WATER QUALITY REPORT
FOR
SDSU MISSION VALLEY CAMPUS
(ONSITE IMPROVEMENTS)

(PRELIMINARY ENGINEERING/ DESIGN DEVELOPMENT)

Job Number 18150

February 12, 2019

RICK™
ENGINEERING COMPANY

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1.0 INTRODUCTION

This water quality report summarizes storm water quality protection approach for the proposed onsite improvements associated with the San Diego State University (SDSU) Mission Valley Campus Project (herein referred to as the "project").

1.1 Project Location

The project is located at 9449 Friars Road within the City of San Diego, California. A vicinity map and exhibit showing the conceptual project layout and street connections is provided in Appendix A.

1.2 Project Description

The project site currently consists of a large multi-purpose former NFL stadium (San Diego Coastal Credit Union Stadium, formerly known as Qualcomm Stadium) and associated parking lot that covers most of the approximately 170 acre site. The project is bounded by the Fenton Marketplace to the West of the site and Friars road to the North of the site. An industrial fuel facility is located across of San Diego Mission Road on the northwestern corner of the site. An earthen berm adjacent to Murphy Canyon Channel bounds the eastern limits of the site. The site also features a light rail/trolley station and a reach of the San Diego River along the southern boundary of the site.

The proposed project consists of demolition of the existing stadium, regrading of the site, and construction of a large mixed-use development consisting of a smaller football stadium, SDSU campus buildings, hotels and residential properties. A major characteristic of the project will be the creation of a "River Park" along the San Diego River and Murphy Canyon Creek which will be a major focal point of the project that will serve as a floodplain buffer between both the San Diego River and Murphy Canyon Creek with the rest of the developed portions of the project area, while also serving as an amenity for the surrounding community. The onsite improvements of the project are scheduled to be constructed through a series of phases as shown in Appendix A.

In addition to the onsite improvements, the adjacent improvements proposed by this project include connections from the onsite roads to the existing off-site roads, and the roadway improvements associated with the connections including widening and restriping. The adjacent improvements proposed by the project, from west to east, include River Park Road, Friars Road, Mission Village Road, San Diego Mission Road, and Murphy Creek Road. These adjacent improvements will generally utilize water quality measures and storm drain systems than those proposed by the onsite design.

For a detailed discussion of the adjacent improvements and the associated drainage and water quality design, refer to the adjacent improvements reports titled, "Drainage Study for SDSU Mission Valley Campus Adjacent Improvements" (herein Adjacent Improvements Drainage Study) and "Green Streets Elements for SDSU Mission Valley Campus Adjacent Improvements," (herein Adjacent Improvements Green Street Letter) dated January 31, 2019 and prepared by Rick Engineering Company (Job Number - 18150). For more information with regards to the onsite drainage characteristics, refer to the drainage study titled, SDSU Mission Valley Campus Onsite Improvements," (herein Onsite Drainage Study) dated January 31, 2019 and prepared by Rick Engineering Company (Job Number – 18150).

1.3 Regulatory Requirements

SDSU is considered a Phase 2 entity with regards to MS4 Permit requirements even though the project is within the City of San Diego. Hence, the project is not subject to the requirements of the San Diego Regional MS4 Permit (order R9-2013-0001); however, the project will still implement permanent storm water BMPs consistent with the requirements of the 2013 Regional MS4 Permit (R9-2013-0001) and the 2018 City of San Diego Storm Water Standards (SWS) manual dated, October 2018 where feasible to the maximum extent practicable. This includes LID site design BMPs, source control BMPs, as well as pollutant control BMPs for water quality treatment.

Hydromodification Management will not be required for the project since it discharges directly to the San Diego River, which has been identified as exempt receiving water along the lower portion of the River. This WQR describes the permanent storm water Best Management

Practices (BMPs) that will be incorporated into the project in order to mitigate the impacts of pollutants in storm water runoff from the proposed project.

1.4 FEMA Flood Zone Information

The project site is within a FEMA 100-year floodplain "Zone A" along the eastern and Zone "AE" on the southern perimeter of the site. The permanent stormwater pollutant control BMPs for the project are anticipated to be within the FEMA 100-year floodplain. The sizing criterion for the BMPs is approximately equivalent to providing water quality treatment of the 2-year storm event; and the BMPs are not intended to provide water quality benefit for larger and less frequent storms. The location of the BMPs in the FEMA 100-year floodplain will not impact performance of the BMPs and will not prohibit their maintenance, as permanent maintenance access will be provided to all of the BMPs.

The following sections of this water quality report describe the pollutants and conditions of concern for the project (Section 2.0), the permanent BMPs to be implemented for the project (Section 3.0), and the operation and maintenance plan for permanent BMPs (Section 4.0).

2.0 IDENTIFICATION OF POLLUTANTS OF CONCERN

The project is a "Priority Development Project," based on the City of San Diego Storm Water Standards Manual dated, October 2018. Section 4 of the Storm Water Standards outlines the procedure for the selection of permanent storm water BMPs. The procedure includes identification of pollutants of concern. This section of the water quality report addresses each step to identify pollutants of concern.

2.1 Identification of Anticipated Project Pollutants

Table B.6-1 of the Storm Water Standards Manual, "Anticipated and Potential Pollutants Generated by Land Use Type," identifies general pollutant categories that are either anticipated or potential pollutants for general project categories. The following general project categories listed in Table 2.1 apply to the project: "Housing Development", "Attached Residential Development", "Commercial Development", "Restaurants", "Parking Lots", "Streets, Highways and Freeways". Table B.6-1 of the Storm Water Standards is renamed as Table 2.1 and reproduced on the following page, with the Priority Development Project categories applicable to the project highlighted.

Table 2.1: Anticipated and Potential Pollutants Generated by Land Use Type

	General Pollutant Categories								
Priority Project Categories	**Sediments**	**Nutrients**	**Heavy Metals**	**Organic Compounds**	**Trash & Debris**	**Oxygen Demanding Substances**	**Oil & Grease**	**Bacteria & Viruses**	**Pesticides**
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P(1)	X
Commercial Development > one acre	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy Industry	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	P(1)
Hillside Developments > 5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X	X	P(1)
Retail Gasoline Outlets			X	X	X	X	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

Source: City of San Diego "Storm Water Standards," dated October 2018.

Based on the highlighted rows, the "anticipated" and "potential" pollutants generated from the project include: sediments, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, oil and grease, bacteria and viruses, and pesticides.

2.2 Identification of Pollutants of Concern for the Receiving Water

Identification of pollutants of concern for the receiving water involves the identification of the receiving water, as well as the impairments of the receiving water and their Total Maximum Daily Loads (TMDL) that have been developed.

2.2.1 Identification of Receiving Waters

The project site discharges to three existing storm drain outfalls along the southern perimeter of the site to the San Diego River. The San Diego River flows west and ultimately outlets to the Pacific Ocean. The proposed project is located in the following hydrologic facility planning area:

Hydrologic Unit – Mission San Diego (907)
Hydrologic Area – Lower San Diego (.11)
Hydrologic Subarea – not applicable

The corresponding number designation is 907.11 (Region '9', Hydrologic Unit '07', Hydrologic Area '11', Hydrologic Subarea 'not applicable'). An exhibit has been provided in Appendix B of this report titled "Hydrologic Unit for SDSU Mission Valley Campus," which shows the project location in reference to the hydrologic facility.

2.2.2 Identification of Receiving Water Impairments

The receiving waters located in Hydrologic Subarea 907.11 that are currently listed as impaired based on the 303(d) List in Appendix K of the Storm Water Standards Manual, dated October 2018 are the Famosa Slough and Channel, Murray Reservoir, Pacific Ocean Shoreline and the Lower San Diego River. The pollutants/stressors causing impairment for the Lower San Diego River are fecal coliform (bacteria), low dissolved oxygen (nutrients, organic compounds, trash

and debris, oxygen demanding substances), phosphorus, total dissolved solids (nutrients), enterococcus (bacteria), manganese (metals), nitrogen (nutrients), and toxicity (pesticides).

2.2.3 Identification of Receiving Water TMDLs

The 2014 and 2016 California Clean Water Act Section 303(d) list identifies Total Maximum Daily Loads (TMDLs) for each identified pollutant, with expected TMDL completion dates ranging from 2011 to 2029. The expected date for enterococcus is 2011, while the others are expected for 2019, 2025 or 2029.

2.3 Pollutants of Concern for the Project

Based on the Anticipated Project Pollutants and those of the Receiving Waters, the most significant pollutants of concern for the project are those that both are anticipated, and are a concern for the receiving water (as described by Appendix K of the Storm Water Standards Manual). Based on the 2014 and 2016 CWA Section 303(d) List of Water Quality Limited Segments, the following are the project's most significant pollutants of concern: nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, oil and grease, bacteria & viruses, and pesticides. This information will be utilized in the selection procedure for Pollutant Control BMPs, described in the following section of the report.

3.0 PERMANENT STORM WATER BEST MANAGEMENT PRACTICES (BMPS)

The project is a Priority Development Project. The following discussion addresses requirements to establish permanent BMPs. Projects subject to Priority Development Project requirements shall implement all applicable source control BMPs, site design BMPs, and pollutant control BMPs, as described in Chapter 4, and 5 of the Storm Water Standards Manual, as well as hydromodification management requirements, as detailed in Chapter 6 of the Storm Water Standards Manual (if applicable).

Sections 3.1 through 3.4 of this water quality report will discuss the permanent storm water BMPs proposed for the project.

3.1 Source Control BMPs

The term "source control BMP" refers to land use or site planning practices, or structures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimizes the contact between pollutants and urban runoff. The following text discusses the source control BMP requirements from Section 4.2 of the Storm Water Standards Manual with respect to the project. Italicized text is taken directly from the Storm Water Standards Manual, and reproduced for this report. Portions of the italicized text are condensed from the Storm Water Standards Manual. Immediately following and written in regular text, will be the response as it applies to the project. For several source control BMP requirements, the project does not anticipate design features that would require them; however, if they are included within individual lot site plans within the project boundary, the design criteria will be implemented for each applicable location.

a. *<u>Prevent illicit discharges into the MS4:</u>*

An illicit discharge is any discharge to the MS4 that is not composed entirely of storm water except discharges pursuant to a National Pollutant Discharge Elimination System permit and discharges resulting from firefighting activities. Projects must effectively eliminate discharges of non-storm water into the MS4. This may involve a suite of housekeeping BMPs

which could include effective irrigation, dispersion of non-storm water discharges into landscaping for infiltration, and controlling wash water from vehicle washing.

The project shall implement the necessary source control BMPs listed in Appendix E of the Storm Water Standards Manual dated, October 2018 to prevent any illicit discharges into the MS4 as the individual lot site plans are developed in the future.

b. *Identify the storm drain system using stenciling or signage:*

Storm drain signs and stencils are visible source controls typically placed adjacent to the inlets. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Stenciling shall be provided for all storm water conveyance system inlets and catch basins within the project area. Inlet stenciling may include concrete stamping, concrete painting, placards, or other methods approved by the local municipality. In addition to storm drain stenciling, projects are encouraged to post signs and prohibitive language (with graphical icons) which prohibit illegal dumping at trailheads, parks, building entrances and public access points along channels and creeks within the project area.

Concrete stamping, or the equivalent with prohibitive language such as, "No Dumping-Drains to Ocean", will be provided for curb inlets, catch basins, and any Brooks Box inlets located within the project site pursuant to the guidelines discussed above.

c. *Protect outdoor material storage areas from rainfall, run-on, runoff, and wind dispersal:*

Materials with the potential to pollute storm water runoff shall be stored in a manner that prevents contact with rainfall and storm water runoff. Contaminated runoff shall be managed for treatment and disposal (e.g. secondary containment directed to sanitary sewer, approval must be obtained from the sanitary sewer agency). Materials with the potential to contaminate storm water shall be:

- *Placed in an enclosure such as, but not limited to, a cabinet, or similar structure, or under a roof or awning that prevents contact with rainfall runoff or spillage to the storm water conveyance system; or*
- *Protected by secondary containment structures such as berms, dikes, or curbs.*

• The storage areas shall be paved and sufficiently impervious to contain leaks and spills, where necessary.

• The storage area shall be sloped towards a sump or another equivalent measure that is effective to contain spills.

• Runoff from downspouts/roofs shall be directed away from storage areas.

• The storage area shall have a roof or awning that extends beyond the storage area to minimize collection of storm water within the secondary containment area. A manufactured storage shed may be used for small containers.

At this time there are no known outdoor material storage areas proposed as part of this project. As the individual lot site plans are developed in the future they will be designed pursuant to the guidelines discussed above, if proposed.

d. *<u>Protect materials stored in outdoor work areas from rainfall, run-on, runoff, and wind dispersal:</u>*

Outdoor work areas have an elevated potential for pollutant loading and spills. All development projects shall include the following structural or pollutant control BMPs for any outdoor work areas with potential for pollutant generation, as applicable and feasible:

• Create an impermeable surface such as concrete or asphalt, or a prefabricated metal drip pan, depending on the size needed to protect the materials.

• Cover the area with a roof or other acceptable cover.

• Berm the perimeter of the area to prevent water from adjacent areas from flowing on to the surface of the work area.

• Directly connect runoff to sanitary sewer or other specialized containment system(s), as needed and where feasible. This allows the more highly concentrated pollutants from these areas to receive special treatment that removes particular constituents. Approval for this connection must be obtained from the appropriate sanitary sewer agency.

• Locate the work area away from storm drains or catch basins.

At this time there are no known outdoor work areas proposed as part of this project. As the individual lot site plans are developed in the future they will be designed pursuant to the guidelines discussed above, if proposed.

e. *Protect trash storage areas from rainfall, run-on, runoff, and wind dispersal:*

Storm water runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. All development projects shall include the following structural or pollutant control BMPs, as applicable:

- *Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This can include berming or grading the waste handling area to prevent run-on of storm water.*
- *Ensure trash container areas are screened or walled to prevent offsite transport of trash.*
- *Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.*
- *Locate storm drains away from immediate vicinity of the trash storage area and vice versa.*
- *Post signs on all dumpsters informing users that hazardous material are not to be disposed. Steep hillside areas disturbed by project development shall be landscaped with deep-rooted, drought tolerant and/or native plans species selected for erosion control, in accordance with the Landscape Technical Manual.*

Trash storage areas for the project will be designed pursuant to the guidelines discussed above.

3.2 Site Design BMPs

The term site design means a storm water management and land development strategy that emphasizes conservation and the use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions.

