moffatt & nichol

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# MEMORANDUM

| | |
|---|---|
| **To:** | Rob Holmlund (Humboldt Bay Harbor, Recreation, and Conservation District) |
| **From:** | Jeremy Patapoff |
| **Date:** | March 27, 2024 |
| **Subject:** | Stormwater Treatment |
| **Project:** | Redwood Marine Multipurpose Terminal Replacement Project |
| **Location:** | Eureka, California |
| **M&N Job No.:** | 212991-03 |
| **Cc:** | Shane Phillips & Michael Jokerst<br>Jared O'Barr and Cole Collins |

**Disclaimer:** *This draft technical memorandum is a work-in-progress and is intended to be an internal document for use by the Humboldt Bay Offshore Wind Heavy Lift Marine Terminal Project team as a part of the conceptual design process and the ongoing permitting process. This memorandum is meant to be read as a part of a comprehensive packet of technical analyses. It is not written to be a standalone document and it is assumed that the reader has substantial project knowledge and context to understand the memorandum's content. All aspects of this memorandum are subject to change and may become less accurate over time. To better understand the project, please review the more comprehensive and up to date documents posted to the Humboldt Bay Harbor District's website at https://humboldtbay.org/humboldt-bay-offshore-wind-heavy-lift-marine-terminal-project-3.*

The purpose of this memorandum is to document Moffatt & Nichol's (M&N's) evaluation process that led to the selection of stormwater treatment types and sizing. This memorandum is organized as follows:

1. Introduction
2. Design Criteria
3. Stormwater Treatment Evaluation
4. Conclusion
5. Limitations
6. Next Phase Considerations

## 1. INTRODUCTION

The proposed Redwood Multi-Purpose Marine Terminal includes two wharves and a wet storage tie-up pier to meet the operational needs of a heavy-lift marine terminal facility to support the offshore wind energy industry and other coastal-dependent industries. The main function of the delivery wharf is to provide berthing, mooring, and offloading capabilities for the delivery vessels and launching of WTD foundations. The assembly berth's main functions include staging, and assembly of WTDs.

The "North Wharf" will be built in two phases. The first phase wharf will be 800 linear feet (LF) and will be wide enough to be able to accommodate a large crane that will be used for assembly of the Wind Turbine Devices (WTD). The second phase will extend the North Wharf 800 LF and would be used primarily as a delivery berth. The second wharf will be the "South Wharf," and will similarly be able to accommodate both delivery and assembly operations with a total length of 1600 LF.

The roughly 170 acres of backland will be graded to provide protection against future sea level rise, provide laydown area for the windfarm components, be compacted to sustain the loads of the component/cranes/SPMTs that move the components around, and provide positive drainage to the proposed stormwater collection and treatment facilities.

The finished surface of the proposed project site will consist primarily of compacted Dense Graded Aggregate (DGA). The compacted DGA surface of the site will be fairly impermeable and will be treated as an impermeable surface for the purpose of stormwater mitigation analysis.

All existing stormwater infrastructure is proposed to be abandoned, removed, or replaced with the proposed storm drain system (see “On-Site Drainage Memo” for further details) and other stormwater treatment infrastructure, after the completion of all preloading work.

- Existing Treatment Conditions

  The north half of the site currently has five Bay Outfall locations as identified on an old photo atlas map, See Attachment 1. Four of the locations connect to on-site collection systems and one connects to a system that terminates at the east end of Samoa near the project boundary. Based on review of aerial photograph and field investigations there are currently no treatment facilities for stormwater within the site. Additionally, the town of Samoa surface drains to a collection point with no identified treatment facilities prior to outfall discharge.
  No existing drainage facilities were identified within the south half of the site; therefore, it is safe to assume that there are no existing stormwater treatment facilities at the south end of the site prior to discharge.
  Based on these observations all runoff from the project does not go through treatment prior to discharge.

- Proposed Treatment Conditions

  Based on the design criteria below the following stormwater treatment devices are proposed:

  Bio-Filtration Planter
  Bio-filtration planters are proposed along the perimeter of the site where stormwater runoff can directly surface flow to the device. They not only meet the LID requirements of the MS4 for treatment, but also provide storage for protection from larger storm events and can also serve as vegetative buffers around the site. The typical bio-filtration planter is 48” in depth and varies from 30-ft to 60-ft in width in order to provide 100% treatment of the stormwater quality volume. The benefit of this type of treatment is it is placed outside the laydown areas within the buffer zone around the perimeter of the site, avoids the need for a buried collection system and can be maintained from the surface.

  StormPod Infiltration Vaults
  Infiltration vaults, such as the StormPod (Rotondo), are conditionally proposed within the site pending favorable field infiltration testing results. Infiltration vaults can help supplement the storage volume of the bio-filtration planters for larger storm events and provide an added level of water quality treatment. They can also provide treatment for industrial stormwater runoff by storing onsite given there are no negative groundwater concerns. The benefit of infiltration vaults is that they do not take up laydown area and provide an additional level of stormwater treatment.

  BioPod Filtration Vaults
  When bio-filtration planters or infiltration cannot be achieved based on site constraints it is proposed to use a mechanical filtration device such as the BioPod (OldCastle). BioPods are a Washington State Department of Ecology (DOE) approved flow through treatment control measure that is certified for “enhanced treatment”. Enhanced treatment meets the basic treatment requirements for removal of total suspended solids (TSS) plus removals of copper and zinc. When combined with a pre-treatment trash capture devices the combination provides results similar to traditional Low Impact Development (LID).

## 2. DESIGN CRITERIA

Permit vs Program Water Quality Approach:

1. **Permitted Operations**. These operations will be analyzed at a detailed "project level" in the Project's California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documents and will be included in permit applications that will be submitted in early 2024. Permitted activities include; outside storage of premanufactured OSW components, outside assemble of components, parking lots, office buildings, storage buildings and maintenance building. See Section 3 of the Terminal Permitted and Future Operations Memo and Attachment 2A of this memo.
2. **Future Operations**. These operations will occur later than Permitted Operations and will be analyzed at a more general "program level" in the Project's CEQA and NEPA documents. Not enough detail regarding the Future Operations is currently known to include them in the initial permit applications. However, because these operations are likely to occur in the future it is important to consider them in the Project's CEQA and NEPA documentation. See Section 4 of the Terminal Permitted and Future Operations Memo.

The purpose of this memo is to focus on the water quality treatment for the permitted operations and discuss how the future operations would be an add-on/supplement to the permitted treatment.

Permit Water Quality Approach
The project site is not located within an MS4 Permit jurisdictional boundary. However, stormwater mitigation design requirements for this project will be triggered by other permit regulations. Since the project will disturb over 1 acre of land, it will be required to comply with the State Construction General Permit (CGP) Post-Construction Standards. Also, since the project will be required to obtain a 401 Certification from the State Water Resources Control Board, it will have to comply with Section 5 of the 401 application (Low Impact Development).

Section 5.A.1 of the 401 application states that if the project will increase and/or replace 5,000 square feet or more of impervious surface, then the project must comply with the requirements of Section 5.B.2 which states that the project must treat and retain the runoff from the 85$^{th}$ percentile/24-hour storm event. This requirement aligns with the requirements of the MS4 Permit for Regulated Projects.

Section 5.B of the 401 application also states that if the project is not located within an MS4 jurisdictional boundary, and where the post-project hydrograph would exceed the pre-project hydrograph by 10 percent or more for the 2-year 24-hour storm event in volume and/or time of concentration, LID measures must be implemented to correct the hydrograph to meet the pre-project conditions.

Since complying with the MS4 Regulated Project permit requirements is more stringent than complying with the CGP Post-Construction Standards, MS4 permit compliance will govern.

This project will create or replace greater than 5,000 square feet of impervious surface and will therefore be classified as a Regulated Project. Additionally, since the post-project hydrograph for the site is expected to exceed the pre-project hydrograph by 10 percent or more for the 2-year, 24-hour storm event in volume and/or time of concentration, the project is expected to be required to comply with the hydromodification requirements of the 401 application and the MS4 permit. *However, it is being discussed with the RWQCB that since all systems are lined and discharge directly to the bay the hydromodification requirement should be waived.*

Requirements for Regulated Projects, in accordance with the MS4 Permit with reference sections noted, are summarized below:

- **Site Development & Redevelopment (E.12.c.ii.a-b)** – New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface.

  - Where a redevelopment project results in an increase of more than 50 percent of the impervious surface of a previously existing development, runoff from the entire project, consisting of all existing, new, and/or replaced impervious surfaces, must be included to the extent feasible.
  - Where a redevelopment project results in an increase of less that 50 percent of the impervious surface of a previously existing development, only runoff from the new and/or replaced impervious surface of the project must be included.
- **Site Design Measures (E.12.e.ii.d)** – The project shall implement the Site Design Measures listed below to reduce the amount of runoff for which retention is required. Any remaining runoff from impervious areas within each Drainage Management Area (DMA) shall be directed to a bioretention facility.
- **Site Design Measures (E.12.b.ii):**
  - Stream setbacks and buffers
  - Soil quality improvement and maintenance
  - Tree planting and preservation
  - Rooftop and impervious area disconnection
  - Porous pavement
  - Green roofs
  - Vegetated swales
  - Rain barrels and cisterns

  Runoff reduction resulting from implementation of the Site Design Measures listed above is determined by using the State Water Board SMARTS Post-Construction Calculator, or an equivalent method. This will quantify the remaining runoff from each DMA that must get directed to a bioretention facility (or similar feature).

The site design measures listed above are typical of residential/commercial development and are expected to have limited to no applicability for this project, so it is expected that the bulk of the stormwater mitigation required for the site will be achieved using bio-filtration planters, infiltration vaults, and bio-filtration vaults with trash capture devices, where necessary. Design criteria for bio-filtration planters per the MS4 Permit are below.

