
North Coast Regional Water Quality Control Board

TO: Coastal Pathogen Project File

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Scientific Aid

DATE: April 19, 2022

SUBJECT: 2022 Salinity Study

Introduction

Staff of the North Coast Regional Water Quality Control Board (Region 1) have assessed 42 sites in Humboldt County as part of the Coastal Pathogens Project investigating coastal surface waters for pathogen indicators to identify potential fecal waste contamination. Samples collected in the Humboldt Bay area from 2016-2018 were analyzed for the fecal indicator bacteria *Escherichia coli* (*E. coli*) and enterococci (collectively FIB), as well as other fecal indicators.

The 2016-2018 studies were guided by the 2016 Basin Plan, which at that time included both a narrative background Water Quality Objectives (WQO) and numeric fecal coliform concentration WQO applicable to the water contact recreation (REC-1) beneficial use. However, since the implementation of those studies, the State Water Resources Control Board adopted Part 3: Bacteria Provisions and Variance Policy as part of the statewide Inland Surface Waters, Enclosed Bays, and Estuaries (ISWEBE) Plan, superseding the numeric WQO for REC-1 in the Basin plan. ISWEBE Part 3: Bacteria Provisions and Variance Policy (2018) directs the use of either *E. coli* or enterococci WQO threshold values when conducting analysis on bacteria WQOs, dependent upon the sampled site salinity. Specifically, ISWEBE dictates the use of *E. coli* for freshwater sites where “salinity is equal to or less than 1 part per thousand (ppt) 95 percent or more of the” calendar year and enterococci for saline sites where “salinity is greater than 1 ppt more than 5 percent of the time during the calendar year”. Because staff did not collect salinity data as part of the 2016-2018 Coastal Pathogen studies, staff conducted the Salinity Study, which is the subject of this technical memorandum in order to properly assign the appropriate WQOs to the 2016-2018 FIB

data. The Salinity Study is composed of two parts, a desktop analysis and site visits to collect additional data then used to determine salinity conditions in Humboldt Bay area streams.

Methods

As mentioned above, to evaluate the salinity conditions of Coastal Pathogen project stream sites, staff utilized two methods: desktop assessment and on-site field visits. The desktop assessment was performed using elevation data to assess potential for saline influence. This desktop method identified 25 of the 42 sample sites as freshwater locations 100% of the time. Categorizing the remaining 17 sites required site visits to verify the salinity conditions at each site.

The desktop assessment was performed utilizing ArcMap, creating a layer of the 42 sites based upon the latitude and longitude information collected during the original sample collection. The sites were then evaluated using USGS elevation data to assess saline conditions. Staff selected a conservative elevational criterion of 50 feet above sea level as freshwater. The elevational information and staff's local knowledge were coupled with information provided by both the "World Topographic Map" and "World Imagery" layers. This provided staff with the ability to determine that sample 25 sites were 100% freshwater at all times, as described in Table 1 of the Appendix.

Staff verified the saline conditions of the remaining 17 sites with site visits during one tidal cycle, from high-high tide to low-low tide. A high-high tide of 7'9" above mean sea level at 11:07 am and a low-low tide of -0'11" at 5:17 pm was predicted by tide charts for March 1, 2022, at the Arcata Wharf. To determine if the single high-high tide event on March 1 was sufficient to delineate freshwater sites from saline sites, the National Oceanic and Atmospheric Administration (NOAA) predicted March 1 high-high tide was compared to all the tidal predictions for calendar year 2022. This comparison demonstrated that the maximum number of hours that any subsequent tides may exceed the high-high tide of March 1 is less than 3% of the hours in the calendar year. Therefore, any waterbody determined to be freshwater during this sample event will be considered to be freshwater for the purposes of this study (freshwater as least 97% of the time) which exceeds the ISWEBE requirement of 95% frequency.

