CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

Unified Assessment and Strategic Monitoring Approach for San Diego Bay

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Executive Summary

The California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) needs to change its approach to monitoring and assessment to be able to proactively direct and use resources to protect and restore the beneficial uses (BUs) of San Diego Bay's waters based on data-driven decisions. The Board developed this approach for the strategic collection of monitoring data after evaluating and understanding the water quality and water body-oriented assessment needs for San Diego Bay. Understanding the assessment needs helps determine what elements should be included in a monitoring program, and what components should be included in each monitoring element.

The goal of this document is to create a unified approach to assessing data along with a strategic approach to collecting monitoring data that can be used to assess the conditions and track progress toward the desired outcomes and goals for restoring and protecting the BUs of San Diego Bay. The assessment and monitoring outlines provided in this document are intended to help guide and inform Board staff, regulated entities, managers of other monitoring programs, and researchers on what the Board needs and wants to assess, and the monitoring data and information needed for assessments.

Ultimately, the information developed based on the assessments from this approach will enable the Board to make better informed and data-driven decisions on how to prioritize and focus its limited staff and resources on what is most important to achieve a healthy San Diego Bay

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1. Introduction

San Diego Bay (Bay) is the largest natural enclosed bay in southern California and the most intensively used water body in the San Diego region. The Bay plays a vital role in sustaining the local and regional economy, supporting national security, and providing a multitude of recreational opportunities as well as important habitats and ecosystems. Because of its importance as a water body supporting so many human and natural environmental beneficial uses (BUs), the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) since its inception has devoted significant resources toward its protection and restoration.

The San Diego Water Board frequently makes regulatory decisions to protect or restore BUs of the Bay. Many of these decisions, however, are made through the lens of a specific Board program or project instead of the water body as a whole. This uncoordinated discharge-oriented regulatory and monitoring approach has resulted in a wide variety and copious amounts of data directly and indirectly related to several types of discharges and facilities around San Diego Bay.

Unfortunately, the purpose and use of the data collected for each discharge-oriented monitoring program has been just different enough to make the data sets difficult to compare with each other. Without comparable data sets, any assessment of the conditions of the Bay, the stressors and sources that impact the conditions, and the performance of the Board's programs to protect and restore the BUs of the Bay can only provide information of limited value.

In 2012, the San Diego Water Board recognized a change to the Board's approach to assessment and monitoring was needed when it supported *A Framework for Monitoring and Assessment in the San Diego Region* (Framework) at its December 12, 2012 meeting by adopting Resolution No. R9-2012-0069. The Framework describes a systematic, logical, problem-solving water body-oriented approach to monitoring and assessment instead of the discharge-oriented approach typically developed and implemented in regulatory actions through the limited perspective of the Board's regulatory programs and requirements. The water body-oriented approach of the Framework (Figure 1) provides a structure for collecting and analyzing monitoring data for assessments that will help the Board proactively direct and use resources to protect and restore the BUs of San Diego Bay in a more effective and efficient way.

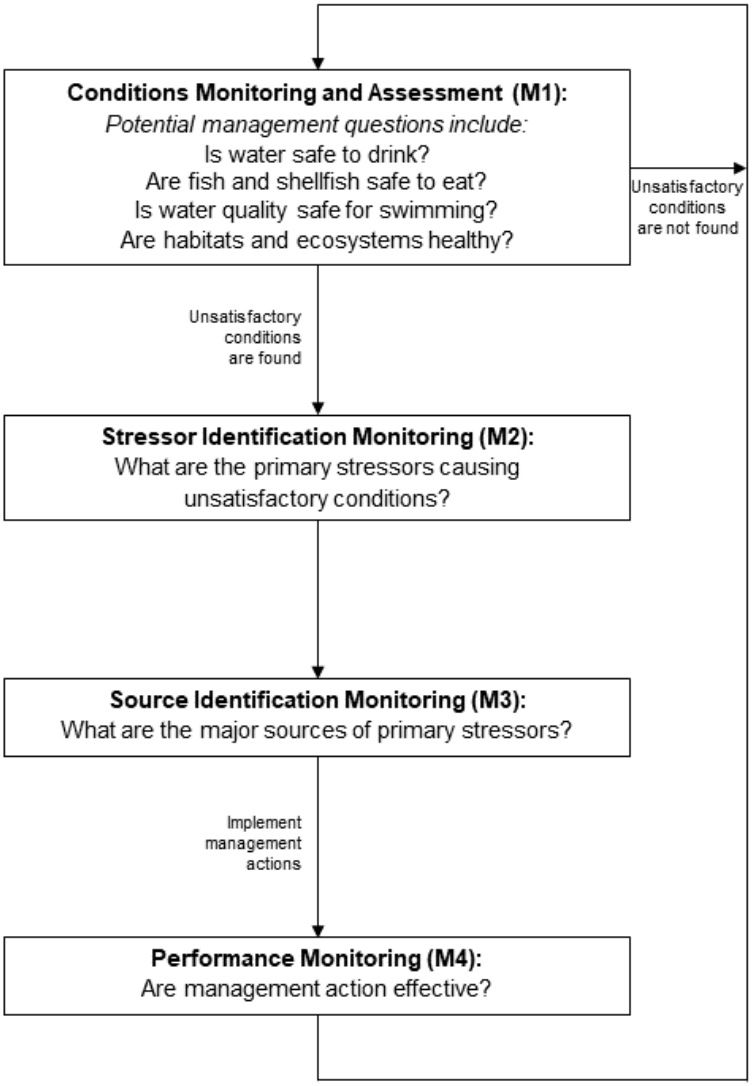

Figure 1: Water Body-Oriented Monitoring and Assessment
(from *A Framework for Monitoring and Assessment in the San Diego Region*)

In accordance with the Framework, the Board developed this approach for the strategic collection of monitoring data by first understanding the assessment needs of the Bay. Knowing the assessment needs helps the Board and the public understand why there is a need to monitor and collect data and information, and how the data and information can be used for assessment purposes. Knowing what types of data and information are needed then helps determine what elements should be included in a monitoring program, and what components should be included in each monitoring element. Thus, understanding the assessment needs creates a unified approach to analyzing data and information, and informs a strategic approach to collecting data through existing monitoring programs and monitoring programs that could be improved upon or developed in the future.

The outlines provided in this unified assessment and strategic monitoring approach for San Diego Bay can help Board staff, regulated entities, managers of other monitoring programs, and researchers understand the information the Board needs and wants to assess, and the monitoring data and information needed for those assessments. For Board staff, the outlines provide guidance on what monitoring elements and components should be included in Board-related monitoring programs, where warranted within policy and regulation. For regulated entities, the outlines help provide context for why monitoring elements and components are included in their monitoring programs. For managers of other monitoring programs and researchers, the outlines identify assessment and monitoring needs requiring additional investigation and research that can help improve the Board's assessments.

Ultimately, the information developed based on the assessments from this approach will allow the Board to make better informed and data-driven decisions on how to prioritize and focus its limited staff and resources on what is most important to achieve a healthy San Diego Bay.

2. Background

With a few exceptions, the San Diego Water Board requires monitoring because there are regulatory requirements for monitoring and reporting that are intended to support future regulatory decisions for a specific discharge or facility. These required monitoring programs are usually developed on a discharge-by-discharge or facility-by-facility basis, and typically not coordinated with each other. This regulatory-driven, or discharge-oriented monitoring approach usually begins with what is required to be monitored and assessments are based on the data from the required monitoring program.

This discharge-oriented approach is centered around what needs to be monitored for compliance purposes, and assessments are used to determine compliance based on data from the monitoring program. This approach only allows the Board to make data-driven decisions for a specific pollutant, discharge and/or facility. While Board program managers and staff can understand these decisions relative to these pollutants, discharges and/or facilities, these management decisions are difficult to apply to a water body as a whole. Because of the uncoordinated nature of this discharge-oriented approach to monitoring and assessment, priorities and goals for protecting and restoring the BUs a water body are often difficult to formulate.

The Board committed to implementing the water body-oriented approach to assessment and monitoring when it supported Chapter 1 (Strategizing for Healthy Waters) and Chapter 2 (Monitoring and Assessment) of the Practical Vision at its November 13, 2013 meeting by adopting Resolution No. R9-2013-0153. At its June 24, 2015 meeting, the San Diego Water Board adopted Resolution No. R9-2015-0086 in support of the implementation of the *Strategy for a Healthy San Diego Bay* (Strategy), developed as a pilot project to apply the concepts of Chapters 1 and 2 the Practical Vision to San Diego Bay.

The Strategy describes a seven-step implementation process to align the Board's work with the highest priorities and most important goals for the Bay, as outlined in Chapter 1 of the Practical Vision. The seven steps of the Strategy are to 1) identify key beneficial uses (KBUs), 2) assess conditions related to those KBUs, 3) develop and implement priorities, 4) set meaningful goals, 5) realign and implement work, 6) track progress, and 7) periodically reevaluate priorities, which may require revisions to the priorities, goals and realignment of work.

Board staff are implementing the seven steps of the Strategy concurrently and iteratively as additional information is identified or becomes available. For many of the steps, however, better information about the conditions of San Diego Bay for the KBUs are necessary before they can be appropriately and adequately implemented. Implementing this unified assessment and strategic monitoring approach for San Diego Bay is necessary for developing and collecting this information.

3. Development Process

The development of this unified assessment and strategic monitoring approach for San Diego Bay started with the *Strategy for a Healthy San Diego Bay*. The Strategy identifies the KBUs of San Diego Bay. KBUs are the categories of water quality-dependent uses most critical to consider for the protection of human and environmental health. The Strategy reviewed the 13 BUs identified for San Diego Bay in the Water Quality Control Plan for the San Diego Basin (Basin Plan).

The 13 BUs for San Diego Bay include:

- Preservation of Biological Habitats of Significance (BIOL),
- Commercial and Sport Fishing (COMM),
- Estuarine Habitat (EST),
- Industrial Service Supply (IND),
- Marine Habitat (MAR),
- Migration of Aquatic Organisms (MIGR),
- Navigation (NAV),
- Rare, Threatened or Endangered Species (RARE),
- Contact Water Recreation (REC-1),
- Non-Contact Water Recreation (REC-2),
- Shellfish Harvesting (SHELL),
- Spawning, Reproduction, and/or Early Development (SPWN), and
- Wildlife Habitat (WILD).

The BUs identified as critical for protecting human and environmental health were grouped into KBU categories. The KBU categories identified in the Strategy for San Diego Bay are:

- Recreation (REC-1 and REC-2[1]);
- Human consumption of fish and shellfish (COMM and SHELL); and
- Habitats and ecosystems (BIOL, EST, MAR, MIGR, RARE, SPWN, and WILD).

The Strategy also broadly describes what a healthy San Diego Bay would mean for each of these KBUs:

- Bay water quality is suitable for recreational activities (i.e., “swimmable”);
- Bay fish and shellfish are safe to eat (i,e., “fishable”); and,
- Bay habitats and ecosystems are healthy.

[1] Non-Contact Water Recreation (REC-2) is in large part dependent on the aesthetic conditions of the habitats and ecosystems of the Bay. For the development of the unified assessment and strategic monitoring approach, REC-2 will be addressed through the protection and restoration of the Habitats and Ecosystems KBU.

Subsequent to the development and adoption of the Strategy, the San Diego Water Board adopted Resolution No. R9-2017-0030 at its March 15, 2017 meeting in support of the Key Beneficial Uses / Key Areas concept to help the San Diego Water Board focus on what is most important for improving the health of the waters in the San Diego region. Resolution No. R9-2017-0030 endorsed the staff report entitled *Key Beneficial Uses and Key Areas – Focusing on What Is Most Important* (KBUKA Report). The KBUKA Report identified four KBUs for which the protection and integrity, or health, of waters in the San Diego region are most important. The KBUs of waters in the San Diego region are:

- Drinking Water Supply;
- Recreation;
- Fish and Shellfish Consumption; and,
- Habitats and Ecosystems.

While the Strategy looked at KBUs from a San Diego Bay-specific perspective, the KBUKA Report looked at water bodies of the San Diego region from a KBU-specific perspective to identify the KAs (i.e., key water body *types* and key *individual* water bodies) that are most important for those KBUs. The KBUKA Report identified and ranked KAs by importance for each KBU, which is intended to inform how the San Diego Water Board should prioritize and focus its resources and efforts.

The KBUKA Report identified and ranked San Diego Bay as a very important KA *individual* water body for the following KBUs:

- Habitats and Ecosystems – First (Highest) Rank KA
- Fish and Shellfish Consumption – Second Rank KA
- Recreation – Third Rank KA[2]

The KBUs for San Diego Bay identified in the KBUKA Report reaffirmed and validated the KBUs identified in the Strategy.

Chapter 2 (Monitoring and Assessment) of the Practical Vision recognizes the need to implement the water body-oriented approach to monitoring and assessment outlined in the Framework. To begin the process outlined in the Framework, initial assessments of the conditions of San Diego Bay for the KBUs were conducted based on readily available data and information. The initial assessments also helped to identify potential data gaps that could prevent adequate assessment of the KBUs.

[2] The KBUKA Report identified San Diego Bay as a Third Rank KA for Contact Water Recreation (REC-1), but also identified the Bay as a First (Highest) Rank KA for Non-Contact Water Recreation (REC-2). Because REC-2 is in large part dependent on the aesthetic conditions of the habitats and ecosystems of the Bay, the development of the unified assessment and strategic monitoring approach assumes REC-2 will be addressed when the Habitats and Ecosystems KBU is restored or protected.

For the initial assessments of conditions, relatively recently collected and readily available data and information related to the KBUs were reviewed. A lot of readily available data and information were collected for Board-required and Board-administered monitoring programs. Data and information from monitoring programs administered and managed by other entities were also reviewed, including but not limited to data and information from the California Office of Environmental Health Hazard Assessment (OEHHA), San Diego County Department of Environmental Health (SDCDEH), San Diego Unified Port District (Port), and United States Department of the Navy (Navy).

In 2017, the Board published a series of "Status Sheets" on the Strategy for a Healthy San Diego Bay webpage summarizing findings of the initial assessments of conditions for the contact recreation and fish and shellfish consumption KBUs (Appendix A). An initial assessment of San Diego Bay conditions for habitats and ecosystems KBU could not be completed due to a lack of key parameters or indicators that could be identified for assessing the health of the Bay.

The initial assessments highlighted that assessing conditions is difficult to conduct based primarily on discharge-oriented monitoring data. It was particularly noteworthy that much of the most useful data and information for assessing San Diego Bay conditions for the KBUs came from outside of the Board's basic regulatory-driven and discharge-oriented monitoring programs. The initial assessments also highlighted the fact that there is a general lack of monitoring data and information available to adequately assess conditions in large part because existing monitoring programs were not developed based on an understanding about what should be or needs to be assessed specific to each KBU from a water body-oriented perspective.

Following the completion of the initial assessments, Board staff organized a series of meetings with the Port and Navy to facilitate discussions about developing and implementing a more coordinated approach to assessing and monitoring San Diego Bay from a more common understanding of assessment needs. The Port and Navy have responsibilities that overlap with the Board's mission to protect and restore the KBUs of the Bay. They are also responsible for collecting and using much of the monitoring data that were reviewed for the initial assessments.

The Port implements the Regional Harbor Monitoring Program (RHMP) in San Diego Bay pursuant to an Investigative Order issued by the San Diego Water Board, which is implemented in coordination with the Southern California Bight Regional Monitoring Program (Bight RMP). The Navy implements several monitoring programs with discharge and receiving water monitoring for National Pollutant Discharge Elimination System (NPDES) permits issued by the Board to the Navy's bases located around the Bay. The Port and Navy also collaborate to collect data and information about the Bay's natural and wildlife resources to support the San Diego Bay Integrated Natural Resources Management Plan (INRMP). While all these monitoring programs are implemented in San Diego Bay, the monitoring programs do not appear to coordinate

with each other to share monitoring resources, or collect, analyze, and report the monitoring data and information.