- **Stormwater Treatment Measures (E.12.e.ii.f)** – After implementation of Site Design Measures, remaining runoff from impervious surfaces within each DMA must be directed to one or more facilities designed to infiltrate, evapotranspire, and/or bioretain the remaining runoff. The facilities must be demonstrated to be at least as effective as a bioretention system with the following parameters:
  - Maximum surface loading rate of 5 inches per hour. A sizing factor of 4% of the tributary impervious area may be used.
  - Minimum surface reservoir volume equal to surface area times a depth of 6 inches
  - Minimum planting depth of 18 inches. The planting media must sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and maximize runoff retention and pollutant removal.
  - Subsurface drainage/storage (gravel) layer with an area equal to the surface area and having a minimum depth of 12 inches.
  - Underdrain with discharge elevation at top of gravel layer.
  - No compaction of soils beneath the facility or ripping/loosening of soils if compacted.
  - No liner or other barriers interfering with infiltration.
  - Appropriate plant palette for the specified soil mix and maximum available water use.

The table below summarizes the design criteria applied to the bio-filtration planters, bio-filtration vaults, and trash capture devices that are proposed at this phase of design.

**Table 1 – Summary of Stormwater Treatment Design Criteria**

| | |
|---|---|
| Design Storm | 1-yr with 10-yr overflow protection (mechanical treatment)<br>1-yr with 10-yr and 100-yr overflow protection (biofiltration treatment) |
| Intensity (in/hr) | 1-yr, 1-hr with 10-yr, 10-min overflow (mechanical treatment)<br>1-yr, 1-hr with 10-yr and 100-yr 10 min overflow protection (biofiltration treatment) |
| Runoff Coefficient | 0.9 for compacted DGA |
| Rainfall Depth (in) | 85$^{th}$ Percentile, 24-hr storm = 0.65 inches |
| BPU-1224IB (BioPod filtration vault) Treatment Capacity (cfs) | 0.86 cfs, 20 cfs by-pass |
| DVS-60C-SC (mechanical treatment/trash capture) Treatment Capacity (cfs) | 2.6 cfs |

Based on preliminary discussions with the State Water Board, it was determined that mechanical trash capture and bio-filtrations vaults would be a reasonable approach in locations where bio-filtration planters are not possible and assuming that LID options were exhausted.

Future Water Quality Approach

As the U.S. West Coast OSW industry matures, the domestic supply chain will begin to build out. The programmatic project options allow for the construction of Tier 1 and 2 manufacturing on the RMMT.

- Tier 1 – Finished Components: These are the major products such as blades, tower sections, assembled foundations, etc.
- Tier 2 – Subassemblies: These products have a specific function for a Tier 1 component such as the pitch system for blades or the struts and cans for foundations.

The on-site manufacturing of OSW components triggers the NPDES General Permit for Stormwater Discharges Associated with Industrial Activities (Order 2014-0057-DWQ No. CAS000001) within Attachment A, Part 2 Manufacturing Facilities. The Industrial Permit is based on a site meeting numeric targets for the potential pollutants generated from the industrial activity. Testing and reporting of stormwater at discharge points to waters of the US is required to demonstrate compliance.

## 3. STORMWATER TREATMENT EVALUATION

A hydrology map for the project site was prepared as part of the Storm Drain Site Plan. The subarea boundaries were delineated in the east-west direction from the high point crown, as established by the grading plan, to the project boundary. Subareas were further divided north-south to separate areas draining to different bio-filtration planters or deck drains. In all, 11 subarea boundaries were created. See Attachment 2 for the hydrology boundaries and their respective stormwater treatment measures.

In order to size the treatment devices, the site was evaluated for the 1-yr, 1-hr storm event with an intensity of 0.425 in/hr, provided by NOAA14 data for the project location, which was used to establish the Stormwater Quality Treatment Flow (SQTF) rates for the wharf areas where mechanical treatment is necessary. The site was also evaluated for the 85$^{th}$ percentile, 24-hr storm event with a rainfall depth of 0.65 inches, provided by the California Coastal Commission, which was used to establish the Stormwater Quality Treatment Volume (SQTV) for the bio-filtration planters. Based on each subarea's acreage, a SQTV and SQTF runoff rate was calculated. Overflow calculations were also performed for the 10-yr, 24-hr storm,

and the 100-yr, 24-hr storm with rainfall depths of 4.14 in and 6.18-in, respectively. A summary of the storm treatment volumes and runoff rates is provided in Table 2 below.

**Table 2 – Volume and Runoff Summary ***

| Subarea | SQTV (cf) | SQTF (cfs) | 10-yr | | 100-yr | |
|---|---|---|---|---|---|---|
| | | | Volume (cu-ft) | Runoff (cfs) | Volume (cu-ft) | Runoff (cfs) |
| 1 | 53083.5 | 9.6 | 165315.0 | 17.3 | 250137.0 | 30.1 |
| 2 | 38638.4 | 7.0 | 408149.0 | 40.2 | 617565.0 | 68.7 |
| 3 | 41615.4 | 7.5 | 262875.0 | 26.7 | 397753.0 | 45.9 |
| 4&9 | 88167.4 | 15.9 | 519875.0 | 59.4 | 786611.0 | 100.4 |
| 5 | 16638.4 | 3.0 | 107079.0 | 11.2 | 162019.0 | 18.7 |
| 6 | 50956.8 | 9.2 | 470535.0 | 54.8 | 711957.0 | 94.3 |
| 7 | 18684.7 | 3.4 | 72771.0 | 11.0 | 110103.0 | 17.7 |
| 8&10 | 46011.0 | 8.3 | 192762.0 | 31.0 | 291653.0 | 51.1 |
| 11 | 13486.3 | 2.4 | 69889.0 | 9.9 | 105745.0 | 17.0 |

* Values are based on preliminary subarea boundaries and will be refined in futures phases of design

Bio-filtration Planter Composition and Preliminary Sizing:

In subareas 1-3, 5-7, and 11, bio-filtration planters are proposed to collect and pre-treat site runoff prior to sending the flow to StormPods (infiltration vaults), which will allow the runoff to infiltrate into the ground, and any excess to discharge to the bay. See Attachment 3 for further information regarding StormPods. Bio-filtration planters consist of four distinct components:

1. Surface Ponding Zone - Provides temporary surface storage of precipitation and runoff which promotes infiltration into the lower components.
2. Soil Media Layer (typically consisting of a sand/compost mix) - Allows for storage of runoff in the void spaces of the media, supports plant growth, and provides treatment via filtration, volatilization, biological uptake, media adsorption, and vegetative transpiration.
3. Gravel Storage Layer – Allows for storage of runoff in the void spaces between the rock and promotes infiltration into the native soils below. The gravel layer may or may not include an underdrain, which allows discharge in the occasional case that the storage and volumetric losses (infiltration and evapotranspiration) are insufficient to retain all precipitation and runoff.
4. Underlying Native Soil – Infiltration into the native soil is dependent on the characteristics of the native soil. Infiltration into the native soils is promoted by ensuring that the native soil beneath the bioretention basin is uncompacted. Liners or other barriers are typically not allowed in order to promote infiltration into the native soils.

The volume of stormwater that can be retained by the bio-filtration vaults can be determined by accounting for the ponding depth on the surface of the basin, the void space in the soil media layer, and the void space in the gravel layer. The storage volume of the ponding zone is determined based on the allowable ponding depth and the overall area of the bio-filtration planter. The storage volume of the soil media layer and gravel storage layer is calculated based on the thicknesses of the layers, the porosities of the materials (typically 30% porosity for soil media and 35% porosity for gravel), and the overall area of the bio-filtration planter. See Attachment 4 for a diagram of a typical bio-filtration planter.

Since the proposed project is expected to consist of complete redevelopment of the site and since the site is expected to consist primarily of impervious surfaces (buildings and compacted DGA), preliminary sizing of the bioretention vaults is expected to be 4% of the entire DMA area. No Site Design Measure runoff reduction credits are anticipated at this time.

BioPod and DVS Trash Capture Device Preliminary Sizing:

In wharf subareas 4, 9, 8, and 10, BioPods (filtration vaults) and DVS trash capture devices have been selected to remove trash and treat stormwater before discharging to the bay. In these subareas, trench drains will collect stormwater and discharge to trash capture devices and then a BioPod. The calculated number of trash capture units (DVS-60C-SC) and biotreatment mechanisms (BPU-1224IB) are summarized below in Table 3, based off of the SQTF and 10-yr bypass flows in Table 2. See Attachment 5 for further information regarding BioPods and DVS systems.

**Table 3 – Trash Capture and Biotreatment Quantities**

| Subarea | Area | Length [ft] | I [in/hr] | C | SQTF =C*I*A [cfs] | Q10 (cfs) | BPU-1224IB Treatment Capacity (cfs) | BPU-1224IB By-Pass Capacity (cfs) | DVS-60C-SC Treatment Capacity (cfs) | # BioPod per DVS | # BioPod Needed | # DVS Needed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 & 10 | 21.67 | 427.5 | 0.425 | 0.9 | 8.29 | 30.93 | 0.86 | 20 | 2.6 | 3 | 10 | 4 |
| 4 & 9 | 41.52 | 946 | 0.425 | 0.9 | 15.88 | 59.37 | 0.86 | 20 | 2.6 | 3 | 19 | 7 |

## 4. CONCLUSIONS

Based on M&N assessment, a combination of bio-filtration planters, infiltration vaults, filtration vaults, and mechanical treatment of on-site storm water is necessary to provide LID treatment and comply with MS4 regulations for the terminal areas.

## 5. LIMITATIONS

The purpose for the work conducted in this phase was to help advance a conceptual design for purposes of project planning, initiation of environmental permitting and regulatory processes, and to aid in development of an overall project narrative and budget estimate. Certain information that is pertinent to design was unavailable at this phase of conceptual design. Soil infiltration testing results were not available at the time of the conceptual design as a result of site access constraints for a large portion of the site. Assumptions were made from the best available current data to be the basis of the design. It is recommended that site field data collection and infiltration testing occur at the start of the next phase of the project.
The lack of the former variables make it difficult to determine whether infiltration will be allowed on site. Additional calculations and analysis will be required in subsequent phases of work to refine and update the results and recommendations outlined in this memorandum.

