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DRAFT Memorandum

DATE   October 28, 2019

TO   Cynthia Mallett, Environmental Programs Supervisor
            City of San Clemente, Utilities Department

FROM   Ted Von Bitner, Project Manager
            Wood Environment & Infrastructure Solutions, Inc.

CC   David Rebensdorf, City of San Clemente
            Kaitlyn Hanley, Wood Environment & Infrastructure Solutions, Inc.
            Roshan Christoph, Wood Environment & Infrastructure Solutions, Inc.
            Joshua Steele, Southern California Coastal Waters Research Project
            Joseph Guzman, OC Health Care Agency
            Stakeholder Advisory Committee Members

SUBJECT San Clemente Pier Bacteria Source Characterization Study Progress Report

Dear Cynthia,

Attached to this cover letter is the first progress report on the *San Clemente Pier Bacteria Source Characterization Study*. Wood Environment & Infrastructure Solutions, Inc. (Wood) prepared this technical report to present a summary of data collection activities to date and to present initial findings. The data presented in this memorandum covers the time period of May 1, 2019 to July 31, 2019. In addition, data received from previous reports and testing is included.

Information presented in this memorandum is organized as follows:

1. A brief summary of the Project Activities completed as described in the Work Plan.
2. Visual observation survey results summarized.
3. Beach water quality and storm drain water quality results.
4. Recommended next steps.

Item 3 provides an initial look at the water quality sampling results to guide the next steps in this study and to also provide perspective for the time period leading up to the start of the study. Not all samples have been analyzed and genetic marker analysis will be forthcoming.

Our analysis of the results available to date provided the following findings:

1. The surveys performed in the Pier Bowl drainage area and on the beach spanned a three month time period of near-daily conditions.

2. The high frequency of the surveys means there are sufficient records to accurately distinguish sources that are persistent (frequently occurring), intermittent (occasionally occurring), and episodic (infrequently occurring).

3. Surveys heavily covered the early morning time period prior to and during the same time period in which Orange County Health Care Agency performed the weekly surfzone water quality

sampling program. The overlap in surveys and water quality sampling may allow for correlations to be drawn between survey results and sources contributing to degraded surfzone water quality.

4. Over the past three years during three separate sampling efforts (June 2016 to October 2016, October 2018 to May 2019, and June 2019 to July 2019), the human and canine genetic markers have not been detected in the surfzone beneath the base of the San Clemente Pier.

5. The genetic marker and indicator bacteria water quality samples collected in the surfzone beneath the base of the San Clemente Pier in the time leading up to the start of the study show an association of positive detections of the avian genetic marker coinciding with indicator bacteria levels being measured above water quality objectives.

6. A human source of bacteria was detected in the Pier Bowl watershed area and additional investigations need to be conducted to locate and eliminate the bacterial source.

A technical progress report summarizing the visual observation surveys and a limited amount of water quality results are presented in Attachment 1 for your consideration.

Please contact me at (949) 363-3232 or email to theodore.vonbitner@woodplc.com if you have any questions or wish to discuss our progress report in further detail.

Sincerely,

Wood Environment & Infrastructure Solutions, Inc.

Ted VonBitner, Ph.D.
Senior Associate Scientist
Project Manager

Attachment 1.

Technical Progress Report
on the
San Clemente Pier Bacteria Source Characterization Study

DISCLAIMER

This progress report presents results for the *San Clemente Pier Bacteria Source Characterization Study* received by the City to date. A portion of this progress report presents a limited analysis of pre-study datasets to provide context and continuity with the time leading up to the start of study implementation. This progress report also contains preliminary data that is being released to provide transparency into the study and allow stakeholders the opportunity to evaluate the data and provide feedback. The data included herein has been collected and undergone quality assurance. This progress report, however, does not provide interpretations or draw final conclusions from the limited amount of data collected for the study since the study is ongoing and does not include analysis of all data collected to date. Therefore, the data is not considered final for purposes of evaluating bacteria sources or source control measures. The City reserves the ability to release future data as it is collected and analyzed for the study.

1. Data Collection Activities.

In the time period between May 1, 2019 and July 31, 2019 a wide range of data collection activities were performed by City staff and the consultant team. Data collection activities focused on completing the planned Project Activities as listed in **Table 1** and as described in the Work Plan dated June 30, 2019.

The City and consultant team conducted comprehensive surveys in the Pier Bowl drainage area, under the pier, and north and south of the pier; detailed results are provided in Section 2 of this progress report. Additionally, the consultant team completed the planned Indicator Bacteria and Genetic Marker water and sand sampling program in the time period of June 1, 2019 to July 31, 2019, and no additional samples are planned to be collected at this time.

For presentation purposes, the dark grey shaded cells in **Table 1** indicate that the data compilation and review process should be considered complete and no further work may be needed for the study. The green shaded cells indicate that the data compilation and review process is ongoing and additional work needs to be completed for this study.

Table 1. Study Data Collection Activities Completed as of October 28, 2019.

Data Collection Activity	Sources to Be Assessed									
	Public Streets	Dogs	Pigeon	People under Pier	Sewer System	Recycled Water	Storm Drain	Kelp	Sand	Surfzone
Observation-Based Surveys	●	●	●	●	●	●	●	●	●	●
Review of Maintenance Records					●	●	●			
Flow and Discharge Monitoring	●						●			
Indicator Bacteria Samples	●						●		●	●
Genetic Marker Samples	●	●	●				●		●	●

Dark grey shaded cells mean data collection activities were completed.
Green shaded cells mean data collection activities are partially complete.