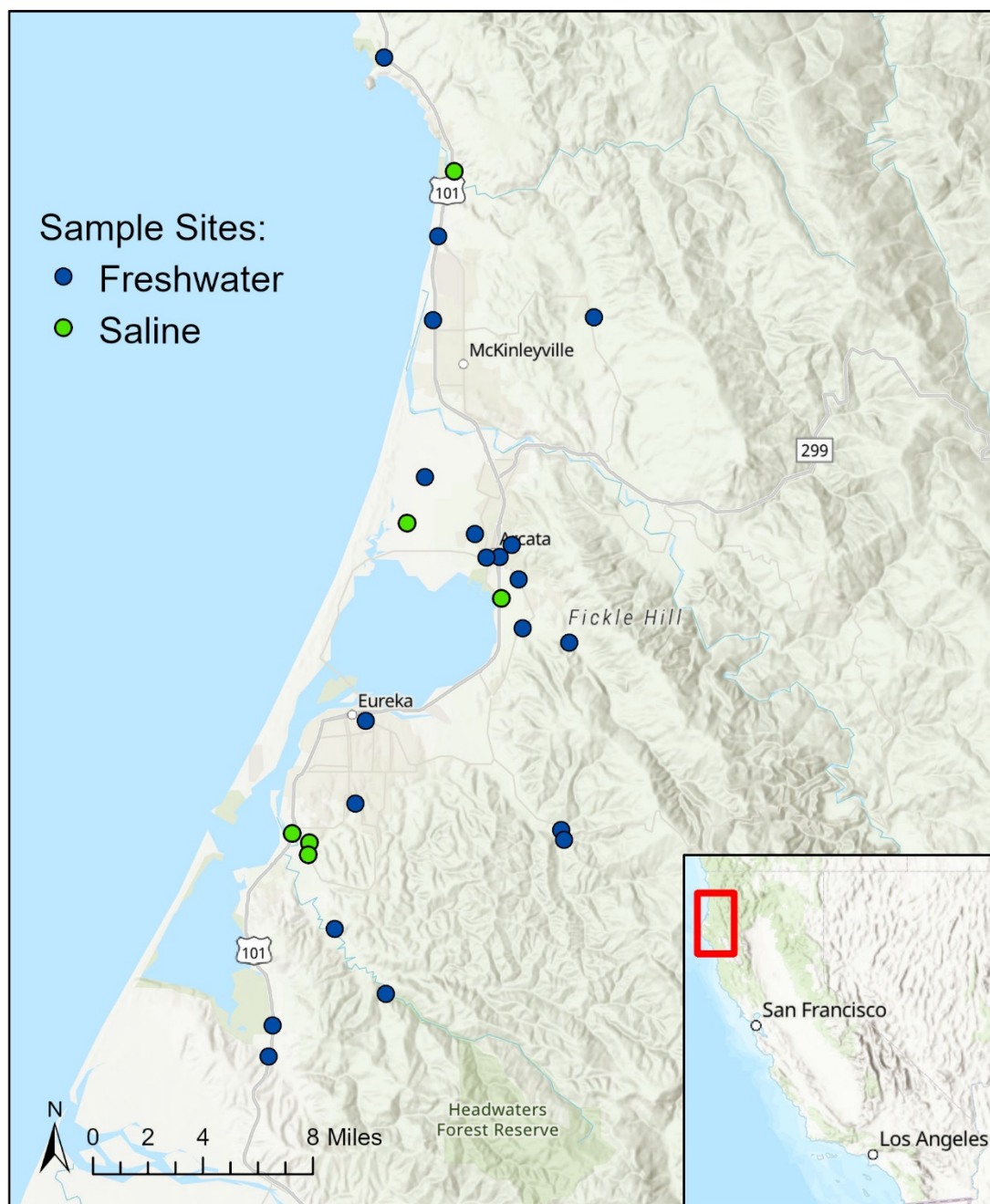
Staff visited each of the 17 sites on March 1 between 9:30 am and 10:45 am to collect water sample data during high-high tide conditions and again between 3:00 pm and 5:45 pm to collect data during low-low tide conditions. Staff utilized YSI® sondes to collect salinity data at the 17 sites. Salinity data was collected within one hour of the predicted high-high tide and within two hours of the low-low tide. The sample event occurred in dry weather, with the last recorded precipitation events occurring on February 15 (0.07") and February 22-23 (0.31"), neither of which led to runoff. Picture of Little River and Jacoby Creek at Old Arcata Road are shown below as examples of sample locations visited during high tide on March 1st, 2022.



