Areas of Special Biological Significance (ASBS)
Caltrans Discharge Monitoring Program

Background

The California Department of Transportation (Caltrans) initiated a program in 2005 to monitor highway stormwater runoff that is tributary to Areas of Special Biological Significance (ASBSs) at five locations along the California coast. This program was initially a part of the Caltrans application to the State Water Resources Control Board (SWRCB) for an exception to the prohibition against discharging stormwater into these areas as outlined in the California Ocean Plan. However, Caltrans has expanded this program in order to provide the SWRCB with a more useful and scientifically defensible body of monitoring data.

Original Monitoring Plan

The SWRCB originally directed Caltrans to collect and analyze samples from five ASBSs using a very simple strategy:

- A single sample of stormwater runoff taken as a grab from the edge of pavement in a location where highway discharge entered the corresponding ASBS;
- A single sample of marine water taken as a grab from the ocean within the boundaries of each selected ASBS.

All samples were to be analyzed for appropriate constituents listed on Table B of the California Ocean Plan.

Modified Monitoring Plan

It was Caltrans' judgment that analysis of a single grab sample at each location would not yield meaningful, scientifically defensible data. A single grab sample is not representative of a storm runoff event; concentrations of analytical constituents vary widely from storm to storm throughout the season and can vary widely over the duration of a single storm. In order to bring a more scientific approach to this project, Caltrans volunteered to expand the ASBS monitoring study and perform stormwater monitoring in accordance with established, accepted sampling protocols.

The expanded monitoring strategy proposed by Caltrans contained the following elements:

- Edge-of-pavement samples collected as flow-weighted composites instead of grabs. Samples were collected using automated composite samplers equipped with flow measurement devices and rain gauges. Samples collected in this way accurately represent the entire storm event and can be used much more reliably than grab samples to determine the quantity of materials entering the ASBSs as part of runoff from highways.
- Two marine water grab samples taken at each ASBS instead of one. The first sample was collected where Caltrans discharge enters the ocean. A second sample collected

approximately one hundred yards away from the first site. The purpose of this second sample was to compare the water quality of seawater mixed with highway runoff to the water quality of an unmixed sample of seawater from the same ASBS.

- Samples collected from natural streams which discharge into the ASBSs. The purpose of these samples is to establish the water quality of surface waters which are relatively unimpacted by human activity. These samples were collected as time-weighted composites over the duration of the storm event.

This monitoring project was initiated in October of 2005 and was planned to continue for five years. Eight storms per season were targeted for collection at each edge-of-pavement location. Four storms per season were targeted for collection at each reference stream location. A single seawater sampling event was conducted at each selected ASBS during the first year of the study.

Monitoring Strategy

Site Selection – Edge-of-Pavement

The SWRCB directed Caltrans to include five ASBSs in this study. One edge-of-pavement site was located within each of these ASBSs. The main selection criteria for these sites were:

- Discharge to ASBS – Runoff from the highway must flow into the associated ASBS. Although this requirement is obvious, locating monitoring sites that fit this description proved to be a surprising challenge. Most runoff from Caltrans facilities along the coast discharges to surface water bodies where it commingles with numerous other sources rather than entering the ocean directly. After a considerable siting effort, Caltrans was able to establish monitoring sites at most ASBSs that either discharged to the ocean directly or that discharged to a water body that visibly entered the ocean.
- Commingled Flow – One of the purposes of this study was to provide the SWRCB with reliable data about the water quality of highway runoff. For this reason it was imperative to locate monitoring sites that were not impacted by run-on flow from non-Caltrans sources. During the first monitoring events of this study the Department made careful field observations to verify that the samples being collected were composed of 100% highway runoff and not compromised by flow from other sources.
- Catchment Area – In order to assure that the data generated by this study is representative of typical highway runoff, Caltrans took care to select monitoring sites that receive stormwater runoff from large roadway areas.
- Site access and safety – Much of the California coastline in ASBSs consists of steep, rocky cliffs, particularly in Northern California. Additionally, large sections of California's coastal highways are steep, twisting, and afford oncoming traffic poor visibility of objects and personnel along the shoulder. Caltrans rejected a considerable number of suitable monitoring sites because of concerns for the safety of equipment, sample collection crews, and passing traffic.

