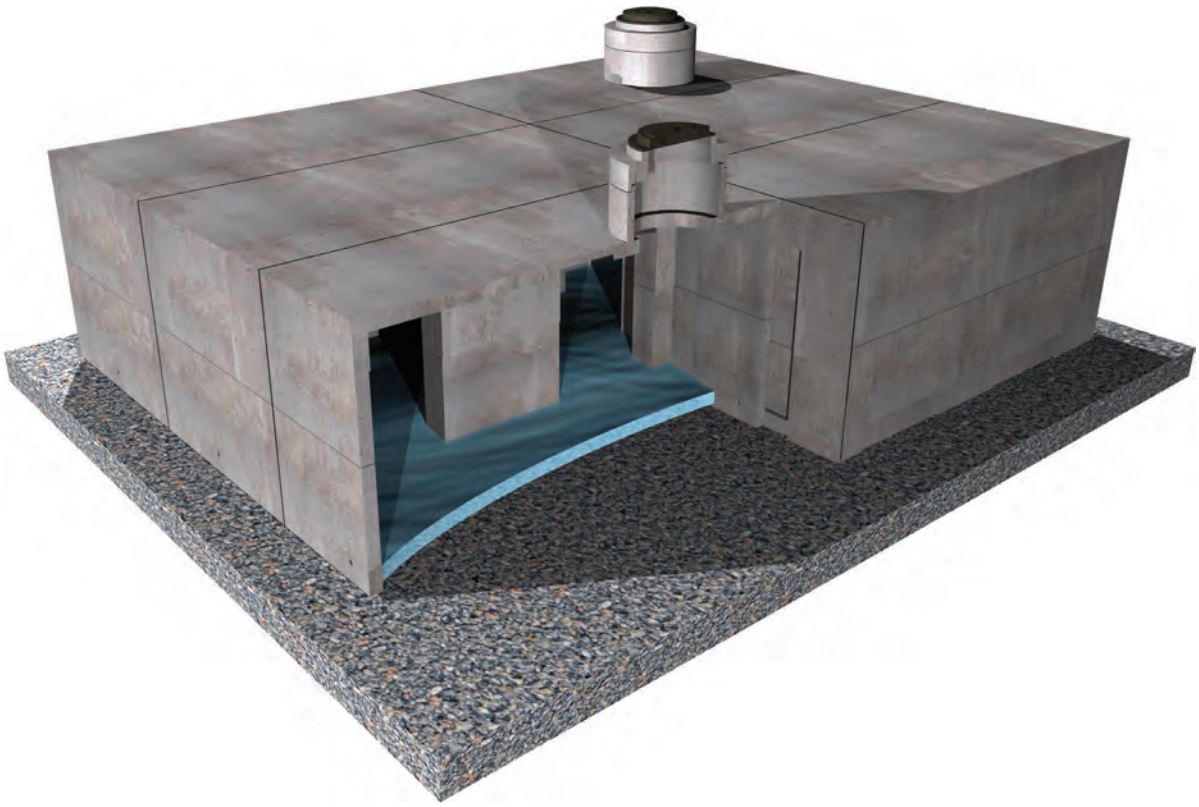
Oldcastle Precast®

STORMCAPTURE®

Infiltration

Submittal Package



Stormwater

Table of Contents

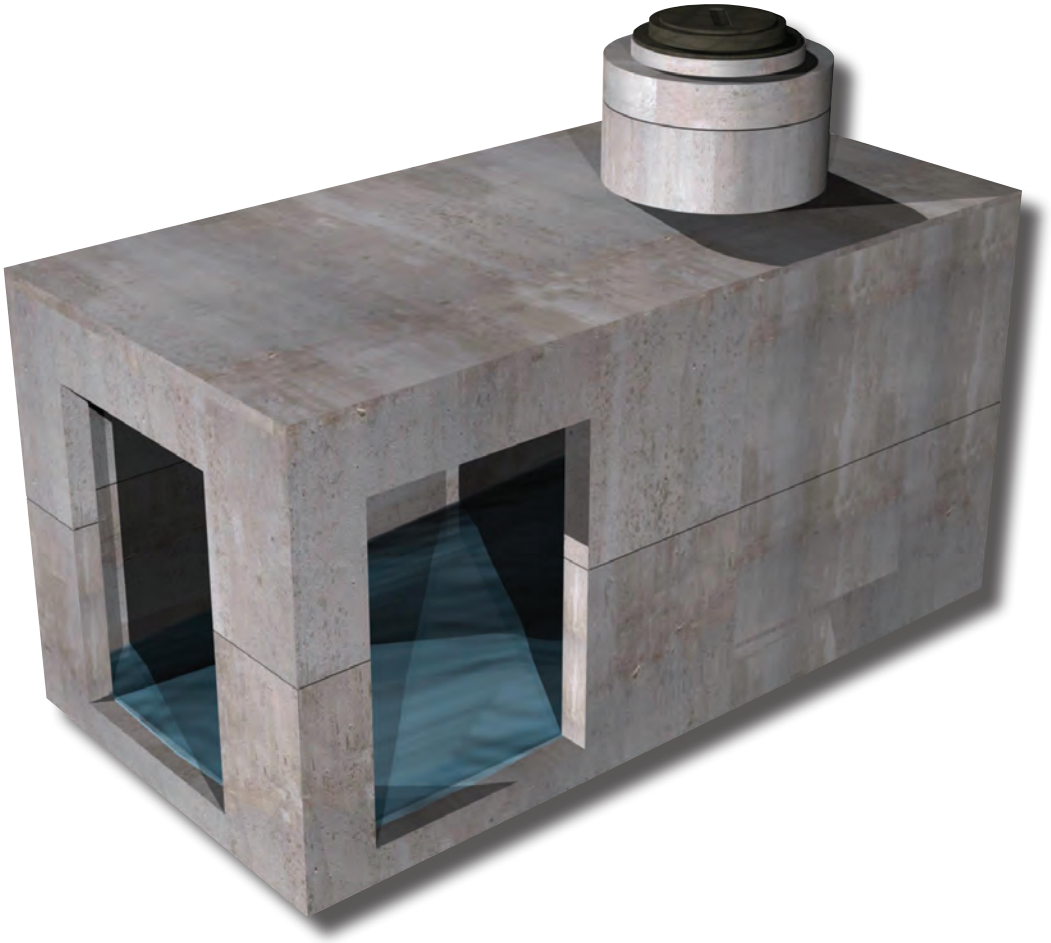
Section 1

Features & Benefits

Oldcastle Precast®

STORMCAPTURE®

StormCapture Modular Stormwater Management System for Infiltration, Detention, Retention and Treatment



DETENTION / RETENTION

Call us today **(800) 579-8819** or visit our website for detailed product information, drawings and design tools at **www.oldcastlestormwater.com**

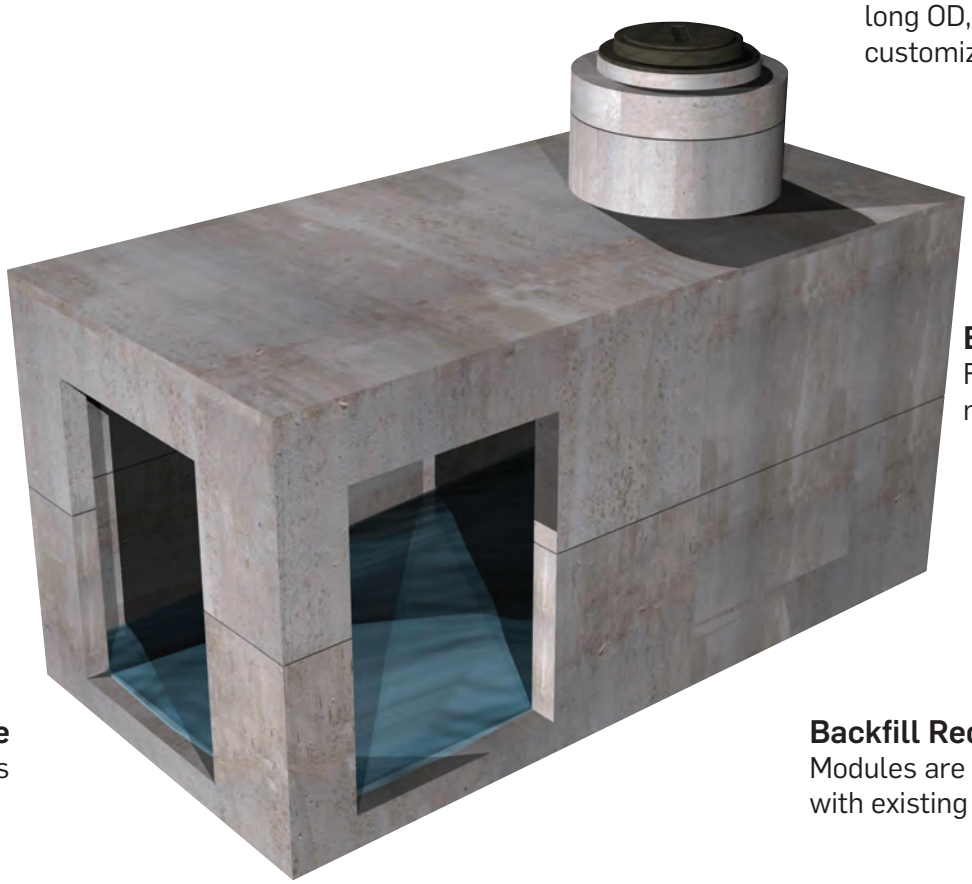
StormCapture® Module

Large Storage Capacity
Smaller system footprint for greater design flexibility.

Traffic Loading
Only requires 6" of cover.

Modular Design
Precast concrete modules measure 8' wide by 16' long OD, (7' x 15' ID), with customizable heights.

Custom Sizes
Available in internal heights from 2' to 14' to best-fit site needs.



Easy to Install
Fast installation with minimal handling.

Design Assistance
Let our professionals customize for your specific needs.

Backfill Requirements
Modules are typically backfilled with existing site materials.

Treatment Train
Available with pre-treatment, post-treatment, or both.

Construction Site Friendly
Contractor does not have to relinquish any ground on the site once the StormCapture system is installed.

Same-day staging and installation of StormCapture project.

StormCapture offers fast installation with minimal handling.

StormCapture modules are designed for HS20 traffic loading.

StormCapture detention system installed beneath office parking lot.

StormCapture Advantages

• **Fast Service** - Get help from our national engineering team with layouts and specifications to meet your project's requirements.

• **Cost Savings** - Highly competitive installation and maintenance costs.

• **Quality** - Manufactured to the rigid standards of the Oldcastle quality control program at Oldcastle facilities around the country.

• **Codes** - Designed to the latest codes for HS-20-44 (full truckload plus impact).

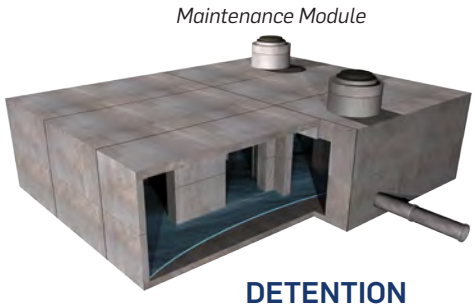
• **Sustainability** - The system is maintainable for long-term sustainability.

• **LID** - Ideal for Low-Impact Development (LID).

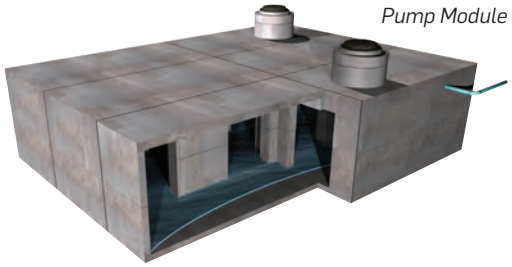
• **LEED** - Manufactured locally with recycled material for potential LEED credits. *LEED 2009 for New Construction & Major Renovation, U.S. Green Building Council: Sustainable Sites (5.1, 5.2, 6.1, 6.2), Materials & Resources (4.1, 4.2, 5.1, 5.2), Water Efficiency (1.1, 1.2, 3.1, 3.2).*

Applications

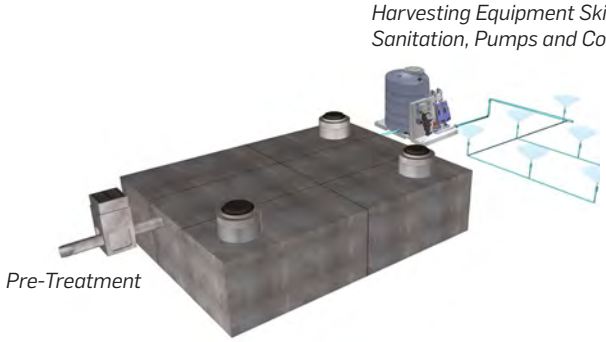
StormCapture offers numerous options for detention, retention, treatment and harvesting to solve your stormwater management needs. Let us show you how we can design and customize a solution for you.



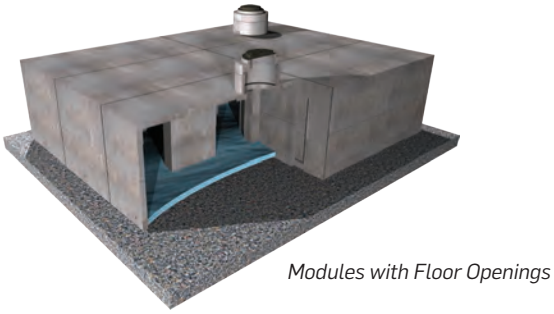
DETENTION



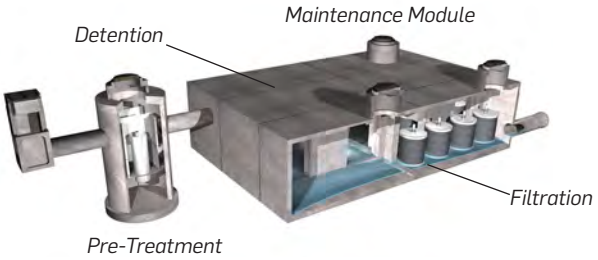
RETENTION



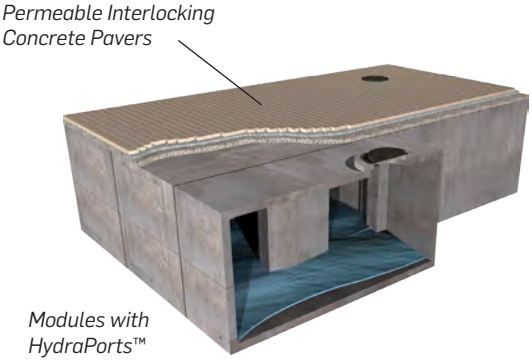
HARVESTING



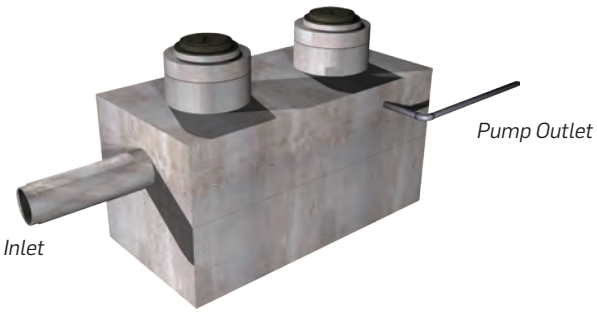
INFILTRATION



TREATMENT



PERMECAPTURE

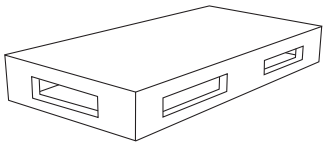


CISTERNS

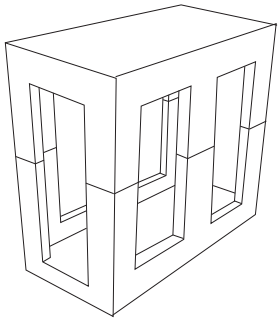



INSTALLED IN JUST ONE DAY

Module Sizes



SC1 - Single piece modules can be used for applications from 2' to 7' tall. Appropriate for cisterns, infiltration, detention and retention systems. SC1 modules are typically installed on minimally compacted gravel base, depending on specific project requirements.



