BACWA EXECUTIVE BOARD ACTION REQUEST

AGENDA NO.: 14a
FILE NO.: N/A
MEETING DATE: January 3, 2013

TITLE: Nutrient Decision Tree and Strawman Science Proposal for Suisun Bay

☐ **MOTION** ☐ **RESOLUTION** ☒ **DISCUSSION**

RECOMMENDED ACTION

Review draft Nutrient Decision Tree and Strawman Science Proposal for Suisun Bay and provide feedback to David Senn and Executive Director to determine next steps.

SUMMARY

As a follow up to discussions at the November 2012 Pardee Technical Seminar and Board authorization (on 11/29/2012) to redirect funds in the existing SFEI Nutrients Strategy Development agreement, David Senn worked with Jim Kelly and Dave Williams to prepare the attached Decision Tree slides and Strawman Science Proposal for Suisun Bay.

The two attachments have been provided to illustrate the approach that is being taken to prepare a decision tree(s) for Nutrients:

- Decision Tree Power Point (7 slides)
- Strawman Science Proposal for Suisun Bay

Slide 1 presents San Francisco Bay (SFB) nutrient loading versus other estuaries plotted against chlorophyll a (Chl-a) for different subembayments. The high nutrient load and low Chl-a compared to other estuaries illustrates the resilience of SFB and reliance on high turbidity, strong tidal mixing and filter-feeding clams, and potentially other factors to maintain that resilience.

Slide 2 presents the overarching management questions; these were paraphrased from the nutrient strategy developed by the RWQCB and SFEI.

Slide 3 presents the masterwork flow diagram-it applies to the overall approach, and to each subembayment.

Slides 4 and 6 are a word charts that describe the management questions addressed in the decision trees on Slides 5 and 7.

Slide 5 is a decision tree for determining whether or not LSB is impaired. Within slide 5 the colored the boxes are coordinated to the colored boxes in Slide 3, but because of time constraints, the details of those boxes are not completed. A decision tree like this will be needed for each subembayment.

Slide 7 is a decision tree is for determining whether or not ammonia is impairing beneficial uses of the Suisun Bay. Again, the colored boxes in Slide 7 are coordinated with the boxes in Slide 3. And again, a decision tree like this one will be needed for each subembayment.

The Strawman Science Plan for Suisun Bay, the second attachment, is an example of what will likely need to be prepared for each subembayment. The types of science questions posed in the Strawman Science Plan will define the number of decision trees needed for each subembayment.

Dave Williams, Dave Senn, and Jim Kelly discussed these two attachments; the general consensus of the discussion was:

- The format used can define the needed science plan for the nutrient strategy.
- The projects, costs and schedule need to be added to either the decision trees or the science plans to allow the program to be defined, agreed upon, tracked and managed.

These attachments are being provided for discussion at the January 3rd BACWA Board meeting; based on the direction of the Board, Dave Senn will develop the remainder of the decision trees.

FISCAL IMPACT

This is a discussion item and has no direct fiscal impact, though this discussion may precipitate next steps which could require the Board to consider a reallocation of existing contract funds.

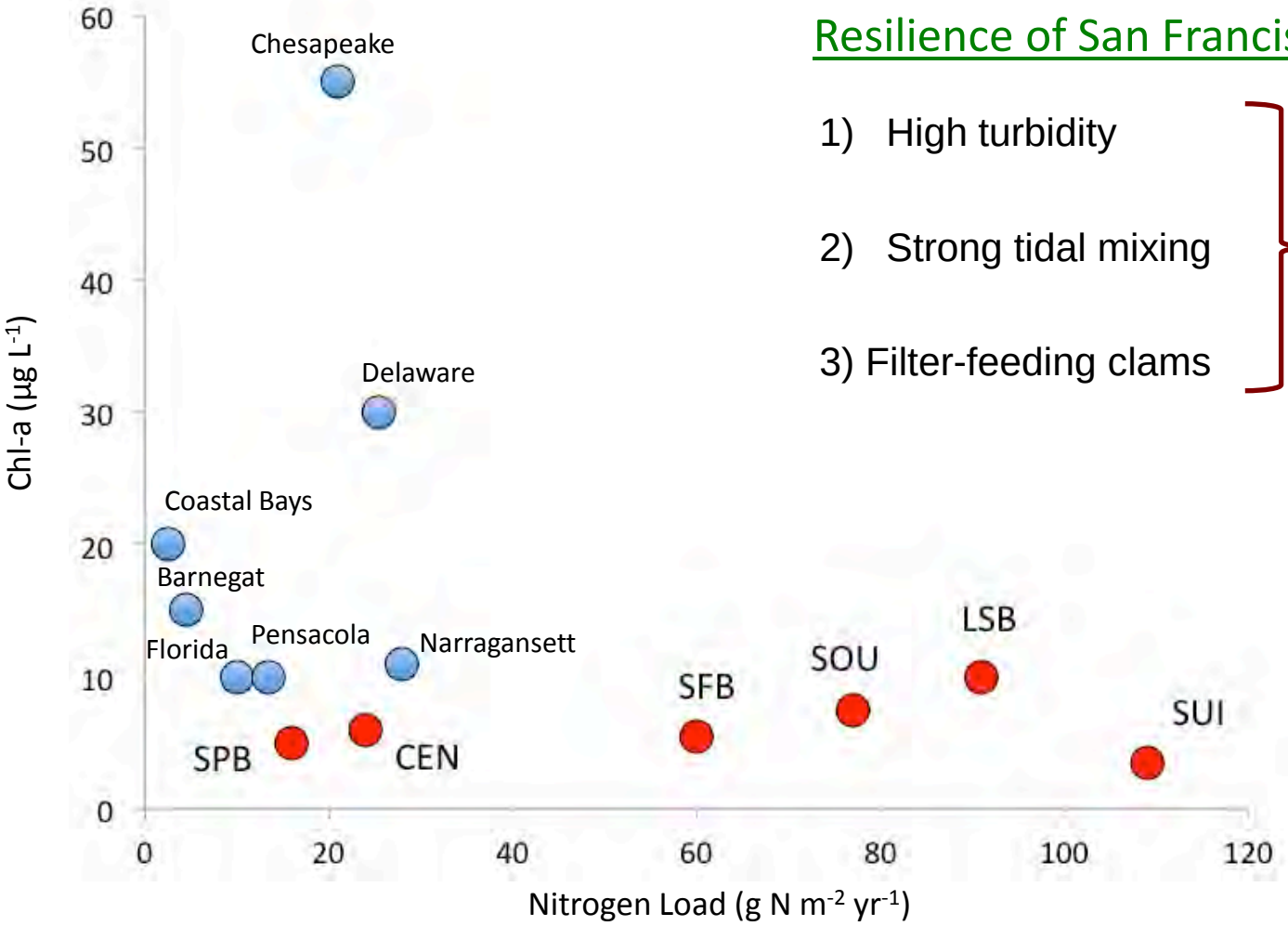
ALTERNATIVES

N/A

Attachments:

1. Nutrient Decision Tree Slides
2. Strawman Science Plan for Suisun Bay

Some subembayments of SFB receive extremely high areal N loads compared to other estuaries. If those subemebayments are not currently experiencing nutrient issues, it is reasonable to suggest that they may be considered as "poised for a future problem" if any major changes occurred to factors that currently keep nutrient problems in check.



Resilience of San Francisco Bay

1) High turbidity
2) Strong tidal mixing
3) Filter-feeding clams

Subject to change?

National Estuarine Experts Workgroup (2010)

SFEI 2013. LSB = Lower South Bay; SUI=Suisun; SOU= South Bay; SFB – overall San Francisco Bay; CEN = Central Bay; SPB = San Pablo Bay. Loads are direct POTW loads to specific subembayments, and currently do not include movement from one subembayment to another (e.g., SPB receives much of the input to Suisun, but that is not included in its load presented here. SUI includes POTW loads + loads from the Delta, which includes SacRegional POTW and also Agriculture

Primary Overarching Management Questions

1. Is there a nutrient problem or are there signs of a problem?
   - Currently, or trending towards, adversely affecting beneficial uses?
   - Impairment in the future due under environmental or management scenarios?

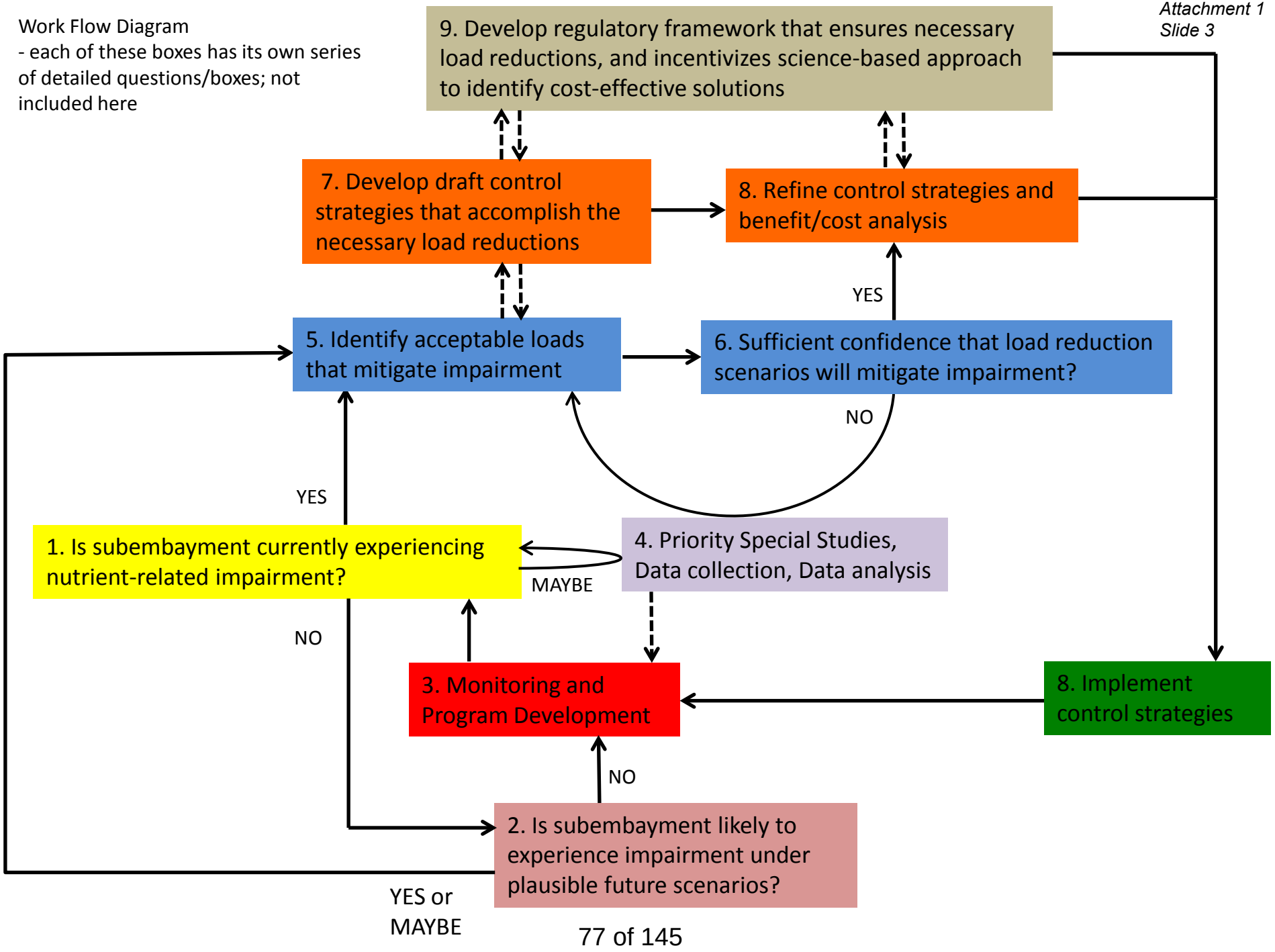
2. What are appropriate guidelines for identifying a nutrient-related problem?

3. What is the relative contribution of each loading pathway?

4. What nutrient loads can the Bay assimilate without impairment of beneficial uses?
   - Nutrient fate and transport: magnitude of internal transformations?
   - Grazing, light limitation, NH4-inhibition of primary production, frequency/duration of stratification?

5. What is the likelihood that the Bay will be impaired by nutrient overenrichment/eutrophication in the future?

Work Flow Diagram
- each of these boxes has its own series of detailed questions/boxes; not included here

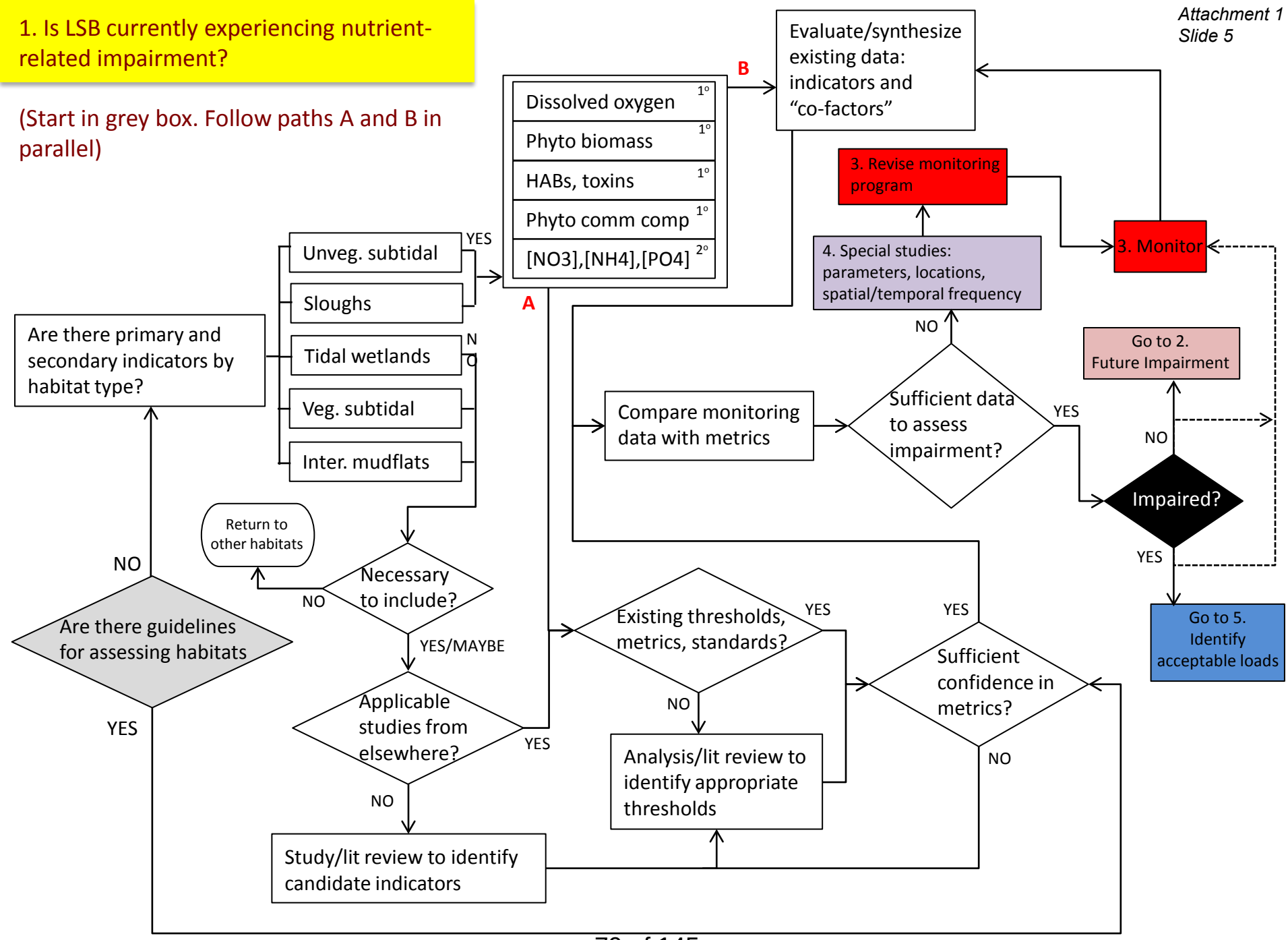


Example 1

- Decisions/work flow related to answering the question “Is subembayment impaired…” for the specific example of
  - Is LSB currently experiencing nutrient-related impairment?
    - for multiple potential indicators
    - additional prioritizations include deciding which indicator(s) are most likely to be a problem, and/or most tractable to evaluate.

