



## Morro Bay Seeps Health

**Date Range: 2014 to 2018**

**Analytes: Nitrate as N, Fecal Coliform**

### Background

The Morro Bay National Estuary Program's Monitoring Program conducts monitoring in the freshwater seeps on the edge of the Morro Bay estuary to track ambient water quality trends and to assess the impacts of specific implementation projects.

The community of Los Osos is an unincorporated area under jurisdiction of San Luis Obispo County with a population of approximately 14,000 residents. Before 2016, the community did not have a centralized wastewater treatment facility, and the majority of households used septic systems. Given the sandy soils and small lot sizes, the septic systems were causing nitrate contamination of the shallow aquifer below Los Osos. The county completed construction of the Los Osos Water Reclamation Facility (LOWRF), and households began coming online between March 2016 and March 2017 in three phases. As of August 2018, 96.5% of households were connected to the treatment facility. Of remaining unconnected households, approximately half of them are in the process of connecting.

The freshwater seeps along the back bay are thought to be locations where shallow groundwater is pushing to the surface. Although the volume of water is not very large, the bacteria and nutrient concentrations in the water can be elevated.

The Estuary Program monitors nitrate concentrations in the seeps, before and after LOWRF completion. Estuary Program staff collect samples under the guidance of a Quality Assurance Project Plan (QAPP). This document contains the monitoring locations, protocols, equipment specifications, and other details that allow users to assess the quality of the collected data. The full document is available upon request.

The California Department of Public Health (CDPH), the entity responsible for regulating the shellfish growing waters in the bay, is concerned about the water quality of the seeps, in particular because of their relatively close proximity to the shellfish growing areas. CDPH has monitored bacteria concentrations in the seeps for many years. The Estuary Program and CDPH have partnered to collect and share data in Morro Bay to support their joint goal of protecting water quality in the bay.

Two monitoring efforts are summarized in this memo: nitrate monitoring by the Estuary Program and fecal coliform monitoring by CDPH.

### Estuary Program Nitrate Monitoring

The Estuary Program aims to assess the impacts of the LOWRF on the water quality in the seeps. To accomplish this, the Estuary Program began monitoring the seeps starting in 2014 with the goal of

establishing a pre-project data set prior to the LOWRF coming online. The Estuary Program continues to collect data to assess the impacts of the LOWRF. The Estuary Program's effort is focused on monitoring for nitrates as nitrogen concentration (NO<sub>3</sub>-N) in milligrams per liter (mg/L).

Each month during a low tide, an Estuary Program staff member collects samples from the seeps. To ensure that the water being sampled is freshwater from the seeps rather than bay water, staff take measurements of salinity, conductivity, and temperature when flows are adequate. Staff ensures that adequate time has elapsed since the high tide, giving the marine water time to drain before conducting sampling. The samples are sent by courier to a certified laboratory for analysis for NO<sub>3</sub>-N.

**Analytical Specifications:** The Estuary Program collects samples using standard techniques. The samples are stored on ice and then delivered by a courier to a certified laboratory for analysis within the specified hold time. The analysis specifications are as follows:

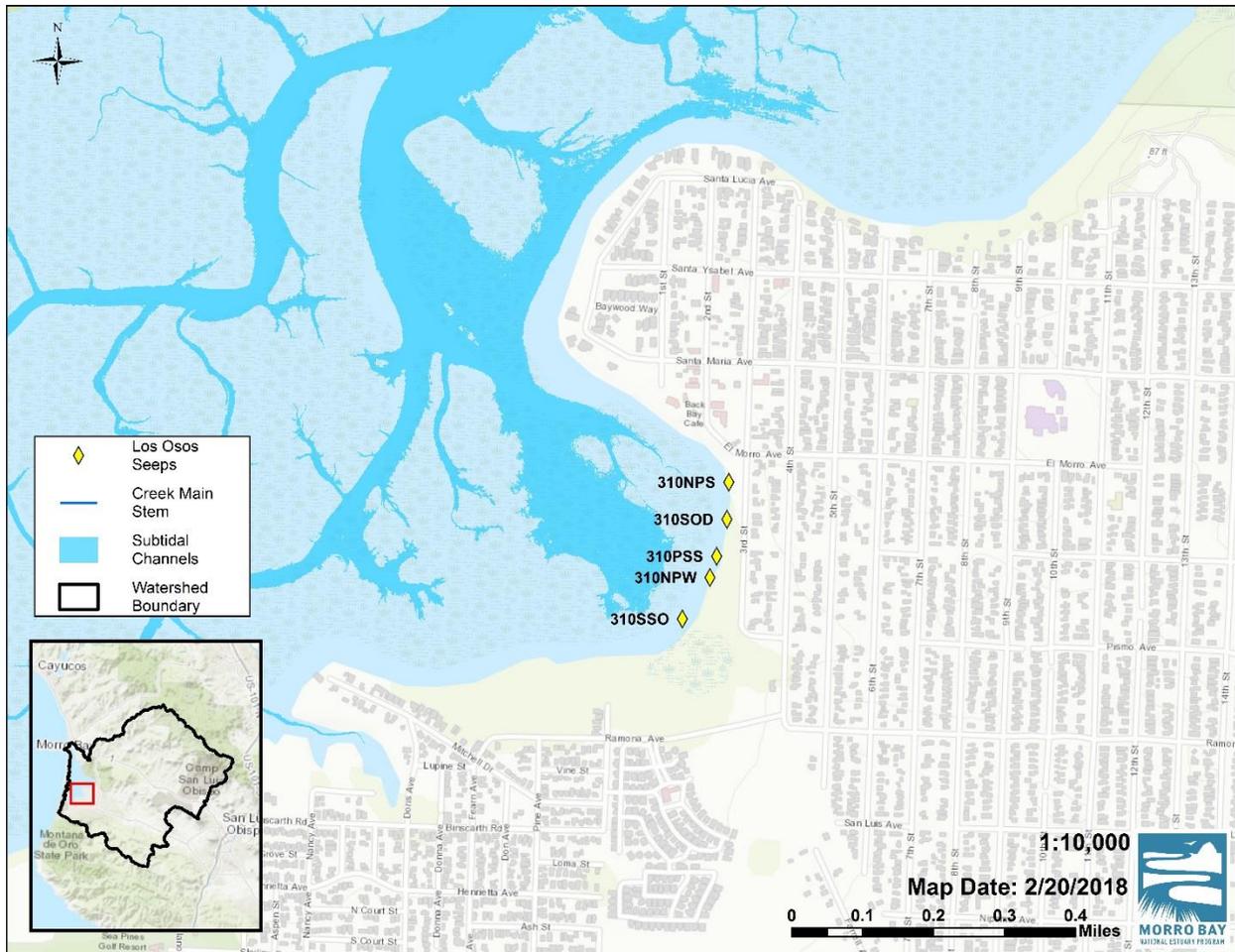
Nitrate as Nitrogen (mg/L)

Specification	Value
Method Number	EPA 300.0
Hold Time	48 hours
Sample storage conditions	4°C in the dark

The minimum detection limit (MDL) and project quantitation limit (PQL) vary depending on how much the lab diluted the sample prior to analysis. Dilutions are required due to the salinity of the samples. The following table indicates the MDL and PQL based on the dilution factor.

Dilution Factor	MDL (mg/L)	PQL (mg/L)
1	0.022	0.10
2	0.044	0.20
5	0.10	0.50
10	0.22	1.0
50	1.0	5.0

**Monitoring Locations:** The seeps are challenging to monitor given their tendency to stop flowing during dry times of year and to shift slightly in locations. Their approximate locations are shown on the following map.