SC2 - Two piece modules can be used for applications from 7' to 14' tall for maximum storage capacity in a condensed footprint. Appropriate for cisterns, infiltration, detention and retention systems. SC2 modules are typically installed on compacted native subgrade.

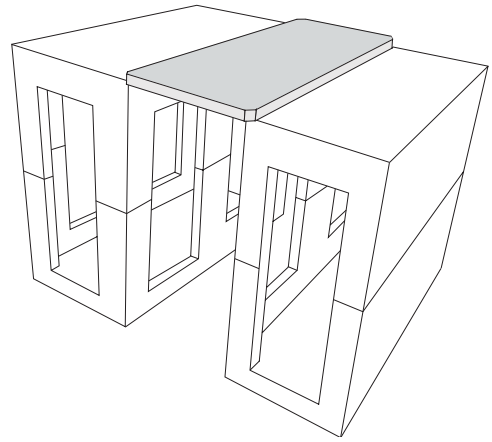
Module Sizes & Capacities

Modules are 8'x16' outside dimensions. Capacity varies by configuration of openings.

Inside Dimensions (ft)	Capacity Range (ft^3)
7x15x2	210-212
7x15x3	315-325
7x15x4	420-442
7x15x5	525-559
7x15x6	630-676
7x15x7	735-793
7x15x8	840-910

Inside Dimensions (ft)	Capacity Range (ft^3)
7x15x9	945-1,027
7x15x10	1,050-1,140
7x15x11	1,155-1,257
7x15x12	1,260-1,374
7x15x13*	1,365-1,491
7x15x14*	1,470-1,608

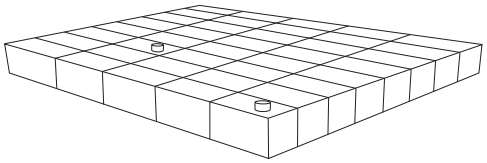
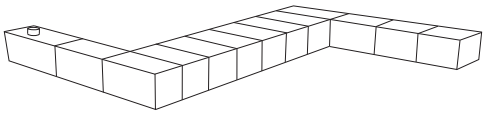
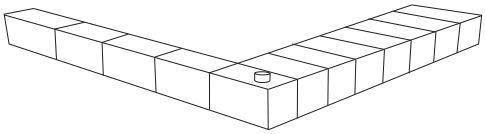
* Special design considerations required and limited availability



Link Slab - Unique design allows for significant reduction in the quantity of modules and associated costs, while providing maximum storage capacity.

Endless Configurations

Contact us today to start designing your system!

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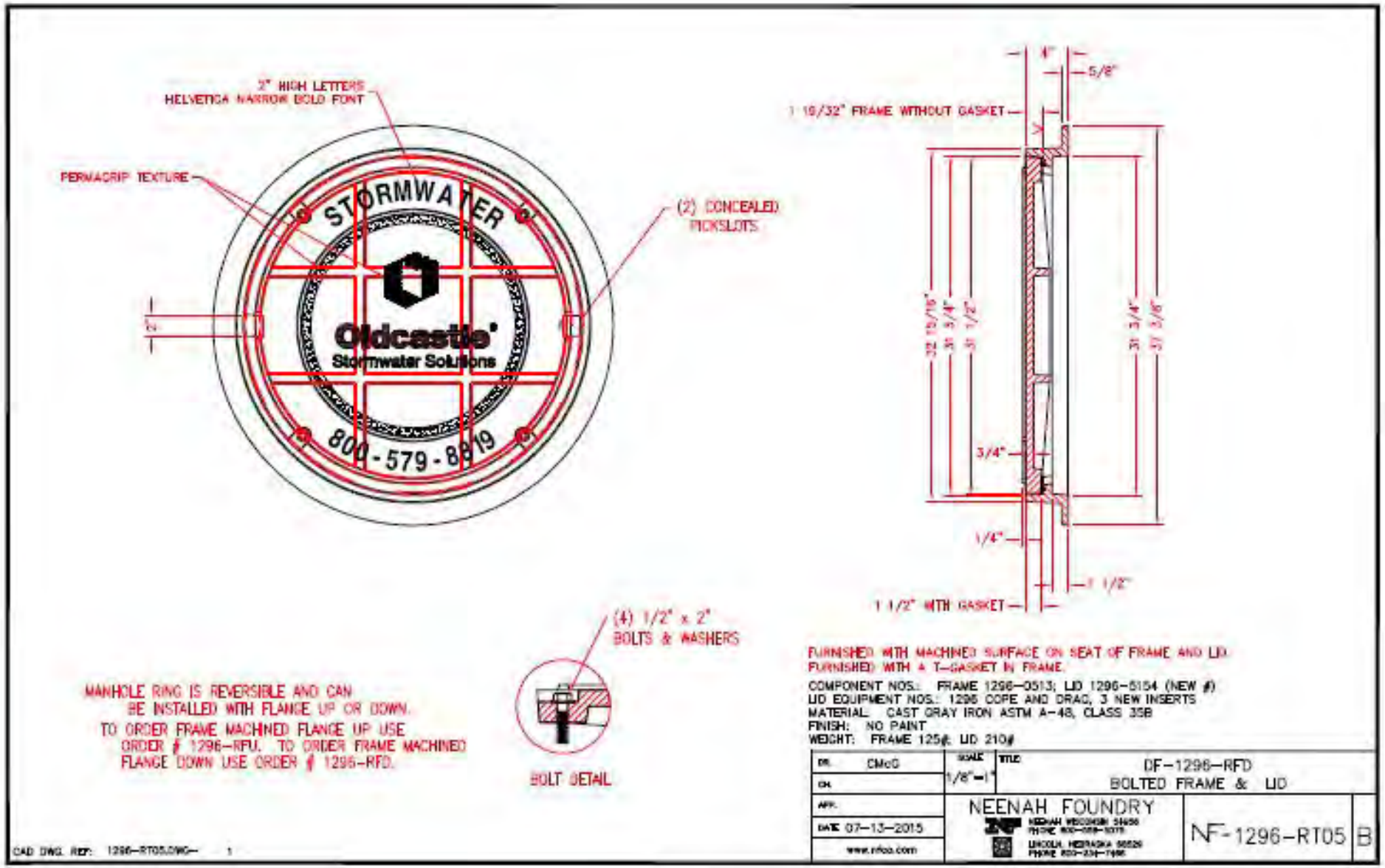
OSS_StormCaptureInsert_032017_v4

Section 2

Accessories

1296-RT05-1 B8



MANHOLE RING IS REVERSIBLE AND CAN BE INSTALLED WITH FLANGE UP OR DOWN.
TO ORDER FRAME MACHINED FLANGE UP USE ORDER # 1296-RFU. TO ORDER FRAME MACHINED FLANGE DOWN USE ORDER # 1296-RFD.

FURNISHED WITH MACHINED SURFACE ON SEAT OF FRAME AND LID.
FURNISHED WITH A T-GASKET IN FRAME.

COMPONENT NOS.: FRAME 1296-0513; LID 1296-5154 (NEW #)
LID EQUIPMENT NOS.: 1295 COPE AND DRAG, 3 NEW INSERTS
MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
FINISH: NO PAINT
WEIGHT: FRAME 125#, LID 210#

DR. CMcG	SCALE 1/8"=1"	TITLE: DF-1296-RFD BOLTED FRAME & LID	
CH.			
APP.			
DATE 07-13-2015	NEENAH FOUNDRY	NF-1296-RT05	B
www.nfco.com	NEENAH, WISCONSIN 54956 PHONE 800-558-5075 LINCOLN, NEBRASKA 68528 PHONE 800-234-7496		

CAD DWG. REF: 1296-RT05.DWG- 1

ConSeal™ CS-102

Butyl Rubber Sealant

ConSeal Concrete Sealants Inc.

Butyl Rubber Sealant for All Precast Concrete Structures - Meets ASTM C-990

Applications

For concrete joints in: Manholes, Concrete Pipe, Vaults, Box Culverts, Septic Tanks, and Vertical Panel Structures. **Not intended for use in expansion joints or joints that move.**

Sealing Properties

- Provides permanently flexible watertight joints.
- Low to high temperature workability: 30°F to 120°F (-1°C to +48°C)
- Rugged service temperature: -30°F to +200°F (-34°C to +93°C)
- Excellent chemical and mechanical adhesion to clean dry surfaces.
- Greater cohesive and adhesive strengths.
- Sealed joints will not shrink, harden or oxidize upon aging.
- Controlled flow resistance for application ease.
- No priming normally necessary. When confronted with difficult installation conditions, such as wet concrete or temperatures below 40°F (4°C), priming the concrete will improve the bonding action. Consult Concrete Sealants for the proper primer to meet your application.

Hydrostatic Strength

ConSeal CS-102 meets the hydrostatic performance requirement as set forth in ASTM C-990 section 10.1 (Performance requirement: 10psi for 10 minutes in straight alignment – in plant, quality control test for joint materials.)

Specifications

ConSeal CS-102 meets or exceeds all of the requirements of Federal Specification SS-S-210 (210-A), AASHTO M-198B, and ASTM C-990-91.

Physical Properties

Description

	Spec	Required	CS-102
Color			Black
Specific Gravity, 77°F	ASTM D71	1.15-1.50	1.25
Ductility, 77°F	ASTM D113	5.0 min.	10
Penetration, cone 77°F (25°C), 150 gm, 5 sec.	ASTM D217	50-100 mm	55-60 mm
Penetration, cone 32°F (0°C), 150 gm, 5 sec.	ASTM D217	40 mm min.	40-65 mm
Flash Point, C.O.C., °F	ASTM D92	350°F min.	450°F
Fire Point, C.O.C., °F	ASTM D92	375°F min.	475°F

Don't Just Seal It, ConSeal It!

ISO 9001 Registered

Concrete Sealants, Inc. 9325 State Route 201 ▪ Tipp City, OH 45371 ▪ P.O. Box 176 ▪ New Carlisle, OH 45344
P. 937.845.8776 **F.** 937.845.3587 **Toll Free** 800.332.7325 ▪ **www.conseal.com**

ConSeal™ CS-102
Butyl Rubber Sealant

ConSeal
Concrete Sealants Inc.

Butyl Rubber Sealant for All Precast Concrete Structures - Meets ASTM C-990

Chemical Composition
Description

	Spec	Required	CS-102
Hydrocarbon plastic content % by weight	ASTM D4 (mod.)	50% min.	51%
Inert mineral filler % by weight	AASHTO T111	30% min.	35%
Volatile Mater % by weight	ASTM D6	2% max.	1.2%

Recycled Content, % by weight
- Post Consumer: 8.41%
- Post Industrial: 10.85%

Immersion Testing
30-Day Immersion Testing: No visible deterioration when tested in 5% Caustic Potash, 5% Hydrochloric Acid, 5% Sulfuric Acid, and 5% saturated Hydrogen Sulfide.

One Year Immersion Testing: No visible deterioration when tested in 5% Formaldehyde, 5% Formic Acid, 5% Sulfuric Acid, 5% Hydrochloric Acid, 5% Sodium Hydroxide, 5% Hydrogen Sulfide, and 5% Potassium Hydroxide.

Limited Warranty
This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufactures in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the **users' responsibility** to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

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ConSeal™ CS-212

Polyolefin Backed Exterior Joint Wrap

Membrane Waterproofing and Exterior Joint Wrap for Precast Concrete Joints

Applications

For joints in: Box Culverts, Underground Concrete Vaults, Segmented Bridge Structures, Wastewater Structures and Arched Bridge Structures, Manholes. **Not intended for use in expansion joints or joints that move.**

Sealing Properties

- Excellent resistance to puncture, tear and abrasions.
- Aggressively bonds to concrete and metal structures.
- Provides a permanent flexible water and soil barrier.
- Will not shrink, harden or oxide upon aging.
- Available in numerous standard sizes.
  - Standard thicknesses: 0.065" and 0.100"
  - Standard widths: 4", 6", 8", 12", 24", 36" and 48"
- Custom widths and lengths available upon request.
- No priming normally necessary. When confronted with difficult installation conditions, such as wet concrete or temperatures below 40°F (4°C), priming the concrete will improve the bonding action. Consult Concrete Sealants for the proper primer to meet your application.

Specifications

ConSeal CS-212 meets ASTM E-1745, C-877, C-990 Specifications, and AASHTO M198 Type B.

Technical Data

ASTM E-1745: Standard specification for plastic water vapor retarders used in contact with soil or granular fill under concrete slabs.

Class C. Specification	Test Method	E-1745 Requirement	CS-212
Water Vapor Permeance	ASTM F-1249	0.30 perms, max.	0.045 perms, max.
Tensile Strength	ASTM E-154	13.6 lbs./ inch, min.	21.0 lbs./ inch, min.
Puncture Resistance	ASTM D-1709	475 grams, min.	864 grams, min.

ASTM C-877: Standard specification for external sealing bands for non-circular concrete sewer, storm drain and culvert pipe.

Type III, Specification	E-1745 Requirement	CS-212
Backing Bond Element	4 Mil, min. thickness	4 Mil
Butyl Rubber Adhesive	0.03 inch, min. thickness	0.065, min.

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ConSeal™ CS-212

Polyolefin Backed Exterior Joint Wrap

ConSeal Concrete Sealants Inc.

Membrane Waterproofing and Exterior Joint Wrap for Precast Concrete Joints

Technical Data Continued

ASTM C-990: Standard specification for joints for concrete pipe, manholes and precast box sections using preformed flexible joint sealants.

Section 6, Specification	Test Method	C-990 Requirements	CS-212
Hydrocarbon blend content % by weight	ASTM D-4	50-70%	52, min.
Inert mineral filler % by weight	ASTM C-990	30% min.	45, min.
Volatile Matter % by weight	ASTM C-990	2.0 max.	1.20
Specific Gravity	ASTM C-990	1.15-1.50	1.20-1.25
Ductility, 7°F	ASTM D-113	5.0, min.	12, min.
Penetration, cone 77°F, 150 gm. 5 sec.	ASTM D-217	50-120 mm	70-80 mm
Softening point, °F	ASTM D-36	320°F, min.	335°F, min.