Because the Port and Navy have similar and overlapping needs as the Board for monitoring data, these meetings allowed the Port and Navy to share information about the types of monitoring data they collect from the Bay, the purpose and use of the data, as well as the resources for collecting the data with the Board, as well as between organizations and internally within each organization. The meetings also allowed the Board to develop and receive feedback on the types of monitoring data and information needed to appropriately and adequately assess the conditions, stressors impacting conditions, sources of those stressors, and performance of management actions to improve conditions of the Bay for the KBUs.

As a result of what was learned during these meetings, Board staff identified the assessment needs for each KBU for San Diego Bay to develop and communicate a unified understanding of the types of monitoring data and information needed and the purpose of each need for each KBU.

4. Assessment Needs of Key Beneficial Uses

Establishing the assessment needs for each KBU is the first and most important step in this water body-oriented approach to identifying the monitoring needs for San Diego Bay. The questions identified by each element of the Framework, as shown in Figure 1, and built upon as appropriate to establish management questions, are the foundation for identifying and establishing the assessment needs for each KBU.

Understanding the information needed to answer those management questions helps determine the types of data that can be collected and analyzed to generate the information. However, understanding what information is needed to answer the questions versus what types of data are available or potentially available to generate the information is also an important consideration.

Ideally, to answer the questions for each element of the Framework, there would be a single direct measurement that is available and can be monitored at a frequency that will collect enough data for the information necessary to answer each question. When a direct measurement that has all these qualities is not available, identifying indirect measurements that can also answer the questions becomes necessary.

Based on the management questions, potential direct measurements that could provide the information to answer the questions for each Framework element (conditions, stressors, sources, and performance) as they relate to each KBU (recreation, fish and shellfish consumption, and habitats and ecosystems) were identified. Potential indirect measurements that could also provide the information to answer the questions for each element of the Framework for each KBU were also identified.

The evaluations were based on knowledge about existing monitoring programs and special studies or research that have collected, currently collect, or can potentially collect the data that needs to be analyzed for assessing the Framework elements (conditions, stressors impacting conditions, sources of stressors, and performance of management actions) for each KBU. The potential direct and indirect measurements were evaluated to determine whether those types of data are feasible and practical to monitor and collect.

Appendix B summarizes the evaluations of the potential direct and indirect measurements that can be used for the assessment of conditions (Tables B-1a and B-1b), stressors impacting conditions (Tables B-2a and B-2b), sources contributing to stressors (Tables B-3a and B-3b), and performance of management actions (Tables B-4a and B-4b) for the recreation, fish and shellfish consumption, and habitats and ecosystems KBUs.

5. Unified Assessment and Strategic Monitoring Approach

The results from the evaluations identified several types of measurements that could be applicable to the assessment needs of multiple Framework elements. Based on the feasibility and practicality of the potential direct and indirect measurements evaluated for assessment needs, an approach to strategically collect monitoring data that can be analyzed for assessment purposes was developed.

After identifying the types of data needed for the assessments, monitoring elements (i.e., what needs to be monitored for analysis) and components (i.e., what data need to be collected, and where and when data should be collected) were developed for each Framework element and KBU. Based on the monitoring elements and components, an outline explaining how each monitoring element data set will be analyzed was developed. The data analysis outlines also provide a unified understanding of what information the monitoring data is providing for assessment purposes.

For each Framework element, the collection of data and data analysis methods are outlined in a unified assessment and strategic monitoring approach, beginning with a "primary" set of monitoring elements that can generally be collected and analyzed with currently available methodologies, metrics, and/or standards, or by comparing relative changes over time. Minor modifications or additions to existing monitoring programs may be necessary to fully implement all the components of the primary monitoring elements.

Each Framework element may also include a "supplemental" set of monitoring elements that may not yet be possible to collect and analyze due to a lack of currently available methodologies, metrics, standards and/or resources for routine monitoring programs. As new methodologies, metrics, standards and/or resources become available, supplemental monitoring may be strategically implemented to collect data that can be incorporated into assessments for each Framework element.

The outlines also identify which monitoring element components are not currently or regularly included in Board-related existing monitoring programs. These components may be partially/occasionally included in Board-related monitoring programs, included or partially/occasionally included in external monitoring programs, or need to be developed to be included in a monitoring program.

The primary and supplemental unified assessment and strategic monitoring approach outlines for each Framework element (conditions, stressors, sources, performance) and for each San Diego Bay KBU (recreation, fish and shellfish consumption, and habitats and ecosystems) are summarized in the tables below.

Unified Assessment and Strategic Monitoring Approach Outlines

Tables 1 through 3 outline the PRIMARY and SUPPLEMENTAL unified CONDITIONS assessment and strategic monitoring approach outlines for each KBU.

Tables 4 through 6 outline the PRIMARY and SUPPLEMENTAL unified STRESSORS assessment and strategic monitoring approach outlines for each KBU.

Tables 7 through 9 outline the PRIMARY and SUPPLEMENTAL unified SOURCES assessment and strategic monitoring approach outlines for each KBU.

Tables 10 through 12 outline the PRIMARY unified PERFORMANCE assessment and strategic monitoring approach outlines for each KBU.

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Table 1a. PRIMARY Unified CONDITIONS Assessment and Strategic Monitoring for RECREATION in San Diego Bay

PRIMARY CONDITIONS Monitoring Elements for RECREATION	PRIMARY CONDITIONS Monitoring Element Components for RECREATION	PRIMARY CONDITIONS Status Assessment Data Analysis Method for RECREATION	PRIMARY CONDITIONS Trend Assessment Data Analysis Method for RECREATION
Primary Recreation Water Quality Monitoring and Assessment	WHAT: Fecal indicator bacteria (FIB), including: - Enterococcus - Fecal coliforms Human source markers (e.g., HF183)* WHERE: Waters at publicly accessible and swimmable beaches by San Diego Bay, including: - NTC Boat Channel* - Kellogg Beach* - Shelter Island Shoreline Park - Spanish Landing Park* - Coronado Ferry Landing* - Tidelands Park - Glorietta Bay Park* - Grand Caribe Park* - Chula Vista Bayside Park WHEN: April-September weekly October-March monthly or bi-weekly* Within 24-hours after all storm events with 0.1 inches or greater rainfall*	i. Compare FIB levels for each sampling event at each station to statistical threshold value (STV) and geometric mean (GM) water quality objectives (WQOs) in Basin Plan. ii. Only analyze samples for human source markers (e.g., HF183) if FIB levels exceed STVs and/or GMs to determine if exceedances are attributed to human sources (i.e., sewage). Samples with HF183 exceeding levels of concern, determined by the San Diego Water Board, State Water Board, and/or USEPA, indicates FIB exceedances likely attributed to human sources (i.e., sewage). iii. Annually analyze STV and GM exceedance frequencies attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall). STV or GM exceedance frequencies greater than 10 percent for all dry weather days analyzed indicates unsatisfactory conditions for recreation by location. iv. Annually analyze STV exceedance frequencies attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours). STV exceedance frequencies greater than 10 percent for all wet weather days analyzed indicates unsatisfactory conditions for recreation by location.	i. Track number of STV and GM exceedances attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in dry weather days with STV and GM exceedances from year to year and/or over time indicates conditions improving during dry weather days by location. ii. Track number of FIB levels that exceed STVs attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in wet weather days with STV exceedances from year to year and/or over time indicates conditions improving during wet weather days by location.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 1b. SUPPLEMENTAL Unified CONDITIONS Assessment and Strategic Monitoring for RECREATION in San Diego Bay

SUPPLEMENTAL CONDITIONS Monitoring Elements for RECREATION	SUPPLEMENTAL CONDITIONS Monitoring Element Components for RECREATION	SUPPLEMENTAL CONDITIONS Status Assessment Data Analysis Method for RECREATION	SUPPLEMENTAL CONDITIONS Trend Assessment Data Analysis Method for RECREATION
Supplemental Recreation Water Quality Monitoring and Assessment	WHAT: Harmful algal blooms (HABs)* Other indicators/pollutants potentially linked to illness in humans from exposure to San Diego Bay waters* WHERE: Same locations as Primary Recreation Water Quality Monitoring and Assessment* WHEN: April-September weekly*	i. Annually analyze number of times HABs detected for each sampling event at each location. Any detection of HABs indicates potentially unsatisfactory conditions for recreation by location. ii. Annually analyze number of times other indicators/pollutants that may be linked to illness in humans by exposure to waters detected for each sampling event at each location. Any detection of other indicators/pollutants that may be linked to illness in humans by exposure to waters indicates potentially unsatisfactory conditions for recreation by location.	i. Track number of times HABs detected and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in number or lack of detections for HABs from year to year and/or over time indicates conditions improving by location. ii. Track number of times other indictors/pollutants detected and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in number or lack of detections for other indictors/pollutants from year to year and/or over time indicates conditions improving by location.
Recreator Health Monitoring and Assessment	WHAT: Survey of recreators who have contracted illnesses after swimming or wading in waters at publicly accessible and swimmable beaches by San Diego Bay* WHERE: San Diego Bay-wide* WHEN: At least once every 5 years*	i. Track number of people with illnesses attributed to ingestion of water from contact water recreation in San Diego Bay. Recreators experiencing illnesses attributed to ingestion of water from contact water recreation in San Diego Bay at a rate greater than 32 per 1000 recreators indicates unsatisfactory conditions for recreation. ii. Track number people with respiratory or skin illnesses that may be attributed to exposure and/or contact with HABs or other indicators/pollutants that may be linked to illness in humans by exposure to waters in San Diego Bay. Any respiratory or skin illnesses attributed to exposure and/or contact with HABs or other indicators/pollutants in San Diego Bay indicates potentially unsatisfactory conditions for recreation.	i. Compare number of people with illnesses attributed to ingestion of water from contact water recreation in San Diego Bay from survey to survey and over time (including historical data/information, if available, for additional context). Decrease in number of people with illnesses attributed to ingestion of water from contact water recreation in San Diego Bay from survey to survey and/or over time indicates conditions improving. ii. Compare number people with respiratory or skin illnesses that may be attributed to exposure and/or contact with HABs and other indicators/pollutants that may be linked to illness in humans by exposure to waters in San Diego Bay from survey to survey and over time (including historical data/information, if available, for additional context). Decrease in number of people with respiratory or skin illnesses that may be attributed to exposure and/or contact with HABs and other indicators/pollutants in San Diego Bay from survey to survey and/or over time indicates conditions improving.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 2a. PRIMARY Unified CONDITIONS Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

PRIMARY CONDITIONS Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	PRIMARY CONDITIONS Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	PRIMARY CONDITIONS Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	PRIMARY CONDITIONS Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Primary Fish and Shellfish Tissue Monitoring and Assessment	WHAT: Levels of contaminants of concern in the tissue of the following indicator fish and shellfish species: - Spotted Sand Bass (filet) - Chub Mackerel (filet) - Topsmelt (without head and guts) - Pacific Oyster* - California Spiny Lobster (legal size tails from males)* Contaminants of concern include: - Total polychlorinated biphenyls (PCBs) - Metals (mercury) - Pesticides (chlordane) - Emerging contaminants of concern* Aging of fish collected for analysis (otoliths or scales if old enough)* WHERE: San Diego Bay-wide with samples from the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years Samples collected within 12 month period	i. Compare fish tissue contaminant levels for indicator fish species (Spotted Sand Bass, Chub Mackerel, Topsmelt) collected within 12 month period from each ecoregion and bay-wide to Office of Environmental Health Hazard Assessment (OEHHA) Fish Contaminant Goals (FCGs) and Advisory Tissue Levels (ATLs). Exceedances of FCGs or ATLs in one or more indicator fish species indicates unsatisfactory conditions for fish consumption. ii. Compare bivalve tissue contaminant levels for indicator bivalve species (Pacific Oyster) collected within 12 month period from each ecoregion and bay-wide to OEHHA FCGs and ATLs. Exceedances of FCGs or ATLs indicates unsatisfactory conditions for bivalves (shellfish) consumption. iii. Compare crustacean tissue contaminant levels for indicator crustacean species (California Spiny Lobster) collected within 12 month period from each ecoregion and bay-wide to OEHHA FCGs and ATLs. Exceedances of FCGs or ATLs indicates unsatisfactory conditions for crustaceans (shellfish) consumption.	i. Track fish tissue contaminant levels based on species and age and compare each species in the same age group year to year and over time (including historical data/information, if available, for additional context). Decrease in fish tissue contaminant levels from year to year and/or over time indicates improvement of conditions for fish consumption. ii. Track fish tissue contaminant levels based on species from different age groups within each year and compare year to year and over time (including historical data/information, if available, for additional context). Lower contaminant levels in younger fish relative to older fish taking into account age and time for bioaccumulation of contaminants may indicate improvement of conditions for fish consumption. iii. Track bivalve tissue contaminant levels and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in bivalve contaminant tissue levels from year to year and/or over time indicates improvement of conditions for bivalve (shellfish) consumption. iv. Track crustacean tissue contaminant levels and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in crustacean tissue contaminant levels from year to year and/or over time indicates improvement of conditions for crustacean (shellfish) consumption.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 2b. SUPPLEMENTAL Unified CONDITIONS Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

