City of Laguna Beach Monitoring Assessment

Final Technical Report

January 10, 2020

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South Orange County Wastewater Authority (SOCWA)

SOCWA's Response Summary

At approximately 3 P.M. on November 27, 2019, David Shissler, City of Laguna Beach Director of Water Quality, contacted the General Manager of the South Orange County Wastewater Authority (SOCWA) who was on vacation to indicate that there was a large spill occurring in Aliso Canyon. David Shissler then called Jim Burror, Director of Operations and acting General Manager of SOCWA, at approximately 3:30 P.M. Just after that call, Marc Serna, District Engineer at the South Coast Water District (SCWD) called Jim Burror to discuss resources available to assist the City of Laguna Beach in the recovery of the spill. Amber Baylor, Director of Environmental Compliance for SOCWA was also on the call.

During the initial call from SCWD, SOCWA staff offered the following five support roles:

1. The Biological Resources Damage Assessment Standard Operating Procedure (Appendix A) to catalogue environmental impacts immediately;
2. Contract support for Environmental & GIS Services, LLC, a firm that specializes in environmental impact assessment, a key lesson learned from the 2017 Regional Treatment Plant spill;
3. Spill Report Form to report the spill to the San Diego Regional Water Quality Control Board; and,
4. Flow estimation from the North Coast Interceptor (NCI) to the Coastal Treatment Plant to help estimate the spill volume used in the final spill report to be submitted by the SDRWQCB (See Attachment No_2 Volume Estimation Methodology Memo in Technical Report to CIQWS)
5. Rainfall data from the Coastal Treatment Plant.

At approximately 4:30 P.M., Jim Burror and Amber Baylor went out to the spill location to determine if the support roles that were initially discussed with the SCWD would be helpful to provide to the City of Laguna Beach. Jim Burror and Amber Baylor called David Shissler to determine if the additional support roles were needed in the ongoing spill. David Shissler indicated that the support roles were needed for the response to the spill. Jim Burror and Amber Baylor called Environmental & GIS Services, LLC to provide an onsite inspection of the biological impact of the spill while also taking an initial set of water quality samples Aliso Creek upstream and downstream of the spill to provide a baseline of the impact of the spill.

Environmental Impact Assessment

The approach to determine the impact to the environment was threefold:

Approach One: Monitor the Aliso Creek flow rates and rainfall data to determine the effect of dilution on the spill.

Approach Two: Identification of water quality constituents at representative locations in Aliso Creek. SOCWA identified water quality parameters to measure and performed analysis in-house and by a private commercial laboratory (both laboratories ELAP accredited). Sample locations were determined by the environmental impact assessment consultant, Environmental & GIS Services, LLC.

Approach Three: Direct the monitoring efforts related to the environmental impact assessment in alignment with the Biological Resources Damage Assessment Standard Operating Procedure.

The multiple lines of evidence help to provide a complete assessment of the impact of the spill to the environment by coupling quantitative data with observations. The City of Laguna Beach was made aware of this approach early in the response efforts and thought the approach was appropriate to determine environmental impacts.

Approach One

On November 27, 2019, SOCWA Operations staff began taking samples within three hours of the notice of the spill. Samples were taken from four locations on the first day to assess upstream and downstream water quality conditions. The sample locations were expanded to nine locations based on a recommendation from Environmental & GIS Services, LLCprovided in Appendix B.

Aliso Creek Flow Rates

The Aliso Creek flow rates were used to determine the appropriate dilution factors of the spill in order to calculate the mass emission rates for environmental assessments that were conducted byEnvironmental & GIS Services, LLC. The hydrograph provided in Figure 1, illustrates the flow of Aliso Creek between November 23, 2019, prior to the spill, through December 1, 2019, after the spill was contained (not shown in the hydrograph is the sixth sample taken on December 2, 2019). Figure 1 also provides the dates/times that water quality samples were collected (yellow circles) with an indication when the spill started and was contained (red circles). It is important to note that the spill was monitored within two hours of the spill notification and within one hour of the containment efforts, thus providing representative quantitative data of the spill effects.

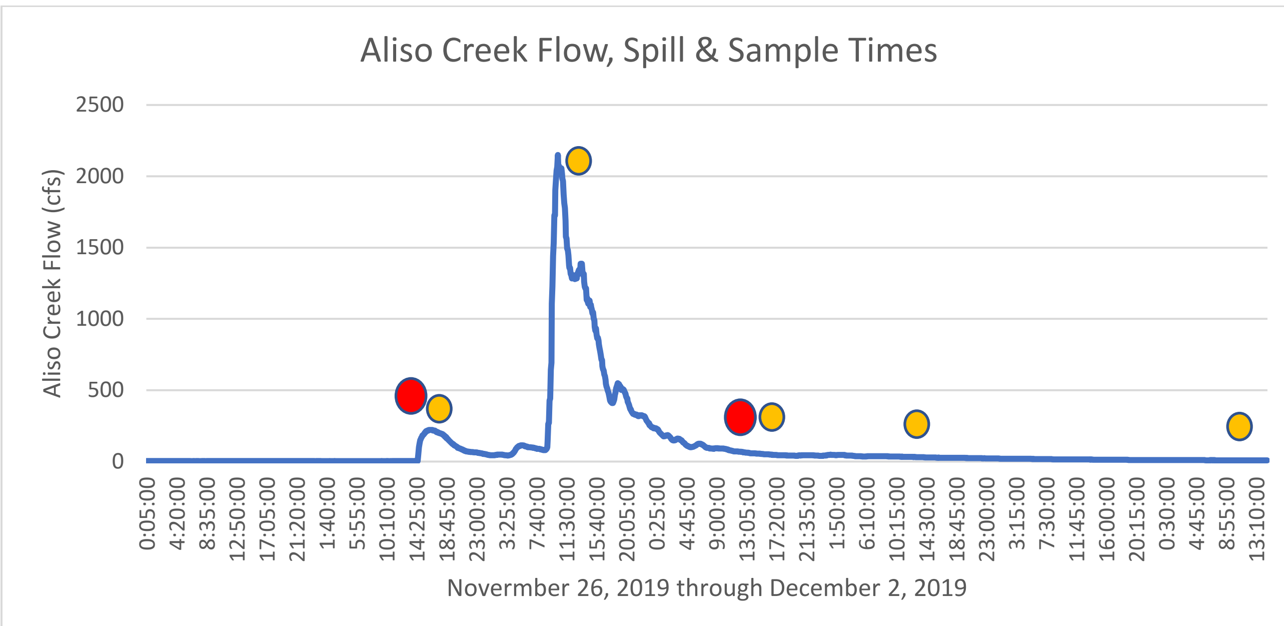


Figure 1: Aliso Creek Spill Analysis

To understand the potential mass emissions based on the water quality parameters, an estimate of the dilution rates based a spill flow rate of approximately 2 cubic feet per second (cfs). Figure 2 provides the sampling event number and the associated dilution rates based on creek flows. The dilution ratios began at 77:1 on 11/27/19, increased on average of 654:1 on 11/28/19, decreased to 31:1 on 11/29, and then theoretically (due to the spill's abatement) dropped to 17:1 on 11/30/19, was reduced to 7:1 on 12/1/19, and decreased to 4.5:1 on 12/2/19.

