Green Infrastructure Champions Program

This program is partially funded by the Rutgers New Jersey Agricultural Experiment Station, Geraldine R. Dodge Foundation, NJ Sea Grant Consortium, and William Penn Foundation and is a collaboration of the Rutgers Cooperative Extension Water Resources Program and the Green Infrastructure Subcommittee of Jersey Water Works.

RUTGERS
New Jersey Agricultural Experiment Station

JERSEY WATER WORKS
Smart infrastructure. Strong communities.

Please enter your full name and affiliation in the chat. This is how will take attendance.

GERALDINE R. DODGE FOUNDATION

Sea Grant
NJ Sea Grant Consortium

WILLIAM PENN FOUNDATION

Green Infrastructure Champion Training: Part 2

"Moving from planning to implementation of green infrastructure"

January 27, 2023
Virtual Class

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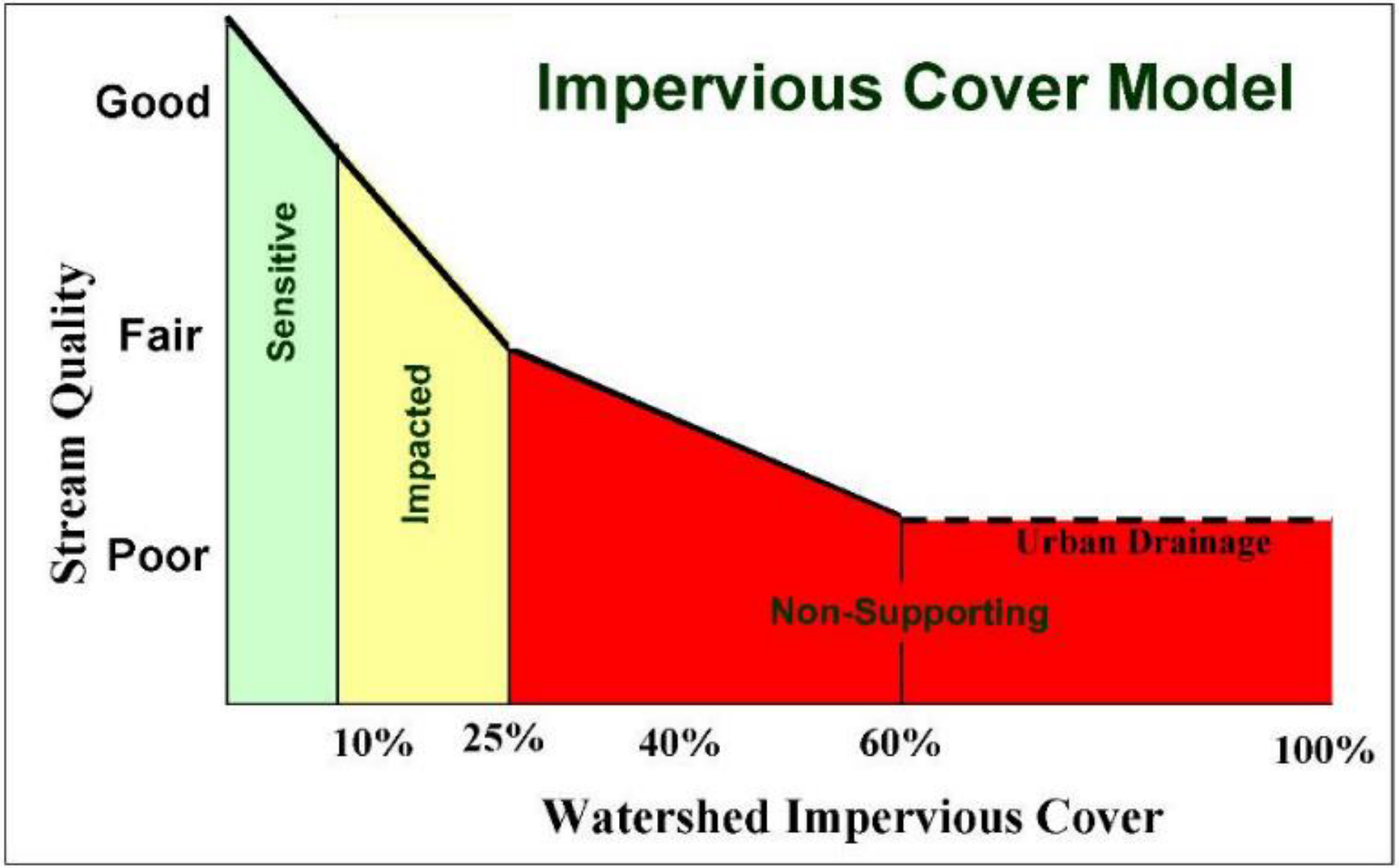
New Jersey Agricultural Experiment Station

Remember

It is all about controlling runoff from impervious surfaces

What does the science say about impervious surfaces?

