

Appendix A: Freshwater and Estuarine Harmful Algal Bloom (FHAB) Program Gap Assessment for Regional Board and State Board Divisions

Introduction

Until 2016, there were no organized efforts by the State Water Resources Control Board (State Board) to address FHABs through a new or existing programs inherently due to lack of any dedicated funding. To begin addressing the issue of the increasing occurrence and prevalence of FHABs in surface waters, the Surface Water Ambient Monitoring Program (SWAMP) at the State Board developed the FHAB Strategy. They also began coordinating efforts and temporarily diverted resources in 2016 from existing SWAMP programmatic areas to address FHABs. This SWAMP effort that began in 2016 accomplished several key infrastructural and coordination milestones that have enabled the State Board to begin to protect public health by informing citizens of risks associated with HABs and identify water quality conditions degraded by HABs. Although a step in the right direction, this SWAMP effort was not formally staffed or funded and lacked support to fully address the complexity and growing prevalence of FHAB incidents across the state.

[Assembly Bill No. 834 \(AB 834\)](#) was approved by the Governor September 27, 2019, requiring the State Board to establish a Freshwater and Estuarine Harmful Algal Bloom Program to protect water quality and public health from HABs. The fiscal year 2020/2021 budget act authorized five new staff positions and \$750,000 in annual contracting funds. The staff positions were filled by June 2021 and are distributed among the State Board (2 positions) and three Regional Boards (1 position each at Regional Board: 1 [North Coast], 5 [Central Valley], and 6 [Lahontan]). These positions provide the initial resources for effective regional incident response, data collection, coordination with relevant agencies, advisory posting, and communication of public and environmental health data. It is important to note that the other six regional boards that did not receive a funded position voluntarily respond to HAB incidents when they are able, although it often impacts other priority Water Board programs and projects.

Gap Assessment Process

Although dedicated resources are now allocated to the FHAB Program, there are still resource gaps to meet all the AB 834 requirements. To clearly identify and characterize what the gaps are, State Board FHAB Program staff reached out to the nine Regional Boards and to State Board Divisions including Department of Water Quality, Division of Water Rights, Division of Drinking Water, Division of Financial Assistance, and Division of Information Technology in a series of meetings in the spring of 2022. In these meetings, State Board FHAB Program staff introduced the new FHAB Program, shared the AB 834 requirements and nexus to Water Board and Regional Board Programs, and

requested input on needs from these groups on what additional resources would be necessary to conform to the AB 834 requirements.

The input from the Regional Boards and State Board Divisions was collated into categories based on the AB 834 requirements. It was further reviewed by the State Board Divisions and Regional Boards to ensure that all data was accurately captured. The information received from the Regional Boards is shown in [Table 1](#) and [2](#). Table 1 provides qualitative information as to resources needed and Table 2 provides the associated numeric staff and contract resources. [Tables 3](#) and [4](#) provide similar information based on Water Board Division input.

Table 1. Regional Board input received during the gap assessment process as organized by AB 834 requirement. For Reference: RB 1: North Coast; RB 2: San Francisco Bay; RB 3: Central Coast; RB 4: Los Angeles; RB 5: Central Valley; RB 6: Lahontan; RB 7: Colorado; RB 8: Santa Ana; RB 9: San Diego

