CONTECH®
ENGINEERED SOLUTIONS

ChamberMaxx®
Design Guide

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CONTECH®
ENGINEERED SOLUTIONS

Detention System Design Tools

Design Your Own Detention System (DYODS®)

Contech's DYODS is an exclusive, online design tool that allows you to design your own detention or infiltration system. DYODS fully automates the layout process for stormwater detention and infiltration systems and produces CAD and PDF files that can be used for creating plans and specs, and for estimating total installed costs.

Features of the new tool include:

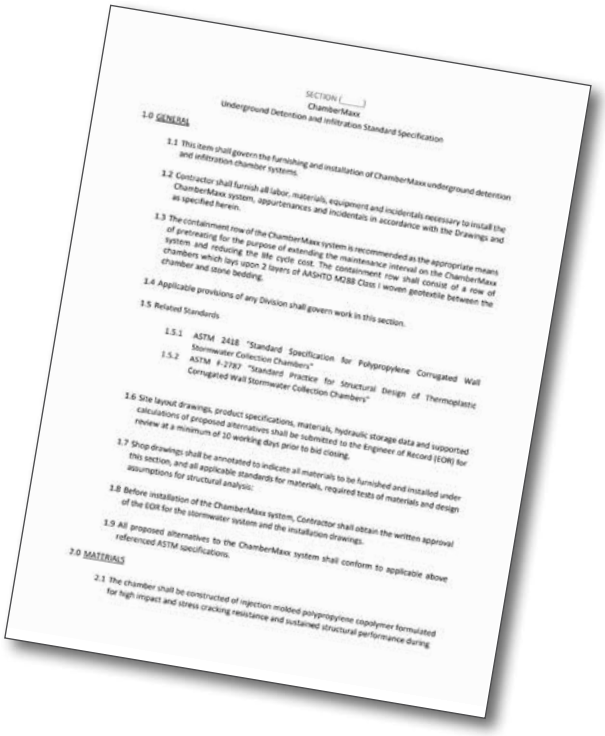
- Optimizes design and layout for cost efficiency
- "Drag and drop" feature allow users to customize layout
- Design multiple systems per project and save for future use
- Provides instant access to customized, project specific drawings
- CAD/PDF files provided for use in creating plans and specs

The DYODS tool is available at www.conteches.com/DYO.

Online Product Design Worksheet (PDW)

Our in-house team of engineers can support you through the entire permitting process. Just enter your information into the online form, and one of our in-house engineers will contact you with specific recommendations for your project.

The Detention Product Design Worksheet is available at www.conteches.com/detentionpdw



Engineering Services & Support

Contech has regional engineering offices and local stormwater consultants trained to provide the following services:

- Regulatory guidance and permitting assistance
- Preliminary standard details and/or site specific final drawings and specifications
- Low Impact Development design assistance
- Engineering calculations for hydraulics/hydrology, buoyancy, and stage-storage
- Review of preliminary site design, feasibility screening, and layout assistance
- Value Engineering - cost estimates and options analysis
- Pre-construction support, project scheduling, and contractor coordination
- Installation and construction support
- Maintenance support, including: guidance manuals, training/demonstrations, and certified contractor identification

ChamberMaxx Overview

The ChamberMaxx corrugated, open-bottom chamber system allows you to meet runoff reduction requirements by providing economic infiltration. Design your low impact development (LID) site by incorporating this belowgrade system to maximize available land for development or green space. ChamberMaxx is most effective on sites where the depth from finished grade to storm sewer outlet is less than 54-inches (1.37-meters).

The ChamberMaxx polypropylene stormwater detention/infiltration chamber has undergone extensive development and structural qualification investigation meeting the performance requirements of the ASTM F2418 Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers. The following is a summary of the design qualification.

The ChamberMaxx chamber is produced by an injection molding process with a high quality UV stabilized co-polymer polypropylene which meets the ASTM F2418 material classification requirement as PP0330B99945 per ASTM D4101. An extensive test program demonstrates that the ChamberMaxx chambers exceed the minimum material performance requirements set forth by the product specification for short term and both 50 and 75 year strength, stiffness, and toughness, including material environmental stress crack resistance (ESCR) which exceeds industry requirements.

The ChamberMaxx structural qualification to ASTM F2418 includes a CANDE FEA predicted installed structural performance which safely meets the AASHTO LRFD Section 12 Design Specification for Buried Structures. As required, performance verification through full scale installation and monitoring was conducted in successful support of the safety of the chamber design and installation.

The ChamberMaxx chamber installation was evaluated for safety with AASHTO load factors for the vehicle and earth fill condition of 1.75 and 1.95 respectively. The general installation capabilities in accordance with AASHTO are:

- Live Load AASHTO Design Truck HS25 (HL93)
- Minimum Cover (HS25): 18 in.
- Maximum Cover, 75 years: 8 ft.

Chamber Manufacturing

The ChamberMaxx chamber and virtually all of its materials of construction are manufactured at ISO 9001 certified US facilities. The chambers are produced with state of the art structural web injection molding equipment resulting in a reliable, high quality product. Weighing approximately 80 pounds, the chamber has a minimum average wall thickness of .175 inches (4.45 mm) and measures approximately 51 x 30 x 91 inches (1.30 x .76 x 2.31 meters) in overall dimension.

A ChamberMaxx system is comprised of start chambers, middle chambers, and end chambers. The end cap of the chamber is integrated into the start and end chambers, thereby making chamber installation fast and efficient.

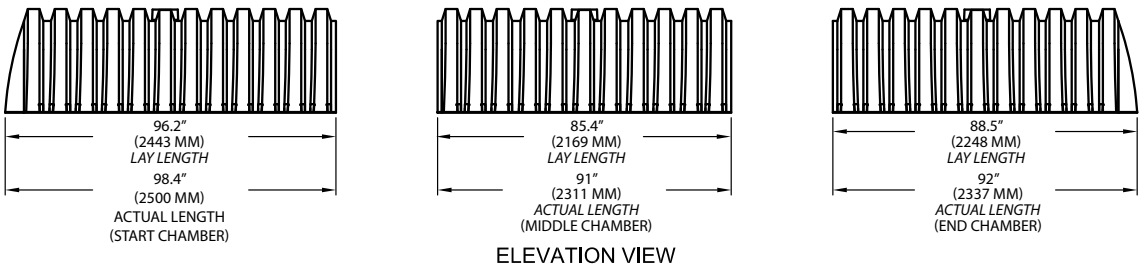
Application-System Configurations

The open-bottom plastic chamber allows infiltration into surrounding soil, effectively achieving runoff reduction objectives often required by an LID design. By utilizing subsurface infiltration, space is preserved for development, runoff is reduced or eliminated and groundwater recharge can occur. The ChamberMaxx is ideal when you need to maximize storage capacity in a shallow footprint.