Limited Warranty

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TENCATE
Mirafi®

Mirafi 160N

Mirafi 160N is a needle-punched, non-woven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi 160N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Mirafi 160N meets AASHTO M288-06 Class 2 for Elongation >50%.

TenCate Geosynthetics Americas Laboratories are accredited by A2LA (The American Association for Laboratory Accreditation) and Geosynthetic Accreditation Institute - Laboratory Accreditation - (GAI-LAP). NTPEP Number: GTX-2012-01-003

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	160 (712)	160 (712)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs (N)	60 (267)	60 (267)
CBR Puncture Strength	ASTM D6241	lbs (N)	410 (1825)	
Apparent Opening Size (AOS)[1]	ASTM D4751	U.S. sieve (mm)	70 (0.212)	
Permittivity	ASTM D4491	sec^{-1}	1.5	
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	110 (4481)	
UV Resistance (at 500 Hours)	ASTM D4355	% strength retained	70	

[1]ASTM D4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Unit	Typical Value[2]
Roll Dimensions (width x length)	ft (m)	15 x 300 (4.5 x 91)
Roll Area	yd^2 (m^2)	500 (418)
Estimated Roll Weight	lb (kg)	215 (97)

[2] ASTM D4439 Standard Terminology for Geosynthetics: typical value, *n—for geosynthetics,* the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Made in USA

TENCATE
materials that make a difference

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FGS000361
ETQR83

GAI-LAP-25-97

ACCREDITED

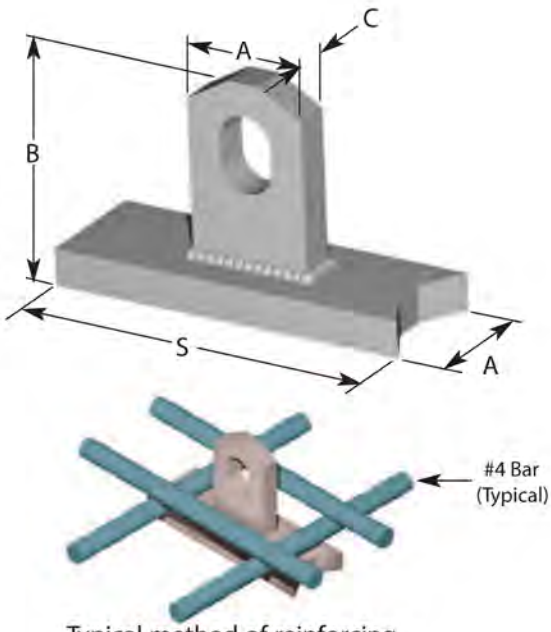
Testing Lab 1291.01 & 1291.02

Rapid Lift System Anchors

(6060) RL-24 PLATE ANCHOR
2-Ton, 4-Ton and 8-Ton

The RL-24 Plate Anchor is designed with a plate welded to the bottom to provide high pullout strength with a low profile. This design makes the anchor ideal for face and back lifts of thin-wall units and stripping, handling and erection applications. The Plate Anchor is available in the sizes shown in the table and in plain or hot dip galvanize finish.

Reinforcing Recommendation:
Criss-cross the lower plate of the anchor with four (4) 18" long #4 rebar as shown in the sketch.



Typical method of reinforcing Plate Anchors

NOTE: The Plate Anchor has allowable face shear loads that are equal to or greater than the face tension loads for anchors located in a panel or concrete unit at a distance of at least 3B+A from the edges.

RL-24 RAPID LIFT PLATE ANCHOR DATA

Ring Clutch System	Clutch I.D.	Item Number	A	B	C	S	Allowable Unreinforced Tension Load 4:1 SF (lbs)	Allowable Reinforced Tension Load 4:1 SF (lbs)	Ultimate Mechanical Load Tension (lbs)	Weight Per Piece (lbs)
2T/2.5T	2.5T	79128	1 1/4"	2 1/4"	3/8"	3 3/4"	952	4,000	16,000	0.71
4T/5T	5T	45846[3]	1 1/2"	3"	5/8"	3"	3,574	8,000	32,000	1.21
4T/5T	5T	45847[3]	1 1/2"	3 1/2"	5/8"	3"	4,700	8,000	32,000	1.31
4T/5T	5T	79044	1 1/2"	4 3/8"	5/8"	3 7/8"	4,732	8,000	32,000	1.91
8T/10T	10T	79054	2 1/2"	6 1/4"	3/4"	5"	6,350	12,000	64,000	4.29
8T/10T	10T	79043	–	7 1/8"	Discontinued: See Plate Anchor Item 79042					
8T/10T	10T	79042	2 1/2"	7 1/8"	3/4"	5"	10,000	16,000	64,000	5.55

1) Table is based on dead load only, 150 PCF and a standard concrete compressive strength of 3,500 psi and a minimum edge distance of (3B+A)/2.
2) Tension values shown are based on 3,000 psi standard weight concrete, a minimum edge distance of 10" and #4 rebar cut to 18" lengths reinforcing the anchor as shown in the sketch.
3) Available with plate anchor base.

To order, specify: quantity, name, item number and finish.

(6190) RL-60 PLATE ANCHOR BASE
4-Ton

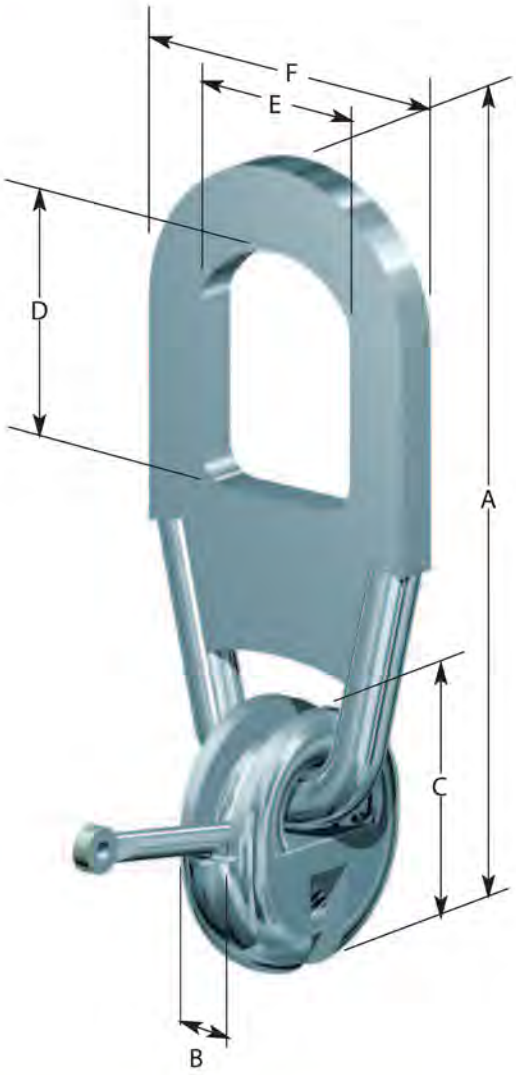
The RL-60 Plate Anchor Base is a plastic base designed for use with specific RL-24 Plate Anchor 4-Ton units (item numbers 45846 and 45847) to hold and position the anchors in face lift applications.

To order, specify: quantity, name and item number.

Rapid Lift System Ring Clutches

(6120) RL-35 RING CLUTCH
2/2.5-Ton, 4/5-Ton, 8/10-Ton and 22/26-Ton

The RL-35 Ring Clutch is an assembly consisting of a main clutch body, a curved bolt/handle and bail. The design of the ring clutch allows a full 360° rotation of the bail around the main body. The installation of the unit is quick and easy; simply rotate the curved bolt/handle to the open position, drop the main body into the anchor recess and rotate the bolt/handle to the closed position.



RL-35 RAPID LIFT RING CLUTCH DATA

Ring Clutch Systems	Clutch I.D.	Item Number	A	B	C	D	E	F	Weight Per Piece (lbs)	Clutch Capacity (ton)
2T/2.5T	2.5T	79001	10 7/16"	1 1/16"	3 1/8"	2 3/4"	2 1/4"	3 5/8"	3.65	2.5
4T/5T[1]	5T	79002	13"	1 7/16"	4 1/8"	3 3/16"	2 9/16"	4 1/2"	8.65	5
8T/10T**	10T	79003	16 3/4"	2"	5 15/16"	4 9/16"	3 9/16"	5 13/16"	19.87	10
22T/26T[2]	26T	79170	23 7/8"	2 13/16"	8 1/4"	7 1/4"	4 3/4"	8 13/16"	55.0	22

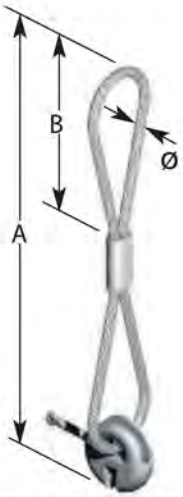
1) Super Lift II Ring Clutch may be used, if a longer handle is required.
2) Available on special order or limited to quantity on hand. Special orders take 8 to 10 weeks.
** May be used with DTA (Double Tee Anchor).
3) Clutch capacities are rated at a 5:1 safety factor; and apply only to clutches manufactured after 1/1/2000.

To order, specify: quantity, name and item number.

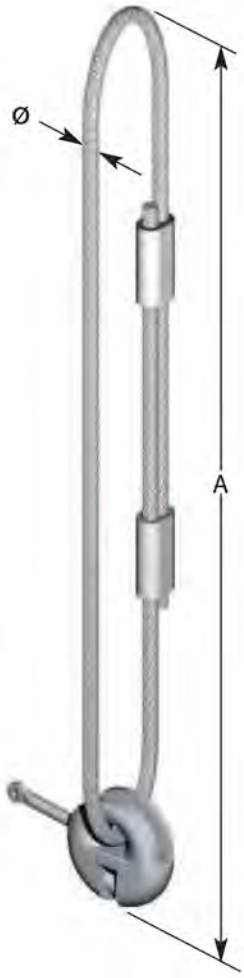
Rapid Lift System Ring Clutches

(6125) RL-38 CABLE RING CLUTCH
1-Ton, 2-Ton, 4-Ton and 8-Ton

The RL-38 Ring Clutch – Cable is identical in use to the standard ring clutch, but is fabricated with a wire cable bail for more versatility. It is often an effective answer for difficult lifting and rotation challenges.



RL-38 Cable Ring Clutch
1-Ton, 2-Ton, 4-Ton
and 8-Ton



RL-39 Cable Ring Clutch
22-Ton

(6130) RL-39 CABLE RING CLUTCH
22-Ton

The RL-39 Ring Clutch – Cable is a heavy-duty version of the cable ring clutch for use where high loads are present.

RL-38 & RL-39 CABLE RING CLUTCH DATA

Item	Ring Clutch System	Clutch I.D.**	Item Number	A	B	Cable Diameter Ø	Weight per Piece	Clutch Capacity (3 ton)
RL-38	1T	1.25T	79216	12 1/2"	8 1/4"	8 mm	2.0 lbs	1
RL-38	2T	2.5T	79001CB	22"	11 7/8"	14 mm	5.0	2
RL-38	4T	5T	79002CB	23 3/8"	11 3/4"	18 mm	8.0	4
RL-38	8T	10T	79003CB	27 3/4"	12 3/4"	22 mm	19.0	8
RL-39*	22T	26T	79170CB	62"	N/A	32 mm	67.0	22

1 Available on special order or limited quantity on hand. Special orders take 8 to 10 weeks. 2 Not to be used with High Capacity System Anchors.

3 Clutch capacities are rated at a 5:1 safety factor.

To order, specify: quantity, name and item number.

Section 3

Installation Manual

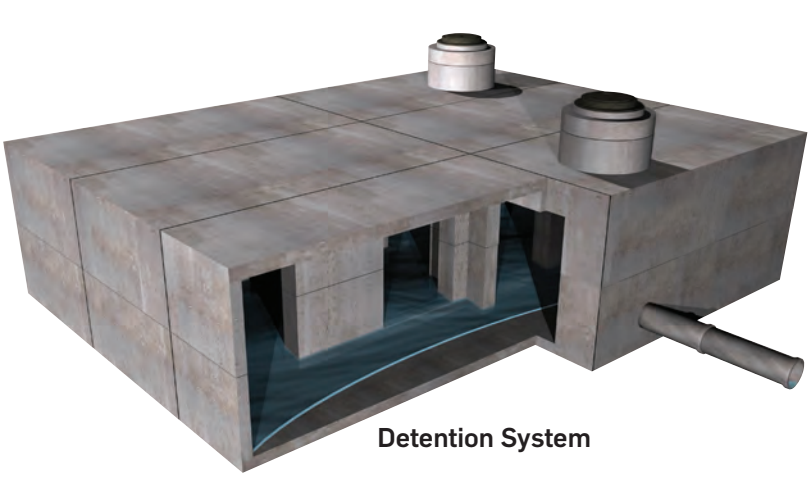
Introduction

StormCapture (shown in **Figure 1**) is a total stormwater management system. The highly-configurable module has many solutions for detention, retention, infiltration, treatment and harvesting. Multiple modules can be arranged into endless formations to meet the needs of even the most challenging sites. The rectangular design facilitates rapid and easy installation, plus stress-free maintenance. The precast concrete provides long-term reliability and low lifecycle costs.

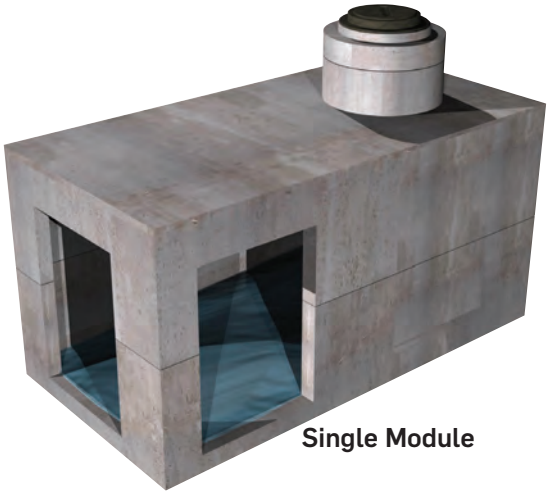
The engineer of record is responsible for reviewing and approving the system design, storage volume, required depth of cover, vehicular loading, water table elevation, backfill material and soil bearing capacity. Any variations found during construction to those stated on the plans must be reported to the engineer and Oldcastle Precast.

This manual is not intended to be all-inclusive and is a reference guide only.

FIGURE 1



Detention System



Single Module

FIGURE 2

StormCapture System During Installation Process

Site Preparation

TIMING

- Excavation and subgrade shall be completed prior to StormCapture delivery.

*EXCAVATION - See **Figures 3 & 4***

- Depth
  Concrete invert: Depth of fill* + Module outside height + 2" subgrade depth
  Open bottom: Depth of fill* + Module outside height + subgrade depth**
  ** 6" minimum, 5' maximum, unless otherwise noted*
  *** Subgrade depth determined in accordance with StormCapture Tech Note SC-01*
- Excavation shall be large enough to allow access around structure for backfilling and compaction equipment.
- Trench sloping shall follow OSHA requirements.
- To prevent excessive water pressure build up on the outside of the modules, the site must be prepared and graded for proper drainage around the StormCapture system.
- Dewatering is required when water level is above bottom of subgrade.