Water Code	Description	
13182.a	Consult with the CWQMC, OEHHA, CDPH, DWR, CA DFW, Dept. of Parks and Recreation, other appropriate state agencies, and CA Native American tribes	
Regional Board	PY/\$	Resources Necessary
RB 1	PY	Expand consultation and coordination with agency and tribal partners, review state-wide documents, and attend state-wide meetings. Work with heads of agencies (CDFW, NOAA, OEHHA) and Tribes to further program development and monitoring.
RB 3	PY	Improve coordination with CWQMC, OEHHA, CDPH, DWR, CA DFW, Dept. of Parks and Rec, other appropriate state and federal agencies, and CA Native American tribes. Including follow up with agencies regarding results and risks.
	PY	Initiate tribal consultation/coordination efforts – this will likely be a heavy lift since our region has had very little engagement with tribes
	PY	Develop Permit requirements: e.g., wastewater treatment discharges (NPDES), ILP (Ag Order), 401s, NPS, WDRs, etc.
	PY	Attend meetings and review documents
RB 8	PY	To ensure successful coordination with local, state and federal agencies, as well as other interested parties, RB8 shall maintain dedicated staff that manages the FHAB program. The employees shall be familiar with the reporting requirements of the FHAB program, have experience investigating and responding to HABs, and will continue to consult and coordinate with outside agencies, when appropriate.
RB 9	PY	Consult and coordinate with local partners, review documents, and attend meetings
	PY	Coordination with relevant entities for San Diego Basin Plan updates for tribal and subsistence uses

Water Code	Description	
13182.a.1	Coordinate immediate and long-term event incident response, including notification to state and local decisionmakers and the public regarding where harmful algal blooms are occurring, waters at risk of developing harmful algal blooms, and threats posed by harmful algal blooms.	
Regional Board	PY/\$	Resources Necessary
RB 1	PY	Continue to provide rapid incident response for all reported blooms, including reviewing and validating reports, coordinating with interagency task force, coordinating field investigations, and recommending postings
	PY	Expand the facilitation and coordination of waterbody specific partnerships for immediate response actions. Develop long-term response plans and programs with partners and secure funding for monitoring and lab analysis. Partnerships include County Health Departments, Division of Drinking Water, Non-Governmental Organizations, and Tribal Governments.
	\$	Sampling supplies and laboratory analysis
RB 2	PY	Triage and respond to short-term incidents via outreach and coordination with landowners (~20) and field sampling (~10) each year and regularly update statewide incident database
	PY	Continue to sample long-term incident sites until HABs subside (~5 sites per year) and regularly update statewide incident database
	\$	Laboratory analysis
	PY	Public notifications: assistant land managers to enter routine monitoring data into updated statewide FHAB data system; coordinate with local landowners and/or county to post public notification signage based on CCHAB Network human health trigger levels; and coordinate with State Board FHAB staff and OPR on press notifications of HAB incidents
RB 3	PY	Increase coordination and outreach to partners (counties, agencies, waterbody managers, landowners, water districts, general public/reporting parties, etc.) to increase regional awareness and facilitate more immediate and ongoing response and timely notification of risks.
	PY	Increase sampling frequency and expand ambient monitoring scope to determine waters at risk and provide consistent and long-term incident response throughout advisory periods
	PY	Develop and provide training opportunities for staff, agencies, partners, public, etc.
	PY	Take more of a lead role for coordinating incident response and data management tasks including reviewing and verifying reports and updating information on web map (SB has been supporting/leading much of these efforts in recent years)
	\$	Need to secure dedicated and sustainable lab funding for analysis (e.g., not SWAMP Regional Allocations or Discretionary funds)
RB 5	PY/\$	Support the streamlining and partial automation of HAB incident response coordination

	PY/\$	Create a set of resources for small or private waterbody owners covering the basics of HAB ecology and formation, the risks of HABs, and an overview of mitigation option (also addresses 13182.a.5)
	\$	Increase monitoring and outreach partnerships in the northern and southern portion of region 5 where there is currently a deficit of information and many rural and disadvantaged communities
	\$	Laboratory analysis
RB 6	PY	Water quality monitoring at priority recreation sites associated with AB 1066
	\$	Laboratory funding for sample analysis
RB 8	PY/\$	Resources to investigate reports of potential HABs through sampling and onsite reconnaissance; funding for lab analysis and monitoring equipment supplies
	PY	Coordinate with land and or water managers, notify local, state and/or federal agencies; update FHAB data system that populates HAB Incident Reports web map; and consult with local agencies for physical advisory sign postings
RB 9	PY	Resources to respond to incidents/complains, including coordination with local decision makers/responsible parties
	\$	Laboratory analysis for samples collected for incident response

