

ORANGE COUNTY OIL SPILL: WATER QUALITY SAMPLING RESULTS



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1 INTRODUCTION

A crude oil spill was first spotted off the coast of Orange County late on Friday October 1, 2021. The likely source is the oil pipe approximately 4.5 miles offshore, owned by Amplify Energy Corp. The pipeline was shut down 6 am Saturday morning on October 2, 2021¹.



Figure 1. Leak Location and Movement of Spill from Oct. 2-5, 2021¹

The City of Huntington Beach closed the beaches on Sunday October 3, 2021, to ensure that beachgoers would not be exposed to health risks. Clean-up efforts with skimmers and containment floating barriers known as booms on the water have continued. The State and appropriate agencies implemented hand removal cleanup procedures on the beaches. As the extent of the oil spill is known and the slick is moving south and away from Huntington Beach

¹ Source: <https://www.cnn.com/2021/10/06/us/huntington-beach-california-oil-spill-timeline/index.html>

area, the City has requested M&N collect environmental data to aid in the determination of any potential health risks that may be present after the City reopened the beach.

2 CONTAMINANT EXPOSURE PATHWAYS

2.1 Human Health

Beachgoers are expected to have potential exposure to chemicals in the environment through the pathways summarized in Table 1. Marine water quality was considered for each pathway and when applicable. Resource agencies have developed numeric standards to evaluate concentration of chemicals in the environment; applicable screening levels were compared to marine waters to estimate the potential for human health exposure.

Table 1. Exposure Pathways for Beachgoers with Recommended Screening Levels

Exposure Route	Consideration of Oil Spill Exposure
Inhalation	<ul style="list-style-type: none">• Oil spill related compounds volatize easily, resulting in petroleum related odors. Beachgoers are outdoors, in well ventilated areas.• The City health officials should provide direction to beachgoers to avoid unnecessary and prolonged exposure when odors are present. This summary does not include air sampling and therefore comparison to air concentrations was not evaluated.• However, there are standards for nuisance odor for 3 compounds that are associated with oil spills. Water quality characterization includes a comparison to Odor Nuisance Levels established by the Regional Water Quality Control Board for groundwater to provide a conservative comparison.
Dermal absorption from contact on sand and from bathing, including immersion contact	<ul style="list-style-type: none">• The oil spill has resulted in oil globules and stained sands in areas where the oil has reached the shore.• The City health officials should provide direction to beachgoers to avoid unnecessary exposure by handling oily sands.• However, it is possible that a swimmer or beachgoer will be inadvertently exposed by accidentally touching oil on the sand or oil slicks on water surface resulting in dermal or direct exposure. Therefore, water quality characterization includes a

	comparison to Direct Exposure Human Health Risk Levels ² established by the Regional Water Quality Control Board for groundwater to provide a conservative comparison.
Ingestion during swimming	<ul style="list-style-type: none"> The oil spill has resulted in an oiled water surface that are often visible as slicks. The City health officials should provide direction to beachgoers to avoid unnecessary exposure by swimming within observed slicks. However, it is possible that a swimmer or beachgoer will be inadvertently exposed by accidentally swallowing water while swimming. Water quality characterization includes a comparison to Oral Exposure Levels³ provided by California Department of Toxic Substances Control (DTSC), Human and Ecological Risk Office (HERO) to provide a conservative comparison.

2.2 Ecological Health

The following ecological screening levels were used to characterize the marine waters off Huntington Beach:

- California Toxics Rule Criteria to protect human health and aquatic life
- California Ocean Plan Water Quality Objectives (no oil standard available, metals only).
- U.S. Environmental Protection Agency (USEPA) Recommended Water Quality Criteria to Protect Human Health and Aquatic Life

Santa Ana Basin Plan was reviewed to confirm no additional standards are applied to the Huntington Beach coastline through Clean Water Act Total Maximum Daily Loads (TMDLs).

² The highly conservative screen level of California maximum contaminant level (MCL) was applied. The MCL Priority lists all available MCL values. If no MCL values are available, the lower of the cancer and noncancer tapwater direct exposure levels is listed. MCL values are established for 13 PAH compounds.

³ Guidance for Evaluating Human Health Risk at Sites Contaminated by Petroleum Hydrocarbons and Related Chemicals of Potential Concern (COPC) – Human Health Risk Assessment NOTE 12 was developed by DTSC. The guidance provides human health total petroleum hydrocarbon (TPH) human health toxicity criteria for carbon ranges of compounds. The marine water samples were tested for diesel range organics (DOR) and oil range organics (ORO) which typically refer to petroleum hydrocarbons with a range of 10-28 and 20-35 carbon atoms, respectively.

3 FIELD COLLECTION PROGRAM

3.1 Field Sampling Methods

3.1.1 Initial Sampling: October 7, 2021

Forty samples were collected along Huntington Beach at 0.25 mile increments (Figure 2); field replicates were collected at sample locations 5, 14, 25, and 35. Two additional samples were collected in San Clemente to serve as reference samples. At each sampling location, water samples were collected within the surf zone (knee to waist deep). Site observations were documented and photographed at each site (Figure 3). The presence of oil in the wrack line, in the sand (globules, discoloration or sheen), and in the water were recorded in the field logs (Figure 4).

All water samples were stored on ice and were transferred to Eurofins at the south end of Huntington State Beach immediately after sampling. All samples were analyzed for PAHs as well as diesel and crude oil. Samples collected at sites 1-3 were also analyzed for metals.



Figure 2: Locations of sampling sites along Huntington Beach on October 7, 2021.



Figure 3: Example site condition photograph (site 33).

Project No. -

Location: HB

Date: 10/7/21

Field Log



Site ID: 034 Sampler: Webb Thickman McMahon Corlett Butler Beck
Time: 3:52 Recorder Webb Thickman McMahon Corlett Butler Beck
Bottle ID: HB — W S — 20211007 — 034
QA/QC Sample: Y N Type: Duplicate (DUP) Blank (BLK) Control (CTL)

Water Depth at Sample (ft): Knee							Notes:
Weather:	Sunny	Partly Cloudy	Overcast		Fog	Rain	Air Temp (F): 68
Wind:	Direction: N NE E SE S SW W NW				Notes:		
	Speed: Calm	Light	Medium		Heavy		
Currents:	Direction: N NE E SE S SW W NW				Notes:		
	Speed: Calm	<1ft/s	1-2ft/s	3+ft/s	Notes:		
Waves:	Direction: N NE E SE S SW W NW				Notes:		
	Height: Flat	<1ft	1-2ft	2-3ft	3-5ft	Overhead	
Tide:	high	mid	low	flood	—	ebb	Wrackline: Y N
Sheen:	Y	N	Notes:				
Surface Debris:	Y	N	Notes:				
Odor:	None	Slight	Mod	Strong	H ₂ S	Petro	Septic
Water Clarity:	Clear (see bottom)				Cloudy (>4")	Murky (<4")	
Water Color:	Colorless			Green	Yellow	Brown	Blue
Photos:	Y	N	Geotagged:	Y	N	Notes:	

Comments: globs. obs

Figure 4: Example field log (Sample Location 34).

