

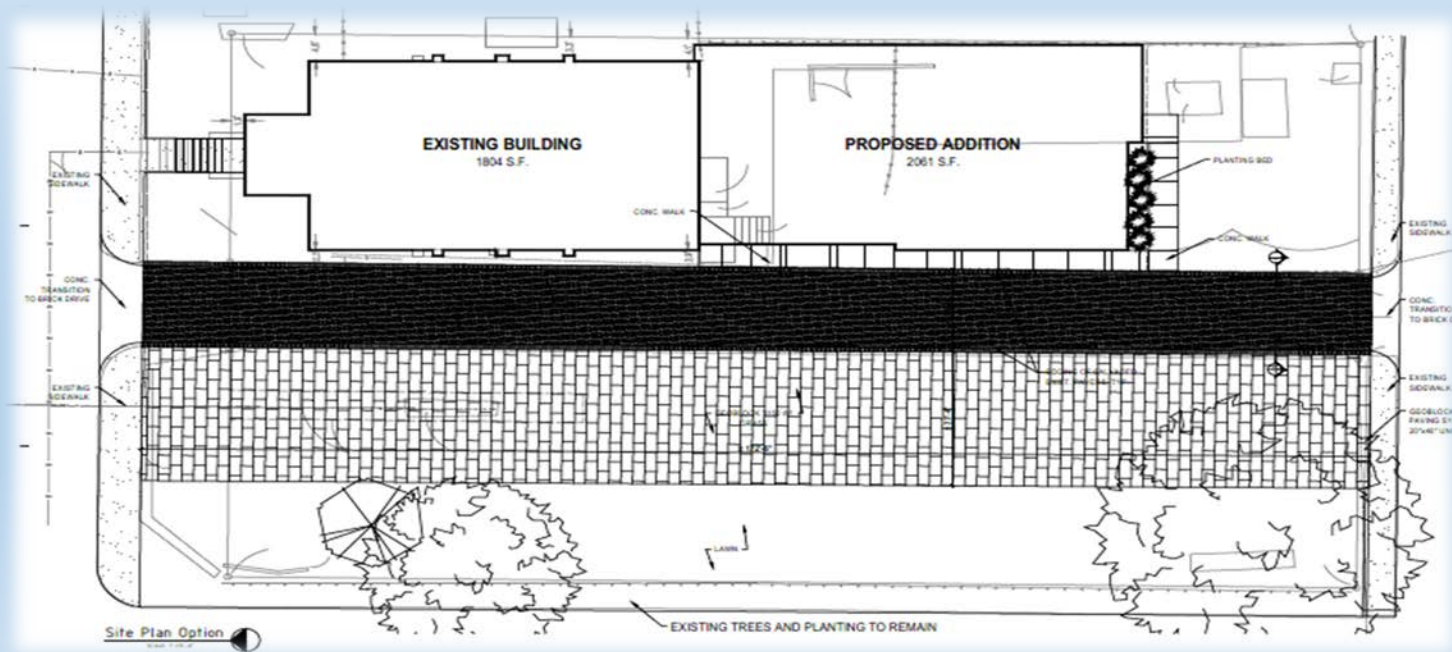


Stormwater Capture and Reuse: Passive Irrigation for Pervious Grass Parking

Jim Blazek, CPESC - D2 Land & Water Resource, Inc.

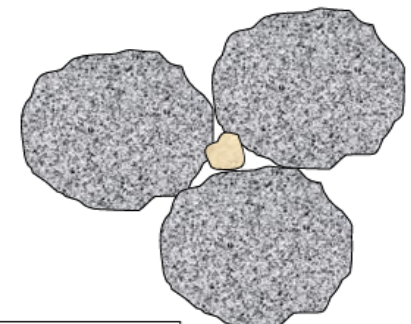
Christa Petzke, PE, MBA - D2 Land & Water Resource, Inc.



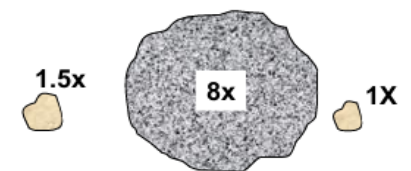




GRAVEL BRIDGING PRINCIPLE



The average diameter of the larger aggregate has to be less than 8X the diameter of the smaller aggregate.