## 6. NEXT PHASE CONSIDERATIONS

At the start of the next phase of work, the following are critical steps in the continuation of the planning, analysis, and design work:

- Obtaining more detailed topographic information and survey of the site area to aid in the further analysis and design of on-site drainage conditions and solutions, such as StormPod depth and bio-filtration planter dimensions.
- Determining the infiltration rates of the site soil to confirm that StormPod can be used for infiltration in addition to storage.
- Determining possible future pollutants that may cause site runoff to need additional treatment.
- Follow up discussions to see if the State Water Board will accept a waiver for hydromodification requirements.
- Analyzing the effect that a storm event exceeding 100-years would have on the design concept, due to the ways the changing climate may alter precipitation events.
- Furthering the design of the bio-filtration planters and overflow risers to determine if there will be any localized standing water in the face of a 100-year precipitation event in order to determine if the water will need to be accounted for in structure floor elevations.

# Attachment 1 - Existing Bay Outfall Locations

Bay Outfall Location 1

Bay Outfall Location 2

Bay Outfall Location 3

Bay Outfall Location 4

Bay Outfall Location 5

## NOTES

1. PURPOSE: THE PURPOSE OF THIS WORMAP IS TO SHOW THE APPROXIMATE LOCATIONS OF EXISTING SEWER MAINS AND STORM DRAIN MAINS AND THE APPROXIMATE LOCATION OF A NEW SEWER LIFT STATION.
2. PROPERTY LINE INFORMATION: CALCULATED PROPERTY LINES ARE SHOWN, BASED ON BOOK 25 OF MAPS, PAGES 127 - 141.
3. UNDERGROUND DISCLAIMER: NO RESEARCH OR INVESTIGATION REGARDING UNDERGROUND PIPES, ELECTRIC LINES, OR OTHER SUBSURFACE FEATURES HAS BEEN PERFORMED. NO LIABILITY IS ASSUMED FOR ANY UNDERGROUND INFORMATION.
4. BEFORE ANY EARTHWORK IS PERFORMED ON SUBJECT PROPERTY, PROPERT OWNER IS ADVISED TO CONTACT UNDERGROUND SERVICES ALERT (USA) FOR ACCURATE LOCATION OF UNDERGROUND UTILITIES (800-227-2600).
5. THE EXISTING BARK FILTER SEWER TREATMENT FACILITY, SEWER LIFT STATIONS AND DRAIN INLETS (DI) ARE FROM AERIAL MAPPING BY 3D1 IN APRIL 2001.

## LEGEND

- PERMANENT EASEMENT FOR SANITARY SEWER PIPE LINE AND SEWER LIFT STATION
- TEMPORARY EASEMENT FOR INGRESS AND EGRESS DURING CONSTRUCTION

## CURVE TABLE

| | RADIUS | DELTA | LENGTH |
|---|---|---|---|
| C1 | 1622.09 | 12°24'48" | 351.43 |
| C2 | 1622.09 | 4°12'19" | 119.05 |
| C3 | 1622.09 | 3°47'29" | 107.34 |
| C4 | 709.65 | 11°29'13" | 142.27 |

ATTACHMENT 2A - PERMITTED LAYOUT

# PERMITTED PROJECT SITE LAYOUT

TWO STAGING AND INTEGRATION
EACH 60 ACRES
ONE 1600 FT WHARF
ONE 1100 FT WHARF

FLOATING FOUNDATION ASSEMBLY
60 ACRES
ONE 500 FT WHARF

N

FLOATING FOUNDATION ASSEMBLY
60 ACRES
500 FT WHARF

Parking (18,000 SF)

Parking (45,000 SF)

Office Building (20,000 SF)

Office Building (20,000 SF)

Storage/Assembly Building (50,000 SF)

STAGING AND INTEGRATION SITE #2
60 ACRES
1100 FT WHARF

Phase 3 South Substation (60/36KV)

Preferred Site Boundary

Property Line

Phase 1 North Substation (60/36KV)

STAGING AND INTEGRATION SITE #1
60 ACRES
1600 FT WHARF

Storage/Assembly Building (50,000 SF)

Office Building (20,000 SF)

Parking (45,000 SF)

1,600 FT HEAVY LIFT WHARF

500'

1,100'

CRANE

DELIVERY

PIER

350'-0"

470'-0"

Wet Storage

DELIVERY

CRANE

1,600 FT HEAVY LIFT WHARF

Fully Integrated WTG Wet Storage

Sinking Basin (Depth: 60 ft)

Floating Foundation Wet Storage

300' 0' 300' 600'

SCALE: 1"=300'

FOR CONCEPTUAL DESIGN
ISSUED: 2023-12-17
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"X34" DRAWING

HUMBOLDT BAY HARBOR RECREATION & CONSERVATION DISTRICT

| Mark | Description | Date | Appr |
|---|---|---|---|
| | | | |

REDWOOD MULTIPURPOSE MARINE TERMINAL REPLACEMENT PROJECT

WATER SITE PLAN

| | | | |
|---|---|---|---|
| Designed by: DSGN | Cad by: CHKR | Drawing scale: | Rev: REVNO |
| Dwn by: DRFT | Reviewed by: REVR | Drawing Scale: | Date: DATE |
| Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL | | Plot scale: 1:1 (D SHEET) | M&N Project No. 212991-03 |


1300 CLAY STREET, SUITE 350
OAKLAND, CA 94612
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DRAFT

SEAL

Sheet Reference No.
**CW100**
INDEX: 22 OF 2

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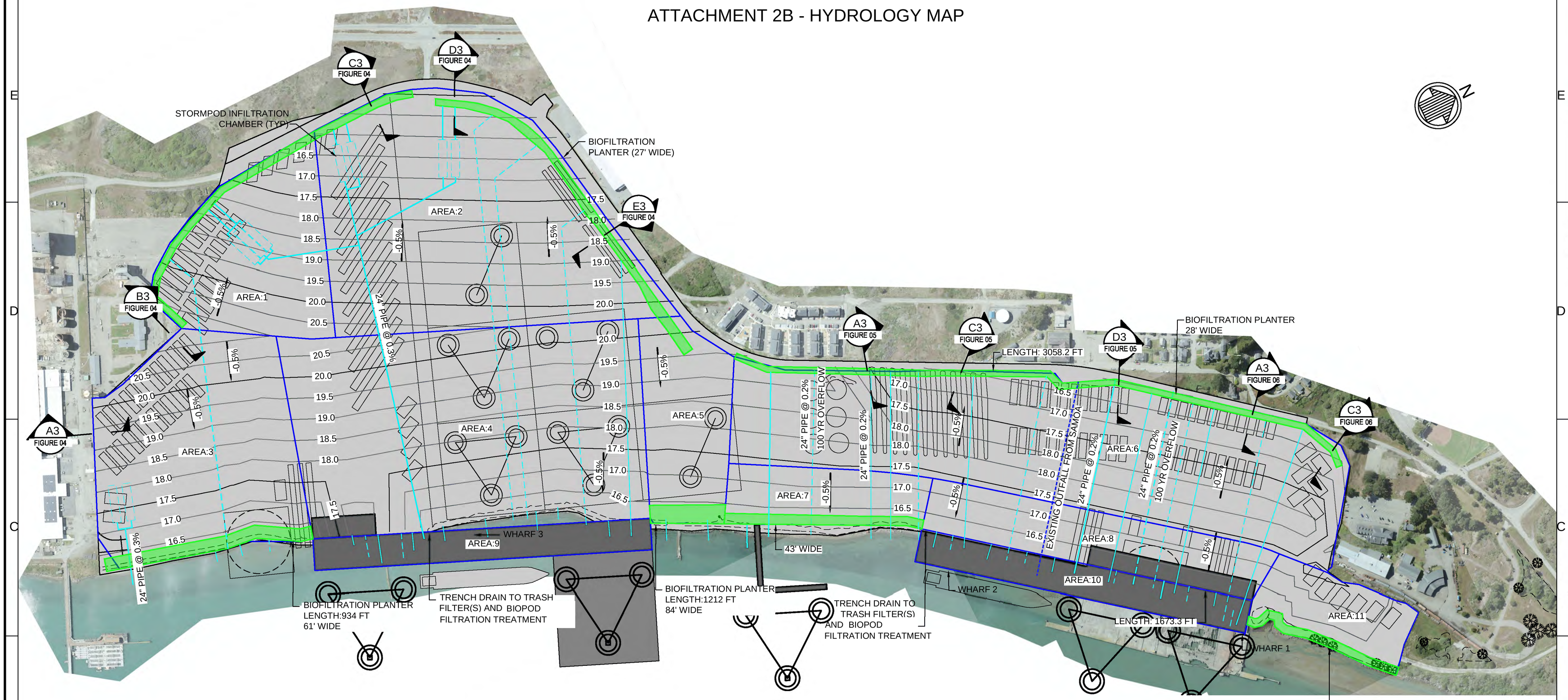
# ATTACHMENT 2B - HYDROLOGY MAP




| PARCEL AREA TABLE | | | | |
|---|---|---|---|---|
| PARCEL # | AREA (Sq. ft) | AREA (Acres) | Q10 (cfs) | Q100 (cfs) |
| 1 | 571578.18 | 13.12 | 17.3 | 30.12 |
| 2 | 1419799.14 | 32.59 | 40.24 | 68.68 |
| 3 | 914227.65 | 20.99 | 26.67 | 45.95 |
| 4 | 1568142.74 | 36.00 | 47.18 | 82.14 |
| 5 | 372498.88 | 8.55 | 11.21 | 18.72 |
| 6 | 1636522.69 | 37.57 | 54.78 | 94.31 |
| 7 | 253011.64 | 5.81 | 10.96 | 17.68 |
| 8 | 416685.85 | 9.57 | 18.05 | 31.76 |
| 9 | 240000.00 | 5.51 | 12.19 | 18.28 |
| 10 | 253572.42 | 5.82 | 12.88 | 19.31 |
| 11 | 242970.69 | 5.58 | 9.88 | 16.98 |

LEGEND:

24" PIPE

24" PIPE 100YR OVERFLOW

250' 0' 250' 500'

SCALE: 1"=250'