Table 2. Sampling locations for Huntington Beach Oil Spill Response on Oct. 7, 2021.

Site No.	Latitude	Longitude	Site No.	Latitude	Longitude
1	33.62745627	-117.9568468	21	33.67195985	-118.0252287
2	33.62956084	-117.9613268	22	33.67459259	-118.0280729
3	33.63190743	-117.9645929	23	33.67728611	-118.0310138
4	33.63390219	-117.967712	24	33.67983323	-118.0339307
5	33.63591285	-117.9713889	25	33.68307159	-118.0373738
6	33.63804687	-117.9751382	26	33.68527335	-118.0396631
7	33.64007595	-117.9786297	27	33.68786205	-118.0427568
8	33.64217174	-117.9821741	28	33.69083209	-118.0452012
9	33.64443859	-117.9855725	29	33.69396705	-118.0477395
10	33.64651855	-117.9889532	30	33.69671868	-118.0502864
11	33.64869394	-117.9925051	31	33.69964387	-118.0531591
12	33.6507199	-117.9961286	32	33.70271043	-118.0554202
13	33.65272222	-117.9996945	33	33.70526435	-118.0586038
14	33.65473133	-118.0031364	34	33.70810019	-118.0614361
15	33.65716729	-118.0060931	35	33.70987461	-118.0655487
16	33.65990028	-118.0090098	36	33.71307107	-118.0677986
17	33.66251944	-118.0124681	37	33.71565067	-118.0707691
18	33.66491447	-118.0152702	38	33.71832631	-118.073878
19	33.6673107	-118.0184806	39	33.72098847	-118.0767187
20	33.66977857	-118.0217971	40	33.72316349	-118.0795235

3.1.2 Second Sampling: October 12, 2021

Twenty samples were collected along Huntington Beach at 0.5 mile increments on October 12, 2021 (Figure 5); field replicates were collected at sample locations 11 and 29. Sample locations coincided with odd-numbered locations from the October 7 sampling event. Two additional samples were collected in Seal Beach at sample locations 41 and 42 to serve as reference samples. At each sampling location, water samples were collected within the surf zone (knee to waist deep). Site observations were documented and photographed at each site (Figure 6). The presence of oil in the wrack line, in the sand (globules, discoloration or sheen), and in the water were recorded in the field logs (Figure 7).

All water samples were stored on ice and were transferred to Eurofins at the south end of Huntington State Beach immediately after sampling. All samples were analyzed for PAHs, diesel and crude oil, and metals.

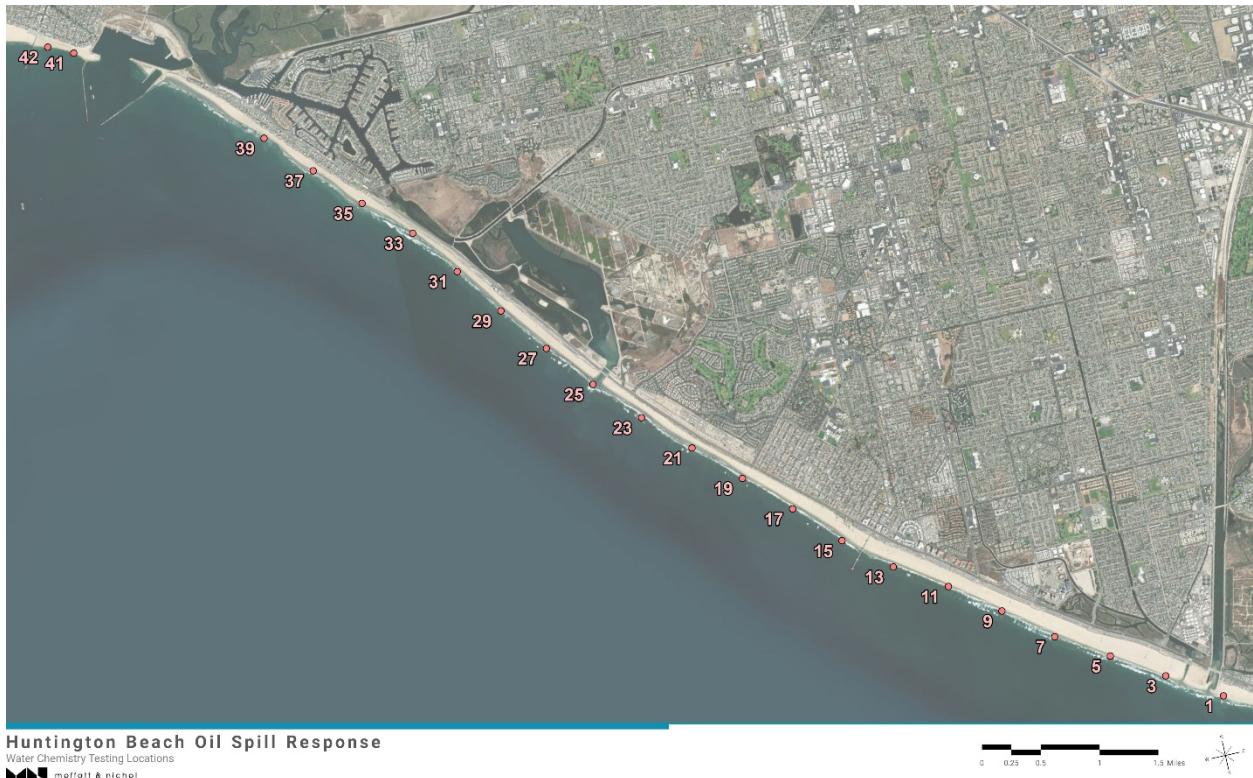


Figure 5: Locations of sampling sites along Huntington Beach on October 12, 2021.



Figure 6: Example site condition photograph (site 33).

Project No. **HB**

Location: **HB**

Date: **10/12/21**

Field Log 

Site ID: 033	Sampler: Webb	Thickman	Moreira	McMahon	Maxwell	Corlett	Butler		
Time: 12:25	Recorder	Webb	Thickman	Moreira	McMahon	Maxwell	Corlett	Butler	
Bottle ID: HB — W S	—	202110 12	—	033					
QA/QC Sample:	Y N	Type:	Duplicate (DUP)	Blank (BLK)	Control (CTL)				
Water Depth at Sample (ft):	knee						Notes:		
Weather:	Sunny	Partly Cloudy	Overcast	Fog	Rain	Air Temp (F): 63	Notes:		
Wind:	Direction: N NE E SE S SW W NW							Notes:	
	Speed: Calm Light Medium Heavy								
Currents:	Direction: N NE E SE S SW W NW							Notes:	
	Speed: Calm <1ft/s 1-2ft/s 3+ft/s								
Waves:	Direction: N NE E SE S SW W NW							Notes:	
	Height: Flat <1ft 1-2ft 2-3ft 3-5ft Overhead								
Tide:	high	mid	low	flood	ebb				Notes:
Wrackline:	Y	N	Notes:						
Oil Globules:	Y	N	Diameter: <0.5cm	0.5-1cm	1-2cm	3+cm			
Sheen:	Y	N	Notes:						
Surface Debris:	Y	N	Notes:						
Odor:	None	Slight	Mod	Strong	H ₂ S	Petro	Septic		
Water Clarity:	Clear (see bottom)			Cloudy (>4")	Murky (<4")				
Water Color:	Colorless		Green	Yellow	Brown	Blue			
Photos:	Y	N	Geotagged:	Y	N	Notes:			
Comments:									

Figure 7: Example field log (Sample Location 33).

