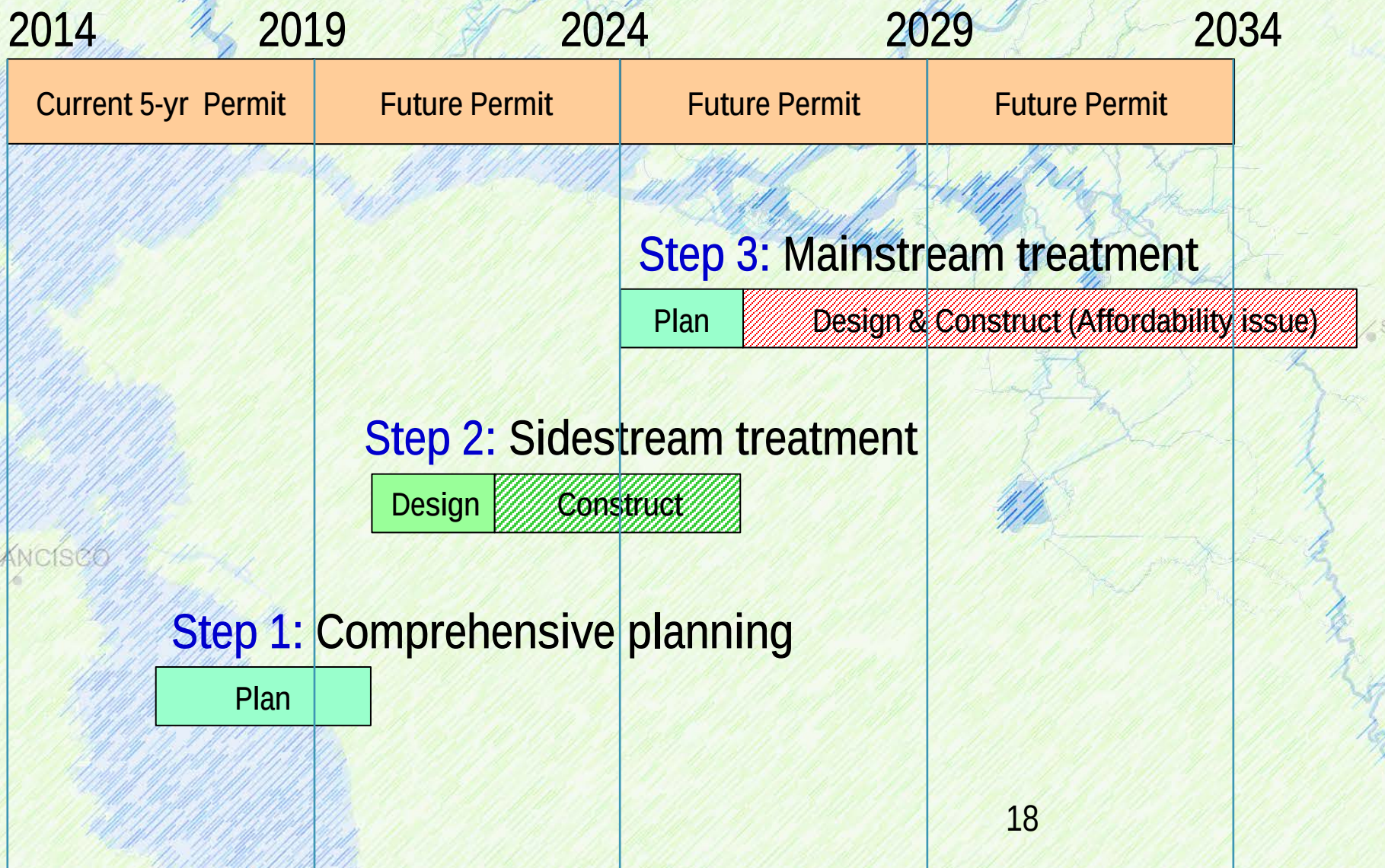
WWTP Effluent for Wetland Restoration



Additional treatment

Various Uses of Recycled Water

District Work Plan—Rough Timeline



Summary and Next Step

- Nutrient discharge to the Bay is a growing regulatory/stakeholder concern
- Complex science—highly unlikely to provide complete answers ahead of regulatory actions
- Cost for nutrient upgrades will be significant ($5–10 Billion for Bay Area WWTPs)
- Continue technical planning and regulatory strategy development
  - Explore strategies to leverage early action to reduce long-term risk to the District