The following text discusses the site design practices from Section 4.3 of the Storm Water Standards Manual with respect to the project.

a. *Maintain Natural Drainage Pathways and Hydrologic Features:*

The San Diego River on the southern perimeter of the project site and the Murphy Canyon Creek Channel on the eastern perimeter of the project site are the two known hydrologic features adjacent to the site. The project proposes no improvements to these adjacent hydrologic features and will maintain the existing conditions. However, the project site itself is approximately 90% impervious in the existing condition; therefore, there are no natural drainage pathways to maintain. The post-project drainage characteristics will remain similar to the pre-project condition.

b. *Conserve natural areas within the project footprint including existing trees, other vegetation and soils:*

There are no existing native trees or shrubs to preserve, however, the project will incorporate additional street trees, shrubs, and vegetation throughout the development footprint. Implementation of pervious surfaces will be considered within the individual site plans of the respective lots and the future phases.

c. *Minimize Impervious Area:*

The project includes building densities allowing for several stories that help reduce overall impervious footprint. Streets will be built to the minimum widths necessary, and landscaping/vegetated areas are included within the public right-of-way, throughout individual lots, and the overall project includes a "River Park" along the San Diego River and Murphy Canyon Creek. The project will also incorporate street trees where feasible as a site design BMP for runoff volume reduction.

d. *Minimize Soil Compaction:*

The project is approximately 90% impervious in the existing condition; therefore, soil compaction has already occurred. However, soil compaction will be minimized within the biofiltration basins.

e. Impervious Area Dispersion:

The project proposes landscaped vegetation to be incorporated throughout the project site, which will reduce the directly connected impervious areas. Rooftop runoff will also be discharged through vegetated areas wherever feasible prior to entering the storm drain system. Runoff from surface parking areas will be directed, where feasible, to adjacent landscaping areas prior to discharge into the storm drain system for additional water quality pre-treatment and conveyance. Such areas may utilize zero-inch curb in combination with wheel stops (with drainage openings) to help facilitate sheet flow across vegetated strips or for locations where 6-inch curb is desirable as part of the drive aisle configuration, curb cuts can be used to direct runoff into landscaped areas. Non-contiguous sidewalks have also been utilized for the project.

f. Runoff Collection:

Implementation of pervious surfaces to collect runoff will be considered within the individual site plans of the respective lots and the future phases.

g. Landscaping with Native or Drought Tolerant Species:

The project will implement native or drought tolerant landscaping where feasible. Landscaping shall be maintained using minimum or no pesticides. Pesticides shall be used only after monitoring indicates they are needed according to established guidelines.

h. Harvest and Use Precipitation:

Harvest and use is deemed infeasible for the project.

3.3 Pollutant Control BMPs

Pursuant to Chapter 5 of the Storm Water Standards, after source control BMPs and site design BMPs have been incorporated into the project, applicants of Priority Development Projects shall design a single or combination of pollutant control BMPs designed to infiltrate, filter, and/or treat runoff from the project footprint.

Pursuant to Section 5.1, selection of pollutant control BMPs shall be based on Figures 5-1 and 5-2 of the Storm Water Standards Manual. The project consists of nine (9) Drainage Management Areas (DMA) namely, DMA 1A, 1B, 1C, 2, 3, 4, 5A, 5B and 5C. Since all of these DMAs contain impervious surfaces, the pollutant control BMP selection process begins at Step1B.

After calculating the Design Capture Volume (DCV) estimations, Step 2 was completed to determine Harvest and Use feasibility. Based on the proposed land use proposed for the site, it was determined that Harvest and Use will be infeasible.

In Step 3, the infiltration feasibility was assessed for the project. At this preliminary stage, infiltration is assumed to be infeasible and "no infiltration" condition has been considered for the project. However, during the final engineering phase of the project, infiltration feasibility will be assessed based on the approved infiltration testing methods in Appendix C and D of the Storm Water Standards Manual. The calculated reliable infiltration rate will then be used to determine the infiltration condition for the project by the Project Geotechnical Engineer.

In Step 4, it was determined that the biofiltration BMPs 1A, 1B, 1C, 3, and 5C, can be designed to treat the full DCV based on the maximum feasible footprint for DMA 1A, 1B, 1C, 3, and 5C respectively. The footprint of the biofiltration basins will satisfy the DCV requirements outlined in Worksheet B.5-1. The biofiltration BMPs 4 and 5B however, will use the DCV reduction gained by implementing street trees in their respective DMAs 4 and and 5B to satisfy the DCV requirements outlined in Worksheet B.5-1. Furthermore, the excess volume provided in BMP 5C will be used to offset the remaining required volume in BMP 5B.

DMA 2 consists of the lower bowl of seating and field of the proposed stadium. For DMA 2, due to the flow line of the storm drain, the finished grade of the field, and the fixed tie-in point downstream, the project has proposed a proprietary compact biofiltration system to treat the project's most significant pollutants of concern. A Modular Wetland System (MWS) has been proposed for DMA 2 since; it has been Washington State Department of Ecology (DOE) Tape Certified through third party field scale evaluation.

The drainage design for the project includes routing onsite runoff from the DMAs via the proposed storm drains designed to convey the peak flow rates towards the proposed River Park, where low flow structures will divert runoff for the small and more frequently occurring storms through these permanent pollutant control storm water BMPs for water quality purposes, then discharging runoff through each of the three (3) existing storm drain outfalls along the San Diego River.

3.3.1 Numeric Sizing Requirements for Pollutant Control BMPs

The biofiltration basin is a volume-based BMP, therefore, the biofiltration basin was sized using the volume-based numeric sizing criteria as outlined in Section B.5 of the Storm Water Standards Manual. The treatment volume is determined pursuant to numeric sizing criteria shown in Worksheet B.5-1 of the Storm Water Standards Manual.

The proprietary compact biofiltration BMP (Modular Wetland System) has been designed as a flow-based BMP, therefore, the treatment flow rates were calculated using the flow-based numeric sizing criteria to meet the requirements of the Storm Water Standards Manual. The rational method equation was used to determine the treatment flow rates, based on the following equation:

- Rational method equation: Q = CIA
- 'Q' is the treatment flow rate in cubic feet per second (cfs),
- 'C' is the weighted runoff factor,
- 'I' is the rainfall intensity in inches per hour (in/hr) [0.2 in/hr per flow-based numeric sizing criteria], and
- 'A' is the drainage area is acres (ac).

The calculations for water quality treatment flow rates are included in Appendix C, along with the typical BMP cross-section schematic and modular wetland standard detail sheet. Location of each Pollutant Control BMP is shown on the exhibit titled "Water Quality Report Exhibit for SDSU Mission Valley Campus Onsite Improvements," located in Map Pocket 1.

These pollutant control BMPs have been sized based on the ultimate condition design. Therefore, no additional pollutant BMPs will be required on individual lots. The future phases will still need to address Source Control BMPs and Site Design BMPs based on individual site/lot plans as they occur within the project site.

3.4 Hydromodification Management Requirements

Pursuant to Chapter 6 of the Storm Water Standards Manual, Priority Development Projects must be designed so that runoff rates and durations are controlled to maintain or reduce pre-project downstream erosion conditions and protect stream habitat. Pursuant to Section 1.6 of the Storm Water Standards Manual, to determine if a proposed project must implement hydromodification controls, projects must refer to the HMP Decision Matrix in Figure 1-2. As noted in Figure 1-2, projects may be exempt from HMP criteria under several specific conditions, including the following condition that applies to the overall SDSU Mission Valley Campus project:

- Direct discharge to an exempt area identified in Watershed Management Area Analysis (WMAA)

As allowed by the MS4 Permit, projects discharging directly to an area identified as appropriate for an exemption in the WMAA for the watershed in which the project resides are exempt. As such, San Diego River downstream of confluence with San Vincente Creek is a designated exempt river reach identified in the WMAA and approved by the RWQCB within City of San Diego jurisdiction. This overall project is exempt from hydromodification management requirements since it outfalls to the San Diego River downstream of San Vicente Creek confluence.

4.0 OPERATION AND MAINTENANCE PLAN (OMP)

4.1 Maintenance Responsibility

The owner of the project is the site operator and will be the party responsible to ensure implementation and funding of maintenance of permanent BMPs. Throughout this section, the owner of the project is the "party responsible to ensure implementation and funding of maintenance of permanent BMPs." The party who actually performs the activities is the "inspector," "maintenance contractor," or "maintenance operator."

4.2 Inspection and Maintenance Activities

4.2.1 Inspection and Maintenance Activities for Source Control and Site Design BMPs

The following source control and site design BMPs for the project requires permanent maintenance: concrete stamping, street trees, landscaped areas, and irrigation systems within the landscaped areas. The discussions below provide inspection criteria, maintenance indicators, and maintenance activities for the above-listed source control and site design BMPs that require permanent maintenance.

a. *Landscaped Areas:*

Inspection and maintenance of the vegetated areas may be performed by the landscape maintenance contractor.

During inspection, the inspector shall check for the maintenance indicators given below:

- Erosion in the form of rills or gullies
- Ponding water
- Bare areas or less than 70% vegetation cover
- Animal burrows, holes, or mounds
- Trash

Routine maintenance of vegetated areas shall include mowing and trimming vegetation, and removal and proper disposal of trash.

If erosion, ponding water, bare areas, poor vegetation establishment, or disturbance by animals are identified during the inspection, additional (non-routine) maintenance will be required to correct the problem. For ponding water or erosion, see also inspection and maintenance measures for irrigation systems. In the event that any non-routine maintenance issues are persistently encountered such as poor vegetation establishment, erosion in the form of rills or gullies, or ponding water, the party responsible to ensure that maintenance is performed in perpetuity shall consult a licensed landscape architect or engineer as applicable.

As applicable, IPM procedures must be incorporated in any corrective measures that are implemented in response to damage by pests. This may include using physical barriers to keep pests out of landscaping; physical pest elimination techniques, such as, weeding, squashing, trapping, washing, or pruning out pests; relying on natural enemies to eat pests; or proper use of pesticides as a last line of defense. More information can be obtained at the UC Davis website (http://www.ipm.ucdavis.edu/WATER/U/index.html).

b. *Outlet Protection:*

Routine maintenance of outlet protection shall include removing trash, debris, and leaves. For outlet protection, immediately reposition all displaced energy dissipaters. If soil erosion is found, extend energy dissipater (i.e. landscape rocks and/or splash pads); reposition or increase limits of energy dissipater to fully cover eroded area.

c. *Concrete Stamping:*

Inspection/maintenance of the concrete stamping may be performed by the building/facilities maintenance contractor or other employees of the owner, as applicable. In addition, there may be storm drain maintenance contractors who will perform this service for a fee.

During inspection, the inspector(s) shall check for the maintenance indicators given below:

- Faded, vandalized, or otherwise unreadable concrete stamping

There are no routine maintenance activities for the concrete stamping. If inspection indicates the concrete stamping is intact, no action is required. If inspection indicates the concrete stamping is not legible, the concrete stamping shall be repaired or replaced as applicable.

d. *Irrigation Systems:*

Inspection and maintenance of the irrigation system may be performed by the landscape maintenance contractor.

During inspection, the inspector shall check for the maintenance indicators given below:

- Eroded areas due to concentrated flow
- Ponding water
- Refer to proprietary product information for the irrigation system for other maintenance indicators, as applicable

Refer to proprietary product information for the irrigation system for routine maintenance activities for the irrigation system, as applicable. If none of the maintenance indicators listed above is identified during inspection of the irrigation system, no other action is required.

If any of the maintenance indicators listed above is identified during the inspection, additional (non-routine) maintenance will be required to restore the irrigation system to an operable condition. If inspection indicates breaks or leaks in the irrigation lines or individual sprinkler heads, the affected portion of the irrigation system shall be repaired. If inspection indicates eroded areas due to concentrated flow from the irrigation system, the eroded areas shall be repaired and the irrigation system shall be adjusted or repaired as applicable to prevent further erosion. If inspection indicates ponding water resulting from the irrigation system, the irrigation system operator shall identify the cause of the ponded water and adjust or repair the irrigation system as applicable to prevent ponding water. Refer to proprietary

product information for the irrigation system for other non-routine maintenance activities as applicable.

e. *Street Trees:*

Inspection and maintenance of the street trees and their tree wells may be performed by the landscape maintenance contractor.

During inspection, the inspector shall check for the maintenance indicators given below:

- Tree health
- Dead or diseased tree
- Standing water in tree well for longer than 24 hours following a storm event
- Presence of mosquito/larvae
- Entrance / opening to the tree well is blocked such that storm water will not drain into the tree well

If dead or diseased tree(s) is found, remove the dead tree and replace per original plans. If water is found stagnant in a tree well for longer than 24 hours following a storm event, loosen or replace soils surrounding the tree to restore drainage and disperse any standing water from the tree well to nearby landscaping.

4.2.2 Inspection and Maintenance Activities for Pollutant Control BMPs

The pollutant control BMPs for the proposed project consists of six (6) biofiltration basins and a proprietary compact biofiltration bmp (modular wetland system) as shown in the Water Quality Exhibit in Map Pocket 1. The discussions below provide inspection criteria, maintenance indicators, and maintenance activities for each pollutant control BMP.

a. *Biofiltration Basin:*

During inspection, the inspector shall check for the maintenance indicators given below:

- Accumulation of sediment, litter or debris
- Obstructed inlet or outlet structure
- Damage to structural components such as weirs, inlet or outlet structures
- Poor vegetation establishment
- Dead or diseased vegetation
- Overgrown vegetation
- Two-thirds of mulch has decomposed or mulch has been removed
- Erosion due to concentrated irrigation/storm water flow
- Standing water in BMP for longer than 24 hours following a storm event
- Presence of mosquitos/larvae
- Underdrain clogged

Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer if sediment, litter or debris accumulates. Clear blockage if outlet or inlet structure is obstructed. Mow or trim overgrown vegetation. Re-seed, re-plant, or re-establish vegetation per original plans if the dead or diseased vegetation is found. If mulch has decomposed or removed, remove the decomposed fraction and top off with fresh mulch to a total depth of 3 inches. If erosion occurs due to concentrated irrigation flow, repair, re-seed or re-plant eroded areas and adjust the irrigation system. If erosion occurs due to concentrated storm water runoff flow, repair, re-seed or re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If standing water is observed, make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils. If mosquitos/larvae are observed: first,

immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water.

