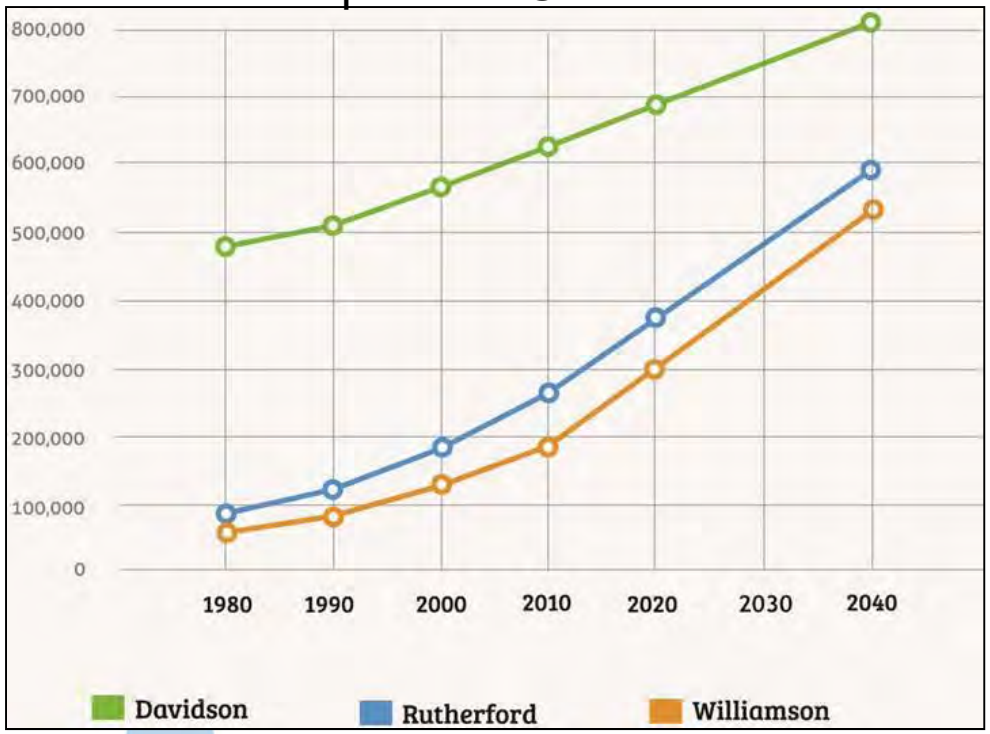
Rebecca Dohn

October 13, 2017

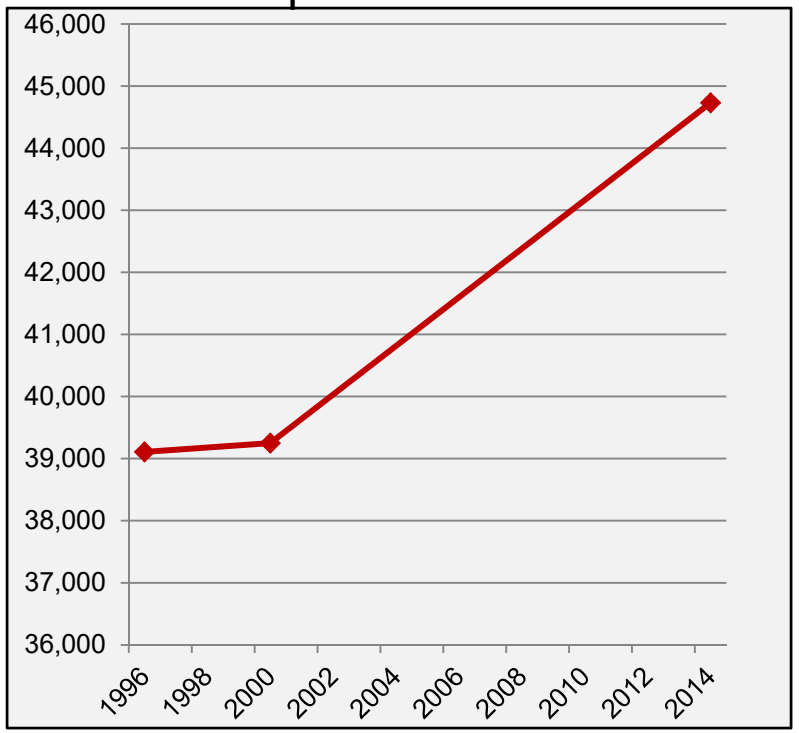
METRO WATER SERVICES

Why Green Infrastructure?

Population Growth

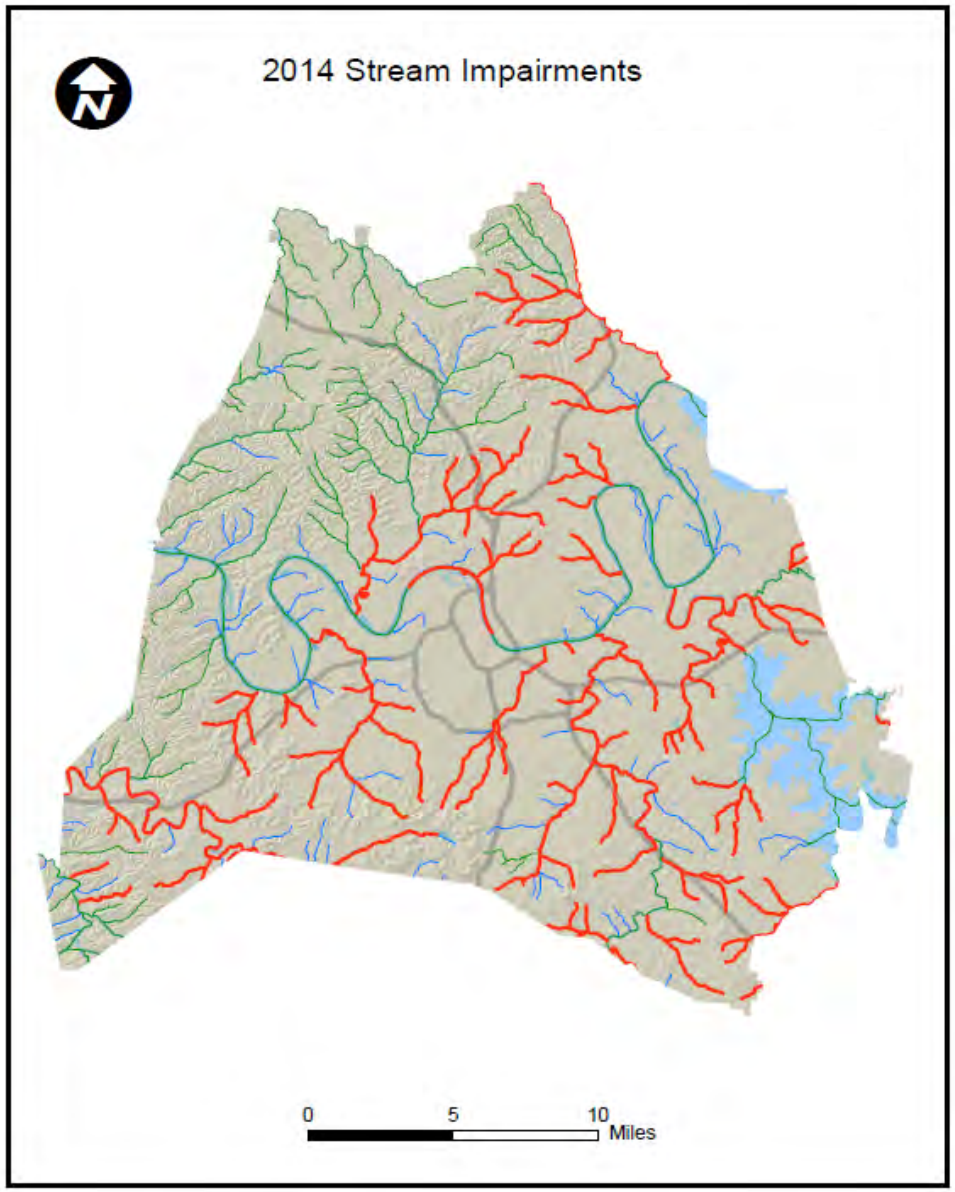


Impervious Acres

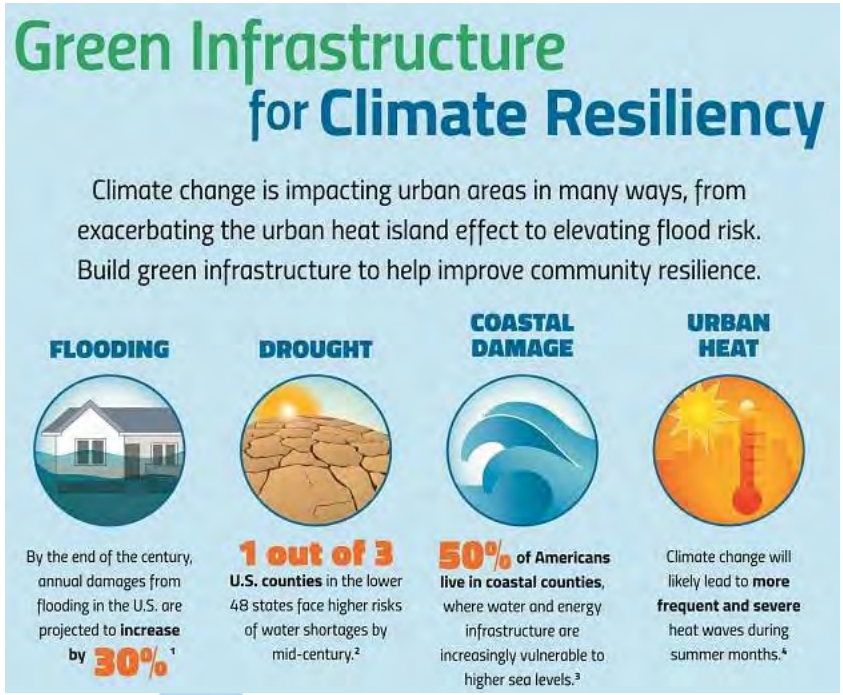


Why Green Infrastructure?

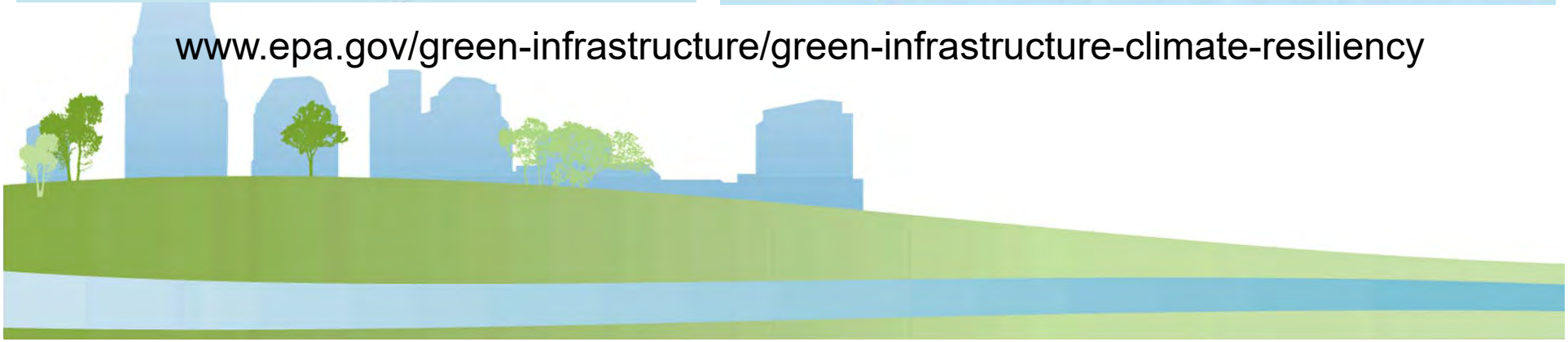
Why Green Infrastructure?