1. Is LSB currently experiencing nutrient-related impairment?

(Start in grey box. Follow paths A and B in parallel)

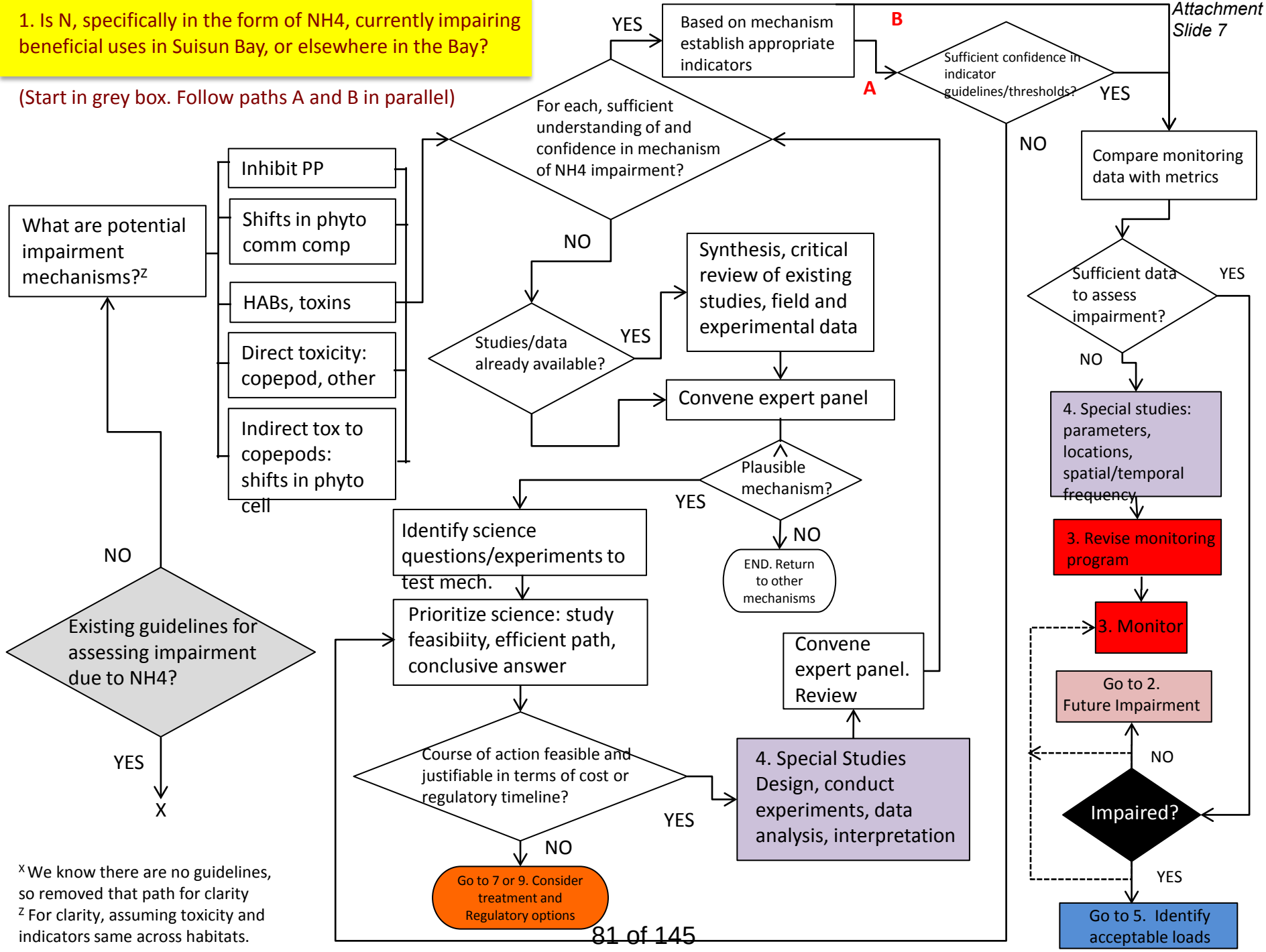


Example 2

- Decisions/work flow related to answering the question "Is subembayment impaired…" for the specific example of
  - Is N, specifically in the form of NH4, currently impairing beneficial uses in Suisun Bay, or elsewhere in the Bay?
  - For the box "Identify science questions/experiments to test mechanisms"
    - See word document with detailed management and science questions for Suisun Bay Science Plan development.
    - Only questions for NH4 inhibition of primary production included.
    - Parallel questions need to be developed for other potential impairment mechanisms

1. Is N, specifically in the form of NH4, currently impairing beneficial uses in Suisun Bay, or elsewhere in the Bay?

(Start in grey box. Follow paths A and B in parallel)



X We know there are no guidelines, so removed that path for clarity

Z For clarity, assuming toxicity and indicators same across habitats.

Approach for soliciting input on and Developing a Strawman Science Plan for Suisun Bay to serve as a starting point for the December meeting

Ask members of Suisun Work Group to provide input on the following…

1. Review management questions and…
    a. Identify questions you agree with
    b. Recommend minor and major changes or nuances
    c. Suggest additional questions

2. Identify studies that are either underway, proposed, or need to be carried out to inform management questions.
    a. Where we already have clear ideas and/or studies are already underway, we can provide these as starting point
    b. Leave opportunity for input

3. Recognizing the need to follow an efficient path toward informing costly management/regulatory decisions, identify the high(est) priority studies for funding.

4. Dave and Emily organize responses and present a strawman (and caveats) to the group at January meeting

5. January meeting will focus on discussing/commenting only on NH4 inhibition questions. After January meeting, a small working group can develop the questions for other potential impairment mechanisms following a similar process, and sending out to group for comment.

General Nutrient Strategy Management Questions

G.1. Is there a problem or are there signs of a problem in subembayments of San Francisco Bay?

- Are current nutrient loads and ambient concentrations presently - or trending toward - adversely affecting beneficial uses of the Bay?

G.2. What are appropriate guidelines for identifying a nutrient-related problem?

G.3. Which sources, pathways, transformations of nutrients are of most concern?

- What is the relative contribution of each loading pathway, and how do these loads vary in magnitude and relative importance in space, season, and time?
- What are the contributions of internal sources (e.g. benthic fluxes) from sediments and sinks (e.g. denitrification) to the Bay nutrient budgets?

G.4. What nutrient loads can subembayments assimilate without impairment of beneficial uses?

G.5. What is the likelihood that the subembayments will be impaired by nutrient overenrichment/eutrophication in the future?

Relevant Management Questions and Science Questions in Suisun Bay

1. Basic Management Questions

1.1. Are current levels of NH4 impairing beneficial uses by preventing phytoplankton blooms, or inhibiting primary production, which in turn contributes to a food-limited ecosystem?

1.2. Are current levels of NH4 (or NH4:NO3 or NH4:DIN) impairing beneficial uses by causing shifts in phytoplankton community composition toward suboptimal assemblages for primary consumers of concern (e.g., copepods)?

1.3. Are current levels of NH4 (or NH4:NO3 or NH4:DIN or high [DIN]) impairing beneficial uses by favoring blooms of harmful algae and production of algal toxins, or nuisance algae?

1.4. Are current levels of NH4 impairing beneficial uses by exerting direct chronic toxic effects primary consumers of concern (e.g., copepods)?

1.5. Are current N:P (or NH4:P or NO3:P or high [NH4], [NO3], [DIP]) impairing beneficial uses by causing shifts in phytoplankton community composition toward suboptimal assemblages for primary consumers of concern (e.g., copepods)?

1.6. Are current values of N:P (or NH4:P or NO3:P or high [NH4], [NO3]) impairing beneficial uses by causing shifts in the composition of individual cells (i.e., changes in individual cell N:P) that exerts stress on primary consumers who (e.g., copepods)? (i.e., they must direct resources toward excreting excess N or it causes physiological stress that impairs individual copepod survival or reproductive success)

1.7 Are current N:P (or NH4:P or NO3:P or high [NH4] or high [NO3]) impairing beneficial uses by impacting the food web at the primary consumer level or higher by additional mechanisms that, for example, adversely effect size, individual survival, reproductive success, or food quality?

2. Management questions if a problem does exist…

2.1 What levels of NH4 (or values of NH4:NO3, NH4:DIN, N:P, [DIN], [DIP]), over what periods of time, induce beneficial use impairment due to 1.1-1.7?
or 2.1.a Recognizing that there is no bright line, what would be considered clearly a problem and what would be considered well within the range of good?

2.2 When (seasonal, tidal, diurnal) and where do NH4 levels (or values of NH4:NO3, NH4:DIN, N:P, [DIN], [DIP]), exceed values that lead to beneficial use impairment due to 1.1-1.7?

3. Questions that Will Shape Management or Regulatory Action

What reductions in loads are required to alleviate, minimize, or reduce impairment due to…

3.1 NH4 inhibition of primary production?

3.2 NH4-related shifts in phytoplankton community composition toward suboptimal assemblages?

3.3. NH4-related blooms of harmful algae and production of algal toxins, or nuisance algae?

3.4. direct chronic toxicity from NH4 on primary consumers of concern (e.g., copepods)?

3.5. N:P (or NH4:P or NO3:P) –related shifts in phytoplankton community composition toward suboptimal assemblages for primary consumers of concern (e.g., copepods)?

3.6. N:P (or NH4:P or NO3:P or elevated [NH4] or elevated [NO3]) –related shifts in the composition of individual cells (i.e., changes in individual cell N:P) that exert stress on primary consumers who (e.g., copepods)?

3.7 N:P (or NH4:P or NO3:P or elevated [NH4] or elevated [NO3]) –related direct impacts on the food web at the primary consumer level or higher?

4. General Science Questions that will inform management questions

4.1 What are the external major loads of NH4 (or NO3 or PO4)? How do they vary seasonally and how have they changed overtime?

4.2 What are the magnitudes of internal transformations/sinks/sources?

4.3 Considering the combination of 4.1 and 4.2, what loads can be sustained without impairing beneficial uses due to 1.1-1.7. In other words, what loads can be assimilated by Suisun Bay?

4.4 Given the multiple stressors in Suisun Bay, to what extent do nutrient-related impairments contribute to overall impairments, and what would be the benefit:cost of reducing nutrient loads from various sources?

5. Science Questions specific to inhibition of primary production

5.1 Does elevated [NH4] inhibit primary production rates, and, if so, what concentrations represent no/low impairment vs. medium or high impairment?

5.1.a How do natural assemblages respond in controlled experiments?

5.1.a.i. What are community-average V_{max} and k_s for NH4 and NO3? Does $V_{max,NO3}$ exceed $V_{max,NH4}$?

5.1.a.ii Across a range of typical ambient [NH4], does the combined uptake rate of DIN, $V_{DIN} = V_{NO3} + V_{NH4}$ vary systematically, such that V_{DIN} is low due to certain NH4 concentration ranges?

5.1.a.iii How do the above relationships vary as a function of light, temperature, or t=0 community composition?

5.1.b How do monocultures of typically-important phytoplankton species or taxa respond in controlled experiments?

5.1.b.i (same as for 5.1.a)

5.1.b.ii (same as for 5.1.a)

5.1.b.iii (same as for 5.1.a)

5.1.c Are primary production rates lower at elevated ambient [NH4] using natural assemblages in controlled experiments?

5.1.c.i Measured using C uptake rates (^{13}C, ^{14}C)

5.1.c.ii Measured using photosynthetic efficiency (e.g., phytoflash)

5.1.d Are primary production rates lower at elevated ambient [NH4] using monocultures in controlled experiments?

5.1.d.i Measured using C uptake rates (^{13}C, ^{14}C)

5.1.d.ii Measured using photosynthetic efficiency (e.g., phytoflash)

5.1.d.iii Do these relationships vary based on light?

5.1.e Are field observations consistent with NH4 inhibiting primary production? During periods when blooms would be generally be expected, does…

5.1.e.i low chl co-occur with high NH4 in space and time, and vice versa?

5.1.e.ii low DIN uptake rates co-occur with high NH4 in space and time, and vice versa?

5.1.e.iii low primary production rates co-occur with high NH4 in space and time, and vice versa, measured by ^{13}C or ^{14}C uptake?

5.1.e.iii low primary production rates co-occur with high NH4 in space and time, and vice versa, measured by photosynthetic efficiency (phytoflash)?

5.2 Do other substances contribute to lower primary production rates?

5.2a Do other substances in treated wastewater effluent inhibit N uptake and primary production, and what are the relative contributions of NH4 vs. non-NH4 inhibition?

5.2.a.i natural phytoplankton assemblages?

5.2.a.ii monocultures?

5.2.a.iii light-depdendence?

5.2b Are other substances known to impair phytoplankton growth detected in ambient water?

5.2.b.i at levels known to affect phytoplankton growth?

5.2.b.ii have studies been conducted in the literature that were performed using sensitive enough approaches, or is more work needed to determine NOELs?

5.2.c Does selective removal of contaminants from ambient water result in greater phytoplankton primary production rates?

5.2.c.i natural phytoplankton assemblage

- NH4 removal?
- organic contaminant removal?
- metals removal?

5.2.c.ii monocultures

- NH4 removal?
- organic contaminant removal?
- metals removal?

5.2.c.iii With either natural assemblages and monocultures, does one come to different conclusions about growth using different measurement techniques?

- change in chl-a
- ^{13}C or ^{14}C uptake
- photosynthetic efficiency

5.2.c.iv light-depdendence of any 5.2.c.i or 5.2.c.ii?

5.2.d Does spiking individual contaminants (or mixtures) at ambient concentrations result in decreases in phytoplankton primary production rates?

5.2.d.i natural phytoplankton assemblage

- NH4?
- organic contaminant removal?
- metals removal?

5.2.d.ii monocultures

- NH4?
- organic contaminants?
- metals?

5.2.d.iii With either natural assemblages or monocultures, what are the best combination of measurement techniques?
- change in chl-a
- ^{13}C or ^{14}C uptake
- photosynthetic efficiency

5.2.d.iv light-depdendence of any 5.d.c.i or 5.d.c.ii?

5.2.e Do other bioassay-type tests that can evaluate multiple specific toxicity endpoints (B. Escher et al.) identify toxicants to phytoplankton?
5.2.e.i in wastewater effluent?
5.2.e.ii in ambient water?
5.2.e.iii in specific chemical fractions that can lead to identification?

5.3 Is the mechanism of NH4 inhibition of primary production consistent with the scientific literature on factors regulating N uptake, N assimilation, and primary production? In other systems or in controlled experiments, does elevated NH4…
5.3.a inhibit the uptake of NO3?
5.3.b cause lower overall DIN uptake?
5.3.c cause lower rates of primary production?

5.4 Based on current understanding of NH4 inhibition of primary production, what is the ecosystem-scale importance of NH4 inhibition, in terms of limiting either the rate of primary production or the accumulation of biomass, relative to other factors?
5.4.a grazing by clams?
5.4.b light limitation
5.4.c flushing (high flow rate)
5.4.d how does the relative importance vary seasonally or interannually or under realistic scenarios (e.g., flows, clam abundance, changes in SPM)?

