

Channel Islands Harbor Nutrient Sources & Sinks Study

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&

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Introduction

The City of Oxnard has initiated a water quality monitoring program in response to a low dissolved oxygen event, and harmful algal bloom, in the back basins at Seabridge, Westport and Mandalay in early June 2018. A remote sensor package has been deployed from the docks (beginning 6 August) in the north channel to continuously monitor for low dissolved oxygen and chlorophyll concentrations. Four new sensor packages have been purchased and will soon be deployed at locations in the back basins to provide a better spatial understanding of dissolved oxygen concentrations and algal biomass. City personnel have been taking water quality measurements at ten locations and water samples are being collected at three locations to identify the species and biomass of phytoplankton that are present. This ongoing effort is providing valuable information regarding the water quality status of the back basins and will inform management decisions for responding to future algal blooms, low dissolved oxygen events or animal mortality events.

The next step in this monitoring process is to understand the sinks and sources of nutrients in the Harbor, and to reassess the hydrology of the back basins to understand the water retention times. These steps are essential and will ensure that a scientifically-informed basis for decisions regarding possible engineering mitigations or regulatory steps that might be necessary to address water quality conditions in the back basins of Channel Islands Harbor. The sampling plan presented below provides the details for how the nutrient sources and sinks study will be completed. The hydrology study will be implemented separately and is not included in this sampling plan. However, the results of the hydrology study, combined with the results of the nutrient study, will provide the basis for informed and cost-effective decision making for the Harbor's water quality issues.

Study Questions and General Approach

The Nutrient Sources and Sinks study is intended to address a few key questions important to the public, regulators and City:

1. Where in Channel Islands Harbor (CIH) are the water concentrations of nutrients driving phytoplankton blooms and poor water quality during wet and dry weather conditions, and do they differ between the conditions?
2. Where in CIH are the concentrations of nutrients in sediments greatest? Are these concentrations spatially associated with locations identified in question one or are they associated with different potential sources?
3. What are the circulation properties and retention times of water in the back basins of the Harbor?
4. Taking into account the sources and standing stocks of nutrients, and the hydrology of the harbor, what recommendations can be made regarding remediation and future management for the CIH water quality issues?

Sampling Design

To help identify sources of nutrients and pesticides to the Channel Islands Harbor, water and sediment sampling will be conducted at up to 30 locations during the following conditions:

1. Water sampling following the first rain event of the 2018 to 2019 storm season.
2. Water sampling following the second rain event of the 2018 to 2019 storm season.
3. During dry weather following at least 28 days without rainfall.
4. Sediment sampling will occur during dry weather sometime in December 2018 or January 2019.

A rainfall event for the purposes of this study is defined as a continuous storm represented by ≥ 0.5 inches of rainfall. Details of the nutrient study are provided in the sections below.

Storm Event Sampling

Following the first and second rainfall events of the 2018 to 2019 rain season, water samples will be collected throughout the Harbor and Edison Canal from 30 locations (Figures 1 and 2, Table 1). Samples will be collected from one of Aquatic Bioassay and Consulting Laboratories (Aquatic Bioassay) monitoring vessels in the Harbor and from the banks of the Edison Canal. Stations will be located using GPS.

At each station observational and logistics data will be recorded including weather, coordinates, date, time, crew, etc. (Figure 3). When water is observed flowing from a storm drain, photos will be taken, and comments will be included on the data sheet. Water samples will be collected from surface waters using either a bucket or Neuman bottle. The water sampler will be rinsed three times with Harbor water prior to sampling at each location.

Water will be distributed into laboratory provided, pre-cleaned and labeled containers, and then placed on wet ice for transport to the chemistry laboratories. Chain of Custody sheets will be filled out at each station (Figure 4).

Sediment Sampling

Sediment sampling will occur once during the nutrient study, sometime in December 2018 or January 2019. Harbor stations will be occupied by an Aquatic Bioassay monitoring vessel, and in the Edison Canal stations will be sampled using a 15-foot AVON. Observational data will be collected at each site like the process described above. For sediments, observational data regarding the color and consistency of the sediment will be included on the data sheet.

At each station a petite ponar grab (0.025 m^2) will be used to collect sediment. Once onboard, the grab will be opened, and a stainless-steel spatula will be used to place sediment into laboratory provided, pre-cleaned and labeled container, and then placed on wet ice for transport to the chemistry laboratories. Chain of Custody sheets will be filled out at each station (Figure 4).