*SUBGRADE - See **Figures 3 & 4***

1. Native soil shall be level and compacted adequately to allow for required bearing capacity on design documents.
2. Add 2" of sand for leveling purposes.
3. Geotextile fabric and containment membrane liner.
   - An 8 oz. non-woven geotextile fabric must be used as a separation layer around the StormCapture system.
   - When the project requires a containment membrane liner, a layer of 8 oz. non-woven geotextile fabric must be used on both the inside and outside face of the liner.
   - Install containment membrane liner per manufacturer's recommendations.
4. Aggregate bearing layer - *See **Figure 3***
   - Open-bottom modules only are required to be placed on a crushed aggregate bearing layer to a depth in accordance with StormCapture Tech Note SC-01. Material shall be clean, durable crushed aggregate compacted as directed by the engineer of record. Oldcastle recommends size 5, 56 or 57 (per ASTM C33).
   - Extend aggregate bearing layer a minimum of 1' around the system perimeter.
   - Aggregate bearing layer must be level and compacted prior to module placement.
   - An 8 oz. non-woven geotextile fabric must be used as a separation layer around the aggregate material and StormCapture system.

***Note:** Further investigation by a geotechnical engineer may be required where there are concerns with seasonally high water table, and/or poor soil conditions such as low allowable bearing capacity, permafrost and seasonal freeze/thaw cycles.*

FIGURE 3

1-Piece Module - With Liner

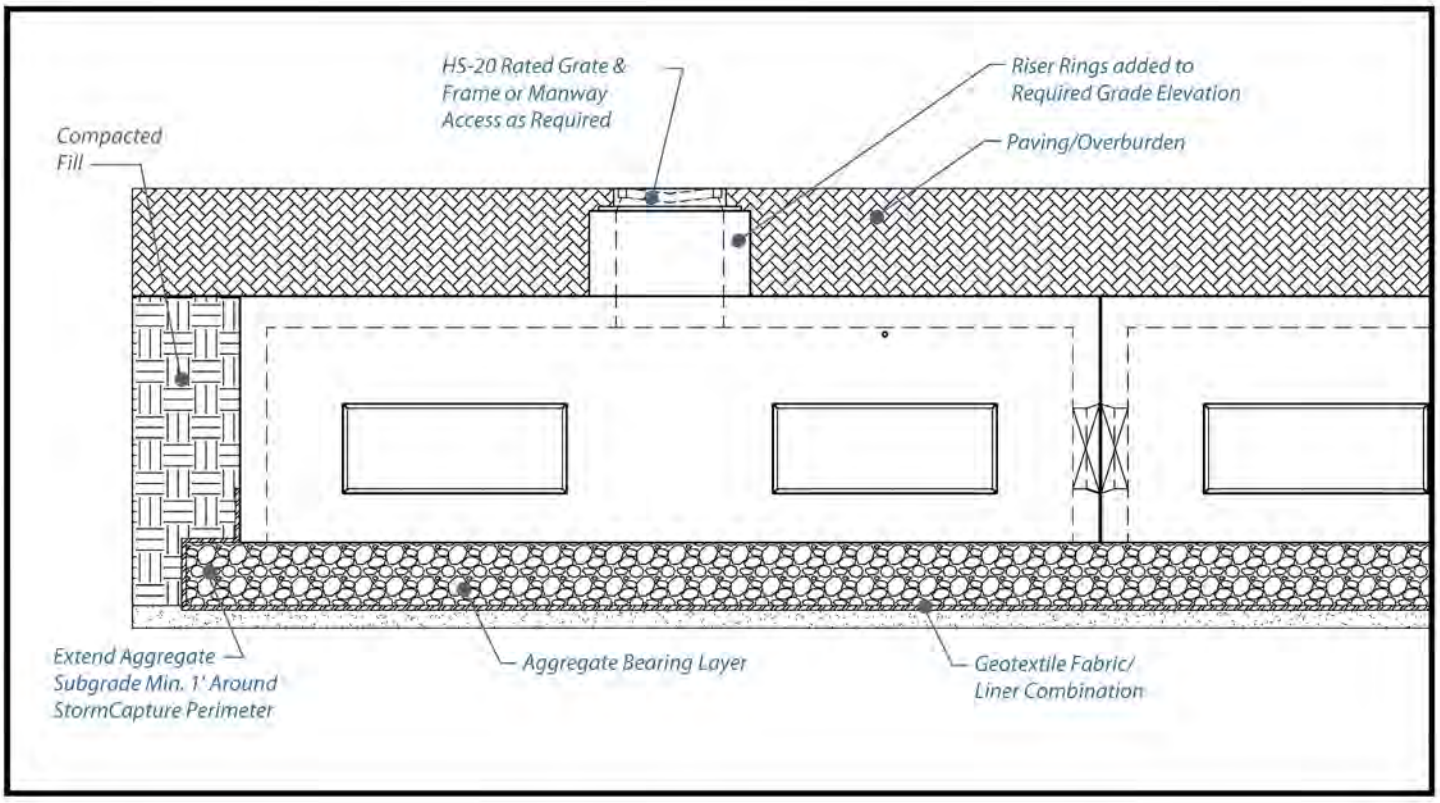
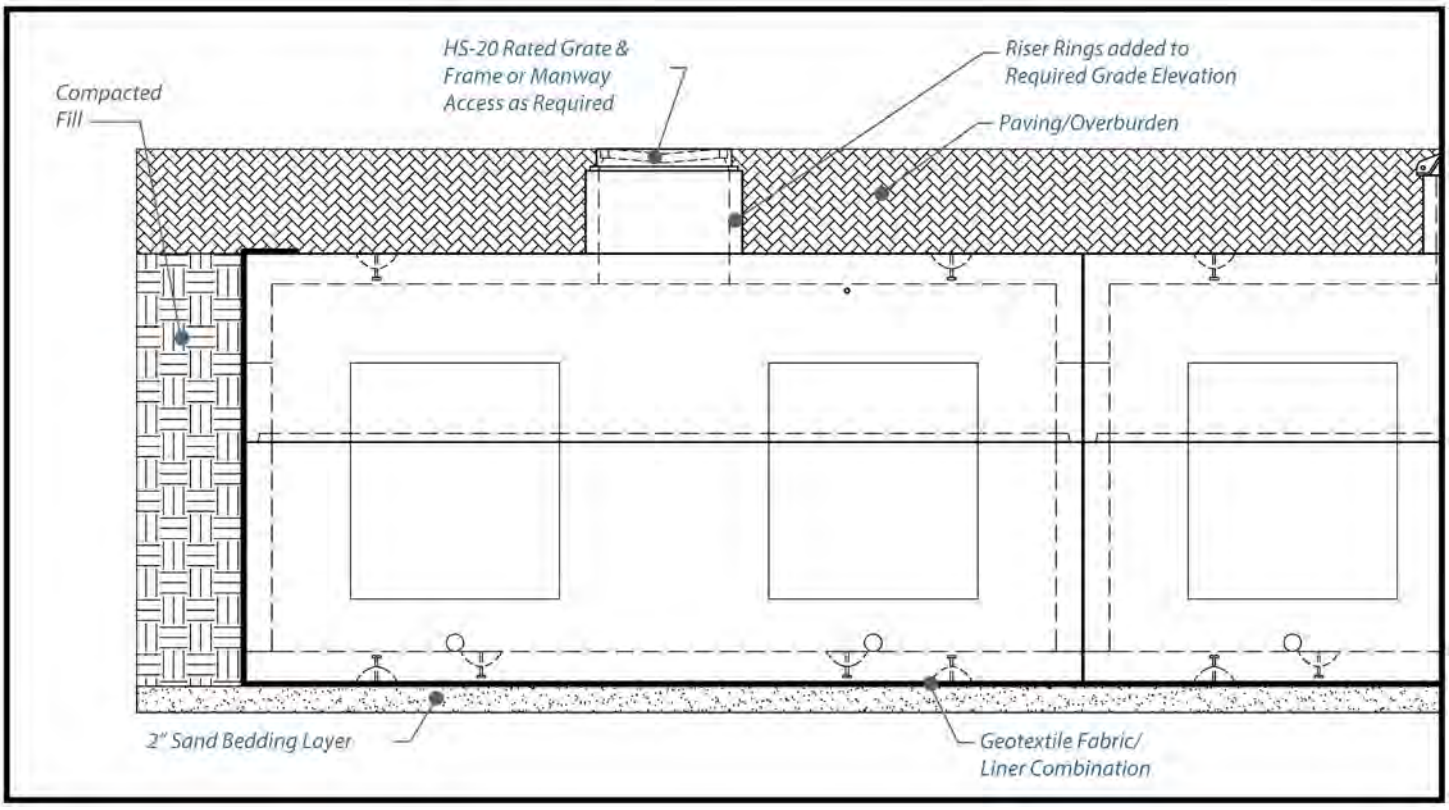


FIGURE 4

2-Piece Module - With Liner



Delivery & Installation

StormCapture modules are to be installed in accordance with ASTM C891-90, Installation of Underground Precast Utility Structures. Project plan and specifications must be followed along with any applicable regulations.

TIMING

- Plan for first delivery of StormCapture modules after site preparation is completed.
- Individual pieces can be installed in as little as 10 minutes.

DELIVERY

- Verify that equipment can handle module weights as noted on construction documents prior to delivery.
- StormCapture modules will be delivered on flatbed trucks.

HANDLING

- StormCapture modules are lifted by the designed embedded lifers at points provided by Oldcastle (**Figure 5**).
- Designed embedded lifters must be used. Use proper rigging to assure all lifters are equally engaged with a minimum 60° angle on slings (**Figure 6**).
- Special lifting clutches are required and shall be coordinated with the producing plant.
- Always follow safety protocols for handling StormCapture modules during installation as illustrated on this page.
- Never stand under load (**Figure 7**).
- Never place hands in the lift gear (**Figure 8**).
- Never place hands under load (**Figure 9**).

PLACEMENT

- Use the plan line, grade and elevations shown on the construction documents to install the modules. The sand bedding or aggregate bearing layer must be level.
- Modules must be placed as close together as possible with gaps no greater than 3/4".
- All vertical & top joints shall be covered with an 8" minimum width self-adhesive joint wrap as shown in **Figure 10**.
- Horizontal joints between modules or slabs shall be sealed with Conseal CS-102 butyl rubber sealant as shown in **Figure 11**.
- Seal pipe penetrations to containment membrane liner with pipe boots per liner manufacturer's recommendations.

FIGURE 6

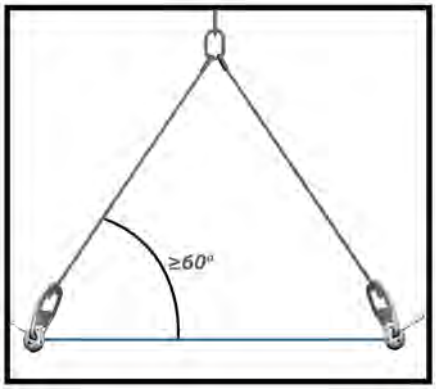


FIGURE 5

EMBEDDED LIFTERS

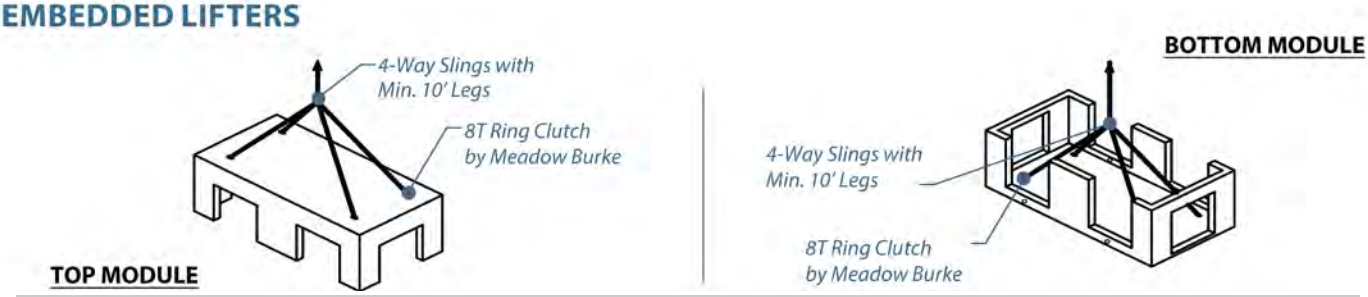


FIGURE 7

FIGURE 8

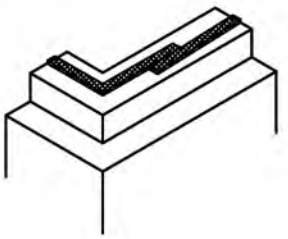
FIGURE 9

FIGURE 10

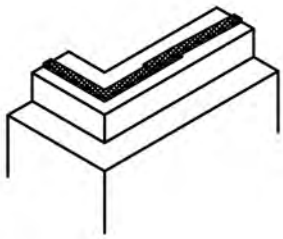
Sealed Joints Between Modules

FIGURE 11

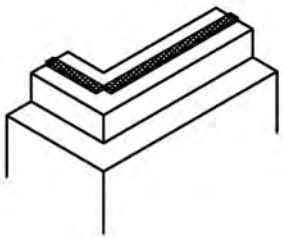
Keyways must be free of dirt, rocks and water. Rocks and dirt prevent the vault sections from seating and sealing properly. Remove all protective paper from rubber sealant material. Splice rubber sealant material with a “side by side” joint, away from corners. Corner splicing will not seal properly.



CORRECT - Install rubber sealant material at the outer edge of the keyway. Rubber sealant should be continuous around corners.



INCORRECT - Do not overlap the rubber sealant material at splice.