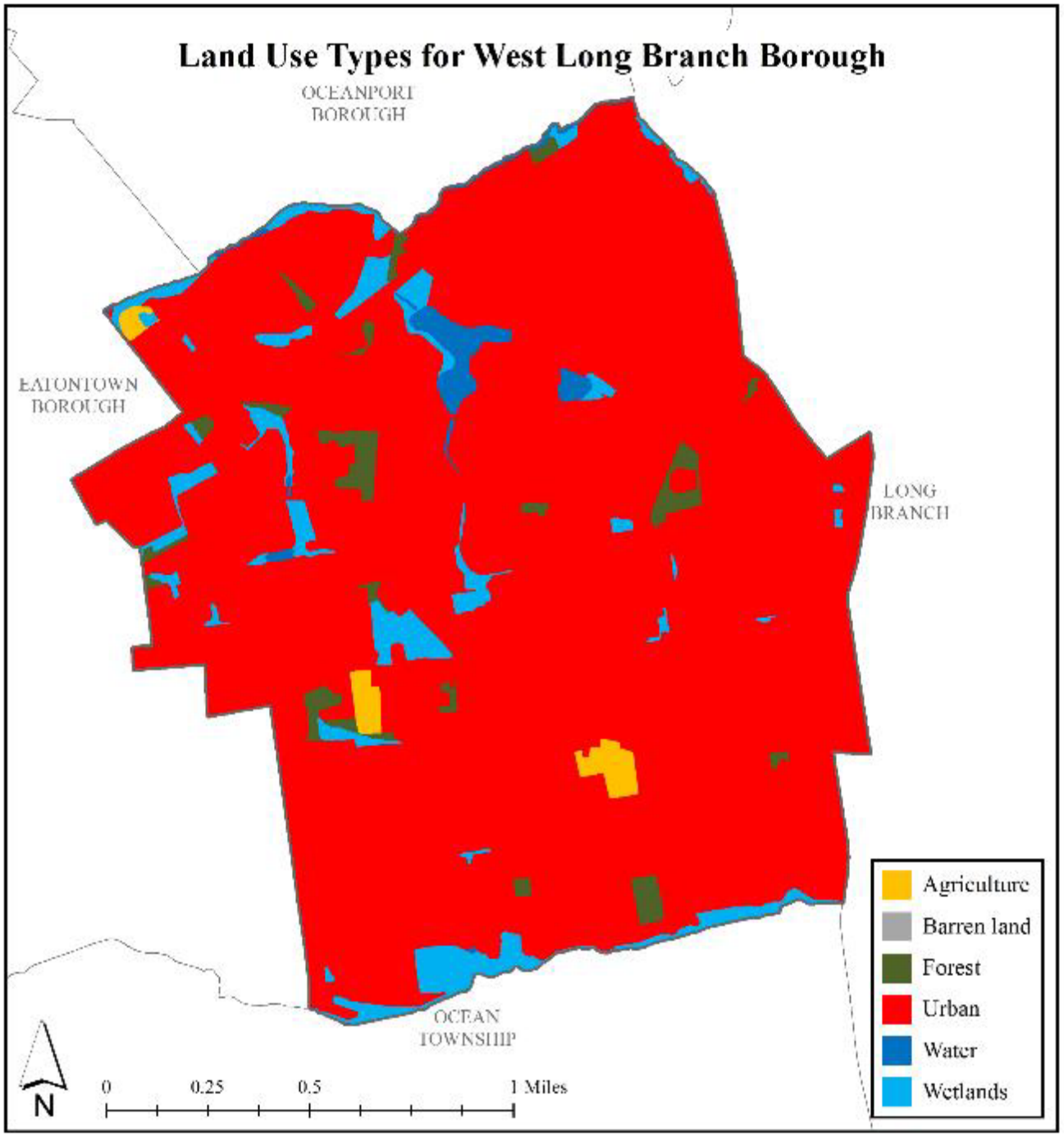


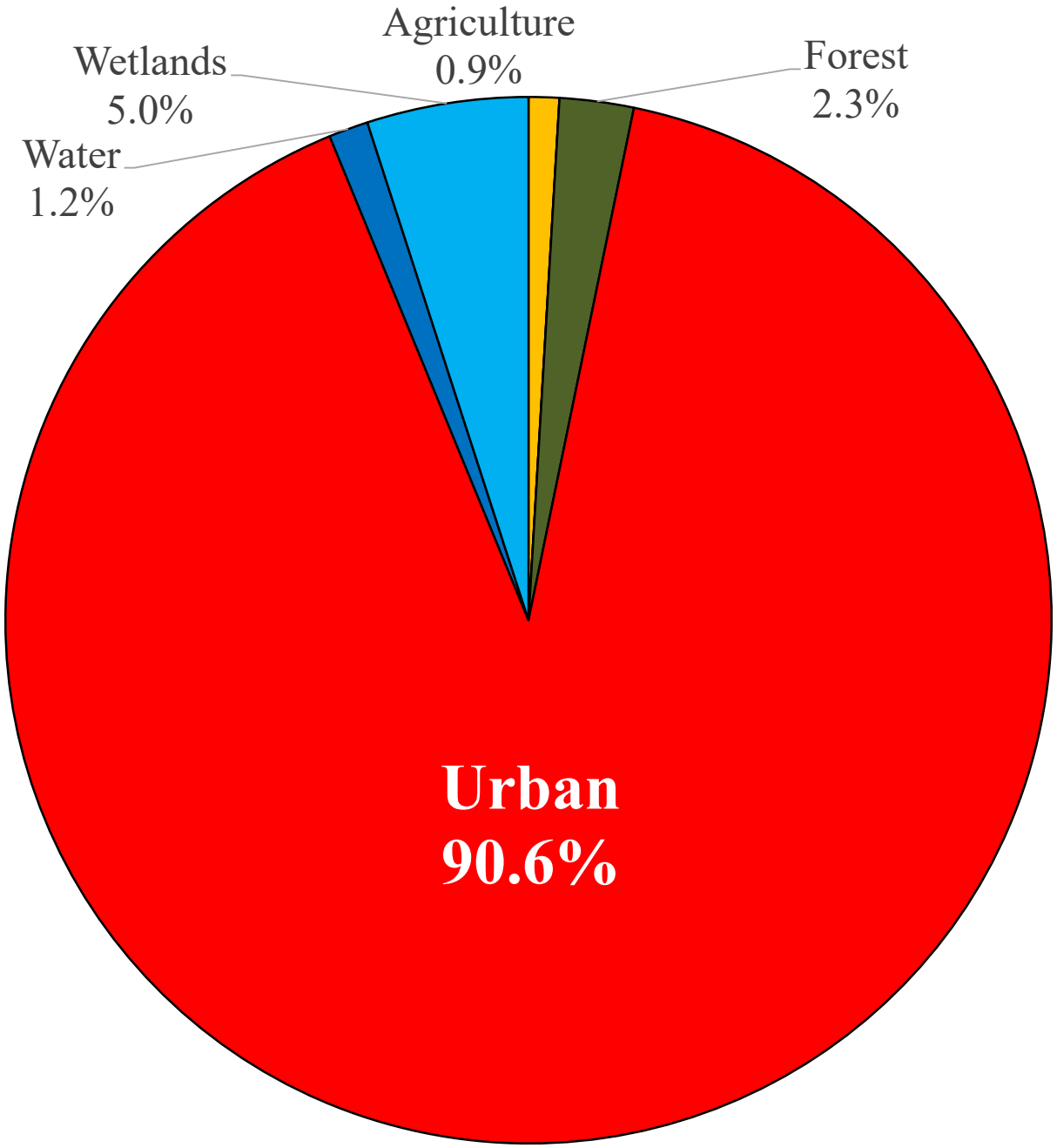
Reference: Tom Schueler and Lisa Fraley-McNeal, Symposium on Urbanization and Stream Ecology, May 23 and 24, 2008

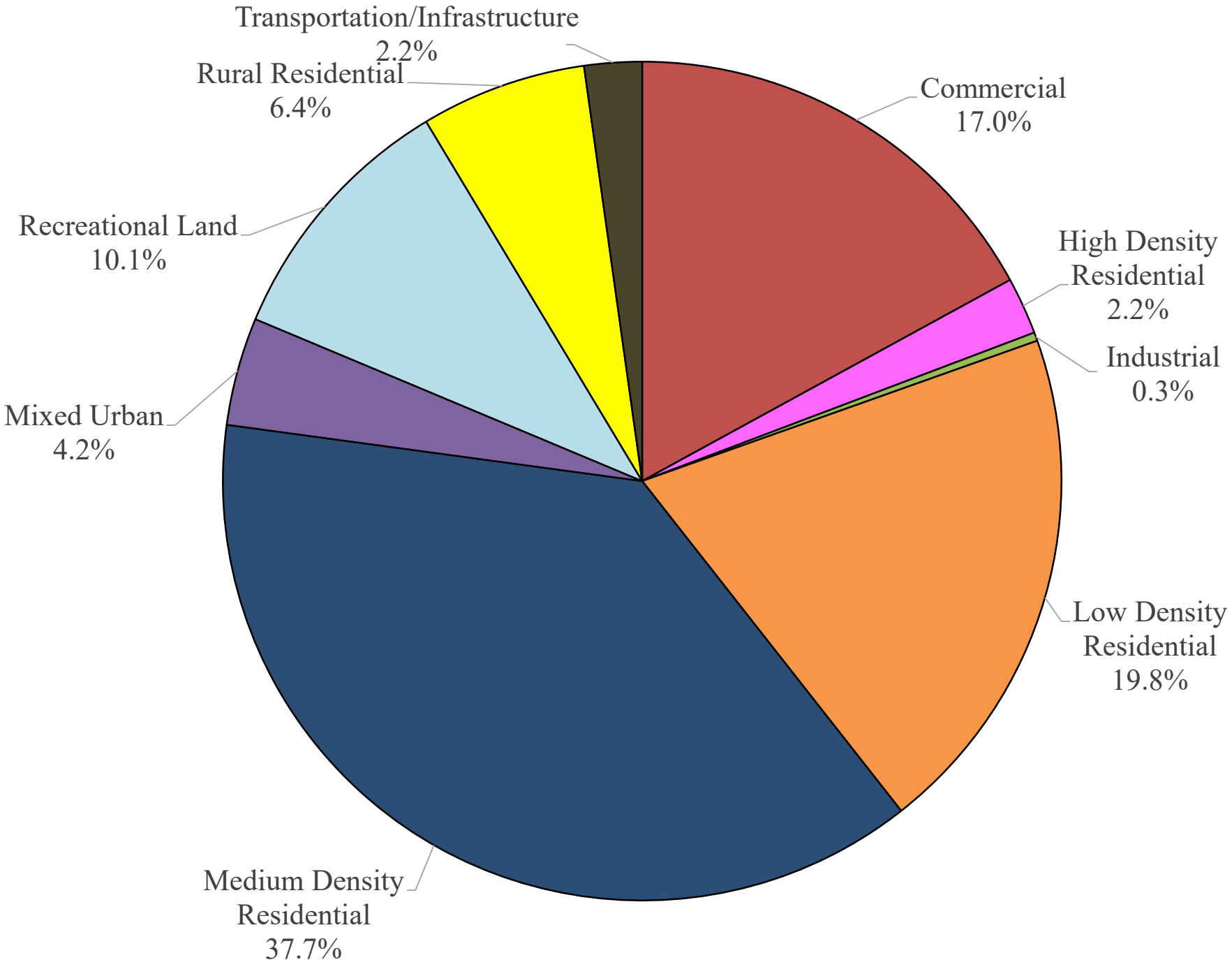
Impervious Cover Assessments (ICAs)

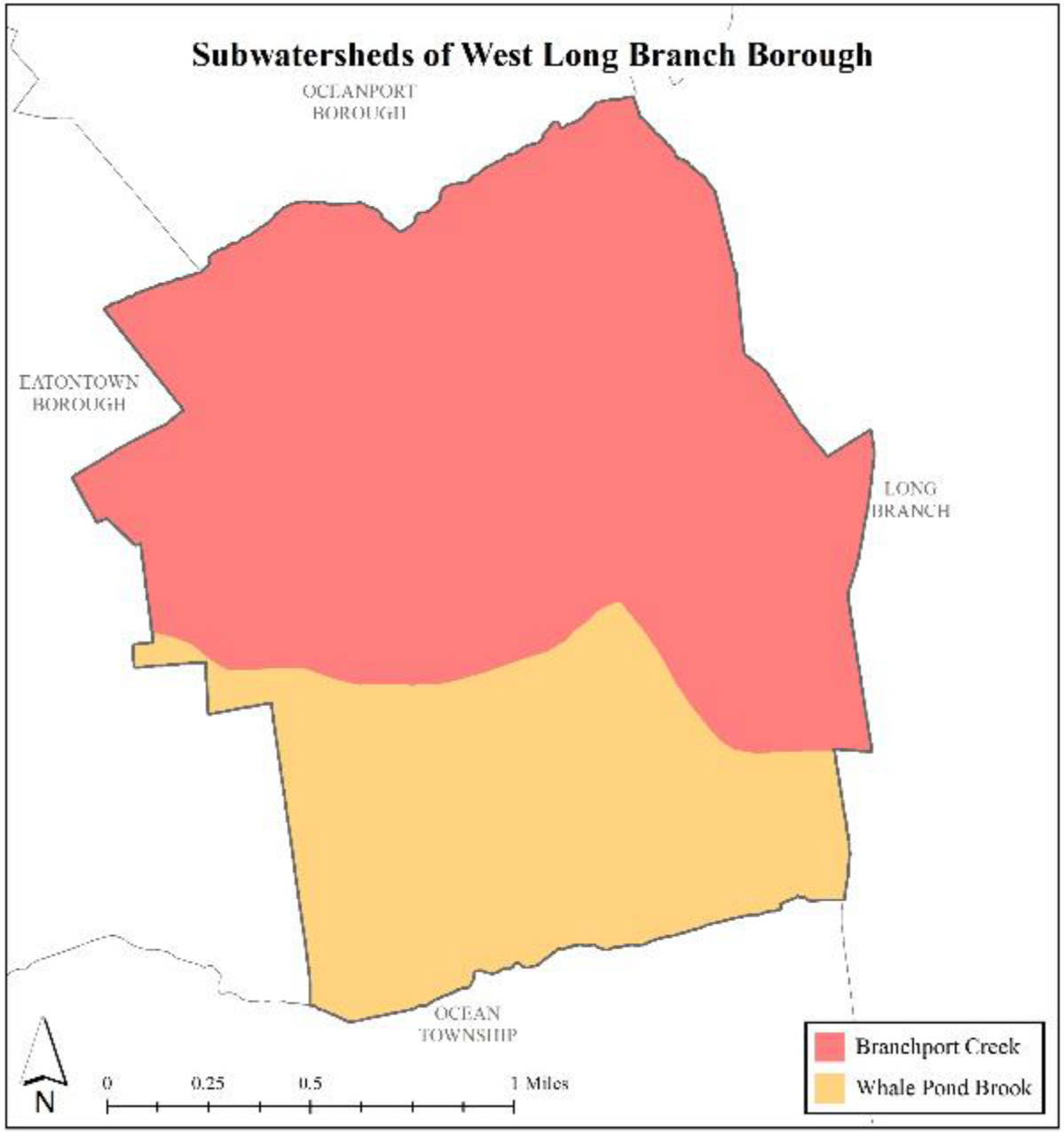
Impervious Cover Assessment

- Help the municipality understand the problem
- Analysis completed by watershed and by municipality
- Use 2015 land use data to determine impervious cover
- Calculate runoff volumes for water quality, 2-, 10- and 100-year design storm and annual rainfall
- Contains three concept designs


Land Use Types for West Long Branch Borough
OCEANPORT BOROUGH
EATONTOWN BOROUGH
LONG BRANCH
OCEAN TOWNSHIP
Agriculture
Barren land
Forest
Urban
Water
Wetlands
N
0
0.25
0.5
1 Miles


