

November 13, 2012

Mr. Rob DuBoux, Esq., PE
Senior Civil Engineer
City of Malibu
23825 Stuart Ranch Road
Malibu, CA 90265

**Subject: Broad Beach Road Biofiltration Project, Preliminary Design Report
Addendum**

Dear Mr. DuBoux,

Geosyntec submitted a Preliminary Design Report (PDR) to the City of Malibu (City) on April 16, 2012 for the Broad Beach Road Biofiltration Project (the Project). The PDR described project objectives and presented two design alternatives. Around this same time, a Settlement Agreement between the City and the Santa Monica Baykeeper and the National Resources Defense Council (Case No.: CV 08-1465-AHM (PLAx)) imposed additional stormwater best management practices (BMPs) and water quality requirements on the City's Broad Beach Road drains. The purpose of this letter is to document the proposed revisions to the PDR, addressing these Settlement Agreement requirements. The letter lists the original project objectives, describes the additional requirements of the Settlement Agreement, proposes changes to the PDR required for compliance, and describes the implications to project cost.

BROAD BEACH BIOFILTRATION PROJECT OBJECTIVES

As set forth in the April 16, 2012 PDR, the original objectives of the Broad Beach Road Biofiltration project are:

- Eliminate dry weather flows to the storm drain;
- Reduce wet weather flows to the storm drain (as feasible);
- Improve water quality of wet weather flows to the storm drain to the maximum extent practicable;
- Reduce potable water use for irrigation (as feasible);
- Restore habitat above Broad Beach Road (as feasible);
- Reduce slope erosion (as feasible); and
- Preserve street and visitor parking.

In the PDR, Geosyntec proposed two stormwater management alternatives. Alternative 1 used biofiltration, vegetated swales, concrete pavers, retaining walls, irrigation system removal/replacement, and habitat restoration. Alternative 2 included all the design elements of Alternative 1 but also incorporated a stormwater storage and reuse system for landscape irrigation. The City selected design Alternative 2. In this PDR Addendum, we propose changes to design Alternative 2.

SETTLEMENT AGREEMENT REQUIREMENTS

In general, the Settlement Agreement requires the City to improve the quality of the Broad Beach Road stormwater runoff. The agreement requires treatment and monitoring to demonstrate a reduction in the number of noncompliant stormwater discharges – the focus of the Settlement Agreement is reduction of fecal indicator bacteria (FIB) to the ocean drains. The details of these Settlement Agreement requirements as they apply to the Project are described below.

1. Stormwater discharge must be monitored for FIB.
2. Samples must be collected at BMP inlets and outlets.
3. Surface overflow (untreated) and underdrain flow (treated) must be combined and sampled together.
4. During dry weather, flow/no flow conditions to catch basins must be continuously monitored.
5. During wet weather, at least 50% of discharges from each of the following storms must be sampled:
 - o 0.10-0.25 inches,
 - o 0.25-0.50 inches, and
 - o greater than 0.50 inches.

ASBS Malibu Drain 2 (Drain 2) is an additional catch basin west of the original eight catch basins that must be added to the project and is subject to the above-listed requirements.

The Settlement Agreement requires five representative catch basins within the new project area be selected by the City for monitoring. Of those five catch basins, three must be monitored concurrently. Each year, the three monitoring locations will be rotated between the five selected catch basins.

PROJECT DESIGN REVISIONS

The proposed revisions to the project design include:

- Modifications to the design of the biofilters with the addition of stormwater monitoring; and
- the addition of a treatment and monitoring design for Drain 2.

The Modifications to the Biofiltration Design section describes the design approach to reduce the number of stormwater discharges containing potentially non-compliant concentrations of FIB and an approach to monitor stormwater influent and effluent water during discharge events. The Malibu Drain 2 section describes the site characteristics, hydrology, design alternatives, and provides design recommendations for Malibu Drain 2.

Modifications to the Biofiltration Design

The Settlement Agreement establishes numerical criteria for both the concentration of FIB in stormwater discharge and for the number of noncompliant discharges (i.e., discharges that exceed the FIB concentration criteria) that may occur each year. Geosyntec proposes biofiltration with bioretention to provide the best opportunity to comply with the agreement requirements. Biofiltration has been demonstrated to reduce the concentration of FIB in stormwater discharge. Bioretention is thought to enhance bacterial removal, while storing water and thus reducing the number of discharge events per year.

In the PDR, the biofilters were sized based on the storm water quality design volume (SWQDv). The biofilters were designed as flow-through devices and a portion of the total volume of water storage in each filter was planned to be ponded at the biofilter surface. This was considered acceptable because the ponded water would only occupy that biofilter surface for a short time and would ultimately drain out of the filter after each storm event. The filters are now planned to function as bioretention vessels and the presence of ponded water on the filters for extended periods of time would be problematic, both for safety and for vector control. We continue to use the calculated SWQDv as the design basis for each biofilter but have lowered the high-water level in the filters to reduce surface ponding. This change required that the size of each filter be increased, to address the loss of water storage volume that was represented by the planned ponding of water. The biofilters are now planned to be deeper and to occupy larger surface areas. Table 1 summarizes these new biofilter areas.

To function as bioretention devices and meet the goal of reducing the number of stormwater discharges, the filling and emptying of the biofilters must be regulated. This will be accomplished by installation of a wet sump within the biofilter, fitted with a sump pump and level controls. A typical profile and section of the biofilters is shown in Figure 1. At the high-water-level set point of the biofilter, the sump pump would be automatically cycled, emptying

the biofilter and readying it to receive additional stormwater. The biofilter would also be constructed with an overflow pipe to prevent flooding, should the biofilter be inundated or in the event of pump failure. Figure 2 illustrates the design flow schematic. Catchments 2, 3, 4, 5, and Drain 2 were selected for monitoring. Applying historical precipitation data to this design, we calculate that the biofilters would discharge approximately 15 times per year.

Stormwater Monitoring

To satisfy the monitoring requirements of the Settlement Agreement, additional stormwater monitoring and sampling equipment will be included in the design. Each of the Settlement Agreement monitoring requirements is listed below, followed by a description of how the design will be modified to accommodate the requirement.

- *Requirement 1 - Stormwater discharge must be monitored for FIB.* The design will include automated sampling equipment that will have the ability to sense system flow and collect water samples at the biofilter inlets and outlets. System flow will be detected by a weir and bubbler (water level indicator) in the sampling manhole. Collected samples can be submitted to a laboratory for FIB testing.
- *Requirement 2 – Samples must be collected at BMP inlets and outlets.* Two automated sampling devices will be installed at each monitored biofilter, one for BMP inlet water (influent) and one for BMP outlet water (effluent). Also see response to Requirement 1.
- *Requirement 3 - Surface overflow (untreated) and underdrain flow (treated) must be combined and sampled together.* The biofilter overflow and treated underdrain flow will be combined downstream of the biofilter in a sampling manhole prior to discharge.
- *Requirement 4 - During dry weather, flow/no flow conditions to catch basins must be continuously monitored.* The sampling manhole (See Requirement 3 above) will be fitted with a weir and water level indicator, providing data on flow from the biofilter and verification of the “no flow” condition during dry weather. A water level sensor will also be installed in each biofilter wet well to monitor biofilter water level and inform the City as to the accumulation of water during both the wet and dry seasons.
- *Requirement 5 - During wet weather, at least 50 percent of discharges from the following storms must be sampled:*
 - *0.10-0.25 inches,*
 - *0.25-0.50 inches, and*
 - *greater than 0.50 inches.*

Requirement 5 will be met by sampling 100 percent of the actual discharges from the biofilters. Because the biofilters act as bioretention devices, several small storms may be stored in the biofilter simultaneously and there will often be no discharge. When the biofilter reaches capacity, the entire biofilter water volume will be evacuated and the discharge will be automatically sampled. If the storm intensity exceeds the biofilter capacity, the biofilter will overflow untreated water and combine it with the treated effluent at the sampling manhole (see Requirement 3 above). This monitoring and sampling approach satisfies the wet weather sampling requirement by sampling all discharges.

The automated stormwater monitoring equipment will log the water levels in the biofilters, the water level (and detection of flow) in the sampling manhole, and the collection of biofilter influent and effluent samples. The system will issue an alert (cellular call) when samples are collected by the automated samplers. Logged monitoring information can be automatically uploaded to the internet and remotely accessed by City personnel or can be downloaded locally using a notebook computer. Automated monitoring equipment requires 110V power and a dedicated cellular communication connection. The monitoring equipment will be installed on a concrete apron and housed in a secure “igloo” type enclosure. The enclosure will be secured to the concrete apron to reduce theft and vandalism.

Malibu Drain 2

The Settlement Agreement added Drain 2 to the project and imposed the same monitoring and sampling requirements as the other drains. The City requested that Geosyntec add Drain 2 to this design project. The drain is located west of the other drains in the vicinity of 31611 Broad Beach Road. This section presents the following:

- A review of existing site characteristics;
- An updated biological assessment;
- A summary of the geotechnical investigation;
- A description of site hydrology;
- A Drain 2 conceptual design; and
- A summary of the recommended approach to stormwater monitoring.

Existing Site Characteristics

Drain 2 is west of the other eight drains – the area generally includes a hillside, three private residences, a road shoulder area with a small parking area, and the northern half of Broad Beach Road.

The hillside that separates Pacific Coast Highway (PCH) from Broad Beach Road is densely vegetated with trees, shrubbery, and mulched groundcover. The elevation difference between the top of the hillside and the edge of the road varies between 11 and 26 feet. The toe of the hillside is close to the edge of the road on the eastern half of the area and then moves away from the road at a parking turnout area and is located behind private residences. Geosyntec contracted with Peak Surveys, Inc. to conduct a field survey and mapping in the area tributary to Drain 2 to document site topography, drain inlet locations, laterals, and other utilities.

A small parking area for visitors and residents is located near the center of the drainage area. It is bounded by a 2-foot decorative retaining wall.

Existing utilities within the Drain 2 area include storm drain, a sanitary sewer force main, potable water, electricity, communications, and natural gas. DigAlert was called and utility owners marked their utilities within the project area. In addition, Geosyntec contracted with a private utility locating subcontractor to verify utility locations adjacent to the Drain 2 catch basin. No potholing was conducted. The utilities generally run along the length of Broad Beach Road, with service laterals crossing the street to the existing homes. The found utilities are presented in the Drain 2 Topography and Utilities Map in Appendix A.

Drain 2 itself is a catch basin situated on the north side of Broad Beach Road, approximately 1,500 feet west of the original project boundary. It is in a recessed area between the entrance and exit of a loop-shaped driveway in front of a private residence. Drain 2 has a six foot wide curb inlet. The drain has an 18-inch reinforced concrete pipe (RCP) penetrating the eastern wall of the structure that conveys stormwater from PCH and the private residence, and has a 24-inch RCP outlet pipe that flows to the south underneath Broad Beach Road towards the ocean. A photograph of the Drain 2 catch basin is included as Figure 3.

Biological Assessment Study Findings

The Biological Assessment was updated to include the Drain 2 area. The Assessment concluded that there are “no significant constraints or barriers to Project implementation.” The full report is included in Appendix B.

Geotechnical Investigation

A soils investigation was conducted to support the preliminary design for Drain 2. One shallow hand-auger boring was completed in the unpaved area adjacent to the drain. The results of the investigation conclude that there are no special geotechnical considerations which would restrict

the installation of the proposed facilities. The report for the Drain 2 geotechnical investigation is included in Appendix C.

Hydrology

The general topography tributary to Drain 2 is similar to the area for the other eight drains. The Drain 2 drainage area is west of the other eight drains, is not contiguous with the other drains, and extends approximately 820 feet along Broad Beach Road. It is bounded on the south by the centerline of Broad Beach Road, and bounded on the north by the top of the hillside along the south side of PCH. The total area is 1.65 acres, with 0.76 acres impervious and 0.89 acres pervious. The impervious area consists of mainly of asphalt pavement on Broad Beach Road and the residential structures and their associated hardscape. These estimates were developed using survey data and available aerial photos.

In the area of Drain 2, Broad Beach Road slopes from east to west. The majority of the runoff flowing to Drain 2 comes from the east side of the drain. Broad Beach Road is crowned such that runoff from the northern half of the roadway flows north toward the hillside and joins with hillside runoff in a local swale near the edge of road pavement. The flow then continues in the swale to the inlet of Drain 2. A small portion of the runoff comes from the west side of the drain, which includes runoff from the hillside behind the private residence north of the drain. This flow reaches the edge of pavement and flows in a swale eastward to the Drain 2 inlet. The existing drainage flow patterns and pervious and impervious areas are shown in Appendix D.

Conceptual Design Description

As presented in the PDR, the applicable stormwater permit for the project area is the Los Angeles County NPDES MS4. In the PDR, Geosyntec concluded that the Broad Beach treatment control BMPs should be designed for the 0.75 inch design storm event. The flow-based treatment shown in Appendix A of the Los Angeles County Department of Public Works' September 2002 edition of *Development Planning for Stormwater Management, A Manual for the Standard Urban Storm Water Mitigation Plan (SUSMP)*, was used to size the BMP at Drain 2. This approach is compliant with the sizing requirements of the MS4 permit for structural and treatment control BMPs for new development and redevelopment projects. This approach is consistent with the recommendations in the *City of Malibu Local Coastal Program Local Implementation Plan* and in the Special Protections of the proposed General Exception to the Ocean Plan. Although the Project is a storm water quality improvement project and does not formally qualify as a new development or redevelopment, this design criterion was selected for

the Project because the MS4 permit requires that pollutants in stormwater discharge be reduced to the maximum extent practicable.

According to the SUSMP, “post-construction structural treatment control BMPs can be designed to mitigate storm water runoff from either a volumetric treatment control BMP or a flow-based treatment control BMP.” Using the SUSMP’s *Appendix A, Volume and Flow Rate Calculations*, the peak mitigation flow rate was calculated. The peak mitigated flow rate, Q_{PM} , for the area tributary to Drain 2 was 0.15 CFS. This flow rate was used to size the treatment BMP. The details of these calculations are included in Appendix E.

Geosyntec proposes to use a commercial off-the-shelf stormwater treatment BMP for Drain 2. The Filterra Biofilter System or Filterra units are flow-through biological treatment devices that are optimized for a high volume/flow treatment rate and high pollutant removal. These units are not designed to retain stormwater for an extended length of time. The inherent advantages of this system over a conventional biofilter design are that they require a much smaller project footprint and have lower construction costs. The disadvantage for this project application is that nearly all storms will discharge from these treatment units and little water is retained.

The Filterra units consist of two precast concrete boxes, each with a 48” curb inlet. The inside of each box is filled with a proprietary media mixture called Bacteria, which is specifically designed for reducing bacteria in stormwater runoff. Beneath the media mixture is a drain rock layer and a perforated underdrain to convey the treated stormwater from the units. Each treatment unit has a tree/shrub well and an 8-inch recessed deck that will allow for a mulch bed, and/or plantings.