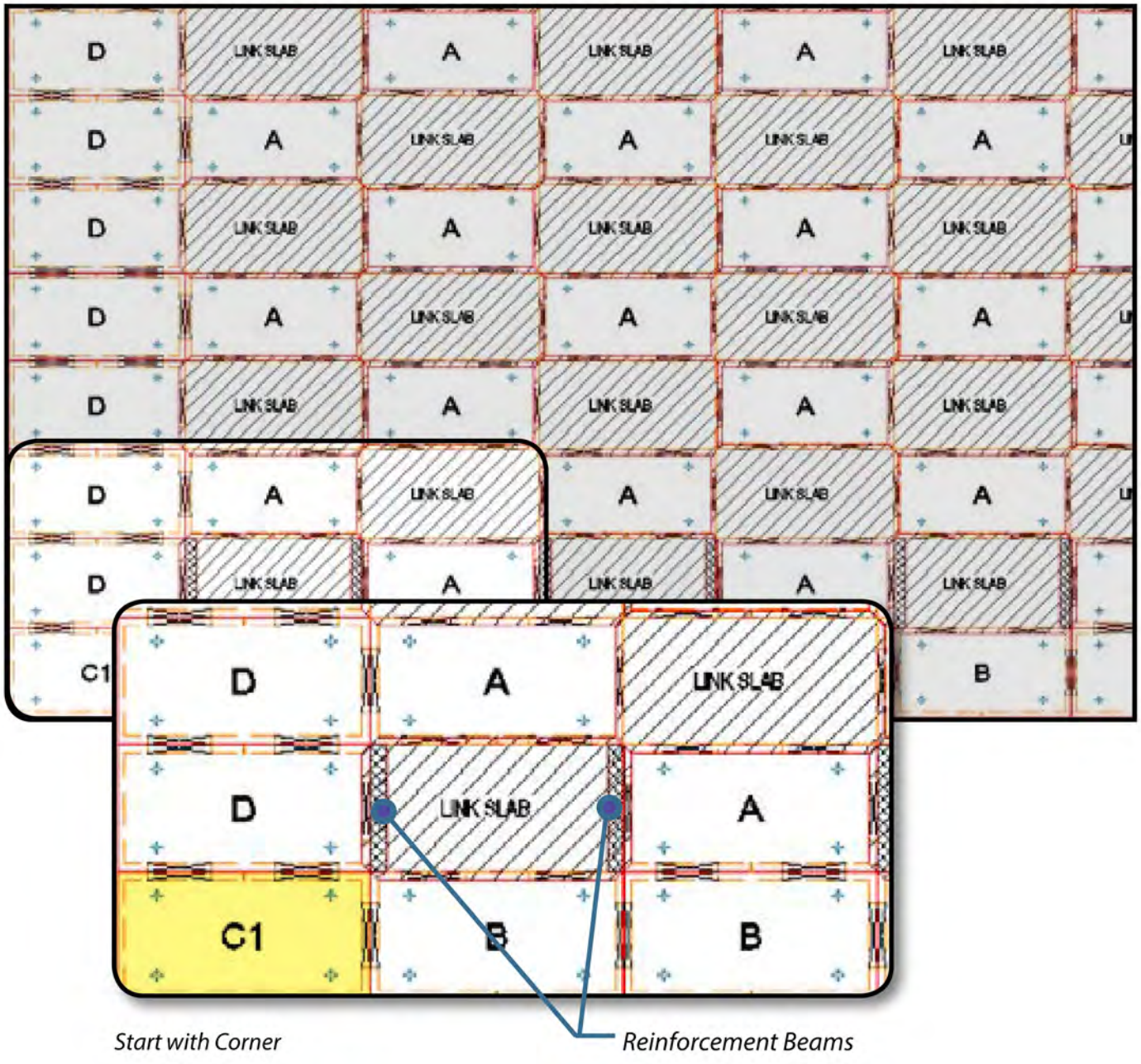
INCORRECT - Do not overlap the rubber sealant material at a corner. Rubber sealant should be continuous around corners.

LinkSlab® Procedure

These procedures reference the diagram below. This diagram is not indicative of all site layouts. Refer to the site plan for the project specific configuration.

FIGURE 12

Example Layout



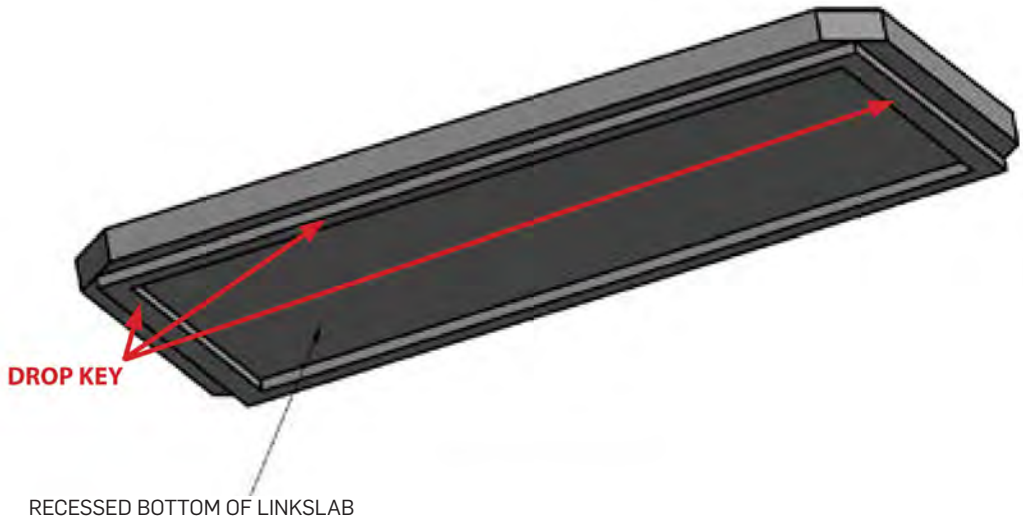
LinkSlab Procedure

Maintaining proper line and grade is critical to installation. A qualified surveyor on the site with proper equipment is recommended to ensure a square, level and straight layout. Subgrade must be compacted.

1. Start in the corner of the layout and place the first bottom module C1.
2. Place adjacent bottom modules B, B, D, D. Be sure to set the corners square and straight (from C1 up with D modules, and from C1 right with B modules).
3. Where called out on plans, place reinforcement beams between the modules where the LinkSlab will sit (between B and A). Reinforcement beams may not be required at all locations, so refer to the project specific configuration.
4. Place interior modules A, A.
   - Check the distance between pieces when there is a gap for a LinkSlab. Both bottom corners should be between 8' and 8'-1 ¼".
5. Place Conseal CS-102 at the horizontal joints.
6. Place top modules (C1, B, B, D, D, A, A).
   - Check the distance between pieces when there is a gap for a LinkSlab. Both top corners should be 8' and 8'-1 ¼".
7. Place Conseal CS-102 for the horizontal LinkSlab joints at D, A, A and B.
8. Place the LinkSlab. Ensure that it fits tightly between all adjacent modules. The drop key should fit inside the adjacent modules. Do not allow the LinkSlab to rest on the drop key.
   - Ensure surface contact with the bottom of the LinkSlab and the top of the adjacent modules. Reset adjacent modules as necessary to correct the problem.
9. Continue placing adjacent modules and LinkSlabs.
   - Oldcastle Precast recommends placing each LinkSlab as soon as the supporting modules are in place to ensure proper fit.
10. Continue installation procedure as recommended in the StormCapture Installation Manual.

FIGURE 13

LinkSlab Isometric View



Backfill

Once all modules are in place with joints sealed and geotextile fabric wrapped, the StormCapture system shall be inspected by the engineer of record or an accepted representative. Upon approval, backfilling can begin.

- Do not compact within 6" of module to avoid damaging the system. Care shall be taken during placement of backfill not to displace modules, joint wrap, containment membrane liner or geotextile fabric.
- Backfilling shall be in 1' lifts with proper compaction between lifts. Typical backfill shall be compacted to 95% standard proctor density or as specified.
- Expansive soil material shall not be used as backfill around the structure.
- Compaction shall be adequate to support expected loads on top of the system and surrounding area. Consult with geotechnical engineer for the project.
- Once installed, StormCapture modules are ready for paving or overburden material (**Figure 14**).
- Finished grading, paving and landscaping shall be per construction documents.
- Construction equipment exceeding design loading shall not be allowed on structure. Consult Oldcastle Precast if unsure.
- Contact Oldcastle Precast and the engineer of record if the live loads are greater than HS-20.
- Track vehicles including D-4 type dozers or lighter are permitted.

FIGURE 14

Backfill

Installation Is Now Complete

Project specific conditions may apply. Please refer to design documents for any special circumstances regarding installation or infiltration. ***Oldcastle Precast is not liable for installation.***

Section 4

Inspection & Maintenance

STORMCAPTURE INSPECTION & MAINTENANCE MANUAL

General

Inspection and maintenance of the StormCapture system is vital for the satisfactory performance and lifecycle of the stormwater management system. Permit requirements, local, state and federal regulations, along with Oldcastle and any incorporated device manufacturer recommendations must be followed for system compliance. The StormCapture design provides manway access for ease of inspection and debris removal if required. Flushing, which can cause particle displacement, undermining and internal disturbance, is not recommended for gravel foundation, open bottom systems. Flushing is acceptable in systems with concrete bases. Inlet controls, internal or external, are recommended for controlling, monitoring and maintaining the StormCapture system.

External Inlets are typically devices that are separate from the StormCapture modules. These external devices receive site stormwater and are designed with manway access for maintenance and typically include an internal sump for sediment capture. External inlets may receive single or multiple pipes and incorporate an open grated top with an outfall pipe to the StormCapture system. Grated inlets may incorporate protection devices or baffles to capture floatables or the “first flush”. Scheduled inspections and maintenance shall include the removal of any sedimentation build up in the external inlets. Debris or sedimentation build up shall not exceed 3” below an outfall elevation. Internal components may be incorporated for pre-treatment. Manufacturer recommendations must be followed. Scheduled maintenance and inspection will include removal of debris and sediments by manual or mechanical means.

Maintenance Modules (MM’s) are optional internal control modules based on design preference. MM’s are modules with roof manway access openings and provide the primary means of access to the StormCapture system for scheduled inspection and maintenance. In addition, MM’s may incorporate weirs or baffles to enhance reduction or removal of Total Suspended Solids (TSS) from the stormwater. Placement of internal components must be part of the system engineering and design. Grated inlets can be incorporated to accommodate surface stormwater flows into the StormCapture and may include an inlet protection device. Scheduled inspection and manufacturer recommendations for maintenance must be followed.

For open bottom systems (no concrete floor), concrete splash pads may be installed below inlet grate openings and pipe inlets to prevent base erosion. During scheduled inspection and maintenance activities, the concrete splash pads must be inspected for proper function and any sediment shall be removed. Standard StormCapture module design incorporates lateral and longitudinal passageways between modules to accommodate internal stormwater conveyance between modules. These passageways may be of a window configuration with standard 12” tall sediment baffles below the windows extending from the internal module invert, or doorway configurations extending from the floor slab. Any sediment and debris build up over 6” deep inside a module shall be removed by manual or mechanical means. Removal by vacuum is recommended. Internal module flushing, which can cause particle displacement, undermining or internal disturbance, is prohibited.

Inspection Frequency

Oldcastle recommends that the StormCapture system be inspected quarterly, and following any significant rain events within the first year of operation. Standard Operating Procedures shall specify an annual inspection and maintenance plan as required thereafter or as stated in the permit, or as required by other governing regulations. **Only authorized and trained personnel shall inspect and enter a StormCapture system.** Personnel must be properly trained and equipped before entering any underground or confined space structure. Training includes being familiar with and following any local, state and federal regulations governing the operation, inspection and maintenance of underground structures, as well as specific StormCapture system requirements.

Inspection Activities

During inspection, a minimum of the following shall be inspected:

- Contributing drainage area inlets are clear of debris.
- If the StormCapture system is an exfiltration system (open bottom with stormwater percolating into the ground), monitor and confirm that the system drains completely within a reasonable time or the required permit time.
- Sediment depths within the modules (anything over 6" deep shall be removed as outlined above).
- Inlet and outlet pipe penetrations to check for movement and/or leakage.
- Movement of modules.
- General interior condition of modules to look for concrete cracking or deterioration.
- Condition of pre-treatment devices, baffles and polishing devices if part of the system.

Recordkeeping

A log must be kept of all inspection and maintenance activities.

Section 5

Technical Note

Oldcastle Precast®

STORMCAPTURE®

Technical Note SC-01

Designing Unreinforced Gravel Foundations for Open Bottom StormCapture Systems

Stormwater

Purpose

This Technical Note is intended to provide guidance to engineers designing underground stormwater detention using the StormCapture system as developed by Oldcastle, in the open bottom configuration. This Technical Note also provides guidance to geotechnical engineers conducting investigations and providing recommendations related to such systems. Designers and geotechnical engineers should understand that allowable soil bearing pressure is an important design consideration for open bottom applications of the StormCapture system.

Figure 1 and Figure 2 illustrate the open and closed bottom configurations of the StormCapture system, respectively. Procedures outlined in this Technical Note are intended for open bottom applications only. Oldcastle does not promote the use of LinkSlab elements in conjunction with StormCapture open bottom vaults with unreinforced gravel foundations.