Subsurface Infiltration

An open bottom plastic chamber the ChamberMaxx allows infiltration into surrounding soils, effectively achieving runoff reduction objectives often required by in an LID (low impact development) design.

Best practice designs for subsurface infiltration include pretreatment to reduce cost and frequency of maintenance while ensuring the infiltration capacity of the facility. Contech has multiple options for pretratment.



ELEVATION VIEW

Bioretention

ChamberMaxx is designed with a minimum of 6" stone above and below the units. The ChamberMaxx can help make bioretention practical by storing 75.1 CF per unit, including storage in stone, before discharging back into the surrounding soil.

Detention

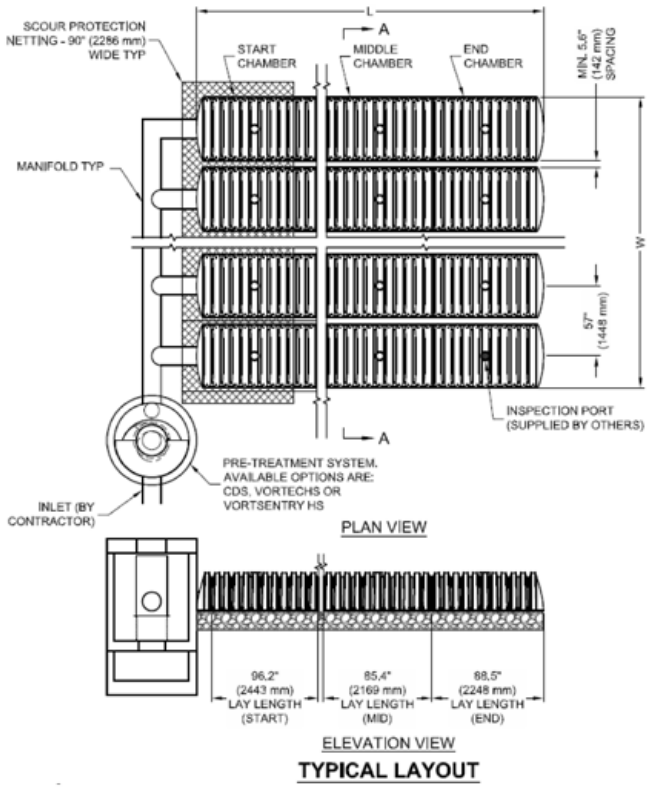
ChamberMaxx systems can also be used for detention applications where infiltraton of stored water is minimized. Minimization of infiltration can be accomplished by wrapping the entire chamber system and stone backfill in an impermeable thermoplastic liner.

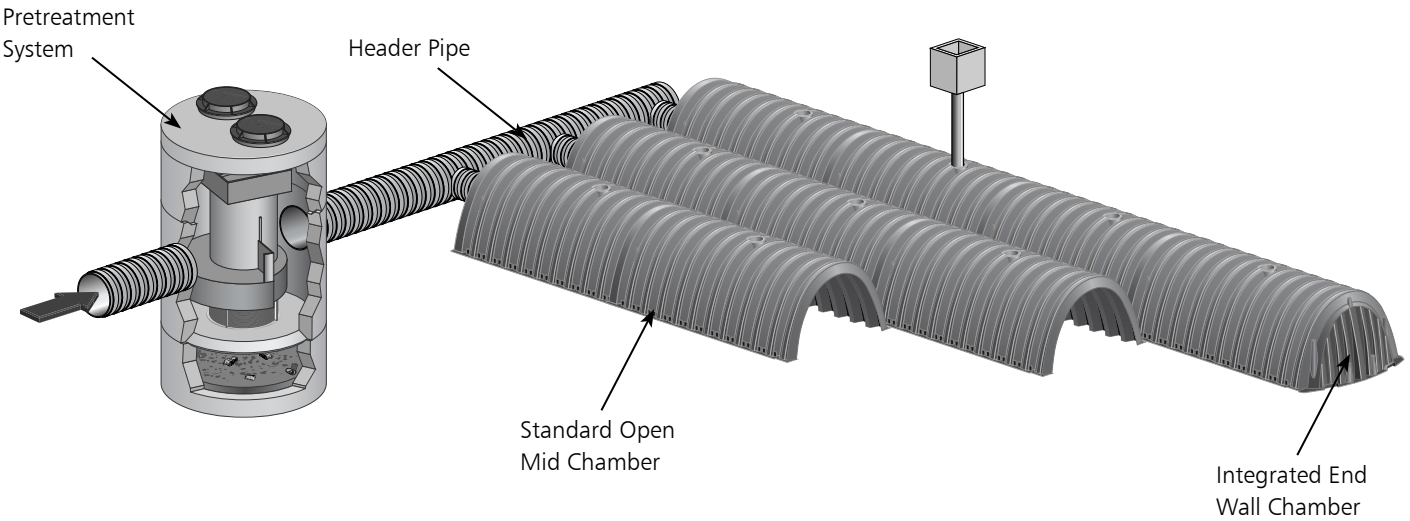
Inlet Congifurations

ChamberMaxx systems are compatible with various inlet configurations. The inlet configuration selected for a design should be based on the site requirements and local regulations. Pretreatment is recommended for all detention/retention systems regardless of type. The initial removal of sediment in a pretreatment device allows easy inspection and unobstructed maintenance. Contech offers standard inlet pretreatment configurations in the form of upstream pretreatment devices or the ChamberMaxx Containment Row.

Pretreatment Devices

In some jurisdictions, it is required to use devices for pretreatment of stormwater prior to entry to stormwater systems. By pretreating the stormwater prior to entry into the ChamberMaxx system, pollutants such as hydrocarbons and sediment may be captured, thereby extending the service life of the chamber system. Pretreatment devices vary in complexity and effectiveness. Several non-proprietary options exist in the form of deep sump manholes, oil grit separators, and bio-swales. Contech offers pretreatment devices such as the CDS and VortSentry HS for designs that require more stringent levels of pollutant removal. See Contech's website to design your own pretreatment device: www.conteches.com/dyohds.