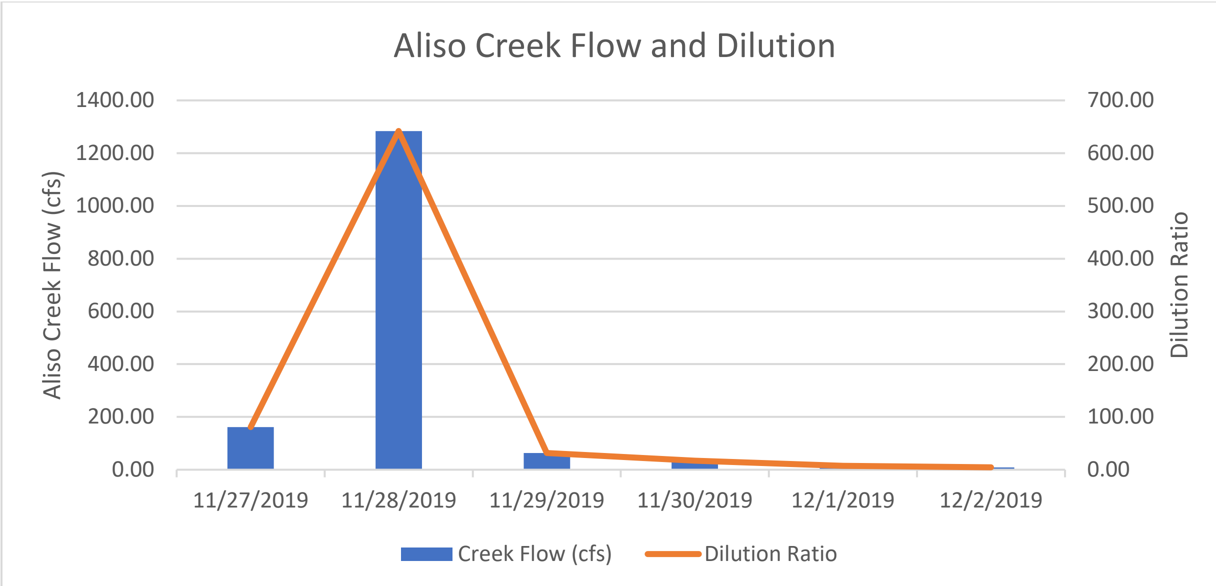


Figure 2: Aliso Creek Sample Dilution Ratio

For comparison, the City of Sacramento discharges secondary treated flow to the Little American River with a dilution ratio of 14:1 as described in their NPDES permit (ORDER R5-2016-0020; NPDES NO. CA0077682). The dilution ratios calculated during the Laguna Beach spill to Aliso Creek, peaking at 654:1, far exceeded the dilution capacity precedent provided by the Region 5 Water Quality Control Board. Although it is understood that a Regional Sanitation's NPDES Permit is governed by point discharge of secondary treated flow, the context of discharge into the Little American River is provided for further discussion related to the input of the City of Laguna Beach's spill into Aliso Creek.

Rain data was also analyzed to determine if the rain pattern fit the pattern within the hydrograph identified in figure 1. Figure 3 provides the peak rain flow event that occurred. The rainfall fit the hydrograph contributing support to the dilution rates and flow from the spill site.

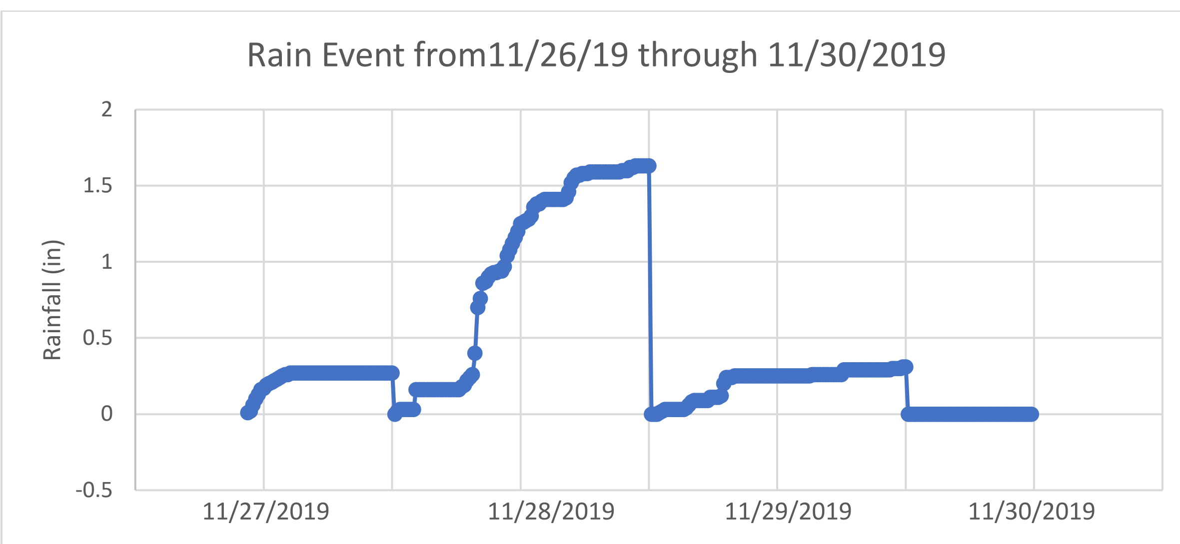


Figure 3: Rainfall from 11/27/2019 through 11/30/2019

Approach 2

Public health is most endangered by acute illnesses when in contact with recreational water that exceeds state and federal standards. The SOCWA laboratory monitored between four and nine sample locations as described in Attachment B. The water quality parameters measured sought to determine the concentration of bacteria at the sample locations, the nutrients in the water, and the total suspended solids. Each water quality parameter chosen supports the environmental assessment by providing quantitative data to determine mass loadings to differentiate between anthropogenic and natural background sources.