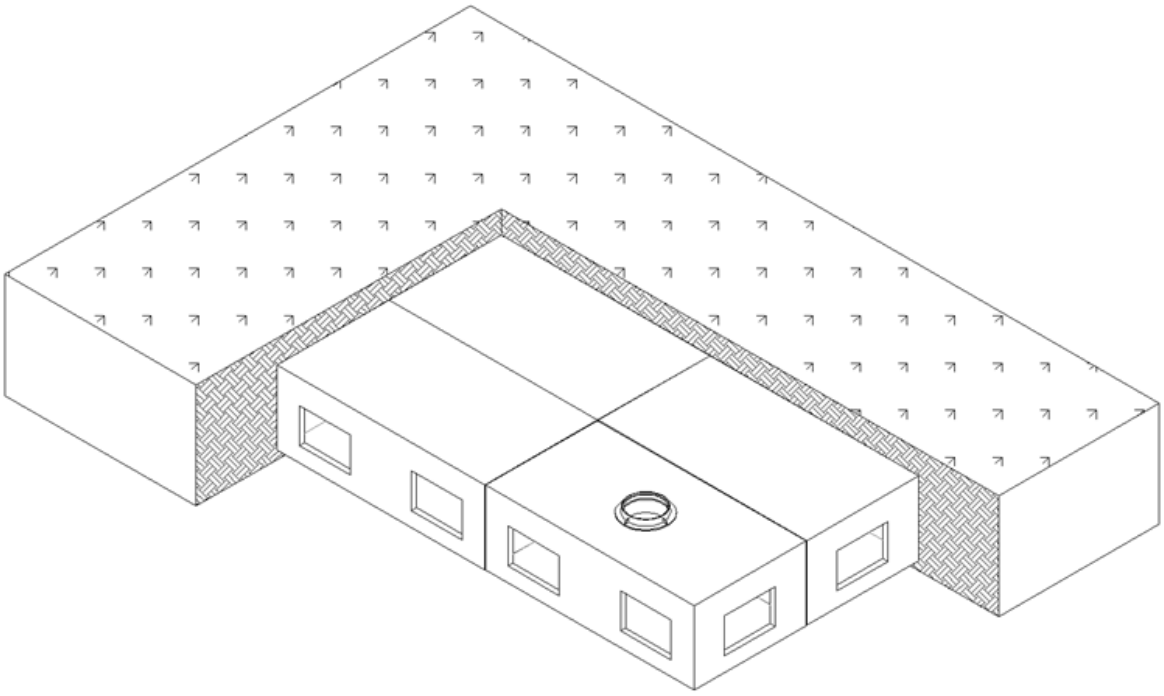


Figure 1: Open Bottom StormCapture System

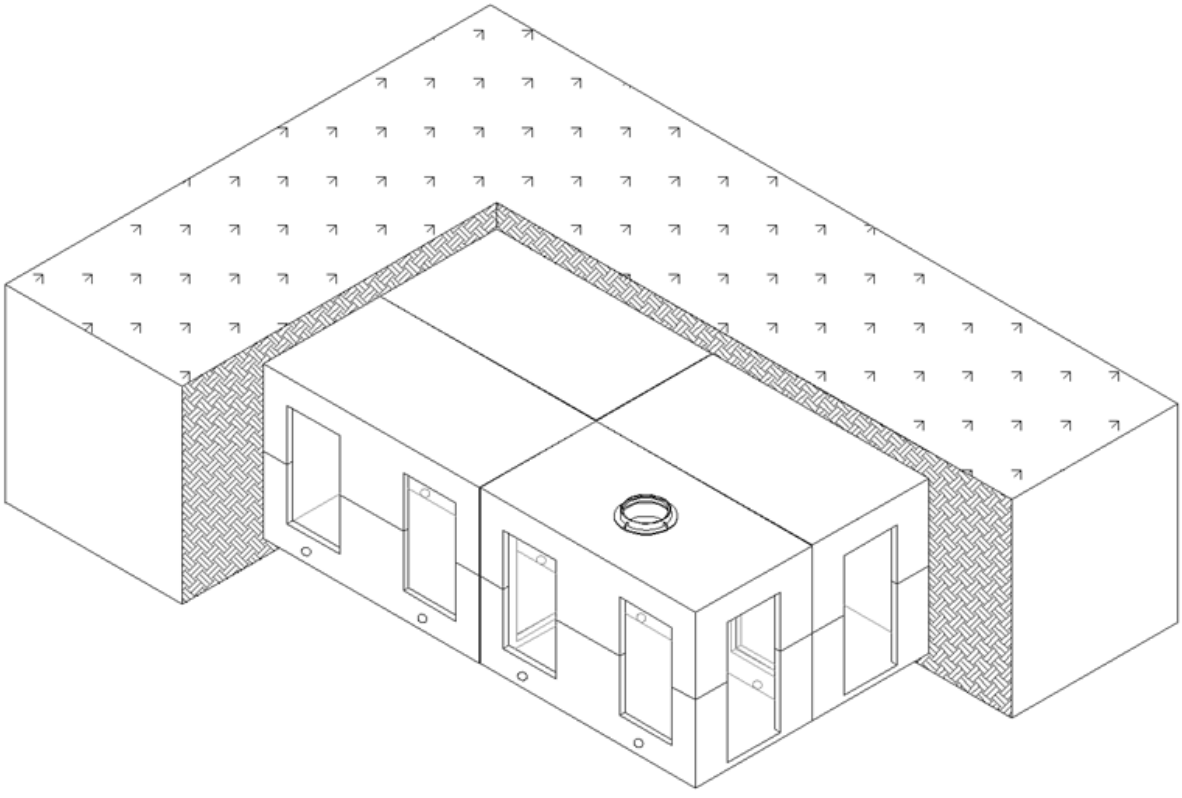


Figure 2: Closed Bottom StormCapture System

The Aggregate Bearing Layer

Open bottom applications of the StormCapture system must be provided with a highly competent compacted crushed Aggregate Bearing Layer (ABL), as shown on Figure 3. Oldcastle also recommends providing a geotextile filter fabric layer on top of the native subgrade and under the ABL to prevent the migration of fines from the subgrade and to help minimize settlement of the rock layer into the native soil layer. Oldcastle recommends a No. 57 or No. 56 stone gradation per ASTM C33 for the ABL. Specifications for the geotextile filter fabric should be developed by the designer. Contact Oldcastle for assistance if needed. Adherence to specifications is important to assure that appropriate stress distribution occurs in the ABL, so that the allowable soil bearing pressure of the subgrade is not exceeded. Adherence to the specification will also help to minimize the potential for settlement. Following the procedures outlined below, the designer can determine the thickness of the ABL required to meet the geotechnical recommendations for allowable soil bearing pressures. Extra care and analysis is recommended for open bottom applications of the StormCapture system for sites with allowable soil bearing pressure below 2000 psf. For sites with allowable soil bearing pressure below 1500 psf several alternatives exist, including the use of a StormCapture precast bottom slab.

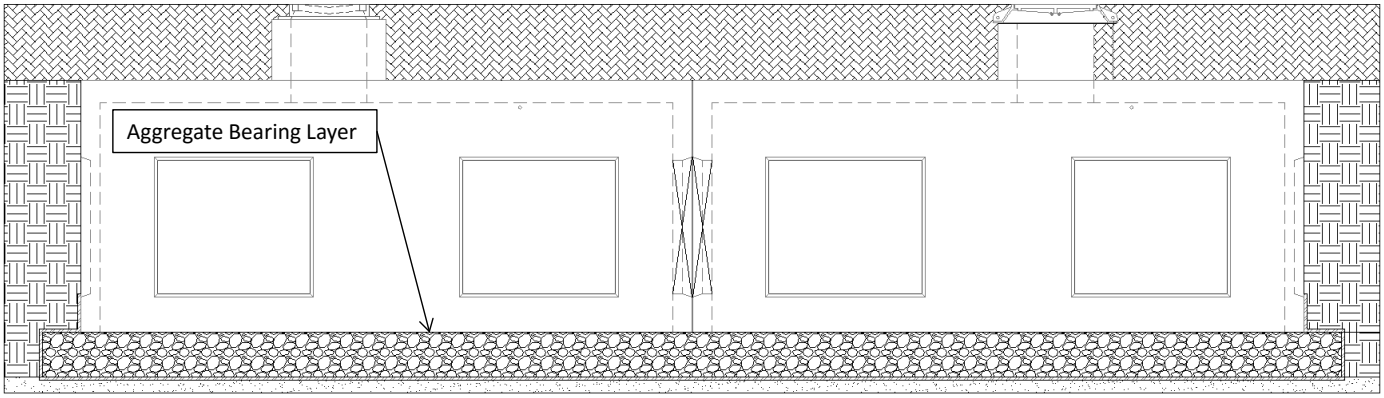


Figure 3: StormCapture System Elevation View

Checklist for Design

In order to proceed with design of the ABL thickness in accordance with this Technical Note, the designer should have already completed the hydraulic and geometric design of the StormCapture system for the site. This process will determine both the system height and depth of cover, which are needed to compute the foundation loading of the StormCapture vaults. The designer must also determine the appropriate traffic loading the system will be subject to, if applicable. For applications that will be subjected to normal highway truck loading, HS-20 loading generally may be assumed. Applications subject to heavy construction equipment may involve higher design traffic loading. Contact Oldcastle for guidance on the impact of construction loading on StormCapture units and foundations. Finally, the designer must know the allowable soil bearing pressure, which will normally be provided by a geotechnical engineer. The following checklist is provided to assist the designer in collecting the necessary information:

1. StormCapture system height.
2. Depth of cover.
3. Traffic loading.
4. Allowable soil bearing pressure at bottom of system.

Geotechnical Criteria

The geotechnical engineer should provide an allowable soil bearing pressure for native soils at the location and depth of the StormCapture system as determined or planned by the system designer. These systems will typically bear 5 to 10 feet below finished grade in the open bottom configuration, and thus an allowable bearing pressure somewhat higher or lower than might be recommended for structures bearing at shallow depths may be appropriate, depending on ground conditions. The geotechnical engineer should consider both bearing capacity and allowable post-construction settlement in determining the allowable soil bearing pressure for open bottom StormCapture system applications. The geotechnical engineer should take into consideration groundwater conditions and seismic criteria (if applicable) in preparing recommendations. If actual foundation loading is not available to the geotechnical engineer from the system designer at the time of preparation of the geotechnical report, the geotechnical engineer can conservatively assume the "typical maximum" load indicated on Figure 4, though recommendations based on actual design configuration should enhance economy and thus are encouraged. Special care is recommended for open bottom applications of StormCapture systems bearing within 2 feet of the groundwater table, or where the allowable bearing pressure is less than 2000 psf.

Determine Design Foundation Loading

Foundation loading for design may typically be determined using Figure 4, which is for HS-20 traffic loading. Enter the chart with the vault inside height and depth of cover, and determine the foundation load, which is a line load given in kips per linear foot. A maximum StormCapture system height of 7 feet (inside dimension), and a maximum depth of cover of 5 feet (from top outside of vault to finish grade), produces the typical maximum load of about 3750 pounds per lineal foot per wall on top of the ABL. When two walls are adjacent to each other the maximum load is doubled to 7500 plf as indicated on Figure 4.

The depth of cover should include the fill thickness over the top of the vault, plus any pavement or road base thickness. Figure 4 is based on HS-20 traffic loading. For applications involving different traffic loading, the designer may contact Oldcastle for assistance.

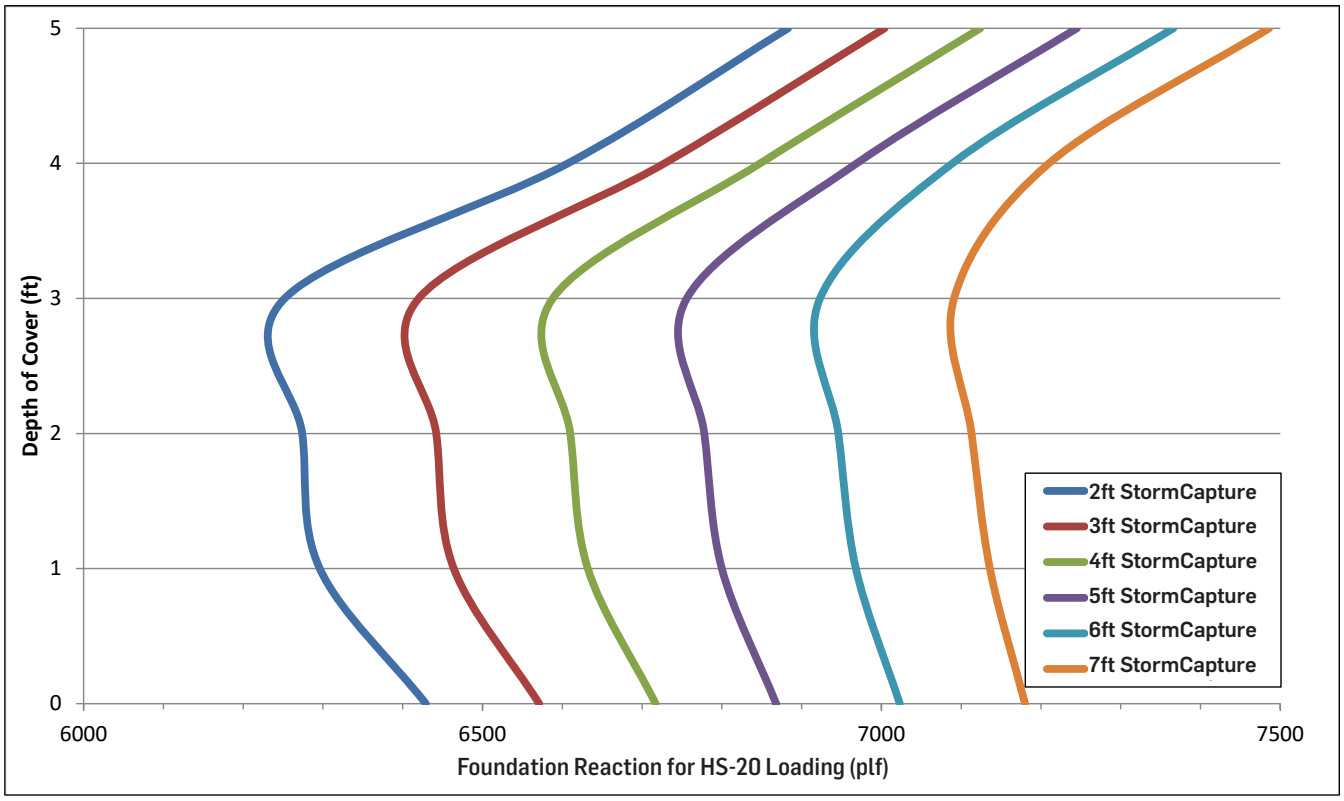


Figure 4: Foundation Reaction for HS-20 Loading with Two Adjacent Walls

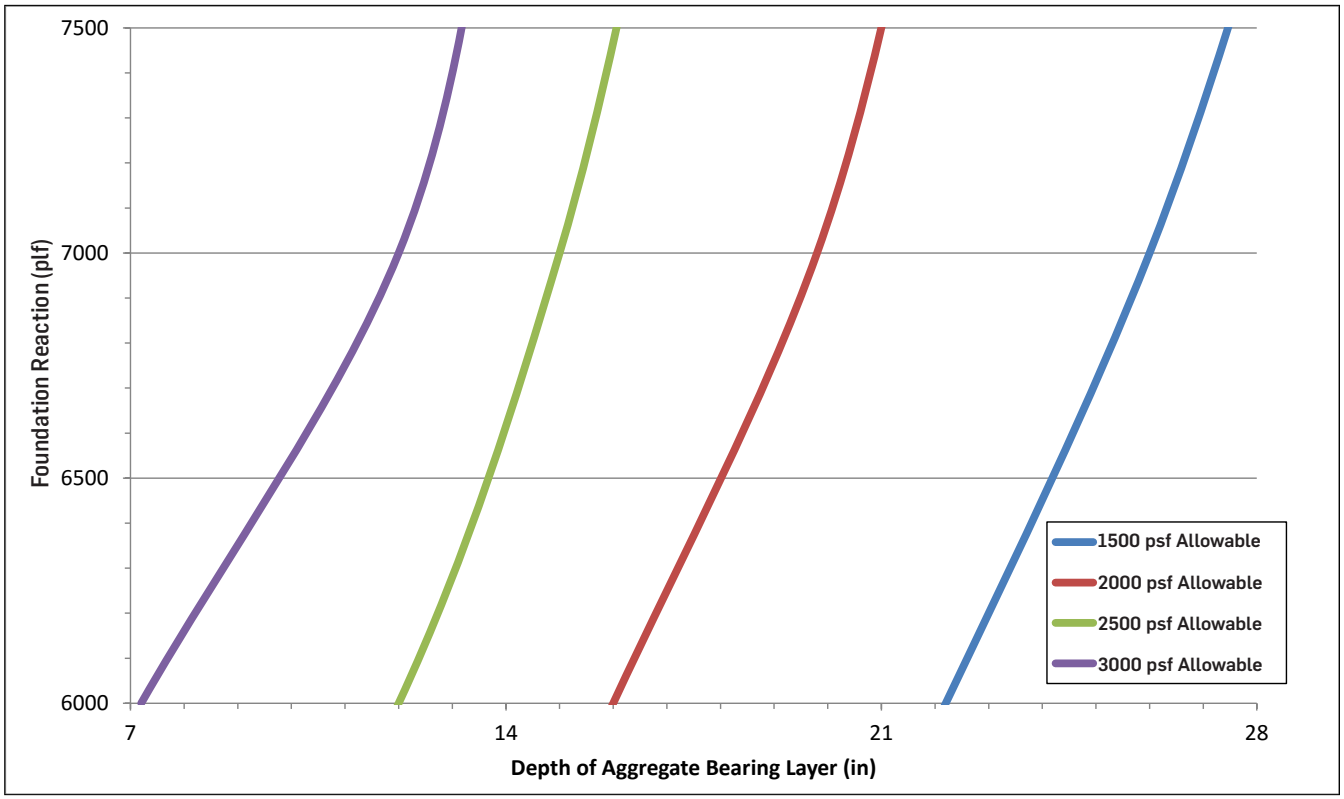


Figure 5: Aggregate Bearing Layer Thickness

Determine ABL Thickness

ABL thickness may be determined using Figure 5. This chart is based on a Westergard stress distribution in the ABL as is explained in numerous references (Sowers, 1979).