FOR CONCEPTUAL DESIGN
ISSUED: 2023-08-21
NOT TO BE USED FOR CONSTRUCTION

HUMBOLDT BAY HARBOR RECREATION & CONSERVATION DISTRICT

| Rev. | Date: | Description | Chkd. | Appr. |
|---|---|---|---|---|
| #### | #### | #### | #### | #### |

MPDG HUMBOLDT WIND PORT

GRADING AND DRAINAGE PLAN

Designed by: ####
Drawn by: ####
Checked by: ####
Reviewed by: ####
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL
M&N Project No. 212991-03
Drawing code:
Drawing Scale: 1:1 (D SHEET)
Plot scale: 1:1 (D SHEET)

1300 CLAY STREET, SUITE 350
OAKLAND, CA 94612
moffatt & nichol

INSERT SUB-CONSULTANT OR CLIENT LOGO AND INFO HERE

SEAL

Sheet Reference No.
FIGURE 03
INDEX: 03 OF ####

DRAWING SCALES SHOWN BASED ON 22 x34" DRAWING

File: O:\SEA\212991-03\20 CADD_Active_Exhibits\212991-03FIG-003 ; Plotted: 11/8/2023 4:50 PM by: SAMANIEGO, RUBEN ; Saved: 11/8/2023 4:03 PM by RSAMANIEGO

ATTACHMENT 3 - StormPod (Infiltration Vault) Informational Sheets

# StormPod®

## UNIVERSAL STORMWATER MANAGEMENT SYSTEM

Innovative Design • Easy to Install • Optimal Solution




4950-C Eisenhower Avenue | Alexandria, VA 22304 | 703-212-4830 | rotondo-es.com

Patented System

## The StormPod® Advantage

StormPod® is a modular, single-chambered, precast concrete groined arch system that is engineered for underground installation. StormPod® utilizes a proven arch design to provide the lowest cost system with the highest strength and durability.

StormPod®'s patented, fiber-reinforced, ribbed-shell design is lightweight, yet incredibly strong. Each module is AASHTO HL93 rated with 12" cover from top of arch to finish grade, and can support fill depths up to 25' with the standard design. Deeper fills can be accommodated if needed. Each StormPod® module installs quickly, adding thousands of cubic feet of storage in a matter of minutes.

8' tall sandfilter system

## Benefits

- 50% less material than other concrete systems.
- Standard design supports AASHTO HL93 loading at 1' earth cover and up to 25' of earth cover.
- 100+ year service life.
- External aquifers provide additional storage capacity at 0.40 void ratio.
- Joints are easily sealed internally for water-tightness (no exterior liners required).
- Modules create a single open chamber with no lateral obstructions for easy maintenance.
- Direct manway access makes inspections and maintenance easy.
- Modular units can create endless configurations for site-specific designs.
- Light-weight modules eliminate the need for a large crane to install.
- 50% reduction in installation time due to attached base section.
- 2' to 18' interior heights.
- No concrete foundations required.

Installation of a typical endwall panel

## Water-tight System

When a water-tight system is required, StormPod®'s joints can easily be sealed to create a water-tight system. Unlike all other SWM systems on the market, StormPod® does not require an impervious liner wrapped around the exterior to make the system water-tight. StormPod® modules are cast with a pre-formed groove around the interior of all exposed edges that, when placed up against another module, form a ½" x ½" interior caulk joint that can be filled with a polyurethane elastomeric sealant. This sealant provides a water-tight seal from the inside of the structure that can easily be inspected or repaired as needed over time. Where if an exterior liner is punctured or damaged during installation or deteriorates over time, there is no way to repair or replace the liner, thus eliminating the water-tight seal.

Sealing the interior joints to make the system water-tight

Filling exterior aquifer with stone

Module with interior wall installed at the factory

Interior of 6' tall structure

## Applications

StormPod® will maximize your land space by storing and treating stormwater runoff underground. This frees up valuable land space for buildings, parking lots and green space. The StormPod® system is a versatile modular system which can be used to meet a variety of stormwater management requirements, including:

- Detention/Retention
- Infiltration
- Underground Sandfilters/Cartridge Filters
- Bioretention
- Rainwater Harvesting
- Treatment Train (Combine multiple systems into one)

## Bedding & Backfill Requirements

- The StormPod® system is typically installed on a 6" thick stone bed on top of a compacted sub-base.
- The exterior sides and top of the StormPod® system can typically be backfilled with existing site material, meaning no imported backfill.
- The exterior aquifer cavities are typically filled with clean, crushed angular #57 stone.

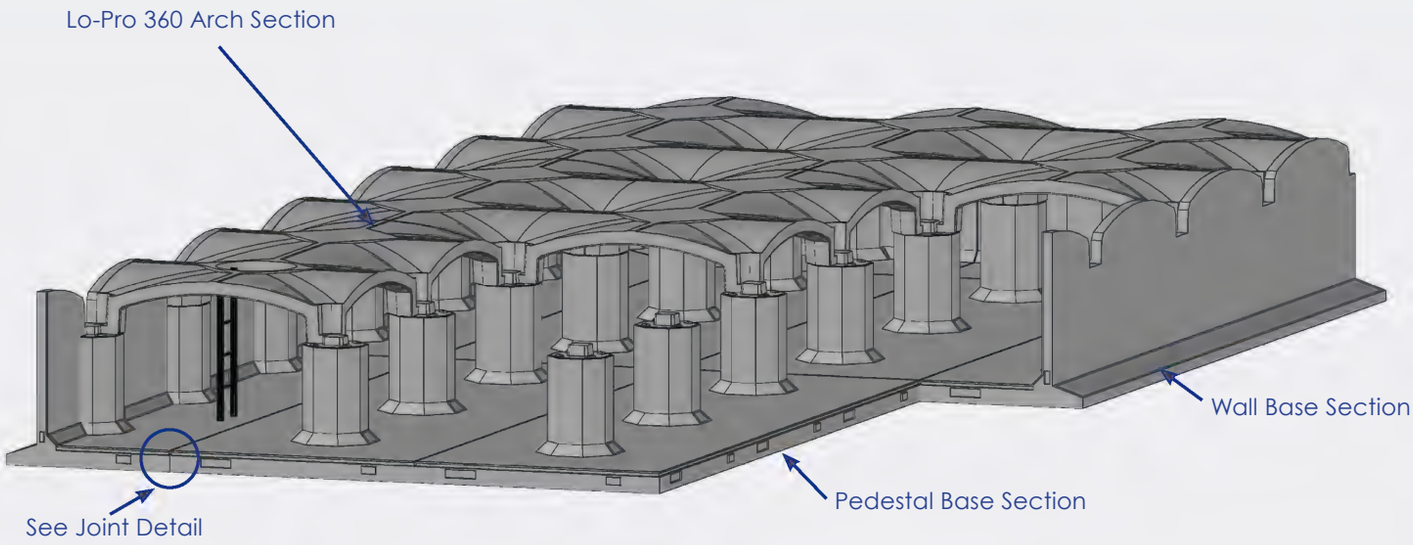
## Installation

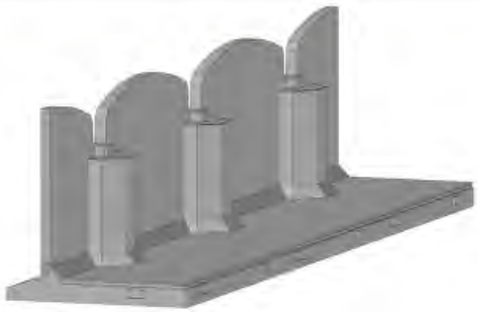
With a properly excavated and prepared base, a StormPod® module can be installed every 10-15 minutes. Because a module consists of an arch and a base slab bolted together, the contractor is installing two sections with one pick compared to other concrete systems where the top and bottom sections are handled separately. Therefore, the contractor is able to install the StormPod® system in half the time it would take him to install the competition's system. Also, because of the light-weight design of the StormPod® module, the contractor can use a small crane to install the modules thus minimizing his cost to install the system.

## Maintenance

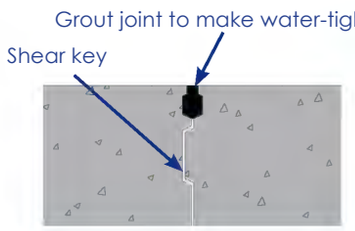
No other storm water management system can match StormPod®'s ease of maintenance. It is the only system on the market that truly provides a single open chamber no matter what the configuration of the system. Where other systems have interior walls that restrict the movement of maintenance crews within their structure, the StormPod® system has no lateral obstructions allowing maintenance crews to move throughout the structure freely, thus reducing the future maintenance costs.

# Lo-Pro



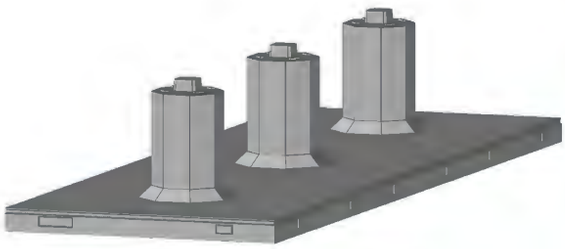
**Wall Base Section**



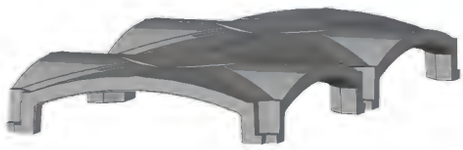

**Joint Detail**

| LO-PRO VOLUMES | |
|---|---|
| HT (FT) | VOLUMES PER MODULE (CF) |
| 2 | 230 |
| 3 | 352 |
| 4 | 474 |
| 5 | 596 |

* Based on 8'x16' Modules.