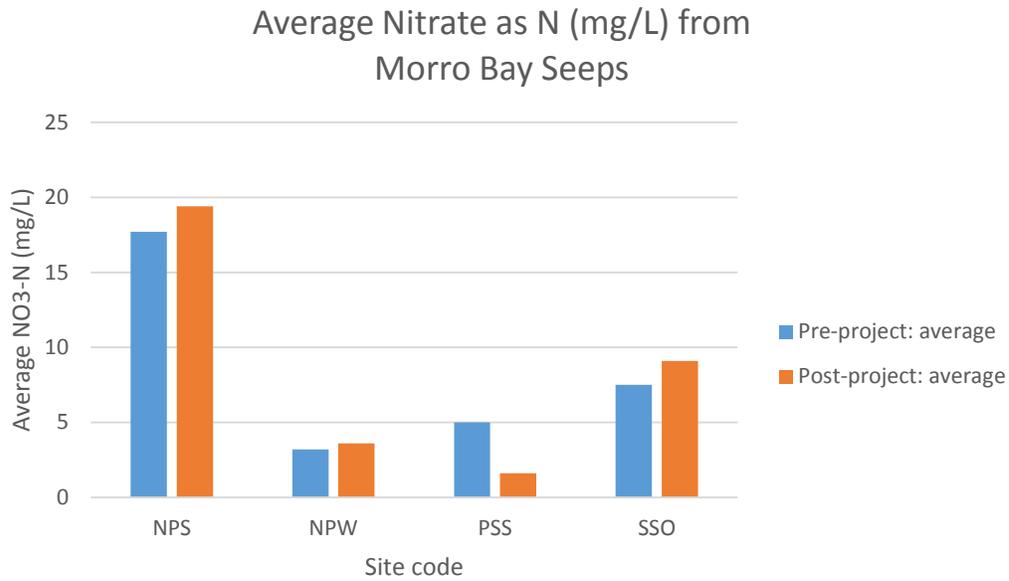
Due to the intermittent nature of the flows and lack of regular data at some of these sites, analysis was only conducted for four sites: NPS, PSS, NPW, and SSO.

**Results:** Monthly monitoring started in September 2014. This memo includes nitrate data through July 2018. Households in the community of Los Osos began connecting to the LOWRF in March 2016 and continued to do so in three phases through the following 12-month period. Data from September 2014 through March 2017 is considered to be pre-project. As of March 2017, 80% of households were connected to the LOWRF. Sampling from April 2017 through July 2018 is considered to be post-project data.

The drinking water standard for  $\text{NO}_3\text{-N}$  is 10 mg/L and is the standard that applies to groundwater that serves as a drinking water source. Although a water quality target does not exist for protection of aquatic life in the bay, the value would likely be far lower than the drinking water standard. For example, such criteria are under development for freshwater systems, and the target for Central Coast creeks is expected to be around 1 mg/L  $\text{NO}_3\text{-N}$ .