Images: Upstream Little River (left) and Jacoby Creek at Old Arcata Road (right) during high tide on March 1st, 2022

Results

As stated in the section above, and shown in Table 1 below, the in-office desktop evaluation resulted in 25 sites being designated as freshwater. The field verification process resulted in the remaining 17 sites being designated as a mixture of saline and freshwater, finding six sites to be saline and eleven to be freshwater. The list of these locations and results is provided in Table 2 of the Appendix and displayed in Figure 1 below.



California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, Esri, CGIAR, USGS, Esri, USGS, Esri, Garmin, FAO, NOAA, EPA

Figure 1. Humboldt County Coastal Waters Categorization of Site Salinity

Discussion

Both the desktop evaluation and the field sampling exercises effectively produced salinity measurements for all the sites associated with data being used in the Coastal Pathogens Project. This information enables staff to apply the statewide WQOs for *E. coli* and enterococci to the data collected from 2016-2018. Consistent with the ISWEBE requirements, *E. coli* will be

used as the freshwater water quality objective and enterococci as the saline water quality objective.

Salinity is an important characteristic of the streams associated with the Coastal Pathogen Project. The information collected during this Salinity Study will be applied during assessment of REC-1 conditions associated with the 42 sites sampled. These results dictate where the next steps of the analysis can correctly apply the current REC-1 WQOs. As indicated in Table 2, appended to this memorandum, the majority of sites assessed during this Salinity Study are freshwater, therefore *E. coli* will be used more than enterococci for REC-1 assessment of Coastal Pathogen streams.

References

- North Coast Regional Water Quality Control Board. (2015). Coastal Watershed Pathogen Indicator Study Quality Assurance Project Plan.
https://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/coastal_pathogen/pdf/181219/Coastal_Pathogen_Study_QAPP_1Nov2015.pdf
- North Coast Regional Water Quality Control Board. (2016). Basin Plan Chapter 3: Water Quality Objectives. [BPChapter3WaterQualityObjectives.pdf \(ca.gov\)](#)
- State Water Resources Control Board. (2019). Part 3 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Bacteria Provisions and a Water Quality Standards Variance Policy.
https://www.waterboards.ca.gov/plans_policies/docs/bacteria.pdf

Appendix

Table 1: Freshwater sites evaluated in-office

Parent Project	Station Code	Station	Overall Status	Method
Natural Background	111AL1359	Albee Creek at Bull Creek Flats Road	Freshwater	Desktop
Natural Background	111CF1805	Calf Creek at Bull Creek Flats Road	Freshwater	Desktop
Source Stream Monitoring Study	110GS6500	Campbell Creek At 14th Street & Union Street	Freshwater	Desktop
Natural Background	103CD0679	Cedar Creek at Howard Hill Road	Freshwater	Desktop
Natural Background	103CK4061	Clarks Creek at Walker Road	Freshwater	Desktop
Natural Background	111CW0458	Cow Creek at Bull Creek Flats Road	Freshwater	Desktop
Source Stream Monitoring Study	110ER6642	Elk River at Zane's Road	Freshwater	Desktop
Source Stream Monitoring Study	110SF1612	Elk River South Fork at Headwaters Forest	Freshwater	Desktop
Natural Background	114FZ3710	Freezeout Creek at Freezeout Creek Road	Freshwater	Desktop
Source Stream Monitoring Study	110FR4642	Freshwater Creek at County Park	Freshwater	Desktop
Source Stream Monitoring Study	110GG0100	Graham Gulch at Pacific Lumber Camp Road	Freshwater	Desktop
Natural Background	111HR0606	Harper Creek at Bull Creek Flats Road	Freshwater	Desktop
Source Stream Monitoring Study	110JC6316	Jacoby Creek at Jacoby Creek Road	Freshwater	Desktop
Natural Background	107LL0600	Little Lost Man Creek at Lost Man Creek Exit	Freshwater	Desktop
Natural Background	111LM0001	Little Mill Creek at Bull Creek Flats Road	Freshwater	Desktop
Natural Background	107LM1856	Lost Man Creek at Lost Man Creek Exit	Freshwater	Desktop
Natural Background	111ML0252	Mill Creek at Bull Creek Flats Road	Freshwater	Desktop
Natural Background	103ML0155	Mill Creek at Howard Hill Road	Freshwater	Desktop