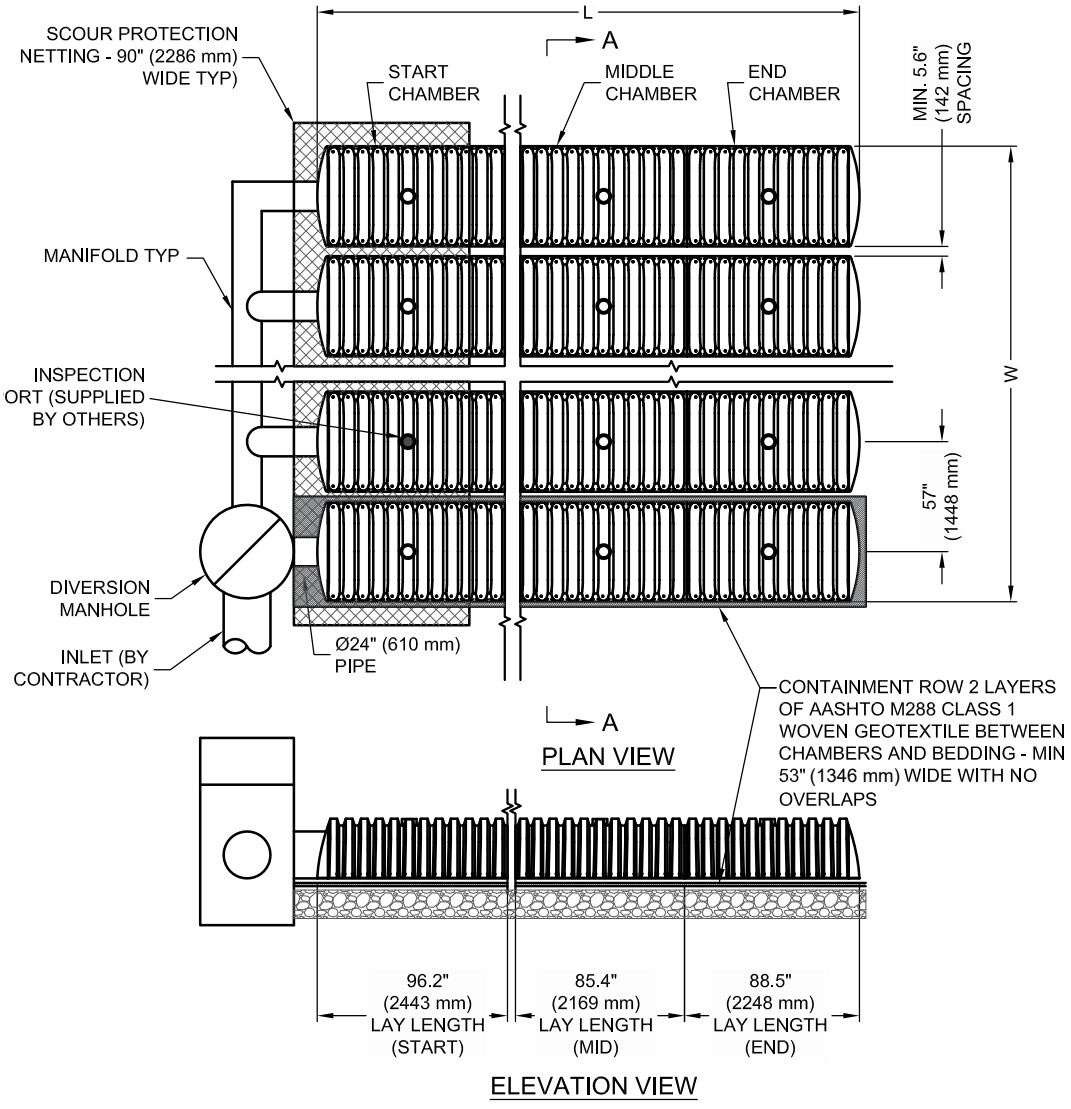
ChamberMaxx Containment Row

Hydrodynamic separators and filtration devices provide the most efficient sediment removal and extended maintenance interval, and are recommended as pretreatment for ChamberMaxx systems. The ChamberMaxx Containment Row should be considered as basic, low cost treatment strategy and should only be considered where sediment loading to the ChamberMaxx system is assumed to be minimal.

The Containment Row is designed to provide TSS removal by direct screening through 2 layers of AASHTO M288 Class 1 Woven Geotextile, located between the containment row chamber and the stone bedding.

The ChamberMaxx Containment Row should be designed with a sumped diversion manhole at the inlet of the Containment Row. The diversion manhole should be designed to allow access for inspection and maintenance of the Containment Row in addition to diverting the required amount of stormwater into the Containment Row for treatment, and a sump for collection of sediment. Once the Containment Row has reached capacity, the overflow should then be distributed to the remainder of the chamber rows by a manifold.

Containment Rows can be sized for water quality volume or water quality flow rate. Contact your local Contech representative at 800-338-1122 for project specific sizing of a Containment Row.



Inlet Manifold Design

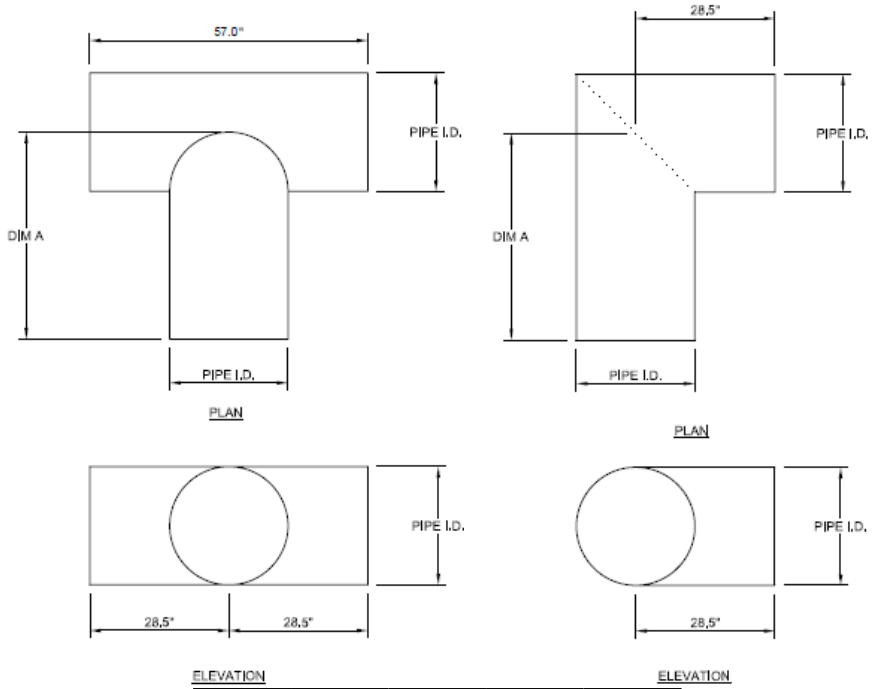
All ChamberMaxx systems require inlet manifolds to ensure that the incoming flow is distributed throughout all chamber rows. The integral end cap of the chamber system can accept up to a 24-inch diameter (0.61m) inlet pipe.