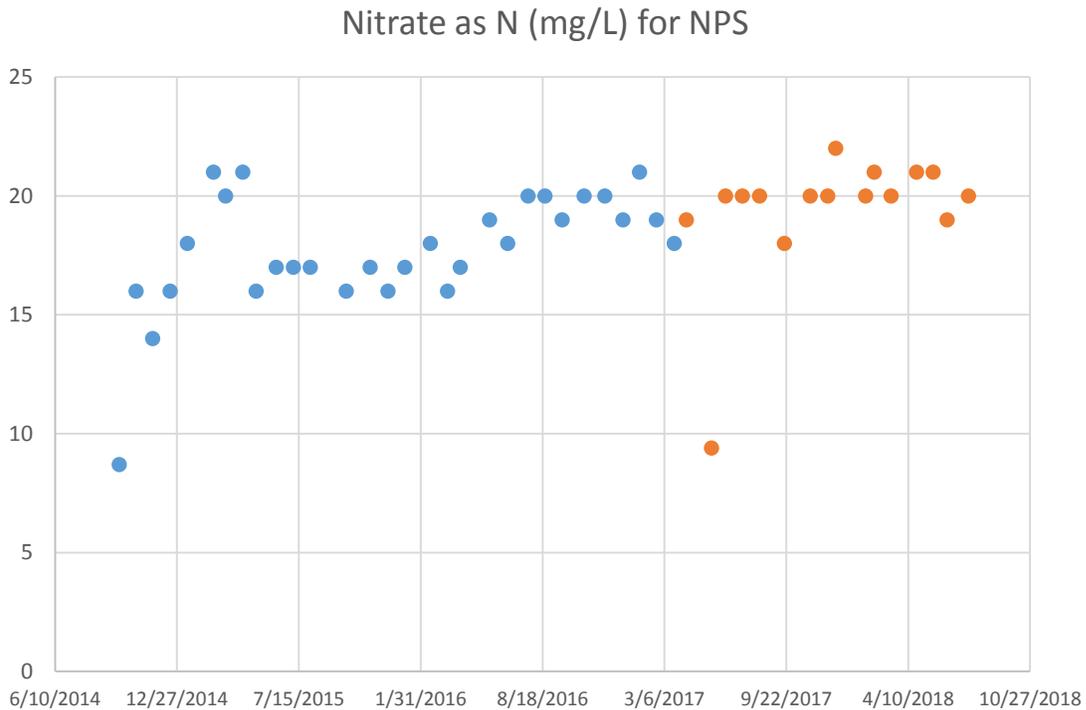
When looking at the average of results from all sites, the pre-project average  $\text{NO}_3\text{-N}$  concentration is 9.1 mg/L, while the post-project average is 10.9 mg/L.

The average NO<sub>3</sub>-N concentration for each location, before and after LOWRF completion, is displayed in the following graph.

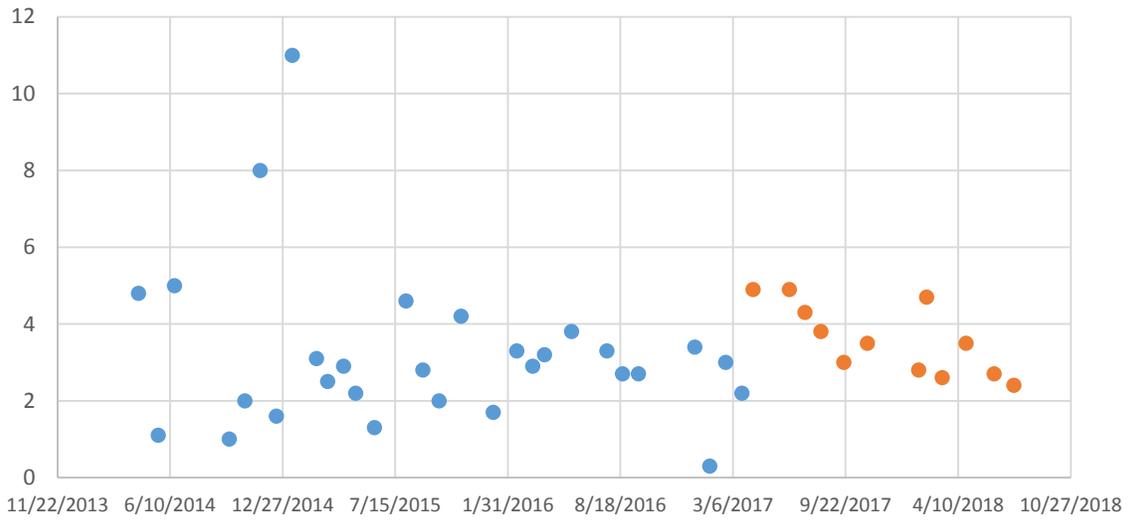


Note that the post-project sample count for PSS is very low with only two samples.