Mulch replacement of the entire area may be required every two or three years. If inspection indicates that the underdrains for the Bioretention Facilities are clogged, then additional non-routine maintenance will be required to backwash and clear the underdrains. Depending on pollutant loads, soils may need to be replaced within 5 to 10 years. The party responsible to ensure implementation and funding of maintenance of permanent BMPs shall contract for additional cleaning and disposal services as necessary if non-routine cleaning and disposal is required.

b. *Proprietary Compact Biofiltration BMP (Modular Wetland System)*:

During inspection, the inspector shall check for the maintenance indicators given below:

- Accumulation of trash in the screening device
- Accumulation of sediments in the separation chamber
- Check the condition of cartridge filter media
- Check the condition of drain down filter media
- Overgrown vegetation

Remove any accumulated trash from the screening device manually or with the use of a vacuum truck. With a pressure washer spray down pollutants accumulated on walls and cartridge filters. Vacuum out separation chamber and remove all accumulated pollutants. Refer to the proprietary product information (included in Appendix D), if the cartridge filter media or drain down filter media needs to be maintained.

4.3 Inspection and Maintenance Frequency

The Table below lists the BMPs to be inspected and maintained and the minimum frequency of inspection and maintenance activities.

Table 4.1: Summary Table of Inspection and Maintenance Frequency

BMP	Inspection Frequency	Maintenance Frequency
Landscaped Areas	Monthly	Routine mowing and trimming and trash removal: monthly Non-routine maintenance as-needed based on maintenance indicators in Section 4.2.1
Outlet Protection	Monthly	Routine maintenance to remove accumulated materials such as trash and debris and sediments: twice a year, on or before September 30th and following the rainy season after May 1st. Non-routine maintenance as-needed
Concrete Stamping (or equivalent)	Annual	As-needed based on maintenance indicators in Section 4.2.1
Irrigation Systems	Monthly	As-needed based on maintenance indicators in Section 4.2.1
Biofiltration BMPs (pollutant control BMP)	Twice a year, and after major storm events	Routine maintenance to remove accumulated materials such as trash and debris and sediments: twice a year, on or before September 30th and following the rainy season after May 1st. As-needed maintenance based on maintenance indicators in Section 4.2.2
Proprietary Compact Biofiltration BMP – Modular Wetland System (pollutant control BMP)	Twice a year, and after major storm events	Routine maintenance to remove accumulated materials such as trash and debris and sediments: twice a year, on or before September 30th and following the rainy season after May 1st As-needed maintenance based on maintenance indicators in Section 4.2.2

The frequencies given in the Summary Table of Inspection and Maintenance Frequency are minimum recommended frequencies for inspection and maintenance activities for the project. Typically, the frequency of maintenance required for permanent BMPs is site and drainage area specific. If it is determined during the regularly scheduled inspection and/or routine maintenance that a BMP requires more frequent maintenance (e.g., to remove accumulated trash) it may be necessary to increase the frequency of inspection and/or routine maintenance.

4.4 Recordkeeping Requirements

The party responsible to ensure implementation and funding of maintenance of permanent BMPs shall maintain records documenting the inspection and maintenance activities. The records must be kept a minimum of 5 years.

5.0 SUMMARY

This water quality report summarizes permanent storm water management requirements and proposed design features to meet these requirements for the SDSU Mission Valley Campus Onsite Improvements. The planned development will include the construction of a football stadium, SDSU campus buildings, River Park, hotels and residential properties.

SDSU is considered a Phase 2 entity with regards to MS4 Permit requirements even though the project is within the City of San Diego. Hence, the project is not subject to the requirements of the San Diego Regional MS4 Permit (order R9-2013-0001); however, the project will still implement permanent storm water BMPs consistent with the requirements of the 2013 Regional MS4 Permit (R9-2013-0001) and the 2018 City of San Diego Storm Water Standards (SWS) manual dated, October 2018 where feasible to the maximum extent practicable. This includes LID site design BMPs, source control BMPs, as well as pollutant control BMPs for water quality treatment.

Hydromodification Management will not be required for the project since it discharges directly to the San Diego River, which has been identified as exempt receiving water along the lower portion of the River.

The drainage design for the project includes routing onsite runoff from the DMAs via the proposed storm drains designed to convey the peak flow rates towards the proposed River Park, where low flow structures will divert runoff for the small and more frequently occurring storms through the permanent pollutant control storm water BMPs for water quality purposes, then discharging runoff through each of the three (3) existing storm drain outfalls along the San Diego River.

Pollutants of concern for the project are based on those anticipated for the project area and those that have been identified as causing impairment in the receiving waters. The receiving waters for the project that are currently listed as impaired based on the 303(d) List in Appendix K of the Storm Water Standards Manual, dated October 2018 are the Lower San Diego River and the

Pacific Ocean Shoreline. The pollutants/stressors causing impairment for the Lower San Diego River are fecal coliform (bacteria), low dissolved oxygen (nutrients, organic compounds, trash and debris, oxygen demanding substances), phosphorus, total dissolved solids (nutrients), enterococcus (bacteria), manganese (metals), nitrogen (nutrients), and toxicity (pesticides).

The project will incorporate Source Control BMPs, Site Design BMPs, and Pollutant Control BMPs to meet storm water management requirements and address the pollutants of concern for the project. The following list provides a summary of pollutant control BMPs selected for the project:

- Biofiltration Basin
- Proprietary Compact Biofiltration (Modular Wetland System)

These pollutant control BMPs are part of the master planned water quality treatment for the onsite improvements of the ultimate condition SDSU Mission Valley Campus project. No additional pollutant control BMPs will be required on individual lots, however, a water quality report/letter will still be provided to outline specific Source Control BMPs and Site Design BMPs implemented on a Unit by Unit basis, or individual lot by lot basis, as development occurs. The specific Source Control BMPs and LID Design Practices will be consistent with those identified in this report, specifically in Section 3.1 and 3.2. The future water quality reports/letters will make reference to this water quality report for the final design of the Pollutant Control BMP that serves that particular Unit or Lot.

An Operation and Maintenance Plan (OMP) has been included to identify maintenance for the following permanent BMPs: landscaped areas, outlet protection, concrete stamping, irrigation system, street trees, eight (8) biofiltration basins, and one (1) proprietary compact biofiltration BMP (Modular Wetland System). The OMP information provided in Section 4.0 of this water quality report provides inspection criteria, maintenance indicators, and maintenance activities for the above-listed BMPs that require permanent maintenance.

The project has incorporated storm water management features in accordance with the City of San Diego Storm Water Standards, dated October 2018 where feasible to the maximum extent practicable.

This report and the accompanying *Preliminary Drainage Study Report for SDSU Mission Valley Campus,* both prepared by Rick Engineering Company, are intended to be preliminary in nature and are not intended to be used for the final engineering design of the onsite drainage and water quality facilities. During the final engineering phase of the project, the engineer of record will need to prepare final drainage and water quality reports to reflect the final site layout and construction documents.

APPENDIX A

Vicinity Map and Conceptual Project Layout

SDSU Mission Valley Campus
Site Plan Date: 12/18/2018

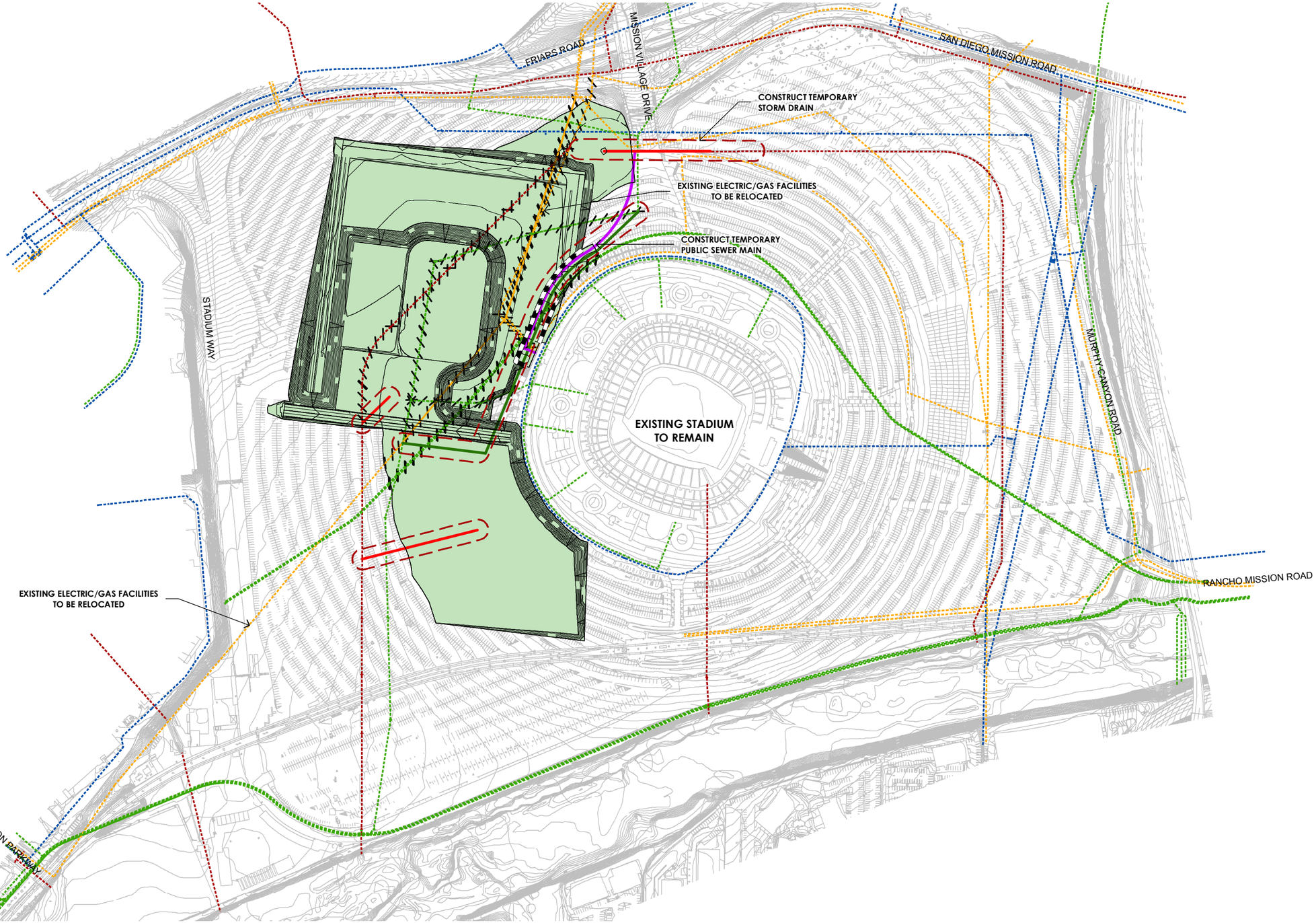
NOT TO SCALE

J-18150

PLAY AZTEC FOOTBALL FOR 2020 AND 2021 SEASONS AT SDCCU STADIUM

LEGEND

- Phase 1a
- Phase 1a Grading
- Temporary Sheet Pile Wall
- Proposed Sewer
- Proposed Storm Drain
- Proposed Joint Trench Dry Utility Temporary Relocation
- Temporary Utilities
- Existing Sewer
- Existing Storm Drain
- Existing Water
- Existing Dry Utilities
- Existing Sewer to be Demolished
- Existing Storm Drain to be Demolished
- Existing Dry Utilities to be Demolished
- Low Flow Storm Drain Diversion Structure
- Sewer Junction Structure
- 2018 Aerial Topo



CONSTRUCTION PHASE NOTES:

- DEMO EXISTING SEWER AND STORM DRAIN
- CONSTRUCT TEMPORARY SEWER AND CONNECT EXISTING STADIUM SEWER LATERAL
- CONSTRUCT TEMPORARY STORM DRAIN SYSTEMS
- EXISTING ELECTRICAL & GAS TO BE RELOCATED

RICK ENGINEERING COMPANY

Scale in Feet: 0 — 350 — 700

North

J-18150
Date of Exhibit: 1/18/2019
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SDSU MISSION VALLEY WEST CAMPUS

WEST STADIUM DEMOLITION AND CONSTRUCTION OF AZTEC STADIUM AND AZTEC DRIVE
DECEMBER 2021 TO APRIL 2022

LEGEND

- Phase 1a
- Phase 1b
- Stadium Limits of Work
- Phase 1a Grading
- Phase 1b Grading
- Stadium Building Wall
- Proposed Sewer
- Proposed Storm Drain
- Proposed Water
- Proposed Dry Utilities
- Proposed Fireline
- Existing Sewer
- Existing Storm Drain
- Existing Water
- Existing Dry Utilities
- Existing Sewer to be Demolished
- Existing Storm Drain to be Demolished
- Existing Water to be Demolished
- Existing Dry Utilities to be Demolished
- Low Flow Storm Drain Diversion Structure
- Sewer Junction Structure
- Stadium Demolition West Side
- 2018 Aerial Topo

APPROXIMATE GRADING QUANTITIES FOR PHASE 1B:

CUT = 410,000 CU YD
FILL = 410,000 CU YD

CONSTRUCTION PHASE NOTES:

- ACCELERATE DEMO OF SOUTHWEST CORNER OF EXISTING STADIUM
- CONSTRUCT AZTEC DRIVE AND RIVERPARK ROAD GRADING
- CONSTRUCTION PARK GRADING
- CONSTRUCT REGIONAL BIO-RETENTION BASINS
- DEMOLISH PORTION OF STADIUM
- RELOCATE 48" WATER MAIN
- CONSTRUCT UTILITIES
- RELOCATE 8"/18" SEWER