EAST BAY MUNICIPAL UTILITY DISTRICT

Food Waste Program Update

Board Workshop

November 22, 2016

Agenda

- Background
- Key Assumptions
- Food Waste Initiatives
  - City of Oakland/Waste Management
  - City of Berkeley
  - Recology/City of San Francisco
- Summary

Background

- Negotiations with Harvest Power to design, build, and operate a large-scale food waste facility ended in April
- Staff has been working to develop alternative food waste pathways to support key initiatives
  - Continuing discussions with potential feedstock suppliers
  - Refining key financial assumptions and expanding understanding of market drivers
  - Developing food waste preprocessing alternatives and associated costs

Background
Dynamic Project Environment

- Solid waste industry still developing strategies to comply with state legislation
  - Requirements to divert organics from landfills with key focus on food waste
  - Multiple contending paths—WWTPs, dry anaerobic digestion, composting
  - Over time, demand for processing options expected to drive higher tipping fees
- Volatile energy and environmental attribute markets
- Preprocessing technology is in early stages of development

Background
Challenges at Other Agencies

Agency	Status	Comments
Massachussetts WRA (Boston)	On Hold	Selected preprocessed food waste provider, but abandoned project due to community concerns
Chicago Metro	On Hold	Planned project to accept preprocessed food waste placed on hold due to concerns regarding securing feedstock
DC Water	On Hold	Despite strong organizational focus on sustainability, nearing decision not to proceed due to economic concerns
LA County	In Development	Ongoing pilot working from a technical standpoint, but continued negotiations on finances
New York City	In Development	Large-scale project driven by solid waste interest and revenue streams
Toronto	Operating	Successful project driven by strong government incentives and directives
Central Marin Sanitation	Operating	Relatively small project built on strong community partnership between WWTP and co-located solid waste transfer facility

Background
Third-Party Review

- Staff has engaged third-party experts to review key assumptions and findings
  - Review assumptions and cost estimates (AECOM)
  - Preprocessing technology evaluation (Black & Veatch)
  - Preprocessing technology and cost estimate (Anaergia)
  - CNG markets, policy, and pricing (Gladstein and Associates)

Key Assumptions
Significant Revision to CNG Price

Harvest Power assumed price of **$1.80** per gasoline gallon equivalent (GGE)
- 25% discount on $2.40/GGE retail price