Why Green Infrastructure?



www.epa.gov/green-infrastructure/green-infrastructure-climate-resiliency



LID Manual - Background

History of Nashville's LID Manual

- Green Ribbon Committee
  - Increase Utilization of LID
- How????
- FLOOD!!!
- NPDES MS4 Permit Requirements
- Started November 2010 & Released in August 2012

Photos: *The Tennessean*

LID Manual - Background

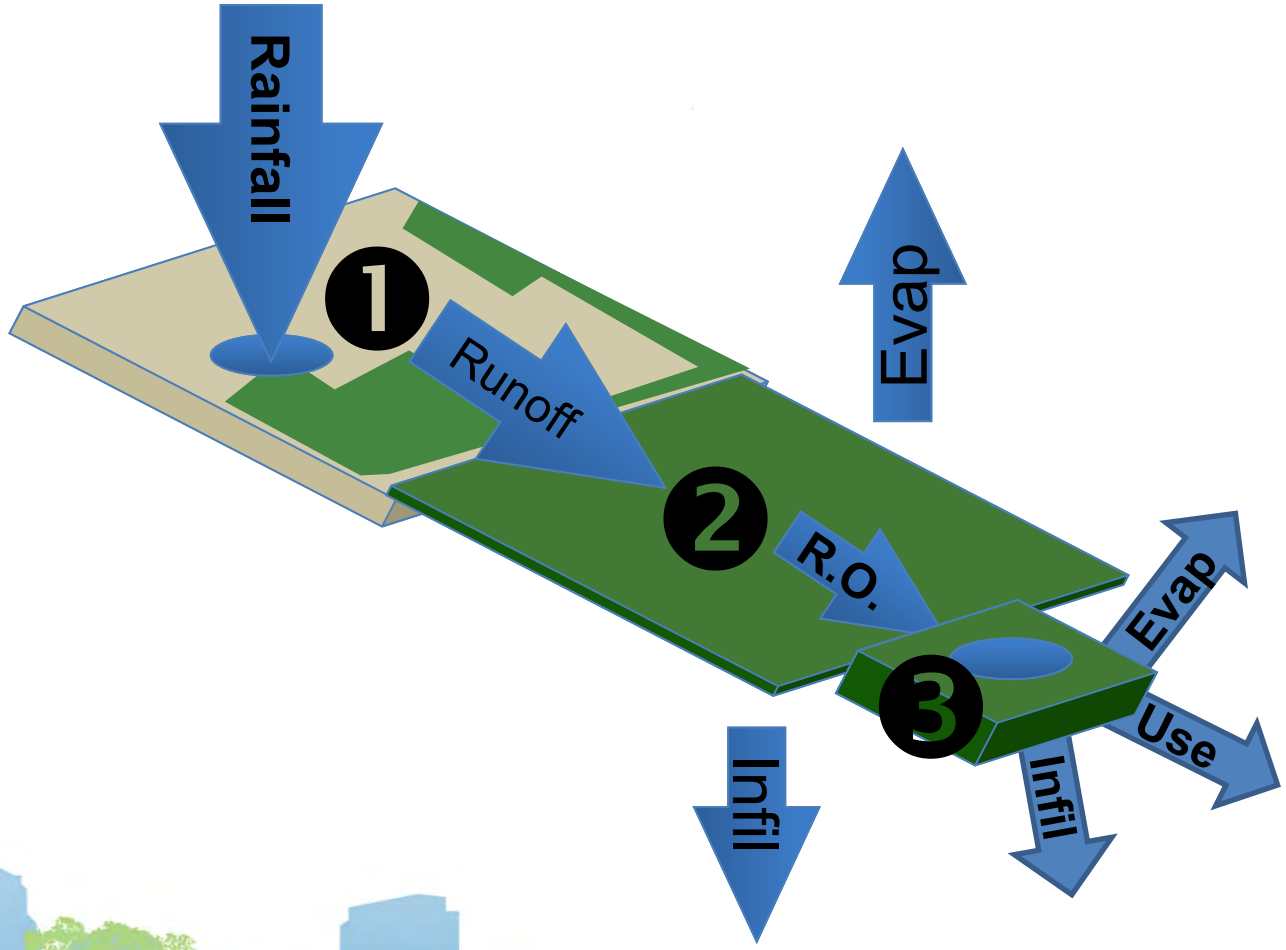
Method Selection

- Review existing methodologies
- Runoff Reduction from the Center for Watershed Protection & the Chesapeake Stormwater Network
- Virginia's Design Specifications

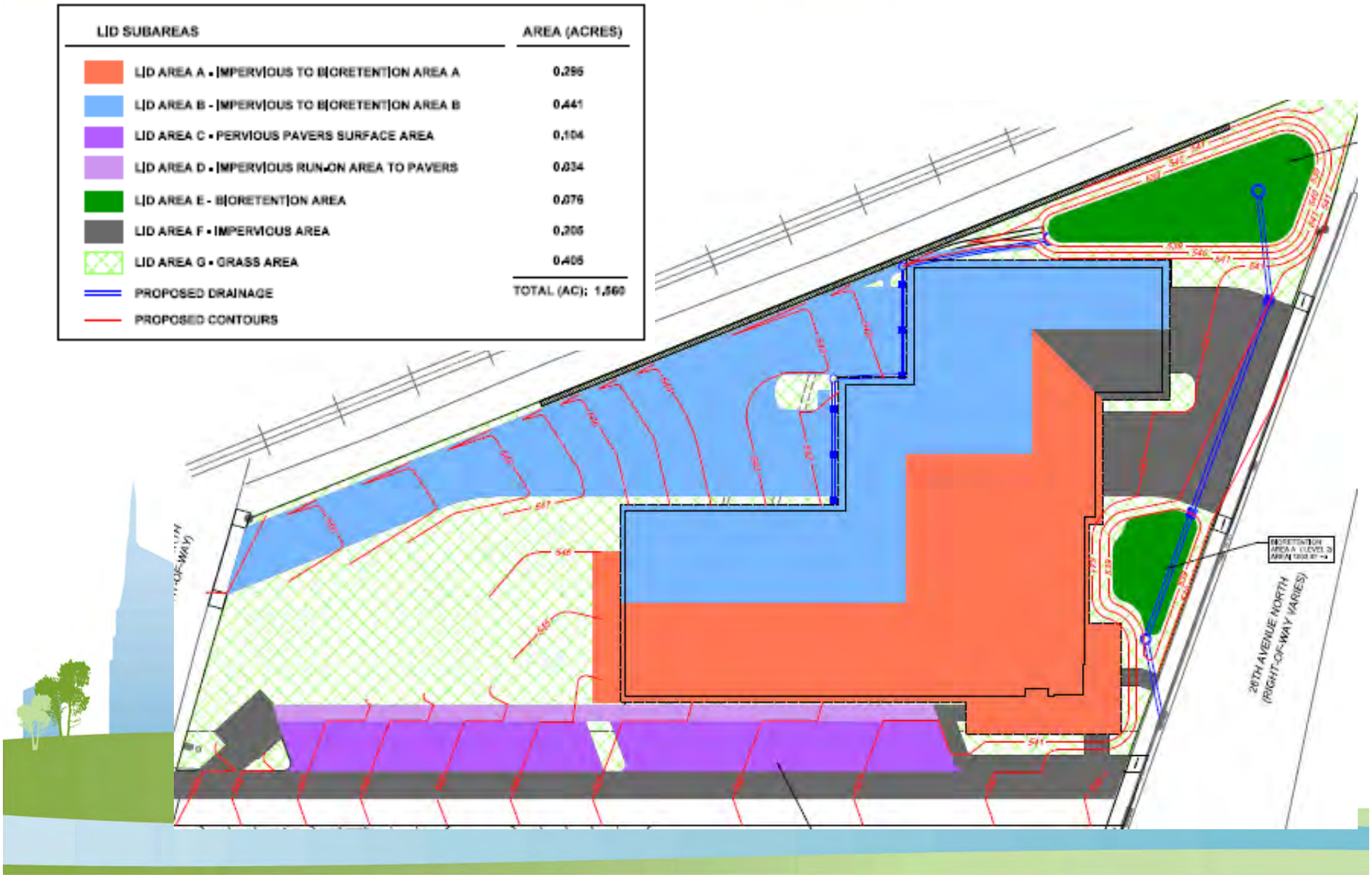
LID Manual - Background

3 Step Process

- Site layout and landuse
- Non-structural treatment
- Structural treatment
- Site weighted Rv=0.20



LID Manual – Tool



LID Manual – Tool

MWS Green Infrastructure Site Worksheet

Project Name	*FIRE HALL No. 19*
Parcel Identification #	*MAP 92-10 PARCEL 302 & 435*

Instructions

1. Input cells are in Green.
2. Break Site Into Sub areas by single soils and land use type combinations.
3. Assign a code to each subarea and input the code into column T. Descriptions can be entered in column S.
4. Input the subarea drainage area in column U.
5. Input treatment credit code (Column W) for the first tier of treatments
6. Input additional treatment code as desired (Column Z) for any subarea
7. Adjust until you reach 80% reduction or better (Cell AE41 turns green if 80% reached).
8. If 80% reduction is not reached and it has been decided that GIPs in series is an option use Step 3a to place GIPs in series . Their respective treatment volumes are calculated in column AN. This volume is separate from GIPs upstream.
9. When using GIPs in Series the user will look to Cell AK41 for confirmation the 80% goal has been met.