Stormwater runoff will be directed from the east and west swales to the 48-inch inlets of the two Filterra units for treatment. After percolating through the Bacteria media mix and the drain rock layer, the treated effluent from the Filterra unit flows through outlet pipes to a wet well structure. The Drain 2 invert is extremely shallow; the wet well invert is located at a lower elevation than the Drain 2 invert. Storms of significant intensity will be treated through the Filterra unit and flow to the wet well where water will accumulate to an elevation where it will gravity discharge to Drain 2. However, a significant residual amount of water will remain in the bottom of the wet well and in the bottom of the hydraulically-connected Filterra units. To evacuate this residual water, a small pump will be installed in the wet well. The low-volume pump will evacuate the wet well and Filterra units, rendering them ready for the next storm. Note the purpose of the pump is to slowly evacuate the wet well and Filterra unit at the end of the storm and not to

convey high volumes of stormwater through the system. The majority of the draining would occur by gravity flow.

Stormwater runoff exceeding the peak mitigated flow rate (exceeding the flow-through capacity of the Filterra units) will bypass the Filterra units and surface drain to a new grate inlet, flowing to the wet well. In the wet well, this overflow will combine with treated underflow from the Filterra units and flow to Drain 2. The preliminary design for the Drain 2 BMPs is included in Figure 4. The design flow schematic is included in Figure 5.

Stormwater Monitoring for Drain 2

Similar to the other project drains, the Settlement Agreement imposes monitoring and sampling requirements on Drain 2. The Settlement Agreement monitoring requirements are listed below, followed by a description of how the proposed Drain 2 design will satisfy each requirement.

- *Requirement 1 - Stormwater discharge must be monitored for FIB.* The Drain 2 design will include automated sampling equipment that will have the ability to measure storm size (rain gauge) and collect water samples at the Filterra unit inlet and from within the wet well. Collected samples can be submitted to a laboratory for FIB testing.
- *Requirement 2 – Samples must be collected at BMP inlets and outlets.* Two automated sampling devices will be installed at the Filterra units, one for inlet water sample collection and one for outlet water sample collection in the wet well. Also see response to Requirement 1. One Filterra unit inlet sample will be assumed to be representative of both units.
- *Requirement 3 - Surface (overflow) and underdrain (treated flow) must be combined and sampled together.* The Filterra unit overflow and treated underdrain flow will be combined in the wet well and can be sampled prior to discharge.
- *Requirement 4 - During dry weather, flow/no flow conditions to catch basins must be continuously monitored.* The wet well will be continuously monitored and logged using a bubbler-type water level indicator. All treated water drains to this wet well. If water accumulates in the wet well such that the wet well pump is actuated, indicating a discharge has occurred, the bubbler will log and document this discharge. This approach fulfills the continuous dry weather discharge monitoring requirement.
- *Requirement 5 - During wet weather, at least 50 percent of discharges from the following storms must be sampled:*
 - *0.10-0.25 inches,*
 - *0.25-0.50 inches, and*

- *greater than 0.50 inches.*

The automatic sampling equipment will be fitted with a rain gauge that will log the rainfall and trigger sampling. This will permit the City to sample the required number of storms from each storm intensity category.

The Drain 2 sampling equipment will issue an alert (cellular call) when samples are collected by the automated sampler. Logged monitoring information can be automatically uploaded to the internet and remotely accessed by City personnel or can be downloaded locally using a notebook computer. Automated monitoring equipment requires 110V power and a dedicated cellular communication connection. The monitoring equipment will be installed on a concrete apron and housed in a secure “igloo” type enclosure. The enclosure will be secured to the concrete apron to reduce theft and vandalism.

IMPLICATIONS OF PROPOSED CHANGES

The imposition of the Settlement Agreement requirements on the Project has resulted in cost increases related to item such as:

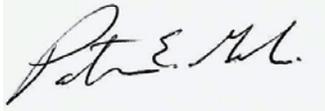
- Increases in biofilter size;
- Addition of sumps, wet wells, pumps, and controls;
- Addition of automated stormwater monitoring equipment;
- Requirement for electrical power at each pump and stormwater monitoring location; and
- The addition of all Drain 2 work.

The construction cost estimates from the PDR were revised to include the above-listed items, using the same estimating methodology as described in Section 7 of the PDR. The preliminary estimate of construction costs for Alternative 2 is \$2,503,000. Detailed cost estimates are presented in Appendix F.

November 13, 2012
City of Malibu
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Geosyntec appreciates the opportunity to provide this PDR Addendum. If you have any questions or comments regarding this addendum, please feel free to contact me at (916) 637-8334.

Sincerely,

A handwritten signature in black ink on a light blue background. The signature appears to read "P. E. Galvin" in a cursive style.

Patrick E. Galvin

Figures

1. Typical Biofilter Sections
2. Revised Flow Schematic for Original Project Area
3. Drain 2 Photograph
4. Drain 2 Preliminary Landscape and BMP Plan
5. Drain 2 Flow Schematic

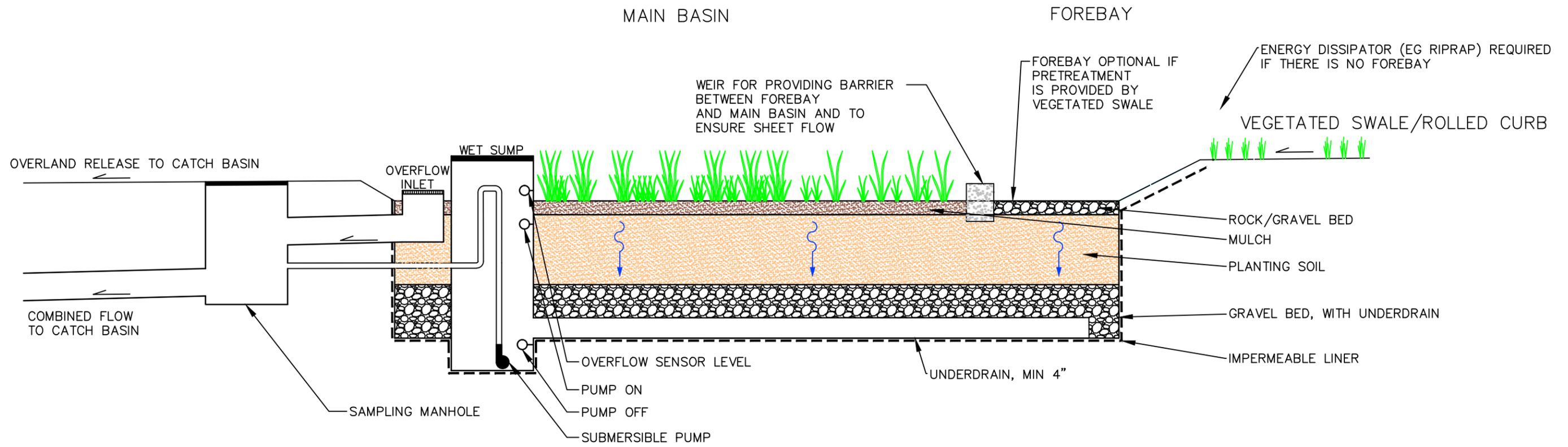
Tables

1. Design Biofilter Volume and Biofilter Design Surface Area

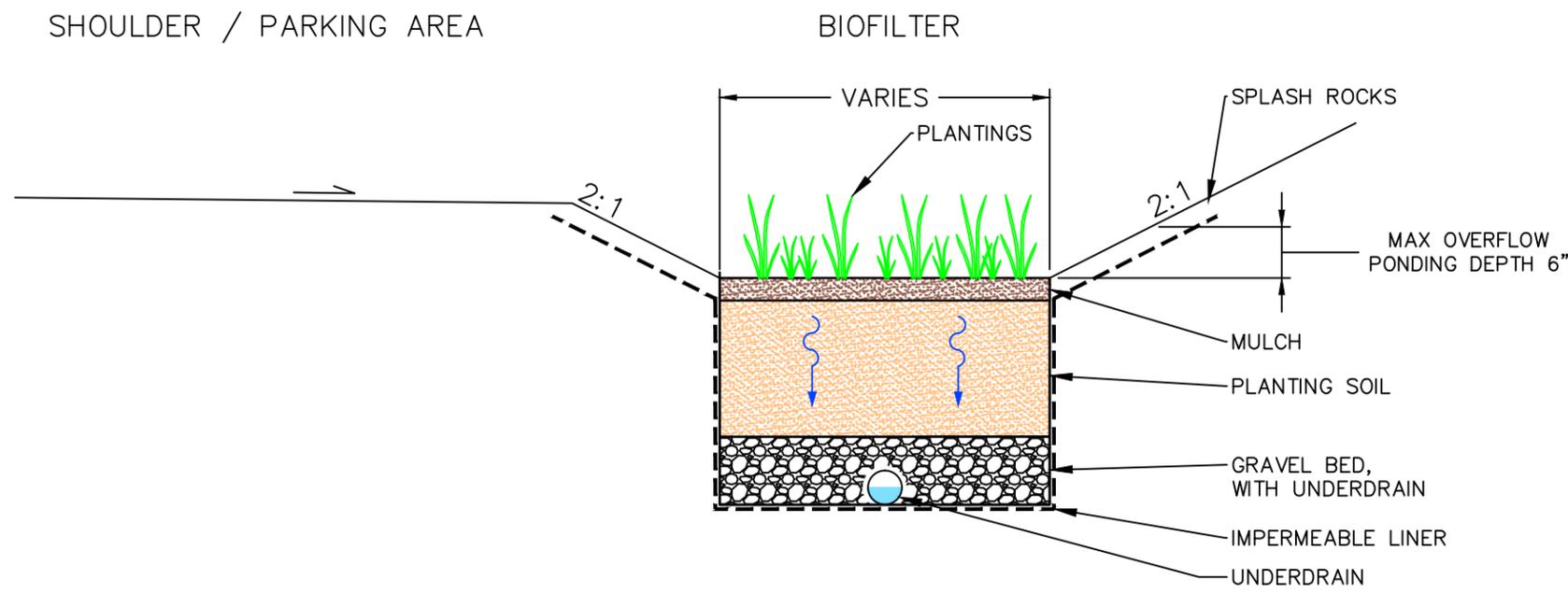
Appendices

- Appendix A – Drain 2 Topography and Utilities
- Appendix B – Drain 2 Biological Assessment Report
- Appendix C – Drain 2 Geotechnical Investigation Report
- Appendix D – Drain 2 Drainage Map
- Appendix E – Drain 2 Hydrology Calculations
- Appendix F – Construction Cost Estimate

FIGURES



BIOFILTER
TYPICAL LONGITUDINAL SECTION



BIOFILTER
TYPICAL CROSS-SECTION

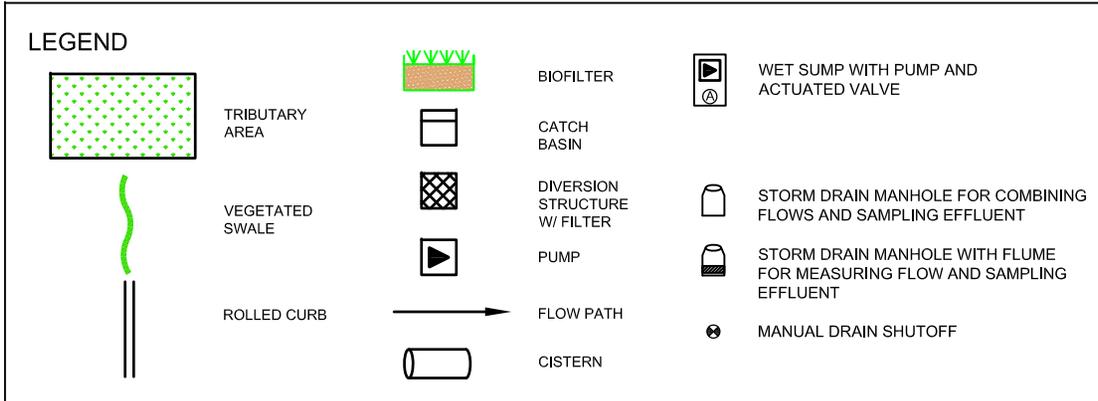
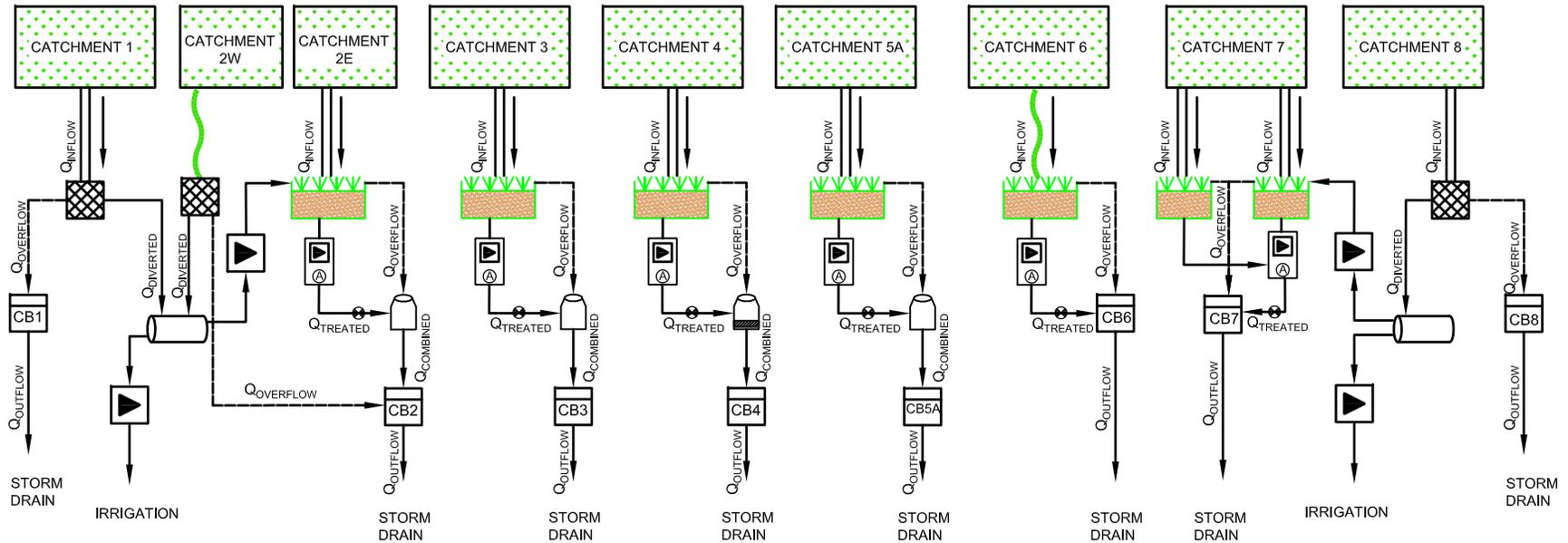
DETAILS ARE NOT TO SCALE

<p>TYPICAL BIOFILTER SECTIONS 10% DESIGN LEVEL PRELIMINARY DESIGN REPORT ADDENDUM BROAD BEACH ROAD BIOFILTRATION PROJECT CITY OF MALIBU</p>	
MALIBU, CALIFORNIA	NOVEMBER 2012

