Appendix y-F: Oxford Retention Basin Multi-Use Enhancement Project

Supporting Documents

(Please see Appendix CD for documents)

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CALIFORNIA DEPARTMENT OF TRANSPORTATION

Guidance on Incorporating Sea Level Rise

For use in the planning and development of Project Initiation Documents

Prepared by the Caltrans Climate Change Workgroup, and the HQ Divisions of Transportation Planning, Design, and Environmental Analysis

May 16, 2011

This guidance is intended for use by Caltrans Planning staff and Project Development Teams to determine whether and how to incorporate sea level rise concerns into the programming and design of Caltrans projects. Because of the evolving nature of climate change science and modeling, this guidance is subject to revision as additional information becomes available.

1. Sea Level Rise in California

Sea level rise (SLR) is perhaps the best documented and most accepted impact of climate change. Observations of sea levels along the California coast, and global climate models indicate that California's coast will experience rising sea levels over the next century and beyond (unless emissions of greenhouse gases are dramatically reduced from current levels). As the earth warms due to global climate change, two changes are occurring that are causing sea levels to rise: glacial melting and thermal expansion of the oceans. Data from tide gauges in the State collected over the past several decades indicates an upward trend of approximately 20 cm per century (which is similar to the change in global mean sea level). Climate models project rising rates that could far exceed any experienced "during modern human development on the California coast and estuaries." (Cayan, 2008)

The effects of SLR will have impacts on all modes of transportation located near the coast. Rising sea levels will significantly increase the challenge to transportation managers in ensuring reliable transportation routes are available. Inundation of even small segments of the intermodal transportation system can render much larger portions impassable, disrupting connectivity and access to the wider transportation network (Gulf Coast Study, Phase I, 2008).

SLR will likely lead to multiple changes to the physical environment beyond a simple increase in sea surface elevation. Higher water levels may increase coastal bluff erosion rates, change environmental characteristics that affect material durability (e.g., pH and chloride concentrations), lead to increased groundwater levels and change sediment movement both along the shore and at estuaries and river mouths. All of these factors will have to be addressed by the California Department of Transportation (Caltrans) at the planning and project level.

2. Why does Caltrans Need to Address SLR?

Future SLR poses a serious threat to residents and existing infrastructure along the coast of California; including transportation assets. In an effort to better understand potential amounts of rise and the associated impacts, then Governor Arnold Schwarzenegger signed Executive Order (EO) S-13-08 in November 2008[1]. The EO directs State agencies planning construction projects in areas vulnerable to SLR to begin planning for potential impacts by considering a range of SLR scenarios for the years 2050 and 2100. Although EO S-13-08 allows for some exemptions for routine maintenance projects and for projects programmed for construction through 2013, the intent is to plan ahead to assess project vulnerability and reduce anticipated risks associated with SLR. Other California State agencies, commissions, and climate action teams are already moving forward to implement guidance on how to address this issue. It should be noted that EO S-13-08 is

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[1] A link to the executive order: http://www.climatechange.ca.gov/publications/EXECUTIVE_ORDER_S-13-08.pdf

still in effect until it is rescinded by a subsequent Governor. Executive Order S-13-08 directs the Natural Resource Agency, in cooperation with Caltrans and other State agencies to commission the National Academy of Sciences (NAS) through the Natural Resources Council to assemble a team of experts to produce a West Coast SLR assessment report for the states of California, Oregon, and Washington. This Pacific Coast SLR assessment is expected to be released in mid-2012. When released, the NAS report will include SLR scenarios for all three states, and will act as the official SLR estimate for State agencies.

Because of the extended release date of the NAS study, the California Ocean Protection Council established the SLR Task Force of the Coastal and Ocean Working Group. The working group is part of the California Climate Action Team (CO-CAT) which developed interim SLR scenarios for the State until the NAS study is completed. The SLR Task Force includes staff from 16 State agencies, including the Business, Transportation and Housing Agency, and Caltrans. The SLR Task Force developed and agreed upon recommendations for incorporating SLR projections into planning and decision making for projects in California. The SLR scenarios adopted by the CO-CAT (see Page 8, Table 2) are based on the values presented in the December 2009 *Proceedings of National Academies of Sciences* publication by Vermeer and Rahmstorf[2]. These scenarios were recommended by the California Ocean Science Trust and the Ocean Protection Council's Science Advisory Team.

Because of the requirements set forth for State agencies in Executive Order S-13-08, as well as increased interest by the public and regulatory agencies, Caltrans must be proactive in addressing SLR impacts on existing infrastructure and for future projects. Despite the long timeframe of the release of the NAS study, regulatory agencies such as the California Coastal Commission are urging Caltrans to incorporate SLR analysis into projects. If the impact analysis and related adaptation measures are not planned for in advance, there is risk of not being able to obtain necessary approvals and permits, which could potentially delay project delivery in the ready to list phase of a project. The public is also expressing its concerns about SLR in comments submitted during public circulation of our draft environmental documents. Climate change issues, including adaptation, have also been a cause of litigation on some transportation projects.

Planning for potential impacts to California's infrastructure due to SLR also requires addressing cost, scope and schedule in our project planning documents. Items that need to be considered, in addition to enhancing the design of structures, will be the potential increased costs of permit fees and mitigation to implement the enhanced design. To reduce the risk of impact on project delivery in the future, it is important to include these considerations into the project planning now.

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[2] Martin Vermeer and Stefan Rahmstorf, "Global sea level linked to global temperature," *Proceedings of the National Academy of Sciences*, published online before print December 7, 2009; 10.1073/pnas.0907765106.

3. Determining and Documenting Whether to Incorporate Sea Level Rise into Project Programming and Design

Making a determination of whether to incorporate SLR adaptation measures into the programming and design of a project is a two-part analysis followed by documentation of the effort to be included into the Project Initiation Document (PID). The first step will be to determine whether there is the potential for the project to be impacted by an increase in SLR. The second step is to balance the potential SLR impacts with the level of risk and the potential consequences to the transportation system to determine whether the potential impacts warrant programming resources to include adaptation measures into the project.

Determining Potential Impact

To assess whether an individual project will potentially be impacted by SLR, a three-part screening criteria has been developed for use by members of the Project Development Team (PDT) (see Appendix A for detailed screening criteria). In brief, the screening involves examination for the following three questions:

1. Is the project located on the coast or in an area vulnerable to SLR?
2. Will the project be impacted by the stated SLR?
3. Is the design life of the project beyond year 2030?

If after using the screening criteria the determination is made that the project does not need to incorporate SLR in the PID, include a sentence or two in the PID to explain why the project does not warrant further consideration of SLR.

If the project requires further analysis, then the PID must include a more detailed discussion of SLR and adaptation. The PDT may decide that due to the nature of the project and the relative risk involved that the project does not need to have additional funds programmed for SLR adaptation (see discussion on balancing below). However, even then, the PID must contain a detailed discussion about how and why the PDT came to that conclusion. Similarly, if the decision is made to incorporate additional project funding for SLR adaptation measures, that decision must also be documented and explained.

Balancing Potential Impacts with the Level of Risk and Potential Consequences

Determining whether and to what extent to program funding for adaptation measures for SLR into a project requires balancing many factors. In the *Coastal-Ocean Climate Action Team Interim Sea-Level Rise Guidance Document*, state agencies are urged to consider timeframe, risk-tolerance and adaptive capacity when determining whether to adapt the project for potential SLR impacts. The discussion below is an excerpt from that guidance document:

> The timeframe identified for a project is important for sea level rise assessments and will affect the approach for assessing impacts. Until 2050, there is strong agreement among the various climate models for the amount of sea level rise that is likely to occur. After mid-century, projections of sea level rise become more uncertain, because the modeling results diverge and the sea level rise projections vary depending upon how quickly the international community reduces greenhouse gas emissions. Therefore, for projects with timeframes beyond 2050, it is especially important to consider adaptive capacity, impacts, and risk tolerance to guide decisions of whether to use low, medium, or high sea level rise projections.
>
> Consequences = Adaptive Capacity + Impacts
> The consequences of failing to address sea level rise for a particular project will depend on both adaptive capacity and the potential impacts of sea level rise to public health and safety, public investments, and the environment.
>
> Adaptive capacity is the ability of a system to respond to climate change, to moderate potential damages, to take advantage of opportunities, and to cope with the consequences.[3] A project that has high adaptive capacity and/or low potential impacts will experience fewer consequences. For example, an unpaved trail built within a rolling easement has high adaptive capacity (because the trail can be relocated as sea level rises) and therefore will experience fewer harmful consequences. In contrast, a new wastewater treatment facility located on a shoreline with no space to relocate inland has low adaptive capacity and high potential impacts from flooding (related to public health and safety, public investments, and the environment). The negative consequences for such a project of failing to consider sea level rise would therefore be high.
>
> Risk tolerance is the amount of risk involved in a decision depends on both the consequences and the likelihood of realized impacts that may result from sea level rise. These realized impacts, in turn, depend on the extent to which the project design integrates an accurate projection of sea level rise. However, current sea level rise projections provide a range of potential sea level rise values and lack precision. Therefore, agencies must consider and balance the relative risks associated with under- and/or overestimating sea level rise in making decisions.[4]
>
> Harmful impacts are more likely to occur if the project design is based upon a low projection of sea level rise and less likely if higher estimates of sea level rise are used. In situations with high consequences (high impacts and/or low adaptive capacity), using a low sea level rise value therefore involves a higher degree of risk.

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[3] Definition of adaptive capacity used in the 2009 California Climate Adaptation Strategy, based upon definition provided in Climate Adaptation: Risk, Uncertainty and Decision-making, UK CIP (2003), UKCIP Technical Report, Oxford, Willows, R. I. and R. K. Cornell (eds.).

[4] Examples of harmful impacts that might result from underestimating SLR include damage to infrastructure, contamination of water supplies due to saltwater intrusion, and inundation of marsh restoration projects located too low relative to the tides. Examples of harmful impacts that might result from overestimating SLR include financial costs of over-engineering shoreline structures, locating in-water development in too shallow a depth to avoid navigational hazards, and marsh restoration projects located too high relative to the tides.

Development of the screening criteria to determine whether to incorporate SLR in Project Programming and Design (Table 1)

Based on the concepts in the California Sea Level Rise Interim Guidance document, Table 1 was developed as an aid to help determine when SLR poses enough of an overall threat to warrant programming of additional funds in the PID to avoid or mitigate the identified risks. The table below is not an exhaustive list of factors; other factors may need to be balanced based on the nature and location of the project. As other factors are identified, this guidance will be updated.

In general, the State Highway System (SHS) is limited in its adaptive capacity because of the numerous services it facilitates (travel routes for the public, emergency evacuation etc.), its permanent location, longitudinal nature, long lifespan, and uncertain resources. However, new methods to increase the resiliency and adaptive capacity of the SHS must be developed in order to cope with the potential impacts of SLR.

Table 1: Factors to consider in whether to incorporate SLR into project programming and design

		Towards incorporating SLR into project design	→	**Towards not incorporating SLR into project design**
1	Project design life	Long (20+ years)		Short (less than 20 years)
2	Redundancy/alternative route(s)	No redundant/alternative route		Redundant/alternative route
3	Anticipated travel delays	Substantial delays		Minor or no delay
4	Goods movement/interstate commerce	Critical route for commercial goods movement		Non-critical route for commercial goods movement
5	Evacuations/emergencies	Vital for emergency evacuations; loss of route would result in major increases to emergency response time		Minor or no delay in the event of an emergency or evacuation
6	Traveler safety (delaying the project to incorporate SLR would lead to on-going or new safety concerns)	Safety project in which little or no delay would result; non safety project		Safety project and delay would be substantial
7	Expenditure of public funds	Large investment		Small investment
8	Scope of project–“point” vs. “linear”	Project scope is substantial–e.g. new section of roadway		Project scope is substantial–e.g. new section of roadway
9	Effect of incorporating SLR on non-state highway (interconnectivity issues with local streets and roads)	Minor or no effect–adjacent local street and roads would not have to be modified	Medium to minor interconnectivity issues	Substantial interconnectivity issues
10	Environmental constraints	Minor or no increase in project footprint in Environmentally Sensitive Area (ESA)	Less than significant increase in project footprint in ESAs	Substantial increase in project footprint in ESAs

1. **Project design life:** Those projects that have a long design life of 20+ years should include further SLR analysis. These projects have a very high likelihood of being impacted by SLR at some point during their lifespan. The shorter lifespan projects may be less likely to face SLR impacts, and as a result be less inclined to incorporate SLR, depending on their proximity to the coast line.
2. **Redundancy/alternative route(s):** Looking at the SHS, as a system, there are, however, some locations that are serviced by multiple routes; for example, SR-99 and I-5 in Central and Northern California and I-5 and I-405 in Southern California. Even in cases where the SHS does have parallel routes, it is important to keep in mind that the need for traveler and goods movement necessitated the construction of those parallel routes.
3. **Anticipated travel delays:** What impacts will result if SLR impacts a roadway? For instance, if during high tides or a storm event a roadway is splashed by spray the travel delays would be minimal. However, if a roadway is inundated by waves, the delays will be substantial and should warrant further consideration of incorporating SLR.
4. **Goods movement /interstate commerce:** If the route is a high priority commercial goods movement route in the State, the cost of delays due to impacts from SLR will be high, and the project should incorporate SLR consideration.
5. **Evacuations /emergencies:** If the route is vital for emergency evacuations, and SLR impacts would greatly increase emergency response time, the project should incorporate SLR analysis.
6. **Traveler safety (delaying the project to incorporate SLR would lead to on-going or new safety concerns):** If incorporating SLR considerations will substantially delay a safety project getting to construction, then the risk to traveler safety must take precedent. However, it is important to also weigh the possibility that if the highway is not designed to incorporate SLR that the result could be flooding of the facility in the future and that inundation of the facility may prevent the route from being used in the event of an emergency or evacuation.
7. **Expenditure of public funds:** Future allocation of resources should consider SLR impacts on the SHS and Caltrans' facilities. Considerations include potential for increased facility maintenance costs and/or more frequent repair/rehabilitation needs due to SLR impacts.
8. **Scope of project–"point" vs. "linear":** If the scope of a project is a single "point" or single project task, it may be less necessary to incorporate SLR (given all other factors).
9. **Effect of incorporating SLR on non-state highway (interconnectivity issues with local streets and roads):** Consideration should be given to whether the infrastructure around Caltrans' facility (adjacent local streets and roads) is being adapted for SLR. For example, if Caltrans were to raise the grade of its roadway to what extent, if any, are the surrounding local entities raising their roadways? Will the two systems interconnect efficiently and effectively?
10. **Environmental constraints:** Adapting the project to SLR may mean an increase in the environmental impacts of the project due to design aspects of adaptation, such as more reinforced bridge structures, larger culverts, or alternative pavements. There is also the potential that adapting the project to SLR may mean

modifying the hydrology in the area in ways that could be beneficial to some species while doing greater harm to others. Incorporating SLR Impacts into Project Programming and Design.

Sea Level Rise Impacts Assessment

Once a determination has been made that SLR should be incorporated into a project, the PDT will need to conduct studies to estimate the degree of potential impact and assess alternatives for preventing, mitigating, and/or absorbing the impact.

The Ocean Protection Council adopted statewide SLR values (Table 2), and a SLR interim guidance Document in March 2011. Caltrans participated in the development of this first set of statewide SLR scenarios. Prior to the adoption of the SLR values, State agencies were individually responsible for determining what amounts of SLR to use for planning purposes. This common set of values allows all state agencies to plan for SLR with the same assumptions. This document will be revised when the NAS releases their final SLR values, but in the interim, provides a standardized set of assumptions to use when determining SLR impacts.

Table 2. Sea-Level Rise Projections[5] using 2000 as the Baseline

Year		Average of Models	Range of Models
2030		7 in (18 cm)	5-8 in (9-17 cm)
2050		14 in (36 cm)	10-17 in (26-43 cm)
2070	**Low**	23 in (59 cm)	17-27 in (43-70 cm)
	Medium	24 in (62 cm)	18-29 in (46-74 cm)
	High	27 in (69 cm)	20-32 in (51-81 cm)
2100	**Low**	40 in (97 cm)	31-50 in (78-128 cm)
	Medium	47 in (121 cm)	37-60 in (95-152 cm)
	High	55 in (140 cm)	43-69 in (110-176 cm)

The SLR values provided in Table 2 reflect global scale changes to mean sea levels. There is often some variation to these values at specific locations. For the purposes of this guidance, local sea surface elevation changes will be ignored. Additionally, Table 2 values represent only the change in sea level in relation to a static land mass. In reality, it is common for subsidence (due to groundwater extraction, subsurface instability, etc.) or uplift (due to tectonic action or glacial rebound) to occur such that the relative change in elevation of the ocean level could be greater or lesser than the Table values for a given location. It will be important for the PDT to obtain data from District Surveys and geotechnical services to fully understand both current and future sea levels compared to project facility elevations. Designers must be aware that current survey benchmarks may or may not have an established relationship to sea level. As a result, the ability to provide

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[5] For dates after 2050, Table 2 includes three different values for SLR - based on low, medium, and high greenhouse gas emission scenarios. These values are based on the Intergovernmental Panel on Climate Change emission scenarios as follows: B1 for the low projections, A2 for the medium projections and A1FI for the high projections.

precise correlation between project site elevations and changing sea levels may be limited until such time that an entire network of new datum can be developed.

Time vs. Risk

As indicated, SLR is variable with time. Facilities which are not at risk today may continue to be unaffected for many years. Even when assessing conditions 50 or more years into the future, the determination may be that there is limited risk of impact. Neither SLR nor ground subsidence or uplift are linear with time and the PDT should assess not only the future target date (e.g., 2050), but also, to the extent practicable, assess the timeframe from project completion to future date of interest for which impacts may be of significance. For example, while we may determine that we anticipate SLR impacts at 2050, for some locations the impacts may become significant in 2045, while in other cases the impacts may become significant in 2025. The facility risks, impacts to the public, and type of response selected should be commensurate with not only the magnitude of the SLR but the spatial and temporal aspects of the impacts.

It must be noted that the values of SLR indicated in Table 2 are tied to mean sea level in 2000. Future SLR estimates must be adjusted for this base line level–so a project where surveys are performed in 2013, for example, will need to use a slightly modified baseline for the estimated rise between 2000 and that future date. Similarly, a project that is in PID phase in 2014 would use a higher initial sea level elevation to determine estimated “rise” during the project life.

The projected values of SLR indicated in Table 2 show narrow ranges of rise for the relative short term and increasing ranges for time frames farther into the future. The ranges are estimates of SLR for multiple future climate scenarios. The scenarios predict fairly consistent values in the short term, but increasingly wide ranges of value in the longer term due to increasing uncertainty. There is no specific probability of occurrence for any of the projected scenarios–they simply represent different possible global climate conditions and the amount of projected SLR for the respective conditions.

Selecting Sea Level Rise Value(s) for Design

When selecting a future design life date up to and including year 2050, use the initial target value from the column titled “Average of Models.” For projects with design life consideration of 2070 or beyond, use the range of the three “Average of Models” values. For design life dates not specifically listed in Table 2 interpolate using an assumption of linear progression for dates between those listed in Table 2 (e.g. 2037 or 2080).

When using the range of the three average values for time periods of 2070 or beyond, it is up to the discretion of the PDT to determine a value to use for the project. There is no specific “right” or “wrong” value, and it is anticipated that as future climate research and studies are completed that these values will change. It is expected that most resource agencies will lean toward the higher indicated values, and expect entities seeking permits to show that such levels can be accommodated or addressed. The PDT will need to confer with the resource agencies in question and reach agreement on an appropriate target value for design purposes.

Choosing a future date from which to select a future SLR estimate should be based on the type of project being programmed. Projects with an estimated design life extending to year 2030 or earlier (e.g., temporary projects, detours, Capital Preventive Maintenance (CAP-M) or other simple overlay projects) should not assume impacts from SLR. SLR values for projects which include new bridge or other major structures should choose a future date commensurate with the life of the structure–meaning 75 years or more.

The PDT should understand that virtually all climate models for SLR indicate that sea levels will continue to rise–potentially for centuries beyond the year 2100. While we cannot accommodate any or all possible scenarios, understanding the extreme long term potential should encourage the PDT to seek opportunities that, for equivalent cost, provide the longest term of protection from impact.

Implementation

Once target values of SLR have been selected for the project, the following procedures should be followed:

1. Request information from District Surveys to evaluate existing vertical elevation data and benchmarks to determine the correlation between current sea level and planned facility elevations for the project.[6]

2. As part of the request for the project preliminary Geotechnical Design Report, request a preliminary assessment of local land subsidence or uplift for the period associated with the project design life.[7]

3. From the SLR Table and data from Surveys and Materials/Geotechnical Services, generate a plot of relative SLR for the project over the time period of concern. This plot will allow the PDT to estimate both the estimated future date for initial impact and the maximum impact at the end of the time period used for analysis.

4. Determine if relative SLR will have negative impacts on facility function or operation. Impacts could be associated with issues such as elevation of culvert

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[6] Foundational information for all sea level rise predictions and impacts cannot be managed or planned without accurate vertical control and datum continuity between the tide stations and ground based benchmarks. Survey control and base mapping needed to generate highly accurate assessments of the actual project year sea level in relation to the assumed levels upon which Table 2 is based, may need updating to current standards.

[7] Detailed assessment of land subsidence or uplift may not be possible due to limited data and/or inability to predict past landform changes into the future. Under these circumstances, the PDT should apply the projected sea level rise value from Table 2 directly to the best available project design elevations to assess impact, and document the currency of data, and the risks and assumptions made.

outlets to revised estimates for foundation scour and/or erosion due to tidal action or exposure of materials to salt water inundation that would otherwise be unaffected. List the various impacts and roughly identify the time scale for these impacts to become problematic.

5. For the listed impacts, determine if adaptive measures will be necessary. In many cases, the project footprint may be impacted but no adaptive measure may be required. In other cases, the impact may be only temporary–such as wave splash during periods of high tide and storm surge. Not all adaptive measures require a physical alteration to the roadway facility. In particular, impacts of limited duration may be able to be addressed via operational modifications–such as short term road or lane closures or restrictions on access. Any proposal for operational mitigation must be approved by District Traffic Operations and District Maintenance.

6. Identify the cost of SLR mitigation in the estimate of project cost as a separate line item.

7. There will be instances where the relative SLR selected for the project cannot be accommodated due to cost or the creation of new impacts (e.g., raising a roadway could cause a larger fill slope to encroach onto environmentally sensitive areas or create impacts to designated scenic highways). The PDT should document the attempts made to address SLR in the PID and indicate what can be achieved and quantify that both in terms of cost as well as the degree of potential impact for the target future year.

8. Incremental or staged improvements to address SLR are also acceptable approaches, particularly where future projects are anticipated.

Other Considerations

SLR is not the only predicted climatic or weather induced change to the physical environment due to climate change. Various scenarios of future climate also include higher temperatures, more intense storms that can lead to increased storm surge and wave heights, as well as changes to precipitation patterns and intensities.

At this point in time, the level of uncertainty regarding these other aspects of future climate change is too great to assess with any degree of confidence. As such, Caltrans is continuing to partner with other State, federal and research entities to better understand and predict magnitudes and severity. For the purposes of this guidance document, it will be assumed that existing practices and policies will remain in effect and no change to future climate other than SLR will be addressed within our projects. At such time as more definitive information is available on both the severity of, and how to address these additional impacts of climate change, guidance will be issued.

Appendix A: Screening Criteria for Incorporating Sea Level Rise into Project Initiation Document

1. Is the project located in the coastal zone or in an area vulnerable to SLR? (If no, stop).

2. Using the SLR projections in Table 2 below, would the project be potentially impacted by an increase in sea level? (If no, stop).

Table 2. Sea-Level Rise Projections[8] using 2000 as the Baseline

Year		Average of Models	Range of Models
2030		7 in (18 cm)	5-8 in (9-17 cm)
2050		14 in (36 cm)	10-17 in (26-43 cm)
2070	**Low**	23 in (59 cm)	17-27 in (43-70 cm)
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	Medium	47 in (121 cm)	37-60 in (95-152 cm)
	High	55 in (140 cm)	43-69 in (110-176 cm)

3. If the project is located in the coastal zone, and could be potentially impacted by SLR, and it is determined that there are enough factors influencing the project to incorporate SLR, then the PID document must contain a discussion of SLR.

If the project is located in the coastal zone and could potentially be impacted by SLR and the design life is beyond 2030 then the PID document must contain a discussion of SLR.

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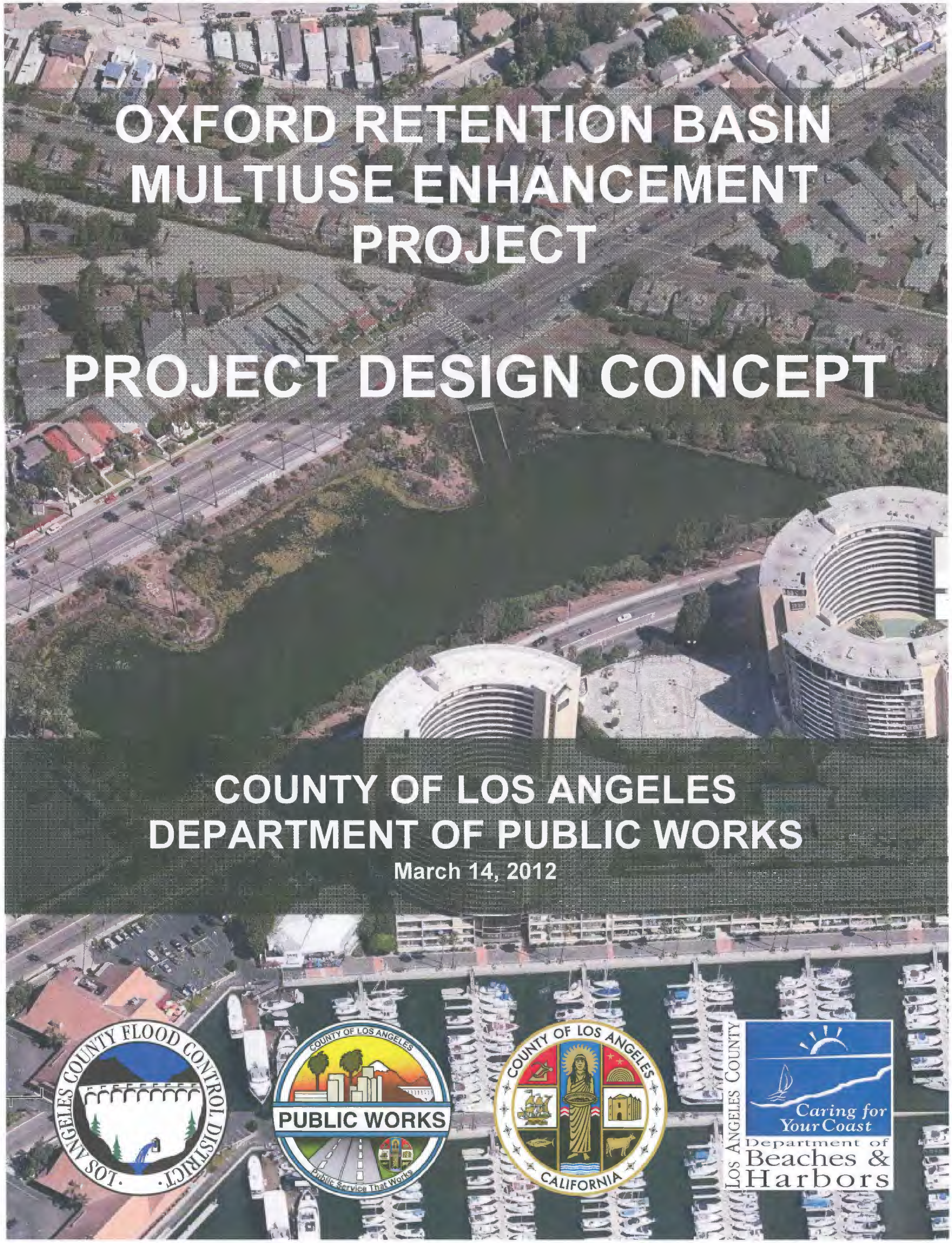
[8] For dates after 2050, Table 2 includes three different values for SLR - based on low, medium, and high greenhouse gas emission scenarios. These values are based on the Intergovernmental Panel on Climate Change emission scenarios as follows: B1 for the low projections, A2 for the medium projections and A1FI for the high projections.

Appendix B: Additional Information Sources

1) U.S. Geological Survey report on shoreline changes for California's beach habitat
   http://pubs.usgs.gov/of/2006/1219/
2) U.S. Geological Survey report on shoreline changes for California's bluff habitat
   http://pubs.usgs.gov/of/2007/1133/.
3) National Oceanic and Atmospheric Administration (NOAA) data on historic sea level change on California's coast
   http://tidesandcurrents.noaa.gov/sltrends/sltrends_states.shtml?region=ca
4) FHWA Hydraulic Engineering Circular 25–Highways in the Coastal Environment, 2nd Edition
   http://www.fhwa.dot.gov/engineering/hydraulics/library_arc.cfm?pub_number=192&id=137
5) U.S. Army Corps of Engineers Coastal Engineering Manual, EM 1110-2-1100
   http://chl.erdc.usace.army.mil/cem
6) National Oceanic and Atmospheric Administration (NOAA) Tidal Information
   http://tidesandcurrents.noaa.gov/tide_predictions.shtml?gid=235
7) U.S. Environmental Protection Agency Climate Change Website
   http://www.epa.gov/climatechange/index.html
8) San Francisco Bay Conservation and Development Commission Climate Change Website
   http://www.bcdc.ca.gov/planning/climate_change/climate_change.shtml
9) California Natural Resources Agency Climate Adaptation Strategy
   http://www.climatechange.ca.gov/adaptation/index.html
10) Caltrans Climate Change Program



OXFORD RETENTION BASIN MULTIUSE ENHANCEMENT PROJECT

PROJECT DESIGN CONCEPT

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
March 14, 2012

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

LOS ANGELES COUNTY
Caring for Your Coast
Department of Beaches & Harbors

Approved Patrick V. DeChellis 3.16.2012
Patrick V. DeChellis

Approved
Diego Cadena

March 14, 2012

TO: Patrick V. DeChellis
Diego Cadena

FROM: Sree Kumar
Design Division

Gary Hildebrand for
Watershed Management Division

PROJECT DESIGN CONCEPT
OXFORD RETENTION BASIN MULTIUSE ENHANCEMENT PROJECT
PROJECT ID FCC0001176, PCA JX0039

RECOMMENDATIONS

1. Approve the Project Design Concept (PDC) for the Oxford Retention Basin Multiuse Enhancement Project (Project) as described herein.

2. Approve a Project budget of $10,190,000 and request Watershed Management Division (WMD) to arrange for necessary financing over Fiscal Years (FY) 2012-15 as described in this PDC.

BACKGROUND

The Project is located at Oxford Retention Basin (Oxford Basin), a flood control facility operated by the Los Angeles County Flood Control District (LACFCD), one block north of Marina Del Rey Harbor Basin E (Basin E) in the unincorporated community of Marina Del Rey (Thomas Guide 671-J6).

The Project will mitigate localized flooding, address water quality deficiencies, enhance native habitat, improve the site's aesthetics, and provide passive recreation features.

WMD completed a Project Concept Report for the Project dated December 31, 2008. Design Division (DES) has studied and evaluated the alternatives for the Project and has refined the project scope and schedule.

PROJECT DESCRIPTION

The Project's scope of work is as follows:

LACFCD FUNDED WORK:

- Excavation of approximately 2,700 cubic yards (CY) of accumulated sediment along the bottom of Oxford Basin to restore basin capacity. The sediment will be disposed at a Class III landfill.
- Construction of a parapet wall along the northwestern and southern boundaries of Oxford Basin. The reinforced concrete wall will be approximately 1,050 linear feet long and a maximum of 2 feet in height. The wall will provide enhanced protection from flooding along Washington Avenue.
- Construction of a berm between the two existing tide gates and reprogramming the opening cycle of the existing tide gates to improve water circulation in Oxford Basin.
- Mitigation of localized flooding by modifying the existing 7-foot-wide catch basin on the south side of Oxford Avenue at the intersection of Oxford Avenue and Olive Street. The catch basin will be modified and a Tideflex "Check-mate" flap-gate will be installed at the connection to Project 5243. Local drainage will be further improved by the removal and replacement of existing Tideflex G-37 valves in four catch basins on Oxford Avenue and Olive Street with more efficient Tideflex "Check-mate" flap-gates.
- Installation of trash BMPs at the outlets of Storm Drain Project Nos. 5243 and 3872 to remove gross solids in urban and storm water runoff.
- Construction of a maintenance vehicle access ramp from Admiralty Way adjacent to the tide gate control house.
- Installation of a steel-grated landing above the two tide gate inlet structures in the basin to provide safer access for trash rack maintenance.
- Construction of a permanent boat ramp near the outlet of Project No. 3872 to allow Flood Maintenance Division (FMD) and the Department of Beaches and Harbors (DBH) access to Oxford Basin for routine maintenance, trash removal, and water quality monitoring.

COUNTY FUNDED WORK:

- Construction of an 8-foot-wide walking trail with wildlife-friendly lighting around the perimeter of Oxford Basin. The sidewalk along Admiralty Way will be replaced with landscaped parkway and integrated with the new walking trail.
- Reconstruct approximately 400 linear feet of slope along Admiralty Way near Project 3872 with geogrid or an approved equal to stabilize the underlying soils.
- Installation of approximately 3,550 linear feet of 4-foot-high ornamental steel fence around the perimeter of Oxford Basin.
- Removal of existing vegetation and approximately 6,200 CY of contaminated soils along the perimeter of Oxford Basin (3,200 CY and 3,000 CY to be disposed at Class I and Class III landfills, respectively) and replacement with clean imported fill and attractive, drought-tolerant native plants to provide aesthetic enhancement, which will also serve to enhance the habitat surrounding Oxford Basin.
- Installation of an irrigation system to establish the new native plants.
- Construction of six observation areas with park benches overlooking Oxford Basin: two along Washington Boulevard and four along Admiralty Way.
- Installation of interpretative signage at the observation decks and along the walking trail to educate users about stormwater pollution prevention measures, native plants, and area wildlife.

The project scope is also shown on Attachment A, artistic rendering of completed project, and Attachment B, Preliminary Design Plans.

DISCUSSION

The Oxford Basin site occupies an area of approximately 10.7 acres and currently has a large retention pond that is inundated year-round with urban and stormwater runoff, high groundwater, and tidal inflows from Basin E. A 10-foot-high chainlink fence encloses the facility, and there are a variety of trees and shrubs along the basin's steep banks. The facility lacks recreational amenities and has little aesthetic appeal. Oxford Basin is primarily a flood control facility, detaining urban and stormwater runoff from the surrounding area (approximately 700 acres) of the Marina Del Rey Watershed. There are automatically controlled tide gates, which allow Oxford Basin to drain to the Marina when the water surface elevation in the Marina is lower than that in Oxford Basin. On occasion, water in Basin E is allowed to enter the Oxford Basin through the gates for water recirculation purposes.

The Los Angeles Regional Water Quality Control Board (RWQCB) has identified Marina Beach ("Mother's Beach") and the Marina Del Rey Harbor Back Basins (Basins D, E, and F) as impaired water bodies. The jurisdictions within Oxford Basin's tributary drainage area are the Cities of Culver City and Los Angeles, the County of Los Angeles (County), and California Department of Transportation. Current Bacteria and Toxics Total Maximum Daily Load (TMDL) regulations call for an improvement to water quality in the Marina Del Rey Harbor back basins.

Basin Hydraulic Analysis

Two LACFCD storm drains discharge into Oxford Basin. Project No. 5243, constructed in 1969, was designed for the 10-year flow of 235 cubic feet per second (CFS), and Project No. 3872, constructed in 1972, was designed for the 10-year storm flows of 235 CFS. A new hydrology and storm routing analysis for Oxford Basin for a 50-year storm was conducted in August 2010, (Attachment D). The 50-year storm flow collected at Oxford Basin using the Watershed Modeling System and the Modified Rational Method was found to be 750 CFS. Based on initial water surface of 1.5 feet MSL in Oxford Basin and 2.7 feet MSL high tide water surface in the marina, routing the 50-year capital storm through the basin indicated that the maximum water surface in Oxford Basin would reach 4.9 feet MSL. While at this level, the discharge to the marina through the existing tide gates of 6-foot-by-6-foot reinforced concrete box and 81-inch diameter reinforced concrete pipe will be limited to 561 CFS. At an elevation of 4.9 feet MSL, the basin will have adequate storage capacity for 13.75 acre-feet. Under the 50-year capital storm event, the southerly and westerly perimeters of Oxford Basin will require a new parapet wall with the top-of-wall elevation at 8.0 feet MSL. This wall will provide the necessary freeboard to prevent flooding to the adjacent Parcel "OT" and along Washington Boulevard.

According to the hydraulic analysis conducted in 2010, when Oxford Basin reaches its maximum of 4.9 feet MSL, the low-lying subarea at the intersection of Oxford Avenue and Olive Street does not adequately drain into the Project 5243 Line "C" storm drain. This could lead to possible flooding above the property line within this reach for approximately 60 minutes before the basin water level recedes back to 3.8 feet MSL. In 2003, to address this flood hazard, check valves (Tideflex G-37) were installed on the connector pipes within the surrounding catch basins. However, one 7-foot-wide catch basin along Oxford Avenue could not be retrofitted with a check valve because it has a direct opening to the existing 6-foot-wide by 4-foot-high reinforced concrete box storm drain (Project 5243 Line "C").

The Project involves modification of the existing 7-foot-wide catch basin by separating the catch basin from Project No. 5243 and installing a check valve to isolate the potential backflow from the drain (See Attachment B, Sheet 3). Prior to forecasted storms, the basin is drained down to the lowest elevation possible, typically between -3.0 and -1.0 feet MSL. Any adverse affect on the lateral storm drain such as storm backflow along Oxford Avenue will be reduced. Therefore, based on the hydrology and reservoir routing analysis, the proposed improvements will alleviate flooding at the intersection of Olive Street and Oxford Avenue and no additional improvements are required on Oxford Avenue.

Water Circulation Operation

The Project will improve the water quality in Oxford Basin by increasing circulation and dissolved oxygen levels of the water within Oxford Basin. This will be accomplished by constructing a berm to direct flows around the basin and by revising the operation program of the tide gates to vary the water elevation between -2.0 and 1.5 feet MSL. This will facilitate better exchange of water between the Marina and the basin during high and low tides. Because the circulation will be powered by tidal action, the berm will have significantly lower maintenance requirements accomplishing the same goal as the mechanical circulation device included in the Project Concept Report.

The proposed berm structure will extend into the middle of Oxford Basin, separating incoming and outgoing flows and increasing circulation of water within Oxford Basin. The berm's function will be enhanced by strategic operation of the tide gates. For example, the west tide gate will be programmed to open during rising tides, sending water from Basin E into Oxford Basin, traveling upstream of the dividing berm. The east tide gate will be programmed to open during falling tides, forcing the water to circulate around the end of the berm and out of Oxford Basin into Basin E.

The top of the berm will be at 2.0 feet MSL and will be 2 feet wide. The berm will be planted with pockets of vegetation at an intermediate water elevation. The vegetation on the berm will potentially help to capture some of the pollutants in the water. See Attachment A for artistic renderings of the completed project.

Water Quality Enhancement

The proposed berm, modifications to the tide gate program, planting along the berm, landscaping on the embankment, and removal of deposited sediment will enhance circulation, increase oxygen levels in the water, remove pollutants, and improve the quality of water discharging from Oxford Basin.

To keep track of the improvements to the water quality, WMD will utilize data collected from the existing water quality monitoring system at station MdRH-5 in front of the tide gates, as well as the toxic monitoring station MdRH-B-2 in the middle of Basin E. Data collected from both stations will be used to evaluate the effectiveness of this Project.

Sediment Excavation

Removal of the contaminated sediment from Oxford Basin will ensure that this sediment is not contributing to concentrations of toxics, metals, or other pollutants of concern in the water within Oxford Basin prior to discharge to Basin E. A sediment and geotechnical study completed at Oxford Basin by URS Corporation in December 2011 identified evidence of elevated levels of hydrocarbons in sediment samples from the bottom of the basin. The report also identified the basin's perimeter to have levels of heavy metals above the thresholds for federal Resource Conservation and Recovery Act (RCRA) and California regulated (non-RCRA) hazardous material. Sediment removed from within the basin between elevation -3.0 MSL and elevation 1.0 MSL (approximately 2,700 CY) will be disposed at a Class III landfill and excavation material for retaining wall, access ramps and landscaping (approximately 300 CY) will need to be disposed at a Class I landfill. Staging, drying, and hauling of the excavated materials in the basin will be done as part of the contractor's soil management plan.

The landscaping work will require the excavation of approximately 6,200 CY of contaminated soil. Approximately 3,200 CY will be directed to a Class I landfill and 3,000 CY to a Class III landfill. This soil exceeds recommended agronomic thresholds, cannot be amended, and will need to be replaced for any type of planting to flourish. Biological assessments of the site have also recommended that approximately 150 non-native mature trees be removed to restore native habitat.

Based on the results and previous removal of material in the project area, the estimated total cost to remove the clean and hazardous soils is approximately $1.4 million, $300,000 for LACFCD funded work and $1.1 million for County funded work.

Recreational and Aesthetic Improvements

The community neighboring Oxford Basin has expressed a strong desire to add recreational and aesthetically pleasing amenities to the area surrounding the basin.

Replacement of the sidewalk along Admiralty Way with a landscaped parkway/bio-swale and construction of an 8-foot-wide decomposed granite walking trail around Oxford Basin will significantly improve the recreational appeal of Oxford Basin. In addition, replacement of existing vegetation with attractive, drought-tolerant native plants, installation of a 4-foot tall ornamental steel fence, construction of observation areas, interpretive signage, and improved wildlife friendly lighting will provide significant improvements to the site's aesthetics. See Attachment A for artistic renderings of the completed project.

The Oceana Del Rey retirement facility, a proposed multi-story housing development on Parcel OT (on the west side of Oxford Basin), is currently scheduled to begin construction in 2012. As part of their lease requirements, the developer has agreed to construct a walking trail and install landscaping in the adjacent space between the new complex and Oxford Basin. The trail and landscaping will be built to the same standard plans and architectural specifications as this Project. See Attachment C for plans of this proposed trail.

The Admiralty Way Settlement Repair Project is scheduled to begin in late 2012 and proposes a new temporary asphalt sidewalk, fencing, and grading into Oxford Basin. This sidewalk will be removed and replaced with a walking path as part of the Oxford Retention Basin Multiuse Enhancement Project.

RIGHT OF WAY AND MAINTENANCE

A construction easement from the City of Los Angeles will be required for the catch basin modification on Oxford Avenue and for construction of the walking trail along Washington Boulevard. No permanent easement or right-of-way acquisitions are required.

The County owns the Oxford Basin site, and the LACFCD, by agreement with the County, has unrestricted access to the site to maintain and operate its facilities thereon. This agreement stipulates that any construction projects initiated by the LACFCD on the Oxford Basin site must first be reviewed and approved by the DBH.

The maintenance responsibility of the non-flood control facilities on the Oxford Basin site, including the walking trail, landscaping, lighting, and other enhancements, has not been finalized. Watershed Management Division will facilitate the establishment of a Memorandum of Understanding (MOU) to be agreed upon by the County DBH, LACFCD, and/or the Department of Public Works for the maintenance of these improvements.

ENVIRONMENTAL DOCUMENT AND PERMIT REQUIREMENTS

Programs Development Division (PDD) has secured the services of Chambers Group as environmental consultant to prepare all required environmental documents. The consultant has determined the Project will require at least a Mitigated Negative Declaration, and that it may be necessary to prepare an Environmental Impact Report depending comments from the public review period from the constituents, regulatory agencies, and the general public. The Initial study will include Biological Resources, Cultural Resources, Hazards, and Hazardous Materials.

The Project is located within the coastal zone and must comply with the County-certified Local Coastal Program (LCP) for Marina Del Rey pursuant to Section 30519.5 of the Coastal Act. In addition, a Clean Water Act Permit for Section 401 from RWQCB and a Nationwide Permit from the United States Army Corps of Engineers will be required. The California Department of Fish and Game will require compliance with Section 1602 for any modifications made to Oxford Basin.

PROJECT CONSTRUCTABILITY AND ISSUES

High groundwater is expected during high tide. Dewatering will be required during excavation within the basin and will be subject to RWQCB regulations. Noise levels may need to be addressed due to construction activities that impact the bird nesting season.

All excavation and sediment disposal included in this Project will be required to comply with hazardous waste discharge requirements and the South Coast Air Quality Management District Rule 1166, Contaminated Soil Mitigation Plan. The trucking of material will be constant during grading and excavation, a truck route plan will need to be approved by the City of Los Angeles.

COMMUNITY OUTREACH

Public Works has been in contact with several stakeholders during the planning of this project. A chronological history of meetings with stakeholders can be seen on Attachment E.

TRAFFIC

A traffic detour plan will be required in order to allow the ingress and egress of heavy equipment to perform excavation operations at Oxford Basin. Detour and/or traffic control measures will also be required during perimeter construction activities.

UTILITIES

No utility relocations are anticipated for this Project.

DIVISION INVOLVEMENT FROM FISCAL YEAR 2009- FEB 2012

DES	Prepare PDC and preliminary design plans,	$	300,000
AED	Prepare preliminary design plans	$	34,000
SPM	Collect field data and create CADD file for DES	$	42,000
GMED	Preliminary Environmental Assessment & Geotechnical Report	$	325,000
CON	Preliminary utility notification	$	3,000
FMD	Review Project plan	$	2,000
PDD	Prepare Environmental report	$	60,000
PMD	Manage Project	$	180,000
TNL	Plan review	$	9,000
WMD	Oversee Project and coordinate with stakeholders	$	428,000
	Engineering Costs from 2009-2012	**$**	**1,383,000**

DIVISION INVOLVEMENT FROM FISCAL YEAR FEB 2012-14

DES	Prepare and complete final design plans, specifications, and engineer's estimate	$	175,000
AED	Prepare and complete final design plans, specifications, and estimate	$	86,000
SPM	Collect additional field data and review project plans.	$	33,000
GMED	Final Environmental Assessment & Geotechnical Report and review project	$	170,000
CON	Coordinate utility notification, prepare construction contract documents including all special monitoring for dewatering and disposal of contaminated material, provide construction contract administration,	$	77,000
FMD	Review Project plans.	$	3,000
PDD	Perform environmental study, prepare MND, obtain regulatory permits for environmental drilling and project construction, and prepare maintenance agreement with DBH	$	75,000
PMD	Manage Project	$	175,000
TNL	Prepare detour plans	$	11,000
WMD	Oversee Project and coordinate with stakeholders	$	112,000
	Estimated Engineering Costs 2012-2014	**$**	**917,000**

CONSTRUCTION ENGINEERING JANUARY 2014-2015

CON & OTHER SUPPORT DIVISIONS	Construction support – provide construction contract administration and inspection services.	$ 1,400,000

CONSTRUCTION COSTS

Drainage Improvements	$ 1,000,000
Landscaping	$ 1,200,000
Aesthetic Enhancements	$ 1,500,000
Water Quality Enhancements	$ 800,000
Excavation and disposal of sediment	$ 1,400,000
Construction Contingency (10%)	$ 590,000
Total Estimated Construction Costs	**$ 6,490,000**

FUNDING BREAKDOWN

The LACFCD will provide funding for the parapet wall, modification to the catch basins on Oxford Ave, access ramps, removal of accumulated sediment within Oxford Basin, grading, and berm construction. The County of Los Angeles Supervisorial District 4 (SD4) has agreed to provide funding for landscaping and associated excavation, fencing, walking path, lighting, signage, and other aesthetic and recreational enhancements through their discretionary fund. Maintenance of the new access road and the berm will be funded by the LACFCD. Funding for maintenance of all proposed aesthetic and recreational improvements, including the fencing, lighting, walking path, and landscaping, will be arranged when establishing the MOU.

LACFCD Funded Work		
Engineering Expenditures in FY 2009-2012:	$	1,383,000
Engineering in FY 2012-2013 through FY 2014-2015:	$	917,000
Construction Engineering FY 2014-2015:	$	1,400,000
LACFCD Improvements (excavation, berm, etc)	$	2,300,000
Removal and Disposal of Accumulated Sediment	$	300,000
Construction Contingency (10%)	$	260,000
Total Estimated LACFCD Costs	**$**	**6,560,000**

SD4 Funded Work

Fencing, Landscaping, Walking Path, Observation Deck/Areas, Aesthetic improvements	$	2,200,000
Excavation and Disposal of Contaminated Soil	$	1,100,000
Construction Contingency (10%)	$	330,000
Total Estimated Aesthetic Enhancement Costs	**$**	**3,630,000**
Total Estimated Project Costs	**$**	**10,190,000**

ISI RATING

Using the Institute for Sustainable Infrastructure's (ISI) Envision 2.0 draft sustainability rating tool released in January 2012, this project scored 438 points out of a possible 768 points (see Attachment F for summary).

PROJECT SCHEDULE

Milestone	**Estimated Start** (actual in **Bold**)	**Estimated Finish** (actual in **Bold**)
Project Design Concept	**April 2010**	**March 2012**
30% Plan	**June 2010**	**August 2010**
30% Plan Review	**September 2010**	**October 2010**
PDD - MND Report / Board approval	March 2012	October 2012
PDD – Drilling permits	**July 2011**	**September 2011**
GMED Environmental Assessment	**September 2011**	March 2012
60% Plan	**October 2010**	**March 2012**
60% Plan Review	March 2012	April 2012
First Utility Notice	March 2012	May 2012
Prepare and submit permit applications	August 2012	September 2012
Secure regulatory permits		September 2013
90% Plans, Specs, & Estimate	March 2012	May 2012
90% Plans, Specs, & Estimate Review	May 2012	June 2012
Final utility clearance	July 2012	September 2012
Final Plans, Specs, & Estimate	September 2012	September 2013
Signed Plans		September 2013
Advertise	September 2013	November 2013
Award		February 2014
Construction	March 2014	March 2015

PREPARED BY:

3/14/12
Charles Chen, Design Division Date
Drainage Section II

Josh Svensson 3/14/12
Joshua Svensson, Watershed Management Division Date
Santa Monica Bay Watershed

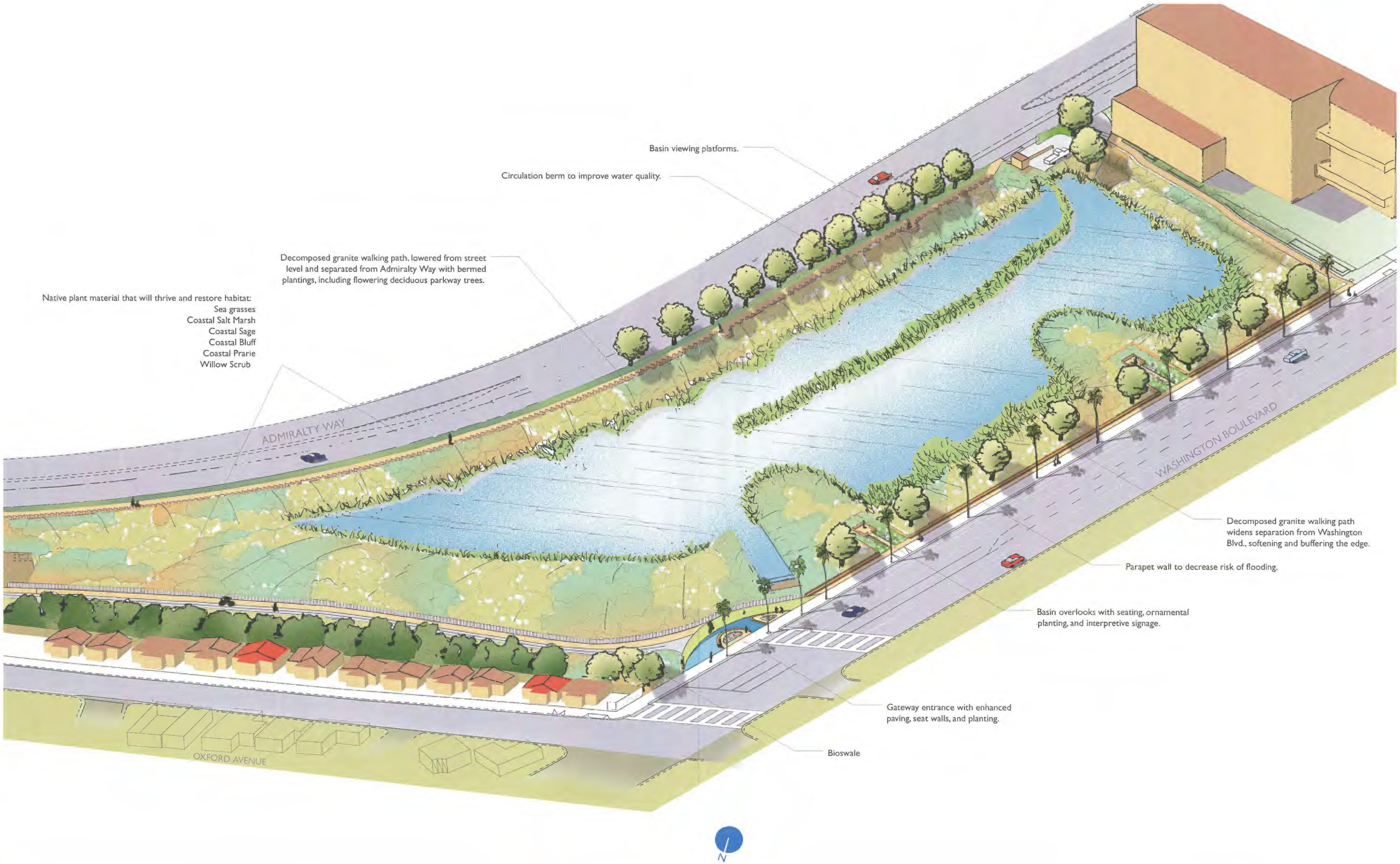
JTS:
CC:
P:\ddpub\Structures\Projects\Oxford Retention Basin PDC v6.4.docx

Attach.

cc: Construction (Sparks, Updyke, Dunn)
Flood Maintenance (Lee, South)
Geotechnical & Materials Engineering (Montgomery, Goodman)
Programs Development (Dingman)
Road Maintenance (MacGregor, MD 4)
Survey/Mapping & Property (Steinhoff, Jeffers)
Watershed Management (Hamamoto)
Project Management (Kearns, E-Nunu)
Design (Atashzay, Grindle)

ATTACHMENT A

PERSPECTIVE RENDERINGS OF PROPOSED BASIN



Basin viewing platforms.

Circulation berm to improve water quality.

Decomposed granite walking path, lowered from street level and separated from Admiralty Way with bermed plantings, including flowering deciduous parkway trees.

Native plant material that will thrive and restore habitat:
Sea grasses
Coastal Salt Marsh
Coastal Sage
Coastal Bluff
Coastal Prarie
Willow Scrub

Decomposed granite walking path widens separation from Washington Blvd., softening and buffering the edge.

Parapet wall to decrease risk of flooding.

Basin overlooks with seating, ornamental planting, and interpretive signage.

Gateway entrance with enhanced paving, seat walls, and planting.