Capture Depth=	1	inch
Cistern Capture=	1	inch(es) capture

Percent Volume Reduction-Based Calculations

Step 1: Lay out the site and divide it into sub-areas each of a specific land use type and Rv.					Step 1a: Change any basic land use types through reforesting, permeable pavement or green roofs - or through use of open space for a GIP.			Step 2: Treat impervious areas through the use of disconnection or sheet flow			Step 3: Treat primarily impervious areas with structural GIPs either in series with Step 3 intrinsic GIPs or alone downstream from Steps 1 and 2 land use.			Size controls for Step 3 by assigning structure ID to each sub-area, combining sub-areas into one structure if appropriate.			Step 3a Treatment in Series Calculation - Place Structural GIPs in same row as upstream GIP			Size controls for Step 3a in series by assigning a sequential structure ID to each area treated in series.		
Step1 Basic Land Use					**Step 1a Modified LU**			**Step 2 Intrinsic GIPs**			**Step 3 Structural GIPs**			**Structure ID**	**IA Capture**		**Step 3a Structural GIPs in Series**			**Structure ID**	**IA Capture**	
Subarea	Description	Code	Acres	Base Rv	Code	Acres	Eff Rv1	Code	Trtmt VR1	Eff Rv2	Code	Trtmt VR2	Eff Rv3		Tv Multiplier	Tv (cf)	Code	Trtmt VR2	Eff Rv4	Site GIP ID Number	Tv Multiplier	Structure in Series Tv (cf)
1	sub-area A	IA	0.295	0.95	IA	0.295	0.95		0	0.95	B2	0.8	0.19		1.25	1,272		0	0.19		0.00	-
2	sub-area B	IA	0.441	0.95	IA	0.441	0.95		0	0.95	B1	0.6	0.38		1.00	1,521		0	0.38		0.00	-
3	sub-area C	IA	0.104	0.95	P1	0.104	0.55		0	0.55	PP1	0	0.55		1.00	359		0	0.55		0.00	-
4	sub-area D	IA	0.034	0.95	IA	0.034	0.95		0	0.95	P1	0.45	0.53		1.00	117		0	0.53		0.00	-
5	sub-area E	TC	0.076	0.20	TC	0.076	0.20		0	0.20		0	0.20		0.00	-		0	0.20		0.00	-
6	sub-area F	IA	0.205	0.95	IA	0.205	0.95		0	0.95		0	0.95		0.00	-		0	0.95		0.00	-
7	sub-area G	TC	0.405	0.20	TC	0.405	0.20		0	0.20		0	0.20		0.00	-		0	0.20		0.00	-
8				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
9				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
10				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
11				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
12				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
13				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
14				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
15				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
16				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
17				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
18				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
19				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
20				0.00		0	0.00		0	0.00		0	0.00		0.00	-		0	0.00		0.00	-
		Weighted Rv		0.719	Weighted Rv		0.692	Weighted Rv		0.692	Weighted Rv		0.378						0.378			
		Total Area=	1.56	1.12	Total Area=	1.56	1.08			1.08			0.59		Step 3 Tv Total	3,268			0.59		Final Tv Total	3,268
	% Removal (Goal ≥80%)-->			28.1%	% Removal		30.8%	% Removal		30.8%	% Removal		62.2%				% Removal		62.2%			
													THIS MUST BE 80% OR GREATER IT WILL TURN GREEN WHEN IT IS						THIS MUST BE 80% OR GREATER IT WILL TURN GREEN WHEN IT IS			

LID Manual – Tool

MWS Green Infrastructure Site Worksheet

Project Name	*FIRE HALL No. 19*
Parcel Identification #	*MAP 92-10 PARCEL 302 & 435*

PreDev CN	79.0

METRO RAINFALL	
Return Period	Rainfall (in)
2-yr	3.39
5-yr	4.50
10-yr	5.23
25-yr	6.16
50-yr	6.85
100-yr	7.53

Curve Number Instructions

1. Enter the composite pre-development curve number (CN), to the left, for the watershed.
2. The tool automatically assigns curve numbers for each subarea based on MWS policy matching the land uses of Steps 1 and 1a to curve numbers (see column G).
3. Curve numbers are shown for both Step 1 and Step 1a in columns AO and AP as well as the composite curve number for the site in line 39 of those columns.
4. The ratio of the **Tv provided/Tv required** for each GIP (as a %) is entered in column AX (e.g. if only required Tv is provided then this should be 100%).
5. Select the rainfall in **Cell AT19** based on return periods shown in table to left.
6. Adjusted curve numbers for each subarea are shown in the table below in column BA, as well as the composite adjusted curve number in **Cell BB39**, for the rainfall selected. If this value is greater than the composite Pre-Development CN then **Cell BB40** will state "Detention Required"
7. These are the curve numbers to be used in flood control design calculations. Each watershed must be calculated independently. If there are multiple watersheds fo the project, then the composite pre-development curve number and composite adjusted curve number should be compared for each watershed to determine if deten is required.

Adjusted Curve Number Calculations

No Controls				With Structural Controls &Treatment Vol Removed						
Original CN	Rainfall (in)	S (in)	Q (in)	Tv required (cu ft)	Tv provided (%)	RO Vol Red (cu ft)	Q reduction (in)	Q adj (in)	Adjusted CN	Difference
98.0	7.53	0.204	7.29	1272	166.0%	2111	1.97125	5.319	81.2	-16.8
98.0	7.53	0.204	7.29	1521	287.0%	4365	2.7265	4.564	74.5	-23.5
98.0	7.53	0.204	7.29	359	451.0%	1617	4.2845	3.006	60.2	-37.8
98.0	7.53	0.204	7.29	117	451.0%	529	4.2845	3.006	60.2	-37.8
79.0	7.53	2.658	5.07	-			0	5.072	79.0	0.0
98.0	7.53	0.204	7.29	-			0	7.291	98.0	0.0
79.0	7.53	2.658	5.07	-			0	5.072	79.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
0.0	7.53	-	-	-			0	-	0.0	0.0
92.1		0.853	0.04	3268.3159			0.577155449	-0.535	79.0	-13.2
									OK	

$$Q = \frac{(P - 0.2 \times S)^2}{(P + 0.8 \times S)} \quad \text{and} \quad S = \frac{1000}{CN} - 10$$

Equation

$$Q_{adj} = Q - \frac{12 * T_v}{43560 * CDA}$$

Equation

Equation 3.8 provides a method to calculated the modified curve number once the Qadj is found.

Equation

$$CN_{adj} = \frac{1000}{10 + 5P + 10Q_{adj} - 10\left(Q_{adj}^2 + 1.25Q_{adj}P\right)^{\frac{1}{2}}}$$

LID Manual - Background

Alternate 1” Compliance Paths

- TDEC released alternate method in January, 2015
- Time-mass approach vs. coefficient
- http://tnpermanentstormwater.org/index.asp

VS.

LID Manual - Background

New NPDES MS4 Permit Requirements

- Infiltrate, evapotranspire, or capture & reuse first 1”
- Released 8/2012 - 2 Initial Compliance Paths
- Trial period to test & identify problems
- Became Requirement February 2016

LID Legistation - RESOLUTION NO. RS2016203

- WHEREAS, SB1830/HB1892 states: "[a]ny local governmental entity that adopts [postconstruction stormwater] control measures that exceed the minimum requirements of federal law must do so by ordinance or resolution, as appropriate, by the local legislative body upon a majority vote . . . ;" and,
- WHEREAS, federal law does not clearly define the minimum postconstruction stormwater control requirements as a numeric standard but instead merely requires that the postconstruction discharge of pollutants be reduced to the maximum extent practicable (MEP); and,
- WHEREAS, the postconstruction stormwater control measures contained in the Manual, which include Green Infrastructure and control measures identified as Low Impact Development (LID), were designed to meet the MEP requirement; and,
- WHEREAS, there is nonetheless a risk of a perception of conflict between the requirements of the Stormwater Management Manual, SB1830/HB1892, if adopted by the State of Tennessee General Assembly, and the conditions of the Phase I Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit issued to the Metropolitan Government by the Tennessee Department of Environment and Conservation (TDEC), which may be confusing for those trying to comply with those authorities and those trying to enforce them, alike; and,
- WHEREAS, it is in the best interest of the Metropolitan Government of Nashville and Davidson County for the Metropolitan Council to approve the postconstruction stormwater control measures in the Stormwater Management Manual by resolution for purposes of reconciling any such perceived conflicts and complying with SB1830/HB1892.

Can't exceed the Federal minimum

Federal standard = Maximum Extent Practicable (MEP)

MEP = LID

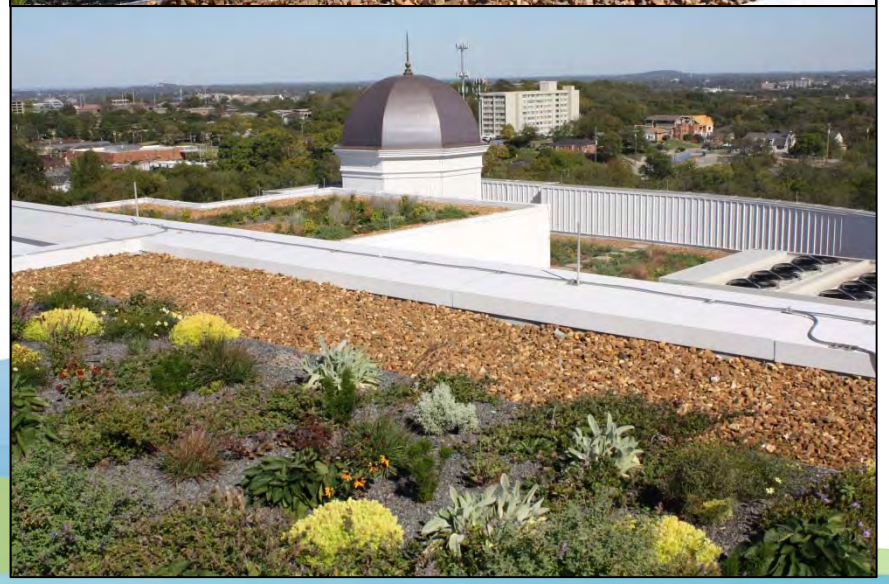
Still might confuse people

Metro Council should approve it just in case!