Water Code	Description	
13182.a.2	Conduct and support field assessment and ambient monitoring to evaluate harmful algal bloom extent, status, and trends at the state, regional, watershed, and site-specific waterbody scales	
Regional Board	PY/\$	Resources Necessary
RB 1	PY/\$	Expand working with partners to develop Monitoring and Response Plans for rivers that experience annual HABs. The goal is for these plans to eventually be implemented by local partners using their funds, however, at present time most of our local partners do not have sufficient staff or resources to support monitoring and response so they responsibility falls on regional staff.
	PY	Implement ambient monitoring through the FHAB Program as outlined in the Strategy for Freshwater Harmful Algal Bloom Monitoring (2021). This monitoring would complement bloom response and partner monitoring to generate more complete data sets for assessment.
	PY	Data analysis, interpretation, and reporting of findings to better characterize the timing, extent, and risk of benthic cyanobacteria within the region
	PY	Review decision support tools for remotely sensed satellite data, support field verification efforts of remotely sensed algorithms, review metrics for satellite data, and explore high resolution satellite imagery
	\$	Monitoring and assessment of HABs
	\$	Monitoring supplies and laboratory analysis
	\$	Perform special studies and/or support new research methods
RB 2	PY	Conduct holiday sampling at 5-10 freshwater sites 3 times per year
	PY	Conduct rotating annual ambient monitoring projects, for example: <ul style="list-style-type: none"> • assess high recreation freshwater sites that are not monitored by other agencies (~10 stream and reservoir sites per sampling year)

		<ul style="list-style-type: none"> • assess FHAB and nutrient levels at reference stream sites (~20 sites) • collect samples and work with community members in high recreation areas in environmental justice communities (~5 sites bi-monthly during high incident period) <p>assess if FHABs are moving downstream of reservoirs into streams (~5 sites bimonthly grab samples during high incident period or SPATT bag deployment)</p>
	PY	Conduct monthly mussel toxin & nutrient monitoring at 10-15 sites around the Bay margin
	PY	Leverage new sampling opportunities with externally funded monthly nutrient, phytoplankton, HAB taxonomy, and HAB toxin data collection
	\$	Laboratory analysis for cyanotoxins, nutrients, and mussel toxins
RB 3	PY	Need dedicated staff/personnel to conduct field assessments, design appropriate special studies, look for opportunities to coordinate and leverage and/or augment other monitoring efforts in region, lead data management efforts (e.g., compile, evaluate, analyze, and interpret data), develop reports/presentations, etc.
	PY	Develop a robust partner monitoring program and increase coordination with partner agencies to implement ambient monitoring at a much broader spatial scale across the region.
	PY	Provide more support and facilitate better coordination with partners for sample collection, sampling materials, trainings, data sharing, etc. (R3 staff conducts bulk of monitoring in our region).
	PY	Offer and lead field and health and safety trainings - staff, agencies, public, etc. (both online modules and in person/field-based training options).
	PY/\$	Increase monitoring frequency and expand scope to include additional riverine/stream and estuarine/marine HAB assessments.
	PY/\$	Incorporate HABs monitoring into other Statewide monitoring programs (e.g., BOG, Tox, PSA/RCMP, etc.).
	\$	Additional funding required for lab analysis to focus on ambient/trend monitoring AND to address special studies.
	\$	Additional funding to support partners and cover monitoring expenses (materials, lab analyses, etc.).
RB 4	\$	Contract for ambient assessment of freshwater HAB species and toxins in marine ecosystems
	PY	Manage contract for ambient assessment
RB 5	PY/\$	Create a fully fleshed out partner monitoring program including recruiting, training, and supporting partners and purchasing, creating, and updating materials
	PY	Increase monitoring and outreach partnerships in the northern and southern portion of region 5 where there is currently a deficit of information and many rural and disadvantaged communities
	PY/\$	Create a formal program and funding mechanism for providing support to a wide variety of monitoring organizations including entities that serve disadvantaged communities, rather than selecting organizations in an ad-hoc manner (also addresses 13182.a)
	PY	Coordinate with other Central Valley Water Board programs so relevant HAB and HAB driver information may be incorporated into their work