FIGURE
1

P:\CADD\LA0245 MALIBU BROAD BEACH\REVISED BMP DETAILS

ALTERNATIVE 2



REVISED FLOW SCHEMATIC
 PRELIMINARY DESIGN REPORT ADDENDUM
 BROAD BEACH ROAD BIOFILTRATION PROJECT
 CITY OF MALIBU, CA

Geosyntec
 consultants

Los Angeles, CA

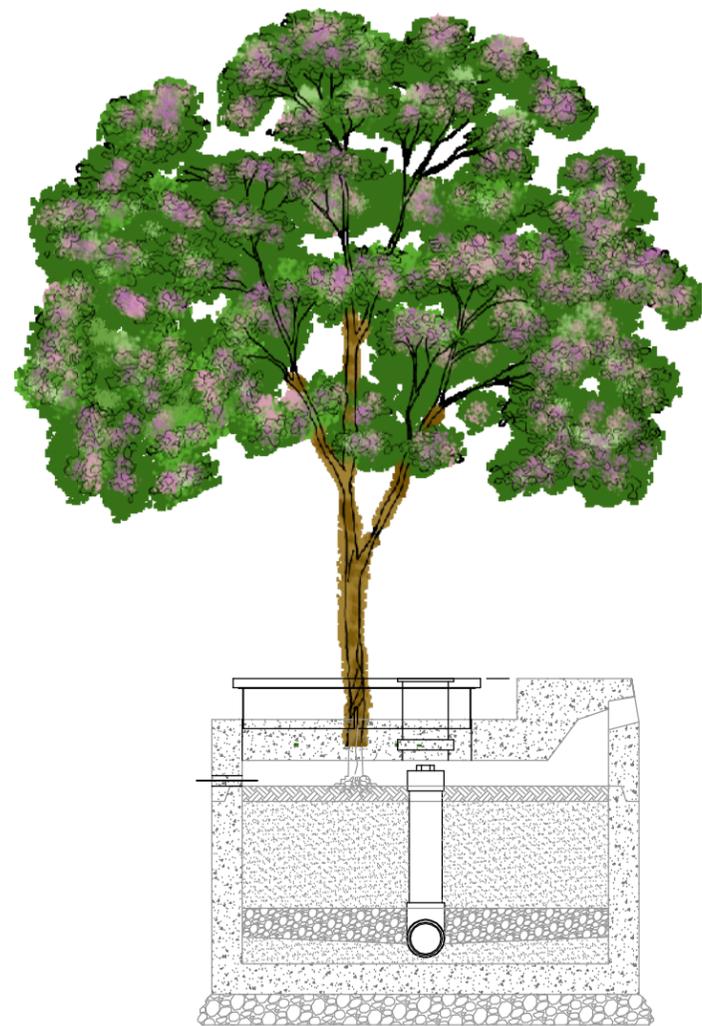
NOVEMBER 2012

Figure

2



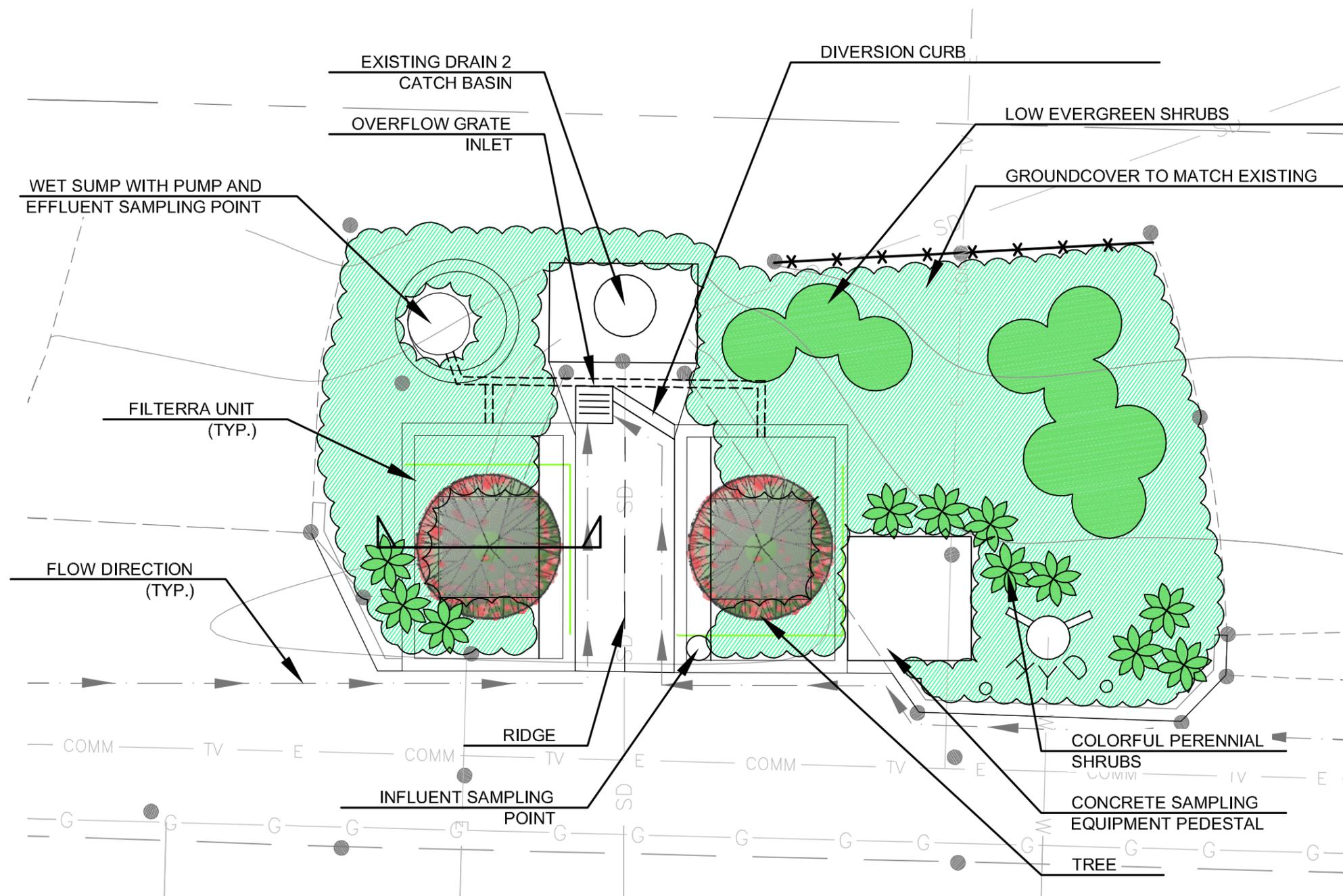
Drain 2 Catch Basin Looking North Across Broad Beach Road.



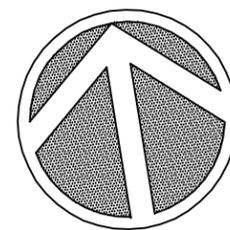
Section

N.T.S.

IRRIGATION NOTES:
 EXISTING HOMEOWNER IRRIGATION TO BE REPAIRED AND ADJUSTED TO PROVIDE HEAD TO HEAD COVERAGE.



Plan



SCALE: 1" = 5'-0"

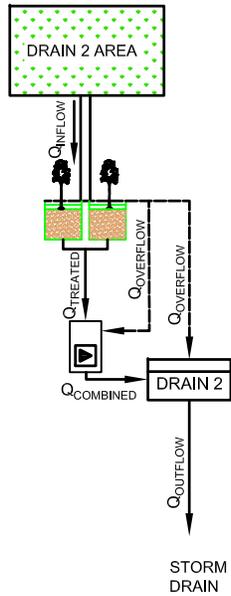
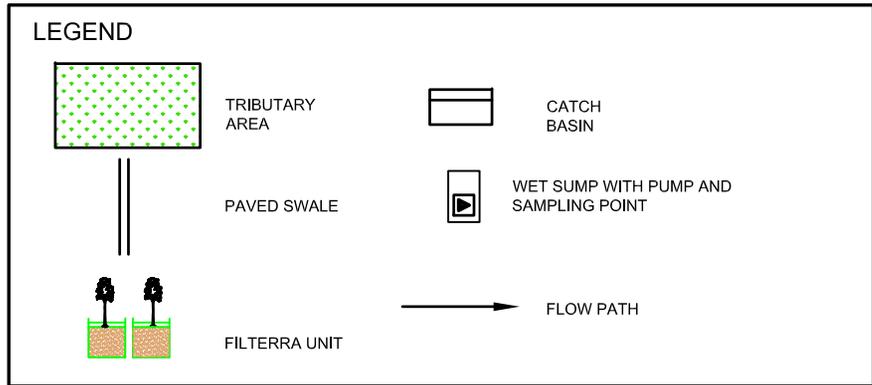
DRAIN 2 PRELIMINARY LANDSCAPE AND BMP
 PLAN - 10% DESIGN LEVEL
 PRELIMINARY DESIGN REPORT ADDENDUM
 BROAD BEACH ROAD BIOFILTRATION PROJECT
 CITY OF MALIBU

Geosyntec
 consultants

FIGURE
 4

MALIBU, CALIFORNIA

OCTOBER 2012



DRAIN 2 FLOW SCHEMATIC
PRELIMINARY DESIGN REPORT ADDENDUM
BROAD BEACH ROAD BIOFILTRATION PROJECT
CITY OF MALIBU, CA

		Figure 5
Los Angeles, CA	NOVEMBER 2012	

TABLES

Table 1. Design Biofilter Volume (Bv) and Biofilter Design Surface Area (A_{design}) for Alternative 2

Catchment No.	Catchment Section	Alternative 2	
		Bv (ft ³)	A _{design} (ft ²)
1*			
2	west*		
	east	1149	776
3		593	379
4		966	645
5A	west	685	445
	east	1101	742
6		801	527
7	west	608	390
	east	218	111
8*			
Drain 2**		3153	2252
Total		9275	6266

*Catchments 1, 2 west, and 8 do not include biofilters. Runoff is directed to cisterns.

**The Drain 2 catchment is included in this table as reference only. The design surface area required to use a biofilter for treatment for Drain 2 was found to be infeasible. Instead, a compact bioretention system featuring a high volume/flow treatment rate was chosen for treating stormwater flow at Drain 2.

APPENDIX A

Drain 2 Topography and Utilities

APPENDIX B

Drain 2 Biological Assessment Report

Biological Assessment



Broad Beach Biofiltration Project

Prepared For: Geosyntec Consultants, Inc.
Los Angeles, CA

Prepared By: Edith Read, PhD
E Read and Associates, Inc.
Orange, CA

October 3, 2012

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1 ASSESSMENT LOCATION

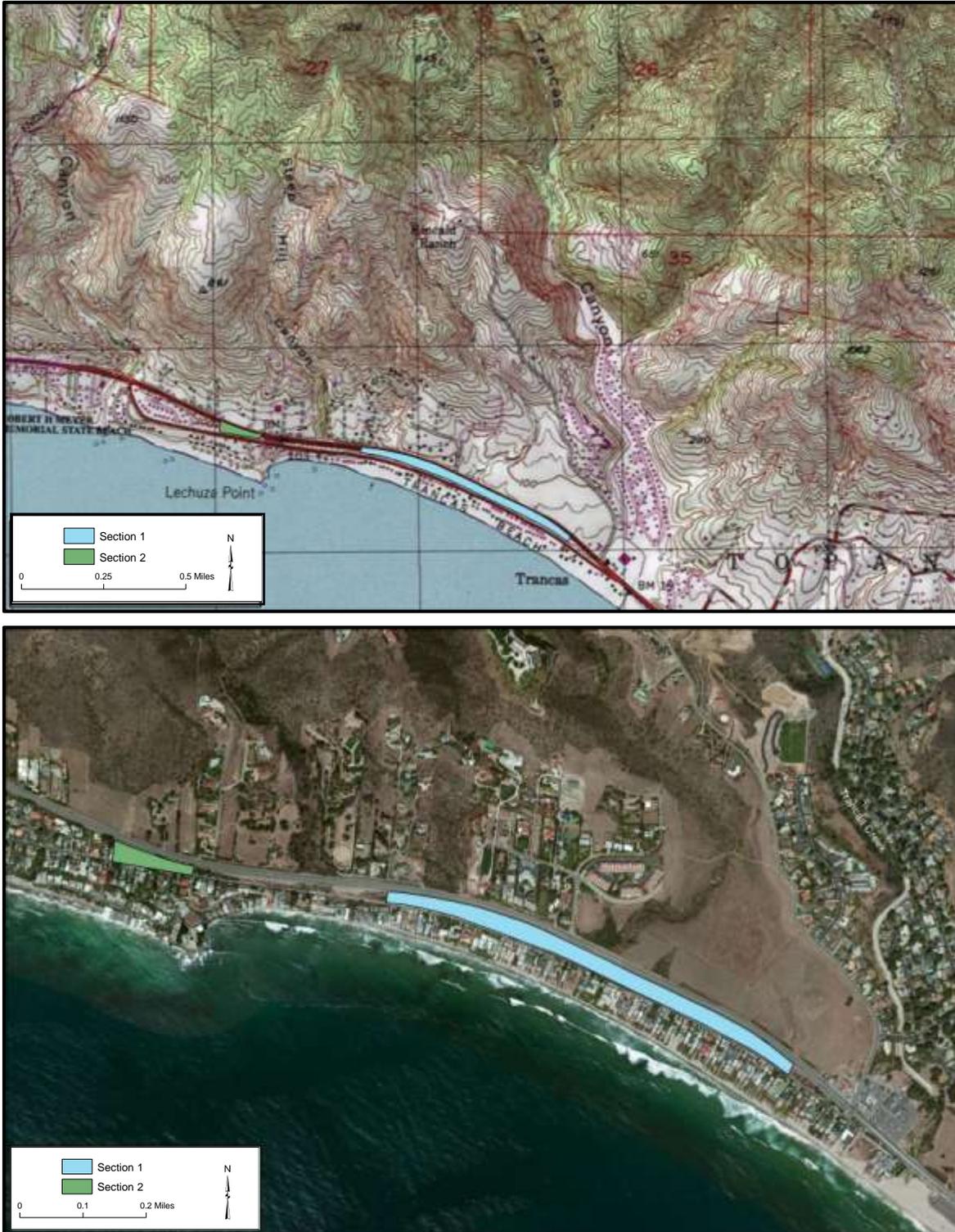
This Biological Assessment covers an area between Broad Beach Road and Pacific Coast Highway (PCH), about nine miles west of the City of Malibu (City), Los Angeles County, California (Figure 1). The study area includes two separate sections. One section is about 11 acres in size and about 3700 feet of length parallel to Broad Beach Road. A second section, added in the fall of 2012 and referred to as the “Drain 2 Catchment”, is about two acres in size and 670 feet of length parallel to Broad Beach Road. This study area is larger than the area of direct disturbance anticipated for construction of the proposed biofiltration project (Project), which is expected to occur within and immediately adjacent to the shoulder of Broad Beach Road. The road shoulder is heavily used for public and visitor parking.

2 PROJECT DESCRIPTION

The Project objective is to reduce stormwater and dry-weather runoff, with associated pollutant loadings, from Broad Beach Road to the City’s storm drain inlets or catch basins (Geosyntec Consultants, 2011). These inlets are part of the City’s Municipal Separate Storm Sewer System (MS4). The City storm drains connect to private drains. Flow ultimately discharges through private beaches, passing through a wave wash mixing zone before reaching a designated Area of Special Biological Significance (ASBS 24). This section is just upcoast from Zuma Beach, one of Los Angeles County’s most popular public beaches.