The water quality parameters chosen were as follows:

- *Total Coliform Bacteria*
  This group of bacteria is used to determine the sanitary conditions of the water body. The group of bacteria includes species that also inhabit soil and other environmental niches. Total coliform bacteria are included in public health monitoring requirements. Receiving water limits for single sample maximum thresholds is 10,000 colony forming units (cfu) per 100mL.
- *Fecal Coliform Bacteria*
  This group of bacteria is used to determine if the source of pollution is related to warm blooded animals as it is consistently found in the intestines of warm-blooded animals. Fecal coliform is a subset of total coliform. Receiving water limits for single sample maximum thresholds is 400 colony forming units (cfu) per 100mL.
- *Enterococcus*
  This group of bacteria is used to determine the source of pollution because Enterococcus is shed from human and animal feces. Receiving water limits for single sample maximum thresholds is 104 colony forming units (cfu) per 100mL.
- *Heterotrophic Bacteria*
  Heterotrophic bacteria are not used for limits in recreational waters and are not in the coliform group of bacteria. Heterotrophic bacteria are used to provide an additional measure of pathogens present in the samples.
- *Total Nitrogen*
  Total nitrogen, at sufficient concentrations, was used to differentiate between the spill and the background creek flows.
- *Ammonia*
  Ammonia, at sufficient concentrations, was used to differentiate between the spill and the background creek flows.
- *Total Phosphorus*
  Total phosphorus, at sufficient concentrations, was used to differentiate between the spill and the background creek flows.
- *Total Suspended Solids*
  Total suspended solids was used to determine the solids loading from the spill and background sources.

Bacterial Analysis

The Fecal Indicator Bacteria (FIB) chosen are a group that indicates pathogenicity. The FIB methods were chosen due to their relatively low cost to run and quick turn around time. There were six water quality sample events over the monitoring period. In the first sample event, four locations were sampled. The subsequent sample events were at nine locations in alignment with the biological assessment sites as identified in Appendix B. The nine locations represent samples upstream of the spill location (200 and 600 feet upstream), at the spill site, and downstream of the spill location (200 feet, 600 feet, 1000 feet, 2000 feet, 3000 feet, and 4000 feet), The dilution ratio as described in Table 2 was included to provide an estimate of the mass loadings based on the dilution due to the high flows in Aliso Creek. At the beginning of the spill, on November 27, 2019, SOCWA collected the first sample of the spill at a location approximately 50 ft downstream from the spill site due to safety considerations raised by the rushing water in the creek. Once these safety issues were resolved, all subsequent samples were taken at the closest proximity to where the spill was occurring. See Appendix B. This explains the higher concentrations of FIB on November 28, 2019 as that sample was taken closer to the spill location. Table 2 indicates that there was an early increase is FIB. There was an instant reduction as soon as the spill was stopped as can be seen on sample dates November 29, 2019 through December 2, 2019.

Date	Time Sample Taken	Creek Flow (cfs)	Dilution Ratio	Total Coliform (cfu/100mL)	Fecal Coliform (cfu/100mL)	Enterococcus (cfu/100mL)
11/27/2019	6:50:00 PM	161.91	80.96	154,200	8,200	1,414,000
11/28/2019	12:52:00 PM	1284.09	642.05	>400000	>400000	>200000
11/29/2019	1:00:00 PM	62.75	31.38	19,600	<2000	18,500
11/30/2019	10:46:00 AM	34.42	17.21	167,000	4,100	9,800
12/1/2019	12:08:00 AM	14.52	7.26	20,000	4,000	<4000
12/2/2019	12:10:00 PM	9.04	4.52	600	<1	900

Table 2: FIB in the Spill/Source/closest sample results.

The upstream input of bacteria was assessed to determine the baseline concentration of input of bacteria. Figure 4 provides a percent contribution from the total number of cfu/100mL of each of the FIB for upstream locations to provide a baseline understanding of the input of bacteria from the environment.

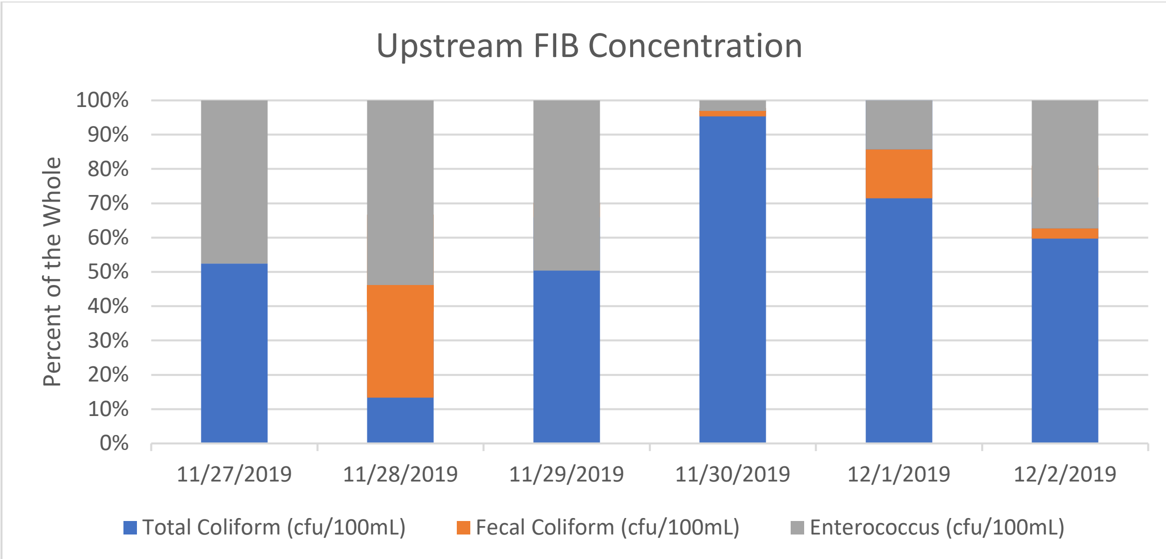


Figure 4: Upstream percent contribution of Total, Fecal, and Enterococcus bacteria

Table 3 provides the concentration of bacteria upstream of the spill site. Based on receiving water quality standards, all FIB concentrations were exceeded. This indicates that baseline conditions in Aliso Creek were impaired without any bacterial input from the spill.