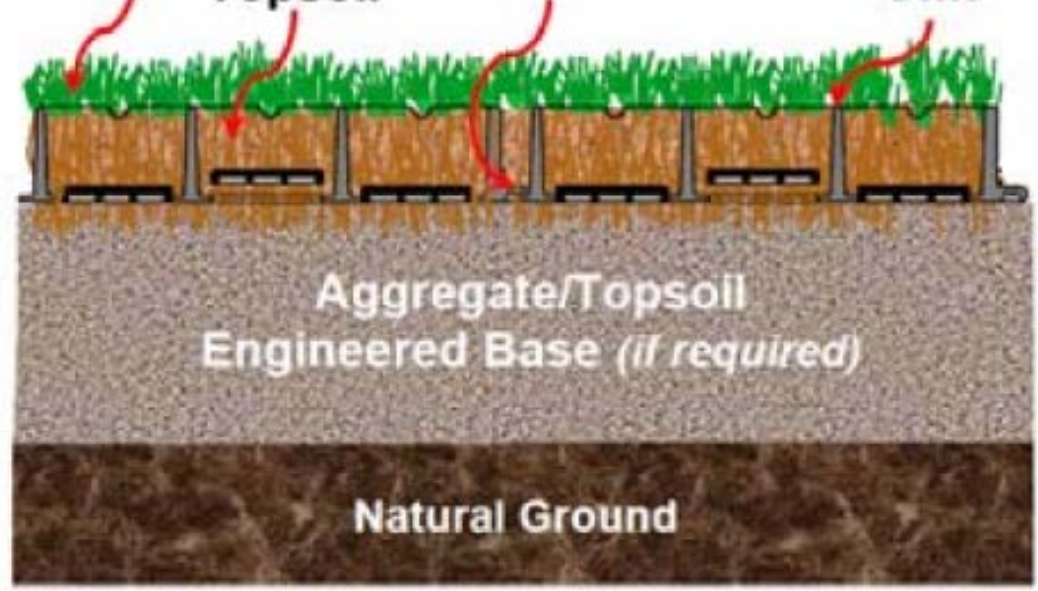


Turf

Topsoil

Interlocking
Tabular Joint

Geoblock® 5150
Unit



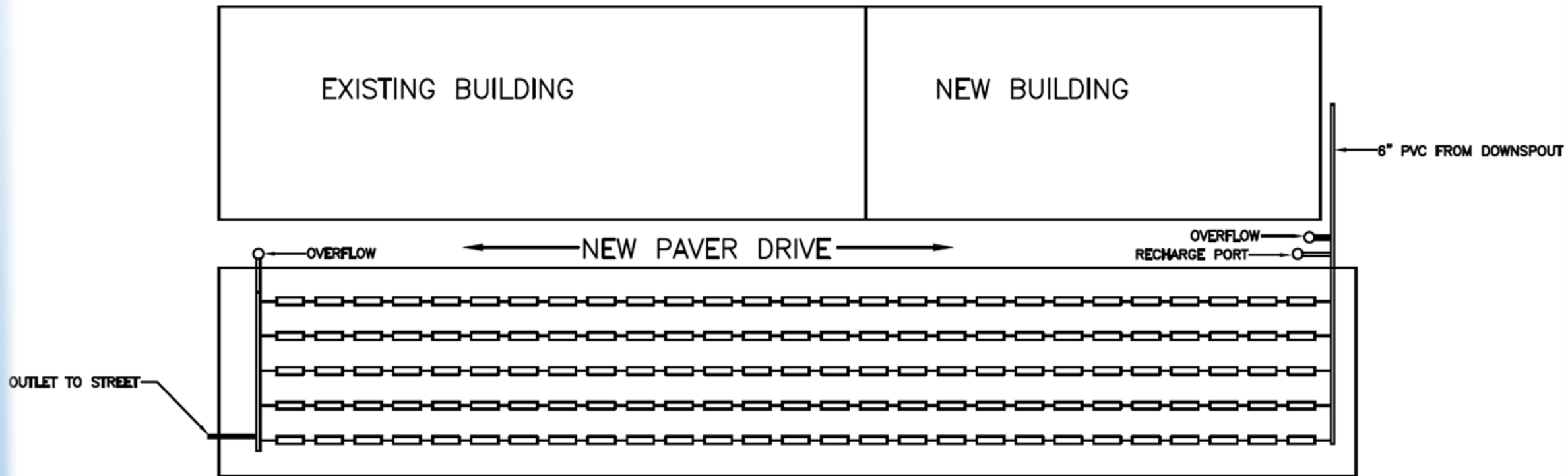
Aggregate/Topsoil

Engineered Base (if required)

Natural Ground

Ground Cover	Runoff Coefficient, C
Lawns	0.05 - 0.35
Forest	0.05 - 0.25
Cultivated land	0.08-0.41
Meadow	0.1 - 0.5
Parks, cemeteries	0.1 - 0.25
Unimproved areas	0.1 - 0.3
Pasture	0.12 - 0.62
Residential areas	0.3 - 0.75
Business areas	0.5 - 0.95
Industrial areas	0.5 - 0.9
Asphalt streets	0.7 - 0.95
Brick streets	0.7 - 0.85
Roofs	0.75 - 0.95
Concrete streets	0.7 - 0.95

Existing Roof	Rain Inches/Hour	GPM	GPH	TOTAL AREA GPH
1804 SF	1	17.5	1050	5010
	2	35	2100	10020
	3	52.5	3150	15030
	4	70	4200	20040
New Roof				
2061 SF	1	20	1200	
	2	40	2400	
	3	60	3600	
	4	80	4800	
Grass Lawn				
6884 SF	1	25	1500	
	2	50	3000	
	3	75	4500	
	4	100	6000	
Alley				
2458 SF	1	21	1260	
	2	42	2520	
	3	63	3780	
	4	84	5040	

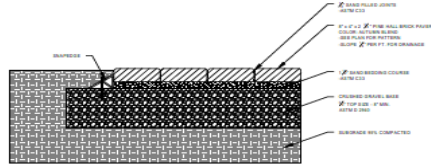


NOTE: FIELD VERIFY ALL DIMENSIONS & CONDITIONS PRIOR TO CONSTRUCTION. PRELIM. SPOT ELEVATIONS ARE TO THE TOP OF PAVERS OR GRADE - FIELD VERIFY.

HOLEY MOLEY SAYS
"DIG SAFELY"



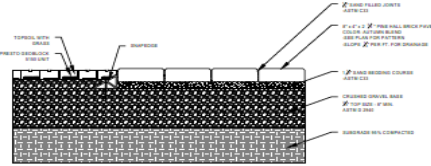
"IT'S THE LAW"
CALL 2 WORKING DAYS BEFORE YOU DIG
7-800-368-5844
CALL TOLL FREE
PER INDIANA STATE LAW 36-1-26
IT IS AGAINST THE LAW TO EXCAVATE
WITHOUT NOTICING THE UNDERGROUND
LOCATION SERVICE TWO (2) WORKING
DAYS BEFORE COMMENCING WORK.



PAVER EDGE @ LAWN

Paver Edge @ Lawn

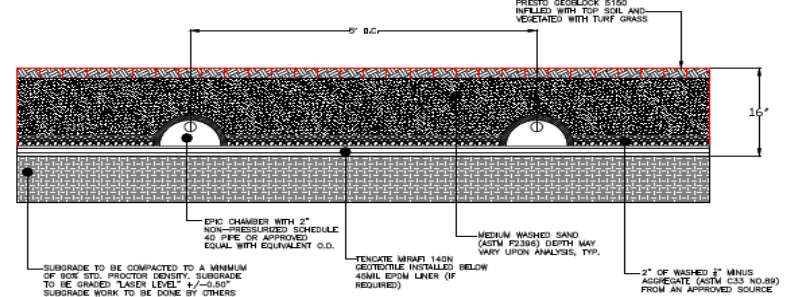
1"=1'-0"