RICK ENGINEERING COMPANY

Scale in Feet
0 350 700
North

J-18150
Date of Exhibit: 1/18/2019
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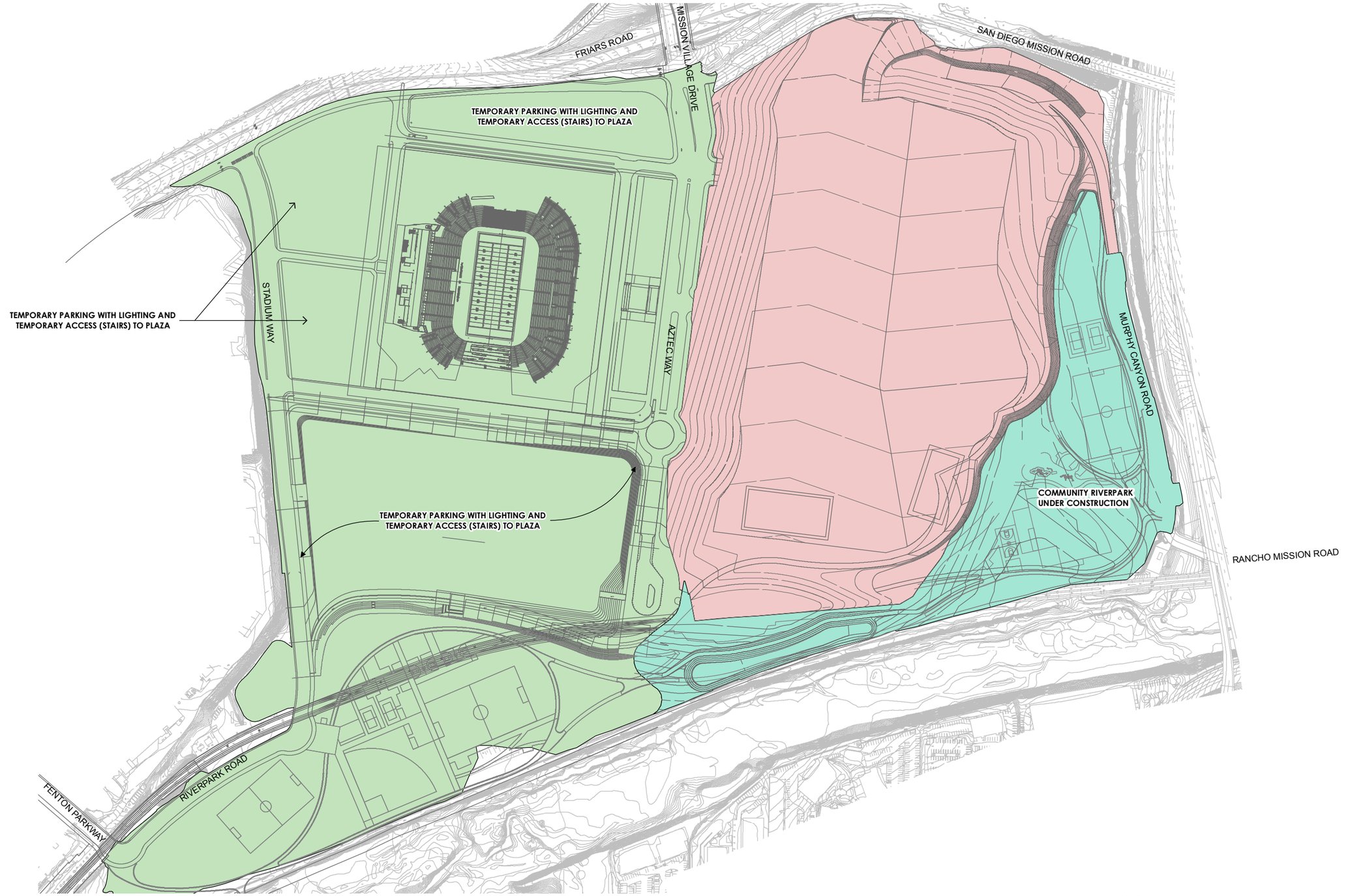
SDSU MISSION VALLEY
WEST CAMPUS

SDSU OPENING DAY PHASE 1 COMPLETE
JULY 2022

LEGEND

- Westside Grading
- Residential Grading Site
- Community Riverpark
- Phase 3 Grading
- Community Riverpark Grading
- Architectural Base
- 2018 Aerial Topo



CONSTRUCTION PHASE NOTES:

- AZTEC STADIUM COMPLETED
- SDSU RIVERPARK COMPLETED
- AZTEC DRIVE COMPLETED
- TEMPORARY PARKING COMPLETE

RICK ENGINEERING COMPANY

Scale in Feet: 0 — 350 — 700

North

J-18150
Date of Exhibit: 1/18/2019
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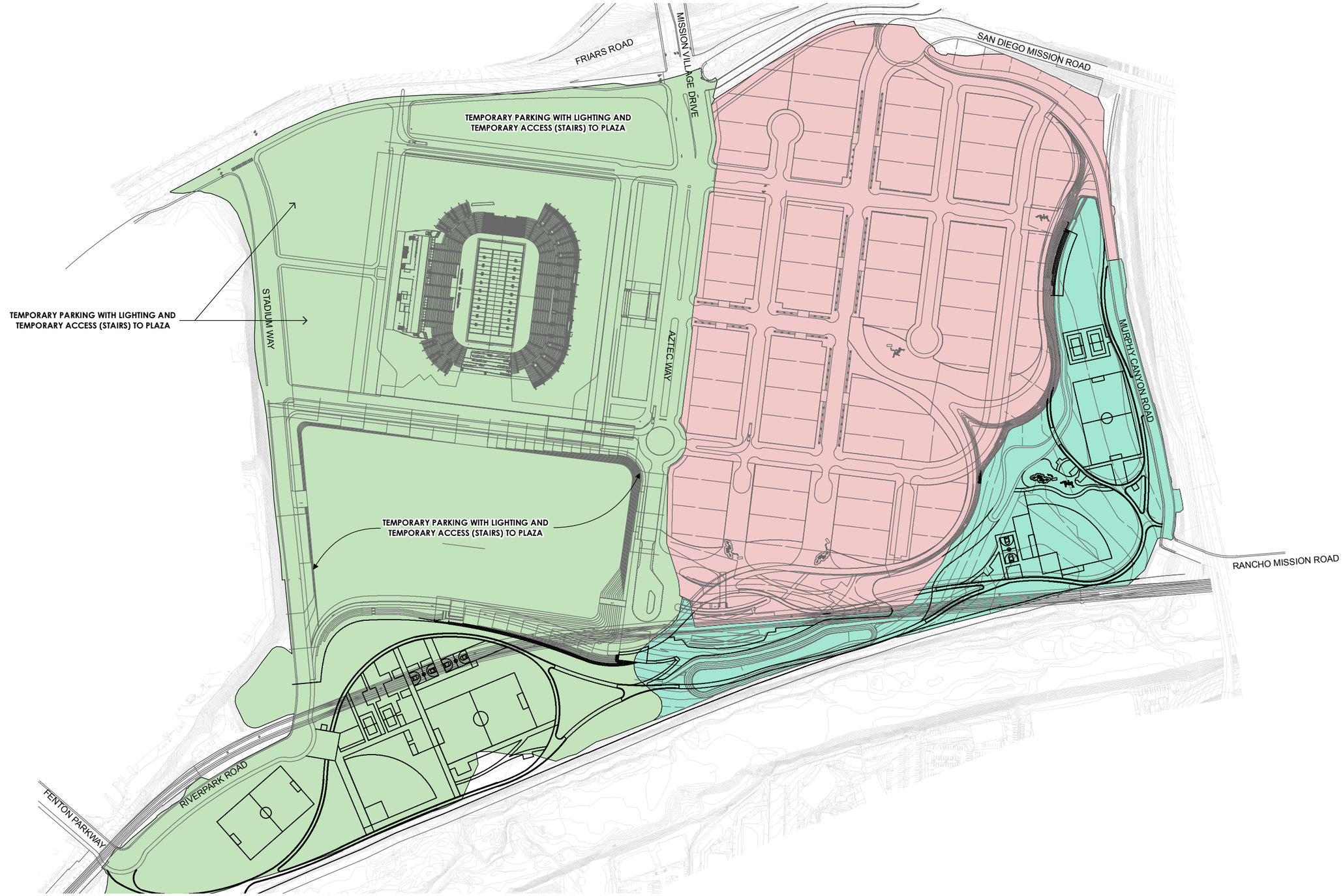
SDSU MISSION VALLEY WEST CAMPUS

COMPLETE COMMUNITY RIVERPARK
JUNE 2022 TO JUNE 2024

LEGEND

- Westside Grading
- Residential Grading
- Community Riverpark
- Phase 4 Grading
- Community Riverpark Grading
- Community Riverpark Base
- Architectural Base
- 2018 Aerial Topo



CONSTRUCTION PHASE NOTES:

- COMPLETE COMMUNITY RIVERPARK

RICK ENGINEERING COMPANY

Scale in Feet: 0 — 350 — 700

North

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Date of Exhibit: 1/18/2019
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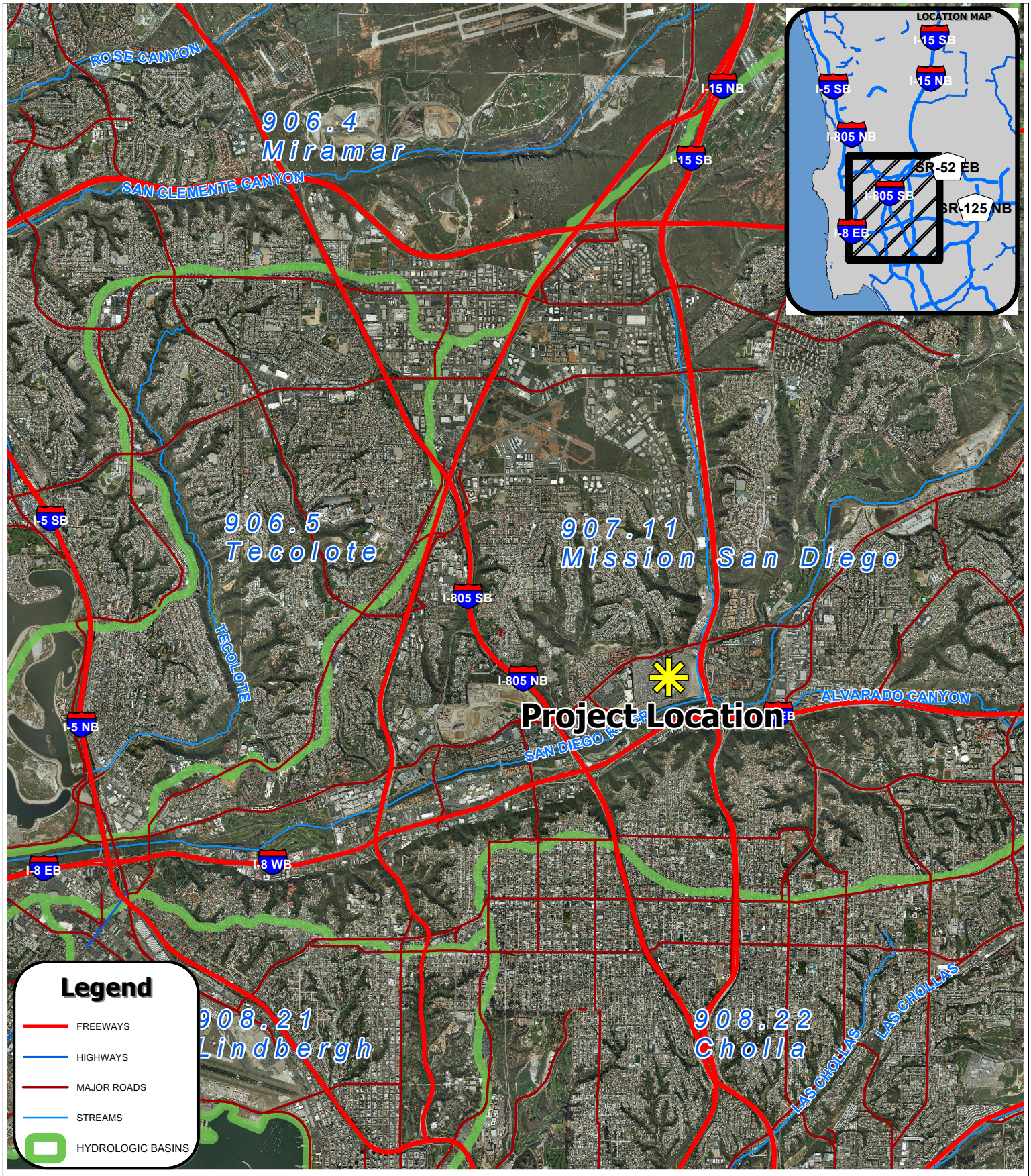
SDSU MISSION VALLEY
WEST CAMPUS

APPENDIX B

Hydrologic Unit Map



RICK ENGINEERING COMPANY

1 inch = 6,000 feet

0 3,000 6,000 12,000 Feet

HYDROLOGIC UNIT FOR SDSU MISSION VALLEY CAMPUS

EXHIBIT DATE: 01/31/2019 REC JN: 18150

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APPENDIX C

BMP Sizing Calculations and Details

WATER QUALITY - BIOFILTRATION BMP SIZING CALCULATIONS

												DCV Calculation				BMP Parameters				
DMA ID	BMP Type	Drainage Management Area (ac)	Drainage Management Area (ft^2)	Impervious Area (ft^2)	Pervious Area (ft^2)	% Impervious	Impervious Area Type	Pervious Area Type	Runoff Factor for Impervious Area [3]	Runoff Factor for Pervious Area [3,4]	Effective Impervious Area (ft^2)	Drainage Management Area (ft^2) (1)	Adjusted Runoff Factor (2)	24-hour 85th Percentile Precipitation (in) (3)	DCV (ft3) (4)	Surface Ponding Depth (in) (5)	Media Thickness (in) (6)	Aggregate Storage Above Underdrain Invert (in) (7)	Aggregate Storage Below Underdrain Invert (in) (8)	Media Available Pore Space (in/in) (9)
DMA 1A/BMP 1A	Biofiltration BMP	35.5	1,548,256	1,238,605	309,651	80%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	1,207,640	1,548,256	0.78	0.57	57,363	6	18	12	3	0.2
DMA 1B/BMP 1B	Biofiltration BMP	0.5	19,745	18,757	987	95%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	17,178	19,745	0.87	0.57	816	6	18	9	3	0.2
DMA 1C/BMP 1C	Biofiltration BMP	0.7	32,294	30,679	1,615	95%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	28,096	32,294	0.87	0.57	1,335	6	18	9	3	0.2
DMA 3/BMP 3	Biofiltration BMP	31.1	1,353,759	1,083,007	270,752	80%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	1,055,932	1,353,759	0.78	0.57	50,157	6	18	12	3	0.2
DMA 4/BMP 4	Biofiltration BMP	39.4	1,715,705	1,235,308	480,397	72%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	1,255,896	1,715,705	0.73	0.57	59,655	6	18	12	3	0.2
DMA 5B/BMP 5B	Biofiltration BMP	14.0	609,546	329,155	280,391	54%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	380,357	609,546	0.62	0.57	18,067	6	18	12	3	0.2
DMA 5C/BMP 5C	Biofiltration BMP	10.8	471,817	268,936	202,881	57%	Concrete or Asphalt	Natural (D Soil)	0.9	0.3	302,907	471,817	0.64	0.57	14,388	6	18	12	3	0.2

Notes:
1. Values shown in paranthesis (1) designate the row number equivalent to Worksheet B. 5-1 "Sizing Method for Pollutant Removal Criteria" from the City of San Diego's Storm Water Standards Manual (October, 2018)
2. The required and provided Water Quality volumes are based on the 2013 MS4 permit and the City of San Diego's Storm Water Standards Manual (October, 2018)
3. Runoff Factors for pervious and impervious areas were determined from Table B. 1-1: " Runoff Factors for Surface Draining to BMPs - Pollutant Control BMPs" from the City of San Diego's Storm Water Standards Manual (October 2018)
4. Although some portions of the impervious areas within the site will be composed of Biofiltration BMPs (amended, mulched soils or landscape), Runoff Factors for pervious areas were assumed to be "Natural". Using the "Natural" surface designation for the entire pervious area provides a more conservative result.
5. Media filtration rate to be used for sizing varies based on whether the filtration rate is controlled by the outlet (i.e., low flow orifice) or the media. 5in/hr if filtration rate is not outlet controlled.