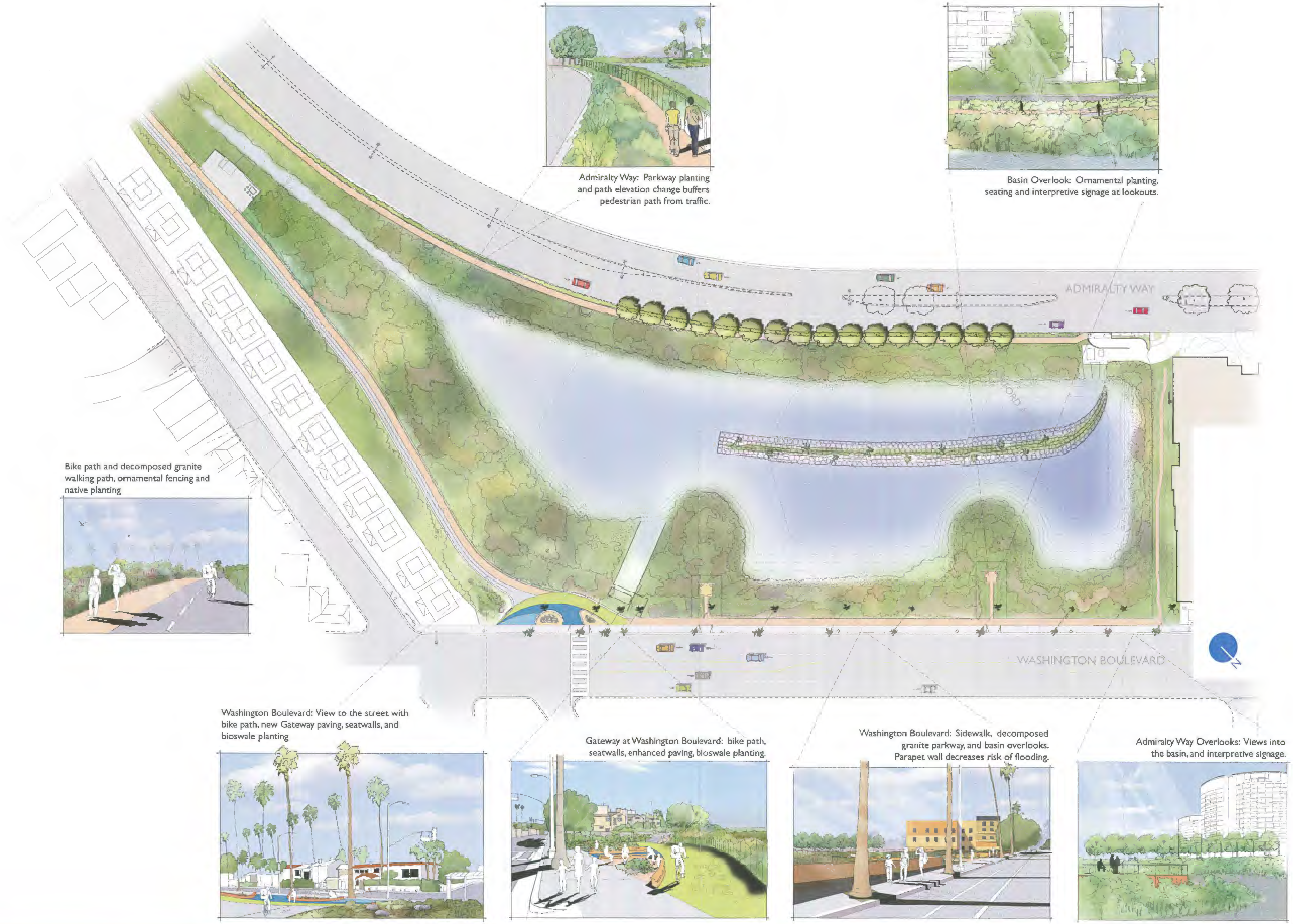
Bioswale

OXFORD RETENTION BASIN MULTIUSE ENHANCEMENT PROJECT

COUNTY OF LOS ANGELES CALIFORNIA

PUBLIC WORKS

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT



Admiralty Way: Parkway planting and path elevation change buffers pedestrian path from traffic.

Basin Overlook: Ornamental planting, seating and interpretive signage at lookouts.

Bike path and decomposed granite walking path, ornamental fencing and native planting

Washington Boulevard: View to the street with bike path, new Gateway paving, seatwalls, and bioswale planting

Gateway at Washington Boulevard: bike path, seatwalls, enhanced paving, bioswale planting.

Washington Boulevard: Sidewalk, decomposed granite parkway, and basin overlooks. Parapet wall decreases risk of flooding.

Admiralty Way Overlooks: Views into the basin, and interpretive signage.

OXFORD RETENTION BASIN MULTIUSE ENHANCEMENT PROJECT

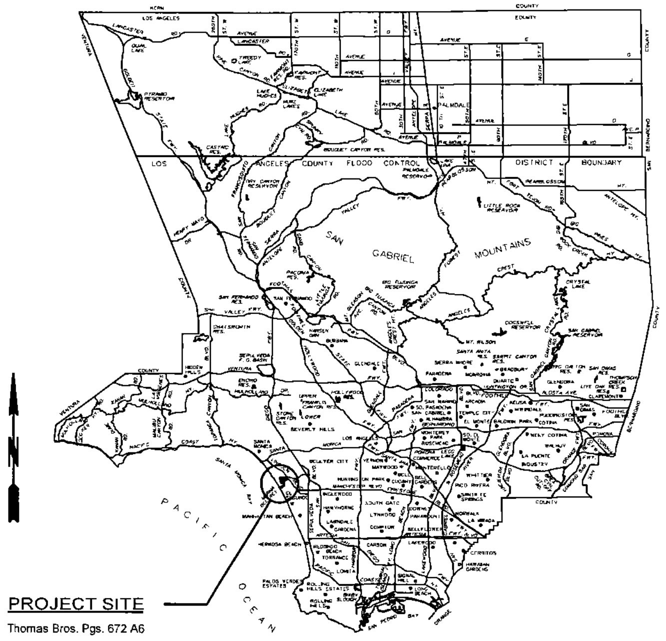
COUNTY OF LOS ANGELES CALIFORNIA
PUBLIC WORKS
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

ATTACHMENT B

PRELIMINARY CONCEPT
PROJECT PLANS

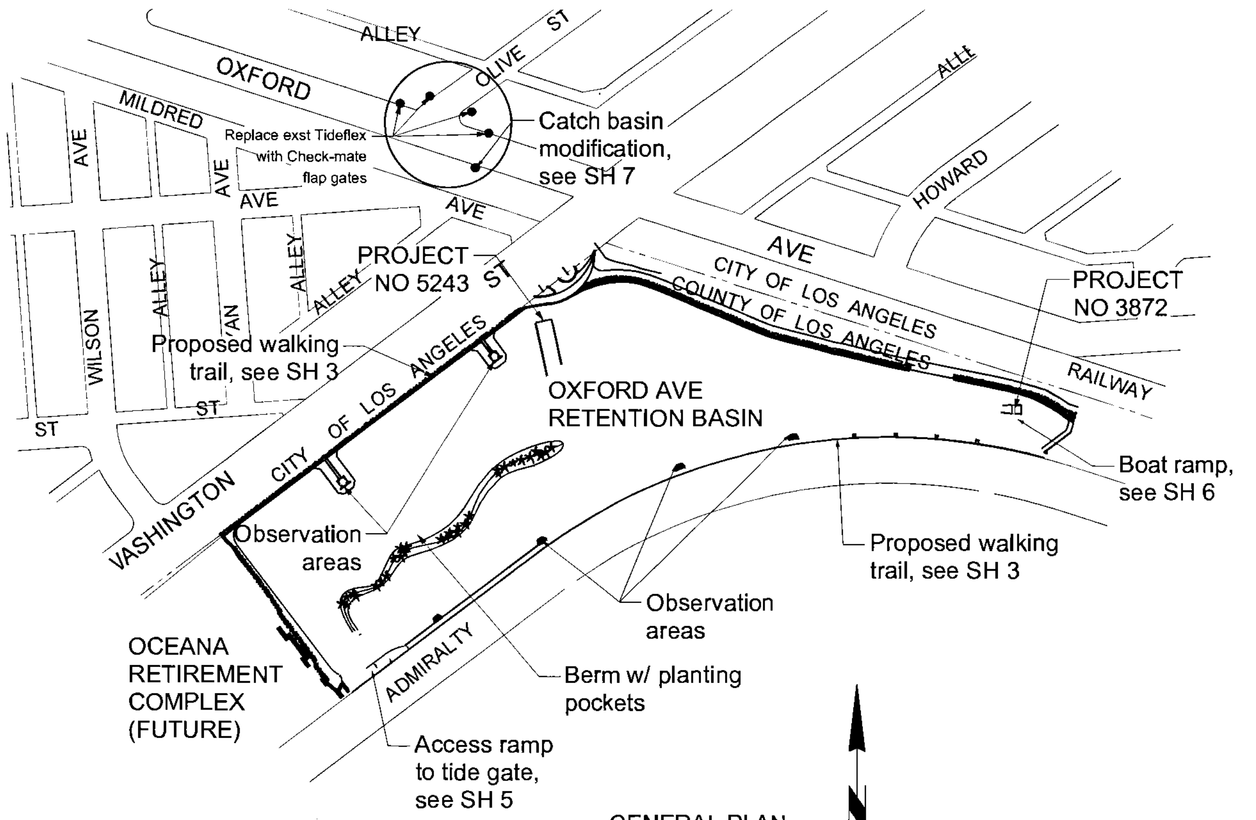
COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS

OXFORD RETENTION BASIN
MULTI-USE ENHANCEMENT PROJECT



PROJECT SITE
Thomas Bros. Pgs. 672 A6

LOCATION MAP



GENERAL PLAN

NOT TO SCALE

INDEX TO PROJECT PLANS

SH.NO.	DESCRIPTION
1.	TITLE SHEET
2.	GENERAL NOTES, STRUCTURAL NOTES, STRUCTURAL DESIGN CRITERIA, AND INDEX TO STANDARD PLANS
3.	SITE GRADING PLAN AND WALKING TRAIL DETAILS
4.	PROFILE AND CROSS SECTION DETAILS
5.	TIDE GATE ACCESS RAMP PROFILE AND DETAILS
6.	BOAT RAMP PLAN AND DETAILS AT PROJECT NO. 3872
7.	OXFORD AVE CATCH BASIN MODIFICATION AND DETAILS
B.	STRUCTURAL CATWALK DETAIL FOR TIDE GATE CONTROL HOUSE
9.	LANDSCAPE CONSTRUCTION LAYOUT PLAN
10.	LANDSCAPE CONSTRUCTION DETAILS
11.	PLANTING PLAN

UTILITIES

WATER	CITY OF LOS ANGELES DEPT OF WATER & POWER
GAS	THE GAS CO.
ELECTRIC	SO. CALIF. EDISON
TELEPHONE	AT&T
SEWER	CITY OF LOS ANGELES BUREAU OF SANITATION

REFERENCES

PROJECT NO. 3872, UNIT 1	DWG. NO.470-3872-D3.1-13
PROJECT NO. 3872, UNIT 1, AUTOMATIC FLAPGATES	DWG.NO.470-3872-D8.1-3
PROJECT NO. 5243	DWG.NO. 364-5243-D2.1-25
OXFORD RETENTION BASIN AND PUMP STATION	DWG.NO.507 D1.1-22
OXFORD RETENTION BASIN AND OUTLET SYSTEM IMPROVEMENT	DWG.NO.507 D3.1-15
PROJECT NO 3872 MARINA DEL RAY LOW FLOW DIVERSION	DWG.NO. 364-5243-D10.1-11
SURVEY NOTES	PWFB 1015-654, 764, 1099 to 1102 PWLB 1015-996 to 1001
ADMIRALTY WAY SETTLEMENT REPAIR PROJECT	PROJ ID NO. RDC0015061

Los Angeles County
Department of Public Works
The Information Shown Hereon Is
PRELIMINARY
Unofficial and Subject to Change

60% REVIEW

CADD PROJECT FILE NAME

CHECKER
J. LI

DESIGNER
C. CHEN

DRAFTER
C. CHEN

TWO DAYS BEFORE YOU DIG
CALL USA TOLL FREE
1-800-227-2600

APPROVED GAIL FARBER DIRECTOR OF PUBLIC WORKS
BY ______ DEPUTY DIRECTOR DATE

RECOMMENDED
BY ______ ASSISTANT DEPUTY DIRECTOR DATE

SUBMITTED
BY ______ DATE

DATE	MK	DESCRIPTION

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
CHARLES C. CHEN
NO. C63209
EXP. 06/30/12
CIVIL
STATE OF CALIFORNIA

PROJECT ENGINEER ______ DATE

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS
OXFORD RETENTION BASIN
MULTI-USE ENHANCEMENT PROJECT
TITLE SHEET

FCC0001176 | JOB JX0039 | DWG 507-D4.1 | SHEET 1 OF 11

TS-DF 07/05

DATE. $DATE$ TIME. $TIME$ FILE. $FILEL$

GENERAL NOTES

1. ELEVATIONS SHOWN ARE IN FEET BASED ON L.A. CITY 1980 ELEV. PER TRIG LEVELS
2. STATIONS SHOWN ON THE PLANS ARE ALONG CENTER LINE OF CONDUIT OR ON A LINE NORMAL TO CENTER LINE OF CONDUIT.
3. STATIONS AND INVERT ELEVATIONS OF PIPE INLETS SHOWN ON THE PROFILES ARE AT THE INSIDE FACE OF THE CONDUIT, UNLESS OTHERWISE SHOWN.
4. ALL PIPE IN OPEN TRENCH SHALL BE BEDDED ACCORDING TO LACDPW STANDARD PLAN 3080, CASE III, EXCEPT BELL AND SPIGOT PIPE WHICH SHALL BE CASE II BEDDING, UNLESS OTHERWISE SHOWN. "W" VALUES SHALL BE AS SPECIFIED ON STANDARD PLAN 3080 FOR CASE III BEDDING, NOTES (a), (b), AND (c). IF THE "W" VALUE AT THE TOP OF THE PIPE IS EXCEEDED, THE BEDDING SHALL BE MODIFIED, AND/OR PIPE OF ADDITIONAL STRENGTH SHALL BE PROVIDED. THE PROPOSED MODIFICATION SHALL BE APPROVED BY THE DEPARTMENT.
5. CONCRETE BACKFILL SHALL BE PROVIDED AROUND PIPE 21 INCHES IN DIAMETER OR LESS WHERE THE COVER IS EQUAL TO OR LESS THAN 2'-0", AROUND PIPE GREATER THAN 21 INCHES IN DIAMETER BUT LESS THAN 39 INCHES WHERE THE COVER IS LESS THAN 1'-3", AND FOR PIPE 39 INCHES OR GREATER WHERE THE COVER IS LESS THAN 1'-0". THE CONCRETE BACKFILL SHALL BE AS SPECIFIED ON LACDPW STANDARD PLAN 3080, NOTE 7.
6. ALL EXISTING UTILITIES SHOWN ON THE PLANS ARE THE PROPERTY OF THE OWNERS LISTED ON SHEET 1, UNLESS OTHERWISE NOTED.
7. EXISTING UTILITIES SHALL BE MAINTAINED IN PLACE BY THE CONTRACTOR, UNLESS OTHERWISE NOTED, AND ALL UTILITIES CROSSING THE TRENCH SHALL BE TEMPORARILY SUPPORTED TO THE SATISFACTION OF THE OWNER.
8. THE CONTRACTOR SHALL MAKE EXPLORATORY EXCAVATIONS TO DETERMINE THE DEPTH AND LOCATION OF EXISTING UTILITIES WHERE SO INDICATED BY THE SYMBOL "△".
9. ALL RESURFACING, CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED SHALL BE CONSTRUCTED AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS, UNLESS OTHERWISE NOTED.
10. THE WORK SHOWN ON THESE DRAWINGS REQUIRES THE PRIME CONTRACTOR TO HAVE A VALID CLASS A OR C42 LICENSE ISSUED BY THE STATE OF CALIFORNIA.
11. ALL FIELD BOOK REFERENCES ARE TO LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS FIELD BOOKS, UNLESS OTHERWISE NOTED.

STRUCTURAL NOTES

1. DIMENSIONS FROM FACE OF CONCRETE TO STEEL ARE TO CENTER OF BAR, UNLESS OTHERWISE SHOWN.
2. CONCRETE DIMENSIONS SHALL BE MEASURED HORIZONTALLY OR VERTICALLY ON THE PROFILE, AND PARALLEL TO OR AT RIGHT ANGELS (OR RADIALLY) TO CENTER LINE OF CONDUIT ON THE PLAN EXCEPT AS OTHERWISE SHOWN.
3. ALL BAR BENDS AND HOOKS SHALL CONFORM TO THE AMERICAN CONCRETE INSTITUTE'S "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION, SECTION 7.2.
4. PLACING OF REINFORCEMENT SHALL CONFORM TO THE AMERICAN CONCRETE INSTITUTE'S "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION, SECTION 7.3
5. TRANSVERSE CONSTRUCTION JOINTS SHALL NOT BE PLACED WITHIN 30 INCHES OF MANHOLE OR JUNCTION STRUCTURE OPENINGS.
6. TRANSVERSE CONSTRUCTION JOINTS IN WALLS AND SLABS SHALL BE IN THE SAME PLANE. NO STAGGERING OF JOINTS WILL BE PERMITTED. TRANSVERSE CONSTRUCTION JOINTS SHALL BE NORMAL OR RADIAL TO THE CENTER LINE OF CONSTRUCTION.
7. THE TRANSVERSE REINFORCING BARS SHALL TERMINATE ONE AND ONE-HALF INCHES FROM THE CONCRETE SURFACES UNLESS OTHERWISE SHOWN ON THE STRUCTURAL DETAILS.
8. EXPOSED SURFACES OF CONCRETE MEMBERS SHALL BE ROUNDED OR BEVELED.
9. NO SPLICES IN TRANSVERSE BARS REINFORCEMENT WILL BE PERMITTED OTHER THAN SHOWN ON THE STRUCTURAL DETAILS WITHOUT APPROVAL OF THE ENGINEER. NO MORE THAN TWO SPLICES WILL BE PERMITTED IN ANY LONGITUDINAL BAR BETWEEN TRANSVERSE JOINTS. SPLICES SHALL BE STAGGERED.
10. LONGITUDINAL BARS SHALL BE LAPPED 20 BAR DIAMETERS AT SPLICES. TRANSVERSE BARS SHALL BE LAPPED 30 BAR DIAMETERS AT SPLICES.
11. LONGITUDINAL STEEL SHALL TERMINATE TWO INCHES FROM TRANSVERSE CONSTRUCTION JOINTS.
12. TRANSVERSE JOINTS SHALL BE SPACED NOT TO EXCEED 50 FEET NOR BE LESS THAN 10 FEET, MEASURED ALONG THE CENTERLINE OF CONSTRUCTION, EXCEPT AS OTHERWISE SHOWN ON THE PLANS.
13. AT THE BEGINNING AND ENDING OF ALL POURS, A COMPLETE CURTAIN OF MAIN REINFORCEMENTS SHALL SHALL BE PLACED THREE INCHES FROM THE TRANSVERSE CONSTRUCTION JOINTS.
14. ALL REBAR USED IN CONSTRUCTION SHALL BE EPOXEY COATED IN CONFORMANCE WITH ASTM SPECIFICATION A775M AND FIELD INSTALLED IN CONFORMANCE WITH ASTM SPECIFICATION D3963/D3963M

INDEX TO STANDARD PLANS

STD. PLAN	LACDPW TITLE
3080-2	AUTOMATIC FLAP GATE INLET
3080-2	PIPE BEDDING IN TRENCHES
3090-1	CRITERIA FOR THE DESIGN OF SHORING FOR EXCAVATIONS
3091-1	SAMPLE SHEET FOR USE AS A GUIDE IN PREPARING CALCULATIONS FOR SHORING OF EXCAVATIONS
3093-1	UNIFIED SOIL CLASSIFICATION SYSTEM
6002-1	PORTABLE SECURITY FENCE FOR OPEN TRENCHES
6008-1	MINIMUM PUBLIC SAFETY REQUIREMENT FOR OPEN EXCAVATIONS

STD. PLAN	SPPWC TITLE
314-2	MODIFICATIONS FOR SIDE OPENING CATCH BASIN
600-2	CHAIN LINK FENCE AND GATES
606-2	METAL HAND RAILING
610-2	REINFORCED CONCRETE RETAINING WALL TYPE 1

CONCRETE REMOVAL NOTES

CONCRETE REMOVAL SHALL BE DONE IN THE FOLLOWING SEQUENCE:

A. WHERE THE PLAN INDICATE THE EXISTING CONCRETE IS TO BE REMOVED AND THE EXISTING REINFORCEMENT IS REQUIRED TO EXTEND THROUGH THE NEW JOINT, CONCRETE SHALL BE REMOVED IN THE FOLLOWING SEQUENCE:

   1. THE CONTRACTOR SHALL MAKE A SUFFICIENT NUMBER OF EXPLORATORY HOLES IN THE EXISTING SLAB TO VERIFY HORIZONTAL SPACING AND CONCRETE COVER OVER EXISTING REINFORCEMENT. THE DEPTH OR EXACT LOCATION OF SAW CUTS MAY VARY AS DETERMINED BY THE ENGINEER IN THE FIELD BASED ON INFORMATION OBTAINED FROM EXPLORATORY HOLES.

   2. A SAW CUT SHALL BE MADE ONE AND ONE-HALF INCHES DEEP AT THE REMOVAL LIMITS. CARE SHALL BE EXERCISED IN SAWING AT THE REMOVAL LIMITS SO AS NOT TO CUT THE REINFORCING STEEL IN THE REMAINING SLAB. THE EXISTING REINFORCING STEEL SHALL BE RETAINED AND EXTENDED INTO THE NEW CONSTRUCTION AS INDICATED ON THE PLANS. ANY STEEL INADVERTENTLY CUT OR DAMAGED SHALL BE REPLACED WITH DOWELING AT CONTRACTORS EXPENSE.

   3. USING HAND-HELD EQUIPMENT, CAREFULLY REMOVE THE CONCRETE FOR THE FULL DEPTH OF THE SLAB AND FOR A MINIMUM DISTANCE FROM THE SAW CUT EQUAL TO THE LONGEST EXTENSION OF THE EXISTING BARS TO BE EXTENDED INTO THE NEW CONSTRUCTION. THIS EXTENSION SHALL BE 30 BAR DIAMETERS, UNLESS OTHERWISE NOTED.

   4. EXISTING REINFORCEMENT SHALL BE CUT TO THE REQUIRED BAR EXTENSIONS.

   5. THE REMAINING CONCRETE MAY BE REMOVED BY ANY SUITABLE METHOD UPON APPROVAL OF THE ENGINEER, WHO SHALL BE THE SOLE JUDGE OF THE USE OF ANY CONCRETE REMOVAL EQUIPMENT, EXPLOSIVE, WRECKING BALL, OR OTHER SIMILAR DEVICES. METHODS AND EQUIPMENT WHICH ARE LIKELY TO DAMAGE THE CONCRETE TO BE LEFT IN PLACE SHALL NOT BE USED.

STRUCTURAL DESIGN CRITERIA

L.A.C.F.C.D. STRUCTURAL DESIGN MANUAL
DATED APRIL 1982

LIVE LOAD

HS 20-44 unless otherwise noted.

DEAD LOAD

Earth load per Marston's formula: w= 130 pcf
Ku=Ku' =0.150
Bd=Outside width of box plus 3 feet
Side earth:
Rubber dam EFP = 60 pcf
Internal water pressure: 62.4 psf per foot of depth
Weight of concrete: 150 pcf

ALLOWABLE STRESSES

f'c=4000 psi at 28 days
fc =1800 psi
fs =24,000 psi
n =8
Shear and bond stresses per A.C.I. 318-63

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EXP. 06/30/12
CIVIL

PROJECT ENGINEER DATE

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

OXFORD RETENTION BASIN
MULTI-USE ENHANCEMENT PROJECT

GENERAL NOTES, STRUCTURAL NOTES, STRUCTURAL DESIGN CRITERIA AND INDEX TO STANDARD PLANS

FCC0001176 | JOB JX0039 | DWG 507-D4.2 | SHEET 2 OF 11

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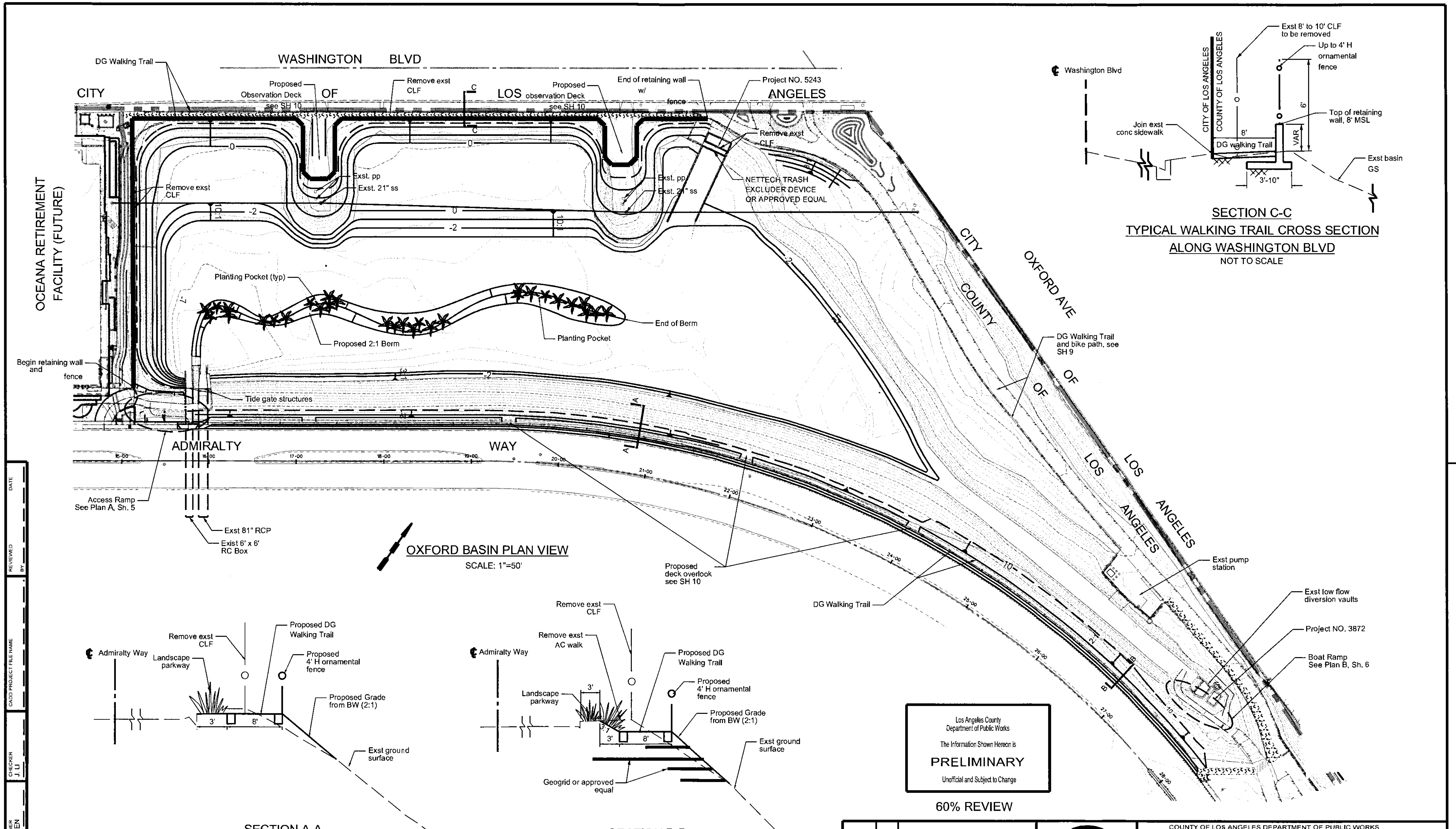
C. CHEN



SECTION C-C
TYPICAL WALKING TRAIL CROSS SECTION
ALONG WASHINGTON BLVD
NOT TO SCALE

SECTION A-A
TYPICAL WALKING TRAIL CROSS SECTION
ALONG ADMIRALTY WAY
FROM STA 15+85 TO STA 21+80
NOT TO SCALE

SECTION B-B
TYPICAL WALKING TRAIL CROSS SECTION
ALONG ADMIRLATY WAY
FROM STA 21+80 T0 STATION 28+20
NOT TO SCALE

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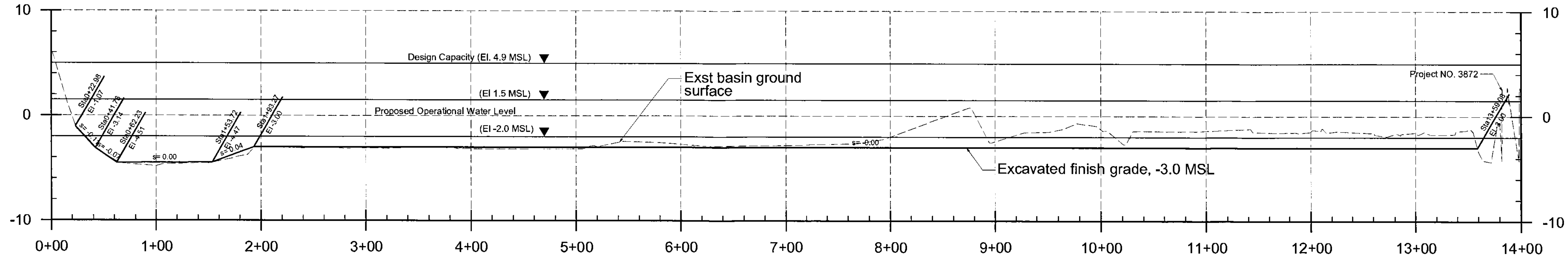
OXFORD RETENTION BASIN
MULTI-USE ENHANCEMENT PROJECT

DETENTION BASIN GRADING PLAN
AND WALKING TRAIL DETAILS

FCC0001176 | JOB JX0039 | DWG 507-D4.3 | SHEET 3 OF 11

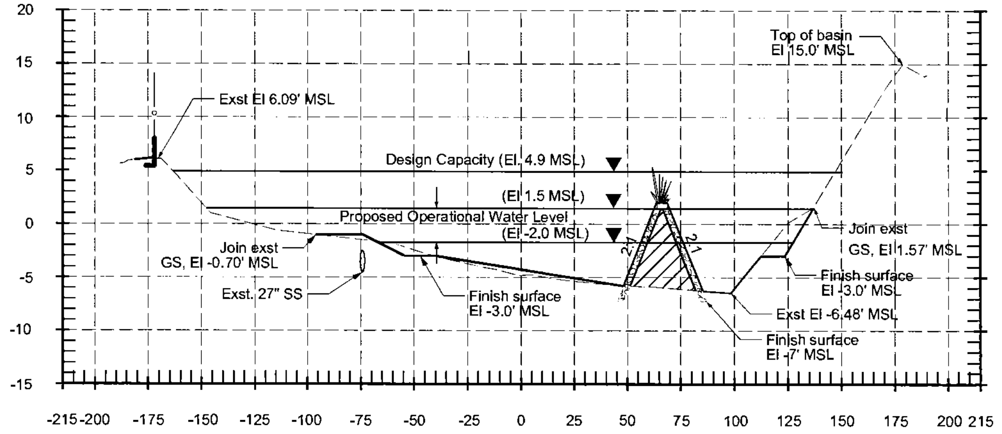
PS-DF 07/05

DATE. $DATE$ME. FILE. $TIMES $FILE$



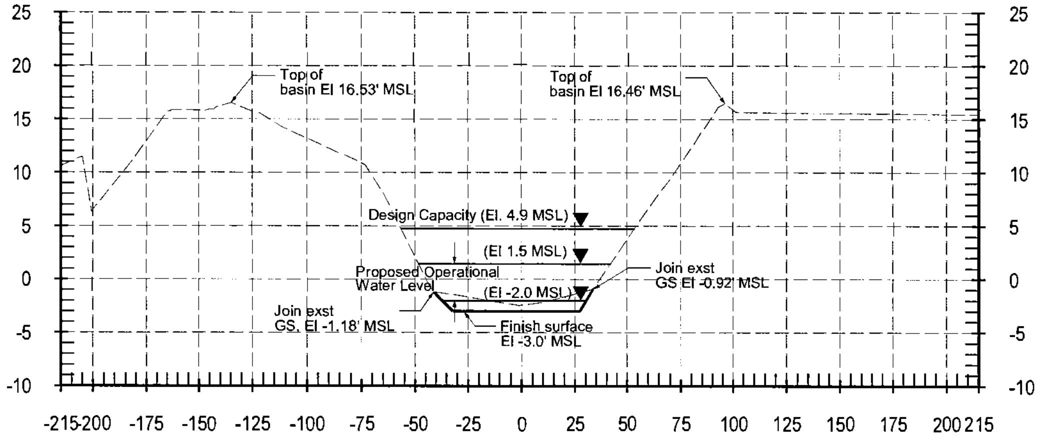
OXFORD BASIN PROFILE ALONG ℄(SH 3)

SCALE: HORZ 1"=50'
VERT 1"=5'



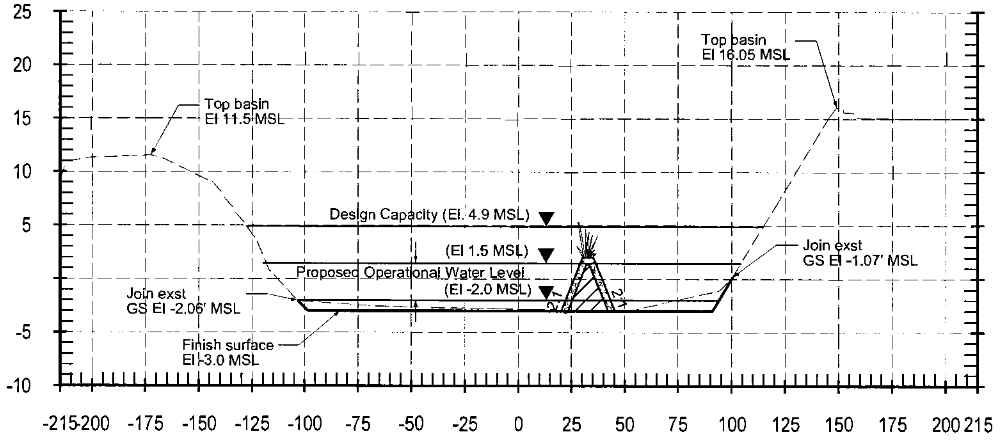
CROSS SECTION AT STATION 1+00 (SH 3)

SCALE: Horiz 1"=40'
Vert 1"=8'



CROSS SECTION AT STATION 9+00 (SH 3)

SCALE: Horiz 1"=40'
Vert 1"=8'



CROSS SECTION AT STATION 7+00 (SH 3)

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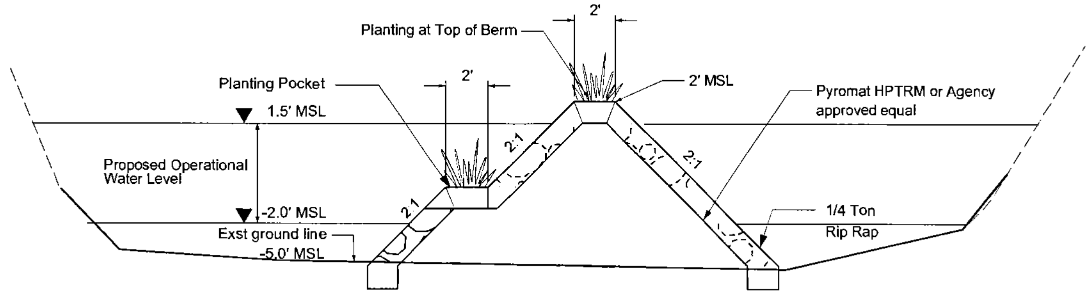
Vert 1"=8'



TYPICAL SECTION
BASIN DIVERSION BERM

NOT TO SCALE

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OXFORD RETENTION BASIN
MULTI-USE ENHANCEMENT PROJECT

PROFILE AND CROSS SECTION DETAILS

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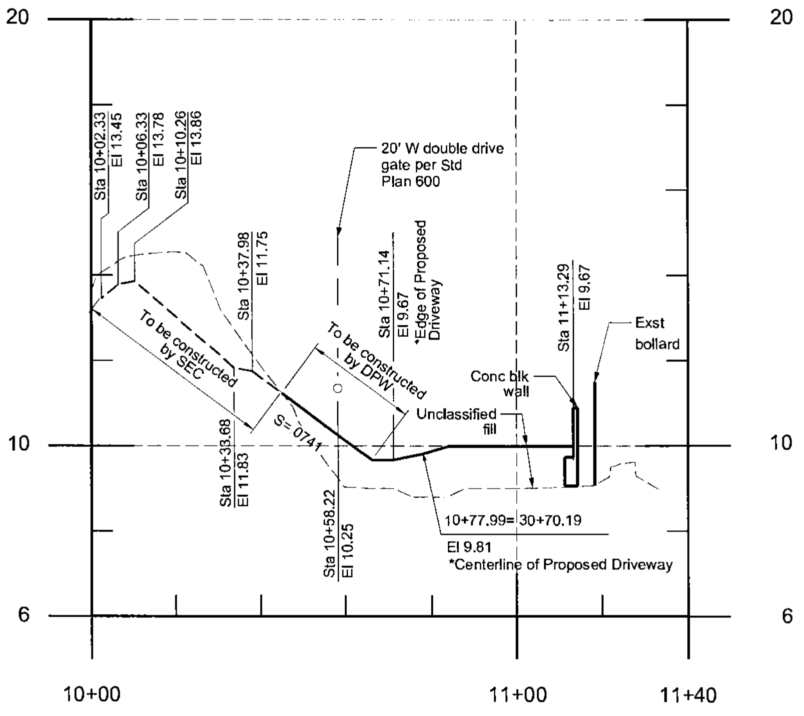
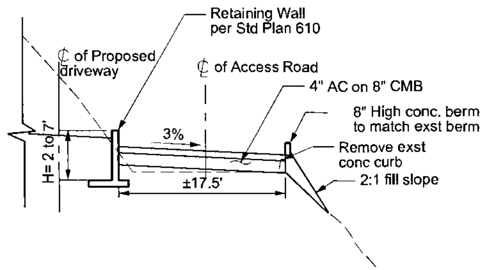


PROFILE FOR EXISTING ACCESS RAMP

SCALE: HORIZ 1"=20'
VERT 1"=2'



SECTION D-D EXISTING ACCESS RAMP CROSS SECTION

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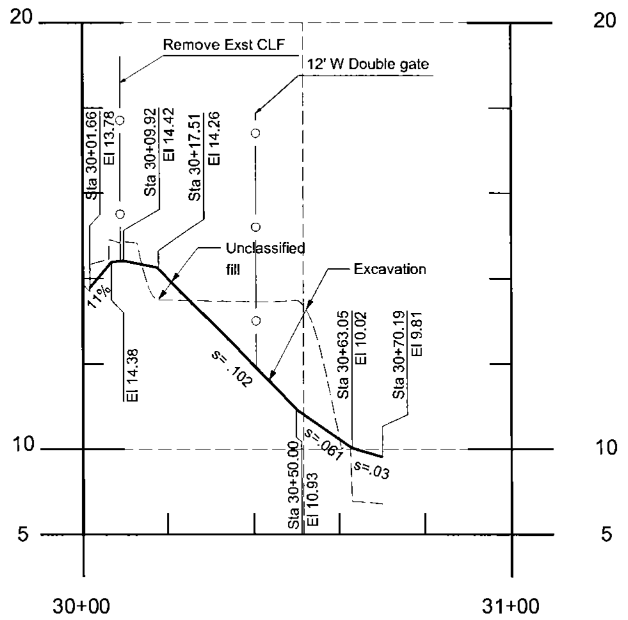
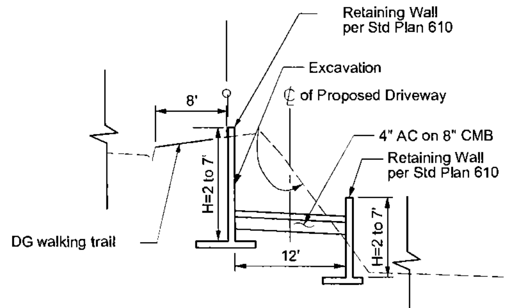


PROFILE FOR PROPOSED DRIVEWAY

SCALE: HORIZ 1"=20'
VERT 1"=2'



SECTION F-F PROPOSED DRIVEWAY CROSS SECTION

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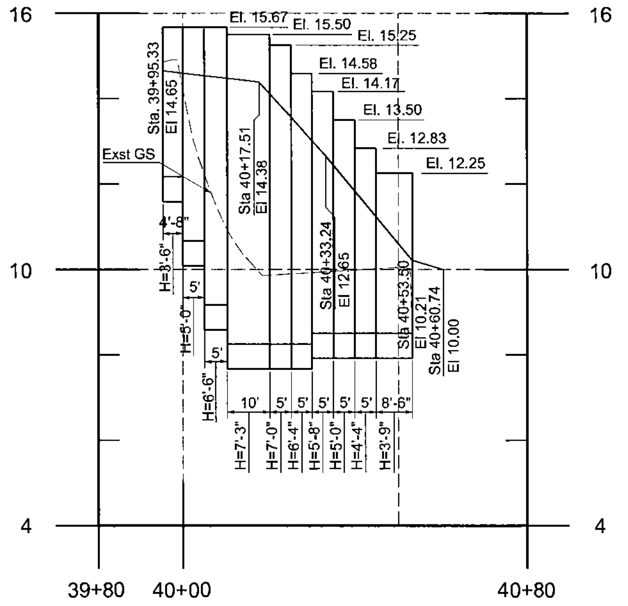
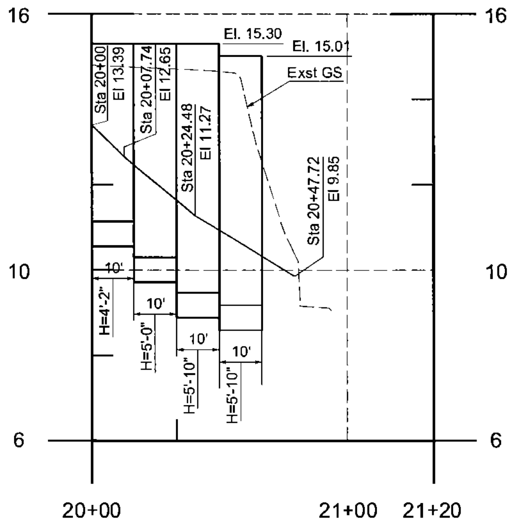


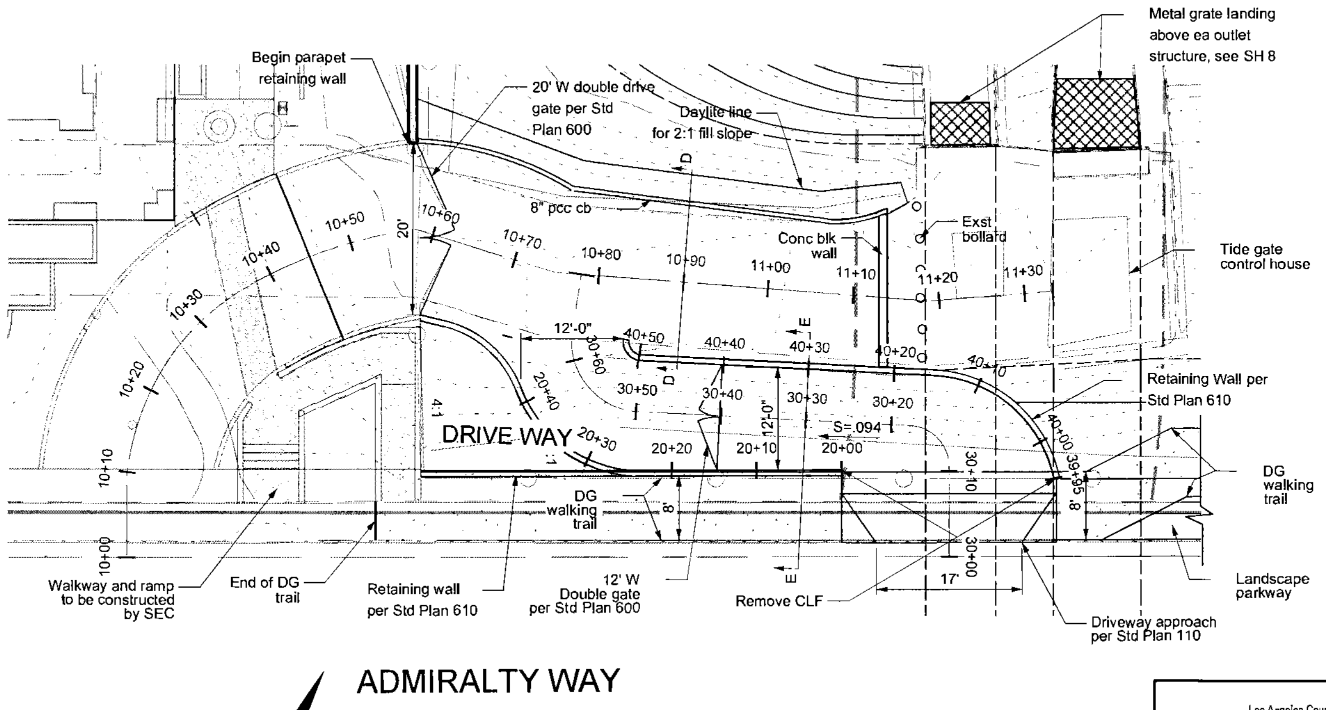
PROFILE FOR DRIVEWAY RETAINING WALL (RIGHT SIDE)

SCALE: HORIZ 1"=20'
VERT 1"=2'



PROFILE FOR DRIVEWAY RETAINING WALL (LEFT SIDE)

SCALE: HORIZ 1"=20'
VERT 1"=2'



PLAN A - ACCESS RAMP PLAN VIEW

SCALE: 1"=10'

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OXFORD RETENTION BASIN MULTI-USE PROJECT

TIDE GATE ACCESS RAMP PROFILE AND DETAILS

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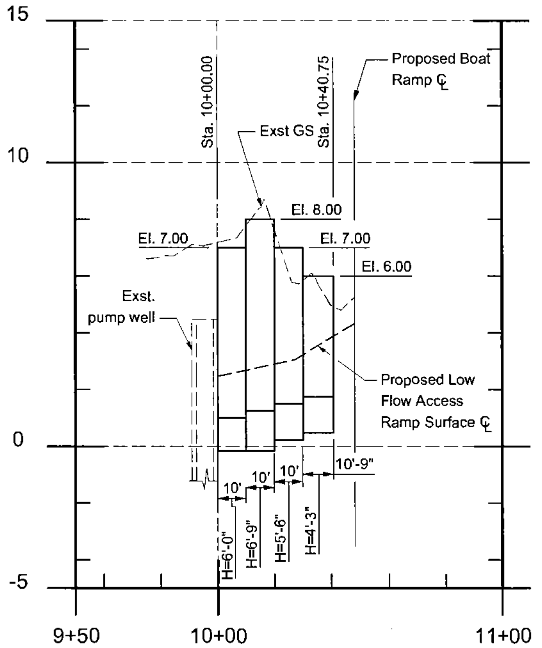
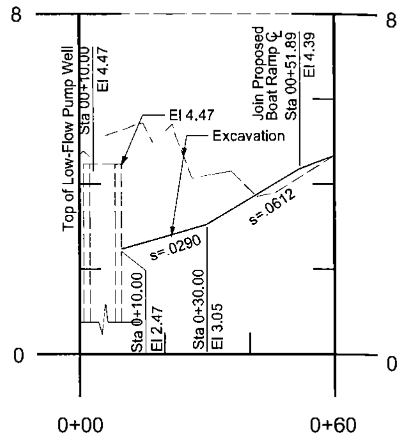


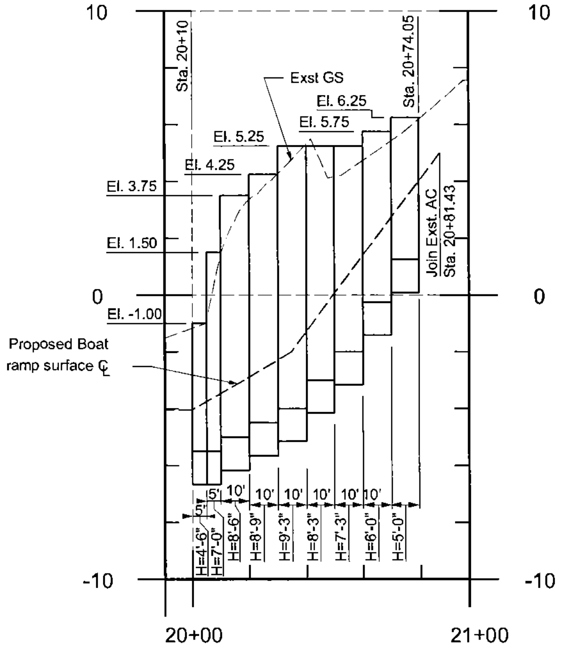
PROFILE "B-B" RETAINING WALL

NOT TO SCALE



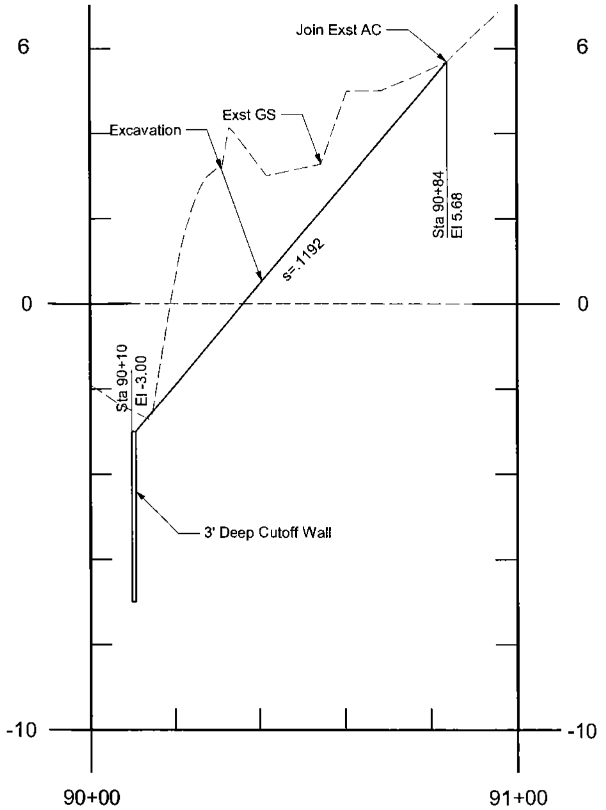
PROPOSED LOW FLOW ACCESS RAMP PROFILE

NOT TO SCALE



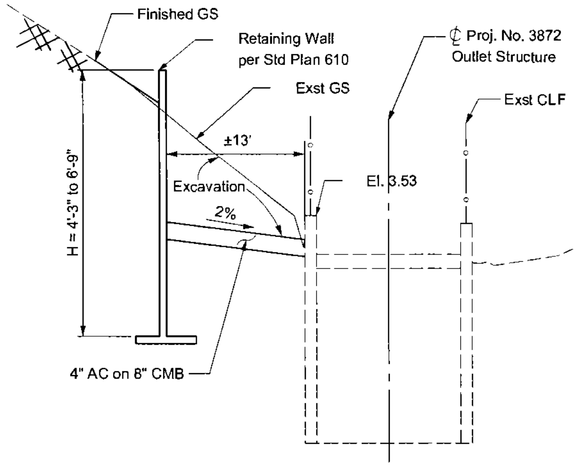
PROFILE "A-A" RETAINING WALL

NOT TO SCALE



PROFILE FOR PROPOSED BOAT RAMP

SCALE: HORIZ 1"=20'
VERT 1"=2'



SECTION H-H PROPOSED LOW FLOW ACCESS RAMP CROSS SECTION

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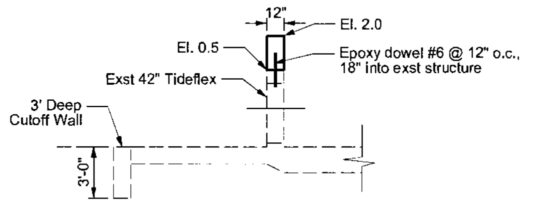
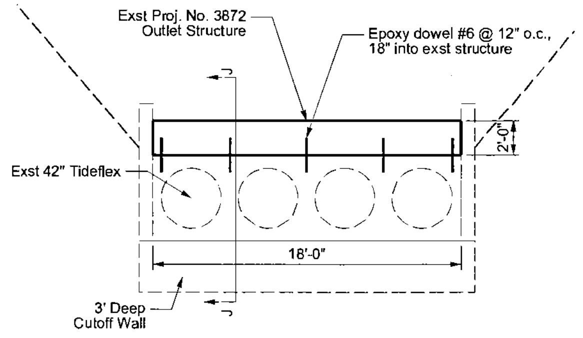


SECTION J-J WEIR WALL EXTENTION CROSS SECTION

NOT TO SCALE



SECTION I-I PROPOSED WEIR WALL EXTENTION CROSS SECTION

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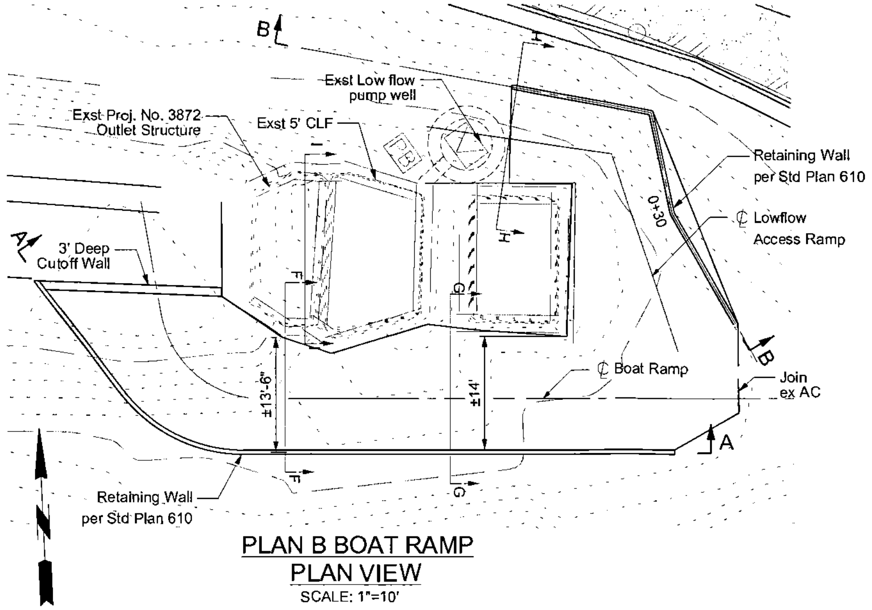
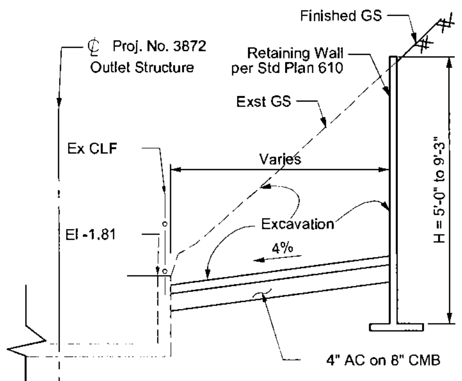


PLAN B BOAT RAMP PLAN VIEW

SCALE: 1"=10'



SECTION F-F PROPOSED BOAT RAMP CROSS SECTION

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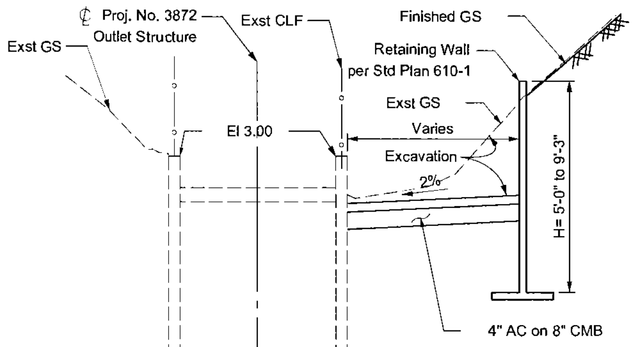

SECTION G-G PROPOSED BOAT RAMP CROSS SECTION

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OXFORD RETENTION BASIN MULTIUSE PROJECT