	PY	Implement ambient monitoring through the FHAB Program as outlined in the Strategy for Freshwater Harmful Algal Bloom Monitoring (2021). This monitoring would complement bloom response and partner monitoring to generate more complete data sets for assessment
	PY	HAB monitoring requirements into relevant permits
RB6	PY/\$	Data analysis, interpretation, and reporting of findings specifically for regularly monitored waterbodies and special studies
	PY/\$	Create a fully flesh out a partner monitoring program including recruiting, training, and supporting partners and purchasing, creating, and updating materials
	PY/\$	Support for SB staff time to find and distribute HAB monitoring programs, funding opportunities, and mitigation control measures across the State. Widely distribute funding opportunities through lyris list or create a page on the website
RB 8	PY/\$	Use remote sensing platforms to develop monitoring response plans
	PY/\$	Conduct field assessments and ambient monitoring of waterbodies where potential HABs can negatively impact beneficial uses, including, but not limited to, recreation and drinking water supplies; resource needs include laboratory analysis, maintenance of monitoring equipment, and SPATT bad deployment
	PY/\$	Conduct pre-holiday assessments three times per year
RB 9	PY	HAB monitoring requirements into relevant permits (e.g. agricultural WDRs)
	PY	Resources for conducting ambient monitoring at priority water bodies in the region
	\$	Perform special studies and/or support new research methods
	\$	Conduct monitoring of various water body types throughout the region; focus on priority waterbodies (streams, wetlands, etc.) and perform trend and condition monitoring
	PY	Support having reservoir owner/operators being responsible for reservoir monitoring and Water board staff reviewing data

Water Code	Description	
13182.a.3	Determine the regions, watersheds, or waterbodies experiencing or at risk of experiencing harmful algal blooms to prioritize those regions, watersheds, or waterbodies for assessment, monitoring, remediation, and risk management.	
Regional Board	PY/\$	Resources Necessary
RB 1	PY	Determine at-risk watersheds and/or waterbodies that experience HABs and prioritize their monitoring, and support development of tools to determine at-risk waterbodies
	PY/\$	Expand pre-holiday assessments for Memorial, Independence, and Labor Days
	PY	Fieldwork assistance to collect nutrient samples and ancillary/appropriate environmental data
	PY	Develop TMDLs, to help develop permitting conditions, as well as work on planning and the impacts of climate change

	PY	Participate in the review of biostimulatory conditions objective and advise on objective development
	PY	Determine how water rights and flow conditions contribute to water quality issues such as HABs
	\$	Risk Assessment: nutrient, flow, shade, and hydrology data collection to better understand the role of biostimulatory conditions on benthic cyanobacterial growth and assess risk for various waterbodies
	\$	Sampling supplies and laboratory analysis
RB 2	PY	Use spatial tools to identify small lakes in our region, determine landowners, and create a database for future outreach, sampling, or incident response (overlap with §13182.a.4)
	PY	Complete a thorough assessment of high recreation water bodies in our region for holiday and ambient monitoring
	PY	Compile and review past reports from the SFEI satellite analysis tool to identify hot spots, create reports, and notify landowners
	PY	Work with OIMA and contractors to develop high resolution satellite imagery data for smaller waterbodies not assessed with the SFEI satellite analysis tool
	PY	Conduct monthly mussel toxin & nutrient monitoring at 10-15 sites around the Bay margin
	PY	Leverage new sampling opportunities with externally funded monthly nutrient, phytoplankton, HAB taxonomy, and HAB toxin data collection
	\$	Contract funding to UCSC and SFEI to maximize and further develop tools
RB 3	PY	Identify and prioritize regional watersheds, or waterbodies experiencing or at risk of experiencing HABs for assessment, monitoring, remediation, and risk management
	PY	Develop tools to better represent and evaluate smaller/shallower waterbodies more accurately
	PY	Develop tools to conduct spatial and land use analysis (modeling?) to identify additional environmental factors that contribute to or increase risk of HABs in various watersheds
	PY	Strategies for determining waterbodies that might be at risk for HABs that are located on tribal lands or in EJ/DAC areas in our region
	PY	Dedicate resources for exploring mitigation and remediation opportunities for high-risk waterbodies
	PY	Develop a consistent way to address private waterbodies or various "water features" that exist on private properties where we do not have jurisdiction
	PY/\$	Increase response to HAB incident reports and conduct follow up monitoring
	PY/\$	Expand holiday assessments and ambient/trend monitoring opportunities
	PY	Integrate HABs monitoring into programmatic workplans and regulation (IR, TMDL, NPS, Basin Planning, AG/ILP, Permits, 401, WDR, etc.)
	\$	Provide dedicated funding to incentivize more frequent monitoring by waterbody managers/partners to alleviate some of the cost burden
	\$	Provide funding to address site specific issues and support remediation efforts
RB 5	PY/\$	Assess which CA waterbodies are naturally eutrophic as opposed to those influenced by cultural eutrophication to guide management prioritization (also addresses 13182.a.4)