PAVER EDGE @ GEOBLOCK CONNECTION

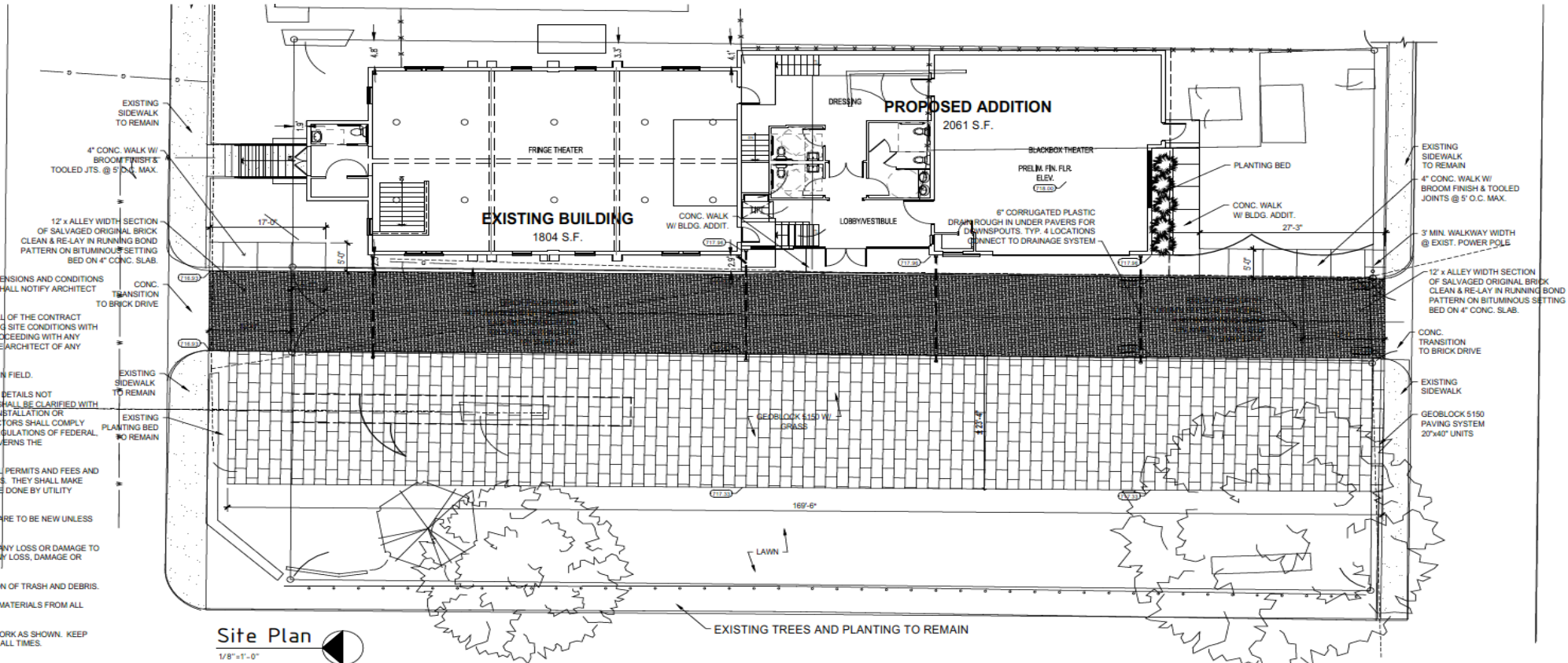
Paver Edge @ Geoblock

1"=1'-0"



Section @ EPIC Drainage System

1"=1'-0"



Site Plan
1/8"=1'-0"

- GENERAL NOTES
- CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND CONDITIONS PRIOR TO START OF CONSTRUCTION AND SHALL NOTIFY ARCHITECT OF ANY DISCREPANCIES IMMEDIATELY.
 - CONTRACTOR SHALL CAREFULLY STUDY ALL OF THE CONTRACT DOCUMENTS AND SHALL VERIFY ALL EXISTING SITE CONDITIONS WITH CONSTRUCTION DOCUMENTS PRIOR TO PROCEEDING WITH ANY PORTION OF THE WORK AND TO NOTIFY THE ARCHITECT OF ANY VARIANCES.
 - CONTRACTOR TO VERIFY ALL DIMENSIONS IN FIELD.
 - ANY CONDITIONS, MATERIALS, DEVICES OR DETAILS NOT SPECIFICALLY SHOWN ON THE DRAWINGS SHALL BE CLARIFIED WITH THE ARCHITECT BEFORE CONSTRUCTION INSTALLATION OR APPLICATION. GENERAL AND SUBCONTRACTORS SHALL COMPLY WITH ALL GOVERNING CODES, BUILDING REGULATIONS OF FEDERAL, STATE, CITY AND COUNTY, WHICHEVER GOVERNS THE CONSTRUCTION WORK.
 - GENERAL AND/OR SUBS SHALL PAY FOR ALL PERMITS AND FEES AND ARRANGE FOR INSPECTION BY AUTHORITIES. THEY SHALL MAKE ARRANGEMENTS AND PAY FOR WORK TO BE DONE BY UTILITY COMPANIES PERTAINING TO THIS WORK.
 - ALL MATERIAL CALLED OUT ON DRAWINGS ARE TO BE NEW UNLESS NOTED OTHERWISE OR "EXISTING".
 - EACH TRADE SHALL BE RESPONSIBLE FOR ANY LOSS OR DAMAGE TO THE OWNER OR THE WORK, MAKE GOOD ANY LOSS, DAMAGE OR INJURY WITHOUT COST TO THE OWNER.
 - KEEP PREMISES FREE FROM ACCUMULATION OF TRASH AND DEBRIS.
 - UPON COMPLETION REMOVE ALL FOREIGN MATERIALS FROM ALL EXPOSED SURFACES.
 - CONFINE ALL OPERATIONS TO AREAS OF WORK AS SHOWN. KEEP AREAS ADJACENT TO THE WORK CLEAR AT ALL TIMES.

blackline
ARCHITECTURE
719 E. ST. CLAIR STREET
INDIANAPOLIS, IN 46202
(317) 644-1111
www.blacklinearch.com