Date	Creek Flow (cfs)	Total Coliform (cfu/100mL)	Fecal Coliform (cfu/100mL)	Enterococcus (cfu/100mL)
11/27/2019	174.02	35,000	<2000	31,800
11/28/2019	1278.12	2,000	8,000	5,000
11/28/2019	1290.08	10,000	2,000	14,000
11/29/2019	66.2	15,000	<2000	14,800
11/29/2019	65.04	32,000	2,000	14,500
11/30/2019	34.42	178,500	2,000	4,100
11/30/2019	34.42	125,900	2,000	4,100
12/1/2019	14.52	20,000	4,000	4,000
12/1/2019	14.52	4,000	<4000	<4000
12/2/2019	9.04	800	40	500
12/2/2019	9.04	1,700	220	450

Table 3: Bacteria loading at upstream locations during the water quality sampling period.

A similar analysis was conducted to determine the effect of the spill on the concentration percentage of bacteria at the spill site. Figure 5 shows a similar effect at the spill site where the Fecal Coliform bacteria represent a larger percentage of bacteria owing to the timing of the spill and also matching the relative contribution from baseline conditions.

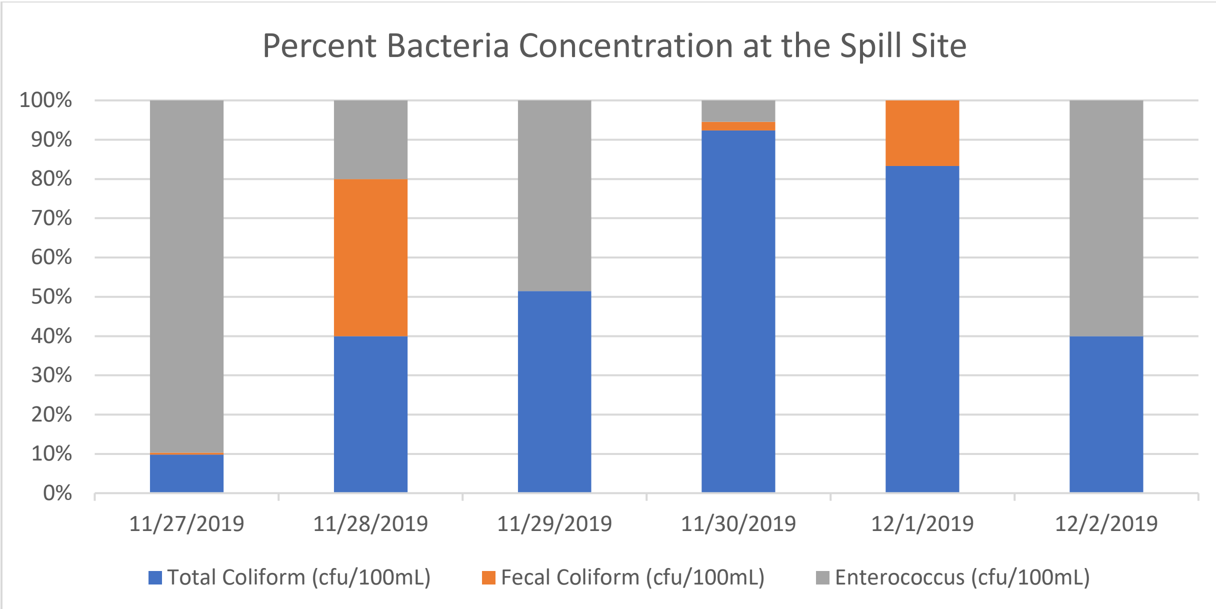


Figure 5: Percent contribution of Total, Fecal, and Enterococcus bacteria at the spill site.

To complete the comparative analysis, percent of FIB at the downstream locations was evaluated to assess the spill contribution to the water quality in Aliso Creek. Figure 6 illustrates a similar pattern of the contribution of Fecal Coliform on the height of the spill, a leveling off of the concentration after the spill and a similar baseline found days after the spill commenced (12/1/2019 through 12/2/2019).

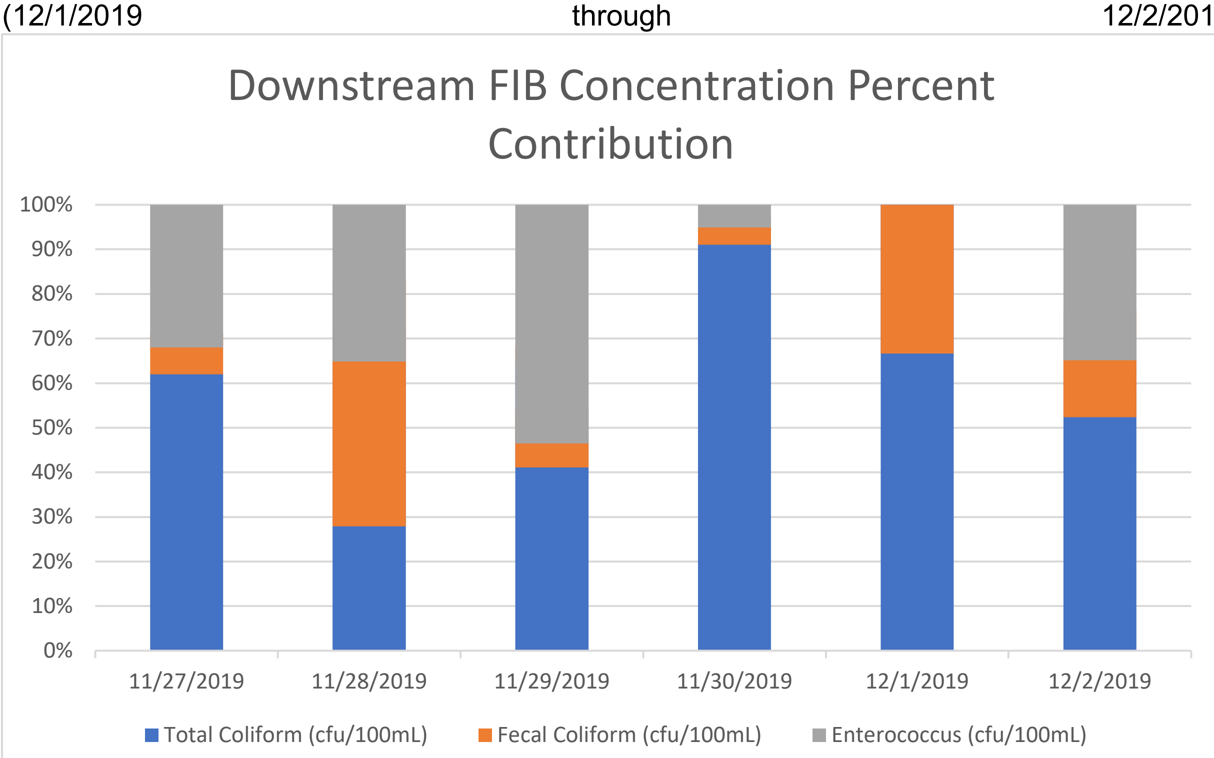


Figure 6: Percent contribution of Total, Fecal, and Enterococcus bacteria downstream.