SUPPLEMENTAL CONDITIONS Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL CONDITIONS Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL CONDITIONS Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL CONDITIONS Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Supplemental Fish and Shellfish Tissue Monitoring and Assessment	WHAT: Levels of contaminants of concern in the tissue of the following species with OEHHA advisories: - Barred Sand Bass (whole/filet)* - Spotted Sand Bass (whole/filet)* - Yellow Croaker (whole/filet)* - Shovelnose Guitarfish (whole/filet)* - Chub Mackerel (whole/filet)* - Black Perch (whole/filet)* - Pile Perch (whole/filet)* - Shiner Perch (whole/filet)* - Rainbow Surfperch (whole/filet)* - Gray Smoothhound Shark (whole/filet)* - Leopard Shark (whole/filet)* - Round Stingray (whole/filet)* - Diamond Turbot (whole/filet)* - Spotted Turbot (whole/filet)* Contaminants of concern same as Primary Fish and Shellfish Tissue Monitoring and Assessment Aging of fish collected for analysis (otoliths or scales if old enough)* WHERE: Same locations as Primary Fish and Shellfish Tissue Monitoring and Assessment WHEN: At least once every 5 years* Samples collected within 5-10 year period*	i. Compare fish tissue contaminant levels for fish species with OEHHA advisories collected within 5 to 10 year period from each ecoregion and bay-wide to OEHHA FCGs and ATLs. Exceedances of FCGs or ATLs in one or more fish species indicates unsatisfactory conditions for fish consumption. ii. OEHHA advisories for the consumption of one or more fish or shellfish species indicates unsatisfactory conditions for fish consumption.	i. Track fish tissue contaminant levels based on species and age and compare each species in the same age group year to year and over time (including historical data/information, if available, for additional context). Decrease in fish tissue contaminant levels from year to year and/or over time indicates improvement of conditions for fish consumption. ii. Track fish tissue contaminant levels based on species from different age groups within each year and compare year to year and over time (including historical data/information, if available, for additional context). Lower contaminant levels in younger fish relative to older fish taking into account age and time for bioaccumulation of contaminants may indicate improvement of conditions for fish consumption. iii. Revision of OEHHA fish consumption advisories to allow more consumption or removal of consumption limitations for one or more fish species indicates improvement of conditions for fish and shellfish consumption.
Fish and Shellfish Consumption Monitoring and Assessment	WHAT: Survey of anglers who have caught and consumed fish and shellfish from San Diego Bay* WHERE: San Diego Bay-wide* WHEN: At least once every 5 years*	i. Track number of people consuming different species of fish and shellfish caught from San Diego Bay and frequency of consumption. ii. Compare fish and shellfish species reported to be consumed and frequency consumed to allowable frequency of consumption in advisories issued by OEHHA. Exceedances of consumption frequencies of one or more specific from OEHHA advisories indicates unsatisfactory conditions.	i. Track number of people consuming different species of fish and shellfish caught from San Diego Bay and frequency of consumption from survey to survey and over time. ii. Compare fish and shellfish species reported to be consumed and frequency consumed to allowable frequency of consumption in advisories issued by OEHHA. Reduction of reported exceedances of consumption frequencies of one or more species from OEHHA advisories indicates improving conditions.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 3a. PRIMARY Unified CONDITIONS Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY CONDITIONS Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY CONDITIONS Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY CONDITIONS Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY CONDITIONS Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Habitats Physical Size and Area Monitoring and Assessment	WHAT: Areal extent and distribution of the following aquatic dependent habitats:* - Eelgrass beds* - Saltmarsh* - Vegetated low marsh* - Mudflats/beaches* - Rocky intertidal* - Unvegetated subtidal* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Measure the areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide. Lack of one or more aquatic dependent habitats in an ecoregion or bay-wide indicates unsatisfactory conditions of habitats and ecosystems.	i. Track areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide from survey to survey and over time (including historical data/information, if available, for additional context). Increase in area of aquatic dependent habitats from survey to survey and/or over time by ecoregion or bay-wide indicates improvement to conditions for habitats and ecosystems. Increases to proportions of high value habitats from survey to survey and/or over time by ecoregion or bay-wide may indicate improvement to conditions for habitats and ecosystems.
Diversity and Abundance of Biology Monitoring and Assessment	WHAT: Diversity and abundance of native, aquatic dependent species for the following: - Fish* - Birds* Presence and distribution of rare/ threatened/endangered aquatic dependent species* Presence and distribution of invasive species that can adversely impact one or more habitats or ecosystems* Observations of adverse impacts to aquatic dependent species, including but not limited to: - Birth defects* - Low birth weights* WHERE: Same locations as Habitats Physical Size and Area Monitoring and Assessment* WHEN: At least once every 5 years* Samples collected within 5-10 year period*	i. Count diversity and abundance of fish and bird species within each ecoregion and bay-wide. Lack of diversity or abundance of fish or bird species in an ecoregion or bay-wide indicates unsatisfactory conditions of habitats and ecosystems. ii. Count observations and/or numbers of rare/ endangered/threatened species within each ecoregion and bay-wide. Lack of rare/endangered/threatened species in an ecoregion or bay-wide indicates unsatisfactory conditions of habitats and ecosystems. iii. Count observations and/or numbers of invasive species that adversely impact one or more habitats or ecosystems within each ecoregion and bay-wide. Presence of invasive species that can adversely impact one or more habitats or ecosystems in an ecoregion or bay-wide indicates unsatisfactory conditions of habitats and ecosystems. iv. Count observations and/or numbers of adverse impacts to aquatic dependent species (e.g., birth defects, low birth weights) within each ecoregion and bay-wide. Presence of adverse impacts to aquatic dependent species in an ecoregion or bay-wide indicates unsatisfactory conditions of habitats and ecosystems.	i. Track diversity and abundance of fish and bird species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in diversity and/or abundance from survey to survey and/or over time by ecoregion or bay-wide indicates improvement to conditions for habitats and ecosystems. ii. Track observations and/or numbers of rare/endangered/ threatened species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in observations and/or numbers from survey to survey and/or over time by ecoregion or bay-wide indicates improvement to conditions for habitats and ecosystems. iii. Track observations and/or numbers of invasive species that can adversely impact one or more habitats or ecosystems within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers of invasive species from survey to survey and/or over time by ecoregion or bay-wide indicates improvement to conditions for habitats and ecosystems. iv. Track observations and/or numbers of adverse impacts to aquatic dependent species (e.g., birth defects, low birth weights) within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers from survey to survey and/or over time by ecoregion or bay-wide indicates improvement to conditions for habitats and ecosystems.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 3b. SUPPLEMENTAL Unified CONDITIONS Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

SUPPLEMENTAL CONDITIONS Monitoring Elements for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL CONDITIONS Monitoring Element Components for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL CONDITIONS Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL CONDITIONS Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Functionality of Habitats and Ecosystems Monitoring and Assessment	WHAT: Measurements related to health or functionality of habitats and ecosystems, including but not limited to: - Sediment Quality Objectives (SQOs) - California Rapid Assessment Method (CRAM) - Other indices or scores for health or functionality of one or more habitats or ecosystems* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Compare measurements related to health or functionality of habitats or ecosystems to available thresholds or standards. Measurements that do not achieve thresholds indicate unsatisfactory conditions for one or more habitats or ecosystems.	i. Track measurements related to health or functionality of habitats or ecosystems (including historical data/information, if available, for additional context) over time. Improvements in measurements indicate improvement to conditions for habitats and ecosystems.

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Table 4a. PRIMARY Unified STRESSORS Assessment and Strategic Monitoring for RECREATION in San Diego Bay

PRIMARY STRESSORS Monitoring Elements for RECREATION	PRIMARY STRESSORS Monitoring Element Components for RECREATION	PRIMARY STRESSORS Status Assessment Data Analysis Method for RECREATION	PRIMARY STRESSORS Trend Assessment Data Analysis Method for RECREATION
Primary Recreation Pollutants Monitoring and Assessment	WHAT: Fecal indicator bacteria (FIB), including: - Enterococcus - Fecal coliforms Human source markers (e.g., HF183)* WHERE: Waters at publicly accessible and swimmable beaches by San Diego Bay, including: - NTC Boat Channel* - Kellogg Beach* - Shelter Island Shoreline Park - Spanish Landing Park* - Coronado Ferry Landing* - Tidelands Park - Glorietta Bay Park* - Grand Caribe Park* - Chula Vista Bayside Park WHEN: April-September weekly October-March monthly or bi-weekly* Within 24-hours after all storm events with 0.1 inches or greater rainfall*	i. Compare FIB levels for each sampling event at each station to statistical threshold value (STV) and geometric mean (GM) water quality objectives (WQOs) in Basin Plan. ii. Only analyze samples for human source markers (e.g., HF183) if FIB levels exceed STVs and/or GMs to determine if exceedances are attributed to human sources (i.e., sewage). Samples with HF183 exceeding levels of concern, determined by the San Diego Water Board, State Water Board, and/or USEPA, indicates FIB exceedances likely attributed to human sources (i.e., sewage). iii. Annually analyze STV and GM exceedance frequencies attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall). STV or GM exceedance frequencies greater than 10 percent for all dry weather days analyzed indicates stressors are adversely impacting conditions for recreation by location. iv. Annually analyze STV exceedance frequencies attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours). STV exceedance frequencies greater than 10 percent for all wet weather days analyzed indicates stressors are adversely impacting conditions for recreation by location.	i. Track number of STV and GM exceedances attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in dry weather days with STV and GM exceedances from year to year and/or over time indicates impacts to conditions for recreation caused by stressors are decreasing during dry weather days by location. ii. Track number of FIB levels that exceed STVs attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in wet weather days with STV exceedances from year to year and/or over time indicates impacts to conditions for recreation caused by stressors are decreasing during wet weather days by location.

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Table 4b. SUPPLEMENTAL Unified STRESSORS Assessment and Strategic Monitoring for RECREATION in San Diego Bay

SUPPLEMENTAL STRESSORS Monitoring Elements for RECREATION	SUPPLEMENTAL STRESSORS Monitoring Element Components for RECREATION	SUPPLEMENTAL STRESSORS Status Assessment Data Analysis Method for RECREATION	SUPPLEMENTAL STRESSORS Trend Assessment Data Analysis Method for RECREATION
Supplemental Recreation Pollutants Monitoring and Assessment	WHAT: Presence and/or levels of neurotoxins/cyanotoxins from harmful algal blooms (HABs)* Presence and/or levels of other indicators/pollutants potentially linked to illness in humans from exposure to San Diego Bay waters* WHERE: Same locations as Primary Recreation Pollutants Monitoring and Assessment* WHEN: April-September weekly*	i. Annually analyze number of times HABs detected for each sampling event at each location. Any detection of HABs indicates neurotoxins/cyanotoxins may be adversely impacting conditions for recreation by location. Comparison of levels of neurotoxins/ cyanotoxins to available thresholds may provide additional context for potential impact to conditions. ii. Annually analyze number of times other indicators/pollutants that may be linked to illness in humans by exposure to waters detected for each sampling event at each location. Any detection of other indicators/pollutants that may be linked to illness in humans by exposure to waters indicates other pollutants may be adversely impacting conditions for recreation by location. Comparison of levels of other pollutants to available thresholds may provide additional context for potential impact to conditions.	i. Track number of times HABs detected and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in number or lack of detections for HABs from year to year and/or over time indicates potential impacts to conditions caused by neurotoxins/ cyanotoxins are decreasing by location. ii. Track number of times other indictors/pollutants detected and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in number or lack of detections for other indictors/pollutants from year to year and/or over time indicates potential impacts to conditions caused by other pollutants are decreasing by location.

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Table 5a. PRIMARY Unified STRESSORS Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

PRIMARY STRESSORS Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	PRIMARY STRESSORS Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	PRIMARY STRESSORS Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	PRIMARY STRESSORS Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Primary Fish and Shellfish Tissue Contaminants Monitoring and Assessment	WHAT: Levels of contaminants of concern in the tissue of the following indicator fish and shellfish species: - Spotted Sand Bass (filet) - Chub Mackerel (filet) - Topsmelt (without head and guts) - Pacific Oyster* - California Spiny Lobster (legal size tails from males)* Contaminants of concern include: - Total polychlorinated biphenyls (PCBs) - Metals (mercury) - Pesticides (chlordane) - Emerging contaminants of concern* Aging of fish collected for analysis (otoliths or scales if old enough)* WHERE: San Diego Bay-wide with samples from the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years Samples collected within 12 month period	i. Compare fish tissue contaminant levels for indicator fish species (Spotted Sand Bass, Chub Mackerel, Topsmelt) collected within 12 month period from each ecoregion and bay-wide to Office of Environmental Health Hazard Assessment (OEHHA) Fish Contaminant Goals (FCGs) and Advisory Tissue Levels (ATLs). Exceedances of FCGs or ATLs in one or more indicator fish species indicates stressors are adversely impacting conditions for fish consumption. ii. Compare bivalve tissue contaminant levels for indicator bivalve species (Pacific Oyster) collected within 12 month period from each ecoregion and bay-wide to OEHHA FCGs and ATLs. Exceedances of FCGs or ATLs indicates stressors are adversely impacting conditions for bivalve (shellfish) consumption. iii. Compare crustacean tissue contaminant levels for indicator crustacean species (California Spiny Lobster) collected within 12 month period from each ecoregion and bay-wide to OEHHA FCGs and ATLs. Exceedances of FCGs or ATLs indicates stressors are adversely impacting conditions for crustaceans (shellfish) consumption.	i. Track fish tissue contaminant levels based on species and age and compare each species in the same age group year to year and over time (including historical data/information, if available, for additional context). Decrease in fish tissue contaminant levels from year to year and/or over time indicates impacts to conditions for fish consumption caused by stressors are decreasing. ii. Track fish tissue contaminant levels based on species from different age groups within each year and compare year to year and over time (including historical data/information, if available, for additional context). Lower contaminant levels in younger fish relative to older fish taking into account age and time for bioaccumulation of contaminants may indicate impacts to conditions for fish consumption caused by stressors are decreasing. iii. Track bivalve tissue contaminant levels and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in bivalve contaminant tissue levels from year to year and/or over time indicates impacts to conditions for bivalves (shellfish) consumption caused by stressors are decreasing. iv. Track crustacean tissue contaminant levels and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in crustacean tissue contaminant levels from year to year and/or over time indicates impacts to conditions for crustaceans (shellfish) consumption caused by stressors are decreasing.

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Table 5b. SUPPLEMENTAL Unified STRESSORS Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

SUPPLEMENTAL STRESSORS Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL STRESSORS Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL STRESSORS Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL STRESSORS Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Supplemental Fish and Shellfish Tissue Contaminants Monitoring and Assessment	WHAT: Levels of contaminants of concern in the tissue of the following species with OEHHA advisories: - Barred Sand Bass (whole/filet)* - Spotted Sand Bass (whole/filet)* - Yellow Croaker (whole/filet)* - Shovelnose Guitarfish (whole/filet)* - Chub Mackerel (whole/filet)* - Black Perch (whole/filet)* - Pile Perch (whole/filet)* - Shiner Perch (whole/filet)* - Rainbow Surfperch (whole/filet)* - Gray Smoothhound Shark (whole/filet)* - Leopard Shark (whole/filet)* - Round Stingray (whole/filet)* - Diamond Turbot (whole/filet)* - Spotted Turbot (whole/filet)* Contaminants of concern same as Primary Fish and Shellfish Tissue Monitoring and Assessment Aging of fish collected for analysis (otoliths or scales if old enough)* WHERE: Same locations as Primary Fish and Shellfish Tissue Monitoring and Assessment WHEN: At least once every 5 years* Samples collected within 5-10 year period*	i. Compare fish tissue contaminant levels for fish species with OEHHA advisories collected within 5 to 10 year period from each ecoregion and bay-wide to OEHHA FCGs and ATLs. Exceedances of FCGs or ATLs in one or more fish species indicates stressors are adversely impacting conditions for fish consumption.	i. Track fish tissue contaminant levels based on species and age and compare each species in the same age group year to year and over time (including historical data/information, if available, for additional context). Decrease in fish tissue contaminant levels from year to year and/or over time indicates impacts to conditions for fish consumption caused by stressors are decreasing. ii. Track fish tissue contaminant levels based on species from different age groups within each year and compare year to year and over time (including historical data/information, if available, for additional context). Lower contaminant levels in younger fish relative to older fish taking into account age and time for bioaccumulation of contaminants may indicate impacts to conditions for fish consumption caused by stressors are decreasing. iii. Revision of OEHHA fish consumption advisories to allow more consumption or removal of consumption limitations for one or more fish species indicates impacts to conditions for fish consumption caused by stressors are decreasing.

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Table 6a. PRIMARY Unified STRESSORS Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY STRESSORS Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY STRESSORS Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY STRESSORS Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY STRESSORS Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Synthetic Chemical Levels in Water, Soil, and Sediment Monitoring and Assessment	WHAT: Levels of synthetic chemicals and pollutants in water, soil, and sediment, including but not limited to:* - Polychlorinated biphenyls (PCBs)* - Polycyclic aromatic hydrocarbons (PAHs)* - Pesticides* - Per- and polyfluoroalkyl substances (PFAS)* - Trash* - Microplastics* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Compare detected levels of synthetic chemicals in water, soil, and/or sediment from each ecoregion and bay-wide to available and applicable guidelines, thresholds, and/or standards (e.g., ERLs, ERMs, California Toxics Rule). Exceedances of available guidelines, thresholds, and/or standards indicate stressors are likely adversely impacting conditions of habitats and ecosystems.	i. Track levels of synthetic chemicals in water, soil, and sediment and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in levels of synthetic chemicals from year to year and/or over time indicates impacts to conditions for fish consumption caused by stressors may be decreasing
Habitats Physical Size and Area Monitoring and Assessment	WHAT: Areal extent and distribution of the following aquatic dependent habitats:* - Eelgrass beds* - Saltmarsh* - Vegetated low marsh* - Mudflats/beaches* - Rocky intertidal* - Unvegetated subtidal* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Measure the areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide. Lack of one or more aquatic dependent habitats in an ecoregion or bay-wide indicates stressors are likely adversely impacting conditions of habitats and ecosystems.	ii. Track areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide from survey to survey and over time (including historical data/information, if available, for additional context). Increase in total area of aquatic dependent habitats from survey to survey and/or over time by ecoregion and bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing. Changes to proportions of aquatic dependent habitats from survey to survey and/or over time by ecoregion or bay-wide may indicate impacts to conditions for habitats and ecosystems from stressors may be related to climate change and/or sea level rise.