		Baseline Calculations				Option 1 - Biofilter 1.5*DCV		Option 2 - Store 0.75 of remaining DCV in Pores and Ponding		Provided BMP Parameters							Check: Provided Biofiltration Volume >= Required Storage	
Aggregate Pore Space (in/in) (10)	Media Filtration rate to be used for sizing (in/hr)[5] (11)	Allowable Routing (hrs) (12)	Depth Filtered during Storm (in) (13)	Depth of Detention Storage (in) (14)	Total Depth Treated (in) (15)	Required Biofiltered Volume (ft^3) (16)	Required Footprint (ft^2) (17)	Required Storage[2] (ft^3) (18)	Required Footprint (ft^2) (19)	Provided BMP Bottom Footprint (ft^2)	Provided Ponding Surface Area (ft^2)	Side Slope (H:V)	Surface Ponding Volume (ft^3)	Subsurface Volume (ft^3)	Conveyance (ft)	Freeboard (ft)	Provided Biofiltration Volume[2] (ft^3)	Adequacy of Provided Biofiltration Volume (ft^3)
0.4	5	6	30	16	46	86,044	22,643	43,022	33,094	34564	35662	3	17,557	27,651	0.25	0.25	45,208	OK
0.4	5	6	30	14	44	1,224	331	612	510	1,894	2,213	3	1,027	1,326	0.25	0.25	2,353	OK
0.4	5	6	30	14	44	2,002	541	1,001	834	1,619	1,865	3	871	1,133	0.25	0.25	2,004	OK
0.4	5	6	30	16	46	75,235	19,799	37,618	28,937	45,741	46,741	3	23,121	36,593	0.25	0.25	59,713	OK
0.4	5	6	30	16	46	89,483	23,548	44,741	34,416	32,575	33,575	3	16,538	26,060	0.25	0.25	42,598	-2144
0.4	5	6	30	16	46	27,100	7,132	13,550	10,423	3,480	4,000	3	1,870	2,784	0.25	0.25	4,654	-8896
0.4	5	6	30	16	46	21,582	5,679	10,791	8,301	17,372	18,019	3	8,848	13,898	0.25	0.25	22,745	OK

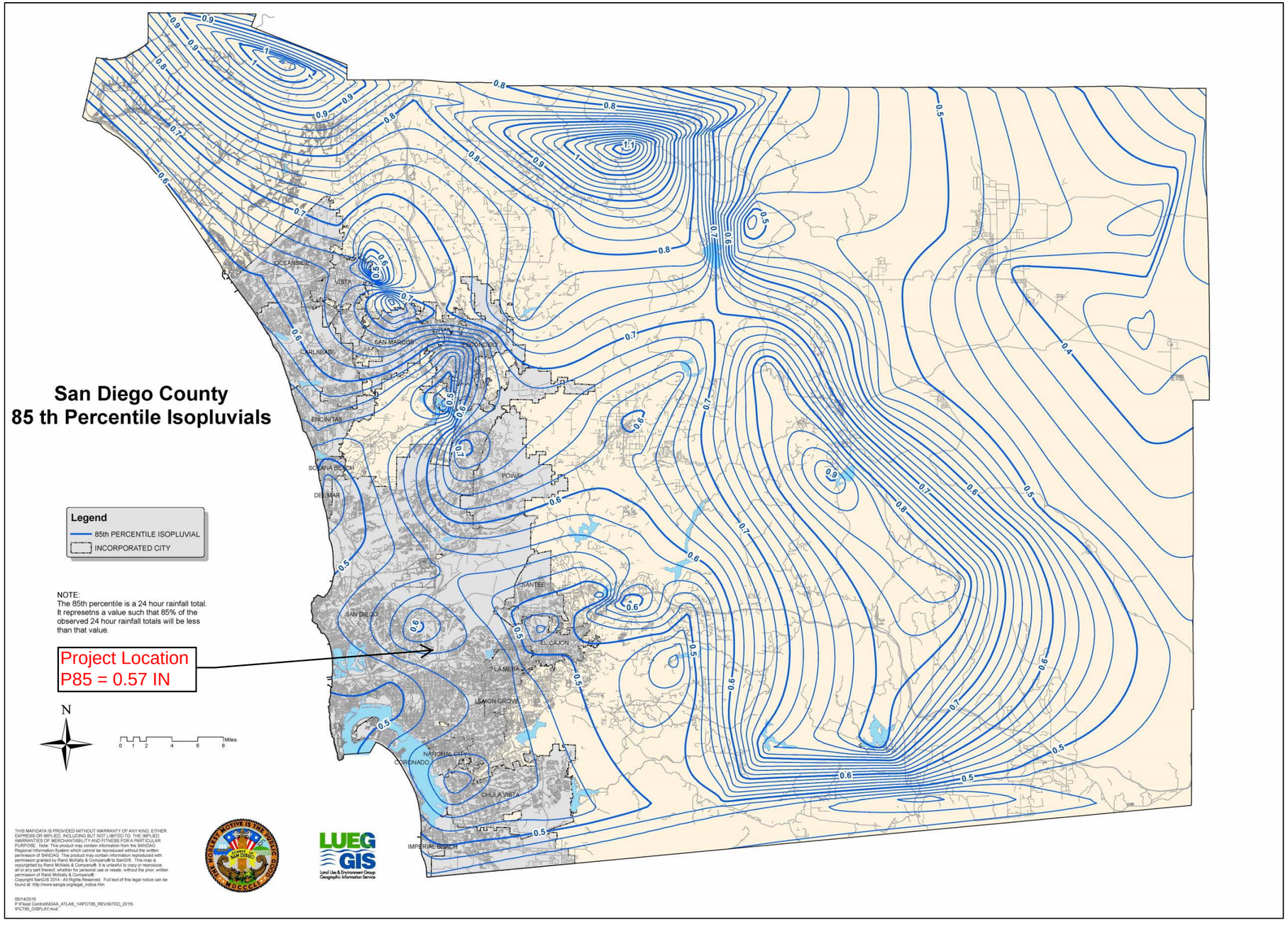

Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

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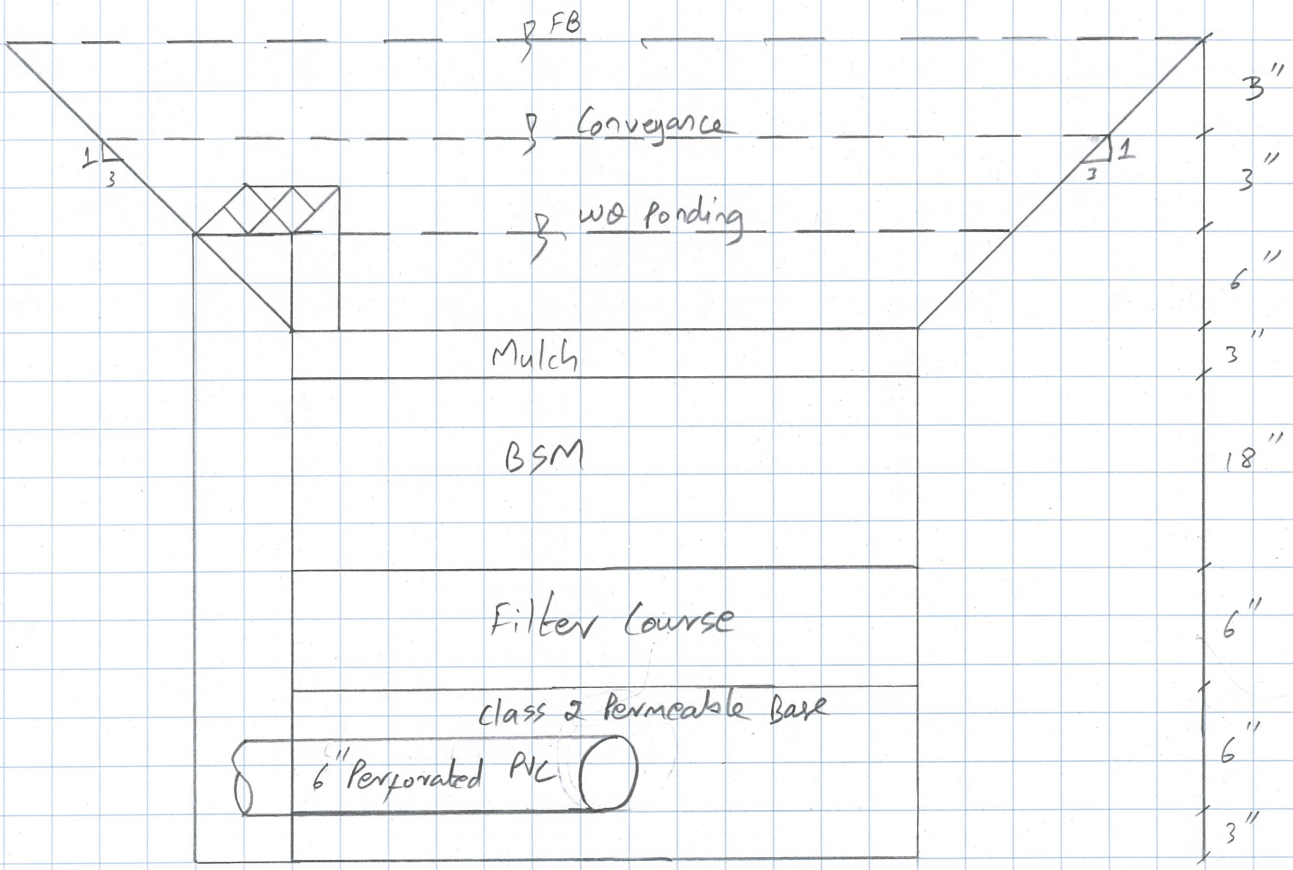
Date: Dec 27, 2018
Job No.: 18150
Page: 1
Done By: Ash
Checked By:

SDSU West.

Biofiltration BMP Typical Cross-section Schematic.



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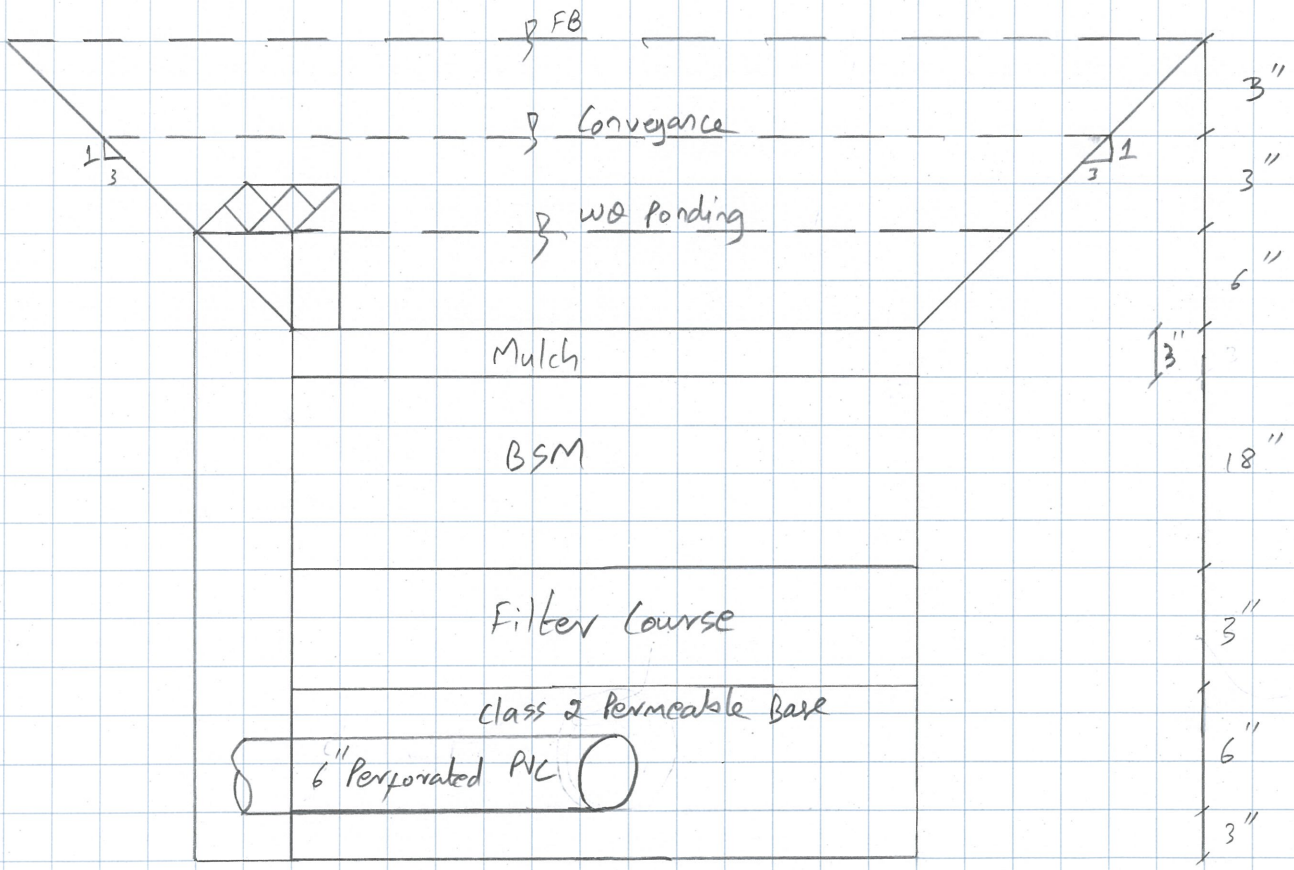
Date Dec 27, 2018
Job No. 18150
Page 2
Done By Ash
Checked By

SDSU West.