Table 4 provides a concentration of the FIB at downstream locations from the spill. All bacterial water quality standards were exceeded during the spill period, and are consistent with the upstream exceedances indicating the baseline input from bacteria from the watershed as a driving factor in bacterial exceedances downstream of the spill. The comparison of the sample taken on 11/28/2019 at the spill site which is in excess of 400,000 cfu/100mL for total and fecal coliform and 200,000 cfu/100mL for enterococcus bacteria (Table 2) indicates that dilution from Aliso Creek was effective in reducing the concentration input from bacteria by orders of magnitude, The spill site relative concentration did not provide an excess input of bacteria in Aliso Creek as evidenced in Table 4.

Date	Creek Flow (cfs)	Total Coliform (cfu/100mL)	Fecal Coliform (cfu/100mL)	Enterococcus (cfu/100mL)
11/27/2019	143.44	118,800	17,000	55,400
11/27/2019	136.40	107,600	10,400	55,600
11/28/2019	1284.09	15,000	6,000	7,000
11/28/2019	1314.18	12,000	18,000	13,000
11/28/2019	1308.13	26,000	4,000	6,000
11/28/2019	1332.41	14,000	10,000	13,000
11/28/2019	1387.94	10,000	4,000	4,000
11/29/2019	62.75	17,000	<2000	13,400
11/29/2019	61.62	37,800	2,000	18,500
11/29/2019	61.62	22,000	<2000	12,200
11/29/2019	59.4	12,600	<2000	14,500
11/29/2019	59.4	19,400	6,200	21,600
11/30/2019	33.61	166,400	2,000	5,200
11/30/2019	34.42	161,600	7,400	8,500
11/30/2019	33.61	307,600	9,800	10,900
11/30/2019	33.61	113,700	3,000	6,300
11/30/2019	33.61	224,700	4,100	8,400
12/1/2019	14.52	4,000	<4000	<4000
12/1/2019	14.52	4,000	<4000	<4000
12/1/2019	14.52	12,000	4000	<4000
12/1/2019	14.52	8,000	4000	<4000
12/1/2019	14.52	16,000	4000	<4000
12/2/2019	9.04	2,400	<1	1000
12/2/2019	9.04	1,100	210	400
12/2/2019	9.04	900	220	600
12/2/2019	9.04	1,100	110	570
12/2/2019	9.04	700	140	400

Table 4: Downstream Fecal Indicator Bacteria Concentration

To determine the spill effect, a review of the Total Coliform concentrations and Fecal Coliform concentrations at the downstream locations was conducted. Figures 7 and 8 illustrate these concentrations.