Table 3. Sampling locations for Huntington Beach Oil Spill Response on Oct. 12, 2021.

Site No.	Latitude	Longitude	Site No.	Latitude	Longitude
1	33.62776084	-117.956915	23	33.67734357	-118.0308977
3	33.63193754	-117.9644164	25	33.68228736	-118.0360422
5	33.63631235	-117.9720215	27	33.68824648	-118.0422539
7	33.64013831	-117.9786842	29	33.69412859	-118.0477987
9	33.6444053	-117.9856122	31	33.70005116	-118.0529003
11	33.64872697	-117.9925027	33	33.70557004	-118.0584051
13	33.65269688	-117.9997256	35	33.71031666	-118.0647486
15	33.65708981	-118.0058986	37	33.71565998	-118.0709813
17	33.66269479	-118.0122654	39	33.72110522	-118.076457
19	33.6674353	-118.0183886	41	33.73622422	-118.1014844
21	33.67237925	-118.0248711	42	33.73761885	-118.1049261

3.2 Chemical Analyses

Seawater from 40 sample locations were tested for PAHs (EPA method 8270 SIM) and diesel range organics (DOR), and oil range organics (ORO) (EPA method 8015). The DOR and ORO typically refer to petroleum hydrocarbons with a range of 10-28 and 20-35 carbon atoms, respectively. Samples collected at sites 1-3 were also analyzed for metals to evaluate potential ecological impacts. The specific tests are listed below.

- PAHs (EPA 8270 SIM)
- DOR / ORO (EPA 8015)
- Metals (EPA 200.8)

4 RESULTS

This section summarizes available information as of all lab results provided on October 15. The follow results are available from the laboratory test results:

October 7, 2021

- No PAHs detected
- No oil detected except at site #33
- All metal concentrations (measured at sites #1-3) were below USEPA acute and chronic concentration thresholds for aquatic life

October 12, 2021

- No PAHs detected

- No oil detected
- All metal concentrations were below USEPA acute and chronic concentration thresholds for aquatic life

Results are summarized in Tables 4 and 5 for samples collected on October 7 and 12, respectively. All screening criteria were compared to results. All minimum detection limit (MDL) values below all applicable screening levels with the exception of the TPH human health toxicity criteria for carbon ranges of compounds.

As stated in the DTSC guidance, consideration of risks associated with TPH should include an assessment of the risk characterization for individual chemicals of potential concern. The mixture of chemicals varies significantly with each source and through time with degradation. The marine water samples were tested for diesel range organics (DOR) and oil range organics (ORO) which typically refer to petroleum hydrocarbons with a range of 10-28 and 20-35 carbon atoms, respectively. All MDL for DOR and ORO samples (33 µg/L to 97 µg/L) were higher than human toxicity criteria. Salt interferes with extraction methods and requires higher MDL than freshwater/drinking water samples. The toxicity criteria (proposed by DTSC) have a daily exposure limit of 0.03 µg/L when these data are coupled with naphthalene and methylnaphthalene measurements. The MDLs for naphthalene and methylnaphthalene ranged from 0.07 to 0.08. If we conservatively assume the concentration is half the detection limit, a beachgoer will need to consume 1 liter of seawater to meet daily toxicity criteria. TPH was detected at sampling station #33 on October 7 (HB-10072021-033); however, none of the individual PAHs were detected on either October 7 or October 12.

5 CONCLUSION

Water sampling was done along the Huntington Beach shoreline on two events in October of 2021 in response to the offshore oil spill. The October 7th event consisted of sampling water at forty sites (spaced apart at 0.25 mile intervals) over a shoreline length of 9.5 miles (from the Santa Ana River to Anderson Street in Sunset Beach). Two reference site samples were taken from San Clemente. All samples were analyzed for PAHs and TPH. All measured analytes were non-detect and below applicable standards with exception of TPH at Station 33 on October 7th. The detected TPH sample at Station 33 on October 7th did not occur with elevated levels of contaminants of concern that would support a conclusive determination of human health risk.

The October 12th event consisted of sampling water at twenty-two water quality samples (spaced apart at 0.50 mile intervals) over the same shoreline length with two reference samples taken from Seal Beach. All samples were analyzed for PAHs, TPH, and metals.

The screening criteria summarized in Table 5 were compared to the analytical results. The following results are available from the laboratory test results:

- No PAHs were detected
- No oil was detected
- All metal and PAHs concentrations are below USEPA acute and chronic concentration thresholds for aquatic life.
- All measured concentrations of PAHs were below Odor Nuisance Levels established by the Regional Water Quality Control Board for groundwater, which provide a conservative comparison for seawater samples.
- All measured concentrations of PAHs and DRO/ORO were below Direct Exposure Human Health Risk Levels established by the Regional Water Quality Control Board for groundwater, which provide a conservative comparison for seawater samples.
- All measured concentrations of PAHs and DRO/ORO were below Oral Exposure Levels provided DTSC for drinking water and therefore, provide a conservative comparison for seawater.

Table 4. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 7, 2021.