5.5 Are observations in South Bay consistent with the NH4 inhibition hypothesis?
5.4.a analysis/statistical analysis of existing data
5.4.b any of the experiments in 5.1-5.3

6. Science Questions specific to Phytoplankton Community Composition
to be completed

7. Science Questions specific to HABs and HAB toxins
to be completed

8. Science Questions specific to direct NH4 toxicity to copepods
to be completed

9. Science questions specific to nutrient loads and cycling
to be completed

Past, on-going, or future studies, and the management questions that they are addressing

	Status	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	3.1	3.2	3.3	3.4	3.5	3.6	3.7	4.1	4.2	4.3	4.4
RTC 1999-2004 (Wilkerson et al 2006; Dugdale et al, 2007)		■							■	■									■		
SWAMP/RTC 2010		■							■	■									■		
SWAMP/RTC 2011		■							■	■									■		
SWAMP/RTC 2012		■							■	■									■		
TIE – SFCWA/CCCSD		■							■												
Sacramento R. Surveys		■							■	■									■		
Parker et al. 2012 Suisun enclosures		■							■										■		
Parker et al. Effluent spiking growth experiments		■							■												
Glibert et al. SFCWA/DSP: N, P ratios and species/growth		■	■	■		■			■												
Parker et al. DSP/SFCWA: microcystis			■	■					■	■											
Phytoplankton "spiking" study		■							■												
POTW effluent characterization																		■			
Modeling – nutrients, phytoplankton		■							■	■	■	■	■	■	■	■	■	■	■	■	■
Loading estimates - RMP																		■			
Suisun Synthesis I		■							■	■								■	■		
Suisun Synthesis II			■						■	■								■	■		
Kudela et al. IEP 2013		■							■	■											
Dugdale et al. IEP 2013		■							■	■											
Senn et al IEP 2013																		■	■	■	
Glibert et al IEP 2013							■		■												
Cornwell and Glibert, SFCWA																			■		
CCCSD effluent plume modeling					■				■									■			
NH4 toxicity to copepods- Redo of Teh et al chronic toxicity					■				■												
NH4 toxicity to copepods – NH4 + Food					■				■												

Other tables under development…
- Which studies are addressing which science questions

Use this as a specific example to walk through…Antioch microcystis hot spot

BACWA EXECUTIVE BOARD ACTION REQUEST

AGENDA NO.: 14c
FILE NO.: N/A
MEETING DATE: January 3, 2013

TITLE: LWA Evaluation of Nutrient Watershed Permit Concept

☐ **MOTION** ☐ **RESOLUTION** ☒ **DISCUSSION**

RECOMMENDED ACTION

Review draft Comprehensive Evaluation of the Nutrient Watershed Permit Concept and provide feedback to Larry Walker Associates (LWA) and Executive Director to determine next steps.

SUMMARY

At the BACWA Technical Seminar on November 6, 2012, the Board listened to and discussed a presentation by LWA on a Nutrient Watershed Permit and other regulatory concepts. That presentation relied upon information contained in two documents prepared by LWA/HDR, titled:

- Evaluation of BACWA Nutrient Watershed Permit Concept – Evaluate Pros and Cons of Nutrient Watershed Permit and Alternatives
- Evaluation of BACWA Nutrient Watershed Permit Concept – Implementing the Best Apparent Alternative

Based on the November 6, 2012 discussion, BACWA presented the Nutrient Watershed Permit and other permit concepts to Regional Water Board staff on the following day (November 7, 2012), as a first brainstorming of ideas. As a result of that discussion, BACWA agreed to have a concept paper prepared that included a comprehensive evaluation of the pros and cons of the current permit-by-permit approach, a Nutrient Watershed Permit approach, and a TMDL-like approach.

Meetings were held with Regional Water Board staff, LWA, and BACWA's IED and RPM on December 11 and 12, 2012 to further discuss ideas for permitting options consistent with the Nutrient Management Strategy and develop a Nutrient Management Plan for the San Francisco Bay.

The attached draft memorandum provides a comprehensive evaluation of the regulatory options that emerged from the above discussions. These options are:

- Individual NPDES Permits (with MOU)
- Nutrient Watershed Permit (with MOU and Basin Plan Amendment)

The factors considered in the analysis include structure, timing, efficiencies to be achieved, permit contents, opportunities for pooling special study resources, commitments by regulated and regulatory agencies, protection from unachievable regulatory requirements, exit strategies, prospects for total or partial agency participation, approach for engaging BACWA Associate and Affiliate members, and ability to address common San Francisco Bay issues and sub-regional issues. Other questions and concerns that are addressed include equitable cost sharing, increased

costs, loss of local agency control, increased demand on staff resources, risk of pursuing the concept, uncertainty of USEPA/SWRCB approvals, detours caused by 3rd party intervention, and ability to change course.

Additional considerations are noted for the following overarching frameworks:

- TMDL-like Implementation Plan (with Basin Plan Amendment)
- MOU

The draft recommended approach is presented at the end of the attached memorandum along with a draft implementation plan drawn from the findings of the attached and prior referenced memorandums.

Tom Grovhoug will attend the January 3rd Board meeting, describe LWA analysis, and receive the Board's input and guidance prior to finalizing the memorandum.

FISCAL IMPACT

This is a discussion item and has no direct fiscal impact.

ALTERNATIVES

N/A

Attachments:

1. LWA Comprehensive Evaluation of the Nutrient Watershed Permit Concept
2. San Francisco Bay Nutrient Management Strategy (November, 2012)

Comprehensive Evaluation of the Nutrient Watershed Permit Concept [DRAFT]

Prepared by:

TR Grovhoug and Denise Conners, LWA

Executive Summary

This memorandum compares the advantages and disadvantages between multiple individual NPDES permits and a single Nutrient watershed NPDES permit as a means of implementing the November 2012 Nutrient Management Strategy for San Francisco Bay. It draws on this information, in addition to information previously documented by LWA and HDR, to provide a recommended a course of action which includes the development of the following:

- Memorandum of Understanding between BACWA, the Regional Water Board and potentially other parties (e.g. State Water Board and USEPA)
- Nutrient Watershed Permit for SF Bay
- Basin Plan amendment to formalize a Nutrient Management Plan for SF Bay (final decision on need to be determined)

This memorandum was prepared in response to questions raised at the November, 2012 BACWA Technical Seminar and was informed by meetings with the staff of the Regional Water Board held in December, 2012. The purpose of the memorandum is to provide sufficient information to allow BACWA and the Regional Water Board to reach adequate agreement to move forward with the development of a draft MOU and draft Nutrient watershed permit.

Introduction

A Nutrient Management Strategy has been developed for the San Francisco Bay by the Regional Water Board and the San Francisco Bay Numeric Nutrient Endpoint (NNE) science team (San Francisco Estuary Institute and Southern California Coastal Water Research Project). The Nutrient Management Strategy is a "living document" that is adapted to address findings from ongoing research and incorporate stakeholder input. The most recent version of the San Francisco Bay Nutrient Management Strategy was released in November 2012 (attached) and was discussed at a November 19, 2012 meeting of the stakeholder advisory group for the San Francisco Bay NNE process.

The purpose of this memorandum is to document BACWA's effort to consider regulatory options[1] for implementation of a Nutrient Management Plan. The Nutrient Management Plan[2] is expected to include POTW management measures informed by joint fact finding and outcome scenarios based on ecological responses and beneficial use protection.

Background

At the BACWA Technical Seminar on November 6, 2012, the Board listened to and discussed a presentation by LWA on a Nutrient Watershed Permit and other regulatory concepts. That presentation relied upon information contained in two documents prepared by LWA/HDR, titled:

- Evaluation of BACWA Nutrient Watershed Permit Concept – Evaluate Pros and Cons of Nutrient Watershed Permit and Alternatives
- Evaluation of BACWA Nutrient Watershed Permit Concept – Implementing the Best Apparent Alternative

Based on the November 6, 2012 discussion, BACWA presented the Nutrient Watershed Permit concept to Regional Water Board staff on the following day (November 7, 2012), as a first brainstorming of ideas. As a result of that discussion, BACWA agreed to have a concept paper prepared that included a comprehensive evaluation of the pros and cons of the current permit-by-permit approach, a Nutrient Watershed Permit approach, and a TMDL-like approach.

Meetings were held with Regional Water Board staff on December 11 and 12, 2012 to further discuss ideas for permitting options consistent with the Nutrient Management Strategy and develop a Nutrient Management Plan for theSan Francisco Bay.

This memorandum provides a comprehensive evaluation of the regulatory options that emerged from the above discussions. These options are:

- Individual NPDES Permits (with MOU)
- Nutrient Watershed Permit (with MOU and Basin Plan Amendment)

Advantages and disadvantages of the above regulatory options for the San Francisco Bay are described. The factors considered in the analysis include structure, timing, efficiencies to be achieved, permit contents, opportunities for pooling special study resources, commitments by regulated and regulatory agencies, protection from unachievable regulatory requirements, exit strategies, prospects for total or partial agency participation, approach for engaging BACWA Associate and Affiliate members, and ability to address common San Francisco Bay issues and

[1] Work Element 8 of the San Francisco Bay Nutrient Management Strategy (November 2012).
[2] Work Element 7 of the San Francisco Bay Nutrient Management Strategy (November 2012).

sub-regional issues. Other questions and concerns that are addressed include equitable cost sharing, increased costs, loss of local agency control, increased demand on staff resources, risk of pursuing the concept, uncertainty of USEPA/SWRCB approvals, detours caused by 3rd party intervention, and ability to change course.

Additional considerations are noted for the following overarching frameworks:

- TMDL-like Implementation Plan (with Basin Plan Amendment)
- MOU

The recommended approach is presented at the end of this memorandum. The implementation plan is drawn from the findings of this comprehensive evaluation, previous assessments completed by LWA/HDR, and input provided by Regional Water Board staff and BACWA Executive Board Members.

Individual NPDES Permits (with MOU)

Advantages and disadvantages of using the individual NPDES permit option to implement the San Francisco Bay Nutrient Management Strategy are:

Structure: PRO – The continued use of individual permits will be the easiest structure to implement in the short term. No changes in status quo would be required. Flexibility would exist to change the approach over time, from permit to permit. Individual permittees may be able to negotiate special conditions and requirements to address local or sub-regional issues. CON – The sequential nature of individual permit reissuances will make coordination on a Bay-wide or sub-regional basis difficult. Consideration of Bay-wide issues will be lacking without extra effort to develop and formalize an MOU. Potential changes to individual permits over time also may impact long term consistency of nutrient regulatory decisions and direction.

Timing: PRO - Timing (in terms of permit adoption) is fairly predictable, will be spaced out over at least a five year interval, will depend on individual reissuance schedules and available resources. CON – Sequential nature of reissuances will make coordination and consistency on common issues difficult.

Efficiencies: PRO – Use of the current approach will avoid possible inefficiencies of work efforts associated with implementing a different protocol for nutrients. CON – Permit-by-permit consideration will not be the most efficient method in the long term to implement a Bay-wide Nutrient Management Plan. It will be more difficult to maintain a consistent approach

Permit contents: PRO – Use of the existing permit template will govern the content of individual permits. CON – New content will need to be added to each permit to address common elements of a Bay-wide Nutrient Management Plan.

Opportunity to pool resources: PRO – Language could be included in individual permits to require participation in Bay-wide studies in support of a Nutrient Management Plan, consistent with the MOU. Additionally, CWC Section 13267 letters could be used to compel Bay-wide participation in specific study requests. CON – Extra effort between Regional Water Board permitting staff and Basin Planning staff would be needed to coordinate permit language in upcoming permits to avoid inconsistency with language in later permits. Over time, language in later permits will likely be different unless adherence to the agreement embodied in the MOU is strong.

Commitments by regulated/regulatory parties: PRO – Commitments under individual permits are clear and well understood. CON – Some permit requirements may offer little flexibility. Commitments to implement elements of the Nutrient Management Plan as a group will require extra effort to coordinate and document such intent as specified in the MOU.

Protection from unachievable requirements: PRO – Each individual permittee will be able to try to negotiate its permit to avoid such requirements. Timing of such requirements will apply at some time over a five year permit cycle, providing more or less time and /or flexibility for some permittees to react. CON – Individual permittees will have less ability to address Bay-wide regulatory issues (e.g., adoption of nutrient objectives which may lead to unachievable effluent limits). Application of requirements will impact some individual permittees much earlier than others.

Exit Strategies: PRO – Continued use of individual permits may avoid some commitments that will occur through participation in a watershed permit. The commitments associated with the Nutrient Management Plan and MOU will limit the ability to entirely "exit" from San Francisco Bay nutrient management activities. CON – The ability of individual permittees to "exit" or otherwise affect the Bay-wide nutrient management effort will likely be less than the aggregated influence of multiple cooperating permittees.

Agency participation: PRO – The individual permitting approach will allow each agency to make its own decisions. If agencies decide not to support the MOU, they would be under no obligation to implement elements of the Nutrient Management Plan. CON – The Regional Water Board has indicated its strong desire to move forward with nutrient management activities and has worked cooperatively with BACWA and others to develop the San Francico Bay Nutrient Management Strategy. The Regional Water Board has numerous tools at its disposal (e.g., CWC Section 13267 letters, permit provisions, best professional judgment, etc.) to encourage participation in Bay-wide initiatives. Therefore, the option by an agency to "not participate" may be more costly than the alternative.

BACWA member engagement: PRO – No special permitting outreach effort is needed in the short term. Special BACWA member engagement will be required to develop and reach agreement on the MOU and associated permit provisions. CON – BACWA member attention during permitting will not necessarily be focused on the nutrient issue. Extra effort may be required by BACWA over time to maintain communication with individual permittees on each permit.

Ability to address common Bay issues: PRO - The MOU and Nutrient Management Plan will provide opportunity to identify and address common nutrient issues. CON – Attention will be required to ensure that common issues are addressed in a consistent way in each permit. Ultimately, this will result in a greater demand on resources than would occur with a single watershed permit.

Ability to address sub-regional issues: PRO – Individual permits, by nature, will focus on local issues. This may include sub-regional nutrient management actions. CON – Individual permits

may not adequately address sub-regional nutrient management issues. Extra effort will likely be required ensure the adequate consideration of sub-regional actions.

Equitable cost sharing: PRO – Costs will be apportioned to each permittee as permits are renewed. Assignment of costs to a specific discharger will be less ambiguous. CON – Costs among POTWs may not be equitable, and no mechanism will exist to balance the cost burden.

Increased costs: PRO – Short term permitting costs will not be increased, apart from any agreements to implement portions of the Nutrient Management Plan under the MOU. CON – Permitting costs for POTWs and the Regional Water Board will likely be increased in the long term due to the inefficiency of implementing provisions of the Nutrient Management Plan in multiple permits.

Loss of local agency control: PRO – Individual permits ensure local control over permitting issues, within the boundaries of the typical regulatory framework. CON – An individual permitting approach may not maximize local interests, to the extent leverage associated with a group approach is not realized or applied. The MOU may partially offset this potential lost opportunity.

Demand on Regional Water Board staff resources: PRO – The demand on NPDES staff resources will be as usual, with the exception of extra efforts to coordinate with Basin Planning staff to incorporate Nutrient Management Plan elements into individual permits. CON - If permit appeal issues arise on multiple permits, NPDES staff resource requirements will increase dramatically.

Risks: PRO – The short term risks will be relatively low. Exceptions may occur if pressure is brought to issue permits with stringent effluent limits prior to completion of appropriate studies under the San Francisco Bay Nutrient Management Strategy. An MOU may help reduce short term risks. CON – The argest long term risk is inclusion of unachievable effluent limits derived from stringent numeric nutrient objectives. An MOU may reduce the impact, but cannot eliminate this risk.

USEPA/SWRCB approvals: PRO – USEPA and SWRCB will support the individual permit approach, but may not support or be constrained by the MOU or Nutrient Management Plan. CON – When numeric objectives are adopted, USEPA and SWRCB will require effluent limit derivation from the objectives, without regards to achievability or MOU agreements.

Third party intervention: PRO – Third party intervention will only occur as each permit is issued. It would be more difficult for a third party to influence Bay-wide permitting decisions through permit appeals. CON – Individual permittees would be compelled to address third party issues in a piece meal fashion.

Flexibility to change course: PRO – On an individual permit basis, flexibility to change course will exist. CON – On an aggregate basis, it will not be possible to implement changes over time through individual permit actions. On a limited basis, aggregate changes may be possible with a Bay-wide permit order or through issuance of CWC Section 13267 letters.

Watershed Permit (with MOU and Basin Plan Amendment)

Advantages and disadvantages of using a Nutrient Watershed Permit option to implement the San Francisco Bay Nutrient Management Strategy for are:

Structure: PRO – The watershed permit structure lends itself to Bay-wide coordination on nutrient management issues of common interest. A watershed permit would provide inherent resource and communication efficiencies over the individual permitting approach during the long term. CON – The structure is a change from current practice and will require resources to develop and implement. The structure focuses all nutrient regulatory issues in a single permit, which forces uniformity and consistency. A watershed permit will prevent individual permittees from negotiating special conditions and requirements to address local or sub-regional issues.

Timing: PRO - A watershed permit could be developed and implemented within one year. It is projected that a watershed permit, together with an MOU and possibly a formal Basin Plan amendment, will allow the most efficient implementation of the Nutrient Management Plan. CON – Individual permits that have already been renewed or will be renewed during the period of transition to a nutrient watershed permit must be prepared with the future watershed permit in mind. This will require extra initial effort and resources to develop the watershed permit elements and provisions. Provisions must also be made to account for requirements adopted during the transition period so that proper credit can be granted to those early permittees.