The biofiltration systems will be located upstream and adjacent to eleven City-owned storm drain inlets along Broad Beach Road. The systems will use a combination of runoff capture, bioretention, evapotranspiration, and infiltration to treat dry-weather and stormwater runoff for multiple pollutants of concern. These pollutants of concern include copper, zinc, oil, grease, and polyaromatic hydrocarbons.

The Project will also incorporate permeable pavement into current public parking areas to help reduce runoff volumes and further promote infiltration. Minor habitat restoration will also be provided for some of the slopes above Broad Beach Road, with the goal of replacing and controlling invasive species with native vegetation.



Base Map Sources: ESRI Bing Aerial and ESRI USGS Topography

Figure 1. Biological Assessment Locations

3 PURPOSE AND SCOPE OF THIS BIOLOGICAL ASSESSMENT

This Biological Assessment is intended to assist decision-makers and the public with objective evaluation of potential impacts of the Project on biological resources, whether beneficial, adverse, or both. This Assessment is also intended to comply with specific City requirements for the content of Biological Assessments (City of Malibu, 2004), and be utilized in preparation of environmental documentation under the California Environmental Quality Act (CEQA).

Design of the Project is ongoing. Therefore, in order to ensure that the Project avoids (or at least minimizes) adverse impacts to biological resources, this assessment encompasses a larger geographic area than will likely be directly impacted by Project construction, operation, or maintenance. Recommended measures for the Project to avoid or minimize adverse biological impacts are provided.

4 METHODS

Field Survey

Section 1 of the assessment area was surveyed on November 16 and December 29, 2011. Section 2 was surveyed on October 2, 2012. The entire perimeter of the area was walked. Wildlife species were recorded as direct observation or sign (e.g. tracks, burrows). Native and naturalized plant species observed were recorded. Planted and landscaped vegetation was mapped, but because ornamental taxa can include a wide variety of nursery cultivars, and are generally of little relevance to assessment of indigenous biological resources, these taxa were not inventoried. Other field observations included surface soils (relevant to sensitive species evaluation), wetland indicators, streambed indicators, and disturbance. Vegetation community data and other features relevant to the assessment were transcribed into Geographic Information System (GIS) software. This software was used to produce maps, calculate acreages, and calculate proximity of the assessment area to off-site resources (ESHA).

Data Review

Records of the California Natural Diversity Database (CNDDDB) of special status species, and the California Native Plant Society's Inventory of Rare and Endangered Plants, were searched and evaluated for possible occurrence of sensitive species in the assessment area. Fire history was interpreted from maps prepared by staff of the Santa Monica Mountains National Recreation Area. Locations and extent of environmentally sensitive areas relative to the assessment area were based on City maps. Historical vegetation conditions were evaluated based on topographic and vegetation maps produced by the Wieslander surveys of the late 1920s–early 1930s.

5 RESULTS AND DISCUSSION

Topography

The assessment area is located in an un-numbered section of the United States Geological Survey (USGS) Point Dume 7.5' quadrangle. Elevations range from about 14 feet above mean sea level (MSL) at the lowest section of Broad Beach Road to about 110 feet MSL at the highest section along Pacific Coast Highway. Section 1 of the assessment area consists of a steep, south-facing bluff below Pacific Coast Highway, with shallow gradients limited to a cleared narrow shoulder along Broad Beach Road and a cleared turnout area along Pacific Coast Highway. Section 2 of the assessment area is fully developed with ornamental landscaping, and a narrow shoulder along Broad Beach Road.

Soils

A soil map available online from the Natural Resources Conservation Service (USDA–NRCS, 2008) was reviewed and not found to accurately represent surface conditions observed at the detailed scale of this assessment. Surface soils in undeveloped portions of the survey area were observed to be typical of coastal bluffs along this part of the Malibu coast, with coarse gravels and cobbles loosely embedded in a matrix of sand and silt. All areas appeared to be well-drained, without development

of wetland conditions despite extensive irrigation. The bluff slopes are readily eroded.

Fire History

Fire history maps available online (UCLA Stunt Ranch, 2009) document incidents in the Santa Monica Mountains beginning in 1925. A review of these maps indicates that the earliest recorded fire for the general region was the Malibu Fire of 1935, which surrounded the assessment area to the northwest and northeast but did not burn past the current alignment of Pacific Coast Highway. The next fire in the region was the Sherwood/Zuma fire of 1956, but again Pacific Coast Highway served as a fuel break. Finally, the Trancas Fire of 1978 extended into the assessment area. Pacific Coast Highway again served as a fuel break for later fires that would have otherwise naturally progressed into the area, particularly the Pacific Fire of 2003.

Vegetation

Figures 2A, 2B, 2C, and 2D show vegetation types in the assessment area. Figures 3 and 4 provide photographs representing site conditions in sections 1 and 2, respectively. Table 1 provides a list of plant species observed.

The study area is significantly degraded from its historic condition prior to development of Broad Beach. A review of historic topographic and vegetation maps (Wieslander 1920, 1934) indicates that Broad Beach Road followed the same alignment as a section of Pacific Coast Highway in 1920. The bluff slope area is shown as “barren” on a vegetation map that was created *circa* 1934, a category that was defined as “practically devoid” of vegetation (Wieslander, undated). No trees are shown as a historic vegetation type in the assessment area. Based on documentation of adjacent vegetation types it can be assumed that “sparse” vegetation on the bluff slope would have consisted of at least two species that have persisted to date: lemonadeberry (*Rhus integrifolia*) and California sagebrush (*Artemisia californica*). A third species common in this historic period was seacliff buckwheat (*Eriogonum*



Figure 2A. Vegetation Types of Section 1 - East



Figure 2B. Vegetation Types of Section 1 - Center



Figure 2C. Vegetation Types of Section 1 - West



Figure 2D. Vegetation of Section 2

View west from Broad Beach



View east from Broad Beach Road



Above: planted sycamore grove mapped on Figure 2C, associated with non-native vegetation (eucalyptus, pampas grass).

Below: view northeast from Broad Beach Road, showing coastal bluff scrub on the upper slopes (outside expected project footprint) and ornamental vegetation on the lower slopes. Flowering shrub is bougainvillea, a planted ornamental that is not invasive but requires irrigation.

View west from Pacific Coast Highway



Figure 3. Site Photographs, Section 1



View west from east end
of Drain 2 catchment

View east from west end
of Drain 2 catchment



Drain location

Figure 4. Site Photographs, Section 2

Table 1. Native and Naturalized Exotic Plant Species Observed

Latin Name ([*] = exotic species)	Common Name
DICOTS	
Aizoaceae	Fig-Marigold Family
<i>Carpobrotus</i> sp.*	sea fig
<i>Mesembryanthemum</i> cf. <i>nodiflorum</i> L.*	slender-leaved iceplant
Anacardiaceae	Sumac Family
<i>Malosma laurina</i> (Nutt.) Abrams	laurel sumac
<i>Rhus integrifolia</i> (Nutt.) Brewer & S. Watson	lemonadeberry
<i>Schinus molle</i> L.*	Peruvian pepper tree
Apiaceae	Carrot Family
<i>Foeniculum vulgare</i> Mill.*	fennel
Asteraceae	Sunflower Family
<i>Ambrosia psilostachya</i> DC.	western ragweed
<i>Artemisia californica</i> Less.	California sagebrush
<i>Baccharis pilularis</i> DC.	coyote brush
<i>Coreopsis gigantea</i> (Kellogg) H.M. Hall	giant coreopsis
<i>Encelia californica</i> Nutt.	coast sunflower
<i>Hazardia squarrosa</i> (Hook. & Arn.) Greene var. <i>grindelioides</i> (DC) W.D. Clark	saw-toothed goldenbush
<i>Heterotheca grandiflora</i> Nutt.	telegraph weed
<i>Lessingia filaginifolia</i> (Hook. & Arn.) M.A. Lane	California-aster
Cactaceae	Cactus Family
<i>Opuntia ficus-indica</i> (L.) Miller*	Indian fig cactus
<i>Opuntia littoralis</i> (Engelm.) Cockerell	coastal prickly pear
<i>Isomeris arborea</i> Nutt.	bladderpod
Chenopodiaceae	Goosefoot Family
<i>Atriplex lentiformis</i> (Torr.) S. Watson	saltbush
<i>Atriplex semibaccata</i> R. Br.*	Australian saltbush
<i>Salsola tragus</i> L.*	Russian thistle, tumbleweed
Convolvulaceae	Morning Glory Family
<i>Convolvulus arvensis</i> L.*	field bindweed
Euphorbiaceae	Spurge Family
<i>Euphorbia terracina</i> L.*	terracina spurge
Fabaceae	Pea Family
<i>Lotus scoparius</i> (Nutt.) Ottley	deerweed, California broom
Geraniaceae	Geranium Family
<i>Erodium cicutarium</i> (L.) L'Her.*	red-stem filaree
Lamiaceae	Mint Family
<i>Salvia mellifera</i> E. Greene	black sage
Myrtaceae	Myrtle Family
<i>Eucalyptus</i> sp.*	eucalyptus
Platanaceae	Sycamore Family
<i>Platanus racemosa</i> Nutt.	western sycamore (planted)

Table 1 -- continued

Polygonaceae

Eriogonum cinereum Benth.

Eriogonum fasciculatum Benth. var. *fasciculatum*

Nicotiana glauca Graham*

Salicaceae

Salix lasiolepis Benth.

MONOCOTS

Liliaceae

Yucca whipplei Torrey

Poaceae

Arundo donax L.*

Avena fatua L.*

Bromus diandrus Roth*

Cortaderia selloana (Schultes) Asch. & Graebner*

*Cynodon dactylon**

Leymus condensatus (C. Presl) A. Love

Pennisetum setaceum (Forssk.) Chiov.*

Buckwheat Family

ashy-leaved buckwheat

California buckwheat

tree tobacco

Willow Family

arroyo willow

GRASSES AND ALLIES

Lily Family

Whipple's yucca

Grass Family

giant reed

common wild oats

ripgut brome

pampas grass

Bermuda grass

giant rye

fountain grass, bristlegrass

parvifolium), but this species appears to have been largely replaced by ashy-leaved buckwheat (*Eriogonum cinereum*) in the current vegetation types described below.

In classifying the vegetation types we attempted to follow the current Manual of California Vegetation (Sawyer et al., 2009), but found that the vegetation was so heavily invaded by naturalized and planted exotic species that strict adherence to this classification system was not possible. The vegetation classifications described below were determined to best characterize Section 1 of the assessment area. Section 2 of the assessment area consists entirely of development and ornamental landscaping, and its vegetation is not discussed further here.

Coastal Bluff Scrub (3.1 acres)

Coastal bluff scrub consists primarily of native plant species, although exotic invasives (especially fountain grass, *Pennisetum setaceum*) are present throughout. This vegetation occurs on the upper, steeper bluff slopes between Pacific Coast Highway and the lower landscaped zone along Broad Beach Road. Native shrub species include ashy-leaved buckwheat (*Eriogonum cinereum*), California sagebrush

(*Artemisia californica*), California brittlebush (*Encelia californica*), coyote brush (*Baccharis pilularis*), lemonadeberry (*Rhus integrifolia*), and laurel sumac (*Malosma laurina*).

Coastal Bluff Scrub (Revegetated Slope) (0.2 acre)

This vegetation type is confined to a small area of steep bluff below Pacific Coast Highway (Figure 2B), and is associated with a short section of the highway that appears to have been repaired. Density and uniformity of the shrub vegetation, along with erosion control material (straw rolls) are evidence of intentional revegetation. The dominant species is native (ashy-leaved buckwheat).

Ornamental Landscaping (4.2 acres)

Ornamental landscaping consists primarily of exotic vegetation that has been planted and irrigated. As can be seen from the photographs in Figure 3, this vegetation dominates the lower slope of the assessment area along Broad Beach Road. This vegetation includes invasive species such as pampas grass (*Cortaderia selloana*). No attempt was made here to identify and list all of the planted ornamental species and nursery cultivars, but examples include pines, junipers, eucalyptus, bamboo, bougainvillea, plumbago, pepper trees, and myoporum.

Ornamental Landscaping/Coastal Bluff Scrub (1.1 acre)

This classification represents an integration of native and planted vegetation, with invasive exotics such as iceplant (*Carpobrotus* sp., *Mesembryanthemum* sp.) also present throughout. Where present, fragmented stands of native vegetation typically consist of lemonadeberry and/or laurel sumac.

Ornamental Landscaping (Planted Sycamores) (0.2 acre)

Planted and irrigated sycamores (*Platanus racemosa*) occupy a localized, small area between Broad Beach Road and artificial terraces upslope (Figure 2C). Trunk diameters of these trees range in size from four to eight inches at breast height (dbh).

Examples of these trees are shown in the photographs in Figure 3. Despite being planted, and arguably not native to the area since there is no historical evidence of trees at this site, these trees probably fall under the protection of the City's Native Tree Protection Ordinance because they are native to California. This Ordinance does not distinguish between indigenous and planted trees.

Arroyo Willow

One willow was observed on a slope in the center section of the site (see mapped location, Figure 2B). The willow is associated with a localized zone of high moisture, most likely irrigation. No streambed or wetland indicators were observed at this location.

Cleared (2.2 acres)

Cleared areas are devoid of vegetation. These areas are confined to a strip along the north shoulder of Broad Beach Road (1.2 acres) and south shoulder of Pacific Coast Highway (1.0 acre).

Wildlife

Table 2 lists wildlife species observed during the surveys and with potential to occur in the assessment area. In general the area has relatively few wildlife species present or expected to occur, due to its condition as fragmented habitat surrounded by high-traffic roads, frequent human disturbance, construction noise, and dominance of exotic vegetation. The exotic vegetation provides cover and limited nesting habitat for birds, but few food resources for native wildlife. Certain wildlife species, especially goldfinches and crows, were frequently observed moving between the study area and landscaping on residential properties to the south. No raptor nests or woodrat middens were observed in the vegetation during the survey. Regular trimming of most of the vegetation along Broad Beach Road likely precludes nesting by raptors. However, nocturnal roosting by certain raptors such as owls is possible. While we did not observe any evidence of a roost site (e.g. pellets, fecal material),

Table 2. Common Wildlife Species Observed and With Potential to Occur

Latin Name	Common Name	Occurrence
Insects		
<i>Danaus plexippus</i>	monarch butterfly	observed
Birds		
Note: any number of migratory birds may be observed during the year. Only the more common are listed in the "potential" category here.		
<i>Aphelocoma californica</i>	western scrub jay	observed
<i>Bubo virginianus</i>	great horned owl	potential
<i>Buteo jamaicensis</i>	red-tailed hawk	potential
<i>Calypte anna</i>	Anna's hummingbird	observed
<i>Carduelis psaltria</i>	lesser goldfinch	observed
<i>Carduelis tristis</i>	American goldfinch	observed
<i>Carpodacus mexicanus</i>	house finch	observed
<i>Corvus brachyrhynchos</i>	American crow	observed
<i>Dendroica coronata</i>	yellow-rumped warbler	observed
<i>Falco sparverius</i>	American kestrel	potential
<i>Mimus polyglottos</i>	northern mockingbird	observed
<i>Pipilo crissalis</i>	California towhee	observed
<i>Psaltriparus minimus</i>	bushtit	potential
<i>Sayornis nigricans</i>	black phoebe	potential
<i>Tyto alba</i>	barn owl	potential
<i>Zonotrichia leucophrys</i>	white-crowned sparrow	potential
Reptiles		
<i>Elgaria multicarinata webbi</i>	alligator lizard	potential
<i>Eumeces skiltonianus</i>	western skink	potential
<i>Sceloporus occidentalis</i>	western fence lizard	observed
<i>Uta stansburiana hesperis</i>	side-blotched lizard	potential
Mammals		
<i>Canis latrans</i>	coyote	potential
<i>Didelphis virginiana</i>	Virginia opossum	potential
<i>Mephitis mephitis</i>	striped skunk	potential
<i>Peromyscus maniculatus</i>	deer mouse	potential
<i>Procyon lotor</i>	raccoon	potential
<i>Spermophilus beecheyi</i>	California ground squirrel	potential
<i>Sylvilagus audubonii</i>	Audubon's cottontail	potential
<i>Thomomys bottae</i>	valley pocket gopher	potential

open fields north of Pacific Coast Highway provide significant off-site foraging opportunities and therefore the potential for the taller, denser stands of trees on site to support roosting by raptors cannot be dismissed completely.