Source Stream Monitoring Study	108MC1250	Mill Creek at Stagecoach Road	Freshwater	Desktop
Natural Background	113MR1171	Miller Creek at Highway 1	Freshwater	Desktop
Source Stream & Impaired Streams Monitoring Study	109NR1488	Norton Creek at Highway 101	Freshwater	Desktop
Natural Background	113PG1586	Phillips Gulch at Highway 1	Freshwater	Desktop
Natural Background	107PR7848	Prairie Creek at Drury Parkway	Freshwater	Desktop
Natural Background	113ST0986	Stockhoff Creek at Highway 1	Freshwater	Desktop
Source Stream Monitoring Study	109UNTANKR	Unnamed Stream at Anker Road	Freshwater	Desktop

Table 2: Salinity of sites verified in-field

Parent Project	Station Code	Station	Overall Status	Salinity	Status High Tide	Status Low Tide	Method
Source Stream & Impaired Streams Monitoring Study	108LR0663	Little River at Highway 101	Saline	25.34	Saline	Saline	Desktop & Field
Source Stream Monitoring Study	108SC0550	Strawberry Creek at Highway 101	Freshwater	0.06	Freshwater	Freshwater	Desktop & Field
Source Stream Monitoring Study	110CG5000	Cooper Gulch at Myrtle Avenue & 8th Street	Freshwater	0.8	Freshwater	Freshwater	Desktop & Field
Source Stream & Impaired Streams Monitoring Study	110EL1278	Elk River at Highway 101	Saline	Not Sampled*	Saline	Saline	Desktop & Field
Source Stream Monitoring Study	110GR0500	Grotzman Creek at Bayside Road	Freshwater	0.09	Freshwater	Freshwater	Desktop & Field
Source Stream & Impaired Streams Monitoring Study	110GS1625	Gannon Slough At Highway 101	Saline	30.20	Saline	Saline	Desktop & Field
Source Stream Monitoring Study	110GS5000	Campbell Creek At 7th Street	Freshwater	Not Sampled*	Freshwater	Freshwater	Desktop & Field
Source Stream Monitoring Study	110JC0966	Jacoby Creek at Old Arcata Road	Freshwater	0.10	Freshwater	Freshwater	Desktop & Field
Source Stream & Impaired Streams Monitoring Study	110JG0264	Jolly Giant Creek at Samoa Boulevard	Freshwater	0.52	Freshwater	Freshwater	Desktop & Field
Source Stream Monitoring Study	110MD3750	McDaniel Slough At Q Street	Freshwater	0.07	Freshwater	Freshwater	Desktop & Field
Source Stream & Impaired Streams Monitoring Study	110MS1481	Martin Slough at Pine Hill Road	Saline	30.6	Saline	Saline	Desktop & Field

Source Stream Monitoring Study	110MS6750	Martin Slough at Campton Street & Fern Street	Freshwater	0.08	Freshwater	Freshwater	Desktop & Field
Source Stream Monitoring Study	110SA1720-1680	Salmon Creek at Eel River Drive	Freshwater	0.20	Freshwater	Freshwater	Desktop & Field
Source Stream Monitoring Study	110SS9000	Swain Slough at Elk River Road	Saline	26.3	Saline	Saline	Desktop & Field
Source Stream Monitoring Study	110UNSJXN	Liscom Slough at Jackson Road	Saline	32.86	Saline	Saline	Desktop & Field
Source Stream Monitoring Study	110UNSLPH R	Unnamed Slough at Lanphere Road	Freshwater	0.33	Freshwater	Freshwater	Desktop & Field
Source Stream Monitoring Study	110UNSRNC H	Unnamed Slough at Ranch Road	Freshwater	0.32	Freshwater	Freshwater	Desktop & Field

*Not Sampled sites were downstream of multiple saline or freshwater sites, respectfully, during both high and low tides. Sampling was therefore unnecessary in determining the salinity of these sites.