Digesters

Gas Upgrading and Conditioning

CNG Tube Trailers

$1.80/GGE
Assumed Price

Off-site CNG Distribution

Off-Site Gas Compressor

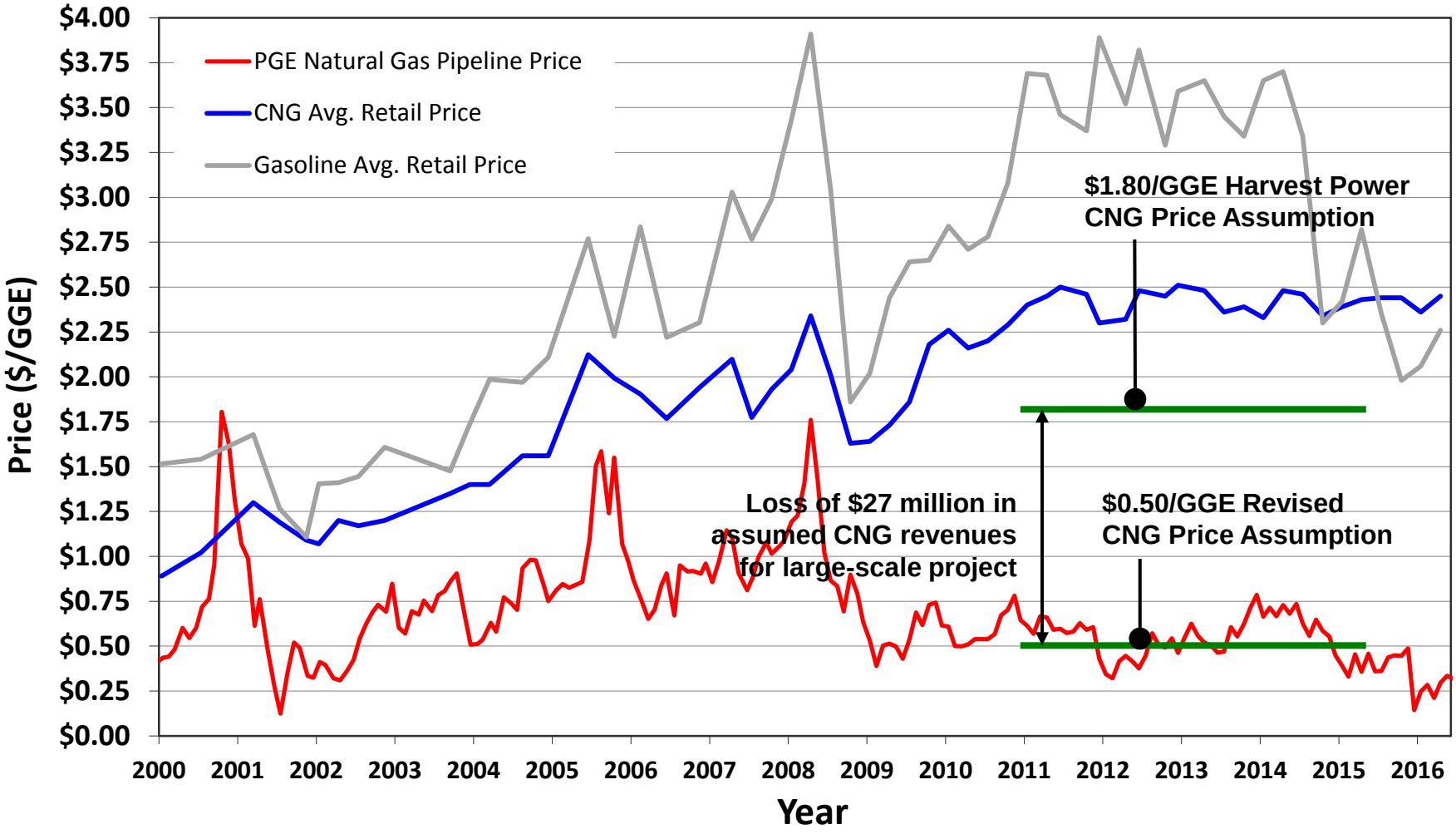
Off-site Fueling Station

$2.40/GGE
Retail Price

Direct Injection of CNG into PG&E Natural Gas Pipeline

Pipeline Natural Gas
Price = **$0.50**/GGE

Key Assumptions
CNG Price Trends



Key Assumptions
Digestate and Landfill ADC

- Stopwaste.org enacted an ordinance that prohibits landfilling of food scraps (Ordinance 2012-1)
  - Directly impacts use of co-digested residuals from receipt of Oakland or Berkeley food waste
- To accept Alameda County food waste, District would need to:
  1) Implement dedicated digestion and dewatering facility capital improvements (~$12M) at the MWWTP,
  2) Divert all commingled biosolids from landfill ADC at an operating cost premium ($1.5M/year), or
  3) Negotiate a short-term alternative approach with Stopwaste.org

EAST BAY MUNICIPAL UTILITY DISTRICT

Review of Food Waste Initiatives

Preprocessing Alternatives Development
Key Considerations

- Capital Costs
  - New facilities and upgrades to existing MWWTP site/process
- Technology Approach and Risks
  - Emerging and unproven nature of technology
  - Material quality and associated preprocessing required
- Level of Service
  - Uptime and reliability requirements, associated penalties
- Facility Operation & Maintenance
  - Reject/recyclable material handling
  - Odors and permitting concerns
- Facility Size
  - Economies of scale vs. small-scale to manage risks