Agriculture
0.9%
Forest
2.3%
Wetlands
5.0%
Water
1.2%
Urban
90.6%


Transportation/Infrastructure
2.2%
Rural Residential
6.4%
Commercial
17.0%
Recreational Land
10.1%
High Density
Residential
2.2%
Industrial
0.3%
Mixed Urban
4.2%
Low Density
Residential
19.8%
Medium Density
Residential
37.7%


Subwatersheds of West Long Branch Borough
OCEANPORT BOROUGH
EATONTOWN BOROUGH
LONG BRANCH
OCEAN TOWNSHIP
N
0
0.25
0.5
1 Miles
Branchport Creek
Whale Pond Brook

Watershed	Total Area (ac)	Impervious Cover (ac)	%
Branchport Creek	1,258	436	35.3%
Whale Pond Brook	596	156	26.2%
Total	1,854	592	32.3%

Subwatershed	NJ Water Quality Storm (MGal)	Annual Rainfall of 44″ (MGal)	2-Year Design Storm (3.3″) (MGal)	10-Year Design Storm (5.0″) (MGal)	100-Year Design Storm (8.2″) (MGal)
Branchport Creek	15	521	40	62	105
Whale Pond Brook	5	186	14	22	38
Total	20	707	55	84	143

WE LOOK HERE FIRST:

- ✓Schools
- ✓Houses of Worship
- ✓Libraries
- ✓Municipal Building
- ✓Public Works
- ✓Firehouses
- ✓Post Offices
- ✓Elks or Moose Lodge
- ✓Parks/ Recreational Fields

- 20 to 40 sites are entered into a PowerPoint
- Site visits are conducted

West Long Branch Borough
Impervious Cover Assessment

West Long Branch Community Center, 116 Locust Avenue

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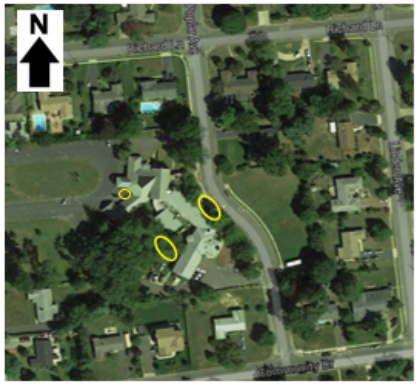
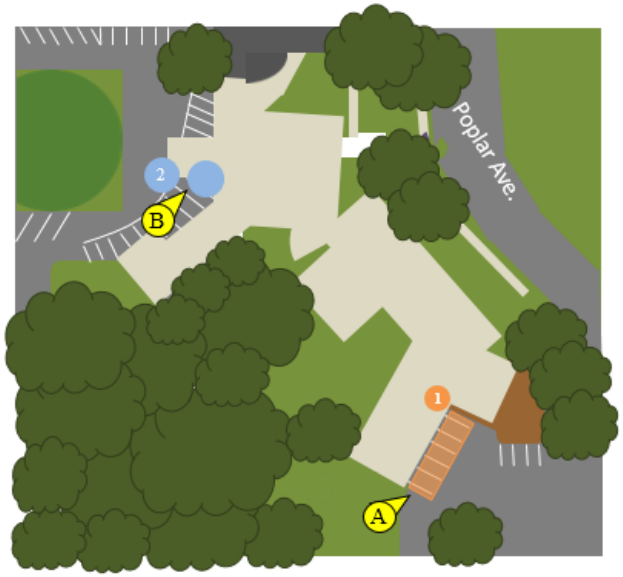
New Jersey Agricultural Experiment Station

PROJECT LOCATION:



SITE PLAN:

N



A

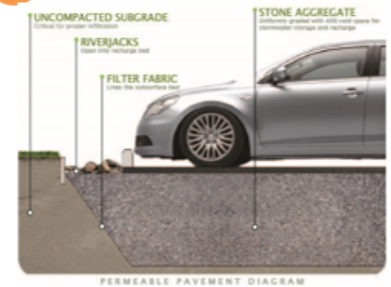
B

1. **BIORETENTION SYSTEMS:** Rain gardens will be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has multiple areas where downspouts can be disconnected, and rain gardens implemented.

2. **RAINWATER HARVESTING SYSTEM:** Rainwater can be harvested from the roof of the building and stored in a cistern. The water can be used for gardening and landscaping around the community center.

3. **EDUCATIONAL PROGRAM:** The RCE Water Resources Program, *Stormwater Management in Your Schoolyard*, can be delivered at West Long Branch Community Center to educate township residents about stormwater management and engage them in designing and building the bioretention systems.

1 PERVIOUS PAVEMENT



PERMEABLE PAVEMENT DIAGRAM

2 RAINWATER HARVESTING SYSTEM

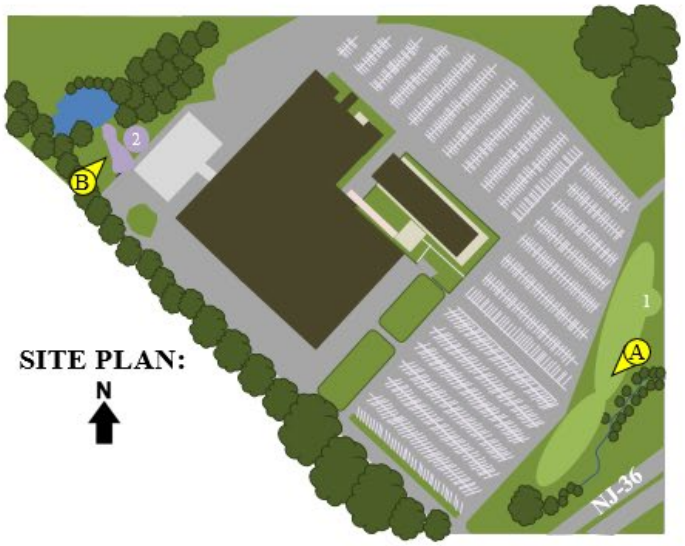
3 EDUCATIONAL PROGRAM

West Long Branch Borough
Impervious Cover Assessment

West Long Branch Home Security Alarm Systems, 185 NJ-36

RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:



A

B

1. **BIORETENTION SYSTEM:** A rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has a turf grass area where a rain garden can be built to catch runoff from the parking lot.
2. **BIOSWALE:** A bioswale is a vegetated system that conveys stormwater while removing sediment and nutrients. It can be installed in the eroded canal.

1 BIORETENTION SYSTEM

2 BIOSWALE

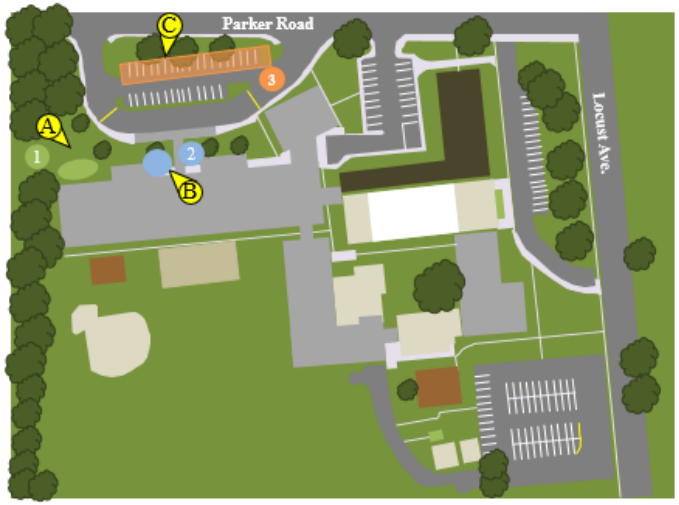
West Long Branch Borough
Impervious Cover Assessment
Betty McElmon Elementary School, 20 Parker Road

RUTGERS New Jersey Agricultural Experiment Station

PROJECT LOCATION:

SITE PLAN:

N

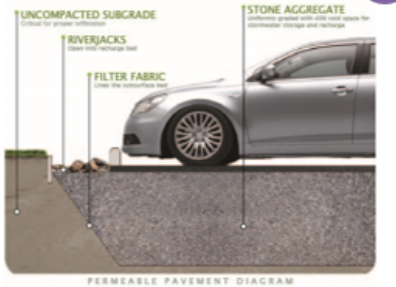


1. **BIORETENTION SYSTEM:** A rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has an area where downspouts can be disconnected, and a rain garden implemented.
2. **RAINWATER HARVESTING SYSTEM:** Rainwater can be harvested from the roof of the building and stored in a cistern. The water can be used for gardening and landscaping around the school.
3. **PERVIOUS PAVEMENT:** Portions of the northwest parking lot can be converted to pervious pavement. This can allow for infiltration of runoff from the parking lot.
4. **EDUCATIONAL PROGRAM:** The RCE Water Resources Program, *Stormwater Management in Your Schoolyard*, can be delivered at Betty McElmon Elementary School to educate the students about stormwater management and engage them in designing and building the bioretention systems.

1 BIORETENTION SYSTEM

2 RAINWATER HARVESTING SYSTEM

3 PERVIOUS PAVEMENT



4 EDUCATIONAL PROGRAM

Calculation Runoff Volumes from Impervious Surfaces

Storms to consider:

- NJ Water Quality Storm (WQS) = 1.25″ of rain over two hours
- 2-year design storm = 3.3″ of rain over 24 hours
- 10-year design storm = 5.1″ of rain over 24 hours
- 100-year design storm = 8.6″ of rain over 24 hours
- Total annual rainfall = 44″ to 46″ of rain per year

- *Design storms are different for every county in NJ*

The Formula

Drainage area in square feet x rainfall total in feet = volume of water in cubic feet

How much water runs off a 1,000 square-foot driveway (50’ x 20’) during the NJ Water Quality Storm?

Water Quality Storm is 1.25″ = 0.1 feet (ft) of rain

1,000 square feet (ft^2) x 0.1 ft = 100 cubic feet (ft^3)

7.48 gallons of water in one cubic foot (ft^3)

100 ft^3 = 748 gallons of water

How much runoff on an annual basis from the driveway?

Annual rainfall total is 45″ = 3.75 ft of rain

1,000 ft^2 x 3.75 ft = 3,750 ft^3

3,750 ft^3 x 7.48 gallons/ft^3 = 28,050 gallons

How big does a rain garden need to be to treat runoff from my driveway?