Sensitive Species

Appendices A and B list all of the special status plant and wildlife species recorded for the project region. Databases of sensitive species are searched by 7.5' USGS topographic quadrangles, and therefore the "project region" defined for the purpose of the database search and this assessment includes Point Dume as well as surrounding quadrangles. We also added quadrangles upcoast (Point Mugu) and downcoast (Topanga) to thoroughly evaluate potential for species specifically associated with habitats along the immediate coast.

Plants

A total of 35 special status plant taxa were reviewed for this assessment (Appendix A). None of the species are known to occur in the assessment area and none were determined to have high potential to occur. Reasons for this determination vary with species and ranges from lack of suitable habitat (e.g. salt marsh) to a decades-old history of highly disturbed conditions on the site.

Wildlife

A total of 48 special status wildlife taxa were reviewed for this assessment (Appendix B). There are no records of any special status species occurring in or adjacent to the assessment area. One special status species was concluded to have moderate potential to occur on the upper slopes of section 1 of the assessment area within coastal bluff scrub vegetation: coast horned lizard (*Phrynosoma blainvillii*), a California Species of Special Concern. Species of Special Concern are generally those whose populations are declining or are otherwise vulnerable. The intent of the California Department of Fish and Game for these species is to halt or reverse the

decline of these populations before they are reduced to threatened or endangered status.

Regardless of listing status, or whether vegetation is native or non-native, all native birds have State and Federal protection while nesting. Nesting season varies by species, year, and location, but in general the season can begin around mid-February and end in late July. If potential roost or nest trees are to be removed or trimmed, the City of Malibu requires surveys for nesting raptors during the period February 15–July 30. The City also requires surveys for wintering raptors during the period of December 1 – February 15.

An individual of one special status species, the monarch butterfly (*Danaeus plexippus*), was observed flying over the coastal scrub vegetation in section 1 of the assessment area during the November 2011 survey. There are no CNDDDB records of winter roost trees on the site, although some records in the CNDDDB are suppressed. Of the records available, known winter roosting locations for the monarch butterfly in the Point Dume region consist of eucalyptus groves that are more mature, more dense, and more numerous than occur in the assessment area. Considering these factors plus frequent human disturbance and no evident nectar sources, the potential for trees on the site to serve as winter roosting habitat for monarchs is considered low.

Sensitive Habitats

Vegetation Communities. There are no CNDDDB records of sensitive habitats within or adjacent to the assessment area (CDFG–CNDDDB, 2012).

ESHA. One drainage north of the assessment area is mapped as an Environmentally Sensitive Habitat Area (ESHA) by the City of Malibu. This drainage is shown on Figure 2B. It extends north from Pacific Coast Highway, beginning about 84 feet north from the edge of the assessment area and about 200 feet upslope from the shoulder of Broad Beach Road. In general, coastal bluff scrub is considered ESHA, whether or not it is shown on the City's ESHA maps. However, all of the native scrub is above and

outside of the expected project footprint along the shoulder of Broad Beach Road. The isolated and fragmented condition of this vegetation, discontinuous with off-site habitat and separated from an existing mapped ESHA by a major highway where wildlife crossing is hazardous, significantly reduces its overall habitat value.

Marine Resources. Off-shore resources with special status, as shown on the City of Malibu's ESHA Overlay Maps, consist of Pismo Clam Habitat and Kelp Beds. In addition, off-shore marine habitat has been designated as Area of Special Biological Significance (ASBS) #24 by the California State Water Resources Control Board. All of these designations are outside of the assessment area but may indirectly benefit from water quality improvements expected from the Project.

Wetlands and Streambeds. No wetlands or streambeds are present in the assessment area. No "blue-line" streambed features mapped by the USGS are located in the assessment area. Certain existing storm drain inlets are connected to a "V"-ditch, rock-lined ditch, or swale, but these are features constructed in uplands for drainage purposes and are not associated with any existing or historical streambed feature.

6 IMPACT ANALYSIS

The Broad Beach Biofiltration Project is still in the design phase. Therefore this impact analysis makes the following assumptions, based on the project description provided to date (Geosyntec Consultants, 2011):

1. Construction of all biofiltration systems, located upstream and adjacent to ten City-owned storm drain inlets along Broad Beach Road, will primarily disturb ornamental landscaping, but may also disturb some native plants in section 1 consisting of lemonadeberry and laurel sumac stands that extend into the landscaping and construction zone, and planted sycamores.
2. Temporary impacts from construction staging and grading will be limited to Broad Beach Road and existing cleared areas (road shoulder).
3. Quality of runoff from Broad Beach Road into City storm drains will improve as result of the Project.

4. Areas disturbed by construction will be revegetated with native plant species and exotic species removed.

Vegetation and Sensitive Plant Species

Impacts to native vegetation communities are not expected to be significant. No special status plant species are expected to occur within areas directly or indirectly impacted by the Project. Impacts to planted sycamores would not be biologically significant, but the City has requirements for protection of “native” trees. Our recommendations for addressing these requirements are discussed in Section 7. Removal of exotic vegetation, especially highly invasive species such as pampas grass and iceplant, would be expected to benefit the surrounding habitat. The significance of this benefit is probably limited, with species re-invading from outside the Project limits, unless the City and/or the California Department of Transportation (CalTrans) undertake a program of removing invasive exotics throughout the assessment area.

Wildlife and Sensitive Animal Species

The Project is not expected to impact listed threatened, endangered, or rare wildlife species. The only special status animal species identified as having moderate potential to occur in the assessment area is coast horned lizard (Species of Special Concern), but if present it would likely be found only on the upper slopes. Limitation of Project disturbance to cleared and landscaped zones along Broad Beach Road would not be expected to impact this species.

The Project is not expected to interfere with, or impact, wildlife movement or movement corridors. No evidence of the site functioning as a corridor for wildlife movement was observed during the surveys for this assessment. Frequent human presence and disturbance, in addition to proximity to heavily traveled roads, significantly reduces the potential for the site to serve as a wildlife corridor.

The Project has potential to disturb nesting and/or roosting bird species, including raptors. Our recommendations for addressing these impacts are discussed in Section 7.

Sensitive Habitats

The Project is expected to improve quality of runoff from Broad Beach Road into City storm drains and therefore have a beneficial effect on marine resources. The significance of this benefit has not been quantified, but baseline conditions and measurements of Project effectiveness are planned (Geosyntec Consultants, 2011).

The Project will not impact any designated ESHA, or any area potentially meeting the definition of ESHA. Removal of invasive exotics within the construction zone, especially those with seeds dispersed by air or birds (e.g., pampas grass), will help reduce the probability of these species invading the mapped ESHA north of Pacific Coast Highway.

7 CONCLUSIONS AND RECOMMENDATIONS

No significant constraints or barriers to Project implementation were identified in this assessment. However, while the Project is expected to have a net beneficial effect on biological resources due to improvement of water quality and removal of some invasive vegetation, there is potential for temporary adverse impacts from construction unless the following measures are implemented. The extent of these temporary impacts will depend on season and extent to which construction is likely to disturb or require removal of vegetation, including planted sycamore trees, vegetation that supports common bird species while nesting, or trees that serve as nesting or roosting sites for raptors. The following measures can address these potential impacts:

1. Planted Sycamore Trees. The sycamores on site are planted, heavily trimmed, and relatively immature. These factors plus their proximity to frequent human disturbance significantly reduces their biological value. If

removal of one or more of these trees cannot be avoided, or protection zones around the trees cannot be avoided, we recommend requesting a waiver from the City's native tree protection ordinance. If a waiver cannot be obtained, the City requires preparation of a Native Tree Protection plan by a qualified biologist or resource expert. Required content of this plan is described in the City's Local Implementation Plan, Chapter 5.

2. Nesting Birds (other than raptors). Construction outside of the nesting season (generally mid-February to July 31) would avoid impacts to nesting birds. While human activity along Broad Beach Road is such that nesting in adjacent landscaping seems unlikely, certain species such as Anna's hummingbird and house finch are well-adapted to urban environments and therefore the potential for nesting cannot be dismissed entirely. If construction within the nesting season cannot be avoided, we recommend that a survey for nesting birds be conducted by a qualified biologist prior to construction, in coordination with the City's biologist. The survey may need to be repeated one or more times depending on expected duration of construction. If an active nest is found, the nest area must be avoided until young have fledged and left the nest. The "buffer" zone around the nest, within which no construction or disturbance can occur will depend on species and recommendations of the City/monitoring biologist.

3. Nesting or Roosting Birds (Raptors). No raptor nests or evidence of roosting were observed during surveys for this assessment, but the extent to which the Project may (or may not) impact trees of sufficient size or structure to become occupied by a raptor as a roost or nest site from the date of this writing until construction is not known at this time. Once the Project disturbance footprint is known, the City may require surveys for nesting or wintering raptors prior to construction. Surveys for nesting raptors must be conducted during the period of February 15-July 30, and surveys for wintering raptors must be conducted during the period of December 1 - February 15. At a minimum, the City

requires that each raptor survey be conducted for two hours between dawn and 10:00 am on five occasions with at least one week between surveys. We recommend that the raptor surveys include surveys for nesting or roosting owls, such that at least three of the raptor surveys should be conducted during the period immediately before nightfall, in addition to the morning surveys. If a raptor nest or roost site is found, protection measures appropriate for the species and site conditions should be developed by a qualified biologist in coordination with the City biologist.

4. Removal of Vegetation. Vegetation removed as part of the Project should be replaced *where feasible* (see below) with native species appropriate for the site conditions. For example, if a “bioswale” is installed as a design feature, native shrub species that have potential to block runoff would not be appropriate, but herbaceous species including grasses and wildflowers may be suitable. Ideally, other vegetation temporarily disturbed or removed during construction should be replaced with coastal bluff scrub species, but this measure may not prove practical in the long term, especially in the presence of irrigation and continual invasion of exotics from the Caltrans right-of-way. An exotics removal and native revegetation plan should be prepared by a qualified biologist familiar with effective methods of removing exotics, the local native flora, and the expected “as-built” condition of areas to be revegetated. Revegetation with natives should include practical considerations of long-term maintenance, capabilities of entities responsible for this maintenance, fuel modification zones, and potential for wildfire. It is possible that removal of invasive exotics alone would significantly improve habitat values of the assessment area and facilitate expansion of existing native species from the surrounding area.

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APPENDIX A. SPECIAL STATUS PLANT SPECIES RECORDED FROM THE PROJECT REGION

Appendix A

Evaluation of Special Status Plant Species Recorded From the Project Region

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
Braunton's milk- vetch <i>Astragalus brauntonii</i>	FE	none	1B.1	Closed-cone conif, chaparral, coastal sage, v&f grassland/ recent burns or disturbed areas- usually carbonate soils.	4-640m PH March-July	Low Potential. Soil within potential impact area not present; nearest known historical coastal location is Malibu Lagoon.
Ventura marsh milk-vetch <i>Astragalus pachostachyus var. lanosissimus</i>	FE	CE	1B.1	Coastal salt marsh	1-35m PH June-October	Not expected. Habitat absent.
coastal dunes milk- vetch <i>Astragalus tener var. titi</i>	FE	CE	1B.1	Moist, sandy depressions of coastal bluffs or dunes.	1-50m AH March-May	Low potential. Suitable habitat not observed during surveys; no records (recent or historical) from project vicinity.
Coulter's saltbush <i>Atriplex coulteri</i>	none	none	1B.2	Coastal bluff scrub, coastal dunes, coastal scrub, valley and foothill grasslands	3-460m PH(s) March-Oct	Low Potential. Nearest known historical location is on bluffs within City of Malibu.

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
Parish's brittle scale <i>Atriplex parishii</i>	none	none	1B.1	Alkali meadows, vernal pools, chenopod scrub, playas; typically on drying alkali flats with fine soils.	25-1900m AH June-October	Not expected; no suitable habitat on site.
Malibu baccharis <i>Baccharis malibuensis</i>	none	none	1B.1	Chaparral, coastal scrub, cismontane woodland, riparian woodland.	150-305 m S (d) August	Low potential. Vegetation on site not typical of the species. Not observed during surveys.
Round-leaved filaree <i>California macrophyllum</i>	none	none	1B.1	Cismontane woodland, valley and foothill grassland; clay soils	15-1200m AH March-May	Low potential. Vegetation on site not typical of the species.
Slender mariposa lily <i>Calochortus clavatus</i> var. <i>gracilis</i>	none	none	1B.2	Chaparral, coastal scrub, grassland.	360-1000m PH(b) March	Low potential. Habitat potentially impacted by the project is not typical of the species.
Plummer's mariposa lily <i>Calochortus plummerae</i>	none	none	1B.2	Coastal scrub, chaparral, grassland, cismontane woodland.	100-1700m PH (b) May-July	Low potential. Habitat potentially impacted by the project is not typical of the species.

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
southern tarplant <i>Centromadia parryi</i> ssp. <i>australis</i>	none	none	1B.1	Marsh margins, vernal mesic grassland, vernal pools.	0-425 m AH May-November	Not expected. Habitat not present on site.
Orcutt's pincushion <i>Chaenactis glabriuscula</i> var. <i>orcuttiana</i>	none	none	1B.1	Sandy substrate in coastal bluff scrub, coastal dunes.	0-100 m AH January-August	Low potential. Highly disturbed conditions and planted vegetation likely precludes occurrence. Nearest location record is historical (1898) from an unmapped area referred to as "South Beach".
salt marsh bird's beak <i>Chloropyron maritimum</i> ssp. <i>maritimum</i>	FE	CE	1B.2	Coastal salt marsh and dunes.	0-30 m AH(h) May-October	Not expected. Habitat not present on site.
San Fernando Valley spineflower <i>Chorizanthe parryi</i> ssp. <i>fernandina</i>	FC	CE	1B.1	Coastal scrub; associated with open, sandy soil habitats.	150-1035 m AH April-June	Low Potential. Conditions on site are not typical of the species; no occurrence records for the Santa Monica Mountains.
Parry's spineflower <i>Chorizanthe parryi</i> ssp. <i>parryi</i>	none	none	1B.1	Chaparral and coastal scrub; associated with sandy or rocky openings.	40 – 1705m AH Apr-Jun	Low Potential. Highly disturbed conditions and planted vegetation likely precludes occurrence. Nearest location record is historical (1957) from Latigo Canyon – no records from project vicinity.
Santa Susana tarplant <i>Deinandra minthornii</i>	none	CR	1B.2	Chaparral and coastal scrub; associated with sandstone outcroppings and rocky areas.	280-760m S (d) July-November	Not expected. Habitat not present on site.