Efficiencies: PRO – The watershed permit option would be the most efficient regulatory framework to implement a unified approach to nutrient management in the San Francisco Bay. CON – Implementation will require some short term inefficiencies as a trade for long term efficiency.

Permit contents: PRO – A watershed permit can include the essential requirements and provisions needed to implement the Nutrient Management Plan. A watershed permit can effectively address nutrient issues of common interest and sub-regional issues as necessary. CON – The specific contents of the watershed permit must be developed and negotiated. Therefore, some uncertainty exists regarding the specific requirements and provisions of the permit.

Opportunity to pool resources: PRO – A watershed permit offers an efficient way to pool resources and policy development efforts for nutrient management. CON – The specific terms and pooling arrangements are yet to be developed, giving rise to uncertainty and concern among prospective permittees.

Commitments by regulated/regulatory parties: PRO – Adoption and implementation of a nutrient watershed permit would represent a strong commitment to the Nutrient Management Plan by both the regulated and regulatory parties. A watershed permit would provide a focus for discussion about the specific commitments by all parties. CON – Perceived lack of flexibility during five-year permit term for all POTWs.

Protection from unachievable requirements: PRO – The Nutrient Management Plan will provide a path to effective and appropriate management measures and regulatory requirements. A watershed permit can provide an effective regulatory construct for successful implementation of the Nutrient Management Plan. CON – A number of uncertainties and challenges exist in creating protection from unachievable regulatory requirements for nutrients. A watershed permit supported by an overarching MOU and Basin Plan Amendment create an opportunity to achieve this goal, but do not guarantee success.

Exit Strategies: PRO – Cooperation under a watershed permit creates negotiating leverage that could be applied to influence nutrient management issues in a watershed permit. CON – A watershed permit and either MOU or Basin Plan Amendment represent a significant commitment to implementing the Nutrient Management Plan. It is not likely that either individual agencies or the collective POTW groups could entirely "exit" a watershed permit, once adopted and implemented.

Agency participation: PRO – The watershed permit provides an easy option for agency participation. CON – The watershed permit "sets the bar" and creates strong momentum for all POTWs in the Bay Area to be covered by the permit. Regional Water Board staff has indicated no interest in allowing agencies to "opt-out" of a watershed permit.

BACWA member engagement: PRO – A watershed permit would both require and result in significant BACWA member engagement. CON – Extra effort, resources and outreach will be required to provide information and advice to garner support for a nutrient watershed permit by BACWA members.

Ability to address common Bay issues: PRO – A watershed permit provides an efficient framework for addressing issues of common interest. It would allow common issues contained in the San Francisco Bay Nutrient Management Strategy to be addressed in a consistent manner. CON – Effort will be required to identify and adequately address common issues

within the watershed permit,MOU, and Basin Plan Amendment.

Ability to address sub-regional issues: PRO – A watershed permit can accommodate sub-regional issues through specific sections and provisions of the permit. CON – Effort will be required to identify and document sub-regional issues and to develop permit,MOU, or Basin Plan Amendment language to address these issues within the context of a watershed permit.

Equitable cost sharing: PRO – A watershed permit consolidates requirements into a single permit document, which facilitates efforts to share costs equitably. CON - Cost sharing arrangements need to be developed separately from the watershed permit. Effort will be required initially to identify and establish the cost sharing parameters and to capture those in a separate BACWA document.

Increased costs: PRO – A watershed permit is projected to be part of a regulatory framework that will reduce permitting costs in the long term. The Nutrient Management Plan has the potential to save significant capital and operating costs for Bay Area POTWs. CON – Initial costs to develop and implement a watershed permit and MOU will be significant. Commitments to fund joint fact finding studies and modeling tool development to support the Nutrient Management Strategy will be significant.

Loss of local agency control: PRO – The joint cooperative approach by multiple permittees on a watershed permit will create negotiating leverage that will at least partially offset a loss of local agency control. CON – A watershed permit will diminish local agency control over the nutrient provisions of its individual NPDES permit.

Demand on Regional Water Board staff resources: PRO – Big picture, long term projections indicate that a watershed permit and MOU will result in a lower demand on staff resources than other regulatory options and approaches. CON - Initial resource demands to develop and implement a watershed permit, MOU, Basin Plan Amendment, and cost sharing approach will be significant.

Risks: PRO – Implementation of the Nutrient Management Plan through a watershed permit, MOU, and Basin Plan Amendment reduces the long term risk of inappropriate management decisions and regulatory conflict. CON – Risks and uncertainties exist for a watershed permit approach that is yet to be defined and approved. However, the risks of business-as-usual permitting are believed to outweigh the risks associated with a new nutrient watershed permit.

USEPA/SWRCB approvals: PRO - USEPA and SWRCB have approved the use of watershed permits in the Bay Area previously. The potential exists to have USEPA and SWRCB to join in an MOU or at least to support the elements of an MOU to implement the Nutrient Management Plan. CON – Effort will be needed to outreach to USEPA and SWRCB to gain support for the

Nutrient Management Plan and the associated regulatory approach.

Third party intervention: PRO – The merging of nutrient issues into a single watershed permit will consolidate third party intervention, if it occurs. This will allow a more effective use of resources in dealing with third party issues. CON – Third parties only concerned with a sub-region of the Bay may be compelled to challenge the watershed permit, potentially impacting regulatory decisions and activities in other areas of the Bay.

Flexibility to change course: PRO – The increased leverage of a coordinated and consolidated permitting effort will likely provide greater potential to shape the course of the nutrient management plan and associated regulatory requirements. CON – Once adopted, it would be very difficult to change course away from a watershed permit or the commitments made in an associated MOU or Basin Plan Amendment.

Considerations for a TMDL-like Implementation Plan (with Basin Plan Amendment)

Another regulatory option that has been identified is to develop a TMDL-like implementation plan to formalize the Nutrient Management Strategy. This option is called "TMDL-like" because it is not, in fact, a TMDL. TMDLs are prepared as plans to attain water quality objectives where a determination has been made that those objectives are not achieved. For San Francisco Bay, the determination has not been made that nutrient objectives are not achieved (i.e., that the Bay is impaired due to nutrients). The goal of the San Francisco Bay Nutrient Management Strategy is to prevent such impairment from occurring in the future.

To clarify, this option is not an alternative to either of the NPDES permitting options described previously. It would instead represent a means to memorialize the overarching approach that the permitting options are implementing and to accrue some of the regulatory benefits associated with an approved TMDL. As such, the decision to develop and adopt a TMDL-like implementation as a Basin Plan Amendment is discretionary and will depend on the consideration of various factors. The decision to move forward with this option should only be made after considering the following:

Content: The content of the Basin Plan Amendment as a water quality-based management strategy should be described in a detailed outline. This is necessary to provide clarity for discussions of this option with BACWA members, Regional Water Board staff, and other parties.

Benefits: The argument for a Basin Plan Amendment to formalize a TMDL-like plan is that it will provide an increased level of certainty that the Nutrient Management Plan and associated NPDES permits will be implemented in accordance with the original vision. Since a Basin Plan

Amendment involves review and approval by the SWRCB and at least a partial review and approval by USEPA, the amendment would formalize the acceptance of the overarching approach by those two key agencies. It has been pointed out that Basin Plan language does not provide absolute security from action by either the SWRCB or USEPA (e.g., SWRCB own motion review of the EBMUD wet weather facilities and management plan). As such, this issue should be fully vetted.

Another argument for a TMDL-like plan is that it could provide greater influence over NPDES permitting decisions and timing, to the degree that it is formally recognized as a TMDL equivalent by USEPA. The Basin Plan Amendment would provide the opportunity for formal adoption of the Nutrient Management Plan.

The above benefits need to be given greater scrutiny to ensure that the effort to develop and adopt a Basin Plan Amendment is worthwhile.

Costs: Basin Plan Amendments typically take two to five years to develop and to get through the approval process. The monetary and Regional Water Board staff resource cost for this effort is significant. Estimates of staff resources to complete the Basin Plan Amendment should be prepared and plans for funding the effort should be developed.

Timing: Since the Basin Plan Amendment process takes up to three years to complete, the decision process regarding a Basin Plan Amendment should occur in the near term. Key parties to this process should be BACWA and Regional Water Board management. A decision whether to move forward with a Basin Plan Amendment does not directly impact efforts to develop and implement an MOU and associated NPDES permitting actions. The decision may have an indirect impact to the extent a Basin Plan Amendment is seen as imperative to the overall effort by one or more parties.

Risks: Given the magnitude and formality of the Basin Planning process, it involves various risks and uncertainties. These risks include (a) Regional Board/USEPA/SWRCB demand for modifications that would alter the original intent of the plan, (b) third party Intervention (public comment, appeals, legal action) that would disrupt and add costs and time to the process, (c) inability to “exit” or modify the process, once started, and (d) unintentional encouragement of early adoption of NNEs as water quality objectives. These risks, and others, should be considered as part of the decision process.

Considerations for an MOU

Several important considerations exist regarding the concept of developing and executing an MOU to provide a written commitment to the overall nutrient management/regulatory process.

- BACWA has advocated development of an MOU with the Regional Water Board (and potentially with other parties) to provide some level of connection between the Nutrient Management Strategy and the NPDES permitting process. It is understood that an MOU can only provide a certain level of security, but the MOU is favored over singular reliance on a watershed permit to capture the overarching framework of agreement regarding the long term nutrient management planning effort.
- Regional Water Board staff has expressed concern that the development of an MOU may be unnecessary and would take resources and time away from the development of a watershed permit. An alternative would be to develop a straw proposal, discuss details of the proposal during watershed permit negotiations, use the public review process to discuss benefits, and memorialize the plan in the watershed permit fact sheet.
- Regional Water Board staff also raised the question of whether the details of a watershed permit would be needed before executing an MOU. This brings into question the timing of the effort for an MOU versus the watershed permit, if that option is selected. An MOU could be developed in parallel with a nutrient watershed permit.
- Regional Water Board staff indicated that an MOU could be acceptable if it is simple and just outlines the framework and goals of the nutrient management strategy and planning effort. The agreement would then be used as a guide for development of a watershed permit and for implementation of the management plan. An MOU is also seen as valuable in garnering the support of BACWA members. Regional Water Board staff also sees advantages to including governance principles in the MOU.
- It is recognized that it will be easier to develop an MOU if just BACWA principals and Regional Water Board management have to sign the agreement. It is also recognized that there are advantages to having other BACWA members, SWRCB and USEPA as signatories to the MOU. To explore this possibility, State Water Board and USEPA should be included in preliminary MOU discussions in order to identify any opportunities/problems/concerns early.

Recommended Approach

A Nutrient Watershed Permit supported by an MOU (and potentially by a TMDL-Like Basin Plan Amendment) is the recommended regulatory option. Details on how the approach may be implemented are presented in the following paragraphs based on previous assessments completed by LWA/HDR and input received from BACWA Executive Board Members, Regional Water Board NPDES Wastewater Division staff, and Regional Water Board Watershed Management Division staff.

Outreach to Regulators and BACWA Members

A next step in the process is expanded outreach regarding the recommended approach. Regional Water Board staff has been involved in early discussions and planning activities. They support the recommended approach and have provided feedback regarding watershed permit conditions with BACWA representatives. Discussions with Regional Water Board staff should continue.

The BACWA Annual Member Meeting (scheduled for January 24, 2013) will be the first public opportunity to introduce the concept of a Nutrient Watershed Permit to BACWA Associate and Affiliate Members. Most BACWA members are aware of the San Francisco Bay NNE effort and the regulatory push for nutrient management, but don't understand how these activities could impact NPDES permit requirements or capital planning efforts. The planned Annual Member Meeting presentations will lay the foundation for BACWA members' understanding and an impetus for early actions, as outlined below.

- Overview of Nutrient Issues (Amanda Roa, DDSD) – Discuss Suisun Bay studies, CCCSD NPDES permit requirements, San Francisco Bay NNE status/stakeholder process, and implications of SRCSD NPDES permit requirements.
- SWRCB Priorities (SWRCB member) – Discuss nutrients along with other regulatory priorities.
- Regional Water Board Priorities (Bruce Wolfe) – Discuss nutrients along with other regulatory priorities.
- Regulatory Alternatives (Tom Grovhoug) – Present Nutrient Watershed Permit concept with MOU/Basin Plan Amendment and compare it to the current permit-by-permit approach. Explain the benefits of a proactive effort.

Outreach to BACWA members should continue on a regular basis after the BACWA Executive Board and the Regional Water Board reach agreement on a preferred regulatory approach. Thorough and timely explanations of selected actions will help garner member support and involvement. Communication should include e-mail notices to members as milestones are reached, invitations to public meetings or workshops, requests for feedback on proposed permit provisions, and discussions at the BACWA Permits Committee meetings.

It is recommended that BACWA and Regional Water Board staff develop a joint strategy for engaging and keeping the USEPA and State Water Board apprised of how the MOU, Nutrient Watershed Permit, Nutrient Management Plan, and Basin Plan Amendment (if pursued) are progressing. While the State

Water Board and EPA don't have to be signatories on an MOU developed between BAWCA and the Regional Water Board, obtaining and documenting their conceptual buy-in on the overall approach is essential.

Memorandum of Understanding (MOU)

The MOU should outline the framework for a 20-year planning period, defining goals and good faith commitments to implement a process to manage nutrients in San Francisco Bay by BACWA and its member agencies, the Regional Water Board, and potentially other parties. The framework is expected to include Nutrient Management Plan development, commitments to undertaking and funding joint fact finding studies, basic provisions and approach for a Nutrient Watershed Permit, and adoption of a Basin Plan Amendment (if deemed beneficial). The MOU should also define governance roles, within the boundaries of the California Water Code. As stated previously, while the State Water Board and the USEPA don't necessarily have to sign the agreement, it should be explored as a means to document their support for the approach.

Nutrient Watershed Permit

The Nutrient Watershed Permit approach may be implemented in phases over 3 to 4 permit terms. For example, permit conditions during the first 5-year term could be utilized to initiate joint fact finding and modeling tool development, while permit conditions during the second 5-year term could be used to begin the evaluation of control measure scenarios and effectiveness. Permit conditions during the third and fourth terms could be used to prescribe and implement management activities, as needed.

The initial Nutrient Watershed Permit would assist in implementation of the San Francisco Bay Nutrient Management Strategy, with consideration for provisions adopted in the Central Contra Costa Sanitary District 2012 NPDES permit and the data collection effort required by the March, 2012 CWC Section 13267 letter issued by the Regional Water Board. With BACWA membership support, the first Nutrient Watershed Permit could be developed and adopted in 9 to 12 months. Permit requirements during the first 5-year term are expected to include a cap on nutrient loadings at current performance, evaluation of feasible treatment technologies (building off work performed to date by HDR for BACWA and by individual agencies), and participation in studies described in the San Francisco Bay Nutrient Management Strategy.[3] Nutrient load reductions would not be expected during the first permit term, but credit may be acknowledged and granted to agencies that implement management practices early. The initial watershed permit will establish a framework for the entire San Francisco Bay. If controversies arise during permit issuance, specific sub-regional requirements may be required. It is expected that clearly defined permit reopener provisions will be needed in the event that special study results point towards problems that should be addressed immediately by POTWs. The Nutrient Watershed Permit provisions and approach will have to be consistent with NNE efforts, but may only cover POTWs at the outset. According to current Regional Water Board policies, any schedules established in the Nutrient Watershed Permit will only be changed if the permit is reopened and amended.

[3] Work Elements 2 and 3 of the San Francisco Bay Nutrient Management Strategy (November 2012).

Initial Watershed Permit Requirements (first 5 years):

(1) Evaluate feasible technologies or actions to reduce effluent nutrient loadings – Applicable technologies/actions may include side-stream treatment, upgrading treatment technologies, optimizing existing treatment processes, operating existing treatment processes in a different manner.

A credit banking system may be developed and implemented to account for early activities undertaken by POTWs. Agencies that implement feasible technologies or optimize existing processes would report on activities undertaken. The credit system should account for such actions and create incentives to promote proactive load reduction activities.

(2) Compliance with existing un-ionized ammonia objective – It is expected that current WQBELs for total ammonia will be implemented in the initial Nutrient Watershed Permit.

(3) Compliance with existing narrative objectives for biostimulatory substances – Compliance may be demonstrated by supporting efforts identified in the San Francisco Bay Nutrient Management Strategy, evaluating management actions, and capping existing performance. Data generated as a result of the March 2, 2012 CWC Section 13267 letter should be used to establish current baseline conditions.