1,000 square-foot driveway for the NJ Water Quality Storm

1,000 ft^2 x 0.1 ft = 100 ft^3 of runoff

<u>Let's make the rain garden 6 inches deep</u>

100 ft^3 / 0.5 ft = 200 ft^2 or 20 ft x 10 ft x 6 inches

<u>Let's make the rain garden 3 inches deep</u>

100 ft^3 / 0.25 ft = 400 ft^2 or 20 ft x 20 ft x 3 inches

A good rule of thumb

A bioretention system (or rain garden) typically needs to be 1/5 the size of the drainage area. For example, 1000 ft^2 driveway needs a rain garden 200 ft^2 in size.

What about climate change?

- Let's overdesign to account for more intense storms
- Instead of 1.25″ we will use 1.50″ = 0.125 ft

Back to our example:

1,000 ft^2 x 0.125 ft = 125 ft^3 of runoff

<u>Let's make the rain garden 6 inches deep</u>

125 ft^3 / 0.5 ft = 250 ft^2 or 25 ft x 10 ft x 6 inches

<u>Let's make the rain garden 3 inches deep</u>

125 ft^3 / 0.25 ft = 500 ft^2 or 25 ft x 20 ft x 3 inches

We will learn how to design a rain garden in our Green Infrastructure Champions class on April 7 and more on climate change on May 19

Side note:

On December 5, 2022, NJDEP proposed new Stormwater Management Rules Flood Hazard Area Control Act Rules

2100 Projection

Future Precipitation Change Factors			
County	2-year Design Storm	10-year Design Storm	100-year Design Storm
Atlantic	1.22	1.24	1.39
Bergen	1.20	1.23	1.37
Burlington	1.17	1.18	1.32
Camden	1.18	1.22	1.39
Cape May	1.21	1.24	1.32
Cumberland	1.20	1.21	1.39
Essex	1.19	1.22	1.33
Gloucester	1.19	1.23	1.41
Hudson	1.19	1.19	1.23
Hunterdon	1.19	1.23	1.42
Mercer	1.16	1.17	1.36

Future Precipitation Change Factors			
County	2-year Design Storm	10-year Design Storm	100-year Design Storm
Middlesex	1.19	1.21	1.33
Monmouth	1.19	1.19	1.26
Morris	1.23	1.28	1.46
Ocean	1.18	1.19	1.24
Passaic	1.21	1.27	1.50
Salem	1.20	1.23	1.32
Somerset	1.19	1.24	1.48
Sussex	1.24	1.29	1.50
Union	1.20	1.23	1.35
Warren	1.20	1.25	1.37

2020 Projection

Current Precipitation Adjustment Factors			
County	2-year	10-year	100-year
Atlantic	1.01	1.02	1.03
Bergen	1.01	1.03	1.06
Burlington	0.99	1.01	1.04
Camden	1.03	1.04	1.05
Cape May	1.03	1.03	1.04
Cumberland	1.03	1.03	1.01
Essex	1.01	1.03	1.06
Gloucester	1.05	1.06	1.06
Hudson	1.03	1.05	1.09
Hunterdon	1.02	1.05	1.13
Mercer	1.01	1.02	1.04

Current Precipitation Adjustment Factors			
County	2-year	10-year	100-year
Middlesex	1.00	1.01	1.03
Monmouth	1.00	1.01	1.02
Morris	1.01	1.03	1.06
Ocean	1.00	1.01	1.03
Passaic	1.00	1.02	1.05
Salem	1.02	1.03	1.03
Somerset	1.00	1.03	1.09
Sussex	1.03	1.04	1.07
Union	1.01	1.03	1.06
Warren	1.02	1.07	1.15

100-Year Storm for Somerset County: 2020 Factor = 1.09, 2100 Factor = 1.48

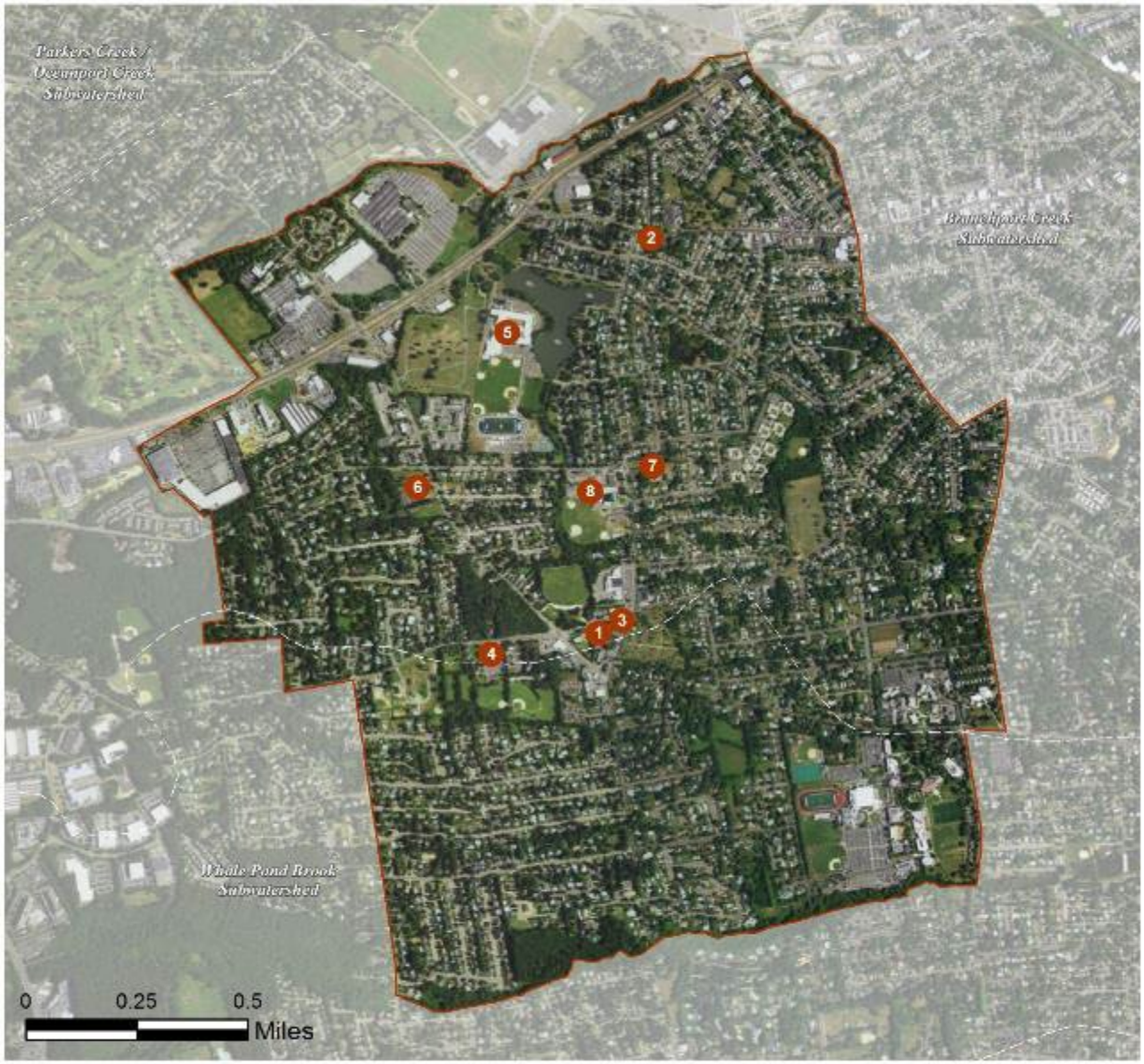
Current = 8.21” **2020 = 8.95”** **2100 = 12.15”**

Impervious Cover Reduction Action Plan (RAP)

Impervious Cover Reduction Action Plan

- A comprehensive document with many opportunities for green infrastructure
- A living document
- Shovel ready projects
- Projects for all ages (youth to seniors)
- Provides mitigation opportunities for developers
- Site level analysis

WEST LONG BRANCH BOROUGH: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE BRANCHPORT CREEK SUBWATERSHED:

1. Frank Antonides Elementary School
2. Lutheran Church Reformation
3. Old First United Methodist Church
4. Saint Jerome's Catholic Church and School
5. Shore Regional High School
6. Sovereign Bank
7. West Long Branch Community Center
8. West Long Branch Public School

FRANK ANTONIDES ELEMENTARY SCHOOL

Subwatershed: Branchport Creek

Site Area: 107,870 sq. ft.

Address: 198-208 Wall Street
West Long Branch, NJ 07764

Block and Lot: Block 20, Lot 13, 15

Parking spots can be replaced with pervious pavement to capture and infiltrate parking lot and roof runoff. A cistern can be installed adjacent to the building to harvest rainwater that can be used to conduct car wash fundraisers A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
56	60,568	2.9	30.6	278.1	0.047	1.66

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavements	0.238	40	18,057	0.49	2,340	$58,500
Rainwater harvesting systems	0.036	6	1,000	0.08	1,000 (gal)	$2,000

How to calculate existing loads for total phophorus (TP), total nitrogen (TN), and total suspended solids (TSS)?

Land Cover	Total Phosphorus (TP) load (lbs/acre/yr)	Total Nitrogen (TN) load (lbs/acre/yr)	Total Suspended Solids (TSS) load (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agriculture	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/ Transitional Area	0.5	5	60

Calculation

- Take the impervious cover in square feet and convert to acres (1 acre = 43,560 square feet)
- Multiple # of acres time loading coefficients

Back to our example:

60,568 square feet ÷ 43,560 square feet per acre = 1.39 acres

1.39 acres x 2.1 lb/acre/year of TP = 2.9 lbs/yr of TP

FRANK ANTONIDES ELEMENTARY SCHOOL

Subwatershed: Branchport Creek

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West Long Branch, NJ 07764

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Calculation

- Take the impervious cover in square feet and convert to acres (1 acre = 43,560 square feet)
- Multiple # of acres time loading coefficients

Back to our example:

60,568 square feet ÷ 0.1 ft of rain = 6,057 cubic feet of water

6,057 ft^3 of water x 7.48 gallons per cubic foot = 45,306 gallons

45,306/1,000,000 = 0.045 million gallons

FRANK ANTONIDES ELEMENTARY SCHOOL

Subwatershed: Branchport Creek

Site Area: 107,870 sq. ft.