Preprocessing Alternatives Development
Large vs. Small Scale Facility

- Revised CNG price results in loss of significant revenue that is needed to offset initial capital cost
  - 200 tpd facility is estimated at $60 million
  - ~$28 million for biogas upgrading, dedicated digestion and dewatering, site and utility improvements
  - 25-year project net present value is estimated at more than $35 million loss
- Shift focus to evaluate project feasibility of smaller scale facilities
  - Do not trigger large capital upgrades
  - Lower inherent project risk

Preprocessing Alternatives Development
Existing WWTP Capacity

- Key process bottleneck at MWWTP is solids dewatering capacity downstream of digesters
- Food waste processing at MWWTP increases hydraulic loading impacts on dewatering centrifuges
- Current dewatering capacity available for food waste equates to 60 tpd (as collected)
  - Material from Oakland, Berkeley, and Recology may cumulatively exceed this capacity

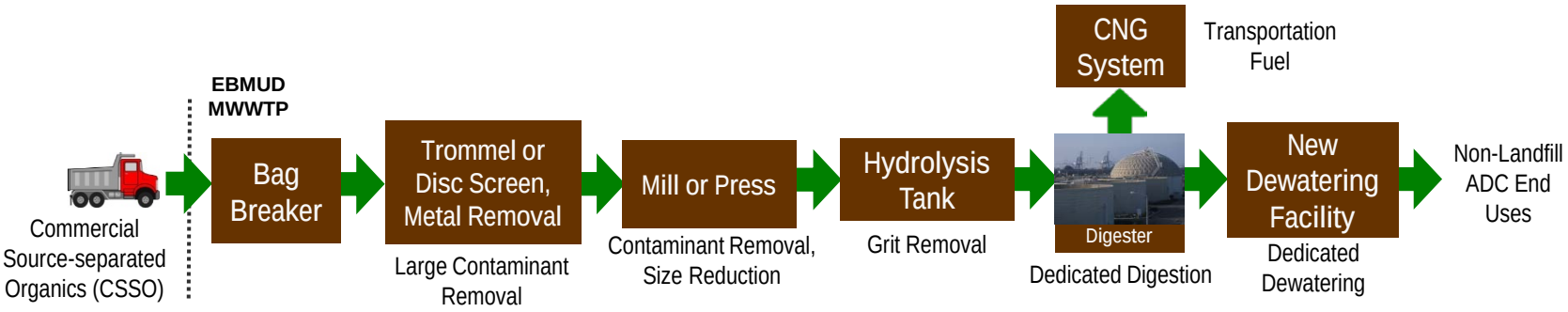
Oakland Food Waste Initiative
Preprocessing Alternatives

❶ Large-scale Facility at EBMUD (200 tpd)

❷ Medium-scale Facility at EBMUD (60 tpd)

❸ Pre-processing at Off-site Location (60 tpd)

Oakland Preprocessing Alternatives
❶ Large Scale at EBMUD (200 tpd)