	PY	Identify tribal and disadvantaged community areas that may be at increased risk from HAB effects
	PY/\$	Funding and time for Solid Phase Adsorption Toxin Tracking (SPATT) materials and SPATT lab analysis to further our understanding of benthic cyanobacteria in Foothill rivers and help prioritize monitoring in this area of our region
	PY	Resources to integrate HABs into Regional Board Programs (e.g. 401 certs, NPS, TMDLs, Basin Planning, IR, permitting, enforcement)
RB 6	PY	Evaluate and develop Basin Plan amendments to include mitigation measures for HABs
	PY	Evaluate existing statewide permits and develop region-wide permits and/or updates to 401 water quality certifications for mitigation measures for HABs
	PY	TMDL development for water bodies/watersheds with HABs
	PY	Incorporate objectives for cyanotoxins and other biostimulatory chemicals into Basin Plan
	PY	Process HAB related data for the Integrated Report that informs 303 (d) List of Impaired Water
	PY	Manage and support HAB related contracts
	PY	Enforce permit requirements related to monitoring and preventing HABs
	PY	HAB data entry into SWAMP database
	PY	Review CEQA documents for projects proposed in at-risk water bodies for HABs
		\$
RB 7	PY/\$	Evaluate up to 30 candidate sites for a comprehensive assessment and follow-up monitoring to further determine risk and/or impairment
RB 8	PY/\$	Develop monitoring plans and perform field assessments for waterbodies that have been identified to have reoccurring HABs to evaluate environmental conditions and trends
	PY	Work with permitting staff to update requirements to include mitigation for HABs or prevent conditions that contribute to HABs
	PY	Collaborate with interested agencies and the public to ensure recreators are informed when blooms occur and are educated on the risk of HABs.
	PY	Work with Replenish Big Bear staff to conduct monitoring to determine if recycled water discharges are contributing to HAB abundance and severity
RB 9	PY	Resources to incorporate this type of monitoring into regular monitoring assessment programs
	PY	Need to identify tribal, subsistence, environmental justice/disadvantage communities and areas that are at risk
	PY	Resources to integrate HABs into Regional Board Programs (e.g. 401 certs, NPS, TMDLs, Basin Planning, IR, permitting, enforcement)

Water Code	Description	
13182.a.4	Conduct applied research and develop tools for decision-support	
Regional Board	PY/\$	Resources Necessary