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Table 6a (Continued). PRIMARY Unified STRESSORS Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY STRESSORS Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY STRESSORS Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY STRESSORS Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY STRESSORS Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Diversity and Abundance of Biology Monitoring and Assessment	WHAT: Diversity and abundance of native, aquatic dependent species for the following: - Fish* - Birds* Presence and distribution of rare/ threatened/endangered aquatic dependent species* Presence and distribution of invasive species that can adversely impact one or more habitats or ecosystems* Observations of adverse impacts to aquatic dependent species, including but not limited to: - Birth defects* - Low birth weights* WHERE: Same locations as Habitats Physical Size and Area Monitoring and Assessment* WHEN: At least once every 5 years* Samples collected within 5-10 year period*	i. Count diversity and abundance of fish and bird species within each ecoregion and bay-wide. Lack of diversity or abundance of fish or bird species in an ecoregion or bay-wide indicates stressors are likely adversely impacting conditions of habitats and ecosystems. ii. Count observations and/or numbers of rare/ endangered/threatened species within each ecoregion and bay-wide. Lack of rare/endangered/threatened species in an ecoregion or bay-wide indicates stressors are likely adversely impacting conditions of habitats and ecosystems. iii. Count observations and/or numbers of invasive species that adversely impact one or more habitats or ecosystems within each ecoregion and bay-wide. Presence of invasive species that can adversely impact one or more habitats or ecosystems in an ecoregion or bay-wide indicates stressors are likely adversely impacting conditions of habitats and ecosystems. iv. Count observations and/or numbers of adverse impacts to aquatic dependent species (e.g., birth defects, low birth weights) within each ecoregion and bay-wide. Presence of adverse impacts to aquatic dependent species in an ecoregion or bay-wide indicates stressors are likely adversely impacting conditions of habitats and ecosystems.	i. Track diversity and abundance of fish and bird species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in diversity and/or abundance from survey to survey and/or over time by ecoregion or bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing. ii. Track observations and/or numbers of rare/endangered/ threatened species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in observations and/or numbers from survey to survey and/or over time by ecoregion or bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing. iii. Track observations and/or numbers of invasive species that can adversely impact one or more habitats or ecosystems within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers of invasive species from survey to survey and/or over time by ecoregion or bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing. iv. Track observations and/or numbers of adverse impacts to aquatic dependent species (e.g., birth defects, low birth weights) within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers from survey to survey and/or over time by ecoregion or bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing.

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Table 6b. SUPPLEMENTAL Unified STRESSORS Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

SUPPLEMENTAL STRESSORS Monitoring Elements for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL STRESSORS Monitoring Element Components for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL STRESSORS Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL STRESSORS Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Synthetic Chemical Levels in Biology Monitoring and Assessment	WHAT: Presence and/or levels of synthetic chemicals the following:* - Fish tissue* - Bird eggs* - Plant tissue* Synthetic chemicals concern, including but not limited to:* - Polychlorinated biphenyls (PCBs)* - Polycyclic aromatic hydrocarbons (PAHs)* - Pesticides* - Per- and polyfluoroalkyl substances (PFAS)* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Measure levels of synthetic chemicals in biology of habitats and ecosystems within each ecoregion and bay-wide. Presence of synthetic chemicals in one or more species indicates stressors are likely adversely impacting conditions of habitats and ecosystems.	i. Track measurements levels of synthetic chemicals in biology of habitats and ecosystems within each ecoregion and bay-wide (including historical data/information, if available, for additional context) over time. Decreases in measurements indicate impacts to conditions for habitats and ecosystems caused by stressors are decreasing.

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Table 7a. PRIMARY Unified SOURCES Assessment and Strategic Monitoring for RECREATION in San Diego Bay

PRIMARY SOURCES Monitoring Elements for RECREATION	PRIMARY SOURCES Monitoring Element Components for RECREATION	PRIMARY SOURCES Status Assessment Data Analysis Method for RECREATION	PRIMARY SOURCES Trend Assessment Data Analysis Method for RECREATION
Discharges of Sewage Monitoring and Assessment	WHAT: Track sewage discharges from sources, including: - Sanitary sewer overflows (SSOs) - Reported boat sewage spills/ discharges* WHERE: San Diego Bay-wide WHEN: Weekly	i. Track reports of SSOs and/or boat spills/discharges of sewage in San Diego Bay. Reported sewage discharges and/or boats spill/discharges within one mile of publicly accessible and swimmable beaches by San Diego Bay indicate sewage may be a source of pollutants contributing to stressors impacting conditions for recreation.	i. Track number of reported SSOs and boat sewage spills/discharges within a one mile of publicly accessible and swimmable beaches by San Diego Bay and compare year to year and over time (including historical data/information, if available, for additional context). Decrease or lack of reported SSOs or discharges indicates sources of sewage contributing to stressors causing impacts to conditions are decreasing.
Presence and Levels of Sewage at Beaches Monitoring and Assessment	WHAT: Fecal indicator bacteria (FIB), including: - Enterococcus - Fecal coliforms Human source markers (e.g., HF183)* WHERE: Waters at publicly accessible and swimmable beaches by San Diego Bay, including: - NTC Boat Channel* - Kellogg Beach* - Shelter Island Shoreline Park - Spanish Landing Park* - Coronado Ferry Landing* - Tidelands Park - Glorietta Bay Park* - Grand Caribe Park* - Chula Vista Bayside Park WHEN: April-September weekly October-March monthly or bi-weekly* Within 24-hours after all storm events with 0.1 inches or greater rainfall*	i. Compare FIB levels for each sampling event at each station to statistical threshold value (STV) and geometric mean (GM) water quality objectives (WQOs) in Basin Plan. ii. Only analyze samples for human source markers (e.g., HF183) if FIB levels exceed STVs and/or GMs to determine if exceedances are attributed to human sources (i.e., sewage). Samples with HF183 exceeding levels of concern, determined by the San Diego Water Board, State Water Board, and/or USEPA, indicates FIB exceedances likely attributed to human sources (i.e., sewage). iii. Correlate known and reported SSOs and boat sewage spills/discharges within a one mile of publicly accessible and swimmable beaches by San Diego Bay with STV exceedances attributed to human sources. iv. Annually analyze STV and GM exceedances attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall). STV and GM exceedances with known or reported discharges of sewage from SSOs or boats indicates sewage sources that contribute to the stressors adversely impacting conditions for recreation by location. v. Annually analyze STV exceedance frequencies attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours). STV exceedances with known or reported discharges of sewage from SSOs or boats indicates sewage sources that contribute to the stressors adversely impacting conditions for recreation by location. STV exceedances without known or reported discharges of sewage from SSOs or boats, but have storm drain outfalls in close proximity may have potential sewage in storm water runoff that contributes to the stressors adversely impacting conditions for recreation by location.	i. Track number of STV and GM exceedances attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in dry weather days with STV and GM exceedances from year to year and/or over time indicates sources contributing to stressors causing impacts to conditions are decreasing during dry weather days by location. ii. Track number of FIB levels that exceed STVs and GMs attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in wet weather days with STV exceedances from year to year and/or over time indicates sources contributing to stressors causing impacts to conditions are decreasing during wet weather days by location.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 7b. SUPPLEMENTAL Unified SOURCES Assessment and Strategic Monitoring for RECREATION in San Diego Bay

SUPPLEMENTAL SOURCES Monitoring Elements for RECREATION	SUPPLEMENTAL SOURCES Monitoring Element Components for RECREATION	SUPPLEMENTAL SOURCES Status Assessment Data Analysis Method for RECREATION	SUPPLEMENTAL SOURCES Trend Assessment Data Analysis Method for RECREATION
Presence and Levels of Other Pollutants at Beaches Monitoring and Assessment	WHAT: Track discharges of pollutants from other sources, including: - Harmful algal blooms (HABs)* - Other discharges of concern with pollutants of concern for recreation* WHERE: San Diego Bay-wide* WHEN: Weekly*	i. Track reports of HABs and other discharges of concern. Reported HABs and/or discharges of concern within one mile of publicly accessible and swimmable beaches by San Diego Bay indicate HABs and/or other discharges of concern may be a source of pollutants contributing to stressors impacting conditions for recreation.	i. Track number of reported HABs and other discharges of concern within a one mile of publicly accessible and swimmable beaches by San Diego Bay and compare year to year and over time (including historical data/information, if available, for additional context). Decrease or lack of reported HABs or discharges of concern indicates sources of neurotoxins/cyanotoxins and/or other pollutants of concern contributing to stressors causing impacts to conditions are decreasing.
Presence and Levels of Other Pollutants at Beaches Monitoring and Assessment	WHAT: HABs that may release neurotoxins/cyanotoxins* Presence and/or levels of other indicators/pollutants potentially linked to illness in humans from exposure to San Diego Bay waters* WHERE: Same locations as Presence and Levels of Sewage at Beaches Monitoring and Assessment* WHEN: April-September weekly*	i. Correlate reported HABs and other discharges of concern within a one mile of publicly accessible and swimmable beaches by San Diego Bay with detected levels of neurotoxins/cyanotoxins and other pollutants of concern. ii. Annually analyze number of times neurotoxins/ cyanotoxins and other pollutants of concern are detected and correlated with known or reported HABs and other discharges of concern within a one mile of publicly accessible and swimmable beaches indicates sources that contribute to the stressors are adversely impacting conditions for recreation by location. Detections of neurotoxins/ cyanotoxins and other pollutants of concern with known or reported HABs and other discharges of concern indicates these are potential sources that contribute to the stressors adversely impacting conditions for recreation by location. Detections of neurotoxins/cyanotoxins and other pollutants of concern without known or reported HABs and other discharges of concern, but have storm drain outfalls in close proximity may have potential storm water runoff that contributes to the stressors adversely impacting conditions for recreation by location.	i. Track number of times HABs reported and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in number or lack of detections for HABs from year to year and/or over time indicates the potential contribution of impacts from neurotoxins/ cyanotoxins to conditions for recreation are decreasing by location. ii. Track number of times other discharges of concern reported and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in number or lack of detections for other indictors/pollutants from year to year and/or over time indicates potential contribution of impacts from other pollutants of concern to conditions for recreation are decreasing by location.

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Table 8a. PRIMARY Unified SOURCES Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

PRIMARY SOURCES Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	PRIMARY SOURCES Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	PRIMARY SOURCES Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	PRIMARY SOURCES Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Sediment Contaminants Monitoring and Assessment	WHAT: Levels of contaminants of concern in sediments that can be directly in contact or resuspended and ingested by fish and shellfish, or ingested by food for fish and shellfish, including: - Total polychlorinated biphenyls (PCBs) - Metals (mercury) - Pesticides (chlordane) - Emerging contaminants of concern* WHERE: San Diego Bay-wide with samples from the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years	i. Compare sediment concentrations for each sample location with effects range low (ERL) and effects range median (ERM) sediment quality guidelines. ii. Correlate sample locations with sediment concentrations that exceed ERLs and ERMs and current and historical discharge locations known to contain pollutants of concern (i.e., PCBs, mercury, pesticides). iii. Exceedances of ERLs indicate sediments from a sample location are a potential source contributing to stressors impacting conditions for fish consumption. Exceedances of ERMs indicate sediments from a sample location are a likely source contributing to stressors impacting conditions for fish consumption. Correlate historical or current discharges with exceedances of ERLs and ERMs. iv. Sediments that exceed ERLs or ERMs collected from the surface (0-5 cm) indicates sources are likely from recent discharges or deposition of contaminated resuspended sediments. Sediments that exceed ERLs or ERMs collected from below the surface (greater than 5cm) indicates sources are likely from historical discharges and/or legacy sources	i. Track sediment concentrations for each ecoregion and bay-wide (including historical data/information, if available, for additional context). ii. Track areas within each ecoregion with current and historical discharge locations known to contain pollutants of concern (i.e., PCBs, mercury, pesticides) where sediment cleanups have been implemented or discharges reduced or eliminated. iii. Decrease in median sediment contaminant levels for an ecoregion from year to year and/or over time indicates sources in the ecoregion contributing to stressors impacting conditions for fish consumption may be decreasing. iv. Decrease in bay-wide median sediment contaminant levels from year to year and/or over time indicates bay-wide sources contributing to stressors impacting conditions for fish consumption may be decreasing.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 8b. SUPPLEMENTAL Unified SOURCES Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

SUPPLEMENTAL SOURCES Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL SOURCES Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL SOURCES Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	SUPPLEMENTAL SOURCES Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Contaminants in Food for Fish and Shellfish Monitoring and Assessment	WHAT: Levels of contaminants of concern in the following foods that may be ingested by fish and shellfish, including the following: - Plankton* - Benthic macroinvertebrates* - Other prey* Contaminants of concern include: - Total polychlorinated biphenyls (PCBs)* - Metals (mercury)* - Pesticides (chlordane)* - Emerging contaminants of concern* WHERE: San Diego Bay-wide with samples from the following ecoregions:* - North* - North-Central* - South-Central* - South* WHEN: At least once every 5 years* Samples collected within 5-10 year period*	i. Compare contaminant levels in food sources for fish and shellfish (i.e., plankton, benthic macroinvertebrates, other prey) with ERLs and ERMs. ii. Exceedances of ERLs indicate one or more food sources are a potential source contributing to stressors impacting conditions for fish consumption. Exceedances of ERMs indicate one or more food sources are a likely source contributing to stressors impacting conditions for fish and shellfish consumption.	i. Track contaminant levels in food sources over time (including historical data/information, if available, for additional context). Decrease in contaminant levels in food sources over time indicates contributions from food sources to stressors impacting conditions for fish and shellfish consumption are decreasing.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 9a. PRIMARY Unified SOURCES Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY SOURCES Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY SOURCES Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY SOURCES Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY SOURCES Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Synthetic Chemical Levels in Discharges Monitoring and Assessment	WHAT: Levels of synthetic chemicals and pollutants in discharges, including but not limited to:* - Polychlorinated biphenyls (PCBs)* - Polycyclic aromatic hydrocarbons (PAHs)* - Pesticides* - Per- and polyfluoroalkyl substances (PFAS)* - Trash and microplastics* WHERE: Locations with discharges to San Diego Bay WHEN: In accordance with monitoring requirements in permits and orders issued by the San Diego Water Board	i. Compare detected levels of synthetic chemicals in discharges to available and applicable guidelines, thresholds, and/or standards (e.g., ERLs, ERMs, California Toxics Rule). Exceedances of available guidelines, thresholds, and/or standards indicate discharges are potential sources contribution to stressors impacting conditions for habitats and ecosystems.	i. Track levels of synthetic chemicals in discharges and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in levels of synthetic chemicals from year to year and/or over time indicates contributions from discharges contributing to stressors impacting conditions for habitats and ecosystems may be decreasing.
Habitat Alteration Projects Monitoring and Assessment	WHAT: Timing and implementation of projects that have resulted in converting, creating, or eliminating aquatic dependent habitats* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: Based on review of available historical records and as habitat alteration projects are implemented*	i. Compare locations of historical and current habitat alteration projects with areas with aquatic dependent habitats. Locations with projects that have converted or eliminated aquatic dependent habitats are sources contributing to stressors impacting conditions for habitats and ecosystems.	i. Track locations of historical and current habitat alteration projects with areas with aquatic dependent habitats. ii. Areas where aquatic dependent habitats are converted and eliminated indicate sources contributing to stressors impacting conditions for habitats and ecosystems are increasing. iii. Areas where projects are creating, restoring, or preserving aquatic dependent habitats indicate sources contributing to stressors impacting conditions for habitats and ecosystems are decreasing.

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Table 9a (Continued). PRIMARY Unified SOURCES Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY SOURCES Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY SOURCES Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY SOURCES Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY SOURCES Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Habitats Physical Size and Area and Biological Changes Monitoring and Assessment	WHAT: Areal extent and distribution of the following aquatic dependent habitats:* - Eelgrass beds* - Saltmarsh* - Vegetated low marsh* - Mudflats/beaches* - Rocky intertidal* - Unvegetated subtidal* Adverse biological changes of the aquatic dependent habitats, including but not limited to: - Presence and distribution of invasive species* - Decreases in sensitive species* - Birth defects* - Low birth weights* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Measure the areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide. Decreases in one or more aquatic dependent habitats in an ecoregion or bay-wide indicates synthetic chemical discharges and/or habitat conversion projects may be contributing to stressors impacting conditions of habitats and ecosystems. ii. Track adverse biological changes within each ecoregion and bay-wide. Increased in biological changes in an ecoregion or bay-wide indicates synthetic chemical discharges and/or habitat conversion projects may be contributing to stressors impacting conditions of habitats and ecosystems.	i. Track areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide from survey to survey and over time (including historical data/information, if available, for additional context). Increase in total area of aquatic dependent habitats from survey to survey and/or over time by ecoregion and bay-wide indicates contributions from synthetic chemical discharges and/or habitat conversion projects to stressors impacting conditions for habitats and ecosystems are decreasing. Changes to proportions of aquatic dependent habitats from survey to survey and/or over time by ecoregion or bay-wide may indicate climate change and/or sea level rise may be contributing to stressors impacting conditions for habitats and ecosystems. ii. Track adverse biological changes within each ecoregion and bay-wide from survey to survey and over time (including historical data/information, if available, for additional context). Decrease in adverse biological changes from survey to survey and/or over time by ecoregion and bay-wide indicates contributions from synthetic chemical discharges and/or habitat conversion projects to stressors impacting conditions for habitats and ecosystems are decreasing.