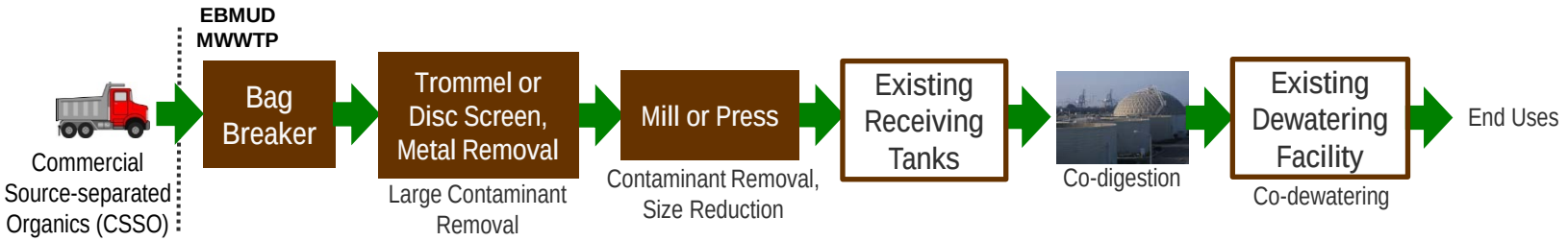


- Feedstock: Food waste from Oakland, Berkeley, others
- Robust processing train with increased likelihood of effectively addressing material quality issues
- Tip Fees: $96/ton for Oakland
- Estimated capital cost = $60 million

❶ Large Scale at EBMUD (200 tpd) Capital Cost Breakdown

Scope	Cost ($M)
Preprocessing Building	19.7
Equalization/Hydrolysis Tank	3.7
Dedicated Digestion and Dewatering Building	12.3
CNG Production Facility	11.0
Odor Control System	7.6
MWWTP Site and Utility Improvements	5.7
Total =	**$60M**

Oakland Preprocessing Alternatives
❷ Medium Scale at EBMUD (60 tpd)

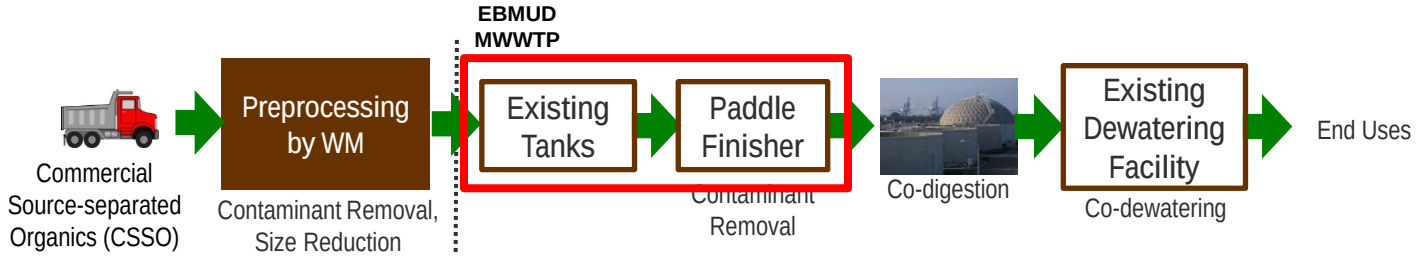


- As-collected Oakland food waste only ($96/ton fee)
- Facility sizing avoids process upgrades (dewatering and CNG)
- Estimated capital cost = $20 million

❷ Medium Scale at EBMUD (60 tpd) Capital Cost Breakdown

Scope	Cost ($M)
Preprocessing Building (foundation, building, equipment, electrical and controls, and site improvements)	12.0
Odor Control System	6.5
MWWTP Site and Utility Improvements	1.5
Total =	**$20M**

Oakland Preprocessing Alternatives
❸ Medium Scale, Off Site (60 tpd)



- Preprocessed food waste ($46/ton fee)
- Assumes WM pays capital for transfer station upgrades
- Assumes material meets quality specification
- Existing facility capacity; no upgrades to gas handling or dewatering facility
- Small upgrades to existing processing train at MWWTP
- Estimated capital cost = $1.5 – 4.0 million

Oakland Preprocessing Alternatives Financial Analysis Summary

Description	Alt. 1 Large at EBMUD (200 tpd)	Alt. 2 Medium at EBMUD (60 tpd)	Alt. 3 Medium at WM (60 tpd)
Capital Costs			
Total Capital Costs	**-$60.0M**	**-$20.0M**	**-$1.5M to -$4.0M**
Present Value of Gross Revenues			
PV of Tip Fees	$59.6	$19.6	$8.3
PV of Electricity Sales	$0.0	$2.8	$2.7
PV of CNG sales	$7.9	$0.0	$0.0
PV of LCFS	$5.6	$0.0	$0.0
PV of RINs	$10.3	$0.0	$0.0
PV of Total Gross Revenue (20 years)	**$83.4M**	**$22.4M**	**$11.0M**
Present Value of O&M Costs			
PV of Total O&M Costs (20 years)	**-$64.0M**	**-$24.3M**	**-$11.7M**
Net Present Value (NPV)			
20-year NPV	**-$40.6M**	**-$21.9M**	**-$2.2M to -$4.7M**