BOAT RAMP PLAN AND DETAIL AT PROJECT NO. 3872

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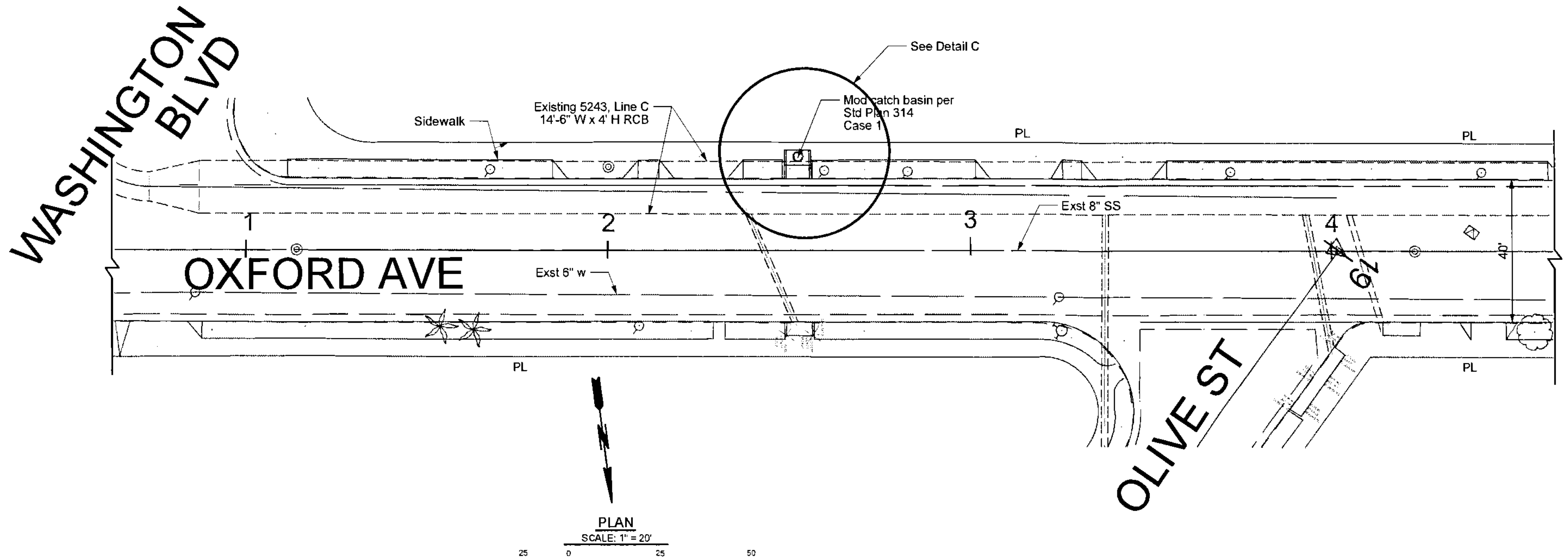
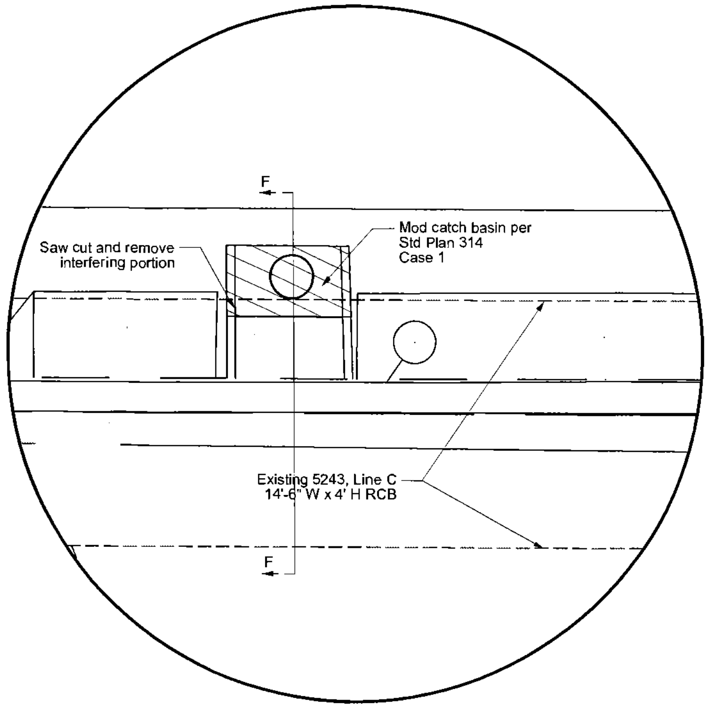
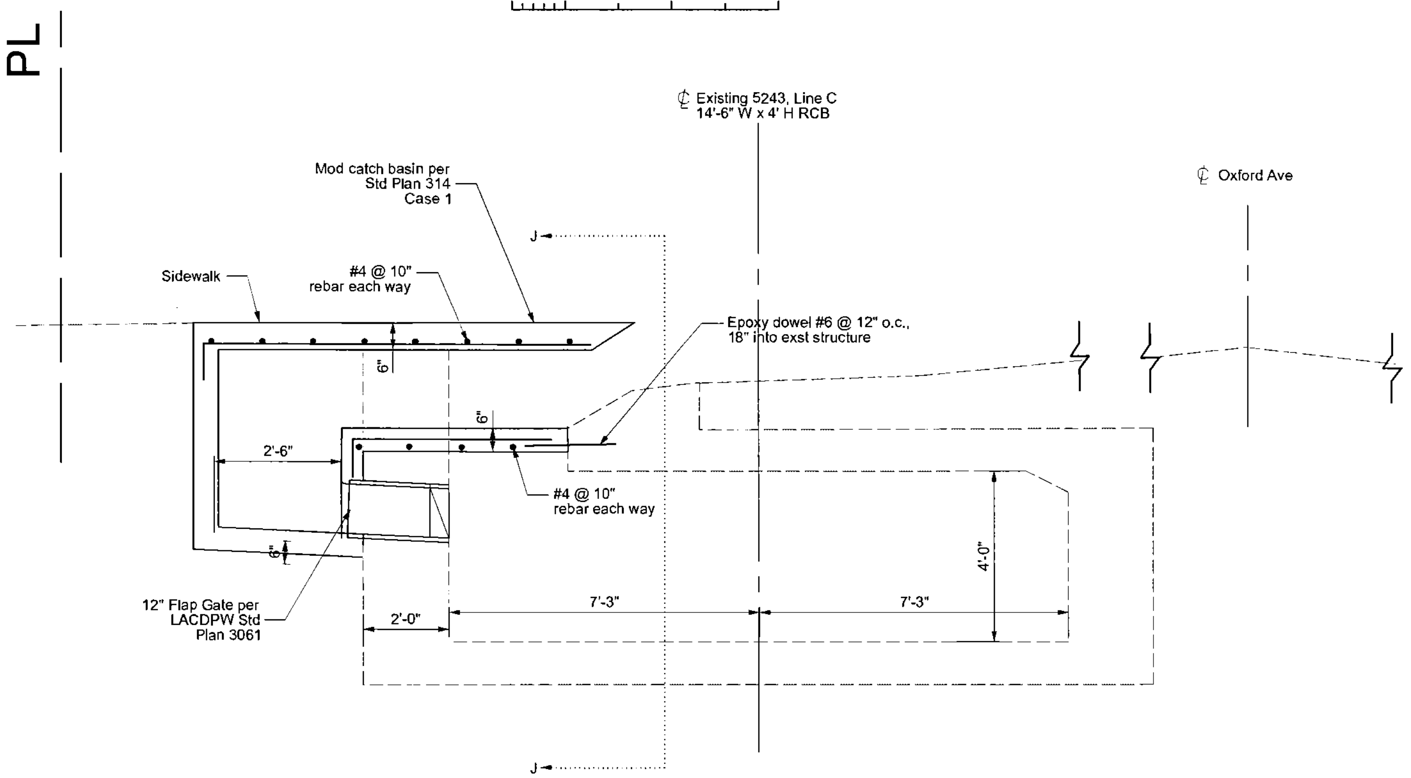


PLAN
SCALE: 1" = 20'



DETAIL C
PLAN VIEW

NOT TO SCALE



SECTION F-F
PROFILE VIEW

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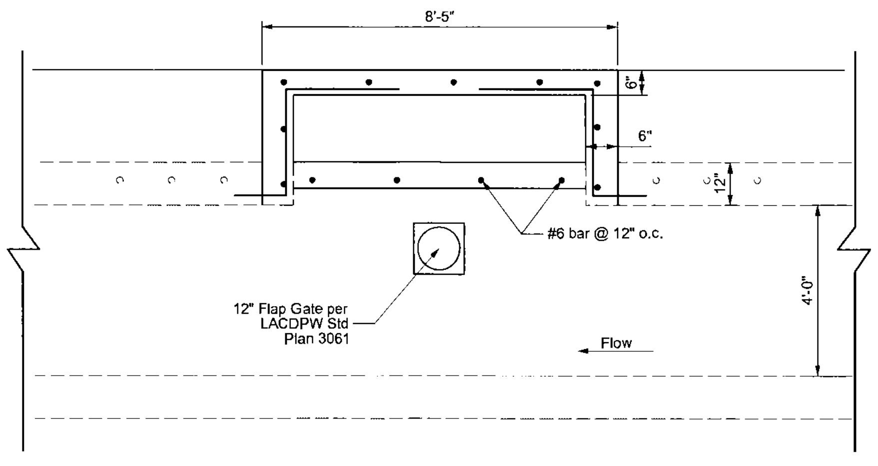

SECTION J-J
SECTION VIEW

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OXFORD RETENTION BASIN
MULTI-USE PROJECT

OXFORD AVE
CATCH BASIN MODIFICATION AND DETAILS

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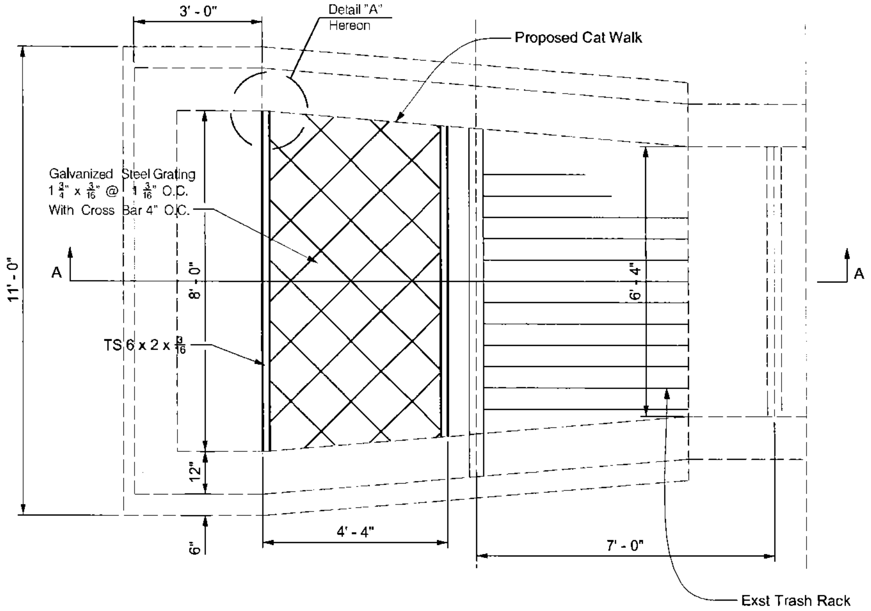
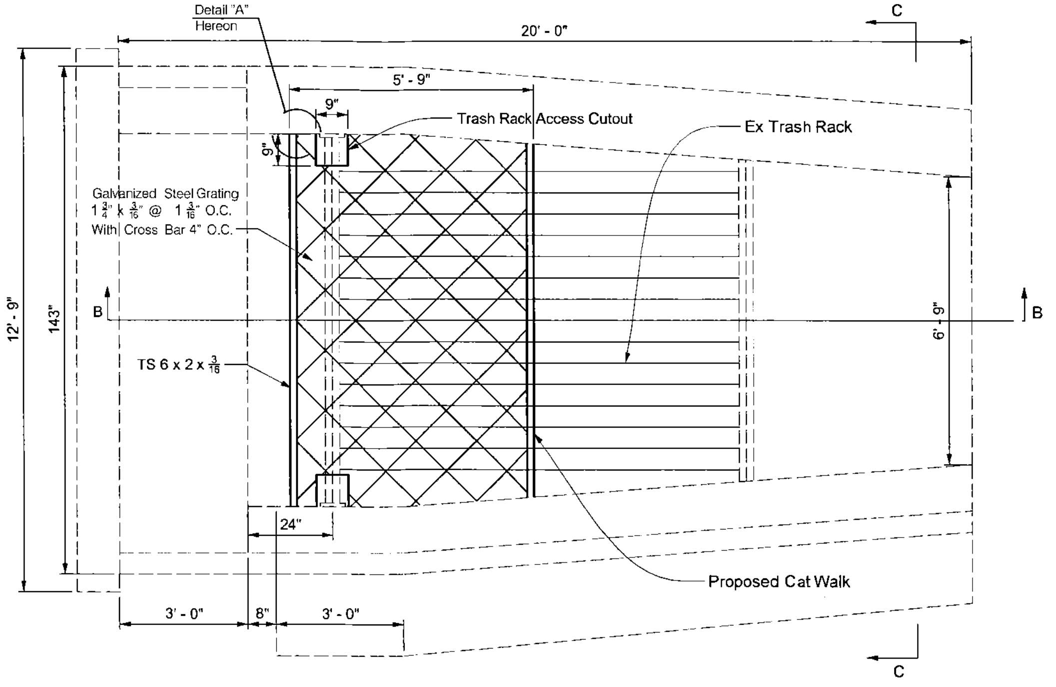


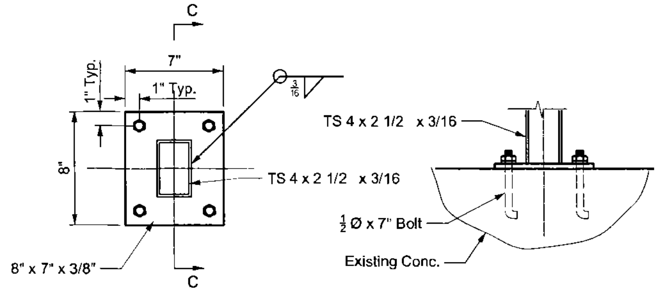
6' X 6' INLET PLAN VIEW

SCALE: 1/2" = 1'-0"



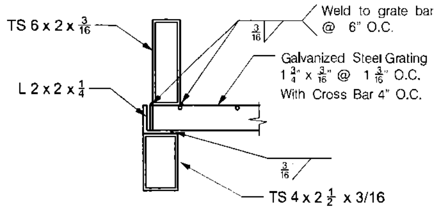
81" INLET PLAN VIEW

SCALE: 1/2" = 1'-0"



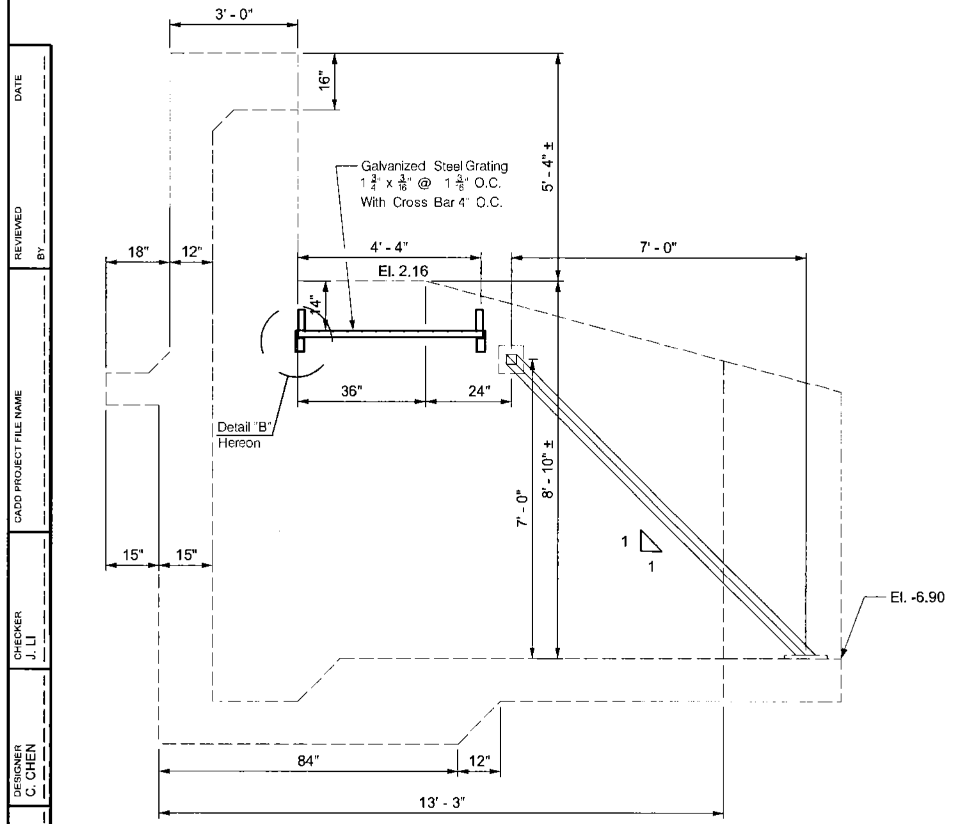
DETAIL "A", TYPICAL WALL ANCHORAGE

SCALE: 1/2" = 1'-0"



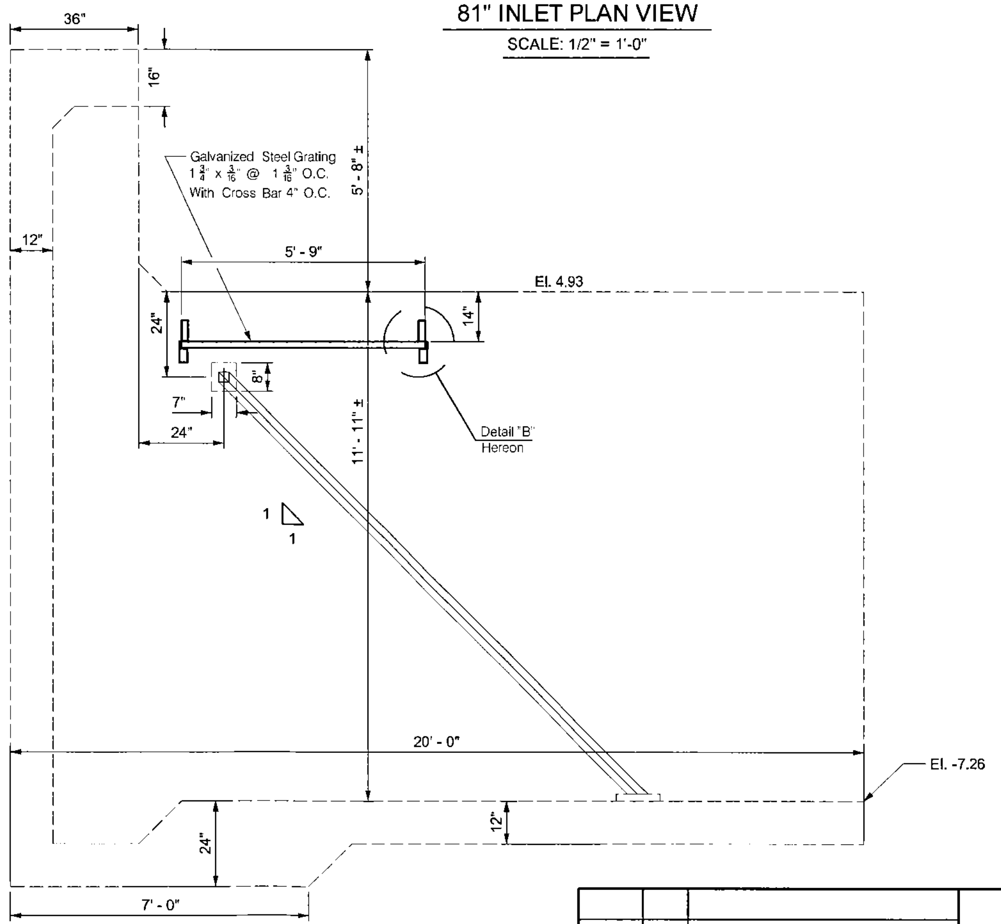
DETAIL "B", TYPICAL GRATING ANCHORAGE

SCALE: 1/2" = 1'-0"



6' X 6' INLET SECTION A-A

SCALE: 1/2" = 1'-0"



81" INLET SECTION B-B

SCALE: 1/2" = 1'-0"

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OXFORD RETENTION BASIN
MULTIUSE PROJECT

STRUCTURAL CATWALK DETAIL
FOR TIDE GATE CONTROL HOUSE

FCC0001176 | JOB JX0039 | DWG 507-D4.8 | SHEET 8 OF 11

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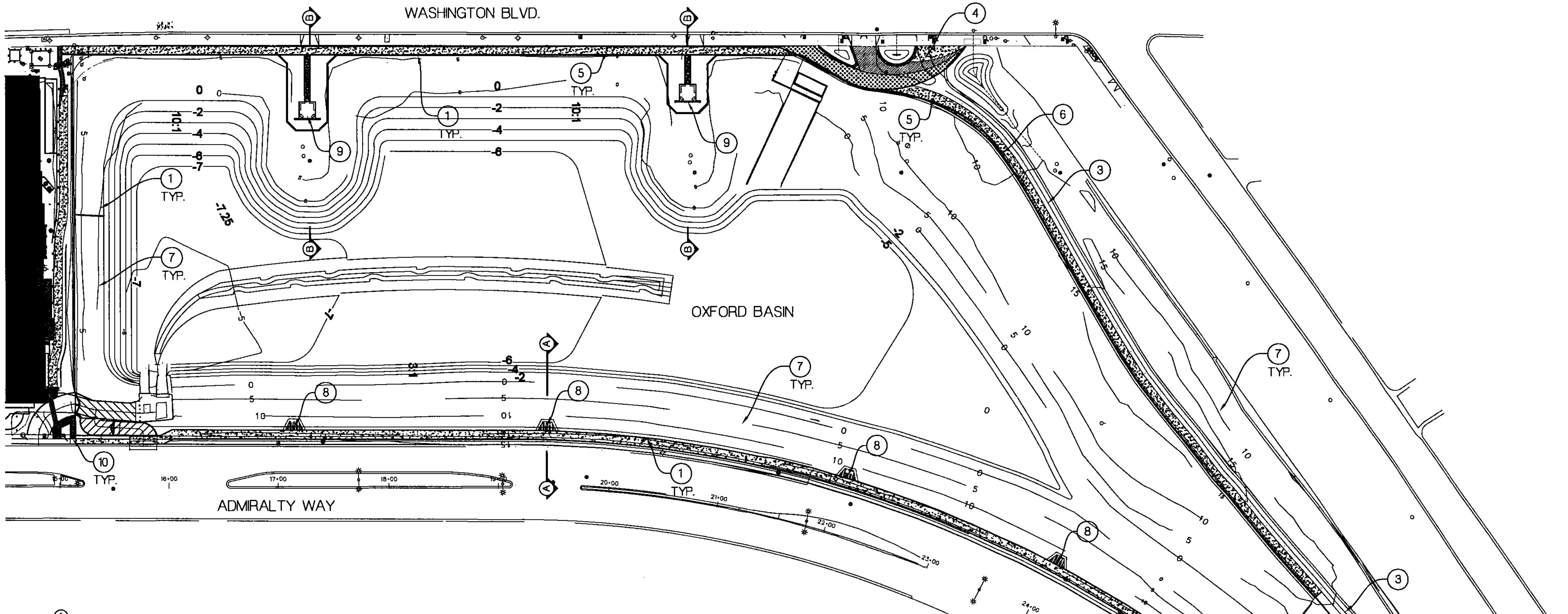
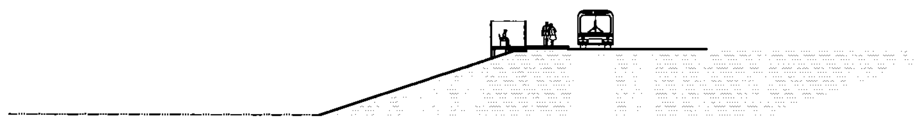
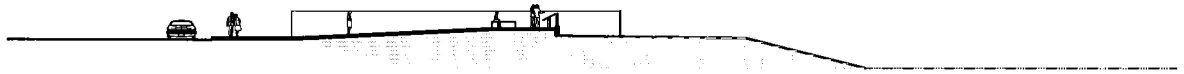


Ⓐ SECTION VIEW - OBSERVATION AREA, DECK:

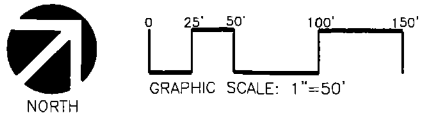


Ⓑ SECTION VIEW - OBSERVATION AREA, RAISED PLATFORM:



CONSTRUCTION LEGEND:

① FENCING, 8' HIGH WELDED WIRE MESH, TYPICAL
② POROUS CONCRETE WALK
③ EXISTING ASPHALT DRIVE (TO REMAIN, SLURRY SEAL)
④ PCC WALK, 6" THICK, INTEGRAL COLOR
⑤ DECOMPOSED GRANITE PATH
⑥ BOLLARD LIGHT (ADJACENT TO D.G. PATH)
⑦ LANDSCAPE AREA
⑧ OBSERVATION AREA, DECK
⑨ OBSERVATION AREA, RAISED PLATFORM
⑩ ADA UPGRADES AND IMPROVEMENTS, TYPICAL



30% PLAN

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COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

OXFORD RETENTION BASIN
MULTIUSE ENHANCEMENT PROJECT

CONSTRUCTION LAYOUT PLAN

8/05/10 | PCA X0000000 | RDC0000000 | SHEET 7 OF 9

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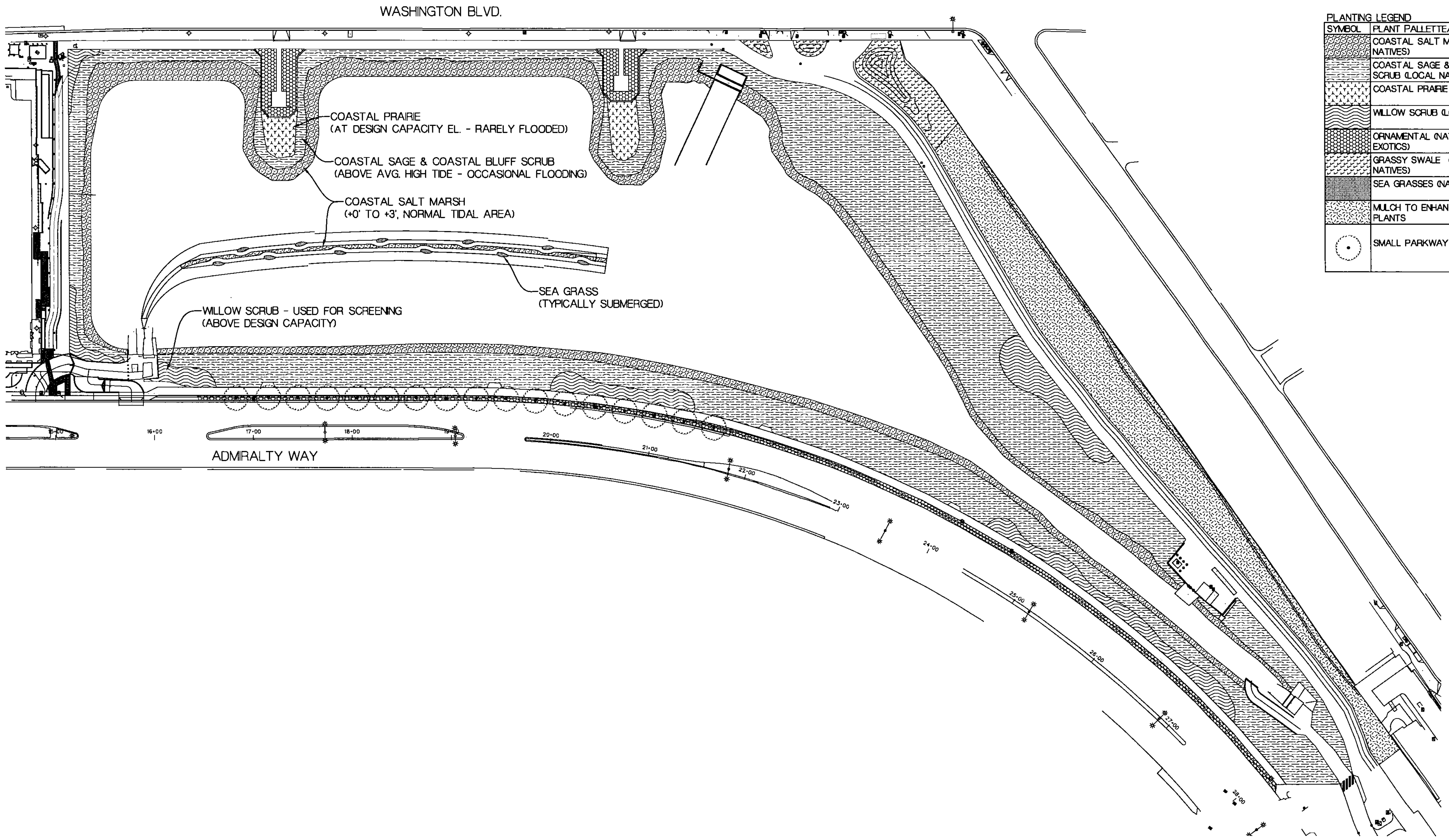
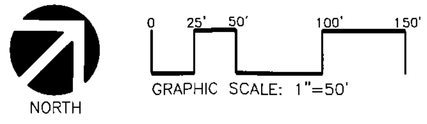
DESIGNER
DRAFTER



PLANTING LEGEND

SYMBOL	PLANT PALLETTE/COMMUNITY
▨	COASTAL SALT MARSH (LOCAL NATIVES)
▤	COASTAL SAGE & COASTAL BLUFF SCRUB (LOCAL NATIVES)
▨	COASTAL PRAIRIE (LOCAL NATIVES)
≋	WILLOW SCRUB (LOCAL NATIVES)
▩	ORNAMENTAL (NATIVES AND EXOTICS)
▨	GRASSY SWALE (CALIFORNIA NATIVES)
▦	SEA GRASSES (NATIVES)
▨	MULCH TO ENHANCE EXISTING PLANTS
⊙	SMALL PARKWAY TREE



30% PLAN

DATE	MK	DESCRIPTION

REVISIONS

PROJECT LANDSCAPE ARCHITECT DATE

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

OXFORD RETENTION BASIN
MULTIUSE ENHANCEMENT PROJECT

PLANTING PLAN

8/05/10 | PCA X0000000 | RDC0000000 | SHEET 9 OF 9

DATE

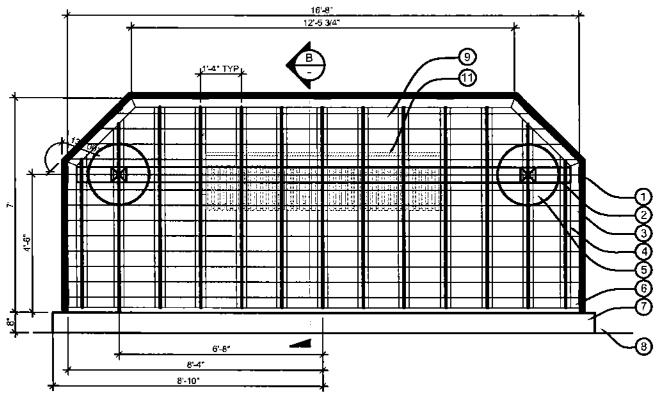
REVIEWED BY

CAD PROJECT FILE NAME

CHECKER

DESIGNER

DRAFTER



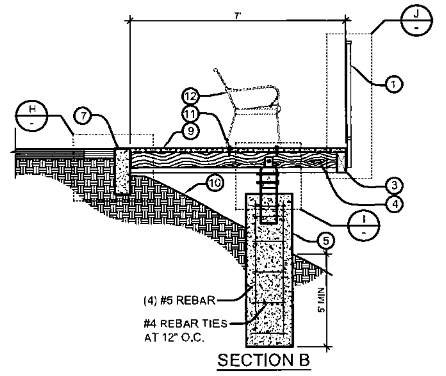
PLAN

LEGEND:

1. TUBE STEEL GUARDRAIL, SEE DETAIL J, THIS SHEET
2. 6X10 PTDF BEAM
3. 4X8 PTDF FASCIA
4. 4X6 PTDF JOIST
5. 24"Ø CONCRETE FOOTING W/ REINFORCEMENT (520-C-2500)
6. 2X8 PTDF HEADER ANCHORED TO CONCRETE CURB WALL WITH ANCHOR BOLTS @ 32" OC
7. CONCRETE CURB WALL, SEE DETAIL H, THIS SHEET
8. SAWCUT EXISTING AC PAVEMENT, PATCH WITH AC (PG 64-10)
9. 2X6 COMPOSITE WOOD DECKING: ACCENT: FIRE DEFENSE MANUFACTURED BY TREX OR AGENCY APPROVED EQUAL. COLOR: SADDLE
10. FINISH GRADE (90% COMPACTION)
11. VANDAL PROOF ANCHOR BOLT SUPPLIED BY BENCH MANUFACTURER OR AGENCY APPROVED EQUAL
12. 8' BENCH MANUFACTURED BY:
    - A. RB-28 BENCH BY VICTOR STANLEY. MODEL # RB-28 8' W/ INTERMEDIATE ARM, POWDER COATED. COLOR: BRONZE
    - OR
    - B. CARNIVAL BENCH BY THOMAS STEELE. MODEL # CRB-8-CA-VS-P. COLOR: BRONZE
    - OR
    - C. CITY VIEW BENCH BY SITESCAPES. MODEL # CV-1-2001-PF. COLOR: BRONZE

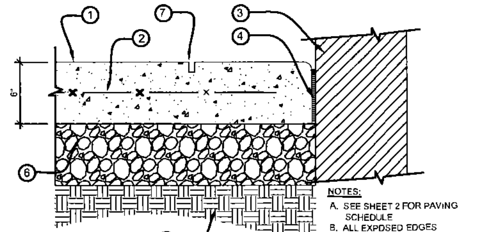
NOTES:

A. ALL STRUCTURAL LUMBER SHALL BE PTDF (PRESSURE TREATED DOUGLAS FIR)
B. PROVIDE 1/4" GAP BETWEEN EACH DECK PLANKS AND 3/8" AT BUTT JOINT OR AGAINST CURB WALL



SECTION B

Ⓚ DECK OVERLOOK NTS



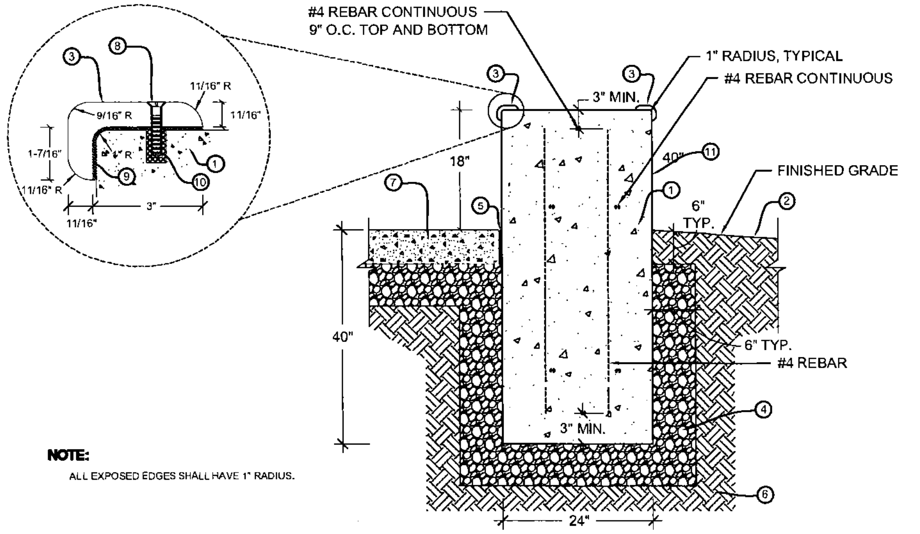
NOTES:

A. SEE SHEET 2 FOR PAVING SCHEDULE
B. ALL EXPOSED EDGES SHALL HAVE 1/4" RADIUS.

LEGEND:

1. PCC, POURED IN PLACE CONCRETE. MIX 520-C-2500. REFER TO CONCRETE & MATERIALS FINISH LEGEND.
2. #3 REBAR @ 18" O.C. BOTH WAYS. CENTERED IN CONCRETE.
3. CONCRETE WALL, SEE PLAN.
4. EXPANSION JOINT (EJ), 1/2" THICK ASPHALT IMPREGNATED FIBERBOARD WITH BACKER ROD AND JOINT SEALANT. EJ AS SHOWN ON PLANS AND/OR BETWEEN ADJACENT WALLS/CONCRETE.
5. SUBGRADE, 90% RELATIVE COMPACTION.
6. 6" CRUSHED MISC. BASE, 95% RELATIVE COMPACTION.
7. 1/4" DEEP TOOLED SCORE JOINT WHERE SHOWN ON PLANS.
8. ADJACENT LANDSCAPE AREAS SHALL BE 3" BELOW FINISHED SURFACE, TYPICAL.

Ⓑ CONCRETE PAVING NTS



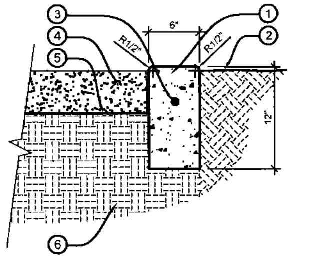
NOTE:

ALL EXPOSED EDGES SHALL HAVE 1" RADIUS.

LEGEND:

1. POURED IN PLACE CONCRETE WALL:
    - A. CONCRETE SHALL BE 560-C-3250
    - B. STANDARD INTEGRAL COLOR: PORCELAIN GRAY (3987) CHROMIX ADMIXTURE, BY L.M. SCOFIELD COMPANY OR APPROVED EQUAL.
    - C. LIGHT SANDBLAST FINISH.
    - D. APPLY A WATERBORNE, LOW VOC, ENVIRONMENTALLY SOUND, CLEAR CURING COMPOUND AND SEALER SUCH AS SCOFIELD CURESEAL-W, BY L.M. SCOFIELD COMPANY OR APPROVED EQUAL.
2. LANDSCAPE AREA.
3. SKATEBOARD DETERRENT, STAINLESS STEEL, FLAT BAR 1" RADIUS CORNER (FB1.0R), BY RAVENSFORGE CONEG LLC., (888) 743-3490, OR APPROVED EQUAL. INSTALL 38" ON CENTER AND CENTERED ON THE ENDS OF EACH WALL.
4. CRUSHED MISCELLANEOUS BASE, 95% RELATIVE DENSITY.
5. EXPANSION JOINT (EJ), 1/2" THICK ASPHALT IMPREGNATED FIBERBOARD. EJ AS SHOWN ON PLANS OR AT EVERY 20' ON CENTER AND AT EVERY CHANGE IN DIRECTION.
6. SUBGRADE, 90% RELATIVE COMPACTION.
7. CONCRETE SURFACE, SEE SHEET 7, DETAIL B..
8. TAMPER PROOF SCREW
9. EPOXY, TYPICAL
10. EXPANSION ANCHOR
11. APPLY GRAFFITI PREVENTION MATERIAL CONTAINING TWO PARTS EPOXY ON ALL EXPOSED SURFACES. KRYSTALKOAT GRAFFITI PREVENTION MATERIAL OR APPROVED EQUAL.

Ⓐ CONCRETE SEAT WALL NTS

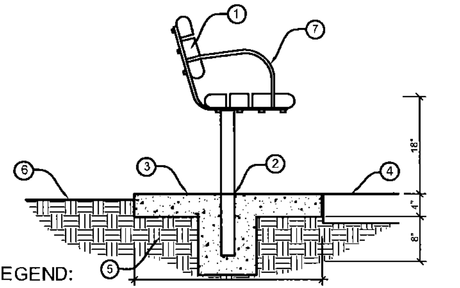


LEGEND:

1. PCC HEADER (520-C-2500)
2. FINISH GRADE TO BE 1/2" BELOW TOP OF HEADER
3. #4 REBAR
4. DECOMPOSED GRANITE PAVING. SEE DETAIL I, SHEET 14
5. NON-WOVEN GEOTEXTILE
6. 90% RELATIVE COMPACTION SUBGRADE

NOTE:
PROVIDE EXPANSION JOINT EVERY 15' AND WEAKENED PLANE JOINT EVERY 7.5'

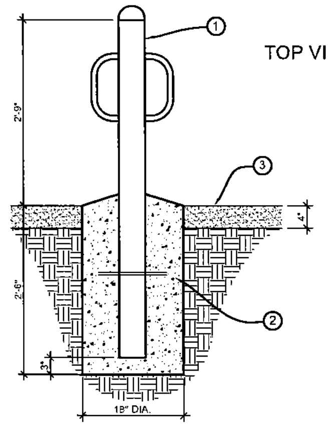
Ⓒ D.G. AND HEADER NTS



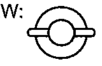
LEGEND:

1. CONTOURED RECYCLED PLASTIC 6' BENCH WITH BACK, MODEL RP6WB-I, BY BELSON OUTDOORS INC., OR APPROVED EQUAL. COLOR OF FRAME: BLACK. COLORS OF SLATS: CEDAR. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
2. IN-GROUND MOUNTING, POST 2-⅞" WIDTH, CENTERED ON SLAB. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
3. CONCRETE SLAB. REFER TO PLAN AND CONCRETE AND MATERIALS FINISH LEGEND.
4. ADJACENT FINISH GRADE
5. SUBGRADE, 90% RELATIVE COMPACTION
6. FINISH GRADE OF ADJACENT PLANTING AREA
7. FOR THE ADA COMPLIANT BENCH AREAS (4 TOTAL), ONLY INSTALL ONE OF THE ARMRESTS. THE REMAINING FOUR BENCHES SHALL RECEIVE BOTH ARMRESTS.

Ⓓ BENCH NTS



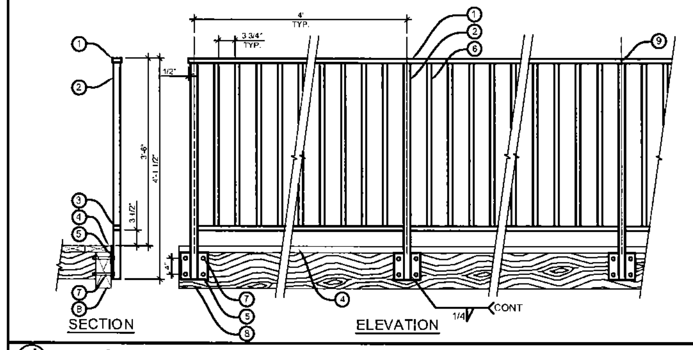
TOP VIEW:



LEGEND:

1. TIMBERFORM CYCLOOPS: MODEL 2172-A02-E BOLLARD ASSEMBLY WITH TWO LOOPS, BY COLUMBIA CASCADE COMPANY (800) 547-1940, OR APPROVED EQUAL. POWDER COATED STEEL VERSION, COLOR: RED.
2. CONCRETE FOOTING WITH # 4 REBAR, CONCRETE (560-C-3250)
3. DECOMPOSED GRANITE WITH STABILIZER

Ⓔ BIKE BOLLARD NTS



SECTION

ELEVATION

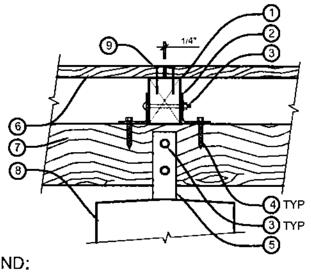
LEGEND:

1. 2"WX1"H TUBE STEEL TOPRAIL, CAP ALL ENDS
2. 1-1/2"X1-1/2" TUBE STEEL POST
3. 1-1/2"WX1"H TUBE STEEL BOTTOM RAIL
4. COMPOSITE WOOD DECKING - SEE DETAIL E, SHT. 7
5. 6"X6"X1/4" THICK STEEL PLATE
6. 1"X1" TUBE STEEL PICKETS
7. 1/2"X5" GALVANIZED CARRIAGE BOLTS AND WASHER, 4 PER PLATE
8. 4X8 PTDF FASCIA BOARD
9. WELD SHUT MITRE JOINT

NOTES:

A. ALL TUBE STEEL SHALL HAVE A MINIMUM WALL GAUGE OF 11
B. ALL STEEL MEMBERS SHALL RECEIVE TWO COATS OF PRIMER AND TWO COATS OF PAINT. COLOR AND FINISH SHALL MATCH EXISTING FENCE RAILING

Ⓙ DECK - RAILING NTS



LEGEND:

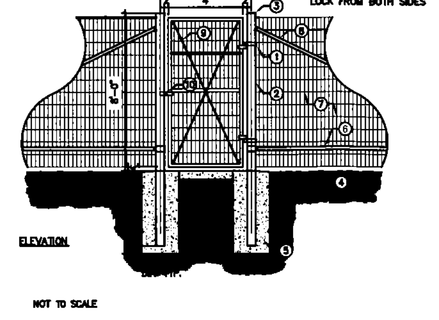
1. 4X6 PTDF JOIST
2. 4"X4" ANGLE STEEL GALVANIZED, TYP
3. 1/2" Ø CARRIAGE BOLT GALVANIZED
4. 1/2" X 4" GALVANIZED LAG BOLT W/ WASHER
5. GALVANIZED STEEL BEAM SUPPORT - SIMPSON CB66 OR AGENCY APPROVED EQUAL
6. 2X6 COMPOSITE WOOD DECKING
7. 8X8 PTDF BEAM
8. 24" Ø CONCRETE FOOTING, SLOPE TOP TO DRAIN
9. 3" STAINLESS STEEL SQUARE HEAD DECK SCREW, 2 SCREWS PER ATTACHMENT POINT

Ⓘ DECK - POST TO BEAM CONNECTION NTS

NOTES:

1. WELDED WIRE MESH SHALL BE TYPHOON, HOT DIPPED GALVANIZED, BY SECURE TECHNOLOGY, INC. (949) 533-9824 OR APPROVED EQUAL. GATE & FENCE SHALL BE CONSTRUCTED PER MANUFACTURER'S SPECIFICATIONS
2. SIZE & TYPE OF FASTENERS, JUNCTION CLIPS & TOUCH CLIPS SHALL BE AS PER THE MANUFACTURER'S RECOMMENDATIONS. QUANTITY PER PANEL OF FASTENERS, JUNCTION CLIPS & TOUCH CLIPS SHALL BE PER MANUFACTURER'S RECOMMENDATION.
3. ALL FENCE MATERIAL, TUBULAR STEEL METAL MEMBERS & HARDWARE SHALL RECEIVE POWDER COAT PAINT – COLOR GREEN
4. EXPOSED PORTION OF FOOTING TO RECEIVE A SMOOTH TROWEL FINISH & SLOPE TO DRAIN
5. CONTRACTOR SHALL INCLUDE CHAIN & COUNTY APPROVED LOCK & KEY WITH EACH SET OF GATES

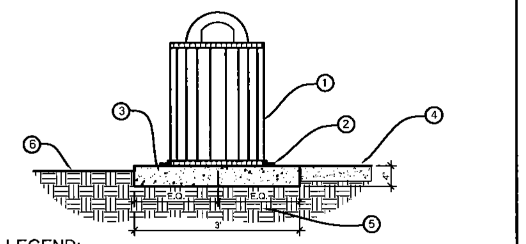
1. GATE HINGE
2. 4"X4" SQUARE FENCE POST BOTH SIDES OF GATE
3. FLAT & FORMED CAP ON EACH POST (TYP)
4. FINISH GRADE/SURFACE
5. PCC FOOTING (TYP)
6. TUBULAR STEEL 1-½" X 2-⅜" AT BOTTOM (EVERY PANEL)
7. 6' HIGH WELDED WIRE MESH WITH 2" HORIZONTAL BY 6" VERTICAL SHAPED OPENING
8. 1-½" X 2-⅜" RECTANGULAR TUBING CROSS MEMBER USED EVERY 5TH PANEL & AT CORNERS ON BOTH SIDES OF GATE
9. SS TRUSS ASSEMBLY (INCLUDE TURNBUCKLES)
10. LATCH WITH ACCESS TO LOCK FROM BOTH SIDES



ELEVATION

NOT TO SCALE

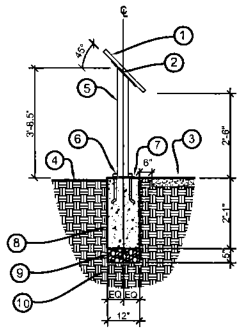
Ⓗ W.W.M. FENCING NTS



LEGEND:

1. ROUND RECYCLED PLASTIC LITTER RECEPTACLE, MODEL RB32-R-DT, BY BELSON OR APPROVED EQUAL. COLOR OF FRAME: BLACK. COLOR OF SLATS: CEDAR. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
2. ATTACH TO SLAB PER MANUFACTURER'S INSTRUCTIONS.
3. CONCRETE SLAB. REFER TO PLAN AND CONCRETE AND MATERIALS FINISH LEGEND.
4. ADJACENT FINISH GRADE
5. SUBGRADE, 90% RELATIVE COMPACTION
6. FINISH GRADE OF ADJACENT PLANTING AREA

Ⓖ TRASH RECEPTACLE NTS



LEGEND:

1. SINGLE POST PEDESTAL: PART # SP121B WITH 2' x 3' EXTERIOR dHPL 1/2" GRAPHIC PANEL, BY FOSSIL INDUSTRIES (www.fossilgraphics.com), OR APPROVED EQUAL. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
2. 12" x 18" x $\frac{3}{16}$" STANDARD MOUNTING PLATE
3. ADJACENT FINISH SURFACE
4. FINISH GRADE OF ADJACENT PLANTING AREA
5. 3" x 3" STEEL POST, COLOR: BLACK
6. $\frac{3}{8}$" Ø J-BOLT, INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
7. 6" x 6" x $\frac{3}{8}$" STEEL PLAT
8. CONCRETE (520-C-5200)
9. 6" CRUSHED MISC. BASE, 95% RELATIVE COMPACTION
10. COMPACT SUBGRADE, 90% RELATIVE COMPACTION

NOTES:

1. ARTWORK SHALL BE PROVIDED BY THE COUNTY. SIGN AND GRAPHICS SHALL BE FABRICATED AND INSTALLED BY THE CONTRACTOR.

Ⓕ INTERPRETIVE SIGN NTS

DATE	MK	DESCRIPTION

REVISIONS

PROJECT LANDSCAPE ARCHITECT DATE

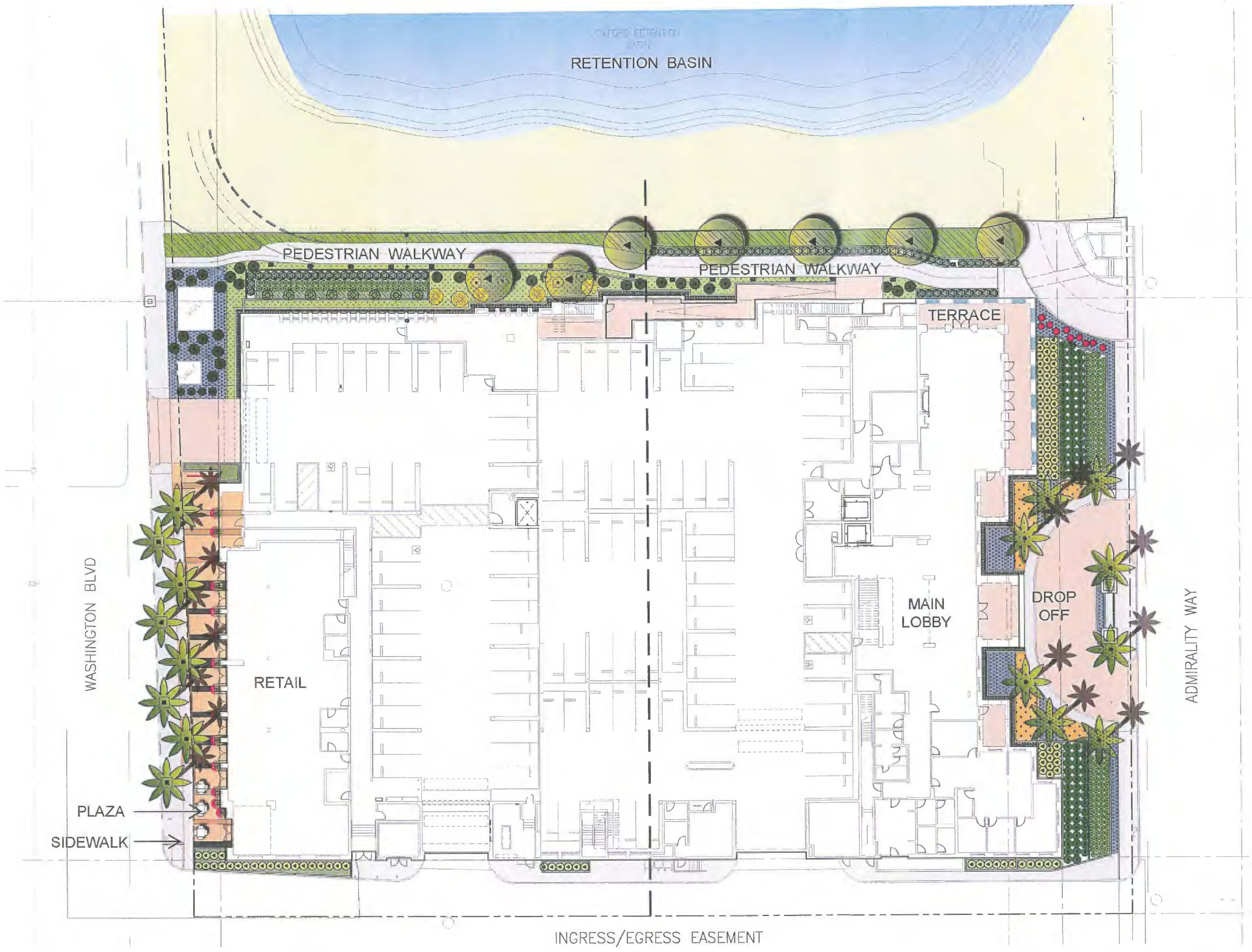
COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

OXFORD RETENTION BASIN
MULTIUSE ENHANCEMENT PROJECT
CONSTRUCTION DETAILS

4/1/10 | PCA EF21507000 | WMD | SHEET 8 OF 9

ATTACHMENT C

MCR OCEANA WALKING TRAIL PLAN FOR PARCEL OT

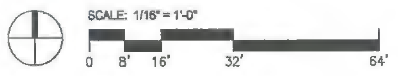


PLANT LEGEND: TREES

SYMBOL	BOTANICAL NAME "COMMON NAME"	SIZE HTxSPR	REMARKS	COMMENTS
▲	PL[illegible]NUS RACEMOSA "CA[illegible]ORNIA SYCAMORE"	24" BOX	X X	A
✳	P[illegible]ENIX DACTYLIFERA [illegible]ATE PALM"	20' BTH	X X	B

PLANT LEGEND: SHRUBS & GROUNDCOVERS

SYMBOL	BOTANICAL NAMF "COMMON NAMC"	SIZC	RCMARKS	COMMCNTS
●	ANIGOZANTHOS FLAVIDUS "KANGAROO PAW"	5 GAL	X X	X X C
▨	CAREX TUMULICOLA "BERKELEY SEDGE"	1 GAL 9" O.C.	X X	X X D
●	MISCANTHUS 'ADAGIO' "DWARF MAIDEN GRASS"	5 GAL	X X	X X E
●	ELYMUS GLAUCUS "GLUE WILDRYE"	1 GAL	X X	X X F
▲	CYPERUS PAPYRUS "PAPYRUS"	15 GAL	X X	X X G
⊗	DENDROMENCON HARFORDII "CHANNEL ISLAND TREE POPPY"	5 GAL	X X	X X H
▨	JUNCUS PATENS "CALIFORNIA RUSH"	1 GAL 24" O.C.	X X	X X I
◎	CHONDROPETALUM TECTORUM "CAPE RUSH"	5 GAL	X X	X X J
▲	ARTEMISIA PYCNOCEPHALA 'DAVID'S CHOICE'	1 GAL	X X	X X K
●	IRIS 'FREQUENT FLYER' "IRIS"	5 GAL 24" O.C.	X X	X X L
▨	BOUGAINVILLEA 'ROSENKA' "ROSENKA BOUGAINVILLEA"	5 GAL 30" O.C.	X X	X X M
▨	BACCHARIS PILULARIS 'PIGEON POINT' "DWARF COYOTE BUSH"	1 GAL 36" O.C.	X X	X X N
▨	SENECIO MANDRALISCAE "KLEINIA"	FLATS 8" O.C.	X X	X X O
✺	ANIGOZANTHOS FLAVIDUS "KANGAROO PAW"	5 GAL		X X
▭	SENECIO MANDRALISCAE "KLEINIA"	1 GAL		X X



LANDSCAPE PLANTING PLAN

DCB HEARING 02.17.2010

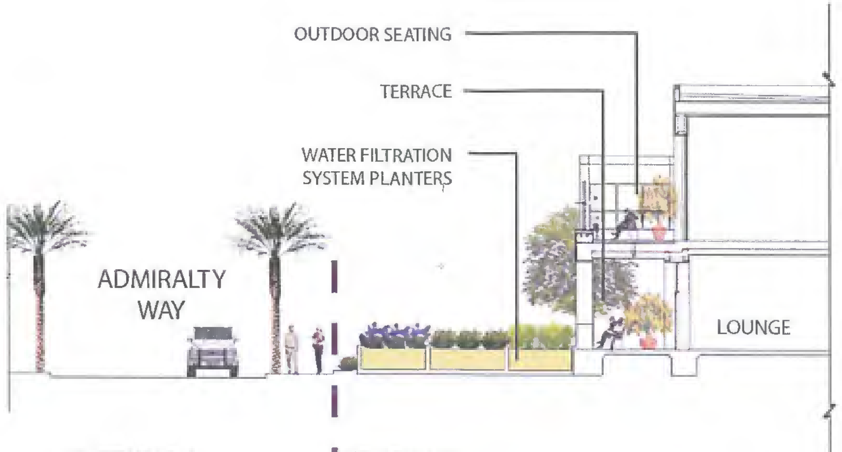
ahbé
landscape architects
8729 washington boulevard | culver city, california 90232
t 310.838.0448 | f 310.204.2664 | www.ahbe.com

GMPA ARCHITECTS
1631 16th Street, Santa Monica, CA 90404
T. 310.450.0200 F. 310.450.0225
www.gmpaArchitects.com

marina del rey PARCEL OT - OCEANA RETIREMENT FACILITY (MDR OCEANA, LLC)

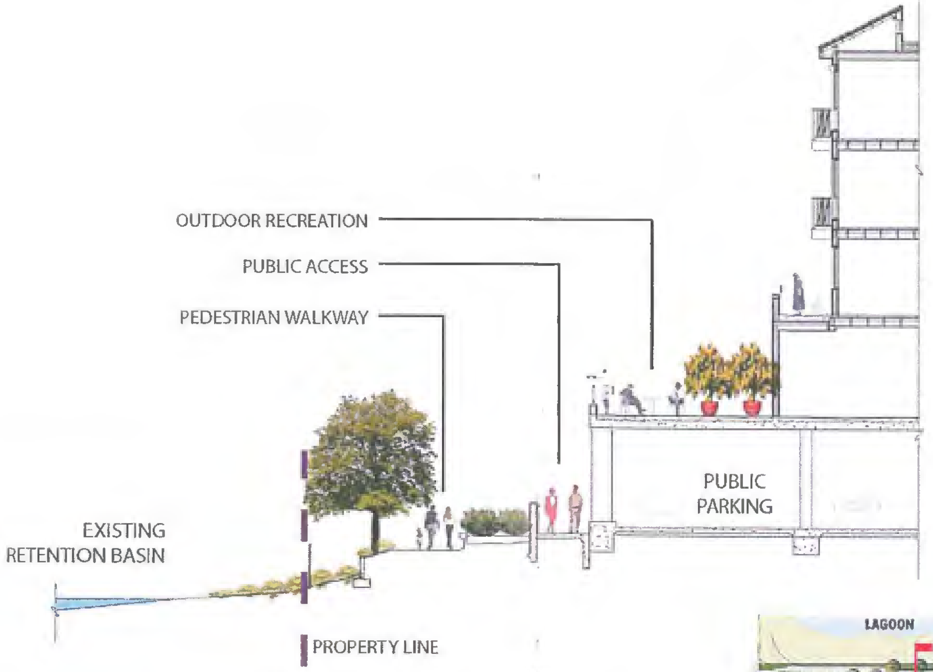
GOLDRICH & KEST INDUSTRIES, LLC

ENLARGED EAST ELEVATION (ALONG ADMIRALITY WAY)

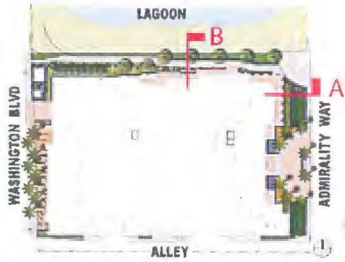


SECTION A

ENLARGED NORTH ELEVATION (ALONG RETENTION BASIN)



SECTION B



KEY PLAN

DCB HEARING 02.17.2010

GMPA ARCHITECTS

1631 16th Street, Santa Monica, CA 90404
T. 310.450.0200 F. 310.450.0225
www.gmpaArchitects.com

marina del rey PARCEL OT - OCEANA RETIREMENT FACILITY (MDR OCEANA, LLC)

GOLDRICH & KEST INDUSTRIES, LLC

ATTACHMENT D

OXFORD RETENTION BASIN
HYDROLOGY STUDY
AUGUST 4, 2010

August 4, 2010

TO: Sree Kumar
Design Division

Attention Zahid Atashzay

FROM: for Christopher Stone Steven Sheridan
Water Resources Division

OXFORD RETENTION BASIN HYDROLOGY STUDY

In response to your request, a revised hydrologic analysis for Oxford Retention Basin including Project Nos. 3872 and 5243 has been completed. The information in this report will assist in evaluating the feasibility of constructing a relief line with linear detention and pump station at Oxford Retention Basin.