(4) Participate in special studies identified in the San Francisco Bay Nutrient Management Strategy – A requirement to support projects identified in the San Francisco Bay Nutrient Management Strategy and necessary to the development of the Nutrient Management Plan should be anticipated.

(5) Compliance with total mass loading limits - Established as either Bay-wide or sub-regional aggregate limits.

Nutrient Management Plan and TMDL-Like Basin Plan Amendment

It is recommended that a Nutrient Management Plan be developed by BACWA, the Regional Water Board, and SFEI during the first term of the Nutrient Watershed Permit. The Nutrient Management Plan should address the overall approach to joint fact finding, modeling tool development and utilization, control measure scenario evaluation, and development of nutrient management objectives. The Nutrient Management Plan should also define the process of evaluating compliance with the existing narrative objectives for biostimulatory substances. Consideration should be given to formalizing this plan as an implementation section in Chapter 4 of the Basin Plan and structured to meet federal TMDL requirements, to the extent possible. The plan could be, in essence, a "prevention-based" TMDL. An advantage to a Nutrient Management Plan approved as a TMDL is that it could supersede other approaches to the establishment of water quality based effluent limitations. If a Basin Plan Amendment is structured as a prevention-based TMDL, the action could provide regulatory certainty for up to 20 years (a reasonable planning horizon) and memorialize the phased approach embodied in the Nutrient Management Plan. A decision process should be commenced to determine whether the development of a TMDL-like Basin Plan Amendment is advantageous to the overall process and should move forward.

November 2012

San Francisco Bay Nutrient Management Strategy

San Francisco Bay Regional Water Quality Control Board

This document was prepared collaboratively by the San Francisco Bay Regional Water Quality Control Board, the San Francisco Estuary Institute and the Southern California Coastal Water Research Project with input from stakeholders, and funding support from the State Water Board and the Bay Area Clean Water Agencies (BACWA)

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Nutrient Management Strategy for San Francisco Bay

1. Purpose of the Nutrient Strategy

This document presents a draft strategy for developing the science needed to make informed decisions about assessing nutrient impacts on water quality, protecting beneficial uses, and managing nutrient loads to San Francisco Bay. The document first provides relevant background, after which management decisions related to nutrients are highlighted. The document then lays out a plan, developed collaboratively by the San Francisco Regional Water Quality Control Board (Water Board) and Bay stakeholders, for the technical studies required to support decisions regarding nutrient management.

2. Background

San Francisco Bay has long been recognized as a nutrient-enriched estuary. Nonetheless, dissolved oxygen concentrations found in the Bay's subtidal habitats are much higher and phytoplankton biomass and productivity are substantially lower than would be expected in an estuary with such high nutrient enrichment, implying that eutrophication is controlled by processes other than straightforward nutrient-limitation of primary production. The published literature suggests that phytoplankton growth and accumulation are largely controlled by a combination of factors, including strong tidal mixing, light limitation due to high turbidity, and grazing pressure by clams (Cloern et al. 2012)

There is a growing body of evidence that suggests the historic resilience of San Francisco Bay to the harmful effects of nutrient enrichment is weakening. Since the late 1990's, regions of the Bay have experienced significant increases in phytoplankton biomass (30- 105% from Suisun to South Bay) and significant declines in DO concentrations (2% and 4% in Suisun Bay and South Bay, respectively; J. Cloern, unpublished data). In addition, an unprecedented autumn phytoplankton bloom in October of 1999, and increased frequency of cyanobacteria and dinoflagellate (2004 red tide event) blooms occurring in the North Bay, further signal changes in the Estuary.

The indications of decreased Bay resilience have come to the fore at a time when the availability of resources to continue assessing the Bay's condition is uncertain. Since 1969, a USGS research program has supported water-quality sampling in the San Francisco Bay. This USGS program collects monthly samples between the South Bay and the lower Sacramento River to measure salinity, temperature, turbidity, suspended sediments, nutrients, dissolved oxygen and chlorophyll a. The USGS data, along with sampling conducted by the Interagency Ecological Program, provide coverage for the entire San Francisco Bay –Delta system. The San Francisco Bay Regional Monitoring Program (RMP) has no independent nutrient-related monitoring program, but instead contributes approximately 20% of the USGS data collection cost. Thus, there is currently an urgent need to lay the groundwork for a locally-supported, long-term monitoring program to provide information that is most needed to support nutrient-related management decisions in the Bay.

The timing also coincides with a major state-wide initiative, led by the California State Water Resources Control Board (State Board), for developing nutrient water quality objectives for the State's surface waters, using an approach known as the Nutrient Numeric Endpoint (NNE)

framework. The NNE establishes a suite of numeric endpoints based on the ecological response of a waterbody to nutrient over-enrichment and eutrophication (e.g. excessive algal blooms, decreased dissolved oxygen). In addition to numeric endpoints for response indicators, the NNE framework must include models that link the response indicators to nutrient loads and other management controls. The NNE framework is intended to serve as numeric guidance to translate narrative water quality objectives.

Since San Francisco Bay is the State's largest estuary, and one for which there is currently a relative wealth of data, it became a primary focus of a state-wide effort to develop NNEs for estuaries. This San Francisco Bay effort was initiated by a literature review and data gaps analysis to recommend indicators to assess eutrophication and other adverse effects of anthropogenic nutrient loading in San Francisco Bay and summarize existing literature in the Bay using these indicators and identify data gaps (McKee et al., 2011). The review made five major recommendations: 1) develop an NNE assessment framework for the Bay, 2) quantify external nutrients loads, 3) develop a suite of models that link NNE response indicators to nutrient loads and other co-factors, 4) implement a monitoring program, and 5) coordinate development of the Bay NNE workplan with nutrient management activities in Sacramento and San Joaquin Delta. The San Francisco Bay Water Board is the State lead for the current effort to develop San Francisco Bay nutrient water quality objectives.

At an RMP-sponsored workshop on nutrient management in the Bay (June 29-30, 2011), participants engaged in monitoring activities in the Bay-Delta were convened on day two to discuss elements of a monitoring strategy. They agreed that developing a NNE assessment framework and funding of a monitoring program were priorities, but that these efforts must begin with spatially–explicit conceptual models of the linkages between nutrient loads, ecological response indicators and Bay beneficial uses.

Another issue that has come to the attention of the Water Board and local stakeholders is that of the potential impact of ammonia/ammonium on Bay beneficial uses. While the USGS has documented a loss of resiliency throughout San Francisco Bay, productivity in Suisun Bay continues to be lower than the South Bay. Recent studies argue that elevated levels of ammonium limit primary productivity in Suisun Bay (Dugdale et al., 2007, 2012; Parker et al., 2012a), and perhaps elsewhere in the Estuary (Parker et al., 2012b). There is currently disagreement within the scientific community about the potential role ammonium plays in limiting primary productivity. To help resolve the issue, the Water Board supported studies in Suisun Bay in 2010 that explored the relationship between ammonium concentrations, nitrogen uptake, and phytoplankton biomass; in the spring of 2011 the Water Board initiated a two-year follow-up study. Additional follow-up studies that are currently underway or planned include toxicity tests and TIE method development to identify the cause of inhibition of diatom growth in Suisun, studies to evaluate copepod toxicity due to ammonium, spiking studies, investigations into the potential influence of nutrient ratios on system response, and the importance of nutrient fluxes from sediments. These data and information from additional studies being conducted in the Delta should be reviewed, synthesized and a process should be developed to resolve these outstanding questions and concerns about ammonium.

In addition, given that several factors (light-limitation/turbidity; grazing pressure by clams; tidal mixing) contribute to maintaining phytoplankton biomass at relatively low levels in this

otherwise nutrient-rich estuary, improved understanding is needed with regards to the relative importance of these factors, including temporal and spatial considerations, and regarding susceptibility to future changes in the level of control they exert (e.g., decreases in suspended sediment loads).

Considering the compelling evidence of changing conditions in San Francisco Bay, uncertainty about future monitoring programs, and new nutrient policies on the horizon, there is a strong need for a coherent nutrient science and management strategy for the Bay. Section 3 identifies upcoming management decisions related to nutrient overenrichment and eutrophication. Section 4 lays out the goals of the nutrient strategy and a plan, developed collaboratively by the Water Board and Bay stakeholders, for the technical studies required to support decisions regarding nutrient management. The current version of the strategy focuses on priority work elements within a five-year planning horizon, with the recognition that this work will extend beyond that time period and will build upon these foundational early efforts. Some commitments have already been made by various groups to fund or undertake priority tasks. These efforts will be tracked as part of the program management work element of this strategy.

There is considerable ongoing research on the role of nutrients in a changing San Francisco Bay ecosystem. Given that this is the case, this nutrient science and management strategy will likely require modification as new information becomes available. While the strategy has a five-year planning horizon, it will remain flexible and adapt to new information.

3. Key Nutrient Management Decisions and Questions

Several key management decisions and questions provide the context for the San Francisco Bay nutrient management strategy. The primary anticipated management decisions include:

1) Establishing Bay nutrient objectives
2) Evaluating the need for revised objectives for dissolved oxygen (in sub-habitats) and ammonium/ammonia
3) Developing and implementing a nutrient monitoring program
4) 303(d) listing decisions for the adverse effects of nutrients – whether impairment exists currently or is forecast in the future
5) Specifying nutrient limits in NPDES permits (e.g. municipal and industrial wastewater and municipal stormwater permits) as well as determining additional data collection needs
6) Determining whether management actions are necessary to prevent or address nutrient enrichment impacts and if so, the schedule, and nature for municipal wastewater treatment plant upgrades and stormwater treatment

Nutrient management issues may be influenced by, or can influence to some degree, decisions on other issues, such as the regulation of freshwater flow from the Delta, a regional sediment management strategy, recycling of wastewater, management of nutrient loading to the Delta, wetland restoration, and the development of nutrient TMDLs, e.g., Suisun Marsh, Sonoma Creek and Napa River.

These upcoming decisions are the foundation for five key management questions that, in turn, drive the elements of the nutrient strategy, and correspond to the recommendations laid out in

a recent literature review and data gap analysis that was conducted as an early step in the NNE process (Table 1 below; McKee et al., 2011).

Table 1. Summary of management questions developed with input from the Nutrient Workgroup, and corresponding recommendations from the San Francisco Bay NNE literature review (McKee et al. 2011).

Type	Management Question	Recommendation From McKee et al. 2011 Review
Status and trends	Is there a problem or are there signs of a problem? Are trends spatially the same or different in San Francisco Bay? a. Is eutrophication currently, or trending towards, adversely affecting beneficial uses of the Bay? b. Are beneficial uses in segments of San Francisco Bay impaired by any form of nutrients (e.g. ammonium)? c. Are trends spatially the same or different in San Francisco Bay?	Implement a monitoring program to support regular assessments of nutrient support for the Bay beneficial uses. Coordinate with Delta nutrient monitoring and management.
Objectives	What are appropriate guidelines for identifying a nutrient-related problem?	Establish a nutrient assessment framework for the Bay
Sources and Pathways	Which nutrient sources, pathways, and cycling processes are most important to understand and quantify? (Get the loads right!) a. What is the relative contribution of each loading pathway (municipal wastewater, Delta inputs, NPS, etc.)? b. What are contributions of internal sources (e.g. benthic fluxes) from sediments and sinks (e.g. denitrification) to the Bay nutrient budgets?	Quantify external sources of nutrients to the Bay and develop a spatially-explicit budget of the Bay.
Fore-casting	What nutrient loads can the Bay assimilate without impairment of beneficial uses?	Develop load-response models
	What is the likelihood that the Bay will be impaired by nutrient overenrichment/eutrophication in the future?	

4. Nutrient Strategy Goals and Work Elements

Generating the scientific understanding needed to fully support all of the management decisions and questions will likely take a decade or more, and will require a significant investment of resources. Therefore, it is imperative that a well-reasoned and cost-effective nutrient strategy be adopted that identifies logical first steps, leverages existing resources, requires development of a funding plan and incorporates elements of adaptive management.

With this philosophy in mind, the five-year strategy has six principal goals:

1. Define the problem (develop conceptual models, synthesize and interpret the available data)
2. Establish guidelines (water quality objectives; i.e., assessment framework) for eutrophication and other adverse effects of nutrient overenrichment, including ammonium;
3. Implement a monitoring program that supports regular assessments of the Bay;
4. Develop and utilize nutrient-load response models to support nutrient management decisions;
5. Evaluate control strategies to reduce nutrient inputs from wastewater treatment plants and other sources; and
6. Consider alternative regulatory scenarios for how to move forward with nutrient management in SF Bay.

Work elements and a list of major tasks associated with each goal are detailed in the sections below. The phasing and timeframe of these work elements and major tasks is provided in Table 2.

WORK ELEMENT 1. NUTRIENT PROGRAM ADMINISTRATION

The SFB Nutrient Management Strategy is being developed and implemented through a collaborative process between the Water Board and multiple partners and stakeholders.Generating the scientific understanding needed to fully support all of the management decisions and questions will likely take time and significant resources, and will involve complex decisions. This work element lays out the basic components of the program for implementing the Nutrient Strategy.

Task 1.1 Develop Governance Structure

A straightforward and transparent governance and decision-making structure for funding and implementing the Nutrient Strategy is needed to

- maximize the effectiveness of stakeholder input;
- identify and allocate limited resources toward research, monitoring, and modeling that will most effectively inform management decisions;
- determine when it is appropriate to carry out external scientific review of approaches that are developed within key work elements (e.g., assessment framework, monitoring, modeling), and major work products, including scientific studies, and what the process for these reviews will be.

Task 1.2 Develop Funding Plan

While this document focuses in detail on activities that should be completed during the next 5 years, implementation of the Nutrient Strategy work elements will likely be a carried out over a substantially longer period. The cumulative costs of sustaining the nutrient-related research, monitoring, and modeling are anticipated to be high. SFB is an ecosystem of regional, state-wide, and national significance, and a valued resource for both the public and private sectors. As such, a funding plan will be developed that casts a wide net, targeting resources from the

discharger community, federal science agencies (e.g., NSF, NOAA), state funding, and foundations, as well as developing partnerships with other SFB science and monitoring programs, and partnerships with regional university and research institutes. This task involves developing initial costs estimates of the work, developing a funding plan, and on-going fundraising.

Task 1.3 Nutrient Program Management

This task involves managing the Nutrient Strategy implementation. Activities will include scientific oversight, stakeholder engagement, coordinating SAG meetings, coordinating external scientific review, information dissemination, fundraising, and overall program management (e.g., overseeing projects, project and contract management).

WORK ELEMENT 2. DEFINE THE PROBLEM

Task 2.1 Develop Conceptual Models of Ecosystem Response to Nutrient Loads

The goal of this task is to develop conceptual models for SFB that characterize important processes linking nutrient and organic matter loading, biological responses, and indicators of adverse effects of nutrient over-enrichment.

The approach to nutrient objectives proposed for San Francisco Bay involves: 1) the use of response indicators to diagnose adverse effects from nutrient overenrichment in an assessment framework 2) the use of models to link response indicators to nutrient loads that will sustain and protect beneficial uses. The conceptual models developed in this task are needed to confirm appropriate indicators and their linkages to SF Bay beneficial uses; identify the spatial and temporal scales of importance in monitoring; and frame the questions that may eventually be explored through quantitative modeling efforts. The conceptual models will identify the key drivers/factors that need to be incorporated into models (e.g., internal processes of biogeochemical cycling of nutrients and carbon, including important internal sources and sinks, important physical drivers, and interactions between nutrients and other stressors). Because of the large differences in hydrography and nutrient dynamics between regions of the Bay, the Bay will be divided into a manageable number of segments and habitat-types, and conceptual models will be evaluated across these sub-embayments and habitat types.

Task 2.2 Develop Problem statement and future scenarios

A problem statement will be developed for SFB that addresses the question “If SFB had a nutrient problem, how would it manifest itself?” A nutrient problem can take multiple forms, and the form(s) may vary by subembayment, habitat, and seasonally. The problem statement will address this spatial and seasonal variability, and be linked to beneficial use impairment.