After exploring a number of candidate ASBSs along the California coast, the following locations were selected for this study.

1. ASBS 8 - Redwoods National and State Parks in Del Norte County
2. ASBS 9 - James V. Fitzgerald Marine Reserve in San Mateo County
3. ASBS 15 – Ano Nuevo Point and Island in San Mateo County
4. ASBS 24 - Located between Mugu Lagoon and Latigo Point in Ventura County
5. ASBS 33 - Irvine Coast Marine Life Refuge in Orange County

Site Selection – Reference Streams

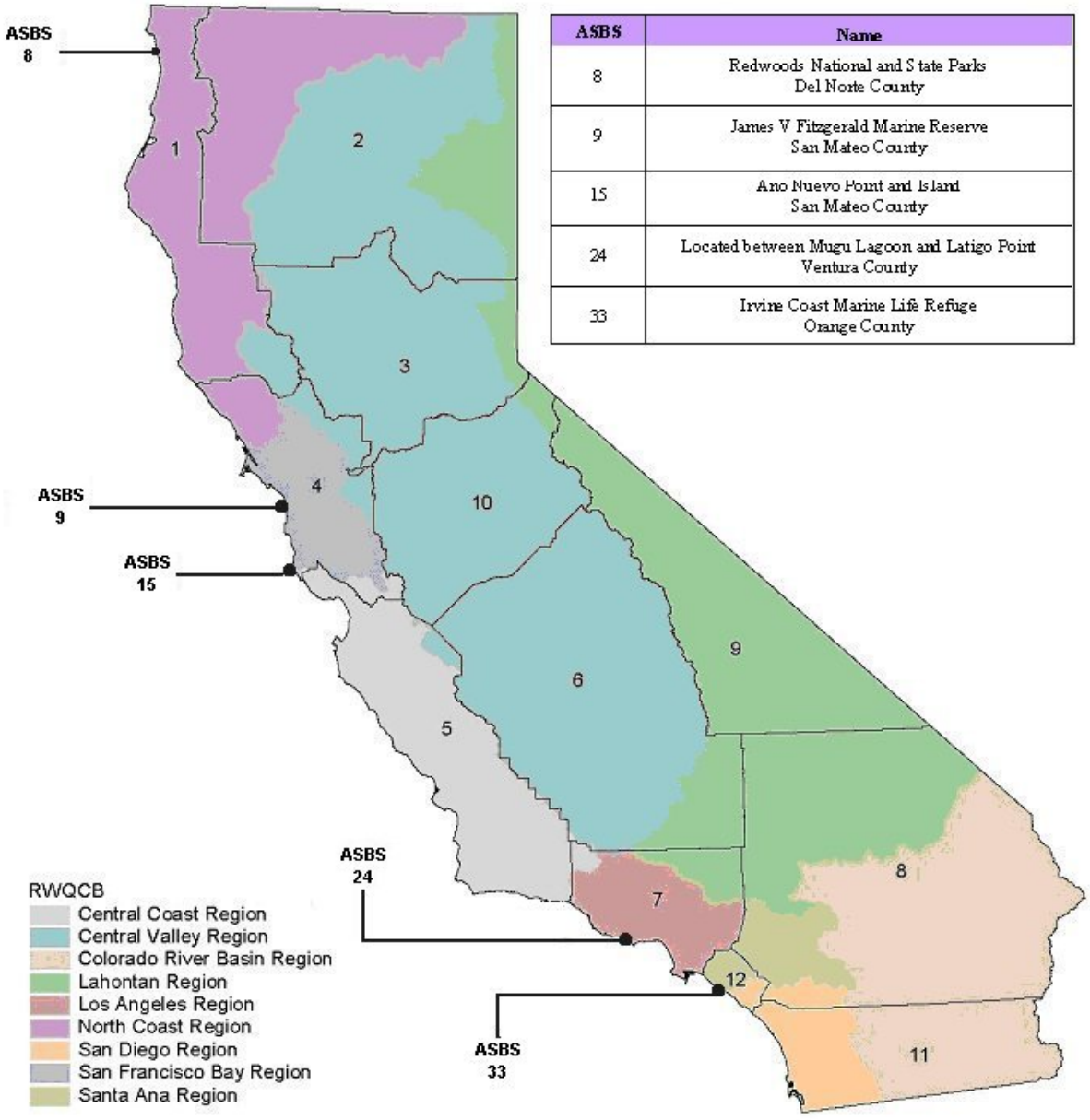
Several natural streams which are tributary to ASBSs were considered this study. The primary considerations for stream selection were accessibility and the degree to which they were impacted by human activity.