LID Legislation

GI in Combined

- green infrastructure ≠ sewerage system
- Can't use rate payer $$$
- Tree guy to the rescue!
- HB1850/SB2417 signed on 4/12/16
- Includes trees, green roofs, cisterns, soil amendments, wetlands, infiltration strips, rain gardens, pervious, swales

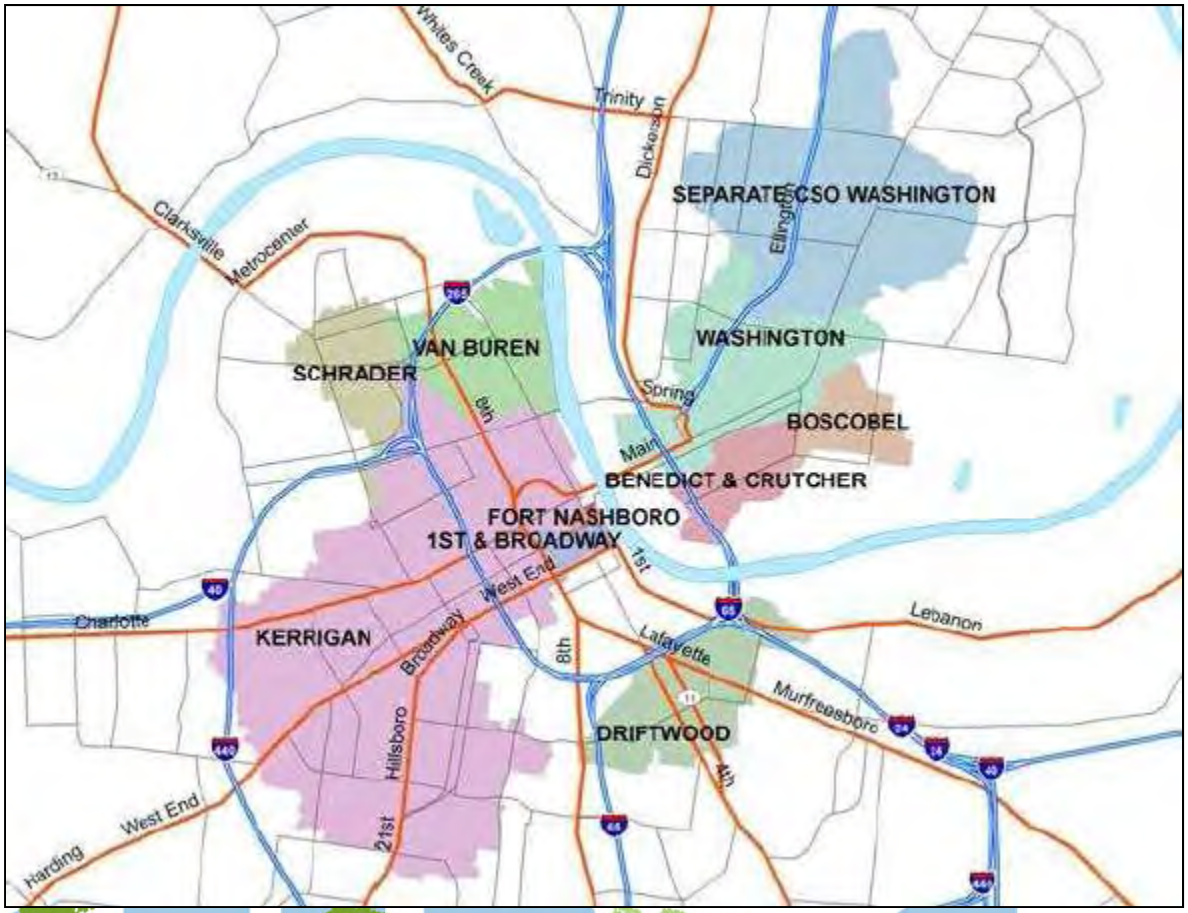


LID Manual - Background

Redevelopment Incentive

- Existing infrastructure
- Reduce sprawl
- Only applies to previously developed sites
  - If pre-dev Rv > 0.4, then Rv = 0.4

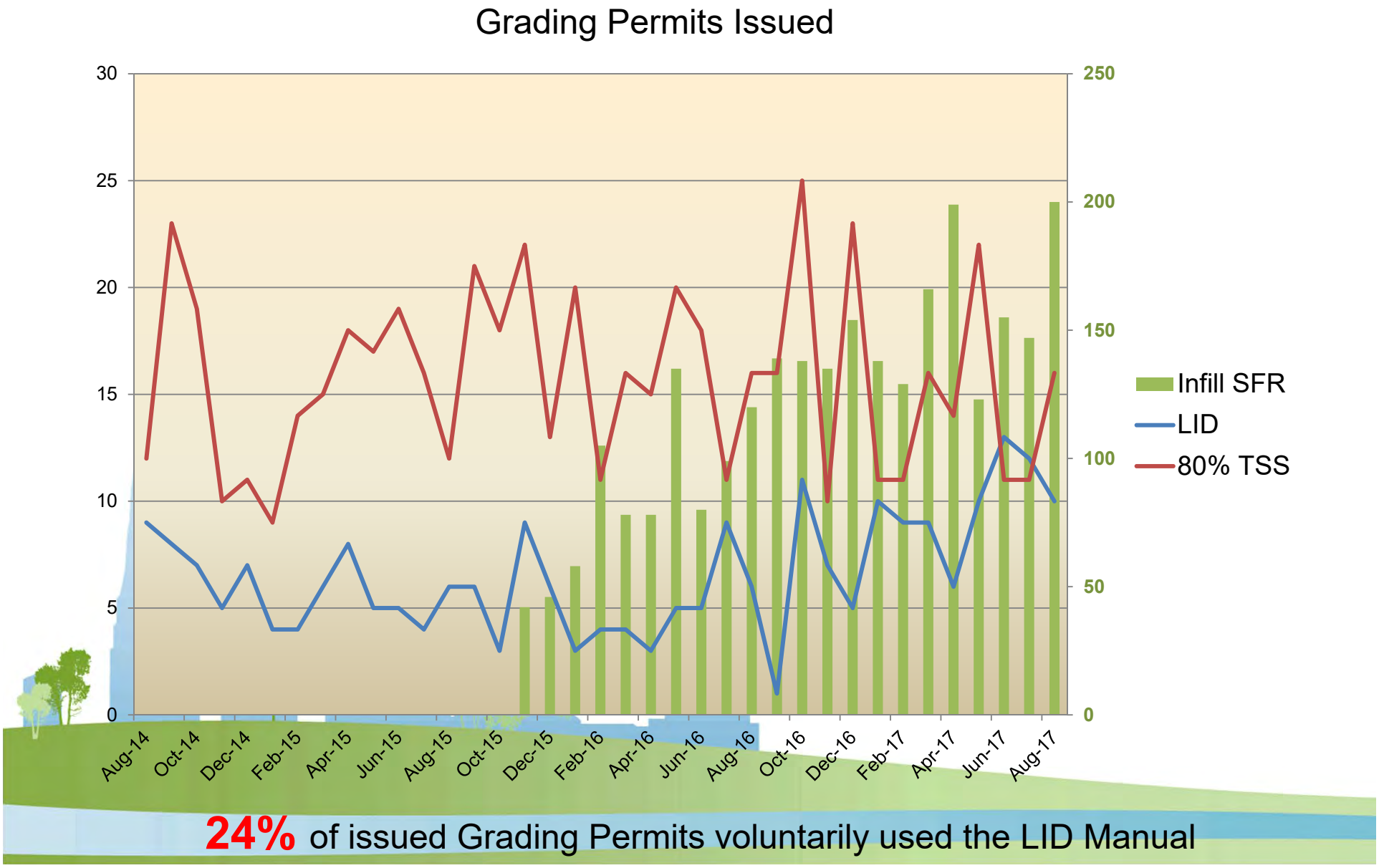
LID Manual - Background



Combined Sewer System Incentive

- If pre-dev Rv $\geq$ 0.4, then Rv = 0.6
- If pre-dev Rv < 0.4, then Rv = 0.4
- Waivers accepted
- Still pre = post for quantity
- Separate the storm

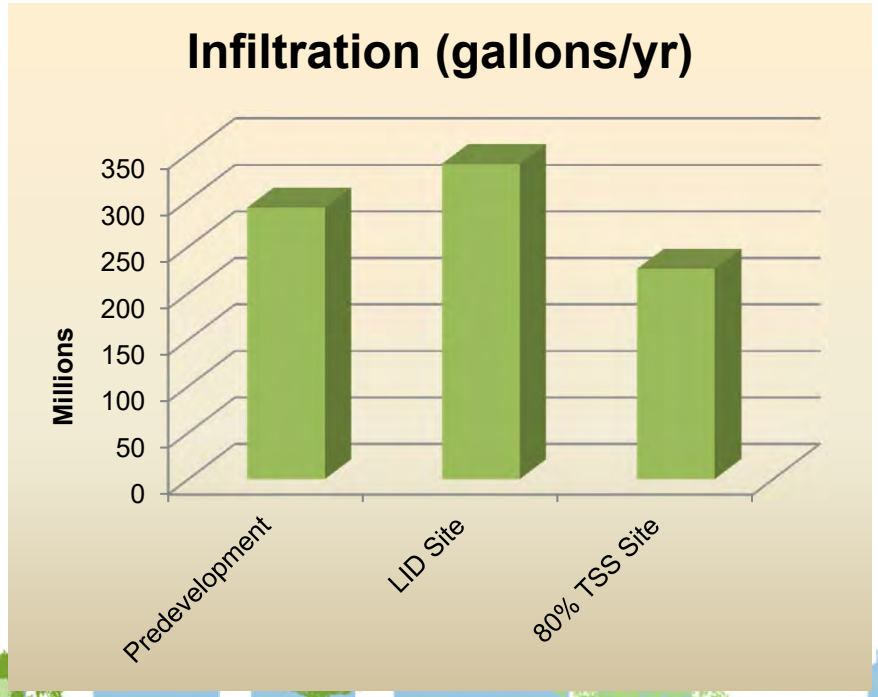
LID Manual - Background

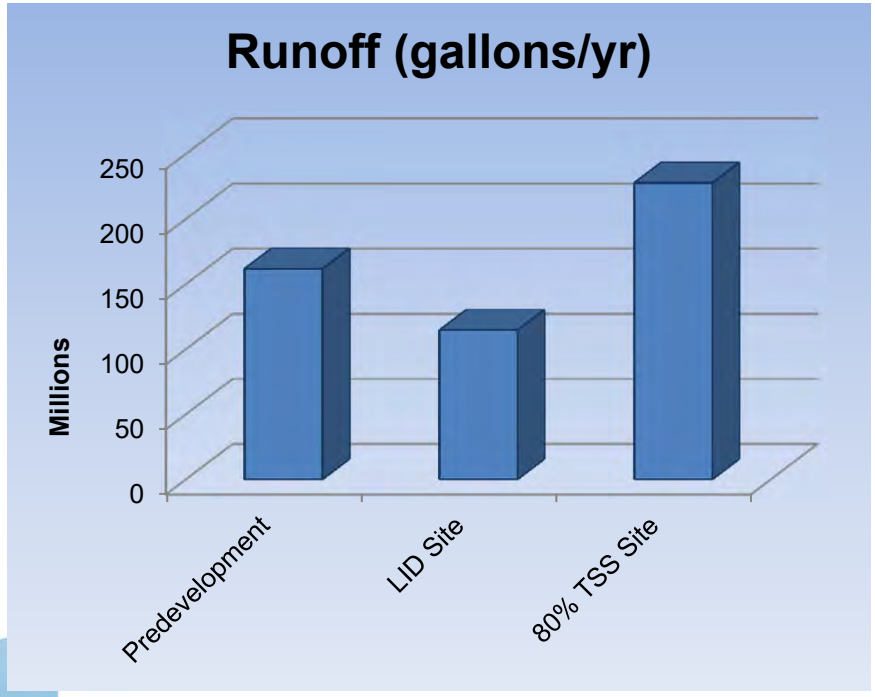


24% of issued Grading Permits voluntarily used the LID Manual

LID Manual - Results

LID sites infiltrated 113 M gallons > Traditional (80% TSS)
LID sites infiltrated 47 M > Predevelopment





LID Manual – Waivers

Waiving the 1” Requirement

- Can’t everyone have a cistern & a green roof?
- Site Constraints
  - Karst
  - Soil conditions
  - High water table
  - Brownfields
  - Hotspots
- Review Committee
- Other considerations

LID Manual – Waivers

Waiver Justification (cannot be based solely upon economic hardship)

- ☐ Groundwater pollution potential (hotspots)
- ☐ Soil contamination (Brownfields) 1
- ☐ Karst geology / sinkholes 9
- ☐ Limited infiltrative capacity (shallow soils, low permeability soils, high water table) 17
- ☐ Other (attach additional pages if needed) 19

Please provide justification that the project cannot use a cistern or construct a green roof:

Supporting Documentation

The application must contain adequate documentation to support the request for waiver. This can include, but is not limited to site plans, geotechnical reports, environmental site assessments, and engineering analysis.