The inlet manifold should be designed to provide ample conveyance of peak flows without creating an unacceptable backwater condition on the upstream structures and piping. To reduce the scour potential of the foundation stone under the chambers from the influent flow, Contech requires the installation of scour protection netting at the manifold entrance to any inlet chamber, extending 1' (0.30 m) beyond the outside edge of the chamber.

When designing an inlet manifold for a ChamberMaxx system, the specifying engineer is responsible for confirmation that the manifold meets the hydraulic needs of the project. The manifold diameter should be equal to or larger than the upstream pipe leading from the site to the chamber system. Contech offers standard high density polyethylene (HDPE) manifold fittings in various sizes to accommodate most project needs.

Contech provides Mar Mac Polyseal couplers to connect manifold fittings, please reference www.MarMac.com for additional information on the provided couplers.

ChamberMaxx cannot accept a pipe directly into the side of the chamber. To accommodate this configuration, the row should be broken up by use of one end chamber and one start chamber to create two separate rows. The inlet pipe should then be joined to a manifold tee that connects into the new start and end chambers. Otherwise, all pipe connections should be made at a manifold or directly stubbed into the end a chamber.



STANDARD MANIFOLD COMPONENTS				
	AVAILABLE DIAMETERS (IN)			
TEE	12	15	18	24
ELBOW	12	15	18	24
DIM A	42	42	48	48

GENERAL NOTES:

1. FITTING MATERIAL TO BE MANUFACTURED FROM CORRUGATED HIGH DENSITY POLYETHYLENE, AASHTO M294 PIPE.
2. FITTINGS TO BE FABRICATED IN ACCORDANCE WITH THE REQUIREMENTS OF AASHTO M294.
3. FITTINGS DESIGNED TO PROTRUDE 8" INTO END OF THE INLET CHAMBERS.
4. MANIFOLD TEE AND ELBOW JOINTS TO BE CONNECTED UTILIZING MAR-MAC POLYSEAL COUPLERS. REFERENCE WWW.MARMAC.COM

Outlet Manifold Design

Some ChamberMaxx systems may require an outlet for volumes in excess of the chamber system capacity. An outlet manifold should be designed to ensure that excess volume or peak flows can be conveyed to downstream structures.

In circumstances where infiltration into the surrounding soil is not an option, an underdrain may be used to completely drain the stone bed below the invert of the chamber. The underdrain should connect to the downstream drainage structure and should accommodate free drainage as required.

Other outlet scenarios may include outlet pipes located higher than the invert of the chambers to allow a designed volume to infiltrate through the base stone before exiting the system, or an outlet control structure external to the chamber system to achieve the same effect. These are common scenarios used for recharging groundwater and replicating a site's pre-construction runoff characteristics.

Outlet manifolds should not directly connect to a Containment Row but should be connected to as many standard chamber rows as required to achieve the desired hydraulic conditions. The outlet manifold fittings provided by Contech are the same HDPE fittings used for inlet manifolds and should be installed and connected in the same way.

Foundation Requirements

ChamberMaxx systems require a bedding of at least 6 inches (152.4mm) of crushed stone below the chambers. With a 6 inch (152.4mm) bedding depth a soil bearing capacity of 4 ksf (191.52 kPa) is required for 8 feet of cover over the top of the chambers and a soil bearing capacity of 2ksf (95.76 kPa)is needed for 18 inches (457.2mm) of cover over the top of the chambers. If the soil bearing pressure does not meet the minimum requirements, a geotechnical engineer should evaluate the application and make the appropriate recommendations to improve the bearing capacity to suit the application.

System Sizing

ChamberMaxx systems store water in the chamber itself and also in the void space of the stone backfill. The "Installed Storage Volume" in the table below shows the water storage capacity for the chamber and stone system assuming a 40% stone void ratio.

The ChamberMaxx DYODS (Design Your Own Detention System) is available for online sizing of ChamberMaxx systems. This tool can be found at www.ContechES.com. For assistance sizing a ChamberMaxx system, Contech Design Engineering services can be contacted at 1-800-338-1122 or through your local Contech representative. Modeling for the ChamberMaxx system is also available in HydroCAD®.

Sizing a ChamberMaxx System

The steps outlined below provide the necessary calculations to size a ChamberMaxx System.

1. Determine the Storage Volume (V_s).
   Required Storage Volume should be determined by the design engineer per project requirements.

2. Determine the number of chambers required (C).

Chamber Part	Width		Height		Weight		Actual Length		Installed Length*		Storage Volume		Installed Storage Volume*	
	in	(m)	in	(m)	lbs	(kg)	in	(m)	in	(m)	cf	(m^3)	cf	(m^3)
Start	51.4	(1.31)	30.3	(0.77)	83.0	(37.65)	98.4	(2.50)	96.2	(2.44)	50.2	(1.42)	78.1	(2.21)
Middle	51.4	(1.31)	30.3	(0.77)	73.0	(33.11)	91.0	(2.31)	85.4	(2.17)	47.2	(1.34)	75.1	(2.13)
End	51.4	(1.31)	30.3	(0.77)	76.0	(34.47)	92.0	(2.34)	88.5	(2.25)	46.2	(1.31)	74.1	(2.10)

** 6" (152 mm) of stone above and below chamber, 5.6" (142 mm) chamber spacing and 40% porosity.*

To calculate the number of chambers needed to store the required volume (Vs), divide the storage volume by the volume of the chamber. For systems with a predetermined number of rows (r), multiply the sum of the start and end chamber volumes by the row count to determine the remainder of middle chambers required.

$$C = C_{start} + C_{mid} + Cend$$

$$C_{start} \& C_{end} = \text{number of rows, r}$$

$$Cmid = Vs / [(Vstart + Vend)*r + Vmid]$$

For systems with an undetermined number of rows, the chamber count can be estimated by using the volume of the middle chamber, ignoring the start and middle chambers.