To determine the ABL thickness enter the chart with the foundation line load determined as outlined above, and the allowable soil bearing value from the geotechnical report. The chart provides the thickness of the ABL in inches. As with Figure 4, this chart is for open bottom StormCapture vaults placed adjacent to each other, which will normally control the ABL thickness.

Recommendations

The following recommendations are provided to engineers and contractors considering use of StormCapture units in open bottom configuration:

1. As indicated in the design examples that follow, the allowable bearing pressure should be developed for the depth and loading of the StormCapture system. Depending on a number of factors, use of a generic allowable bearing pressure for building foundations may or may not be appropriate.
2. Consider grade changes in developing the allowable bearing pressure. A significant grade change at the system location could affect the allowable pressure.
3. Bearing at or below the groundwater table is not recommended for an open bottom configuration. Oldcastle recommends bearing a minimum of 2 feet from the groundwater elevation.
4. Open bottom systems require special care for allowable bearing pressure less than 2000 psf.
5. Open bottom applications bearing on significant thicknesses of site fill (other than ABL) are generally not recommended, unless that fill is specifically engineered to tolerate subsequent moisture infiltration, or a liner is provided.
6. Similarly, open bottom applications are generally not recommended over moisture sensitive soils such as highly expansive soils or collapse-prone soils, unless specifically evaluated and addressed by the geotechnical engineer, or an appropriate liner is provided.

Sowers, G. F. (1979). *Introductory Soil Mechanics and Foundations: Geotechnical Engineering.* New York: Macmillan.

Section 6

Appendix: Design Examples

Design Example 1

Description:

The project involves construction of a shopping center in the coastal plain on the eastern seaboard. Underground detention is desired in a portion of the paved parking area. The geotechnical engineer was informed of this desire and was provided with the location, basic geometry, and loading estimates for the StormCapture system prior to his investigation. Borings located for the proposed system detected a thin (3 to 5 foot thick) surface layer of stiff sandy clay over 20 or more feet of medium dense to dense sands and silty sands, with groundwater at 15 feet. Grading plans call for finished grade to be 2 to 3 feet above existing grade in the area of the proposed detention system. Hydraulic and geometric design has been performed for the system to determine vault height and depth of cover.

Available Information:

1. Inside height of StormCapture vault = 5 feet.
2. Depth of cover = 5 feet.
3. Standard highway truck loading.
4. Geotechnical report recommends "3000 psf allowable native soil bearing pressure for StormCapture open bottom system bearing approximately 10 feet below finished grade (or 7 to 8 feet below existing grade), supported on a compacted crushed aggregate bearing layer (ABL) designed and constructed in accordance with Oldcastle recommendations for StormCapture vaults."

Solution:

1. Since standard highway truck loading applies, **Figure 4** is applicable for determination of foundation load.
2. See **Figure 6**, design loading is taken to be 7.3 kips per foot (for two adjacent walls).
3. The geotechnical report provides an allowable soil bearing pressure for the appropriate location and depth, with a general stated understanding of the proposed system.
4. The allowable bearing value is sufficiently high and the reported groundwater sufficiently deep that open bottom StormCapture system is appropriate.
5. From **Figure 5**, an ABL of 13 inches is appropriate for an allowable bearing pressure of 3000 psf (see **Figure 7**).

The aggregate bearing layer should be prepared with a minimum of 13 inches highly competent compacted crushed aggregate.

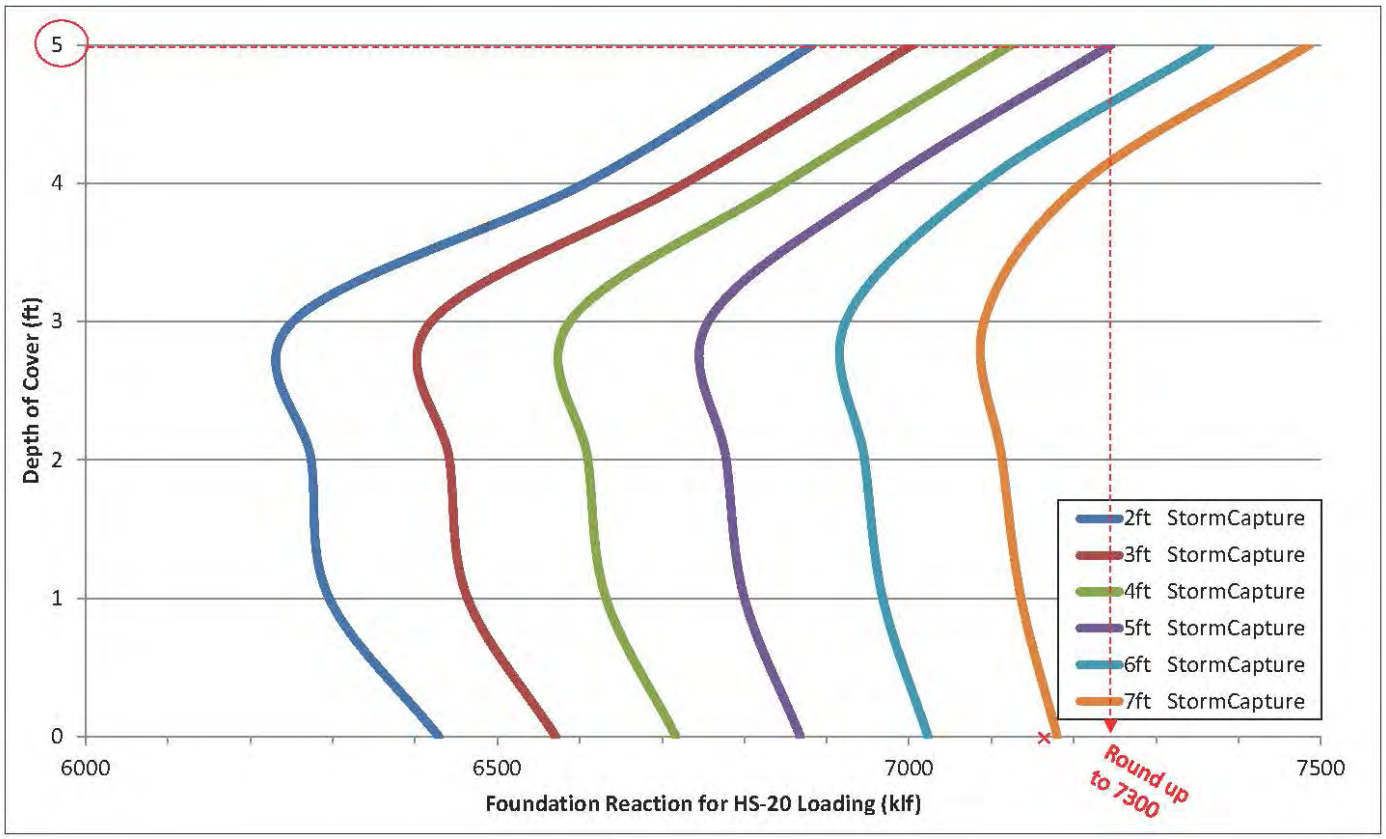


Figure 6: Replication of Figure 4 for Design Example 1

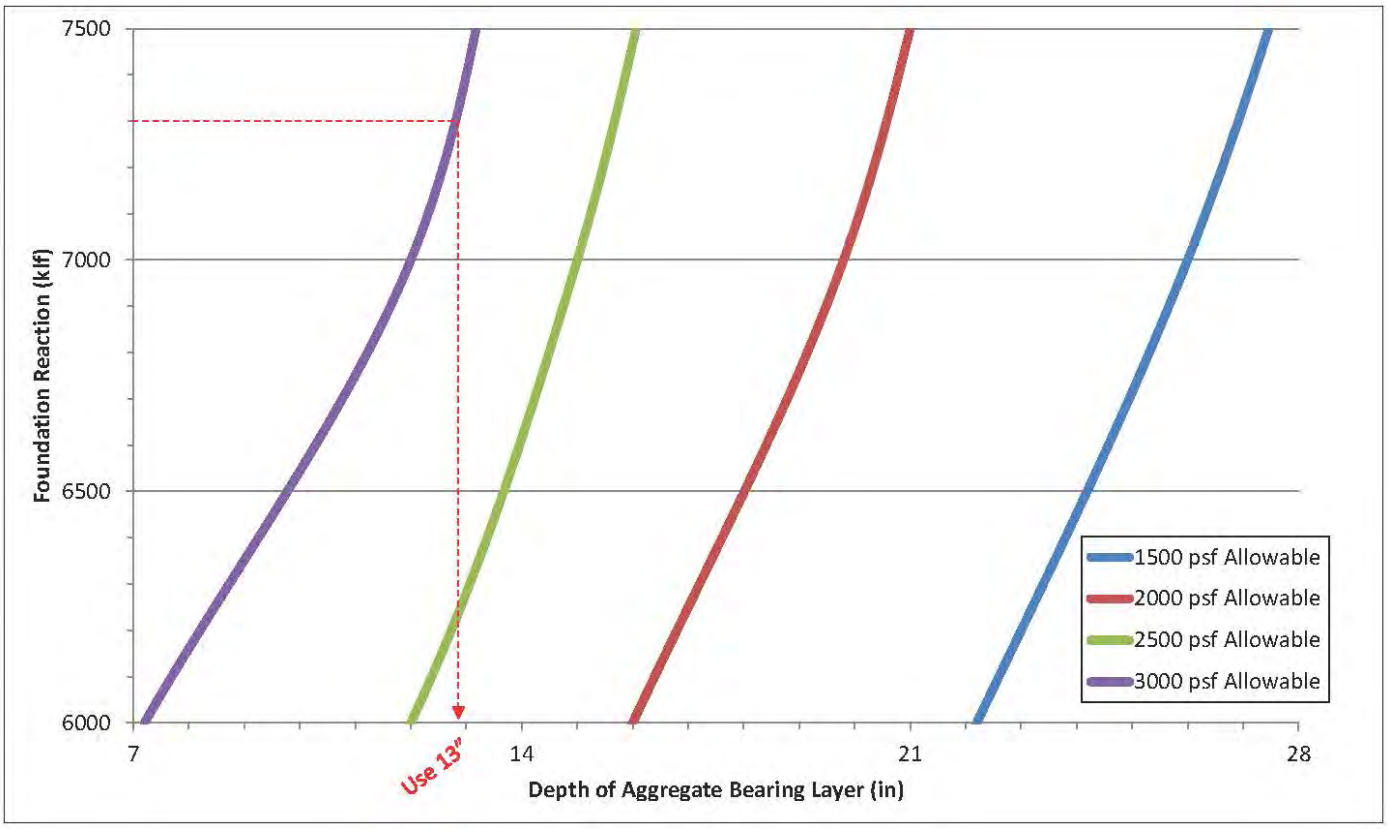


Figure 7: Replication of Figure 5 for Design Example 1

Design Example 2

Description:

The project involves construction of a mixed use office and retail complex in a southern state. Space is at a premium, so underground detention is desired. However, this need has only recently become apparent. The geotechnical report is over 2 years old, and predates plans for underground detention. Borings scattered throughout the building and parking areas appear to cover the area that has been selected for the proposed StormCapture system, but the geotechnical report does not address underground detention, nor does it provide allowable bearing values for the appropriate depths. Borings detected pockets of existng loose sand fill in the upper 5 feet, and the report provides recommendations for removing and replacing this material with imported engineered fill. Deeper soils were loose to medium dense sands, with blowcounts increasing with depth. The report recommends an allowable bearing pressure of 2000 psf for footings placed in engineered fill, or in native material subject to inspection, with the expectation that these footings will bear 18 to 24 inches below finished grade. Groundwater was encountered about 13 to 16 feet below grade in the general area proposed for the underground system. Proposed grade change in this area is minimal. Hydraulic and geometric design has been performed for the system to determine vault height and depth of cover.

Available Information:

1. Inside height of vault 5 feet.
2. Depth of cover 4 feet.
3. Standard highway truck loading.
4. Geotechnical report does not address underground detention, and does not provide bearing pressures relevant to the StormCapture system.

Solution:

1. Contact owner and geotechnical engineer and explain need for allowable bearing value at depth approximately 9 feet below existing and proposed grade in area of proposed detention system. Provide loading estimate and background information on StormCapture system.
2. Geotechnical engineer reviews file, including boring logs, lab data and previous calculations. He conducts some additional calculations and informs system designer and owner that at the location and depth in question, a somewhat higher allowable pressure is appropriate, since the system will bear below any questionable near surface soils, and the density generally improves with depth at this location. After some discussion, he recommends an allowable native soil bearing pressure of 2500 psf for the specific location and depth in question. Now you have what you need.
3. Using **Figure 4**, the foundation line load is approximately 7000 kips per linear foot (see **Figure 8**).
4. Enter **Figure 5** with 7000 kips per linear foot and an allowable native soil bearing pressure of 2500 psf. From Figure 5, an ABL with a thickness of 15 inches is sufficient (see **Figure 9**).

The aggregate bearing layer should be prepared with a minimum of 15 inches highly competent compacted crushed aggregate.