Station Locations

Thirty stations have been identified for sampling (Figures 1 and 2, Table 1). Twenty-five stations are located throughout the back basins and five are in the Edison Canal.

Analyte List & Laboratories

Water and sediment samples will be analyzed for the constituents listed in Table 2. Water and sediment nutrients will be analyzed by PHYSIS Environmental Laboratories in Anaheim, CA. Water chlorinated hydrocarbons, orthophosphate pesticides and pyrethroids will be analyzed by Weck Laboratories in Yorba Linda, CA.

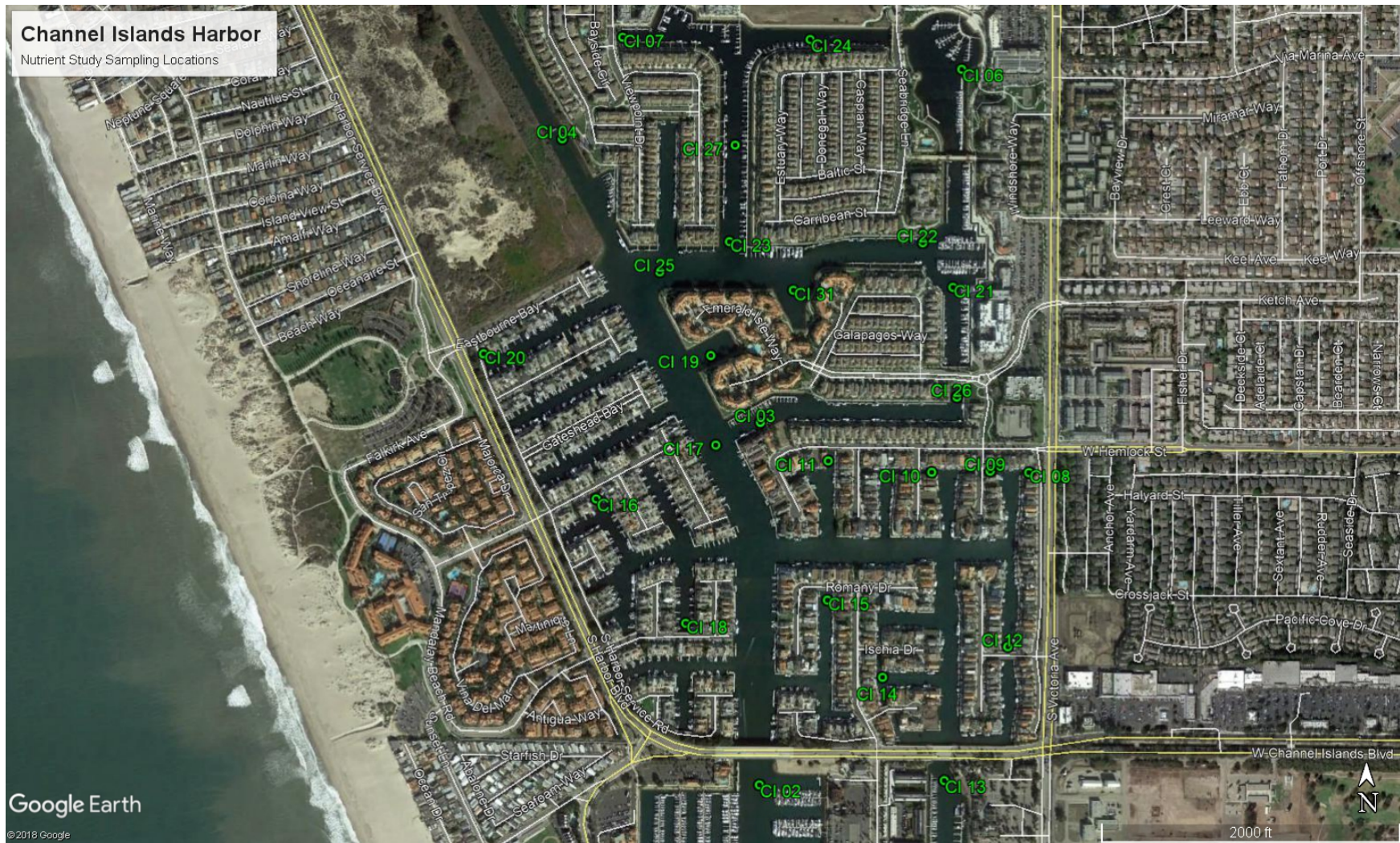


Figure 1. Channel Islands Harbor nutrient study station locations.



Figure 2. Edison Canal nutrient study station locations.