**Pedestal Base Section**



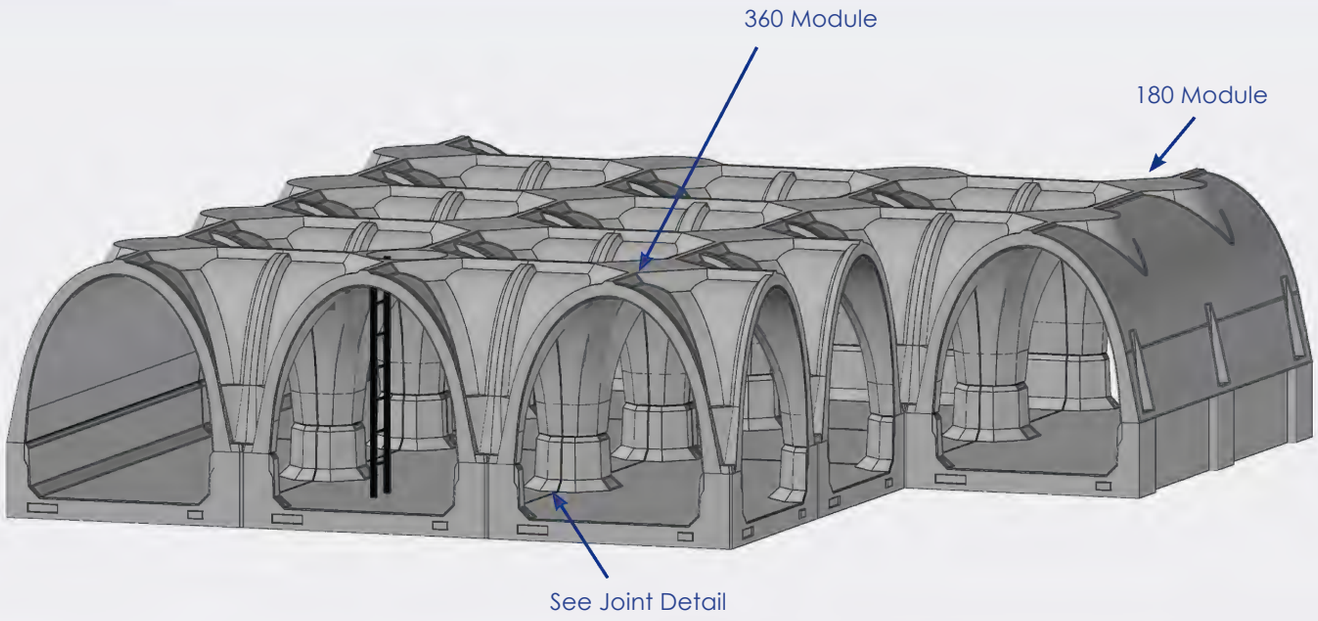
**Lo-Pro 360 Arch Section (8'x16')**

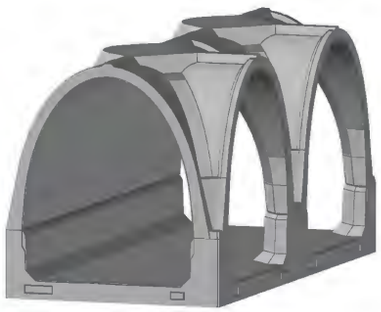

Internal outlet control structure installed at factory



ROTONDO Environmental Solutions LLC

# Mid-Pro



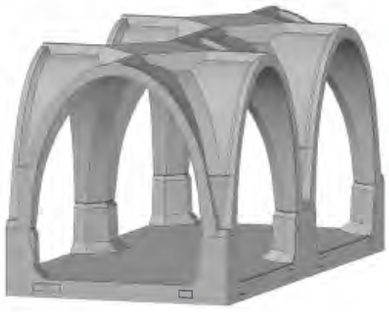



**180 Module (7'-8"x16')**

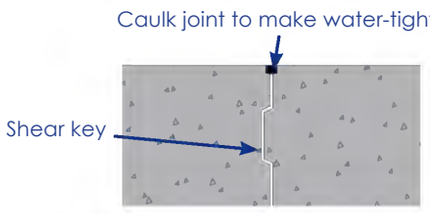
**MID-PRO VOLUMES**

| HT (FT) | VOLUMES PER MODULE (CF) | | VOLUMES PER MODULE W/ STONE VOID (CF)* | |
|---|---|---|---|---|
| | **180** | **360** | **180** | **360** |
| 6 | 560 | 643 | 576 | 676 |
| 7 | 670 | 765 | 686 | 798 |
| 8 | 780 | 887 | 796 | 920 |
| 9 | 890 | 1,009 | 906 | 1,042 |

* Volumes include storage in aquifer stone voids at 0.40 void ratio.



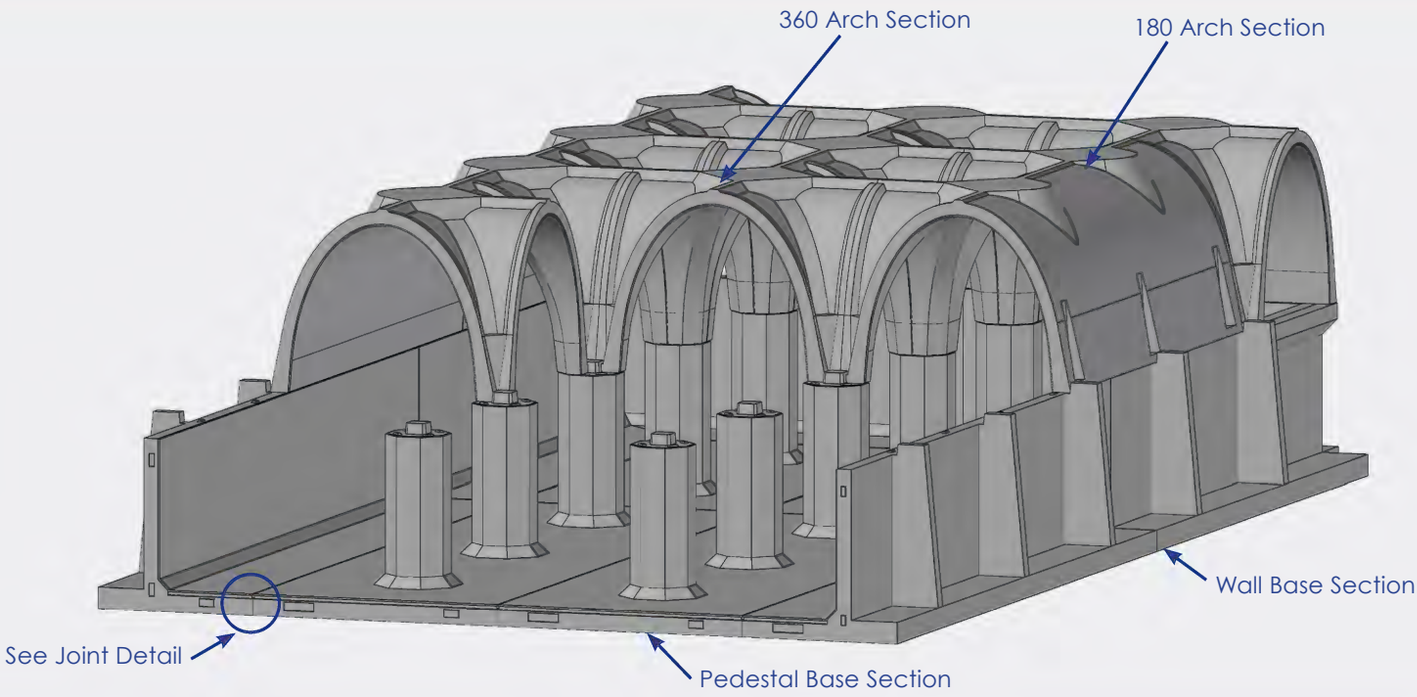
**360 Module (8'x16')**

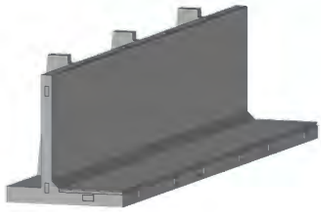



**Joint Detail**

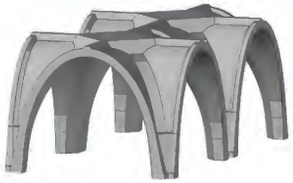
Backfilling structure with on-site soils