RB 1	PY	Expand participation in FHAB, USEPA Benthic Work Groups, and CCHAB and its subcommittees to further develop benthic cyanobacteria program and research
	PY	Expand development of benthic signage, sampling SOPs, visual guides, and various research projects such as using SPATTs and eDNA
	PY	Expand coordination with State Board on press releases, training and outreach, webmap updates, and disseminating signs and sampling supplies
	PY	Explore utility of high spectral resolution satellite imagery for detecting benthic mats in rivers and identifying toxigenic cyanobacteria genera in all waterbody types
	PY	Support development of tools for case management, data analysis, and visualization
	PY/\$	Support research for determining toxins of concern and associated threshold for protection of different beneficial uses
	\$	Funding for additional Solid Phase Adsorption Toxin Tracking (SPATT) and SPATT lab analysis to further and strengthen our knowledge regarding the applicability of SPATTs as a proactive trigger tool for initiating additional monitoring tools and techniques
RB 2	PY	Support and engage with statewide FHAB efforts to develop new decision tool
	PY	Work with the Integrated Report roundtable, Basin Planning roundtable, OEHHA, and CCHAB team to develop evaluation thresholds
	PY	Work with NOAA and CA HABs map https://calhabmap.org/ steering committee and membership to develop coastal HAB modeling and warning tools
RB 3	PY/\$	Design and implement special studies that augment and leverage other types of monitoring conducted in region
	PY	Increase data collection and integration from various sources (internal and external partners, other agencies, etc.) and compile into comprehensive/centralized or compatible system (e.g., SWAMP/CEDEN, FHAB data system, etc.)
	PY	Work with subject matter experts/specialists to conduct research and perform scientific literature review
	PY	Work with internal groups/departments and partner agencies to develop/identify specific thresholds/evaluation criteria for assessments (support Integrated Report, TMDLs, Permits, etc.)
	PY	Ensure data/information is shared with all applicable programs, roundtables, workgroups, etc. (e.g., Integrated Report, TMDL, Permits, etc.)
	PY	Develop and refine data analysis and visualization tools, conduct more “ground truthing” studies
	\$	Dedicated funds to conduct research and create opportunities to work with contractors to develop said tools
RB 5	PY/\$	Coordinate with relevant teams to understand and address HABs’ impacts on tribal beneficial uses
	PY/\$	Support and/or conduct research into HAB controls and mitigation
	PY/\$	Funding for additional Solid Phase Adsorption Toxin Tracking (SPATT) and SPATT lab analysis to further and strengthen our knowledge regarding the applicability of SPATTs as a proactive trigger tool for initiating additional monitoring tools and techniques

	\$	Convene a scientific panel to obtain guidance on performing relevant statistical analyses and modeling of HABs and HAB driver data
RB 6	PY/\$	Contract funding and personnel time to support new areas of investigations and application of new control technologies
	PY/\$	Help improve the use of satellite tool within small waterbodies, and high elevation lakes
RB 8	PY	Review results from special study conducted from 2021 to 2022 and summarize conclusions and next steps. Collaborate with other interested parties and share results of study.
	PY/\$	Develop and implement a HABs special study for the Big Bear watershed that evaluates sources of nutrients or other biostimulator constituents that can impact HABs in Big Bear Lake. Conclusions from the study will be used to inform revisions to the nutrient TMDLs for Big Bear Lake.
	PY/\$	Develop special study to determine the impact on HABs of the addition of recycled water to Big Bear Lake. Collaborate with other interested parties to use models to predict the impacts to the Lake.
	PY/\$	Develop special study to assess the impact of in-lake best management practices in use at Lake Elsinore on HAB abundance. Collaborate with TMDL Task Force to combine sampling efforts and utilize group expertise
RB 9	PY/\$	Conduct research and test new tools
	PY/\$	Support research for determining toxins of concerns and associated thresholds for protection of different beneficial uses
	PY	Conduct research on internal lab analysis screening capabilities

Water Code	Description	
13182.a.5	Provide outreach and education and maintain a centralized internet website for information and data related to harmful algal blooms	
Regional Board	PY/\$	Resources Necessary
RB 1	PY	Conduct outreach and develop new partnerships
	PY	Expand HAB trainings for regional partners, statewide agencies, and the public
	PY	Support production of physical and digital outreach content for distribution
RB 2	PY	Conduct outreach and develop relationships with land managers (e.g., cities, water districts, park districts) to provide trainings (e.g., FHAB identification, sample collection, database input)
	PY	Conduct outreach and develop relationships with environmental and watershed community groups to provide resources (e.g., lab sampling) and trainings (e.g., FHAB identification, sample collection)
	PY	Work with the Water Board tribal liaisons to provide resources to local tribes and to sample culturally significant sites
	PY	Work with local RCDs and the Water Board grazing and CAF permit programs to provide resources for ranchers about FHAB risks in stock ponds
	PY	Coordinate a region-wide conference to discuss HAB science, monitoring, and mitigation