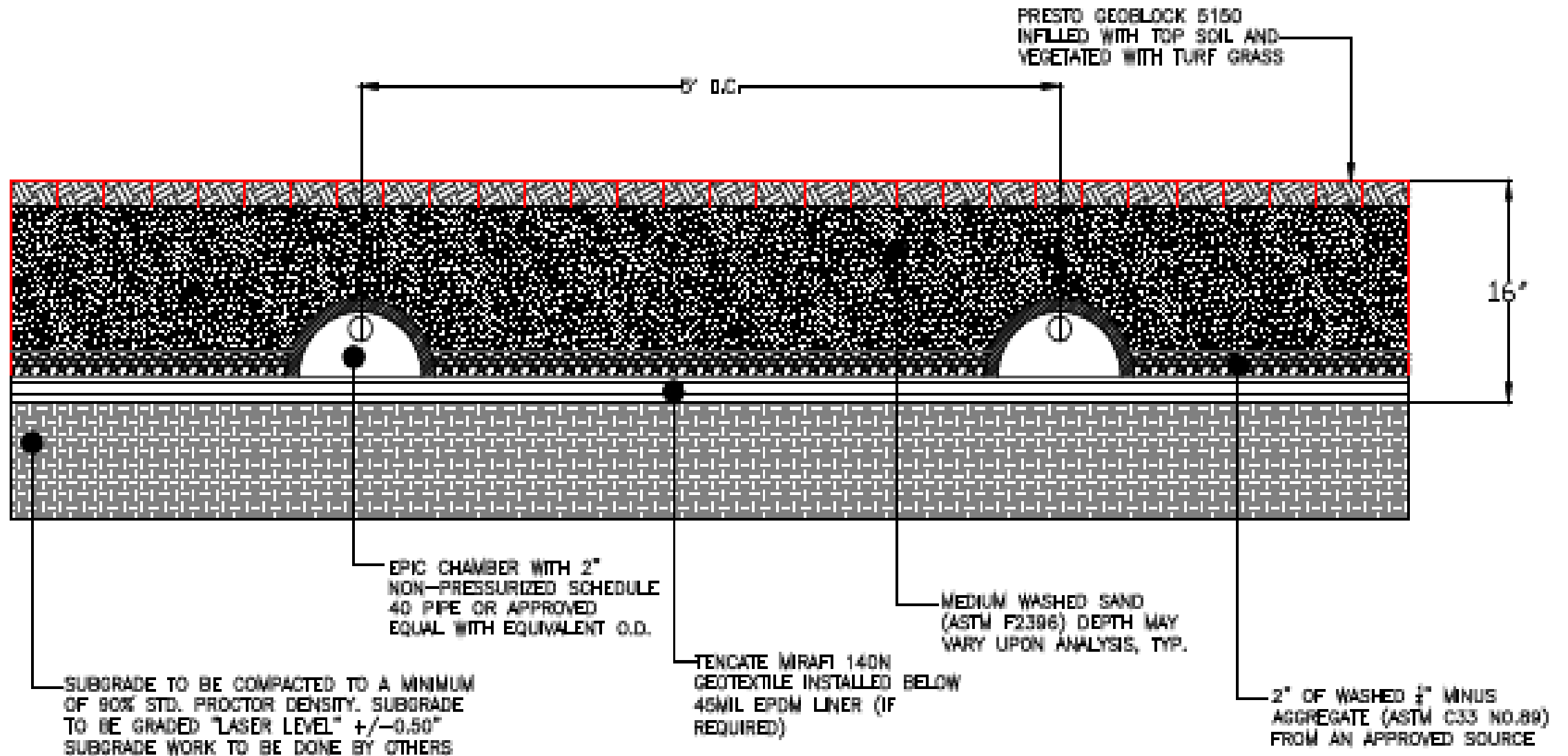
INDY FRINGE TRAILHEAD &
BLACK BOX THEATER
719 E. ST. CLAIR STREET
INDIANAPOLIS, IN 46202

CERTIFICATION

DRAWN BY	
CHECKED BY	
REVISIONS	

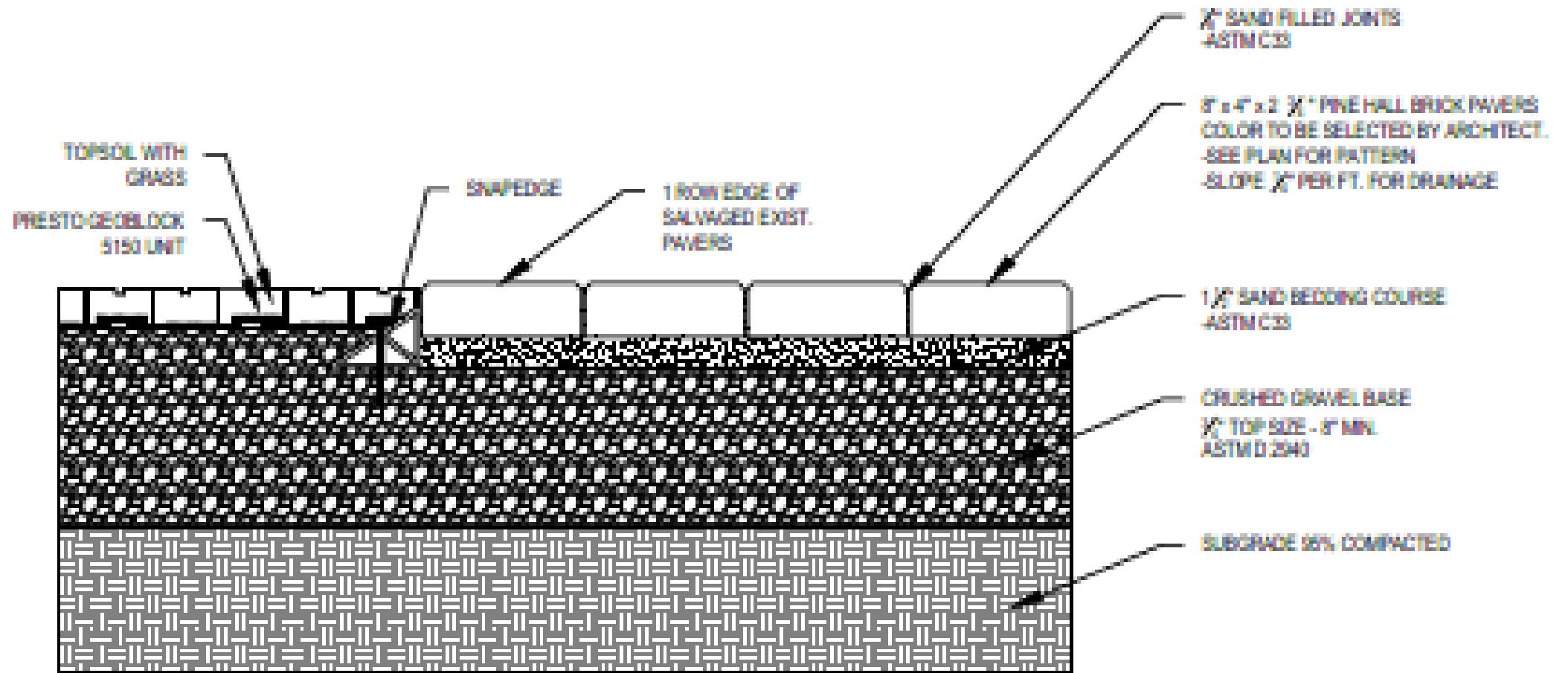
SITE PLAN
SITE DETAILS
10/17/2012
SHEET NUMBER
C1

NOTE: FIELD VERIFY ALL DIMENSIONS & CONDITIONS PRIOR TO CONSTRUCTION. PRELIM. SPOT ELEVATIONS ARE TO THE TOP OF PAVERS OR GRADE - FIELD VERIFY.