# Hi-Pro

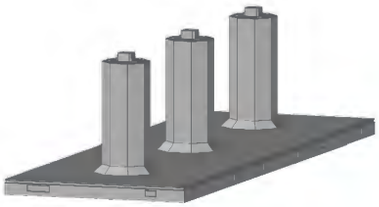


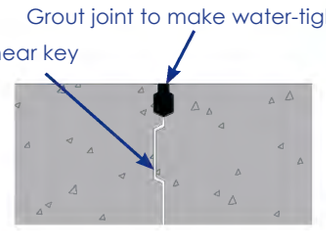
**Wall Base Section**



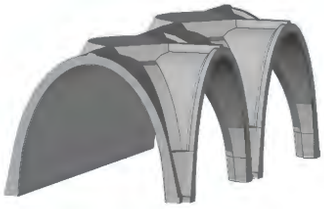
**360 Arch Section (8'x16')**



**Pedestal Base Section**




**Joint Detail**



**180 Arch Section (7'-8"x16')**

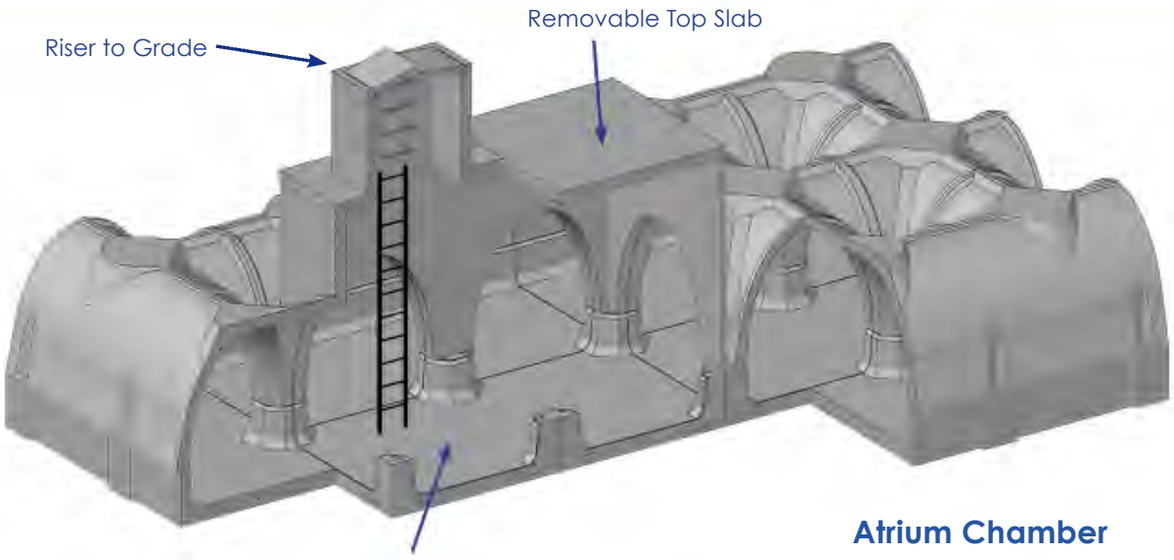
**HI-PRO VOLUMES**

| HT (FT) | VOLUMES PER MODULE (Cf) | | VOLUMES PER MODULE W/ STONE VOID (CF)* | |
|---|---|---|---|---|
| | **180** | **360** | **180** | **360** |
| 10 | 1,000 | 1,131 | 1,016 | 1,164 |
| 11 | 1,110 | 1,253 | 1,126 | 1,286 |
| 12 | 1,220 | 1,375 | 1,236 | 1,408 |
| 13 | 1,330 | 1,497 | 1,346 | 1,530 |
| 14 | 1,440 | 1,619 | 1,456 | 1,652 |
| 15 | 1,550 | 1,741 | 1,566 | 1,774 |
| 16 | 1,660 | 1,863 | 1,676 | 1,896 |
| 17 | 1,770 | 1,985 | 1,786 | 2,018 |
| 18 | 1,880 | 2,107 | 1,896 | 2,140 |

* Volumes include storage in aquifer stone voids at 0.40 void ratio.