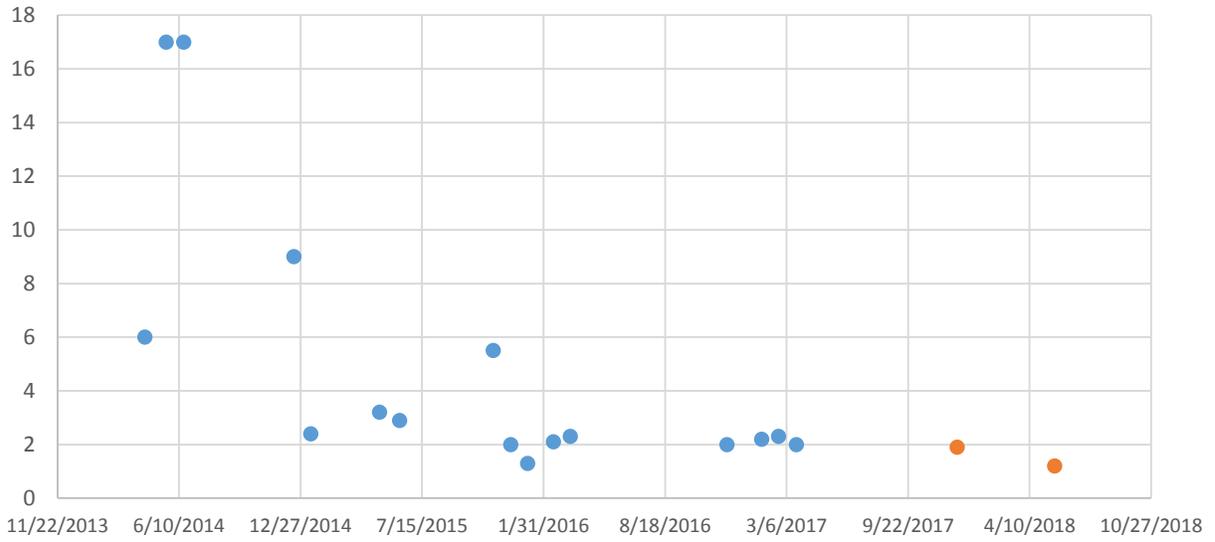
The following graphs show the results over time for each site, with the pre-project indicated in blue and post-project samples indicated in orange.