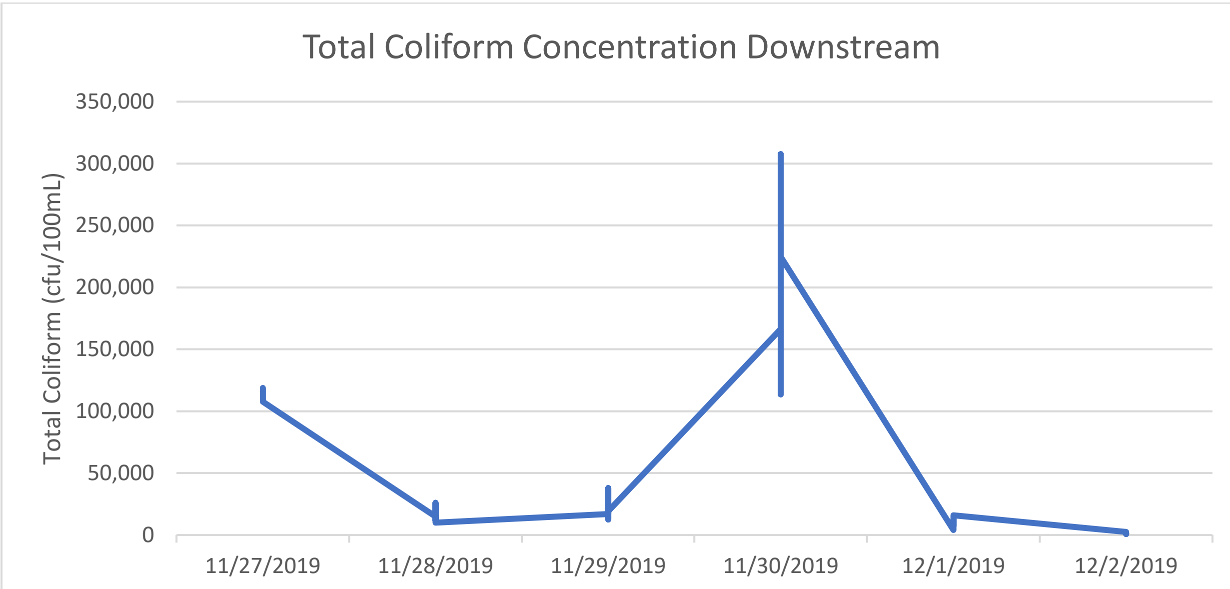


Figure 7: Total Coliform Downstream of the spill

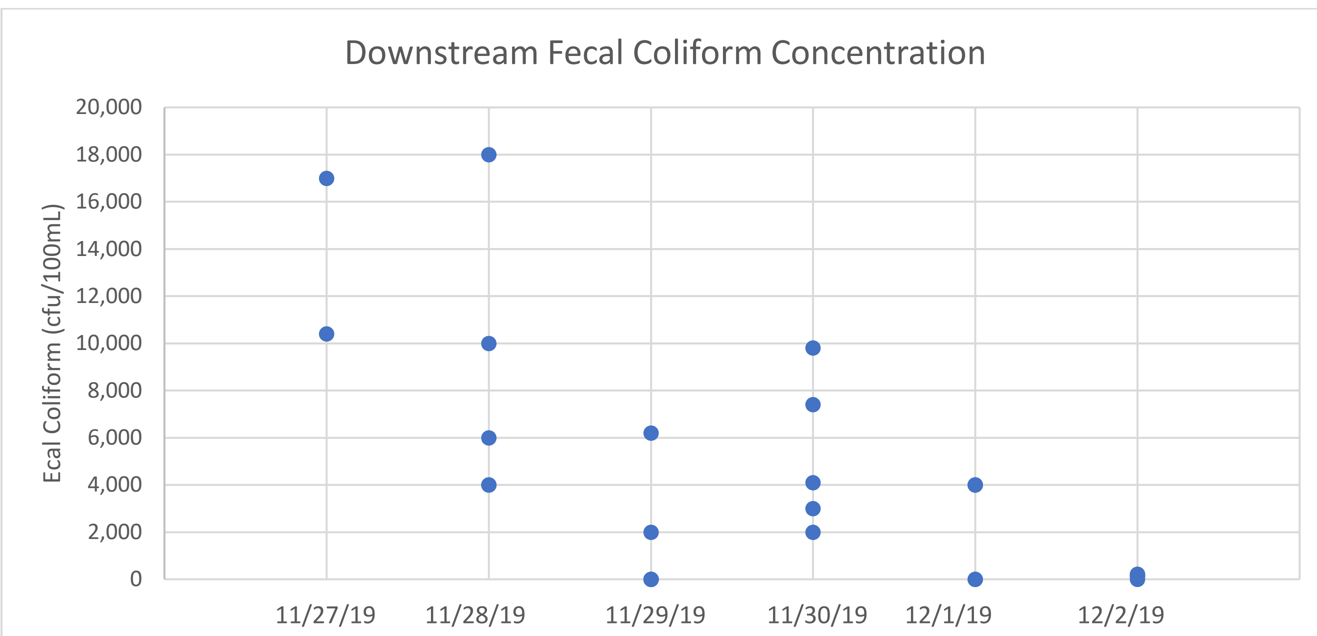


Figure 8: Concentration of Fecal Coliform at Downstream locations

Solids Contribution

Total Suspended Solids (TSS) was measured in six sample events and between four and nine sample locations on Aliso Creek (refer to Appendix B for the map of sample locations). The highest concentration of TSS occurred on 11/28/2019 which was also a time when the creek flows were the highest as evidenced in Figure 1. The sample on 11/28/2019 with a concentration of almost 600mg/L was the sample site at the spill location which provides a stark difference in the input solids loading from the other sample locations. The increase in TSS indicates natural inputs since the concentration did not vary in a significant amount, with the exception of the source sample from the spill location which was half the concentration than all other samples collected, both upstream and downstream of the spill location as can be seen in Figure 9.

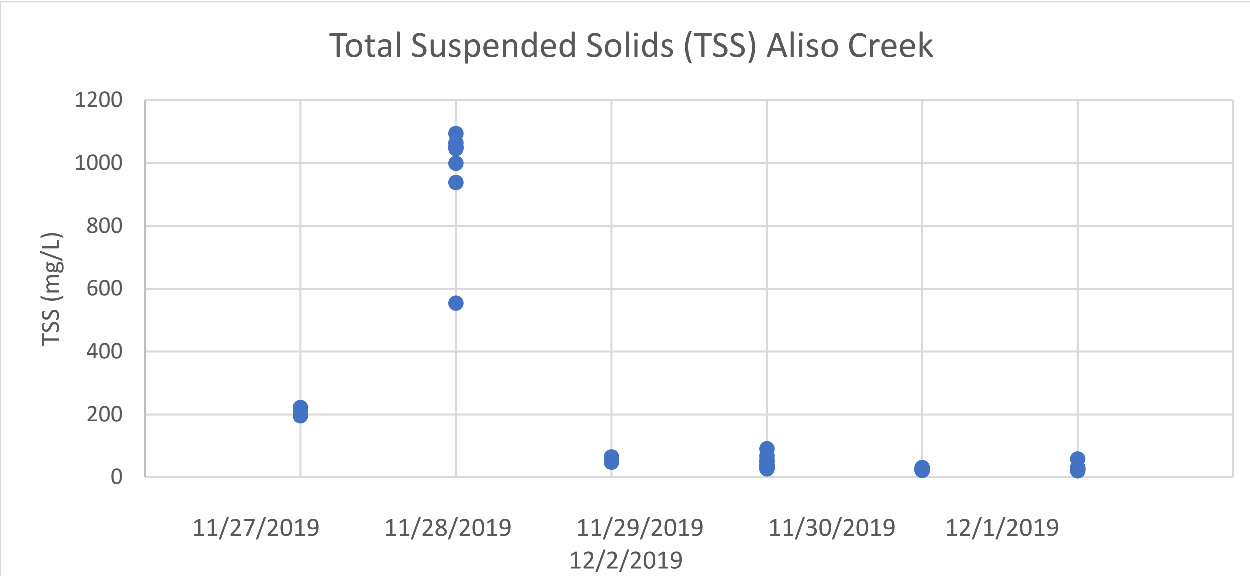


Figure 9: Total Suspended Solids at each sample location.

The upstream input from total suspending solids can be seen in Table 5 which indicates a large amount of solids occurring from upstream locations.

Date	Creek Flow (cfs)	TSS (mg/L)
11/27/2019	174.02	196
11/28/2019	1278.12	1065
11/28/2019	1290.08	1051
11/29/2019	66.2	56
11/29/2019	65.04	64
11/30/2019	34.42	48
11/30/2019	34.42	55
12/1/2019	14.52	31
12/1/2019	14.52	22
12/2/2019	9.04	31
12/2/2019	9.04	25

Table 5: Total Suspended Solids at Upstream Locations

That baseline condition of peaking suspended solids can also be seen throughout the sample period as illustrated in Table 6.

Date	Creek Flow (cfs)	TSS (mg/L)
11/27/2019	161.91	222
11/27/2019	143.44	212
11/27/2019	136.40	220
11/28/2019	1284.09	938
11/28/2019	1314.18	1051
11/28/2019	1308.13	1046
11/28/2019	1332.41	999
11/28/2019	1387.94	1094
11/29/2019	62.75	52
11/29/2019	61.62	60
11/29/2019	61.62	64
11/29/2019	59.4	56
11/29/2019	59.4	56
11/30/2019	33.61	37
11/30/2019	34.42	34
11/30/2019	33.61	68
11/30/2019	33.61	32
11/30/2019	33.61	36
11/30/2019	33.61	37
11/30/2019	34.42	34
11/30/2019	33.61	68
11/30/2019	33.61	32
11/30/2019	33.61	36
12/2/2019	9.04	25
12/2/2019	9.04	25
12/2/2019	9.04	23
12/2/2019	9.04	26
12/2/2019	9.04	20

Table 6: Downstream Total Suspended Solids

Nutrient Analysis

Nutrient analysis was coupled with the assseement to determine the potential to create algae blooms which could remove oxygen from the Aliso Creek when the alge dies and create an anoxic condition that would not support biological life at the spill site. As Figure 10 illustrates, the nutrient input spiked at the spill location. It is important to note that the sample taken on 11/28/2019 was directly from the source of the spill.