2. Visual Observation Results.

Visual observation-based surveys (surveys) were generated by walking the Pier Bowl drainage and the portion of San Clemente City Beach located beneath, north of, and south of the pier. A copy of the Field Data Sheet is included in Exhibit 1 for convenience. The near-daily records were compiled, sorted, and summarized to extract information about the type and location of sources.

The first analysis performed with the results focused on documenting the times at which surveys were recorded over the nearly three-month period. Between May 1, 2019 and June 30, 2019 surveys were performed across the 24-hour period of a day capturing a wide range of potential sources at varying times of the day, as shown below in **Figure 1.**

Surveys from July 1, 2019 to July 31, 2019 focused heavily on the early morning hours prior to and during the same time period as the County's water quality monitoring program at the point zero pier monitoring (PIERz) location. The intent of this adaptive approach was to focus the available resources on the critical time period to better correlate observations with the surfzone sampling program and to better support the latter data analysis portion of this study.

The information provided by the surveys generated the following results.

- 81 surveys were recorded within a period of 89 days in the time period between May 2, 2019 and July 31, 2019.
- Surveys ranged in time from 12 minutes to 5 hours and 55 minutes with the average length of time equal to 1 hour and 13 minutes.
- 46 days had two or more surveys performed within the same 24-hour time period meaning that surveys were able to record source changes within a given day on more than half of all the surveys performed.

The second analysis performed with the surveys focused on compiling, sorting, and summarizing the data recorded in the Pier Bowl drainage area and on the San Clemente City Beach under and around the pier. Summarized survey results by potential bacteria source type for the Pier Bowl and this targeted beach area, are presented in **Tables 2** and **3** below, respectively. The following text provides more context for these two tables.

In **Table 2**, the potential bacteria sources within the Pier Bowl drainage area that may be contributing to water quality objective exceedances in the surfzone are arranged from most frequently observed to least or not-at-all observed. The column titled "Number of Times Each Source was Observed" refers to the total count of sources during the observation period from May 1 – July 31, 2019. The column titled "Number of Surveys when Source was Observed" refers to number of surveys in which the source was present. For example, "Curb-cut Drain Flowing into Street" was observed 356 times over the entire survey period as noted in column two. In column three, this source was observed at least once on 75 of the 81 surveys. The column titled "Percent of Total Surveys when Source was Present" refers to the number of surveys in which a source was observed divided by the total number of surveys (81). Column four can be interpreted as the prevalence of the source. The visual observation survey results recorded on the beach were analyzed in an identical manner.

Table 3 shows the potential bacteria sources on the beach that may be contributing to water quality objective exceedances in the surfzone (People, Domestic Water and Wastewater Infrastructure, Pigeons, Dogs, Gull, and Kelp) with results individually tallied for the three different observation areas (On the Pier, Under the Pier, On Sand within 25 Feet of Pier).

Figure 1. Temporal Coverage of Observation-Based Surveys (81 in total).
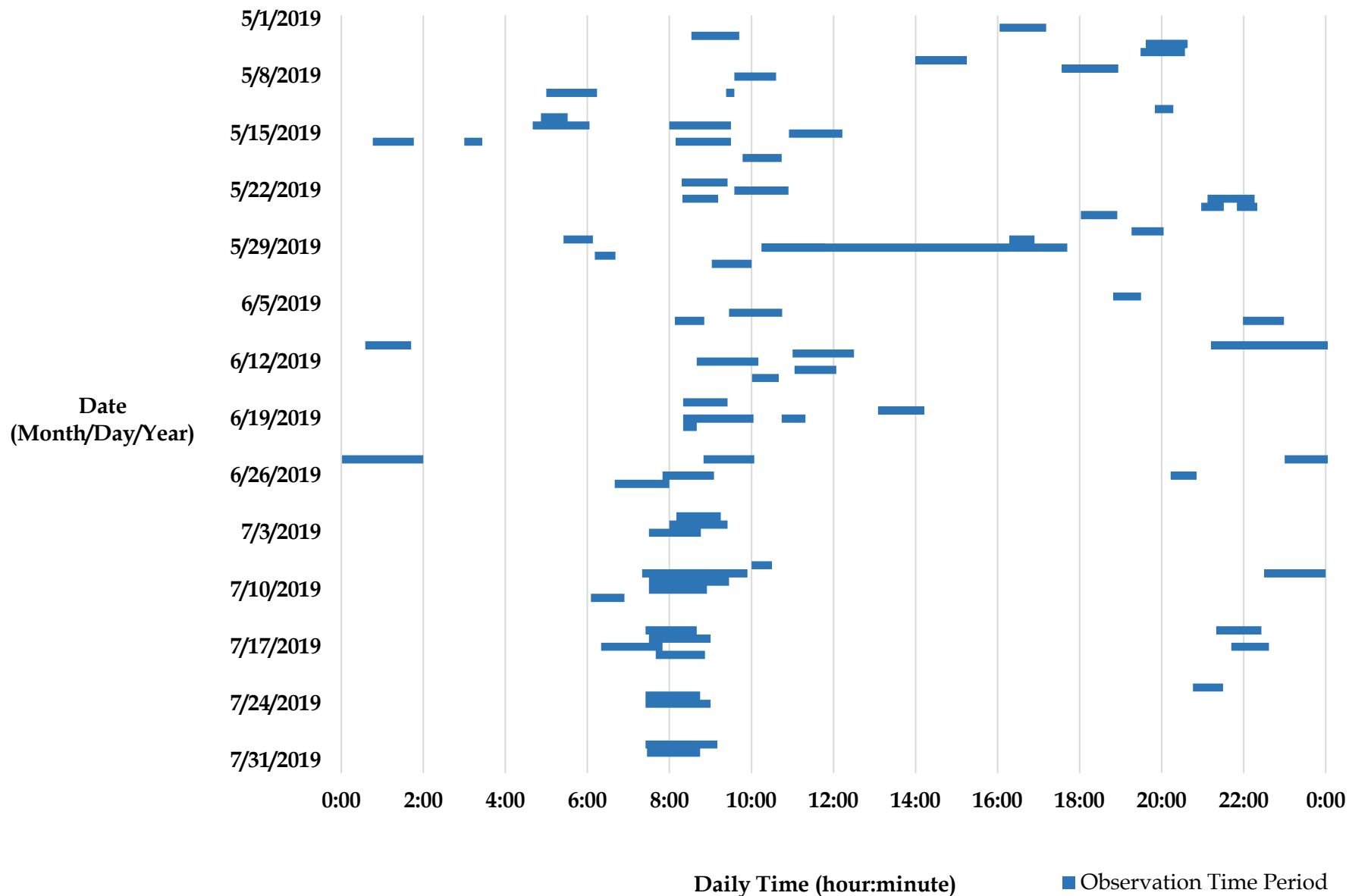
Table 2. Pier Bowl Stormwater Drainage Area Visual Observation Survey Results for May 2019 to July 2019.