$$C = Vs / V_{mid}$$

3. Determine the system footprint.
   To determine the system length: Divide the number of middle chambers required (Cmid) by the number of rows (r), rounding up (n). This will be number of middle chambers required in the longest row. Add up the installed lengths of 1 start, 1 end, and the required count of middle chambers. After adding the length of perimeter stone around start and end chambers (minimum 12"or .3048 m), the total length is the system length.

   $$n = C_{mid}/r$$

   $$L = 12" + L_{start} + n*L_{mid} + L_{end} + 12"$$
   $$(.3048m + L_{start} + n*L_{mid} + L_{end} + .3048m)$$

   To determine the system width: Multiply the chamber width (51.4" or 1.31 m) by the number of rows (r). Add the total chamber width plus chamber spacing multiplied by (r-1) and the perimeter stone (minimum 12" or 0.30 mm). Standard spacing between chambers is 5.6"(396.2 mm). The resulting sum is the system width.

   $$W = 12"+ r*51.4" + (r-1)*5.6" + 12"$$
   $$(.3048m + r*1.306m + (r-1)*0.3962m + .3048m)$$

4. Determine the amount of stone (Vst).
   To determine the amount of clean, crushed, angular stone is required for the ChamberMaxx System, multiply the number of start, middle, and end chambers by their respective stone volumes in the table below.

Chamber Type	Amount of stone needed per chamber (cubic feet)	Amount of stone needed per chamber (cubic meters)
Start Chamber	78.69	2.228
Middle Chamber	69.85	1.978
End Chamber	72.36	2.049