	US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 2021007- 001	SP-W- 2021007- 001	HB-W- 2021007- 002	SP-W- 2021007- 002	HB-W- 2021007- 003	SP-W- 2021007- 003	HB-W- 2021007- 004	HB-W- 2021007- 005	HB-W- 2021007- 005-DUP	HB-W- 2021007- 006	HB-W- 2021007- 007	HB-W- 2021007- 008
	Chronic CCC	Acute CMC	Odor	Exposure	07-Oct-21	07-Oct-21	07-Oct-21									
Metals (µg/L)																
Antimony	-	-	-	-	-	-	10 U	-	10 U	-	10 U	-	-	-	-	-
Arsenic	36	69	-	-	-	-	0.698 J	-	0.926 J	-	0.582 U	-	-	-	-	-
Barium	-	-	-	-	-	-	8.81 J	-	7.75 J	-	8.34 J	-	-	-	-	-
Beryllium	-	-	-	-	-	-	4.2 U	-	4.2 U	-	4.2 U	-	-	-	-	-
Cadmium	7.9	33	-	-	-	-	0.138 U	-	0.138 U	-	0.138 U	-	-	-	-	-
Chromium	50	1100	-	-	-	-	0.965 U	-	1.27	-	0.965 J	-	-	-	-	-
Cobalt	-	-	-	-	-	-	0.147 U	-	0.147 U	-	0.147 U	-	-	-	-	-
Copper	3.1	4.8	-	-	-	-	0.839 J	-	1.41	-	0.736 J	-	-	-	-	-
Lead	8.1	210	-	-	-	-	0.14 J	-	0.211 J	-	0.0915 J	-	-	-	-	-
Mercury	0.94	1.8	-	-	-	-	0.141 U	-	0.141 U	-	0.141 U	-	-	-	-	-
Molybdenum	-	-	-	-	-	-	14.5 J	-	11.8 U	-	11.8 U	-	-	-	-	-
Nickel	8.2	74	-	-	-	-	0.249 U	-	0.249 U	-	0.249 U	-	-	-	-	-
Selenium	71	290	-	-	-	-	1.31	-	1.32	-	0.905 J	-	-	-	-	-
Silver	-	1.9	-	-	-	-	0.113 U	-	0.113 U	-	0.113 U	-	-	-	-	-
Thallium	-	-	-	-	-	-	0.041 U	-	0.041 U	-	0.041 U	-	-	-	-	-
Vanadium	-	-	-	-	-	-	4.47 J	-	4 U	-	4 U	-	-	-	-	-
Zinc	81	90	-	-	-	-	4.5 U	-	4.5 U	-	4.5 U	-	-	-	-	-
PAHs (µg/L)																
1-Methylnaphthalene	-	-	-	-	-	-	0.072 U	0.072 U	0.072 U	0.072 U						
2-Methylnaphthalene	-	-	-	-	-	-	0.076 U	0.076 U	0.076 U	0.076 U						
Acenaphthene	40*	970	200	530	-	-	0.095 U	-	0.095 U	-	0.096 U	-	0.096 U	0.095 U	0.095 U	0.096 U
Acenaphthylene	-	300	-	-	-	-	0.068 U	0.068 U	0.068 U	0.068 U						
Anthracene	-	300	-	1800	-	-	0.058 U	0.058 U	0.058 U	0.058 U						
Benz[a]anthracene	-	300	-	0.02	-	-	0.084 U	0.084 U	0.084 U	0.085 U						
Benz[a]pyrene	-	300	-	0.2	-	-	0.061 U	-	0.061 U	-	0.061 U	-	0.062 U	0.061 U	0.061 U	0.062 U
Benz[b]fluoranthene	-	300	-	0.25	-	-	0.12 U	0.12 U	0.12 U	0.12 U						
Benz[g,h,i]perylene	-	300	-	-	-	-	0.099 U	-	0.099 U	-	0.099 U	-	0.10 U	0.099 U	0.099 U	0.10 U
Benz[k]fluoranthene	-	300	-	2.5	-	-	0.091 U	-	0.091 U	-	0.092 U	-	0.092 U	0.091 U	0.092 U	0.091 U
Chrysene	-	300	-	25	-	-	0.058 U	0.058 U	0.058 U	0.058 U						
Dibenz(a,h)anthracene	-	300	-	0.03	-	-	0.11 U	0.11 U	0.11 U	0.11 U						
Fluoranthene	11*	800	-	800	-	-	0.066 U	-	0.066 U	-	0.067 U	-	0.067 U	0.066 U	0.066 U	0.067 U
Fluorene	-	300	-	290	-	-	0.074 U	-	0.073 U	-	0.074 U	-	0.074 U	0.073 U	0.074 U	0.074 U
Indeno[1,2,3-c,d]pyrene	-	300	-	0.25	-	-	0.10 U	0.10 U	0.10 U	0.10 U						
Naphthalene	1.4†	2400	210	0.17	-	-	0.081 U	-	0.081 U	-	0.081 U	-	0.082 U	0.081 U	0.081 U	0.082 U
Phenanthrene	4.6‡	7.7‡	10000	-	-	-	0.072 U	0.072 U	0.072 U	0.072 U						
Pyrene	-	300	-	120	-	-	0.065 U	0.065 U	0.065 U	0.065 U						
Total PAHs (ND = 0)	-	300	-	-	-	-	0.0088**	-	0.12 U	-	0.12 U	-	0.12 U	0.12 U	0.12 U	0.12 U
Additional Analytes																
C8-C40 (µg/L)	-	-	-	-	-	-	0.03	33 U	-	97 U	-	32 U	-	33 U	32 U	33 U
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	-	-	33 U	-	97 U	-	32 U	-	33 U	32 U	32 U

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenz[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

TPH human health toxicity criteria exceeded.

Bold Detected result

- No criteria

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U Indicates the analyte was analyzed for but not detected.

CCC Criteria Continuous Concentration

CMC Criteria Maximum Concentration

PAH Polycyclic Aromatic Hydrocarbon

For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest MDL of all samples was used as the total result.

Total PAHs are the sum of available HMW and LMW PAHs.

Table 4. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 7, 2021 (cont'd.).

	US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 20211007- 009	HB-W- 20211007- 010	HB-W- 20211007- 011	HB-W- 20211007- 012	HB-W- 20211007- 013	HB-W- 20211007- 014	HB-W- 20211007- 014-DUP	HB-W- 20211007- 015	HB-W- 20211007- 016	HB-W- 20211007- 017	HB-W- 20211007- 018	HB-W- 20211007- 019	
	Chronic CCC	Acute CMC	Odor	Exposure	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21							
Metals (µg/L)																	
Antimony	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arsenic	36	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Barium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Beryllium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cadmium	7.9	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chromium	50	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Copper	3.1	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lead	8.1	210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mercury	0.94	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Molybdenum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Nickel	8.2	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Selenium	71	290	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Silver	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Thallium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc	81	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PAHs (µg/L)																	
1-Methylnaphthalene	-	-	-	-	-	0.072 U	0.072 U	0.073 U	0.073 U	0.072 U	0.073 U	0.072 U	0.072 U	0.072 U	0.072 U	0.073 U	
2-Methylnaphthalene	-	-	-	-	-	0.076 U	0.076 U	0.077 U	0.076 U	0.077 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.077 U	
Acenaphthene	40*	970	200	530	-	0.096 U	0.096 U	0.097 U	0.097 U	0.096 U	0.097 U	0.095 U	0.095 U	0.095 U	0.096 U	0.097 U	
Acenaphthylene	-	300	-	-	-	0.068 U	0.068 U	0.069 U	0.069 U	0.068 U	0.069 U	0.068 U	0.068 U	0.068 U	0.068 U	0.069 U	
Anthracene	-	300	-	1800	-	0.058 U	0.058 U	0.059 U	0.059 U	0.059 U	0.059 U	0.058 U	0.058 U	0.058 U	0.058 U	0.059 U	
Benz(a)anthracene	-	300	-	0.02	-	0.084 U	0.084 U	0.086 U	0.086 U	0.085 U	0.085 U	0.084 U	0.084 U	0.085 U	0.085 U	0.085 U	
Benz(a)pyrene	-	300	-	0.2	-	0.062 U	0.062 U	0.063 U	0.062 U	0.062 U	0.062 U	0.061 U	0.061 U	0.062 U	0.062 U	0.062 U	
Benz(b)fluoranthene	-	300	-	0.25	-	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U						
Benz(g,h,i)perylene	-	300	-	-	-	0.099 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	
Benz(k)fluoranthene	-	300	-	2.5	-	0.092 U	0.092 U	0.093 U	0.093 U	0.092 U	0.093 U	0.091 U	0.091 U	0.092 U	0.092 U	0.093 U	
Chrysene	-	300	-	25	-	0.058 U	0.058 U	0.059 U	0.059 U	0.059 U	0.059 U	0.058 U	0.058 U	0.058 U	0.058 U	0.059 U	
Dibenz(a,h)anthracene	-	300	-	0.03	-	0.11 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	
Fluoranthene	11*	800	-	800	-	0.067 U	0.067 U	0.068 U	0.068 U	0.067 U	0.067 U	0.066 U	0.066 U	0.067 U	0.067 U	0.067 U	
Fluorene	-	300	-	290	-	0.074 U	0.074 U	0.075 U	0.075 U	0.074 U	0.075 U	0.073 U	0.073 U	0.074 U	0.074 U	0.075 U	
Indeno[1,2,3-c,d]pyrene	-	300	-	0.25	-	0.10 U	0.10 U	0.11 U	0.11 U	0.11 U	0.11 U	0.10 U	0.10 U	0.10 U	0.10 U	0.11 U	
Naphthalene	1.4†	2400	210	0.17	-	0.081 U	0.082 U	0.083 U	0.083 U	0.082 U	0.082 U	0.081 U	0.081 U	0.082 U	0.082 U	0.082 U	
Phenanthrene	4.6‡	7.7‡	10000	-	-	0.072 U	0.072 U	0.073 U	0.073 U	0.072 U	0.073 U	0.072 U	0.072 U	0.072 U	0.072 U	0.073 U	
Pyrene	-	300	-	120	-	0.065 U	0.065 U	0.066 U	0.066 U	0.066 U	0.066 U	0.065 U	0.065 U	0.065 U	0.066 U	0.066 U	
Total PAHs (ND = 0)	-	300	-	-	0.0088**	-	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U					
Additional Analytes																	
C8-C40 (µg/L)	-	-	-	-	-	0.03	34 U	32 U	33 U	32 U	34 U	34 U	32 U	35 U	33 U	34 U	33 U
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	-	34 U	32 U	33 U	32 U	34 U	34 U	32 U	35 U	33 U	34 U	33 U