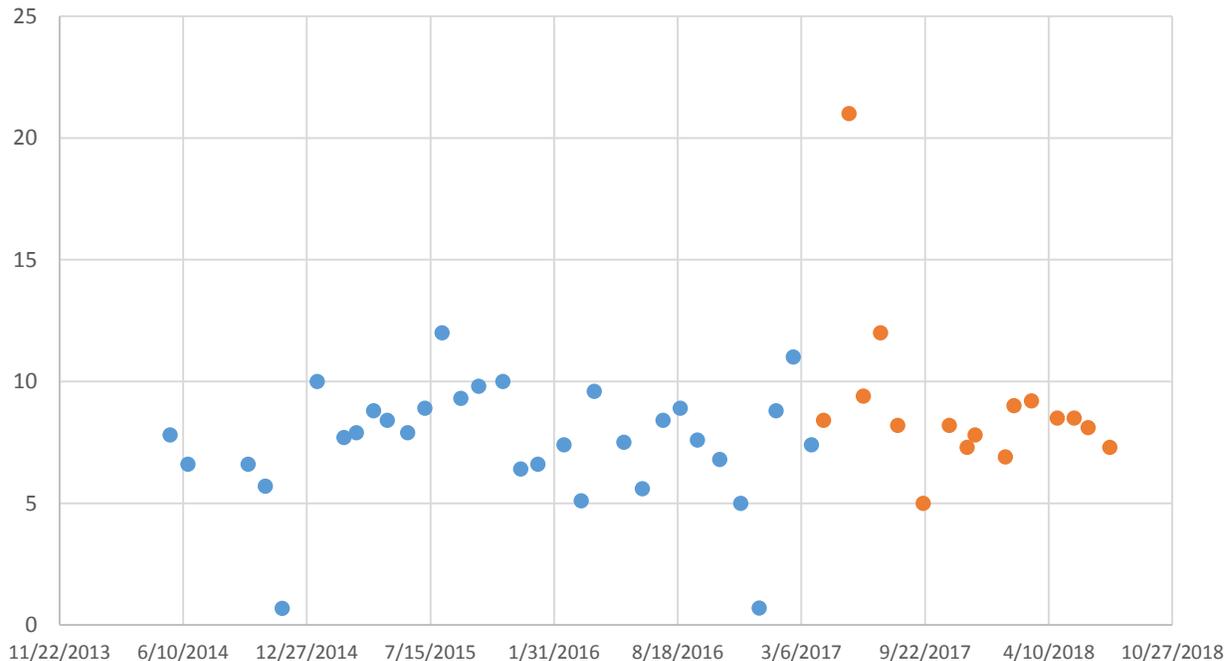
Nitrate as N (mg/L) for NPW



Nitrate as N (mg/L) for PSS



## Nitrate as N (mg/L) for SSO



**Discussion:** The freshwater seeps along the Morro Bay back bay shoreline have not yet exhibited any changes in  $\text{NO}_3\text{-N}$  concentrations since the three phases of households connecting to the LOWRF ended in the spring of 2017. This is thought to be due to the way nitrates move through the system. Nitrates are readily transported by water and into the groundwater. The time this takes varies greatly and depends on the type of soil. Thus, although the source of nitrate to the groundwater was halted through connection to the LOWRF, historic contamination continues to travel into the groundwater. Nitrate in the groundwater must breakdown, and it is thought that these reductions in nitrate will likely take on the order of years to occur, rather than months. We might also expect to see reductions in flow from these seeps, given that the septic systems that contributed to the shallow groundwater are no longer in operation.

However, there are still households in Los Osos that have not yet connected to the LOWRF. Thus, a few remaining operating septic systems could be causing localized impacts and continuing to effect seeps water quality.

**Data Availability:** The data is available from the California Environmental Data Exchange Network (CEDEN), a State Water Resources Control Board managed data portal. To retrieve data,

- Visit [www.CEDEN.org](http://www.CEDEN.org)
- Click on Find Data
- For Program, choose Morro Bay National Estuary Program
- For Stations, choose the five sites designated as “bay shoreline freshwater seeps”: Sweet Springs outlet, Third St/Pismo, North of Pismo wetland, North of pump station, and South of dock.
- Click on Retrieve Data

The most recent data is currently being loaded to CEDEN and should be available in the fall.

## CDPH Fecal Coliform Monitoring

Regulation of shellfish growing waters is under the jurisdiction of CDPH. They work with the shellfish growers, the Estuary Program, and other partners to monitor water quality in the bay and the creeks.

CDPH staff regularly visit Morro Bay to coordinate with the shellfish growers and conduct monitoring. They have conducted periodic monitoring of the seeps for fecal coliform, which is the fecal indicator bacteria utilized in regulating shellfish growing waters. Monitoring has occurred since the 1990s, but due to the uncertainty in monitoring locations, we have only included data collected since 2014.

Samples are collected by CDPH or Estuary Program staff and delivered to the San Luis Obispo County Environmental Health Lab, located in San Luis Obispo. This lab is certified through the National Shellfish Sanitation Program (NSSP) to conduct analysis of water samples for fecal coliform.