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
dune larkspur <i>Delphinium parryi</i> ssp. <i>blochmaniae</i>	none	none	1B.2	Coastal dunes, chaparral (maritime)	0-200m PH April-May	Not Expected. Suitable habitat not present on site.
Norris's beard moss <i>Didymodon norrisii</i>	none	none	2.2	Cismontane woodland; lower montane coniferous forest (mesic, rocky)	600-1973m Moss	Not Expected. Suitable habitat not present on site.
beach spectaclepod <i>Dithyrea maritima</i>	none	CT	1B.1	Coastal dunes, coastal scrub on sea shores and sandy places near the shore.	3-50m PH March-May	Not Expected. Suitable habitat not present on site.
Blochman's dudleya <i>Dudleya blochmaniae</i> ssp.	none	none	1B.1	Coastal bluff scrub, coastal scrub, chaparral and grasslands; often associated with clay or serpentinite soils.	5-450m PH April-June	Low Potential. Soils typically associated with the species not present.
Agoura Hills dudleya <i>Dudleya cymosa</i> ssp. <i>agourensis</i>	FT	none	1B.2	Chaparral, cismontane woodland/ rocky, volcanic soils.	200-500m. PH May-June	Not Expected. Suitable habitat not present on site.

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
Marcescent dudleya <i>Dudleya cymosa</i> ssp. <i>marcescens</i>	FT	CR	1B.2	Chaparral; occurs on the lower reaches of sheer volcanic cliffs and canyon walls near perennial streams.	150-520m. PH April-July	Not Expected. Suitable habitat not present on site.
Santa Monica dudleya <i>Dudleya cymosa</i> ssp. <i>ovatifolia</i>	FT	none	1B.2	Chaparral on shaded, rocky north-facing slopes; associated with Conejo volcanic outcrops, rocky sites.	150-1675m PH March-June	Not Expected. Suitable habitat not present on site.
Many-stemmed dudleya <i>Dudleya multicaulis</i>	none	none	1B.2	Chaparral, coastal scrub, valley and foothill grassland (clay)	15-790m PH April-July	Not Expected. Suitable habitat not present on site.
Conejo dudleya <i>Dudleya parva</i>	FT	none	1B.2	Coastal scrub, valley and foothill grassland (clay or volcanic)	60-450m PH May-June	Low Potential. Site conditions not typical of the species.
Verity's dudleya <i>Dudleya verityi</i>	FT	none	1B.2	Volcanic outcrops in chaparral, cismontane woodland, coastal scrub.	60-120m PH May-June	Not Expected. Suitable habitat not present on site.

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
Conejo buckwheat <i>Eriogonum crocatum</i>	none	CR	1B.2	Chaparral, coastal scrub, valley and foothill grassland (rocky volcanic)	50-580m PH April-July	Not Expected. Suitable habitat not present on site.
Coulter's goldfields <i>Lasthenia glabrata</i> ssp. <i>coulteri</i>	none	none	1B.1	Coastal salt marshes, playas, vernal pools	1-1220 m AH February-June	Not Expected. Suitable habitat not present.
Ojai navarretia <i>Navarretia ojaiensis</i>	none	none	1B.1	Openings in chaparral, coastal scrub, grassland.	275-620 m AH May-July	Low Potential. Site conditions not typical of the species.
Peninsular nolina <i>Nolina cismontana</i>	none	none	1B.2	Chaparral, coastal scrub (sandstone or gabbro substrate)	140-1275m S(e) May-July	Low Potential. Site conditions not typical of the species.
California Orcutt grass <i>Orcuttia californica</i>	FE	CE	1B.1	Vernal pools within chaparral, valley and foothill grasslands.	15-660m AH April-August	Not Expected. Suitable habitat not present on site.

Common Name <i>Latin Name</i>	Status			Habitat	Elevation Range, Life Form, and Reproductive Period	Potential Occurrence on the Project Site
	Federal	State	CNPS			
Lyon's pentachaeta <i>Pentachaeta lyonii</i>	FE	CE	1B.1	Chaparral, valley and foothill grasslands. Ecotonal edges and cleared areas	30-630m AH March-August	Not Expected. Suitable habitat not present on site.
chaparral ragwort <i>Senecio aphanactis</i>	none	none	2.2	Drying alkaline flats in cismontane woodland, coastal scrub.	15-1800m AH January-April	Not Expected. Suitable habitat not present on site.
salt spring checkerbloom <i>Sidalcea neomexicana</i>	none	none	2.2	Alkaline and mesic sites in chaparral, coastal sage scrub, lower montane coniferous forest, Mojavean desert scrub, playas.	15-1530 m PH March-June	Not Expected. Suitable habitat not present on site.
estuary seablite <i>Suaeda esteroa</i>	none	none	1B.2	Coastal salt marshes	0-5 m PH May-January	Not Expected. Suitable habitat not present on site.
Sonoran maiden fern <i>Thelypteris puberula var. sonorensis</i>	none	none	2.2	Meadows and seeps	50-610m RH January-September	Not Expected. Suitable habitat not present on site.

SOURCES:

1. California Department of Fish and Game, Natural Diversity Database (CNDDDB), January 2012. Record search of the following USGS quadrangles: Calabasas, Malibu Beach, Newbury Park, Point Dume (project quadrangle), Point Mugu, Thousand Oaks, Topanga, Triunfo Pass.
2. California Native Plant Society Inventory of Rare and Endangered Plants.

STATUS KEY:

Federal

FE: Federally Endangered
 FT: Federally Threatened

State

CE: State Endangered
 CT: State Threatened
 CR: State Rare

CNPS

List 1B: Plants rare, threatened, or endangered in California and elsewhere.

List 2: Plants rare, threatened, or endangered in California but more common elsewhere.

Threat Ranks:

.1 : Seriously Threatened in California
 .2 : Fairly Threatened in California

LIFE FORM KEY:

AH: Annual Herb
 PH: Perennial Herb
 RH: Rhizomatous Herb
 S: Shrub
 (b): bulb
 (d): deciduous
 (e): evergreen
 (h): hemi parasitic

Appendix B. Special Status Wildlife Species Recorded From the Project Region

Appendix B

Evaluation of Special Status Wildlife Species Recorded From the Project Region

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
INVERTEBRATES				
Santa Monica shieldback katydid <i>Agalothorax longipennis</i>	--	SA	Chaparral and canyon stream bottom vegetation; can inhabit introduced iceplant and native chaparral plants.	Low Potential ; patches of iceplant present but no chaparral or stream bottom vegetation. Nearest record of occurrence is from 1975 near the entrance to Big Rock (Piedra Gorda) Canyon, about 15 air miles east of the project site -- the two individuals reported from this location were collected, so current population status is unknown.
Sandy beach tiger beetle <i>Cicindela hirticollis gravida</i>	--	SA	Clean, dry, light-colored sand in upper beach zones adjacent to non-brackish water; e.g. dune depressions.	Not Expected ; no suitable habitat on site.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
senile tiger beetle <i>Cicindela senilis frosti</i>	--	SA	Marine shoreline; dried salt pans.	Not Expected ; no suitable habitat on site.
globose dune beetle <i>Coelus globosus</i>	--	SA	Coastal dunes.	Not Expected ; no suitable habitat on site.
Monarch butterfly (wintering sites) <i>Danaus plexippus</i>	--	SA	Winter roost sites located in wind-protected tree groves, with nectar and water sources nearby.	Low potential ; tree groves present (all non-native) but are not wind-protected and nectar sources not observed; tree trimming reduces habitat value; individual fliers may be observed occasionally (one observed during survey) but no roosting populations observed during surveys. Project location not reported in numerous available records from Point Dume area, but details of some records have been suppressed by CNDDB.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
Trask shoulderband <i>Helminthoglypta traskii traskii</i>	--	SA	Only habitat information in region is from collection record in La Jolla Canyon, Santa Monica Mtns – algae covered rock under waterfall.	Not Expected ; for what is known of habitat associations, there no suitable habitat on site.
wandering (saltmarsh) skipper <i>Panoquina errans</i>	--	SA	Coastal salt marshes.	Not Expected ; no suitable habitat on site.
Gertsch's socalchemmis spider <i>Socalchemmis gertschi</i>	--	SA	No information available	Low potential ; only records are from Topanga Canyon area.
Santa Monica grasshopper <i>Trimerotropis occidentiloides</i>	--	SA	Hillsides, dirt trails in chaparral; known only from the Santa Monica Mountains.	Low potential ; habitat on site not suitable, based on limited habitat information about the species; no records from project vicinity.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
mimic tryonia (California brackishwater snail) <i>Tryonia imitator</i>	--	SA	Coastal lagoons, estuaries, salt marshes.	Not Expected; no suitable habitat on site.
FISH				
Tidewater goby <i>Eucyclogobius newberryi</i>	FE	SSC	Shallow lagoons and lower coastal stream reaches with salinities from brackish to fresh.	Not Expected; no aquatic habitat on site.
Arroyo chub <i>Gila orcutti</i>	--	SSC	Slow-moving or backwater sections of warm to cool streams with mud or sand substrates.	Not Expected; no aquatic habitat on site.
Steelhead rainbow trout (SoCal DPS) <i>Oncorhynchus mykiss</i>	FE	SSC	Coastal seasonal to perennial streams with suitable cobble for spawning	Not Expected; no aquatic habitat on site.
REPTILES				

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
Silvery legless lizard <i>Anniella pulchra pulchra</i>	--	SSC	Sandy or loose loamy soils under sparse vegetation; soil moisture essential.	Low Potential ; poor quality habitat on site; nearest records of occurrence are from the Simi Hills and Thousand Oaks.
Coastal whiptail <i>Aspidoscelis tigris stejnegeri</i>	--	SA	Deserts and semiarid habitats with sparse vegetation, open areas; woodlands and riparian areas; firm soil, sandy or rocky.	Low potential ; vegetation and substrate highly disturbed and mostly planted/heavily irrigated. No records of occurrence in project area.
San Bernardino ringneck snake <i>Diadophis punctatus modestus</i>	--	SA	Woodlands, grassland, chaparral, and scrub habitats; often found in mesic areas under rocks, logs, and debris.	Low potential ; only mesic areas on site are due to irrigation; no records of occurrence in project area.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
western pond turtle <i>Emys marmorata</i>	--	SSC	Streams, ponds, freshwater marshes, and lakes.	Not Expected; no suitable habitat on or adjacent to site.
California mountain kingsnake (San Diego population) <i>Lampropeltis zonata pulchra</i>	--	SSC	Occurs in riparian woodlands, and the adjacent chaparral and coastal sage scrub vegetation; associated with rock outcrops.	Low Potential; thought to be restricted to the San Gabriel and San Jacinto Mountains, but there is a record of occurrence at Stunts Ranch in the Santa Monica Mountains; no records from project area.
coast horned lizard <i>Phrynosoma blainvillii</i>	--	SSC	Relatively open grasslands, scrublands, and woodlands with fine, loose soil; requires open areas for sunning and abundant supply of ants and other insects.	Moderate Potential. Marginal quality habitat in coastal scrub vegetation on the upper slopes. No sign or food resources observed during site surveys, and while most records of occurrence in the Point Dume quadrangle are in upper Latigo canyon, there is one historical (1966) record of occurrence at Point Dume State Beach.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
two-striped garter snake <i>Thamnophis hammondi</i>	--	SSC	In or near permanent fresh water.	Not Expected; no suitable habitat on site.
AMPHIBIANS				
arroyo toad <i>Anaxyrus californicus</i>	FE	SSC	Washes, intermittent streams, rivers.	Not expected; no habitat on site.
California red-legged frog <i>Anaxyrus californicus</i>	FT	SSC	In or near permanent deep water.	Not expected; no habitat on site.
BIRDS				
Cooper's hawk (nesting) <i>Accipiter cooperi</i>	--	WL	Dense stands of live oaks and riparian woodlands.	Not expected to nest on site due to lack of suitable nesting habitat; species may be observed occasionally foraging over the site; no raptor nests observed in October and December 2011 surveys.
tri-colored blackbird (nesting colony) <i>Agelaius tricolor</i>	--	SSC	Emergent marsh near open water.	Not expected; habitat absent.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
southern California rufous-crowned sparrow (nesting) <i>Aimophila ruficeps canescens</i>	--	WL	Coastal sage scrub and sparse mixed chaparral; steep rocky hillsides with patches of grasses and forbs.	Low potential; species may be observed occasionally as a forager but is not expected to nest on site due to frequent disturbance of habitat; no records of nest sites in project area.
golden eagle (nesting & wintering) <i>Aquila chrysaetos</i>	--	WL; CFP	Mountains, deserts, and open country.	Low potential; species may be observed occasionally as a forager; not expected to nest on site; no raptor nests observed during October and December 2011 surveys.
burrowing owl (burrow sites & some wintering sites) <i>Athene cunicularia</i>	--	SSC	Grasslands and open scrub.	Not Expected; no suitable habitat present on site and no occurrences of this species in project area.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
ferruginous hawk (wintering) <i>Buteo regalis</i>	--	WL	Open grasslands, sagebrush flats, desert scrub, low foothills and edges of pinyon-juniper vegetation.	Not expected to nest on site due to lack of suitable nesting habitat; species may be observed occasionally foraging over the site; no raptor nests observed in October and December 2011 surveys.
western snowy plover (nesting) <i>Charadrius alexandrinus nivosus</i>	FT (Pacific coastal population) MNBMC	SSC (Pacific coastal and interior populations)	Sandy ocean beaches and around the drying margins of lagoons; nests on sparsely vegetated sandy or gravelly habitats, on dry mud flats, or on dirt dikes and fills.	Not Expected; no suitable habitat on site.
Belding's savannah sparrow <i>Passerculus sandwichensis beldingi</i>	--	SE	Pickleweed on and around margins of tidal flats.	Not expected; no suitable habitat on site.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
California brown pelican (nesting colony and communal roosts) <i>Pelecanus occidentalis californicus</i>	--	CFP	Coastal islands.	Not expected; no suitable habitat on site.
California gnatcatcher <i>Polioptila californica</i>	FT	CSC	Coastal sage scrub in areas of flat or gently sloping terrain.	Not Expected, no suitable habitat present on site and no occurrences of this species in project area.
light-footed clapper rail <i>Rallus longirostris levipes</i>	FE	SE	Salt marshes.	Not Expected; no suitable habitat on site.
bank swallow (nesting) <i>Riparia riparia</i>	--	ST	Colonial nester; primarily in riparian and lowland habitats west of desert; known to nest in coastal bluff habitats.	Low potential; no records from project site and nesting unlikely due to frequent disturbance; nearest record is from 1907 in the bluffs above the historical "Port Los Angeles" long wharf; thought to be extirpated as a breeder in southern California.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
California least tern (nesting colony) <i>Sterna antillarum browni</i>	FE	CE, CFP	Marine and estuarine shores with nearby lagoons or lacustrine waters.	Not Expected; no suitable habitat on site.
Least Bell's vireo (nesting) <i>Vireo bellii pusillus</i>	FE	SE	Riparian vegetation with extensive willows below 2,000 ft.	Not Expected; no suitable habitat on site.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
MAMMALS				
pallid bat <i>Antrozous pallidus</i>	--	SSC	Deserts, grasslands, shrublands, woodlands, and forests; prefers rocky outcrops, cliffs, and crevices with access to open habitats for foraging; roosts highly sensitive to disturbance.	Low potential; poor quality roosting habitat on site; nearest record of occurrence is from the Simi Hills.
spotted bat <i>Euderma maculata</i>	--	SSC	Deserts, scrublands, chaparral, and coniferous woodlands.	Low potential; may occur as infrequent forager, limited roosting habitat present on site; no records from project area.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
western mastiff bat <i>Eumops perotis</i>	--	SSC	Primarily arid lowlands and coastal basins with rugged, rocky terrain, along with suitable crevices for day-roosts.	Low potential; may occur as infrequent forager, limited roosting habitat present on site; nearest location record is from the Paramount ranch area of the Santa Monica Mountains.
western red bat <i>Lasiurus blossevillii</i>	--	SSC	Roosts primarily in trees, 2-40' above ground.	Low potential; may occur as infrequent forager, limited roosting habitat present on site; nearest location records are from the Paramount and Strauss ranch areas of the Santa Monica Mountains.
hoary bat <i>Lasiurus cinereus</i>	--	SA	Open habitats or habitat mosaics with access to trees for cover & open areas or edges for feeding	Low potential; may occur as infrequent forager, limited roosting habitat present on site; nearest location record is from the Strauss ranch area of the Santa Monica Mountains.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
California leaf-nosed bat <i>Macrotus californicus</i>	--	SSC	Deserts and palm oases.	Not expected; nearest reported location is from a cave in Canoga Park area.
south coast marsh vole <i>Microtus californicus stephensi</i>	--	SSC	Tidal marshes in LA, Orange and Southern Ventura Counties	Not Expected; no suitable habitat on site.
western small-footed myotis <i>Myotis ciliolabrum</i>	--	SA	Uplands near water; seeks cover in caves, buildings, mines, and crevices.	Low potential; may occur as infrequent forager, limited roosting habitat present on site. No records of occurrence in project area.
Yuma myotis <i>Myotis yumanensis</i>	--	SA	Open forests and woodlands with water sources, over which to forage; maternity colonies occur in caves, crevices, mines, and buildings.	Low potential; may occur as infrequent forager, limited roosting habitat present on site. No records of occurrence in project area.