Section @ EPIC Drainage System

1"=1'-0"



2
 A1

Paver Edge @ Geoblock

SCALE: 1-1/2" = 1'-0"

GALLONS/CHAMBER	QUANTITY OF CHAMBERS	STORAGE CAPACITY GALLONS	TOTAL STORAGE CAPACITY GALLONS
9.67	135	1305.45	28256
SAND VOID RATIO = 0.4	FT³ SAND IN THE REINFORCED GRASS/CHAMBER AREA	STORAGE CAPACITY GALLONS	
	5616	16803.07	
AGGREGATE VOID RATIO = 0.35	FT³ OPEN GRADED AGGREGATE PAVER BASE COURSE	STORAGE CAPACITY GALLONS	
	3391.5	10147.37	



Planners and the owners asked a local vendor to work with the contracted installer to discuss the alternate design and installation. The original plan called for a 20000-gallon cistern, associated plumbing, and irrigation system. The material budget for these components was \$31,800. The material budget for the alternate system was \$32,225. The contractor agreed to install the LID driven design for the same cost.



November 2012

CLASSIFICATION

PARTICLE SIZE (mm)

SIEVE #

ACCEPTABLE RANGE (%)

Fine Gravel
Very Course Sand

2.00 and up
1.00 - 2.00

10
18

0-10

Course sand
Medium Sand
Fine Sand

0.50 - 1.00
0.25 - 0.50
0.10 - 0.25

35
60
140

82 - 100

Very Fine sand
Silt and Clay

0.05 - 0.10
under 0.05

270
-

0 - 8



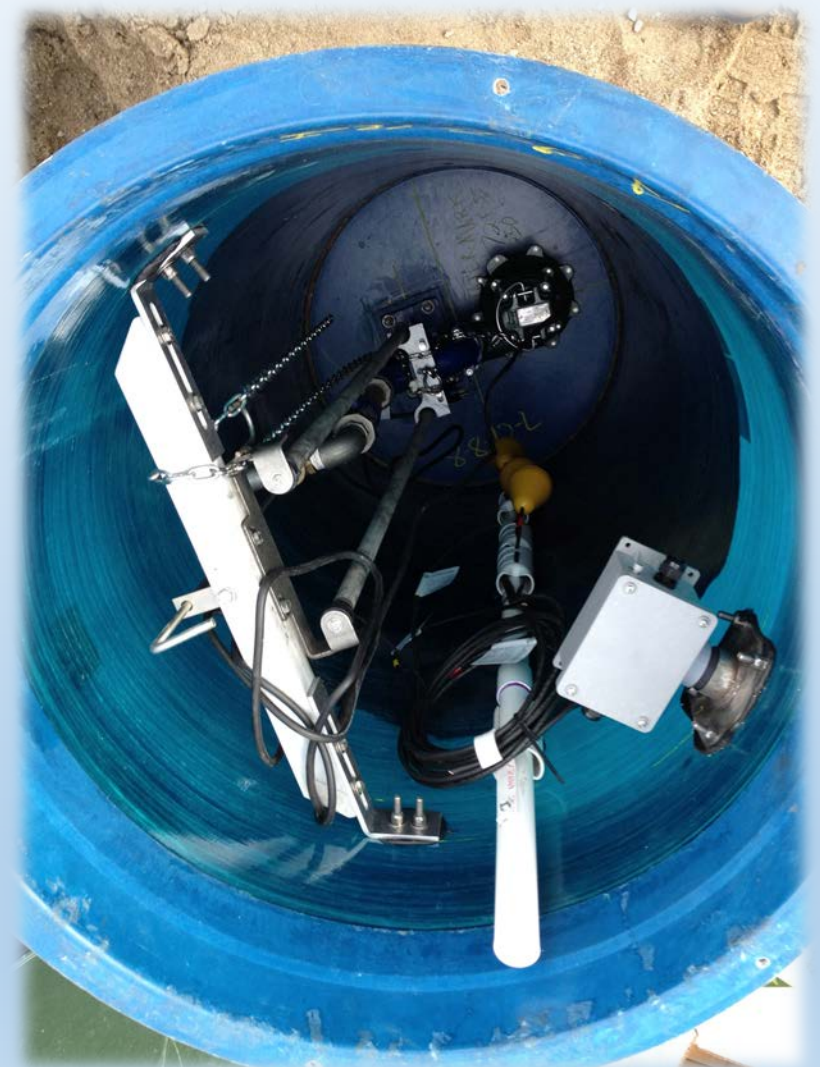
















November 2012



November 2012



April 2013



April 2013



May 2013



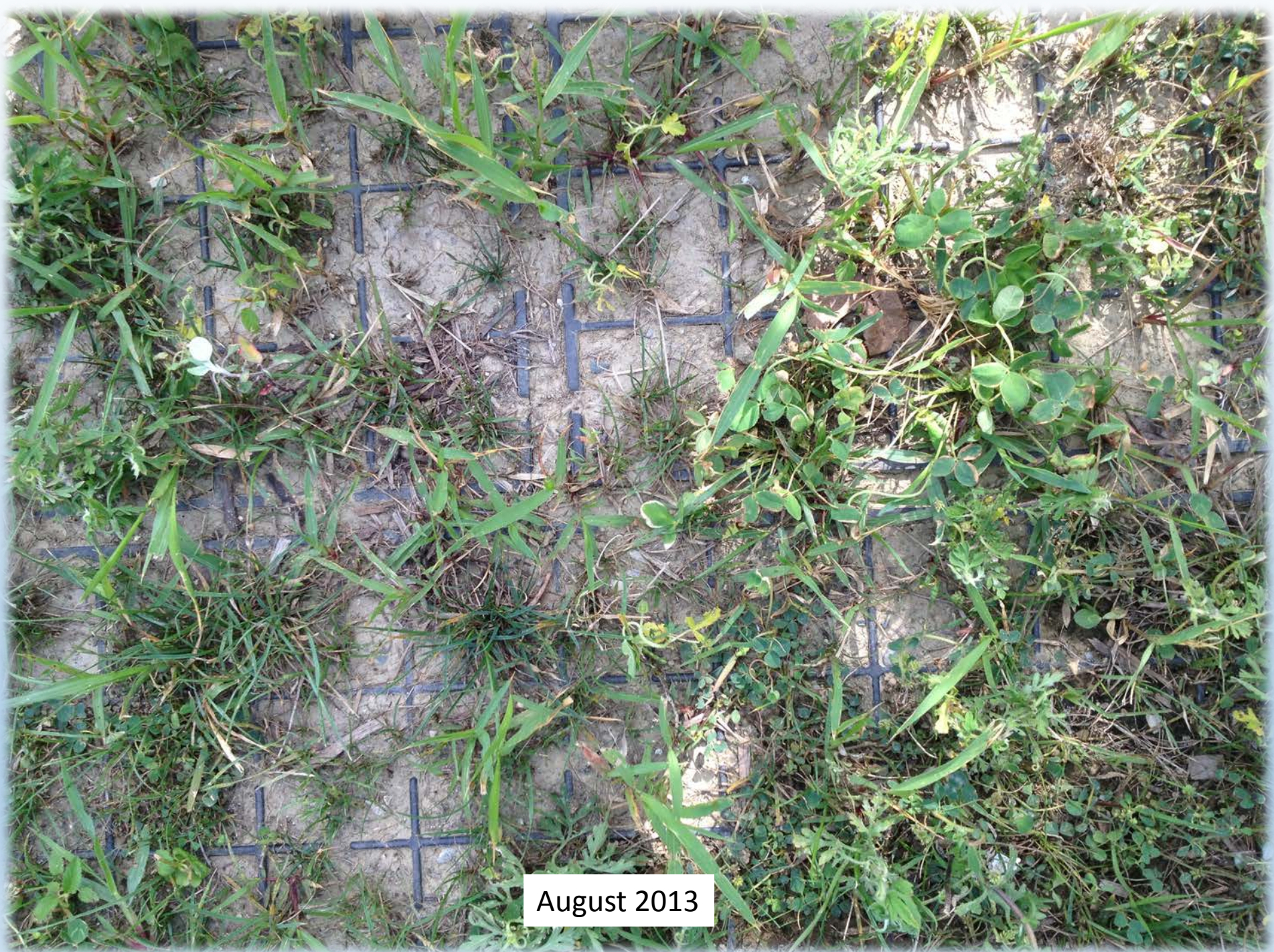
June 2013



August 2013



August 2013



August 2013



November 2014

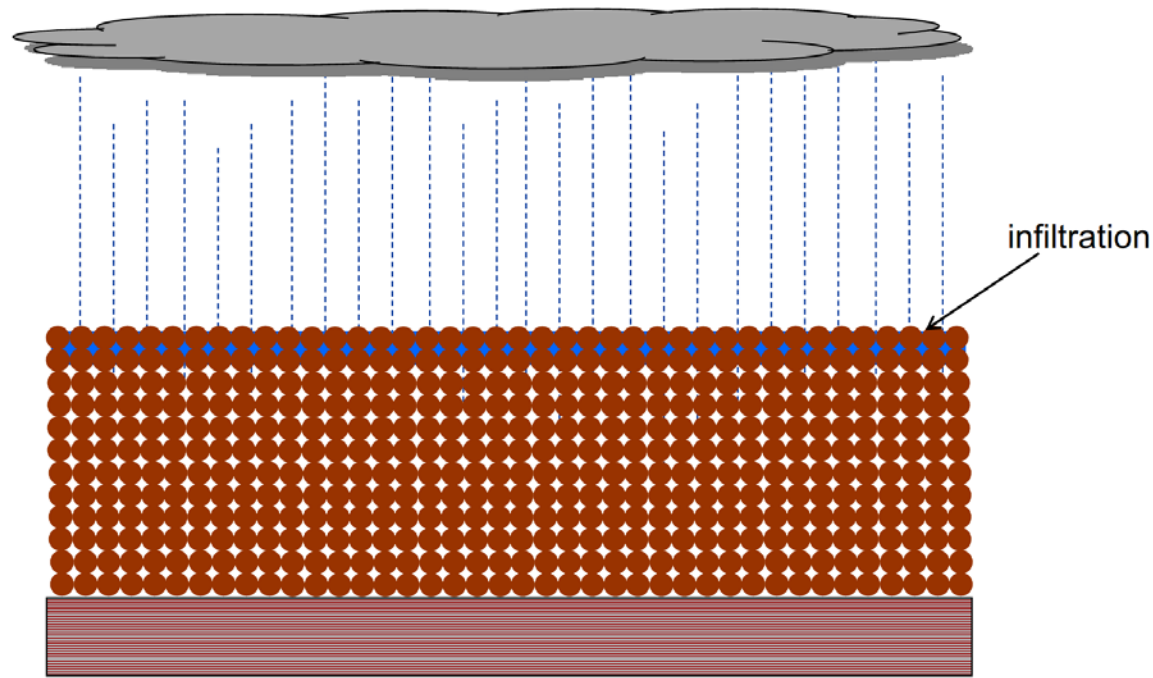


November 2014





Infiltration is the movement of water INTO the soil surface



Percolation is the movement of water WITHIN the soil matrix.