BMP 1B & 1C Typical Cross-section Schematic.



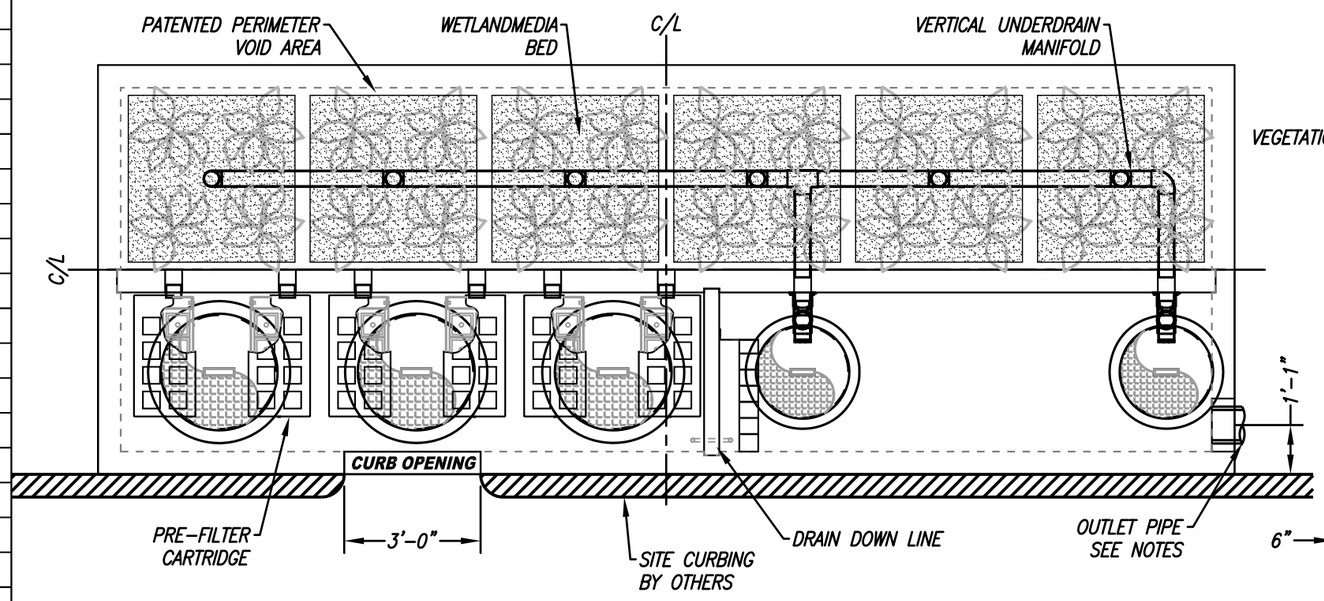
Water Quality - Modular Wetland BMP Sizing Calculations

DMA/BMP Name	BMP Type	Drainage Management Area (acres)	Drainage Management Area (ft^2)	% Impervious	Impervious Area (ft^2)	Pervious Area (ft^2)	Impervious Area Type	Pervious Area Type	Runoff Factor for Impervious Area [1]	Runoff Factor for Pervious Area[1]	Effective Impervious Area (ft^2)	Water Quality Intensity (in/hr)	Water Quality Flow Rate, Q (cfs)	Provided BMP Flow Rate (cfs)	Adequacy of provided BMP (Mod Wetland) Flowrate	Provided BMP (Mod Wetland) Footprint (ft^2)	MWS Model Name
DMA 2/BMP 2	Compact Biofiltration - Modular Wetlands	5.5	240,286	55%	132,157	108,129	Concrete or Asphalt	Amended, Mulched Soil or Landscape	0.9	0.10	129,754	0.20	0.59575	0.693	OK	302	MWS-L-8-24

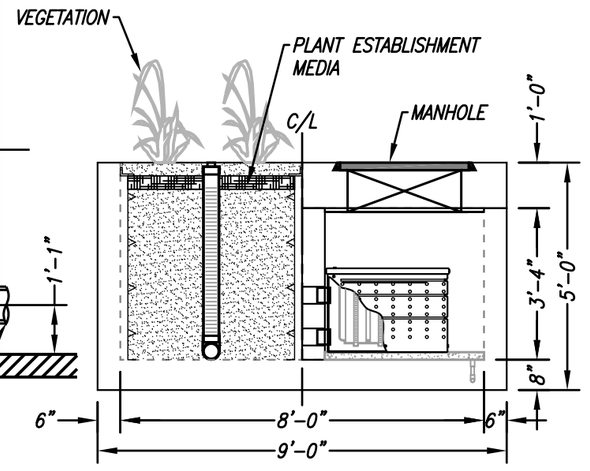
Notes:

1. Runoff Factors for pervious and impervious areas were determined from Table B. 1-1: " Runoff Factors for Surface Draining to BMPs - Pollutant Control BMPs" from the City of San Diego's SWS Manual (October 2018)

SITE SPECIFIC DATA			
PROJECT NUMBER			
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	3 EA ø30"	N/A	2 EA ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



PLAN VIEW



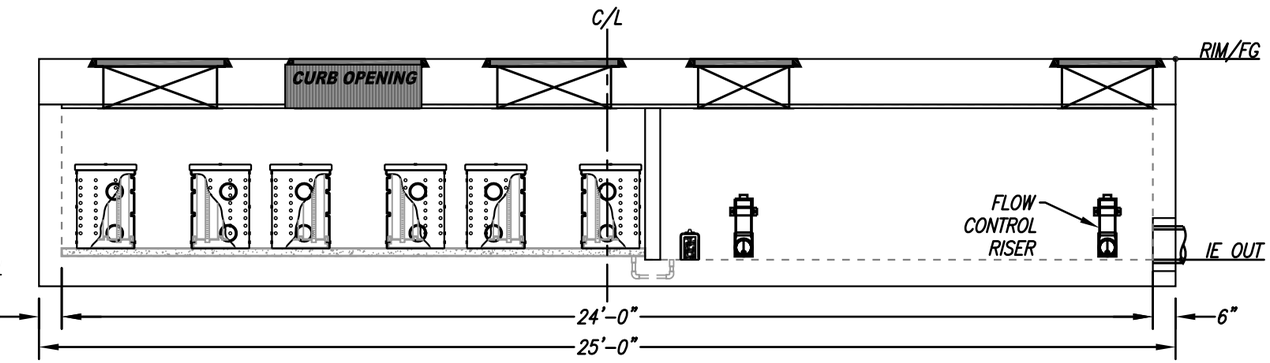
LEFT END VIEW

INSTALLATION NOTES

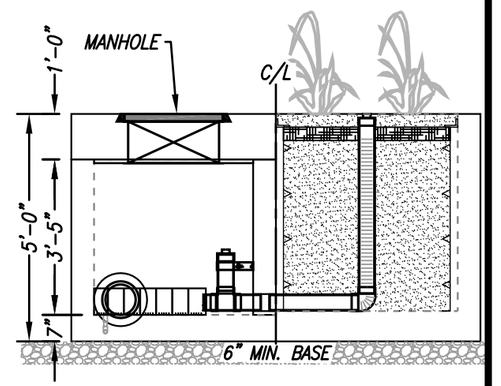
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON–SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING MODULAR WETLANDS FOR ACTIVATION OF UNIT. MANUFACTURES WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A MODULAR WETLANDS REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.693
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-24-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Bio Clean

A Forterra Company

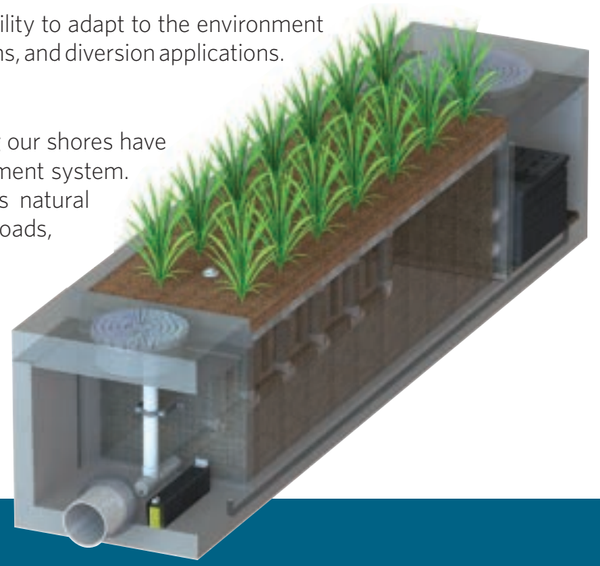
Modular Wetlands® System Linear

A Stormwater Biofiltration Solution

OVERVIEW

The Bio Clean Modular Wetlands® System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint, higher treatment capacity, and a wide range of versatility. While most biofilters use little or no pretreatment, the Modular Wetlands® incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, reducing maintenance costs and improving performance.

Horizontal flow also gives the system the unique ability to adapt to the environment through a variety of configurations, bypass orientations, and diversion applications.



The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as cities grow and develop, our environment's natural filtration systems are blanketed with impervious roads, rooftops, and parking lots.

Bio Clean understands this loss and has spent years re-establishing nature's presence in urban areas, and rejuvenating waterways with the Modular Wetlands® System Linear.

PERFORMANCE

The Modular Wetlands® continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the Modular Wetlands® has been field tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. In fact, the Modular Wetlands® harnesses some of the same biological processes found in natural wetlands in order to collect, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The Modular Wetlands® System Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world. Here is a list of some of the most high-profile approvals, certifications, and verifications from around the country.

Washington State Department of Ecology TAPE Approved
The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft² loading rate. The highest performing BMP on the market for all main pollutant categories.

California Water Resources Control Board, Full Capture Certification
The Modular Wetlands® System is the first biofiltration system to receive certification as a full capture trash treatment control device.

Virginia Department of Environmental Quality, Assignment
The Virginia Department of Environmental Quality assigned the MWS Linear the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) regulation technical criteria.

Maryland Department of the Environment, Approved ESD
Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP Evaluation
The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

Rhode Island Department of Environmental Management, Approved BMP
Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

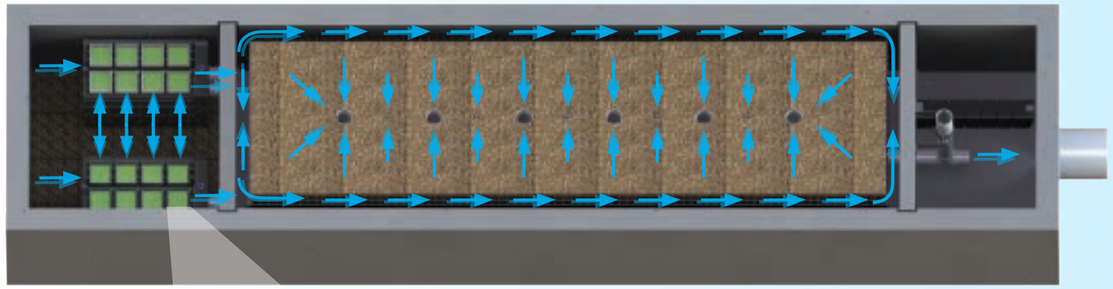
- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The Modular Wetlands® System Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which:

- Improves performance
- Reduces footprint
- Minimizes maintenance

Figure 1 & Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.



2x to 3x more surface area than traditional downward flow bioretention systems.

Figure 2, Top View

1 PRETREATMENT

SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN™ filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber

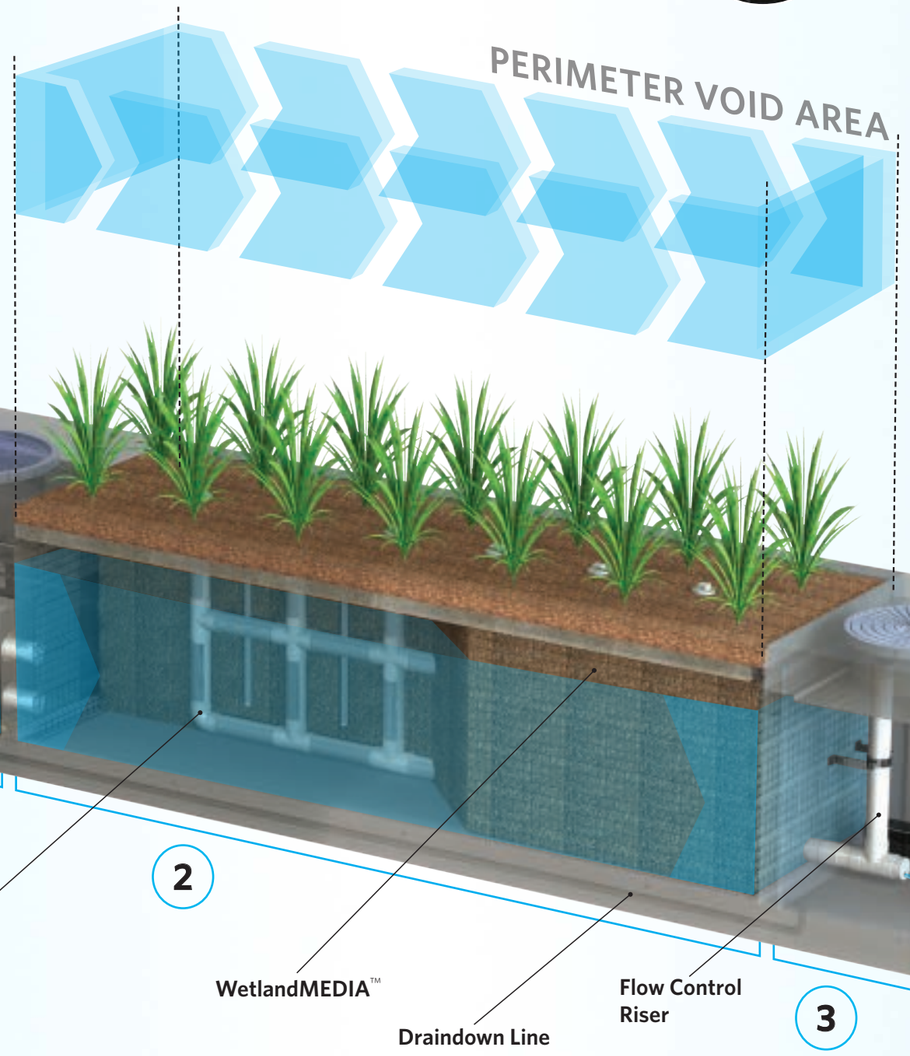


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA™ on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

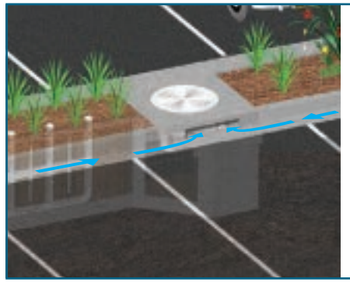
- Orifice plate controls flow of water through WetlandMEDIA™ to a level lower than the media's capacity
- Extends the life of the media and improves performance

DRAINDOWN FILTER

- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated

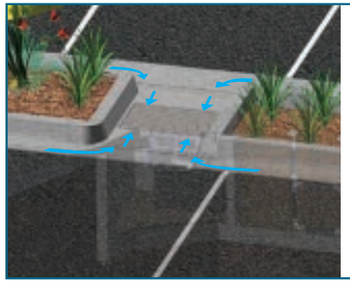
CONFIGURATIONS

The Modular Wetlands® System Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.