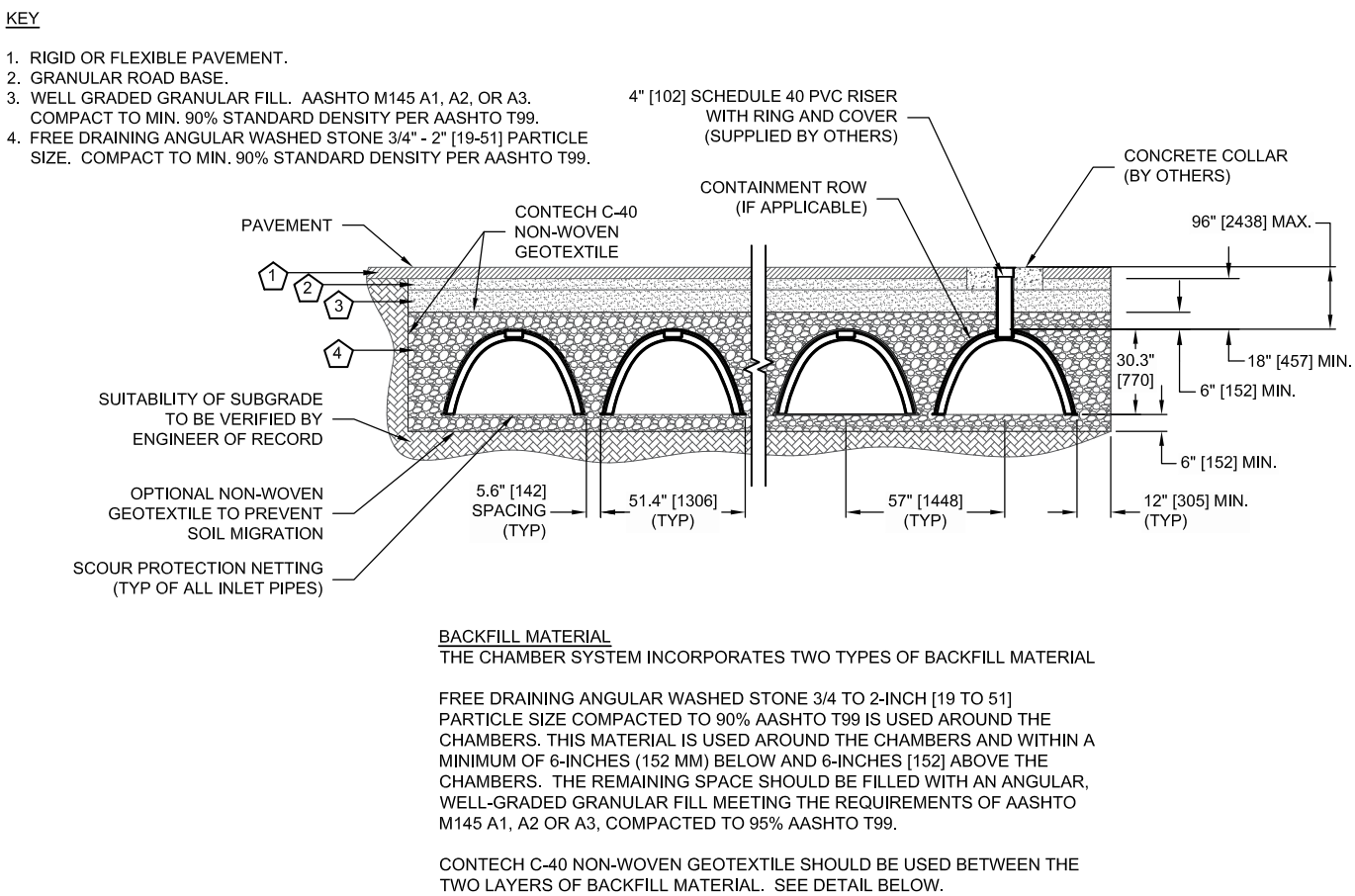
Stage Storage Table

	Elevation		Chamber Storage Volume		Stone Storage Volume		Cumulative Volume Increment		Cumulative Storage Volume	
	(in)	(m)	(cf)	(m^3)	(cf)	(m^3)	(cf)	(m^3)	(cf)	(m^3)
STONE	42.30	1.07	47.20	1.34	27.94	0.79	1.13	0.03	75.14	2.13
	41.30	1.05	47.20	1.34	26.82	0.76	1.13	0.03	74.02	2.09
	40.30	1.02	47.20	1.34	25.69	0.73	1.13	0.03	72.89	2.06
	39.30	1.00	47.20	1.34	24.56	0.70	1.13	0.03	71.76	2.03
	38.30	0.97	47.20	1.34	23.44	0.66	1.13	0.03	70.64	2.00
	37.30	0.95	47.20	1.34	22.31	0.63	1.13	0.03	69.51	1.97
CHAMBERMAXX CHAMBERS	36.30	0.92	47.20	1.34	21.18	0.60	0.62	0.02	68.38	1.94
	35.00	0.89	47.20	1.34	20.56	0.58	1.13	0.03	67.76	1.92
	34.00	0.86	47.20	1.34	19.43	0.55	1.13	0.03	66.63	1.89
	33.00	0.84	47.20	1.34	18.30	0.52	1.13	0.03	65.50	1.85
	32.00	0.81	47.20	1.34	17.18	0.49	1.56	0.04	64.38	1.82
	31.00	0.79	46.48	1.32	16.34	0.46	1.76	0.05	62.82	1.78
	30.00	0.76	45.43	1.29	15.63	0.44	1.83	0.05	61.06	1.73
	29.00	0.74	44.26	1.25	14.98	0.42	1.90	0.05	59.23	1.68
	28.00	0.71	42.97	1.22	14.36	0.41	1.96	0.06	57.33	1.62
	27.00	0.69	41.58	1.18	13.79	0.39	2.02	0.06	55.37	1.57
	26.00	0.66	40.09	1.13	13.26	0.38	2.07	0.06	53.35	1.51
	25.00	0.64	38.53	1.09	12.76	0.36	2.11	0.06	51.29	1.45
	24.00	0.61	36.89	1.04	12.29	0.35	2.15	0.06	49.18	1.39
	23.00	0.58	35.18	1.00	11.84	0.34	2.18	0.06	47.03	1.33
	22.00	0.56	33.42	0.95	11.42	0.32	2.22	0.06	44.84	1.27
	21.00	0.53	31.60	0.89	11.02	0.31	2.24	0.06	42.63	1.21
	20.00	0.51	29.74	0.84	10.64	0.30	2.27	0.06	40.38	1.14
	19.00	0.48	27.84	0.79	10.27	0.29	2.29	0.06	38.11	1.08
	18.00	0.46	25.90	0.73	9.92	0.28	2.31	0.07	35.82	1.01
	17.00	0.43	23.93	0.68	9.59	0.27	2.33	0.07	33.51	0.95
	16.00	0.41	21.92	0.62	9.26	0.26	2.35	0.07	31.18	0.88
	15.00	0.38	19.88	0.56	8.95	0.25	2.37	0.07	28.83	0.82
	14.00	0.36	17.82	0.50	8.65	0.24	2.39	0.07	26.46	0.75
	13.00	0.33	15.72	0.44	8.36	0.24	2.40	0.07	24.08	0.68
	12.00	0.30	13.59	0.38	8.09	0.23	2.42	0.07	21.68	0.61
	11.00	0.28	11.43	0.32	7.82	0.22	2.45	0.07	19.25	0.54
	10.00	0.25	9.23	0.26	7.58	0.21	2.47	0.07	16.81	0.48
	9.00	0.23	6.99	0.20	7.34	0.21	2.50	0.07	14.34	0.41
	8.00	0.20	4.71	0.13	7.13	0.20	2.52	0.07	11.84	0.34
	7.00	0.18	2.38	0.07	6.93	0.20	2.56	0.07	9.32	0.26
STONE	6.00	0.15	0.00	0.00	6.76	0.19	1.13	0.03	6.76	0.19
	5.00	0.13	0.00	0.00	5.63	0.16	1.13	0.03	5.63	0.16
	4.00	0.10	0.00	0.00	4.51	0.13	1.13	0.03	4.51	0.13
	3.00	0.08	0.00	0.00	3.38	0.10	1.13	0.03	3.38	0.10
	2.00	0.05	0.00	0.00	2.25	0.06	1.13	0.03	2.25	0.06
	1.00	0.03	0.00	0.00	1.13	0.03	0.00	0.00	1.13	0.03

ChamberMaxx Flow Routing

Proper design of any detention system typically requires that flow routing be performed. Engineers at Contech can be a valuable resource when designing a ChamberMaxx retention system. Typically, stage- storage curves are utilized in the analysis. A Contech stage-storage calculator is available for download on www.ContechES.com. This information can simply be inserted into common hydrology/ hydraulic software such as HydroCAD, HydroFlow, PondPack or TR20. This makes a flow routing design with ChamberMaxx just as simple as an aboveground pond design.

ChamberMaxx - Backfill Detail



BACKFILL MATERIAL
THE CHAMBER SYSTEM INCORPORATES TWO TYPES OF BACKFILL MATERIAL

FREE DRAINING ANGULAR WASHED STONE 3/4 TO 2-INCH [19 TO 51] PARTICLE SIZE COMPACTED TO 90% AASHTO T99 IS USED AROUND THE CHAMBERS. THIS MATERIAL IS USED AROUND THE CHAMBERS AND WITHIN A MINIMUM OF 6-INCHES (152 MM) BELOW AND 6-INCHES [152] ABOVE THE CHAMBERS. THE REMAINING SPACE SHOULD BE FILLED WITH AN ANGULAR, WELL-GRADED GRANULAR FILL MEETING THE REQUIREMENTS OF AASHTO M145 A1, A2 OR A3, COMPACTED TO 95% AASHTO T99.

CONTECH C-40 NON-WOVEN GEOTEXTILE SHOULD BE USED BETWEEN THE TWO LAYERS OF BACKFILL MATERIAL. SEE DETAIL BELOW.

Inspection And Maintenance

ChamberMaxx Safety

Before entering into any storm sewer or underground retention/ detention system check to make sure all OSHA and local safety regulations and guidelines are observed during the maintenance process. Hard hats, safety glasses, steel-toed boots and any other appropriate personal protective equipment shall be worn at all times.

Inspection Frequency

Inspections are recommended at a minimum annually. The first year of operation may require more frequent inspections. Frequency of inspections will vary significantly on the local site conditions. An individual inspection schedule should be established for each site.

Inspections

Inspection is the key to effective maintenance and is easily performed. Inspections may need to be performed more often in the winter months in climates where sanding operations may lead to rapid sediment accumulations, or in equipment washdown areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

The entire treatment train should be inspected and maintained. The treatment train may consist of an upstream sump manhole, manifold system or pre-treatment HDS device. Inspections should start at the upstream device and continue downstream to the discharge orifice if incorporated into the chamber system.

Pre-Treatment Device Inspection

Inspection and maintenance procedures provided by the manufacturer should be followed for pre-treatment systems such as a CDS®, Vortechs®, VortSentry® or VortSentry® HS. Expected pollutants will be floatable trash, sediment and oil and grease. Pre-treatement devices are recommended for all detention/ retention devices regardless of type.

Containment Row™ Inspection

The optional Containment Row consists of a diversion concrete manhole with a weir, and a row of chambers placed on woven geotextile. The diversion weir directs the first flush flows into the Containment Row of chambers. The majority of sediment will be captured in the Containment Row due to the extended detention time which allows the particles to settle out. Higher flows overtop (bypass) the weir into the manifold system.