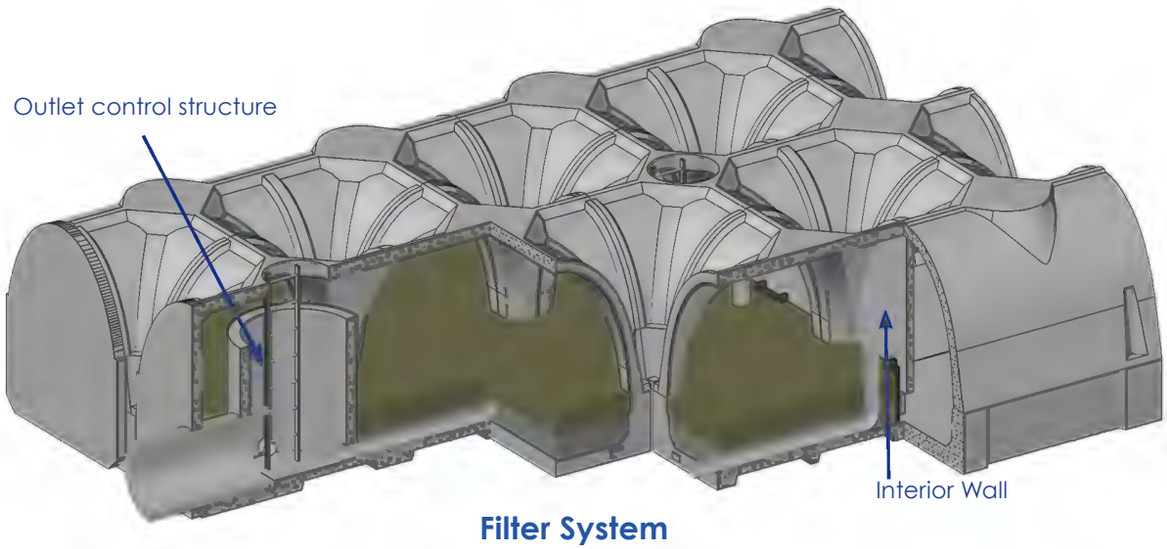
Typical joint between modules

# Accessory Options




8'x16' Varying Height Atrium Chamber

## Atrium Chamber

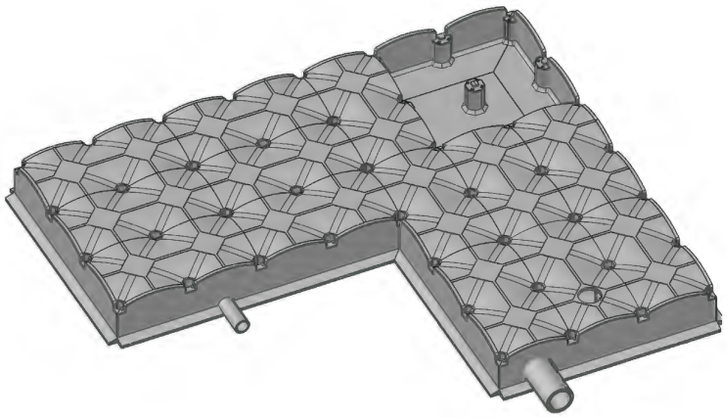



## Filter System

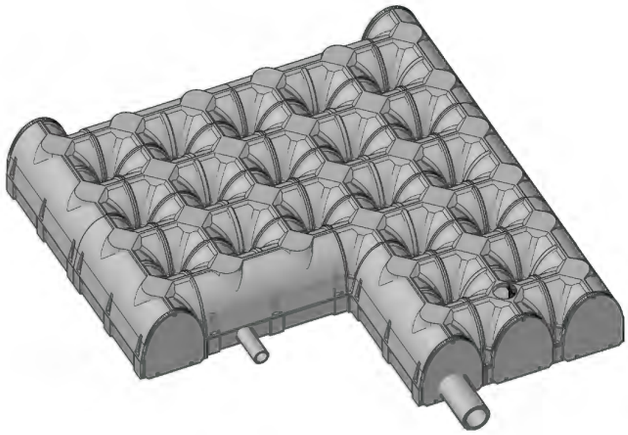
## Sump Detail

Interior of filter chamber

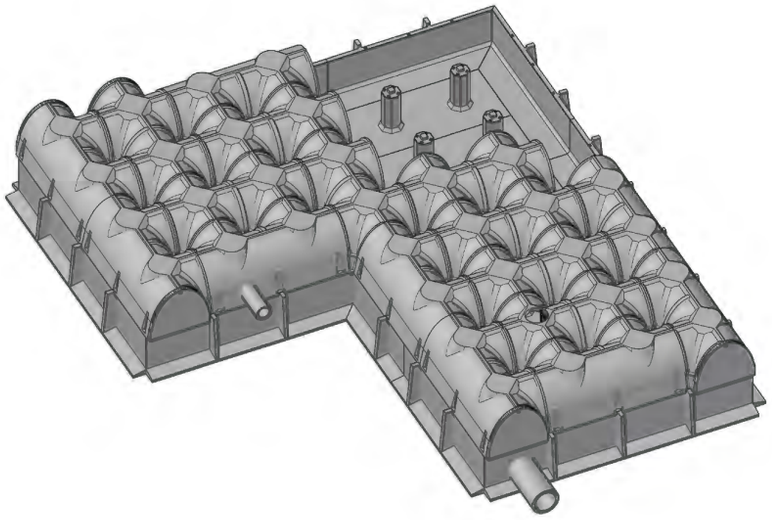
Lo-Pro Layout



Mid-Pro Layout



Hi-Pro Layout



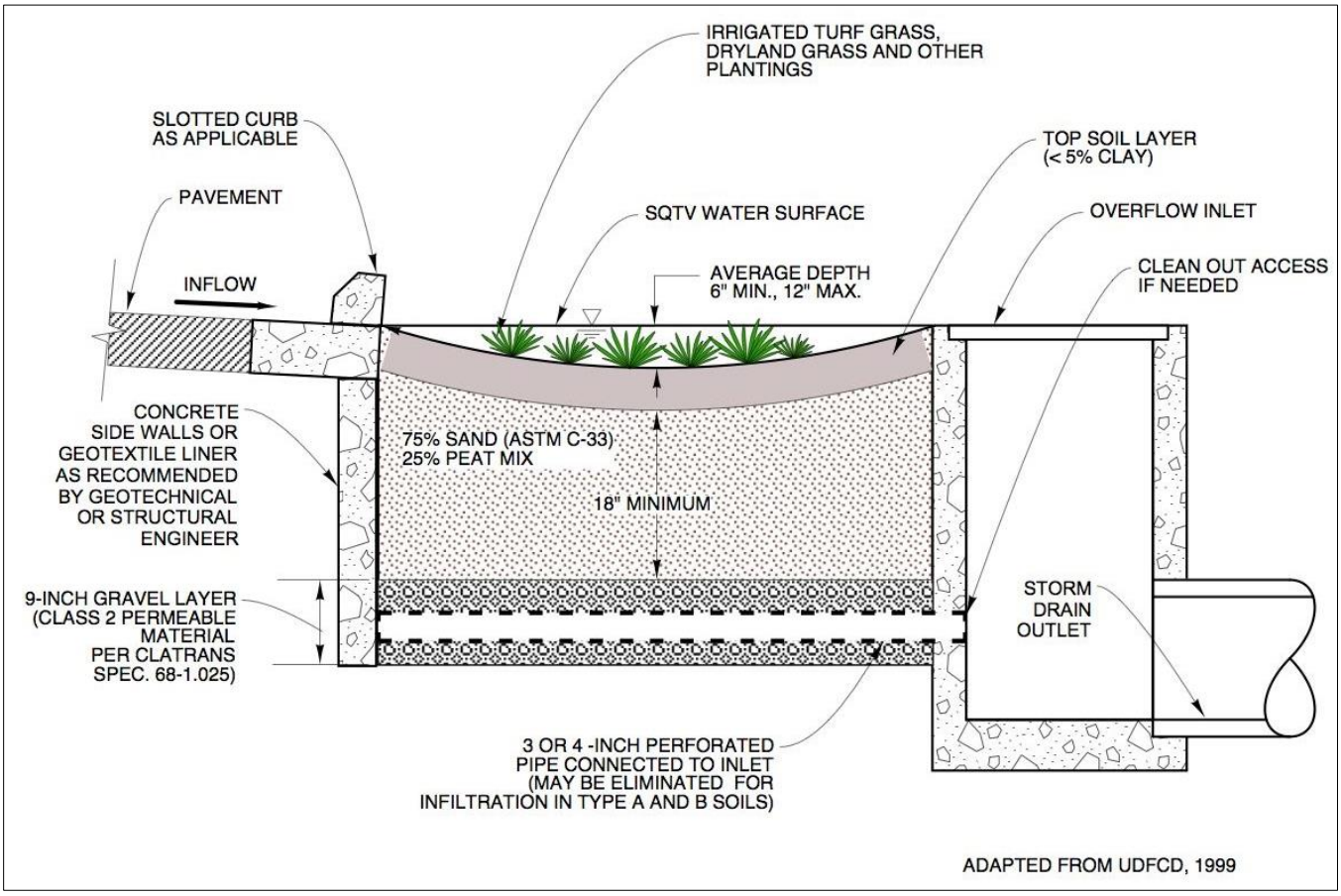
ROTONDO Environmental Solutions LLC

Patented System



4950-C Eisenhower Avenue | Alexandria, VA 22304 | 703-212-4830 | rotondo-es.com

ATTACHMENT 4 - Bio-Filtration
Planter Section

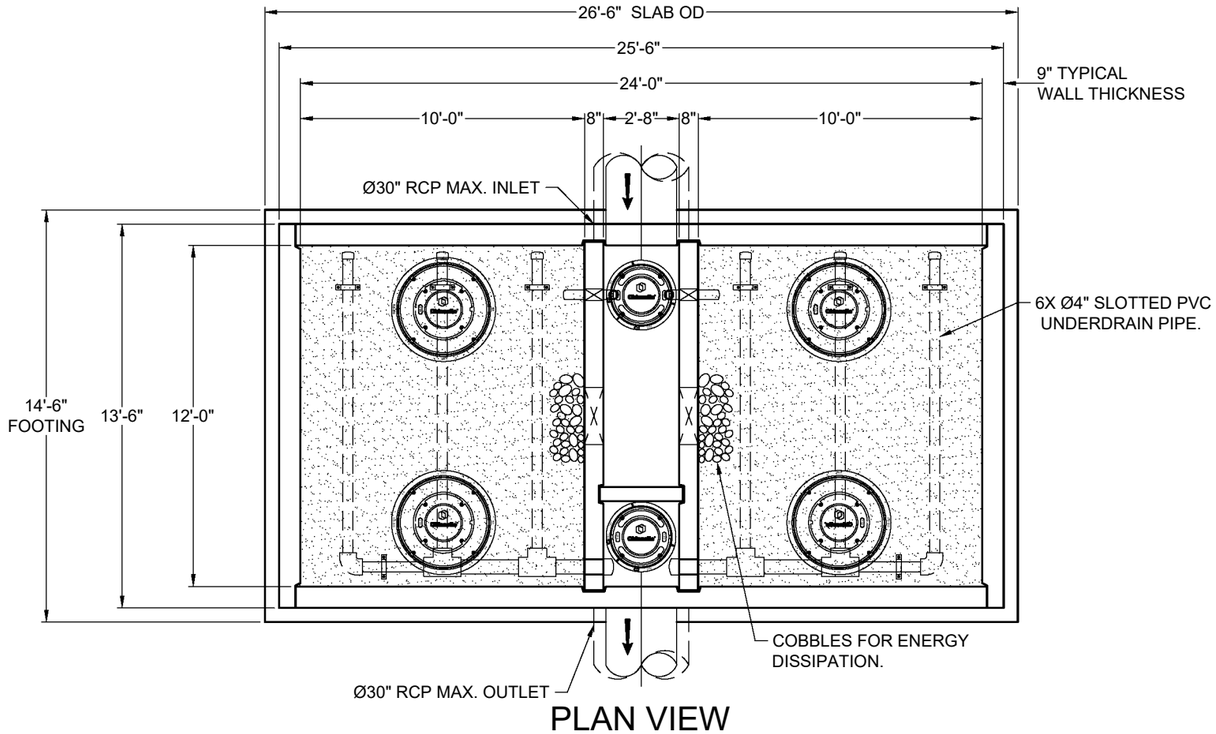



**Stormwater Planter (no underdrain) Configuration**

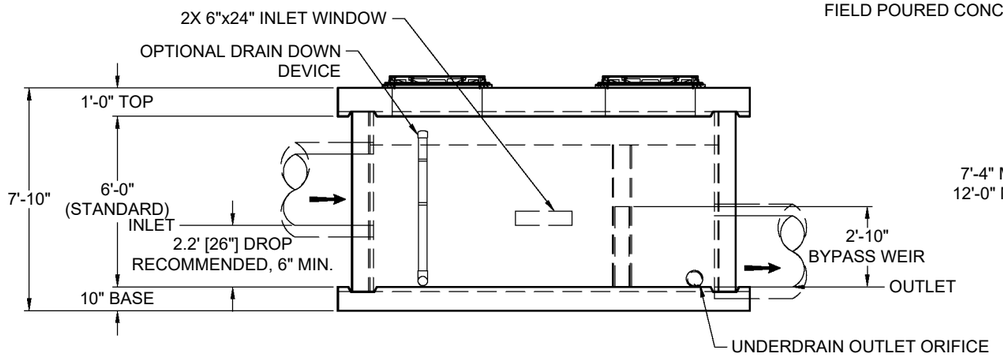
# ATTACHMENT 5 - BioPod and DVS Spec Sheets

| SITE SPECIFIC DATA | | | | |
|---|---|---|---|---|
| Structure ID | | | | ID |
| Treatment Flow Rate (cfs) | | | | - |
| Peak Flow Rate (cfs) | | | | - |
| Rim Elevation | | | | - |
| Top of Vault Elevation | | | | - |
| **Pipe Data** | **Pipe Location** | **Pipe Size** | **Pipe Type** | **Invert Elevation** |
| Inlet | - | - | - | - |
| Outlet | - | - | - | - |
| Notes: | | | | |

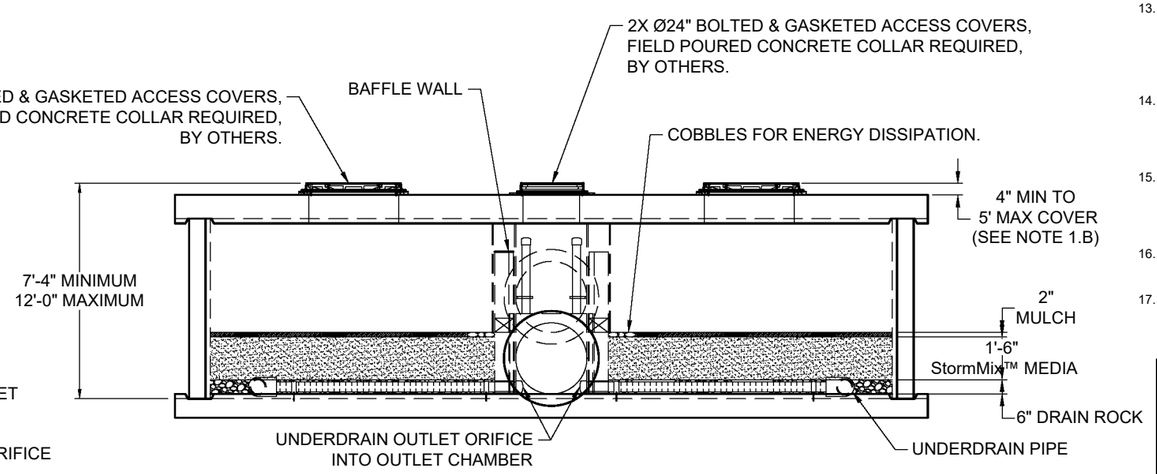
| PERFORMANCE SPECIFICATIONS | |
|---|---|
| Treatment Flow Capacities: | |
| NJDEP 80% Removal, 75 micron | 0.960 cfs |
| WA Ecology GULD - Basic, Enhanced & Phosphorus | 0.860 cfs |
| Bypass Capacity | 20.00 cfs |
| *Contact Oldcastle for alternative treatment flow capacities. | |




PLAN VIEW




LEFT END VIEW




ELEVATION VIEW

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. MESH REINFORCEMENT: ASTM A1064, S1.2, GRADE 80
5. CEMENT: ASTM C150
6. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
7. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
8. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW.
9. OVERSIZED HOLES TO ACCOMMODATE SPECIFIC PIPE TYPE MUST BE CONCENTRIC TO PIPE ID. AFTER PIPES ARE INSTALLED, ALL ANNULAR SPACES SHALL BE FILLED WITH A MINIMUM OF 3,000 PSI CONCRETE FOR FULL THICKNESS OF PRECAST WALLS.
10. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS .
11. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
12. ADAPTORS/ANGLES AND EXTERNAL PIPING BY OTHERS.
13. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
14. MAXIMUM PICK WEIGHTS:
   A. TOP SLAB: XX,XXX LBS
   B. PANELS: XX,XXX LBS
   C. BASE SLAB: XX,XXX LBS
15. INTERNALS SHALL CONSIST OF UNDERDRAIN PIPE, ROCK, STORMMIX™ MEDIA, MULCH, DIVIDER WALLS, BAFFLE WALLS, BYPASS WEIR AND OPTIONAL DRAIN DOWN.
16. SYSTEM SHIPPED EMPTY. INTERNALS INSTALLED BY CONTRACTOR.
17. CONTRACTOR RESPONSIBLE FOR OFF-LOAD AND INSTALLATION. OLDCASTLE REPRESENTATIVE TO BE ON SITE TO OVERSEE THE INSTALLATION OF ALL INTERNAL COMPONENTS.