Please note – the results of the waiver assessment apply only to this project and are not transferable.

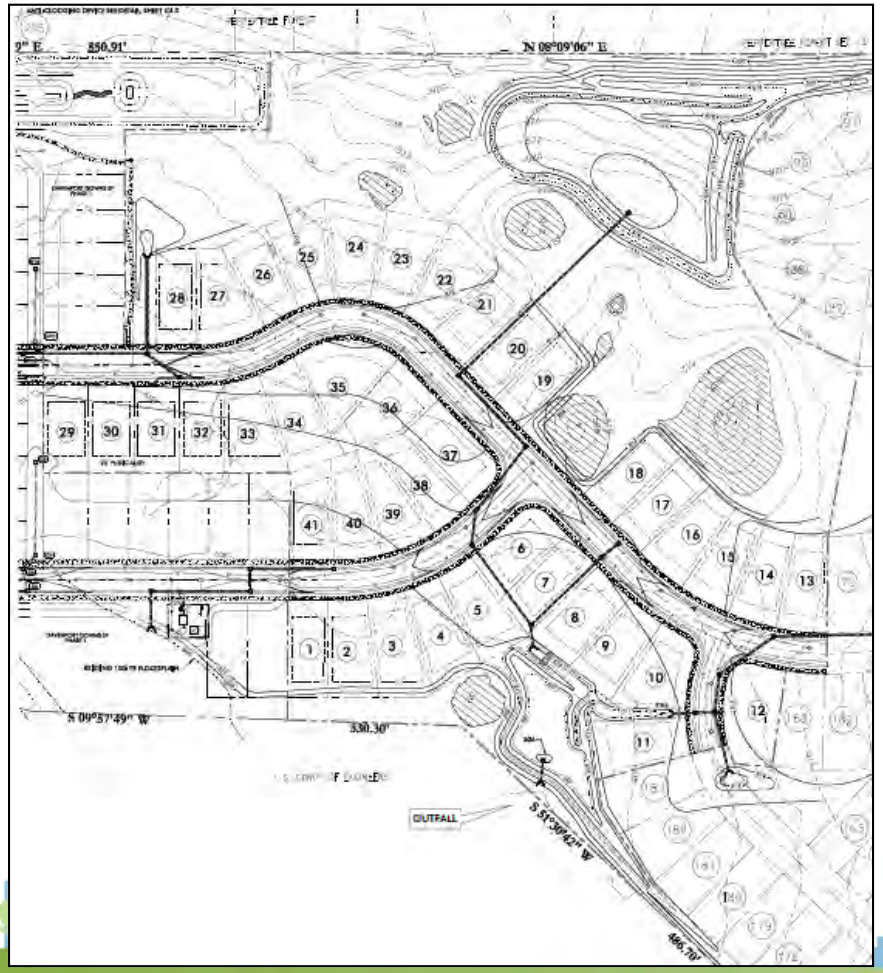
23 Denied, 2 granted on appeal

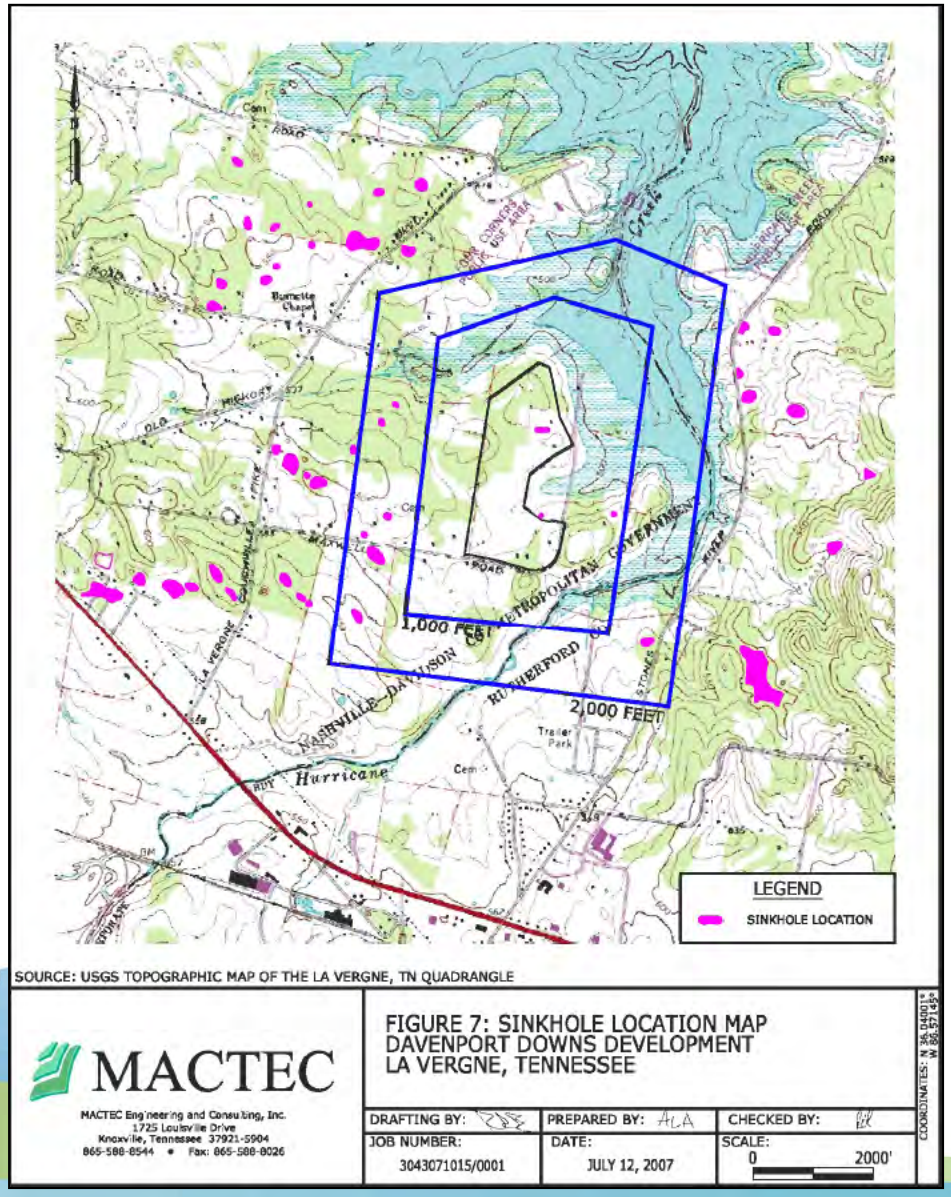
LID Manual – Waivers

KARST!!!!!!!!

- Underlying carbonate rock
- Sinkholes, caves, springs
- Challenges of Development
  - Subsidence & collapse
  - Increased runoff
  - Highly variable subsurface
  - Groundwater contamination
- Davidson County: 609 sinkholes & 87 caves (www.http://tnlandforms.us/)

LID Manual – Waivers





SOURCE: USGS TOPOGRAPHIC MAP OF THE LA VERGNE, TN QUADRANGLE

MACTEC

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

FIGURE 7: SINKHOLE LOCATION MAP
DAVENPORT DOWNS DEVELOPMENT
LA VERGNE, TENNESSEE

DRAFTING BY:	PREPARED BY: ALA	CHECKED BY:
JOB NUMBER: 3043071015/0001	DATE: JULY 12, 2007	SCALE: 0 2000'

COORDINATES: N 36°04'01" W 86°57'45"

LID Manual – Waivers

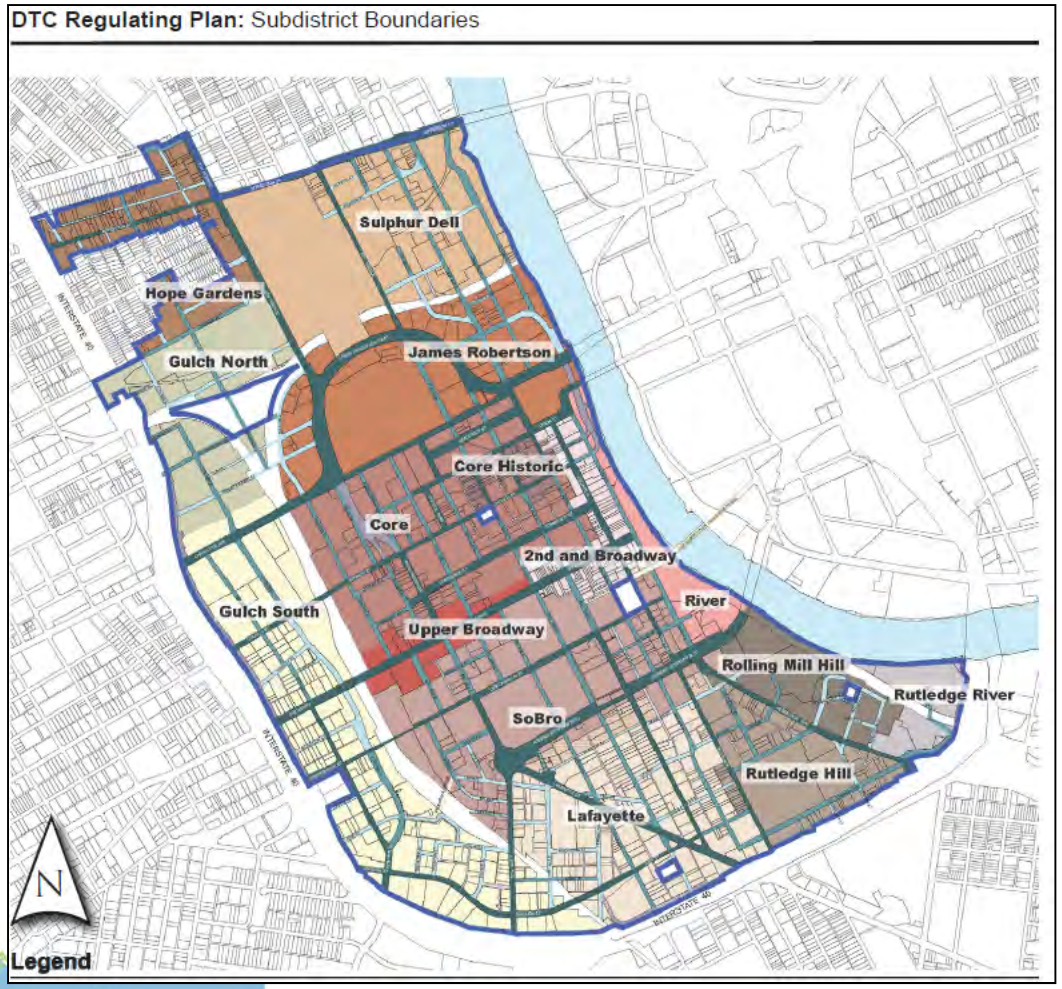
Crying Karst – better watch what you ask for