With the problem statement identifying states of the SFB ecosystem that would result in beneficial use impairment, and the conceptual models from Task 2.1 serving as a framework for evaluating change, a list of plausible future scenarios for the Bay will be developed that identify changes that could lead to a problem, and changes under which a problem would be less likely to occur. Two broad categories of scenarios are envisioned: i) changes in management actions (e.g., increases or decreases in nutrient loads via various sources, changes in the timing or quantity of freshwater flows); and ii) changes in environmental factors outside of human

2010) in Suisun Bay and in the Delta. Factors considered include physical alterations to habitat; water withdrawals and changes in flow regime; land use changes; invasive species (including the Asian overbite clam, *Potamocorbula amurensis*, and multiple invasive copepods and other zooplankton); and changes in nutrient concentrations. Recent studies have argued that anthropogenic nutrient loads, in particular ammonium (NH4), play a role in ecosystem change and degradation. Dugdale et al (2007, 2012) and Parker et al. (2012a,b) present the case that elevated NH4 concentrations in Suisun and the Delta inhibit primary productivity (Dugdale et al., 2007; Parker et al., 2012a,b), and potentially contribute to low phytoplankton biomass in Suisun, with cascading effects up the food web. Elevated NH4 levels have been suggested to contribute to the increased frequency of *Microcystis* blooms in the Delta (Lehman et al., 2008). Changes in nutrient ratios (N:P) and forms of N have been hypothesized to be exerting additional bottom-up pressures on Delta and Suisun food webs, through influencing phytoplankton community composition and other pathways (e.g., Glibert et al., 2011).

Given the scientific and regulatory attention that issues such as elevated NH4 and shifts in N:P are receiving in Suisun Bay, and in order to resolve the differing scientific perspectives on the issues, a separate work element was created. Nutrient related issues can be divided into four broad categories: 1. NH4 inhibition of primary production; 2. NH4 toxicity to copepods (e.g., Teh et al., 2011); 3. NH4 concentration increases and N:P shifts, and effects on phytoplankton community composition and the Suisun/Delta food web; and 4. other potential causes of low primary productivity in Suisun. A detailed accounting of all relevant projects and their timelines is beyond the scope of this document, but is under development in Task 3.2.

Task 3.1 Field studies and experiments to assess potential impairment due to elevated ammonium or changes in N:P

A number of field and laboratory studies are underway, some affiliated with the Nutrient Strategy (e.g., SWAMP Suisun Bay studies) or funded by the Delta Science Program or the State and Federal Contractors Water Agency (SFCWA). Other studies are currently under review, planned or are funded and slated to start in late 2012 or 2013. These studies will be tracked, results synthesized (Task 3.2), and where applicable conceptual models will be refined to incorporate new understanding.

Task 3.2 Synthesis of Research to Date and Suisun Ambient Water Quality Data

A series of synthesis reports will be prepared on the following topics: 1.) NH4 inhibition of primary production; 2.) NH4 toxicity to copepods; and, 3.) NH4 concentration increases and N:P shifts, and effects on phytoplankton community composition and the Suisun/Delta food web.

These reports will summarize results of peer-reviewed studies or reports from Suisun and the Delta to date, as well as relevant studies from other systems. In addition to reviewing published work, new analyses and data interpretation will be carried out, utilizing the abundant monitoring data collected by IEP/DWR and USGS, with the goal of characterizing temporal and seasonal trends, quantifying loads and internal transformations of nutrients, and using statistical tools to identify potential causal mechanisms underlying ecosystem change.

control (e.g., changes in suspended sediment load and water clarity, changes in temperature, interannual variability in freshwater flow, large-scale climate forcings and climate change).

The combination of the conceptual models and evaluation of future scenarios will assist in visualizing the spectrum of current, suspected, or potential future sources of impairment.

Task 2.3 Synthesize and Interpret Existing Ambient Water Quality Data and Identify Major Data or Conceptual Gaps in Bay Response to Nutrients

Through nearly 40 years of Bay-wide research by the USGS[1], and nearly 40 years of California-sponsored research and monitoring in northern San Francisco Bay and the Delta[2], there is an enormous archive of nutrient and phytoplankton related data. Some of this data has been analyzed in scientific publications. Other data has received limited attention to date.

This task will synthesize and interpret nutrient and phytoplankton-related data in SFB's subembayments. The data will be interpreted within the context of the conceptual models developed in Task 2.1, and where necessary conceptual models will be modified to reflect new insights. Goals will include: i) identifying spatial, seasonal, and temporal trends in ecosystem condition or response; ii) developing improved understanding of ecosystem response to nutrients; and iii) compiling and preparing data for eventual use in numerical modeling.

Based on analysis in Tasks 2.1-2.2, this task will also identify major data and knowledge gaps, and identify monitoring priorities and additional scientific investigation (e.g., Special Studies) that will be required in order to adapt conceptual models into quantitative models (Work Element 6).

Task 2.4 Develop Nutrient Loading Conceptual Model

A conceptual model for external loads to SFB will be developed that considers major sources and pathways through the watershed, airshed, and oceanic sources. This conceptual model will identify differences in important loads between subembayments.

Task 2.5 Synthesize Existing Loading Data, Identify Data Gaps, and Refine load estimates

The purpose of this task is to synthesize existing information to develop, to the extent possible, spatially and temporally explicit estimates of nutrient and organic carbon external loads via major pathways. This task will also identify major data gaps that contribute to current uncertainty in total loads, speciation of those loads, and the relative importance of various sources. In addition, the Water Board is requiring a two year effluent characterization data collection effort (July 2012 through 2014) by Bay area municipal wastewater dischargers and industrial dischargers which can be used to refine the wastewater load estimates

WORK ELEMENT 3. NUTRIENTS AND POTENTIAL IMPAIRMENT IN SUISUN BAY

The Interagency Ecological Program's (IEP) conceptual model for the Pelagic Organism Decline (POD) recognizes that multiple factors may be acting in concert to degrade habitat and contribute to the sudden decline in native and non-native pelagic fish species (Baxter et al.,

[1] http://sfbay.wr.usgs.gov/access/wqdata/index.html
[2] http://www.water.ca.gov/iep/products/data.cfm

Task 3.3 Assess Science Related to Ecosystem Impacts in Suisun Bay and Relationship to Nutrients

An approach is necessary to resolve issues that have been raised relative to nutrient impacts in Suisun Bay and develop a coordinated science plan. The strategy recommended here is to convene one or more expert panels and sponsor technical workshop(s) to address the three broad categories of proposed nutrient-related impairment in Suisun Bay. The goals of these expert panels will include: 1. evaluating existing scientific evidence for nutrient-related impairment in Suisun Bay; 2. identifying areas of agreement and disagreement within the scientific literature and among the regional research community; 3. recommending studies that can address critical conceptual gaps and data gaps. The results of these panels and the reports from Task 3.2 will be used to refine conceptual models and inform monitoring and special studies (Work Element 5) and modeling (Work element 6). Consideration will be given to involving an external third party, e.g., the Delta Science Program or the USEPA or some other entity in convening or sponsoring the technical workshops.

WORK ELEMENT 4. ESTABLISH GUIDELINES

The purpose of this work element is to develop the technical foundation for policy decisions to establish nutrient-related water quality objectives. This strategy assumes that the development of nutrient related water quality objectives would be accomplished using an approach consistent with the “nutrient numeric endpoint framework”—the numeric guidance that would serve as a means to translate narrative nutrient water quality objectives. This numeric guidance will be centered on an "assessment framework," a structured set of indicators and associated thresholds that can be used to categorize potential ecological states of the Bay from supporting to impairment of beneficial uses. These assessment frameworks also specify the spatial and temporal density and types of data needed to make an assessment of beneficial uses support.

The Bay NNE literature review and data gaps analysis proposed a suite of indicators appropriate to assess the effects of eutrophication and other adverse effects of nutrients on Bay beneficial uses (McKee et al. 2011). Indicators were proposed for three principal habitat types: 1) subtidal unvegetated habitat, 2) vegetated subtidal (seagrass and other SAV), and 3) intertidal flats. The review proposes specific tasks to develop the NNE assessment framework for each habitat types. These tasks are given in Table 3. An initial rank of high, medium, and low priority was assigned to each by the Water Board. Prioritization of work elements reflects: 1) percentage of habitat type represented in the Bay and 2) best professional judgment as to whether an indicator represents the most sensitive assessment of potential impacts to beneficial uses. Based on these two criteria, phytoplankton (biomass and community composition), dissolved oxygen, HABs and HAB toxins were the primary NNE indicators of interest in unvegetated subtidal habitat. Ammonium, N:P ratio and other nutrient forms are also indicators of interest, pending the outcome of studies being conducted in Suisun Bay (see Work Element 3) and assessment by a working group of scientists.

Indicators representative of other habitat types such as intertidal flats and seagrass are of high interest in the Bay as well as other estuaries around the state. Several studies are ongoing to support decisions on NNE thresholds in California estuaries outside of the Bay. Thus, these work

elements are designated as moderate priority, with the intention of evaluating the applicability of these studies to assessment of these habitats in San Francisco Bay sometime in the future.,

Five tasks were designated as high priority and as such they are components of planned activities during the first four years.

Task 4.1 Nutrient Assessment Framework

The purpose of this task is to develop an assessment framework that considers the use of phytoplankton, algal toxins and nutrient forms (e.g. ammonium and other nutrient species or ratios) to assess the condition of the Bay. This will be done by choosing the precise indicators and metrics; specifying how and when they will be measured; and creating decision rules for how the indicators will be combined in order to classify Bay segments into categories of degree of beneficial use support (from supporting to impairing beneficial uses). Existing data on phytoplankton, nutrients and other co-factors will be used to graphically illustrate options with respect to how to use data to make an assessment.

Task 4.2 Review of Dissolved Oxygen Objectives

McKee et al. (2011) found that dissolved oxygen monitoring data taken along the longitudinal "spine" of the SF Bay typically meets established DO objectives. However, SF Bay dissolved oxygen objectives were established in the first Basin Plan in 1975 and the science of supporting derivation of dissolved oxygen objectives has evolved considerably since that time. The main focus of this review is on the application of the DO objectives to shallow water habitats, tidal marshes, managed ponds and tidal sloughs, although it can be argued that a comprehensive review should be conducted. Near-term tasks consist of: 1) synthesizing existing dissolved oxygen data; and 2) evaluating the adequacy of existing dissolved oxygen objectives.

4.2a Synthesize existing dissolved oxygen data

This task will synthesize existing dissolved oxygen data Bay-wide and for specific habitats, such as tidal sloughs, and shallow subtidal areas. This topic was not covered in the Bay NNE literature review and data gaps analysis (McKee et al. 2011). The synthesis effort will include analysis of data currently being collected (since 2011) at 6 USGS moored stations (DO, chlorophyll, and fluorescence), as well as other data sources, including historical studies conducted in the Lower South Bay. This synthesis will assess status and trends of dissolved oxygen relative to Basin plan standards, and will assess whether objectives are being met and whether there is evidence of impairment.

4.2b Evaluate existing dissolved oxygen objectives

The purpose of this task is to synthesize data on dissolved oxygen requirements of species representing the variety of beneficial uses in SF Bay and to inform whether there is a need to revise dissolved oxygen objectives for SF Bay. The product would be a report that synthesizes methodology, summarizes availability of DO tolerance data for key indicator species, and, assuming data are available, calculates DO criteria protective under acute and chronic conditions for the range of beneficial uses represented in SF Bay. To the extent feasible, this analysis will also qualitatively consider naturally occurring low oxygen (e.g., in tidal wetlands or in waters exiting naturally low-oxygen habitats) versus low oxygen due to anthropogenic perturbations. Depending on available resources, this work may be phased so that shallow

subtidal areas and tidal sloughs are initially the focus of the review. Based on the synthesis in subtask 4.3b, data gaps will be identified and, if necessary, recommendations for additional data collection to support the derivation of DO criteria will be made.

Task 4.3 Macroalgal Assessment Framework

The objectives of this task are: 1) to document baseline abundance of macroalgae in a variety of habitat types and regions of the Bay and 2) participate in statewide effort to develop an assessment framework for eutrophication in intertidal flats and shallow subtidal habitat, based on macroalgae. The intent is that progress on this work element would be monitored for applicability to the Bay and that SF Bay stakeholders have the opportunity to comment on studies supporting these work elements, while progress is made on other tasks.

WORK ELEMENT 5. MONITORING PROGRAM DEVELOPMENT AND IMPLEMENTATION

The purpose of this work element is to develop the San Francisco Bay monitoring program. Targeted habitats include unvegetated and vegetated subtidal and mudflat habitat in the Bay. Managed pond habitats will be excluded, as this habitat type will be addressed in a separate work element in the strategy. Two major tasks are associated with this work element.

Task 5.1 Develop a Monitoring Program

5.1a Identify elements of a core SF Bay monitoring program to assess status and trends of loads and Bay response.

The purpose of this task is to recommend specific indicators and methods, spatial and temporal density of sampling that should be included in a "core" monitoring program to make regular assessments of the status of the Bay with response indicators and to assess trends in external nutrient loads and response. An evaluation of existing monitoring data (predominantly USGS data) collected in the Bay will be considered, along with the potential for maximizing synergies and leveraging resources. The product of Task 5.1a will be used to develop a detailed nutrient monitoring program for the Bay (5.1c). This task will involve bringing together local or national level scientists and managers to determine the core elements of a SF Bay monitoring program, including spatial and temporal considerations, including the consideration of how to optimize the use of moored stations and boat cruise sampling collection efforts. In addition, decisions will need to be made on the spatial extent of the monitoring program, and how to coordinate monitoring efforts in the estuary and share data across programs.

Load monitoring may be included as an element of the monitoring program for point and non-point sources, including stormwater, wastewater, agriculture and Delta inputs to the northern estuary.

5.1b Develop a program of special studies to improve fundamental understanding and quantification of processes in the system

In addition to status and trend monitoring, special studies will be carried out to address fundamental data or conceptual gaps that need to be filled to support the assessment framework and model calibration and validation. Data or conceptual gaps identified in any of work completed under this strategy will be compiled and prioritized as part of this task.

5.1c Develop San Francisco Bay nutrient monitoring program Work Plan and QAPP

The purpose of this work element is to develop the work plan and quality assurance project plan (QAPP) for the Bay nutrient monitoring program. The work plan and QAPP covers monitoring to assess status and trends in external nutrient loads and ecosystem response of the Bay to those loads. This task includes development of field, sampling handling, laboratory analyses, data management and reporting procedures for data collection.

Task 5.2 Implement the San Francisco Bay nutrient monitoring program

The expectation is that the existing monitoring program currently conducted by the USGS will transition over a number of years to this locally sponsored program. The program is anticipated to be adaptively managed.

WORK ELEMENT 6. MODELING PROGRAM DEVELOPMENT AND IMPLEMENTATION

The purpose of this work element is to develop models to forecast the nutrient and carbon sources, pathways, and loads to SF Bay, and simulate the ecological response to those loads and other environmental factors in the Bay. These models will be used to engage stakeholders in discussion of options for nutrient management under a variety of different scenarios. Previous work elements will define conceptual models and scenarios of interest (Work Element 1), and management endpoints of concern (Work Element 2).

Task 6.1 Modeling of External Sources

Task 6.1a Basic Loading Estimates or Modeling

Building on the loading conceptual model and loading data compiled in Tasks 2.3 and 2.4, respectively, initial nutrient load estimates will be calculated. To the extent feasible, spatially explicit (e.g., subembayments) and temporally-explicit nutrient loads will be quantified. The nutrient sources considered will include: municipal and industrial wastewater discharges; stormwater discharges; flows from the San Joaquin and Sacramento Rivers entering through the Delta, along with other smaller downstream tributaries; exchange across the Golden Gate; and direct atmospheric deposition. Nutrient fluxes from Bay sediments to the water column will also be considered. Initial estimates of municipal and industrial wastewater loads will be based on treatment technologies employed (expected effluent nutrient speciation and concentrations) and flow. When historical data is available, these data will be used to refine municipal and industrial wastewater loads. In addition, the Water Board is requiring a two year effluent characterization data collection effort (July 2012 through 2014) by Bay area municipal wastewater dischargers and industrial dischargers. These data will be used to further refine load estimates.

Task 6.1b Review models for Estimating Nutrient/ Organic Carbon Loads

This task will review existing models or types of models that can be used to estimate the sources and pathways of nutrient load to the Bay and summarize the data requirements. The task will begin by identifying the types of questions that the model(s) or empirical data must answer. The intent is to review models and tools that can assist in decision-making on nutrient management strategies and test the cost-effectiveness of implementation scenarios. This work element will feed into the development of a modeling strategy.