### Analytical Specifications:

Fecal Coliform (MPN/100 mL)

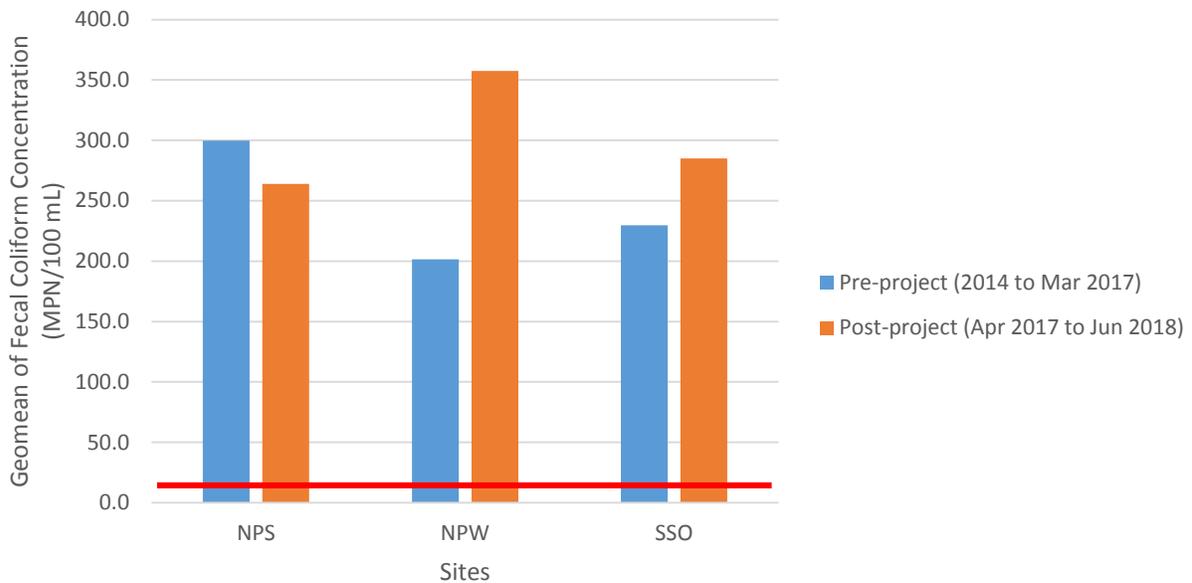
Specification	Value
Method Number	SM9221E2 (A1)
Detection Range	> 2 MPN/100 mL, < 1,600 MPN/100 mL
Hold Time	24 hours
Sample storage conditions	4°C in the dark

**Monitoring Locations:** The monitoring locations are approximately the same as the Estuary Program locations. See above map. Given inaccuracies of GPS units and the ephemeral nature of the freshwater seeps, the exact location cannot always be documented.

For this analysis, NPS, NPW, and SSO sites were included as they had the longest running data sets and appeared to coincide mostly closely with the Estuary Program sampling locations. These sites had data starting in 2014 and continuing through June 2018.

**Results:** Data utilized in the analysis is limited for some of the sites, with sample counts varying from eight to 22 for the time periods of interest (pre and post-project). The NSSP regulations allow harvesting of shellfish from a growing area if the geomean of the fecal coliform concentration is less than 14 Most Probable Number per 100 milliliters (MPN/100 mL) and the estimated 90<sup>th</sup> percentile of the data is less than 43 MPN/100 mL. Please note that these regulatory standards apply only to the water within the growing areas and that these seeps are located outside of this area. The following graph shows the geomean of all results for the pre and post-project time periods for the three sites. The redline represents the 14 MPN/100 mL geomean regulatory criteria.

## Geomean of Fecal Coliform (MPN/100 mL) for Morro Bay Seeps 2014 to 2018



**Discussion:** CDPH agrees with the Estuary Program’s conclusion that the impacts of the LOWRF likely won’t be evident in the data for some time. Thus at this time, we are not drawing any conclusion on the results to date.

**Data Availability:** The data is collected and managed by CDPH. It is available from the agency upon request.

### Future Monitoring Efforts

Given the lack of change in the data and the expectation that it may take years to detect the impacts, the Estuary Program has decided to reduce the monitoring frequency to every other month. This reduced sampling frequency frees up the staff time and analysis costs that will allow us to conduct the effort for the long-term.