Table 1. Channel Islands Harbor station ID's and coordinates.

Station ID	Location	Latitude	Longitude
CI 30	Edison Canal	34.20610	-119.24970
CI 29	Edison Canal	34.20358	-119.23904
CI 28	Edison Canal	34.19512	-119.23547
CI 05	Edison Canal	34.19782	-119.23582
CI 12	CI Outer Harbor	34.17771	-119.22233
CI 13	CI Outer Harbor	34.17527	-119.22373
CI 02	CI Inner Harbor	34.17519	-119.22781
CI 03	CI Inner Harbor	34.18181	-119.22779
CI 04	CI Inner Harbor	34.18698	-119.23217
CI 06	CI Inner Harbor	34.18825	-119.22334
CI 07	CI Inner Harbor	34.18884	-119.23083
CI 08	CI Inner Harbor	34.18089	-119.22186
CI 09	CI Inner Harbor	34.18092	-119.22271
CI 10	CI Inner Harbor	34.18090	-119.22400
CI 11	CI Inner Harbor	34.18110	-119.22629
CI 14	CI Inner Harbor	34.17716	-119.22509
CI 15	CI Inner Harbor	34.17856	-119.22631
CI 16	CI Inner Harbor	34.18041	-119.23142
CI 17	CI Inner Harbor	34.18139	-119.22877
CI 18	CI Inner Harbor	34.17814	-119.22944
CI 19	CI Inner Harbor	34.18303	-119.22888
CI 20	CI Inner Harbor	34.18306	-119.23390
CI 21	CI Inner Harbor	34.18427	-119.22354
CI 22	CI Inner Harbor	34.18509	-119.22420
CI 23	CI Inner Harbor	34.18511	-119.22847
CI 24	CI Inner Harbor	34.18880	-119.22669
CI 25	CI Inner Harbor	34.18456	-119.23001
CI 26	CI Inner Harbor	34.18227	-119.22345
CI 27	CI Inner Harbor	34.18687	-119.22835
CI 31	CI Inner Harbor	34.18422	-119.22706

Station: _____	Sample Time: _____	Weather (Check one) <input type="checkbox"/> Clear <input type="checkbox"/> Rain <input type="checkbox"/> Overcast <input type="checkbox"/> Drizzle <input type="checkbox"/> Prtly Cldy <input type="checkbox"/> Fog <input type="checkbox"/> Thunderstorm		
Latitude: _____	Sample Date: _____			
Longitude: _____	Water Color¹: _____			
Turbidity: Low / Mod / High (circle one)	Photos: Yes / No (circle one)			
Wet Weather / Dry Weather (circle one)	Crew: _____			
Drains Flowing: Yes / No (circle one)	_____			
Comments: _____				

Samples Type:	Chlorophyll a	Phytoplankton	Nutrients	Pesticides
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Station: _____	Sample Time: _____	Weather (Check one) <input type="checkbox"/> Clear <input type="checkbox"/> Rain <input type="checkbox"/> Overcast <input type="checkbox"/> Drizzle <input type="checkbox"/> Prtly Cldy <input type="checkbox"/> Fog <input type="checkbox"/> Thunderstorm		
Sample Date: _____	Latitude: _____			
Water Color¹: _____	Longitude: _____			
Turbidity: Low / Mod / High (circle one)	Photos: Yes / No (circle one)			
Wet Weather / Dry Weather (circle one)	Crew: _____			
Drains Flowing: Yes / No (circle one)	_____			
Comments: _____				

Samples Type:	Chlorophyll a	Phytoplankton	Nutrients	Pesticides
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1. Water Color: Blue, Green, Blue-Green, Brown, Red Tide (note strength)

Figure 3. Observation data sheet.

Table 2. Water and sediment analyte list.

Water				
Analyte	PHYSIS Method	Units	MDL	RL
Ammonia	SM 4500-NH3 D	mg/L	0.007	0.03
Nitrate	SM 4500-NO3 E	mg/L	0.01	0.02
Total Nitrogen	SM 5310 B	mg/L	0.28	0.6
Dissolved Phosphate (SRP)	SM 4500-P E	mg/L	0.016	0.02
Total Phosphorus	SM 4500-P E	mg/L	0.016	0.02

Sediment				
Analyte	PHYSIS Method	Units	MDL	RL
Percent Solids	SM 2540B	%	0.01	0.01
Total Nitrogen	EPA 9060	% Dry Weight	0.01	0.01
Total Phosphorus	EPA 9061	% Dry Weight	0.01	0.01