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenz[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

TPH human health toxicity criteria exceeded.

Bold Detected result

- No criteria

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U Indicates the analyte was analyzed for but not detected.

CCC Criteria Continuous Concentration

CMC Criteria Maximum Concentration

PAH Polycyclic Aromatic Hydrocarbon

For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest MDL of all samples

Total PAHs are the sum of available HMW and LMW PAHs.

Table 4. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 7, 2021 (cont'd.).

	US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 20211007- 020	HB-W- 20211007- 021	HB-W- 20211007- 022	HB-W- 20211007- 023	HB-W- 20211007- 024	HB-W- 20211007- 025	HB-W- 20211007- 025-DUP	HB-W- 20211007- 026	HB-W- 20211007- 027	HB-W- 20211007- 028	HB-W- 20211007- 029	HB-W- 20211007- 030
	Chronic CCC	Acute CMC	Odor	Exposure	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21							
Metals (µg/L)																
Antimony	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arsenic	36	69	-	-	-	-	-	-	-	-	-	-	-	-	-	
Barium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Beryllium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cadmium	7.9	33	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chromium	50	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Copper	3.1	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lead	8.1	210	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mercury	0.94	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	
Molybdenum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Nickel	8.2	74	-	-	-	-	-	-	-	-	-	-	-	-	-	
Selenium	71	290	-	-	-	-	-	-	-	-	-	-	-	-	-	
Silver	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	
Thallium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc	81	90	-	-	-	-	-	-	-	-	-	-	-	-	-	
PAHs (µg/L)																
1-Methylnaphthalene	-	-	-	-	-	0.073 U	0.071 U	0.072 U	0.071 U	0.072 U	0.071 U	0.072 U	0.071 U	0.071 U	0.071 U	
2-Methylnaphthalene	-	-	-	-	-	0.077 U	0.075 U	0.076 U	0.075 U	0.076 U	0.075 U	0.076 U	0.075 U	0.075 U	0.075 U	
Acenaphthene	40*	970	200	530	-	0.097 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U					
Acenaphthylene	-	300	-	-	-	0.069 U	0.067 U	0.068 U	0.067 U	0.068 U	0.067 U	0.068 U	0.067 U	0.067 U	0.067 U	
Anthracene	-	300	-	1800	-	0.059 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U					
Benz[a]anthracene	-	300	-	0.02	-	0.085 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U					
Benz[a]pyrene	-	300	-	0.2	-	0.062 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U					
Benz[b]fluoranthene	-	300	-	0.25	-	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U						
Benz[g,h,i]perylene	-	300	-	-	-	0.10 U	0.099 U	0.099 U	0.099 U	0.099 U	0.10 U	0.099 U	0.099 U	0.099 U	0.099 U	
Benz[k]fluoranthene	-	300	-	2.5	-	0.093 U	0.091 U	0.092 U	0.091 U	0.091 U	0.091 U					
Chrysene	-	300	-	25	-	0.059 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U					
Dibenz(a,h)anthracene	-	300	-	0.03	-	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U						
Fluoranthene	11*	800	-	800	-	0.067 U	0.066 U	0.066 U	0.066 U	0.066 U	0.067 U	0.066 U	0.066 U	0.066 U	0.066 U	
Fluorene	-	300	-	290	-	0.075 U	0.073 U	0.073 U	0.073 U	0.073 U	0.074 U	0.073 U	0.073 U	0.073 U	0.073 U	
Indeno[1,2,3-c,d]pyrene	-	300	-	0.25	-	0.11 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U					
Naphthalene	1.4†	2400	210	0.17	-	0.082 U	0.081 U	0.081 U	0.081 U	0.081 U	0.082 U	0.081 U	0.081 U	0.081 U	0.081 U	
Phenanthrene	4.6‡	7.7‡	10000	-	-	0.073 U	0.071 U	0.072 U	0.071 U	0.072 U	0.071 U	0.072 U	0.071 U	0.071 U	0.071 U	
Pyrene	-	300	-	120	-	0.066 U	0.064 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	
Total PAHs (ND = 0)	-	300	-	-	0.0088**	-	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U					
Additional Analytes																
C8-C40 (µg/L)	-	-	-	-	0.03	34 U	33 U	32 U	33 U	33 U	32 U	33 U	32 U	33 U	32 U	
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	34 U	33 U	32 U	33 U	32 U	33 U	32 U	33 U	32 U	33 U	

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenz[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

TPH human health toxicity criteria exceeded.

Bold Detected result

- No criteria

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U Indicates the analyte was analyzed for but not detected.

CCC Criteria Continuous Concentration**CMC** Criteria Maximum Concentration**PAH** Polycyclic Aromatic Hydrocarbon

For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest MDL of all samples

Total PAHs are the sum of available HMW and LMW PAHs.

Table 4. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 7, 2021 (cont'd.).