- Accessibility - The reference streams selected for this study flowed through dense brush, over hilly terrain, and through private property. Caltrans expended considerable effort exploring along the course of the selected streams in order to establish monitoring sites that could be reached safely, legally, and relatively easily.
- Anthropogenic Impacts – Because the purpose of including reference streams in this study was to gather water quality data about natural discharges into ASBSs, it was important to choose streams that were minimally affected by human activity.

Although Caltrans was unable to locate any streams with absolutely no contact with human activity, two streams were located with only minimal anthropogenic impact upstream of the points at which samples were collected.

1. Wilson Creek – Located in the Redwoods National and State Parks in Del Norte County, tributary to ASBS 8
2. Waddell Creek – Located between Ano Nuevo Point and Island and the James V. Fitzgerald Marine Reserve in San Mateo County, tributary to ASBS 15

Areas of Special Biological Significance (ASBS)
Monitoring Locations



ASBS	Name
8	Redwoods National and State Parks Del Norte County
9	James V Fitzgerald Marine Reserve San Mateo County
15	Ano Nuevo Point and Island San Mateo County
24	Located between Mugu Lagoon and Latigo Point Ventura County
33	Irvine Coast Marine Life Refuge Orange County

Site Selection – Seawater

The SWRCB directed Caltrans to collect marine samples from each selected ASBS at a point where highway runoff either visibly enters the ocean or visibly infiltrates near the surf zone. However, no sites of this description could be located at ASBSs 8, 9, and 15, and so it was not possible to collect a marine sample mixed with stormwater runoff at these locations.

The SWRCB stipulated that sea water samples be collected during monitored stormwater events. Because storm surge posed a potential safety concern, field sampling personnel were instructed to evaluate safety conditions before collecting samples. If the surf in the target sampling area was determined to be unsafe, sampling crews were instructed to proceed along the shore and try to find a safer place to take seawater samples.

Constituent Selection

The constituent list for this project was taken from Table B of the California Ocean Plan and from the Caltrans standard minimum constituent list. The constituent list for this study is shown on Table 1.

Permitting

All monitoring locations associated with this project required Coastal Development Permits from the California Coastal Commission (CCC).

The CCC operates differently in different areas. County governments are often authorized to act as permitting agents for CCC; in other areas, the CCC processes permit applications directly. Caltrans was often required to coordinate with multiple agencies in order to obtain the necessary permits for monitoring in a single area.

Regulatory agencies were particularly concerned about the potential environmental impacts associated with the construction of monitoring stations in coastal areas. The Department employed biologists to verify that no damage would be done to local environments before construction began.

As part of any multi-year monitoring project, Caltrans usually establishes semi-permanent roadside monitoring stations consisting of concrete pads and steel or fiberglass enclosures, flumes or other primary flow measurement devices, and poles for rain gauges and solar panels. However, because ASBSs are sensitive areas with respect to both environmental and cosmetic impact, Caltrans contacted State and local authorities in each area before beginning construction and requested their input. The design and/or positioning of monitoring stations in all five regions were modified to suit local requirements.

- At ASBS 8 local historical societies and a Native American Tribal Council requested that no permanent footprint be placed on site and no stakes be driven into the ground. Caltrans

developed a portable monitoring station for this area that can be completely dismantled and removed between storm events.

- At ASBS 9 the monitoring station was planned for a narrow area next to the highway shoulder. There was a concern that a monitoring station this close to a busy highway might pose traffic safety problems. Caltrans constructed a redwood pad suspended over a steep cliff in order to move the monitoring station a safe distance from the highway.
- At ASBS 15 Caltrans removed a considerable amount of poison oak in order to place the monitoring station in an area where it is not visible from the highway. Clearing of poison oak will be an ongoing requirement at this site for the duration of the project.
- At ASBSs 24 and 33, the concrete pads normally used to anchor equipment enclosures were replaced by redwood platforms at the request of local authorities. This step was taken in order to reduce the environmental impact of the monitoring stations.