Task 6.2 Modeling of Load-response

Task 6.2a Basic Numeric Modeling and Scenario Analysis

The purpose of this task is to develop and apply basic numeric biogeochemical models, as an early step in modeling efforts, to inform future model development and data collection. The models will be used to quantitatively synthesize existing data; develop nutrient budgets; support evaluation of proposed indicators as part of the NNE; test appropriate management endpoints; determine how key processes should be modeled and assess the relative importance of and uncertainty related to those processes; and identify major data gaps at an early stage to inform the monitoring program and the need for special studies. In addition, these models may be used to evaluate biological responses under future scenarios (e.g., changes in nutrient loads, changes in major physical drivers affecting productivity, decreases in suspended sediment concentrations).

Initial model development will focus on Suisun Bay and South Bay or Lower South Bay. A technical advisory group consisting of regional and national experts would be convened to develop a modeling study plan. A key task of this group will be to identify the main questions to be addressed through the modeling work, approaches for incorporating key processes into the model, and the appropriate model platform(s). It should be emphasized that the model(s) developed and used in this task are not intended to be the final models that may ultimately be required for the Bay (which may be more complex and computationally intensive), but rather as scoping tools.

Task 6.2b Review of existing models and available model approaches to model the ecological response of the Bay to nutrient loads and other co-factors

This task will produce a review of available models and/or modeling platforms that will be the basis for developing a modeling strategy for the Bay. A work group will identify the management questions and endpoints (indicators) of concern and relevant spatial and temporal scales, focusing on hydrodynamic, water quality (dissolved oxygen, nutrients, carbon) and a phytoplankton-zooplankton production and phytoplankton speciation models. A review will be conducted of existing Bay and Delta hydrodynamic and water quality models or other applicable types of models, from simple spreadsheet to complex dynamic simulation models, their data needs, and advantages and disadvantages.

Task 6.3 Develop and Implement Modeling Strategy

The purpose of this task is to synthesize information generated from Tasks 6.1 and 6.2 tasks to develop a modeling strategy for the Bay. The strategy will identify questions to be answered by the models and what policies will be informed; types of models needed (e.g. external loads, bay hydrodynamic and water quality); potential modeling platforms; amount of data required and estimates of cost; and schedule. Information will be presented as cost/benefits of model options with trade-offs in terms of what indicators can be modeled at varying levels of accuracy/precision or timescales. The strategy will also address what partnerships need to be created to build and maintain a model.

WORK ELEMENT 7. CONTROL STRATEGIES

This work element will identify control strategies that are feasible in the near-term and long-term for reducing nutrient loads to the Bay, and evaluate their potential effectiveness for addressing nutrient-related impairment in the Bay, and their cost-efficiency. This could be accomplished via a work group that would identify key decisions and environmental, technical, and economic considerations or individual groups of stakeholders may work on this task and present the results of their efforts to the wider stakeholder group. All major nutrient sources should be considered, including municipal and industrial wastewater loads, stormwater runoff, and agricultural and other loads from the Delta. Effort directed toward exploring control strategies for various sources will be prioritized based on their relative importance and potential for load reductions, and based on spatial/temporal considerations. The evaluation of control strategy options will also consider multiple benefits. Work Element 7 will be carried out in parallel with the other activities above so that implementation plan scenarios can be considered as part of development of nutrient objectives. Where applicable, implementation scenarios will be evaluated and refined through modeling work in Task 6.4. Where necessary and feasible, the potential effectiveness of control strategies will be evaluated through scenario modeling (Task 6.3).

WORK ELEMENT 8. REGULATORY APPROACHES

This work element will identify and evaluate potential regulatory approaches for achieving nutrient load reductions in SFB should reductions be necessary. A variety of approaches will be considered and evaluated for their applicability to the San Francisco Bay setting and for their potential effectiveness for achieving nutrient objectives. As with Work Element 7, this work will be carried out in parallel with other tasks so that, should nutrient regulations be necessary, a range of options will already have been evaluated to a certain degree. Where it is feasible, the potential effectiveness of different regulatory approaches (and related control strategies) may be evaluated through scenario modeling (Task 6.3).

Table 2. GANTT chart of approximate timing of work elements and tasks associated with 5-yr nutrient plan.

Task No.	Brief Task Description	Yr1	Yr2	Yr3	Yr4	Yr5
Element 1 Nutrient Program Administration						
1.1	Develop Governance Structure					
1.2	Develop Funding Plan					
1.3	Nutrient Program Management					
Element 2: Define the Problem						
2.1	Create Conceptual Model(s) of Ecosystem Response to Nutrient Loads					
2.2	Develop Problem Statement and future scenarios					
2.3	Synthesize and Interpret Existing Ambient Water Quality Data; Identify Data Gaps					
2.4	Develop Nutrient Loading Conceptual Model					
2.5	Synthesize Existing Loading Data and Data Gaps Analysis					
Element 3: Nutrients and Potential Impairment of Suisun Bay						
3.1	Field studies and experiments to assess potential impairment due to elevated ammonium or changes in N:P					
3.2	Synthesis of Research to Date and Ambient Water Quality Data in Suisun Bay					
3.3	Assess science related to Ecosystem Impacts in Suisun Bay and Relationship to Nutrients					
Element 4: Establish Guidelines						
4.1	Nutrient Assessment Framework					
4.2	Review of Dissolved Oxygen Objectives					
4.2a	Synthesize existing dissolved oxygen data					
4.2b	Evaluate existing dissolved oxygen objectives					

Task No.	Brief Task Description	Yr1	Yr2	Yr3	Yr4	Yr5
4.3	Macroalgal Assessment Framework.					
Element 5: Monitoring Program Development and Implementation						
5.1	Develop a Monitoring Program					
5.1a	Identify elements of a core SF Bay monitoring program					
5.1b	Develop a program of special studies to improve fundamental understanding and quantification of processes in the system					
5.1c	Develop the Bay nutrient monitoring program Work Plan and QAPP					
5.2	Implement the Bay nutrient monitoring program and special studies program (some special studies will begin in Yr2)					
Element 6: Modeling Program Development and Implementation						
6.1	Modeling of External Sources					
6.1a	Basic Loading Estimates or Modeling					
6.1b	Review Models for Estimating Nutrient/Organic Carbon Loads					
6.2	Modeling of Load-Response					
6.2a	Basic Numeric Modeling and Scenario Analysis					
6.2b	Review of existing models/platforms to model Bay hydrodynamics & water quality					
6.3	Develop and Implement Modeling Strategy					
7	Control Strategies					
8	Regulatory Approaches					

Table 3. Specific recommendations for science to support development of habitat-type specific nutrient assessment frameworks.

Habitat Type	Recommended Action	Priority
All subtidal	Sponsor a series of expert workshops or develop an expert panel to develop a draft assessment framework based on indicators of phytoplankton (biomass, productivity, assemblage, cyanobacteria cell counts and toxin concentrations) and dissolved oxygen	High
	Form a working group of Bay scientists to synthesize available data on factors known to control primary productivity in different regions in the Bay, developing consensus on relative importance of ammonium inhibition of phytoplankton blooms to Baywide primary productivity, and determining next steps with respect to incorporating ammonium into the NNE assessment framework for the Bay.	High
	Consider a review of the Bay dissolved oxygen objectives, either Bay-wide or for specific habitat types such as tidally muted areas (tidal sloughs, managed ponds)	High
Un-vegetated Subtidal	Utilize IEP-EMP data to explore use of macrobenthos to assess beneficial use impairment in oligohaline habitats. Consider including biomass in the protocol to improve diagnosis of eutrophication or other nutrient-related beneficial-use impairment. Determine whether combination of indicators can be used reliably to diagnose eutrophication and other nutrient-related beneficial-use impairment distinctly from other stressors.	Low
Submerged Aquatic Vegetation	Conduct studies to establish light requirements for the Bay seagrass species;	Low
	Collect baseline data to characterize prevalence of macroalgal blooms and other stressors on seagrass beds	Moderate
	Evaluate the findings of statewide NNE studies characterizing effects of macroalgae on seagrass for applicability to the Bay	Moderate
	Participate in statewide group to develop an assessment framework for eutrophication in seagrass, based on phytoplankton biomass, macroalgae, and epiphyte load.	High
Intertidal Flats	Evaluate the findings of studies characterizing effects of macroalgae on intertidal flats for applicability to the Bay	Moderate
	Participate in statewide group to develop an assessment framework for eutrophication in intertidal flats, based on macroalgae and other supporting indicators.	High
Tidally muted habitats - managed ponds	Synthesize existing DO oxygen data for tidally muted areas and collect baseline data primary and supporting indicators (macroalgal biomass and cover and phytoplankton biomass, taxonomic composition, and HAB toxin concentrations) in these habitats needed to make a full assessment of status of eutrophication.	High

Executive Board Special Meeting Agenda

Friday, January 11, 2013, 10:00 a.m. – 12:00 p.m.
Regional Water Board, 1515 Clay Street, St. 1400 Oakland, CA

ROLL CALL AND INTRODUCTIONS (10:00 a.m. – 10:05 a.m.)

PUBLIC COMMENT (10:05 a.m. – 10:10 a.m.)

OTHER BUSINESS (10:10 a.m. – 12:00 p.m.)

1. Toxicity Policy (10:10 a.m.- 10:20 a.m.)
    a. Status report on State Water Board draft toxicity policy.
    b. Discuss IWC/Acute Reasonable Potential
2. SFRWQCB Permit related issues (10:20 a.m.-10:30 a.m.)
    a. Future permit issues:
        i. Risk Reduction for PCB and Hg: Discuss how to prepare for next permit renewal
        ii. Discuss 1668C review.
        iii. Discuss how to reduce future 1669C testing
    b. PCB P2 reporting
        i. Background: Agency PCBs P2 Annual Reports for 2011 were summarized and reviewed by BAPPG. There were a lot of differences in the submittals in part to how the Order's language on page 7 reads.
        ii. The Regional Board will prepare a list of what they think should be in the P2 report. Lila Tang also requested BACWA prepare suggested language to clarify. What is the status?
3. Pardee Technical Seminar: Feedback (10:30-10:40)

4. Nutrients – 13267 Letter; On track? (10:40 a.m.- 10:50 a.m.)
    a. Nutrient Monitoring began in July –discuss first submittals. How much more is needed
    b. Data reporting format/template: Needed next steps?
5. Nutrients Strategy (10:50 a.m.- 12:00 p.m.)
    a. Developing the nutrient strategy is expected to be a very long-term effort for the Bay. Science plans and decision trees should foster a common understanding of the work plan, cost, and schedule. Discuss SEI effort to date on Decision Tree development
    b. Given the magnitude and duration of nutrient effort, setting it up the management and oversight structure in the near future is important to BACWA. Report on Naomi and Ben's effort

c. Discuss NPDES permitting nutrient strategy and Watershed Permit pros and cons.

ADJOURNMENT (12:00 p.m.)

Members Meeting

Thursday, January 24, 2013, 8:00 a.m. – 12:00 p.m.
California Endowment Conference Facility, 7th Floor, Laurel Room
1111 Broadway, Oakland, CA

8:00 a.m. – 8:30 a.m. **Coffee and Refreshments**

8:30 a.m. – 9:00 a.m. **Welcome**
- Introduction
Ben Horenstein, BACWA Executive Board Chair
- Year in Review
Jim Kelly, BACWA Interim Executive Director ??

9:00 a.m. – 10:00 a.m. **SWRCB, RWQCB, U.S. EPA, & Baykeeper Priorities**
Moderator-Ben Horenstein, BACWA Chair
Frances Spivey-Weber, State Water Resources Control Board(Confirmed)
Bruce Wolfe, Executive Officer, SF Water Board(confirmed)
Terry Fleming, Region IX EPA(confirmed)
Deb Self, Executive Director, Baykeeper (confirmed)

10:00 a.m. – 10:45 a.m. **Nutrients – What is happening in the San Francisco Bay**
Moderator - *Ann Farrell, Central Contra Costa Sanitary District*
- The State of the Science on Nutrients in SF Bay
Amanda Roa, Delta Diablo Sanitation District
- Bay Area Nutrient Strategy
David Senn, San Francisco Estuary Institute
- San Francisco Bay Regional Water Board Perspective
Tom Mumley, San Francisco Regional Water Quality Control Board
- Considerations of an Alternative Regulatory Framework
Tom Grovhoug, Larry Walker Associates

10:45 a.m. – 11:15 a.m. **Nutrient Removal Technologies**
- Survey of Nutrient Technologies and Considerations
Don Grey, East Bay Municipal Utilities District

11:15 a.m. – 11:45 a.m. **Regulatory Update**
Moderator – *Laura Pagano, San Francisco Public Utilities Commission*
– Mercury & PCB Watershed Permit Renewal
Lorien Fono, BACWA Regulatory Program Manager
– TST & WET Policy
James Ervin, City of San Jose(confirmed)
– SWRCB WDR for Collection Systems
Monica Oakley, RMC Water and Environment

11:45 a.m. – 12:00 p.m. **Wrap up –BACWA Board member-TBD**

BACWA EXECUTIVE BOARD ACTION REQUEST

AGENDA NO.: 21
FILE NO.: 12,879
MEETING DATE: January 3, 2013

TITLE: Process and Planning for Fiscal Year 2013-14 Budget & Workplan Development

☐ **MOTION** ☐ **RESOLUTION** ☒ **DISCUSSION**

RECOMMENDED ACTION

Review BACWA Budget planning requirements and historical process to determine next steps and timeline for development and approval of the Fiscal Year 2013-14 BACWA, CBC and Special Program budgets.

SUMMARY

The Joint Powers Agreement (JPA) establishing BACWA requires approval of a budget and workplan for the coming fiscal year's activities no later than June of the preceding fiscal year. In practice, the budget and workplan must be approved at least sixty days in advance of the start of the fiscal year to allow time for BACWA's Treasurer to enter the budget into the accounting systems. The JPA also requires notification to all agencies of their dues for the upcoming fiscal year by March 1st.

Over the years BACWA has spent a varied amount of time on budget and workplan development. Some years, the Board has held as many as two half-day workshops (that included Committee Chair participation) to prepare a draft budget and workplan, whereas in other years, planning discussions that took place during regular monthly Board meetings were sufficient for development of the draft budget and workplan.

As discussed during the 2012 Pardee Technical Seminar, FY2012-13 BACWA and CBC expenditures were budgeted to exceed revenues. Current projections indicate that actual expenses for this fiscal year may be less than budgeted and as a result, it may not be necessary to utilize reserve funds during fiscal year 2012-13, as previously planned. However, if CBC expenditures, specifically those that address regulatory issues, are expected to remain the same or increase in 2013-14, the Board will need to consider funding options, which may include an increase in membership dues and use of reserve funds.

At this time the Board is being asked to determine their preferred process and timeline for Fiscal Year 2013-14 budget and workplan development.

FISCAL IMPACT

This is a discussion item and has no direct fiscal impact at this time.

ALTERNATIVES

This action does not require consideration of alternatives.

Attachments:

1. Fiscal Year 2012-13 Budget and Workplan

Table of Contents

INTRODUCTION

The Bay Area Clean Water Agencies (BACWA) is a joint public powers agency created by a 1984 Joint Powers Agreement (JPA) between the Central Contra Costa Sanitary District (CCCSD), the East Bay Dischargers Association (EBDA), the East Bay Municipal Utility District (EBMUD), the City of San Francisco, and the City of San Jose (collectively, "the Principal Agencies"). The JPA requires approval of an annual budget and workplan divided into three parts: overhead (Part A), general benefit programs (Part B), and special benefit programs (Part C).

The JPA requires that revenues for each fiscal year be equivalent to anticipated expenditures. Expenditures for Management & Administration (Part A), and General Benefit Programs (Part B) are funded by all BACWA members because these programs are carried out on behalf of all member agencies. BACWA currently has two General Benefit Programs: the core BACWA program to support member agencies and the Clean Bay Collaborative. Expenditures for Special Benefit Programs (Part C) are funded by those agencies that elect to fund those programs because those benefits accrue primarily to those participating agencies. BACWA currently has five Special Benefit Programs: the Air Information and Resources Committee, the Bay Area Pollution Prevention Committee, Water Operator Training, Proposition 50 Administration, and Proposition 84 Administration.

The purpose of this document is to fulfill the requirements of the JPA for the 2012 – 2013 Fiscal Year (2012 FY). This workplan and budget specify the purpose of each of BACWA's programs during the 2012 FY, the methods by which they will be carried out, the products that will be developed, and the persons responsible for implementation. The schedule for implementation of these programs is July 1, 2012 through June 30, 2013.