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Table 9b. SUPPLEMENTAL Unified SOURCES Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

SUPPLEMENTAL SOURCES Monitoring Elements for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL SOURCES Monitoring Element Components for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL SOURCES Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	SUPPLEMENTAL SOURCES Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Water Parameters Monitoring and Assessment	WHAT: San Diego Bay water parameters, including:* - Elevation* - Temperature* - pH* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least weekly over 24-month periods*	i. Track water parameters data collected over 24 month period within each ecoregion and bay-wide. ii. Increase in average 12-month water elevation indicates potential sea level rise related to climate change. iii. Increase in average 12-month water temperature indicates potential warming of waters related to climate change. iv. Decrease in average 12-month pH indicates potential acidification related to climate change.	i. Track water parameters data collected over 5 year period within each ecoregion and bay-wide (including historical data/information, if available, for additional context) over time. ii. No change or decrease in average 12-month water elevation indicates climate change may not be contributing to stressors impacting conditions for habitats and ecosystems. iii. No change or increase in average 12-month pH indicates climate change may not be contributing to stressors impacting conditions for habitats and ecosystems. iv. No change or decrease in average 12-month temperature indicates climate change may not be contributing to stressors impacting conditions for habitats and ecosystems. v. Lack of habitat conversions related to changes in water elevation, temperature, and/or pH indicates climate change may not be contributing to stressors impacting conditions for habitats and ecosystems.

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Table 10. PRIMARY Unified PERFORMANCE Assessment and Strategic Monitoring for RECREATION in San Diego Bay

PRIMARY PERFORMANCE Monitoring Elements for RECREATION	PRIMARY PERFORMANCE Monitoring Element Components for RECREATION	PRIMARY PERFORMANCE Status Assessment Data Analysis Method for RECREATION	PRIMARY PERFORMANCE Trend Assessment Data Analysis Method for RECREATION
Implementation of Management Actions Monitoring and Assessment	WHAT: Timing and implementation of structural and non-structural management actions to reduce pollutants in discharges and by publicly accessible and swimmable beaches associated with the following:* - NPDES permits - Cleanup and abatement orders - Clean Water Act section 401 water water quality certifications - Voluntary and non-regulatory programs/projects WHERE: San Diego Bay-wide WHEN: Based on review of available historical records and as management actions are implemented*	i. Compare available water pollutant levels data collected from publicly accessible and swimmable beaches before, if possible, and after a management action is implemented with statistical threshold value (STV) and geometric mean (GM) water quality objectives (WQOs) in Basin Plan. Reduction in exceedances of STVs and/or GMs indicates management actions may be effective.	i. Track locations of historical and current structural and non-structural management actions to reduce pollutants in discharges and by publicly accessible and swimmable beaches. Increased number of locations of structural and non-structural management actions may be linked to improvements in conditions, impacts from stressors on conditions, and/or contributions from sources on stressors to conditions for recreation.

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Table 10 (Continued). PRIMARY Unified PERFORMANCE Assessment and Strategic Monitoring for RECREATION in San Diego Bay

PRIMARY PERFORMANCE Monitoring Elements for RECREATION	PRIMARY PERFORMANCE Monitoring Element Components for RECREATION	PRIMARY PERFORMANCE Status Assessment Data Analysis Method for RECREATION	PRIMARY PERFORMANCE Trend Assessment Data Analysis Method for RECREATION
Presence and Levels of Sewage at Beaches Monitoring and Assessment	WHAT: Fecal indicator bacteria (FIB), including: - Enterococcus - Fecal coliforms Human source markers (e.g., HF183)* WHERE: Waters at publicly accessible and swimmable beaches by San Diego Bay, including: - NTC Boat Channel* - Kellogg Beach* - Shelter Island Shoreline Park - Spanish Landing Park* - Coronado Ferry Landing* - Tidelands Park - Glorietta Bay Park* - Grand Caribe Park* - Chula Vista Bayside Park* WHEN: April-September weekly October-March monthly or bi-weekly* Within 24-hours after all storm events with 0.1 inches or greater rainfall*	i. Compare FIB levels for each sampling event at each station to statistical threshold value (STV) and geometric mean (GM) water quality objectives (WQOs) in Basin Plan. ii. Only analyze samples for human source markers (e.g., HF183) if FIB levels exceed STVs and/or GMs to determine if exceedances are attributed to human sources (i.e., sewage). Samples with HF183 exceeding levels of concern, determined by the San Diego Water Board, State Water Board, and/or USEPA, indicates FIB exceedances likely attributed to human sources (i.e., sewage). iii. Correlate timing and implementation of management actions that may improve conditions, stressors impacting conditions, or sources contributing to stressors at publicly accessible and swimmable beaches by San Diego Bay with STV and GM exceedances attributed to human sources. iv. Annually analyze STV and GM exceedances attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall). Decreases to STV and GM exceedances attributed to human sources on dry weather days that can be correlated to the implementation of one or more management actions improving conditions, stressors impacting conditions, or sources contributing to stressors at publicly accessible and swimmable beaches by San Diego Bay indicates a potentially effective management action during dry weather days. v. Annually analyze STV exceedance frequencies attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours). Decreases to STV exceedances attributed to human sources on wet weather days that can be correlated to the implementation of one or more management actions improving conditions, stressors impacting conditions, or sources contributing to stressors at publicly accessible and swimmable beaches by San Diego Bay indicates a potentially effective management action during wet weather days.	i. Track number of STV and GM exceedances attributed to human sources at each location for dry weather conditions (days with less than 0.1 inches rainfall) and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in dry weather days with STV and GM exceedances from year to year and/or over time indicates management actions are effective at improving conditions for dry weather days by location. ii. Track number of FIB levels that exceed STVs and GMs attributed to human sources at each location for wet weather conditions (days with 0.1 inches or greater rainfall and the following 72 hours) and compare year to year and over time (including historical data/ information, if available, for additional context). Decrease in wet weather days with STV exceedances from year to year and/or over time indicates management actions are effective at improving conditions for wet weather days by location.

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Table 11. PRIMARY Unified PERFORMANCE Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

PRIMARY PERFORMANCE Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	PRIMARY PERFORMANCE Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	PRIMARY PERFORMANCE Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	PRIMARY PERFORMANCE Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Implementation of Management Actions Monitoring and Assessment	WHAT: Timing and implementation of management actions associated with the following:* - Cleanup and abatement orders - Clean Water Act section 401 water water quality certifications - Department of Navy maintenance dredging - Voluntary and non-regulatory programs/projects Contaminants of concern in sediment before and after management actions:* - Total polychlorinated biphenyls (PCBs)* - Metals (mercury)* - Pesticides (chlordane)* - Emerging contaminants of concern* WHERE: San Diego Bay-wide WHEN: Based on review of available historical records and as management actions are implemented*	i. Compare available sediment concentrations data collected from a dredging or cleanup action area before, if possible, and after the action is completed with ERLs and ERMs, as well as background concentrations, if available. Reduction of median or average sediment concentration, whichever is higher, for the dredging or cleanup area to below ERLs or background, whichever is lower, indicates sediment dredging or cleanup action is effective. ii. Analyze sediment concentration data for 5 year period by ecoregion and bay-wide before and after sediment dredging and cleanup actions to determine median sediment contaminant levels for an ecoregion. A reduction in median sediment contaminant levels for the ecoregion and bay-wide indicates sediment dredging or cleanup actions are potentially effective at improving impacts on conditions from stressors, and/or contributions from sources of stressors to conditions for fish and shellfish consumption. iii. Compare available concentrations data for food that may be consumed by fish and shellfish collected before, if possible, and after a management action is implemented with ERLs and ERMs. Reduction of ERL and ERM exceedances indicate management actions potentially effective.	i. Track locations of historical and current management actions to reduce pollutants in sediments and food for fish and shellfish. Increased number of locations of management actions may be linked to improvements in conditions, impacts from stressors on conditions, and/or contributions from sources on stressors to conditions for fish and shellfish consumption. ii. Track sediment concentrations for each ecoregion and bay-wide (including historical data/information, if available, for additional context) from year to year and over time. A reduction in median sediment contaminant levels for the ecoregion and bay-wide indicates management actions are potentially improving impacts on conditions from stressors, and/or contributions from sources of stressors conditions of San Diego Bay for fish and shellfish consumption.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 11 (Continued). PRIMARY Unified PERFORMANCE Assessment and Strategic Monitoring for FISH AND SHELLFISH CONSUMPTION in San Diego Bay

PRIMARY PERFORMANCE Monitoring Elements for FISH AND SHELLFISH CONSUMPTION	PRIMARY PERFORMANCE Monitoring Element Components for FISH AND SHELLFISH CONSUMPTION	PRIMARY PERFORMANCE Status Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION	PRIMARY PERFORMANCE Trend Assessment Data Analysis Method for FISH AND SHELLFISH CONSUMPTION
Primary Fish and Shellfish Tissue Monitoring and Assessment	WHAT: Levels of contaminants of concern in the tissue of the following indicator fish and shellfish species: - Spotted Sand Bass (filet) - Chub Mackerel (filet) - Topsmelt (without head and guts) - Pacific Oyster* - California Spiny Lobster (legal size tails from males)* Contaminants of concern include: - Total polychlorinated biphenyls (PCBs) - Metals (mercury) - Pesticides (chlordane) - Emerging contaminants of concern* Aging of fish collected for analysis (otoliths or scales if old enough)* WHERE: San Diego Bay-wide with samples from the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years Samples collected within 12 month period	i. Analyze fish and shellfish tissue contaminant concentrations data for 5 year period by ecoregion and bay-wide correlated to before and after management actions, if possible, to determine median fish and shellfish tissue concentrations by species for bay-wide and each ecoregion. A reduction in median contaminant levels for the bay-wide and/or ecoregion indicate management actions are potentially effective at improving impacts on conditions from stressors, and/or contributions from sources of stressors to conditions for fish and shellfish consumption.	i. Track fish tissue contaminant levels based on species and age and compare each species in the same age group year to year and over time (including historical data/information, if available, for additional context). Decrease in fish tissue contaminant levels from year to year and/or over time indicates management actions are improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors to conditions of San Diego Bay for fish consumption. ii. Track bivalve tissue contaminant levels and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in bivalve tissue contaminant levels from year to year and/or over time indicates management actions are improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors to conditions of San Diego Bay for bivalve (shellfish) consumption. iii. Track crustacean tissue contaminant levels and compare year to year and over time (including historical data/information, if available, for additional context). Decrease in crustacean tissue contaminant levels from year to year and/or over time indicates management actions are improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for crustacean consumption.

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Table 12. PRIMARY Unified PERFORMANCE Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY PERFORMANCE Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY PERFORMANCE Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY PERFORMANCE Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY PERFORMANCE Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Implementation of Management Actions Monitoring and Assessment	WHAT: Timing and implementation of management actions that have resulted in the following:* - Reducing or eliminating discharges of synthetic chemicals or pollutants - Created, restored, or enhanced aquatic dependent habitats WHERE: San Diego Bay-wide WHEN: Based on review of available historical records and as management actions are implemented*	i. Compare available data about discharges and conditions of habitats and ecosystems before, if possible, and after management actions are implemented. Improvement in conditions potentially impacted by synthetic chemicals indicates management actions are potentially effective at improving impacts on conditions from stressors, and/or contributions from sources of stressors to conditions for habitats and ecosystems. ii. Compare available data about the creation, restoration, or enhancement of habitats and ecosystems before, if possible, and after management actions are implemented. Increase in area and/or biological abundance and diversity indicates management actions are potentially effective at improving impacts on conditions from stressors, and/or contributions from sources of stressors to conditions for habitats and ecosystems.	i. Track locations of historical and current management actions to reduce pollutants in aquatic dependent habitats and create, restore, or enhance habitats and ecosystems. Increased number of locations of management actions may be linked to improvements in conditions, impacts from stressors on conditions, and/or contributions from sources on stressors to conditions for habitats and ecosystems.
Synthetic Chemical Levels in Discharges Monitoring and Assessment	WHAT: Levels of synthetic chemicals discharges, including but not limited to:* - Polychlorinated biphenyls (PCBs)* - Polycyclic aromatic hydrocarbons (PAHs)* - Pesticides* - Per- and polyfluoroalkyl substances (PFAS)* WHERE: Locations with discharges to San Diego Bay WHEN: In accordance with monitoring requirements in permits and orders issued by the San Diego Water Board	i. Track management actions that reduce or eliminate discharges of synthetic chemicals or create or enhance aquatic dependent habitats in San Diego Bay. Reduction or elimination of discharges of synthetic chemicals in one or more discharges to San Diego Bay indicates one or more management actions are effective.	i. Track levels of synthetic chemicals in discharges to San Diego Bay from monitoring event to monitoring event and over time. Decrease in levels and/or lack of detection of one or more synthetic chemicals in a discharge indicates management actions are potentially improving impacts on conditions from stressors, and/or contributions from sources of stressors conditions of San Diego Bay for habitats and ecosystems.
Habitats Physical Size and Area Monitoring and Assessment	WHAT: Areal extent and distribution of the following aquatic dependent habitats:* - Eelgrass beds* - Saltmarsh* - Vegetated low marsh* - Mudflats/beaches* - Rocky intertidal* - Unvegetated subtidal* WHERE: San Diego Bay-wide and separated into the following ecoregions: - North - North-Central - South-Central - South WHEN: At least once every 5 years*	i. Track changes to the areal extent and proportions of aquatic dependent habitats within each ecoregion and bay-wide. Increase in area of one or more aquatic dependent habitats and total area of aquatic dependent habitats in an ecoregion or bay-wide indicates one or more management actions may be effective at improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems.	i. Track areal extent and proportions of aquatic dependent habitats and correlate with habitat conversion projects within each ecoregion and bay-wide from survey to survey and over time (including historical data/information, if available, for additional context). Increase in total area of aquatic dependent habitats from survey to survey and/or over time by ecoregion and bay-wide indicates management actions are potentially improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

Table 12 (Continued). PRIMARY Unified PERFORMANCE Assessment and Strategic Monitoring for HABITATS AND ECOSYSTEMS in San Diego Bay

PRIMARY PERFORMANCE Monitoring Elements for HABITATS AND ECOSYSTEMS	PRIMARY PERFORMANCE Monitoring Element Components for HABITATS AND ECOSYSTEMS	PRIMARY PERFORMANCE Status Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS	PRIMARY PERFORMANCE Trend Assessment Data Analysis Method for HABITATS AND ECOSYSTEMS
Diversity and Abundance of Biology Monitoring and Assessment	WHAT: Diversity and abundance of native, aquatic dependent species for the following: - Fish* - Birds* Presence and distribution of rare/ threatened/endangered aquatic dependent species* Presence and distribution of invasive species that can adversely impact one or more habitats or ecosystems* Observations of adverse impacts to aquatic dependent species, including but not limited to: - Birth defects* - Low birth weights* WHERE: Same locations as Habitats Physical Size and Area Monitoring and Assessment* WHEN: At least once every 5 years* Samples collected within 5-10 year period*	i. Track diversity and abundance of fish and bird species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in diversity and/or abundance of fish and/or bird species indicates one or more management actions may be effective at improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems. ii. Track observations and/or numbers of rare/endangered/threatened species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in observations and/or numbers of rare/endangered/threatened species indicates one or more management actions may be effective at improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems. iii. Track observations and/or numbers of invasive species that can adversely impact one or more habitats or ecosystems within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers of invasive species that can adversely impact one or more habitats or ecosystems indicates one or more management actions may be effective at improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems. iv. Track observations and/or numbers of adverse impacts to aquatic dependent species (e.g., birth defects, low birth weights) within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers of adverse impacts to aquatic dependent species indicates one or more management actions may be effective at improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems.	i. Track diversity and abundance of fish and bird species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in diversity and/or abundance of fish and/or bird species from survey to survey and/or over time by ecoregion and bay-wide indicates management actions are potentially improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems. ii. Track observations and/or numbers of rare/endangered/threatened species within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Increase in observations and/or numbers of rare/endangered/threatened species from survey to survey and/or over time by ecoregion or bay-wide indicates management actions are potentially improving conditions, impacts on conditions from stressors, and/or contributions from sources of stressors of San Diego Bay for habitats and ecosystems. iii. Track observations and/or numbers of invasive species that can adversely impact one or more habitats or ecosystems within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers of invasive species from survey to survey and/or over time by ecoregion or bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing. iv. Track observations and/or numbers of adverse impacts to aquatic dependent species (e.g., birth defects, low birth weights) within each ecoregion and bay-wide (including historical data/information, if available, for additional context). Decrease in observations and/or numbers from survey to survey and/or over time by ecoregion or bay-wide indicates impacts to conditions for habitats and ecosystems caused by stressors are decreasing.