- Distributed treatment >>> centralized
- Wet & Dry ponds discouraged - liner required
- Use Small scale LID – bioretention, swale, filter strips
  - Underdrains
- Use green roofs, cisterns, urban bioretention(closed)

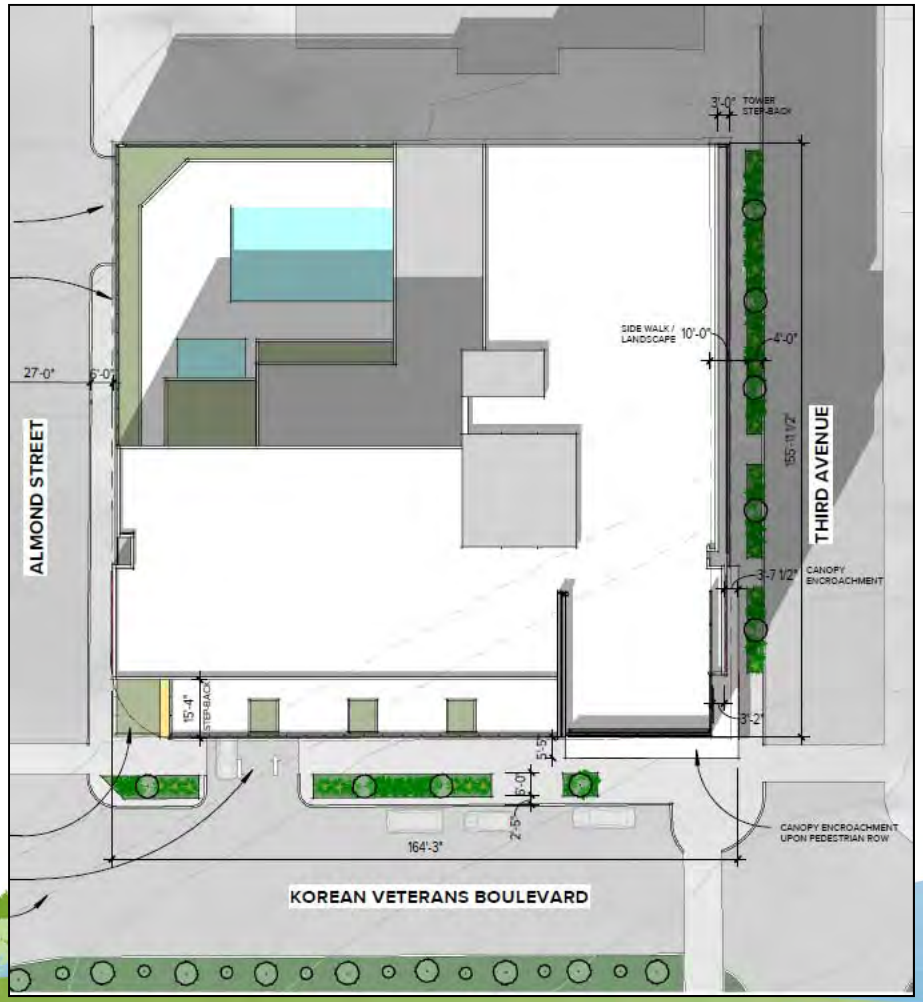
LID Manual – Waivers

Downtown

- What's down there?
- Downtown Code "is based on frontage design"
- Sidewalks & Alleys
- Cost?
  - $2.5 million bioretention area



LID Manual – Waivers

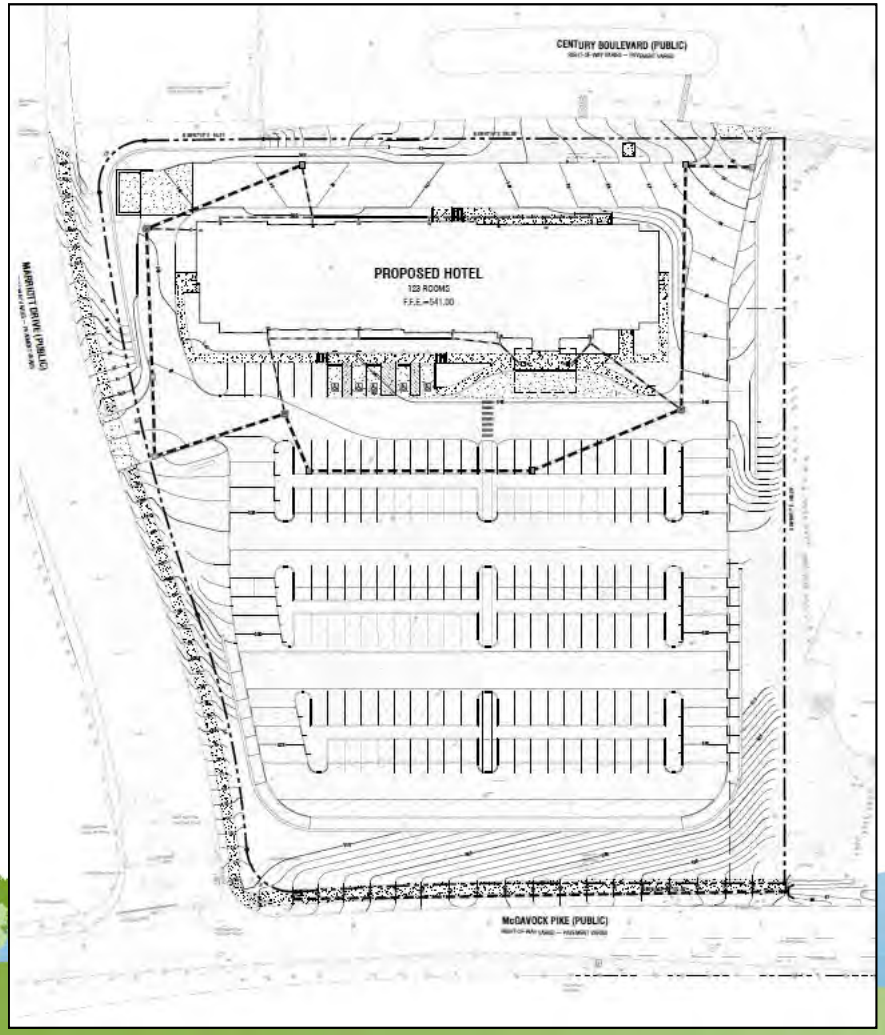


Downtown Hotels

- Building w/in few feet of property line
- Major & Collector Street Plan – sidewalks curb to building
- HVACs & pools on roof
- Underground parking
- Shallow bedrock
- High groundwater table

APPROVED

LID Manual – Waivers



Application

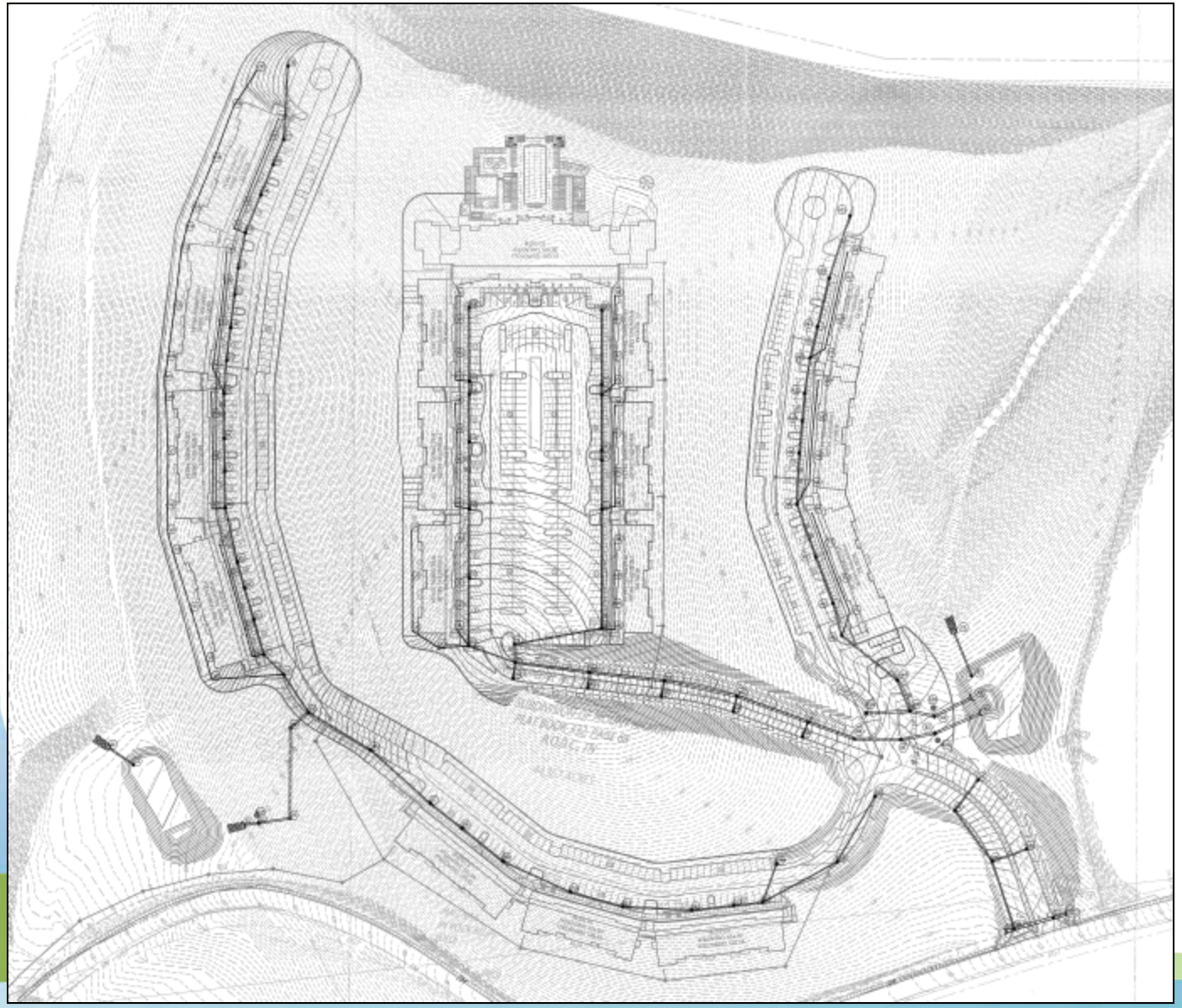
- Limited infiltration
- Tall retaining walls
- Shallow clay over bedrock
- Green roof maintenance

Review

- Bioretention? Permeable pave?
- Did not provide adequate technical rationale

DENIED

LID Manual – Waivers



LID Manual – Waivers

PROJECT: **Beach at Cabot**
7342 Cabot Drive - Nashville, Tennessee
S&ME Project No. 1247-15-080