As requested, the hydrologic information provided is for the Capital Flood, based on a 50-year frequency 4-day design storm. The total watershed area tributary to Oxford Retention Basin is 687.4 acres.

Additionally, a reservoir routing analysis was performed for the basin using the 4-day design storm with an initial water surface elevation of 2.7 feet MSL and also 3.4 feet MSL. As requested by your staff, the elevation-storage-discharge rating curve from the previous August 15, 1994, study was used to perform these analyses.

The subarea hydrograph for the sump located at Oxford Avenue is provided to determine the volume and depth of ponding that could result when the water surface elevation at Oxford Retention Basin exceeds the existing Project 5243 catch basin's invert.

The hydrology was performed using the Watershed Modeling System and the Modified Rational Method. The hydrologic analysis is based on the standards and procedures described in the 2006 Hydrology Manual.

Attachments

A-1. Hydrologic map with aerial photograph showing existing drain alignment and drainage boundaries.

A-2. Hydrologic map with Thomas Brothers streets showing existing drain alignment and drainage boundaries.

B. Hydrologic data sheets listing subarea sizes, subarea, and reach peak flow rates from an adequately collected system based on a 50-year frequency design storm.

C-1. Reservoir routing analysis results assuming initial water surface elevation of 2.7 feet MSL.

C-2. Reservoir routing analysis results assuming initial water surface elevation of 3.4 feet MSL.

D. Capital Flood hydrograph for Subarea 33F.

E. Supporting information, including design parameters.

F. Comparison with previous hydrology study.

Summary of Findings

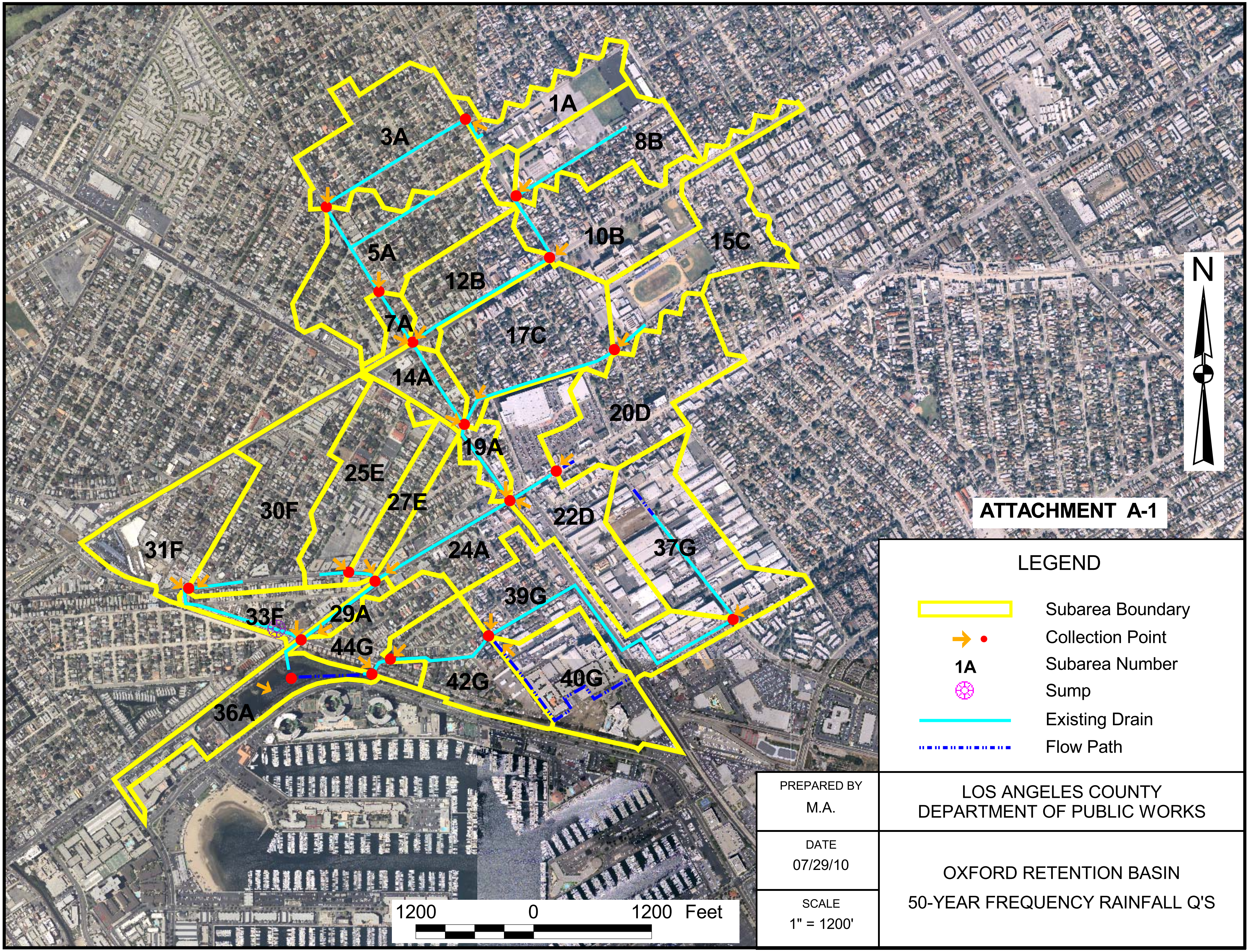
The Capital Flood for Oxford Retention Basin is 751 cfs. A reservoir routing analysis of Oxford Retention Basin using the calculated 4-day inflow hydrographs along with the existing elevation-storage-discharge relationship used in the 1994 study showed that for on an initial water surface elevation of 2.7 feet MSL, the basin will reach a maximum elevation of 4.90 feet MSL. A second analysis showed that based on an initial water surface elevation of 3.4 feet MSL, the basin will reach a maximum elevation of 5.60 feet MSL.

If you have any questions, please contact Martin Araiza at Extension 6152.

MA:yg
P:\wrd\Hyddev\Users\Martin\memos\Oxford Memo.doc

Attach.

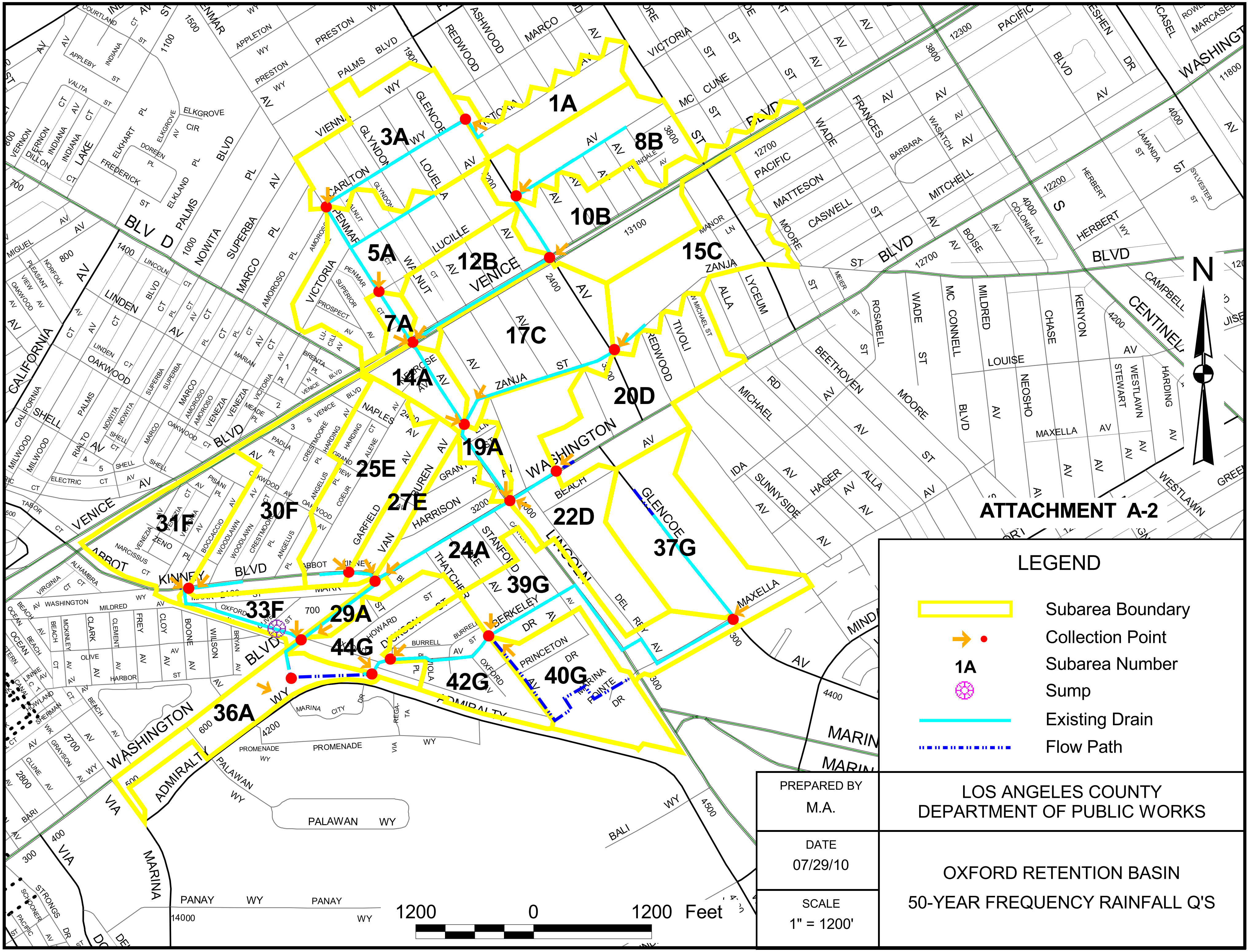
ATTACHMENT A-1



LEGEND

▭	Subarea Boundary
→ ●	Collection Point
1A	Subarea Number
⊛	Sump
—	Existing Drain
-·-·-	Flow Path

PREPARED BY M.A.	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 07/29/10	OXFORD RETENTION BASIN 50-YEAR FREQUENCY RAINFALL Q'S
SCALE 1" = 1200'	



LEGEND

▭	Subarea Boundary
→ ●	Collection Point
1A	Subarea Number
✺	Sump
━	Existing Drain
‐·‐·‐	Flow Path

PREPARED BY M.A.	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 07/29/10	OXFORD RETENTION BASIN 50-YEAR FREQUENCY RAINFALL Q'S
SCALE 1" = 1200'	

County of Los Angeles Department of Public Works
ATTACHMENT B
HYDROLOGIC DATA

Project: OXFORD RETENTION BASIN

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

50 -Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area (acres)		Peak Q (cfs)	
	Length (feet)	Type	Size (feet)		Subarea	Total	Subarea[1]	Reach[2]
Line A								
1A					16.9		25	
1A - 3A	1,684	4	2.00	0.01671		16.9		25
3A					41.0		67	
3A - 5A	1,016	4	5.25	0.00100		57.9		90
5A					42.1		58	
5A - 7A	620	4	4.25	0.00838		100.0		143
7A					4.7		11	
7A - Line B	-	-	-	-		104.7		145
Line B					89.0		120	
Line B - 14A	988	4	7.75	0.00100		193.7		265
14A					10.3		16	
14A - Line C	-	-	-	-		204.0		272
Line C					73.4		84	
Line C - 19A	933	4	6.00	0.00644		277.4		355
19A					5.7		11	
19A - Line D	-	-	-	-		283.1		357
Line D					81.7		108	
Line D - 24A	1,597	5	12.00	0.00100		364.8		454
24A					27.7		36	

[1] Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

[2] Peak flow rate at the top of the reach for design of the conveyance.

County of Los Angeles Department of Public Works
ATTACHMENT B
HYDROLOGIC DATA

Project: OXFORD RETENTION BASIN

Conveyance Types:

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50 -Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area (acres)		Peak Q (cfs)	
	Length (feet)	Type	Size (feet)		Subarea	Total	Subarea[1]	Reach[2]
24A - Line E	-	-	-	-		392.5		474
Line E					43.3		50	
Line E - 29A	973	5	13.00	0.00100		435.8		519
29A					3.3		5	
29A - Line F	-	-	-	-		439.1		519
Line F					83.4		94	
Line F - 36A	279	5	13.00	0.00100		522.5		601
36A					19.7		26	
36A - Line G	-	-	-	-		542.2		620
Line G					145.2		140	
Line G - Oxford Ret Basin	-	-	-	-		687.7		751
Line B								
8B					27.1		40	
8B - 10B	764	4	2.50	0.00831		27.1		40
10B					40.9		53	
10B - 12B	1,640	4	3.75	0.00689		68.0		92
12B					21.0		32	

[1] Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

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	Length (feet)	Type	Size (feet)		Subarea	Total	Subarea[1]	Reach[2]
12B - Line A	-	-	-	-		89.0		120
Line C								
15C					33.5		46	
15C - 17C	1,776	4	4.00	0.00100		33.5		46
17C					39.9		46	
17C - Line A	-	-	-	-		73.4		84
Line D								
20D					39.8		51	
20D - 22D	561	4	4.25	0.00100		39.8		51
22D					41.9		59	
22D - Line A	-	-	-	-		81.7		108
Line E								
25E					30.8		36	
25E - 27E	309	4	3.75	0.00100		30.8		36

[1] Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

[2] Peak flow rate at the top of the reach for design of the conveyance.

County of Los Angeles Department of Public Works
ATTACHMENT B
HYDROLOGIC DATA

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50 -Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area (acres)		Peak Q (cfs)	
	Length (feet)	Type	Size (feet)		Subarea	Total	Subarea[1]	Reach[2]
27E					12.5		14	
27E - Line A	-	-	-	-		43.3		50
Line F								
30F					40.8		47	
31F					28.9		34	
31F - 33F	1,428	4	5.00	0.00100		69.7		81
33F					13.7		19	
33F - Line A	-	-	-	-		83.4		94
Line G								
37G					40.5		49	
37G - 39G	3,251	4	4.25	0.00100		40.5		49
39G					33.5		39	
40G					29.4		34	
40G - 42G	1,111	4	5.50	0.00100		103.4		104
42G					24.0		25	
42G - 44G	260	4	5.75	0.00100		127.4		124

[1] Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

[2] Peak flow rate at the top of the reach for design of the conveyance.

County of Los Angeles Department of Public Works
ATTACHMENT B
HYDROLOGIC DATA

Project: OXFORD RETENTION BASIN

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50 -Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area (acres)		Peak Q (cfs)	
	Length (feet)	Type	Size (feet)		Subarea	Total	Subarea[1]	Reach[2]
44G					17.8		23	
44G - Line A	-	-	-	-		145.2		140

[1] Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

[2] Peak flow rate at the top of the reach for design of the conveyance.

ATTACHMENT E

CHRONOLOGICAL HISTORY OF COMMUNITY OUTREACH

Community Outreach & Support

Date	Audience
Early 2012	*Additional Community Meeting(s)*
March 2012	Marina Del Rey Lessee's Association
January 2012	Ballona Creek Task Force
August 2011	MdR Convention & Visitor's Bureau
August 2010	MdR Design Control Board
August 2010	Small Craft Harbors Committee
September 2009	Public Meeting
November 2007	Santa Monica Bay Restoration Commission
November 2007	Ballon Creek Task Force
July 2007	Small Craft Harbors Committee
July 2007	MdR Design Control Board

ATTACHMENT F

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Project Application

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Section 5 choices updated.

"Oxford Retention basin Multi-Use Project"

Section Totals Summary

Section	Maximum Possible Score	Section Points	Innovation Points	Total Points Earned
QL	181	121	5	126
LD	106	79	3	82
RA	182	30	3	33
NW	177	135	5	140
CR	122	54	3	57
Total Project Points	**768**	**419**	**19**	438

< Previous Page Next Page >

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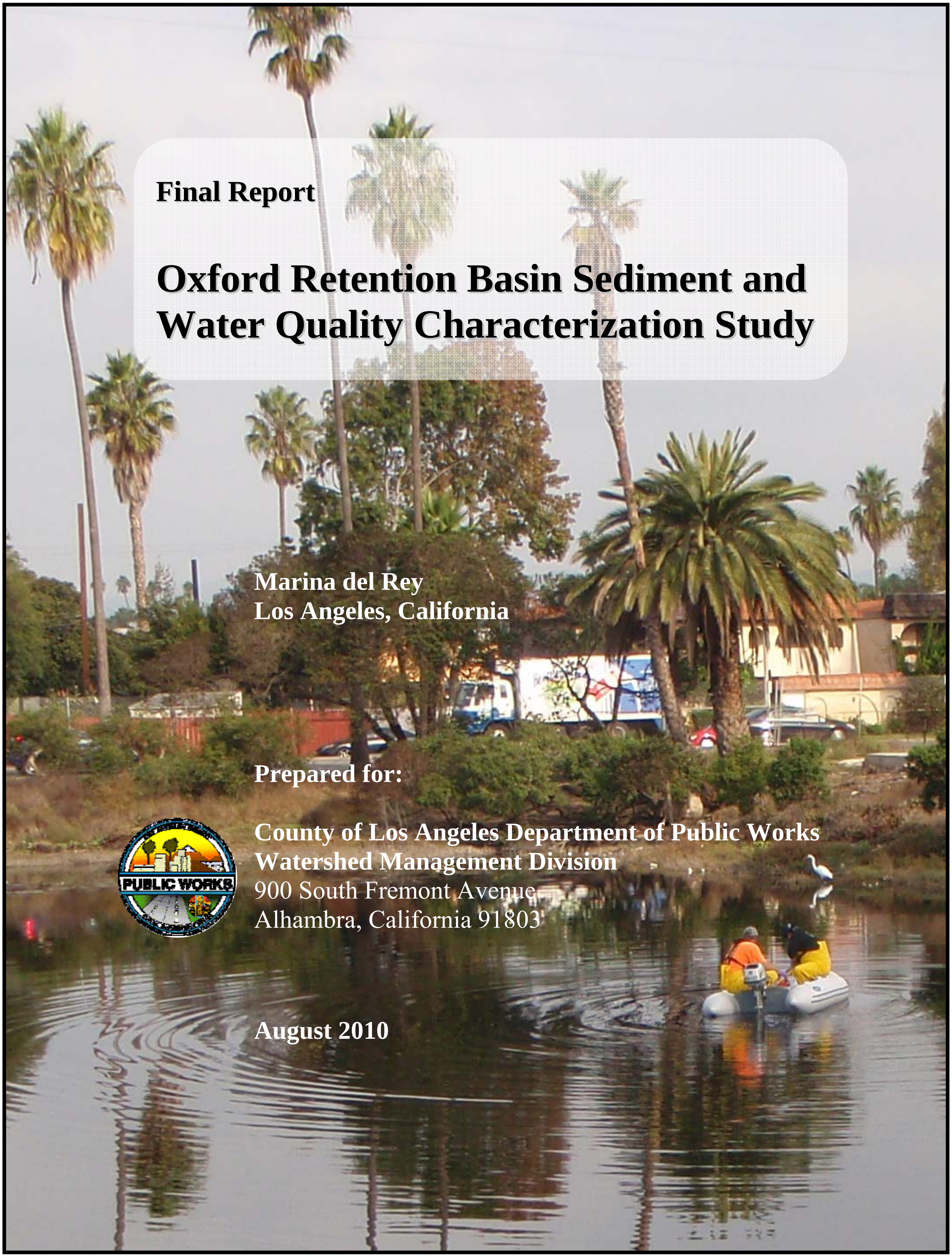
www.sustainableinfrastructure.org



Final Report

Oxford Retention Basin Sediment and Water Quality Characterization Study

Marina del Rey
Los Angeles, California

Prepared for:

County of Los Angeles Department of Public Works
Watershed Management Division
900 South Fremont Avenue
Alhambra, California 91803

August 2010

Final Report

Oxford Retention Basin Sediment and Water Quality Characterization Study

Marina del Rey
Los Angeles, California

Prepared for:

County of Los Angeles Department of Public Works
Watershed Management Division
900 South Fremont Avenue
Alhambra, California 91803

Prepared by:

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Carlsbad, California 92010

August 2010

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B – Field Logs
C – Sediment Chemistry Analytical Report
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E – Dry Weather Water Chemistry Analytical Report
F – Quality Assurance / Quality Control Summary

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ACRONYMS AND ABBREVIATIONS

Σ	sum
µg	microgram
AVS	acid volatile sulfides
BHC	hexachlorobenzene
BMP	best management practice
BOD	biochemical oxygen demand
CAM	California Assessment Manual
COC	chain of custody
COD	chemical oxygen demand
COP	California Ocean Plan
CTR	California Toxics Rule
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DOC	dissolved organic carbon
ID	identification
IDW	Inverse Distance Weighted
LARWQCB	Los Angeles Regional Water Control Board
MDL	method detection limit
MdRH	Marina del Rey Harbor
MPN	most probable number
NDMA	N-Nitrosodimethylamine
NDPA	N-Nitrosodi-n-propylamine
NTU	nephelometric turbidity unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated bipheynl
PCE	tetrachloroethene
pH	hydrogen ion concentration
Q-PCR	Quantitative Polymerase Chain Reaction
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SEM	Simultaneously Extracted Metal
SM	standard method
STLC	soluble threshold limit concentration
SVOC	semi-volatile organic carbon
SWRCB	State Water Resources Control Board
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSS	total suspended solids
TTLC	total threshold limit concentration
USEPA	United States Environmental Protection Agency
VOC	volatile organic carbon
WET	Waste Extraction Test
WQO	water quality objective

1.0 INTRODUCTION

1.1 Study Overview

Water and sediment samples were collected from Oxford Retention Basin and Basin E in Marina del Rey Harbor (MdRH) to characterize existing contaminant levels and to assess available options for water quality improvements and sediment disposal (Figure 1). Specifically, sediment and water quality characterizations were performed for the County of Los Angeles Department of Public Works (LADPW) for the following purposes:

- Characterize sediments that have been deposited in the Oxford Retention Basin so that informed management decisions can be made in the future regarding excavation and water quality management.
- Determine the spatial extent of bacterial and chemical contamination in the sediments and in the water column within Oxford Retention Basin.
- Determine the organic composition of the sediment to examine evaluate the feasibility of bioremediation.
- Characterize water quality conditions in Oxford Retention Basin in relation to the compliance requirements of the Bacteria Total Maximum Daily Load (TMDL) and Toxics TMDL for Basin E within MdRH.
- Satisfy the necessary requirements to evaluate the disposal options for sediment removal from Oxford Retention Basin.

The Oxford Retention Basin serves primarily as a flood control facility and is an integral part of the Marina del Rey local drainage system. The purpose of the basin is to retain urban and stormwater runoff until it can be safely discharged into Basin E of the MdRH. During storms, contaminants associated with development and street runoff are carried into Oxford Retention Basin and then into Basin E through two tide gates. The quality of the discharged water is speculated to be poor, mainly due to high recorded concentrations of bacteria and other pollutants of concern. Basin E is on the Clean Water Act (CWA) Section (§)303(d) list due to impairments caused by high concentrations of bacteria and toxic contaminants that on occasion have exceeded the water quality objectives (WQOs) contained in the California Ocean Plan (COP) (SWRCB, 2005). TMDLs for bacteria and toxics were adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) and became effective on March 18, 2004, and March 17, 2006, respectively. The current TMDL requirements call for improving water quality in the MdRH Mother's Beach and Basins D, E, and F. Because Oxford Retention Basin discharges directly into Basin E, excavation of accumulated sediments in the Oxford Retention Basin is considered a potential remediation measure to improve water quality discharged into Basin E and the MdRH.

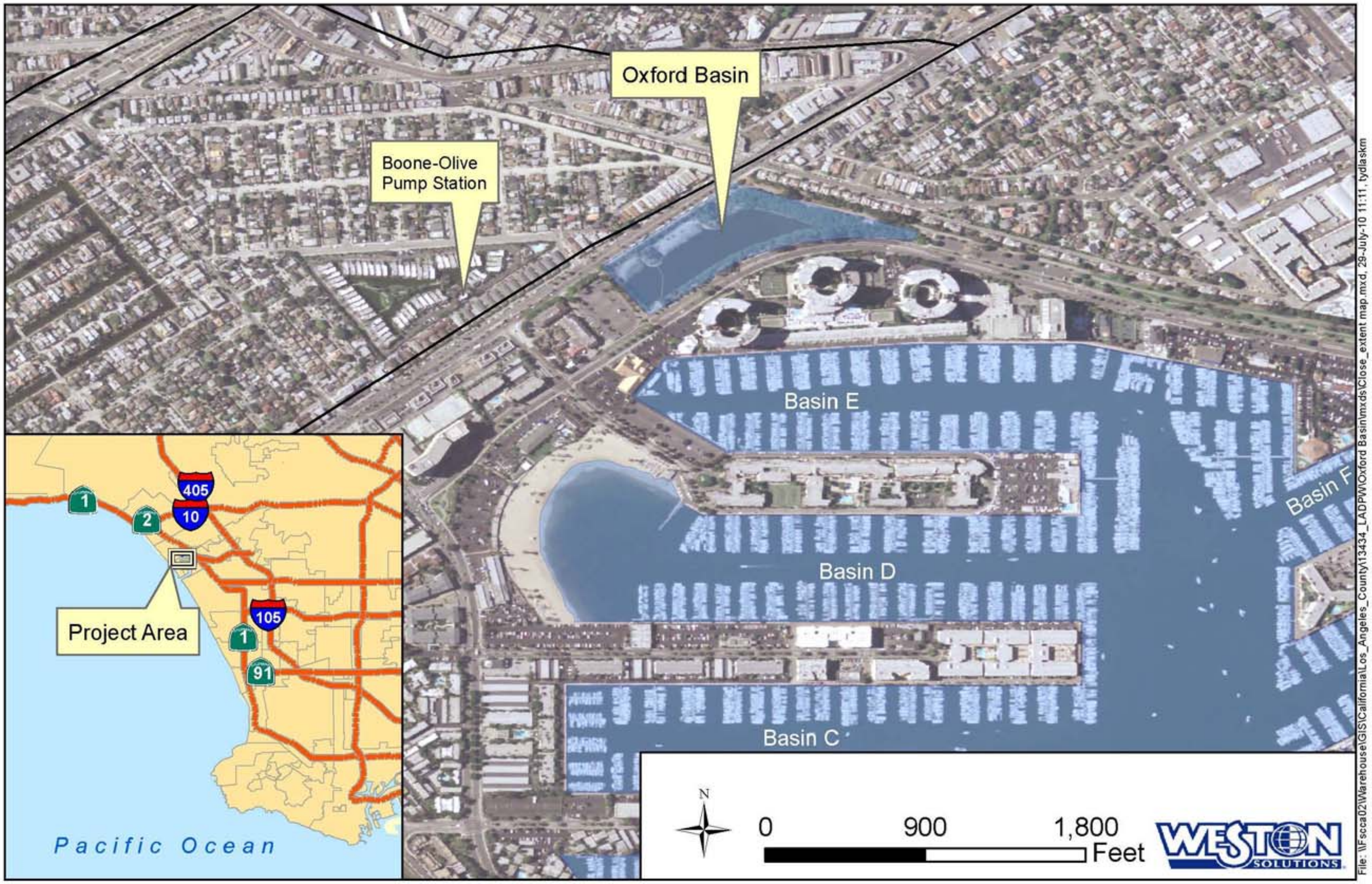

Figure 1. Project Area showing Oxford Retention Basin and Basin E in Marina del Rey Harbor and Boone Olive Pump Station

1.2 Study Objectives

Study objectives were defined for each of the three sampling components of the characterization study. The objectives of the sediment study were to define the spatial extent of sediment contamination using a scientifically defensible approach and to determine the overall organic content of the sediment so that bioremediation options could be evaluated. Specifically, the sediment study aimed to complete the following:

- Surficial sediment data were collected to determine feasibility of proposed bioremediation.
- Surficial sediment bacterial tests were conducted to determine if sediments are a likely source of bacteria.
- Surficial sediment acid volatile sulfides (AVS) / simultaneously extracted metals (SEM) analyses were conducted to determine bioavailability of metals in surface sediments.
- Sediment from the surface to the design depth was evaluated to characterize the bulk of the sediment proposed for excavation.
- Sediment at or below the design depth was evaluated to characterize what will become the new surface layer based on the proposed grading plan.

The objectives of the wet weather and dry weather water sampling were to characterize water quality in both Oxford Retention Basin and Basin E. Specifically, the water quality study aimed to complete the following:

- Understand the extent of chemical and bacterial contamination in the water column within the Oxford Retention Basin.
- Characterize water quality conditions in Oxford Retention Basin in relation to the Bacteria and Toxics TMDLs compliance requirements at Basin E within MdRH.
- Determine the relationship among contaminants found in the Oxford Retention Basin and their potential impacts to Basin E in MdRH.
- Satisfy the necessary requirements to evaluate the disposal options for sediment removal.

Analyses for sediment and water samples included semivolatile organic compounds (SVOCs), California Assessment Manual (CAM) 17 metals, organochlorine pesticides, total petroleum hydrocarbons (TPH), total organic carbon (TOC), hydrogen ion concentration (pH), nutrients, and indicator bacteria. Additional analyses for sediment samples included AVS/SEM, grain size, percent solids, total sulfides, and Toxicity Characteristic Leaching Procedure (TCLP) for metals, SVOCs, and organochlorine pesticides, whereas additional analyses for water included volatile organic compounds (VOCs), polychlorinated biphenyl (PCB) congeners, dissolved organic carbon (DOC), hardness, total dissolved solids (TDS), and total suspended solids (TSS).

1.3 Previous Studies

Results and findings from several previous studies were reviewed prior to creating a *Sampling and Analysis Plan (SAP) for the Oxford Retention Basin Sediment and Water Quality Characterization Study*. Sampling locations for this study were selected based upon information from these prior studies to provide high-resolution data regarding water quality and the vertical and horizontal distribution of sediment contamination within Oxford Retention Basin. A summary of the previous studies conducted in MdRH is presented below.

1.3.1 Mother's Beach and Back Basins' Bacteria Total Maximum Daily Load Non-Point Source Study

The Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study was conducted to assess the bacterial sources that may potentially impact water quality at Mother's Beach and the back basins and attribute loads to these sources. A weight-of-evidence approach, including visual observations, a public questionnaire, temporal and spatial bacteria sampling studies during both wet conditions and dry conditions, an illicit boating discharge investigation, hydrologic modeling, sewerage infrastructure inspections, and a novel approach to bacterial source tracking known as the 'toolbox approach' using Quantitative Polymerase Chain Reaction (Q-PCR) and ribotyping techniques to determine the significant non-point sources of contamination continually affecting the quality of the waters within the back basins of MdRH and Mother's Beach. After completing the source identification (ID) aspect of this study, loading was assessed for the primary contributors of bacterial pollution.

Spatial and Temporal Bacterial Investigation—Circulation within MdRH is relatively poor in the back basins and limited in general. The highest concentration of fecal indicator bacteria occurred in Oxford Retention Basin and the Boone Olive Pump Station and Basin E during dry weather or wet weather monitoring events. Ribotyping analyses determined that the majority of bacteria contained in water samples collected from Basins D, E, and F during both dry weather and wet weather were avian in origin. Rodent and canine were secondary to avian sources during both dry weather and wet weather. Q-PCR analysis showed little human contamination throughout the back basins; human sources (direct human and/or sewage) were found to attribute 3% of the bacteria load for both wet weather and dry weather overall. Based on visual observation, the back basins appeared to be affected by contamination sources local to the basins themselves.

Sewerage Infrastructure Investigation—The sewerage infrastructure investigation determined that the sanitary sewer lines surrounding the back basins of MdRH did have structural defects and operational and maintenance problems.

Illicit Boat Discharge Investigation— Results based on this weight-of-evidence approach indicate that illegal discharges of sewage from boats in Basins D, E, and F were not likely a major cause of contamination. However, because illegal discharges of sewage from boat holding tanks is inherently episodic, results of this study do not rule out the potential for isolated events.

Sediment Investigation—Results from the sediment investigation conducted at Mother's Beach indicate that the surficial sediments in the inter-tidal zone and beach face were generally low in fecal indicator bacteria suggesting that it was unlikely that sediment re-suspension resulting from beach activity was contributing large amounts of bacteria to the water (Figure 2).

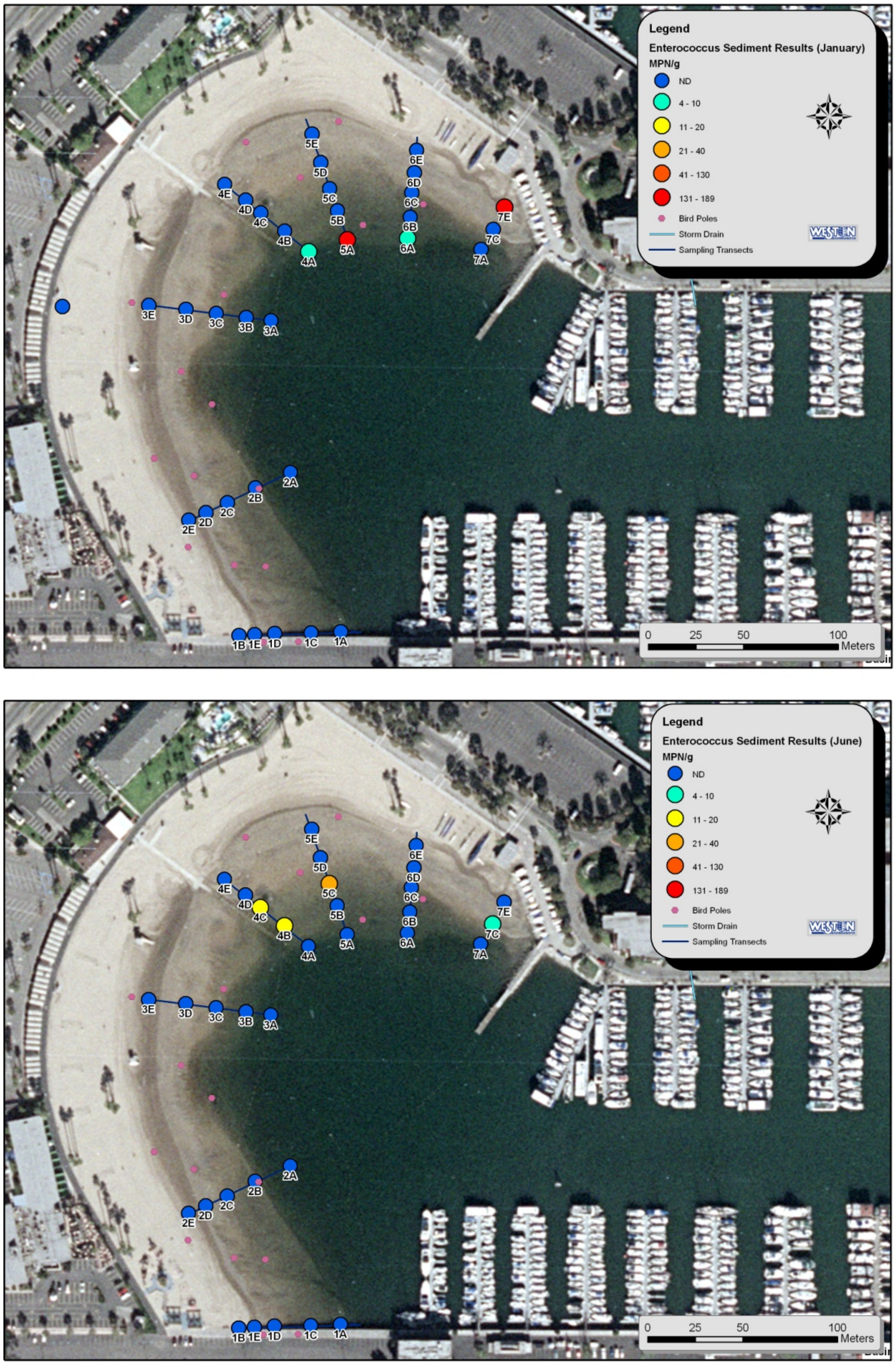

Figure 2. Sediment Results for Enterococci for January and June

Bacterial Loading Estimate—An Excel-based loading model was developed for the assessment of bacterial contributions. Because of the complexities of modeling bacteria in a tidal system, the model was limited in scope and was not designed for best management practice (BMP) development but rather as a tool for general assessment of different management actions. The bacterial results of a one-day comprehensive bacterial sampling event, coupled with the sampling of four upstream sampling locations within the MdRH watershed, was incorporated into a hydrologic mass balance model to estimate bacteria concentrations in Oxford Retention Basin and Basin E during dry weather. The model results suggested some of the greatest impacts to fecal coliform loads were attributable to effluent from Oxford Retention Basin as it drained into Basin E. Additionally, higher bacteria concentrations were measured from the Boone Olive Pump Station and were found to correlate with higher bacteria concentrations in Basin E.

Overall, the results of the Mother's Beach and Back Basins Bacteria TMDL Non-Point Source Study suggested that the majority of the indicator bacteria in MdRH originated from direct and indirect (i.e., through storm drains) avian sources. However, in the case of Basin E, dry weather and wet weather point sources were identified as including discharges from Oxford Retention Basin and (during wet weather) the Boone Olive Pump Station. This resulted in a number of BMP recommendations, including structural bird controls and sewerage infrastructure improvements.

Recommendations were also provided for reducing bacterial densities in the back basins with a focus on illicit boat discharges, irrigation, sediment management, wash down activities, sewerage infrastructure and BMPs of Boone Olive Pump Station and Oxford Retention Basin.

1.3.2 Marina del Rey Harbor Mother's Beach and Back Basins' Indicator Bacteria Total Maximum Daily Load Compliance Study

The MdRH Mother's Beach and Back Basins' Indicator Bacteria TMDL Compliance Study provided an analysis of compliance data collected in response to the MdRH Mother's Beach and Back Basins' Indicator Bacterial TMDL. Eight months of TMDL compliance monitoring indicator bacteria data were analyzed for compliance with TMDL goals, and sampling stations were assessed for the applicability of CWA §303(d) listing status based on historic data from ten years of sampling. The study also assessed differences between geometric mean calculation methods and how they affect TMDL compliance, as well as a comparison of bacterial levels before and after BMP implementation. The following findings were made during this study:

- TMDL compliance targets were mostly met with the exception of compliance monitoring stations during summer dry weather sampling events.

Station Type	□ within TMDL Compliance Targets		
	Summer Dry Weather	Winter Dry Weather	Wet Weather
Compliance monitoring	22□	89□	78□
Ambient monitoring	80□	100□	100□

- Analysis of historical data showed that all stations exceeded the TMDL single sample compliance targets, although only four stations would have met the criteria for State Water Resources Control Board (SWRCB) §303(d) listing. Due to this difference in assessment methodology, the TMDL compliance targets are expected to be more difficult to achieve than meeting the SWRCB §303(d) listing policy.

- Data collected for TMDL and historical monitoring were used to evaluate differences between conditions before and after BMP implementation in Basins D, E, and F. Receiving water data in Basin E showed no significant difference between bacterial levels pre and post BMP implementation. Receiving water data in Basin D showed significantly higher levels of total coliforms and enterococci after BMP implementation when compared to pre-implementation levels. Receiving water data in Basin F showed significantly higher levels of enterococci after sewer lining was completed. Bacterial levels during days following mechanical circulation of water at Mothers Beach compared to bacterial levels on days when no mechanical circulation occurred showed no significant difference.

1.3.3 Marina del Rey Sediment Characterization

The MdRH Sediment Characterization Study was completed in April 2008 in compliance with the *Requirement of Submit Information* letter from the LA RWQCB regarding sediment contamination in MdRH (WESTON, 2008a). The letter specified that the responsible agencies were to design a study plan to assess the areal extent of sediment contamination in the harbor for constituents listed in the Toxics TMDL, including total PCBs, chlordane, copper, lead, and zinc.

In this study, 23 sites were assessed with the collection of sediment cores, with samples collected at the surface, top (0–10 cm) and bottom (11 cm and deeper). Sixteen predetermined sampling locations were assessed by removal of surface sediments and sediment cores. Pore water was collected from five of the 23 sites. Sediment samples were analyzed for benthic infauna, toxicity and physical/chemical composition with regard to sediment grain size, total organic content (TOC), metals, organochlorine pesticides, and PCBs.

Results from the surface sediment analyses indicated that chlordane distribution was most highly concentrated at the mouth of the main channel (Figure 3). Copper (Figure 4), lead (Figure 5), zinc, and PCB (Figure 6) concentrations were highest in the mouths of each Back Basin and in the main channel.

Metals were found to be higher in the main channel and the mouths of each Back Basin compared with concentrations further into the Back Basins (Figure 4 and Figure 5).

These results are consistent with those of the MdRH Annual Report, which suggests influences external to the harbor for higher concentrations of chlordane and PCBs at the mouth of the harbor.

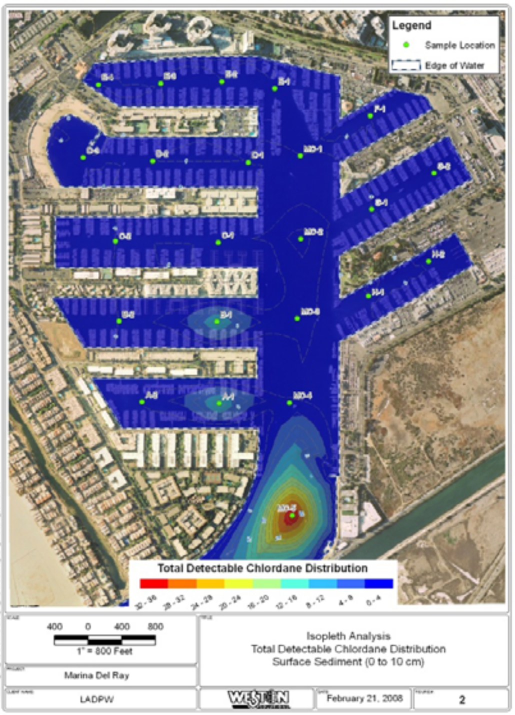

Figure 3. Distribution of Total Chlordane in Surface Sediment in Marina del Rey Harbor

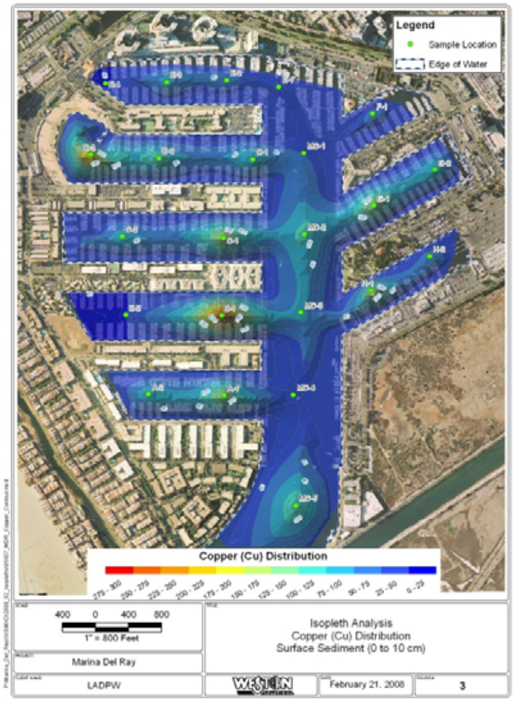

Figure 4. Distribution of Copper in Surface Sediment in Marina del Rey Harbor

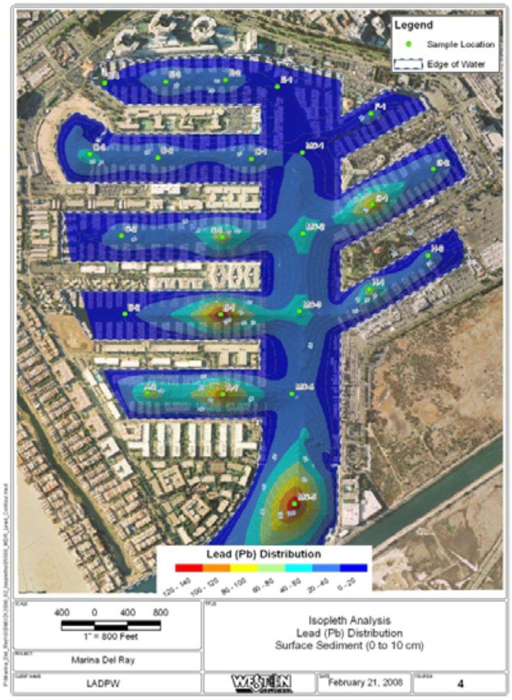

Figure 5. Distribution of Lead in Surface Sediment in Marina del Rey Harbor

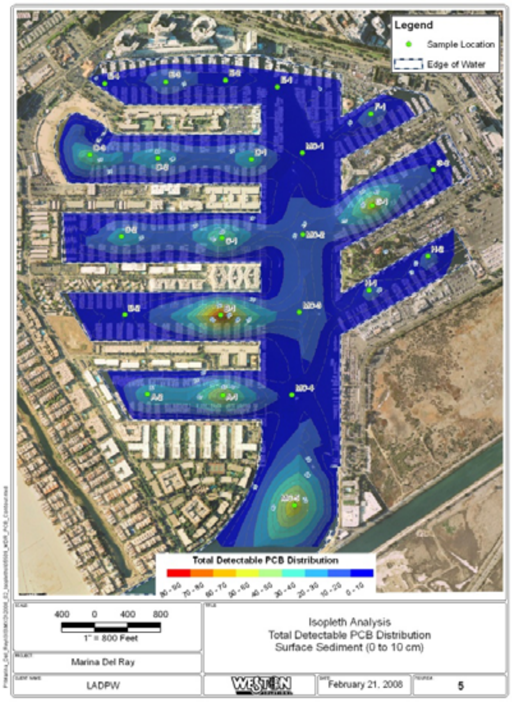

Figure 6. Distribution of Total Polychlorinated Biphenyls in Surface Sediment in Marina del Rey Harbor

2.0 MATERIALS AND METHODS

Water and sediment samples were collected from MdRH and Oxford Retention Basin between October 2009 and March 2010 as part of a sediment and water quality characterization study for the LADPW. Details of each of these monitoring components are provided below.

2.1 Sampling Locations and Sample Nomenclature

Sampling locations for wet weather and dry weather water samples were located in Oxford Retention Basin, Basin E, and Boone Olive Pump Station while sediment sampling was confined to Oxford Retention Basin. All station locations were pre-planned.

2.1.1 Sediment Sampling

Sediment cores were collected at all ten stations within the Oxford Retention Basin (Figure 7). Cores extended through recently deposited (unconsolidated) sediments and into the consolidated sediment layer at seven of the ten stations. At three stations, the consolidated layer was not encountered due to refusal. Once collected, the cores were delivered to an on-site processing station where a certified California geologist characterized the vertical stratification of cores. The targeted sampling latitude and longitude coordinates and targeted core lengths are provided in the approved SAP.

Multiple cores per location were collected to ensure an adequate volume of material (approximately 2 L) for all required testing and archival. Based on sediment stratification, the cores were split into vertical segments to assess the vertical resolution of potential chemical contamination. Since multiple samples were collected from each core, additional nomenclature was appended to the station ID to derive unique sample IDs (e.g., EL represents sediment from the excavation layer and NL represents sediment from the consolidated layer). Figure 8 illustrates the derivation of the sample IDs relative to the station ID and sample point for the sediment sampling event.

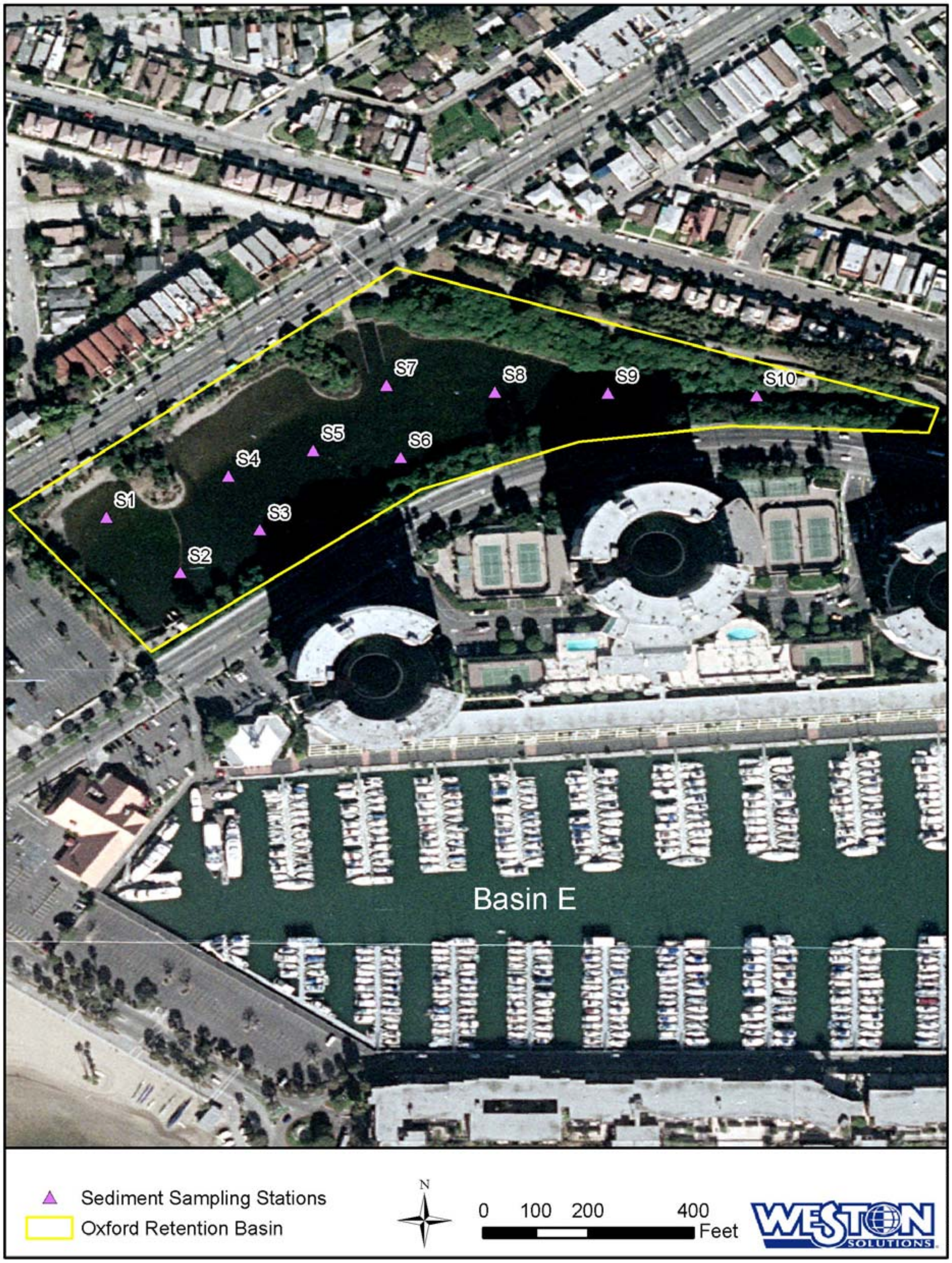

Figure 7. Sediment Sampling Stations within Oxford Retention Basin

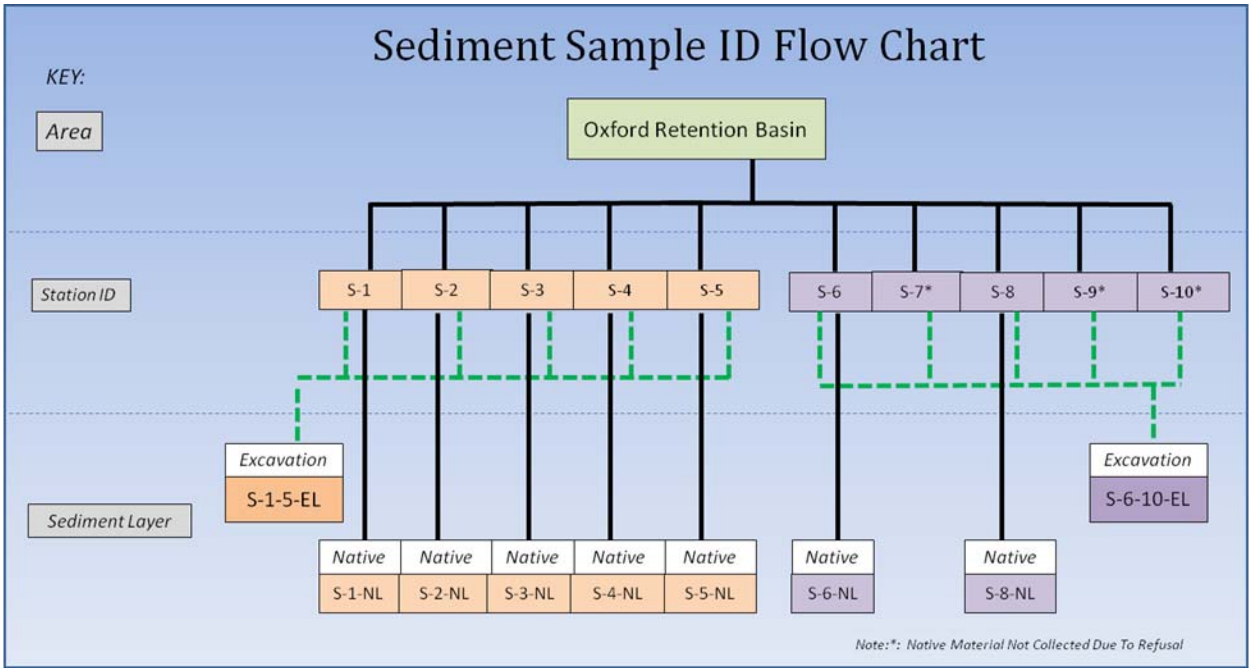

Figure 8. Sediment Quality Sample Identification Flow Chart

2.1.2 Water Sampling – Wet Weather

The sampling stations for the wet weather component of the water quality sampling are shown on Figure 9. Due to extremely shallow water during low tide, Station ORB-E was moved approximately 40 meters southwest of the proposed location as described in the SAP. The relocation of Station ORB-E to an area slightly deeper allowed for water collection without the draft of the inflatable boat disturbing the sediment layer during water sample collection. The targeted sampling latitude and longitude coordinates and targeted core lengths are provided in the approved SAP.