In addition, Caltrans has developed ways to use existing conveyances at each location as primary flow devices instead of installing flumes. This significantly reduces the cosmetic and environmental impact of the monitoring effort.

The reference stream monitoring sites proved to be particularly sensitive with respect to construction permitting and environmental impact. Caltrans developed a monitoring station template with a very small footprint especially for stream monitoring. Composite samplers are placed directly on the stream bank prior to a monitoring event. The intake strainer and bubbler line are anchored to the stream bed with untreated wooden stakes. Stream flow is measured manually by field crews prior to, during, and after a monitored storm event, using handheld flow measurement equipment. The entire monitoring station is then removed between monitored storm events, leaving no trace of human activity at the monitoring site.

Sample Collection – First Season

Edge-of-Pavement

Because of the numerous permitting challenges involved in this project, Caltrans was not able to construct monitoring stations in time to collect flow-weighted samples during the first year of the study. Instead, time-weighted composite samples were collected manually in each study area. One storm was monitored at ASBSs 8, 9, and 15. Two storms were monitored at ASBSs 24 and 33.

Seawater

Marine water samples were collected by a field technician wearing a life vest and a safety line. The technician waded approximately knee-deep into ocean and collected grab samples from the surf zone.

Marine samples were successfully collected at ASBSs 9, 15, 24, and 33. Two attempts were made to collect seawater samples at ASBS 8; however, conditions were deemed unsafe by field personnel due to high storm surge and these attempts were abandoned.

Reference Streams

Caltrans was unable to locate suitable monitoring sites at the selected reference streams and complete the permitting process in time to collect stream samples. No reference stream monitoring took place during the first season of this study.

Sample Collection – Second Season

Edge-of-Pavement

Construction was completed on all edge-of-pavement monitoring stations prior to the start of the 2006-2007 storm season. Grab sample were collected for Ammonia, Oil & Grease, Toxicity, low-level Mercury, and the microbiological analyses. Flow-weighted composites were collected for all other analyses listed on Table 1.

Eight storms were monitored at ASBS 8. Five storms were monitored at ASBSs 9 and 15.

Seawater

Marine water samples were targeted for collection only during the first year of this study. There are no plans for further seawater monitoring.

Reference Streams

When developing a monitoring strategy for reference streams, Caltrans borrowed heavily from existing methodology used by organizations such as CClean and SCCWRP. This approach will help to assure that data produced from this study can be easily compared to data produced by other agencies.

Field personnel took stream flow measurements over the course of each monitored storm. This data, combined with precipitation data, was used to create hydrographs of each monitored event.

Time-weighted composites were collected from the reference streams every six hours over the duration of each monitored storm event. Each six-hour composite was analyzed for the full suite of analyses listed on Table 1, with the exception of Toxicity which was performed on 24-hour composites. One grab sample was collected for Ammonia, Oil & Grease, and the microbiological analyses. Additionally, a grab sample was collected every six hours over the duration of the storm and analyzed for low-level Mercury.

The reason for a six-hour composite and analysis cycle was to create a detailed water quality data set for each leg of the event hydrograph. Data with this level of detail may be useful to the

SWRCB in establishing a baseline for natural discharges into ASBSs along the California coast, and may be of interest to other State and local agencies.

Four storm events at Wilson Creek and two events at Waddell Creek were monitored during the 2006-2007 storm season.

Current Project Status

Caltrans plans to continue monitoring both edge-of-pavement sites and reference streams during the upcoming storm season. No changes are planned either in sample collection strategy or laboratory analyses.

Caltrans has decided to add a third reference stream to the scope of this project. The Department is currently searching Gazos Creek in San Mateo County for potential monitoring sites. When an acceptable monitoring site is located and the permitting process is completed Caltrans will begin monitoring at this location as well as the two existing reference stream sites.