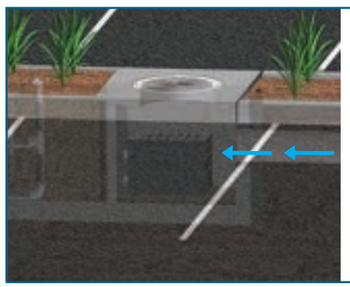
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

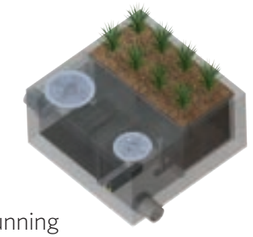
The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the Modular Wetlands® can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

DOWNSPOUT TYPE

The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

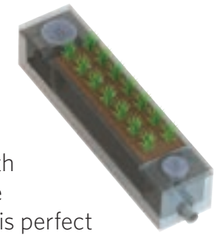
ORIENTATIONS

SIDE-BY-SIDE



The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

EXTERNAL DIVERSION WEIR STRUCTURE

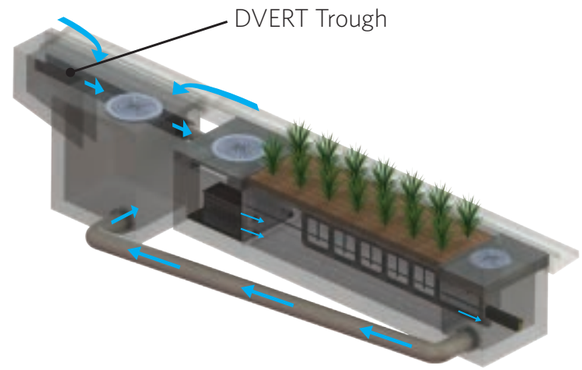
This traditional offline diversion method can be used with the Modular Wetlands® in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the Modular Wetlands® for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the Modular Wetlands® and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION

This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the Modular Wetlands® via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over



to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the Modular Wetlands® to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED DESIGNS

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements. Since the Modular Wetlands® is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

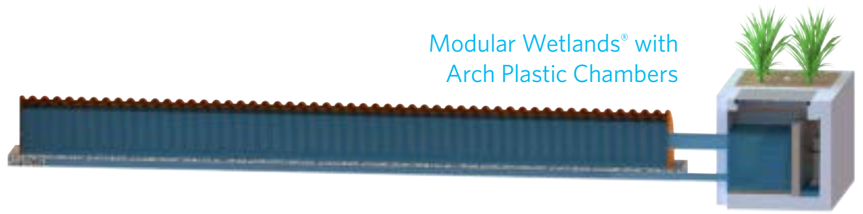
MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq. ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4′ x 4′	23	0.052
MWS-L-4-6	4′ x 6′	32	0.073
MWS-L-4-8	4′ x 8′	50	0.115
MWS-L-4-13	4′ x 13′	63	0.144
MWS-L-4-15	4′ x 15′	76	0.175
MWS-L-4-17	4′ x 17′	90	0.206
MWS-L-4-19	4′ x 19′	103	0.237
MWS-L-4-21	4′ x 21′	117	0.268
MWS-L-6-8	7′ x 9′	64	0.147
MWS-L-8-8	8′ x 8′	100	0.230
MWS-L-8-12	8′ x 12′	151	0.346
MWS-L-8-16	8′ x 16′	201	0.462
MWS-L-8-20	9′ x 21′	252	0.577
MWS-L-8-24	9′ x 25′	302	0.693
MWS-L-10-20	10' x 20'	302	0.693

VOLUME-BASED DESIGNS

HORIZONTAL FLOW BIOFILTRATION ADVANTAGE

Modular Wetlands® with
Box Culvert Prestorage

The Modular Wetlands® System Linear offers a unique advantage in the world of biofiltration due to its exclusive horizontal flow design: Volume-Based Design. No other biofilter has the ability to be placed downstream of detention ponds, extended dry detention basins, underground storage systems and permeable paver reservoirs. The systems horizontal flow configuration and built-in orifice control allows it to be installed with just 6" of fall between inlet and outlet pipe for a simple connection to projects with shallow downstream tie-in points. In the example above, the Modular Wetlands® is installed downstream of underground box culvert storage. Designed for the water quality volume, the Modular Wetlands® will treat and discharge the required volume within local draindown time requirements.



Modular Wetlands® with
Arch Plastic Chambers

DESIGN SUPPORT

Bio Clean engineers are trained to provide you with superior support for all volume sizing configurations throughout the country. Our vast knowledge of state and local regulations allow us to quickly and efficiently size a system to maximize feasibility. Volume control and hydromodification regulations are expanding the need to decrease the cost and size of your biofiltration system. Bio Clean will help you realize these cost savings with the Modular Wetlands®, the only biofilter than can be used downstream of storage BMPs.

ADVANTAGES

- LOWER COST THAN FLOW-BASED DESIGN
- MEETS LID REQUIREMENTS
- BUILT-IN ORIFICE CONTROL STRUCTURE
- WORKS WITH DEEP INSTALLATIONS

APPLICATIONS

The Modular Wetlands® System Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The Modular Wetlands® has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.

RESIDENTIAL

Low to high density developments can benefit from the versatile design of the Modular Wetlands®. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

STREETS

Street applications can be challenging due to limited space. The Modular Wetlands® is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

PARKING LOTS

Parking lots are designed to maximize space and the Modular Wetlands'® 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

COMMERCIAL

Compared to bioretention systems, the Modular Wetlands® can treat far more area in less space, meeting treatment and volume control requirements.

MIXED USE

The Modular Wetlands® can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the Modular Wetlands® System Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the Modular Wetlands®, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the Modular Wetlands'® micro/macro flora and fauna.

A wide range of plants are suitable for use in the Modular Wetlands®, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION

The Modular Wetlands® is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians is available to supervise installations and provide technical support.

MAINTENANCE

Reduce your maintenance costs, man hours, and materials with the Modular Wetlands®. Unlike other biofiltration systems that provide no pretreatment, the Modular Wetlands® is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

Bio Clean
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122018R1A

WASHINGTON STATE DEPARTMENT OF ECOLOGY

July 2017

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, AND PHOSPHORUS TREATMENT

For the

MWS-Linear Modular Wetland

Ecology's Decision:

Based on Modular Wetland Systems, Inc. application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Basic treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

2. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Phosphorus treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

3. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Enhanced treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

4. Ecology approves the MWS - Linear Modular Wetland Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:

    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
    - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
    - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

5. These use level designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use:

Applicants shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the MWS – Linear Modular Wetland Stormwater Treatment System units, in accordance with Modular Wetland Systems, Inc. applicable manuals and documents and the Ecology Decision.
2. Each site plan must undergo Modular Wetland Systems, Inc. review and approval before site installation. This ensures that site grading and slope are appropriate for use of a MWS – Linear Modular Wetland Stormwater Treatment System unit.
3. MWS – Linear Modular Wetland Stormwater Treatment System media shall conform to the specifications submitted to, and approved by, Ecology.
4. The applicant tested the MWS – Linear Modular Wetland Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to MWS – Linear Modular Wetland Stormwater Treatment Systems whether plants are included in the final product or not.
5. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

    - Typically, Modular Wetland Systems, Inc. designs MWS - Linear Modular Wetland systems for a target prefilter media life of 6 to 12 months.
    - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
    - Owners/operators must inspect MWS - Linear Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific

maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
    - Standing water remains in the vault between rain events, or
    - Bypass occurs during storms smaller than the design storm.
    - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
    - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6. Discharges from the MWS - Linear Modular Wetland Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant:	Modular Wetland Systems, Inc.
Applicant's Address:	*PO. Box 869* *Oceanside, CA 92054*

Application Documents:

- *Original Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011
- *Quality Assurance Project Plan*: Modular Wetland system – Linear Treatment System performance Monitoring Project, draft, January 2011.
- *Revised Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011
- *Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014*
- *Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014.*

Applicant's Use Level Request:

General use level designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The MWS – Linear Modular wetland is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 50-percent of Total Phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 30-percent of dissolved Copper from stormwater with influent concentrations between 0.005 and 0.020 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 60-percent of dissolved Zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/l.

Ecology Recommendations:

- Modular Wetland Systems, Inc. has shown Ecology, through laboratory and field-testing, that the MWS - Linear Modular Wetland Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Total phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The MWS-Linear Modular wetland has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Modular Wetland Systems, Inc. should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Modular Wetland Systems, Inc. should use these data to establish required maintenance cycles.
2. Modular Wetland Systems, Inc. should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Modular Wetland Systems, Inc. will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at http://www.modularwetlands.com/

Contact Information:

Applicant: Zach Kent
BioClean A Forterra Company.
398 Vi9a El Centro
Oceanside, CA 92058
zach.kent@forterrabp.com

Applicant website: http://www.modularwetlands.com/

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Revision History

Date	**Revision**
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS-Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)

Section [_____]
Modular Subsurface Flow Wetland System

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Modular Subsurface Flow Wetland Systems used for biofiltration of stormwater runoff including dry weather flows and other contaminated water sources. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure . Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

01.03.00 Manufacturer
The manufacturer of the MSFWS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the MSFWS(s) shall be a filter device Manufactured by Bio Clean Environmental Services, Inc., or Modular Wetland Systems, Inc., or assigned distributors or licensees. Bio Clean Environmental Services Inc., and Modular Wetland Systems, Inc., can be reached at:

Corporate Headquarters:
Bio Clean Environmental Service, Inc.
2972 San Luis Rey Road
Oceanside, CA 92058
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

Corporate Headquarters:
Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049
Phone: (760) 433-7650
www.modularwetlands.net

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Shop drawings are to detail the MSFWS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on shop drawings

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of MSFWS.

01.05.02 Manufacturer to supply components of the MSFWS(s):

- Pretreatment chamber components (pre-assembled)
- Concrete Structure(s)
- Biofiltration chamber components (pre-assembled)
- Flow control discharge structure (pre-assembled)

01.06.00 Reference Standards

ASTM C 29	Standard Test Method for Unit Weight and Voids in Aggregate
ASTM C 88	C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 330	C 330 Standard Specification for Lightweight Aggregate for Structural Concrete
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft3 (600 kN-m/m3)
ASTM D 1621	10 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1777	ASTM D1777 - 96(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
AASHTO T 99-01	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 104	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials.
AASHTO T 288	Standard Method of Test for Determining Minimum Laboratory Soil Resistivity
AASHTO T 289	Standard Method of Test for Determining ph of Soil for Use in Corrosion Testing
AASHTO T 291	Standard Method of Test for Determining Water Soluble Chloride Ion Content in Soil
AASHTO T 290	T 290 Standard Method of Test for Determining Water Soluble Sulfate Ion Content in Soil

PART 2 – COMPONENTS

The Modular Subsurface Flow Wetland Systems (MSFWS) and all of its components shall be self-contained within a concrete structure constructed of concrete with a minimum 28 day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports and H20 loading as indicated by AASHTO. Each Chamber shall have appropriate access hatches for easy maintenance and sized to allow removal of all internal components without disassembly. All water transfer system components shall conform with the following;

- Filter netting shall be 100% Polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Drainage cells shall be manufactured of lightweight injection-molded plastic and have a minimum compressive strength test of 6,000 psi and a void area along the surface making contact with the filter media of 75% or greater. The cells shall be at least 2" in thickness and allow water to freely flow in all four directions.

02.01.00 Pretreatment Chamber Components

02.01.01 Filter Cartridges shall operate at a loading rate not to exceed 3 gallons per minute per square foot surface area.

02.01.02 Drain Down System shall include a pervious floor that allows water to drain into the underdrain pipe that is connected to the discharge chamber.

02.02.00 Biofiltration Chamber Components

02.02.01 Media shall consist of ceramic material produced by expanding and vitrifying select material in a rotary kiln. Media must be produced to meet the requirements of ASTM C330, ASTM C331, and AASHTO M195. Aggregates must have a minimum 24-hour water absorption of 10.5% mass. Media shall not contain any organic material. Flow through media shall be horizontal from the outer perimeter of the chamber toward the centralized and vertically extending underdrain. The retention time in the media shall be at least 3 minutes. Downward flow filters are not acceptable alternatives. The thickness of the media shall be at least 19" from influent end to effluent end. The loading rate on the media shall not exceed 1.1 gallons per minute per square foot surface area. Media must be contained within structure that spaces the surface of the media at least 2" from all vertically extending walls of the concrete structure.

02.02.02 Planting shall be native, drought tolerant species recommend by manufacturer and/or landscape architect.

02.02.03 Plant Support Media shall be made of a 3" thick moisture retention cell that is inert and contains no chemicals or fertilizers, is not made of organic material and has an internal void percentage of 80%.