As the goal of these sampling events was to characterize the baseline wet weather water quality conditions in the two basins, water samples were collected from a number of locations and composited together to more accurately represent water quality conditions in each basin (Figure 10). In Oxford Retention Basin, water was collected from five sample locations and composited to represent one sample for analysis. Basin E samples were collected from three sample locations and composited into one sample for laboratory analysis. Three of the constituents from the analyte list were not conducive to composite analysis. Thus, for VOCs, TPH, and fecal indicator bacteria analysis, samples were collected from a single sample location (Station ORB-C in Oxford Retention Basin and Station E-C in Basin E) that was determined to best represent the basin water quality as a whole.

In addition to the samples collected in Oxford Retention Basin and Basin E, samples were also collected from Boone Olive Pump Station. During dry weather conditions, runoff entering Boone Olive Pump Station is diverted to the sanitary sewer system. However, during storm conditions the sanitary sewer diversion is shut off, and stormwater flows freely to Basin E, approximately 90 meters south of the Oxford Retention Basin outfall.

Figure 9. Water Quality Sampling Stations within Oxford Retention Basin, Basin E, and Boone Olive Pump Station

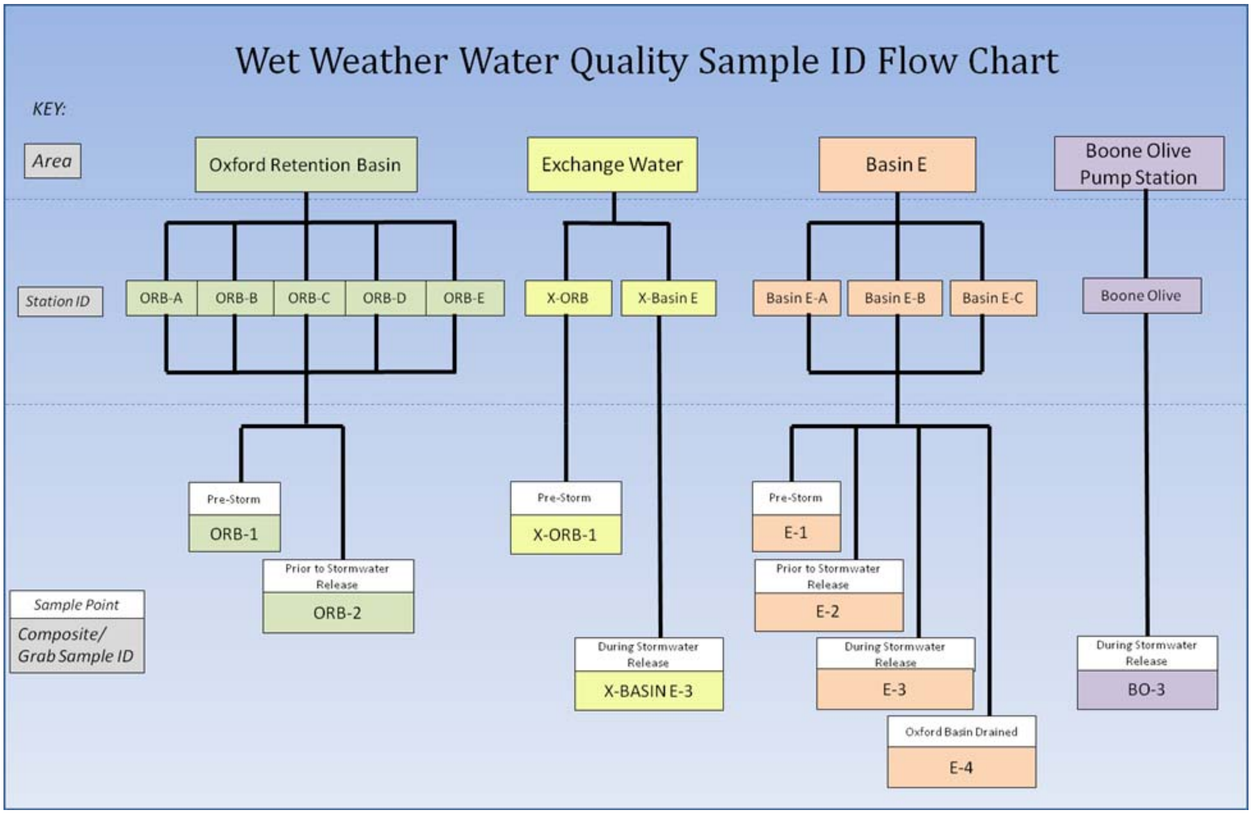

Figure 10. Wet Weather Water Quality Sample Identification Flow Chart

During the wet weather survey, an additional set of water quality grab samples were collected from Oxford Retention Basin and the Exchange water between Oxford Retention Basin and Basin E. These samples were collected for use in understanding the potential feasibility of bioremediation techniques on existing sediment within Oxford Retention Basin.

For the wet weather water sampling, Exchange water samples were collected on the Oxford Retention Basin side prior to the storm and on the Basin E side of the culverts during drainage of Oxford Retention Basin.

During the wet weather event, multiple samples were collected at each station representing each sampling period relative to the storm, therefore, additional nomenclature was appended to the station ID to derive unique sample IDs (e.g., ‘1’ represents prior to the storm, ‘2’ represents after the storm but before drainage of Oxford Retention Basin, ‘3’ represents during the drainage of Oxford Retention Basin, and ‘4’ represents conditions after Oxford Retention Basin had been completely drained). Figure 10 illustrates the derivation of the sample IDs relative to the station ID and sample point for the wet weather event.

2.1.3 Water Sampling – Dry Weather

The sampling stations for the dry weather component of the water quality sampling are shown on Figure 9. Due to extremely shallow water during low tide, Station ORB-E was moved approximately 40 meters southwest of the proposed location as described in the SAP. The relocation of Station ORB-E to an area slightly deeper allowed for water collection without the draft of the inflatable boat disturbing the sediment layer during water sample collection.

As the goal of these sampling events was to characterize the baseline dry weather water quality conditions in the two basins, water samples were collected from a number of locations and composited together to more accurately represent water quality conditions in each basin (Figure 11). In Oxford Retention Basin, water was collected from five sample locations and composited to represent one sample for analysis. Basin E samples were collected from three sample locations and composited into one sample for laboratory analysis. Three of the constituents from the analyte list are not conducive to composite analysis. Thus, for VOC, TPH, and fecal indicator bacteria analysis, samples were collected from a single sample location (Station ORB-C in Oxford Retention Basin and Station E-C in Basin E) that was determined to best represent the basin water quality as a whole.

In addition to the samples collected in Oxford Retention Basin and Basin E, samples were also collected from Boone Olive Pump Station. During dry weather conditions, runoff entering Boone Olive Pump Station is diverted to the sanitary sewer system.

For the dry weather water sampling, Exchange water samples were collected on the Basin E side of the culverts during flood tide and on the Oxford Retention Basin side during ebb tide.

During the dry weather sampling event, multiple samples were collected at each station representing different tidal stages, therefore, additional nomenclature was appended to the station ID to derive unique sample IDs (e.g., 1 represents ebb tide and 2 represents flood tide). Figure 11 illustrates the derivation of the sample IDs relative to the station ID and sample point for the dry weather event.

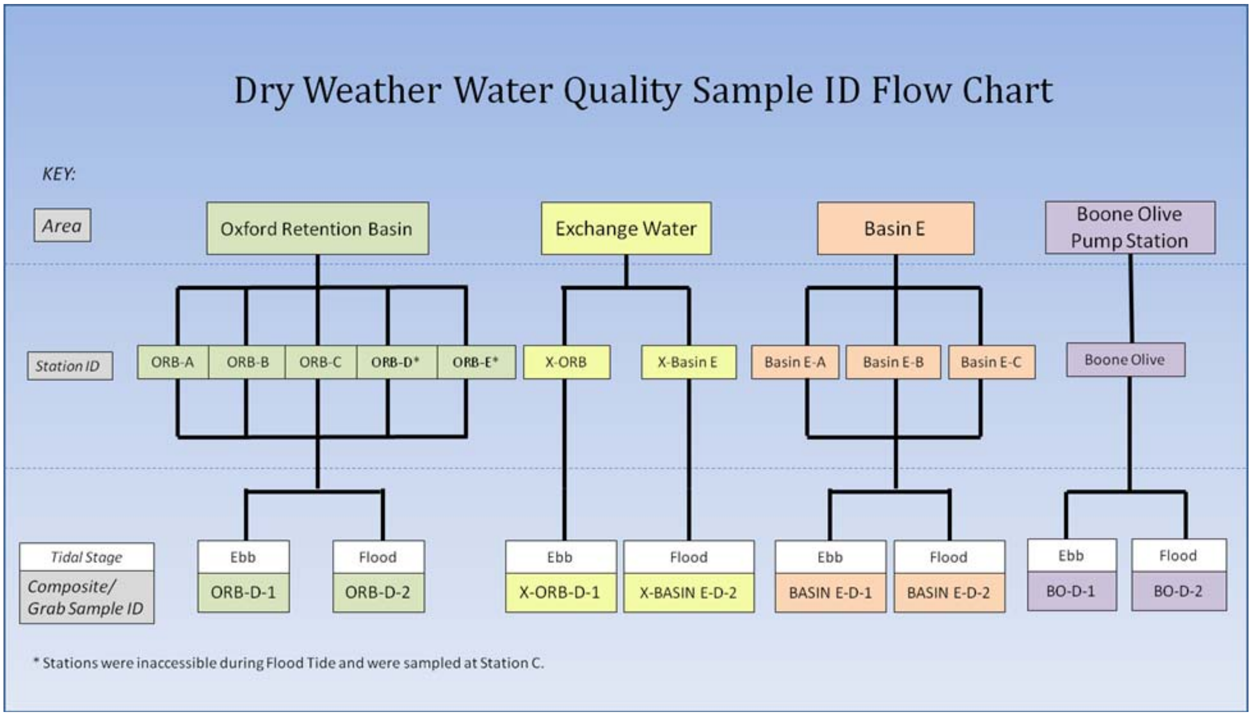

Figure 11. Dry Weather Water Quality Sample Identification Flow Chart

2.2 Navigation

Stations were located using a Garmin Wide Area Augmentation System (WAAS) enabled global positioning system (GPS) device. The system uses corrections provided by the Federal Aviation Administration (FAA) and is accurate to within 15 ft. All final station locations were recorded in the field using positions from the GPS.

2.3 Sampling Methods

2.3.1 Sediment Sampling

Figure 12. Piston Core Sampling

Sediment cores were collected at all stations using a piston core (Figure 12). The piston core was deployed from an inflatable vessel and was the preferred sampling device for areas inaccessible to larger vessels such as the Oxford Retention Basin. The piston core was equipped with a 3-inch outer diameter polycarbonate tube. Piston coring is the process of obtaining continuous well-preserved sediment core samples from water saturated, unconsolidated sediments. Penetration of the polycarbonate core tube was achieved by manually pushing the tube into the sediment via application of downward pressure on aluminum extensions attached to the piston core. To prevent compaction of the core during penetration, a plunger within the tube was set at the sediment water interface and maintained static pressure ensuring core integrity. To increase penetration, a hammering device was utilized to drive the core deeper into sediments. To eliminate the possibility of cross contamination between stations, a new polycarbonate tube was used at each station.

Following sampling, the piston core was retrieved to the deck of the boat and the liner with sediment removed from the piston device and placed in a core tray for processing. At the on-site processing station, the tube was placed vertically in a rack for 20 minutes to allow settling and then the tube was cut vertically along the length of the core to expose the sediment for processing. A certified geologist examined and classified the sediment as well as photographed the sediment core (Appendix A). The core stratigraphy, sediment grain-size distribution, color, texture, and other pertinent sediment characteristics were logged according to the Unified Soil Classification System (USCS). The station ID, actual latitude and longitude coordinates, and core lengths were also documented in the sample core logs (Appendix B).

At all stations, cores did not penetrate sediment to the anticipated target core length (based on existing bathymetry and planned design drawings). Refusal was encountered at shallower depths than expected. Refusal was defined as less than 2 inches of penetration per minute. Each time refusal was encountered, the vessel or sampling point was moved slightly and a second core attempted. If refusal was encountered again, additional cores were attempted until a sufficient amount of sample was collected. In cases where sediment cores with consolidated layers were insufficient to collect a full sample set, sample volume was reduced.

2.3.1.1 Sample Processing and Storage

Sediment cores were vertically subsampled to determine the vertical extent of sediment contamination and assess the presence of distinct layers of sedimentation. Each core was vertically segmented into two sections, representing the proposed excavation material in the upper section and the consolidated material in the lower section. No residual layers were found to be present in the sediment cores.

Once collected, subsamples from each of the ten cores were taken from the upper 6 inches of the excavation layer to be analyzed for grain size and indicator bacteria (i.e., total coliforms, fecal coliforms, enterococci, and *Escherichia coli*). The remaining sediment from the excavation layer was combined into two composite samples; Composite 1 was comprised of sediment from sites S1 through S5, and Composite 2 was comprised of sediment from sites S6 through S10. Consolidated sediment from each of the cores was analyzed separately.

All cores were processed on site, and the sediment samples homogenized to a uniform consistency using a stainless-steel mixing apparatus. Subsamples representing the distinct layers were placed in appropriate containers for all analyses. All samples were labeled (with project name, date, sampler ID, analysis, and preservative where applicable), logged into a field chain-of-custody (COC) form, and placed into a cooler. Samples were stored in the dark on ice or at 4°C until shipped or delivered to the appropriate analytical laboratory.

2.3.1.2 Decontamination of Field and Laboratory Equipment

All sampling equipment was cleaned prior to sampling. Between stations, the piston core was rinsed and a new polycarbonate tube used at each sample location. Before homogenizing each core segment, all stainless-steel utensils (i.e., stainless-steel bowls, spoons, spatulas, mixers, and other utensils) were cleaned with soapy water, rinsed with tap water, and then rinsed three times with deionized water.

2.3.2 Water Sampling – Wet Weather and Dry Weather

Water quality samples in Oxford Retention Basin and Basin E for both wet weather and dry weather sampling events were collected from an inflatable boat in Oxford Retention Basin and from a kayak in Basin E. The latitude and longitude, as well as station depth, depth of saltwater lens (if present), and physical water quality measurements, were recorded at the five locations within Oxford Retention Basin and three locations within Basin E. The physical water quality measurements that were recorded at each station were temperature, pH, specific conductivity, dissolved oxygen (DO), and turbidity.

During the wet weather and dry weather events, one water quality sample was collected from the Boone Olive Pump Station sump. The samples were collected using a telescoping sample pole with appropriate analyte sample containers. Physical water quality measurements, depth, and presence/depth of the saltwater lens were recorded as well.

At each water quality sample location, salinity measurements were collected to determine if any freshwater lenses or layers were present. If a freshwater lens was present, the depth of the lens at that location was recorded. Water quality samples for were collected from below the freshwater lens, if detected. During the course of this study, one field duplicate and one field blank sample were collected for quality assurance (QA) purposes.

Field scientists wearing clean, disposable gloves collected water grab samples in sterile, glass containers. Water to be tested for conventional analytes was collected from beneath the water surface to a depth of 6 inches (or below the freshwater lens, if determined present). The bottle was submerged open-end down approximately 6 inches below the water’s surface. The bottle was then turned face-up and allowed to fill. Care was taken to avoid contaminating the sample with debris and/or disturbed sediment.

2.3.2.1 Sample Processing and Storage

The composite water samples were collected directly into new 2-L glass jars and composited into 19-L borosilicate glass jugs. The composite sample was then partitioned from the glass jug into separate, appropriate analyte containers as needed.

The grab samples that were not conducive to composite sampling, as well as the Exchange water sites and additional analytes samples were collected in the field directly into the appropriate lab containers for each respective analyte.

After samples were partitioned to the appropriate analyte containers they were immediately placed in coolers on ice. The samples were kept in accordance with strict COC procedures until relinquished to laboratory couriers.

2.3.2.2 Decontamination of Field and Laboratory Equipment

All sampling equipment was cleaned prior to sampling. Water samples collected for composite analysis samples were collected in new lab certified precleaned 2-L jars. The composite samples were then poured into lab-cleaned 19-L borosilicate jars, and then homogenized and partitioned into appropriate containers for laboratory analysis.

Grab samples were collected in the field directly into the appropriate lab containers for analytes that were not conducive to composite sampling, such as oil and grease, and also for the Exchange water samples.

2.3.3 Shipping

Prior to delivery of samples to the various chemistry laboratories, sample containers were securely packed inside the cooler with ice. Then, COC forms were filled out, and the original signed COC forms were inserted in a sealable plastic bag and placed inside the cooler. The cooler lids were securely taped shut. Samples were delivered to the analytical laboratories listed in Table 1.

Table 1. Analytical Laboratories, Point-of-Contact Information, and Shipping Information

Laboratory	Analyses Performed	Point-of-Contact	Shipping Information
CRG Marine Laboratories, Inc.	Sediment and water chemistry	Mr. Eugene Chae (310) 533-5190 or Mr. Joseph Doak (310) 533-5190	CRG Marine Laboratories, Inc. 2020 Del Amo Blvd. Torrance, CA 90501

2.3.4 Chain-of-Custody Procedures

Samples were considered to be in custody if they were (1) in the custodian’s possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession were COC records, field log books, and field tracking forms. COC procedures were used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures were initiated during sample collection. A COC record was provided with each sample or sample group. Each person who had custody of the samples signed the form and ensured that the samples were not left unattended unless properly secured. Minimum documentation of sample handling and custody included the following:

- Sample ID.
- Sample collection date and time.
- Any special notations on sample characteristics.
- Initials of the person collecting the sample.
- Date the sample was sent to the laboratory.
- Shipping company and waybill information.

The completed COC form was placed in a sealable plastic envelope that traveled inside the ice chest containing the listed samples. The COC form was signed by the person transferring the custody of the samples. The condition of the samples was recorded by the receiver. COC records were included in the final analytical report prepared by the laboratory, and were considered an integral part of that report.

2.4 Sample Analyses

All chemical analyses were conducted in accordance with United States Environmental Protection Agency (USEPA) or Standard Methods (SMs) approved methods.

2.4.1 Sediment Samples

A total of ten sediment samples were submitted for laboratory analysis for the following list of analytes. Subsamples from each of the ten cores were taken from the upper six inches of the excavation layer to test for indicator bacteria (i.e., total coliforms, fecal coliforms, enterococci, and *E. coli*) and grain-size analyses. The remaining sediment from the excavation layer was combined into two composite samples. Composite 1 was comprised of sediment from stations S1 through S5, whereas Composite 2 was comprised of sediment from S6 through S10. The two composite samples were analyzed for the following parameters:

- General chemistry (i.e., TOC, pH, ammonia, nitrate, nitrite, percent solids, and total sulfides).
- SVOCs (i.e., polycyclic aromatic hydrocarbons (PAHs), base/neutral-extractables, phthalates, and acid extractables (phenols)).
- CAM 17 metals.
- AVS/SEM for TMDL-listed metals (i.e., copper, lead, and zinc).
- Organochlorine Pesticides (i.e., aroclor PCBs and PCB congeners).
- TPH (C6-C44).
- TCLP for metals, SVOCs, and organochlorine pesticides.
- Grain size.
- Organophosphorus pesticides.

Consolidated sediment from each of seven cores was analyzed separately (at three sites consolidated material was not sampled due to refusal). Sediment from the consolidated layer was analyzed for the same parameters as listed above for the composite samples with the exception of AVS/SEM for TMDL listed metals. A residual layer (i.e., in cases where the proposed grading depth was shallower than the consolidated layer) was not identified; therefore, no residual layer samples were collected. The compositing scheme and list of analyses performed on sediment samples is provided in Table 2.

To understand the potential feasibility of bioremediation techniques on existing sediment, Weston Solutions, Inc. (WESTON®), in consultation with Anderson Environmental, conducted the additional analysis of organophosphorus pesticides on the composite sediment samples.

Table 2. Analyses Performed on Oxford Retention Basin Sediment Samples

Sample Matrix	Sample Description		Number of Samples	Bacteria	Grain Size	Total Metals	Organochlorine Pesticides and PCBs	SVOCs	Organophosphorus pesticides	General Chemistry	TCLP Analyses		
											Metals	SVOCs	Organochlorine Pesticides
Sediment	Excavation layer	Subsamples from upper 6 inches	10	x	x								
		Entire excavation layer (composites)	2		x	x	x	x	x	x	x	x	x
	Consolidated layer		7		x	x	x	x	x	x	x	x	x

The sediment chemistry results were compared to the total threshold limit concentration (TTLC) and ten times the soluble threshold limit concentration (STLC) values. Briefly, TTLC and STLC values are published in Title 22 of the State of California Code of Regulations and are the benchmark for determining whether a solid, or its leachate, respectively, exhibits the characteristics of toxicity, thereby causing it to be classified as hazardous. If bulk chemistry values exceed ten times the STLC, it does not definitively classify the material as hazardous; rather, it suggests those analytes have the potential to exceed the STLC after conducting the Waste Extraction Test (WET). Sediment was also subjected to TCLP tests. Briefly, the TCLP values are published in the Code of Federal Regulations (40 CFR §261.24) and are the federal benchmark for determining whether the leachate from a solid would be classified as toxic and, therefore, hazardous.

2.4.2 Water Samples – Wet Weather

A total of 14 water samples plus one field duplicate and one blank were collected and analyzed during this project. Each water sample was analyzed for the following:

- VOCs.
- SVOCs.
- CAM 17 metals (total and dissolved).
- Chlorinated pesticides.
- TPH (C6-C44).
- PCBs.
- TOC.
- DOC.
- pH.
- Hardness.
- TDS.
- TSS.
- Indicator bacteria (i.e., total coliforms, fecal coliforms, *E. coli*, and enterococci) (not composited).
- Nutrients (i.e., ammonia, total Kjeldahl nitrogen (TKN), nitrate, nitrite, and orthophosphate).
- Sulfides.

Total and dissolved metals were also analyzed and ultra-low detection limits (0.1 ng/L) for PCB analysis were used to satisfy established TMDL requirements.

To understand the potential feasibility of bioremediation techniques on existing sediment, WESTON, in consultation with Anderson Environmental, collected an additional volume of water from Oxford Retention Basin and at the discharge point just prior to discharge to Basin E following the wet weather event. The following additional analyses on the composite water samples were performed:

- Oil and grease.
- Cyanide.
- Biochemical oxygen demand (BOD).
- Chemical oxygen demand (COD).
- Chloride.
- Organophosphorus pesticides.

The wet weather water quality results were compared to criteria presented in either the COP or the California Toxics Rule (CTR), as appropriate.

2.4.3 Water Samples – Dry Weather

A total of seven samples, plus one field duplicate and one field blank were collected and analyzed during this project. Each water sample was analyzed for the following:

- pH.
- TOC.
- DOC.
- Hardness.
- TDS.
- TSS.
- Nutrients (i.e., ammonia, TKN, nitrate, and nitrite)
- Indicator bacteria (i.e., total coliforms, fecal coliforms, *E. coli*, and enterococci) (not composited).
- CAM 17 metals (total and dissolved).
- SVOCs.
- TPH (C6-C44).
- Chlorinated pesticides.
- PCBs.
- VOCs.

Total and dissolved metals were also analyzed and ultra-low detection limits (0.1 ng/L) for PCB analysis were used to satisfy established TMDL requirements.

The dry weather water quality results were compared to criteria presented in either the COP or the CTR, as appropriate.

2.5 Quality Assurance / Quality Control Procedures

All data were reviewed and verified by participating team laboratories to determine that all data quality objectives were met and that appropriate corrective actions were taken when necessary. Analytical laboratories provided a QA / quality control (QC) narrative that described the results of the standard QA/QC protocols that accompanied analysis of field samples. All hard copies of results are maintained in the project file at WESTON in Carlsbad and included in this report. In addition, back-up copies of results generated by each laboratory are maintained at their respective facilities. At a minimum, the laboratory reports contained results of the laboratory analysis, QA/QC results, all protocols and any deviations from the project SAP, and a case narrative of COC details.

3.0 RESULTS AND DISCUSSION

3.1 Sediment Sampling Results

3.1.1 Field Results

Piston core sampling was conducted between October 19, 2009, and October 20, 2009, at ten stations located within the Oxford Retention Basin. All ten stations were successfully sampled, although consolidated material from stations S7, S9, and S10 was not recovered due to refusal. Field coordinates, number of cores per station, depth of core penetration, final core length (i.e., recovery length), and thickness of the consolidated and unconsolidated layers are summarized in Table 3.

3.1.2 Excavation Layer Results

3.1.2.1 Physical and Conventional Parameters

Results of the physical and conventional parameter analyses for sediments collected within the excavation layer of the Oxford Retention Basin are presented in Table 4 (the complete laboratory analytical data report for sediment samples is included in Appendix C). The composite sample S-1-5-EL consisted of 82.8% fine-grained material (47.5% silt and 35.3% clay); and 17.2% coarse-grained material (1.4% gravel and 15.8% sand). The composite sample S-6-10-EL consisted of 49.1% fine-grained material (30.8 silt and 18.3% clay); and 50.9% coarse-grained material (4.7% gravel and 46.2% sand). The ammonia-N concentrations reported for S-1-5-EL and S-6-10-EL were 19.61 mg/kg and 8.5 mg/kg, respectively. TKN results ranged from 732 mg/kg to 1130 mg/kg. TOC levels for both samples ranged from 4.07–5.62%, and percent solids ranged from 57.8–65.9%. Total sulfides and AVS ranged from 4.76 mg/kg to 5.02 mg/kg. TPH-CC ranged from 160 mg/kg to 200 mg/kg, and pH ranged from 8.3 to 8.4 for both excavation layer composite samples.

3.1.2.2 Chemical Analyses

Results of the bulk chemical analyses for sediments collected within the Oxford Retention Basin are presented in Table 4. In the results discussion below, ‘J flag’ values (i.e., estimated concentrations below the reporting limit) were considered not detected.

Trace Metals

Chromium and lead were the only metals to exceed the screening level assessment of ten times the STLC values (50 microgram per gram (µg/g)) in the proposed excavation layer composite samples. The chromium concentrations reported for S-1-5-EL and S-6-10-EL were 66.28 µg/g) and 52.11 µg/g, respectively. The lead concentrations reported for S-1-5-EL and S-6-10-EL were 306.3 µg/g) and 359.6 µg/g, respectively. All other metals listed in Table 4 were reported below the TTLC values, and none exceeded the federal TCLP criteria.

Table 3. Field Coordinates, Sample Depths, and Piston Core Recoveries for Samples Collected in the Oxford Retention Basin

Station ID	Attempt	Latitude (WGS 84)	Longitude (WGS 84)	Water Depth (ft)	Target Core Length (ft)	Actual Depth Sampled (ft)	Penetration (ft)	Final Core Length (ft)	Thickness of Consolidated Layer (ft)	Thickness of Un-consolidated Layer (ft)	Comments
S1	1	33.984971°	-118.456618°	3.9	8	6.4	2.5	0.3	0	0.3	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.984971°	-118.456618°	3.9	8	6.4	2.5	1	0.5	0.5	
	3	33.984971°	-118.456618°	3.9	8	6.4	2.5	1.5	1	0.5	
S2	1	33.984679°	-118.456232°	3.9	8	6.4	2.5	0.3	0.15	0.15	Refusal encountered in consolidated layer due to sediment composition/compaction
	2	33.984679°	-118.456232°	3.9	8	6.9	3	0.7	0.2	0.5	
	3	33.984679°	-118.456232°	3.9	8	6.9	3	0.7	0	0.7	
	4	33.984679°	-118.456232°	3.9	8	NA	NA	NA	0	NA	
	5	33.984679°	-118.456232°	3.9	8	NA	NA	NA	0	NA	
	6	33.984679°	-118.456232°	3.9	8	6.9	3	1.5	0.3	1.2	
	7	33.984679°	-118.456232°	3.9	8	6.9	3	2.6	0.4	2.2	
S3	1	33.984904°	-118.455816°	3.9	8	6.4	2.5	0.7	0.4	0.3	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.984904°	-118.455816°	3.9	8	6.9	3	1.4	0.3	1.1	
	3	33.984904°	-118.455816°	3.9	8	6.9	3	1.3	0	1.3	
	4	33.984904°	-118.455816°	3.9	8	6.9	3	1.1	0.3	0.8	
	5	33.984904°	-118.455816°	3.9	8	6.9	3	1.4	0	1.4	
S4	1	33.985186°	-118.455979°	3.9	8	6.4	2.5	1.5	0.3	1.2	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.985186°	-118.455979°	3.9	8	6.4	2.5	1.4	0.8	0.6	
S5	1	33.985321°	-118.455536°	3.9	8	6.4	2.5	1.6	0.5	1.1	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.985321°	-118.455536°	3.9	8	6.4	2.5	1.6	0	1.6	
	3	33.985321°	-118.455536°	3.9	8	6.9	3	2.2	0.3	1.9	
S6	1	33.985286°	-118.455077°	3.3	8	4.3	1	0.5	0	0.5	Refusal encountered in consolidated layer due to sediment composition and/or compaction
	2	33.985286°	-118.455077°	3.3	8	4.8	1.5	1	0.2	0.8	
	3	33.985286°	-118.455077°	3.3	8	6.3	3	2.1	0.4	1.7	
S7	1	33.985664°	-118.455151°	3.3	8	4.8	1.5	0.6	0	0.6	Refusal encountered in consolidated layer due to woody/vegetated debris and possible riprap
	2	33.985664°	-118.455151°	3.3	8	4.8	1.5	0.6	0	0.6	
S8	1	33.985627°	-118.454585°	2.6	8	5.6	3	1.2	0.6	0.6	Refusal encountered in consolidated layer due to sediment composition and/or compaction
S9	1	33.985624°	-118.453995°	3.3	8	6.3	3	1.3	0	1.3	Refusal encountered in consolidated layer due to woody/vegetated debris and possible riprap
	2	33.985624°	-118.453995°	3.3	8	5.8	2.5	1	0	1	
	3	33.985624°	-118.453995°	3.3	8	5.8	2.5	1.5	0	1.5	
S10	1	33.985609°	-118.453217°	3.3	8	6.3	3	2.3	0	2.3	Refusal encountered in consolidated layer due to woody/vegetated debris and possible riprap

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Grain Size												
Gravel	%			1.4	4.7	0.4	2.0	2.5	1.5	2.2	2.6	2.0
Sand	%			15.8	46.2	23.4	47.5	35.8	29.0	37.1	47.5	39.9
Silt	%			47.5	30.8	51.0	35.0	39.8	41.4	35.7	31.4	35.3
Clay	%			35.3	18.3	25.3	15.6	21.9	28.0	25.0	18.5	22.8
General Chemistry												
Ammonia-N	mg/dry kg			19.61	8.5	3.41	22.82	8.27	6.96	11.6	9.25	8.66
Total sulfides	mg/dry kg			4.8	5	<0.2	5.3	<0.2	<0.2	<0.2	<0.2	1.7
AVS	mg/dry kg			4.76	5.02	<0.05	5.31	<0.05	<0.05	<0.05	<0.05	1.67
TKN	mg/kg			1,130	732	333	239	310	301	345	182	217
TOC	% Dry weight			4.07	5.62	0.54	0.63	0.56	1.15	0.76	0.33	0.86
TPH-CC (C6-C44)	mg/kg			160	200	150	22	12	<4.8	59	<4.8	<4.8
pH	pH units			8.3	8.4	9.3	8.9	8.8	9	8.9	9.3	9.2
Percent solids	Percent			57.8	65.9	76.2	77.1	81.9	80.9	78.9	88.5	76.8
Trace Metals												
Antimony (Sb)	µg/dry g	500	150	1.57	2.002	0.925	1.009	0.593	1.198	0.772	0.564	0.893
Arsenic (As)	µg/dry g	500	50	15.17	10.51	7.952	32.51	6.23	12.77	7.998	5.09	8.854
Barium (Ba)	µg/dry g	10,000	1,000	162	140	219.7	194	167.1	183.2	176.3	68.44	209.2
Beryllium (Be)	µg/dry g	75	7.5	0.653	0.398	0.676	0.701	0.559	0.673	0.512	0.416	0.581
Cadmium (Cd)	µg/dry g	100	10	2.842	3.093	0.533	1.217	0.303	0.775	0.673	0.658	0.5
Chromium (Cr)	µg/dry g	2,500	50	66.28	52.11	49.34	56.84	35.75	51.93	37.46	25.27	45.97
Cobalt (Co)	µg/dry g	8,000	800	12.05	8.36	10.14	13.06	8.441	12.79	9.22	9.608	8.775
Copper (Cu)	µg/dry g	2,500	250	157.7	101.9	33.91	39.8	26.09	33.74	31.35	18.06	31.58
Lead (Pb)	µg/dry g	1,000	50	306.3	359.6	5.987	36.16	10.88	13.78	28.49	7.026	30.22
Mercury (Hg)	µg/dry g	20	2	0.37	0.28	0.03	0.07	0.04	0.04	0.06	0.04	0.04
Molybdenum (Mo)	µg/dry g	3,500	3,500	6.367	6.046	1.935	2.215	1.445	2.845	1.761	1.847	3.092
Nickel (Ni)	µg/dry g	2,000	200	39.41	30.26	36.87	39.8	25.59	36.57	25.12	19.31	27.3
Selenium (Se)	µg/dry g	100	10	1.088	0.79	1.807	0.577	1.996	1.768	1.204	1.139	0.37
Silver (Ag)	µg/dry g	500	50	1.978	1.059	0.598	0.52	0.47	0.674	0.668	0.58	0.72
Thallium (Tl)	µg/dry g	700	70	0.329	0.187	0.277	0.288	0.185	0.276	0.198	0.155	0.218
Vanadium (V)	µg/dry g	2,400	240	95.5	60.9	107.2	110.7	74.05	103.7	73.8	51.06	93.29
Zinc (Zn)	µg/dry g	5,000	2,500	481.2	459.2	72.06	107.8	76.65	98	105.1	51.02	86.82
AVS/SEM												
Cadmium (Cd) – SEM	µmol/dry g			<0.0018	0.0022J	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018
Copper (Cu) – SEM	µmol/dry g			<0.0062	<0.0062	0.0102J	<0.0062	0.0085J	0.007J	0.0065J	0.0116J	<0.0062
Lead (Pb) – SEM	µmol/dry g			0.147	0.2691	0.0015	0.0847	0.007	0.0029	0.0121	0.0101	0.0198
Nickel (Ni) – SEM	µmol/dry g			0.0167	0.0325	0.007	0.0142	0.0098	0.013	0.0119	0.015	0.0089
Silver (Ag) – SEM	µmol/dry g			<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047
Zinc (Zn) – SEM	µmol/dry g			0.7977	1.5269	0.008	0.2	0.0884	0.0348	0.106	0.0797	0.0826
ΣSEM[1]	µmol/dry g			0.967	1.835	0.029	0.304	0.116	0.060	0.139	0.118	0.116
AVS	µmol/dry g			0.148	0.157	0.001	0.166	0.001	0.001	0.001	0.001	0.052
ΣSEM:AVS	ratio			6.511	11.72	36.91	1.836	148.5	76.67	177.7	152.0	2.236
Polynuclear Aromatic Hydrocarbons												

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
1-Methylnaphthalene	ng/dry g			2.4J	3.4J	<1	<1	<1	<1	<1	<1	<1
1-Methylphenanthrene	ng/dry g			4.4J	<1	<1	<1	<1	<1	<1	<1	<1
2,3,5-Trimethylnaphthalene	ng/dry g			1.8J	1.9J	<1	<1	<1	<1	<1	<1	<1
2,6-Dimethylnaphthalene	ng/dry g			32.9	21.4	<1	1.1J	<1	<1	<1	<1	<1
2-Methylnaphthalene	ng/dry g			5.9	11.3	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	ng/dry g			2.6J	4J	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	ng/dry g			3.6J	4.6J	<1	<1	<1	<1	2J	<1	<1
Anthracene	ng/dry g			18.9	30.7	<1	1J	<1	<1	2.8J	<1	1J
Benz[a]anthracene	ng/dry g			105.5	198.5	<1	6.1	1.2J	<1	14	11.1	4.2J
Benzo[a]pyrene	ng/dry g			231	275	32.1	11.6	5.9	1.6J	22.3	11	5.4
Benzo[b]fluoranthene	ng/dry g			254.5	361.3	<1	8.6	<1	<1	14.7	11	4.4J
Benzo[e]pyrene	ng/dry g			215.3	285.6	8.8	9.2	3.2J	<1	13.2	8.8	5
Benzo[g,h,i]perylene	ng/dry g			265.5	353.2	7.5	11.1	3.1J	<1	16.1	10.6	5.8
Benzo[k]fluoranthene	ng/dry g			95.8	148.1	<1	3.6J	<1	<1	4.5J	6	1.9J
Biphenyl	ng/dry g			2.4J	7.5	<1	<1	<1	<1	<1	<1	<1
Chrysene	ng/dry g			154.4	267.1	11.8	8	2.9J	<1	21.1	14.8	5.9
Dibenz[a,h]anthracene	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	ng/dry g			<1	7.6	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	ng/dry g			169.6	493.3	5.2	9.8	2.8J	<1	22.8	25.5	6.7
Fluorene	ng/dry g			4.6J	7.8	<1	<1	<1	<1	<1	<1	<1
Indeno[1,2,3-c,d]pyrene	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	ng/dry g			5.7	10.3	<1	1J	<1	<1	1.8J	<1	<1
Perylene	ng/dry g			113.7	99	59.1	3.8J	4J	3.5J	19.2	3.6J	2.9J
Phenanthrene	ng/dry g			42.7	80.3	<1	3J	1.5J	<1	12.2	5	5.1
Pyrene	ng/dry g			362.9	671.3	12.6	18.6	5.6	1.1J	32.2	27.3	11.9
Total detectable PAHs	ng/dry g			2,096.1	3,343.2	137.1	96.5	30.2	6.2	198.9	134.7	60.2
Base/Neutral-Extractable Compounds												
1,2,4-Trichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	ng/dry g			<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Azobenzene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Benzidine	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorobenzene	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Hexachlorobutadiene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
N-Nitrosodi-n-propylamine (NDPA)	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
N-Nitrosodimethylamine (NDMA)	mg/kg			<0.3	<0.26	<0.33	<0.28	<0.27	<0.3	<0.31	<0.3	<0.29
N-Nitrosodiphenylamine	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
Phthalates												
bis(2-Ethylhexyl) phthalate	ng/dry g			4773	6158	<100	168	<100	<100	158	149	<100
Butylbenzyl phthalate	ng/dry g			344	460	<25	<25	<25	<25	<25	<25	<25
Di-n-butyl phthalate	ng/dry g			<75	<75	<75	<75	<75	<75	<75	<75	<75
Di-n-octyl phthalate	ng/dry g			<10	60	<10	<10	<10	<10	<10	<10	<10
Diethyl phthalate	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
Dimethyl phthalate	ng/dry g			222	271	<50	<50	<50	<50	<50	<50	<50
Acid-Extractable Compounds												
2,4,6-Trichlorophenol	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Chlorophenol	ng/dry g			<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	ng/dry g	17,000	17,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Phenol	ng/dry g			<100	<100	<100	<100	<100	<100	<100	<100	<100
Organochlorine Pesticides												
2,4'-DDD	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	ng/dry g			9.9	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	ng/dry g	1,000	1,000	<1	44.8	<1	<1	<1	<1	<1	<1	1J
4,4'-DDE	ng/dry g	1,000	1,000	<1	3.8	<1	2.3	<1	<1	<1	<1	<1
4,4'-DDT	ng/dry g	1,000	1,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable DDTs	ng/dry g			9.9	48.6	<1	2.3	<1	<1	<1	<1	1
Aldrin	ng/dry g	1,400	1,400	<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-beta	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-delta	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-gamma	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	ng/dry g			17.9	34.3	<1	<1	<1	<1	<1	<1	<1
Chlordane-gamma	ng/dry g			28.5	50	<1	1.6J	<1	<1	1.1J	<1	1J
Total detectable chlordane (a,g)	ng/dry g			46.4	84.3	<1	1.6	<1	<1	1.1	<1	1

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
DCPA (dacthal)	ng/dry g			<5	<5	<5	<5	<5	<5	<5	<5	<5
Dicofol	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Dieldrin	ng/dry g	8,000	8,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin	ng/dry g	200	200	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin aldehyde	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin ketone	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor	ng/dry g	4,700	4,700	<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	ng/dry g	100,000	100,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mirex	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-Nonachlor	ng/dry g			<1	15	<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	ng/dry g			15.5	24.8	<1	<1	<1	<1	<1	<1	<1
Oxychlordane	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
Perthane	ng/dry g			<5	<5	<5	<5	<5	<5	<5	<5	<5
Toxaphene	ng/dry g	5,000	5,000	61.29	168.71	<10	<10	<10	<10	<10	<10	<10
Aroclor PCBs												
Aroclor 1016	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1221	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1232	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1242	ng/dry g	50,000	50,000	137	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1248	ng/dry g	50,000	50,000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1254	ng/dry g	50,000	50,000	110	199	<10	20	<10	<10	<10	<10	16J
Aroclor 1260	ng/dry g	50,000	50,000	<10	148	<10	38	<10	<10	<10	<10	<10
Total Aroclor	ng/dry g			247	347	<10	58	<10	<10	<10	<10	16
PCB Congeners												
PCB003	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB008	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB018	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB028	ng/dry g			11	<1	<1	<1	<1	<1	<1	<1	<1
PCB031	ng/dry g			4.8	<1	<1	<1	<1	<1	<1	<1	<1
PCB033	ng/dry g			10.4	<1	<1	<1	<1	<1	<1	<1	<1
PCB037	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB044	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	1J
PCB049	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	1.1J
PCB052	ng/dry g			<1	11.4	<1	<1	<1	<1	<1	<1	<1
PCB056/060	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB066	ng/dry g			7.1	4.2	<1	<1	<1	<1	<1	<1	<1
PCB070	ng/dry g			5.8	32	<1	<1	<1	<1	<1	<1	1J
PCB074	ng/dry g			<1	11.4	<1	<1	<1	<1	<1	<1	<1
PCB077	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
PCB081	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB087	ng/dry g			6.2	4.2	<1	<1	<1	<1	<1	<1	<1
PCB095	ng/dry g			6.9	15.8	<1	1.3J	<1	<1	1.1J	<1	<1
PCB097	ng/dry g			<1	7.4	<1	<1	<1	<1	<1	<1	<1
PCB099	ng/dry g			6.2	8.4	<1	1.1J	<1	<1	<1	<1	<1
PCB101	ng/dry g			18	30.3	<1	2.7	<1	<1	<1	<1	1.5J
PCB105	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB110	ng/dry g			13.5	24.3	<1	2.4	<1	<1	<1	<1	2
PCB114	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB118	ng/dry g			<1	22.1	<1	<1	<1	<1	<1	<1	<1
PCB119	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB123	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB126	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB128	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB138	ng/dry g			<1	13	<1	3	<1	<1	<1	<1	1J
PCB141	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB149	ng/dry g			14.3	16.8	<1	1.6J	<1	<1	<1	<1	<1
PCB151	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB153	ng/dry g			<1	12.2	<1	1.4J	<1	<1	<1	<1	1.3J
PCB156	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB157	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB158	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB167	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB168+132	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB169	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB170	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB174	ng/dry g			<1	4.4	<1	<1	<1	<1	<1	<1	<1
PCB177	ng/dry g			<1	1.1J	<1	<1	<1	<1	<1	<1	<1
PCB180	ng/dry g			8.3	9	<1	3	<1	<1	<1	<1	<1
PCB183	ng/dry g			<1	2.2	<1	<1	<1	<1	<1	<1	<1
PCB187	ng/dry g			4.9	8.3	<1	3	<1	<1	<1	<1	<1
PCB189	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB194	ng/dry g			<1	18.5	<1	4.7	<1	<1	<1	<1	<1
PCB195	ng/dry g			<1	<1	<1	<1	<1	<1	<1	<1	<1
PCB200	ng/dry g			1.3J	<1	<1	1J	<1	<1	<1	<1	<1
PCB201	ng/dry g			<1	6.6	<1	8.2	<1	<1	<1	<1	<1
PCB203	ng/dry g			<1	2.3	<1	6.9	<1	<1	<1	<1	<1
PCB206	ng/dry g			<1	3.9	<1	9.5	<1	<1	1J	<1	<1
PCB209	ng/dry g			<1	<1	<1	2.9	<1	<1	1.7J	<1	<1
Total PCBs	ng/dry g			118.7	269.8	<1	52.7	<1	<1	3.8	<1	8.9
Organophophorus Pesticides												
Azinphos methyl	ng/dry g			<50	<50							
Bolstar (sulprofos)	ng/dry g			<10	<10							

Table 4. Summary of Oxford Retention Basin Sediment Chemistry

Parameter	Units	CRITERIA		EXCAVATION LAYER		CONSOLIDATED LAYER						
		TTLC	10x-STLC	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Chlorpyrifos	ng/dry g			<5	<5							
Demeton	ng/dry g			<10	<10							
Diazinon	ng/dry g			<5	<5							
Dichlorvos	ng/dry g			<10	<10							
Dimethoate	ng/dry g			<5	<5							
Disulfoton	ng/dry g			<10	<10							
Ethoprop (ethoprofos)	ng/dry g			<10	<10							
Ethyl parathion	ng/dry g			<10	<10							
Fenchlorphos (ronnel)	ng/dry g			<10	<10							
Fenitrothion	ng/dry g			<10	<10							
Fensulfothion	ng/dry g			<10	<10							
Fenthion	ng/dry g			<10	<10							
Malathion	ng/dry g			<5	<5							
Merphos	ng/dry g			<10	<10							
Methamidophos (monitor)	ng/dry g			<50	<50							
Methidathion	ng/dry g			<10	<10							
Methyl parathion	ng/dry g			<10	<10							
Mevinphos (phosdrin)	ng/dry g			<10	<10							
Phorate	ng/dry g			<10	<10							
Phosmet	ng/dry g			<50	<50							
Tetrachlorvinphos (stirofos)	ng/dry g			<10	<10							
Tokuthion	ng/dry g			<10	<10							
Trichloronate	ng/dry g			<10	<10							

<	Less than the method detection limit (MDL).
J	Estimated value less than the reporting limit but greater than the MDL.
[1]	ΣSEM = sum (Cd + Cu + Pb + Ni + (Ag/2) + Zn); if ND, then 1/2 MDL used.
🟨	ΣSEM:AVS = >1, indicating potential for metal toxicity due to excess ΣSEM.
BHC	Hexachlorobenzene.
Σ	Sum.
DDD	Dichlorodiphenyldichloroethane.
DDE	Dichlorodiphenyldichloroethylene.
DDT	Dichlorodiphenyltrichloroethane.

The aforementioned data for chromium and lead suggested the potential for leachate from the excavation layer composite samples to exhibit the characteristics of toxicity. Further analyses of these samples (Table 5) using the WET showed that chromium and lead results (4.4 mg/L and 2.4 mg/L, respectively) for sample S-1-5-EL did not exceed STLC criteria (5 mg/L for both metals) and was therefore classified as non-hazardous material. On the other hand, the WET confirmed that chromium and lead results (5.5 mg/L and 5.3 mg/L, respectively) for sample S-6-10-EL, collected from the excavation layer, exceeded STLC criteria for both metals and was therefore classified as hazardous material as defined by the State of California.

Table 5. Oxford Retention Basin Sediment Chemistry – Soluble Threshold Limit Concentration Results

Parameter	Units	Criteria	Excavation Layer	
		STLC	S-1-5-EL	S-6-10-EL
Trace Metals				
Chromium (Cr)	mg/L	**5**	4.4	5.5
Lead (Pb)	mg/L	**5**	2.4	5.3

Simultaneously Extracted Metals / Acid-Volatile Sulfides

The SEM/AVS method was used to determine the potential toxicity of metals in a sediment sample. This method is based on the theory that AVS, comprised primarily of iron monosulfides in sediments, bind to divalent cationic metals and form metal-sulfide complexes. Because these metal-sulfide complexes have low solubility, metal bioavailability and toxicity to benthic organisms is therefore affected by the amount of AVS in sediment. Thus, to determine the potential toxicity of metals in a sediment sample, the ratio of SEM to the concentration of AVS in a sample is evaluated. If SEM is higher than AVS, or SEM:AVS more than 1, then some portion of the metals are not bound up by AVS and therefore are bioavailable and potentially toxic. If SEM is less than AVS, or SEM:AVS is less than 1, then the metals are bound to AVS in the sediment sample are likely not toxic to benthic organisms.

It should be emphasized that this approach works specifically with divalent metals, including cadmium, copper, lead, nickel, and zinc (McGrath et al., 2002). Further research has suggested that silver may also bind with AVS; however, unlike the one to one relationship of the each of the other metals to AVS, one mole of SEM silver reacts with two moles of AVS (Berry et al., 1999; USEPA, 2000).

In addition, results should be interpreted in light of other environmental factors (e.g., DO and salinity), which, at their extremes, may interfere with the determination of this ratio (Long et al., 1988). However, a number of studies have demonstrated the usefulness of this method to predict the toxicity of metals in sediments (Di Toro et al., 1991; Ankley et al., 1991, Casas and Crecelius, 1994).

Table 4 presents the SEM results for the six divalent metals that are likely to bind AVS and the concentration of AVS for each sample. The table also presents the sum (Σ) of the SEM metals and the ratio of the ΣSEM to AVS. Stations with a ΣSEM:AVS ratio greater than one have been highlighted. All of the station samples that were analyzed using the SEM:AVS method had ΣSEM:AVS ratios greater than one. Ratios ranged from 6.511 in the S-1-5-EL sample to 11.72 in the S-6-10-EL sample. This indicates that the concentration of SEM was higher than the concentration of AVS in the sediment sample, suggesting that not all of the metals in the sediment samples were bound up by AVS and therefore may be bioavailable and potentially toxic to benthic organisms. Although the ratios for each station were greater than one, suggesting the potential for metal toxicity from excess ΣSEM to AVS, the calculated ratios for the samples were within a range of 2 to 40, making the prediction of effects uncertain (McGrath et al., 2002). Therefore, these results should be interpreted in the context of toxicity test results and other chemical/physical measurements.

Organic Sediment Constituents

The results of the organic constituents analyses are summarized in Table 4. Several PAH compounds were detected in the sample composites representing the excavation layer. Total detectable PAHs were calculated (low + high molecular weight) at concentrations of 2,096.1 µg/kg and 3,343.2 µg/kg for S-1-5-EL and S-6-10-EL, respectively.

Base/neutral-extractable compounds, acid-extractable compounds, and organophosphorus pesticides were not detected in both excavation layer composite samples. Three phthalates compounds were detected in S-1-5-EL, ranging from 222 ng/g to 4,773 ng/g. Four phthalate compounds were detected in S-6-10-EL, ranging from 60–6,158 ng/g.

Although seven organochlorine pesticide analytes were detected in low concentrations in sample S-1-5-EL and nine organochlorine pesticide analytes were detected in low concentrations in sample S-6-10-EL, none exceeded their respective TTLC or ten times STLC values. The value reported for 4,4'-DDD, in sample S-6-10-EL was 3.8 ng/g, significantly below the ten times STLC value of 1,000 ng/g. The values reported for toxaphene ranged from 61.29 ng/g to 168.71 ng/g for both excavation layer samples, significantly below the ten times STLC value of 50,000 ng/g. Total detectable chlordane ranged from 46.4 ng/g to 84.3 ng/g.

Fourteen individual PCB congeners were detected in sample S-1-5-EL and 21 individual PCB congeners were detected in sample S-6-10-EL. Aroclor 1242 and Aroclor 1254 were the only PCB Aroclors detected in sample S-1-5-EL with a concentration of 137 µg/kg and 110.0 µg/kg, respectively. Aroclor 1254 and Aroclor 1260 were the only PCB Aroclors detected in sample S-1-5-EL with a concentration of 199 µg/kg and 148 µg/kg, respectively. Total detectable PCBs were calculated at a concentration of 247 µg/kg for S-1-5-EL and at a concentration of 347 µg/kg for S-6-10-EL. All reported PCB results for the excavation layer samples were significantly below the ten times STLC criteria value of 50,000 ng/g.

3.1.2.3 Sediment Chemistry using Toxicity Characteristic Leaching Procedure

Results of the TCLP analyses are presented in Table 6. Briefly, the TCLP values are published in the Code of Federal Regulations (40 CFR §261.24) and are the federal benchmark for determining whether the leachate from a solid would be classified as toxic and, therefore, hazardous. Results of TCLP analyses of project sediments from the excavation layer indicated no metals were reported above the TCLP criteria.

All base/neutral-extractable compounds, acid-extractable compounds, and organochlorine pesticides were reported less than the reporting limit, with the exception of N-Nitrosodimethylamine (NDMA). NDMA values ranged from 7,600 ng/L to 24,000 ng/L. As shown in Table 6, all analytes were reported below the TCLP values.

Table 6. Summary of Oxford Retention Basin Sediment Chemistry using TCLP

Parameter	Units	Criteria	Excavation Layer		Consolidated Layer						
		TCLP	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Trace Metals											
Antimony (Sb)	µg/L		1.3	4.5	1.7	1.1	1	2	1.5	0.9	1
Arsenic (As)	µg/L	5,000	178	94.5	11.7	24.7	10.3	9.5	18.8	8.5	35.2
Barium (Ba)	µg/L	100,000	406.2	393.5	546.4	620.4	586.8	461.2	512.5	628.1	456.2
Beryllium (Be)	µg/L		3.7	2.9	6.8	5.6	5.2	5.3	4.6	3	3.4
Cadmium (Cd)	µg/L	1,000	24.7	17.7	3.8	6.8	7.3	7.5	6	6.7	4.1
Chromium (Cr)	µg/L	5,000	11.6	9	6.6	4.5	1.6	2.2	2.6	1.5	2.6
Cobalt (Co)	µg/L		26.5	37.3	56.8	66.6	67.8	73.2	75.5	78.9	48.6
Copper (Cu)	µg/L		13.2	7.6	8.5	1.7	35	14.9	7	31.9	5.9
Lead (Pb)	µg/L	5,000	942.71	744.51	8.97	36.17	16.53	14.91	12.23	3.93	21.43
Mercury (Hg)	µg/L	200	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (Mo)	µg/L		0.7	0.8	0.4J	0.3J	<0.2	0.2J	0.2J	<0.2	0.3J
Nickel (Ni)	µg/L		63.3	98.1	107.7	109.8	111.6	110.7	104.6	114.5	77
Selenium (Se)	µg/L	1,000	<0.2	<0.2	0.8	0.4J	3.4	6.5	5.4	19.6	0.3J
Silver (Ag)	µg/L	5,000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium (Tl)	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium (V)	µg/L		128.2	77.4	227.6	190	83.3	106.3	128.6	142.5	111.1
Zinc (Zn)	µg/L		6,187.9	5,215.9	432.3	766.7	879.8	642.6	620.6	301.3	384.2
Base/Neutral-Extractable Compounds											
1,2,4-Trichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	ng/L		<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Azobenzene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Benzidine	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorobenzene	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
NDPA	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
NDMA	ng/L		7,600	24,000	4,500	6,800	5,400	7,200	7,300	6,500	8,200
N-Nitrosodiphenylamine	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 6. Summary of Oxford Retention Basin Sediment Chemistry using TCLP

Parameter	Units	Criteria	Excavation Layer		Consolidated Layer						
		TCLP	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Acid-Extractable Compounds											
2,4,6-Trichlorophenol	ng/L	2,000,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Chlorophenol	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	ng/L	100,000,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Phenol	ng/L		<100	<100	<100	<100	<100	<100	<100	<100	<100
Organochlorine Pesticides											
2,4'-DDD	ng/L	10,000,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable DDTs	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Aldrin	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-beta	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-delta	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-gamma	ng/L	400,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-gamma	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable chlordane (a,g)	ng/L	30,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
DCPA (dacthal)	ng/L		<5	<5	<5	<5	<5	<5	<5	<5	<5
Dicofol	ng/L		<50	<50	<50	<50	<50	<50	<50	<50	<50
Dieldrin	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin	ng/L	20,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin aldehyde	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin ketone	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor	ng/L	8,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	ng/L	8,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	ng/L	10,000,000	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mirex	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-Nonachlor	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 6. Summary of Oxford Retention Basin Sediment Chemistry using TCLP

Parameter	Units	Criteria	Excavation Layer		Consolidated Layer						
		TCLP	S-1-5-EL	S-6-10-EL	S-1-NL	S-2-NL	S-3-NL	S-4-NL	S-5-NL	S-6-NL	S-8-NL
Oxychlordane	ng/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Perthane	ng/L		<5	<5	<5	<5	<5	<5	<5	<5	<5
Toxaphene	ng/L	500,000	<10	<10	<10	<10	<10	<10	<10	<10	<10

< Less than the MDL.
J Estimated value less than the reporting limit but greater than the MDL.