Address: 198-208 Wall Street
West Long Branch, NJ 07764

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Pervious pavements	0.238	40	18,057	0.49	2,340	$58,500
Rainwater harvesting systems	0.036	6	1,000	0.08	1,000 (gal)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Frank Antonides Elementary School

- disconnected downspouts
- pervious pavements
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

West Long Branch Borough

RUTGERS
New Jersey Agricultural Experiment Station


1 Frank Antonides Elementary School


2 Lutheran Church Reformation

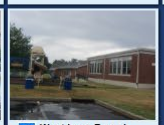

3 Old First United Methodist Church

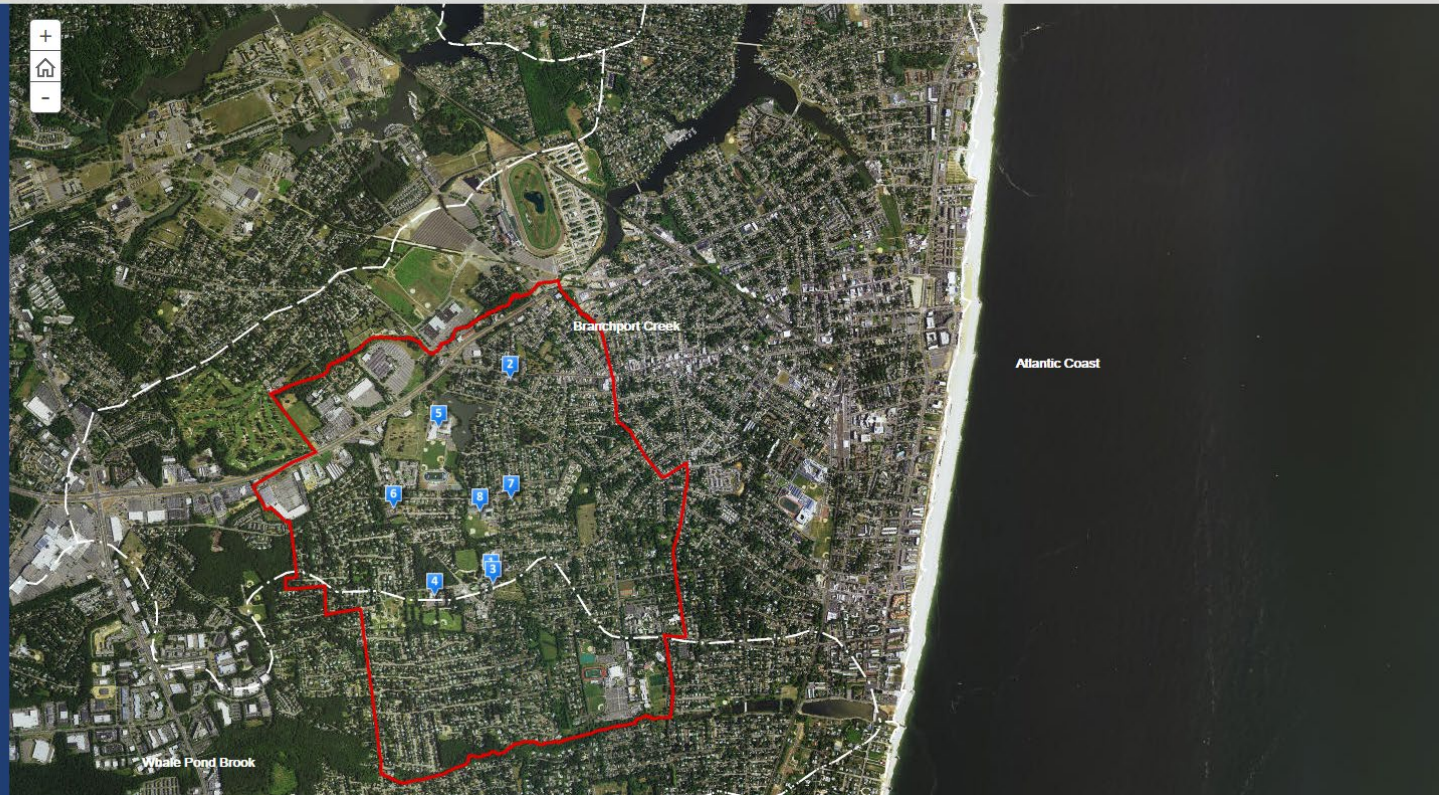

4 Saint Jerome's Catholic Church and School


5 Shore Regional High School


6 Sovereign Bank


7 West Long Branch Community Center


8 West Long Branch Public School



West Long Branch Borough

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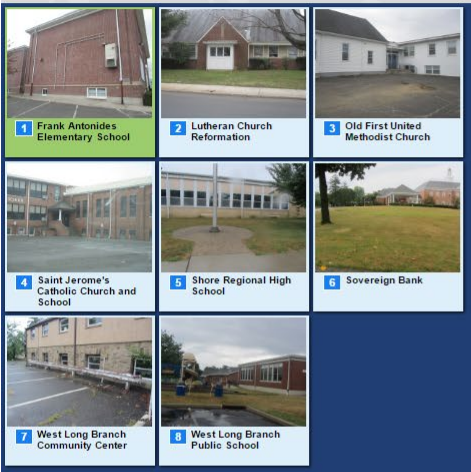
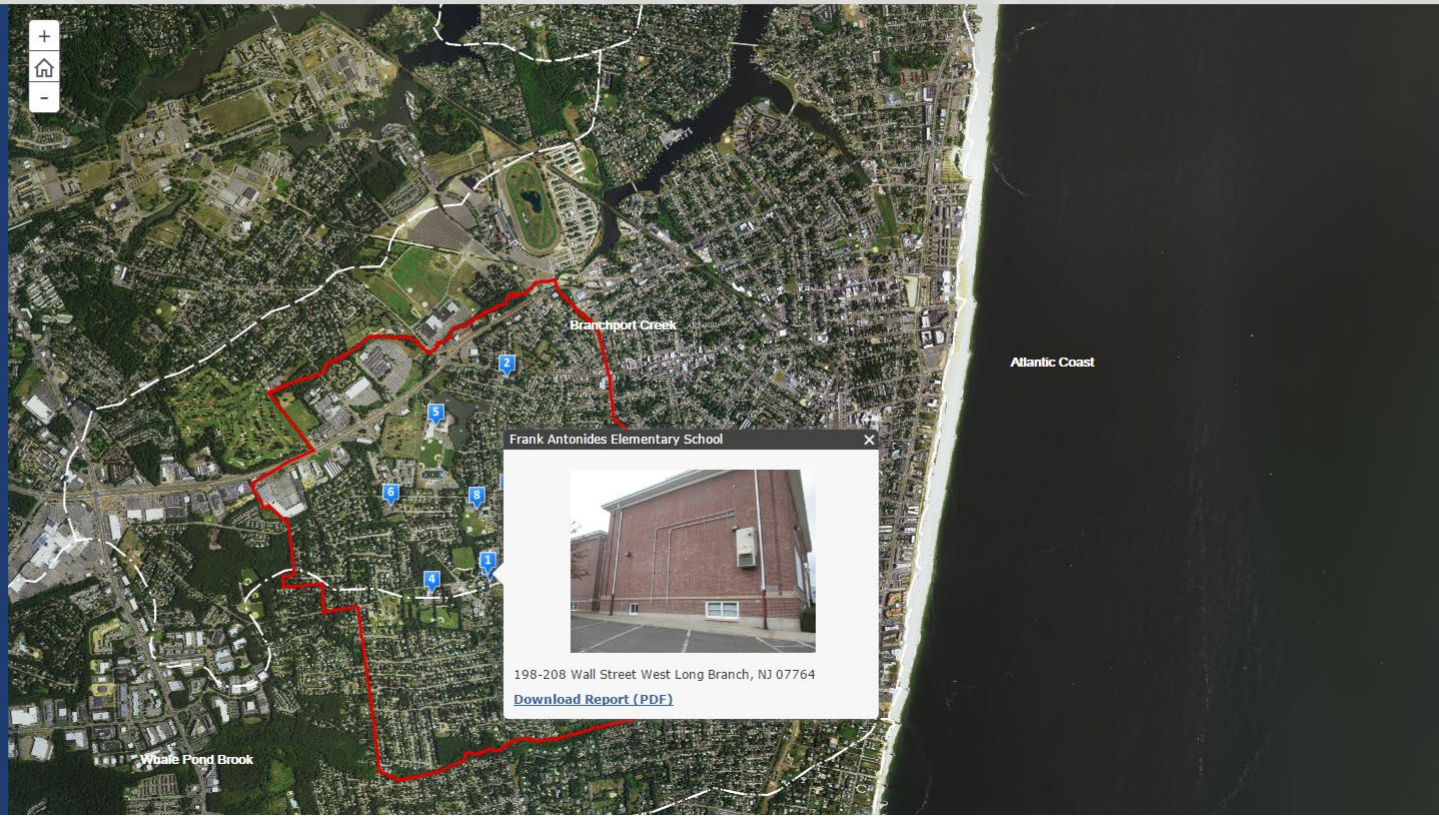
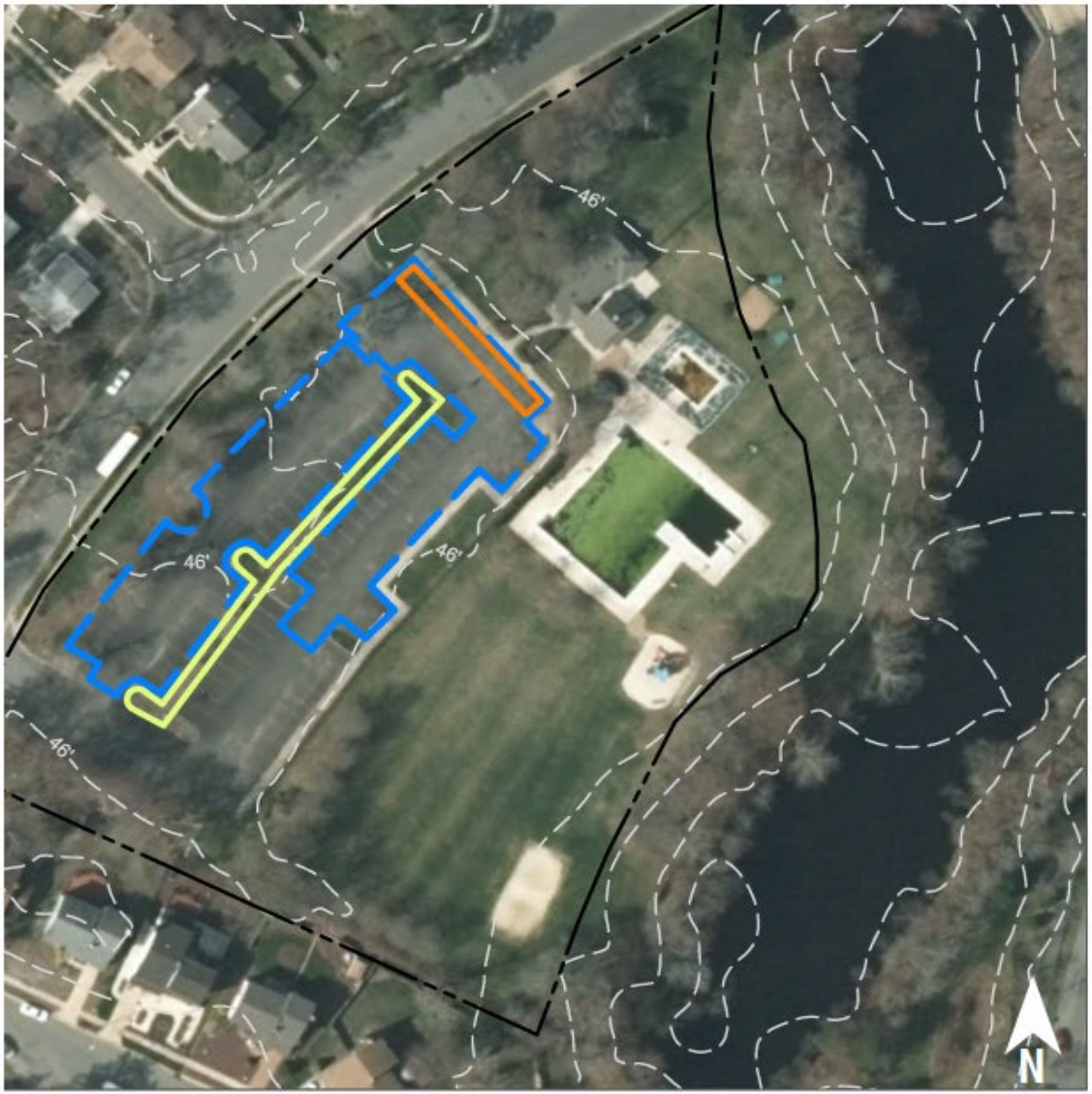