	US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 20211007- 031	HB-W- 20211007- 032	HB-W- 20211007- 033	HB-W- 20211007- 034	HB-W- 20211007- 035	HB-W- 20211007- 035-DUP	HB-W- 20211007- 036	HB-W- 20211007- 037	HB-W- 20211007- 038	HB-W- 20211007- 039	HB-W- 20211007- 040
	Chronic CCC	Acute CMC	Odor	Exposure	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	07-Oct-21	
Metals (µg/L)															
Antimony	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	36	69	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	7.9	33	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	50	1100	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	3.1	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	8.1	210	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.94	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	8.2	74	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	71	290	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	81	90	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs (µg/L)															
1-Methylnaphthalene	-	-	-	-	-	-	0.071 U	0.071 U	0.071 U	0.071 U	0.072 U	0.071 U	0.071 U	0.072 U	0.071 U
2-Methylnaphthalene	-	-	-	-	-	-	0.075 U	0.075 U	0.075 U	0.075 U	0.076 U	0.075 U	0.075 U	0.076 U	0.075 U
Acenaphthene	40*	970	200	530	-	-	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U	0.096 U	0.095 U	0.095 U	0.095 U
Acenaphthylene	-	300	-	-	-	-	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.068 U	0.067 U	0.067 U	0.068 U
Anthracene	-	300	-	1800	-	-	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U
Benz(a)anthracene	-	300	-	0.02	-	-	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.083 U	0.084 U
Benz(a)pyrene	-	300	-	0.2	-	-	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U
Benz(b)fluoranthene	-	300	-	0.25	-	-	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.11 U
Benz(g,h,i)perylene	-	300	-	-	-	-	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.098 U
Benz(k)fluoranthene	-	300	-	2.5	-	-	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.092 U	0.091 U	0.091 U	0.092 U
Chrysene	-	300	-	25	-	-	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U
Dibenz(a,h)anthracene	-	300	-	0.03	-	-	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
Fluoranthene	11*	800	-	800	-	-	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U
Fluorene	-	300	-	290	-	-	0.073 U	0.073 U	0.073 U	0.073 U	0.073 U	0.074 U	0.073 U	0.073 U	0.074 U
Indeno[1,2,3-c,d]pyrene	-	300	-	0.25	-	-	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Naphthalene	1.4†	2400	210	0.17	-	-	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
Phenanthrene	4.6‡	7.7‡	10000	-	-	-	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U	0.072 U	0.071 U	0.071 U	0.072 U
Pyrene	-	300	-	120	-	-	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.064 U	0.065 U	0.064 U
Total PAHs (ND = 0)	-	300	-	-	0.0088**	-	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.11 U
Additional Analytes															
C8-C40 (µg/L)	-	-	-	-	-	0.03	34 U	32 U	53	32 U	33 U	33 U	32 U	32 U	32 U
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	-	34 U	32 U	39 J	32 U	33 U	33 U	32 U	33 U	32 U

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenz[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

TPH human health toxicity criteria exceeded.

Bold Detected result

- No criteria

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U Indicates the analyte was analyzed for but not detected.

CCC Criteria Continuous Concentration

CMC Criteria Maximum Concentration

PAH Polycyclic Aromatic Hydrocarbon

For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest MDL of all samples

Total PAHs are the sum of available HMW and LMW PAHs.

Table 5. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 12, 2021.

		US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 20211012- 001	HB-W- 20211012- 003	HB-W- 20211012- 005	HB-W- 20211012- 007	HB-W- 20211012- 009	HB-W- 20211012- 011	HB-W- 20211012- 011-DUP	HB-W- 20211012- 013	HB-W- 20211012- 015	HB-W- 20211012- 017	HB-W- 20211012- 019	
		Chronic CCC	Acute CMC	Odor	Exposure	12-Oct-21	12-Oct-21	12-Oct-21	12-Oct-21	12-Oct-21							
Metals (µg/L)																	
Antimony	-	-	-	-	-	10 U	10 U	10 U	10 U	10 U							
Arsenic	36	69	-	-	-	1.2	1.28	0.975 J	1.24	0.769 J	0.582 U	1.25	1.31	0.737 J	0.687 J	1.3	
Barium	-	-	-	-	-	7.53 J	8.13 J	7.02 J	6.6 J	6.82 J	8.21 J	6.69 J	7.69 J	7.54 J	7.19 J	10.1 J	
Beryllium	-	-	-	-	-	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U							
Cadmium	7.9	33	-	-	-	0.138 U	0.138 U	0.138 U	0.138 U	0.138 U							
Chromium	50	1100	-	-	-	2.36	2.26	1.97	2.3	1.32	1.12	0.965 U	2.2	1.54	1.22	1.99	
Cobalt	-	-	-	-	-	0.147 U	0.147 U	0.147 U	0.147 U	0.153 J							
Copper	3.1	4.8	-	-	-	1.33	1.38	1.2	1.67	0.941 J	0.39 J	1.47	1.7	0.93 J	0.856 J	1.59	
Lead	8.1	210	-	-	-	0.317 J	1.58	0.245 J	0.364 J	0.17 J	0.543 J	0.778 J	0.385 J	0.171 J	0.302 J	2.43	
Mercury	0.94	1.8	-	-	-	0.141 U	0.141 U	0.141 U	0.141 U	0.141 U							
Molybdenum	-	-	-	-	-	11.8 U	11.8 U	11.8 U	11.8 U	11.8 U							
Nickel	8.2	74	-	-	-	0.27 J	0.418 J	0.25 J	0.253 J	0.249 U	0.249 U	0.935 J	0.414 J	0.249 U	0.249 U	0.805 J	
Selenium	71	290	-	-	-	0.359 U	1.02	0.431 J	1.23	0.821 J	0.52 J	0.631 J	1.4	0.359 U	0.371 J	0.359 U	
Silver	-	1.9	-	-	-	0.113 U	0.113 U	0.113 U	0.113 U	0.113 U							
Thallium	-	-	-	-	-	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U							
Vanadium	-	-	-	-	-	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	
Zinc	81	90	-	-	-	4.5 U	5.59	4.5 U	4.5 U	4.5 U	4.5 U	5.36					
PAHs (µg/L)																	
1-Methylnaphthalene	-	-	-	-	-	0.068 U	0.068 U	0.068 U	0.067 U	0.068 U	0.067 U	0.069 U	0.069 U	0.068 U	0.068 U	0.067 U	
2-Methylnaphthalene	-	-	-	-	-	0.072 U	0.071 U	0.071 U	0.071 U	0.072 U	0.071 U	0.072 U	0.073 U	0.071 U	0.072 U	0.071 U	
Acenaphthene	40*	970	200	530	-	0.090 U	0.090 U	0.090 U	0.090 U	0.091 U	0.089 U	0.091 U	0.092 U	0.090 U	0.091 U	0.089 U	
Acenaphthylene	-	300	-	-	-	0.064 U	0.063 U	0.065 U	0.065 U	0.064 U	0.064 U	0.063 U					
Anthracene	-	300	-	1800	-	0.055 U	0.054 U	0.056 U	0.056 U	0.055 U	0.055 U	0.054 U					
Benz(a)anthracene	-	300	-	0.02	-	0.080 U	0.079 U	0.079 U	0.079 U	0.080 U	0.079 U	0.080 U	0.081 U	0.079 U	0.080 U	0.079 U	
Benz(a)pyrene	-	300	-	0.2	-	0.058 U	0.057 U	0.059 U	0.059 U	0.058 U	0.058 U	0.057 U					
Benz(b)fluoranthene	-	300	-	0.25	-	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U							
Benz(g,h,i)perylene	-	300	-	-	-	0.094 U	0.094 U	0.094 U	0.093 U	0.094 U	0.093 U	0.095 U	0.095 U	0.094 U	0.094 U	0.093 U	
Benz(k)fluoranthene	-	300	-	2.5	-	0.087 U	0.086 U	0.086 U	0.086 U	0.087 U	0.086 U	0.088 U	0.088 U	0.086 U	0.087 U	0.086 U	
Chrysene	-	300	-	25	-	0.055 U	0.054 U	0.056 U	0.056 U	0.055 U	0.055 U	0.054 U					
Dibenz(a,h)anthracene	-	300	-	0.03	-	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U							
Fluoranthene	11*	800	-	800	-	0.063 U	0.062 U	0.064 U	0.064 U	0.063 U	0.063 U	0.062 U					
Fluorene	-	300	-	290	-	0.070 U	0.069 U	0.069 U	0.069 U	0.070 U	0.069 U	0.070 U	0.071 U	0.069 U	0.070 U	0.069 U	
Indeno[1,2,3-c,d]pyrene	-	300	-	0.25	-	0.099 U	0.098 U	0.098 U	0.098 U	0.099 U	0.097 U	0.10 U	0.10 U	0.098 U	0.099 U	0.097 U	
Naphthalene	1.4†	2400	210	0.17	-	0.077 U	0.077 U	0.077 U	0.076 U	0.077 U	0.076 U	0.078 U	0.078 U	0.077 U	0.077 U	0.076 U	
Phenanthrene	4.6‡	7.7‡	10000	-	-	0.068 U	0.068 U	0.068 U	0.067 U	0.068 U	0.067 U	0.069 U	0.069 U	0.068 U	0.068 U	0.067 U	
Pyrene	-	300	-	120	-	0.061 U	0.061 U	0.061 U	0.061 U	0.062 U	0.061 U	0.062 U	0.062 U	0.061 U	0.062 U	0.061 U	
Total PAHs (ND = 0)	-	300	-	-	0.0088**	-	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U						
C8-C40 (µg/L)	-	-	-	-	-	0.03	33 U	34 U	33 U	33 U	34 U	33 U	35 U	33 U	32 U	33 U	33 U
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	-	33 U	34 U	33 U	33 U	34 U	33 U	35 U	33 U	32 U	33 U	33 U