3.1.2.4 Microbiological Characteristics of Sediment

Results of the sediment bacterial analyses are provided in Table 7. Currently, no sediment quality criteria have been established for indicator bacteria, therefore, these results should be interpreted based on an understanding of the behavior and natural occurrence of these parameters in the environment. Preliminary review of these data suggest the total coliform concentrations were likely indicative of nutrient rich sediment and may be influenced by recent activities in the Oxford Retention Basin to control algae. The fecal coliform, *E. coli*, and enterococcus concentrations are considered indicative of natural sediment background levels. None of the indicator bacteria concentrations suggested anthropogenic sources that required abatement.

Table 7. Indicator Bacterial Concentrations in Oxford Retention Basin Sediment

Parameter	Units	EXCAVATION LAYER									
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Total coliforms	MPN/dry gram	218	451	435	278	591	2,174	21,782	14,953	1,110	5,693
Fecal coliforms	MPN/dry gram	10	34	33	18	81	625	554	935	236	436
E. coli	MPN/dry gram	11*	58*	66*	530*	640*	106	146	5851*	140	407
Enterococci	MPN/dry gram	3	58	59	10	81	<5	8	32	32	133

*Although *E. coli* is a subgroup of fecal coliforms, some values may be higher due to differences in methodology, the sample's matrix (sediment), or statistical range.

MPN = most probable number.

3.1.3 Consolidated Layer Results

3.1.3.1 Physical and Conventional Parameters

Results of the physical and conventional parameter analyses for sediments collected within consolidated layer of the Oxford Retention Basin are presented in Table 4. The individuals sediment samples (S-1-NL through S-6-NL, and S-8-NL) ranged from 23.8–50.1% in coarse-grained material (gravel and sand); and 49.9–76.3% in fine-grained material (silt and clay). The ammonia-N concentrations reported for the consolidated layer samples ranged from 3.41 mg/kg to 22.82 mg/kg. TKN results ranged from 182 mg/kg to 345 mg/kg. TOC levels ranged from 0.33–1.15%, and the percent solids ranged from 76.2–88.5%. Total sulfides and AVS ranged from non-detected (value reported under the method detection limit (MDL)) to 5.31 mg/kg. TPH-CC ranged from non-detected to 150 mg/kg, and pH ranged from 8.8 to 9.3 for all individual consolidated layer sediment samples.

3.1.3.2 Chemical Analyses

Results of the bulk chemical analyses for sediments collected within the Oxford Retention Basin are presented in Table 4. Similar to the excavation layer sediment results, these results were compared to the TTLC and ten times the STLC values. The consolidated layer sediment was also subjected to TCLP tests. Results of the TCLP analyses are presented in Table 6.

Trace Metals

Chromium was the only metal to minimally exceed the screening level assessment of ten times STLC value (50 µg/g) in the consolidated layer individual sediment samples. The chromium concentrations reported for S-2-NL and S-4-NL were 56.84 µg/g and 51.93 µg/g, respectively. All metals, including chromium, were reported significantly below their respective TTLC values.

Simultaneously Extracted Metals / Acid-Volatile Sulfides

Table 4 presents the SEM results for the six divalent metals that are likely to bind AVS and the concentration of AVS for each sample. The table also presents the sum (Σ) of the SEM metals and the ratio of the ΣSEM to AVS. Stations with a ΣSEM:AVS ratio greater than one have been highlighted. All of the station samples that were analyzed using the SEM:AVS method had ΣSEM:AVS ratios greater than one. Ratios ranged from 1.836 in the S-2-NL sample to 177.7 in the S-5-NL sample. This indicates that the concentration of SEM was higher than the concentration of AVS in the sediment sample, suggesting that not all of the metals in the sediment samples were bound up by AVS and therefore may be bioavailable and potentially toxic to benthic organisms. It should be noted that although the ratios for each station were greater than one, suggesting the potential for metal toxicity from excess ΣSEM to AVS, the calculated ratios for the samples, S-1-NL, S-2-NL, and S-8-NL were within a range of 2 to 40, making the prediction of effects uncertain (McGrath et al., 2002). Therefore, these results should be interpreted in the context of toxicity test results and other chemical/physical measurements.

Organic Sediment Constituents

The results of the organic constituents analyses are summarized in Table 4. Several PAH compounds were detected in the sample composites representing the excavation layer. Total detectable PAHs were calculated (low + high molecular weight) at concentrations ranging from 6.2 µg/kg and 198.9 µg/kg for consolidated layer samples.

Base/neutral-extractable compounds and acid-extractable compounds were not detected in the individual consolidated layer sediment samples. One phthalate compound (bis[2-Ethylhexyl] phthalate) was detected in S-2-NL, S-5-NL and S-6-NL, ranging from 149 ng/g to 168 ng/g.

Three organochlorine pesticide analytes were detected in low concentrations in sample S-2-NL, one organochlorine pesticide analyte was detected in sample S-5-NL, and two organochlorine pesticide analytes were detected in low concentrations in sample S-8-NL. The value reported for 4,4'-DDE, in sample S-2-NL was 2.3/g, significantly below the ten times STLC value of 1,000 ng/g. Total detectable chlordane ranged from non-detected to 1.6 ng/g. Organophosphorus pesticides were not tested for in the individual consolidated layer sediment samples.

Eleven individual PCB congeners were detected in sample S-2-NL, one individual PCB congener was detected in sample S-5-NL and two individual PCB congeners were detected in sample S-8-NL. Aroclor 1254 and Aroclor 1260 were the only PCB Aroclors detected in sample S-1-5-EL with a concentration of 137 µg/kg and 110.0 µg/kg, respectively. Aroclor 1254 and Aroclor 1260 were the only PCB Aroclors detected in sample S-2-NL with a concentration of 20 µg/kg and 30 µg/kg, respectively. Total detectable PCBs were calculated at a concentration of 58 µg/kg for S-2-NL and at a concentration of 16 µg/kg for S-8-NL. All reported PCB results for the excavation layer samples were significantly below the ten times STLC criteria value of 50,000 ng/g.

3.1.3.3 Sediment Chemistry using Toxicity Characteristic Leaching Procedure

Results of the TCLP analyses are presented in Table 6. All base/neutral-extractable compounds, acid-extractable compounds, and organochlorine pesticides were reported less than the reporting limit, with the exception of NDMA. NDMA values ranged from 4,500 ng/L to 8,200 ng/L. As shown in Table 6, all analytes, including trace metals were reported significantly below the TCLP values.

3.2 Water Sampling Results – Wet Weather

3.2.1 Sample Collection

The wet weather water quality field sampling program was completed on January 12–13, 2010, in accordance with the approved SAP. Four sampling efforts were conducted during the sampling event. Table 8 presents the station locations where samples were collected during each sampling round.

The first sampling effort was conducted prior to the onset of rain (termed ‘pre-storm’) during the low tide. This pre-storm sampling effort was conducted to assess water quality during dry weather conditions. Samples were collected from the Oxford Retention Basin (sample ORB-1), from the Exchange Area between Oxford Retention Basin and Basin E, from the Oxford Retention Basin side of the Exchange, (X-ORB-1), and from Basin E (E-1).

The second sampling effort (termed ‘prior to stormwater release’) was conducted after the storm had passed, and Oxford Retention Basin had filled with stormwater runoff (with the tide gates closed). This sampling effort was collected to assess stormwater quality entering Oxford Retention Basin via the associated storm drain system. During this sampling effort, samples were also collected from within Basin E, and represent water quality within Basin E prior to the release of stormwater runoff from Oxford Retention Basin into Basin E. Samples were also collected during this sampling effort for the additional list of analytes listed at the end of Subsection 2.4.2. These additional analyte samples were collected from Oxford Retention Basin as well as the Exchange water between the two basins.

The third sampling effort (termed ‘during stormwater release’) was conducted after the tide gate between Oxford Retention Basin and Basin E was opened. During this sampling effort, samples were collected from the Exchange water (i.e., discharge from Oxford Retention Basin to Basin E), Basin E, and Boone Olive Pump Station.

The fourth sampling effort was collected after Oxford Retention Basin had completely discharged (termed ‘Oxford Retention Basin drained’). Samples were collected from Basin E only during this sampling effort.

Table 8. Station Identification and Latitude and Longitude Coordinates for Water Samples Collected within the Oxford Retention Basin, Basin E, and Boone Olive Pump Station

Area/Basin	Station ID	Latitude	Longitude
Oxford Retention Basin	**ORB-A**	33.98482°	-118.45650°
	ORB-B	33.98530°	-118.45570°
	ORB-C	33.98524°	-118.45525°
	ORB-D	33.98548°	-118.45505°
	ORB-E	33.98536°	-118.45479°
Exchange Area	**X-ORB**	33.98437°	-118.45632°
	X-Basin E	33.98355°	-118.45609°
Basin E	**Basin E-A**	33.98290°	-118.45499°
	Basin E-B	33.98328°	-118.45547°
	Basin E-C	33.98292°	-118.45600°
Boone Olive Pump Station	**Boone Olive**	33.98461°	-118.45928°

3.2.2 Pre-Storm Results

3.2.2.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 12, 2010, to represent the pre-storm conditions. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin
Water depth varied between the stations from 0.4 ft at ORB-E to 1.0 ft at ORB-A. Conductivity, a measure of the dissolved solutes in the water, ranged from 20.76 mS (ORB-E) to 28.91 mS (ORB-A). Turbidity ranged from 5.0 nephelometric turbidity units (NTU) (ORB-A) to 31.7 NTU (ORB-E). DO was relatively consistent among the five stations, ranging from 6.6 mg/L to 12.4 mg/L. pH ranged from 8.23 to 8.50. Temperature was consistent among the five stations monitored, ranging from 15.38ºC to 16.59ºC.

Exchange Water
Field observations and measurements were only taken at one station, X-ORB to represent the Exchange Area water. Water depth was measured at 4.16-ft deep, and temperature was reported at 14.64ºC. Conductivity was 54.16 mS and turbidity was measured at 1.0 NTU. DO was measured at 14.60 mg/L, and ph was measured at 7.94 at station X-ORB.

Basin E
Water depth varied between the stations from 12.5 ft at Basin E-B to 18.6 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.15 mS to 50.82 mS. Turbidity was also consistent among the stations ranging from -0.3 NTU to -0.5 NTU. DO ranged from 7.96 mg/L to 8.03 mg/L. pH ranged from 8.02 to 8.04. Temperature was consistent among the three stations monitored, ranging from 14.79ºC to 14.82ºC.

3.2.2.2 Analytical Chemistry Results

Results of the wet weather (i.e., pre-storm) water quality sampling are presented in Table 10 (the complete laboratory analytical data report for wet weather water quality samples is included in Appendix D). The results from composite sample ORB-1 represent the Oxford Retention Basin, the results from the composite sample X-ORB-1 represent the Exchange Area, and the results from the composite sample E-1 represents Basin E. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, ‘J flag’ values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Concentrations of ammonia in all three samples, ORB-1, X-ORB-1, and E-1were significantly less than the COP water quality criteria of 6.0 mg/L. The greatest concentration was observed at ORB-1 (0.34 mg/L). TKN was only detected in the sample, ORB-1, at 2.62 mg/L. Orthophosphate results ranged from 0.02 mg/L (ORB-1) to 0.04 mg/L (X-ORB-1). DOC and TOC were only detected in the ORB-1 sample, reported at 3.0 mg/L and 4.9 mg/L, respectively. TDS ranged from 15,840 mg/L (ORB-1) to 33,380 mg/L (X-ORB-1). TSS were only detected in sample ORB-1, reported at 29.3 mg/L.

Table 9. Field Observations of Water Quality during Wet Weather Monitoring Event at Oxford Retention Basin

Parameter	Unit	Pre Storm										
		Oxford Basin					Exchange Water		Basin E			Boone Olive Pump Station
		ORB-A	ORB-B	ORB-C	ORB-D	ORB-E	X-ORB	X-Basin E	Basin E-A	Basin E-B	Basin E-C	Boone Olive
Date		1.12.10	1.12.10	1.12.10	1.12.10	1.12.10	1.12.10		1.12.10	1.12.10	1.12.10	
Time		2040	2040	2040	2040	2040	2210		2310	2310	2310	
pH		8.31	8.37	8.50	8.38	8.23	7.94		8.03	8.04	8.02	
Conductivity	mS	28.91	27.29	27.34	25.39	20.76	54.16		50.69	50.15	50.82	
Turbidity	NTU	5.0	9.5	5.7	18.3	31.7	1		-0.4	-0.3	-0.5	
Dissolved Oxygen	mg/L	12.4	9.44	11.55	8.36	6.6	7.45		7.96	8.22	8.03	
Temperature	°C	16.48	16.59	15.97	15.46	15.38	14.64		14.8	14.79	14.82	
Color		slight yellow	slight yellow	slight yellow	slight yellow	yellow	None		None	None	None	
Odor		None	None	sulfide	sulfide	sufide	None		None	None	None	
Clarity		Clear	Clear	Clear	Clear	Opaque	Clear		Clear	Clear	Clear	
Water Depth (Total)	feet	1.0	0.9	0.6	0.6	0.4	4.16		14	12.5	18.6	
Fresh Water Lens Depth	feet	0	0	0	0	0	0		0	0	0	
Prior to Stormwater Release												
Date		1.13.10	1.13.10	1.13.10	1.13.10	1.13.10	1.13.10		1.13.10	1.13.10	1.13.10	
Time		1010	1010	1010	1010	1010	1130		1150	1150	1150	
pH		7.9	8.02	7.93	7.94	7.99	7.87		7.94	7.92	7.69	
Conductivity	mS	46.2	36.25	45.55	44.52	42.99	51.06		51.00	50.95	50.81	
Turbidity	NTU	5.6	9.2	5.2	6.4	9.8	1.4		-0.2	-0.2	-0.3	
Dissolved Oxygen	mg/L	7.70	7.77	7.23	7.09	7.12	7.98		7.54	7.53	7.69	
Temperature	°C	14.91	15.0	15.0	15.08	15.15	16.04		14.87	14.96	14.84	
Color		None	None	None	None	None	None		None	None	None	
Odor		None	None	None	None	None	None		None	None	None	
Clarity		Clear	Clear	Clear	Clear	Clear	Clear		Clear	Clear	Clear	
Water Depth (Total)	feet	3.5	2.25	2.4	1.8	2.0	5.8		12.5	11.2	15.5	
Fresh Water Lens Depth	feet	1.3	2.0	1.66	1.5	1.5	0		<0.3	0	0	
During Stormwater Release												
Date								1.13.10	1.13.10	1.13.10	1.13.10	1.13.10
Time								1400	1425	1425	1425	1500
pH								8.02	7.83	7.86	7.81	7.69
Conductivity	mS							32.53	50.04	50.41	50.58	N/A
Turbidity	NTU							12.5	1.1	1.0	1.7	34.8
Dissolved Oxygen	mg/L							7.48	7.62	7.91	7.45	7.36
Temperature	°C							18.36	15.2	15.25	15.04	16.56
Color								slight yellow	None	None	None	slight yellow
Odor								None	None	None	None	None
Clarity								Clear	Clear	Clear	Clear	Clear
Water Depth (Total)	feet							6.75	10.5	9.5	13.0	1.0
Fresh Water Lens Depth	feet							0	<0.3	<0.3	<0.3	N/A
Oxford Basin Drained												
Date									1.13.10	1.13.10	1.13.10	
Time									1600	1600	1600	
pH									7.91	7.93	7.81	
Conductivity	mS								50.7	51.28	50.85	
Turbidity	NTU								1.3	0.3	5.3	
Dissolved Oxygen	mg/L								7.79	7.84	6.33	
Temperature	°C								15.22	15.17	15.14	
Color									None	None	None	
Odor									None	None	None	
Clarity									Clear	Clear	Clear	
Water Depth (Total)	feet								11.3	9.9	13.0	
Fresh Water Lens Depth	feet								<0.3	<0.3	<0.3	

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
General Chemistry													
Ammonia-N	mg/L	6			0.34B	<0.03	0.05B	0.33B	0.05B	0.05B	0.13B	0.08B	0.69B
DOC	mg/L				3	2.9	<0.1	4.6	<0.1	<0.1	2.9	1.4J	11.3
Nitrate-N	mg/L				1.23	0.42	0.07	0.52	0.13	0.21	0.36	0.17	
Nitrate-N by IC	mg/L												1.98
Nitrite-N	mg/L				0.06	0.03J	0.01J	0.05	0.01J	0.01J	0.03J	0.01J	0.08
pH	pH Units				8H	7.4H	7.5H	7.2H	7.4H	7.3H	7.1H	7.2H	7.1H
TDS	mg/L				15,840	24,980	33,380	19,000	31,660	31,320	27,400	29,420	1,106
Total hardness as CaCO3	mg/L				3,097.9	4,688.4	6,035.6	3,676.0	5,856.8	5,735.5	5,075.4	5,616.3	276.9
TKN	mg/L				2.62	1.088	<0.456	1.862	<0.456	<0.456	0.872J	0.586J	2.06
TOC	mg/L				4.9	4.2	0.6J	8.2	0.1J	0.4J	4.3	6.3	15.4
Total orthophosphate as P	mg/L				0.02	0.03	0.04	0.1	0.03	0.06	0.08	0.04	0.69
Total sulfides	mg/L				0.01J,H	0.01J,H	<0.01	0.02J,H	<0.01	0.01J,H	0.01J,H	0.01J,H	0.04J,H
TSS	mg/L				29.3	20.8	3.3J	17.5	2J	5	9.8	5	39.3
Indicator Bacteria													
Enterococci	MPN/100mL	104			10	6,867	10	1,664	10	246	6,131	19,863	>241,960
Fecal coliforms	MPN/100mL	400			130	30,000	40	24,000	70	300	50,000	13,000	17,000
Total coliforms	MPN/100mL	10,000			1,100	50,000	70	50,000	300	2,400	220,000	24,000	240,000
Acid-Extractable Compounds													
2,4,6-Trichlorophenol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Chlorophenol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	ng/L		(a)	13,000	988	<50	<50	951	<50	<50	<50	<50	1203
Phenol	ng/L				<100	<100	<100	<100	<100	<100	<100	<100	<100
Total chlorinated phenolics	ng/L	10,000			<100	<100	<100	<100	<100	<100	<100	<100	<100
Total non-chlorinated phenolics	ng/L	300,000			988	<100	<100	951	<100	<100	<100	<100	1203
Base/Neutral-Extractable Compounds													
1,2,4-Trichlorobenzene	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Azobenzene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Benzidine	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Butylbenzyl Phthalate	ng/L				117	504	<25	593	35J	47J	347	132	450
Di-n-butyl Phthalate	ng/L				340	116	<75	182	84J	<75	274	<75	217
Di-n-octyl Phthalate	ng/L				79	113	<10	151	<10	12J	121	27	267
Diethyl Phthalate	ng/L				144	116J	<100	208	<100	<100	179	<100	234
Dimethyl Phthalate	ng/L				<50	97	<50	179	<50	<50	148	<50	89
Hexachlorobenzene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
NDPA	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
NDMA	ng/L				<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	2.7
N-Nitrosodiphenylamine	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
bis(2-Ethylhexyl) Phthalate	ng/L				860	999	<100	1124	146	237	625	257	1983
Chlorinated Pesticides													
2,4'-DDD	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	ng/L		1,100	130	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable DDTs	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Aldrin	ng/L		3,000	1,300	<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-beta	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-delta	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
BHC-gamma	ng/L		950	160	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total detectable BHC	ng/L	12			<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlordane-gamma	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
DCPA (dacthal)	ng/L				<5	<5	<5	<5	<5	<5	<5	<5	<5
Dicofol	ng/L				<50	<50	<50	<50	<50	<50	<50	<50	<50
Dieldrin	ng/L		240	710	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin	ng/L	6	83	37	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Endrin aldehyde	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Endrin ketone	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Mirex	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Oxychlordane	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Perthane	ng/L				<5	<5	<5	<5	<5	<5	<5	<5	<5
Total detectable chlordane	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Toxaphene	ng/L		730	210	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-Nonachlor	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	<1
Aroclor PCBs													
Aroclor 1016	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1221	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1232	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1242	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1248	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1254	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Aroclor 1260	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Aroclor	ng/L				<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB Congeners													
PCB1	ng/L				0.0111	0.0071	0.0052	<0.0045	0.0047	<0.0066	<0.0044	<0.0036	<0.0065
PCB2	ng/L				0.0057	<0.0039	<0.0038	<0.0048	<0.0035	<0.0068	<0.0045	<0.0037	<0.0053
PCB3	ng/L				<0.0087	0.0074	0.0043	0.0066	0.0036	<0.0067	0.0066	0.0057	0.0136
PCB4	ng/L				0.038	0.0376	0.0424	0.021	0.035	0.025	0.0273	0.0227	0.0249
PCB5	ng/L				<0.0065	<0.0053	<0.0083	<0.0059	<0.0052	<0.0067	<0.0034	<0.0042	<0.0049
PCB6	ng/L				0.0187	0.0143	<0.015	0.0099	0.0146	<0.0091	0.0091	<0.0084	0.0117
PCB7	ng/L				<0.0064	<0.0053	<0.0082	<0.0067	<0.0051	<0.0076	<0.0038	<0.0048	<0.0056
PCB8	ng/L				0.086	0.0748	0.0753	0.0563	0.0744	0.0545	0.0523	0.0602	0.082
PCB9	ng/L				0.0064	<0.0049	<0.0077	<0.0061	<0.0048	<0.007	<0.0035	<0.0044	<0.0051
PCB10	ng/L				<0.02	<0.013	<0.014	<0.012	<0.014	<0.018	<0.011	<0.012	<0.0053
PCB11	ng/L				0.12	0.13	0.0444	0.141	0.0243	0.0341	0.0857	0.0522	0.248
PCB12+13	ng/L				0.0076	<0.0061	<0.0079	<0.0068	0.0069	<0.0078	<0.0039	<0.0048	0.0063
PCB14	ng/L				<0.0059	<0.0048	<0.0075	<0.0064	<0.0047	<0.0073	<0.0037	<0.0046	<0.0054
PCB15	ng/L				0.045	0.0393	0.041	0.0243	0.0407	0.022	0.0254	0.0242	0.0346
PCB16	ng/L				0.036	0.048	<0.039	0.036	0.037	0.03	<0.031	0.038	0.043
PCB17	ng/L				0.045	0.055	0.049	0.027	0.043	0.024	<0.024	0.0255	0.0267
PCB18+30	ng/L				0.102	0.119	0.102	0.0665	0.083	<0.047	0.0572	0.0556	0.0556
PCB19	ng/L				<0.012	0.0138	<0.012	<0.0086	0.0153	0.0109	0.0098	0.0116	0.0087
PCB20+28	ng/L				0.159	0.14	0.178	0.0883	0.122	0.0853	0.0885	0.091	0.0911
PCB21+33	ng/L				0.0893	0.0837	0.091	0.052	0.069	0.047	0.0471	0.0482	0.0577

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB22	ng/L				0.0533	0.0544	0.056	0.0335	0.0418	0.0291	0.0311	0.0295	0.0381
PCB23	ng/L				<0.0038	<0.0019	<0.0023	<0.0067	<0.0043	<0.0042	<0.0032	<0.003	<0.0035
PCB24	ng/L				<0.016	<0.01	<0.0097	<0.0074	<0.012	<0.0078	<0.0058	<0.0065	<0.0054
PCB25	ng/L				<0.011	0.011	0.0123	0.0076	<0.0085	0.0068	0.0076	<0.0062	0.0067
PCB26+29	ng/L				0.0271	0.0245	0.0251	0.015	0.0204	0.0142	<0.015	0.015	0.0153
PCB27	ng/L				<0.012	0.0088	0.0104	<0.0081	<0.009	<0.0085	<0.0058	<0.0071	<0.0059
PCB31	ng/L				0.138	0.122	0.132	0.0841	0.0912	0.063	0.0722	0.0711	0.0807
PCB32	ng/L				0.03	0.0355	0.0389	0.0206	0.0304	0.0197	0.0205	0.021	<0.016
PCB34	ng/L				<0.0035	<0.0017	<0.0021	<0.006	<0.0039	<0.0037	<0.0029	<0.0027	<0.0031
PCB35	ng/L				0.0055	<0.0058	<0.0022	0.0064	<0.0041	<0.0038	<0.0029	<0.0028	0.0099
PCB36	ng/L				<0.0032	<0.0016	<0.002	<0.0054	<0.0037	<0.0034	<0.0026	<0.0025	<0.0029
PCB37	ng/L				0.0365	0.0372	0.0446	0.0229	0.0254	0.0167	0.0198	0.0181	0.0341
PCB38	ng/L				<0.0036	<0.0018	<0.0022	<0.0062	<0.0041	<0.0039	<0.003	<0.0028	<0.0033
PCB39	ng/L				<0.0034	<0.0017	<0.0021	<0.0058	<0.0039	<0.0037	<0.0028	<0.0026	<0.0031
PCB40+41+71	ng/L				<0.073	0.0925	0.066	0.0854	0.0451	0.0319	0.0563	<0.038	0.045
PCB42	ng/L				0.042	0.0458	0.0414	0.0379	0.026	0.0191	0.0284	0.0243	<0.017
PCB43	ng/L				<0.01	<0.0081	<0.0057	<0.01	<0.0059	<0.011	<0.0065	<0.0092	<0.008
PCB44+47+65	ng/L				0.173	0.301	0.138	0.38	0.093	0.0774	0.191	0.118	0.0801
PCB45+51	ng/L				<0.022	0.0314	0.0229	0.0211	<0.017	<0.012	0.0169	0.0172	<0.013
PCB46	ng/L				<0.011	<0.0091	0.0092	0.0098	0.0071	<0.01	<0.006	<0.0086	<0.0075
PCB48	ng/L				0.0306	0.0364	0.0278	0.0254	0.0197	0.0132	<0.016	0.0159	<0.013
PCB49+69	ng/L				0.104	0.159	0.1	0.175	0.0606	0.0526	0.0992	0.0721	0.0427
PCB50+53	ng/L				0.0259	0.031	0.0226	0.0314	0.0182	<0.014	0.0218	0.021	<0.0092
PCB52	ng/L				0.298	0.558	0.16	0.791	0.103	0.0867	0.363	0.167	0.107
PCB54	ng/L				<0.013	<0.008	<0.008	<0.0088	<0.0089	<0.0097	<0.0077	<0.0097	<0.01
PCB55	ng/L				<0.0041	<0.0031	<0.003	<0.0051	<0.0023	<0.0051	<0.0024	<0.0047	<0.0049
PCB56	ng/L				<0.043	0.0512	0.0391	0.0644	0.0167	0.0175	0.0333	0.0266	0.0386
PCB57	ng/L				<0.0037	<0.0028	<0.0028	<0.0048	<0.0021	<0.0049	<0.0023	<0.0044	<0.0047
PCB58	ng/L				<0.0041	<0.0031	<0.003	0.0262	<0.0023	<0.0049	<0.0087	<0.0044	<0.0047
PCB59+62+75	ng/L				0.012	0.0136	0.0136	0.0115	<0.0076	<0.0067	0.0102	0.0084	0.0068
PCB60	ng/L				0.0257	0.0276	0.0232	0.024	0.0091	<0.0093	0.0163	0.0121	0.0194
PCB61+70+74+76	ng/L				0.256	0.406	0.188	0.552	0.077	0.0817	0.271	0.14	0.141
PCB63	ng/L				0.0051	0.005	0.004	0.0061	0.0021	<0.0046	0.0034	<0.0042	<0.0044
PCB64	ng/L				<0.06	0.0924	0.0523	0.108	0.0315	0.0275	<0.054	0.0371	0.0341
PCB66	ng/L				0.115	0.118	0.105	0.149	0.047	0.0557	0.0936	0.0709	0.071
PCB67	ng/L				<0.0034	<0.0032	0.0029	<0.0046	<0.0019	<0.0047	<0.0022	<0.0043	<0.0045
PCB68	ng/L				<0.0038	<0.0029	<0.0028	<0.0047	<0.0021	<0.0048	<0.0023	<0.0043	<0.0046
PCB72	ng/L				<0.0037	<0.0028	<0.0027	<0.0047	<0.0021	<0.0048	<0.0023	<0.0044	<0.0046
PCB73	ng/L				<0.0075	<0.0059	<0.0042	<0.0065	<0.0043	<0.007	<0.0041	<0.0059	<0.0051
PCB77	ng/L				0.0196	0.0266	0.0084	0.0373	0.0046	<0.0061	0.018	0.0083	0.0293
PCB78	ng/L				<0.0038	<0.0029	<0.0028	<0.0047	<0.0022	<0.0048	<0.0023	<0.0044	<0.0046
PCB79	ng/L				<0.0034	0.0037	<0.0025	<0.0052	<0.0019	<0.0043	0.0037	<0.0039	<0.0042

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB80	ng/L				<0.0034	<0.0026	<0.0026	<0.0043	<0.0019	<0.0043	<0.0021	<0.0039	<0.0042
PCB81	ng/L				<0.0052	<0.0039	<0.0039	<0.006	<0.0029	<0.006	<0.0029	<0.0055	<0.0058
PCB82	ng/L				0.042	0.0697	<0.011	0.102	<0.0048	<0.008	0.0452	0.019	0.0273
PCB83+99	ng/L				0.16	0.319	0.113	0.423	0.0427	0.0476	0.197	0.0947	0.0854
PCB84	ng/L				0.086	0.223	0.0331	0.339	0.0211	0.0185	0.142	0.0532	0.0524
PCB85+116+117	ng/L				0.0516	0.0896	0.0308	0.113	0.0117	<0.007	0.0492	0.0241	0.0291
PCB86+87+97+109+119+125	ng/L				0.23	0.469	0.105	0.649	0.0467	0.0541	0.29	0.119	0.165
PCB88+91	ng/L				0.047	<0.089	0.0229	0.144	0.0123	0.0091	0.0623	0.0269	0.0213
PCB89	ng/L				<0.0097	<0.0074	<0.0053	0.0101	<0.0042	<0.0077	<0.0053	<0.0048	<0.0065
PCB90+101+113	ng/L				0.334	0.722	0.205	0.94	0.0866	0.106	0.439	0.195	0.261
PCB92	ng/L				0.0585	0.119	0.0337	0.168	0.0143	0.0185	0.0746	0.0366	0.0405
PCB93+98+100+102	ng/L				<0.0093	0.0247	0.0083	0.0362	<0.0041	<0.0073	0.0162	0.0066	<0.0062
PCB94	ng/L				<0.0097	<0.0074	<0.0053	<0.0076	<0.0042	<0.0079	<0.0054	<0.0049	<0.0067
PCB95	ng/L				0.25	0.628	0.11	0.979	0.0685	0.0726	0.41	0.163	0.193
PCB96	ng/L				<0.012	<0.013	<0.022	<0.0086	<0.015	<0.014	<0.0073	<0.012	<0.011
PCB103	ng/L				<0.0082	<0.0063	<0.0044	<0.0061	<0.0036	<0.0064	<0.0043	<0.004	<0.0054
PCB104	ng/L				<0.0049	<0.0052	<0.0091	<0.0054	<0.006	<0.0085	<0.0046	<0.0075	<0.0066
PCB105	ng/L				0.126	0.177	0.0445	0.237	0.0196	0.025	0.113	0.0496	0.102
PCB106	ng/L				<0.0033	<0.0025	<0.0022	<0.0048	<0.0028	<0.0056	<0.0024	<0.0031	<0.0026
PCB107	ng/L				0.0181	0.0279	0.0106	0.0376	<0.0025	<0.005	0.0181	0.0104	0.0158
PCB108+124	ng/L				0.0108	0.0189	0.0053	0.0256	<0.0026	<0.0054	0.0115	0.0054	0.0103
PCB110+115	ng/L				0.379	0.742	0.188	1.06	0.0806	0.0944	0.492	0.206	0.305
PCB111	ng/L				<0.0068	<0.0052	<0.0037	<0.0052	<0.003	<0.0054	<0.0037	<0.0034	<0.0046
PCB112	ng/L				<0.0074	<0.0057	<0.004	<0.0053	<0.0032	<0.0056	<0.0038	<0.0035	<0.0047
PCB114	ng/L				0.0052	0.0103	0.0029	0.0125	<0.0032	<0.0061	0.0047	<0.0033	0.0056
PCB118	ng/L				0.282	0.445	0.144	0.583	0.0516	0.0688	0.29	0.132	0.215
PCB120	ng/L				<0.0066	<0.0051	<0.0036	<0.005	<0.0029	<0.0052	<0.0035	<0.0032	<0.0044
PCB121	ng/L				<0.0068	<0.0053	<0.0037	<0.0052	<0.003	<0.0054	<0.0037	<0.0034	<0.0046
PCB122	ng/L				<0.0033	0.0041	<0.0022	<0.0055	<0.0028	<0.0057	<0.0025	<0.0031	<0.0027
PCB123	ng/L				<0.0048	0.0093	0.0032	0.0106	<0.0032	<0.0061	0.0047	<0.0033	<0.0029
PCB126	ng/L				<0.0052	<0.0058	<0.0024	0.0095	<0.0031	<0.006	0.0043	<0.0033	<0.0063
PCB127	ng/L				<0.003	<0.0023	<0.002	<0.0044	<0.0026	<0.0052	<0.0022	<0.0028	<0.0024
PCB128+166	ng/L				<0.07	<0.081	0.0222	0.144	<0.0086	0.015	0.0655	0.0281	0.0654
PCB129+138+163	ng/L				0.467	0.589	0.191	0.816	0.0791	0.11	0.377	0.171	0.458
PCB130	ng/L				0.028	0.037	0.0106	0.061	<0.011	<0.014	0.0245	0.0105	<0.022
PCB131	ng/L				<0.02	<0.013	<0.0078	0.017	<0.011	<0.014	<0.0073	<0.009	<0.01
PCB132	ng/L				0.16	0.233	0.051	0.341	0.024	0.036	0.146	0.058	0.143
PCB133	ng/L				<0.018	<0.012	<0.0072	<0.015	<0.01	<0.013	<0.0067	<0.0082	<0.0095
PCB134+143	ng/L				0.024	0.038	0.0082	0.05	<0.011	<0.014	0.0216	0.0117	0.019
PCB135+151	ng/L				<0.095	0.196	0.067	<0.2	0.03	0.04	0.098	0.053	0.12
PCB136	ng/L				0.052	0.097	0.022	<0.11	<0.016	<0.014	0.0557	0.025	0.0521
PCB137	ng/L				0.023	<0.022	<0.0073	0.046	<0.01	<0.013	0.0175	<0.0082	0.0121

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB139+140	ng/L				<0.017	0.012	<0.0068	0.018	<0.0094	<0.012	0.0086	<0.0078	<0.009
PCB141	ng/L				0.072	0.1	0.0348	0.136	0.0107	0.014	0.0555	0.0298	0.0815
PCB142	ng/L				<0.019	<0.012	<0.0075	<0.016	<0.01	<0.013	<0.007	<0.0086	<0.01
PCB144	ng/L				0.023	<0.025	<0.013	0.032	<0.02	<0.016	0.015	<0.013	0.02
PCB145	ng/L				<0.016	<0.014	<0.011	<0.014	<0.017	<0.013	<0.009	<0.011	<0.01
PCB146	ng/L				<0.05	<0.061	0.0263	0.092	0.011	0.014	0.0468	0.0256	0.0604
PCB147+149	ng/L				0.329	0.464	0.142	0.582	0.0643	0.082	0.265	0.134	0.32
PCB148	ng/L				<0.02	<0.018	<0.014	<0.017	<0.022	<0.016	<0.011	<0.013	<0.012
PCB150	ng/L				<0.015	<0.013	<0.011	<0.013	<0.016	<0.012	<0.0084	<0.01	<0.0094
PCB152	ng/L				<0.015	<0.013	<0.011	<0.013	<0.016	<0.012	<0.0084	<0.01	<0.0094
PCB153+168	ng/L				0.316	0.413	0.186	0.5	0.0657	0.0907	0.247	0.138	0.325
PCB154	ng/L				<0.018	<0.016	<0.012	<0.015	<0.019	<0.015	<0.01	<0.012	<0.011
PCB155	ng/L				<0.007	<0.0061	<0.0049	<0.0087	<0.0074	<0.0085	<0.0058	<0.0069	<0.0065
PCB156+157	ng/L				0.049	0.0624	0.0171	0.087	0.0063	0.0105	<0.04	<0.015	0.0518
PCB158	ng/L				0.043	0.059	<0.013	0.081	<0.007	<0.009	0.0348	0.0156	0.0449
PCB159	ng/L				<0.0069	<0.0038	<0.0034	<0.0091	<0.0037	<0.0066	<0.0033	<0.004	<0.0049
PCB160	ng/L				<0.014	<0.0095	<0.0057	<0.012	<0.0079	<0.01	<0.0053	<0.0065	<0.0076
PCB161	ng/L				<0.013	<0.0088	<0.0053	<0.011	<0.0073	<0.0093	<0.0049	<0.006	<0.007
PCB162	ng/L				<0.0072	<0.0039	<0.0035	<0.0095	<0.0038	<0.0069	<0.0035	<0.0042	<0.0052
PCB164	ng/L				0.029	0.0401	0.0113	0.053	<0.0076	<0.0096	0.0245	0.0123	0.0335
PCB165	ng/L				<0.015	<0.0098	<0.0059	<0.013	<0.0081	<0.01	<0.0055	<0.0067	<0.0078
PCB167	ng/L				0.0171	0.021	0.0062	0.033	<0.0047	<0.008	0.0151	0.007	0.0207
PCB169	ng/L				<0.0089	<0.0049	<0.0043	<0.011	<0.0048	<0.0082	<0.0041	<0.005	<0.0062
PCB170	ng/L				0.066	0.068	0.0346	0.085	0.0125	0.021	0.0445	0.028	0.131
PCB171+173	ng/L				<0.019	0.022	0.013	0.029	<0.0085	<0.018	<0.013	<0.012	<0.031
PCB172	ng/L				<0.019	<0.013	<0.0087	<0.016	<0.0085	<0.018	<0.01	<0.012	0.021
PCB174	ng/L				0.078	0.078	<0.036	0.074	0.019	0.023	0.041	0.026	0.103
PCB175	ng/L				<0.021	<0.011	<0.0096	<0.015	<0.0095	<0.014	<0.0067	<0.0097	<0.012
PCB176	ng/L				<0.016	0.0109	<0.0075	<0.012	<0.0074	<0.011	<0.0053	<0.0077	<0.011
PCB177	ng/L				0.042	0.04	<0.021	0.044	0.0099	<0.018	<0.022	0.015	0.065
PCB178	ng/L				<0.022	<0.015	<0.0099	<0.016	<0.0098	<0.015	0.01	<0.01	<0.022
PCB179	ng/L				0.039	0.0395	0.0206	<0.037	0.0116	0.012	0.022	0.0146	0.0368
PCB180+193	ng/L				0.142	0.125	0.0745	0.148	0.0269	<0.039	0.0802	0.0467	0.247
PCB181	ng/L				<0.019	<0.013	<0.0085	<0.015	<0.0083	<0.017	<0.0096	<0.011	<0.01
PCB182	ng/L				<0.021	<0.011	<0.0098	<0.015	<0.0097	<0.014	<0.0068	<0.0099	<0.012
PCB183	ng/L				0.038	0.038	0.0257	0.048	0.0113	<0.018	<0.022	0.021	0.078
PCB184	ng/L				<0.016	<0.0081	<0.0073	<0.011	<0.0072	<0.011	<0.0051	<0.0073	<0.0088
PCB185	ng/L				<0.02	<0.013	<0.009	<0.015	<0.0087	<0.017	<0.0096	<0.011	<0.01
PCB186	ng/L				<0.017	<0.0086	<0.0078	<0.012	<0.0077	<0.011	<0.0055	<0.0079	<0.0095
PCB187	ng/L				<0.095	0.099	0.0579	0.094	<0.026	0.032	0.0522	<0.034	0.127
PCB188	ng/L				<0.012	<0.0062	<0.0056	<0.011	<0.0055	<0.011	<0.0052	<0.0075	<0.0089
PCB189	ng/L				<0.013	<0.0091	<0.0043	<0.02	<0.0065	<0.0094	<0.012	<0.0078	<0.0081

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
PCB190	ng/L				<0.015	<0.012	0.0077	0.017	<0.0066	<0.014	0.0084	<0.009	<0.019
PCB191	ng/L				<0.014	<0.0093	<0.0063	<0.012	<0.0061	<0.014	<0.0079	<0.009	<0.0086
PCB192	ng/L				<0.015	<0.01	<0.007	<0.013	<0.0068	<0.015	<0.0084	<0.0096	<0.0091
PCB194	ng/L				0.031	<0.018	<0.0088	<0.025	<0.0079	<0.017	<0.014	<0.012	0.061
PCB195	ng/L				<0.024	<0.016	<0.0083	<0.021	<0.0084	<0.018	<0.015	<0.012	<0.02
PCB196	ng/L				<0.03	<0.023	<0.016	<0.027	<0.011	<0.023	<0.018	<0.016	0.035
PCB197	ng/L				<0.024	<0.019	<0.013	<0.02	<0.0088	<0.017	<0.014	<0.012	<0.016
PCB198+199	ng/L				<0.041	0.038	0.016	0.039	<0.011	<0.023	0.022	0.016	0.069
PCB200	ng/L				<0.021	<0.017	<0.011	<0.019	<0.0077	<0.016	<0.013	<0.011	<0.015
PCB201	ng/L				<0.023	<0.018	<0.012	<0.019	<0.0082	<0.017	<0.013	<0.011	<0.016
PCB202	ng/L				<0.021	<0.017	<0.011	<0.021	<0.0077	<0.018	<0.014	<0.012	0.018
PCB203	ng/L				<0.028	<0.022	<0.015	<0.024	<0.01	<0.021	<0.017	<0.014	0.038
PCB204	ng/L				<0.022	<0.017	<0.012	<0.019	<0.0081	<0.016	<0.013	<0.011	<0.016
PCB205	ng/L				<0.023	<0.015	<0.0078	<0.018	<0.008	<0.016	<0.013	<0.011	<0.011
PCB206	ng/L				<0.046	<0.025	<0.014	<0.032	<0.016	<0.023	<0.025	<0.021	0.044
PCB207	ng/L				<0.04	<0.022	<0.012	<0.027	<0.014	<0.02	<0.022	<0.018	<0.012
PCB208	ng/L				<0.047	<0.026	<0.015	<0.033	<0.016	<0.024	<0.026	<0.022	<0.014
PCB209	ng/L				<0.048	<0.028	<0.014	<0.039	<0.017	<0.047	<0.019	<0.029	0.028
Total PCBs	ng/L				6.3154	10.081	4.0823	12.8006	2.1814	1.9604	6.2485	3.3569	5.9616
PAHs													
1-Methylnaphthalene	ng/L				3J	<1	<1	2.6J	<1	<1	1.8J	1.1J	28.7
1-Methylphenanthrene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	26.5
2,3,5-Trimethylnaphthalene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	7.2
2,6-Dimethylnaphthalene	ng/L				38.5	5.4	<1	7.3	<1	<1	3.3J	1.5J	21.4
2-Methylnaphthalene	ng/L				3.8J	1.5J	<1	4.1J	<1	<1	3.1J	1.1J	54.8
Acenaphthene	ng/L				<1	<1	<1	<1	<1	<1	3.1J	<1	7.1
Acenaphthylene	ng/L				3.2J	2.7J	<1	1.6J	<1	<1	5	2.6J	5.6
Anthracene	ng/L				4.1J	7.9	<1	6.1	<1	<1	1.9J	3.8J	12.5
Benz[a]anthracene	ng/L				7.4	9.5	<1	6.6	<1	<1	4.6J	2.1J	20.3
Benzo[a]pyrene	ng/L				7.7	9	<1	9.8	<1	<1	6.2	4.1J	26.5
Benzo[b]fluoranthene	ng/L				13.1	11.9	<1	12.3	<1	5.1	8.5	6.1	39
Benzo[e]pyrene	ng/L				13.8	17.2	<1	14.1	<1	3.2J	7.4	4.9J	69.8
Benzo[g,h,i]perylene	ng/L				6.9	3.3J	<1	4.9J	<1	<1	<1	<1	38.5
Benzo[k]fluoranthene	ng/L				6.9	65	<1	8.4	<1	3.1J	6.7	2.6J	18.3
Biphenyl	ng/L				6.3	3.9J	<1	5.5	<1	<1	2.6J	2.8J	11
Chrysene	ng/L				20.2	34.2	<1	27.3	<1	4.1J	16.5	6.9	97.7
Dibenz[a,h]anthracene	ng/L				3.3J	<1	<1	5.5	<1	<1	<1	<1	8.6
Dibenzothiophene	ng/L				<1	<1	<1	<1	<1	<1	<1	<1	18.5
Fluoranthene	ng/L				26.6	40.9	<1	32.6	<1	7.5	17.2	7.4	89.5
Fluorene	ng/L				<1	3J	<1	5.2	<1	<1	3.3J	1.6J	14.8
Indeno[1,2,3-c,d]pyrene	ng/L				12.2	10.6	<1	17.4	<1	<1	2J	<1	19
Perylene	ng/L				2.1J	4.4J	<1	4.3J	<1	<1	4J	6.5	37.4

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Phenanthrene	ng/L				11	15.7	<1	12.9	<1	5.5	9.8	4.6J	90.4
Pyrene	ng/L				29.7	35.5	<1	32.1	<1	6.8	20.7	7.5	94.7
Total detectable PAHs	ng/L				219.8	281.6	<1	220.6	<1	35.3	127.7	67.2	857.8
TPH-CC													
C6	ug/L				<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
C7	ug/L				<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1
C8	ug/L				<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
C9-C10	ug/L				<13	<13	<13	<13	<13	<13	<13	<13	<13
C11-C12	ug/L				<14	<14	<14	<14	<14	<14	<14	<14	<14
C13-C14	ug/L				<16	<16	<16	16	<16	<16	<16	<16	28
C15-C16	ug/L				<17	<17	<17	18	<17	<17	<17	<17	49
C17-C18	ug/L				<17	<17	<17	24	<17	<17	<17	<17	57
C19-C20	ug/L				<18	<18	<18	23	<18	<18	<18	<18	64
C21-C22	ug/L				<18	<18	<18	28	<18	<18	<18	<18	75
C23-C24	ug/L				<18	<18	<18	32	<18	<18	<18	<18	93
C25-C28	ug/L				<16	<16	<16	34	<16	<16	17	19	130
C29-C32	ug/L				15	20	<8.5	41	<8.5	<8.5	18	18	190
C33-C36	ug/L				<7.9	12	<7.9	21	<7.9	<7.9	8.5	8	140
C37-C40	ug/L				<6.8	<6.8	<6.8	21	<6.8	<6.8	<6.8	<6.8	130
C41-C44	ug/L				9	<6.6	<6.6	11	<6.6	<6.6	<6.6	<6.6	66
C6-C44 Total	ug/L				<47	<47	<47	270	<47	<47	<47	<47	1000
Dissolved Metals													
Antimony (Sb)	µg/L				0.38B	0.4B	0.14B	0.62B	0.23B	0.26B	0.5B	0.34B	<0.1
Arsenic (As)	µg/L		0.34 (b)	69	0.91B	1.45B	2.02B	1.36B	2.17B	2.24B	1.55B	1.59B	<0.2
Barium (Ba)	µg/L				43	21.3	10.6	25.9	12.5	12.9	16.5	12.9	34.4
Beryllium (Be)	µg/L				0.032	0.034	0.025	0.032	0.024	0.038	0.026	0.02	<0.2
Cadmium (Cd)	µg/L		(c)	42	0.015	0.067	0.108	0.048	0.112	0.123	0.105	0.107	<0.2
Chromium (Cr)	µg/L		(c)	1100	1.671B	0.701B	0.198B	0.859B	0.481B	0.256B	0.461B	0.303B	<0.1
Cobalt (Co)	µg/L				0.291B	0.203B	0.189B	0.237B	0.215B	0.198B	0.204B	0.183B	<0.1
Copper (Cu)	µg/L		(c)	4.8	1.46B	3.52B	10.74B	3.88B	12.11B	9.59B	7.02B	9.94B	<0.4
Lead (Pb)	µg/L		(c)	210	0.078	0.158	0.207	0.188	0.147	0.107	0.17	0.144	<0.05
Mercury (Hg)	µg/L				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (Mo)	µg/L				8.044	7.408	7.995	6.667	8.135	8.598	7.197	7.943	<0.2
Nickel (Ni)	µg/L		(c)	74	1.019B	1.02B	0.572B	1.341B	0.629B	0.667B	0.959B	0.742B	<0.2
Selenium (Se)	µg/L			290	0.01J	0.03	0.02	0.04	0.02	0.03	0.02	0.03	<0.2
Silver (Ag)	µg/L		(c)	1.9	0.09B	0.07B	0.11B	0.06B	0.08B	0.09B	0.07B	0.07B	<0.5
Thallium (Tl)	µg/L				<0.005	<0.005	0.011	<0.005	0.012	0.01	0.007J	0.01	<0.1
Vanadium (V)	µg/L				3.08	2.01	1.89	2.32	2.17	1.97	2.09	1.92	<0.2
Zinc (Zn)	µg/L		(c)	90	10.22B	52.44B	89.5B	48.91B	84.59B	77.79B	66.53B	74.18B	<0.1
Total Metals													
Antimony (Sb)	µg/L				0.5B	0.55B	0.24B	0.76B	0.15B	0.26B	0.47B	0.34B	2.2B
Arsenic (As)	µg/L	80			1.11B	1.52B	2.07B	1.5B	2.24B	1.92B	1.72B	2.16B	3.6B

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Barium (Ba)	µg/L				49.3	26.3	11.9	37.8	13	15	20.4	15.1	43.9
Beryllium (Be)	µg/L				0.046	0.048	0.033	0.046	0.03	0.04	0.035	0.037	<0.2
Cadmium (Cd)	µg/L	10			0.368	0.132	0.108	0.141	0.107	0.181	0.114	0.105	0.3J
Chromium (Cr)	µg/L	20			4.116B	1.951B	0.347B	2.169B	0.51B	0.463B	1.028B	0.676B	1.9B
Cobalt (Co)	µg/L				0.377B	0.308B	0.2B	0.324B	0.208B	0.204B	0.244B	0.208B	0.5B
Copper (Cu)	µg/L	30			10.6B	14.75B	14.03B	16.51B	14.14B	13.44B	15.04B	14.41B	21.6B
Lead (Pb)	µg/L	20			3.504B	3.255B	0.56B	3.659B	0.332B	0.767B	1.748B	0.92B	7.38B
Mercury (Hg)	µg/L	0.4			0.01J	0.01J	<0.01	0.01J	<0.01	<0.01	<0.01	<0.01	0.01J
Molybdenum (Mo)	µg/L				6.707	5.279	7.423	4.912	8.093	7.072	5.636	6.71	5.3
Nickel (Ni)	µg/L	50			1.596B	1.464B	0.63B	1.861B	0.617B	0.702B	1.284B	0.85B	3.9B
Selenium (Se)	µg/L	150			0.04	0.04	0.02	0.04	0.03	0.03	0.04	0.03	2.3
Silver (Ag)	µg/L	7			0.09B	0.07B	0.11B	0.07B	0.08B	0.08B	0.06B	0.08B	<0.5
Thallium (Tl)	µg/L				<0.005	0.007J	0.012	0.006J	0.012	0.01	0.009J	0.01	<0.1
Vanadium (V)	µg/L				5.01	3.19	2.13	3.45	2.14	2.26	2.55	2.37	5.4
Zinc (Zn)	µg/L	200			50.35B	79.66B	91.85B	80.32B	67.43B	82.14B	77.5B	78.15B	89.7B
VOCs													
1,1,1-Trichloroethane (TCA)	µg/L				<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365
1,1,2,2-Tetrachloroethane	µg/L				<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228
1,1,2-Trichloroethane	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	1.2	<0.031	<0.031	<0.031
1,1-Dichloroethane	µg/L				<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076
1,1-Dichloroethene	µg/L				<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177
1,2-Dichlorobenzene	µg/L				<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
1,2-Dichloroethane (EDC)	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
1,2-Dichloropropane	µg/L				<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266
1,3-Dichlorobenzene	µg/L				<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283	<0.0283
1,4-Dichlorobenzene	µg/L				0.1J,B	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
2-Chloroethyl vinyl ether (2-CVE)	µg/L				<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951
Acrolein	µg/L				<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217
Acrylonitrile	µg/L				<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401
Benzene	µg/L				<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118
Bromodichloromethane	µg/L				<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281
Bromoform	µg/L				<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347
Bromomethane (methyl bromide)	µg/L				0.4J,B	0.3J,B	0.5B	0.3J,B	0.3J,B	0.4J,B	0.3J,B	0.2J	0.2J
Carbon Tetrachloride	µg/L				<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323
Chlorobenzene	µg/L				<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
Chloroethane (ethyl chloride)	µg/L				<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583
Chloroform	µg/L				<0.1795	<0.1795	<0.1795	0.2J	<0.1795	<0.1795	<0.1795	<0.1795	<0.1795
Chloromethane (methyl chloride)	µg/L				0.4J,B	0.3J,B	0.4J,B	0.3J,B	0.4J,B	0.3J,B	0.2J	0.2J	0.2J
Dibromochloromethane	µg/L				<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Dichlorodifluoromethane (F12)	µg/L				0.3J,B	0.2J,B	0.2J,B	0.2J,B	0.2J,B	0.3J,B	0.2J,B	0.2J,B	0.2J,B
Ethylbenzene	µg/L				0.1J	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156
Methyl-t-butyl ether (MTBE)	µg/L				<0.1318	<0.1318	0.2J	<0.1318	0.2J	0.2J	<0.1318	<0.1318	<0.1318

Table 10. Summary of Oxford Retention Basin Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater								Freshwater
					Oxford Retention Basin		Exchange		Basin E				Boone Olive Pump Station
					ORB-1	ORB-2	X-ORB-1	X-BasinE-3	E-1	E-2	E-3	E-4	BO-3
					01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/12/2010	01/13/2010	01/13/2010	01/13/2010	01/13/2010
Methylene chloride (dichloromethane)	µg/L				1.5B	2.2B	1.3B	2.9B	2B	2.9B	2.3B	1.8B	0.3J,B
Tetrachloroethene (PCE)	µg/L				0.1J	<0.0167	<0.0167	<0.0167	<0.0167	<0.0167	0.1J	0.4J	10.7
Toluene	µg/L				0.2J,B	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Trichloroethene (TCE)	µg/L				0.1J	<0.0277	<0.0277	<0.0277	<0.0277	<0.0277	<0.0277	<0.0277	0.4J
Trichlorofluoromethane (F11)	µg/L				<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	0.1J
Vinyl Chloride	µg/L				0.1J	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983
c-1,2-Dichloroethene	µg/L				<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	0.3J
c-1,3-Dichloropropene	µg/L				<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198
o-Xylene	µg/L				<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152
p/m-Xylene	µg/L				<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201	<0.0201
t-1,2-Dichloroethene	µg/L				<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403
t-1,3-Dichloropropene	µg/L				<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218

CVE = chloroethyl vinyl ether.
EDC = dichloroethane.
F11 = trichlorofluoromethane.

Organic Constituents Results

Acid-extractable compounds were not detected in samples X-ORB-1 and E-1. Total non-chlorinated phenolics (i.e., pentachlorophenol) were reported at 988 ng/L in sample ORB-1, which is below the CTR value of 13,000 ng/L and the COP value of 300,000 ng/L. Five base/neutral-extractable compounds were detected in sample ORB-1, and one base/neutral-extractable compound was detected in sample E-1.

There were no chlorinated pesticides detected during the pre-storm event in all three composite samples.

Aroclor PCBs were not detected in the three samples. Although, 59 individual PCB congeners were detected in sample ORB-1, 63 individual PCB congeners were detected in sample X-ORB-1, and 52 individual PCB congeners were detected in sample E-1, total detectable PCBs were calculated at low concentrations of 6.32 ng/L for ORB-1, 4.08 ng/L for X-ORB-1, and 2.1814 ng/L for E-1.

Several PAH compounds were detected only in sample ORB-1. Total detectable PAHs were calculated (low + high molecular weight) at a concentration 219.8 µg/L.

Two TPH-CC analytes were detected in sample ORB-1. C29-C32 was reported at 15.0 ug/L, and C41-C44 was reported at 9.0 ug/L.

One VOC (methylene chloride) was detected in sample ORB-1 at 1.5 µg/kg, two VOCs (bromomethane and methylene chloride) were detected in X-ORB-1, at 0.5 µg/kg and 1.3 µg/kg, respectively; and one VOC (methylene chloride) was detected in E-1 at 2.0 µg/kg.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/L) in samples X-ORB-1 (10.74 µg/L) and E-1 (12.11 µg/L). There were no other exceedances reported for dissolved metals in all three samples. In addition, there were no observed exceedances for total metals in all three composite samples.

3.2.2.3 Microbiology Results

The indicator bacteria monitored during the pre-storm event—representing the Oxford Retention Basin, Exchange Area, and Basin E—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 10 MPN/100 mL for all three samples, which is significantly below the COP values of 104 MPN/100 mL (Table 10). The fecal coliform concentrations ranged between 40 MPN/100 mL (X-ORB-1) and 130 MPN/100 mL (ORB-1), which is below the COP values of 400 MPN/100 mL. The total coliform concentrations ranged between 70 MPN/100 mL (X-ORB-1) and 1,100 MPN/100 mL (ORB-1), which is also significantly below the COP values of 10,000 MPN/100mL.