Potential Bacteria Sources	Number of Times Each Source was Observed[1]	Number of Surveys when Source was Observed[2]	Percent of Total Surveys when Source was Present
Curb-cut Drain Flowing into Street	356	75 out of 81	92.6%
Groundwater Seepage into Street	102	68 out of 81	84.0%
Landscape Overwatering	154	52 out of 81	64.2%
Domestic Pet Waste	90	45 out of 81	55.6%
Ponded or Pooled Water in Gutter	72	31 out of 81	38.3%
Sidewalk/Driveway Washing Runoff	30	24 out of 81	29.6%
Landscape Debris in Gutter	22	17 out of 81	21.0%
Food Waste in Gutter	11	11 out of 81	13.6%
Commercial Trash Truck Spills	17	10 out of 81	12.3%
Trash in Gutter	11	10 out of 81	12.3%
Leaking Trashcan or Dumpster	10	9 out of 81	11.1%
Mobile Business Discharge to Street	2	2 out of 81	2.5%
Vehicle Washing	1	1 out of 81	1.2%
Human Excrement	1	1 out of 81	1.2%
Commercial-activity Wastewater	1	1 out of 81	1.2%
Broken Water Line	0	0 out of 81	0%
Hydrant Flushing	0	0 out of 81	0%
RV/Camper Sewer Spill	0	0 out of 81	0%
Private Property Sewer Spill	0	0 out of 81	0%
Portable Toilet Spill	0	0 out of 81	0%

1. Column 2 refers to the total number of times or locations the source listed in Column 1 was observed during entire observation period
2. Column 3 refers to how many of the surveys resulted in the source being observed at least once

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Table 3. San Clemente City Beach Visual Observation Survey Results at Base of the Pier from May 2019 to July 2019.

Potential Bacteria Sources on Beach	Number of Times Each Source was Observed[1]	Number of Surveys when Source was Observed[2]	Percent of All Surveys when Source was Present
People			
Under the Pier Recreating	83	27 out of 81	33.3%
On Sand Within 25 Feet of Pier Recreating	118	34 out of 81	42.0%
Camping or living under the Pier and feces present	0	0 out of 81	0%
Domestic Water and Wastewater Infrastructure Under Pier			
Water observed dripping from pipes	119	47 out of 81	58.0%
Pigeons			
On the Pier	654	51 out of 81	63.0%
Under the Pier	1,970	74 out of 81	91.4%
On Sand Within 25 Feet of Pier	225	45 out of 81	55.6%
In Storm Drain Drinking Water	181	44 out of 81	54.3%
Dogs			
On the Pier	5	5 out of 81	6.2%
Under the Pier	3	3 out of 81	3.7%
On Sand Within 25 Feet of Pier	1	1 out of 81	1.2%
Gulls			
On the Pier	25	13 out of 81	16.0%
Under the Pier	3	2 out of 81	2.5%
On Sand Within 25 Feet of Pier	33	19 out of 81	23.4%

Kelp	Number of Surveys Low Amounts Observed[3]	Number of Surveys Medium Amounts Observed[3]	Number of Surveys High Amounts Observed[3]
Under the Pier	49 out of 81	5 out of 81	0 out of 81
On Sand within 25 feet of Pier	43 out of 81	0 out of 81	0 out of 81

1. Column 2 refers to the total number of times or locations the source listed in Column 1 was observed during entire observation period
2. Column 3 refers to how many of the surveys resulted in the source being observed at least once
3. Low generally refers to 1-5 gallon. Medium generally refers to 5-25 gallons. High refers to more than 25 gallons.