The Containment Row will typically be located in the first row of chambers connected to the diversion manhole. Inspection can be done through accessing the diversion manhole and visually inspecting the Containment Row through the inlet pipe. Inspection ports throughout the system can be used for visual observation and measurement of sediment accumulation using a stadia rod. When the depth of sediment accumulates over 4-inch (102 mm), cleanout is recommended.

Manifold System Inspection

The main manifold pipe can be inspected from the diversion manhole upstream. When a quarter of the pipe volume has been filled with sediment the header system should be maintained.

Visual Inspection

Maintenance or further investigation may be required if any of the following conditions exist:

- Evidence of an unusual amount of silt and soil build-up on the surface.
- Clogged outlet drainpipe.
- System does not drain to the elevation of the lowest pipe in dry conditions.
- Evidence of potholes or sinkholes

Maintenance

Underground stormwater retention/detention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities rather than the size or configuration of the system. If accumulated silt is interfering with the operation of the detention system (i.e.: blocking outlet pipes or deposits significantly reduce the storage capacity of the system) it should be removed.

It is easiest to maintain a system when there is no flow entering. For this reason, cleanout should be scheduled during dry weather.

A vacuum truck or other similar devices can be used to remove sediment from the treatment train. Starting upstream, maintain manholes with sumps and any pre-treatment devices (following manufacturer recommended procedures). Once maintenance is complete, replace all caps, lids and covers. It is important to document maintenance events on the Inspection and Maintenance Log.

Header System Maintenance

If maintenance is required, use a high pressure nozzle with rear facing jets to wash the sediments and debris into the diversion manhole. Use the vacuum hose stinger nozzle to remove the washed sediments from the sump of the diversion manhole. It is important to not flush sediments into the chamber system during the maintenance process.

Containment Row™ Maintenance

If maintenance is required, a JetVac truck utilizing a high pressure nozzle (sledge dredging tool) with rear facing jets will be required. Insert the nozzle from the diversion manhole into the Containment Row through the inlet pipe. Turn the water feed hose on and feed the supply hose until the nozzle has reached the end of the Containment Row. Withdraw the nozzle slowly.

The tool will backflush the Containment Row forcing debris into the diversion manhole sump. Use the stringer vacuum hose to remove the sediments and debris from the sump of the diversion manhole. Multiple passes may be required to fully cleanout the Containment Row. Vacuum out the diversion manhole and remove all debris. See Figure 1.

Figure 1. Containment Row shown with high pressure cleaning nozzle.

APPENDIX A: ChamberMaxx Specification with Pretreatment

SPECIFICATION:

ChamberMaxx

Underground Detention and Infiltration Standard Specification with Pretreatment Device

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of ChamberMaxx underground detention and infiltration chamber systems.

1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the ChamberMaxx system, appurtenances and incidentals in accordance with the Drawings and as specified herein.

1.3 A stormwater treatment device upstream of the ChamberMaxx system is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the ChamberMaxx system and reducing the life cycle cost. Both engineered solutions shall be provided by a single supplier/manufacturer. Filtration by wrapping a chamber row with geotextile is not an acceptable means of pretreatment.

1.4 Applicable provisions of any Division shall govern work in this section.

1.5 Related Standards

1.5.1 ASTM 2418 "Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers"

1.5.2 ASTM F-2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers"

1.6 Site layout drawings, product specifications, materials, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the Engineer of Record (EOR) for review at a minimum of 10 working days prior to bid closing.

1.7 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

1.8 Before installation of the ChamberMaxx system, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

1.9 All proposed alternatives to the ChamberMaxx system shall conform to applicable above referenced ASTM specifications.

2.0 MATERIALS

2.1 The chamber shall be constructed of injection molded polypropylene copolymer formulated for high impact and stress cracking resistance and sustained structural performance during high temperatures. The chamber shall be designed and manufactured in accordance to ASTM F-2418 and F-2787.

2.2 The chamber shall be designed to AASHTO LRFD Bridge Design Specifications (Section 12), as applied to material and performance requirements for buried thermoplastic pipes. Design live load shall be the AASHTO HS-20 and HS-25 truck, including multiple lane presence factors, over a minimum cover of 18 inches and chamber row spacing of 5 inches or greater.

2.3 The chamber system shall be comprised of three chamber configurations: The MIDDLE chambers shall be open-ended to allow unobstructed hydraulic flow, inspection, and maintenance. The START and END chambers shall each have an integral end wall designed to resist loading at the start and end of the chamber rows. The chambers within a row shall be installed with overlapping end corrugations.

2.4 The nominal dimensions of the START chamber shall be 51.4 inches wide, 30.3 inches tall, and 98.4 inches long. The nominal dimensions of the MIDDLE chamber shall be 51.4 inches wide, 30.3 inches tall, and 91.0 inches long. The nominal dimensions of the END chamber shall be 51.4 inches wide, 30.3 inches tall, and 92.0 inches long. The nominal storage volume inside the chamber shall be 77 cubic feet when utilizing 6" of stone above and below chamber with 40% stone porosity per ChamberMaxx standard detail.

2.5 The chamber shall have a continuously-curved, arch-shaped section profile.

2.6 The START and END chamber integral end wall shall be structurally suitable for cutting and inserting inlet pipes and shall provide a range of pipe diameter indicants up to 24" diameter as cutting templates.

2.7 The chamber shall be a corrugated, open-bottom design and top vent orifices for hydraulic pressure equalization. Corrugation valleys and crests shall be sub-corrugated to increase stiffness.

2.8 The chamber shall have a circular cut line for an optional reinforced inspection port configured to accept a 4" Schedule 40 pipe.

2.9 The END chambers shall be capable of being cut to shorter lengths to accommodate site specific requirements.

2.10The chamber shall be supported by integral structural

footings comprised of load dispersing toe ribs and longitudinally aligned stiffening ribs.

2.11 The manufacturer of the ChamberMaxx system shall be one that has regularly been engaged in the engineering design and production of these systems for at least eight (8) years and which has a history of successful production, acceptable to the Engineer of Record (EOR). In accordance with the Drawings, the ChamberMaxx system shall be supplied by:

Contech Engineered Solutions
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

3.0 PERFORMANCE

3.1 The ChamberMaxx system proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

3.2 ChamberMaxx row spacing and stone base thickness cannot be altered with consultation from Contech Engineered Solutions, LLC.