* Component not currently included or regularly included in Board-related monitoring programs but may be included or partially/occasionally included in other monitoring programs or needs to be developed

6. Guidance for Applying Approach

This unified assessment and strategic monitoring approach is not self-implementing. Instead, this approach relies upon Board staff, the regulated community, and other partners and entities to develop or incorporate the strategic monitoring elements and components into their monitoring programs, investigations, or research when possible, and as applicable and appropriate. This approach also can help to coordinate and maximize the use of existing resources and minimize redundancy between existing monitoring programs.

In general, many of the components for the primary monitoring elements outlined above are being implemented, wholly or in part, by existing monitoring programs (e.g., RHMP, INRMP, NPDES permits). There are opportunities for coordination of monitoring resources and data utilization between the RHMP and INRMP monitoring programs, especially since the Port participates in both. The Board can help to encourage the coordination between the Port and Navy and the RHMP and INRMP by modifying existing permits and orders to allow and include incentives for the utilization of data from both these monitoring programs.

The Board can also modify monitoring programs incorporated into permits and other orders issued to other dischargers in San Diego Bay to encourage and incentivize the collection of data needed for the primary unified assessment and strategic monitoring elements, as applicable and appropriate, in coordination with the RHMP and INRMP.

The supplemental monitoring elements outlined above could be incorporated into existing monitoring programs. However, the supplemental monitoring elements generally require the development of new or additional methodologies, metrics, standards and/or resources before they can be incorporated into or implemented as part of routine monitoring programs. The Board needs to begin working on developing the methodologies, metrics, and standards that can be used to collect the data that can supplement the information needed for assessment purposes. This may be through research or special studies implemented by Board staff, or in coordination with the State Water Resource Control Board and academic or research institutions. In any case, including these outlines for the supplemental unified assessment and strategic monitoring approach in this document helps to communicate the types of data needed, why the data are needed, and how the data would be used in assessing conditions, stressors, sources, and performance of management actions pertaining to the San Diego Bay KBUs.

Finally, Board staff should periodically conduct assessments of conditions, stressors that impact conditions, sources that contribute to stressors, and performance of management actions. The assessments should be based on the available and applicable monitoring data and analyzed in accordance with the data analysis methods described in the outlines for the unified assessment and strategic monitoring approaches provided for each Framework element as they relate to each KBU for San Diego Bay.

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APPENDICES

to

Unified Assessment and Strategic Monitoring Approach for San Diego Bay

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APPENDIX A

2017 San Diego Bay Status Sheets

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This "status sheet" reports on current conditions of San Diego Bay in terms of its ability to support water-contact recreation (i.e., the "REC-1" beneficial use). Water quality standards are commonly used to determine if waters are safe for human contact. Fecal indicator bacteria such as *Enterococcus* have been linked to various pathogens commonly associated with sewage (or fecal matter). When *Enterococcus* levels in water exceed standards deemed safe for human water contact, the potential risk of contracting a water-borne illness increases.

SAN DIEGO BAY:
A RESOURCE OF MANY USES

San Diego Bay is an important water body in the San Diego region due to its ecological value and because it supports tourism; commercial, recreational, and subsistence fishing; and a variety of recreational, maritime, industrial, commercial, and military uses. For this reason, the San Diego Water Board endorsed a "Strategy for a Healthy San Diego Bay" via Resolution No. R9-2015-0086 in June 2015. The Strategy identified the key beneficial use categories of the Bay as:

- Recreation (water contact ("REC-1") and non-water-contact ("REC-2"));
- Human consumption of fish and shellfish; and
- Habitats and ecosystems

A primary goal of the Strategy is to use monitoring data to assess attainment of these key beneficial uses, as well as changes in their status over time, and to communicate findings to the public.

Beach advisories are posted when bacteria levels are above the water quality standards and swimming is not advised. SD County Department of Environmental Health routinely monitors swimming areas to evaluate bacteria levels. In San Diego Bay, weekly samples are collected at six beaches between April 1st and October 31st of each year. In some cases (such as at Shelter Island Shoreline Park in 2015), monitoring continues through the winter months. This monitoring of bacteria levels allows for evaluation of how often each beach met or did not meet safe swimming water quality standards during the "dry" season (May through September) and "wet" season (October through April).

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MONITORING & ASSESSMENT | SAN DIEGO WATER BOARD

ASSESSING THE REC-1 BENEFICIAL USE IN SAN DIEGO BAY

For regulatory purposes, *Enterococcus* levels are expressed in two ways: The first is the one-time *Enterococcus* concentration detected in a single sample. The other is the average level of the *Enterococcus* concentrations detected in up to five samples collected during any 30-day period. Sample results are compared to *Enterococcus* REC-1 water quality standards. If concentrations in a given water body are greater than the REC-1 water quality standards more than 10 percent of the time, there is a greater risk for illness in humans from water contact. San Diego Bay *Enterococcus* data were compiled from a 2-year period (May 2014 through April 2016) to assess the bacteria conditions during the "dry" and "wet" seasons.

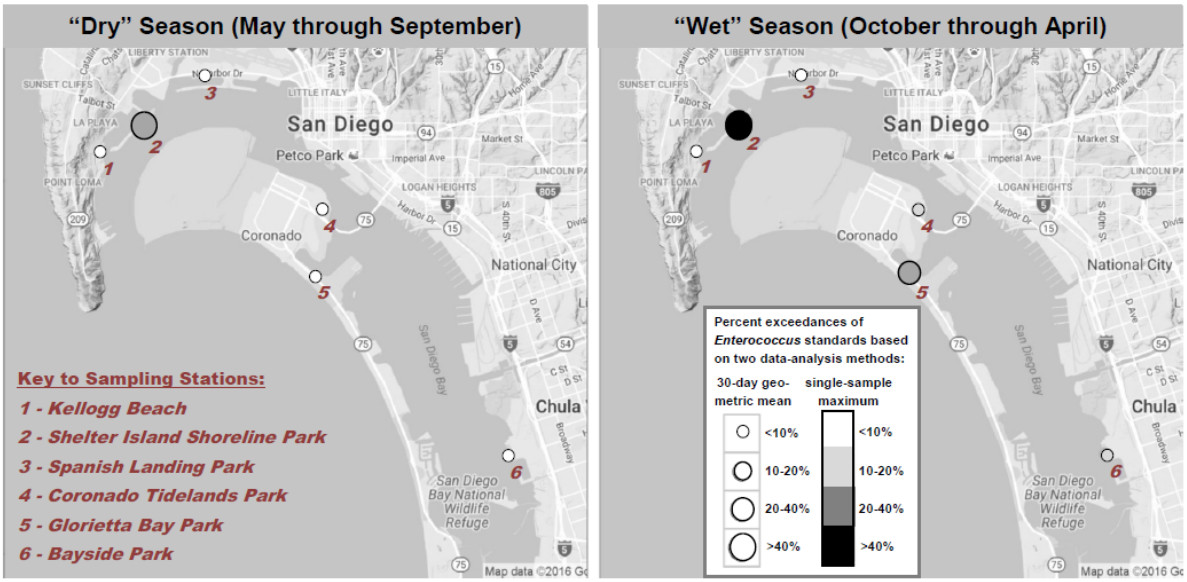

Figure 1. Frequencies at which contact-recreation standards for *Enterococcus* were exceeded, in the dry and wet seasons, reported in two ways, as: 1) 30-day geometric mean, and 2) single-sample maximum. For the former, increasing diameter of the data point, and for the latter, the shift from white toward black, represent higher percentages of exceedances of *Enterococcus* standards.

Enterococcus levels were found to be higher in the "wet" season, suggesting that the increased risk of illness in humans from water contact may be linked to storm water runoff.

ARE REC-1 STANDARDS BEING MET?

While *Enterococcus* results show water quality standards are being met and support water contact recreation much of the time, there were some variations by season and location. At Spanish Landing Park and Kellogg Beach, *Enterococcus* levels met REC-1 standards during both "dry" and "wet" seasons. At Glorietta Bay, Coronado Tidelands, and Bayside Parks, *Enterococcus* levels met REC-1 standards during the "dry" season, but did not meet REC-1 standards during the "wet" season. At Shelter Island Shoreline Park, where samples were collected throughout the year, *Enterococcus* levels did not meet REC-1 standards during both the "dry" and "wet" seasons.

BE PART OF THE SOLUTION

The San Diego Water Board and the Port of San Diego are working together to improve water quality throughout San Diego Bay.

How can you be part of the solution?

- **KEEP YOURSELF INFORMED! Visit the County of San Diego Beach Water Quality website to see the most up-to-date water quality data and closure information (http://www.sdbeachinfo.com).**
- **Avoid water contact in San Diego Bay following storm events and in areas where beach advisories are posted.**
- **Do your part to reduce human pathogens in San Diego Bay:**
  -Properly pump out boat holding tanks.
  -Maintain your sewage lines to prevent leaks.
  -Report sewage spills to the local authorities.

SAN DIEGO WATER BOARD: http://www.waterboards.ca.gov/sandiego/

Healthy waters realized through collaborative, outcome-focused efforts that support both human uses and sustainable ecosystems.

Fishing is a key recreational and subsistence activity in San Diego Bay. Several contaminants exist in bay sediments that can become incorporated into fish and shellfish tissue, via bioaccumulation and biomagnification, potentially posing a threat to humans consuming the seafood.

The California Office of Environmental Health Hazard Assessment (OEHHA) conducts scientific evaluations of risks to public health. In 2013, OEHHA released an advisory for San Diego Bay identifying the weekly number of servings of select fish species considered safe to eat, based on contaminant levels measured in fish tissue that could affect human health. The 2013 OEHHA advisory relies on contaminant-concentration data in fish tissue collected from 1999 through 2010. Since that time, additional data from several efforts have become available.

SAN DIEGO BAY: A RESOURCE OF MANY USES

San Diego Bay is an important water body in the San Diego region due to its ecological value and because it supports tourism; commercial, recreational, and subsistence fishing; and a variety of recreational, maritime, industrial, commercial, and military uses. For this reason, the San Diego Water Board endorsed a "Strategy for a Healthy San Diego Bay" via Resolution No. R9-2015-0086 in June 2015. The Strategy identified the key beneficial use categories of the Bay as:

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- Human consumption of fish and shellfish; and
- Habitats and ecosystems

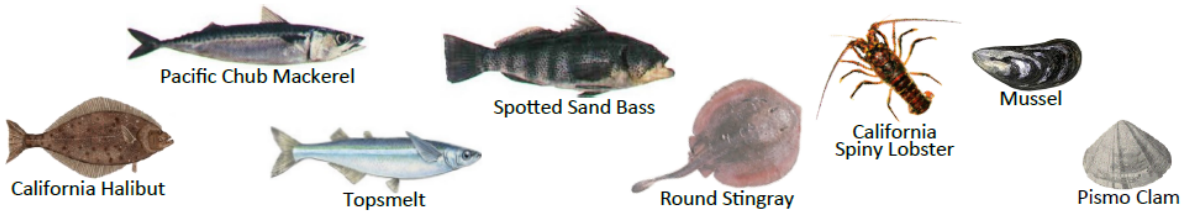
A primary goal of the Strategy is to use monitoring data to assess attainment of these key beneficial uses, as well as changes in their status over time, and to communicate findings to the public.

DATA AVAILABLE FOR ANALYSIS SINCE THE 2013 OEHHA ADVISORY

- SCCWRP Bight Regional and Regional Harbor Monitoring Programs and City of San Diego Shallow Water Habitat Survey (Fish Tissue, 2013-2014)
- San Diego Water Board Surface Water Ambient Monitoring Program (Lobster Tissue, 2014-2015)
- NOAA Mussel Watch Program (Mussel Tissue, 2010-2015)
- CDPH Marine Biotoxin Monitoring Program (Clam and Mussel Tissue, 2011-2016)
- San Diego County DEH Beach and Bay Monitoring Program (Water Quality, 2014-2016)

This "status sheet" presents analyses of more recent data collected by federal, state, and local agencies. Data analyzed included contaminant levels in fish, lobster, and mussel tissue, marine biotoxins in clam and mussel tissue, and levels of fecal indicator bacteria in water where bivalve shellfish may be harvested by the public. This information is not intended as a consumption advisory; rather, the goal is to evaluate whether the key beneficial use category of "safe to eat" is being met. This information can be used to educate the public and to prioritize efforts for achieving healthy waters in San Diego Bay.

Common Fish and Shellfish Analyzed



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Project partners:

Table 2. Chemical Contaminants Found Above Levels of Concern in Analyzed Fish and Shellfish Tissue

Species Analyzed	Key Contaminants of Concern
California Halibut	Mercury, PCBs
Pacific Chub Mackerel	Mercury, PCBs
Round Stingray	Mercury, PCBs
Spotted Sand Bass	Mercury, PCBs
Topsmelt	PCBs
California Spiny Lobster	Mercury
Mussel	PCBs, Pesticides (Dieldrin)

LEVELS OF OTHER CONTAMINANTS IN BIVALVE SHELLFISH

Bivalve shellfish (e.g. clams and mussels) may also contain biotoxins which can cause illness in humans if consumed. Levels of marine biotoxins were not found to be above Food and Drug Administration action levels at the two locations sampled in San Diego Bay. As an extra precaution, there is a statewide annual mussel quarantine limiting consumption from May 1 to October 31, the time of year when marine biotoxins tend to be most prevalent.

Levels of bacteria in the water can also indicate risk of human illness for shellfish consumption. Levels of total coliform indicator bacteria measured from water at six public beaches in San Diego Bay were analyzed and compared to the total coliform standards for shellfish harvesting in the San Diego Basin Plan. Bacteria levels were elevated at all beaches analyzed, indicating that shellfish harvested from these areas may be unsafe to eat.

PCBs and mercury are still present at levels of concern in fish from San Diego Bay. Contaminants in lobster and bivalve shellfish from San Diego Bay may also pose a risk.

CONTAMINANTS IN FISH AND SHELLFISH TISSUE

Tissue from fish, lobsters, and mussels were analyzed for several contaminants (e.g. heavy metals, PAHs, PBDEs, PCBs, pesticides) that can pose a risk to human health if consumed in seafood. Contaminant levels measured in fish, lobster, and mussel tissue were compared to OEHHA advisory concentrations (Table 2).

Tissue from all fish species analyzed contained levels of concern for PCBs. Most fish species analyzed also contained levels of concern for mercury. These findings support the OEHHA advisory for limiting the consumption of fish from San Diego Bay.

Lobster tissue samples were found to contain levels of concern for mercury. Tissue analyzed from mussels contained levels of concern for PCBs and pesticides (specifically dieldrin). Consumption of lobster and mussels in large enough quantities may pose a risk to human health.

