CITY OF LOS ANGELES
CALIFORNIA

BUREAU OF SANITATION

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December 19, 2013

Mr. Sam Unger, Executive Officer
Los Angeles Regional Water Quality Control Board
320 W. Fourth Street, Suite 200
Los Angeles, CA 90013

Attention: Mr. Ivar Ridgeway

Dear Mr. Unger:

RESPONSE TO THE REVIEW OF THE NOTIFICATION OF INTENT TO DEVELOP AN ENHANCED WATERSHED MANAGEMENT PROGRAM FOR THE DOMINGUEZ CHANNEL WATERSHED MANAGEMENT AREA GROUP

On behalf of the Dominguez Channel Watershed Management Area Group (Group), the City of Los Angeles, as lead agency for the Group, is clarifying and submitting additional information in response to the Board's letter of December 6, 2013 regarding the review of the Notice of Intent submitted by the Group on June 27, 2013. The Group acknowledges the Board's staff thorough review and anticipates the provided information will address the comments.

Responses to Regional Board staff comments are presented as attachments to this letter. If you wish to discuss the Group's NOI further, please give Alfredo Magallanes, of my staff, a call at (213) 485-3958.

Sincerely,

SHAHRAM KHARAGHANI, PhD, PE, BCEE
Program Manager

SK:DC:AM:am
WPDCR9091

Attachment

cc: Adel Hagekhalil, BOS Assistant Director
Alfredo Magallanes, BOS/WPD

ATTACHMENT 1

Comment No. 1
The final compliance date for the Los Angeles Harbor Bacteria TMDL passed on March 10, 2010. The Permittees need to identify the final water quality based effluent limitations (WQBELs) and the final receiving water limitations (RWL) for the Los Angeles Harbor Bacteria TMDL.

The water quality based effluent limitations (WQBEL) and the final receiving water limitations (RWL) for the Los Angeles Harbor Bacteria TMDL are shown below as identified in pages N-1 and N-2 of the Los Angeles MS4 Permit.

Table 1. WQBELs

Constituent	Effluent Limitations (MPN or cfu)	
	Daily Maximum	Geometric Mean
Total coliform*	10,000/100 mL	1,000/100 mL
Fecal coliform	400/100 mL	200/100 mL
Enterococcus	104/100 mL	35/100 mL

* Total coliform density shall not exceed a daily maximum of 1,000/100 mL, if the ratio of fecal-to-total coliform exceeds 0.1.

Table 2. Single-sample RWLs

Time Period	Receiving Water	Compliance Monitoring Location	Annual Allowable Exceedance Days of the Single Sample Objective (days)	
			Daily sampling	Weekly sampling
Summer Dry-Weather (April 1 to October 31)	Inner Cabrillo Beach	CB1 & CB2	0	0
	Main Ship Channel	HW07	0	0
Winter Dry-Weather (November 1 to March 31)	Inner Cabrillo Beach	CB1 & CB2	0	0
	Main Ship Channel	HW07	8	1
Wet Weather[2] (Year-round)	Inner Cabrillo Beach	CB1 & CB2	0	0
	Main Ship Channel	HW07	15	3

Table 3. Geometric Mean RWLs

Constituent	Geometric Mean
Total coliform	1,000 MPN/100 mL
Fecal coliform	200 MPN/100 mL
Enterococcus	35 MPN/100 mL

ATTACHMENT 2

Comment No. 2
The Permittees need to identify watershed control measures to be implemented by the City and County of Los Angeles to comply with the final WQBELs and RWL for the Los Angeles Harbor Bacteria TMDL.

The Los Angeles Harbor Bacteria TMDL is measured for compliance at three monitoring points (CB-01, CB-02, and HW-07). CB-01 and CB-02 are located at Inner Cabrillo Beach, while HW-07 is located in the main ship channel.

As stated in the City of Los Angeles letter of March 10, 2010 to the Regional Board (Attachment 2.1), the main ship channel has achieved compliance with the Los Angeles Harbor Bacteria TMDL meeting the WQBELs and RWLs at the HW-07 compliance point. It should be noted that the County of Los Angeles is listed as a responsible party for only this monitoring point, HW-07.

The City of Los Angeles continues to implement various actions and special studies to achieve compliance for CB-01 and CB-02. Provided below are summaries of actions that the City is moving forward, with more detailed information provided in the referenced Attachments.

The City of Los Angeles, for CB-01, submitted a Time Schedule Order Request (Attachment 2.2) to the Regional Board in December 2012 followed by an email transmittal from the City of Los Angeles Harbor Department providing more details for compliance actions at CB-01 (Attachment 2.3).

CB01 compliance strategies include:

- Human source and other source identification studies;
- Inventory of point source discharges near CB01;
- Implementation of non-structural BMPs;
- Implementation of simple structural BMPs;
- Construction of feasible storm drain modifications; and
- Submission of annual progress reports.

For monitoring location CB-02, the City of Los Angeles will continue actions documented in the Inner Cabrillo Beach ICB Work Plan submitted to the Regional Board in May 2012 (Attachment 2.4). The work plan also includes a summary of the Tier I through Tier III non-structural and structural BMPs that have already been implemented at Inner Cabrillo Beach. The focus of current efforts is a proposed Natural Source Exclusion study which is being conducted in consultation with Regional Board staff.

ATTACHMENT 3

Comment No. 3
The City of Los Angeles proposes to implement the Phase IV –Trash TMDL Implementation project. The City's proposed project will retrofit catch basins within the Machado Lake and Dominguez Channel Watersheds. The proposed project within the Machado Lake subwatershed does not meet the requirement of a structural BMP because the City of Los Angeles is required by the Machado Lake Trash TMDL to achieve an 80% reduction of trash by March 2015.

The City agrees with the Regional Board staff assessment that the catch basin retrofit work in the Machado Lake subwatershed does not meet the requirement of a structural BMP. It was not the intent of the City of Los Angeles to assert that the work in this subwatershed be included in the consideration of the structural BMP. Confusion may have arisen in that the City of Los Angeles provided a fact sheet, within the NOI, of the planned Phase IV – Trash TMDL Implementation Project that includes a much greater scope of work that the City is pursuing to meet Trash TMDL obligations.

The City of Los Angeles firmly believes that the Dominguez Channel Catch Basin Retrofit project will make a significant improvement in water quality in the Dominguez Channel by the prevention of trash discharges from the City's storm drain system. It should be noted that the Dominguez Channel Watershed is not under a Trash TMDL and the City's investment of approximately $1.5 million for the project will provide a significant improvement in the watershed/channel.

ATTACHMENT 4

Comment No. 4

The proposed project is expected to be completed by 2016. The project exceeds the 30-month deadline of June 28, 2015, to fully implement one structural BMP or a suite of BMPs. The City of Los Angeles needs to quantify the number of catch basin retrofits that will be completed within the Dominguez Channel Watershed by the June 28, 2015, deadline and the associated drainage area addressed by the retrofitted catch basins.

The table below shows the number of catch basins in the City of Los Angeles within the Dominguez Channel watershed, not including those in the Machado Lake watershed. The total number of catch basins includes those owned by the City, Los Angeles County Flood Control District, and State of California. It is the intent of the City of Los Angeles to retrofit all feasible catch basins with catch basin opening screen covers.

City of Los Angeles in the Dominguez Channel[1]

Drainage Area	16,469.33 acres	**Drainage Area per CB**
Catch Basins	3,151 total	5.23 acres/CB

Note:
1. Does not include the Machado Lake watershed area portion of the City of Los Angeles.
2. The drainage area does not include the water area of the City of Los Angeles Harbor Department.

City of Los Angeles Dominguez Channel Catch Basin Retrofit Status

Retrofits with CB Opening Screen Covers		
Completed	**Pending**	**Infeasible**
1,171	154	1,826

By June 28, 2015 the Dominguez Channel Catch Basin Retrofit project, by the City of Los Angeles will have installed 1,325 catch basin opening screen covers at an approximate cost of $1,587,600. The associated drainage area addressed by the retrofitted catch basin will be 6,929.75 acres (*1,325CB X 5.23 ac/CB = 6,929.75ac*) or 42% of the City of Los Angeles drainage area.

City of Los Angeles staff has field verified all 3,151 catch basins and has determined that 1,826 are infeasible to be retrofitted with a catch basin opening screen cover due to various causes as listed in the table below.

Itemization of Causes for CBs determined to be Infeasible for Retrofit

Cause	Number
Storm Drain Maintenance Hole	575
Hydraulic sump / low lying area	396
Junction / transition structure	328
Freeway	167
Grated catch basin	97
Low flow outlet / inlet catch basin or culvert	91
Restricted area (LAX or POLA)	66
Other (asset database error, field verify not to exist)	106
TOTAL	**1,826**

ATTACHMENT 2.1

HAND DELIVERED

CITY OF LOS ANGELES
CALIFORNIA

DEPARTMENT OF
PUBLIC WORKS
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March 10, 2010

Tracy Egoscue
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013

LOS ANGELES HARBOR (CABRILLO BEACH AND MAIN SHIP CHANNEL)
UPDATE ON BACTERIA TOTAL MAXIMUM DAILY LOAD (TMDL)

Dear Ms. Egoscue:

In regards to the Los Angeles Harbor Bacteria TMDL (Inner Cabrillo Beach and Main Ship Channel) compliance milestone of March 10, 2010, the City's Harbor Department, and Bureau of Sanitation, would like to provide the Regional Board with an update on the status of the City's efforts. Based on monitoring data collected at the Main Ship Channel (HW-07) and Cabrillo Beach (CB-01 and CB-02) sampling stations, we are pleased to report that compliance at the Main Ship Channel (HW-07) has been achieved. Unfortunately, despite all of the City's efforts, sampling stations CB-01 and CB-02 have yet to be brought into compliance.

To date, we have completed all but one of the Tier 2 measures: the bird exclusion system. Although the water quality has not improved with the implementation of the sand replacement and groin removal, it is anticipated that compliance could be achieved with the implementation of the bird exclusion system. The bird exclusion system will be installed prior to the end of June 2010. Therefore, the City is requesting a two-year time extension to conduct monitoring to assess the degree of water quality compliance. During that timeframe, the City will also continue working with the Regional Board to develop Tier 3 TMDL compliance alternatives should the remaining Tier 2 elements not bring the beach into compliance with the bacteria TMDL for the beach.

Status of Tier 1 and Tier 2 Measures

As previously reported, various Best Management Practices (BMPs) and Tier 1 actions were completed by March, 2006 (Attachment 1). With the exception of the bird exclusion system, all Tier 2 actions have also been implemented (Attachment 1). These measures have included major structural improvements such as a dry weather flow diversion that eliminated all dry weather landside contributions, sand replacement at the swimming beach both above and below the high tide line, and removal of the rock groin between the southern beach and the boat launch ramp area. The last remaining activity of the Tier 2 actions is the installation of a redesigned bird exclusion system which is scheduled to be completed by the end of June 2010. The unexpected delay is due to additional time required to execute the Project Cooperative Agreement (PCA) Amendment with the Corps of Engineers whose contractors are doing the work at Cabrillo Beach.

Tier 3 Measures Under Consideration

As required in the TMDL, the City has been evaluating potential Tier 3 actions to achieve full compliance at Cabrillo Beach should the Tier 2 actions not achieve compliance. One potential Tier 3 measure consists of the installation of a circulation system, which will require contouring of the swimming beach and removal of over 6 acres of existing eelgrass. Operation of this Tier 3 measure would require ongoing eelgrass removal in the near shore area to maintain the circulation system.

The City has undertaken planning and engineering efforts related to the circulation system option in parallel with the construction of the remaining Tier 2 structural measure. This has included engineering design, eelgrass mitigation plan development, initiation of CEQA review, and coordination with various resource and regulatory agencies.

As we have proceeded through this planning process, the City has also been investigating other Tier 3 options and would like to discuss the various options with the Regional Board. Specifically we would like to discuss the effectiveness and cost of the circulation system and the potential of implementing interim options such as Probiotics which has achieved some success at other locations. We understand a meeting to discuss these issues that was to take place Monday, March 8th has been rescheduled for March 18th.