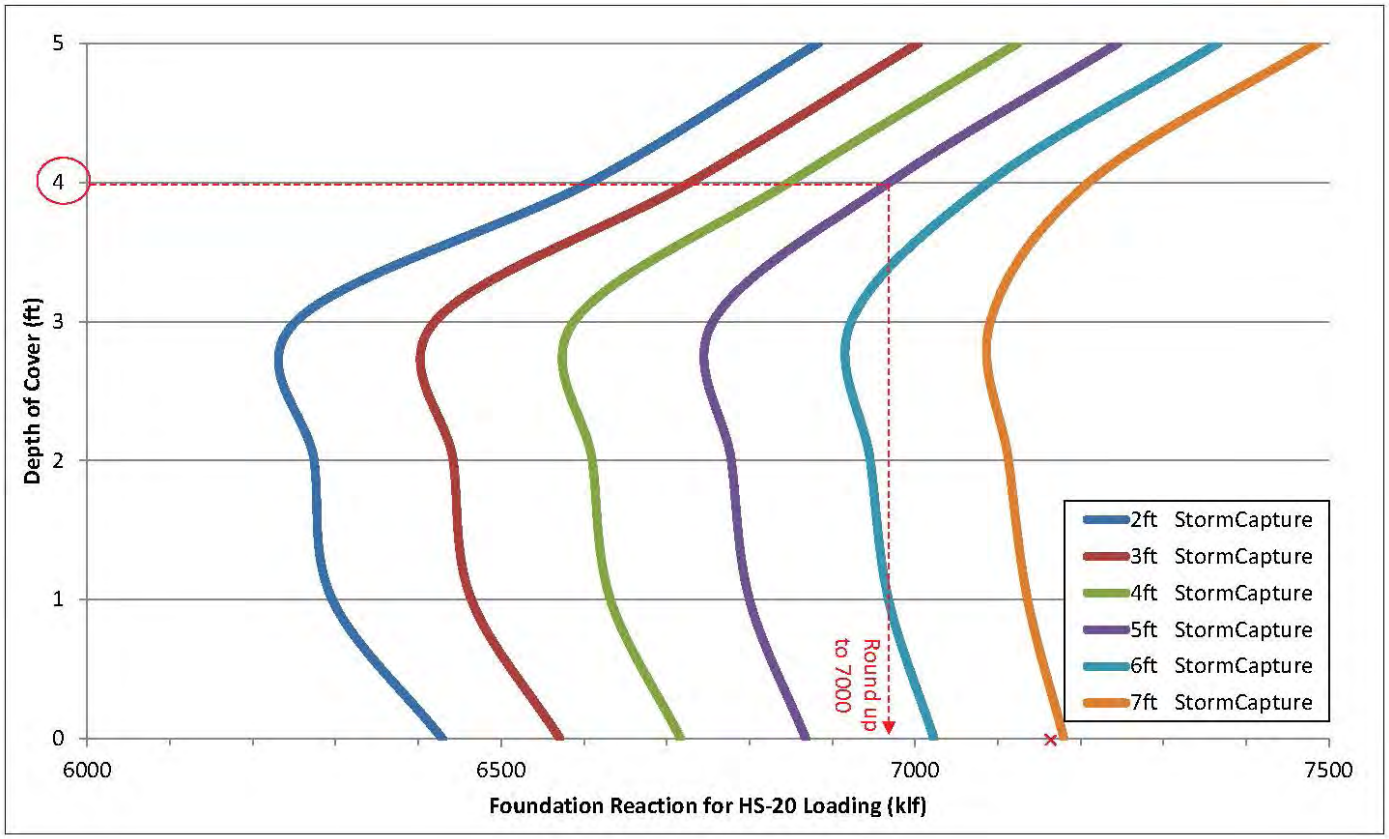


Figure 8: Replication of Figure 4 for Design Example 2

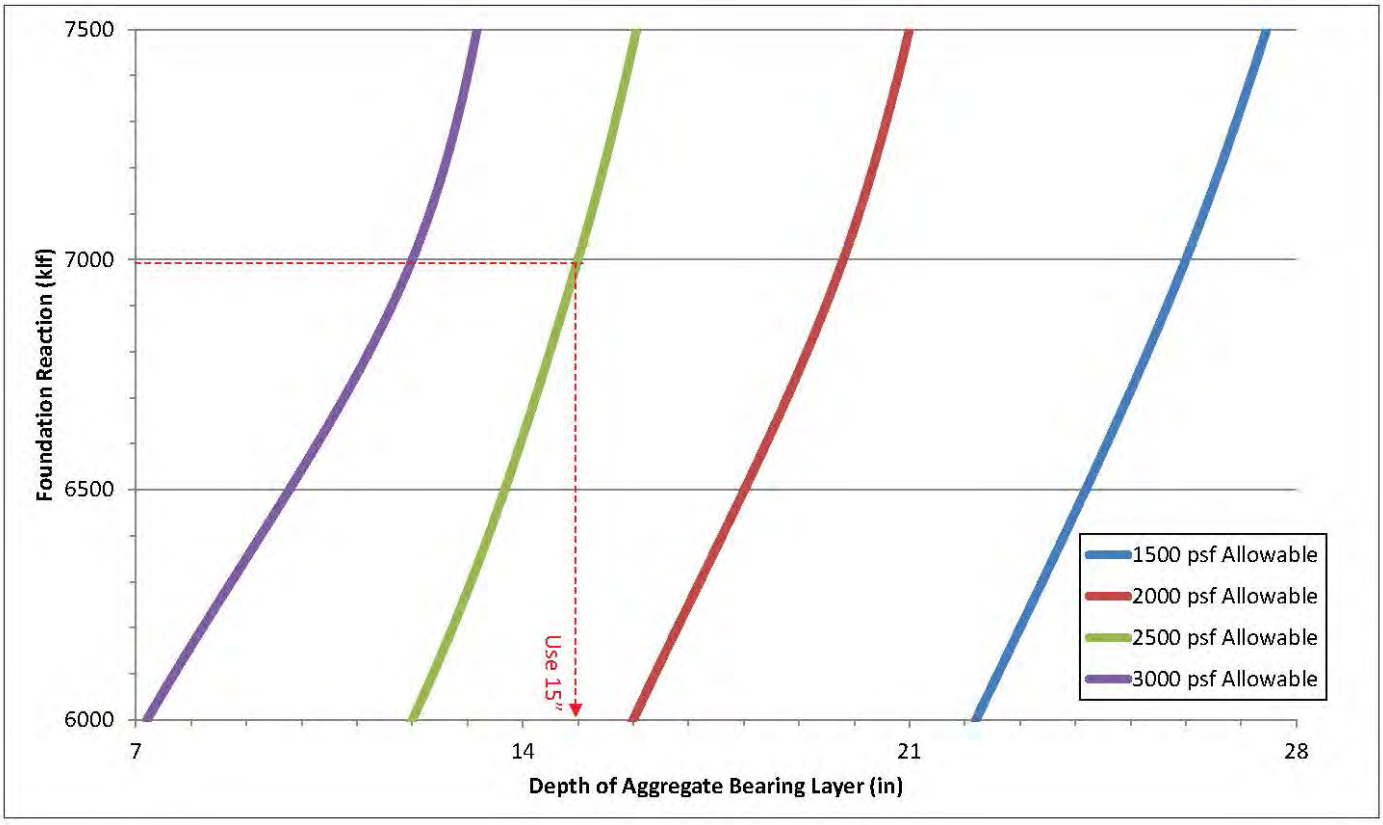


Figure 9: Replication of Figure 5 for Design Example 2

Design Example 3

Description:

The project involves construction of a large apartment complex with surface parking lots along the gulf coast. Adequate space for a conventional surface detention pond is not available, and an underground detention system is desired. The geotechnical engineer understood this when the report was prepared, but he did not understand the details and concepts of the StormCapture open bottom system, and prepared his report with recommendations related to closed bottom systems. Borings in the area of the proposed system found 8 to 12 feet of relatively firm sand over a layer of soft, organic clay, becoming softer with depth. Groundwater was encountered near the top of this soft clay layer. Grading plans call for a grade raise of about 2 feet in the area of the proposed system. The geotechnical report identifies settlement concerns where grade is raised, and thus recommends settlement monitoring following grade. Foundation recommendations include shallow (18 inch depth) footings designed for 3000 psf allowable bearing pressure after settlement monitoring is complete. It also provides an alternative for deep foundations. Preliminary hydraulic and geometric design has been completed for an open bottom StormCapture system.

Available Information:

1. Inside height of vault 5 feet.
2. Depth of cover 3 feet.
3. Standard highway truck loading.
4. Geotechnical report does not provide bearing pressures relevant to the StormCapture system in open bottom configuration.

Solution:

1. Contact owner and geotechnical engineer and explain need for allowable bearing value at depth approximately 8 feet below proposed grade (6 feet below existing grade) in area of proposed detention system. Provide loading estimate and background information on StormCapture system in open bottom configuration.
2. Geotechnical engineer reviews file, including boring logs, lab data and previous calculations. He expresses concern over use of open bottom in this application due to the soft clay layer near the bearing level of the system. He conducts some additional analysis and meets with the civil engineer. They review grading plans and the depth of the soft layer and conclude that it should be 3 or more feet below the excavation bottom at the location of the proposed system due to the grade rise in the area. After some discussion and additional analysis, he recommends an allowable native soil bearing pressure of 2000 psf for the specific location and depth in question, subject to special inspection of ground conditions. In addition, he cautions that the grade raise and settlement monitoring must be complete prior to excavation and construction of the system.
3. **Figure 4** applies. The foundation line load is approximately 6800 kips per linear foot (see **Figure 10**).
4. Enter **Figure 5** with 6800 kips per linear foot and an allowable native soil bearing pressure of 2000 psf. An ABL with a thickness of 20 inches is sufficient (see **Figure 11**).

Prepare plans for an ABL with minimum thickness of 20 inches. Include notes cautioning contractor regarding special inspection and settlement monitoring.

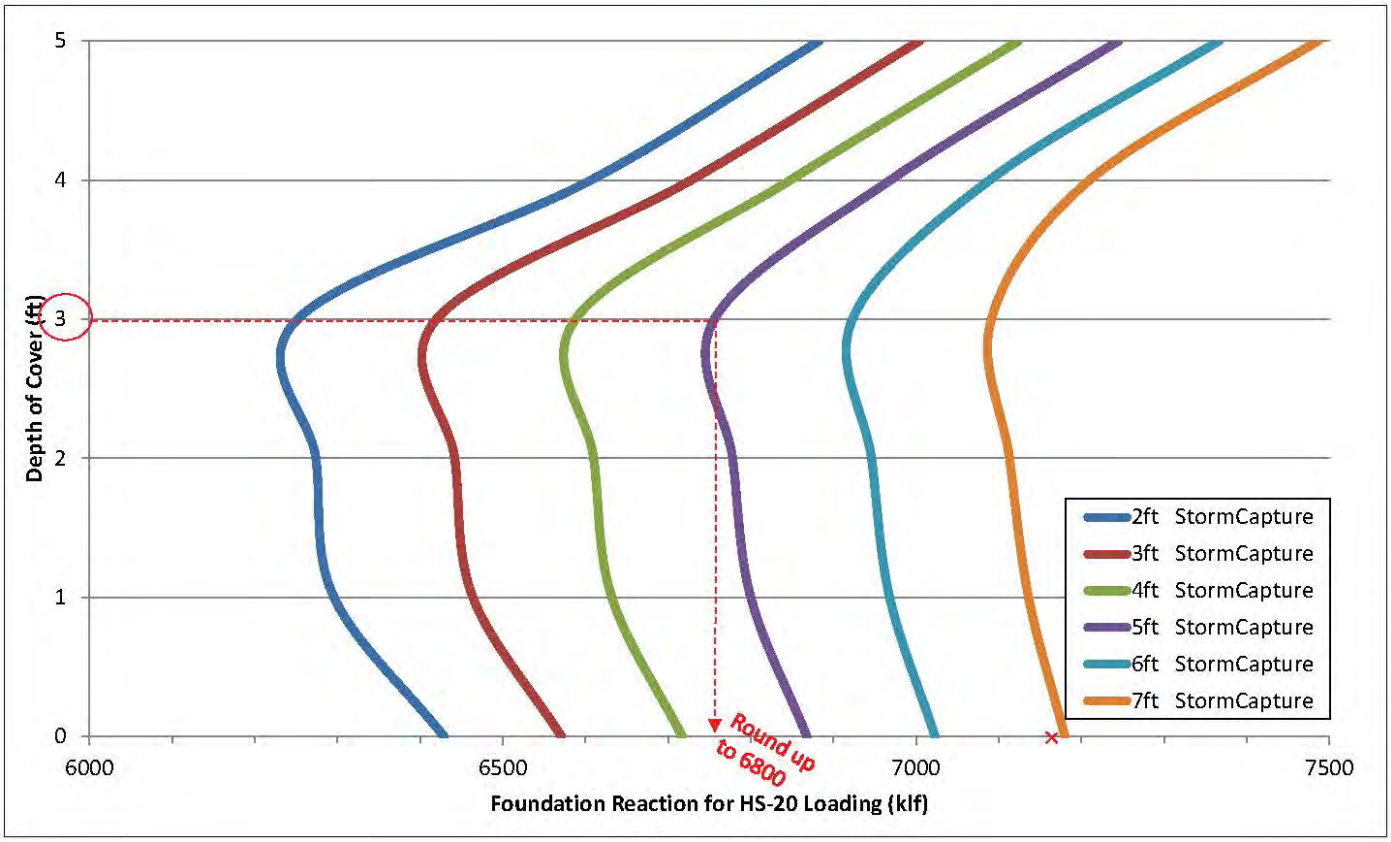


Figure 10: Replication of Figure 4 for Design Example 3

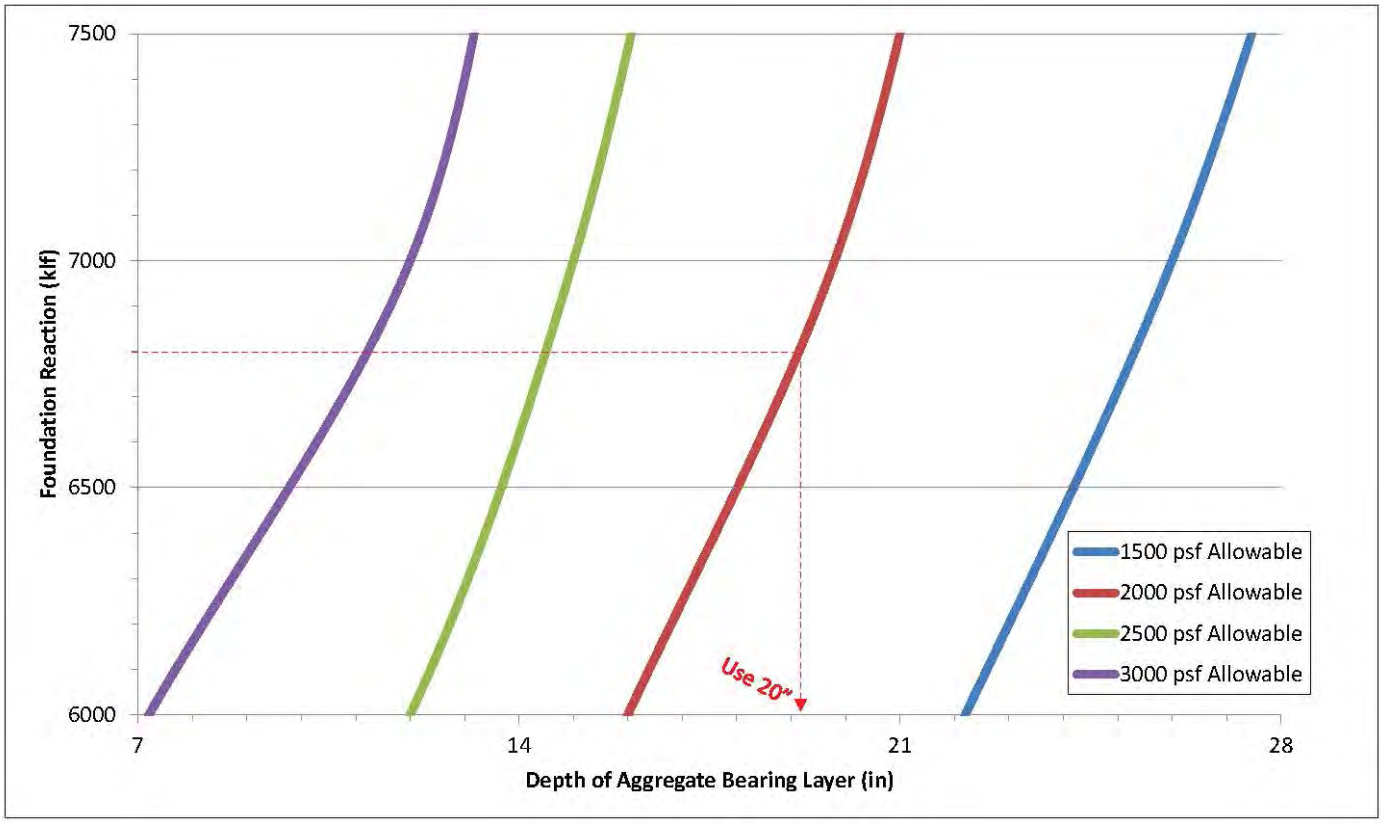


Figure 11: Replication of Figure 5 for Design Example 3

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