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

Bold Detected result

- No criteria

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U Indicates the analyte was analyzed for but not detected.

CCC Criteria Continuous Concentration

CMC Criteria Maximum Concentration

PAH Polycyclic Aromatic Hydrocarbon

For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest MDL of all samples was used as the total result.

Total PAHs are the sum of available HMW and LMW PAHs.

Table 5. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 12, 2021 (cont'd.).

		US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 20211012- 021	HB-W- 20211012- 023	HB-W- 20211012- 025	HB-W- 20211012- 027	HB-W- 20211012- 029	HB-W- 20211012- 029-DUP	HB-W- 20211012- 031	HB-W- 20211012- 033	HB-W- 20211012- 035	HB-W- 20211012- 037	HB-W- 20211012- 039
		Chronic CCC	Acute CMC	Odor	Exposure											
Metals (µg/L)																
Antimony	-	-	-	-	-	10 U	10 U	10 U	10 U	10 U	10 U					
Arsenic	36	69	-	-	-	1.3	0.942 J	1.37	0.642 J	0.914 J	1.24	1.13	0.95 J	1.09	1.09	1.08
Barium	-	-	-	-	-	7.61 J	8.51 J	6.02 J	8.58 J	7.15 J	6.73 J	8.59 J	8.8 J	8.53 J	8.05 J	7.9 J
Beryllium	-	-	-	-	-	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U					
Cadmium	7.9	33	-	-	-	0.138 U	0.138 U	0.138 U	0.138 U	0.138 U	0.138 U					
Chromium	50	1100	-	-	-	2.01	1.65	2.3	0.965 U	1.26	1.36	1.5	1.48	1.76	1.19	1.4
Cobalt	-	-	-	-	-	0.147 U	0.147 U	0.147 U	0.147 U	0.147 U	0.147 U					
Copper	3.1	4.8	-	-	-	1.97	1.35	1.82	0.824 J	1.63	2.01	2.42	1.3	1.7	1.92	1.55
Lead	8.1	210	-	-	-	0.575 J	0.346 J	0.551 J	0.235 J	0.49 J	0.453 J	0.338 J	0.314 J	0.535 J	0.309 J	0.381 J
Mercury	0.94	1.8	-	-	-	0.141 U	0.141 U	0.141 U	0.141 U	0.141 U	0.141 U					
Molybdenum	-	-	-	-	-	11.8 U	11.9 J	11.8 U	11.8 U	11.8 U	12.2 J	11.8 U				
Nickel	8.2	74	-	-	-	0.38 J	0.366 J	0.301 J	0.72 J	0.497 J	0.604 J	7.64	0.504 J	0.34 J	2.92	4.68
Selenium	71	290	-	-	-	1.38	0.359 U	1.6	0.689 J	0.751 J	0.852 J	1	1.32	0.856 J	0.473 J	0.664 J
Silver	-	1.9	-	-	-	0.113 U	0.113 U	0.113 U	0.113 U	0.113 U	0.113 U					
Thallium	-	-	-	-	-	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U					
Vanadium	-	-	-	-	-	4 U	4 U	4.3 J	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Zinc	81	90	-	-	-	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U					
PAHs (µg/L)																
1-Methylnaphthalene	-	-	-	-	-	0.068 U	0.071 U	0.072 U	0.071 U	0.071 U	0.073 U	0.071 U	0.072 U	0.071 U	0.071 U	0.071 U
2-Methylnaphthalene	-	-	-	-	-	0.072 U	0.075 U	0.076 U	0.075 U	0.075 U	0.077 U	0.075 U	0.076 U	0.075 U	0.075 U	0.075 U
Acenaphthene	40*	970	200	530	-	0.090 U	0.095 U	0.095 U	0.095 U	0.095 U	0.097 U	0.094 U	0.095 U	0.095 U	0.095 U	0.095 U
Acenaphthylene	-	300	-	-	-	0.064 U	0.067 U	0.068 U	0.067 U	0.067 U	0.069 U	0.067 U	0.068 U	0.067 U	0.067 U	0.067 U
Anthracene	-	300	-	1800	-	0.055 U	0.058 U	0.058 U	0.058 U	0.058 U	0.059 U	0.057 U	0.058 U	0.058 U	0.058 U	0.058 U
Benz(a)anthracene	-	300	-	0.02	-	0.080 U	0.084 U	0.084 U	0.083 U	0.084 U	0.086 U	0.083 U	0.084 U	0.084 U	0.084 U	0.084 U
Benz(a)pyrene	-	300	-	0.2	-	0.058 U	0.061 U	0.061 U	0.061 U	0.061 U	0.062 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U
Benz(b)fluoranthene	-	300	-	0.25	-	0.11 U	0.12 U	0.12 U	0.11 U	0.12 U	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U	0.12 U
Benz(g,h,i)perylene	-	300	-	-	-	0.094 U	0.098 U	0.099 U	0.098 U	0.099 U	0.10 U	0.098 U	0.099 U	0.099 U	0.099 U	0.098 U
Benz(k)fluoranthene	-	300	-	2.5	-	0.086 U	0.091 U	0.091 U	0.091 U	0.091 U	0.093 U	0.090 U	0.091 U	0.091 U	0.091 U	0.091 U
Chrysene	-	300	-	25	-	0.055 U	0.058 U	0.058 U	0.058 U	0.058 U	0.059 U	0.057 U	0.058 U	0.058 U	0.058 U	0.058 U
Dibenz(a,h)anthracene	-	300	-	0.03	-	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U					
Fluoranthene	11*	800	-	800	-	0.063 U	0.066 U	0.066 U	0.066 U	0.066 U	0.068 U	0.066 U	0.066 U	0.066 U	0.066 U	0.066 U
Fluorene	-	300	-	290	-	0.069 U	0.073 U	0.073 U	0.073 U	0.073 U	0.075 U	0.073 U	0.073 U	0.073 U	0.073 U	0.073 U
Indeno[1,2,3-c,d]pyrene	-	300	-	0.25	-	0.098 U	0.10 U	0.10 U	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Naphthalene	1.4†	2400	210	0.17	-	0.077 U	0.081 U	0.081 U	0.080 U	0.081 U	0.083 U	0.080 U	0.081 U	0.081 U	0.081 U	0.081 U
Phenanthrene	4.6‡	7.7‡	10000	-	-	0.068 U	0.071 U	0.072 U	0.071 U	0.071 U	0.073 U	0.071 U	0.072 U	0.071 U	0.071 U	0.071 U
Pyrene	-	300	-	120	-	0.061 U	0.064 U	0.065 U	0.064 U	0.065 U	0.066 U	0.064 U	0.065 U	0.065 U	0.065 U	0.064 U
Total PAHs (ND = 0)	-	300	-	-	0.0088**	-	0.11 U	0.12 U	0.12 U	0.11 U	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U	0.12 U
C8-C40 (µg/L)	-	-	-	-	-	0.03	33 U	33 U	34 U	32 U	34 U	33 U	32 U	33 U	32 U	33 U
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	-	33 U	33 U	34 U	32 U	34 U	33 U	32 U	33 U	32 U	33 U