Current status of monitoring and bacterial exceedances

Both CB-01 and CB-02 are monitored daily (5 days/week) for bacteria indicators in order to fulfill Terminal Island Treatment Plant's (TITP's) NPDES discharge permit. In 2005, monitoring results from TITP's NPDES permit began to be used to fulfill the monitoring requirements of the Los Angeles Harbor Bacteria TMDL. Historic (10 year)

records of bacterial monitoring at these locations have been evaluated and CB-01 and CB-02 have consistently exceeded the TMDL requirements in all seasons.

The tables below summarize the single sample exceedances for the summer dry and winter dry periods over the past five years.

Los Angeles Harbor Bacterial TMDL - Summer Dry

Summer Dry	Allowable exceedances	# of exceedances @		
		CB-01	CB-02	HW-07
April '05 – Oct '05	0	3	19	0
April '06 – Oct '06	0	17	28	0
April '07 – Oct '07	0	15	28	0
April '08 – Oct '08	0	13	59	0
April '09 – Oct '09	0	3	67	0

Los Angeles Harbor Bacterial TMDL - Winter Dry

Winter Dry	Allowable exceedances	# of exceedances @		
		CB-01	CB-02	HW-07*
Nov '05 – Mar '06	3	25	39	0
Nov '06 – Mar '07	3	14	51	0
Nov '07 – Mar '08	3	12	47	0
Nov '08 – Mar '09	3	12	47	0
Nov '09 – Mar '10[1]	3	6	29	0

* Allowable exceedances at HW-07 = 1
1. As of February 28, 2010

Over the past 7 years, the Harbor Department, working with the Bureau of Sanitation, has expended over $20 million and implemented numerous major improvements to resolve the bacteria problems at Cabrillo Beach. To date, these activities have not resolved the problem. As discussed above, the Harbor Department will complete implementation of planned Tier 2 remedial actions at the beach prior to the end of June 2010, and ongoing monitoring at CB-01 and CB-02 will continue after that time.

The City's Harbor Department and Bureau of Sanitation are committed to reducing bacteria loads at the Cabrillo beach. We would like to continue interaction with your staff to insure the successful implementation of the aforementioned activities and look forward to meeting with you on March 18, 2010 to discuss Tier 3 measures.

If you have any questions, please contact Dr. Ralph Appy at (310) 732-3497 or Dr. Shahram Kharaghani at (213) 485-0587.

Sincerely,

GERALDINE KNATZ, Ph.D.
Executive Director
Harbor Department
City of Los Angeles

ENRIQUE C. ZALDIVAR
Director
Bureau of Sanitation
City of Los Angeles

SK:RMV:DC:MS:WKT

Attachments

cc: L.B. Nye, California Regional Water Quality Control Board, Los Angeles Region
Samuel Unger, California Regional Water Quality Control Board, Los Angeles Region
Enrique C. Zaldivar, Director, City of Los Angeles, Bureau of Sanitation
Adel Hagekhalil, Assistant Director, City of Los Angeles, Bureau of Sanitation
Mark Pestrella, Assistant Deputy Director, Los Angeles County Department of Public Works
Geraldine Knatz, Executive Director, Port of Los Angeles
Antonio V. Gioiello, Chief Harbor Engineer, Port of Los Angeles
Jon K. Mukri, General Manager, City of Los Angeles, Department of Recreation and Parks
Councilmember Janice Hahn, City of Los Angeles, Council District 15
Nancy Sutley, City of Los Angeles, Mayor's Office
Michael Mullin, City of Los Angeles, Mayor's Office
Rafael Prieto, City of Los Angeles, Chief Legislative Analyst's Office
Emilio Rodriguez, City of Los Angeles, Office of the City Administrative Officer
Mark Tullai, City of Los Angeles, Office of the City Administrative Officer

Attachment 1
Los Angeles Harbor
Timeline of Activities

TIER I Implementation Activities (2004-2007)

Storm drain and sanitary sewer inspections and dye tests conducted. Other investigative work under the Inner Cabrillo Beach Water Quality Improvement Project continues.

June - July 2004

- Repaired the leaking sanitary sewer lateral from the Bath House and Lifeguard station.
- Plugged and abandoned the remaining sewer lines from the Fishing Pier.
- Removed the stormdrain that discharged under the sand and rebuilt the overflow structure (for large storms) at the southern end of the beach.
- Created a diversion structure in the storm water conveyance system in the parking lot (near the boat launch) to convey "first flush" and urban nuisance flows to the sanitary sewer and protect against sewer overflows from uphill urban areas of San Pedro.

March 10, 2005

- Effective date of the L.A. Harbor Bacteria TMDL.

September 2005

- Department of Recreation and Parks commence cleaning the beach 5 times per week.
- Designed additional educational signage to control behavior at Inner Cabrillo Beach in order to improve the local environment, protect wildlife, maintain a clean facility, and reduce potential primary and secondary sources of bacterial contamination.
- Manufactured 24 and installed 16 new educational and regulatory signs with the warnings of "Do Not Feed Birds", "Trash in Trash Cans" and "Trash Not on Ground".

November 2005

- Existing bird exclusion structure was restrung.

December 2005

- Reaffirmed, with maintenance staff, Sidewalk Washing BMP and restroom cleaning.
- Clarified with maintenance staff that Recreation and Parks has a procedure for removing excess trash during peak season to a central collection facility.

January 2006

- Trash can lids replaced. Rec and Parks conducts a thorough investigation on all trash cans located within the beach, parking lot, and surrounding areas to ensure all trash cans have lids in place.

March 2006

- In a letter from the City of Los Angeles to the Regional Board (John Bishop, Executive Officer), all Tier I activities were reported completed.

March 2007

- Regional Board and City Staff agree to accelerate implementation of a water circulation pilot project as part of the requirements by the City of Los Angeles's Collection System Settlement Agreement with the Los Angeles Regional Water Quality Control Board.

TIER II Implementation Activities (2006 - 2010)

March 2007

- Phase I of the sand replacement (above High tide line) started.

June 2007

- Phase I of the sand replacement completed. Old sewer outfall pipes removed.

September – December 2007

- As part of the water circulation pilot project, conducted by the Port of Los Angeles, a 2000 gpm pump was installed and additional sampling was conducted.

May 2009

- Phase II of the sand replacement completed.

August 2009

- Completion of circulation enhancement by removal of rock groin at boat launch ramp.

End of June 2010

- Replacement of bird exclusion device.

TIER III Implementation Activities (2010)

March 10, 2010

- Compliance deadline for Inner Cabrillo Beach and Main ship Channel.

Ongoing

- Monitoring Tier 2 effectiveness.

ATTACHMENT 2.2

CITY OF LOS ANGELES

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2012 DEC 24 AM 11:

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MAYOR

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December 24, 2012

Mr. Samuel Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Dear Mr. Unger:

LOS ANGELES HARBOR BACTERIA TMDL – INNER CABRILLO BEACH COMPLIANCE STATION CB 01 –REQUEST FOR TIME SCHEDULE ORDER

The City of Los Angeles Bureau of Sanitation and Harbor Department would like to thank you for the opportunity to continue to work with you and your staff on the challenging issues associated with indicator bacteria exceedances at Inner Cabrillo Beach in Los Angeles Harbor. The bacteria TMDL became effective on March 10, 2005 with a five year compliance timeline. The deadline passed in March 2010, and, although the City has continued efforts to improve conditions in the Inner Cabrillo Beach area, bacteria indicator exceedances continue above those allowed in the TMDL. This letter is submitted as a request for a Time Schedule Order (TSO) so that the City can continue its diligent efforts to comply with the Bacteria TMDL for the Inner Cabrillo Beach boat launch ramp (Station CB01).

WATER QUALITY MONITORING DATA

Indicator bacteria are sampled five days per week at Station CB01 (Tuesday-Saturday). Results from the most recent six years are summarized in Table 1.

Table 1. Annual number of bacteria indicator exceedance days at CB01 (2007- 2012)*

Year	Single samples Summer dry weather		Single samples Winter dry weather		Geometric mean Year round	
	Actual	Allowed	Actual	Allowed	Actual	Allowed
2007	15	0	9	8	84	0
2008	17	0	12	8	63	0
2009	3	0	10	8	31	0
2010	10	0	17	8	63	0
2011	19	0	18	8	59	0
2012	23	0	11	8	53**	0

* Consistent wet weather sampling began in October, 2010; thus far no single sample exceedances have been recorded
** Data included until December 7, 2012

IMPLEMENTATION EFFORTS FOR TMDL COMPLIANCE

The City has installed numerous structural BMPs, completed exhaustive surveys and hydrodynamic studies, and made several housekeeping improvements in the Inner Cabrillo Beach area since year 2000. These measures have satisfied the Tier 1, Tier 2, and Tier 3 requirements set forth in the TMDL. Storm drain and sewer lines potentially influencing the area of the beach were extensively surveyed in 2002-2004, with attention placed on identifying abandoned or unmapped lines that could be cross connected, leaking, or improperly plugged. Any potential problem lines were repaired, diverted, plugged, or removed, including two leaking sanitary sewer lines from the bathhouse and lifeguard station. This process was ground-truthed in 2007, when the beach sand from the high tide line inland to the sidewalk area was excavated (described below). The main storm drain line affecting the beach area was diverted to the sanitary sewer (capacity to handle dry weather flow and first flush) in 2004.

The storm drain work described above diverted most of the flow coming into the Inner Cabrillo Beach area. Any remaining lines in proximity to CB01 will be inventoried as part of the plan for this TSO (see below). The boat launch area is separated from any drainage lines by a spit of riprap and it is currently unclear whether storm drain discharges are affecting bacteria levels at CB01.

Beach area housekeeping practices, including trash removal, restroom maintenance, beach sand grooming, and sidewalk and parking lot maintenance were examined and operating procedures improved in the 2004-2006 time frame. Public signage was also installed in the picnic areas.

The sand on the entire beach was replaced in two phases between 2007 and 2010. The new sand was selected from quarry material based on superior grain size and drainage characteristics. The beach was re-contoured to eliminate ponding that had occurred after high tides.

Several extensive hydrodynamic studies and modeling exercises have been conducted in concert with the U.S. Army Corps of Engineers. At the same time, microbiological surveys and ribotyping were conducted to determine the extent of the bacteria problem and quantify sources in the Inner Cabrillo Beach area. These efforts have continued with the investigation of eligibility for a Natural Source Exclusion.

These comprehensive measures, while focused primarily on the public swimming beach, were expected to improve conditions in the boat launch area as well. Despite these efforts, CB01 continues to have exceedances in indicator bacteria at a frequency above that allowed in the TMDL. We will continue to work closely with the Los Angeles Regional Water Quality Control Board staff to implement solutions for the beach bacteria issues and thus request additional time to bring CB01 into compliance as outlined below.

COMPLIANCE STRATEGIES

In order to address the administrative process specific to Inner Cabrillo Beach CB01 compliance, the City requests that a TSO be developed. We request that the TSO incorporate the following measures (deadlines are listed in parenthesis):

- Continue to monitor CB01 for indicator bacteria on a 5-day per week basis (ongoing)
- Inventory point source discharges in proximity to CB01 (September 2013)
- Conduct studies to determine extent of impact of identified point source discharges on CB01 (December 2013)
- Add CB01 to human marker studies underway for main beach face (ongoing)
- Conduct source identification/source tracking studies (December 2013)
- Investigate and institute additional non-structural BMPs (December 2013)
- Assess feasibility of diversion of identified storm drains impacting CB01 (December 2014)
- Construct feasible storm drain modifications (December 2016)
- Submit progress reports (annually, beginning December 2013)

We will monitor the effectiveness of the measures above, and, if necessary, institute additional site-specific bacteria control measures as technology becomes available.