02.03.00 Discharge Chamber

The discharge device shall house a flow control orifice plate that restricts flows greater than designed treatment flow rate. All piping components shall be made of a high-density polyethylene. The discharge chamber shall also contain a drain down filter if specified on the drawing.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The MSFWS has no moving internal components and functions based on gravity flow, unless otherwise specified. The MSFWS is composed of a pretreatment chamber, a biofiltration chamber and a discharge chamber. The pretreatment device houses cartridge media filters, which consist of filter media housed in a perforated enclosure. The untreated runoff flows into the system via subsurface piping and or surface inlet. Water entering the system is forced through the filter cartridge enclosures by gravity flow. Then the flow contacts the filter media. The flow through the media is horizontal toward the center of each individual media filter. In the center of the media shall be a round slotted PVC pipe of no greater than 1.5" in diameter. The slotted PVC pipe shall extend downward into the water transfer cavity of the cartridge. The slotted PVC pipe shall be threaded on the bottom to connect to the water transfer cavity. After pollutants have been removed by the filter media the water discharges the pretreatment chamber and flows into the water transfer system and is conveyed to the biofiltration chamber. Once runoff has been filtered by the biofiltration chamber it is collected by the vertical underdrain and conveyed to a discharge chamber equipped with a flow control orifice plate. Finally the treated flow exits the system.

03.01.02 Pollutants - The MSFWS will remove and retain debris, sediments, TSS, dissolved and particulate metals and nutrients including nitrogen and phosphorus species, bacteria, BOD, oxygen demanding substances, organic compounds and hydrocarbons entering the filter during frequent storm events and continuous dry weather flows.

03.01.03 Treatment Flow Rate and Bypass - The MSFWS operates in-line. The MSFWS will treat 100% of the required water quality treatment flow based on a minimum filtration capacities listed in section 03.02.00. The size of the system must match those provided on the drawing to ensure proper performance and hydraulic residence time.

Minimum Treatment Capabilities

• System must be capable of treating flows to the specified treatment flow rate on the drawings. The flow rate shall be controlled by an orifice plate.

PART 4 - EXECUTION

04.01.00 General

The installation of the MSFWS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the (MSFWS) device(s) and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies and/or DigAlert to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of MSFWS components.

04.02.03 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.

04.02.04 Concrete Structures – After backfill has been inspected by the governing agency and approved the concrete structures shall be lifted and placed in proper position per plans.

04.02.05 Subsurface Flow Wetland Media shall be carefully loaded into area so not to damage the Wetland Liner or Water Transfer Systems. The entire wetland area shall be filled to a level 9 inches below finished surface.

04.02.06 Planting layer shall be installed per manufacturer's drawings and consist of a minimum 3" grow enhancement media that ensures greater than 95% plant survival rate, and 6" of wetland media. Planting shall consist of native plants recommended by manufacturer and/or landscape architect. Planting shall be drip irrigated for at least the first 3 months to insure long term plant growth. No chemical herbicides, pesticides, or fertilizers shall be used in the planting or care and maintenance of the planted area.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – MSFWS shall be shipped to the contractor's address or job site, and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the MSFWS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be born by the contractor. The MSFWS(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The MSFWS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the MSFWS has been properly installed at the correct location(s), elevations, and with appropriate components. All components associated with the MSFWS and its installation shall be subject to inspection by the engineer at the place of installation. In addition, the contractor shall demonstrate that the MSFWS has been installed per the manufacturer's specifications and recommendations. All

components shall be inspected by a qualified person once a year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of once a year and replacement of the Cartridge Filters as needed. The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the MSFWS. A Maintenance/Inspection record shall be kept by the maintenance operator. The record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured by the MSFWS shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURNACE

05.01.00 Warranty

The Manufacturer shall guarantee the MSFWS against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the _____. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The MSFWS is limited to recommended application for which it was designed.

05.02.00 Performance Certification

The MSFWS manufacturer shall submit to the Engineer of Record a "Manufacturer's Performance Certificate" certifying the MSFWS is capable of achieving the specified removal efficiency for suspended solids, phosphorous and dissolved metals.

APPENDIX D

OMP Table

SITE DESIGN, SOURCE CONTROL AND POLLUTANT CONTROL BMP OPERATION & MAINTENANCE PROCEDURE DETAILS						
O&M RESPONSIBLE PARTY DESIGNEE: SAN DIEGO STATE UNIVERSITY						
BMP DESCRIPTION		**INSPECTION FREQUENCY**	**MAINTENANCE FREQUENCY**	**MAINTENANCE METHOD**	**INCLUDED IN O&M MANUAL**	**SHEET NUMBER (S)**
SITE DESIGN	LANDSCAPED AREAS	MONTHLY (NOTE: INSPECTOR SHALL CHECK FOR THE FOLLOWING MAINTENANCE INDICATORS: EROSION IN THE FORM OF RILLS OR GULLIES, PONDING WATER, BARE AREAS, BURROWS, MOUNDS, AND TRASH.)	1. AS DETERMINED BY INSPECTION; AND 2. ON OR BEFORE SEPTEMBER 30TH.	1. FILL AND COMPACT AREAS OF RUTS, RILLS, OR GULLIES; 2. RE-SEED AND/OR PLANT SLOPES AND AREAS OF EXPOSED SOILS; AND 3. ROUTINE MOWING AND TRIMMING AND TRASH REMOVAL.	YES	
	OUTLET PROTECTION	1. MONTHLY; 2. WITHIN 24 HOURS AFTER EACH "SIGNIFICANT RAIN EVENT" [2] AND 3. WITHIN 24 HOURS FOLLOWING CONSTRUCTION IN IMMEDIATE AREA OF OUTLET PROTECTION	1. AS DETERMINED BY INSPECTION; 2. WHEN DISTURBED OR MISSING ROCKS (RIP RAP), OR SOIL EROSION BELOW AND/OR ADJACENT TO OUTLET PROTECTION ARE OBSERVED.	1. REMOVE TRASH, DEBRIS AND LEAVES. REPAIR ANY DAMAGE TO ROOF DRAINS; 2. IMMEDIATELY REPOSITION ALL DISPLACED ENERGY DISSIPATER; AND 3. IF SOIL EROSION IS FOUND, EXTEND ENERGY DISSIPATER (I.E. LANDSCAPE ROCKS OR SPLASH PADS); REPOSITION OR INCREASE LIMITS OF ENERGY DISSIPATER TO COVER ERODED AREA.	YES	
SOURCE CONTROL	INTEGRATED PEST MANAGEMENT	MONTHLY (NOTE: INSPECTOR SHALL CHECK FOR INDICATIONS OF THE PRESENCE OF PESTS ON-SITE)	WHEN THE PEST OR PESTS, OBSERVED IN GREATEST ABUNDANCE OR CAUSE THE MOST OBSERVED SYMPTOMS, ARE IDENTIFIED.	CHECK FREQUENTLY FOR PESTS, AND TREAT WITH A PESTICIDE ONLY WHEN A PEST IS PRESENT, ETC.	YES	
	EFFECTIVE IRRIGATION SYSTEM	MONTHLY	WHEN BROKEN SPRINKLER HEADS, RAIN SHUTOFF DEVICES, AND FLOW REDUCERS ARE OBSERVED; OR RUNNING SPRINKLERS IN RAIN ARE OBSERVED.	REPAIR OR REPLACE THE BROKEN AND/OR MALFUNCTIONING PARTS OF IRRIGATION SYSTEM.	YES	
SOURCE CONTROL	TRASH STORAGE AREAS	WEEKLY	1. AS DETERMINED BY INSPECTION; 2. STANDING WATER IN TRASH STORAGE AREA. 3. LOOSE TRASH OR DEBRIS. 4. LEAKED OR SPILLED MATERIALS. 5. COMPROMISED FENCE	1. IF STANDING WATER IS OBSERVED IN THE AREA, DETERMINE THE WATER SOURCE AND REMOVE THE SOURCE. ALLOW STANDING WATER TO EVAPORATE. IF WATER DOES NOT EVAPORATE IN 48 HOURS, REDISTRIBUTE THE WATER TO LANDSCAPED AREA(S). DO NOT DRAIN	YES	

			5. COMPROMISED FENCE, SCREEN, GATE, WALL, BIN. LID OR ROOF AWNING (WHERE APPLICABLE). 6. CRACKED OR OTHERWISE COMPROMISED PAVING OR OTHER FLAWED FLOOR SURFACE (AS APPLICABLE).	LANDSCAPED AREA(S). DO NOT DRAIN WATER TO STORM DRAIN SYSTEM; 2. REMOVE AND PROPERLY DISPOSE LOOSE TRASH, DEBRIS, AND LEAKED OR SPILLED MATERIALS. USE APPROPRIATE SPILL CLEANUP MATERIAL AS NECESSARY TO REMOVE ALL LEAKED AND SPILLED MATERIALS INCLUDING MATERIALS ADHERED TO PAVEMENT. IDENTIFY AND REMOVE OR REPAIR THE SOURCE OF ANY LEAKED OR SPILLED MATERIALS; AND 3. REPAIR THE FOLLOWING AS APPLICABLE: COMPROMISED FENCE, SCREEN, GATE, WALL, BIN, LID OR ROOF AWNING, CRACKED OR COMPROMISED PAVING OR OTHER FLOOR SURFACE.		
	PREVENTIVE STENCILING AND SIGNAGE	ANNUALLY	WHEN FULLY OR PARTIALLY ERASED SIGNS ARE OBSERVED; WHEN DUMPING OF TRASH ARE OBSERVED AT PUBLIC ACCESS POINTS, BUILDING ENTRANCES, PUBLIC PARKS, ETC.	1. REPLACE OR REPAINT THE STENCILS AND SIGNAGE SO THAT THEY ARE LEGIBLE; AND 2. MAKE SURE THAT THEY ARE PLACED AT ALL REQUIRED LOCATIONS (I.E.- ALL INLETS).	YES	
POLLUTANT CONTROL	BIOFILTRATION BMP	1. TWICE A YEAR (ON OR BEFORE SEPTEMBER 15TH AND FOLLOWING THE RAINY SEASON AFTER MAY 1ST); AND 2. AFTER EACH "SIGNIFICANT RAIN EVENT" [2] (NOTE: INSPECTOR SHALL CHECK FOR THE FOLLOWING MAINTENANCE INIDICATORS: EROSION IN THE FORM OF RILLS OR GULLIES, PONDING WATER, BARE AREAS, DEAD VEGETATION, ANIMAL BURROWS, HOLES, MOUNDS, AND TRASH)	1. AS DETERMINED BY INSPECTION; AND 2. ON OR BEFORE SEPTEMBER 30TH AND FOLLOWING THE RAINY SEASON AFTER MAY 1ST; AND 3. AFTER EACH "SIGNIFICANT RAIN EVENT"[2]	1. REPLACE MULCH IN AREAS OF RUTS, RILLS, OR GULLIES; 2. RE-SEED AND/OR PLANT SLOPES AND AREAS OF EXPOSED SOILS; 3. ROUTINE MAINTENANCE TO REMOVE ACCUMULATED MATERIALS SUCH AS TRASH AND DEBRIS; 4. NON-ROUTINE MAINTENANCE WILL BE REQUIRED TO BACKWASH AND CLEAR UNDERDRAINS IF INSPECTION INDICATES UNDERDRAINS ARE CLOGGED; 5. DEPENDING ON POLLUTANT LOADS, SOILS MAY NEED TO BE REPLACED EVERY 5 TO 10 YEARS; AND 6. THE RISER STRUCTURE SHOULD BE MAINTAINED TO AVOID CLOGGING AND ANY LEAKAGE THROUGH BOLTHOLES	YES	

	MODULAR WETLAND SYSTEM	1. TWICE A YEAR (ON OR BEFORE SEPTEMBER 30TH AND FOLLOWING THE RAINY SEASON AFTER MAY 1ST); AND 2. AFTER EACH "SIGNIFICANT RAIN EVENT" [2]	1. AS DETERMINED BY INSPECTION; AND 2. THE SCREENING FILTER, SEPARATION CHAMBER AND THE PERIMETER FILTER (BIOMEDIAGREEN) SHALL BE MAINTAINED ANNUALLY.	1. ROUTINE MAINTENANCE TO REMOVE ACCUMULATED MATERIALS AND REPLACE FILTER MEDIA: ANNUALLY, ON OR BEFORE SEPTERMBER 30TH; 2. IF INSPECTION INDICATES INTERNAL COMPONENTS ARE DAMAGED, ADDITIONAL NON-ROUTINE MAINTENANCE WILL BE REQUIRED TO REPAIR OR REPLACE DAMAGED PARTS AS APPLICABLE; AND 3. DISPOSE OF POLLUTANTS IN ACCORDANCE WITH LOCAL MUNICIPALITY'S REQUIREMENTS (NOTE: FOR MORE DETAILS, REFER TO BIOCLEAN'S "MAINTENANCE GUIDELINES FOR MODULAR WETLAND SYSTEM - LINEAR")	YES	

NOTES:

1. REFER TO THE "WATER QUALITY REPORT FOR SDSU MISSION VALLEY CAMPUS ONSITE IMPROVEMENTS", DATED JANUARY 31, 2019 OR ANY REVISIONS THEREOF FOR MORE SPECIFIC INFORMATION.
2. A SIGNIFICANT RAIN EVENT CONSIDERED WHENEVER THE NATIONAL WEATHER SERVICE REPORTS 0.50" OF RAIN IN 48 HOURS FOR THE LOCAL COMMUNITY.
3. DURING THE FIRST YEAR OF NORMAL OPERATION, ALL BMPS SHOULD BE INSPECTED ONCE BEFORE AUGUST 31 AND THEN MONTHLY FROM SEPTEMBER THROUGH MAY. THE MINIMUM INSPECTION AND MAINTENANCE FREQUENCY SHOULD BE DETERMINED BASED ON THE RESULTS OF THE FIRST YEAR

APPENDIX E

Copy of Plan Sheets Showing Permanent Storm Water BMPs

MAP POCKET 1

Water Quality Report Exhibit

for

SDSU Mission Valley Campus Onsite Improvements

NOTES

1. ADDITIONAL WATER QUALITY DESIGN OF THE ADJACENT IMPROVEMENTS IS PROVIDED IN A SEPRATE REPORT PREPARED BY RICK ENGINEERING COMPANY TITLED, "GREEN STREET ELEMENTS FOR SDSU MISSION VALLEY CAMPUS ADJACENT IMPROVEMENTS", DATED JANUARY 31, 2019 OR ANY REVISIONS THEREOF.

LEGEND:

- DMA BOUNDARY
- SUB BASIN BOUNDARY
- FLOW PATH
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- DMA X — DMA ID
- PROPOSED BIOFILTRATION BMP
- * PROPOSED COMPACT BIOFILTRATION BMP (MODULAR WETLAND SYSTEM)

WATER QUALITY REPORT EXHIBIT FOR SDSU MISSION VALLEY CAMPUS ONSITE IMPROVEMENTS

J-18150 Date: February 12, 2019

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J-18150

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