3. Water Quality Results

3.1 Surfzone Water Quality from October 2018 to May 2019

Orange County Health Care Agency performed weekly beach water quality monitoring at the PIERz monitoring location from October 10, 2018 to May 21, 2019 representing the time period prior to study development and during the May visual observation survey data collection activities for the *San Clemente Pier Bacteria Source Characterization Study.* Study specific water quality sampling activities started in June 2019 and the dataset provided by the County provides additional perspective on surfzone conditions leading up to the start of the *San Clemente Pier Bacteria Source Characterization Study.* **Table 4** summarizes the PIERz indicator bacteria laboratory testing results generated by Orange County Health Care Agency.

Table 4. Surfzone Water Quality Results for the San Clemente Pier at the Point-Zero (PIERz) Location from October 2018 to May 2019.

PIERz Water Quality Monitoring	Single Sample Maximum			Geometric Mean		
	Number Sample Results Compared to WQO	Number Exceeding WQO	Percent Exceedance	Number Sample Results Compared to WQO	Number Exceeding WQO	Percent Exceedance
Enterococcus[1]	37	11	29.7%	26	19	53.3%
Fecal Coliforms[2]	37	6	16.2%	28	5	10.5%
Total Coliforms[3]	37	0	0%	28	0	0%

Data Source: Orange County Health Care Agency website (ocbeachinfo.com).
CFU = colony forming units. mL = milliliter. WQO = Water Quality Objective.
Geometric Mean means a logarithmic mean of not less than 5-samples in a 30-day period.
1. Enterococcus: Single Sample Maximum WQO (104 CFU/100mL), Geometric Mean WQO (35 CFU/100mL)
2. Fecal Coliform: Single Sample Maximum WQO (400 CFU/100mL), Geometric Mean WQO (200 CFU/100mL)
3. Total Coliform: Single Sample Maximum WQO (10,000 CFU/100mL), Geometric Mean WQO (1,000 CFU/100mL)

Enterococcus represented the indicator bacteria with the highest percentage of single sample maximum and geometric mean water quality objective exceedances. Fecal Coliform exceeded fewer times than Enterococcus. Total Coliform levels did not exceed during any of the County's sampling events.

In late July 2019, the consultant team received a copy of genetic marker testing results produced by Orange County Public Works and Orange County Health Care Agency in coordination with the City of San Clemente. **Table 5** summarizes the PIERz human and canine genetic marker testing results for surfzone samples collected at the PIERz monitoring location during this preceding time period. Genetic marker results are additionally provided in **Exhibit 2 Tables E2-1.**

Table 5. Surfzone Human and Canine Genetic Marker Results for the San Clemente Pier at the Point-Zero (PIERz) Location from October 2018 to May 2019.

PIERz Surfzone Marker Results	Human Marker (HF183)	Canine Marker (BacCan)
Samples Analyzed	3	3
Positive Detections of Marker	0	0

The number of samples analyzed for human and canine genetic markers from October 2018 to May 2019 were very limited in quantity. For comparison purposes, a second dataset was reviewed to characterize human and canine genetic marker results during the pre-study time period. Orange County Health Care Agency collected 18 samples in the surfzone at the PIERz from June 2016 to October 2016 that resulted in no positive detections of either the human or canine marker (see **Exhibit 2, Tables E2-2**) which provides a similar result to the October 2018 to May 2019 dataset.

Avian genetic marker positive results were additionally compared with the indicator bacteria results for samples that exceeded the single sample maximum and geometric mean water quality objectives. The goal of these analyses is to assess whether a correlation existed between the positive genetic marker detections and indicator bacteria levels. The genetic marker results and correlations between positive detections of the marker and indicator bacteria levels above the water quality objectives are shown in **Table 6**. Genetic marker results are additionally provided in **Exhibit 2 Tables E2-3**. No avian genetic marker results accompanied the June 2016 to October 2016 dataset provided by the County.

Table 6. Surfzone Avian Genetic Marker Results for the San Clemente Pier at the Point-Zero (PIERz) Location from October 2018 to May 2019.

PIERz Surfzone Marker Results	Avian Marker (AvianGFD and HeliBac)
Samples Analyzed	27
Positive Detections of Marker	27
Positive Detections Coinciding with Single Sample Maximum WQO Exceedances	**Avian Marker**
Enterococcus	8 positive in 11 exceedances
Fecal Coliform	4 positive in 6 exceedances
Positive Detections Coinciding with Geometric Mean WQO Exceedances	**Avian Marker**
Enterococcus	11 positive in 19 exceedances
Fecal Coliform	3 positive in 5 exceedances

Notes on Table 6. WQO means Water Quality Objective

3.2. Surfzone Water Quality from May 2019 to July 2019.

Orange County Health Care Agency performed weekly beach water quality monitoring at the PIERz monitoring location from May 1, 2019 to July 31, 2019 coinciding with data collection activities for the *San Clemente Pier Bacteria Source Characterization Study*. **Table 7** summarizes the PIERz indicator bacteria laboratory testing results generated by Orange County Health Care Agency during implementation of study activities.