Oldcastle Infrastructure™ A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater



BioPod™ Biofilter System (STANDARD)

Underground Vault with Internal Bypass

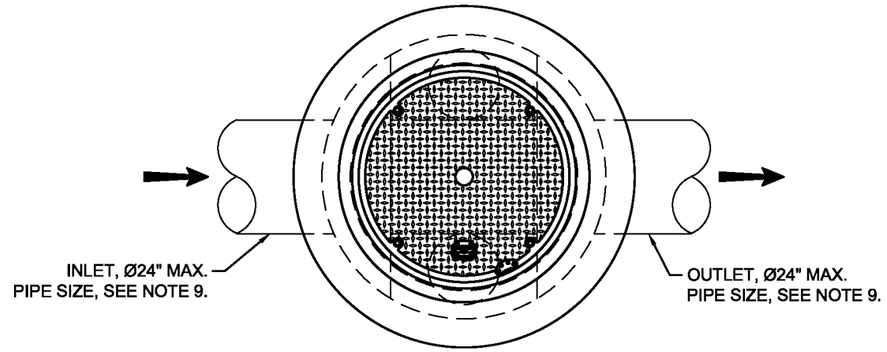
CUSTOMER: -

PROJECT NAME: -

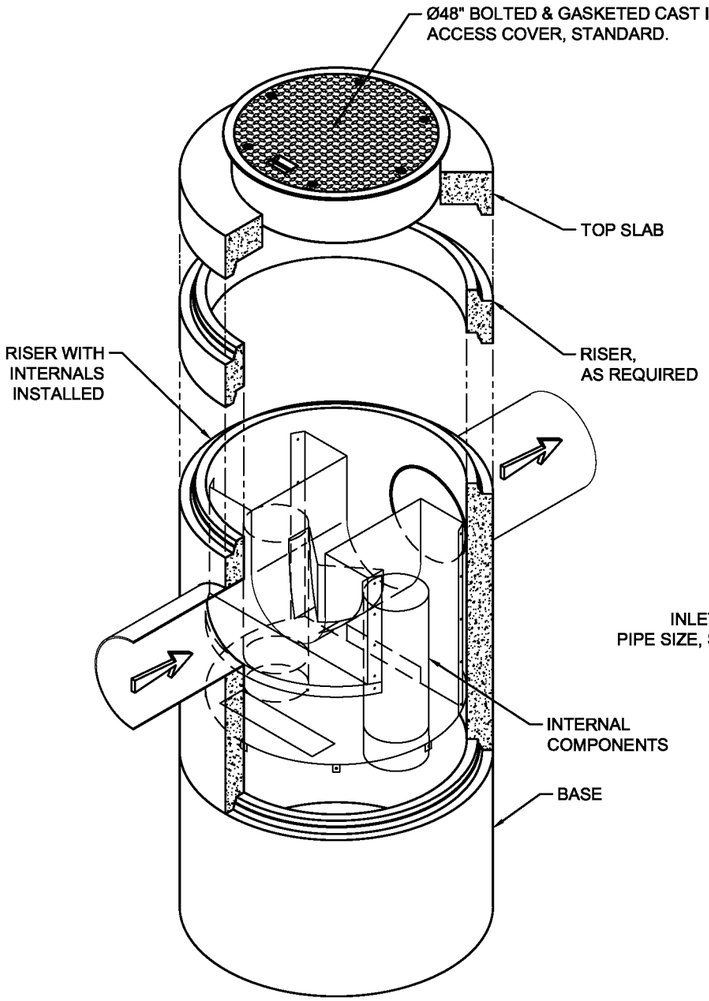
| SHEET NAME | REVISION | SHEET |
|---|---|---|
| Specifier Drawing BPU-1224IB | - | 1 OF 1 |
| | REV DATE - | |

Bioretention/ Biofiltration

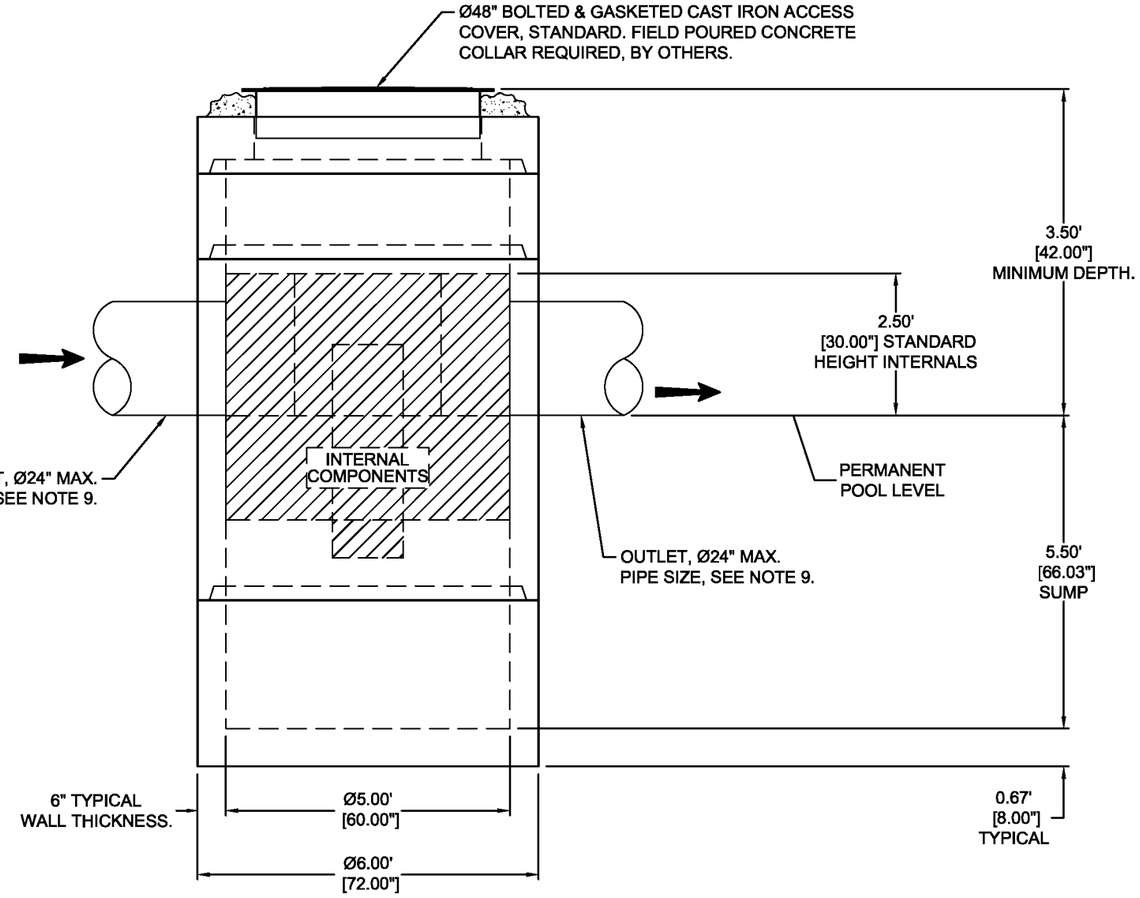
| SITE SPECIFIC DATA | | | | |
|---|---|---|---|---|
| Structure ID | | | | |
| Water Quality Flow Rate (cfs) | | | | |
| Peak Flow Rate (cfs) | | | | |
| Rim Elevation | | | | |
| Pipe Data | Pipe Angle* | Pipe Size | Pipe Type | Invert Elevation |
| Inlet | | | | |
| Inlet | | | | |
| Outlet at 0° | | | | |
| *Angle is Clockwise from Outlet at 0°. | | | | |
| Notes: | | | | |




PLAN VIEW




ISOMETRIC VIEW
(SCALE 3/4)




ELEVATION VIEW

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 W/ IMPACT.
   B. DESIGN FILL: 1' MAXIMUM.
   C. ASSUMED WATER TABLE = BELOW INVERT.
   D. DRY LATERAL EARTH PRESSURE (EFP) = 45 PCF.
   E. LATERAL LIVE LOAD SURCHARGE = 80 PSF (APPLIED TO 8' BELOW GRADE).
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 5,000 PSI MINIMUM.
3. STEEL REINFORCEMENT: REBAR, ASTM A-615 OR A-706, GRADE 60.
4. CEMENT: ASTM C-150 SPECIFICATION.
5. REQUIRED NATIVE ALLOWABLE SOIL BEARING PRESSURE = 2,500 PSF.
6. REFERENCE STANDARD:
   A. ASTM C 478
   B. ASTM C 497
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. PLEASE VERIFY THAT THESE PARAMETERS MEET PROJECT REQUIREMENTS (I.E. LIVE LOAD, FILL RANGE, WATER TABLE). IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW OF THIS SUBMITTAL.
8. TREATMENT CAPACITY IS DEPENDENT ON LOCAL REGULATORY REQUIREMENTS. BYPASS CAPACITY IS DEPENDENT ON OUTLET PIPE DIAMETER. CONTACT OLDCASTLE INFRASTRUCTURE FOR PROJECT-SPECIFIC TREATMENT AND BYPASS SIZING RECOMMENDATIONS.
9. STANDARD INLET/OUTLET PIPE CONFIGURATION TO ENTER AND EXIT STRUCTURE AT 180°. SPECIAL ANGLED CONFIGURATIONS AVAILABLE.
10. OVERSIZED HOLES TO ACCOMMODATE SPECIFIC PIPE TYPE MUST BE CONCENTRIC TO PIPE ID. ALL ANNULAR SPACES SHALL BE FILLED WITH A MINIMUM OF 3000 PSI CONCRETE FOR FULL THICKNESS OF PRECAST WALLS.
11. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED & LEVEL PER PROJECT SPECIFICATIONS)
12. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT OLDCASTLE INFRASTRUCTURE.

Hydrodynamic Separation

THIS PRODUCT IS PROTECTED BY THE FOLLOWING US PATENT: 7,182,874; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater



# Dual-Vortex Separator DVS-60C

| CUSTOMER | | | |
|---|---|---|---|
| - | | | |
| JOB NAME | | | |
| - | | | |
| DRAWING NUMBER | REVISION - REV DATE - | SHEET | |
| DVS-60C-SC | | 1 OF 1 | |