In the interim, the City proposes that the Regional Board considers adoption of interim limits for CB01 as presented in Table 2. The Regional Board has relied upon Appendix E of USEPA's Technical Support Document (1994) in the past as the guidance for the statistical derivation of interim limits where the monthly average limitation has been set at the 95th percentile and the daily maximum set at the 99th percentile. Additionally, this approach has been used by the

Regional Board to establish interim limitations in instances where final WLAs in TMDLs are past due. Thus, as proposed, the interim limits are set equal to the 99th and 95th percentiles of the single sample maximum and geometric mean exceedances, respectively as observed over 2007-2012 using the data presented in Table 1. At this point, based on limited available data (see footnote to Table 1.), we have no basis on which to request an interim wet weather limit.

Table 2. Requested Interim Limitations for CB01

	Single samples Summer Dry Weather [1]	Single samples Winter Dry Weather [2]	Geometric mean Year round [3]
Interim Limitation	23	18	80

1 – Interim limit based on the 99th percentile of observed single sample maximum exceedance days during summer dry weather over 2007-2012.
2 – Interim limit based on the 99th percentile of observed single sample maximum exceedance days during winter dry weather over 2007-2012.
3 – Interim limit based on the 95th percentile of observed geometric mean exceedance days during dry weather over 2007-2012.

We will complete the program and anticipate that CB01 will come into compliance before December 2017. The City of Los Angeles is committed to resolving the Bacteria TMDL at Cabrillo Beach. We would like to continue interaction with your staff to insure the successful implementation of the aforementioned activities. We look forward to discussing the elements of the TSO with you at your convenience. If you have any questions, please contact us.

Sincerely,

SHAHRAM KHARAGHANI, Ph.D., P.E., BCEE
Program Manager
Bureau of Sanitation

CHRISTOPHER CANNON
Director, Environmental Management Division
Harbor Department

SK:CP:la
WPDCR9002

cc: Renee Purdy, California Regional Water Quality Control Board, Los Angeles Region
Ivar Ridgeway, California Regional Water Quality Control Board, Los Angeles Region
LB. Nye, California Regional Water Quality Control Board, Los Angeles Region
Traci Minamide, Chief Operating Officer, City of Los Angeles, Bureau of Sanitation
Adel Hagekhalil, Assistant Director, City of Los Angeles, Bureau of Sanitation
Robert Vega, Assistant Division Manager, City of Los Angeles, Bureau of Sanitation
Antonio V. Gioiello, Chief Harbor Engineer, Port of Los Angeles
Jon K. Mukri, General Manager, City of Los Angeles, Department of Recreation and Parks
Mike Christensen, Deputy Director of Development, Port of Los Angeles

ATTACHMENT 2.3

---------- Forwarded message ----------
From: **Jirik, Andrew** <AJirik@portla.org>
Date: Thu, Feb 14, 2013 at 4:39 PM
Subject: TSO for ICB station CB01--additional information
To: "Christmann, Rebecca@Waterboards" <Rebecca.Christmann@waterboards.ca.gov>
Cc: "Ridgeway, Ivar@Waterboards" <Ivar.Ridgeway@waterboards.ca.gov>, "Purdy, Renee@Waterboards" <Renee.Purdy@waterboards.ca.gov>, "donna.chen@lacity.org" <donna.chen@lacity.org>, "McPherson, Rachel" <RMcPherson@portla.org>, "hubertus.cox@lacity.org" <hubertus.cox@lacity.org>, Zora Baharians <zora.baharians@lacity.org>, Robert Vega <robert.vega@lacity.org>, "Kharaghani, Shahram" <shahram.kharaghani@lacity.org>, "Patton, Christopher" <CPatton@portla.org>, Michael Scaduto <michael.scaduto@lacity.org>, "Curtis, Kathryn" <KCurtis@portla.org>

Hello Rebecca-
Attached please find additional information regarding the City's TSO request for Inner Cabrillo Beach station CB01. We have added some detail to the compliance strategy and provided a map of the area. Also attached are proposed interim limits and a summary of the methodology used to generate them. Please let us know if you have any questions.

Thanks.

Andrew

CB01 Compliance Strategies (deadlines in parenthesis)

- Continue to monitor CB01 for indicator bacteria on a 5-day per week basis (ongoing for duration of project)

- Add CB01 sampling to human marker studies underway for main beach face (ongoing during planned NSE-related surveys)
    - Samples for molecular analysis will be analyzed for presence of the human-specific *Bacteroides* by real-time PCR using the HF183 Taqman assay.

- Conduct source identification/source tracking studies and related studies to determine extent of impact of point source discharges and Cabrillo Salt Marsh on CB01 (Phase I by December 31, 2013)
    - Submit CB01 Work Plan Version 1.0 for Regional Board review (June 30, 2013)
    - Conduct bacteria sampling at nearby storm drain outlets
        - Baseline/Preliminary water sampling
        - Sanitary surveys at storm drains with potential impact, per work plan
    - Conduct bacteria sampling in Cabrillo Salt Marsh
        - Baseline/Preliminary water sampling
        - Dry weather surveys of FIB and qPCR (human and bird markers), in water column and in sediment, per work plan
    - Conduct local water circulation assessment to determine influence of Cabrillo Salt Marsh on boat launch area (Rhodamine dye tracer study)
    - Monitor flow at targeted storm drains
    - Design and implement Phase II study as warranted by results of Phase I (December 31, 2014)

- Inventory point source discharges in proximity to CB01 per CB01 Work Plan (September 30, 2013)
    - Trace lines and verify drainage areas and jurisdictions for remaining storm drain in ICB parking lot
    - Trace lines and verify drainage areas and jurisdictions for storm drains discharging into Cabrillo Salt Marsh

- Conduct activity assessments (December 31, 2013) --repeat during high use summer season (July 31, 2014)
    - Boater activity (boat washing, bait tank draining, fish cleaning, ice chest dumping, trash disposal, etc.)
    - Other human activity (trash generation, use of trash cans, pet waste, animal feeding, other activities that may impact indicator bacteria concentrations)
    - Feral animal activity (nesting, scat deposit patterns, etc.)

- Investigate and institute additional non-structural BMPs (July 31, 2014)
    - Verify housekeeping procedures are in place to limit animal waste in parking lot
    - Verify trash can lids are appropriate to exclude animals; correct as necessary

    - Assess need for additional signage (e.g. bird feeding, cat/raccoon feeding, "boat BMPs"); install signage as needed
    - Develop and distribute educational materials based on findings of activity assessments
    - Institute debris/animal waste removal procedures in parking lot storm drain line
    - Repair any breaches in Cabrillo Salt Marsh fence
    - Assess function/drainage of boat wash facility; correct/repair as necessary

- Investigate and institute simple structural BMPs (July 31, 2014)
    - Determine feasibility of storm drain catch basin inserts in ICB parking lot drain (e.g. debris excluders, anti-bacteria media filters); install if feasible
    - Determine feasibility of animal excluding devices in ICB parking lot drain (e.g. end of pipe "flip-up" grate); install if feasible

- Assess effectiveness of non-structural and simple structure BMPs (December 31, 2014)

- Assess feasibility of diversion of identified storm drains impacting CB01 (December 31, 2014)
    - Conduct engineering survey of current storm drain routes, elevations and design size
    - Conduct engineering survey of nearby sewer systems and their elevations and design capacity
    - Determine feasibility of low-flow diversion connections to sewer lines

- Construct feasible storm drain modifications (December 31, 2016)

- Submit progress reports (annually, beginning December 2013)

References for scientific work conducted to date related to CB01:

Attached are the formal report titles for the CB01 studies completed to date.

- City of Los Angeles, 2010. Los Angeles Harbor Bacteria TMDL Northern Cabrillo Beach Special Studies Task 1 – Shoreline Monitoring Data Evaluation, Task 2 – Storm Drain Investigation, Prepared from the Los Angeles Regional Water Quality Control Board. March 2010.

- Kinnetic Laboratories Incorporated, 2006. Inner Cabrillo Beach Water Quality Improvement Project Source Identifications and Mitigation Alternatives, Volume I

Summary Report. Prepared for the Port of Los Angeles Engineering Division. January, 2006.

The Details of the Historic Cabrillo Marsh study are in:

- Kinnetic Laboratories Incorporated, 2006. Inner Cabrillo Beach Water Quality Improvement Project Source Identification and Mitigation Alternatives, Appendix C Inshore Circulation and Hydrodynamic Results, Inner Cabrillo Beach. Prepared for the Port of Los Angeles Engineering Division. January 2006.

The Details of the Historic MS4 surveys are in:

- Kinnetic Laboratories Incorporated, 2006. Inner Cabrillo Beach Water Quality Improvement Project Source Identification and Mitigation Alternatives, Appendix D Local Sources of Bacterial Contamination and Inner Cabrillo Beach. Prepared for the Port of Los Angeles Engineering Division. January 2006.

- Kinnetic Laboratories Incorporated and AECOM, 2010. Monitoring Effects of Beach Sand Replenishment and Groin Removal, Inner Cabrillo Beach Water Quality Improvement Project, Draft Final Report. Prepared for the Port of Los Angles Engineering Division. March, 2010.

APPROACH TO INTERIM LIMITS CALCULATIONS

The following is a description of the approach used to calculate interim limits for bacteria TMDLs based on exceedance days. The approach to interim limits calculations was based on the following formula:

> *Interim Exceedance Days* = Percentile[*Historic % Exceedance*] x [*Number of Days in a Critical Year*],
>
> where Percentile can be incrementally decreased for phased implementation (e.g., from 99th percentile to 85th percentile to 75th percentile).

The resulting numbers of exceedance days are based on daily sampling; the values would be scaled proportionately if the CMP performs weekly sampling (or other frequency).

Calculating Percentile[*Historic % Exceedance]*:

The *Historic % Exceedance* was calculated using data collected during the TMDL Coordinated Monitoring Plans. For most TMDLs, relatively few years of data are available (10 years or less). As such, if *Historic % Exceedance* was calculated based on discrete calendar year or seasonal exceedance rates, then relatively few data points would be available to calculate percentiles. As such, a rolling calculation was used to step through the dataset and calculate exceedance rates over multiple intervals, greatly increasing the number of data points to use for percentile calculations. The rolling approach also captures varying wet and dry periods, thereby representing future periods could be exceptionally wet or dry.

The duration of the rolling calculation was based on whether the exceedance type is expressed seasonally (winter dry weather and summer dry weather) or annually (wet weather and geometric mean), as follows:

- **Interim limits for wet weather and geometric mean exceedance days:** a calculation duration of 365-days was applied. Each time a sample was collected, the exceedance rate was calculated for the previous 365-days (starting on the 365th day in the record). For wet weather, the single sample WQO exceedance rate was calculated. For the geometric mean, the geometric mean WQO exceedance rate was calculated. If any of the applicable indicators (total coliform, fecal coliform, enterococcus, or the total-to-fecal ratio) was exceeded in a given sample, that sample was counted as one exceedance.

- **Interim limits for summer dry weather and winter dry weather:** a calculation duration of 42-days was applied. Each time a sample was collected, the single sample WQO exceedance rate was calculated for the previous 42-days (starting on the 42nd day in each season). If any of the applicable indicators (total coliform, fecal coliform, enterococcus, or the total-to-fecal ratio) was exceeded in a given sample, that sample was counted as one exceedance.

    - For summer dry and winter dry calculation, a duration of less than 5 months was needed. Potential options for the duration included 30, 42, or 60 days. For example, a

duration of 90 days was considered too long because calculations would essentially be limited to the last two months of the winter dry season (calculations don't start until the 4th month and the season is five months long).

- A duration of 42-days was selected because it corresponds to the duration of the geometric mean calculation and thus has relevance to the applicable WQOs for the bacteria TMDLs. This duration is also sufficiently short to allow the calculation to be performed over the course of the whole season.

The percentiles were calculated based on all the exceedance rates calculated in the CMP dataset (i.e., the exceedance rates calculated with the rolling calculation were ranked from highest to lowest and percentiles were determined).