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

Bold Detected result

- No criteria

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U Indicates the analyte was analyzed for but not detected.

CCC Criteria Continuous Concentration

CMC Criteria Maximum Concentration

PAH Polycyclic Aromatic Hydrocarbon

For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest MDL of all samples

Total PAHs are the sum of available HMW and LMW PAHs.

Table 5. Analytical Results with Comparison to Applicable Criteria for Samples Collected on October 12, 2021 (cont'd.).

		US EPA Ambient Water Quality Criteria	Groundwater ESLs (SF RWQCB ESLs, 2019)	California Ocean Plan	TPH human health toxicity criteria	HB-W- 20211012- 041	HB-W- 20211012- 042
	Chronic CCC	Acute CMC	Odor	Exposure		12-Oct-21	12-Oct-21
Metals (µg/L)							
Antimony	-	-	-	-	-	10 U	10 U
Arsenic	36	69	-	-	-	0.582 U	1.32
Barium	-	-	-	-	-	8.24 J	9.06 J
Beryllium	-	-	-	-	-	4.2 U	4.2 U
Cadmium	7.9	33	-	-	-	0.138 U	0.138 U
Chromium	50	1100	-	-	-	0.965 U	1.49
Cobalt	-	-	-	-	-	0.147 U	0.147 U
Copper	3.1	4.8	-	-	-	0.881 J	2.08
Lead	8.1	210	-	-	-	0.364 J	0.984 J
Mercury	0.94	1.8	-	-	-	0.141 U	0.141 U
Molybdenum	-	-	-	-	-	11.8 U	12.3 J
Nickel	8.2	74	-	-	-	0.249 U	0.374 J
Selenium	71	290	-	-	-	0.359 U	0.739 J
Silver	-	1.9	-	-	-	0.113 U	0.113 U
Thallium	-	-	-	-	-	0.041 U	0.041 U
Vanadium	-	-	-	-	-	4 U	4 U
Zinc	81	90	-	-	-	4.5 U	25.5
PAHs (µg/L)							
1-Methylnaphthalene	-	-	-	-	-	0.073 U	0.073 U
2-Methylnaphthalene	-	-	-	-	-	0.077 U	0.077 U
Acenaphthene	40*	970	200	530	-	0.097 U	0.098 U
Acenaphthylene	-	300	-	-	-	0.069 U	0.069 U
Anthracene	-	300	-	1800	-	0.059 U	0.059 U
Benz(a)anthracene	-	300	-	0.02	-	0.085 U	0.086 U
Benz(a)pyrene	-	300	-	0.2	-	0.062 U	0.063 U
Benz(b)fluoranthene	-	300	-	0.25	-	0.12 U	0.12 U
Benz(g,h,i)perylene	-	300	-	-	-	0.10 U	0.10 U
Benz(k)fluoranthene	-	300	-	2.5	-	0.093 U	0.094 U
Chrysene	-	300	-	25	-	0.059 U	0.059 U
Dibenz(a,h)anthracene	-	300	-	0.03	-	0.11 U	0.12 U
Fluoranthene	11*	800	-	800	-	0.067 U	0.068 U
Fluorene	-	300	-	290	-	0.075 U	0.075 U
Indeno(1,2,3-c,d)pyrene	-	300	-	0.25	-	0.11 U	0.11 U
Naphthalene	1.4†	2400	210	0.17	-	0.082 U	0.083 U
Phenanthrene	4.6‡	7.7‡	10000	-	-	0.073 U	0.073 U
Pyrene	-	300	-	120	-	0.066 U	0.066 U
Total PAHs (ND = 0)	-	300	-	-	0.0088**	-	0.12 U
Additional Analytes							
C8-C40 (µg/L)	-	-	-	-	0.03	33 U	32 U
Diesel Range Organics [C10-C28] (µg/L)	-	-	-	-	-	33 U	32 U

Notes:

* Chronic value from Eco - EPA EcoUpdate, Ecotox Thresholds, EPA 540/F-95/038

† Chronic value = LOEL - Avian

‡ Acute and chronic - proposed criteria

** Per the California Ocean Plan, total PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

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