	PY	Provide HAB identification and management resources to marina managers and harbor masters
	PY	Summarize HABs information for public consumption on the Water Board portal, NMS stakeholder group, and Regional Water Board website.
	PY	Present on HABs at conferences (e.g., Delta RMP, Bay RMP, Bay-Delta IEP)
	PY	Work with CDPH and shellfish harvesters to communicate monitoring information and risks to the public
	PY	Work with NMS Steering Committee and stakeholders to integrate monitoring under this position with existing efforts
	PY	Develop a technical advisory committee to improve study design and develop robust data analysis techniques
	PY	Share HAB decision tools, management via CA HABsmap (https://calhabmap.org), NOAA partners, other coastal regional Water Boards
	\$	Develop Technical Advisory Committee with a focus on estuarine HABs
RB 3	PY	More consistent messaging for press & social media notifications, and coordinate state press release with local (Region specific) media
	PY	Ensure all internal applicable programs (Integrated Report, TMDL, Basin Planning, AG, Permits, etc.) know how to find and acquire data and information
	PY	Targeted outreach with partners, tribes, DACs, various lyrics lists, etc.
	PY	Host local workshops for partner agencies and the public and offer training/guidance materials upon request
	PY	Provide physical and digital outreach content for distribution
	PY	Develop maps/dashboards/etc. identifying risk information for local recreation areas/waterbodies (lakes, lagoons, beaches, etc.)
	PY	Link to HABs portal through relevant R3 website pages
	PY	Better coordination with drinking water purveyors
RB 5	PY/\$	Create a multi-lingual public outreach program at public recreation areas including national, state and city parks that experience HABs
	PY	Conduct outreach and develop relationships with land managers (e.g., cities, water districts, park districts) to provide trainings (e.g., FHAB identification, sample collection, database input)
	PY	Conduct outreach and develop relationships with environmental and watershed community groups to provide resources (e.g. lab sampling) and trainings (e.g. FHAB identification, sample collection)
	PY	Work with the Water Board tribal liaisons to provide resources to local tribes and to sample culturally significant sites
	PY	Coordinate a region-wide conference to discuss HAB science, monitoring, and mitigation
	PY	Provide HAB identification and management resources to marina managers and harbor masters
	PY	Present on HABs at conferences (e.g. Delta RMP, Bay-Delta IEP, CALMS)

RB 6	PY	Individual to attend and actively participate in TAC's that are in development to meet goals and tasks outlined in the Implementation Plan
RB 8	PY	Continue to conduct outreach and develop relationships with land managers to provide trainings. Provide assistance with interpretation of sampling results
	PY	Work with US Forest Service staff to discuss best management practice implementation to reduce nutrient/sediment load to Big Bear Lake to prevent biostimulatory substances that contribute to HABs occurrence and severity

Table 2. Associated resources needed for Regional Boards to implement tasks identified in Table 1.

Regional Board	Resources Necessary	
	Permanent Full-Time Staff (PY)	Annual Contract Funding
RB 1	2 (1 ES/ 1 Senior ES Specialist)	\$75,000
RB 2	2 (1 ES / 1 Senior ES Specialist)	\$460,000
RB 3	3 (2 ES/1 Senior ES Specialist)	\$35,000
RB 4	0.1	\$50,000
RB 5	2 (1 ES / 1 Senior ES Specialist)	\$250,000
RB 6	1	\$70,000
RB 7	0.2	\$20,000
RB 8	2 (1 ES / 1 Senior ES Specialist)	\$175,000
RB 9	0.5	\$30,000
TOTAL	12.8 PY	\$1,165,000