3.3 The ChamberMaxx system shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by entirely transporting stormwater through stone.

3.4 A stormwater pretreatment device is recommended upstream of the ChamberMaxx system as follows:

3.4.1 Infiltration: Where feasible, the selected stormwater treatment device upstream of an infiltration system shall be a filter system and have General Use Level Designation (GULD) for Basic Treatment by the Washington State Department of Ecology or demonstrate equivalent performance in independently verified field testing following a peer reviewed testing protocol, and must be sized consistent with the system producing those results.

3.4.2 Detention: Where feasible, the selected Stormwater treatment device upstream of a detention system shall be a separator system and have GULD for Pretreatment by the WADOE or demonstrate equivalent performance in independently verified field testing following a peer reviewed testing protocol, and must be sized consistent with the system producing those results.

3.4.3 Selected pretreatment stormwater device shall incorporate a physical barrier capable of capturing and retaining trash and debris (i.e.: floatable and neutrally buoyant materials) for all flows up to the treatment capacity of the device.

3.4.4 The application of wrapping a system with geotextile of any branding or material type, that allows the passage of stormwater, shall not be regarded as an acceptable treatment or pretreatment device.

3.4.5 The manufacturer of the selected Stormwater treatment device shall have been regularly engaged in the engineering design and production of systems for the physical treatment of Stormwater runoff for 15 years.

3.4.6 In order to not restrict the Owner's ability to maintain the stormwater pretreatment device, the minimum dimension providing access from the ground surface to the sump chamber shall be 20 inches in diameter.

4.0 EXECUTION

4.1 The ChamberMaxx system shall be installed per the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail", available from local Contech representative or from www.conteches.com.

4.2 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the chambers. The Height-of-Cover shall meet the minimum requirements shown in the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail". The use of heavy construction equipment necessitates greater protection for the chambers than finished grade cover minimums for normal highway traffic.

4.3 The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

4.4 Contractor is required to participate in an on-site preconstruction meeting with the supplier prior to the scheduled delivery date of the ChamberMaxx system.

APPENDIX B: ChamberMaxx Specification with Containment Row

ChamberMaxx

Underground Detention and Infiltration Standard Specification with Containment Row

5.0 GENERAL

5.1 This item shall govern the furnishing and installation of ChamberMaxx underground detention and infiltration chamber systems.

5.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the ChamberMaxx system, appurtenances and incidentals in accordance with the Drawings and as specified herein.

5.3 The containment row of the ChamberMaxx system is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the ChamberMaxx system and reducing the life cycle cost.

5.4 Applicable provisions of any Division shall govern work in this section.

5.5 Related Standards

5.5.1 ASTM 2418 "Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers"

5.5.2 ASTM F-2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers"

5.6 Site layout drawings, product specifications, materials, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the Engineer of Record (EOR) for review at a minimum of 10 working days prior to bid closing.

5.7 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

5.8 Before installation of the ChamberMaxx system, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

5.9 All proposed alternatives to the ChamberMaxx system shall conform to applicable above referenced ASTM specifications.

6.0 MATERIALS

6.1 The chamber shall be constructed of injection molded polypropylene copolymer formulated for high impact and stress cracking resistance and sustained structural performance during high temperatures. The chamber shall be designed and manufactured in accordance to ASTM F-2418 and F-2787.

6.2 The chamber shall be designed to AASHTO LRFD Bridge Design Specifications (Section 12), as applied to material and performance requirements for buried thermoplastic pipes. Design live load shall be the AASHTO HS-20 and HS-25 truck, including multiple lane presence factors, over a minimum cover of 18 inches and chamber row spacing of 5 inches or greater.

6.3 The chamber system shall be comprised of three chamber configurations: The MIDDLE chambers shall be open-ended to allow unobstructed hydraulic flow, inspection, and maintenance. The START and END chambers shall each have an integral end wall designed to resist loading at the start and end of the chamber rows. The chambers within a row shall be installed with overlapping end corrugations.

6.4 The nominal dimensions of the START chamber shall be 51.4 inches wide, 30.3 inches tall, and 98.4 inches long. The nominal dimensions of the MIDDLE chamber shall be 51.4 inches wide, 30.3 inches tall, and 91.0 inches long. The nominal dimensions of the END chamber shall be 51.4 inches wide, 30.3 inches tall, and 92.0 inches long. The nominal storage volume inside the chamber shall be 77 cubic feet when utilizing 6" of stone above and below chamber with 40% stone porosity per ChamberMaxx standard detail.

6.5 The chamber shall have a continuously-curved, arch-shaped section profile.

6.6 The START and END chamber integral end wall shall be structurally suitable for cutting and inserting inlet pipes and shall provide a range of pipe diameter indicants up to 24" diameter as cutting templates.

6.7 The chamber shall be a corrugated, open-bottom design and top vent orifices for hydraulic pressure equalization. Corrugation valleys and crests shall be sub-corrugated to increase stiffness.

6.8 The chamber shall have a circular cut line for an optional reinforced inspection port configured to accept a 4" Schedule 40 pipe.

6.9 The END chambers shall be capable of being cut to shorter lengths to accommodate site specific requirements.

6.10The chamber shall be supported by integral structural footings comprised of load dispersing toe ribs and longitudinally aligned stiffening ribs.

6.11The manufacturer of the ChamberMaxx system shall be one that has regularly been engaged in the engineering design and production of these systems for at least eight (8) years and which has a history of successful production, acceptable to the Engineer of Record (EOR). In accordance with the Drawings, the ChamberMaxx system shall be supplied by:

Contech Engineered Solutions
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

7.0 PERFORMANCE

7.1 The ChamberMaxx system proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

7.2 ChamberMaxx row spacing and stone base thickness cannot be altered with consultation from Contech Engineered Solutions, LLC.

7.3 The ChamberMaxx system shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by entirely transporting stormwater through stone.

8.0 EXECUTION

8.1 The ChamberMaxx system shall be installed per the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail", available from local Contech representative or from www.conteches.com.

8.2 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the chambers. The Height-of-Cover shall meet the minimum requirements shown in the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail". The use of heavy construction equipment necessitates greater protection for the chambers than finished grade cover minimums for normal highway traffic.

8.3 The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

8.4 Contractor is required to participate in an on-site preconstruction meeting with the supplier prior to the scheduled delivery date of the ChamberMaxx system.

END SECTION

NOTES:

NOTES:

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800-338-1122
www.ContechES.com

Support

- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other product offerings, visit www.conteches.com or call 800.338.1122

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