Green Infrastructure Feasibility Studies

Green Infrastructure Feasibility Study

- A high-end visual presentation of opportunities
- Provides green infrastructure overview
- Incorporates ICA and RAP information
- User-friendly format



bioretention system

pervious pavement

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 50' 100'

Stormwater is currently directed to an existing catch basin. Installing rain gardens in the parking lot islands can capture, treat, and infiltrate stormwater runoff from the parking lot. Replacing parking spaces with porous pavement can capture and infiltrate runoff from the other side of the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	From the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
30	51,770	2.5	26.1	237.7	0.040	1.42

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.288	48	21,834	0.82	2,765	$13,825
Pervious pavement	0.352	59	26,651	1.00	2,410	$60,250

CURRENT CONDITION

CONCEPT DESIGN

- Impervious Cover Assessment (ICA) = ICA (5 points)
- Impervious Cover Reduction Action Plan (RAP) = Green Infrastructure Action Plan (5 points)
- Green Infrastructure Feasibility Study = Green Infrastructure Strategic Plan (10 points)

GET YOUR SUSTAINABLE JERSEY POINTS !

Implement a Green Infrastructure Project

Funding Implementation

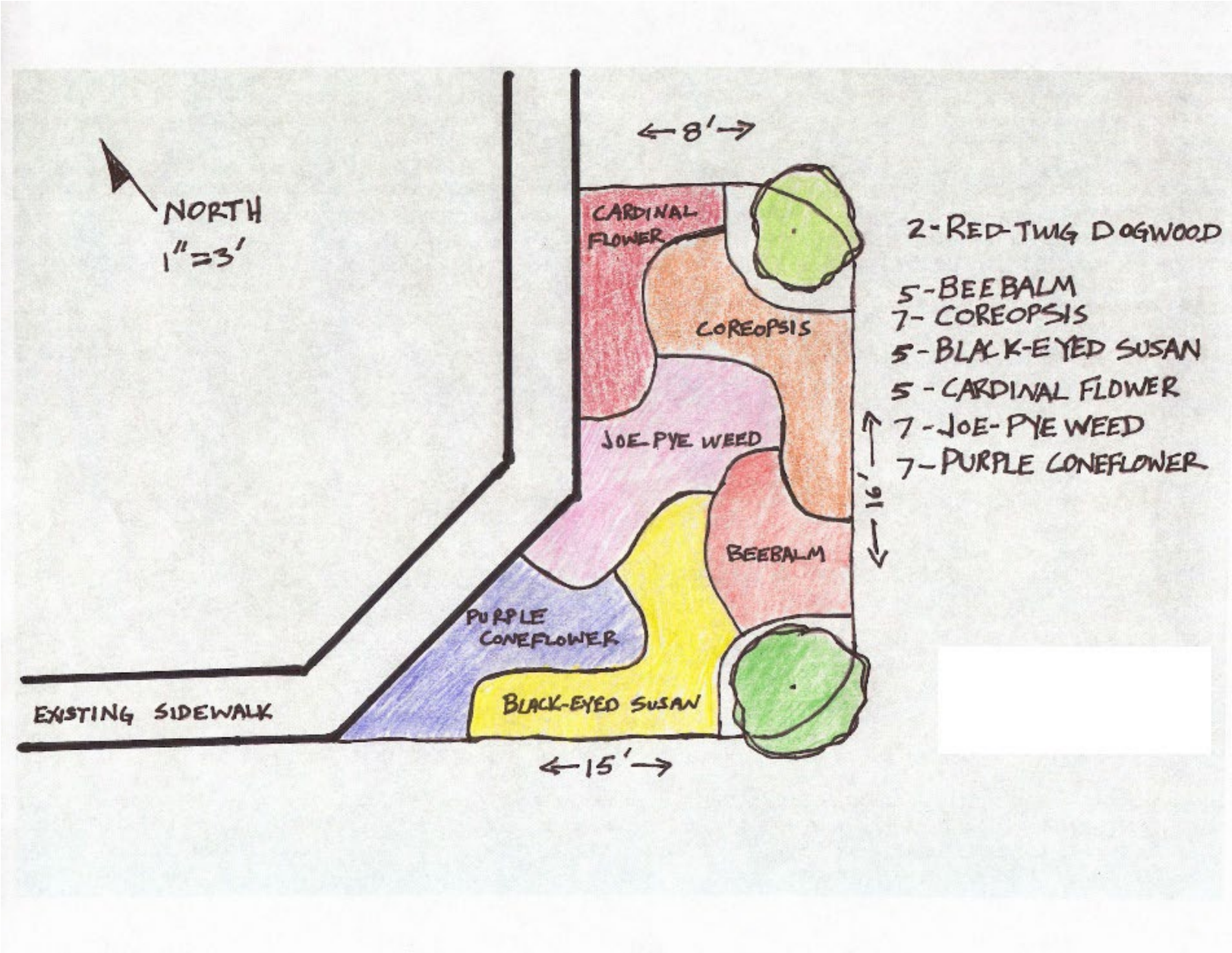
- Leverage existing projects
- Build partnerships
- Write grants

What do things cost?

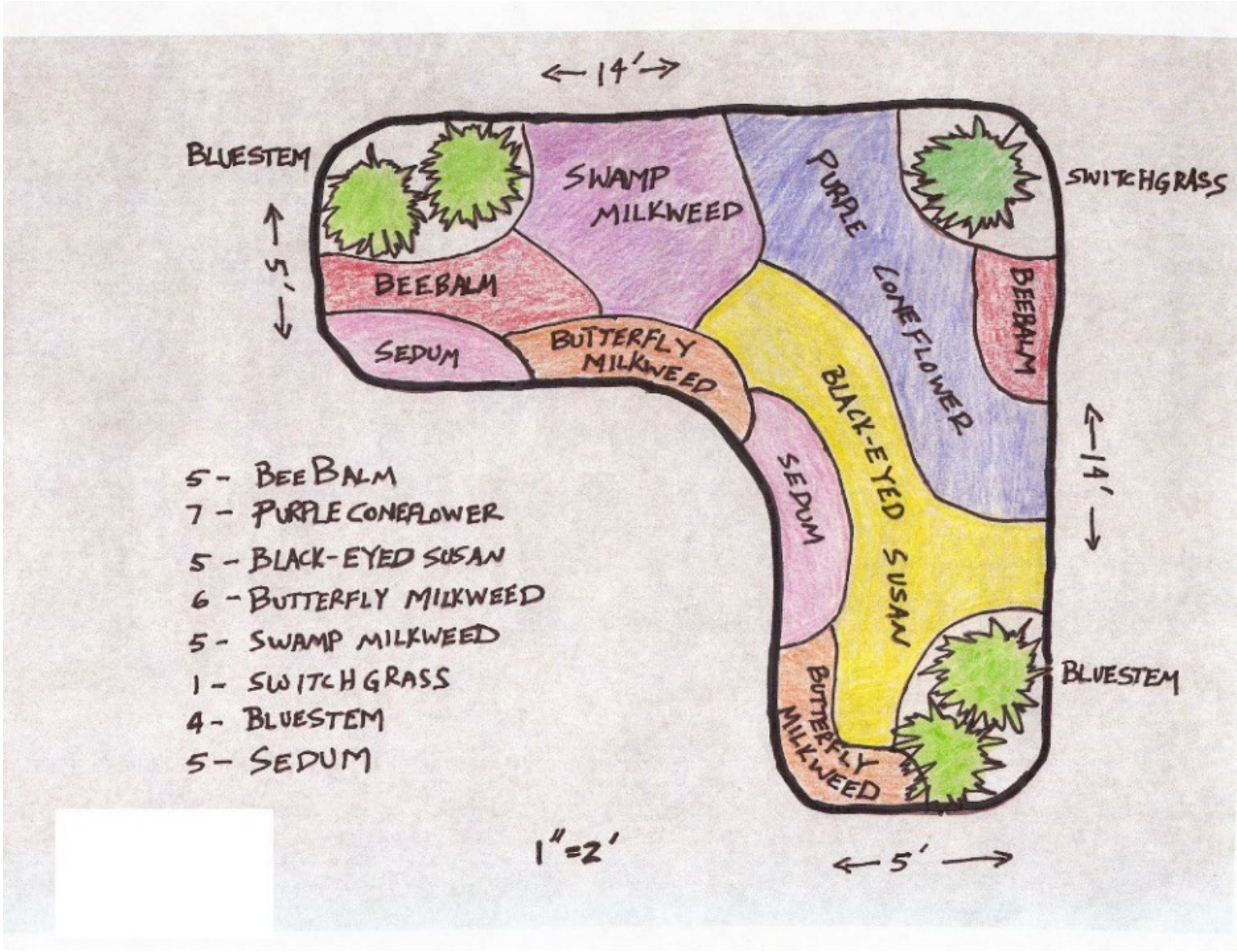
Design Costs

- What level of design is needed?
  1. Simple sketch
  2. Single sheet engineering drawing
  3. Full engineering drawing set (3 to 5 sheets)
  4. Construction specifications and bid documents
- Do you need a rendering?