Common Name <i>Latin Name</i>	Status		Habitat Requirements	Potential Occurrence on the Project Site
	Federal	State		
San Diego desert woodrat <i>Neotoma lepida intermedia</i>	--	SSC	Chaparral and coastal sage scrub.	Low potential; no sign observed during surveys; nearest location record is from the west side of Pepperdine University.
southern California saltmarsh shrew <i>Sorex ornatus salicornicus</i>	--	SSC	Coastal salt marsh.	Not Expected; no suitable habitat on site.
American badger <i>Taxidea taxus</i>	--	SA	Drier open stages of shrub, forest, and herbaceous habitats with friable soils.	Low potential; no burrows observed during surveys; no records from project area.

SOURCE: California Department of Fish and Game, Natural Diversity Database (CNDDDB), January 2012. Record search of the following USGS quadrangles: Calabasas, Malibu Beach, Newbury Park, Point Dume (project quadrangle), Point Mugu, Thousand Oaks, Topanga, Triunfo Pass.

NOTES: For most wildlife taxa only resident populations are tracked by the CNDDDB. In some cases (primarily birds), the CNDDDB only tracks certain parts of the species range or life history. The area or life stage is indicated in parenthesis after the common name.

STATUS CODES:

Federal -- U.S. Fish and Wildlife Service

FE: Federally-listed Endangered Species

FT: Federally-listed Threatened Species

FC: Candidate Species for Federal listing

State -- California Department of Fish and Game

SE: State-listed Endangered Species

ST: State-listed Threatened Species

CFP: California Fully Protected Species

SSC: California Species of Special Concern

WL: CDFG Watch List

SA: California Special Animal. These species have no official federal or state status, but are tracked by the CNDDDB due to their rarity.

APPENDIX C

Drain 2 Geotechnical Investigation Report



Broad Beach Road Biofiltration Project
Malibu, California

DAILY FIELD REPORT

PROJECT:	Broad Beach Road Biofiltration Project						
LOCATION:	31570 Broad Beach Road, Malibu, CA 90265	PROJECT NO.:	LA0245	TASK NO.:	3.1		
DESCRIPTION:	Hand Auger – Filterra Unit	WEATHER:	Sunny, Clear, 80°F				
DAY OF WEEK:	Wednesday	DAY:	26	MONTH:	September	YEAR:	2012

1045	Arrived on Broad Beach Boulevard in Malibu, California.
1100	Met with Megan Otto (Geosyntec) who gave me background information on the project and showed me the exact location of where the Filterra unit would be installed. The unit will be installed approximately 25 feet north of the centerline of the road and adjacent to 31570 Broad Beach Road.
1115	Began to hand auger. The location that was chosen was in between a storm drain and a fire hydrant. Photo 1 shows the exact location of the boring. Vegetation on the surface had to be cleared in order to dig. See attached boring log for an in-depth description of the type of soils encountered at the site.
1415	Stopped hand auger. A total depth of 9 feet (7 feet below the road surface) was reached with the hand auger. Photo 2 shows the soil that was removed from the hole. Four bag samples of soil were collected throughout various phases of the excavation.
1430	Packed up supplies and departed the site.

In summary, the soils encountered on Broad Beach Boulevard in Malibu California appear to be adequate to support the construction of the Filterra Bioretention System. The upper 8 inches of the borehole consisted of an organic low plasticity silt, which was most likely placed in the area for landscaping purposes. Low plasticity silt was found directly below the vegetated area. A sand-silt seam of approximately 6 inches thick was found below the silt layer. Below the sand seam, low plasticity clay extended throughout the rest of the borehole. In general, the water content and the plasticity of the soil both increased with depth. Based on the visual classification of the soils in the vicinity, it does not appear that there are special geotechnical conditions which would restrict the installation of the Filterra unit.

Spencer Marcinek

Printed Name

Signature

Megan Otto

copy to

GS FORM:
GEOTECH2 01/04

BOREHOLE LOG

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE					COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)		PID READING (ppm)	TIME (00:00)	DRY DENSITY (pcf)	MAX DRY DENSITY (pcf)	PERCENT FINES (%)	PERCENT GRAVEL (%)	MOIST CONTENT (%)	OPT MOIST CONTENT (%)	ATTERBERG LIMITS	
		1) Soil Name (USCS) 6) Plasticity 2) Color 7) Density/Consistency 3) Moisture 8) Other (Mineral Content, Discoloration, Odor, etc.) 4) Grain Size 5) Percentage								1) Rig Behavior 2) Air Monitoring 3) Pocket Pen 4) Tor Vane									
0'		Organic silt of low plasticity (OL). Brown black. Absorbs moisture, dry. (10, 10, 80). Roots.	OL							11:00									
1'		Inorganic silt of low plasticity (ML) low plasticity. Black brown Dry to moist. (15, 10, 75)	ML																
2'	10																		
3'	20																		
4'	20	Sand-silt mixtures (SM) Brown. Dry to moist. (10, 45, 45). Piece of sandstone.	SM																
5'	25	Inorganic clay of low plasticity (CL). Brown. Dry to moist. (10, 20, 70). Smearing	CL	2															
6'	30																		

CONTRACTOR Geosyntec
EQUIPMENT
DRILL MTHD Hand Auger
DIAMETER 3"
LOGGER Spencer Marcinek

NORTHING
EASTING
COORDINATE SYSTEM:
REVIEWER

NOTES:

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GS FORM:
GEOTECH2 01/04

BOREHOLE LOG

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE					COMMENTS	LABORATORY RESULTS										
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)		PID READING (ppm)	TIME (00:00)	DRY DENSITY (pcf)	MAX DRY DENSITY (pcf)	PERCENT FINES (%)	PERCENT GRAVEL (%)	MOIST CONTENT (%)	OPT. MOIST CONTENT (%)	ATTERBERG LIMITS		
6'			CL	3																
7'																				
8'		Inorganic clay of medium plasticity (CH). Brown. Medium moisture. (10, 20, 70). More difficult to remove from auger.	CL CH	4																
9'		Bottom of boring at 9' 1"								14:30										

CONTRACTOR Geosyntec
EQUIPMENT
DRILL MTHD Hand Auger
DIAMETER 3"
LOGGER Spencer Marcinek REVIEWER

NORTHING
EASTING
COORDINATE SYSTEM:

NOTES:

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

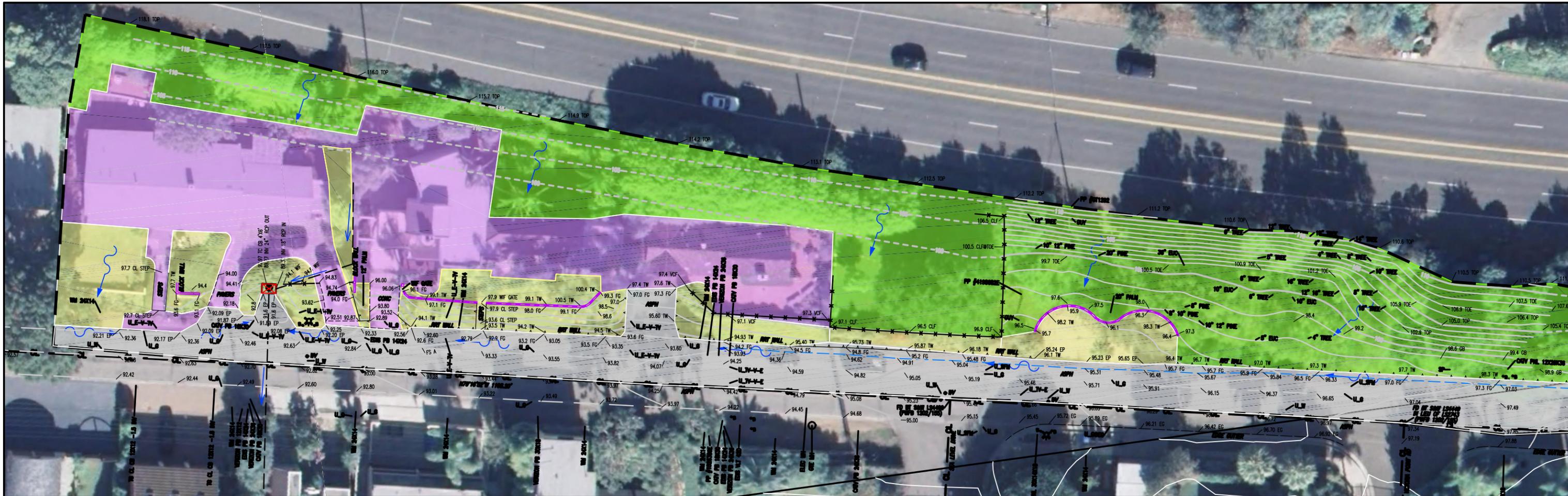
Borehole 1





APPENDIX D

Drain 2 Drainage Map



LEGEND

- CATCHMENT BOUNDARY
- HILLSIDE
- ROADSIDE SHOULDER (UNPAVED)
- PAVED AREA (ROADWAY AND SHOULDER)
- IMPERVIOUS AREA (HOMES)
- FLOW DIRECTION - SURFACE RUNOFF
- FLOW DIRECTION - PIPE / SWALE FLOW
- DRAIN 2 CATCH BASIN
- STORM DRAIN PIPE (CITY-OWNED)
- STORM DRAIN PIPE (NOT CITY-OWNED)
- WALL

40 20 0 40 80
SCALE IN FEET

PROJECT: BROAD BEACH ROAD BIOFILTRATION PROJECT									
PREPARED FOR: CITY OF MALIBU, DEPT. OF PUBLIC WORKS 23825 STUART RANCH ROAD MALIBU, CA 90265 PHONE: 310.456.2489	TITLE: DRAINAGE MAP DRAIN 2 CATCHMENT								
PREPARED BY: GEOSYNTEC CONSULTANTS 3415 S. SEPULVEDA BLVD., SUITE 500 LOS ANGELES, CA 90034 PHONE: 310.957.6100	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">DESIGNED BY: P. SHOPBELL</td> <td style="width: 25%;">REVIEWED BY: M. OTTO</td> <td style="width: 25%;">DATE: NOV 2012</td> <td style="width: 25%;">DRAWING: DR-5</td> </tr> <tr> <td>DRAWN BY: P. SHOPBELL</td> <td>APPROVED BY:</td> <td>PROJ. NO.:</td> <td>LA 0254</td> </tr> </table>	DESIGNED BY: P. SHOPBELL	REVIEWED BY: M. OTTO	DATE: NOV 2012	DRAWING: DR-5	DRAWN BY: P. SHOPBELL	APPROVED BY:	PROJ. NO.:	LA 0254
DESIGNED BY: P. SHOPBELL	REVIEWED BY: M. OTTO	DATE: NOV 2012	DRAWING: DR-5						
DRAWN BY: P. SHOPBELL	APPROVED BY:	PROJ. NO.:	LA 0254						

APPENDIX E

Drain 2 Hydrology Calculations

Drain 2 Catchment Area

Calculation of Peak Mitigated Flow Rate

Per Development Planning for Stormwater Management - A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP)

Definitions:

$$A_C = \text{Catchment total area (acres)} = A_I + A_P$$

$$A_I = \text{Impervious area (acres)}$$

$$A_P = \text{Pervious area (acres)}$$

$$A_U = \text{Contributing Undeveloped Upstream Area (acres)}$$

$$C_U = \text{Undeveloped Runoff Coefficient}$$

$$C_D = \text{Developed Runoff Coefficient} = (0.9 * \% \text{Imp.}) + [(1.0 - \% \text{Imp.}) * C_U]$$

$$T_C = \text{Time of Concentration (min)}$$

$$I_x = \text{Intensity per } T_C \text{ (in/hr)}$$

$$Q_{PM} = \text{Peak Mitigated Flow Rate (cfs)} = C_D * I_x * A_C * (1.008333 \text{ ft}^3\text{-hour} / \text{acre-inches-seconds})$$

Project Characteristics:

Type of development: Residential

Predominate Soil Type Number: 38

A_C	1.65
A_I	0.76
A_P	0.89
A_U	0.00
% Impervious	0.46
% Pervious	0.54
% Undeveloped	0
Length =	777 ft
Slope =	0.0193 ft/ft