Table 1 – Analytical Constituents

Constituent	Method Reference	Maximum Reporting Limit	Spike Recovery Lower Limit	Spike Recovery Upper Limit	Duplicate RPD Limit
Metals (Total and Dissolved)					
Antimony	EPA 200.8	0.5 ug/L	75%	125%	20%
Arsenic	EPA 200.8	0.5 ug/L	75%	125%	20%
Beryllium	EPA 200.8	1.0 ug/L	75%	125%	20%
Cadmium	EPA 200.8	0.2 ug/L	75%	125%	20%
Chromium	EPA 200.8	1.0 ug/L	75%	125%	20%
Copper	EPA 200.8	1.0 ug/L	75%	125%	20%
Lead	EPA 200.8	0.5 ug/L	75%	125%	20%
Mercury	EPA 200.8	0.2 ug/L	75%	125%	20%
Mercury (low-level)	EPA 1631	0.5 ng/L	75%	125%	20%
Nickel	EPA 200.8	1.0 ug/L	75%	125%	20%
Selenium	EPA 200.8	2.0 ug/L	75%	125%	20%
Silver	EPA 200.8	0.2 ug/L	75%	125%	20%
Thallium	EPA 200.8	1.0 ug/L	75%	125%	20%
Zinc	EPA 200.8	5.0 ug/L	75%	125%	20%
Hexavalent Chromium (Total only)	EPA 1636	0.5 ug/L	80%	120%	20%
Nutrients					
Total Phosphorus	EPA 365.2	0.03 mg/L	80%	120%	20%
Orthophosphate	EPA 365.2	0.03 mg/L	80%	120%	20%
Nitrate as N	EPA 300.0	0.1 mg/L	80%	120%	20%
Ammonia as N	EPA 350.3	0.01 mg/L	80%	120%	20%
Conventionals					
pH	EPA 150.1	N/A	N/A	N/A	± 0.1 unit
Conductivity	EPA 120.1	N/A	N/A	N/A	10%
Turbidity	EPA 180.1	0.05 ntu	N/A	N/A	20%
TSS	EPA 160.2	1 mg/L	80%	120%	20%
TOC	EPA 415.1	1 mg/L	85%	115%	15%
DOC	EPA 415.1	1 mg/L	85%	115%	15%
Hardness as $CaCO_3$	SM 2340B	2 mg/L	80%	120%	20%
Microbiologicals					
Total Coliform	SM 9221B	2 MPN/100ml	N/A	N/A	N/A
Fecal Coliform	SM 9221E	2 MPN/100ml	N/A	N/A	N/A
Enterococcus	SM 9230B	2 MPN/100ml	N/A	N/A	N/A
Organics					
Oil and Grease, Total	EPA 1664	1 mg/L	79%	114%	18%
Polynuclear Aromatic Hydrocarbons	EPA 625/8270	2 to 10 ug/L	Lab-specific		
Toxicity					
Acute Toxicity (Ceriodaphnia, Fathead Minnow)					
Chronic Toxicity (Ceriodaphnia, Selenastrum, Fathead Minnow)					

Caltrans Documents

The following Caltrans documents are available for further information.

Caltrans Document No.	Document Title
CTSW-PL-06-127.03.1	Areas of Special Biological Significance Stormwater Monitoring Work Plan
CTSW-RT-06-132.18.2	Recommended Areas of Special Biological Significance Monitoring Locations
CTSW-RT-06-127.03.3	Final Interim Report Areas of Special Biological Significance Monitoring Program Monitoring Season 2005-2006
CTSW-RT-06-132.18.2	Additional Information for Consideration of Exceptions to Discharges into Areas of Special Biological Significance Monitoring
CTSW-TM-06-131-051	Area of Special Biological Significance 33 (ASBS) Study Stormwater Monitoring Site Selection
CTSW-TM-06-131.05-2	Area of Special Biological Significance 33 (ASBS) Study Post-storm Event 1
CTSW-TM-06-131.05-3	Area of Special Biological Significance 33 (ASBS) Study Post-storm Event 2
CTSW-RT-07-127.04.2	Final Interim Report Areas of Special Biological Significance Monitoring Program Monitoring Season 2006-2007
CTSW-RT-07-130.11.1	Areas of Special Biological Significance 24 Study 2006-07 Wet Season Interim Report
CTSW-RT-07-131.06.1	Areas of Special Biological Significance 33 Study 2006-07 Wet Season Interim Report