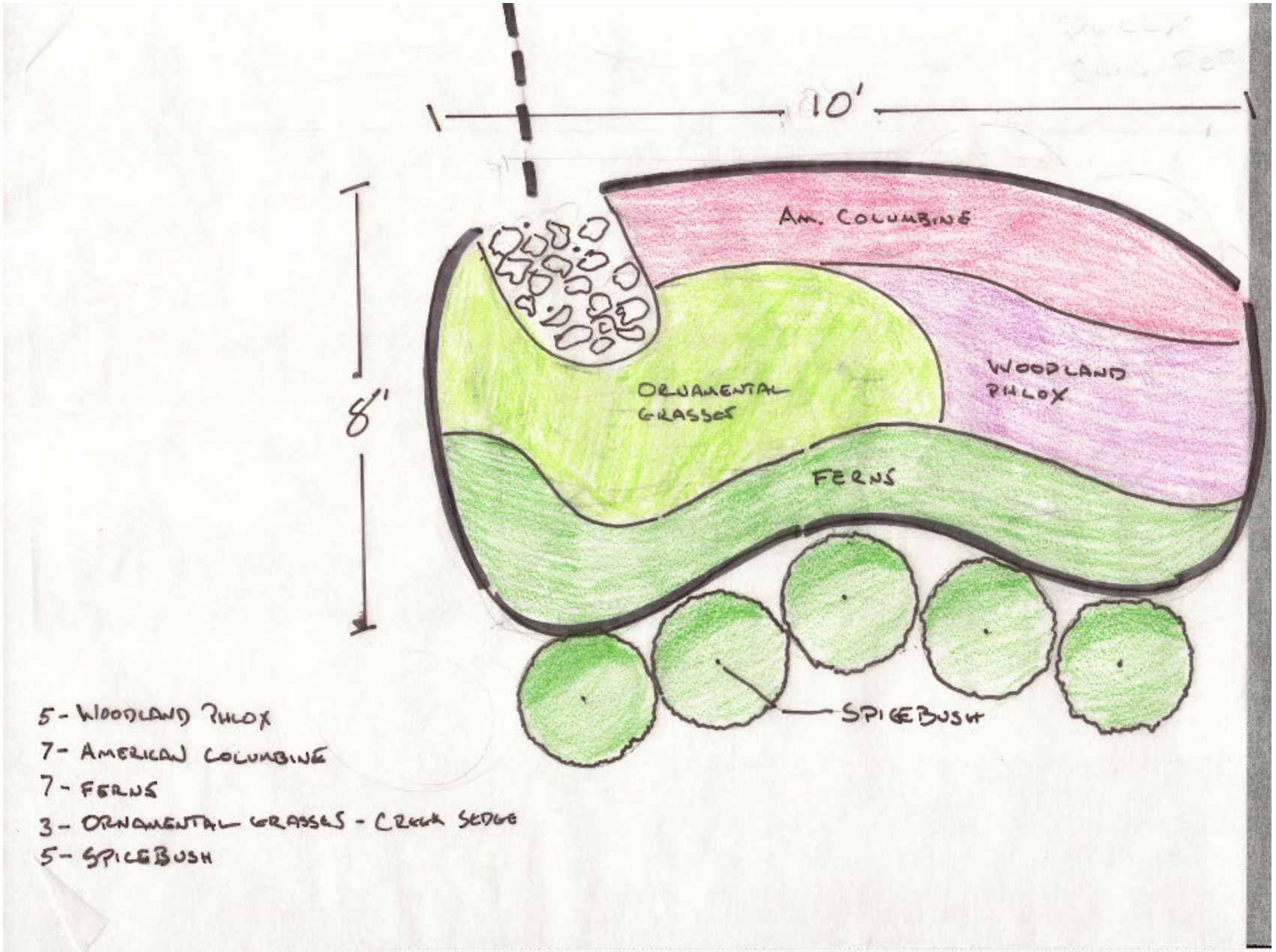
Simple Design



Simple Design

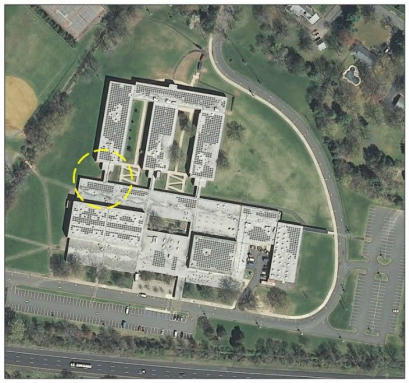


Simple Design

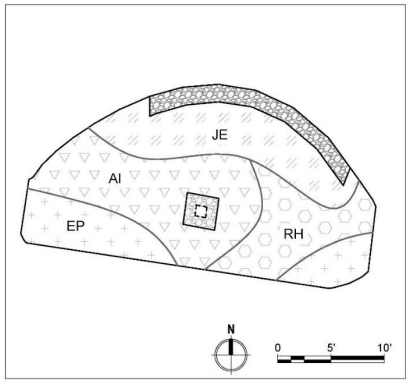


Single Sheet Engineering Drawing

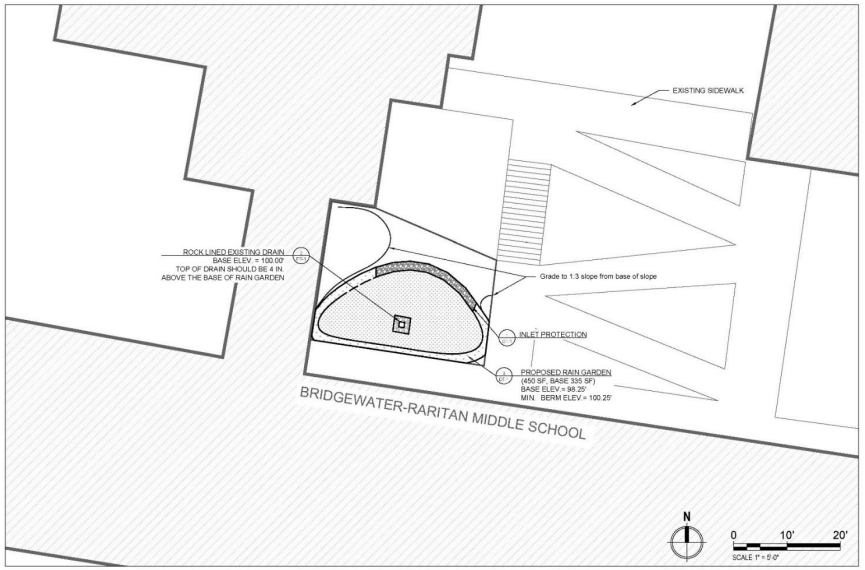
LOCATION MAP (N.T.S)



PLANTING PLAN (N.T.S)



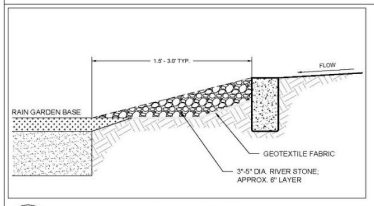
SITE PLAN



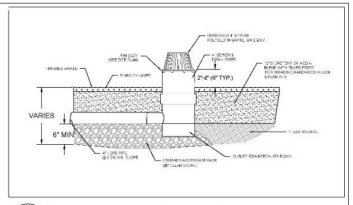
PLANTING SCHEDULE

PLANT SPECIES				QUANTITY	SIZE
TYPE	KEY	BOTANICAL NAME	COMMON NAME		
RAIN GARDEN					
PERENNIALS	**AI**	*Asclepias incarnata*	SWAMP MILKWEED	25	1 QUART
	EP	*Echinacea purpurea*	PURPLE CONEFLOWER	15	1 QUART
	JE	*Juncus effasus*	SOFT RUSH	20	1 QUART
	RH	*Rudbeckia hirta*	BLACKEYED SUSANS	15	1 QUART