Calculating [*Number of Days in a Critical Year*]:

The numbers of days in a critical year were pre-determined by the bacteria TMDLs, as follows:

- Wet days: 75 days
- Winter dry days: 122 days
- Summer dry days: 168 days

The geometric mean WQO applies to all days and thus 365 days was used to calculate the interim limits for geometric mean exceedances.

Table 1. Summer Dry Weather: Percentile Exceedance Rates and Exceedance Days

Percentile	CB01	
	% Exc.	Exc. Days
Max	35.7%	60
99th	30.8%	52
95th	23.3%	40
90th	20.0%	34
85th	17.4%	30
80th	16.7%	28
75th	14.3%	24
50th	7.1%	12
25th	3.3%	6
Min	0.0%	0

Table 2.Winter Dry Weather: Percentile Exceedance Rates and Exceedance Days

Percentile	CB01	
	% Exc.	Exc. Days
Max	61.1%	75
99th	52.2%	64
95th	46.3%	57
90th	36.7%	45
85th	32.0%	40
80th	29.0%	36
75th	26.7%	33
50th	18.8%	23
25th	8.7%	11
Min	0.0%	0

Table 3.Wet Weather: Percentile Exceedance Rates and Exceedance Days

Percentile	CB01	
	% Exc.	Exc. Days
Max	67.6%	51
99th	66.7%	50
95th	61.8%	47
90th	60.0%	45
85th	57.7%	44
80th	55.0%	42
75th	51.5%	39
50th	41.9%	32
25th	36.4%	28
Min	20.0%	15

Table 4.Geometric Mean: Percentile Exceedance Rates and Exceedance Days

Percentile	CB01	
	% Exc.	Exc. Days
Max	48.1%	176
99th	47.3%	173
95th	44.2%	162
90th	40.4%	148
85th	36.5%	134
80th	36.5%	134
75th	34.6%	127
50th	26.9%	99
25th	17.3%	64
Min	1.9%	8


Legend
City of Los Angeles Monitoring Site
Storm Drain Lines*
*Storm Drain data from Port of LA and LACDPW
Imagery from ESRI Basemap: Bing Maps Hybrid
Fort MacArthur Military Reservation
Officers Rd
W 28th St
Arthur MacArthur Rd
W 29th St
Via Cabrillo Marina
Whalers Walk
SD04
W 31st St
Shoshonean Rd
W 31st Ct
SD03-N
SD03-W
W 33rd St
SD02
CB01
SD01
W 35th St
Inner Cabrillo Beach
CB02
Stephen M White Dr
Bluff Pl
Outer Cabrillo Beach
N
W
E
S
0
400
800
Feet

ATTACHMENT 2.4

Los Angeles Harbor Inner Cabrillo Beach TMDL Implementation and Natural Source Exclusion Work Plan

Work Plan Version 2.0

Prepared For:

Port of Los Angeles
Environmental Management Division

May 30, 2012

WESTON SOLUTIONS

Los Angeles Harbor
Inner Cabrillo Beach
TMDL Implementation and
Natural Source Exclusion Work Plan

Work Plan
Version 2.0

Prepared For:

Port of Los Angeles
Environmental Management Division

Prepared By:

Weston Solutions, Inc.
2433 Impala Drive
Carlsbad, California 92010

May 30, 2012

RECORD OF CHANGES TO THE WORK PLAN

This work plan will be updated periodically during 2012/2013 according to the Schedule presented in Section 6.0. A summary of comments and document revisions is provided below.

Section No.	Table/ Figure	Page	Comment/ Change Made to the Document	Commenter
May 21, 2012				
-	-	-	Technical Edit of entire document. Made terminology consistent throughout document.	-
3.2.3	-	-	Revised language referring to macro- and micro-circulation systems for consistency.	-
4.2	-	-	Revised pump & barge design based on field reconnaissance efforts from 2012 Micro-Circulation Mass Balance Pilot Study.	-
May 26, 2012				
App. A	-	-	2009 study results for Enterococcus speciation, qPCR analysis (human, gull, and universal Bacteroidales), eel grass studies, and sand reservoir studies incorporated into Record after Weston was provided report by Kinnetic Laboratories, Inc. (Kinnetic).	Pat Kinney, Kinnetic
5.2.1	Figure 7	-	Updated maps and data related to the 2009 qPCR studies.	Pat Kinney, Kinnetic

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APPENDICES

Appendix A – Administrative Record of ICB Tier I, Tier II and Tier III Management Activities
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Appendix C – Workshop PPT on NSE
Appendix D – Literature Review

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LIST OF ACRONYMS

BMP	Best Management Practice
BOS	Bureau of Sanitation
cm/s	centimeter per second (unit)
CFR	Code of Federal Regulations
CMA	Cabrillo Marine Aquarium
FIB	Fecal Indicator Bacteria
ft	feet (unit)
gpm	gallons per minute (unit)
ICB	Inner Cabrillo Beach
LARWQCB	Los Angeles Regional Water Quality Control Board
MLLW	Mean Lower Low Water
NSE	Natural Source Exclusion
POLA	Port of Los Angeles
QCA	Quality Control Assessment
QMRA	Quantitative Microbial Risk Assessment
qPCR	Quantitative Polymerase Chain Reaction
SCCWRP	South California Coastal Water Research Project
SIPP	Source Identification Pilot Project
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
WESTON®	Weston Solutions, Inc.

1.0 INTRODUCTION

Beginning with initial efforts in early 2000, the Port of Los Angeles (POLA) and other City of Los Angeles (City) Departments have worked to meet the water quality objectives for recreational water beneficial uses at Inner Cabrillo Beach (ICB) and to understand the factors affecting fecal indicator bacteria (FIB) concentrations at the ICB compliance point CB02. Subsequently and throughout the past 12 years, the City and POLA have implemented corrective measures to reduce sources of FIB according to the *Los Angeles Harbor Bacteria Total Maximum Daily Load – Inner Cabrillo Beach and Main Ship Channel Implementation Plan*, (bacteria TMDL), which was adopted in 2005.

The City and POLA are committed to protecting public health and improving water quality conditions at ICB, as demonstrated by the breadth and scope of Tier I and Tier II projects implemented to date and the dedication to implementing Tier III measures, including an expanded bird exclusion structure (construction in fall 2012), two pilot micro-circulation studies (May 2012 and summer 2012), and design and construction of a practicable circulation system (by 2013).

POLA believes the structural measures planned for 2012 and 2013 represent the technically feasible limitation of Tier III activities for anthropogenic sources of FIB. Based on bacterial monitoring conducted by the City as part of the bacteria TMDL, the open waters of Los Angeles Harbor (harbor) rarely exceed FIB standards and the FIB exceedances at ICB seem to be localized to areas just offshore. It is believed that natural ecological conditions or natural sources are the source of elevated levels of FIB. In the event that FIB results remain elevated after all of the planned Tier III measures have been implemented, POLA has made a request to the Los Angeles Regional Water Quality Control Board (LARWQCB) to develop a process to establish natural source exclusion (NSE) eligibility at ICB as presented in this work plan. This process will be used to develop a transparent, scientifically sound methodology and does not predetermine the final NSE decision.

This work plan document serves as an abbreviated administrative record of activities implemented under the current bacteria TMDL at ICB and a work plan for future activities that will also define natural sources of FIB. Defining nonhuman natural sources of bacteria is intended to provide evidence of eligibility for NSE under the LARWQCB Basin Plan amendment (LARWQCB, 2002) while maintaining a commitment to protecting public health.

This work plan is organized into five major sections:

Section 1 – Introduction and general location information
Section 2 – ICB Existing Conditions
Section 3 – Bacteria TMDL Implementation Project Summary
Section 4 – Bacteria TMDL Tier III Implementation Plan
Section 5 – Natural Source Exclusion Work Plan

1.1 General Vicinity, Port and Cabrillo Beach Recreational Complex

ICB is located in the State of California, County of Los Angeles, City of Los Angeles, Port of Los Angeles Harbor Complex at the southwestern corner just inside the breakwater (Figure 1). Since the early 1900s, ICB has served as a recreational swimming area and destination. Today, the now historical Bathhouse comprises administrative offices, conference rooms, and recreational rooms. The Cabrillo Marine Aquarium (CMA), instituted in the Bathhouse in the 1930s as an established collection of marine species, was moved to its current location in 1949. The ICB complex also includes lifeguard towers; a small recreational boat launch; a private youth facility; a small tidally influenced wetland; and parking for vehicles, boat trailers, and tour and school buses (see Figure 2).

Figure 1. Inner Cabrillo Beach Vicinity Map

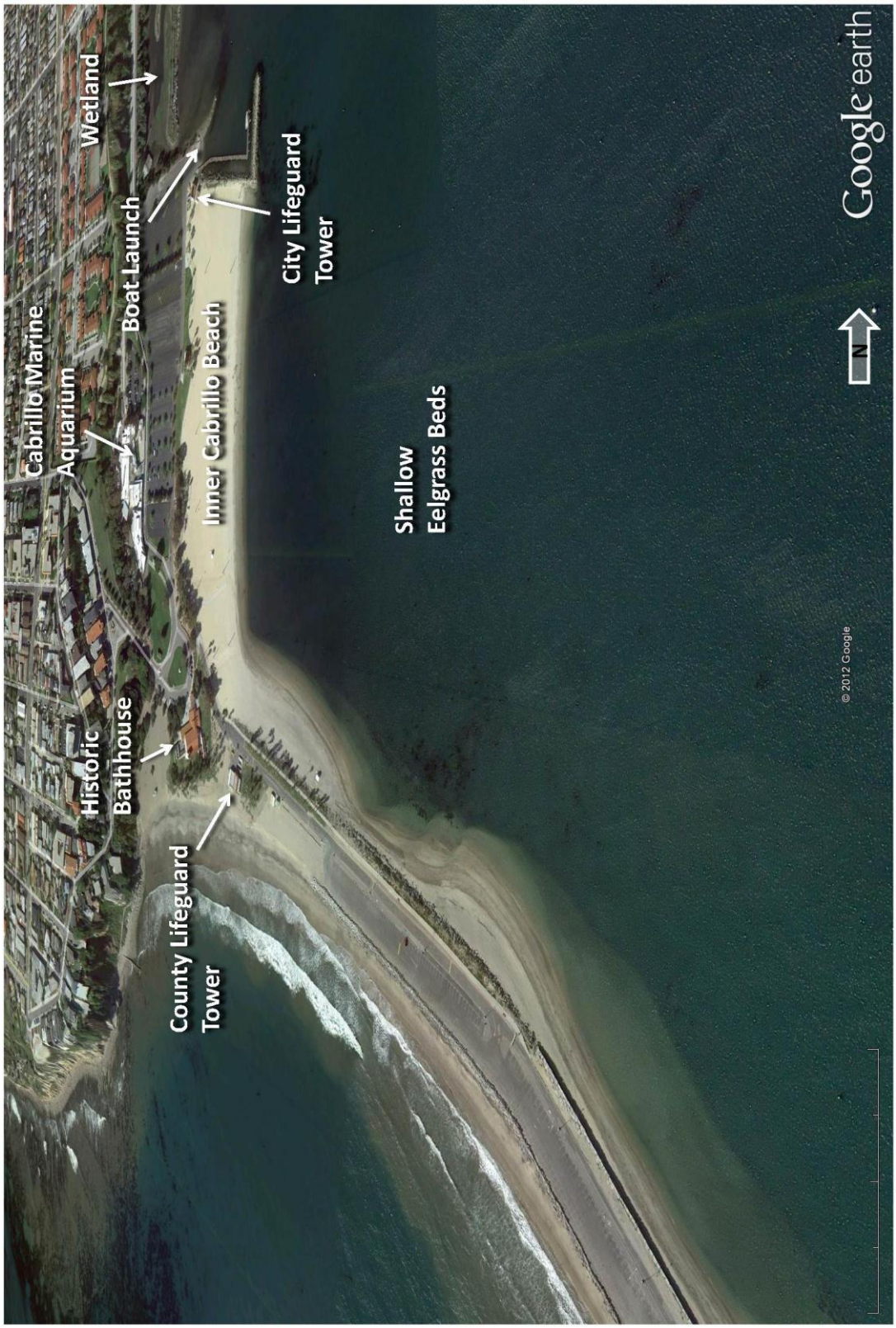

Figure 2. Inner Cabrillo Beach Detail Map

2.0 EXISTING CONDITIONS INNER CABRILLO BEACH RESOURCES AND USES

The Cabrillo Beach Recreational Complex, which covers 370 acres (150 hectares), is located in the POLA West Channel and is managed by the City.