3.2.3 Prior to Stormwater Release

3.2.3.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 13, 2010, to represent conditions prior to stormwater release. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin
Water depth varied between the stations from 1.3 ft at ORB-A to 2.0 ft at ORB-B. Conductivity, a measure of the dissolved solutes in the water, ranged from 36.25 mS (ORB-B) to 46.2 mS (ORB-A). Turbidity ranged from 5.2 NTU (ORB-C) to 9.8 NTU (ORB-E). DO was relatively consistent among the five stations, ranging from 7.09 mg/L to 7.77 mg/L. pH ranged from 7.90 to 8.02. Temperature was consistent among the five stations monitored, ranging from 14.91ºC to 15.15ºC.

Exchange Water
Field observations and measurements were only taken at one station, X-ORB, to represent the Exchange Area water. Water depth was measured at 5.8-ft deep, and temperature was reported at 16.04ºC. Conductivity was 51.06 mS and turbidity was measured at 1.4 NTU. DO was measured at 7.98 mg/L, and ph was measured at 7.87 at station X-ORB.

Basin E
Water depth varied between the stations from 11.2 ft at Basin E-B to 15.5 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.81 mS to 51.00 mS. Turbidity was also consistent among the stations ranging from -0.2 NTU to -0.3 NTU. DO ranged from 7.53 mg/L to 7.69 mg/L. pH ranged from 7.69 to 7.94. Temperature was consistent among the three stations monitored, ranging from 14.84ºC to 14.96ºC.

3.2.3.2 Analytical Chemistry Results

Results of the wet weather (i.e., prior to stormwater release) water quality sampling are presented in Table 10. The results from composite sample ORB-2 represent the Oxford Retention Basin, and the results from the composite sample E-2 represents Basin E. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Ammonia was only detected in sample E-2, at 0.05 mg/L; significantly less than the COP water quality criteria of 6.0 mg/L. TKN was only detected in the sample, ORB-2, at 1.088 mg/L. Orthophosphate results ranged from 0.03 mg/L (ORB-2) to 0.06 mg/L (E-2). DOC and TOC were only detected in the ORB-2 sample, reported at 2.9 mg/L and 4.2 mg/L, respectively. TSS ranged from 24,980 mg/L (ORB-2) to 31,320 mg/L (E-2). TSS were ranged from 5.0 mg/L (E-2) to 17.5 mg/L (ORB-2).

Organic Constituents Results
Acid-extractable compounds were not detected in samples X-ORB-2 and E-2. Five base/neutral-extractable compounds were detected in sample ORB-2, and one base/neutral-extractable compound was detected in sample E-2.

There were no chlorinated pesticides detected prior to the stormwater release in both composite samples.

Aroclor PCBs were not detected in both samples. Although 77 individual PCB congeners were detected in sample ORB-2, and 48 individual PCB congeners were detected in sample E-2, total detectable PCBs were calculated at low concentrations of 10.08 ng/L and 1.96 ng/L for E-2.

Several PAH compounds were detected only in both samples. Total detectable PAHs were calculated (low + high molecular weight) at a concentration 281.6 µg/L for ORB-2 and 35.3 µg/L for E-2.

Two TPH-CC analytes were detected in sample ORB-2. C29-C32 was reported at 20 µg/L, and C33-C36 was reported at 12.0 µg/L.

One VOC (methylene chloride) was detected in sample ORB-2 at 2.2 µg/kg, two VOCs (1,1,2-trichloroethane and methylene chloride) were detected in E-2, at 1.2 µg/kg and 2.9 µg/kg, respectively.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/kg) in sample E-2, reported at 9.59 µg/L. There were no other observed exceedances for dissolved metals in the two composite samples. In addition, there were no observed exceedances for total metals in both composite samples.

3.2.3.3 Microbiology Results

The indicator bacteria monitored prior to the stormwater release—representing the Oxford Retention Basin and Basin E—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 6,867 for sample ORB-2 and 246 MPN/100 mL for sample E-2, which exceeds the COP values of 104 MPN/100 mL (Table 10). The fecal coliform concentrations ranged between 300 MPN/100 mL (E-2) and 30,000 MPN/100 mL (ORB-2). This concentration reported for ORB-2 exceeds the COP values of 400 MPN/100 mL. The total coliform concentrations ranged between 2,400 MPN/100 mL (E-2) and 50,000 MPN/100 mL. This concentration reported for sample ORB-2 exceeds the COP value of 10,000 MPN/100mL.

3.2.3.4 Additional Analytes Results

Additional analytes were collected prior to the stormwater release for the composite samples ORB-Add-2 and X-ORB-Add-2. General chemistry (i.e., BOD, COD, chloride, cyanide, and oil and grease) and organophosphorus pesticides results are presented in Table 11. These additional analytes will be used for the bioremediation study.

BOD ranged from not-detected (X-ORB-Add-2) to 6.9 mg/L for ORB-Add-2. COD ranged from 119 mg/L (ORB-Add-2) to 161 mg/L (X-ORB-Add-2). Chloride ranged from 15,143.34 mg/L (ORB-Add-2) to 17,594.57 mg/L (X-ORB-Add-2). Cyanide and oil and grease were not detected in both samples. There were no detected organophosphorus pesticides reported in the two composite samples.

Table 11. Summary of Additional Analytes Wet Weather Water Quality Chemistry

Parameter	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater	
					Oxford Retention Basin	Exchange
					ORB-Add-2	X-ORB-Add-2
					01/13/2010	01/13/2010
General Chemistry						
BOD	mg/L				6.9	<2
COD	mg/L				119	161
Chloride by IC	mg/L				15143.34	17594.57
Cyanide	mg/L	0.01		0.001*	<0.005	<0.005
Oil & grease	mg/L				1.7J	1.6J
Organophosphorus Pesticides						
Azinphos methyl	ng/L				<10	<10
Bolstar (sulprofos)	ng/L				<2	<2
Chlorpyrifos	ng/L				<1	<1
Demeton	ng/L				<1	<1
Diazinon	ng/L				<2	<2
Dichlorvos	ng/L				<3	<3
Dimethoate	ng/L				<3	<3
Disulfoton	ng/L				<1	<1
Ethoprop (ethoprofos)	ng/L				<1	<1
Ethyl parathion	ng/L				<10	<10
Fenchlorphos (ronnel)	ng/L				<2	<2
Fenitrothion	ng/L				<10	<10
Fensulfothion	ng/L				<1	<1
Fenthion	ng/L				<2	<2
Malathion	ng/L				<3	<3
Merphos	ng/L				<1	<1
Methamidophos (monitor)	ng/L				<50	<50
Methidathion	ng/L				<10	<10
Methyl parathion	ng/L				<1	<1
Mevinphos (phosdrin)	ng/L				<8	<8
Phorate	ng/L				<6	<6
Phosmet	ng/L				<50	<50
Tetrachlorvinphos (stirofos)	ng/L				<2	<2
Tokuthion	ng/L				<3	<3
Trichloronate	ng/L				<1	<1

< = Results are less than the MDL.

J = Analyte was detected at a concentration below the reporting limit and above the laboratory MDL. Reported value is estimated.

*MDL is above WQO.

3.2.4 During Stormwater Release

3.2.4.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 13, 2010, to represent conditions during stormwater release. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin

Physical parameter measurements were not taken in the field during the stormwater release event in the Oxford Retention Basin.

Exchange Water

Field observations and measurements were only taken at one station, X-Basin E, to represent the Exchange Area water. Water depth was measured at 6.75 ft, and temperature was reported at 18.36ºC. Conductivity was 32.53 mS and turbidity was measured at 12.5 NTU. DO was measured at 7.48 mg/L and ph was measured at 8.02 at station X-Basin E.

Basin E

Water depth varied between the stations from 9.5 ft at Basin E-B to 13.0 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.04 mS to 50.58 mS. Turbidity was also consistent among the stations ranging from 1.0 NTU to 1.7 NTU. DO ranged from 7.53 mg/L to 7.69 mg/L. pH ranged from 7.45 to 7.91. Temperature was consistent among the three stations monitored, ranging from 15.04ºC to 15.25ºC.

Boone Olive Pump Station

Field observations and measurements were only taken at one station (i.e., Boone Olive) to represent the Boone Olive Pump Station. Water depth was measured at 1.0 ft, and temperature was reported at 16.56ºC. Turbidity was relatively high, measured at 34.8 NTU. DO was measured at 7.36 mg/L, and ph was measured at 7.69 at the Boone Olive Pump Station.

3.2.4.2 Analytical Chemistry Results

Results of the wet weather (i.e., during stormwater release) water quality sampling are presented in Table 10. The results from composite sample X-BasinE-3 represent the Exchange Area, the results from the composite sample E-3 represents Basin E, and the results from the composite sample BO-3 represents Boone Olive Pump Station. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry

Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Ammonia ranged from 0.13 mg/L in sample E-3, to 0.69 mg/L in sample BO-3; significantly less than the COP water quality criteria of 6.0 mg/L. TKN ranged from 0.872 mg/L (E-3) to 2.06 mg/L (B)-3). Orthophosphate results ranged from 0.08 mg/L (E-3) to 0.69 mg/L (BO-3). DOC results ranged from 2.9 mg/L (E-3) to 11.3 mg/L (BO-3). TOC results ranged from 4.3 mg/L (E-3) to 15.4 mg/L (BO-3). TDS ranged from 1,106 mg/L (BO-3) to 27,400 mg/L (E-3). TSS were ranged from 9.8 mg/L (E-3) to 39.3 mg/L (BO-3).

Organic Constituents Results

Acid-extractable compounds were not detected in samples E-3. Pentachlorophenol was reported at 951 ng/L in sample X-BasinE-3 and 1203 ng/L in sample BO-3, thus the total non-chlorinated phenolics were calculated at 951 ng/L and 1203 ng/L, respectively. These values are significantly below the COP value of 300,000 ng/L. Six base/neutral-extractable compounds were detected in sample X-Basin E-3, six compounds were detected in sample E-3, and seven compounds were detected in sample BO-3.

There were no chlorinated pesticides detected during the stormwater release in all three composite samples.

Aroclor PCBs were not detected in all three samples. Although 78 individual PCB congeners were detected in sample X-BasinE-3, 72 individual PCB congeners were detected in sample E-3, and 73 individual PCB congeners were detected in sample BO-3, total detectable PCBs were calculated at low concentrations of 12.8006 ng/L for sample X-BasinE-3, 6.2486 ng/L for sample E-3, and 5.9616 ng/L for BO-3.

Several PAH compounds were detected only in both samples. Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 220.6 µg/L for X-Basin-E-3, 127.7 ng/L for sample E-3, and 857.8 µg/L for BO-3.

Eleven TPH-CC analytes were detected in sample X-BasinE-3, and the total C6-C44 TPH-CC was calculated at 270 µg/L. Two TPH-CC analytes were detected in sample E-3, and C29-C32 was reported at 18.0 µg/L and C33-36 was reported at 8.5 µg/L. Eleven TPH-CC analytes were detected in sample BO-3, and the total C6-C44 TPH-CC was calculated at 1,000 µg/L.

One VOC (methylene chloride) was detected in sample X-BasinE-3 at 2.9 µg/kg, one VOC (methylene chloride) was detected in E-3, at 2.3 µg/kg and one VOC (tetrachloroethene (PCE)) was detected 10.7 µg/kg.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the stormwater release event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/kg) in sample E-3, reported at 7.02 µg/L. There were no other observed exceedances reported for dissolved metals in the three composite samples. Additionally, there were no observed exceedances reported for total metals in all three composite samples.

3.2.4.3 Microbiology Results

The indicator bacteria monitored during the stormwater release—representing the Exchange Area, and Basin E, and the Boone Olive Pump Station—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 1,664 MPN/100 mL for sample X-BasinE-3, 6,131 MPN/100 mL for sample E-3, and greater than 241,960 MPN/100 mL for sample BO-3, which exceed the COP values of 104 MPN/100 mL (Table 10). The fecal coliform concentrations ranged between 17,000 MPN/100 mL (BO-3) and 50,000 MPN/100 mL (E-3). All three station results exceed the COP values of 400 MPN/100 mL for fecal coliforms. The total coliform concentrations ranged between 50,000 MPN/100 mL (X-BasinE-3) and 240,000 MPN/100 mL (BO-3). All three station results exceed the COP values of 10,000 MPN/100 mL for total coliforms.

3.2.5 Oxford Retention Basin Drained

3.2.5.1 Field Data Results

Physical parameter measurements were taken in the field during the wet weather event of January 12–13, 2010. The following results were taken on January 13, 2010, to represent conditions while the Oxford Retention Basin was drained. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 9.

Oxford Retention Basin
Physical parameter measurements were not taken in the field during the event while the Oxford Retention Basin was drained.

Exchange Water
Physical parameter measurements were not taken in the field in the Exchange Area Water for the event conducted while the Oxford Retention Basin was drained.

Basin E
Water depth varied between the stations from 9.9 ft at Basin E-B to 13.0 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 50.7 mS to 51.28 mS. Turbidity ranged among the stations from 0.3 NTU to 5.3 NTU. DO ranged from 6.33 mg/L to 7.84 mg/L. pH ranged from 7.81 to 7.93. Temperature was consistent among the three stations monitored, ranging from 15.14ºC to 15.22ºC.

Boone Olive Pump Station
Physical parameter measurements were not taken in the field at the Boone Olive Pump Station for the event conducted while the Oxford Retention Basin was drained.

3.2.5.2 Analytical Chemistry Results

Results of the wet weather (i.e., Oxford Retention Basin drained) water quality sampling are presented in Table 10. The results from the composite sample E-4 represent Basin E. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, ‘J flag’ values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 10). Of these, a water quality benchmark is available for ammonia. Ammonia was reported at 0.08 mg/L in sample E-4, significantly less than the COP water quality criteria of 6.0 mg/L. TKN was reported at 0.586 mg/L. Orthophosphate was reported at 0.04 mg/L. DOC was reported as not detected TOC was 6.3 mg/L. TDS were 29,420 mg/L, and TSS was 5.0 mg/L.

Organic Constituents Results
Acid-extractable compounds were not detected in samples E-4. Three base/neutral-extractable compounds were detected in sample E-4.

There were no chlorinated pesticides detected during the Oxford Retention Basin drainage event in composite sample E-4.

Aroclor PCBs were not detected in all three samples. Although 65 individual PCB congeners were detected in sample E-4, total detectable PCBs were calculated at a low concentration of 5.96 ng/L.

Several PAH compounds were detected only in sample E-4. Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 857.8 µg/L sample E-4.

Three TPH-CC analytes were detected in sample E-4. C25-C28 was reported at 19 µg/L, C29-C32 was reported at 18 µg/L and C33-C36 µg/L in sample E-4. One VOC (methylene chloride) was detected in sample E-4 at 1.8 µg/kg.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the stormwater release event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/kg) in sample E-4, reported at 9.94 µg/L. There were no other observed exceedances reported for dissolved metals in the three composite samples. Additionally, there were no observed exceedances reported for total metals in all three composite samples.

3.2.5.3 Microbiology Results

The indicator bacteria monitored while the Oxford Retention Basin was drained—representing Basin E (composite sample E-4)—included enterococci, fecal coliforms, and total coliforms. Enterococcus concentrations were measured at 19,863 MPN/100 mL for sample E-3, which exceeds the COP value of 104 MPN/100 mL (Table 10). The fecal coliform concentrations were 13,000 MPN/100 mL, which exceeds the COP value of 400 MPN/100 mL for fecal coliforms. The total coliform concentrations were measured at 24,000 MPN/100 mL, which exceeds the COP value of 10,000 MPN/100 mL for total coliforms.

3.3 Water Sampling Results – Dry Weather

3.3.1 Sample Collection

The dry weather water quality field sampling program was completed on March 11, 2010, in accordance with the approved SAP. Two rounds of sampling were conducted during the sampling event, once during the ebbing tide and once during flooding tide. Table 8 presents the station locations where samples were collected during each sampling round. Boone Olive Pump Station was only sampled during the ebb tide.

The first round of sampling was conducted after the high tide peak, while the tide was receding (termed ‘ebb tide’). The ebb tide sampling round was conducted to evaluate how water discharged from Oxford Retention Basin and Boone Olive Pump Station may affect water quality in Basin E. Samples were collected from Oxford Retention Basin (with the tide gates closed), the Exchange water from the Oxford Retention Basin side of the tide gate, the Boone Olive Pump Station, and Basin E.

The second round of sampling was conducted after the low tide nadir, while the tide was filling in (termed ‘flood tide’). The flood tide sampling round was conducted to evaluate how flood water from Basin E may affect water quality in Oxford Retention Basin. Samples were collected from Basin E, the Exchange water from the Basin E side of the tide gate, and Oxford Retention Basin. All samples were taken after the tide gate between Oxford Retention Basin and Basin E was opened.

Due to extremely low water levels in Oxford Retention Basin during the flood tide sampling round, samples could not be taken at Station ORB-D or Station ORB-E. A strong current was created in Oxford Retention Basin while the tide gate was open. Water being discharged from Oxford Retention Basin to Basin E had significantly dropped the water level in the east end of the basin, leaving it inaccessible for sampling. Samples ORB-D and ORB-E were collected at Station ORB-C, where water levels were sufficient enough for sampling. These samples were processed following the procedure described in Subsection 2.3.2.

3.3.2 Ebbing Tide

3.3.2.1 Field Data Results

Physical parameter measurements were taken in the field during the dry weather event of March 11, 2010. The following results were taken on March 11, 2010, to represent the ebbing tide conditions. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 12.

Oxford Retention Basin
Water depth varied between the stations from 1.5 ft (ORB-C, ORB-D, and ORB-E) to 2.0 ft at ORB-A. Conductivity, a measure of the dissolved solutes in the water, ranged from 43.27 mS (ORB-E) to 45.65 mS (ORB-D). Turbidity ranged from 0.3 NTU (ORB-A) to 2.6 NTU (ORB-D). DO was relatively consistent among the five stations, ranging from 2.65 mg/L to 6.77 mg/L. pH ranged from 7.66 to 7.91. Temperature ranged from 14.59ºC to 17.29ºC among all five stations.

Exchange Water
Field observations and measurements were only taken at one station, X-Basin E to represent the Exchange Area water. Water depth was measured at 5.5-ft deep, and temperature was reported at 17.61ºC. Conductivity was 33.81 mS, and turbidity was measured at 2.9 NTU. DO was measured at 6.33 mg/L, and ph was measured at 7.93 at station X-Basin E.

Basin E
Water depth varied between the stations from 11.1 ft at Basin E-B to 14.7 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 52.45 mS to 52.66 mS. Turbidity was also consistent among the stations ranging from 0.0 NTU to 1.4 NTU. DO ranged from 7.15 mg/L to 7.27 mg/L. pH ranged from 7.91 to 7.92. Temperature was consistent among the three stations monitored, ranging from 16.05ºC to 16.23ºC.

Boone Olive Pump Station
Field observations and measurements were only taken at one station, to represent the Boone Olive Pump Station. Water depth was measured at 2.4-ft deep, and temperature was reported at 18.41ºC. Conductivity was 7.51 mS and turbidity was measured at 0.4 NTU. DO was measured at 7.11 mg/L and ph was measured at 7.62 at the Boone Olive Pump Station.

3.3.2.2 Analytical Chemistry Results

Results of the dry weather (ebbing tide) water quality sampling are presented in Table 13 (the complete laboratory analytical data report for dry weather water quality samples is included in Appendix E). The results from Composite sample Basin E-D-1 represent Basin E, the results from the composite sample ORB-D-1 represent the Oxford Retention Basin, the results from the composite sample X-ORB-D-1 represents the Exchange Area, and the results from the composite sample BO-D-1represents The Boone Olive Pump Station. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, ‘J flag’ values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry
Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 13). Of these, a water quality benchmark is available for

ammonia. Concentrations of ammonia in all four samples, Basin E-D-1, ORB-D-1, X-ORB-D-2, and BO-D-1 were significantly less than the COP water quality criteria of 6.0 mg/L. The greatest concentration was observed at X-ORB-D-1 (0.07 mg/L). TKN was recorded as not-detected in all four samples. Orthophosphate results ranged from 0.03 mg/L (Basin E-D-1) to 0.18 mg/L (BO-D-1).

DOC carbon results ranged from 2.6 mg/L (BO-D-1) to 7.4 mg/L (Basin E-D-1), and TOC results ranged from 2.0 mg/L (ORB-D-1) to 3.0 mg/L (X-ORB-D-1). DOC was not detected in sample ORB-D-1, and TOC was not detected in sample Basin E-D-1. TDS ranged from 3,944 mg/L (BO-D-1) to 32,760 mg/L (Basin E-D-1). TSS were not-detected in all four samples.

Organic Constituents Results

Acid-extractable compounds were not detected in all four composite samples. Base/neutral-extractable compounds were not detected in sample Basin E-D-1. Two base/neutral-extractable compounds were detected in sample ORB-D-1, three base/neutral-extractable compounds were detected in sample X-ORB-D-1, and one base/neutral-extractable compound was detected in sample BO-D-1.

There were no chlorinated pesticides detected during the dry weather, ebbing tide event in all four composite samples.

Aroclor PCBs were not detected in the four composite samples. No individual PCB congeners were detected in samples Basin E-D-1 and BO-D-1; only two individual PCB congeners were detected in sample ORB-D-1, and four individual PCB congeners were detected in sample X-ORB-D-1. Total detectable PCBs were calculated at a concentration of 2.0599 ng/L for ORB-D-1, and 2.3804 ng/L for X-ORB-D-1.

Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 7.4 µg/L for Basin E-D-1, 90.1 ng/L for sample ORB-D-1, 37.8 ng/L for sample ORB-D-1, and 48.3 µg/L for BO-D-1.

Five TPH-CC analytes were detected in sample ORB-D-1 and the Total C6-C44 was reported at 110 µg/L. Four TPH-CC analytes were detected in sample X-ORB-D-1 and the Total C6-C44 was reported at 96 µg/L.

No VOCs were detected in sample Basin E-D-1 and sample X-ORB-D-1. One VOC (methyl bromide) was detected in sample ORB-D-1 at 0.5 µg/kg, two VOCs (methylene chloride and PCE) were detected in BO-D-1, at 1.0 µg/kg and 8.8 µg/kg, respectively.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. Only dissolved copper exceeded the CTR saltwater criteria (4.8 µg/L) in sample Basin E-D-1 (5.1 µg/L). There were no other exceedances reported for dissolved metals in all four samples. In addition, there were no observed exceedances for total metals in all four composite samples.

Table 12. Field Observations of Water Quality during Dry Weather Event

Parameter	Unit	Oxford Basin					Exchange Water	Basin E			Pump Station
		ORB-A	ORB-B	ORB-C	ORB-D	ORB-E	X-Basin E	Basin E-A	Basin E-B	Basin E-C	Boone Olive
Flood Tide											
Date		3/11/2010	3/11/2010	3/11/2010	Stations ORB-D and ORB-E were inaccessible due to low water levels; physical parameter measurements and samples collected at station ORB-C.		3/11/2010	3/11/2010	3/11/2010	3/11/2010	
Time		1245	1245	1245			1200	1400	1400	1400	
pH		7.77	7.88	7.91			7.70	7.85	7.27	7.82	
Conductivity	mS	37.65	25.42	26.06			46.04	52.37	52.31	53.32	
Turbidity	NTU	2.7	1.3	11.7			0.3	-0.3	0.1	0.0	
Dissolved Oxygen	mg/L	7.79	9.68	10.3			5.87	7.38	7.87	7.3	
Temperature	°C	19.74	20.75	20.87			16.73	16.71	16.46	16.55	
Color		None	None	Light Brown			None	None	None	None	
Odor		None	None	Organic			None	None	None	None	
Clarity		Clear	Clear	Slightly Turbid			Clear	Clear	Clear	Clear	
Water Depth (Total)	feet	1.7	0.41	0.41			7.4	10.8	9.7	12.5	
Fresh Water Lens Depth	feet	1.5	None	None			None	2.5	2.8	2.7	
Ebb Tide											
Date		3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010	3/11/2010
Time		0800	0800	0800	0800	0800	1055	1015	1015	1015	0930
pH		7.91	7.83	7.88	7.66	7.87	7.93	7.92	7.91	7.91	7.62
Conductivity	mS	43.48	44.5	45.4	45.65	43.27	33.81	52.66	52.46	52.45	7.52
Turbidity	NTU	0.3	1.7	1.8	2.6	1.4	2.9	1.4	0.0	0.0	0.4
Dissolved Oxygen	mg/L	6.77	4.21	5.23	2.65	4.66	6.33	7.23	7.15	7.27	7.11
Temperature	°C	14.59	16.1	15.8	17.29	15.7	17.61	16.23	16.05	16.08	18.41
Color		None	None	None	None	None	None	None	None	None	None
Odor		Sulfide	None	None	Sulfide	Sulfide	None	None	None	None	Sulfide/ Anaerobic
Clarity		Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Water Depth (Total)	feet	3.3	2.2	1.6	1.7	1.6	5.5	12.5	11.1	14.7	2.4
Fresh Water Lens Depth	feet	2.0	1.9	1.5	1.5	1.5	None	None	None	None	N/A

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
General Chemistry												
pH	SM 4500 H+	pH Units				7.8 H	7.9 H	7.5 H	7.5 H	7.9 H	7.7 H	7 H
Total hardness as CaCO3	SM 2340 B	mg/L				5,778.30	5,050	4,836.50	5,094.20	2,852.50	3,651.60	899.9
TDS	SM 2540 C	mg/L				32,760	28,480	27,780	28,640	15,900	19,800	3,944
TSS	SM 2540 D	mg/L				3.8 J	3.2 J	4.2 J	4.5 J	23	3.5 J	1.3 J
DOC	SM 5310 B	mg/L				7.4	0.9 J	2.2	1.3 J	1.7 J	4	2.6
TOC	SM 5310 B	mg/L				0.8 J	1 J	3.1	2	2.1	3	2.7
Ammonia-N	SM 4500-NH3 F	mg/L	6			<0.03	0.07	0.11	0.16	0.14	0.15	0.03 J
Nitrite-N	SM 4500-NO2 B	mg/L				<0.01	0.02 J	0.03 J	0.04 J	0.05	0.07	0.01 J
Nitrate-N	SM 4500-NO3 E	mg/L				0.09	0.51	0.5	0.46	2.8	1.67	4.73
TKN	SM 4500-N D	mg/L				<0.456	<0.456	0.458 J	0.586 J	0.642 J	0.632 J	<0.456
Total orthophosphate as P	SM 4500-P E	mg/L				0.03	0.05	0.06	0.06	0.14	0.08	0.18
Total sulfides	SM 4500-S2 D	mg/L				<0.01	<0.01	<0.01	<0.01	0.02 J	<0.01	0.01 J
Indicator Bacteria												
E. coli	Colilert	MPN/100mL				30	10	<10	10	63	<10	20
Enterococci	Enterolert	MPN/100mL	104			20	20	<10	30	195	30	63
Fecal coliforms	SM 9221E	MPN/100mL	400			40	<20	<20	<20	230	<20	20
Total coliforms	SM 9221B	MPN/100mL	10,000			220	70	40	220	1400*	220	1,100
Total Metals												
Antimony (Sb)	EPA 1640m/EPA 200.8m	µg/L				0.21 B	0.45 B	0.52 B	0.47 B	0.76 B	0.86 B	0.4 J
Arsenic (As)	EPA 1640m/EPA 200.8m	µg/L	80			2.84	2.08	2.49	1.84	1.7	1.67	11.1
Barium (Ba)	EPA 200.8m	µg/L				11.2	17.6	21	19.8	38.6	32.5	56.3
Beryllium (Be)	EPA 1640m/EPA 200.8m	µg/L				0.042 B	0.031 B	0.041 B	0.036 B	0.052 B	0.04 B	<0.2
Cadmium (Cd)	EPA 1640m/EPA 200.8m	µg/L	10			0.076	0.089	0.066	0.067	0.123	0.06	<0.2
Chromium (Cr)	EPA 1640m/EPA 200.8m	µg/L	20			0.358	1.363	1.684	1.533	9.161	3.728	1.1
Cobalt (Co)	EPA 1640m/EPA 200.8m	µg/L				0.355 B	0.396 B	0.39 B	0.461 B	0.593 B	0.51	0.3 J
Copper (Cu)	EPA 1640m/EPA 200.8m	µg/L	30			6.99 B	5.92 B	3.98 B	4.78 B	8.82 B	3.81 B	0.9
Lead (Pb)	EPA 1640m/EPA 200.8m	µg/L	20			0.689 B	0.944 B	1.122 B	1.508	5.987 B	1.162 B	<0.05
Mercury (Hg)	EPA 245.7m	µg/L	0.4			<0.01	<0.01	<0.01	<0.01	0.01 J	<0.01	0.01 J
Molybdenum (Mo)	EPA 1640m/EPA 200.8m	µg/L				10.33 B	10.83 B	10.14 B	10.2 B	10.4 B	9.732 B	19.6
Nickel (Ni)	EPA 1640m/EPA 200.8m	µg/L	50			0.494 B	0.685 B	0.787 B	0.814 B	1.547 B	1.021 B	2.7
Selenium (Se)	EPA 1640m/EPA 200.8m	µg/L	150			0.02	0.05	0.05	0.04	0.07	0.05	4.4
Silver (Ag)	EPA 1640m/EPA 200.8m	µg/L	7			0.68 B	0.68 B	0.65 B	0.61 B	0.64 B	0.64 B	<0.5
Thallium (Tl)	EPA 1640m/EPA 200.8m	µg/L				0.009 J	0.007 J	<0.005	<0.005	0.005 J	<0.005	<0.1
Vanadium (V)	EPA 1640m/EPA 200.8m	µg/L				2.05	2.3	2.09	1.9	4.22	2.57	3.6
Zinc (Zn)	EPA 1640m/EPA 200.8m	µg/L	200			30.14 B	27.79 B	25.27 B	28.01 B	42.21 B	22.97 B	5.2 B
Dissolved Metals												
Antimony (Sb)	EPA 1640m/EPA 200.8m	µg/L				0.26 B	0.44 B	0.7 B	0.52 B	0.82 B	0.79 B	0.5
Arsenic (As)	EPA 1640m/EPA 200.8m	µg/L		340 (a)	69	2.26 B	1.7 B	1.29 B	1.75 B	1.34 B	1.49 B	12.6
Barium (Ba)	EPA 200.8m	µg/L				9.1	17.5	20.5	19.8	37.4	30.6	53.3
Beryllium (Be)	EPA 1640m/EPA 200.8m	µg/L				0.03 B	0.032 B	0.029 B	0.033 B	0.038 B	0.04 B	<0.2
Cadmium (Cd)	EPA 1640m/EPA 200.8m	µg/L		(b)	42	0.074 B	0.073 B	0.057 B	0.038 B	0.028 B	0.047 B	0.2 J

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Chromium (Cr)	EPA 1640m/EPA 200.8m	µg/L		(b)	1100	0.17	0.874	0.792	0.578	4.902	2.625	1
Cobalt (Co)	EPA 1640m/EPA 200.8m	µg/L				0.374 B	0.502 B	0.415 B	0.4 B	0.442 B	0.46 B	0.4 J
Copper (Cu)	EPA 1640m/EPA 200.8m	µg/L		(b)	4.8	5.1 B	3.82 B	1.58 B	1.09 B	0.76 B	1.89 B	1.5
Lead (Pb)	EPA 1640m/EPA 200.8m	µg/L		(b)	210	0.131	0.051	0.032	0.025	0.077	0.057	0.12
Mercury (Hg)	EPA 245.7m	µg/L				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (Mo)	EPA 1640m/EPA 200.8m	µg/L				10.1	10.42	10.06	9.914	10.32	9.686	21
Nickel (Ni)	EPA 1640m/EPA 200.8m	µg/L		(b)	74	0.445 B	0.613 B	0.719 B	0.674 B	0.986 B	0.972 B	2.8
Selenium (Se)	EPA 1640m/EPA 200.8m	µg/L			290	0.02	0.04	0.04	0.04	0.07	0.03	5.6
Silver (Ag)	EPA 1640m/EPA 200.8m	µg/L		(b)	1.9	0.63 B	0.66 B	0.63 B	0.58 B	0.64 B	0.64 B	1.2
Thallium (Tl)	EPA 1640m/EPA 200.8m	µg/L				0.012	0.006 J	<0.005	<0.005	<0.005	<0.005	<0.1
Vanadium (V)	EPA 1640m/EPA 200.8m	µg/L				1.75	1.85	1.58	1.32	3.05	2.26	3.4
Zinc (Zn)	EPA 1640m/EPA 200.8m	µg/L		(b)	90	29.26 B	23.73 B	20.33 B	18.79 B	6.111 B	15.48 B	5.5
Acid-Extractable Compounds												
2,3,4,6-Tetrachlorophenol	EPA 625m	ng/L										<50
2,4,5-Trichlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,4,6-Trichlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,4-Dichlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,4-Dimethylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2,4-Dinitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2,6-Dichlorophenol	EPA 625m	ng/L										<50
2-Chlorophenol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2-Methyl-4,6-dinitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2-Methylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
2-Nitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
3+4-Methylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
4-Nitrophenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
Benzoic Acid	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
Pentachlorophenol	EPA 625m	ng/L		(c)	13000	<50	<50	<50	<50	<50	<50	<50
Phenol	EPA 625m	ng/L				<100	<100	<100	<100	<100	<100	<100
Total chlorinated phenolics	Calculations	ng/L	10000			<100	<100	<100	<100	<100	<100	<100
Total non-chlorinated phenolics	Calculations	ng/L	300000			<100	<100	<100	<100	<100	<100	<100
Base/Neutral-Extractable Compounds												
1,2,4-Trichlorobenzene	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2,6-Dinitrotoluene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
2-Chloronaphthalene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
3,3'-dichlorobenzidine	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
4-Chlorophenylphenylether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Azobenzene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Benzidine	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Butylbenzyl phthalate	EPA 625m	ng/L				40 J	44 J	41 J	57	58	58	60
Di-n-butyl phthalate	EPA 625m	ng/L				<75	<75	<75	91 J	98 J	<75	<75
Di-n-octyl phthalate	EPA 625m	ng/L				<10	<10	<10	17 J	58	<10	<10
Diethyl phthalate	EPA 625m	ng/L				<100	<100	<100	<100	115 J	167	<100
Dimethyl phthalate	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Hexachlorobenzene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Hexachlorocyclopentadiene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Hexachloroethane	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Isophorone	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
NDPA	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
N-Nitrosodimethylamine	EPA 1625M	ng/L				<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	2.5
N-Nitrosodiphenylamine	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Nitrobenzene	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethoxy)methane	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroethyl)ether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Chloroisopropyl)ether	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
bis(2-Ethylhexyl) Phthalate	EPA 625m	ng/L				<100	178	<100	276	1118	148	<100
PAHs												
1-Methylnaphthalene	EPA 625m	ng/L				<1	<1	<1	<1	1.7 J	2.3 J	1.2 J
1-Methylphenanthrene	EPA 625m	ng/L				<1	<1	<1	<1	3.1 J	<1	<1
2,3,5-Trimethylnaphthalene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
2,6-Dimethylnaphthalene	EPA 625m	ng/L				1 J	<1	1.2 J	5.1	15.7	3.3 J	<1
2-Methylnaphthalene	EPA 625m	ng/L				<1	<1	<1	<1	4.7 J	3.3 J	1.9 J
Acenaphthene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	EPA 625m	ng/L				<1	<1	<1	<1	2.4 J	1.1 J	<1
Anthracene	EPA 625m	ng/L				<1	<1	<1	<1	3.5 J	<1	1.7 J
Benz[a]anthracene	EPA 625m	ng/L				<1	<1	<1	4.7 J	9.6	<1	<1
Benzo[a]pyrene	EPA 625m	ng/L				<1	<1	<1	3.3 J	11.9	<1	<1
Benzo[b]fluoranthene	EPA 625m	ng/L				<1	<1	<1	6.3	23.7	<1	<1
Benzo[e]pyrene	EPA 625m	ng/L				<1	<1	<1	3.4 J	21.2	<1	<1
Benzo[g,h,i]perylene	EPA 625m	ng/L				<1	<1	<1	13.3	21.2	<1	<1
Benzo[k]fluoranthene	EPA 625m	ng/L				<1	<1	<1	1.6 J	6.5	<1	<1
Biphenyl	EPA 625m	ng/L				1.6 J	1.6 J	2.1 J	2.3 J	5.1	3.6 J	2.2 J
Chrysene	EPA 625m	ng/L				<1	<1	3.8 J	11	28.2	1.8 J	5.7
Dibenz[a,h]anthracene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Fluoranthene	EPA 625m	ng/L				1.2 J	4.2 J	5.5	16.4	46.6	5.5	9.6
Fluorene	EPA 625m	ng/L				<1	<1	<1	<1	4.9 J	2.9 J	1.7 J
Indeno[1,2,3-c,d]pyrene	EPA 625m	ng/L				<1	<1	<1	<1	14.3	<1	<1
Naphthalene	EPA 625m	ng/L				2.2 J, B	3 J, B	3.1 J, B	3.4 J, B	9.7 B	5.1 B	6.8 B
Perylene	EPA 625m	ng/L				<1	<1	<1	<1	5.8	<1	<1

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Phenanthrene	EPA 625m	ng/L				<1	2 J	3 J	4.6 J	20.1	5.1	10.2
Pyrene	EPA 625m	ng/L				1.4 J	3.4 J	4 J	14.7	38.7	3.8 J	7.3
Total detectable PAHs	Calculations	ng/L				7.4	14.2	22.7	90.1	298.6	37.8	48.3
TPH-CC												
C6	EPA 8015B (M)	ug/L				<1.4	<1.4	<1.4	<1.4	<2.8	<1.4	<1.4
C7	EPA 8015B (M)	ug/L				<6.1	<6.1	<6.1	<6.1	<12	<6.1	<6.1
C8	EPA 8015B (M)	ug/L				<9.9	<9.9	<9.9	<9.9	<20	<9.9	<9.9
C9-C10	EPA 8015B (M)	ug/L				<13	<13	<13	<13	<26	<13	<13
C11-C12	EPA 8015B (M)	ug/L				<14	<14	<14	<14	<29	<14	<14
C13-C14	EPA 8015B (M)	ug/L				<16	<16	<16	<16	<31	<16	<16
C15-C16	EPA 8015B (M)	ug/L				<17	<17	<17	<17	<34	<17	<17
C17-C18	EPA 8015B (M)	ug/L				<17	<17	<17	<17	<35	<17	<17
C19-C20	EPA 8015B (M)	ug/L				<18	<18	<18	<18	<35	<18	<18
C21-C22	EPA 8015B (M)	ug/L				<18	<18	<18	<18	<35	<18	<18
C23-C24	EPA 8015B (M)	ug/L				<18	<18	<18	<18	<35	<18	<18
C25-C28	EPA 8015B (M)	ug/L				<16	<16	<16	21	<31	24	<16
C29-C32	EPA 8015B (M)	ug/L				<8.5	<8.5	16	29	37	31	<8.5
C33-C36	EPA 8015B (M)	ug/L				<7.9	<7.9	14	25	30	25	<7.9
C37-C40	EPA 8015B (M)	ug/L				<6.8	8.2	14	20	28	16	<6.8
C41-C44	EPA 8015B (M)	ug/L				<6.6	<6.6	<6.6	20	19	<6.6	<6.6
C6-C44 Total	EPA 8015B (M)	ug/L				<47	<47	<47	110	110	96	<47
Chlorinated Pesticides												
2,4'-DDD	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
2,4'-DDE	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
2,4'-DDT	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
4,4'-DDD	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
4,4'-DDE	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
4,4'-DDT	EPA 625m	ng/L		1100	130	<1	<1	<1	<1	<1	<1	<1
Aldrin	EPA 625m	ng/L		3000	1300	<1	<1	<1	<1	<1	<1	<1
BHC-alpha	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
BHC-beta	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
BHC-delta	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
BHC-gamma	EPA 625m	ng/L		950	160	<1	<1	<1	<1	<1	<1	<1
Chlordane-alpha	EPA 625m	ng/L				<1	<1	<1	<1	3.3 J	<1	<1
Chlordane-gamma	EPA 625m	ng/L				<1	<1	<1	1.6 J	2.1 J	<1	<1
DCPA (dacthal)	EPA 625m	ng/L				<5	<5	<5	<5	<5	<5	<5
Dicofol	EPA 625m	ng/L				<50	<50	<50	<50	<50	<50	<50
Dieldrin	EPA 625m	ng/L		240	710	<1	<1	<1	<1	<1	<1	<1
Endosulfan sulfate	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Endosulfan-I	EPA 625m	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1
Endosulfan-II	EPA 625m	ng/L	27	220	34	<1	<1	<1	<1	<1	<1	<1
Endrin	EPA 625m	ng/L	6	83	37	<1	<1	<1	<1	<1	<1	<1

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
Endrin aldehyde	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Endrin ketone	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Heptachlor	EPA 625m	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1
Heptachlor epoxide	EPA 625m	ng/L		52	53	<1	<1	<1	<1	<1	<1	<1
Methoxychlor	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Mirex	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Oxychlordane	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Perthane	EPA 625m	ng/L				<5	<5	<5	<5	<5	<5	<5
cis-Nonachlor	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
trans-Nonachlor	EPA 625m	ng/L				<1	<1	<1	<1	1.1 J	<1	<1
Toxaphene	EPA 625mNCI	ng/L		730	210	<10	<10	<10	<10	<10	<10	<10
Total detectable BHC	Calculations	ng/L	12			<1	<1	<1	<1	<1	<1	<1
Total detectable chlordane	Calculations	ng/L				<1	<1	<1	1.6	6.5	<1	<1
Total detectable DDTs	Calculations	ng/L				<1	<1	<1	<1	<1	<1	<1
Aroclor PCBs												
Aroclor 1016	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1221	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1232	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1242	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1248	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1254	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Aroclor 1260	EPA 625m	ng/L				<10	<10	<10	<10	<10	<10	<10
Total aroclor	Calculations	ng/L				<10	<10	<10	<10	<10	<10	<10
PCB Congeners												
PCB003	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB008	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB018	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB028	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB031	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB033	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB037	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB044	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB049	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB052	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB056/060	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB066	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB070	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB074	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB077	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB081	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB087	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB095	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB097	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB099	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB101	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB105	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB110	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB114	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB118	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB119	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB123	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB126	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB128	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB138	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB141	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB149	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB151	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB153	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB156	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB157	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB158	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB167	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB168+132	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB169	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB170	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB174	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB177	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB180	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB183	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB187	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB189	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB194	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB195	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB200	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB201	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB203	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB206	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB209	EPA 625m	ng/L				<1	<1	<1	<1	<1	<1	<1
Total PCBs for EPA 625m	Calculations	ng/L				<1	<1	<1	<1	<1	<1	<1
PCB1	EPA 1668A	ng/L				<0.019	<0.056	<0.03	<0.0082	<0.017	<0.017	<0.014
PCB10	EPA 1668A	ng/L				<0.042	<0.074	<0.028	<0.022	<0.016	<0.019	<0.024
PCB103	EPA 1668A	ng/L				<0.0066	<0.006	<0.0075	<0.0075	<0.0069	<0.0068	<0.0043
PCB104	EPA 1668A	ng/L				<0.0055	<0.012	<0.0074	<0.0093	<0.01	<0.0076	<0.005
PCB105	EPA 1668A	ng/L				0.0151 J	<0.024	0.0371 J	0.0492 J	0.26	0.0463 J	<0.0066

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB106	EPA 1668A	ng/L				<0.0041	<0.0063	<0.0051	<0.0065	<0.0074	<0.0064	<0.0041
PCB107	EPA 1668A	ng/L				<0.0044	<0.0068	0.0084 J	0.0079 J	0.0484 J	0.0099 J	<0.0044
PCB108+124	EPA 1668A	ng/L				<0.0044	<0.0067	<0.0054	<0.0068	0.0228 J	<0.0067	<0.0043
PCB11	EPA 1668A	ng/L				0.057 J	0.1	0.1 J	0.1	0.21	0.13	<0.06
PCB110+115	EPA 1668A	ng/L				0.0696 J	0.105 J	0.143 J	0.178 J	1	0.18 J	0.0336 J
PCB111	EPA 1668A	ng/L				<0.0059	<0.0054	<0.0067	<0.0067	<0.0062	<0.0061	<0.0038
PCB112	EPA 1668A	ng/L				<0.0057	<0.0052	<0.0065	<0.0064	<0.0059	<0.0059	<0.0037
PCB114	EPA 1668A	ng/L				<0.005	<0.0076	<0.0061	<0.0077	0.0137 J	<0.0077	<0.0049
PCB118	EPA 1668A	ng/L				0.0473 J	0.068 J	0.0994 J	0.11	0.6	0.12	0.0218 J
PCB12+13	EPA 1668A	ng/L				<0.019	<0.02	<0.019	<0.0059	<0.015	<0.012	<0.0093
PCB120	EPA 1668A	ng/L				<0.0057	<0.0052	<0.0065	<0.0065	<0.006	<0.0059	<0.0037
PCB121	EPA 1668A	ng/L				<0.0059	<0.0054	<0.0067	<0.0067	<0.0062	<0.0061	<0.0038
PCB122	EPA 1668A	ng/L				<0.0048	<0.0073	<0.0059	<0.0075	<0.0086	<0.0074	<0.0047
PCB123	EPA 1668A	ng/L				<0.005	<0.0077	<0.0062	<0.0079	0.0129 J	<0.0078	<0.005
PCB126	EPA 1668A	ng/L				<0.0049	<0.0075	<0.006	<0.0077	0.0112 J	<0.0076	<0.0048
PCB127	EPA 1668A	ng/L				<0.0042	<0.0065	<0.0052	<0.0066	<0.0076	<0.0065	<0.0042
PCB128+166	EPA 1668A	ng/L				<0.011	<0.013	0.02 J	<0.023	0.153 J	0.027 J	<0.0082
PCB129+138+163	EPA 1668A	ng/L				0.066 J	0.099 J	0.13 J	0.162 J	0.85	0.161 J	0.041 J
PCB130	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	0.053 J	<0.02	<0.0097
PCB131	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	<0.013	<0.019	<0.0095
PCB132	EPA 1668A	ng/L				0.017 J	0.027 J	0.036 J	0.05 J	0.27	0.05 J	0.0113 J
PCB133	EPA 1668A	ng/L				<0.012	<0.013	<0.014	<0.011	<0.012	<0.018	<0.0089
PCB134+143	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	0.033 J	<0.02	<0.0096
PCB135+151	EPA 1668A	ng/L				<0.017	0.022 J	0.028 J	<0.027	0.146 J	0.042 J	<0.012
PCB136	EPA 1668A	ng/L				<0.0077	<0.015	<0.011	<0.014	0.066 J	0.0151 J	<0.0085
PCB137	EPA 1668A	ng/L				<0.014	<0.015	<0.016	<0.013	<0.035	<0.021	<0.01
PCB139+140	EPA 1668A	ng/L				<0.012	<0.012	<0.013	<0.011	0.014 J	<0.018	<0.0086
PCB14	EPA 1668A	ng/L				<0.018	<0.018	<0.018	<0.0055	<0.014	<0.011	<0.0087
PCB141	EPA 1668A	ng/L				<0.012	<0.013	<0.015	0.024 J	0.13	0.023 J	<0.0087
PCB142	EPA 1668A	ng/L				<0.013	<0.014	<0.015	<0.012	<0.013	<0.02	<0.0097
PCB144	EPA 1668A	ng/L				<0.0096	<0.018	<0.013	<0.018	0.021 J	<0.012	<0.011
PCB145	EPA 1668A	ng/L				<0.008	<0.015	<0.011	<0.015	<0.013	<0.01	<0.0088
PCB146	EPA 1668A	ng/L				<0.011	<0.012	<0.014	0.018 J	0.095 J	0.02 J	<0.0083
PCB147+149	EPA 1668A	ng/L				0.044 J	0.063 J	0.079 J	0.095 J	0.46	0.104 J	0.0312 J
PCB148	EPA 1668A	ng/L				<0.0095	<0.018	<0.013	<0.017	<0.015	<0.012	<0.01
PCB15	EPA 1668A	ng/L				<0.026	<0.027	<0.026	<0.0082	<0.021	<0.016	<0.013
PCB150	EPA 1668A	ng/L				<0.008	<0.015	<0.011	<0.015	<0.013	<0.01	<0.0088
PCB152	EPA 1668A	ng/L				<0.0065	<0.012	<0.009	<0.012	<0.01	<0.0081	<0.0071
PCB153+168	EPA 1668A	ng/L				0.054 J	0.075 J	<0.086	0.111 J	0.54	0.128 J	0.0342 J
PCB154	EPA 1668A	ng/L				<0.0088	<0.017	<0.012	<0.016	<0.014	<0.011	<0.0097
PCB155	EPA 1668A	ng/L				<0.0065	<0.012	<0.009	<0.012	<0.01	<0.0081	<0.0071
PCB156+157	EPA 1668A	ng/L				0.0062 J	<0.01	0.0141 J	0.015 J	0.093 J	0.017 J	<0.0087

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB158	EPA 1668A	ng/L				<0.0094	<0.01	<0.011	<0.015	0.0889 J	<0.014	<0.0069
PCB159	EPA 1668A	ng/L				<0.0054	<0.0093	<0.0088	<0.009	<0.0089	<0.0097	<0.0077
PCB16	EPA 1668A	ng/L				<0.018	<0.056	<0.025	<0.019	<0.022	<0.019	<0.02
PCB160	EPA 1668A	ng/L				<0.011	<0.011	<0.012	<0.0097	<0.01	<0.016	<0.0077
PCB161	EPA 1668A	ng/L				<0.0097	<0.01	<0.011	<0.009	<0.0095	<0.015	<0.0071
PCB162	EPA 1668A	ng/L				<0.0055	<0.0094	<0.009	<0.0092	<0.0091	<0.0099	<0.0078
PCB164	EPA 1668A	ng/L				<0.0094	<0.01	<0.011	0.0148 J	0.0652 J	<0.014	<0.0069
PCB165	EPA 1668A	ng/L				<0.011	<0.011	<0.012	<0.0098	<0.01	<0.016	<0.0078
PCB167	EPA 1668A	ng/L				<0.0059	<0.01	<0.0097	<0.01	0.033 J	<0.011	<0.0085
PCB169	EPA 1668A	ng/L				<0.0062	<0.011	<0.01	<0.01	<0.01	<0.011	<0.0088
PCB17	EPA 1668A	ng/L				<0.015	<0.048	<0.021	<0.017	<0.019	<0.016	<0.017
PCB170	EPA 1668A	ng/L				0.0127 J	0.013 J	0.0199 J	0.028 J	0.13	0.032 J	0.0126 J
PCB171+173	EPA 1668A	ng/L				<0.009	<0.01	<0.0094	<0.013	0.038 J	<0.014	<0.0096
PCB172	EPA 1668A	ng/L				<0.0092	<0.01	<0.0096	<0.013	<0.021	<0.014	<0.0098
PCB174	EPA 1668A	ng/L				<0.0086	<0.0096	0.0162 J	<0.023	0.12	0.028 J	<0.0092
PCB175	EPA 1668A	ng/L				<0.008	<0.013	<0.01	<0.013	<0.011	<0.015	<0.0065
PCB176	EPA 1668A	ng/L				<0.0064	<0.01	<0.008	<0.01	0.0103 J	<0.012	<0.0052
PCB177	EPA 1668A	ng/L				<0.0088	<0.0099	<0.0093	<0.012	0.067 J	0.017 J	<0.0094
PCB178	EPA 1668A	ng/L				<0.008	<0.013	<0.01	<0.013	0.019 J	<0.015	<0.0065
PCB179	EPA 1668A	ng/L				0.0069 J	<0.01	<0.0077	<0.0099	<0.032	0.013 J	0.0059 J
PCB18+30	EPA 1668A	ng/L				0.014 J	<0.039	<0.018	<0.014	0.042 J	0.027 J	<0.014
PCB180+193	EPA 1668A	ng/L				0.0235 J	0.0263 J	0.0445 J	0.049 J	0.24	0.065 J	<0.02
PCB181	EPA 1668A	ng/L				<0.0087	<0.0097	<0.0091	<0.012	<0.011	<0.013	<0.0093
PCB182	EPA 1668A	ng/L				<0.0084	<0.014	<0.01	<0.014	<0.011	<0.015	<0.0068
PCB183	EPA 1668A	ng/L				0.0085 J	0.0092 J	0.0121 J	0.017 J	0.0668 J	0.02 J	<0.0081
PCB184	EPA 1668A	ng/L				<0.0062	<0.01	<0.0077	<0.0099	<0.0082	<0.011	<0.005
PCB185	EPA 1668A	ng/L				<0.009	<0.01	<0.0095	<0.013	<0.011	<0.014	<0.0097
PCB186	EPA 1668A	ng/L				<0.0062	<0.0099	<0.0077	<0.0099	<0.0082	<0.011	<0.005
PCB187	EPA 1668A	ng/L				0.0147 J	0.019 J	0.027 J	0.031 J	0.12	0.032 J	<0.011
PCB188	EPA 1668A	ng/L				<0.007	<0.011	<0.0087	<0.011	<0.0093	<0.013	<0.0057
PCB189	EPA 1668A	ng/L				<0.0068	<0.0079	<0.01	<0.01	<0.012	<0.0077	<0.0085
PCB19	EPA 1668A	ng/L				<0.014	<0.043	<0.019	<0.015	<0.017	<0.015	<0.016
PCB190	EPA 1668A	ng/L				<0.0072	<0.008	<0.0076	<0.01	0.0261 J	<0.011	<0.0077
PCB191	EPA 1668A	ng/L				<0.0072	<0.0081	<0.0076	<0.01	<0.0089	<0.011	<0.0077
PCB192	EPA 1668A	ng/L				<0.0077	<0.0085	<0.008	<0.011	<0.0094	<0.012	<0.0082
PCB194	EPA 1668A	ng/L				<0.012	<0.012	<0.015	<0.015	0.058 J	<0.019	<0.01
PCB195	EPA 1668A	ng/L				<0.013	<0.012	<0.015	<0.016	0.023 J	<0.02	<0.011
PCB196	EPA 1668A	ng/L				<0.012	<0.013	<0.015	<0.016	<0.024	<0.015	<0.0074
PCB197	EPA 1668A	ng/L				<0.01	<0.011	<0.013	<0.013	<0.013	<0.013	<0.0061
PCB198+199	EPA 1668A	ng/L				<0.012	<0.013	<0.016	0.016 J	0.067 J	<0.015	<0.0074
PCB2	EPA 1668A	ng/L				<0.019	<0.058	<0.031	<0.0086	<0.018	<0.018	<0.015
PCB20+28	EPA 1668A	ng/L				0.0261 J	0.03 J	0.0278 J	0.0286 J	0.0724 J	0.0386 J	0.0126 J