Table 7. Surfzone Water Quality Results for the San Clemente Pier at the Point-Zero (PIERz) Location from May 2019 to July 2019.

PIERz Water Quality Monitoring	Single Sample Maximum			Geometric Mean		
	Number Sample Results Compared to WQO	Number Exceeding WQO	Percent Exceedance	Number Sample Results Compared to WQO	Number Exceeding WQO	Percent Exceedance
Enterococcus[1]	19	7	36.8%	15	8	53.3%
Fecal Coliforms[2]	23	6	26.1%	19	2	10.5%
Total Coliforms[3]	21	0	0%	17	0	0%

Data Source: Orange County Health Care Agency website (ocbeachinfo.com).
CFU = colony forming units. mL = milliliter. WQO = Water Quality Objective.
Geometric Mean means a logarithmic mean of not less than 5-samples in a 30-day period.
1. Enterococcus: Single Sample Maximum WQO (104 CFU/100mL), Geometric Mean WQO (35 CFU/100mL)
2. Fecal Coliform: Single Sample Maximum WQO (400 CFU/100mL), Geometric Mean WQO (200 CFU/100mL)
3. Total Coliform: Single Sample Maximum WQO (10,000 CFU/100mL), Geometric Mean WQO (1,000 CFU/100mL)

Enterococcus represented the indicator bacteria with the highest percentage of single sample maximum and geometric mean water quality objective exceedances similar to the time period presented in **Table 4**. Fecal Coliform exceeded fewer times than Enterococcus. Total Coliform levels did not exceed during any of the County's sampling events.

The *San Clemente Pier Bacteria Source Characterization Study* implements the source prioritization process described in the California Microbial Source Identification Manual that prioritizes testing waters for human-associated bacteria sources before other sources such as birds (avian markers) and dogs (canine markers). To date, the consultant team analyzed samples for the two human-associated genetic markers, HF183 and Lachno3, as described in the Work Plan. **Table 8** summarizes the PIERz genetic marker testing results for surfzone samples collected at the PIERz monitoring location by the consultant team from June 2019 to July 2019. Genetic marker results are additionally provided in **Exhibit 2 Tables E2-4.**

Genetic testing results collected by the consultant team are consistent with the June 2016 to October 2016 and October 2018 to May 2019 genetic marker testing results, in that, no human or canine sources have been detected in the surfzone.

Table 8. Surfzone Genetic Marker Results for the San Clemente Pier at the Point-Zero (PIERz) Location from June 2019 to July 2019.

Surfzone	Samples Collected[1]	Samples Analyzed	Human Marker 1 (HF183)[2]	Human Marker 2 (Lachno3)[2]	Avian Marker (LeeSeagull)[2]	Canine Marker (DG3)[2]
			Positive Detections			
Count	14	9	0	0	TBA	TBA

Notes on Table 7. TBA means To Be Analyzed
1. All samples collected will be analyzed.
2. Genetic markers defined in the Work Plan dated June 30, 2019.

3.3. Storm Drain Water Quality

The *San Clemente Pier Bacteria Source Characterization Study* includes genetic marker testing of the storm drain system to determine if human-associated bacteria may be present in dry weather flows. Similar to the surfzone water quality testing approach, the study implements a source prioritization process described in the California Microbial Source Identification Manual that prioritizes testing waters for human-associated bacteria sources before other sources such as birds and dogs. To date, the consultant team analyzed samples for the two human-associated genetic markers, HF183 and Lachno3, as described in the Work Plan, for samples collected from the storm drain system below the last catch basin inlets located on the south side of Avenida Victoria. **Table 9** summarizes the PIERz genetic marker testing results for storm drain samples collected by the consultant team from June 2019 to July 2019.

Table 9. Dry Weather Runoff Genetic Marker Results for the Pier Bowl Storm Drain System from June 2019 to July 2019.

Watershed	Samples Collected[1]	Samples Analyzed	Human Marker 1 (HF183) [2]	Human Marker 2 (Lachno3)[2]	Avian Marker (LeeSeagull) [2]	Canine Marker (DG3) [2]
			Positive Detections			
North Drain	10	8	4	2	TBA	TBA
South Drain	9	7	2	2	TBA	TBA

Notes on Table 8. TBA means To Be Analyzed

1. All samples collected will be analyzed.

2. Genetic markers defined in the Work Plan dated June 30, 2019.

4. Recommended Next Steps

The next steps for the study should implement the following activities in accordance with Phase 1 of the Work Plan which focuses on the human source investigation and is consistent with the California Microbial Source Identification Manual that prioritizes analysis for human sources prior to birds and dogs:

1. Initiating a watershed investigation to locate the human source including, but not limited to;
   - Analyzing the source samples collected from dry weather runoff in the gutter and streets for both human markers.
   - Performing closed circuit television-based inspections for the storm drain system and the sanitary sewer collection system for the relevant portion contained within the Pier Bowl area near the storm drain system.
   - Confirming the absence of septic systems in the watershed through review of sewer utility accounts.
   - Verifying that the city's park and landscaped areas do not use recycled water.
   - If necessary, collect additional water samples in the watershed area to locate the intermittent human source.