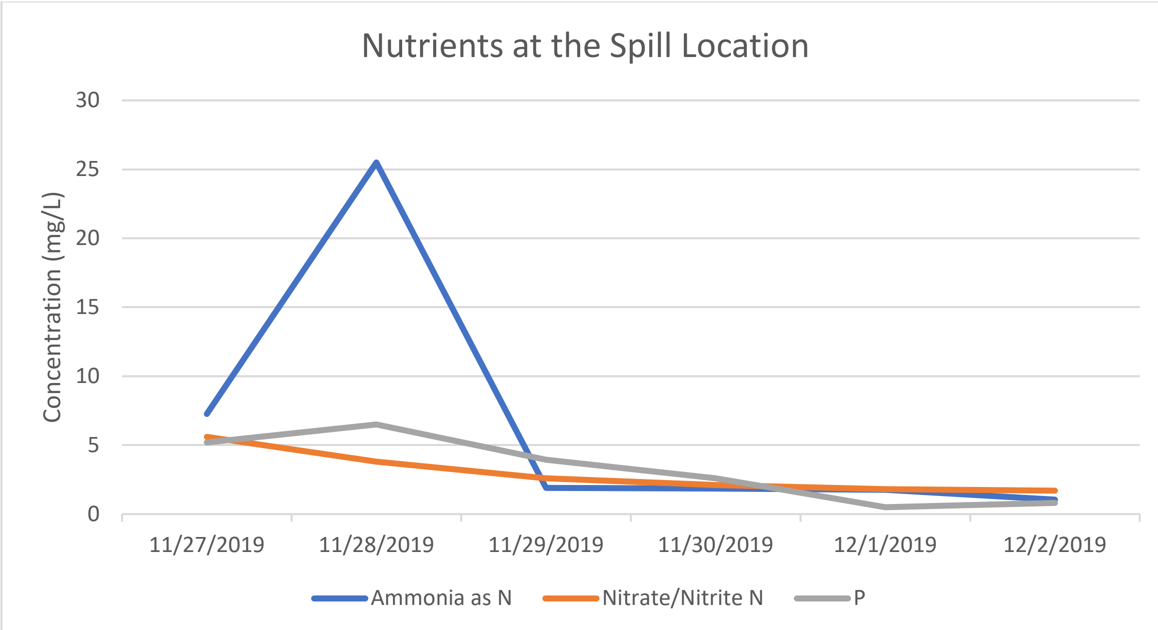


Figure 10: Nutrient monitoring at the Spill Site

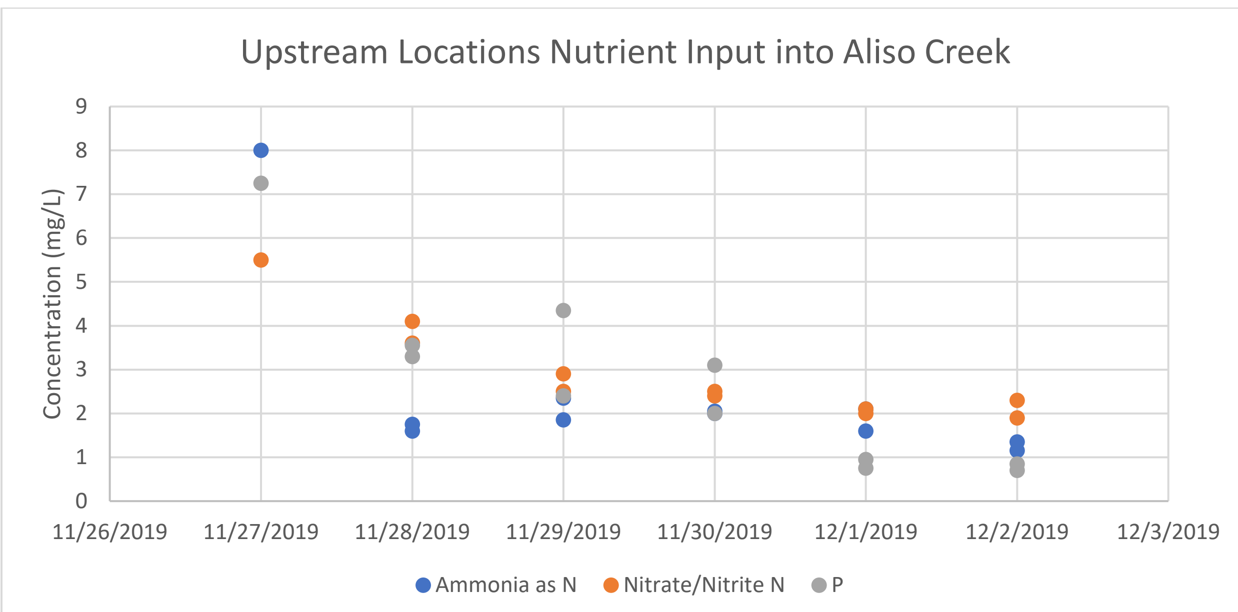


Figure 11: Upstream Concentration of Nutrients into Aliso Creek.

Figure 11 provides a review of the upstream sample locations. Figure 11 illustrates that the input background loadings are higher on 11/27/2019. This indicates that the watershed is discharging a relatively higher contribution of nutrients into Aliso Creek.

Downstream of the spill, Figure 12 provides an analysis of the input of the nutrients into Aliso Creek.