STRATEGIC PLAN

BACWA adopted its first strategic plan and accompanying workplan in 2009 and subsequently refined it in 2011. The strategic plan states the mission, values and goals of the organization as demonstrated in the work undertaken annually by the agency.

Mission

Through leadership, science and advocacy, BACWA provides an effective regional voice for the clean water community's role in stewardship of the San Francisco Bay environment.

Values

Leadership
Environmental Stewardship
Collaboration
Transparency
Fiscal Responsibility
Member Service

Goals

Member Service

1. Members are informed of critical issues and activities.
2. Members comply with applicable rules and regulations.

Informed Regulation

3. Environmental regulations and policies reflect the best available scientific, technical, and economic information.
4. Regulations consider environmental, social and economic sustainability.

Environmental Stewardship

5. Members optimize the value available from wastewater.
6. Watershed management principles are applied to address San Francisco Bay management challenges.

MANAGEMENT AND ADMINISTRATION (PART A)

BACWA has administrative and management expenses that are necessary for the agency to carry out its non-program related core functions (JPA, Section 9). They include expenses related to financial management, insurance, and organizational support. Administration of BACWA is carried out by an Executive Director and Assistant Executive Director selected by the Executive Board. Treasurer services are provided by EBMUD who manages BACWA's finances and performs an annual audit. The objective of these expenditures is to ensure effective, efficient, and transparent management of BACWA, which serves all of BACWA's goals.

Management & Administration				
Objective	**Deliverables/Outcomes**	**Lead**	**FY13 Budget**	**Budget Line**
A. Effectively and efficiently manage BACWA as an organization	**A.1.** Executive Board meetings	ED, AED	6,000	Mtg Expenses
	A.2. Monthly Treasurer Reports, annual audit	ED, AED, EBMUD	$40,000	Financial Services
	A.3. Compliance with organization legal requirements	ED, AED	$2,000	EB Legal Support
	A.4. Insurance to manage organizational risk	ED, AED	$4,000	Insurance
	A.5. Administrative support services for organization (incl. file hosting)	ED, AED	$137,720	ED (40%), AED Services, Admin Exp.
		TOTAL	**$189,720**	

GENERAL BENEFIT PROGRAMS (PART B)

There are two general benefit programs: the core BACWA Member Agency program and the technically –focused Clean Bay Collaborative (CBC) program.

BACWA MEMBER AGENCY PROGRAM (PART B.1.)

The **BACWA Member Agency Program** serves the following of BACWA's goals: (1) Members are informed of critical issues and activities, (2) Members comply with applicable rules and regulations, and (3) Environmental regulations and policies reflect the best available scientific, technical, and economic information.

These goals are accomplished by providing member agencies with information on regulations, scientific and technical developments; forums for participating in policy discussions and collaborating on mutually beneficial projects; and opportunities to engage with the larger Bay Area environmental community. Program expenses include support for committee facilitation and special projects; member workshops and trainings; membership in state and national organizations that disseminate information to

members; and communication expenses such as the website, newsletters, the annual report, and the annual meeting.

Bay Area Clean Water Agencies				
Objective(s)	**Deliverables/Outcomes**	**Lead**	**FY13 Budget**	**Budget Line**
A. Provide forums for members to share information, learn, participate in policy and regulatory discussions, and collaborate on mutually beneficial projects **(Comm. Support)**	**A.1.** Collection System Meeting Support	Chair, Consultant	$25,000	CS Comm.
	A.2. Permits Comm. Meeting Support	Chair, Consultant	$0	Permits Comm.
	A.3. Recycled Water Comm. Support	Chair, Consultant	$10,000	RW Comm.
	A.4. Biosolids Comm. Support - Conference attendance - Workshop/Training	Chair	$5,000	Biosolids Comm.
	A.5. Laboratory Comm. Support - Conference attendance - Workshop/Training	Chair	$7,000	Lab. Comm.
	A.6. Infoshare Groups	Consultant	$25,000	Infoshare Groups
	A.7. IRWM Plan Update Support	ED, Chairs, Consultant	$40,000	Misc. Comm. Support
	A.8. Executive Director (60%)	Board Chair	$96,000	Misc. Comm. Support
	A.9. Regulatory Program Manager	ED, Board Chair	$100,000	Misc. Comm. Support
	A.10. Legal Support	ED	$2,000	Misc. Comm. Support
B. Increase direct communication with members regarding regulatory developments and BACWA accomplishments **(Commun.)**	**B.1.** Monthly newsletter	ED	$2,000	Commun. & Reports
	B.2. Annual Report	ED, AED Consultant	$15,000	Commun. & Reports
	B.3. Annual Meeting	ED, AED	$7,000	Commun.
	B.4. Website	ED, AED, Consultant	$10,000	Commun.
	B.5. Misc. media support	ED	$3,000	Commun.
C. Encourage partnerships and relationships that further BACWA's strategic goals. **(Collaborations)**	**C.1.** CWAA	ED, AED	$1,000	Collaborations
	C.2. State of the Estuary Conf.	ED, AED	$20,000	Collaborations
	C.3. CPSC	ED, AED	$5,000	Collaborations
	C.4. PSI	ED, AED	$500	Collaborations
	C.5. ReNUWIt ERC IAB	ED, AED	$10,000	Collaborations
	C.1. BAPPG	ED, AED	$50,000	Special Programs
D. Contingency			$30,000	Contingency
		TOTAL	**$463,500**	

CLEAN BAY COLLABORATIVE PROGRAM (PART B.2.)

The purpose of the **CBC program** is to respond to current regulatory requirements and to develop scientific, technical and industry information to inform future regulations and policies affecting Bay Area POTWs and the environment. Program expenses include the costs of special studies and reports requested by regulatory agencies, policy strategy development and implementation, and collaborations with statewide organizations to do the same. The goals of the CBC are to ensure that (1) regulations and policies reflect the best available scientific, technical, and economic information; (2) regulations consider environmental, social and economic sustainability; (3) members optimize the value available from wastewater; and (4) watershed management principles are applied to address San Francisco Bay management challenges.

Clean Bay Collaborative				
Objective(s)	**Deliverables/Outcomes**	**Lead**	**FY13 Budget**	**Budget Line**
A. Further **nutrient** related science and management goals for SF Bay	**A.1.** SFEI	ED, SFEI	$175,000	Tech. Support
	A.2. Nutrients workshop	ED, Consultant	$10,000	Tech. Support
	A.3. To be determined	ED	$140,000	Tech. Support
B. Inform development and implementation of **Whole Effluent Toxicity** regulations	**B.1.** Comments on draft policy	ED, Consultant	$20,000	Tech. Support
	B.2. Consultant assistance with implementation (experts, workshops)	ED, Consultant	$10,000	Tech. Support
C. Ensure compliance with the **Mercury/PCBs Permit**	**C.1.** Annual mass report	ED, Consultant	$20,000	Commun. & Reporting
	C.2. Risk reduction contribution	ED, Consultant	$15,000	Tech. Support
	C.3. Successful permit renewal	ED, Consultant	$15,000	Tech. Support
D. Advance understanding of the impacts of and controls for **Chemicals of Concern**	**D.1.** Participate in statewide Green Chemistry/Pesticide regulation efforts	ED, Consultant	$15,000	Tech. Support
E. Ensure Climate Change regulations reflect POTW perspectives	**E.1.** Participate in CWCCG	ED, Consultant	$50,000	Collaborations & Sponsorships
	F.1. Maintain sewer rate database	ED, Consultant	$6,000	Commun. & Reporting
F. Other	**F.2.** Contingency	ED, Board	$45,000	
		TOTAL	**$521,000**	

SPECIAL BENEFITS PROGRAMS (PART C)

BACWA has five active special benefit programs: the Bay Area Pollution Prevention Group (BAPPG), the Air Committee, Proposition 50, Proposition 84 Administration, and Water Operator Training (WOT). Member dues for BAPPG, the Air Committee, and WOT are optional and are established on an annual basis by the entities (the BAPPG Executive Committee, the Air Committee Chair, and the Central Contra Costa Sanitary District in conjunction with Solano Community College, respectively) that manage those programs. Proposition costs are paid for by the agencies that receive the grants from the Department of Water Resources.

BAY AREA POLLUTION PREVENTION GROUP (PART C.1.)

BAY AREA POLLUTION PREVENTION GROUP ($80,114)		
Deliverables/Outcomes	**Manager**	**FY13 Budget**
Fats, Oils, Grease • Spanish holiday outreach ($8,000). • Asian holiday outreach ($6,000).	Comm. Rep, Consultant	$14,000
Pharmaceuticals • No Drugs Down the Drain ($4,999). • Disposal campaign ($2,500). • Kaiser Partnership ($0)	Comm. Rep, Consultant	$7,499
Copper • Copper Algaecide Outreach ($5,000).	Comm. Rep, Consultant	$5,000
Dioxins • Partnership with Air District	Comm. Rep, Consultant	$2,000
Pesticides • "Our Water Our World" Program ($10,000). • Permetherin Outreach ($0).	Comm. Rep, Consultant	$10,000
Sanitary Sewer Overflows • Outreach re toilet is not a trash can	Comm. Rep, Consultant	$3,000
Multi-Pollutant • Parents Groups/Neighborhood Outreach ($0) • Hospital P2 audits ($1,500) • Training/outreach to professional orgs ($16,000) • Outreach to demo contractors ($1,500)	Comm. Rep, Consultant	$19,000
Misc. • Agency coord. For P2 week ($1,500) • Regional msg coord. ($0) • Nutrients cross-comm. work ($0) • BAPPG website ($6,000)	Comm. Rep, Consultant	$7,500
Unplanned Issues		$8,000
Administration	AED	$3,800
	Total	$79,799

AIR RESOURCES & INFORMATION GROUP (PART C.2.)

AIR INFORMATION & RESOURCE GROUP		
Deliverables/Outcomes	**Manager**	**FY13 Budget**
Provide member agencies with assistance regarding air quality related issues, research and regulations as they affect the operation and maintenance of Bay Area POTWs.	Chair, Consultant	To be determined by member interest.

WATER OPERATOR TRAINING (PART C.3.)

WATER OPERATOR TRAINING		
Deliverables/Outcomes	**Manager**	**FY13 Budget**
Encourage development of a skilled workforce by offering classes.	CCCSD, Solano Community College, AED	To be determined by member interest.

PROPOSITION 50 ADMINISTRATION (PART C.4)

PROPOSITION 50 ADMINISTRATIVE SUPPORT		
Deliverables/Outcomes	**Manager**	**FY13 Budget**
Continue administration of Proposition 50 to fund projects that benefit the environment and BACWA members by ensuring timely generation of invoices and progress reports to DWR, and distribution of grant funds to participating agencies.	EBMUD, Consultant, AED, ED	Annual budget to be determined by DWR schedule. See expense summary for entire project budget.

PROPOSITION 84 ADMINISTRATION (PART C.5)

PROPOSITION 84 ADMINISTRATIVE SUPPORT		
Deliverables/Outcomes	**Manager**	**FY13 Budget**
Continue administration of Proposition 84 to fund projects that benefit the environment and BACWA members by ensuring timely generation of invoices and progress reports to DWR, and distribution of grant funds to participating agencies.	EBMUD, Consultant, AED, ED	Annual budget to be determined by DWR schedule. See expense summary for entire project budget.

REVENUE AND EXPENSE ACCOUNT SUMMARY

BACWA	2013 Budget	Notes
REVENUES	**597,000**	No change from 2012 proj
Principals' Contributions	420,000	
Assoc. & Aff. Contributions	162,000	
Other	10,000	Carryforwards to be added later
Interest Income	5,000	
EXPENSES	**653,220**	
BACWA Committees	**212,000**	
Collections System	25,000	
Permit Committee	0	Moved to RPM
Water Recycling Committee	10,000	
Biosolids Committee	5,000	
InfoShare Groups	25,000	
Laboratory Committee	7,000	
Misc. Tech. & Reg	140,000	
IRWMP Update assistance	*40,000*	
Regulatory Program Manager	*100,000*	
Legal Support	**4,000**	
Regulatory Support	2,000	
Executive Board Support	2,000	
Collaboratives and Sponsorships	**36,500**	
CWAA	1,000	
State of the Estuary	20,000	
CPSC	5,000	
PSI	500	
Stanford ERC	10,000	
Communications and Reporting	**30,720**	
Annual Report	15,000	
Website Development/Maintenance	10,720	
Power DNN	*500*	
Box.net	*720*	
Circlepoint (web)	*8,000*	
Adammer as-needed	*1,500*	
Other Communications	5,000	
I-contact	*2,000*	
Media relations support	*3,000*	
Special Programs	**50,000**	
Contribution to BAPPG	50,000	
General BACWA Support	**43,000**	
Contingency	30,000	5% of revenues
Meeting Support	13,000	
EB Meetings	*1,000*	
Annual Meeting	*7,000*	
Pardee	*5,000*	

Administrative Support	**277,000**	
Executive Director	160,000	Assumes new ED @ 175k
Assistant Executive Director	70,000	
EBMUD Financial Service & Audit	40,000	
Administrative Expenses	3,000	
Insurance	4,000	
TOTAL	(56,220)	Will be funded through reserves or the projected 2012 surplus

CBC	**2013 Budget**	**Notes**
REVENUES	**451,600**	No change
Principals' Contributions	300,000	
Assoc. & Aff. Contributions	150,000	
Interest	1,600	
EXPENSES	**521,000**	
Technical Support	**385,000**	
Nutrients	325,000	
SFEI 2012/2013	*175,000*	
Annual workshop	*10,000*	
To be determined	*140,000*	
PCBs/Hg	15,000	Permit Rewrite
Whole Effluent Toxicity	30,000	
Comments on draft policy	*20,000*	
Implementation Assistance	*10,000*	
Risk Reduction	15,000	
Collaborations & Sponsorships	**65,000**	
CWCCG	50,000	
CECs	15,000	
Commun. & Reporting	**26,000**	
Hg Emissions Report	20,000	
Rate database	6,000	
Contingency	**45,000**	10% of revenues
TOTAL	(69,400)	Deficit funded through reserves

BAPPG	2013 Budget	Notes
REVENUES	**80,000**	No change
Member Contributions	80,000	
EXPENSES	**79,799**	
Mercury	0	
FOG	14,000	
Pharmaceuticals	7,499	
Copper	5,000	
Dioxin	2,000	
Pesticides	10,000	
SSOs	3,000	
Unplanned Issues	8,000	
Multi-Pollutant	19,000	
Misc.	7,500	
BACWA Indirect Costs	3,800	Per BACWA Policy
TOTAL	201	

AIR	2013 Budget	Notes
REVENUES	**85,000**	
Participant's Contributions	85,000	Est. depends on member interest.
EXPENSES	**85,000**	
Contract expenses	81,000	Est. depends on member interest.
BACWA Indirect Expenses	4,000	Per BACWA Policy
TOTAL	0	

WOT	2013 Budget	Notes
REVENUES	**160,500**	
Participant's Contributions	160,500	Est. depends on member interest.
EXPENSES	**160,500**	
Contract expenses	158,000	Est. depends on member interest.
BACWA Indirect Expenses	2,500	Per BACWA Policy
TOTAL	0	

Prop 50 Admin	2012-2015 (est) Budget	Notes
REVENUES	**265,245**	
Grant Funds	250,000	Includes pre-funding
Interest	15,245	
EXPENSES	**265,245**	
Consultant	109,000	
BACWA Legal	50,000	
BACWA Staff - Direct	40,000	
BACWA Accounting	15,000	
Other Direct Costs	12,000	
EBMUD Grant Manager	15,000	New for 2013. In-kind contribution prior
EBMUD Admin Support	0	
Indirect Costs	8,025	Per BACWA policy
Contingency	16,220	
TOTAL	0	

Prop 84 Admin	2012-2017 (est) Budget	Notes
REVENUES	**640,000**	
Agencies' Pre-funding	100,000	
Grant Funds	540,000	Reimbursement of admin costs; or invoice agencies again if necessary
EXPENSES	**640,000**	
Consultant	157,000	Assist with DWR reporting and coord.
BACWA Legal	51,000	
BACWA Staff - Direct	57,000	
BACWA Accounting	51,000	
Other Direct Costs	35,000	Mailing, shipping , telecom, etc.
EBMUD Grant Manager	180,000	Includes allowable overhead
EBMUD Admin Support	60,000	
Indirect Costs	18,000	Per BACWA policy
Contingency	31,000	
TOTAL	0	