2. Completing the remaining work for the Review of Maintenance Records which are the following:
   - Coordinating with staff from the Fisherman's Restaurant to investigate, and if necessary, perform repairs on leaking potable water and wastewater infrastructure (see **Table 3**).
   - Leak testing of the recycled water pipeline that travels parallel to the railway and below the railway underpass stairwell.
     - Recycled water pipeline leak testing will only be needed if the sand and/or remaining surfzone samples indicate positive detections of the human-associated genetic markers.

3. Continuing the human genetic marker sample analyses collected in the storm drain system, surfzone, and sand.

4. Analyzing the flow data, wave, and tide information for patterns and relationships that provide further insight into the mechanisms or sources causing water quality objective exceedances in the surfzone.

5. Continuing to provide project updates to the City and the Stakeholder Advisory Committee as additional results are generated.

Exhibit 1.

Field Data Sheet for Visual Observations
during the
San Clemente Pier Bacteria Source Characterization Study

San Clemente Pier Bacteria Source Characterization Study

SOURCE OBSERVATIONS FIELD DATA SHEET

Name:_____ **Date:**_____ (**mm/dd/yyyy**) **Start Time:**_____(24 hour**)**

Photos Collected: [ ] Yes [ ] No

Weather: [ ] Sunny [ ] Partly Cloudy [ ] Overcast [ ] Fog [ ] Drizzle [ ] Rain More than 0.04"?: [ ] > 72 hours [ ] < 72 hours

SOURCES TO PUBLIC STREET and STORM DRAIN (check all observed and mark map with symbol at source location)_____

Dry Weather Flows Reaching Catch Basins: [ ] Yes   [ ] No   (If yes, mark on map with "X")

[ ] Landscape Overwater (L) [ ] Landscape Debris in Gutter (LD) [ ] Mobile Business Discharge (M) [ ] Pet Waste (P)

[ ] Vehicle Washing (V)   [ ] Sidewalk/Driveway Wash(S)   [ ] Broken Water Line (B)   [ ] Hydrant Flushing (FH)

[ ] Curb-cut Drain Flowing (D) [ ] Ponded or Pooled Water (PP)   [ ] Groundwater Seep (GW) [ ] Rabbits (R)

[ ] Trash Truck Spill (TS)   [ ] Trash in Gutter (TG)   [ ] Leaking Trashcan or Dumpster (LT)   [ ] Food Waste in Gutter (F)

[ ] Commercial-activity wastewater (W) (e.g., washing equipment, washing floor maps, dumping mop water, etc.)

[ ] Human Excrement (H) [ ] RV/Camper Sewer Spill (HR) [ ] Private Property Sewer Spill (HS)   [ ] Portable Toilet Spill (HP)

BEACH SOURCE INVENTORY_____

Tide: Low Tide Time_____   High Tide Time_____ [ ] Incoming   [ ] Outgoing **Tide Height at Survey**:_____meter

Surf: Direction_____ Wave Size_____ feet Current Direction_____ **Waves Reach Storm Drain:** [ ] Yes [ ] No

Sand Under Pier: [ ] Sandy [ ] Sand/Rock mix [ ] Mostly Rocks   [ ] Trash (L/M/H)_____ [ ] Land-based Debris(L/M/H)_____

Sand In Front of Storm Drain: [ ] Sandy   [ ] Sand/Rock mix   [ ] Mostly Rocks   [ ] Birds (L/M/H)_____

Location	People		Bird - Gulls		Bird - Pigeon		Dog		Kelp	
	(Y/N)	Count	(Y/N)	Count	(Y/N)	Count	(Y/N)	Count	(Y/N)	Amount (L/M/H)
On the Pier	----	NA							----	NA
Under the Pier										
Sand w/in 25 feet Pier										

Animals in Storm Drain: [ ] Yes [ ] No **Type:** [ ] Pigeons [ ] Other **How many pigeons?**_____ Other?_____

Do you see people camping or living under Pier: [ ] Yes [ ] No   If yes, do you see or smell (urine or feces) [ ] Yes   [ ] No

Do you see or hear water dripping from the understory: [ ] Yes [ ] No

Can you collect a flow measurement at the storm drain outlet: NORTH [ ] Yes [ ] No   SOUTH [ ] Yes [ ] No

What time did you start the flow measurements?_____   End the flow measurements? _____

NORTH OUTLET	VOLUME (liters)	TIME (min:sec)	SOUTH OUTLET	VOLUME (liters)	TIME (min:sec)
TRIAL 1			TRIAL 1		
TRIAL 2			TRIAL 2		
TRIAL 3			TRIAL 3		

Stop Time:_____(**24 hour)**   **Signature:**_____

PUBLIC STREET WALKING SURVEY RESULTS   **Date:** _____ (mm/dd/yyyy)

ID	Time (24:00 hours)	ADDRESS	WATERSHED (North/ South)	Property Type (Residential/ Commercial)	ACTIVITY	REACHING GUTTER (Y/N)	PHOTO TAKEN (Y/N)
example	*22:30*	*123 State Street*	*North*	*Residential*	*Car washing*	*Y*	*Y*
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Notes: _____

_____

_____

SOURCE LOCATION MAP

Date: _____ (mm/dd/yyyy)

For any dry weather flow identified above, mark the associated ID symbol on the map below for the location of the observed source.