Table 3. State Board Divisions input received during the gap assessment process as organized by AB 834 requirement. For Reference: Division of Information Technology: DIT; Division of Water Rights: DWR; Division of Water Quality: DWQ; Division of Drinking Water: DDW; Division of Financial Assistance: DFA; Water Board (general): WB

Water Code	Description	
13182.a.1	Coordinate immediate and long-term event incident response, including notification to state and local decisionmakers and the public regarding where harmful algal blooms are occurring, waters at risk of developing harmful algal blooms, and threats posed by harmful algal blooms.	
Water Board	PY/\$	Resources Necessary
DDW	PY	Dedicated personnel for coordination in HAB incident response
DFA	PY/\$	Bottled water for private water systems (not regulated by DDW including tribes) affected by HABs

Water Code	Description	
13182.a.2	Conduct and support field assessment and ambient monitoring to evaluate harmful algal bloom extent, status, and trends at the state, regional, watershed, and site-specific waterbody scales	
Water Board	PY/\$	Resources Necessary
DIT	PY	Update and maintain data infrastructure to house and maintain partner monitoring program
DWQ	PY	Coordination to integrate cyanotoxin water quality objectives into Basin Plans and permits
	PY/\$	Coordination for understanding trends, trainings, statewide implementation, and assisting in trend and effectiveness monitoring to facilitate adaptive management

Water Code	Description	
13182.a.3	Determine the regions, watersheds, or waterbodies experiencing or at risk of experiencing harmful algal blooms to prioritize those regions, watersheds, or waterbodies for assessment, monitoring, remediation, and risk management.	
Water Board	PY/\$	Resources Necessary
DWQ	PY	Assessing cyanotoxin data for the Integrated Report: evolving methods for determining evaluations based on new science and support through Advisory Committees
	PY/\$	Additional resources and support to establish cyanotoxin water quality objectives and a program of implementation

DWR	PY	Standard language for permit provisions to address monitoring and management for HABs and review monitoring plans and reports
	PY/\$	Resources to address drought and climate change that trigger HAB response
	PY	Liaison with other Water Board divisions for data sharing, participating on advisory committees, and coordination
DDW	PY	Staff to insert HAB data into a data system
DFA	PY/\$	Repayment of loans for mitigation
	PY/\$	Grant reimbursement for HAB monitoring

Water Code	Description	
13182.a.4	Conduct applied research and develop tools for decision-support	
Water Board	PY/\$	Resources Necessary
DIT	PY	Develop, update, and maintain data infrastructure to easily ingest data from external partners
	PY	Develop and refine data analysis and visualization tools
DWQ	PY/\$	Studies to better understand drivers of blooms, sources, and causes to inform options for source control, restoration, or other actions to reduce frequency and extent of blooms
DWR	PY/\$	Advisement on new impoundments; reservoir management based on FERCs
	PY	Coordination for understanding drivers/mitigation for reservoirs
DDW	PY/\$	Resources for water treatment facilities to research treatment based on type of toxin class
	PY	Need expertise in HABs (only one staff has it in duty statement) to coordinate with management and other Water board Programs/Divisions
	PY/\$	Development of MCLs for cyanotoxins
WB	PY/\$	New research to consider new analysis methods that are more cost-effective

Water Code	Description	
13182.a.5	Provide outreach and education and maintain a centralized internet website for information and data related to harmful algal blooms	
Water Board	PY/\$	Resources Necessary
DIT	PY	Graphics for use in physical and digital outreach content for distribution. Examples include but not limited to: pamphlets, fact sheets, tri-folds

Table 4. Associated resources needed for State Board Divisions to implement tasks identified in Table 3.

Water Board	Resources Necessary	
	Permanent Full-Time Staff (PY)	Annual Contract Funding
DWQ	2 PY	\$200,000
DWR	1 Senior ES Specialist	\$150,000
DDW	3 PY (northern/southern/HQ)	\$200,000
DFA	0.5	\$100,000

TOTAL	5.75	\$650,000
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