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB200	EPA 1668A	ng/L				<0.0093	<0.0096	<0.012	<0.012	<0.012	<0.012	<0.0056
PCB201	EPA 1668A	ng/L				<0.0096	<0.0099	<0.012	<0.012	<0.012	<0.012	<0.0057
PCB202	EPA 1668A	ng/L				<0.011	<0.011	<0.014	<0.014	<0.015	<0.014	<0.0066
PCB203	EPA 1668A	ng/L				<0.012	<0.012	<0.015	<0.015	0.038 J	<0.015	<0.007
PCB204	EPA 1668A	ng/L				<0.0099	<0.01	<0.012	<0.013	<0.013	<0.012	<0.0059
PCB205	EPA 1668A	ng/L				<0.011	<0.01	<0.013	<0.013	<0.013	<0.017	<0.0092
PCB206	EPA 1668A	ng/L				<0.012	<0.018	<0.013	<0.017	<0.042	<0.017	<0.013
PCB207	EPA 1668A	ng/L				<0.011	<0.015	<0.011	<0.014	<0.023	<0.015	<0.011
PCB208	EPA 1668A	ng/L				<0.013	<0.019	<0.014	<0.017	<0.028	<0.018	<0.014
PCB209	EPA 1668A	ng/L				<0.013	<0.04	<0.021	<0.032	0.042 J	<0.023	<0.01
PCB21+33	EPA 1668A	ng/L				<0.0075	<0.012	0.0085 J	0.009 J	0.0253 J	0.0162 J	<0.0047
PCB22	EPA 1668A	ng/L				<0.0055	<0.013	0.0071 J	0.007 J	0.0225 J	0.0113 J	<0.005
PCB23	EPA 1668A	ng/L				<0.0052	<0.013	<0.0067	<0.0061	<0.0062	<0.007	<0.0049
PCB24	EPA 1668A	ng/L				<0.012	<0.038	<0.017	<0.013	<0.015	<0.013	<0.014
PCB25	EPA 1668A	ng/L				<0.0046	<0.011	<0.0059	<0.0054	<0.0055	<0.0062	<0.0043
PCB26+29	EPA 1668A	ng/L				<0.0048	<0.012	<0.0062	<0.0056	0.0114 J	<0.0065	<0.0046
PCB27	EPA 1668A	ng/L				<0.012	<0.036	<0.016	<0.012	<0.014	<0.012	<0.013
PCB3	EPA 1668A	ng/L				<0.019	<0.056	<0.03	<0.0083	<0.017	<0.017	<0.014
PCB31	EPA 1668A	ng/L				0.0157 J	0.017 J	0.0201 J	<0.02	0.0667 J	0.0309 J	0.0127 J
PCB32	EPA 1668A	ng/L				<0.011	<0.033	<0.015	<0.011	0.016 J	<0.011	<0.012
PCB34	EPA 1668A	ng/L				<0.0049	<0.012	<0.0063	<0.0057	<0.0059	<0.0066	<0.0046
PCB35	EPA 1668A	ng/L				<0.0049	<0.012	<0.0063	<0.0058	<0.0059	<0.0066	<0.0047
PCB36	EPA 1668A	ng/L				<0.0044	<0.011	<0.0057	<0.0052	<0.0053	<0.0059	<0.0042
PCB37	EPA 1668A	ng/L				<0.0062	<0.015	<0.008	<0.0073	0.0218 J	0.0118 J	<0.0059
PCB38	EPA 1668A	ng/L				<0.005	<0.012	<0.0064	<0.0058	<0.006	<0.0067	<0.0047
PCB39	EPA 1668A	ng/L				<0.0047	<0.012	<0.0061	<0.0056	<0.0057	<0.0064	<0.0045
PCB4	EPA 1668A	ng/L				<0.04	<0.071	<0.026	<0.021	<0.027	<0.018	<0.023
PCB40+41+71	EPA 1668A	ng/L				0.0159 J	<0.015	0.0165 J	0.02 J	<0.065	<0.022	<0.0086
PCB42	EPA 1668A	ng/L				0.0079 J	<0.012	<0.0093	<0.011	<0.032	0.0128 J	<0.0089
PCB43	EPA 1668A	ng/L				<0.0086	<0.013	<0.011	<0.013	<0.011	<0.01	<0.01
PCB44+47+65	EPA 1668A	ng/L				0.0432 J	0.042 J	0.051 J	0.0821 J	0.263 J	0.07 J	0.012 J
PCB45+51	EPA 1668A	ng/L				<0.0068	<0.011	<0.0085	<0.01	<0.016	<0.0081	<0.0082
PCB46	EPA 1668A	ng/L				<0.0078	<0.012	<0.0098	<0.012	<0.01	<0.0093	<0.0094
PCB48	EPA 1668A	ng/L				<0.007	<0.011	<0.0088	<0.01	<0.018	0.0095 J	<0.0084
PCB49+69	EPA 1668A	ng/L				<0.025	0.0266 J	0.0338 J	0.0402 J	0.146 J	<0.036	<0.0072
PCB5	EPA 1668A	ng/L				<0.02	<0.021	<0.02	<0.0062	<0.016	<0.012	<0.0098
PCB50+53	EPA 1668A	ng/L				0.0084 J	<0.01	<0.0082	<0.0098	0.0239 J	0.0082 J	<0.0079
PCB52	EPA 1668A	ng/L				0.0515 J	0.068 J	0.0953 J	0.12	0.57	0.14	0.0156 J
PCB54	EPA 1668A	ng/L				<0.012	<0.039	<0.015	<0.02	<0.021	<0.019	<0.0095
PCB55	EPA 1668A	ng/L				<0.0063	<0.0095	<0.0094	<0.0096	<0.0073	<0.01	<0.011
PCB56	EPA 1668A	ng/L				0.0113 J	0.0156 J	0.0121 J	<0.013	0.0568 J	0.0194 J	<0.01
PCB57	EPA 1668A	ng/L				<0.0054	<0.0082	<0.0081	<0.0083	<0.0063	<0.0088	<0.0093

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
PCB58	EPA 1668A	ng/L				<0.0056	<0.0085	<0.0084	<0.0085	<0.0065	<0.0091	<0.0096
PCB59+62+75	EPA 1668A	ng/L				<0.0056	<0.0086	<0.007	<0.0083	<0.0071	<0.0066	<0.0067
PCB6	EPA 1668A	ng/L				<0.018	<0.019	<0.018	<0.0056	<0.015	<0.011	<0.0089
PCB60	EPA 1668A	ng/L				<0.006	<0.0091	<0.009	<0.0092	0.0312 J	<0.011	<0.01
PCB61+70+74+76	EPA 1668A	ng/L				0.0388 J	0.059 J	0.0707 J	0.0839 J	0.399 J	0.0951 J	0.019 J
PCB63	EPA 1668A	ng/L				<0.0052	<0.0079	<0.0078	<0.008	<0.0061	<0.0085	<0.009
PCB64	EPA 1668A	ng/L				0.0136 J	0.0142 J	0.0176 J	0.0207 J	0.0896 J	0.0231 J	<0.0066
PCB66	EPA 1668A	ng/L				0.0296 J	0.0425 J	0.0353 J	0.0433 J	0.14	0.0414 J	<0.0094
PCB67	EPA 1668A	ng/L				<0.0051	<0.0078	<0.0077	<0.0079	<0.006	<0.0084	<0.0088
PCB68	EPA 1668A	ng/L				<0.0051	<0.0078	<0.0077	<0.0079	<0.006	<0.0084	<0.0088
PCB7	EPA 1668A	ng/L				<0.018	<0.019	<0.018	<0.0057	<0.015	<0.011	<0.009
PCB72	EPA 1668A	ng/L				<0.0052	<0.0079	<0.0078	<0.008	<0.0061	<0.0085	<0.009
PCB73	EPA 1668A	ng/L				<0.0055	<0.0085	<0.0068	<0.0082	<0.007	<0.0065	<0.0066
PCB77	EPA 1668A	ng/L				<0.0074	<0.011	<0.011	<0.011	0.0385 J	<0.012	<0.013
PCB78	EPA 1668A	ng/L				<0.0056	<0.0085	<0.0084	<0.0086	<0.0065	<0.0091	<0.0096
PCB79	EPA 1668A	ng/L				<0.0048	<0.0073	<0.0072	<0.0074	0.007 J	<0.0078	<0.0083
PCB8	EPA 1668A	ng/L				<0.017	<0.018	<0.017	<0.0053	0.02 J	<0.011	<0.0084
PCB80	EPA 1668A	ng/L				<0.005	<0.0075	<0.0074	<0.0076	<0.0058	<0.0081	<0.0085
PCB81	EPA 1668A	ng/L				<0.0074	<0.011	<0.011	<0.011	<0.0086	<0.012	<0.013
PCB82	EPA 1668A	ng/L				<0.0084	<0.0076	<0.0095	0.0161 J	0.0839 J	0.0172 J	<0.0054
PCB83+99	EPA 1668A	ng/L				0.0424 J	0.0502 J	0.0669 J	0.0767 J	0.38	0.0676 J	0.0206 J
PCB84	EPA 1668A	ng/L				0.0137 J	<0.017	0.0286 J	0.0353 J	0.2	0.0407 J	<0.0054
PCB85+116+117	EPA 1668A	ng/L				0.0073 J	0.007 J	0.015 J	0.0194 J	0.0923 J	0.0201 J	<0.0039
PCB86+87+97+109+119+125	EPA 1668A	ng/L				0.0435 J	0.0578 J	0.0816 J	0.1 J	0.498 J	0.0984 J	0.0281 J
PCB88+91	EPA 1668A	ng/L				<0.0073	<0.0087	0.0147 J	0.0175 J	0.0932 J	0.0164 J	<0.0047
PCB89	EPA 1668A	ng/L				<0.0078	<0.0071	<0.0088	<0.0088	<0.0081	<0.0081	<0.005
PCB9	EPA 1668A	ng/L				<0.018	<0.019	<0.018	<0.0057	<0.015	<0.011	<0.009
PCB90+101+113	EPA 1668A	ng/L				0.0666 J	0.0887 J	0.124 J	0.127 J	0.66	0.138 J	0.0329 J
PCB92	EPA 1668A	ng/L				<0.011	<0.017	0.0231 J	0.0272 J	0.12	0.0264 J	<0.0052
PCB93+98+100+102	EPA 1668A	ng/L				<0.0074	<0.0067	<0.0084	<0.0083	0.0243 J	<0.0076	<0.0048
PCB94	EPA 1668A	ng/L				<0.008	<0.0073	<0.0091	<0.009	<0.0083	<0.0083	<0.0052
PCB95	EPA 1668A	ng/L				0.0513 J	0.063 J	0.0866 J	0.11	0.58	0.12	0.0235 J
PCB96	EPA 1668A	ng/L				<0.0071	<0.016	<0.0097	<0.012	<0.014	<0.0098	<0.0065
Total PCBs for EPA1668A	Calculation	ng/L				0.9433	1.2081	1.651	2.0599	11.1501	2.3804	0.3686
VOCs												
1,1,1-TCA	EPA 624	µg/L				<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365	<0.0365
1,1,2,2-Tetrachloroethane	EPA 624	µg/L				<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228	<0.0228
1,1,2-Trichloroethane	EPA 624	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
1,1-Dichloroethane	EPA 624	µg/L				<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076	<0.0076
1,1-Dichloroethene	EPA 624	µg/L				<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177	<0.0177
1,2-Dichlorobenzene	EPA 624	µg/L				<0.019	<0.019	<0.019	0.1 J	<0.019	<0.019	<0.019
1,2-Dichloroethane (EDC)	EPA 624	µg/L				<0.031	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031

Table 13. Summary of Oxford Retention Basin Dry Weather Water Quality Chemistry

Parameter	Method	Units	COP	CTR Freshwater	CTR Saltwater	Saltwater						Freshwater
						Basin E	Basin E	Basin E Exchange	Oxford Retention Basin	Oxford Retention Basin	Oxford Exchange Area	Boone Olive Pump Station
						BASIN E -D -1	BASIN E -D -2	X -BASIN E -D -2	ORB -D -1	ORB -D -2	X -ORB -D -1	BO -D -1
1,2-Dichloropropane	EPA 624	µg/L				<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266	<0.0266
1,3-Dichlorobenzene	EPA 624	µg/L				<0.0283	<0.0283	<0.0283	0.1 J	<0.0283	<0.0283	<0.0283
1,4-Dichlorobenzene	EPA 624	µg/L				<0.031	<0.031	<0.031	0.2 J	<0.031	<0.031	<0.031
2-Chloroethyl vinyl ether (2-CVE)	EPA 624	µg/L				<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951
Acrolein	EPA 624	µg/L				<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217	<0.8217
Acrylonitrile	EPA 624	µg/L				<1.401	<1.401	<1.401	<1.401	<1.401	<1.401	<1.401
Benzene	EPA 624	µg/L				<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118	<0.0118
Bromodichloromethane	EPA 624	µg/L				<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281	<0.0281
Bromoform	EPA 624	µg/L				<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347	<0.0347
Bromomethane (methyl bromide)	EPA 624	µg/L				0.3 J, B	0.2 J, B	0.3 J, B	0.5 B	0.2 J, B	0.4 J, B	0.4 J, B
Carbon Tetrachloride	EPA 624	µg/L				<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323	<0.0323
Chlorobenzene	EPA 624	µg/L				<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
Chloroethane (ethyl chloride)	EPA 624	µg/L				<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583	<0.0583
Chloroform	EPA 624	µg/L				<0.1795	<0.1795	<0.1795	<0.1795	0.2 J	<0.1795	<0.1795
Chloromethane (methyl chloride)	EPA 624	µg/L				<0.0763 J	<0.0763	<0.0763	<0.0763 J	<0.0763	<0.0763 J	<0.0763 J
Dibromochloromethane	EPA 624	µg/L				<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Dichlorodifluoromethane (F12)	EPA 624	µg/L				<0.0654	<0.0654	<0.0654	<0.0654	<0.0654	<0.0654	<0.0654
Ethylbenzene	EPA 624	µg/L				<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156
MTBE	EPA 624	µg/L				<0.1318	<0.1318	<0.1318	<0.1318	<0.1318	<0.1318	<0.1318
Methylene chloride	EPA 624	µg/L				0.6 J	0.4 J	0.6 J	0.6 J	0.5 J	0.5 J	1
PCE	EPA 624	µg/L				<0.0167	0.3 J	<0.0167	<0.0167	0.2 J	0.1 J	8.8
Toluene	EPA 624	µg/L				<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
TCE	EPA 624	µg/L				<0.0277	<0.0277	<0.0277	<0.0277	0.2 J	0.1 J	0.3 J
Trichlorofluoromethane (F11)	EPA 624	µg/L				<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312	<0.0312
Vinyl chloride	EPA 624	µg/L				<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983	<0.0983
c-1,2-Dichloroethene	EPA 624	µg/L				<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	0.3 J
c-1,3-Dichloropropene	EPA 624	µg/L				<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198	<0.0198
o-Xylene	EPA 624	µg/L				<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152
p/m-Xylene	EPA 624	µg/L				<0.0201	<0.0201	<0.0201	0.1 J	<0.0201	<0.0201	<0.0201
t-1,2-Dichloroethene	EPA 624	µg/L				<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403	<0.0403
t-1,3-Dichloropropene	EPA 624	µg/L				<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218	<0.0218

< = Results less than the MDL.
B = Analyte was detected in the associated method blank.
H = Samples received and/or analyzed past the recommended holding time.
J = Analyte was detected at a concentration below the reporting limit and above the MDL. Reported value is an estimate.
*Fecal coliforms : total coliforms ratio exceeds 0.1, therefore total coliform criterion becomes 1,000 MPN/100 mL.
(a) = Water quality benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(b) = Water quality benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The criterion maximum concentration (CMC) was used.
(c) = Water quality benchmark for Pentachlorophenol is based on pH as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The CMC was used.

3.3.2.3 Microbiology Results

A total of seven samples were collected from the Oxford Retention Basin, Basin E, and Boone Olive Pump Station. The indicator bacteria monitored during the dry weather, ebbing tide event—representing the Basin E, Oxford Retention Basin, Oxford Retention Basin Exchange Area, and Boone Olive Pump Station—included *E. coli*, enterococci, fecal coliforms, and total coliforms.

E. coli was not detected in the X-ORB-D-1 sample, and ranged from 10 MPN/100 mL (ORB-D-1) to 30 MPN/100 mL (Basin E-D-1) for the other three samples. Enterococcus concentrations ranged from at 20 MPN/100 mL (Basin E-D-1) to 63 MPN/100 mL (BO-D-1), which is significantly below the COP values of 104 MPN/100 mL (Table 13). The fecal coliform concentrations ranged between 20 MPN/100 mL (BO-D-1) and 40 MPN/100 mL (Basin E-D-1), which is significantly below the COP values of 400 MPN/100 mL. Fecal coliforms were not detected in samples ORB-D-1 and X-ORB-D-1. The total coliform concentrations ranged between 220 MPN/100 mL (basins E-D-1, ORB-D-1, and X-ORB-D-1) and 1,100 MPN/100 mL (BO-D-1), which is also significantly below the COP values of 10,000 MPN/100mL.

3.3.3 Flooding Tide

3.3.3.1 Field Data Results

Physical parameter measurements were taken in the field during the dry weather event of March 11, 2010. The following results were taken on March 11, 2010, to represent the flooding tide conditions. The parameters measured were conductivity, pH, turbidity, DO, temperature, color, odor, clarity, and water depth. Measurements were recorded at each designated sample station in conjunction with sample collection. The data collected in the field are summarized in Table 12.

Oxford Retention Basin
Water depth varied between the stations from 0.41 ft at ORB-B and ORB-C to 1.7 ft at ORB-A. Conductivity, a measure of the dissolved solutes in the water, ranged from 25.42 mS (ORB-B) to 37.65 mS (ORB-A). Turbidity ranged from 2.7 NTU (ORB-A) to 11.7 NTU (ORB-C). DO was relatively consistent among the three stations, ranging from 7.79 mg/L to 10.3 mg/L. pH ranged from 7.77 to 7.91. Temperature was consistent among the three stations monitored, ranging from 19.74ºC to 20.87ºC.

Exchange Water
Field observations and measurements were only taken at one station, X-Basin E to represent the Exchange Area water. Water depth was measured at 7.4-ft deep, and temperature was reported at 16.73ºC. Conductivity was 46.04 mS, and turbidity was measured at 0.3 NTU. DO was measured at 5.87 mg/L and ph was measured at 7.70 at station X-Basin E.

Basin E
Water depth varied between the stations from 9.7 ft at Basin E-B to 12.5 ft at Basin E-C. Conductivity was consistent between the three stations ranging from 52.31 mS to 53.32 mS. Turbidity was also consistent among the stations ranging from -0.3 NTU to 0.1 NTU. DO ranged from 7.30 mg/L to 7.87 mg/L. pH ranged from 7.27 to 7.85. Temperature was consistent among the three stations monitored, ranging from 16.46ºC to 16.71ºC.

Boone Olive Pump Station
Field observations and measurements were not taken at the Boone Olive Pump Station during the flooding tide event.

3.3.3.2 Analytical Chemistry Results

Results of the dry weather (i.e., flooding tide) water quality sampling are presented in Table 13. The results from the composite sample Basin E-D-2 represent the Basin E, the results from the composite sample X-Basin E-D-2 represent the Basin E Exchange Area, and the results from the composite sample ORB-D-2 represent Oxford Retention Basin. These results were compared to the either the COP and/or the CTR as appropriate. In the results discussion below, 'J flag' values (i.e., estimated concentrations below the reporting limit) were considered not detected.

General Chemistry

Several nutrients were monitored as part of the ambient monitoring analyte list, including nitrate, nitrite, TKN, ammonia, and total orthophosphate (Table 13). Of these, a water quality benchmark is available for ammonia. Concentrations of ammonia in all three samples, Basin E-D-2, X-Basin E-D-2, and ORB-D-2 were significantly less than the COP water quality criteria of 6.0 mg/L. The greatest concentration was observed at ORB-D-2 (0.14 mg/L). TKN was recorded as not-detected in all three samples. Orthophosphate results ranged from 0.05 mg/L (Basin E-D-2) to 0.14 mg/L (ORB-D-2). DOC was only detected in sample X-Basin E-D-2 at 2.2 mg/L, and TOC results ranged from 2.1 mg/L (ORB-D-2) to 3.1 mg/L (X-Basin E-D-2). TOC was not detected in sample Basin E-D-2. TDS ranged from 15,900 mg/L (ORB-D-2) to 28,480 mg/L (Basin E-D-2). TSS were not-detected in samples Basin E-D-2 and X-Basin E-D-2. TSS was reported as 23.0 mg/L for sample ORB-D-2.

Organic Constituents Results

Acid-extractable compounds were not detected in all three composite samples. Base/neutral-extractable compounds were not detected in sample Basin E-D-1. One base/neutral-extractable compound was detected in sample Basin E-D-2, no base/neutral-extractable compounds were detected in sample X-Basin E-D-2, and three base/neutral-extractable compounds were detected in sample ORB-D-2. Bis(2-Ethylhexyl) Phthalate was recorded at 1,118 ng/L in sample ORB-D-2.

There were no chlorinated pesticides detected during the dry weather, flooding tide event in all three composite samples.

Aroclor PCBs were not detected in the three composite samples. No individual PCB congeners were detected in sample X-Basin E-D-2; only one individual PCB congener was detected in sample Basin E-D-2 and 29 individual PCB congeners were detected in sample ORB-D-2. Total detectable PCBs were calculated at a concentration of 1.2081 ng/L for Basin E-D-2 and at a concentration of 11.1501 ng/L for ORB-D-2.

Total detectable PAHs were calculated (low + high molecular weight) at a concentration of 7.4 µg/L for Basin E-D-1, 90.1 ng/L for sample ORB-D-1, 37.8 ng/L for sample ORB-D-1, and 48.3 µg/L for BO-D-1.

One TPH-CC analyte (C37-C40) was detected in sample Basin E-D-2 and reported at 8.2 µg/L. Three TPH-CC analytes (C29-C32, C33-C36, C37-C40) were detected in sample X-Basin E-D-2 and reported at 16.0 µg/L, 14.0 µg/L, and 14.0 µg/L, respectively. Four TPH-CC analytes were detected in Sample ORB-D-1 and the total C6-C44 was reported at 110.0 µg/L.

No VOCs were detected in all three composite samples.

Total and Dissolved Metals

The total and dissolved fractions of 17 metals were tested for in each of the composite samples during the pre-storm event. There were no exceedances reported for dissolved metals in all three composite samples. In addition, there were no observed exceedances for total metals in all three composite samples.

3.3.3.3 Microbiology Results

A total of seven samples were collected from the Oxford Retention Basin, Basin E, and Boone Olive Pump Station. The indicator bacteria monitored during the dry weather, ebbing tide event—representing the Basin E, Oxford Retention Basin, Oxford Retention Basin Exchange Area, and Boone Olive Pump Station—included *E. coli*, enterococci, fecal coliforms, and total coliforms.

E. coli was not detected in the sample X-Basin-D-2 and ranged from 10 MPN/100 mL (Basin E-D-2) to 63 MPN/100 mL (ORB-D-2). Enterococcus concentrations were not detected in sample X-Basin E-D-2 and ranged from 20 MPN/100 mL (Basin E-D-2) to 195 MPN/100 mL (ORB-D-2). The results for ORB-D-2 exceed the COP values of 104 MPN/100 mL (Table 13). Fecal coliform concentrations were not detected in sample Basin E-D-2 and X-Basin E-D-2. The fecal coliform concentrations for sample ORB-D-2 were reported at 230 MPN/100 mL, which is below the COP values of 400 MPN/100 mL. The total coliform concentrations ranged between 40 MPN/100 mL (X-Basin E-D-2) and 1,400 MPN/100 mL (ORB-D-2). The fecal coliform : total coliform ratio exceeded 0.1, thus the total coliform criterion became 1,000 MPN/100 mL, and the sample ORB-D-2 exceeded the COP criteria.

3.4 Quality Assurance / Quality Control

A complete review of analytical results is provided in Appendix F.

4.0 DISCUSSION AND CONCLUSIONS

As stated in the study objectives, water and sediment samples were collected from Oxford Retention Basin and Basin E in MdRH to characterize existing contaminant levels and to assess available options for water quality improvements and sediment disposal. Specifically, sediment and water quality characterizations were performed for the LADPW for the following purposes:

- Characterize sediments that have been deposited in the Oxford Retention Basin so that informed management decisions can be made in the future regarding excavation and water quality management.
- Determine the spatial extent of bacterial and chemical contamination in the sediments and in the water column within Oxford Retention Basin.
- Determine the organic composition of the sediment to examine evaluate the feasibility of bioremediation.
- Characterize water quality conditions in Oxford Retention Basin in relation to the compliance requirements of the Bacteria and Toxics TMDLs for Basin E within MdRH.
- Satisfy the necessary requirements to evaluate the disposal options for sediment removal from Oxford Retention Basin.

This section reviews each of these five main project objectives and discusses the data collected in this study relative to these objectives.

4.1 Objective 1

Characterize sediments that have been deposited in the Oxford Retention Basin so that informed management decisions can be made in the future regarding excavation and water quality management.

Subsection 3.1 (Sediment Sampling Results) presented a detailed characterization of sediments contained with Oxford Retention Basin. In summary, sediments in Oxford Retention Basin are comprised of the following two distinct layers:

- Unconsolidated sediments made up of recently deposited sediments, generally higher in organics and nutrients.
- Consolidated sediments made up of an artificial cap placed over an historical landfill that lies beneath the Oxford Retention Basin.

Sediments within Oxford Retention Basin are generally finer grained towards the discharge into Basin E and are generally coarser grained in the areas closer to the storm drain input. This characterization suggests that any management of sediments should focus on finer-grained sediments that pose the potential to transport constituents out into the MdRH.

Sediment characterization of unconsolidated layers suggests that Oxford Retention Basin contains sediments that exceed the Toxics TMDL compliance targets for metals and PCBs (Objective 4). If left undisturbed, these sediments may not impact compliance in Basin E. However, disturbance or flushing of these sediments has the potential to impact Basin E. Analysis of sediments suggests that excavation could be done in compliance with disposal regulations under the classification of hazardous material (per the State of California), specifically for chromium and lead (Objective 5). However, under federal guidelines, this material would not be classified as hazardous.

With regard to bacteria concentrations, sediments were not found to be a reservoir for bacteria and therefore removal and disposal of sediments would not appear to provide a management solution for compliance with the Bacteria TMDL targets.

Sediment management can therefore be approached in the following four ways:

1. Excavation can be implemented to remove unconsolidated sediments that may contribute to non-compliance with Toxics TMDL targets at the risk of disturbing finer grains and allowing further transport out into Basin E. Excavation of the consolidated layer is not recommended.
2. Unconsolidated sediments can be left undisturbed, and improved circulation can be implemented to reduce environmental fluctuations (which may cause bacterial growth) at the risk of allowing sediments to be resuspended and transported into Basin E.
3. Bioremediation (i.e., uptake of contaminants into bacteria, algae, or emergent vegetation) can be investigated (Subsection 4.3).
4. Leave the system as it is and allow sediments to remain undisturbed while assuming a risk of increased bacterial concentrations from a fluctuating environment.

4.2 Objective 2

Determine the spatial extent of bacterial and chemical contamination in the sediments and in the water column within Oxford Retention Basin.

A number of water quality and sediment quality studies have been undertaken in both Oxford Retention Basin and Marina del Rey's Back Basins providing directly comparable data for this study.

The studies used in comparison include the following:

- *Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study* (WESTON, 2007).
- *Marina del Rey Harbor Sediment Characterization Study* (WESTON, 2008a).
- *Marina del Rey Annual Reports* (LADPW, 2008).

In this section, results of those previous studies are compared to the results of this study to address the objective stated above.

4.2.1 Sediment Conditions

Sediment collected with Oxford Retention Basin became increasingly finer-grained closer to the Exchange with Basin E, whereas the eastern portion of Oxford Retention Basin contained coarser-grained material. These results are consistent with the sediment grain-size data collected in the Marina del Rey Annual Reports, which found increasing grain size towards the centre of the main channels and finer grains sizes in those area of the MdRH with low flows and longer retention times. The grain-size analysis in the Oxford Retention Basin, comprising predominantly silts and clays, is consistent with these findings and suggest that deposition of finer grains towards the Exchange with Basin E is attributable to lower flows and longer retention times from the storm drain inputs.

Total metals were detected in all samples, with chromium and lead exceeding the STLC criteria in the excavation layer in the eastern portion of Oxford Retention Basin (Table 14). These results are consistent with the *Marina del Rey Sediment Characterization Study* (WESTON, 2008a), which used Isopleth mapping to assess pollutant distribution in sediments. The results showed that copper concentrations were higher in the main channel and Mother's Beach than in Basin E, suggesting that Oxford Retention Basin was not a source of copper. Analysis of lead in MdRH sediments found that the highest concentrations were at the mouths of the main channel and each Back Basin, with concentrations decreasing towards the further reaches of the basins. Basin E was found to have lower lead concentrations in comparison to other basins in this study, which was undertaken in 2007–2008. These results suggest that, while Oxford

Retention Basin may be a reservoir for some metals (e.g., chromium and lead), concentrations of most metals are higher outside of the Oxford Retention Basin and suggest an external source. previous studies have hypothesized that those sources may include maritime activities such as boat hull paints, storm drain discharges and inputs from outside the MdRH. Ballona Creek has been identified as a potentially significant external source for metal contamination.

Table 14. Summary of Results

	Sediment Quality	Wet Weather Water Quality	Dry Weather Water Quality
Boone Olive Pump Station	Not Applicable	Appears to be a source of total metals though dissolved metals were not detected. All dissolved values below the CTR. Appears to be a contributing source of bacteria at the Exchange and in Basin E. This site exceeded the WQO for bacteria stated in the TMDL	Boone Olive Pump station does not pump to Basin E during dry weather and concentrations of total and dissolved metals were below WQOs. Boone Olive Pump Station does not pump to Basin E during dry weather and concentrations of bacteria in the pump station were below WQOs.
Oxford Retention Basin	Total metals detected throughout Oxford Retention Basin; only chromium and lead exceeded STLC. No TTLC or TCLP exceedances. Trace amounts of semivolatile compounds, chlorinated pesticides and PCBs at some locations. Bacteria indicative of nutrient rich sediments.	Both total and dissolved metals were detected though all dissolved values below CTR. Appears to receive bacterial pollution from tributary storm drains and contribute bacteria to the Exchange and Basin E. Stormwater within Oxford Retention Basin exceeded the WQO for bacteria stated in the TMDL.	Both total and dissolved metals were detected though all dissolved values were below the CTR. Dry weather flows are diverted from Oxford Retention Basin. May be a reservoir for bacteria. One exceedance at ORB D-2 for total coliform and enterococcus exceeded the WQO for bacteria stated in the TMDL.
Exchange	Not Applicable	Both total and dissolved metals were detected and dissolved copper values were above the CTR. Appears to receive bacterial pollution from Oxford Retention Basin and contribute bacteria to Basin E. These sites exceed the WQO for bacteria stated in the TMDL.	Both total and dissolved metals were detected though all dissolved values were below the CTR. May receive bacterial pollution from the Oxford Retention Basin if conditions for bacteria regrowth in Oxford Retention Basin are optimal; though concentrations of bacteria in the exchange were below WQOs.
Basin E	Not Applicable	Both total and dissolved metals were detected and dissolved copper values were above the CTR. Appears to receive bacteria from the Exchange. These sites	Both total and dissolved metals were detected though all dissolved values were below the CTR with exception of dissolved copper at E-D-1. May receive bacterial

Table 14. Summary of Results

	Sediment Quality	Wet Weather Water Quality	Dry Weather Water Quality
		exceed the WQO for bacteria stated in the TMDL.	pollution from the Exchange if conditions for bacteria regrowth in the Oxford Retention Basin are optimal; though concentrations of bacteria in the Basin E were below WQOs.

Trace amounts of SVOCs (i.e., PAHs, base/neutrals, phthalates, and acid extractables), and chlorinated pesticides were found in the unconsolidated layer in the Oxford Retention Basin. Again, these results are consistent with those of the Marina del Rey Sediment Characterization Study, which found that concentrations of chlordane and PCBs were highest at the mouth of the Main Channel and were found only in very low concentrations in Basin E. Again, it has been postulated that a key source (e.g., Ballona Creek) is responsible for the majority of chlordane and PCBs in the main channel of the MdRH.

Indicator bacteria concentrations found in Oxford Retention Basin sediments in this study were comparable to those found in sediments at Mother's Beach during the *Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study* (WESTON, 2007). This study showed that enterococcus concentrations in sediments within Mother's Beach were generally low (the majority of samples were at the MDLs) and were not a significant source of contamination to the receiving water. However, at the deeper sediment depths, where nutrients and organics are higher and sediment is constantly below the water line, concentrations of enterococci were found to increase at Mother's Beach. These results are consistent with the results found within the Excavation Layer of the Oxford Retention Basin sediments where enterococcus concentrations were between 3 MPN/gram and 133 MPN/gram. The results suggest that sediments within the Oxford Retention Basin are not a significant source of indicator bacteria.

4.2.2 Water Column Conditions

4.2.2.1 Wet Weather Monitoring Conditions

During wet weather monitoring, four conditions were monitored within Oxford Retention Basin, including 1) pre-storm, 2) post-storm but immediately prior to stormwater discharges from Oxford Retention Basin, 3) during stormwater discharges from Oxford Retention Basin, and 4) after Oxford Retention Basin had been completely drained of stormwater (Table 14). Prior to the storm, physical observations and measurements indicated a freshwater lens was not present in either Oxford Retention Basin or Basin E. After the storm, a freshwater lens appeared in Oxford Retention Basin, but Basin E still appeared well mixed. A shallow freshwater lens developed in Basin E during the discharge of stormwater from Oxford Retention Basin and persisted for at least two hours post-discharge.

Prior to the storm event, all indicator bacteria were below TMDL WQOs (Table 14**)**. However, during the storm events, all indicator bacteria were detected at levels that exceeded WQOs within Oxford Retention Basin and at the tidal Exchange. Although bacterial concentrations were elevated, there was no difference between the concentrations observed at each of the monitoring locations, with the exception of enterococcus concentrations at the Boone Olive Pump Station. Enterococcus concentrations at this site were one to two orders of magnitude higher than those observed within the Oxford Retention Basin, Exchange and Basin E. These results suggest that Boone Olive Pump Station may be a contributing source of fecal indicator bacteria during wet weather. These results are consistent with observations from the Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study, which identified the Boone Olive Pump Station as a potential source of bacteria.

Nutrients and general chemistry were within expected ranges with no exceedances of COP objectives. As noted in the subsection below, the low nutrient concentrations may have been a causal link to the low bacterial concentrations observed in the water column.

There were detections for nearly all total and dissolved metals. There were exceedances of the WQO for one metal (i.e., dissolved copper at the tidal Exchange and in Basin E), which could contribute to concentrations of dissolved copper in Oxford Retention Basin.

PAHs, PCBs, TPH, VOCs, and base/neutral-extractable compounds (phthalates) were detected at low levels below WQO. Acid-extractable compounds and chlorinated pesticides were not detected in stormwater samples.

4.2.2.2 Dry Weather Monitoring Conditions

During dry weather monitoring, two conditions were monitored within Oxford Retention Basin (i.e., 1) ebbing tide and 2) flooding tide). During the ebbing tide, a freshwater lens was present within Oxford Retention Basin, but this lens was not apparent in Basin E. During the flooding tide, a freshwater lens was only apparent in the western portion of Oxford Retention Basin (Station ORB-A); a freshwater lens had also developed in Basin E. In both cases (i.e., Oxford Retention Basin during ebbing tide and Basin E during flooding tide), it was assumed the freshwater lens was from nuisance flow, but this study's results regarding nuisance flow origin (i.e., either from Oxford Retention Basin or Basin E) and potential transport mechanisms were inconclusive. Note that construction of the Washington/Thatcher low flow diversion and Marina del Rey low flow diversion systems was completed at the two primary stormwater conveyances in Oxford Retention Basin in January 2007 and January 2010, respectively. The Marina del Rey low flow diversion system was completed prior to the wet weather and dry weather monitoring events conducted as part of this study.

During both ebbing and flooding tide sampling events, all indicator bacterial concentrations during dry weather were low relative to the wet weather event and were near detection limits with the exception of one sample in Oxford Retention Basin during the flooding tide (Table 14). Total coliforms and enterococci in this sample exceeded WQOs. Analysis results of the Exchange water and Boone Olive Pump Station water quality showed bacteria concentrations below WQOs. These results are not consistent with observations from the Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study, which showed dry weather indicator bacteria concentrations consistently exceeding WQOs. Although it is difficult to draw conclusions from only one monitoring event, this may due to the completion of the dry weather diversion in Oxford Retention Basin.

Nutrients and general chemistry were within expected ranges with no exceedances of COP objectives. As noted in the subsection below, the low nutrient concentrations may have been a causal link to the low bacterial concentrations observed in the water column.

With the exception of one sample, all total and dissolved metals were detected at concentrations below COP WQOs. There were no exceedances of WQOs for total and dissolved metals within the Oxford Retention Basin. Dissolved copper exceeded WQOs in one sample collected from Basin E at concentrations five times higher than those from the Oxford Retention Basin. These results suggest that Oxford Retention Basin is not a contributing source of metals during dry weather.

PAHs, PCBs, TPH, VOCs, base/neutral-extractable compounds (phthalates), and chlorinated pesticides were detected at low levels below WQO. Acid-extractable compounds were not detected in dry weather samples.

4.2.2.3 Overall Summary of Water Quality Conditions

With the exception of fecal indicator bacteria, sediment and water quality results are comparable to other studies conducted in MdRH, and demonstrate that Oxford Retention Basin and the Boone Olive Pump Station are not contributors of metals and toxics during dry weather and wet weather.

Contrary to the Mother's Beach and Back Basins' Bacteria TMDL Non-Point Source Study conducted in 2007, this study did not find higher concentrations of fecal indicator bacteria in the Oxford Retention Basin compared to concentrations in Basin E during wet weather. The 2007 study was conducted with temporally and spatially intensive sampling during dry weather and wet weather and provides a robust dataset for comparison. The study concluded that, due to low flushing, bacterial contamination was site specific within MdRH, and each basin was found to have its own local sources of bacteria. Basin E was identified as having the most complex contamination issues with both direct and in-direct sources, including birds, irrigation, the influence of Oxford Retention Basin and the Boone Olive Pump Station. A significant emphasis was placed on the impact of the Oxford Retention Basin and Boone Olive Pump Station with most bacterial exceedances occurring in direct proximity to the discharge point from Oxford Retention Basin. In addition, a rudimentary Excel-based model was prepared, which calculated potential bacterial load transfer between Oxford Retention Basin and Basin E. Overall, the 2007 study identified Oxford Retention Basin as a key contributing source of bacteria.

In contrast, this present study found lower than expected bacterial concentrations in the water column and sediments as well as unconsolidated sediments and low nutrients. These conditions suggest that bacterial survival and growth in Oxford Retention Basin was nutrient-limited at the time of sampling. The impact of nutrients, freshwater inputs and circulation can have significant repercussions on bacterial survival. The discrepancy in results may be explained in part by the temporal and spatial characteristics impacting indicator bacteria growth. Conditions within the Oxford Retention Basin on the day of sampling do not suggest the presence of a large reservoir within the water column. However, seasonal and spatial effects can change very rapidly with increases in nutrients, algae and decreases in UV penetration causing increases in bacterial growth. In addition, the completion of the Washington/Thatcher low flow diversion system and Marina del Rey low flow diversion system may assist in reducing inputs of indicator bacteria during dry weather.

To better control season and spatial fluctuations in bacterial growth, a increased circulation within the Oxford Retention Basin may be implemented. Increased circulation has the benefit of introducing more oxygen into the water column, maintaining an aerobic sediment structure and reducing algal growth. All these factors can assist in providing a steady state, rather than a fluctuating, environment that would reduce the risk of bacterial proliferation.

4.3 Objective 3

Determine the organic composition of sediment to examine and evaluate the feasibility of bioremediation.

Samples collected from the unconsolidated layer of sediment contained 58–66% solids, 4.1–5.6% TOC, and 724–1,110 mg/kg total organic nitrogen (TON) (calculated as TKN – ammonia-N).

There are several operational parameters that need to be considered with use of bioremediation as a treatment strategy for decreasing the organic carbon load of the Oxford Retention Basin. After discussions regarding the goodness-of-fit of microbial augmentation with Pro-Act Biotech (Warren, Rhode Island) and AquaBio Environmental Technologies, Inc. (Marina del Rey, California), TOC, DO, BOD, nutrients (i.e., ammonia, nitrate, phosphorus, etc.), vertical depth of the targeted sediments, overlying water depth, and operation of flow-control structures must be considered during an evaluation of this technology as a treatment option. If bioremediation successfully decreased all the available carbon within the excavatable layers, only a 3% decrease in mass would be realized. In other words, as a technology to solely decrease sediment mass in this basin, there would not be much 'bang for the buck.' However, addition of the right microorganism blend to this system would out-compete resident algae and bacteria populations for available nutrients in the sediments and stormwater influent and subsequently decrease their potential to be a nuisance to water quality in Oxford Retention Basin and Basin E.

Additional benefits to this system from bioaugmentation include but are not limited to decreased nutrient loads, increased oxygen concentrations in overlying waters, decreased odors, and a small increase in storage capacity. Algae fix carbon, using available oxygen to respire carbon dioxide into the water column and during eutrophic conditions can deplete oxygen concentrations below potentially harmful thresholds to resident biota within a confined basin. Introduction of microorganisms (that do not fix carbon dioxide) to the basin twice a year would suppress potential algae blooms and decrease the potential of oxygen depletion in the system. Additionally, without a large die-off of algae biomass in the fall/winter providing a pulse of carbon for decay, associated odors (due to ammonia, hydrogen sulfide, and methane) would decrease. If microorganisms were used for algae control in this system, chlorophyll concentrations could be monitored over time to measure treatment performance. Addition of this type of microorganism blend does not require additional supplements and or operational changes (e.g., discharge gate closure, and aeration) to the system and could be applied by current personnel with minimal training and health and safety concerns.

Stormwater contaminants (i.e., PCBs, chlordane, copper, lead, zinc, and nutrients) transported to the Oxford Retention Basin may be sequestered within the basin's sediments via sedimentation, precipitation, adsorption, and absorption and other transfers and transformations. Within a natural engineered treatment system, these contaminants may be simultaneously transferred to basin sediments and vegetation and/or transformed to less mobile chemical species. Adsorption to natural organic matter (NOM) and organic carbon is expected to be the primary transfer pathway of PCBs, organochlorine pesticides, and metals from the stormwater to sediments of this treatment system. Metals (e.g., copper, lead, and zinc) have a lithic biogeochemical cycle and have a predisposition to return to freshwater and marine sediments, especially when organic material is available for adsorption. Metals may also be absorbed by resident biota (e.g., hyperaccumulaters) and/or precipitate from the water to sediments depending on the hydrodynamics and ionic strength of the engineered system. If not utilized, sedimentation will also facilitate transfer of nutrients (N and P) to basin sediments. However, low concentrations of nitrogen and phosphorus flushing into this system should be quickly used by algae, bacteria, and floating vegetation in the system.

Speciation or a change in the oxidation state of dissolved metals is the primary transformation facilitated in a potential treatment system designed for stormwater mitigation. PCBs and organochlorine pesticides will biodegrade, but typically this transformation process occurs over the course of several years. Overall, several characteristics (i.e., pH, hardness, redox, and alkalinity) within the basin must be stabilized and maintained in order for these transfers and transformations to initially occur and be sustainable over time.

As previously discussed in Section 3 (Results), the SEM:AVS method is often used to determine the potential toxicity and speciation of divalent metals (i.e., copper, lead, and zinc) in a sediment sample. This method is based on the theory that AVS binds to divalent cationic metals and forms metal-sulfide complexes. Because these metal-sulfide complexes have low water solubility, they will subsequently precipitate to the sediments of the treatment system. Therefore, the ratio of SEM to the concentration of AVS in a sample may be measured to determine the metal speciation occurring within the basin's sediments. If SEM is higher than AVS (SEM:AVS ratio greater than 1), then some portion of the metals are not bound by AVS and probably in their ionic (i.e., dissolved) form. If SEM is less than AVS (i.e., SEM:AVS ratio is less than 1), then metal concentrations are bound to AVS within the sediments and in their precipitated form (i.e., salt or chelation).

The results from this study indicate that the current basin system is not engineered to maintain the chemical characteristics necessary to facilitate these desired transfers and transformations for the stormwater contaminants of concern. Neither the Oxford Retention Basin (excavated and consolidated sediments) nor Basin E had organic carbon (i.e., DOC and TOC) concentrations required for both adsorption and sufficient bacterial activity to decrease the system's redox for subsequent AVS production.

Confirmation of these results were indicated by SEM:AVS ratios greater than one in both excavation and consolidated sediment layers throughout the basin system. Remember, ratios greater than one indicate that AVS concentrations are insufficient for chelation of total metal concentrations and thus dissolved metal species are likely within the engineered system. Additionally, a significant increase in metals, PAHs, organochlorine pesticides, PCBs, and other hydrophobic contaminants concentrations were measured in the excavated layers of these basin sediments compared to consolidated sediments due to significantly higher organic material loads.

There are several factors to consider in the design of a natural engineered treatment system for these potential stormwater contaminants, as follows:

- Redox within the Oxford Retention Basin is probably positive due to tidal flushing and unpredictable stormwater events, thus a consistent overlying water depth is not maintained.
- Inputs of organic material are lost from the basin during daily, tidal flushing events.
- Hydraulic retention time and other hydrodynamic characteristics of these stormwater events have not been sufficiently modeled and correlated with the desired fate processes of these contaminants.
- The contaminants of concern have a predisposition to adsorb to organic matter, thus are transported with the organic materials out of the retention basin during these tidal events.
- Although native biota are present within the basin, these species may be antagonistic to the desired sediment characteristics required for this treatment system and its fate processes. Additionally, vegetation absorbs nutrients and other contaminants at varying rates depending on life-stage of the population. An appropriate operation and maintenance program should be designed and implemented to maintain optimal removal performance.

Recommendations to be considered include:

- Perform a cost–benefit analysis of bioaugmentation for algae control compared to other chemical treatment options and request proposals from qualified vendors.
- Review the literature for natural engineered treatment systems located in tidally influenced areas that mitigate comparable contaminants.
- Model the potential fate processes (i.e., transfers and transformations) of the contaminants of concern and prioritize those processes that are synergistic for this system.
- Quantify and model the treatment system for mass loading of organic material compared to contaminants.
- Review the hydrodynamics of the treatment system compared to the desired water and sediment quality characteristics.
- Inventory native vegetation species and perform a literature review for species that will facilitate desired water and sediment quality characteristics as well as potential hyperaccumulaters.

4.4 Objective 4

Characterize water quality conditions in Oxford Retention Basin in relation to the compliance requirements of the Bacteria and Toxics TMDLs for Basin E within MdRH.

4.4.1 Bacteria Total Maximum Daily Load

The MdRH Marina Beach and Back Basins' Bacteria TMDL established bacterial compliance targets and waste load allocations (WLAs) based on the numeric targets set under the Assembly Bill 411 health standards. The TMDL WLAs are expressed as allowable exceedance days or the maximum number of days where sampling results can surpass the established Assembly Bill 411 standards without exceeding the limits in the Bacteria TMDL. The indicator bacteria standards for the TMDL are presented in Table 15.

Table 15. Total Maximum Daily Load Compliance Limits

	Rolling 30-Day Geometric Mean Limit*	Single Sample Limit
Total coliforms	1,000 MPN/ 100 mL	1,000 MPN/ 100 mL if fecal > 10% of total, or 10,000 MPN/100 mL**
Fecal coliforms	200 MPN/100 mL	400 MPN/100 mL
Enterococci	35 MPN/100 mL	104 MPN/100 mL

*30-day limit is based on the geometric mean of 30 sample days. For days without sampling, the result for that day is applied to the remaining days of the week until the next sample event (excluding wet weather days).
**The total coliform single sample limit of 10,000 MPN decreases to 1,000 when the fecal coliform value is greater than 10% of total coliform value.

The Bacteria TMDL is divided into the following three defined seasons:

- *Summer Dry* – April 1 to October 3.
- *Winter Dry* – November 1 to March 31.
- *Wet Weather* – Year-round wet weather (defined as days of 0.1 inch of rain or more plus three days following the rain event).

Each season has its own compliance dates, requirements, and limits as provided in Table 16.

Table 16. Total Maximum Daily Load Compliance Targets

Compliance Categories	Compliance Dates	Compliance Days/Year
Summer dry weather	April 1–October 31	0 days per year (daily and weekly sampling)
Winter dry weather	November 1–March 31	3 days per year (daily sampling) 0 days per year (weekly sampling)
Wet weather	Rain event ≥ 0.1 inch at LAX rain gage, and three days following the end of the rain event	17 days per year (daily sampling) 3 days per year (weekly sampling)

In this study, bacteria samples were collected during both winter dry conditions (March 2010) and wet conditions (January 2010).

During wet weather, six of the nine bacterial water samples collected exceeded the Bacteria TMDL compliance targets. Compliance points for the TMDL are located in Basin E, where four samples were collected during wet weather. Of these, three of the four enterococcus samples exceeded the TMDL compliance targets while two of the four exceeded the fecal coliform and total coliform targets set out in the TMDL. Given these data, the discharges from Oxford Retention Basin and the Boone Olive Pump Station have an influence on TMDL compliance in Basin E.

During dry weather, one sample within Basin E, out of a total of seven sample locations, exceeded the Bacteria TMDL compliance targets for enterococci and total coliforms. Due to the limited temporal and spatial sampling undertaken in this study these results are inconclusive. However, analysis of the historical data collected in Marina del Rey, undertaken in the *Marina del Rey Harbor Mother's Beach and Back Basins' Indicator Bacteria TMDL Compliance Study* (WESTON, 2008b) indicated the following:

- TMDL compliance targets were mostly met with the exception of compliance monitoring stations during summer dry weather sampling events.

Station Type	**□ within TMDL Compliance Targets**		
	Summer Dry Weather	**Winter Dry Weather**	**Wet Weather**
Compliance Monitoring	22□	89□	78□
Ambient Monitoring	80□	100□	100□

- Analysis of historical data showed that all stations exceeded the TMDL single sample compliance targets, although only four stations would have met the criteria for SWRCB §303(d) listing. Due to this difference in assessment methodology, the TMDL compliance targets are expected to be more difficult to achieve than meeting the SWRCB §303(d) listing policy.

4.4.2 Toxics Total Maximum Daily Load

Numeric targets for the Toxics TMDL were used to calculate WLAs for the impairing metals and organic compounds, and/or to indicate attainment of numeric limits (Table 17).

Table 17. Numeric Targets for Sediment Quality in the Marina del Rey Back Basins

Organics	Numeric Target for Sediment
Chlordane	0.5 µg/kg
Total PCBs	22.7 µg/kg
Copper	34 mg/kg
Lead	46.7 mg/kg
Zinc	150 mg/kg

The CTR criterion for the protection of human health from the consumption of aquatic organisms was selected as the final numeric target for total PCBs in the water column (Table 18). The interim numeric target is applied until advances in technology allow for the ultra-low detection of PCBs.

Table 18. Numeric Targets for Total Polychlorinated Biphenyls in the Water Column

	Numeric Target (µg/L)
Interim	0.03
Final	0.00017

Sediment
Data collected from Oxford Retention Basin showed that sediment Toxics TMDL compliance targets were not met for copper (101.9 mg/kg and 157.7 mg/kg), lead (306.3 mg/kg and 359.6 mg/kg), or zinc (459.2 mg/kg and 481.2 mg/kg) in the unconsolidated sediments. Total PCB concentrations were also higher than Toxics TMDL compliance targets in the unconsolidated sediments. The two sediment samples collected in the unconsolidated sediments had total PCB concentrations of 118.7 µg/kg and 269.8 µg/kg.

The implications for compliance with the Toxics TMDL are that Oxford Retention Basin may present a source of metals if those sediments were to be transferred into Basin E.

Water
Data collected from the Oxford Retention Basin during wet weather showed that concentrations of total PCBs ranged from 1.9 ng/L through 12.8 ng/L. The interim compliance target is 30 ng/L. Therefore, PCB concentrations in the water column during wet weather comply with Toxics TMDL compliance targets. During dry weather, total PCBs ranged from 0.3 ng/L to 11.1 ng/L again in compliance with Toxics TMDL targets.

4.4.3 Summary

Water and sediment quality, as it related to the Toxics TMDL, does not indicate that Oxford Retention Basin is a key contributor to exceedances in Basin E. However, during wet weather, the impact of Oxford Retention Basin, when all historical data are viewed as a whole, does have an impact on Basin E in terms of compliance with the Bacteria TMDL. In addition, while the bacteria results of dry weather monitoring in this study were low, data collected historically indicate that dry weather flows from Oxford Retention Basin will impact Basin E and will cause compliance issues in terms of the Bacteria TMDL. However, with the recent completion of the Washington/Thatcher low flow diversion system and Marina del Rey low flow diversion system in Oxford Retention Basin, further monitoring to be considered to determine if dry weather flows into Oxford Retention Basin may still impact Basin E or if the system will benefit (i.e., reduce indicator bacteria concentrations) the water quality within the Basin.

4.5 Objective 5

Satisfy the necessary requirements to evaluate the disposal options for sediment removal from Oxford Retention Basin.

4.5.1 Classification of Sediments

Sediment chemistry results were compared to the TTLC and ten times the STLC values. Briefly, TTLC and STLC values are published in Title 22 of the State of California Code of Regulations and are the benchmark for determining whether a solid, or its leachate, respectively, exhibits the characteristics of toxicity, thereby causing it to be classified as hazardous. If bulk chemistry values exceed ten times the STLC, it does not definitively classify the material as hazardous; rather, it suggests those analytes have the potential to exceed the STLC after conducting the WET. None of the analytes exceeded TTLC criteria; however, two analytes did exceed the ten times STLC criteria. These were chromium and lead. These data suggested the potential for leachate from these samples to exhibit the characteristics of toxicity, specifically from chromium and lead. Chromium exceeded in four samples (both composite samples representing the unconsolidated layer, and two individual station samples (S2 and S4) representing the consolidated layer). Lead only exceeded in two samples (both composite samples representing the non-unconsolidated layer).

Further analyses of these samples using the WET showed that chromium and lead results (4.4 mg/L and 2.4 mg/L, respectively) for sample S-1-5-EL, collected from the excavation layer, did not exceed STLC criteria (5 mg/L for both metals) and is therefore classified as non-hazardous material. On the other hand, the WET confirmed that chromium and lead results (5.5 mg/L and 5.3 mg/L, respectively) for sample S-6-10-EL, collected from the excavation layer, exceeded STLC criteria for both metals and is therefore classified as hazardous material as defined by the State of California. Material classified as (California) hazardous must be disposed of at approved facilities such as Clean Harbors Facility in Buttonwillow, California; Chemical Waste Management Facility in Kettleman City, California; or United States Ecology Facility in Beatty, Nevada. Material classified as non-hazardous may be disposed of at approved facilities such as Otay Landfill in Chula Vista, California.

Sediment was also subjected to TCLP tests. Briefly, the TCLP values are published in the Code of Federal Regulations (40 CFR §261.24) and are the federal benchmark for determining whether the leachate from a solid would be classified as toxic and, therefore, hazardous. None of the analytes exceeded published TCLP criteria. Therefore, the material would not be classified as hazardous under federal guidelines.

4.5.2 Volume of Material to be Excavated

Using the descriptions from our core logs, the unconsolidated layer depth for each station location was input into the geographic information system (GIS) project file and excavation volumes were calculated. Since multiple cores were collected at each station, a minimum volume (based on the thinnest layer of unconsolidated material observed in cores taken from each station), a maximum volume (based on the thickest layer of unconsolidated material observed in cores taken from each station), and an average volume (based on the average thickness of unconsolidated material observed in cores taken from each station) was calculated using the method described below.

Data from the ten core sample locations within the Oxford Retention Basin were used in an interpolation procedure to create a surface for the Oxford Retention Basin area that represented the unconsolidated layer depth. Three different surfaces were created that represented the minimum, maximum and mean depth of the unconsolidated layer based on the sediment data collection. The interpolation method used was Inverse Distance Weighted (IDW). The IDW interpolation implements the assumption that points that are close to one another are more alike than those that are farther apart. Therefore, to predict a value for any unmeasured location, IDW used the measured values surrounding the prediction location. Those measured values closest to the prediction location had more influence on the predicted value than those farther away. Cell values in the grid were determined using a linearly weighted combination of a set of sample points in which weight is a function of inverse distance. IDW is an exact interpolator meaning that the predictions will be exactly equal to the data value at locations where data has been input, and predicted values will not fall outside the range of the data input values.

For each of these depth estimates, a volume was calculated using the 3D Analyst Surface Analysis function, which calculates area and volume for a surface above or below a reference plane at a specified height. The height of the reference plane was set to zero, and statistics were calculated for the area above the plane.

There were no assumptions required of the data for IDW. Therefore, the measured values rather than a transformation of the data were used for this set of interpolations. The resulting grid values were then classified by multipliers of the effects range–low (ER-L) threshold. It should be noted that with IDW, there was no assessment of prediction errors, and IDW can produce bull's eyes around data locations as noted in some of the maps.

Based on this GIS exercise, the following estimated volume of material is to be removed:

- The minimum volume of material to be removed is 5,281 cy (142,600 ft^3).
- The maximum volume of material to be removed is 10,896 cy (294,200 ft^3).
- The average volume of material to be removed is 7,982 cy (215,500 ft^3).

4.5.3 Estimated Disposal Costs

Cost estimates associated with the transportation and disposal of hazardous unconsolidated sediments from Oxford Retention Basin to the Clean Harbors Facility in Buttonwillow, California are based on the following assumptions:

- Approximately 4,000 cy (108,000 ft^3) of hazardous material. Since composite sample S-6-10-EL exceeded STLC criteria for both chromium and lead, approximately half of the proposed volume of unconsolidated sediments to be removed from Oxford Retention Basin (4,000 cy) can be assumed to be comprised of hazardous material.
- A transportation and disposal cost of $85/ton (2,000 pounds) of material.
- A conservative weight estimate of 100 pounds/ft^3 for the excavated material.

The estimated total cost to dispose of 4,000 cy of hazardous sediment at the Clean Harbors Facility is $459,000. Costs to excavate the material are not included in this estimate.

Cost estimates associated with the transportation and disposal of non-hazardous dredged material from Oxford Retention Basin to the Otay Landfill in Chula Vista, California are based on the following assumptions:

- Approximately 4,000 cy (108,000 ft^3) of non-hazardous material. Since composite sample S-1-5-EL did not exceed STLC criteria for either chromium or lead, approximately half of the proposed volume of unconsolidated sediments to be removed from Oxford Retention Basin (4,000 cy) can be assumed to be comprised of non-hazardous material.
- A transportation and disposal cost of $45/ton (2,000 pounds) of material
- A conservative weight estimate of 100 pounds/ft^3 for the excavated material.

The estimated total cost to dispose of 4,000 cy of non-hazardous sediment at the Otay Landfill is $243,000. Costs to excavate the material are not included in this estimate.

The total estimated cost to dispose of approximately 8,000 cy of sediment from Oxford Retention Basin (4,000 cy of hazardous material + 4,000 cy of non-hazardous material) is $702,000.

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