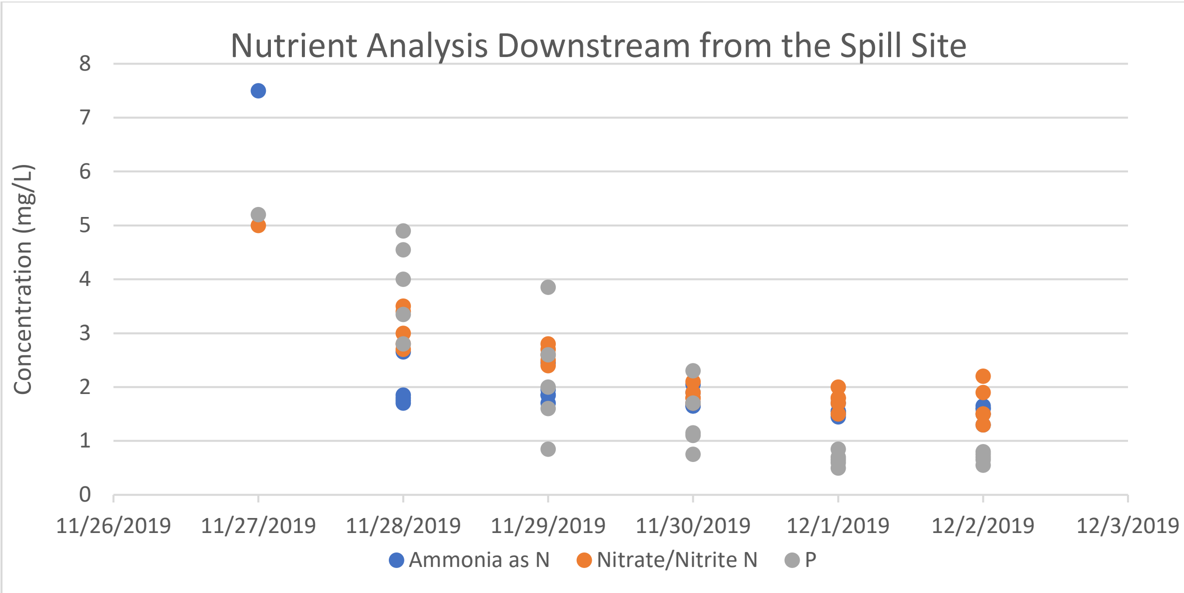


Figure 12: Downstream Nutrients from the Spill Site

Approach 3

Approach 3 sought to direct the monitoring efforts related to the environmental impact assessment in alignment with the Biological Resources Damage Assessment Standard Operating Procedure (SOP) that was created in response to the SOCWA spill in 2017. The biological impact assessment independent report is found in Appendix C. The SOCWA Spill Response SOP is found in Appendix D.

Conclusion

The bacterial, solids, and nutrient analysis was evaluated to provide data to assess the overall impact of the spill. The data consistently shows bacterial, suspended solids, and nutrients upstream of the spill site indicating runoff from the watershed. This conclusion is supported by the rainfall data from the storm during the period of the spill. The impact of the spill site was acute and dissipated quickly after the spill was abated.

Appendix A
Sample Field Data Sheet

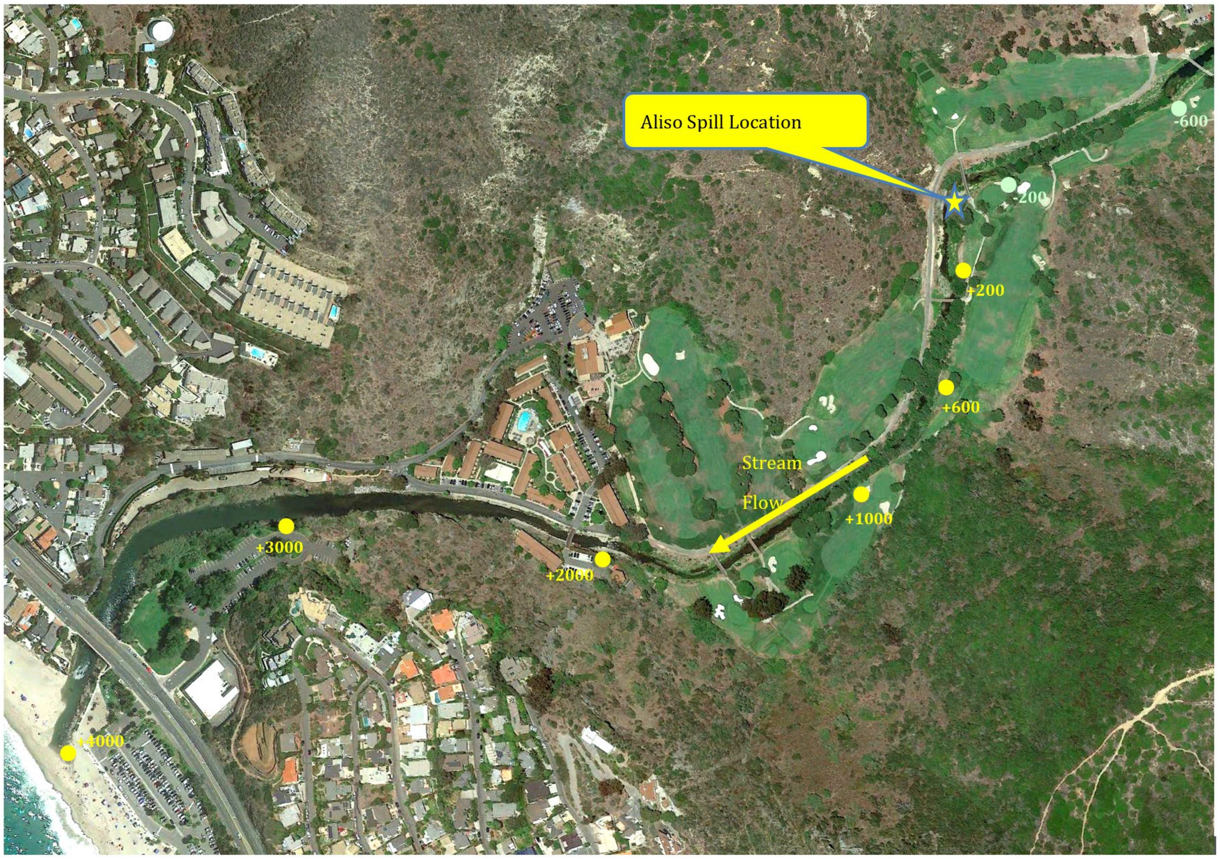
Site ID____________ Time______ Date_________ Observer __________

Gross estimation of pollutants	Present	Notes
Visible pollutants		
Unusual Odor		
Organic matter		
Surface film		
Water clarity		
Algae growth/bloom		
Other indications of residual spill		
Drainage Description		
Dry when observed		
Marsh, pond, still water		
Flowing water		
Vegetation		
Ground cover: bare, leaf litter, grasses, etc.		
Estimated % coverage of rooted plants		
Vegetative type(s)		
Species composition		
Discoloration or stress		
Substrate		
Est. % substrate type (sand, gravel, cobble)		
Stream Flow		
Measured stream flow, if available		
Estimated flow		
Channel		
Bank to bank width at high water mark		
Wetted channel width		
Average stream channel depth		
Human Development or Influence		
Animals		
Insects		
Fish		
Reptiles, Amphibians		
Birds		
Mammals		
Species observed (attach list)		
Activity observed (Note 1)		
Mortality		
Photographs		

Notes: 1. Use a uniform observation time at each site, 10 minutes for example

Appendix B

Sample locations in relation to the spill.



Appendix C

Final Environmental & GIS Services, LLC Report dated