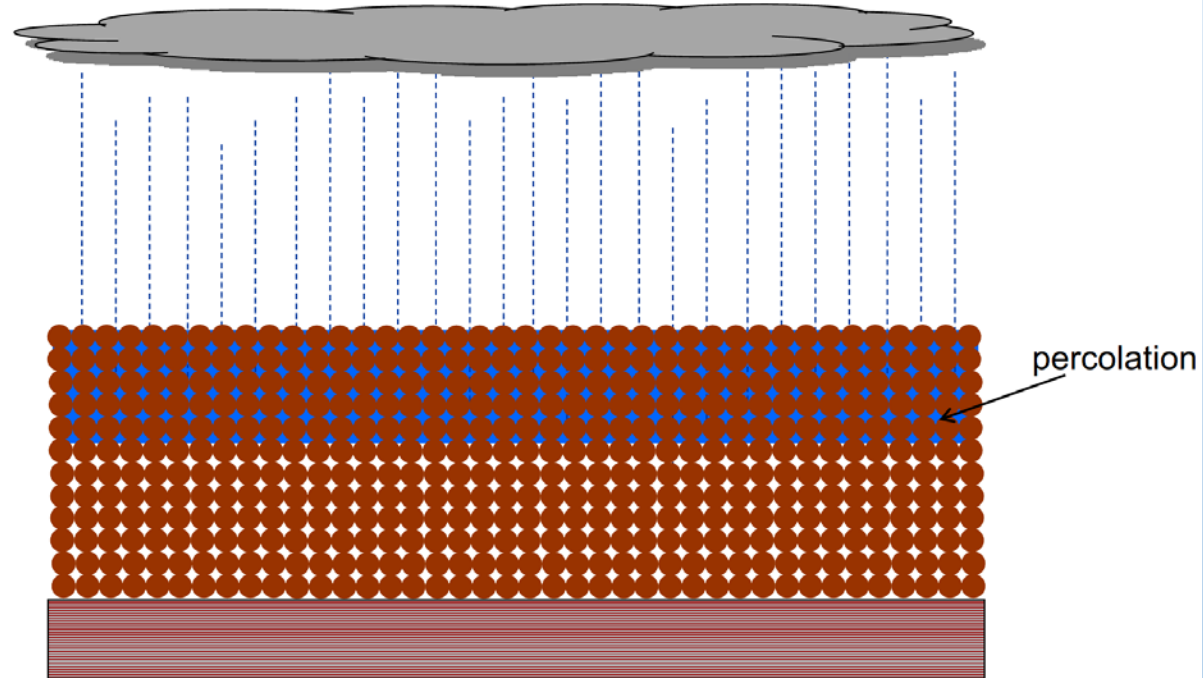




Figure 3: Hammering Pipe Into Media



Figure 4: Pipe Installed Into Media



Figure 5: Oil Application



Figure 6: Dissipater Stones



Figure 7: Infiltrometer Placement



Figure 8: Gradation of Clear Pipe



Figure 9: Filling Infiltrometer with Water



INDY FRINGE INFILTRATION & PERCOLATION TEST RESULTS

Date: 5/23/2016

SW Corner of Property

Infiltration Test (wet):

		IN/MIN	IN/HR
12"	00:28:00 Hr:Min:Sec	0.429	25.714
19"	00:58:21 Hr:Min:Sec	0.326	19.544
24"	01:43:21 Hr:Min:Sec	0.232	13.936
36"	02:30:45 Hr:Min:Sec	0.239	14.328

Date: 5/27/2016

Center of Property

Percolation Test (wet - Clay Infill):

		IN/MIN	IN/HR
8.19"	28:09:59 Hr:Min:Sec	0.005	0.292

Date: 5/27/2016

North End of Property

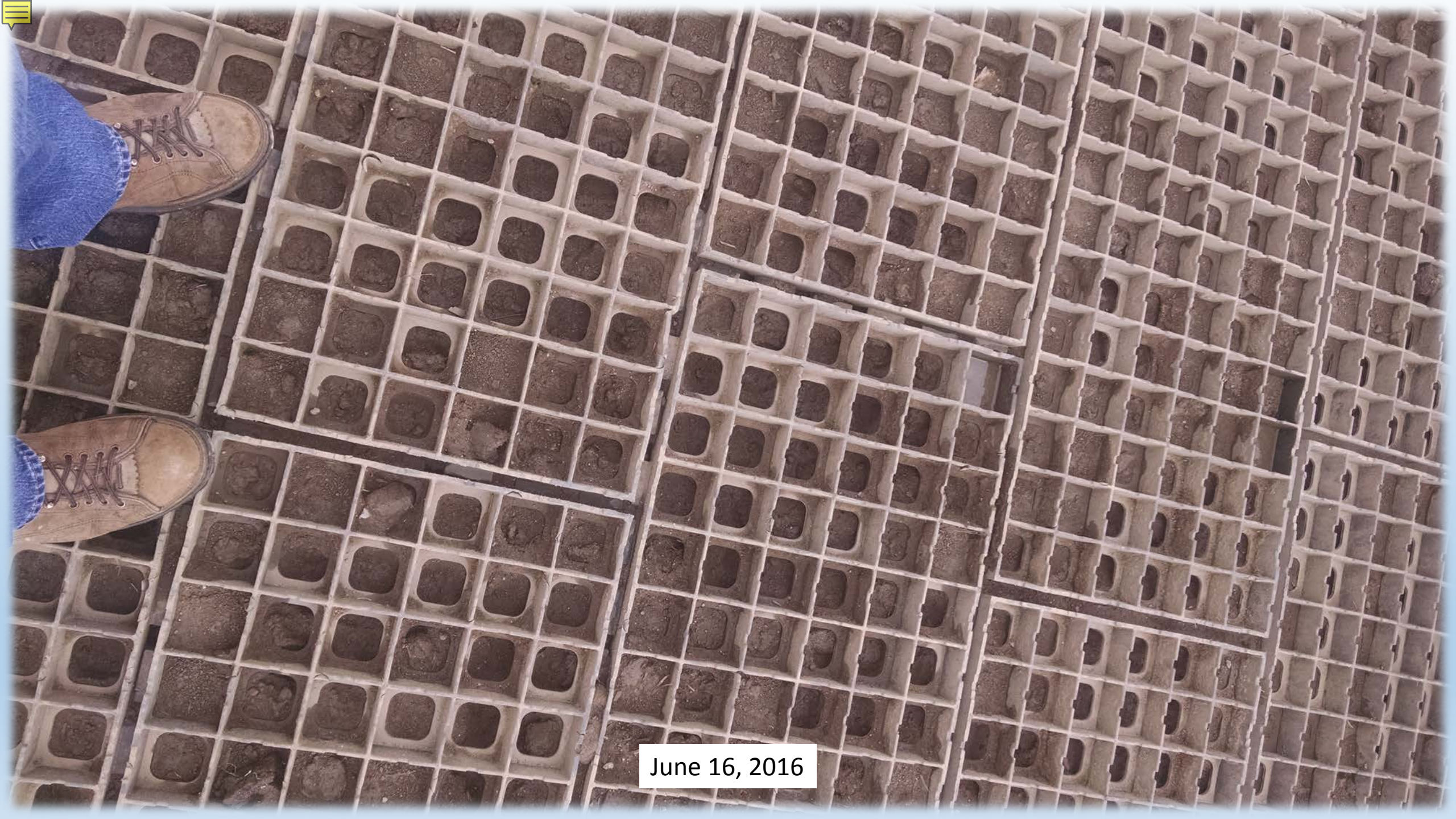
Percolation Test (wet - Validated Soil Infill):