Oakland Preprocessing Alternatives
Key Findings/Next Steps

❶ Large-scale Facility at EBMUD (200 tpd)
- Not financially feasible due to insufficient net revenues to payback high capital cost

❷ Medium-scale Facility at EBMUD (60 tpd)
- Although significantly lower in capital cost ($20M vs. $60M), does not appear financially viable

❸ Medium-scale Facility at Off-site Location (60 tpd)
- Preprocessing off site by WM is favorable relative to other alternatives

➢ Continue discussions with WM regarding a proposal for the District to accept preprocessed material

Berkeley Food Waste Initiative
Current Status

- Berkeley collects approximately 30 tpd of commercial food waste that is hauled to off-site composting facilities
- Berkeley recently issued an RFP for organics processing services for five years with two one-year extensions
- District submitted a proposal for anaerobic digestion of food waste
- Berkeley staff has consistently reported to City Council their intent to maintain an option to deliver food waste to the District

Berkeley Food Waste Initiative
Preprocessing Alternatives

❶ Full Preprocessing Facility at EBMUD (30 tpd)

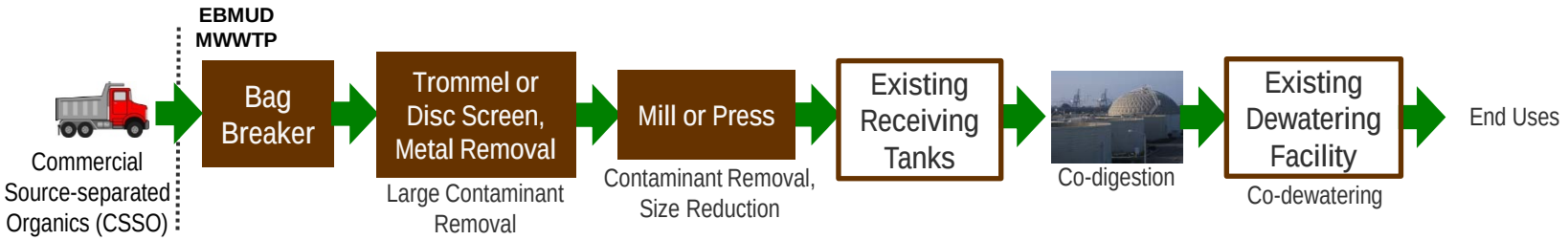
- Similar to Alternative 2 for Oakland food waste, but smaller

❷ Pilot Preprocessing Facility at EBMUD (20 tpd)

- "Stripped down" approach to conduct demonstration test to evaluate preprocessing technologies

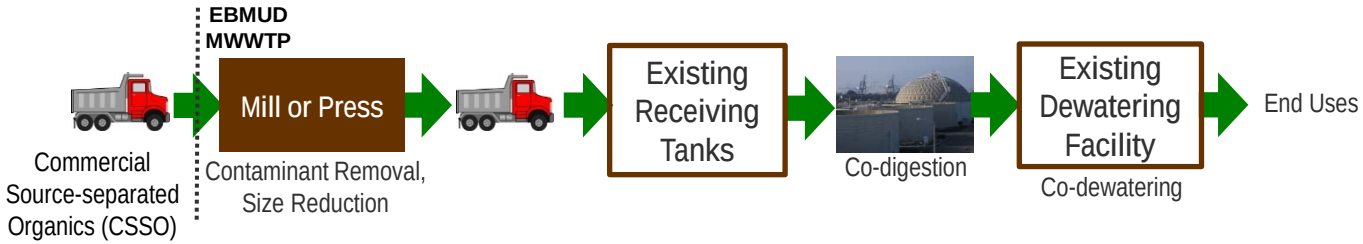
Both alternatives limit initial capital outlay by not requiring new RNG or dedicated dewatering facilities