Inner Cabrillo Beach
ICB is the only recreational beach within a west coast / southern California major industrial port complex. A long sloping shoreline provides for calm waters and a shallow swimming area.

Dense eelgrass beds are present in the ICB swimming area, and the protected environment of the beach provides a place for birds to roost, forage, and rest.

Because of the shallow slope of the beach, the tidal range of the spring tides (extreme tides of the tidal cycle) can cover a large area (over 150 linear feet between high and low tides) as shown in Figure 3. Additionally, wind driven circulation effects influence water movement during most days as a result of prevailing winds out of the southwest at approximately 10 to 20 knots.

Figure 3. Large Tidal Fluctuations Observed at Inner Cabrillo Beach

ICB is managed by several City Departments and Divisions. POLA manages the harbor complex and its uses. The Bureau of Sanitation manages and administers a stormwater management program for City compliance with TMDLs (including the bacteria TMDL for ICB) and municipal stormwater permits issued by the LARWQCB. It also conducts monitoring of receiving waters. The Department of Recreation and Parks manages City facilities, including the ICB recreation center and many of the facilities at ICB.

3.0 BACTERIA TMDL IMPLEMENTATION PROJECT SUMMARY

3.1 Legislative Framework (including reopener)

LARWQCB establishes beneficial uses and water quality standards for all waters within its jurisdiction, including ICB, and administers and enforces its Basin Plan. The beneficial uses identified in the Basin Plan for ICB include those listed in Table 1.

Table 1. LARWQCB Basin Plan Designated Beneficial Uses for Inner Cabrillo Beach

Basin Plan Beneficial Use Category	NAV	REC1	REC2	COMM	MAR	WILD	RARE	SPWN	SHELL
Basin Plan Beneficial Use Designation	E	E	E	E	E	E	E	P	E

E - Existing Beneficial Use
P - Potential Beneficial Use

ICB is currently on the State Water Resources Control Board (SWRCB) Clean Water Act Section (§) 303d list for Beach Closures for Coliform Bacteria. The §303d list uses the term beach "closures"; however, the appropriate term would be beach "posting." When the FIB, primarily *Enterococcus*, exceeds the REC1 standard and there is no known source of sanitary sewer spills or sanitary sewage release from vessels, the beach is posted to warn bathers that there may be an increased risk for illness. As a result of the §303d listing for Beach Closures at ICB, LARWQCB developed the bacteria TMDL, effective March 10, 2005, that required tiered implementation over a 5-year time period and included several required special studies. A recommendation to reconsider the bacteria TMDL was presented in the ICB bacteria TMDL. The reconsideration of the bacteria TMDL was scheduled for 2009, 4 years after adoption of the bacteria TMDL, or during reconsideration of the Santa Monica Beach Bacteria TMDL. The draft bacteria TMDL reopener was initiated on March 23, 2012 with LARWQCB issuance of a draft staff report, Basin Plan amendment, and resolution.

The following Basin Plan amendment provided the administrative process for NSE work plans, Existing Regulation (LARWQCB – 2002 Basin Plan Amendment), (Attachment A to Resolution No. 2002-022, pg. 1) (adopted as part of the Santa Monica Bay Beaches TMDL):

> Under the natural sources exclusion implementation procedure, *after all anthropogenic sources of bacteria have been controlled* such that they do not cause or contribute to an exceedance of the single sample objectives and *natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The 'natural sources exclusion' approach may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body.* These approaches are consistent with the State Antidegradation Policy (State Board

Resolution No. 68-16) and with federal antidegradation requirements (40 Code of Federal Regulations [CFR] 131.12).

3.2 Bacteria TMDL Implementation Plan and Timeline

The implementation strategies were organized into three tiers, some of which included special studies to assess FIB sources, circulation, and surveys. Tier I activities were designated as immediate remedial actions and best management practices (BMPs). Tier II activities included further study, additional BMPs and some structural controls. Tier III activities are discussed in Section 4.0. The following sections highlight the accomplishments under the bacteria TMDL implementation plan, showcase the breadth of activities conducted to identify and abate sources of FIB, and describe the variable and dynamic factors at ICB that affect FIB concentrations.

An inventory of management activities implemented at ICB for bacteria TMDL preparation and implementation is provided in a tabular format as Appendix A.

3.2.1 Tier I Activities – Immediate Remedial Actions and Best Management Practices

Under the bacteria TMDL implementation plan, several immediate Tier I remedial actions and BMPs were employed at ICB to reduce potential sources of FIB as shown below.

Description	**Date Accomplished**
Storm Drain Low Flow Diversion	July 2004
Remove Sanitary Sewer Outfall	July 2004
Gravity Sewer Repair	July 2004
Sand Cleaning	Sept. 2005
Additional Trash Pick Up	Sept. 2005
Redesign Bird Exclusion Structure	Nov. 2005
Educational Signage	Dec. 2005
Tier I Report Complete	Mar. 2006

3.2.2 Tier II Activities – Structural Improvements and Best Management Practices

In accordance with the Work Plan of Tier II BMPs, the following list of activities was implemented to reduce sources and transportation of FIB to ICB. These activities were conducted between 2007 and the present.

Activity Description	**Date Accomplished**
Replace Beach Sand and Beach Re-contouring (Phase I)*	June 2007
Beach Management Plan	Nov. 2008
Replace Beach Sand and Beach Re-contouring (Phase II)*	June 2009
Circulation Enhancement – Remove Rock Groin	Aug. 2009
Permanent Bird Exclusion Structure (Phase I)*	July 2010
Bird Dropping Removal Pilot Program	2011
Permanent Bird Exclusion Structure (Phase II)*	Planned – fall 2012

These activities are Tier II BMPs; however, they were implemented in steps (phases).

3.2.2.1 Bird Dropping Removal Pilot Program

Based on past investigations that identified daily roosting of local avian species on the beach as a significant source of FIB, the City Department of Recreation and Parks implemented an aggressive daily bird dropping removal program targeted at birds observed foraging along the intertidal zone. During winter 2010/2011, a City staff person removed bird droppings from the ICB shoreline using a hand-held scooping device. The device was designed to remove both the dropping and the surrounding (potentially contaminated) sand to ensure adequate source control to prevent direct inoculation and re-growth. At the same time, regular and ongoing compliance monitoring was conducted at the CB02 compliance monitoring location in accordance with the bacteria TMDL requirements. The FIB monitoring results before, during, and after implementation of the hand removal activities show no change in FIB results, frequency of exceedance, or improved water quality directly associated with this activity. The program was discontinued after the 2011 pilot program was completed.

3.2.2.2 Existing Bird Exclusion Structure (Phase I)

A pilot bird exclusion structure was constructed on a small footprint at the southern end of ICB in 2000. This action was based on the results of investigations that identified daily roosting of local avian species on the upper beach sand area as a significant source of bird fecal matter. An effectiveness assessment indicated that birds were deterred by the structure, resulting in a reduction of FIB exceedances in the receiving water (Dalkey and Bahariance, 2003). The temporary pilot structure was re-strung in September 2005 and replaced with the Phase I permanent bird exclusion structure in July 2010. The Phase I structure covers approximately two-thirds of the sandy portion of ICB from the upper beach to the high tide line at +7 feet (ft) mean lower low water (MLLW). Expansion of the bird exclusion structure is planned in 2012 and is discussed in Section 4.1.

3.2.3 Tier III Activities – Circulation System

The implementation section of the bacteria TMDL states that a near shore circulation system will be developed if Tier I and Tier II activities do not reduce FIB concentrations to below water quality objectives. Prior to design and implementation of a practicable near shore circulation system, potential factors impacting the efficiency and effectiveness of this type of system have been evaluated to establish design criteria. Supporting field work is scheduled for May 2012 and summer 2012.

3.2.3.1 Macro-Circulation – Models and Pilot Study

Kinnetic Laboratories, Inc (Kinnetic) and the POLA (POLA, 2006a) studied the potential effect of macro-circulation and potential water quality improvement on ICB using the following two-pronged approach:

- Three-dimensional hydrodynamic modeling to size/locate a practicable circulation system.
- Pilot study of a 20,000-gallon per minute (gpm) macro-circulation system.

The modeling exercise evaluated three circulation rates. A micro-circulation system, defined by Kinnetic as having an output of 500 to 800 gpm, a medium sized macro-circulation system (10,000 gpm), and a large macro-circulation system (30,000 gpm) were modeled under varying wind and tidal circumstances. The models indicated that a medium macro-circulation system could impact water flow at CB02. Kinnetic recommended conducting a pilot study for a slightly larger flow output. A 20,000 gpm macro-circulation system was tested in the waters outside the swim-buoy line, at the southern end of the beach from August 3 - 5, 2005. This pilot study used a combination of FIB monitoring, dye injections, current data, fluorescence and turbidity meters, and aerial photography to assess the effectiveness of the proposed macro-circulation system. Results of the modeling exercise and pilot study (i.e., increased flow velocities along the beach face from 2.5 centimeter per second [cm/s] to 10 cm/s and increased vertical mixing) suggested that circulation in the near shore area of the ICB could be augmented using a circulation system.

The results from a pilot study conducted from September to December 2007, evaluating a 2,000-gpm macro-circulation system installed on a barge located off shore from ICB, were inconclusive.

3.2.3.2 Micro-Circulation – Pilot Studies

In 2008, a micro-circulation/treatment system called Jet Streamer® was piloted at shoreline locations at nearby Machado Lake (WESTON, 2008). The pilot study found that FIB results decreased when the system was operational, but FIB concentrations remained several times greater than the water quality objective. This micro-circulation system was determined to be ineffective.

In summer and fall 2011, a micro-circulation pilot study was implemented to expand on a similar effort conducted by the LARWQCB and Weston Solutions, Inc. (WESTON®) in 2004. Micro-circulation was introduced and concentrations of FIB were measured to determine the effect at CB02. The results presented by WESTON (2012) were based on the following study designs:

- Study 1 – Micro-circulation through use of a 4-inch trash pump operated for approximately 1 hour, replicating the 2004 study, with enhanced monitoring.
- Study 2 – Micro-circulation through use of a 4-inch trash pump operated continuously for 6 hours and replicated for 3 consecutive days. The second study was developed based on findings from Study 1.

Monitoring was conducted at four locations along the ICB shoreline, including CB02, and at the offshore water inlet location. The pilot study results showed that FIB were detected at the pump inlet (located above the eelgrass beds within the buoyed swim area) at low levels and at times above standards. In contrast, the 2006 macro-circulation pilot study conducted by Kinnetic (POLA, 2006a, 2006b) did not detect FIB offshore (outside of the swim-buoy line, possibly beyond the influence of the eelgrass bed). The 2011 micro-circulation pilot study was inconclusive.

A micro-circulation pilot study was conducted May 15-18, 2012. The data from this 4-day pilot study are undergoing analysis. The results from this pilot study will be used to refine a mass balance model developed by the LARWQCB. A work plan for this study has been developed

separately, in partnership with LARWQCB and City Departments. The May 2012 micro-circulation pilot study had and all future circulation systems shall have an inlet located in waters documented to be free of FIB and will be based upon lessons learned in previous pilot studies. A copy of the work plan for the May 2012 pilot study is included as Appendix B.

4.0 BACTERIA TMDL PLANNED TIER III ACTIVITIES

4.1 Expanded Bird Exclusion Structure (Phase II)

Consistent with past efforts and the current ICB bacteria TMDL, a bird exclusion structure expansion is proposed that would cover more of ICB along the waterline where birds have been observed foraging and resting. The existing exclusion structure does not extend below the high tide line. This effort will be implemented as a source control for bird fecal matter that comes in direct contact with harbor water through tidal fluctuation.