TEST PIT LOG RW1 TP-12

DATE STARTED: **10/15/15**	ELEVATION: **464.0 ft**	NOTES: **Pocket Penetrometer (PP) readings in tons per square foot (tsf).**
EQUIPMENT: **Caterpillar 315 Trackhoe**	TEST PIT DEPTH: **0.9 ft**	**1. Limestone Shelving**
OPERATOR: **Kemper Construction**	WATER LEVEL: **Dry' ATD**	**2. Exposed rock with negligible soil cover**
HAMMER TYPE: **N/A**	LOGGED BY: **S. Jackson Brown**	NORTHING: **656171.186** EASTING: **1702702.681**

SAMPLING METHOD: **Grab**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	DYNAMIC CONE PENETRATION RESISTANCE (blows/1.75 in.) 0 5 10 15 20
0		**TOPSOIL** - 3 inches		464.0	
0.3		**RESIDUUM: LEAN CLAY (CL)** - stiff, brown, with limestone boulders, moist			
		Test pit refusal at 0.9 feet			

PHOTO DESCRIPTION:

PROJECT: **Beach at Cabot**
7342 Cabot Drive - Nashville, Tennessee
S&ME Project No. 1247-15-080

BORING LOG RW1 B-11

CLIENT: **Southeast Ventures**	ELEVATION: **463.0 ft**	NOTES: Pocket Penetrometer (PP) readings in tons per square foot (tsf).
DATE DRILLED: **11/1/15 - 11/1/15**	BORING DEPTH: **10.5 ft**	1) Limestone Outcrop Area
DRILL RIG: **Diedrich D-50**	WATER LEVEL: **Dry' ATD**	
DRILLER: **S&ME, Inc.**	CAVE-IN DEPTH: **Not measured**	
HAMMER TYPE:	LOGGED BY: **S. Jackson Brown**	

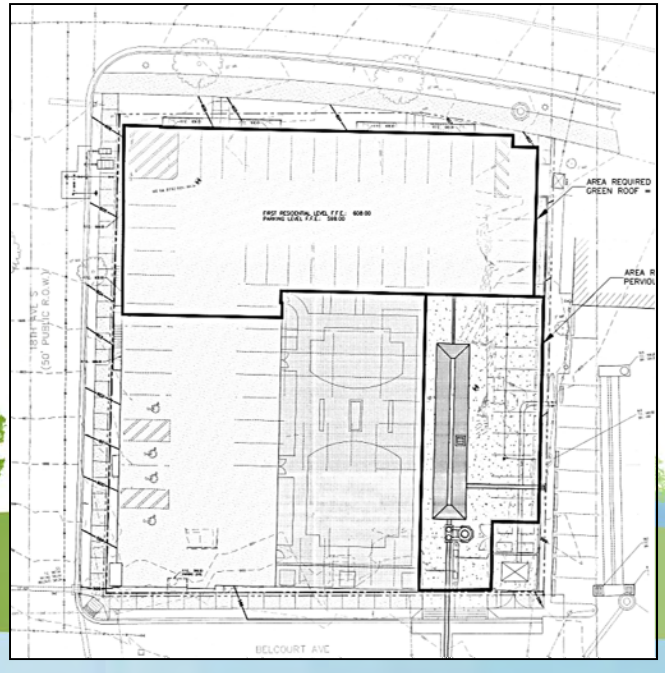
SAMPLING METHOD: **Rock Core**
DRILLING METHOD:

DEPTH (feet)	ELEV. (')	GRAPHIC LOG	MATERIAL DESCRIPTION	TESTS	SAMPLE DATA	BLOWS	STANDARD PENETRATION TEST DATA (blows/ft) 10 20 30 60 80
			TOPSOIL - 5 inches				
			Refusal at 0.5 feet; Start NQ Coring				
	460		**LIMESTONE** - hard, light to medium gray, coarse grained, medium bedded, with shale laminae, and brown-stained weathering		1 Rec = 82% RQD = 42%		
5			- - - Clay seams at 0.7 to 1.1 feet, 5.6 to 5.9 feet, 6.5 to 6.7 feet, and 7.2 to 7.6 feet				
	455				2 Rec = 94% RQD = 71%		
10			Boring terminated at 10.5 feet		3 Rec = 100% RQD = 100%		

LID Manual – Waivers

Site Limitations

- Can't be solely $$$
- Road widening
- Shallow clay over bedrock



DESCRIPTION

Option #1: Low Impact Development (LID) for stormwater detention.

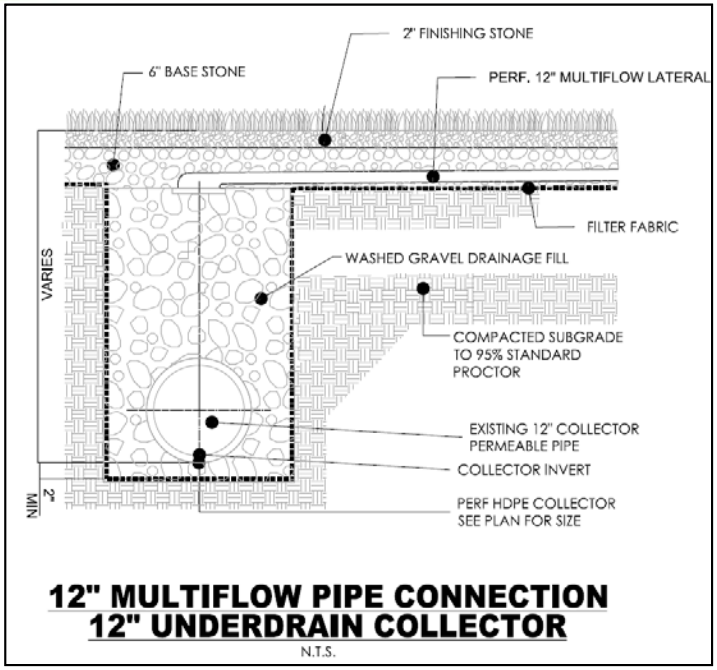
Description		Qty	Unit	Unit Cost	Cost
STORMWATER AS DESIGNED					$0
Parking slab-on-grade	-	4,400	sf	$5.25	-$23,100
Water quality unit (AquaSwirl AS-5)	-	1	ea	$48,000.00	-$48,000
Underground detention (100 LF of 60" CMP)	-	1	LS	$70,000.00	-$70,000
					$0
					$0
LID STORMWATER SYSTEM					$0
Pervious pavers (Aqua Bric by Belgard)	+	4,400	sf	$15.75	$69,300
Green roof	+	9,600	sf	$34.20	$328,320
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0

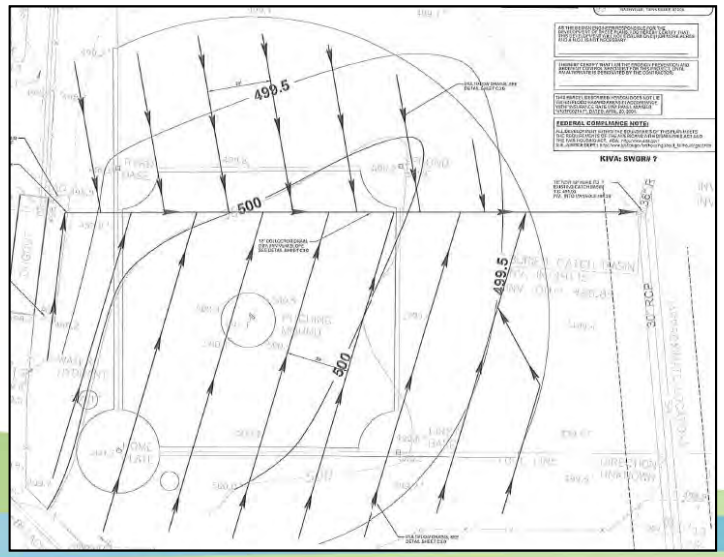
10/04/12 Subtotal $256,520

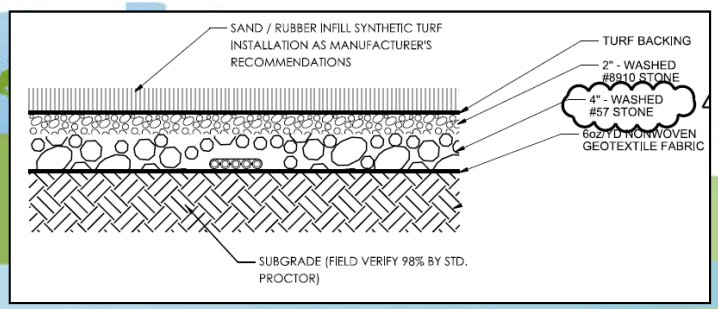
LID Manual – Waivers

Synthetic Turf

- Qualify for Waiver?
- Treat as pervious pavement?
  - Doesn't meet spec
  - Still require treatment
- Toxicity considerations
  - Aquatic
  - Human