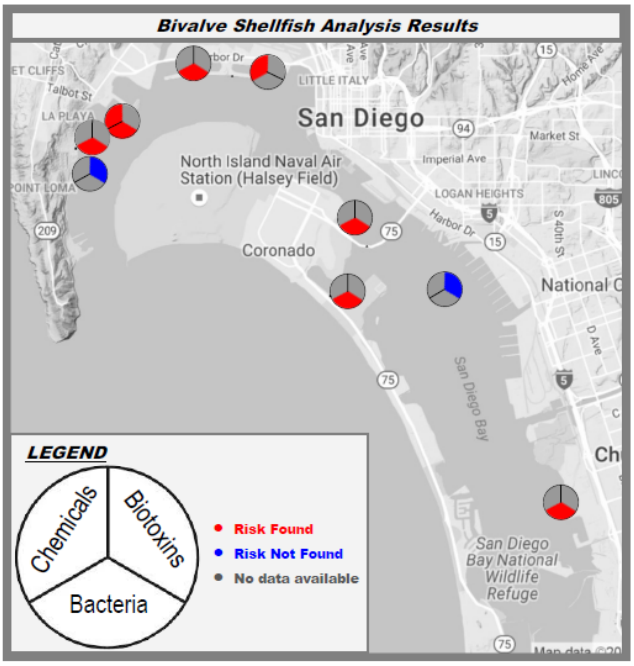

Figure 1. Sampling locations and analysis results for bivalve-shellfish tissue or water-column grabs. Depending upon the monitoring program, stations were sampled for either chemical constituents or marine biotoxins in tissue, or for total coliforms indicator bacteria in the water column. See legend for a key to what was measured at each station, and analysis results.

STAY INFORMED!

- Visit the OEHHA website for the latest consumption guidelines and advisories (http://oehha.ca.gov/advisories/san-diego-bay).
- Look for consumption guidelines and advisory signs posted at popular fishing piers throughout San Diego Bay.
- Visit the San Diego Water Board website for information about bioaccumulation studies and angler surveys conducted in San Diego Bay (http://www.waterboards.ca.gov/sandiego).

APPENDIX B

Evaluation of Assessment Needs of San Diego Bay

Table B-1a. Evaluation of Assessment Needs of San Diego Bay CONDITIONS for Key Beneficial Uses (Potential Direct Measurements)

Table B-1b. Evaluation of Assessment Needs of San Diego Bay CONDITIONS for Key Beneficial Uses (Potential Indirect Measurements)

Table B-2a. Evaluation of Assessment Needs of San Diego Bay STRESSORS Impacting Conditions for Key Beneficial Uses (Potential Direct Measurements)

Table B-2b. Evaluation of Assessment Needs of San Diego Bay STRESSORS Impacting Conditions for Key Beneficial Uses (Potential Indirect Measurements)

Table B-3a. Evaluation of Assessment Needs of San Diego Bay SOURCES Contributing to Stressors for Key Beneficial Uses (Potential Direct Measurements)

Table B-3b. Evaluation of Assessment Needs of San Diego Bay SOURCES Contributing to Stressors for Key Beneficial Uses (Potential Indirect Measurements)

Table B-4a. Evaluation of Assessment Needs of San Diego Bay PERFORMANCE of Management Actions to Protect and Restore Key Beneficial Uses (Potential Direct Measurements)

Table B-4b. Evaluation of Assessment Needs of San Diego Bay PERFORMANCE of Management Actions to Protect and Restore Key Beneficial Uses (Potential Indirect Measurements)

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Table B-1a. Evaluation of Assessment Needs of San Diego Bay CONDITIONS for Key Beneficial Uses (Potential Direct Measurements)

CONDITIONS Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Conditions Assessment Management Questions	Is San Diego Bay water quality safe for swimming? If conditions of San Diego Bay are unsatisfactory for swimming, are conditions improving?	Are fish and shellfish from San Diego Bay safe to eat? If conditions of San Diego Bay are unsatisfactory for fish and shellfish to be safe to eat, are conditions improving?	Are San Diego Bay habitats and ecosystems healthy? If conditions of San Diego Bay are unsatisfactory for healthy habitats and ecosystems, are conditions improving?
Condition of Concern	Illness in humans that may be caused by contact (i.e., ingestion, inhalation, skin contact) with pollutants during recreational activities in San Diego Bay waters	Illness in humans that may be caused by consumption of fish and shellfish caught from San Diego Bay	Adverse impacts to ecological health of the habitats and ecosystems in and around San Diego Bay caused by alterations to the chemical, physical, and biological conditions of waters in San Diego Bay
Potential Direct Measurements That Can Be Used to Assess Conditions	MEASUREMENTS: Survey of people who have recreated (i.e., swim or wade) in San Diego Bay waters correlated with adverse health effects LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Survey of people who have consumed fish and shellfish caught from San Diego Bay correlated with adverse health effects LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Measurements related to overall health or functionality of habitats and ecosystems of San Diego Bay and/or specific habitats and ecosystems (e.g., Sediment Quality Objectives (SQOs), California Rapid Assessment Method (CRAM) scores, or other indices as they are developed) LOCATIONS: San Diego Bay-wide
Evaluation of Feasibility and Practicality of Potential Direct Measurements	FEASIBILITY: Feasible to conduct surveys of people adversely affected as a result of recreational activities in San Diego Bay. PRACTICALITY: Not practical. Very difficult to enlist consistent and regular participation of a significant number of people for surveys, and surveys would be needed at a relatively high frequency (weekly or monthly) for useful information. Collection of survey data at lower frequency may be practical but less useful.	FEASIBILITY: Feasible to conduct surveys of people adversely affected as a result of consumption of fish and shellfish caught from San Diego Bay. PRACTICALITY: Not practical. Very difficult to enlist consistent, regular, long-term participation of a significant number of people for surveys. Relating chronic or long-term health effects to consumption of fish and shellfish can also be very difficult. Collection of survey data at lower frequency may be practical but less useful.	FEASIBILITY: Infeasible to collect data about overall health of the habitats and ecosystems of San Diego Bay. Potentially feasible to collect data about health of specific habitats of San Diego Bay. PRACTICALITY: Not practical to collect data about overall health or functionality of habitats and ecosystems in San Diego Bay due to lack of established health indicators or parameters for overall Bay health. Potentially practical to collect data about health or functionality of specific habitats. Assessments may need to be based on relative changes in measurements until indices and thresholds are developed. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess conditions of San Diego Bay for habitats and ecosystems.

Table B-1b. Evaluation of Assessment Needs of San Diego Bay CONDITIONS for Key Beneficial Uses (Potential Indirect Measurements)

CONDITIONS Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Conditions Assessment Management Questions	Is San Diego Bay water quality safe for swimming? If conditions of San Diego Bay are unsatisfactory for swimming, are conditions improving?	Are fish and shellfish from San Diego Bay safe to eat? If conditions of San Diego Bay are unsatisfactory for fish and shellfish to be safe to eat, are conditions improving?	Are San Diego Bay habitats and ecosystems healthy? If conditions of San Diego Bay are unsatisfactory for healthy habitats and ecosystems, are conditions improving?
Condition of Concern	Illness in humans that may be caused by exposure (i.e., ingestion, inhalation, skin contact) to pollutants in San Diego Bay waters	Illness in humans that may be caused by consumption of fish and shellfish caught from San Diego Bay	Adverse impacts to ecological health of the habitats and ecosystems in and around San Diego Bay caused by alterations to the chemical, physical, and biological conditions of waters in San Diego Bay
Potential Indirect Measurements That Can Be Used to Assess Conditions	MEASUREMENTS: Levels of pollution, contamination, and nuisance (e.g., pathogens from sewage, cyanotoxins) in San Diego Bay waters that can adversely affect human health LOCATIONS: San Diego Bay waters where people are known to regularly wade and swim (e.g., publicly accessible and swimmable beaches)	MEASUREMENTS: Levels of pollutants and contaminants (e.g., polychlorinated biphenyls [PCBs], mercury, pesticides, chemicals of emerging concern) in tissue from fish and shellfish in San Diego Bay that can adversely impact human health when consumed LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Areal extent and distribution of aquatic dependent habitats in and around San Diego Bay. Diversity and abundance of native species in and around San Diego Bay. LOCATIONS: San Diego Bay-wide
Evaluation of Feasibility and Practicality of Potential Indirect Measurements	FEASIBILITY: Feasible to collect data about levels of pollutants in San Diego Bay waters where persons are known to regularly wade or swim. PRACTICALITY: Practical. There are existing Board-related and external monitoring programs collecting data about levels of pollutants in water, and established thresholds that can be used to assess water quality conditions for swimming or wading. Existing Board-related monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess conditions of San Diego Bay for recreation.	FEASIBILITY: Feasible to collect data about levels of pollutants in tissue from fish and shellfish in San Diego Bay. PRACTICALITY: Practical. There are existing Board-related and external monitoring programs collecting data about pollutants in fish and shellfish tissue, and established thresholds that can be used to assess conditions. Existing Board-related and external monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess conditions of San Diego Bay for fish and shellfish consumption.	FEASIBILITY: Feasible to collect data about areal extent and distribution of aquatic dependent habitats and diversity and abundance of native species in and around San Diego Bay. PRACTICALITY: Potentially practical. There are existing external monitoring programs collecting areal and biological data for different habitats. Assessments may need to be based on relative changes in measurements until indices and thresholds are developed. Monitoring programs may require modifications to collect data that can fully assess conditions of San Diego Bay for habitats and ecosystems.

Table B-2a. Evaluation of Assessment Needs of San Diego Bay STRESSORS Impacting Conditions for Key Beneficial Uses (Potential Direct Measurements)

STRESSORS Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Stressors Assessment Management Questions	Are stressors adversely impacting the conditions for San Diego Bay for recreation? Are impacts caused by stressors to conditions of San Diego Bay for recreation increasing or decreasing?	Are stressors adversely impacting the conditions for San Diego Bay for fish and shellfish consumption? Are impacts caused by stressors to conditions of San Diego Bay for fish and shellfish consumption increasing or decreasing?	Are stressors adversely impacting the conditions for San Diego Bay for habitats and ecosystems? Are impacts caused by stressors to conditions of San Diego Bay for habitats and ecosystems increasing or decreasing?
Stressors of Concern	Pollutants (e.g., pathogens from sewage, cyanotoxins, etc.) in water at levels that cause San Diego Bay waters to be unsafe for water contact recreational activities	Pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in fish and shellfish tissue that cause fish and shellfish from San Diego Bay to be unsafe for consumption	Alterations to the chemical, physical, and biological characteristics of San Diego Bay habitats and ecosystems
Potential Direct Measurements That Can Be Used to Assess Stressors	MEASUREMENTS: Levels of pollutants (e.g., pathogens from sewage, cyanotoxins from harmful algal blooms [HABs], etc.) in water that can adversely impact human health at the time when recreators are wading or swimming in San Diego Bay LOCATIONS: San Diego Bay-wide, including any location along the shore and within the Bay where people may enter the water to wade or swim	MEASUREMENTS: Levels of pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in tissue from fish and shellfish in San Diego Bay that can adversely impact human health when fish and shellfish consumed and linked to acute or chronic human health effects LOCATIONS: San Diego Bay-wide, and potentially any location where fish and shellfish from San Diego Bay are taken to be consumed	MEASUREMENTS: Levels of synthetic chemicals or pollutants (e.g., PCBs, polycyclic aromatic hydrocarbons [PAHs], pesticides, trash, microplastics, etc.) in the media of habitats and ecosystems (i.e., air, water, soil, and sediment), physical size/area of aquatic dependent habitats, and the diversity and abundance of the native species, as well as the levels of synthetic chemicals in the flora and fauna inhabiting aquatic dependent habitats and all correlated to conditions data within the same monitoring periods (e.g., day, week, month, season) LOCATIONS: San Diego Bay-wide
Evaluation of Feasibility and Practicality of Direct Measurements	FEASIBILITY: Feasible to collect data about levels of pollutants (e.g., pathogens from sewage, cyanotoxins, etc.) in water at times and places when wading or swimming is taking place in San Diego Bay. PRACTICALITY: Not practical. Resources not available to determine when to collect and analyze samples from locations in San Diego Bay at the time swimming is taking place. Mobilization of resources to collect timely samples also very difficult. Methods not available to instantaneously or continuously analyze samples for immediately available results.	FEASIBILITY: Feasible to collect data about levels of pollutants in tissue of fish and shellfish caught from San Diego Bay at the time of consumption. Potentially feasible to collect data about acute and chronic health effects linked to consumption of fish and shellfish caught from San Diego Bay. PRACTICALITY: Not practical. Resources not available to locate and enlist consistent participation of a large enough sample size of people catching fish and shellfish from San Diego Bay to submit data about fish and shellfish caught and consumed from San Diego Bay and report acute and chronic health effects over several years or decades.	FEASIBILITY: Feasible to collect data about levels of synthetic chemicals or pollutants (e.g., PCBs, PAHs, trash, microplastics, etc.) in media (i.e., air, water, soil, and sediment) that support habitats and ecosystems, physical size/area of aquatic dependent habitats, and the diversity and abundance of the native species, as well as the levels of synthetic chemicals in the biology inhabiting aquatic dependent habitats. Potentially feasible to collect all data within the same monitoring period (e.g., month, season) and correlate to each other. PRACTICALITY: Not practical. Resources not available to collect chemical, physical, and biological stressor data within the same monitoring period and correlate data with each other.

Table B-2b. Evaluation of Assessment Needs of San Diego Bay STRESSORS Impacting Conditions for Key Beneficial Uses (Potential Indirect Measurements)

STRESSORS Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Stressors Assessment Management Questions	Are stressors adversely impacting the conditions for San Diego Bay for recreation? Are impacts caused by stressors to conditions of San Diego Bay for recreation increasing or decreasing?	Are stressors adversely impacting the conditions for San Diego Bay for fish and shellfish consumption? Are impacts caused by stressors to conditions of San Diego Bay for fish and shellfish consumption increasing or decreasing?	Are stressors adversely impacting the conditions for San Diego Bay for habitats and ecosystems? Are impacts caused by stressors to conditions of San Diego Bay for habitats and ecosystems increasing or decreasing?
Stressors of Concern	Pollutants (e.g., pathogens from sewage, cyanotoxins, etc.) in water at levels that cause San Diego Bay waters to be unsafe for swimming	Pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in fish and shellfish tissue that cause fish and shellfish from San Diego Bay to be unsafe from for consumption	Alterations to the chemical, physical, and biological characteristics of San Diego Bay habitats and ecosystems
Potential Indirect Measurements That Can Be Used to Assess Stressors	Presence and/or levels of pollutants (e.g., pathogens from sewage, cyanotoxins, etc.) in San Diego Bay waters where swimming is known to occur on a regular basis	Presence and/or levels of pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in tissue of fish and shellfish known to be caught in San Diego Bay and consumed on a regular basis	Presence and/or levels of synthetic chemicals or substances in water, soil and sediment, physical size/area of aquatic dependent habitats, and the diversity and abundance of the native species measured within a defined period a time
Potential Indirect Measurements	MEASUREMENTS: Presence and/or levels of pollutants (e.g., pathogens from sewage, cyanotoxins, etc.) in San Diego Bay water that can adversely impact human health where swimming is known to occur on a regular basis LOCATIONS: Publicly accessible and swimmable beaches around San Diego Bay	MEASUREMENTS: Presence and/or levels of pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in tissue from fish and shellfish Bay known to be caught for consumption on a regular basis in San Diego LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Presence and/or levels of synthetic chemicals or substances (e.g., PCBs, PAHs, pesticides, trash, microplastics) in media of habitats and ecosystems (i.e., air, water, soil, and sediment), physical size/area of aquatic dependent habitats, and the diversity and abundance of the native species, as well as the levels of synthetic chemicals in the flora and fauna inhabiting habitat within a defined period of time (e.g., 1, 2, 5, or 10 years) LOCATIONS: San Diego Bay-wide
Evaluation of Feasibility and Practicality of Indirect Measurements	FEASIBILITY: Feasible to collect data about levels of pollutants in water where swimming is known to occur on a regular basis). PRACTICALITY: Practical. There are existing Board-related and external monitoring programs collecting data about levels of pollutants in water, and established thresholds that can be used to assess impacts from stressors. Existing Board-related and external monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess stressors impacting conditions of San Diego Bay for recreation.	FEASIBILITY: Feasible to collect data about levels of pollutants in tissues from fish and shellfish known to be caught for consumption on a regular basis in San Diego Bay. PRACTICALITY: Practical. There are existing Board-related and external monitoring programs collecting data about pollutants in fish and shellfish tissue, and established thresholds that can be used to assess conditions. Existing Board-related and external monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess stressors impacting conditions of San Diego Bay for fish and shellfish consumption.	FEASIBILITY: Feasible to collect data about levels of synthetic chemicals or pollutants (e.g., PCBs, PAHs, trash, microplastics, etc.) in media of habitats and ecosystems (i.e., air, water, soil, and sediment), physical size/area of aquatic dependent habitats, and the diversity and abundance of the native species, as well as the levels of synthetic chemicals in the flora and fauna inhabiting aquatic dependent habitats. Potentially feasible to collect chemical, physical, and biological data that can indicate changes to aquatic dependent habitats over defined periods of time (e.g., 1, 2, 5, or 10 years). PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting chemical, physical, and biological data. Assessments may need to be based on relative changes in measurements until indices and thresholds are developed. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess stressors impacting conditions of San Diego Bay for habitats and ecosystems.