Berkeley Preprocessing Alternatives
❶ Full Preprocessing EBMUD (30 tpd)



- As-collected Berkeley food waste (30 tpd)
- Includes building enclosure and odor control
- Estimated capital cost = $20 million

Berkeley Preprocessing Alternatives
❷ Pilot Facility at EBMUD (20 tpd)



- As-collected Berkeley food waste (20 tpd)
- Test preprocessing equipment with limited capital investment (effectiveness, reliability challenges)
- No building or odor control system
- Estimated capital cost = $6-8 million

Berkeley Preprocessing Alternatives Financial Analysis Summary

Description	Berkeley Alt. 1 Full at EBMUD (30 tpd)	Berkeley Alt. 2 Pilot at EBMUD (20 tpd)	Oakland Alt. 1 Large at EBMUD (200 tpd)	Oakland Alt. 2 Medium at EBMUD (60 tpd)	Oakland Alt. 3 Medium at WM (60 tpd)
Capital Costs					
Total Capital Costs	**-$20.0M**	**-$6.0 to -$8M**	**-$60.0M**	**-$20.0M**	**-$1.5M to -$4.0M**
Present Value of Gross Revenues					
PV of Tip Fees	$11.0	$6.5	$59.6	$19.6	$8.3
PV of Electricity Sales	$1.4	$0.8	$0.0	$2.8	$2.7
PV of CNG sales	$0.0	$0.0	$7.9	$0.0	$0.0
PV of LCFS	$0.0	$0.0	$5.6	$0.0	$0.0
PV of RINs	$0.0	$0.0	$10.3	$0.0	$0.0
PV of Total Gross Revenue (20 years)	**$12.4M**	**$7.3M**	**$83.4M**	**$22.4M**	**$11.0M**
Present Value of O&M Costs					
PV of Total O&M Costs (20 years)	**-$12.8M**	**-$6.3M**	**-$64.0M**	**-$24.3M**	**-$11.7M**
Net Present Value (NPV)					
20-year NPV	**-$20.4M**	**N/A***	**-$40.6M**	**-$21.9M**	**-$2.2M to -$4.7M**

*Note: Pilot project will not generate sufficient revenues to consider payback analysis

Berkeley Preprocessing Alternatives Summary

❶ Full Preprocessing Facility at EBMUD (30 tpd)
- Does not appear to be economically viable

❷ Pilot Preprocessing Facility at EBMUD (20 tpd)
- Not designed for long-term operation or growth
- Project approach has uncertain value

- Staff has initiated discussions with City of Berkeley regarding potential preprocessing capabilities at Berkeley transfer station

Recology Urban Organics Initiative Current Status

- Conducting a pilot test since May to evaluate quality of preprocessed "urban organics" material from Recology
  - "Black bin" mixed materials (i.e., MSW minus recyclables)
  - Press technology installed at Recology in SF
  - Lower than expected throughput and yield
  - Equipment performance and reliability issues
  - Quality of material appears manageable
- Continue evaluation once preprocessing equipment issues are addressed

Changing Marketplace

- Legislative initiatives continue to push material out of landfills (AB 1826 => SB 1383)
- High-level interest in supporting innovation in this area yet no integrated policy approach
  - National – Department of Energy, EPA
  - State – Water Board, Cal Recycle, Air Board
- Over time, the solid waste fee structure is expected to better support this direction to higher-use approaches
- Value of energy; both commodity price and environmental attributes may rise, over time, helping project economics

Summary

- Oakland: Off-site preprocessing by WM may be financially viable
- Berkeley: Challenges in developing a financially feasible approach
- Recology: Continuing with the ongoing pilot evaluation
- Others
  - Interest from CCCSWA in expanding current program
  - Other haulers continue (e.g., Republic) continue to express interest
- Continuing to pursue federal and state agency support (e.g., grants) to improve overall project economics
- Advocate for increased policy support via environmental attributes, grants and other market incentives