		IN/MIN	IN/HR
8.19"	00:07:03 Hr:Min:Sec	1.162	69.702



June 16, 2016





June 16, 2016

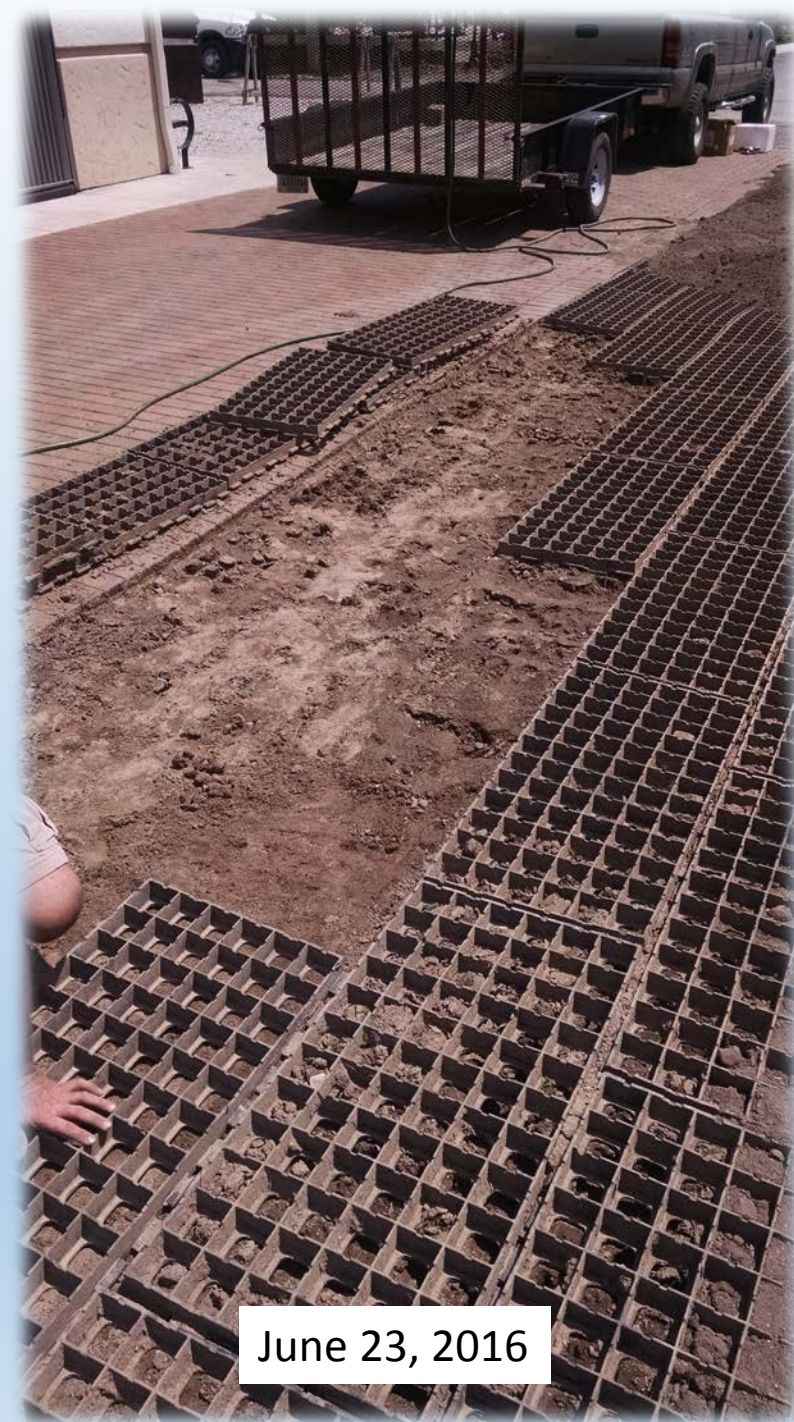
Composition and Characteristics

INDOT #23	35% by Volume
*Clay Loam	25% by Volume
Biotic Earth Black	2.5% by Volume
Bio Solids	7.5% by Volume
Compost	30% by Volume
Compost Quality	Solvita Test Passing
pH	7.0 to 7.8

***NOTE:** Screened Clay Loam shall be according to USDA Textural Soil Classification 27% to 40% Clay and 20% to 45% Sand



June 22, 2016



June 23, 2016



June 24, 2016



June 24, 2016



June 24, 2016



July 19, 2016



August 15, 2016



August 15, 2016



August 15, 2016

Thank You!

CONCLUSIONS? QUESTIONS?



Environmental Passive Integrated Chamber



Environmental Passive Integrated Chamber



Responsible Water Management

A total system approach expands beyond traditional stormwater systems, which historically only stored stormwater or treated it for pollutants. The Firestone Environmental Passive Integrated Chamber (EPIC Chamber™) is an onsite water management and reuse system designed to collect, filter, retain and distribute water below ground at its source. Bringing together passive subsurface irrigation, water storage and filtration in a single, customizable solution, the Firestone EPIC system utilizes capillary rise and gravity to provide controlled water management.



The Firestone Environmental Passive Integrated Chamber (EPIC Chamber™) is a drainage and irrigation device that uses natural passive processes to manage and direct water resources.



Water

Considered one of the world's most precious resources, water is essential to life around the globe. Despite the fact that water covers 75% of the earth's surface, less than 1% is available for the world's ecosystems and expanding population of more than 6.9 billion humans, the Environmental Protection Agency (EPA) names urban run-offs in its top 10 leading sources of impairments of rivers, lakes and estuaries. It is critical to protect these bodies of freshwater from contamination and stormwater run-off, especially since 83,337 square miles (215,842 square kilometers) of impervious surfaces exist across the U.S. today and an estimated 7.8 billion gallons of freshwater are spent on outdoor uses, the majority being landscaping.





Sustainable Benefits

- Irrigates with 50-85% less potable water
- Reduces the need for open retention ponds
- Utilizes a Firestone EPDM Geomembrane to create a cost effective barrier to store water
- Minimizes the amount of pollutants from entering the groundwater
- Requires minimal maintenance and management



The EPIC system can utilize 40%-85% less water for irrigation while removing nutrients. The EPIC profile stops soil as water wicks upward by capillary action from the chamber.
Source: Synthesis, Firestone Environmental Solutions

Stormwater Management Solutions

Trying to control the discharge of stormwater run-off from roads, parking lots, roofs and other hardscapes has traditionally been a challenge for conventional curb and gutter designs. The Firestone EPIC system enables run-off water from impervious surfaces to be filtered, collected, stored and reused. When designed properly, it has been shown to manage the volume incurred during a 100-year storm event. With the ability to store water in subsurface detention areas, this technology can decrease or potentially eliminate a facility's reliance on municipal water for irrigation purposes and improve your Best Management Practices (BMPs). The system utilizes local sand and gravel to filter and delay stormwater run-off prior to its entrance into city storm sewer systems or downstream bodies of water. Furthermore, the EPIC system may eliminate the need for a retention pond, therefore maximizing your land use.



- Jim Blazek, CPESC - D2 Land & Water Resource, Inc.
- Christa Petzke, PE, MBA - D2 Land & Water Resource, Inc.