The Phase II Project will extend the existing bird exclusion structure from +7 ft MLLW to 0 ft MLLW to expand source exclusion along the ICB Public Beach Area (see Figure 4). This action is based on the results of past investigations that identified daily roosting of local avian species on the upper beach sand area as a significant source of FIB. Expansion of the bird exclusion structure through the tidal zone to 0 ft MLLW will minimize daily bird roosting and foraging at lower tides. This is a bacterial source exclusion/management project in conformance with the ICB bacteria TMDL Work Plan. Implementation is expected in late 2012.

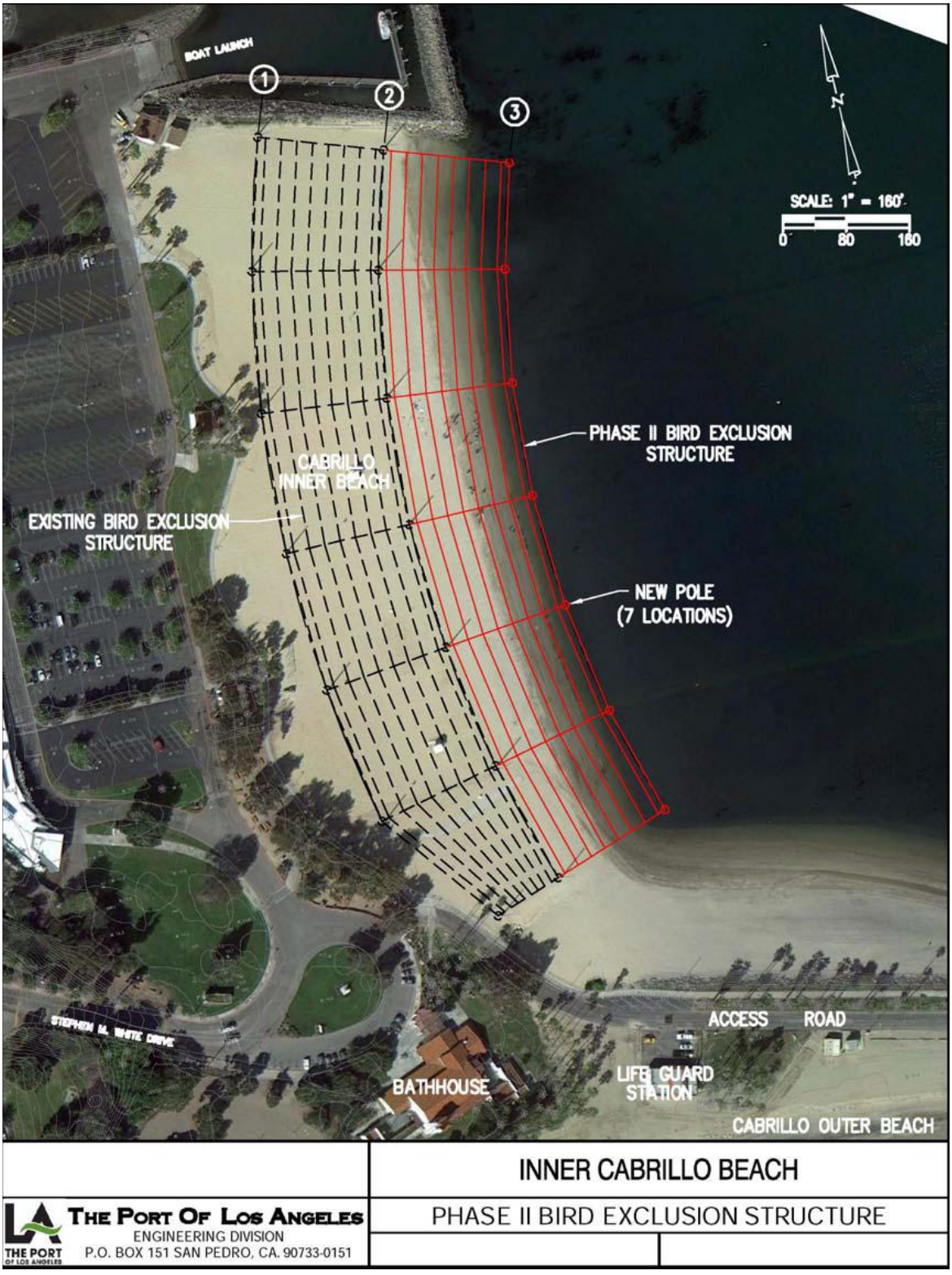

Figure 4. Bird Exclusion Structure (Phase II) Schematic

4.2 Circulation Studies

Several pilot studies have been implemented at ICB to determine possible FIB reduction effectiveness at CB02 (see Section 3.2.3.1 and 3.2.3.2). Building upon the results and recommendations of these pilot studies, POLA will implement a micro-circulation pilot study during summer 2012 (see Figure 5). The location of the small barge and clean water inlet will be based on results of sampling conducted to identify waters free of FIB (In May 2012, FIB sampling was completed for low wind/low tide conditions. The proposed intake location will be confirmed with sampling during high wind/high tide conditions). The length of the outlet pipe may change, depending on tidal conditions. The final pilot study design will be developed in partnership with LARWQCB and City Departments.

The goal of this pilot study is to enhance circulation at CB02 by implementing the following field tasks:

1. **Operations—**Operational parameters will be developed based on previous micro-circulation monitoring data and observations collected during the 2011 pilot study and May 2012 pilot study. These data will be used to determine or refine operational and equipment options (such as pump size/type, inlet location, localized bathymetry, etc). Pumping times and schedules may change over the course of the summer. The City is committed to placing this interim micro-circulation system at ICB during summer 2012 and will implement a practicable circulation system before summer 2013. The design criteria for the 2013 practicable circulation system will be based on feasibility and on feedback/lessons learned from the 2012 interim micro-circulation system pilot study (i.e., from discussion with City and LARWQCB and discuss any recommendations for modification). The summer operation is proposed to consist of the following activities:
   - Each morning, personnel will ensure a safe working and operating environment.
   - Personnel will check-in with the lifeguards each day prior to initiating work.
   - Personnel will install the outlet pipe/hose each morning and direct the outlet according to the final design.
   - The system will operate for several hours (to be refined based on the May 2012 pilot study).

2. **Equipment—**The City will coordinate with LARWQCB staff on the design of the interim micro-circulation system. Currently proposed equipment is described as follows:
   - A small barge equipped with the micro-circulation system will be anchored and fixed in position for the duration of the study (2 months) using three semi-permanent anchors. The location of the barge will accommodate the highest and lowest tidal range expected during the pilot study and generally be located outside of the swim-buoy line.
   - A micro-circulation system consisting of two or more 4-inch trash pumps installed in parallel will have the capacity to pump 400 – 1,000 gpm. Additional pumps may be added to increase the flow rate, but there is a trade-off between system weight and overall capacity (flow and force).

- The inlet pipe/hose will be semi-rigid and anchored outside of the swim-buoy line (clean water area) at approximately mid-water depth (4 ft below water surface) for the duration of the summer. Appropriate safety procedures will be implemented to designate the location of the semi-rigid inlet line and inlet location. Water samples will be collected periodically to measure the FIB concentrations at the inlet point. The inlet location will be placed or monitored to ensure that no adverse effects occur from wind-driven circulation, as was noted during the 2011 micro-circulation pilot study and previous circulation studies.
- The outlet pipe/hose will be deployed each day of operation. The outlet will be positioned at approximately mid-water depth and aimed at a 45-degree angle to the shoreline toward CB02. The outlet will be secured on location each day using a combination of sand anchors, rebar and tie straps. The anchoring equipment will be removed each day after the pumping cycle is complete.
- The outlet and any anchoring equipment near shore will be removed each day after pumping is complete to ensure swimmers do not encounter any dangers from equipment.

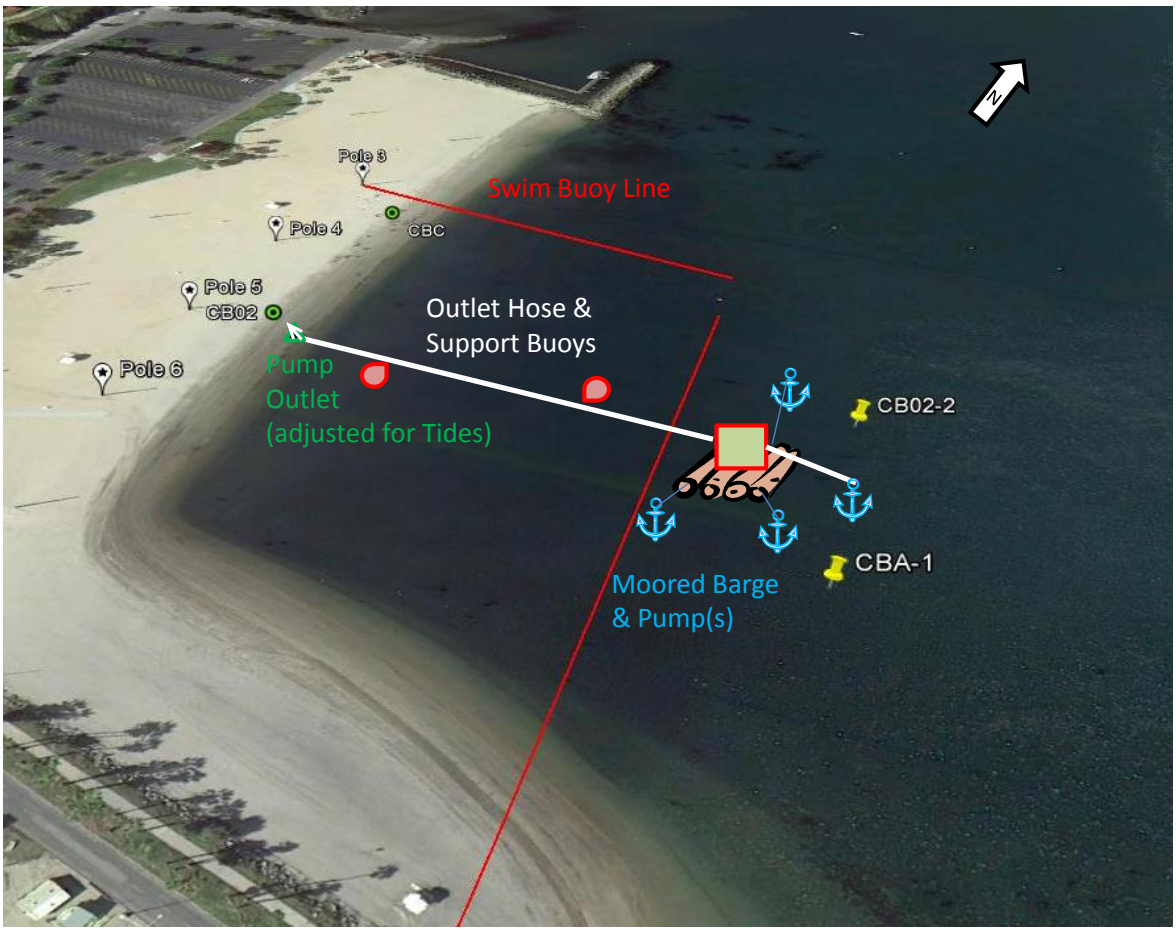

Figure 5. Conceptual Schematic of 2012 Interim Micro-Circulation System Pilot Study

4.3 Bacteria TMDL Implementation Plan Summary

This work plan demonstrates the commitment of the City and POLA to protecting public health and improving water quality conditions at ICB, as demonstrated by the breadth and scope of Tier I and Tier II projects implemented to date and the dedication to implementing the Tier III measures described in Sections 4.1 and 4.2. POLA believes the structural measures planned for 2012 and 2013 represent the technically feasible limitation of Tier III activities. In the event that FIB results remain elevated after all of the planned Tier III measures have been implemented, POLA has coordinated with LARWQCB to develop a process to establish NSE eligibility at ICB. This process will be used to develop a transparent, scientifically sound methodology and does not predetermine the final NSE decision.