Table B-3a. Evaluation of Assessment Needs of San Diego Bay SOURCES Contributing to Stressors for Key Beneficial Uses (Potential Direct Measurements)

SOURCES Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Sources Assessment Management Questions	Are contributions from sources of stressors that are adversely impacting conditions of San Diego Bay for recreation increasing or decreasing?	Are contributions from sources of stressors that are adversely impacting conditions of San Diego Bay for fish and shellfish consumption increasing or decreasing?	Are contributions from sources of stressors that are adversely impacting conditions of San Diego Bay for habitats and ecosystems increasing or decreasing?
Sources of Concern	Discharges (e.g., sewage, harmful algal blooms) to waters where swimming is taking place in San Diego Bay that can cause or contribute to water that is unsafe for swimming	Historical and current discharges and/or accumulation of pollutants linked to elevated contaminant levels of concern in fish and shellfish tissue (e.g., PCBs, mercury, pesticides) in water, soil, sediment, and/or food (e.g., benthic macroinvertebrates [BMIs], plankton, other prey) in San Diego Bay that can be ingested and bioaccumulated and cause or contribute to fish and shellfish caught from San Diego Bay to be unsafe for consumption	Historical and current discharges of pollutants linked to elevated levels of synthetic chemicals of concern (e.g., PCBs, PAHs, pesticides, PFAS) in water, soil, and sediment, and bioaccumulating in the biology of habitats and ecosystems, anthropogenic activities that alter or impact aquatic dependent habitats (e.g., habitat conversion, development projects), and alterations to habitats and ecosystems (e.g., habitat conversion, water elevation, temperature, pH) related to climate change
Potential Direct Measurements That Can Be Used to Assess Sources	MEASUREMENTS: Levels of pollutants (e.g., pathogens, cyanotoxins) in every direct and indirect discharge (e.g., sewage from SSOs, boat and other sources, HABs) to San Diego Bay waters directly before or during the times where swimming is taking place. LOCATIONS: San Diego Bay-wide, including any location along the shore and within the Bay where people may enter the water to wade or swim	MEASURMENTS: Levels of pollutants linked to elevated contaminant levels of concern (i.e., PCBs, mercury, pesticides) bioaccumulating in fish and shellfish tissue in sediment observed to be directly in contact or resuspended and ingested by fish and shellfish, or ingested by sources of food for fish and shellfish; and, levels of pollutants in food (i.e., benthic macroinvertebrates, plankton, other prey) observed to be consumed by fish and shellfish. LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Levels of synthetic chemicals or substances synthetic chemicals of concern (e.g., PCBs, PAHs, pesticides, PFAS) in every discharge to San Diego Bay, changes to aquatic dependent habitats caused by habitat conversion or development, and changes in temperature, pH, and water level potentially caused by climate change. LOCATIONS: San Diego Bay-wide
Evaluation of Feasibility and Practicality of Direct Measurements	FEASIBILITY: Potentially feasible to collect data about levels of pollutants (e.g., pathogens, cyanotoxins) in every direct and indirect discharge (e.g., sewage from SSOs, boat and other sources, harmful algal blooms) to San Diego Bay waters right before or during the times where swimming is taking place. PRACTICALITY: Not practical. Resources not available determine when to collect and analyze samples from locations in San Diego Bay at the time swimming is taking place. Mobilization of resources to collect timely samples also very difficult. Methods not available to instantaneously or continuously analyze samples for immediately available results.	FEASIBILITY: Potentially feasible to collect data about levels of pollutants in sediment observed to be directly in contact or resuspended and ingested by fish and shellfish, or ingested by sources of food for fish and shellfish; and, levels of pollutants in food (i.e. benthic macroinvertebrates, plankton, other prey) observed to be consumed by fish and shellfish. PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting data on pollutants in sediment, and sources of food for fish and shellfish. Assessments may need to be based on relative changes in measurements until indices and thresholds are developed for some sources of food. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess sources contributing stressors of San Diego Bay for fish and shellfish consumption.	FEASIBILITY: Feasible to collect data about levels of synthetic chemicals or substances synthetic chemicals of concern (e.g., PCBs, PAHs, pesticides, PFAS) in every discharge to San Diego Bay, changes to aquatic dependent habitats caused by habitat conversion or development, and changes in temperature, pH, and water level potentially caused by climate change. PRACTICALITY: Not practical. Resources not available and very difficult to collect and correlate data for every potential change to habitats and ecosystems to every potential discharge, every habitat conversion and development project, and every change related to climate change.

Table B-3b. Evaluation of Assessment Needs of San Diego Bay SOURCES Contributing to Stressors for Key Beneficial Uses (Potential Indirect Measurements)

SOURCES Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Sources Assessment Management Questions	Are contributions from sources of stressors that are adversely impacting conditions of San Diego Bay for recreation increasing or decreasing?	Are contributions from sources of stressors that are adversely impacting conditions of San Diego Bay for fish and shellfish consumption increasing or decreasing?	Are contributions from sources of stressors that are adversely impacting conditions of San Diego Bay for habitats and ecosystems increasing or decreasing?
Sources of Concern	Discharges (e.g., sewage, harmful algal blooms) to waters where swimming is taking place in San Diego Bay that can cause or contribute to water that is unsafe for swimming	Historical and current discharges and/or accumulation of pollutants linked to elevated contaminant levels of concern in fish and shellfish tissue (e.g., PCBs, mercury, pesticides) in water, soil, sediment, and/or food (e.g., benthic macroinvertebrates [BMIs], plankton, other prey) in San Diego Bay that can be ingested and bioaccumulated and cause or contribute to fish and shellfish caught from San Diego Bay to be unsafe for consumption	Historical and current discharges of pollutants linked to elevated levels of synthetic chemicals of concern (e.g., PCBs, PAHs, pesticides, PFAS) in water, soil, and sediment, and bioaccumulating in the biology of habitats and ecosystems, anthropogenic activities that alter or impact aquatic dependent habitats (e.g., habitat conversion, development projects), and alterations to habitats and ecosystems (e.g., habitat conversion, water elevation, temperature, pH) related to climate change
Potential Indirect Measurements That Can Be Used to Assess Sources	MEASUREMENTS: Presence and/or levels of pollutants (e.g., pathogens from sewage, cyanotoxins, etc.) in San Diego Bay water that can adversely impact human health where swimming is known to occur on a regular basis correlated with known or reported discharges LOCATIONS: Publicly accessible and swimmable beaches around San Diego Bay	MEASUREMENTS: Presence and/or levels of pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in tissue from fish and shellfish Bay known to be caught for consumption on a regular basis in San Diego correlated with available data about levels of pollutants in discharges to San Diego Bay, and water, soil, sediment, and/or food (e.g., BMIs, plankton, other prey) in San Diego Bay that can be ingested by fish and shellfish LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Alterations to physical size/area of aquatic dependent areas correlated to anthropogenic activities (e.g., habitat conversions and development) and climate change, and presence and/or levels of pollutants linked to elevated contaminant levels of concern (e.g., PCBs, mercury, pesticides) in discharges to San Diego Bay correlated to changes in biology of habitats LOCATIONS: San Diego Bay-wide
Evaluation of Feasibility and Practicality of Indirect Measurements	FEASIBILITY: Feasible to collect data about levels of pollutants in water where swimming is known to occur on a regular basis) and locations of known and reported discharges. PRACTICALITY: Practical. There are existing Board-related and Board-related and external monitoring programs collecting data about pollutants in water, and reported discharges. There are and established thresholds that can be used to assess contributions from sources. Existing Board-related and existing monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess sources contributing to stressors of San Diego Bay for recreation.	FEASIBILITY: Feasible to collect data about levels of pollutants in tissues from fish and shellfish known to be caught for consumption on a regular basis in San Diego Bay and correlate with available data about levels of pollutants in discharges to San Diego Bay, and water, soil, sediment, and/or food in San Diego Bay that can be ingested by fish and shellfish. PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting data about pollutants in fish and shellfish tissue and levels in some food sources. Thresholds need to be established to assess pollutant contributions from sources. Existing Board-related and external monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess stressors impacting conditions of San Diego Bay for fish and shellfish consumption.	FEASIBILITY: Feasible to collect data about alterations to physical size/area of aquatic dependent areas, habitat conversions and development projects, changes related to climate (e.g., water level, pH, and temperature), and presence and/or levels of pollutants of concern (e.g., PCBs, mercury, pesticides) in discharges to San Diego Bay. PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting data for discharges, changes to habitats from development, and climate change related data. Correlation of data may be difficult. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess sources contributing stressors of San Diego Bay for habitats and ecosystems.

Table B-4a. Evaluation of Assessment Needs of San Diego Bay PERFORMANCE of Management Actions to Protect and Restore Key Beneficial Uses (Potential Direct Measurements)

PERFORMANCE Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Performance Assessment Management Questions	Are management actions improving conditions of San Diego Bay for recreation? Are management actions reducing adverse impacts from stressors on conditions of San Diego Bay for recreation? Are management actions reducing contributions from sources to stressors adversely impacting conditions of San Diego Bay for recreation? Water management actions are most effective for improving conditions of San Diego Bay for recreation?	Are management actions improving conditions of San Diego Bay for fish and shellfish consumption? Are management actions reducing adverse impacts from stressors on conditions of San Diego Bay for fish and shellfish consumption? Are management actions reducing contributions from sources to stressors adversely impacting conditions of San Diego Bay for fish and shellfish consumption? Water management actions are most effective for improving conditions of San Diego Bay for fish and shellfish consumption?	Are management actions improving conditions of San Diego Bay for habitats and ecosystems? Are management actions reducing adverse impacts from stressors on conditions of San Diego Bay for habitats and ecosystems? Are management actions reducing contributions from sources to stressors adversely impacting conditions of San Diego Bay for habitats and ecosystems? Water management actions are most effective for improving conditions of San Diego Bay for habitats and ecosystems?
Potential Direct Measurements That Can Be Used to Assess Performance	MEASUREMENTS: Changes to conditions, impacts on conditions from stressors, and/or contributions from sources of stressors before and after the implementation of one or more management actions LOCATIONS: San Diego Bay-wide, including any location along the shore and within the Bay where people may enter the water to wade or swim	MEASUREMENTS: Changes to conditions, impacts on conditions from stressors, and/or contributions from sources of stressors before and after the implementation of one or more management actions LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Changes to conditions, impacts on conditions from stressors, and/or contributions from sources of stressors before and after the implementation of one or more management actions LOCATIONS: San Diego Bay-
Evaluation of Feasibility and Practicality of Potential Direct Measurements	FEASIBILITY: Potentially feasible to collect data about conditions, stressors, and sources before and after management actions. PRACTICALITY: Not practical. Very difficult to time collection of data on conditions, stressors, and sources to occur directly before and after implementation of management actions. Management actions may also require varying periods of time to become observable or measurable.	FEASIBILITY: Potentially feasible to collect data about conditions, stressors, and sources before and after management actions. PRACTICALITY: Not practical. Very difficult to time collection of data on conditions, stressors, and sources to occur directly before and after implementation of management actions. Management actions may also require varying periods of time to become observable or measurable.	FEASIBILITY: Potentially feasible to collect data about conditions, stressors, and sources before and after management actions. PRACTICALITY: Not practical. Very difficult to time collection of data on conditions, stressors, and sources to occur directly before and after implementation of management actions. Management actions may also require varying periods of time to become observable or measurable.

Table B-4b. Evaluation of Assessment Needs of San Diego Bay PERFORMANCE of Management Actions to Protect and Restore Key Beneficial Uses (Potential Indirect Measurements)

PERFORMANCE Assessment Needs Evaluation Components	RECREATION Key Beneficial Use	FISH AND SHELLFISH CONSUMPTION Key Beneficial Use	HABITATS AND ECOSYSTEMS Key Beneficial Use
Performance Assessment Management Questions	Are management actions improving conditions of San Diego Bay for recreation? Are management actions reducing adverse impacts from stressors on conditions of San Diego Bay for recreation? Are management actions reducing contributions from sources to stressors adversely impacting conditions of San Diego Bay for recreation? Water management actions are most effective for improving conditions of San Diego Bay for recreation?	Are management actions improving conditions of San Diego Bay for fish and shellfish consumption? Are management actions reducing adverse impacts from stressors on conditions of San Diego Bay for fish and shellfish consumption? Are management actions reducing contributions from sources to stressors adversely impacting conditions of San Diego Bay for fish and shellfish consumption? Water management actions are most effective for improving conditions of San Diego Bay for fish and shellfish consumption?	Are management actions improving conditions of San Diego Bay for habitats and ecosystems? Are management actions reducing adverse impacts from stressors on conditions of San Diego Bay for habitats and ecosystems? Are management actions reducing contributions from sources to stressors adversely impacting conditions of San Diego Bay for habitats and ecosystems? Water management actions are most effective for improving conditions of San Diego Bay for habitats and ecosystems?
Potential Indirect Measurements That Can Be Used to Assess Performance	MEASUREMENTS: Changes to conditions, impacts on conditions from stressors, and/or contributions from sources of stressors correlated to the implementation of one or more management actions LOCATIONS: Publicly accessible and swimmable beaches around San Diego Bay	MEASUREMENTS: Changes to conditions, impacts on conditions from stressors, and/or contributions from sources of stressors correlated to the implementation of one or more management actions LOCATIONS: San Diego Bay-wide	MEASUREMENTS: Changes to conditions, impacts on conditions from stressors, and/or contributions from sources of stressors correlated to the implementation of one or more management actions LOCATIONS: San Diego Bay-
Evaluation of Feasibility and Practicality of Potential Indirect Measurements	FEASIBILITY: Potentially feasible to collect data about conditions, stressors, and sources and correlate changes to one or more management actions. PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting data related to conditions, stressors, and sources, and established thresholds that can be used to assess improvements to conditions, stressors, and sources. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess performance of management actions to improve conditions, stressors, and sources contributing to stressors of San Diego Bay for recreation.	FEASIBILITY: Potentially feasible to collect data about conditions, stressors, and sources and correlate changes to one or more management actions. PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting data related to conditions, stressors, and sources. There are established thresholds that can be used to assess improvements to conditions and stressors. Thresholds need to be established to assess pollutant contributions from sources. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess performance of management actions to improve conditions, stressors, and sources contributing to stressors of San Diego Bay for fish and shellfish consumption.	FEASIBILITY: Potentially feasible to collect data about conditions, stressors, and sources and correlate changes to one or more management actions. PRACTICALITY: Potentially practical. There are existing Board-related and external monitoring programs collecting data related to conditions, stressors, and sources. Assessments may need to be based on relative changes in conditions, stressors and sources until indices and thresholds are developed. Monitoring programs may require modifications and/or additions of parameters, locations, and frequencies to collect data that can fully assess performance of management actions to improve conditions, stressors, and sources contributing to stressors of San Diego Bay for habitats and ecosystems.