Iteration No	Initial T_C (min)	I_x (in/hr)	C_U	C_D	$C_D * I_x$ (in/hr)	Calculated T_C (min)	Difference (min)	
1	15	0.267	0.1	0.467	0.1247	38.1	23.1	(Use $T_C = 30$)
2	30	0.193	0.1	0.467	0.0901	44.9	14.9	
3	N/A							

Use I_{30} since T_C is greater than 30 minutes.

$$T_C = 30 \text{ min}$$

$$I_{30} = 0.193 \text{ in/hr}$$

$$C_D = 0.467$$

$Q_{PM} = 0.15 \text{ cfs}$

Filtterra Box Sizing Calculation

Bacteria Flow Rate: 0.001389 cfs per square foot of media (per Hal at Kristar)

$$Q_{PM} = 0.15 \text{ cfs (from flow rate calculation)}$$

Square footage needed: **108 ft²**

APPENDIX F

Construction Cost Estimate

Alternative 2

TOTAL CONSTRUCTION COSTS

Site Name:

Broad Beach Road

Site Location:

Malibu, CA

Total Construction Costs	Unit Cost
Biofilters	\$ 157,000
Drain 2 Improvements	\$ 85,000
Vegetated Swale	\$ 4,000
Planting of Slope	\$ 38,000
Irrigation	\$ 156,000
Walls	\$ 413,000
Concrete Interlocking Pavers	\$ 566,000
Storage and diversion structures - Catchment 2	\$ 124,000
Storage and diversion structures - Catchment 8	\$ 77,000
Maintenance of planting and irrigation (3 months)	\$ 8,000
Demolition of hardscape/landscape	\$ 34,000
Wet Sump, Pump, Valves, and Controls	\$ 59,000
Sampling Manhole and Sampling Equipment	\$ 58,000
Storm Drain Manhole and Flume	\$ 7,000
Rolled Curb	\$ 49,000
Valley Gutter	\$ 6,000
SUBTOTAL 1	\$ 1,841,000
Mobilization & Demobilization	\$ 184,000
Bonds	\$ 55,000
Traffic Control	\$ 20,000
SWPPP	\$ 20,000
SUBTOTAL 2	\$ 2,120,000
Contingency (20%)	\$ 424,000
Total Construction Cost	\$ 2,544,000

Note: Costs rounded to the nearest \$1,000

Alternative 2

CONSTRUCTION COSTS

BIOFILTERS

Biofilter unit media surface area (SF): 200
Biofilter total media surface area (SF): 4014

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	58	\$ 693
Haul/Dispose of Excavated Material	CY	\$ 20.00	58	\$ 1,156
Basin Liner	SF	\$ 2.30	650	\$ 1,495
Geotextile	SF	\$ 0.60	850	\$ 510
Anchor Trench	LF	\$ 8.00	100	\$ 800
Drain Gravel Layer	CY	\$ 50.00	22	\$ 1,111
Underdrain	LF	\$ 15.00	50	\$ 750
Engineered Planting Media	CY	\$ 40.00	22	\$ 889
Bark Mulch	SY	\$ 8.00	22	\$ 178
Planting of biofilter	SF	\$ 0.75	200	\$ 150
Planting of side slopes	SF	\$ 0.75	135	\$ 101
Facility Unit Cost		\$58,000	\$ 39	\$ 7,833
Total Facility Base Cost				\$ 157,207

Assumptions:

Based on a biofilter with a media surface area = 200 ft² and dimensions 5' x 40'

Alternative 2

CONSTRUCTION COSTS

DRAIN 2 IMPROVEMENTS

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	61	\$ 732
Off Haul/Dispose of Excavated Material	CY	\$ 20.00	28	\$ 562
6" Curb	LF	\$ 12.00	28	\$ 336
Ridged Gutter Pan	LF	\$ 15.00	12	\$ 180
Filtterra with Bacterra Biofiltration System	LS	\$ 23,000.00	2	\$ 46,000
Concrete Pedastal for Monitoring Equipment	LS	\$ 500.00	1	\$ 500
Sampling and Pump Control Equipment	LS	\$ 15,000.00	1	\$ 17,500
6" Effluent Piping	LF	\$ 10.00	20	\$ 200
Relocation of Existing Dry Utilities	LS	\$ 15,000.00	1	\$ 15,000
48" Wet Sump	LS	\$ 3,000.00	1	\$ 3,000
Sump Pump (15 gpm)	LS	\$ 600.00	1	\$ 600
Associated Piping in Wet Sump	\$ 58,000	\$ 500.00	1	\$ 500
Total Facility Base Cost				\$ 85,110

Assumptions:

Alternative 2

CONSTRUCTION COSTS

VEGETATED SWALES

Swale unit length (LF): 200
Swale total length (LF): 340

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	59	\$ 711
Level & Tilling	SY	\$ 1.00	89	\$ 89
Haul/Dispose of Excavated Material	CY	\$ 20.00	59	\$ 1,185
Planting	SF	\$ 0.75	800	\$ 600
Facility Unit Cost	LF	\$ 13		\$ 2,585
Total Facility Base Cost				\$ 4,395

Assumptions:

Based on a swale length of 200 ft.

=> average width = 4' from top slope to top slope

Alternative 2

CONSTRUCTION COSTS

PLANTING

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Planting - hillside	SF	\$ 0.75	50305	\$ 37,729
Total Facility Base Cost				\$ 37,729

Assumptions:

Alternative 2

CONSTRUCTION COSTS

IRRIGATION

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Irrigation network - slope area	SF	\$ 1.00	50305	\$ 50,305
Irrigation network - biofilter and swale	SF	\$ 1.00	13800	\$ 13,800
Drip irrigation system (2 separate lines)	LS	\$ 5,000.00	2	\$ 10,000
Water meters and hot taps	LS	\$ 80,000.00	1	\$ 80,000
Electrical for rotary controllers and meters	LS	\$ 2,000.00	1	\$ 2,000
Total Facility Base Cost				\$ 156,105

Assumptions:

Alternative 2

CONSTRUCTION COSTS

WALLS

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Soil Nail Wall	SF	\$ 75.00	4,400	\$ 330,000
Fencing	LF	\$ 15.00	380	\$ 5,700
Brow Ditch	LF	\$ 40.00	380	\$ 15,200
Earthwork	CY	\$ 25.00	1,000	\$ 25,000
CQA	DAY EQUIV.	\$ 2,500.00	15	\$ 37,500
Total Facility Base Cost				\$ 413,400

Assumptions:

Alternative 2

CONSTRUCTION COSTS

PARKING AREA PAVERS

Paver surface area (SF): 33762

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	3126	\$ 37,513
AC/Concrete cut	LF	\$ 1.00	3376	\$ 3,376
Haul/Dispose of Excavated Material	CY	\$ 20.00	3126	\$ 62,522
Pavement demo and removal	CY	\$ 20.00	188	\$ 3,751
Rough grading	SY	\$ 1.00	3751	\$ 3,751
Subgrade prep	SF	\$ 0.50	33762	\$ 16,881
Parking area concrete pavers	SF	\$ 12.00	33762	\$ 405,144
Concrete header	LF	\$ 5.00	6541	\$ 32,706
Concrete curb and gutter	LF	\$ 20.00	0	\$ -
Concrete ribbon gutter	LF	\$ 15.00	0	\$ -
Total Facility Base Cost	SF			\$ 565,645

Assumptions:

Area of pavement to be removed assumed to be 4400 LF * 3 ft
Pavement thickness assumed to be 6"

Alternative 2

CONSTRUCTION COSTS

UNDERGROUND STORAGE SYSTEM - CATCHMENT 2

Detention storage for runoff from Catchments 1 and 2 (west)

Storage pipe length (LF): 110

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	239	\$ 2,862
Shoring	LS	\$ 8,000.00	1	\$ 8,000
Storage pipe complete	LS	\$ 36,000.00	1	\$ 36,000
Pipe installation	LS	\$ 3,200.00	1	\$ 3,200
Bedding and fill	CY	\$ 60.00	125	\$ 7,504
Backfill with excavated soil	CY	\$ 40.00	60	\$ 2,385
Haul/Dispose of Excavated Material	CY	\$ 20.00	179	\$ 3,577
Geotextile	SY	\$ 0.60	396	\$ 238
Basin with Pump	LS	\$ 27,000.00	1	\$ 27,000
Pressure pipe and trench	LF	\$ 60	140	\$ 8,400
Additional pump for irrigation	LS	\$ 2,500.00	1	\$ 2,500
Electrical	LS	\$ 5,000.00	1	\$ 5,000
Controllers	LS	\$ 10,000.00	1	\$ 10,000
Total Facility Base Cost				\$ 116,666

Assumptions:

Based on use of Contech's Duromaxx SRPE Pipe (Diam. 60")

Alternative 2

CONSTRUCTION COSTS

DIVERSION STRUCTURE CATCHMENTS 1 AND 2

Diversion of runoff from Catchments 1 and 2 (west) to storage in Catchment 2 (west)

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	9	\$ 111
Haul/Dispose of Excavated Material	CY	\$ 20.00	8	\$ 167
Catch Basin (small) with flat grate	LS	\$ 1,200.00	2	\$ 2,400
Diversion pipe and trench (from catch basins to tank)	LF	\$ 50.00	100	\$ 5,000
Total Facility Base Cost				\$ 7,678

Assumptions:

Alternative 2

CONSTRUCTION COSTS

UNDERGROUND STORAGE SYSTEM - CATCHMENT 8

Detention storage for runoff from Catchments 8

Storage pipe length (LF): 75

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	89	\$ 1,067
Shoring	LS	\$ 5,200.00	1	\$ 5,200
Storage pipe complete	LS	\$ 10,100.00	1	\$ 10,100
Pipe installation	LS	\$ 2,400.00	1	\$ 2,400
Bedding and fill	CY	\$ 60.00	53	\$ 3,188
Backfill with excavated soil	CY	\$ 40.00	30	\$ 1,185
Repaving excavated area	SF	\$ 4.00	640	\$ 2,560
Haul/Dispose of Excavated Material	CY	\$ 20.00	59	\$ 1,184
Geotextile	SY	\$ 0.60	1840	\$ 1,104
Basin with Pump	LS	\$ 27,000.00	1	\$ 27,000
Pressure pipe and trench	LF	\$ 60	40	\$ 2,400
Additional pump for irrigation	LS	\$ 2,500.00	1	\$ 2,500
Electrical	LS	\$ 5,000.00	1	\$ 5,000
Controllers	LS	\$ 10,000.00	1	\$ 10,000
Total Facility Base Cost				\$ 74,888

Assumptions:

Based on use of Contech's Duromaxx SRPE Pipe (Diam. 36")

Asphalt to be removed 6" thick

Alternative 2

CONSTRUCTION COSTS

DIVERSION STRUCTURE CATCHMENT 8

Diversion of runoff from Catchment 8 to storage tank in Catchment 8

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	28	\$ 335
Haul/Dispose of Excavated Material	CY	\$ 20.00	25	\$ 502
Catch Basin (small) with flat grate	LS	\$ 1,200.00	1	\$ 1,200
Diversion pipe and trench (from catch basin to tank)	LF	\$ 50.00	10	\$ 500
Total Facility Base Cost				\$ 2,537

Assumptions:

Alternative 2

CONSTRUCTION COSTS PLANTING AND IRRIGATION MAINTENANCE

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Planting - slope	SF/3 months	\$ 0.12	50305	\$ 6,037
Planting - biofilters and swales	SF/3 months	\$ 0.12	15800	\$ 1,896
Total Facility Base Cost				\$ 7,933

Assumptions:

For a 3 month period

Alternative 2

CONSTRUCTION COSTS

DEMOLITION

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Existing slope irrigation & conflicting/invasive planting	LS	\$ 25,000.00	1	\$ 25,000
Trees	EA	\$ 500.00	12	\$ 6,000
Rubble and garden walls	CY	\$ 30.00	111	\$ 3,333
Total Facility Base Cost				\$ 34,333

Assumptions:

Assumed 1000 feet of wall and an average wall cross-section of 3 sq ft.

Alternative 2

CONSTRUCTION COSTS

WET SUMP, PUMP, CHECK VALVE, AND CONTROL DEVICES

Located in each biofilter.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Wet Sump Vault	EA	\$ 2,175.00	6	\$ 13,050
Sump Pump (40 gpm)	EA	\$ 900.00	6	\$ 5,400
Check Valve	EA	\$ 1,225.00	6	\$ 7,350
Electrical Service and Conduit	EA	\$ 5,000.00	6	\$ 30,000
Associated Piping in Vault	EA	\$ 500.00	6	\$ 3,000
Total Facility Base Cost				\$ 58,800

Assumptions:

Excavation accounted for in biofilter quantity.

Alternative 2

CONSTRUCTION COSTS

SAMPLING MANHOLE and Sampling Equipment

For combining flows and sampling effluent.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Storm Drain Manhole with Weir	LS	\$ 3,000.00	4	\$ 12,000
Excavation	CY	\$ 12.00	26	\$ 310
Concrete Pedastal for Sampling Equipment	LS	\$ 500.00	1	\$ 500
Sampling Equipment	LS	\$ 15,000.00	3	\$ 45,000
Haul/Dispose of Excavated Material	CY	\$ 20.00	24	\$ 480
Total Facility Base Cost				\$ 58,290

Assumptions:

Monitoring manholes installed to measure flow rate at CB-4 per Grant requirements.

Alternative 2

CONSTRUCTION COSTS

STORM DRAIN MANHOLE AND FLUME

For monitoring flow per Grant Requirements. Located between Biofilter and CB-4.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Storm Drain Manhole with Inlaid Flume	LS	\$ 6,000.00	1	\$ 6,000
Excavation	CY	\$ 12.00	11	\$ 129
Check Valve	LS	\$ 500.00	1	\$ 500
Haul/Dispose of Excavated Material	CY	\$ 20.00	10	\$ 200
Total Facility Base Cost				\$ 6,829

Assumptions:

Monitoring manholes installed to measure flow rate at CB-4 per Grant requirements.

Alternative 2

CONSTRUCTION COSTS

ROLLED CURB

Curb unit length (LF): 200
Curb total length (LF): 3191

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	16	\$ 186
Haul/Dispose of Excavated Material	CY	\$ 20.00	16	\$ 311
Aggregate Base Bedding	CY	\$ 45.00	9	\$ 388
Rolled Curb	LF	\$ 10.95	200	\$ 2,190
Facility Unit Cost	LF	\$ 15		\$ 3,075
Total Facility Base Cost				\$ 49,068

Assumptions:

Based on a swale length of 200 ft.

=> average width = 4' from top slope to top slope

Alternative 2

CONSTRUCTION COSTS

VALLEY GUTTER

Valley Gutter unit length (LF): 200
Valley Gutter total length (LF): 350

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Excavation	CY	\$ 12.00	30	\$ 356
Haul/Dispose of Excavated Material	CY	\$ 20.00	30	\$ 593
Aggregate Base Bedding	CY	\$ 45.00	15	\$ 667
Valley Gutter	LF	\$ 10.00	200	\$ 2,000
Facility Unit Cost	LF	\$ 18		\$ 3,615
Total Facility Base Cost				\$ 6,326

Assumptions:

Based on a swale length of 200 ft.

=> average width = 4' from top slope to top slope