Legend

- ■ City MS4 System
- ▨ SC Pier Drain - North
- ▨ SC Pier Drain - South
- ↑ Drainage Flow

Notes:

Exhibit 2.

Genetic Marker Results
for the
San Clemente Pier Bacteria Source Characterization Study

Table E2-1. Surfzone Human, Avian, and Canine Genetic Marker Testing Results from Orange County Health Care Agency.

Station	Date and Time	Human Marker (HF183)	Bird Marker (HeliBac)	Canine Marker (BacCan)
		copies/100mL	copies/100mL	copies/100mL
PIERz	11/8/18 6:40	ND	2550	ND
PIERz	11/9/18 11:02	ND	875	ND
PIERz	2/20/2019 8:15	ND	NA	ND

mL = milliliter. ND = Not Detected. NA = Not Analyzed

Data courtesy of Orange County Health Care Agency, Public Health Laboratory.

Table E2-2. Surfzone Human and Canine Genetic Marker Testing Results from Orange County Health Care Agency for June 2016 to October 2016.

Site ID	Date	Time	Parameter	Result	Units	Method
PIERz	07/05/16	07:07	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	06/22/16	09:11	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	06/27/16	08:32	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	06/30/16	09:36	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	07/11/16	08:15	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	07/18/16	08:12	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	07/25/16	08:26	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	08/01/16	08:20	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	08/08/16	08:20	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	08/15/16	07:38	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	08/22/16	08:20	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	08/31/16	10:10	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	09/06/16	08:04	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	09/12/16	08:35	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	09/19/16	08:13	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	09/26/16	07:49	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	10/03/16	07:59	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	10/11/16	10:58	Canine Bacteroides (BacCan)	ND	DNA/100mL	qPCR
PIERz	07/05/16	07:07	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	06/22/16	09:11	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	06/27/16	08:32	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	06/30/16	09:36	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	07/11/16	08:15	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	07/18/16	08:12	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	07/25/16	08:26	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	08/01/16	08:20	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	08/08/16	08:20	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	08/15/16	07:38	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	08/22/16	08:20	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	08/31/16	10:10	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	09/06/16	08:04	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	09/12/16	08:35	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	09/19/16	08:13	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	09/26/16	07:49	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	10/03/16	07:59	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR
PIERz	10/11/16	10:58	Human Bacteroides (HF183)	ND	DNA/100mL	qPCR

mL = milliliter. ND = Not Detected

Data courtesy of Orange County Health Care Agency, Public Health Laboratory.

Table E2-3. Surfzone Avian Genetic Marker Testing Results from October 2018 to May 2019.

Avian- associated marker (AvianGFD)										
Site ID	Date Sampled	Sample Result[C]	Qualifier[D]	Sample Concentration[E]	Sample Stdev[F]	Units[G]	SLOD[H]	SLLOQ[H]	cpr	Inhibition Result[I]
PIERz	10/10/2018	BDL		467	207	copies/100mL	714	714	7	0
PIERz	10/23/2018	BDL		693	542	copies/100mL	714	714	10	0
PIERz	10/30/2018	BDL		421	243	copies/100mL	781	781	5	0
PIERz	11/6/2018	Detected, ROQ		1,015	187	copies/100mL	714	714	14	0
PIERz	11/14/2018	BDL		519	123	copies/100mL	714	714	7	0
PIERz	11/19/2018	Detected, ROQ		885	198	copies/100mL	714	714	12	0
PIERz	12/4/2018	BDL		478	280	copies/100mL	781	781	6	0
PIERz	12/11/2018	BDL		224	177	copies/100mL	714	714	3	0
PIERz	12/18/2018	BDL		152	120	copies/100mL	714	714	2	0
PIERz	12/20/2018	BDL		227	39	copies/100mL	714	714	3	0
PIERz	1/2/2019	BDL		266	215	copies/100mL	714	714	4	0
PIERz	1/8/2019	Detected, ROQ		1,915	982	copies/100mL	714	714	27	0
PIERz	1/23/2019	BDL		168	66	copies/100mL	714	714	2	0
PIERz	1/29/2019	Detected, ROQ		1,105	1,496	copies/100mL	714	714	15	0
PIERz	2/20/2019	Detected, ROQ		1,993	428	copies/100mL	714	714	28	0
PIERz	2/26/2019	Detected, ROQ		1,838	722	copies/100mL	714	714	26	0
Blank	3/18/2019	ND	<	13	0	copies/100mL	714	714	0	0
PIERz	3/26/2019	BDL		444	379	copies/100mL	714	714	6	0

Avian- associated marker (AvianGFD)										
Site ID	Date Sampled	Sample Result[C]	Qualifier[D]	Sample Concentration[E]	Sample Stdev[F]	Units[G]	SLOD[H]	SLLOQ[H]	cpr	Inhibition Result[I]
PIERz	4/2/2019	BDL		633	404	copies/100mL	714	714	9	0
PIERz	4/9/2019	BDL		107	18	copies/100mL	714	714	1	0
PIERz	4/16/2019	BDL		487	266	copies/100mL	714	714	7	0
PIERz	4/23/2019	BDL		343	193	copies/100mL	714	714	5	0
PIERz	4/30/2019	Detected, ROQ		7,230	834	copies/100mL	714	714	101	0
PIERz	5/7/2019	Detected, ROQ		820	178	copies/100mL	714	714	11	0
PIERz	5/14/2019	BDL		347	190	copies/100mL	714	714	5	0
PIERz	5/21/2019	BDL		628	478	copies/100mL	714	714	9	0