4.4 Technical Review Group

POLA held an internal workshop on March 20, 2012, to discuss the possible eligibility of ICB for a NSE. A copy of the Microsoft PowerPoint presentation given at the meeting is included as Appendix C. LARWQCB and City Departments are collaboratively developing a process for establishing eligibility for a NSE designation. The NSE work plan presented in Section 5.0 is a transparent, scientifically sound, step-wise methodology that establishes FIB source and relative human health risk, if needed.

Recognizing that the NSE process is the first of its kind to be implemented for a Bacteria TMDL in California, LARWQCB and City Departments will invite a third-party technical peer review group to provide input on the process.

5.0 NATURAL SOURCE EXCLUSION

5.1 Regulatory and Implementation Guidance

Little guidance exists regarding development or implementation of NSE work plans. The following Basin Plan amendment provided the administrative process for NSE work plans, Existing Regulation (LARWQCB – 2002 Basin Plan Amendment), (Attachment A to Resolution No. 2002-022, pg. 1) (adopted as part of the Santa Monica Bay Beaches TMDL):

> Under the natural sources exclusion implementation procedure, *after all anthropogenic sources of bacteria have been controlled* such that they do not cause or contribute to an exceedance of the single sample objectives and *natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The 'natural sources exclusion' approach may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body.* These approaches are consistent with the State Antidegradation Policy (State Board Resolution No. 68-16) and with federal antidegradation requirements (40 CFR 131.12).

LARWQCB initiated insertion of the NSE language by means of a Basin Plan amendment, recognizing that a NSE may be applicable under certain conditions, and that microbial scientific methods (in 2002) would likely need to be improved.

In the absence of guidance, the steps outlined in Section 5.2 are proposed to determine the contribution of natural sources of FIB at ICB to support a NSE designation for contribution of FIB from nonhuman sources. To date, there have been no requests to LARWQCB for a NSE designation within its jurisdictional area. This effort will be the first of its kind within the LARWQCB jurisdictional area and within the State of California. Concurrently, the State of California is developing a handbook on microbial source tracking efforts for various fecal host markers. This handbook, known as the Source Identification Pilot Project (SIPP) study during its development, will augment the ability of the scientific community to determine nonhuman fecal host markers.

A project technically administered by South California Coastal Water Research Project (SCCWRP) is currently under way in Ventura County to evaluate elements of quantitative microbial risk assessment (QMRA). This local effort and technical staff may provide value, review, and assistance to the development of a NSE work plan for ICB.

5.1.1 Selected Review of Literature

A review of selected projects and literature will be summarized in a tabular format highlighting key findings pertinent to conditions at ICB and development of the NSE work plan. This project review will incorporate site-specific data collected for ICB, as well as references used in these

historical reports that support conclusions and recommendations (see Appendix A for past project references). A list of selected literature references is included as Appendix D. Many of the selected literature references are very recent and many more exist that are near publication or currently under peer review. It is suggested that this selected literature review be updated semi-annually at a minimum.

5.2 Bacterial Source Tracking and Natural Source Exclusion Work Plan

In an effort to document conditions and provide a case for a NSE designation, this NSE work plan includes a background evaluation of existing laboratory methodologies, regulatory and implementation guidance, selected literature review, existing data and information review, and a NSE task work plan:

1. **Background—**In an effort to reduce human exposure to microbial contaminants, recreational waters are monitored for FIB, such as enterococci (USEPA, 2004), because of the relationship between FIB and human illness when human sewage is present. However, it is known that FIB can be present not only in human sewage, but also in nonhuman fecal sources (e.g., birds, dogs, cattle, horse). Furthermore, FIB have been measured in some non-fecal sources (e.g., plants, wrack line material) and have been shown to persist and/or reproduce in some environments (e.g., sand, storm drains). Therefore, in some instances, it may be appropriate to explore a NSE designation.

   Over the past 10 years since the Basin Plan amendment allowing a NSE designation was adopted, detection techniques and microbiological methods have undergone refinement and development. Methods have been developed that confidently determine and detect human sources of FIB. These newer methods differ from the ribotyping efforts conducted in the late 1990s and during investigation of fecal sources at ICB from 2002. Some of these newer methods were used in studies conducted at ICB in 2009. The value of historical ICB FIB concentration data, 2005 ribotyping data, and 2009 quantitative polymerase chain reaction (qPCR) human and bird marker data are discussed in the work plan data inventory (see Section 5.2.1) (POLA / Kinnetic, 2010).

2. **Natural Source Exclusion Work Plan—**The following section presents the anticipated key steps of the NSE process and is consistent with regulatory language summarized in Section 5.1 (also see Figure 6). The following are the key elements of this approach and assume that previous data results of no human fecal sources have been verified. This assumption will be verified as discussed in Section 5.2.3.2.

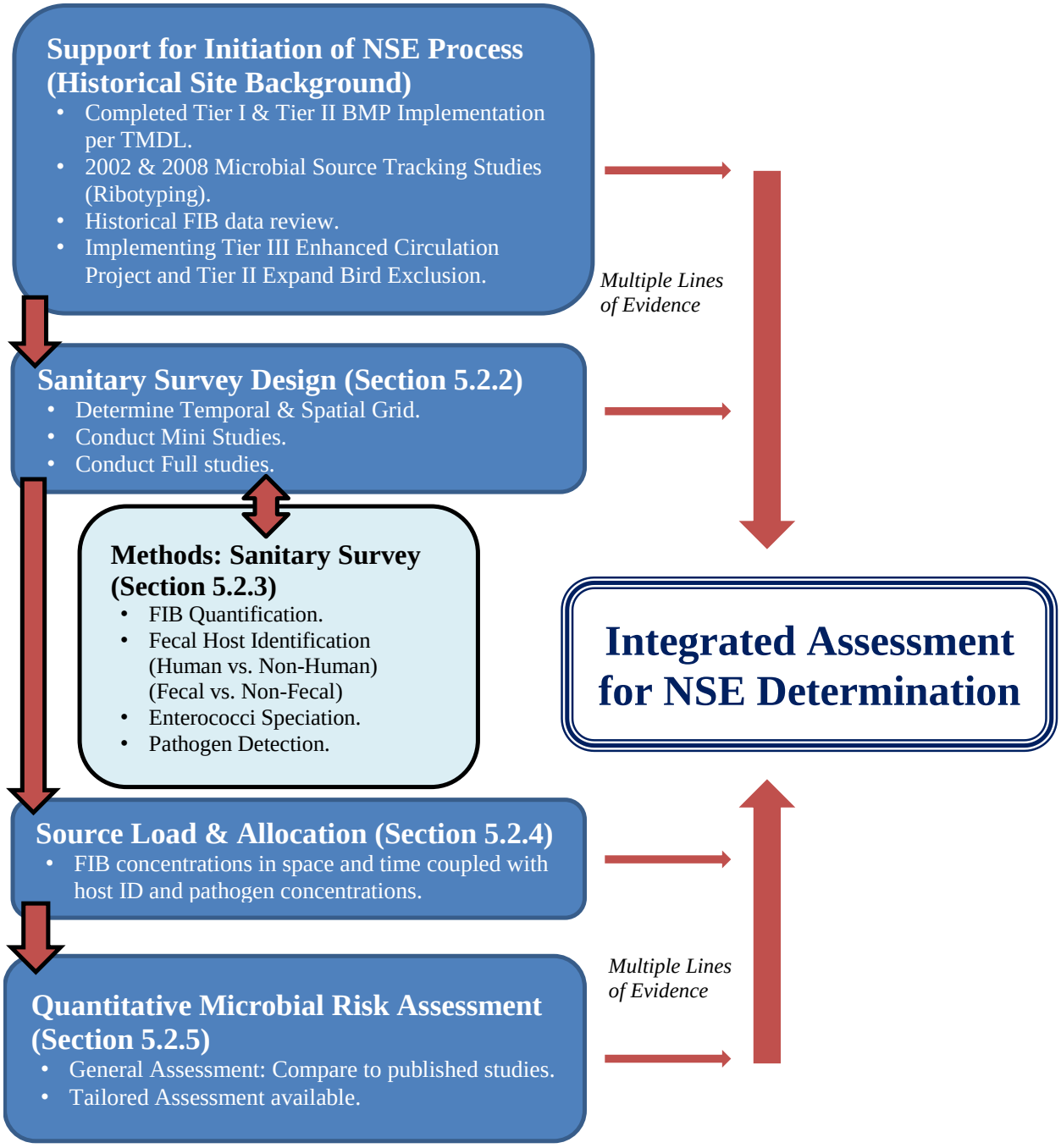

Figure 6. Natural Source Exclusion Work Plan Process

5.2.1 Data Inventory

The first step in this process is to conduct a data inventory, Quality Control Assessment (QCA) and review of special studies to assess conditions, determine trends and identify data gaps. The administrative and implementation history to date (See Appendix A) supports exploration of eligibility for a NSE at ICB. Findings from a 2005 ribotyping special study that detected human fecal signature bacteria were used to develop structural rehabilitation of infrastructure and other BMPs (POLA / Kinnetic, 2006). A series of special studies were conducted in 2009, after implementation of multiple Tier I and Tier II beach activities, to evaluate conditions at ICB. The efforts included conducting a statistical analysis of the historical monitoring results for CB02, speciation of *Enterococcus*, and evaluation of eel grass and sand as potential bacterial reservoirs. These studies used newer identification methods for human pollution by means of qPCR. A dry weather survey in July 2009 found no human fecal signature bacteria at ICB (Figure 7, equivalent CB02 location Site C). A concurrent study consisting of eight consecutive weeks of sampling (August-October 2009) also found no human fecal signature bacteria at ICB (Figure 8). The 2009 qPCR results indicating no human sources at ICB provide a strong foundation for scientific study in support of a potential NSE designation. The historical record and reports will be reviewed in more detail to best guide special studies at ICB. Information will be updated as needed and may include literature review, reanalysis of past data (e.g., quality control review, and statistical analyses), and collection of new data. Current data in the inventory include the following:

- FIB data from daily Bureau of Sanitation (BOS) monitoring and bacteria TMDL Implementation. These data will serve as the foundation and baseline historical record of FIB at ICB.
- Human Fecal Source Identification Projects Historical Record (Figure 7). These data indicate abatement of human sources after engineered controls:
  - A 2005 ribotyping special study conducted at CB02 identified a small contribution from human sources at ICB.
  - Two 2009 qPCR special studies identified no contribution from human sources at ICB after several Tier I and Tier II beach management actions were implemented.
- Enterococcus Speciation.
- QCA on Laboratory Reports.
  - Consistent methods—The review to date indicates that standard and consistent methods have been used.
  - Detection limits—The review to date indicates that detection limits are adequate and consistent over time.
- Field instrumentation (verification, inventory). Data from field instrumentation will be verified by reviewing calibration records.
- Circulation Pilot Studies and Model assumptions (review)—Historical macro-circulation and micro-circulation pilot studies will be reviewed and evaluated along with additional information gathered during the summer 2012 interim micro-circulation system pilot study described in Section 4.2. All circulation studies performed to date have identified a key component, tide- and wind-driven circulation, as a vehicle or carrier of FIB.

Figure 7. Map of Study Locations for the Human Fecal Marker Study (July 2009)

Figure 8. Map of Study Locations for the Human Fecal Marker Study, Beach Sand Reservoir Study and Eel Grass Study (August-October 2009)

5.2.2 Sanitary Survey Design

A sanitary survey is a method of investigating the sources of fecal contamination to a water body. Samples of seawater, sand, and putative sources (e.g., gull feces, cat feces, dog feces, eelgrass) will be collected. A designated spatial area for sample collection will be chosen for the survey. Sample collection times will be standardized to minimize confounding factors known to affect bacterial concentrations such as wet weather, tidal conditions, solar radiation, and beach use (e.g., samples will be collected at approximately the same point in the tidal cycle). The first task is to confirm a lack of human fecal sources, as outlined below (sanitary survey mini-study [mini-study]). If confirmed, the next step would be to use a suite of tools (described below) to determine the contributions of nonhuman and non-fecal sources of indicator bacteria at site CB02. The eligibility of ICB for a NSE designation will be determined through multiple lines of evidence (Figure 6).