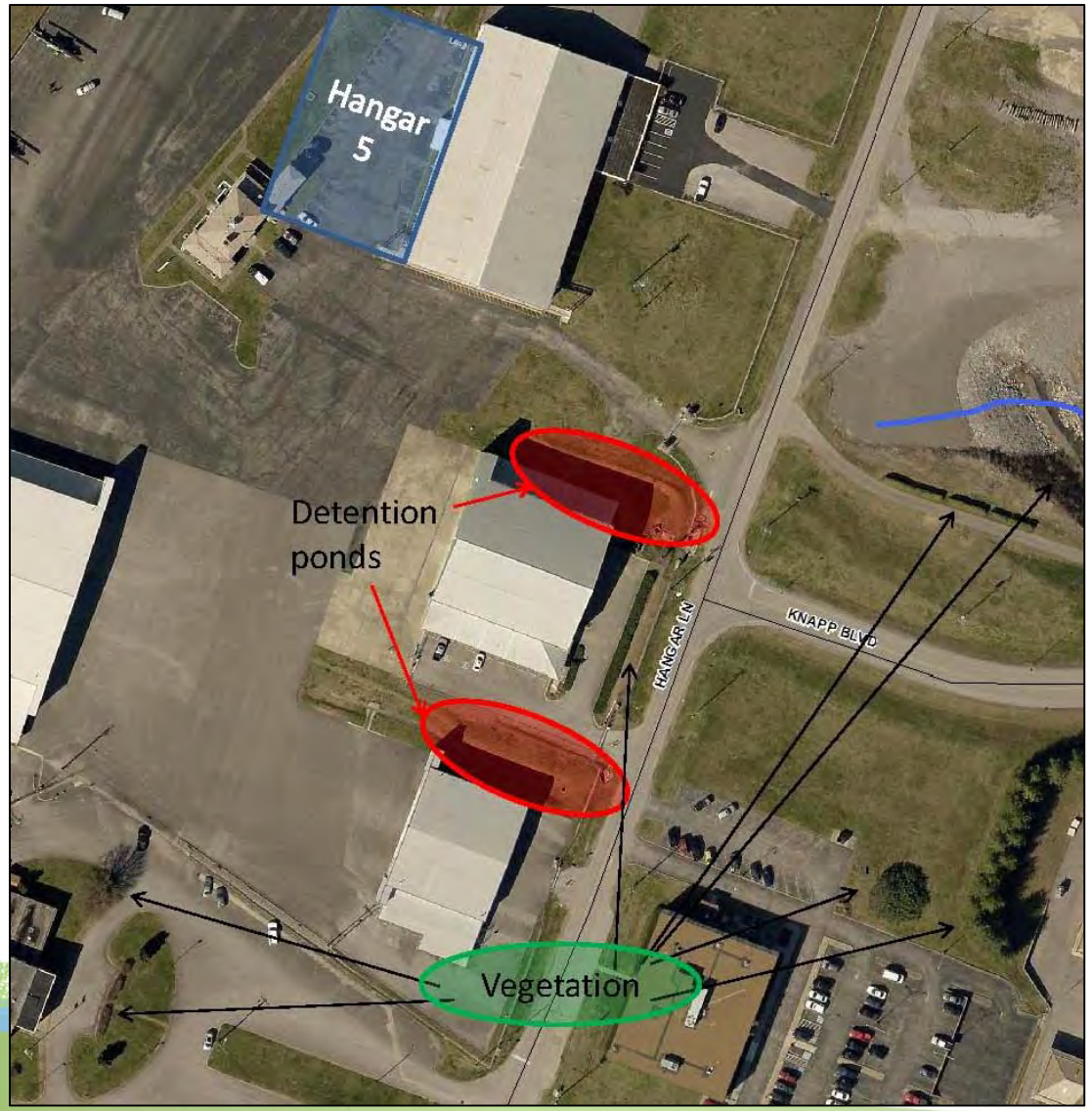
LID Manual – Waivers

Airport

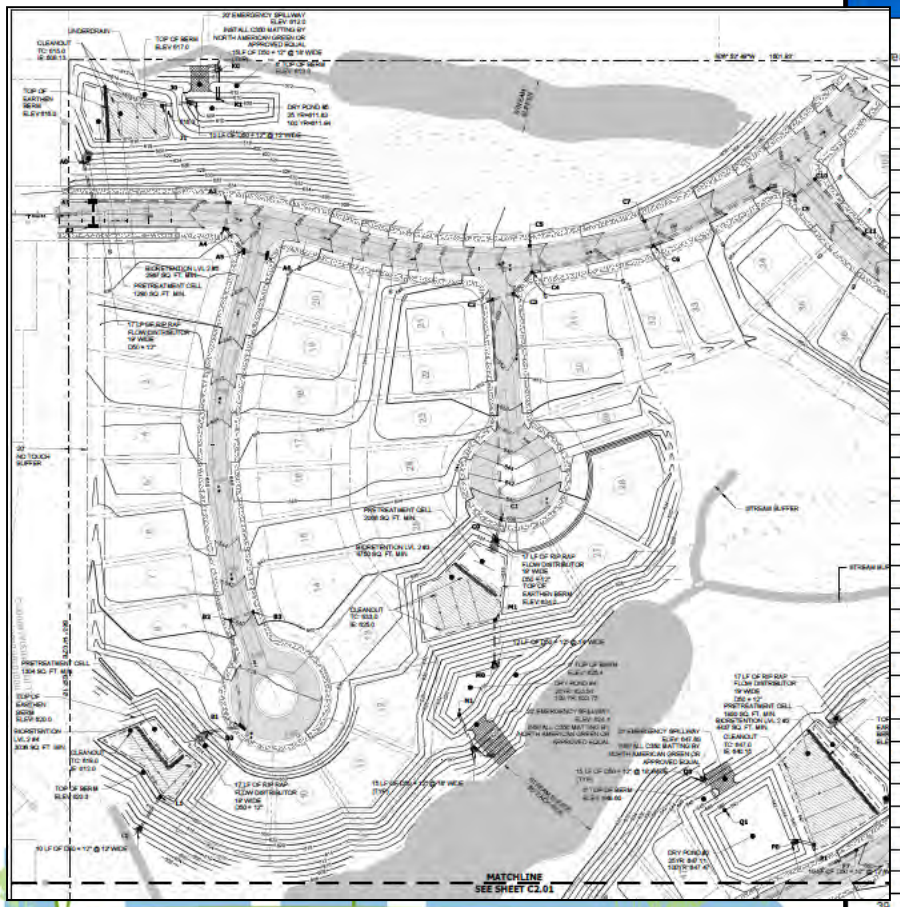
- Wildlife Attractants
  - Vegetation
  - Ponding water
- ATL Example
- Off-site mitigation

Other

- Unsuitable Fill
- Slope Stability



LID Manual – Waivers



Percent Volume Reduction-Based Calculations

	Step 1: Lay out the site and divide it into sub-areas each of a specific land use type and Rv.				Step 1a: Change any basic land use types through reforesting, permeable pavement or green roofs - or through use of open space for a GIP			Step 2: Treat impervious areas through the use of disconnection or sheet flow			Step 3: Treat primarily impervious areas with structural GIPs either in series with Step 3 intrinsic GIPs or alone downstream from Steps 1 and 2 land use		
	Step1 Basic Land Use				Step 1a Modified LU			Step 2 Intrinsic GIPs			Step 3 Structural GIPs		
ea	Description	Code	Acres	Base Rv	Code	Acres	Eff Rv1	Code	Trtmt VR1	Eff Rv2	Code	Trtmt VR2	Eff Rv3
	Hydrograph #8			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass/A Soils	TA	0.5	0.15	TA	0.5	0.15		0	0.15		0	0.15
	Lots Grass/C Soils	TC	0.45	0.20	TC	0.45	0.20		0	0.20		0	0.20
	Forest A	FA	1	0.02	FA	1	0.02		0	0.02		0	0.02
	Lots/Roads IA to A	IA	1.53	0.95	IA	1.53	0.95		0	0.95		0	0.95
				0.00		0	0.00		0	0.00		0	0.00
	Hydrograph #13			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass	TA	1.25	0.15	TA	1.25	0.15		0	0.15		0	0.15
	Lots Grass	TC	0.53	0.20	TC	0.53	0.20		0	0.20		0	0.20
	Lots/Roads IA	IA	1.07	0.95	IA	1.07	0.95		0	0.95		0	0.95
				0.00		0	0.00		0	0.00		0	0.00
	Hydrograph # 22			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass to #1	TC	1.69	0.20	TC	1.69	0.20		0	0.20	B2	0.8	0.04
	Lots/Roads IA to #1	IA	1.73	0.95	IA	1.73	0.95		0	0.95	B2	0.8	0.19
				0.00		0	0.00		0	0.00		0	0.00
	Hydrograph # 24			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass to #2	TA	2.15	0.15	TA	2.15	0.15		0	0.15	B2	0.8	0.03
	Lots Grass to #2	TC	0.79	0.20	TC	0.79	0.20		0	0.20	B2	0.8	0.04
	Lots/Roads IA to #2	IA	2.01	0.95	IA	2.01	0.95		0	0.95	B2	0.8	0.19
				0.00		0	0.00		0	0.00		0	0.00
	Hydrograph # 25			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass to #3	TA	1.5	0.15	TA	1.5	0.15		0	0.15	B2	0.8	0.03
	Lots Grass to #3	TC	1.93	0.20	TC	1.93	0.20		0	0.20	B2	0.8	0.04
	Lots/Roads IA to #3	IA	2.45	0.95	IA	2.45	0.95		0	0.95	B2	0.8	0.19
				0.00		0	0.00		0	0.00		0	0.00
	Hydrograph # 23			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass to #4	TC	1.83	0.20	TC	1.83	0.20		0	0.20	B2	0.8	0.04
	Lots/Roads IA to #4	IA	1.16	0.95	IA	1.16	0.95		0	0.95	B2	0.8	0.19
				0.00		0	0.00		0	0.00		0	0.00
	Hydrograph # 26			0.00		0	0.00		0	0.00		0	0.00
	Lots Grass to #5	TA	0.88	0.15	TA	0.88	0.15		0	0.15	B2	0.8	0.03
	Lots Grass to #5	TC	0.59	0.20	TC	0.59	0.20		0	0.20	B2	0.8	0.04
	Lots/Roads IA to #5	IA	1.22	0.95	IA	1.22	0.95		0	0.95	B2	0.8	0.19
	Hydro 5-7, 12, 17-18			0.00		0	0.00		0	0.00		0	0.00
	minus buffer areas			0.00		0	0.00		0	0.00		0	0.00
	Impervious Bypass	IA	2	0.95	IA	2	0.95		0	0.95		0	0.95
	Forest A Bypass	FA	5.06	0.02	FA	5.06	0.02		0	0.02		0	0.02
	Forest C Bypass	FC	11.93	0.04	FC	11.93	0.04		0	0.04		0	0.04
39	Turf A Bypass	TA	1.65	0.15	TA	1.65	0.15		0	0.15		0	0.15
40	Turf C Bypass	TC	7.12	0.20	TC	7.12	0.20		0	0.20		0	0.20
		Weighted Rv		0.320	Weighted Rv		0.320	Weighted Rv		0.320	Weighted Rv		0.169
		Total Area=	54.02	17.29	Total Area=	54.02	17.29			17.29			9.14
		% Removal		68.0%	% Removal		68.0%	% Removal		68.0%	% Removal		83.1%

83.1%

LID Manual – The Adventure Continues!

Future Considerations

- Increasing incentives
- Allow more drainage to pavers
  - Currently allow area equal to the size of pavers
- Increasing runoff reduction values
  - Pavers + green roof may not meet requirement
  - New Runoff Reduction Study
- Bioretention media – sand vs. plant health

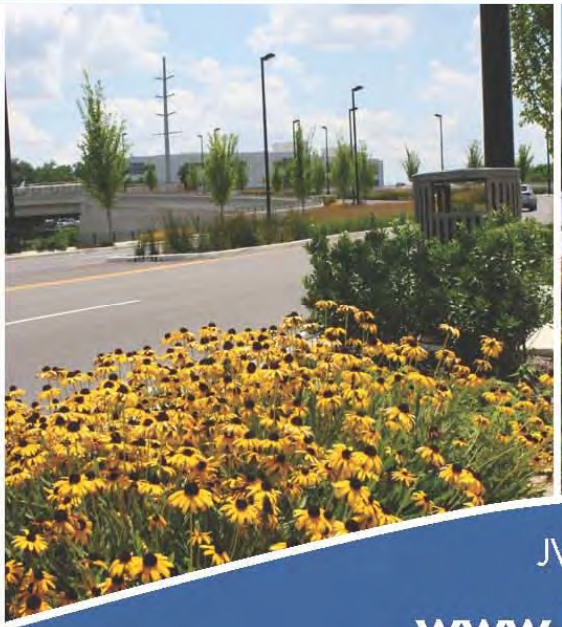
SAVE THE DATE

INTERNATIONAL LOW IMPACT DEVELOPMENT CONFERENCE 2018

Nashville, Tennessee | August 12-15

Key Dates

Abstracts Due: January 16, 2018
Notification to Authors: February 15, 2018
Final Papers Due: April 24, 2018
Pre-Conference Events Begin: August 12, 2018



JW Marriott Nashville

www.lidconference.org

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