Abbreviations: Avg = Average; BDL = Below Detection Limit; cpr = copies per reaction; Cq = quantification (threshold) cycle; DNQ = Detectable But Not Quantifiable; FB = Field Blank; FW: Fresh Water; GW: Ground Water; L; SLT: Salt Water; SW: Storm Water; LOQ = Lower Limit of Quantification; LOD = Limit of Detection; n=number; N/A = Not Applicable; ND = Not Detected; NDsub = substitution value for nondetects; PCR = Polymerase chain reaction; rxs = reactions; StdDev = Standard Deviation; sub = substitution; TSC = Target Sequence Copies; ROQ = Range of Quantification; SLLOQ = Sample Specific Lower Limit of Quantification; SLOD = Sample Specific Limit of Detection.

Footnotes: [A]Sample Process Control (SPC), Sketa assay for salmon sperm. [B]Inhibition Control = assay used for 2 well spike with DNA dilution method. [C]Suggestion for conversion of sample result into categorical results: ROQ and DNQ = positive; ND = negative; BDL = equivocal (see explanation on Part B). [D]If shown: §Average computed for ND result by a) qPCR: substituting Cq with maximum number of cycles (Boehm et al., 2013) or b) ddPCR: substituting with 1 cpr. [E]Concentration = mean of at least 3 technical replicates. [F]Standard Deviation of at least 3 technical replicates. [G]For enterococci, results are given in Target Sequence Copies (TSC), as per EPA Method 1611 (standard concs in TSC/ul = copies/ul x 4). [H]SLOD and SLLOQ: sample specific detection and quantification limits calculated based on sample specific processing volumes see more information on Part B. [I]Inhibition: 0 = no inhibition observed, 1 = inhibition observed, but overcome in diluted sample, 2 = inhibition not overcome in diluted sample: The given concentration may be underestimated for positive samples, 3 = Dilution needed to overcome inhibition did not yield amplification. Given concentration may be underestimated. NT = not tested. See Part B for additional comments.

Data courtesy of City of San Clemente, Utilities Department and Orange County Public Works Department

Table E2-4. Human Genetic Marker Testing Results from San Clemente Pier Bacteria Source Characterization Study for June 2019 to July 2019.

Location	Sample ID	Sampling Week	Sampling Event	HF183 copies/100mL	Lachno3 copies/100mL	Enterococcus_1A copies/100mL	Percent Recovery
Surfzone	DW-1-2 PierZ-HT	Week 1	Event 2	BD	BD	BD	26%
	DW-1-2 PierZ-LT	Week 1	Event 2	BD	BD	176	35%
	DW-1-3 PierZ	Week 1	Event 3	BD	BD	296	41%
	DW-2-1 PierZ	Week 2	Event 1	BD	BLOQ	512	39%
	DW-2-2 S-PierZ-HT	Week 2	Event 2	BD	BD	68	44%
	DW-2-2 S-PierZ-LT	Week 2	Event 2	BD	BD	188	38%
	DW-3-1 PierZ	Week 3	Event 1	BLOQ	BD	36	42%
	DW-3-2 PierZ-HT	Week 3	Event 2	BD	BD	20	40%
	DW-3-2 PierZ-LT	Week 3	Event 2	BD	BD	136	38%
South Drain	DW-1-2 S-Drn-LT	Week 1	Event 2	224	148	1,940,000	39%
	DW-1-3 S-Drn	Week 1	Event 3	9,840	2,360	313,000	40%
	DW-2-1 S-Drn	Week 2	Event 1	BLOQ	BD	2,000	41%
	DW-2-2 S-Drn-HT	Week 2	Event 2	BD	BD	20,400	43%
	DW-3-1 S-Drn	Week 3	Event 1	BD	BD	10,000	43%
	DW-3-2 S-Drn-HT	Week 3	Event 2	BLOQ	BD	16,300	39%
	DW-3-3 S-Drn	Week 3	Event 3	BD	BLOQ	251,000	43%
North Drain	DW-1-2 N-Drn	Week 1	Event 2	BD	BD	1,680	38%
	DW-1-2 N-Drn-LT	Week 1	Event 2	BLOQ	BD	14,500	39%
	DW-1-3 N-Drn	Week 1	Event 3	BD	BD	69,200	44%
	DW-2-1 N-Drn	Week 2	Event 1	3,920,000	414,000	8,000	41%
	DW-2-2 N-Drn-HT	Week 2	Event 2	840	584	4,280	37%
	DW-3-1 N-Drn	Week 3	Event 1	19,000	BD	37,400	41%
	DW-3-2 N-Drn-HT	Week 3	Event 2	3,960	BD	71,600	45%
	DW-3-3 N-Drn	Week 3	Event 3	BD	BD	1,080	43%

BD = Below Detection Limit (not present), mL = milliliter

BLOQ = Below Limit of Quantification (present but not quantifiable)

Percent Recovery refers to the measurement of a marker (not listed) with a known concentration added to the study samples

Enterococcus_1A refers to the Polymerase Chain Reaction genetic marker for indicator bacteria *Enterococcus*