The proposed mini-study area will focus on the shoreline compliance monitoring location at CB02 (Figure 9). Sampling will include collection of seawater at CB02 and a comparison site. The ideal comparison site (to be determined) is one participating in an existing monitoring data collection program and having a demonstrated record of good water quality. The mini-study design will consist of a transect line through CB02 that includes a sand sampling site (between the mean high and low water lines), a comparison site for the sand (needed for statistical analysis), and a water collection site at a depth just above the eelgrass bed. In addition, samples from putative sources (bird, dog, and cat feces; eelgrass) of indicator bacteria will be collected opportunistically. Sample collection will occur under environmental conditions that would ensure relatively high counts of enterococci (e.g., near high tide). The proposed number of samples to be collected is detailed below. The sampling strategy may differ depending upon the purpose of the study; however, the principle applied will be to collect a number of samples that is sufficient to allow confidence when drawing conclusions.

Figure 9. Conceptual Sanitary Survey Design Overlaying Proposed 2012 Expansion of Bird Exclusion Structure for Context

5.2.2.1 Sanitary Survey Mini-Studies

The first task at ICB is to confirm the 2009 qPCR findings that indicated a lack of human fecal sources at ICB. This mini-study will use the new assays for identification of human fecal sources, as slated for recommendation to the State of California as a result of the SIPP. In order to confirm a lack of human fecal sources at ICB, a mini-study is proposed. An overview of mini-study methods is provided in Table 2 and Table 3 and the methods are further detailed in Section

5.2.3. A mini-study is one in which the spatial coverage and/or the number of methods applied to the samples are reduced. Sampling sites will be chosen based on a transect described above. For example, a mini-study might consist of the following collection sites: CB02, eelgrass bed seawater, and reference site seawater. (Note: CB02 tested positive for the human fecal marker in 2005. No other subsequent human fecal marker studies had positive human results. Sewage leaks at the south beach, repaired in 2004, were identified and confirmed by means of inspections and standard bacterial monitoring results. A monitoring site could be at this south beach location).

It is recommended that the initial mini-study use a minimum number of methods: (a) quantification of fecal indicator bacteria by culture-based methods and (b) fecal source identification for humans by qPCR (Table 2). Water samples would be collected from the CB02 transect (Figure 9) and from site(s) previously identified as having human fecal sources (e.g., CB02 and southern beach near old sewer lines). Samples would be collected under environmental conditions that would ensure relatively high enterococci counts (e.g., near high tide). Replicate numbers would be sufficient to allow statistically meaningful site comparisons of the data taken within this initial mini-study.

Table 2. Proposed Methods for an Initial Sanitary Survey Mini-Study with the Goal of Verifying Lack of Human Fecal Sources

Goal	Sanitary Survey Method
Quantify Enterococci	IDEXX
Determine Human Fecal Source	qPCR-Human Marker

If the initial mini-study confirms a lack of human sources, the next proposed step would be an expanded mini-study. In this case, the sampling sites would be the three seawater collection sites of the CB02 transect (CB02, eelgrass bed seawater, reference site seawater). The methods would include those described in Table 2: (a) quantification of fecal indicating bacteria by culture-based methods; and (b) fecal source identification for humans by qPCR. The methods would be expanded to include the following: (c) fecal source identification for birds by qPCR; and (d) quantification of enterococci by qPCR (Table 3). The additional methods would be used to confirm the 2009 enterococci speciation and bird marker results, allow initial assessment of the locations and strength of this nonhuman fecal source. Again, the number of replicates performed in the expanded mini-study would allow statistically meaningful site comparisons of the data taken within the mini-study.

Table 3. Proposed Methods for an Expanded Sanitary Survey Mini-Study with the Goal of Verifying a Lack of Human Fecal Sources and Preliminary Allocation Information

Goal	Sanitary Survey Method
Quantify Enterococci	IDEXX and qPCR*
Quantify Total Coliforms and *E. coli*	IDEXX
Determine Human Fecal Source	qPCR- Human Marker
Determine Bird Fecal Source	qPCR – Bird Marker

** To aid allocation calculations for microbial source tracking (comparison of molecular methods rather than molecular to culture methods).*

5.2.2.2 Sanitary Survey Full-Study

After data from the mini-studies (Table 2 and Table 3) are analyzed, the project would pursue full sanitary survey studies. The full sanitary survey studies would consist of expanding the CB02 seawater transect to include a sand site and a reference sand site (Figure 9). The sand sites would be used to evaluate whether sand is a natural source of indicator bacteria at ICB. These full sanitary survey studies would use a full suite of methods, as described in Section 5.2.3 and outlined in Figure 6, in order to build the dataset needed to determine source and load allocations. Replicate sanitary surveys would be performed and conclusions would be based on the entire dataset; thus, individual sanitary surveys would not require as many replicates as the mini-studies, which are designed to be self-contained. The needed number of replicate surveys (e.g., four wet season/four dry season, including high/low beach usage) will be assessed using power analysis, findings from previous studies (including the mini-studies), and input from POLA and LARWQCB. It should be noted that achieving an adequate number of replicates is primarily a concern for the qPCR and culture methods because those methods will be used to compare sites and to calculate load allocations. Enterococci speciation and pathogen detection methods would not require the same extent of replication.

5.2.3 Methods Applied to Sanitary Survey Samples

Methods will include culture and molecular methods to determine the source strength and spatial and temporal patterns of FIB as outlined below.

5.2.3.1 Fecal Indicator Bacteria Quantification

A variety of methods are available to determine FIB concentrations (e.g., membrane filtration, multiple tube, IDEXX, and qPCR). ICB has routinely been monitored for enterococci using IDEXX Enterolert and for total coliform and *E. coli* using IDEXX Colilert-18. Continued use of these methods is suggested for sanitary survey samples in order to maintain continuity of the data record.

5.2.3.2 Fecal Host Identification (Human vs. Nonhuman)

qPCR assays are suggested for fecal host identification. A variety of methods are available (e.g., bovine, dog, horse, pig, bird, human). Host fecal source tracking markers will be used in conjunction with quantification of FIB. For example, a high FIB load associated with eelgrass without the presence of human or fecal host identification markers would suggest that the eelgrass associated indicator bacteria were not associated with a fecal source. This method will focus on three source tracking markers as outlined below and in Table 4. In addition, it is

recommended that samples also be analyzed by qPCR for *Enterococcus* spp. in order to facilitate load allocation calculations, as follows:

- **Human—**Perform fecal host identification by qPCR for a human fecal marker to confirm lack of human fecal sources (HF183, *Bacteroidales* human marker). This first step is necessary in order to justify full sanitary surveys for the purpose of assessing natural source allocation.
- **Nonhuman—**Based on confirmation of no human sources, perform fecal host identification assays by qPCR to identify and quantify fecal contamination by birds and dogs (C-Bird assay, *Catellicoccus* bird marker*;* Dog-Bac assay, *Bacteroidales* dog marker*)*.

Table 4. Molecular Source Tracking Assays

Molecular Assays Available	Proposed Method Use at ICB
Human marker (*Bacteroidales*), qPCR	X
Bird marker (*Catellicoccus*; for gull, pelican, pigeon), qPCR	X
Dog marker (*Bacteroidales*), qPCR	X
Bovine marker (*Bacteroidales*), qPCR	
Horse marker (*Bacteroidales*), presence/absence	

5.2.3.3 Fecal Indicator Bacteria: Enterococci Speciation

Certain species of enterococci are thought to be primarily associated with plants (e.g., *E. casseliflavus*). Membrane filtration, colony isolation, and Vitek identification and/or qPCR identification can be used to assess seawater samples and samples taken from putative sources of indicator bacteria, such as eelgrass, to develop a line of evidence with regard to natural/non-fecal sources of indicator bacteria. Speciation data that showed a preponderance of plant–associated enterococci in conjunction with a lack of fecal sources, as indicated by microbial source tracking (Table 3), would support eligibility of ICB for a NSE designation.

5.2.3.4 Pathogen Detection

Pathogen assessment coupled with data on indicator bacteria source and load are important lines of investigation into natural and non-fecal sources of indicator bacteria. As outlined in the example above, indicator bacteria load associated with eelgrass but not associated with fecal host markers suggests a non-fecal source. Pathogen detection would provide a next layer of evidence. The absence of pathogens suggests that the non-fecal source of indicator bacteria presents minimal human health risk.

The choice of pathogens to be assessed (e.g., *Cryptosporidium*, enterovirus, *Staphylococcus aureus*, *Campylobacter*, *Salmonella*, *Toxoplasma gondii*) will focus on those pathogens associated with bird, cat, and dog feces, and/or with existing QMRA data (i.e., available dose-response curves and/or published QMRA analysis at beaches). Existing QMRA studies and process are described in more detail in the QMRA discussion in Section 5.2.5. Furthermore, this phase of the project will be aligned with the QMRA study scheduled to be conducted in Ventura, CA (see Table 5) in order to streamline efforts, maximize leveraging, and to ensure the widest applicability of results.

5.2.4 Source Load and Allocation

FIB concentrations in samples collected during the sanitary surveys will be mapped in space and time and coupled with data from fecal host identification assays, bacterial speciation, and pathogen detection in order to translate results into an assessment of source allocation and load allocation.

5.2.5 Quantitative Microbial Risk Assessment

Source and load allocations may be adequate for the NSE process. If it is determined that risk assessment is also needed, QMRA may also be employed. FIB concentrations, fecal host identification results, and resulting source and load allocations and pathogen concentrations are inputs used in QMRA models. Therefore, the work outlined above directly feeds into the QMRA step, if needed. In order to coordinate with the effort of SCCWRP to conduct a QMRA analysis at beach(es), a similar process is proposed to leverage commonalities between the efforts in Ventura and at ICB, unless a sound scientific justification mitigates against it (i.e., variability of pathogen sources or inconsistent source and load allocations). The process would include the following steps:

- **Generic QMRA—**Compare FIB and pathogen results to published QMRA studies using reference levels available in published microbial risk assessments. This QMRA method utilizes pre-existing QMRA models. If these models prove inadequate for the site, e.g., do not capture mechanistic details unique to ICB, then models will be tailored to the site (see next step).
- **Tailored QMRA—**Development of a site appropriate QMRA model may be pursued if a more stringent calculation of health risk assessment is required. This step will be conducted if necessary to capture mechanistic details unique to ICB in order to demonstrate that there is no human health risk.

6.0 PROJECT MILESTONE SCHEDULE

The following summary of imminent future activities provides a schedule for updates to the work plan and also milestone points when significant project information will be available for review (Table 5). This information may assist in study design, sampling method selection, collaboration, and technical approach development.

Table 5. Project Milestone Summary

Project Activity	Anticipated Date	Updates
Coordination Meeting with SCCWRP to discuss Ventura QMRA	May 8, 2012 (Complete)	Update Work Plan Section 5.0
Finalize Work Plan	May 2012	Completed Working Document
Micro-Circulation Mass Balance Pilot Study	May-June 2012	Update Work Plan Section 4.2
2012 Interim Micro-Circulation System Pilot Study	July-September 2012	Update Work Plan Section 4.2
2012 Sanitary Survey Mini-Study (Mini-Study)	August 2012	Update Work Plan Section 5.0
Summer Study Technical Reporting	October 2012	Update Work Plan Sections 4.2 and 5.0
Implement Expansion of Bird Exclusion Structure	October –November 2012	Update Work Plan Section 4.1
Full Sanitary Surveys Initiated	Winter 2012	Update Work Plan Section 5.0
Literature Review Update	December 2012	Update Work Plan Appendix D
Practicable Circulation System	July 2013	Update Work Plan Section 4.2

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