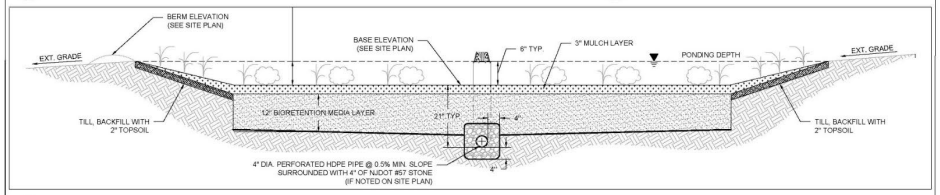
DETAILS



1 DT INLET PROTECTION CROSS-SECTION N.T.S.



2 DT ROCK-LINED OUTLET DETAIL N.T.S.



3 DT RAIN GARDEN CROSS SECTION N.T.S.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL INFORMATION PRIOR TO EXCAVATION INCLUDING ELEVATIONS AND LOCATIONS OF EXISTING UTILITIES.
2. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY IF ANY FIELD CONDITIONS DIFFER MATERIALLY FROM THOSE REPRESENTED ON THESE DRAWINGS AND THE SPECIFICATIONS OR IF, IN THE CONTRACTOR'S OPINION, SAID CONDITIONS CONFLICT WITH THE DESIGNS SHOWN HEREON.
3. THE ENGINEER SHALL INSPECT ALL PLANTING BED AREAS BEFORE MULCHING TO INSURE THAT ADEQUATE DRAINAGE EXISTS. IF ANY AREAS TO BE MULCHED SHOW EVIDENCE OF POOR DRAINAGE, THE CONTRACTOR SHALL TAKE CORRECTIVE ACTION.
4. THE CONTRACTOR SHALL AVOID DISTURBING ALL EXISTING TREES. ANY DISTURBANCE TO TREES OR TREE ROOTS MUST BE COORDINATED WITH THE PROPERTY OWNER.
5. DIMENSIONS AND SHAPE WILL VARY. REFER TO SITE PLAN.
6. RIVER STONE PROTECTION DIMENSIONS ARE TYPICAL AND MAY VARY PER SITE. CONSULT THE ENGINEER AND SITE PLAN FOR DIMENSIONS ON A PER SITE BASIS.
7. RIVER STONE PROTECTION SHALL SLOPE TO RAIN GARDEN BASE.
8. REFER TO SITE PLAN FOR ALL ELEVATIONS AND INVERTS.
9. THE CONTRACTOR SHALL EXCAVATE 12" LOWER THAN THE BASE ELEVATION SHOWN ON THE SITE PLANS. THE SLOPES OF THE RAIN GARDEN SHALL BE AT A 2:1 MINIMUM.
10. THE SUBGRADE OF THE RAIN GARDEN SHALL BE LEVEL TO ENSURE PROPER DRAINAGE. CONTRACTOR SHALL OBTAIN ENGINEER APPROVAL PRIOR TO BACKFILLING WITH 12" OF BIORETENTION MEDIA.
11. THE CONTRACTOR SHALL INSTALL OVERFLOW IF SPECIFIED IN SITE PLANS PRIOR TO BACKFILLING WITH BIORETENTION MEDIA.
12. THE BIORETENTION LAYER SHALL BE LEVEL TO ENSURE PROPER DRAINAGE. CONTRACTOR SHALL OBTAIN ENGINEER APPROVAL PRIOR TO SPREADING MULCH AND PLANTING.
13. INLET AND OUTLET PROTECTION SHALL BE UNDERLAIN WITH GEOTEXTILE FABRIC.
14. THE CONTRACTOR SHALL TILL THE BERM SECTION AND BACKFILL WITH TOPSOIL.
15. ALL DISTURBED AREAS EXCLUSIVE OF RAIN GARDEN AND SLOPED BERM SHALL BE RESTORED TO ORIGINAL CONDITIONS BY CONTRACTOR.
16. THE CONTRACTOR SHALL HAVE A PRE-CONSTRUCTION MEETING WITH THE PROJECT ENGINEER PRIOR TO ANY WORK ON SITE.
17. ALL ELEVATIONS ARE RELATIVE TO ASSUMED DATUM DRIVEWAY EDGE OF PAVEMENT (100.00').

SPECIFICATIONS:

1. THE APPROVAL OF MATERIALS AND MIXING OF SAND, COMPOST, AND SOIL SHALL BE DONE UNDER THE SUPERVISION OF THE PROJECT ENGINEER/LANDSCAPE ARCHITECT. BIORETENTION MEDIA SHALL CONSIST OF 70% SAND AND 30% COMPOST MIXTURE.
2. SAND SHALL AT THE MINIMUM CONFORM TO THE SIEVE ANALYSIS FOR CONCRETE AGGREGATE SAND (ASTM C-33). USGA TEE/GREEN SIEVE GRADATION MIX IS PREFERABLE WHERE AVAILABLE.
3. UNDERLYING SOILS SHALL BE TILLED/SCARIFIED PRIOR TO SPREADING/MIXING OF BIORETENTION MEDIA.
4. ALL BIORETENTION MEDIA SHALL BE PLACED FROM THE SIDES OF THE BUILDING, AND IN NO EVENT SHALL ANY TRACKED OR WHEELED EQUIPMENT BE PERMITTED TO CROSS THE RAIN GARDEN.
5. RAIN GARDEN SHALL BE CONSTRUCTED TO DIMENSIONS INDICATED ON THE SITE PLAN.
6. 3-5 INCH DELAWARE RIVER STONE SHALL BE USED FOR STONE CHANNEL AND INLET/OUTLET PROTECTION.
7. NON-DYED, TRIPLE-SHREDDED HARDWOOD MULCH SHALL BE USED.
8. PLANTING OF RAIN GARDEN AND SLOPED BERM SHALL BE COMPLETED AS INDICATED ON THE SITE PLAN.

CHRISTOPHER C. OBROPTA, Ph.D., P.E.
PROFESSIONAL ENGINEER - NJ LICENSE # 37332
DATE 09/09/16

REVISIONS

No.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY	DATE ISSUED

BRIDGEWATER-RARITAN MIDDLE SCHOOL
128 MERRIWOOD ROAD, BRIDGEWATER
SOMERSET COUNTY, NJ

PROPOSED SITE PLAN AND DETAILS

RUTGERS New Jersey Agricultural Experiment Station

SHEET # P-1

TOTAL # OF SHEETS 1

Full Engineering Drawing Set

HENRY INMAN LIBRARY

RAIN GARDEN DEMONSTRATION PROJECT
AS-BUILT PLANS
607 INMAN AVENUE, WOODBRIDGE
MIDDLESEX COUNTY, NEW JERSEY

PROJECT DESCRIPTION:

A RAIN GARDEN HAS BEEN DESIGNED AND CONSTRUCTED TO MANAGE STORM WATER RUNOFF FROM THE LIBRARY'S ROOFTOP. EXISTING DOWNSPOUTS ARE DISCONNECTED AND PIPED INTO RAIN GARDEN.

LOCATION MAP:

LEGEND:

- EXISTING DRAINAGE AREA
- EDGE OF PAVEMENT
- EXISTING CENTERLINE
- EXISTING FENCE
- EXISTING TREELINE
- EXISTING TREE
- EXISTING BUILDING
- EXISTING UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING CONTOURS
- EXISTING SPOT ELEVATIONS
- TOP OF STREAM BANK
- LIMIT OF WORK
- PROPOSED GREEN INFRASTRUCTURE

LIST OF DRAWINGS:

SHEET NAME	TITLE
COVER	COVER SHEET
P-1	EXISTING CONDITIONS AND DEMOLITION PLAN
P-2	AS BUILT SITE PLAN
P-2	AS BUILT PLANTING PLAN
D-1	RAIN GARDEN DETAILS
D-2	PLANTING DETAILS

CHRISTOPHER C. OBROPTA, Ph.D., P.E.

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607 INMAN AVENUE, WOODBRIDGE
MIDDLESEX COUNTY, NJ
COVER SHEET

RUTGERS
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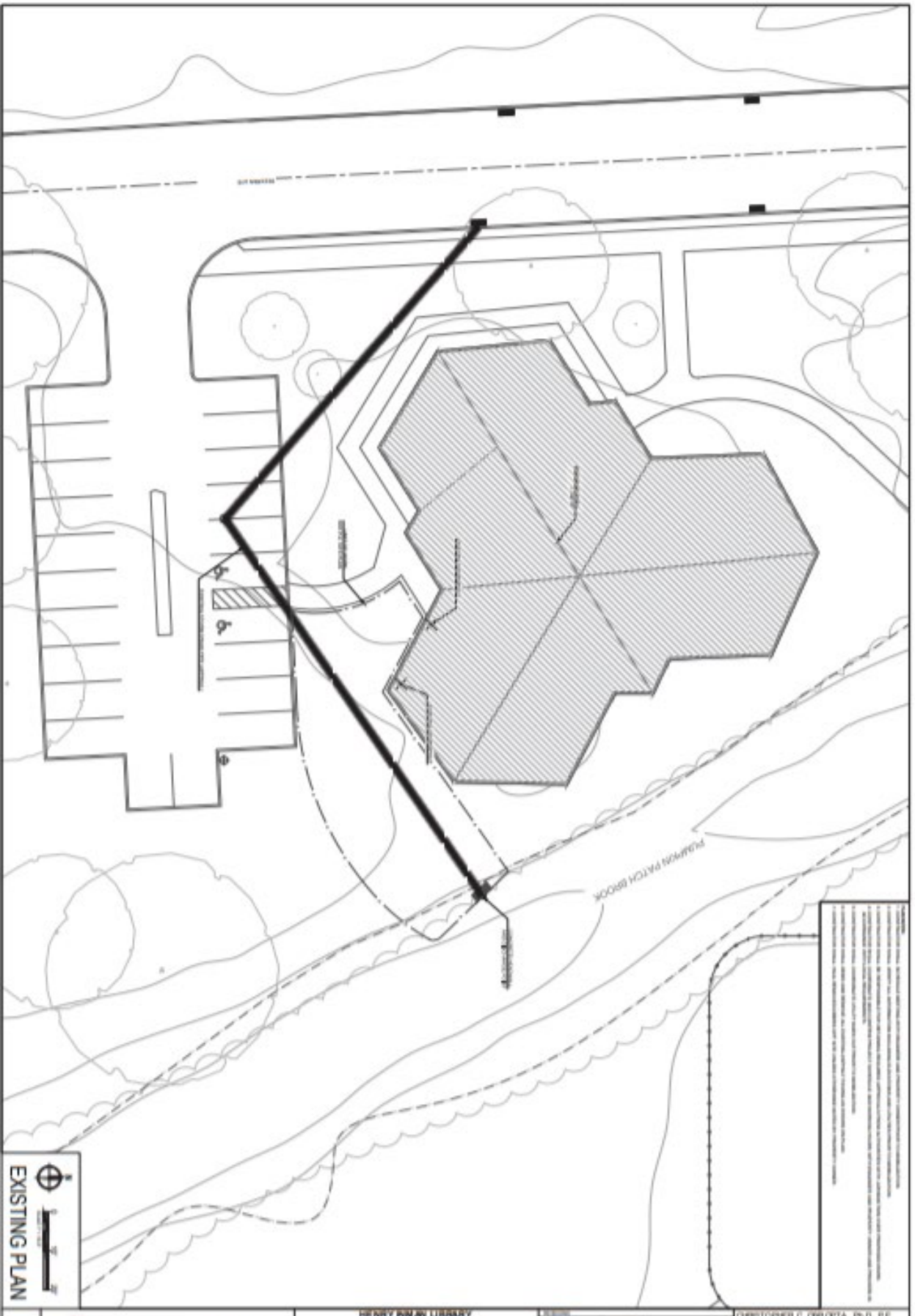
COVER



EXISTING PLAN

P-1

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MIDDLESEX COUNTY, NJ

EXISTING CONDITIONS AND DEMOLITION PLAN

CHRISTOPHER C. OBROPTA, Ph.D., P.E.

SITE PLAN

P-2

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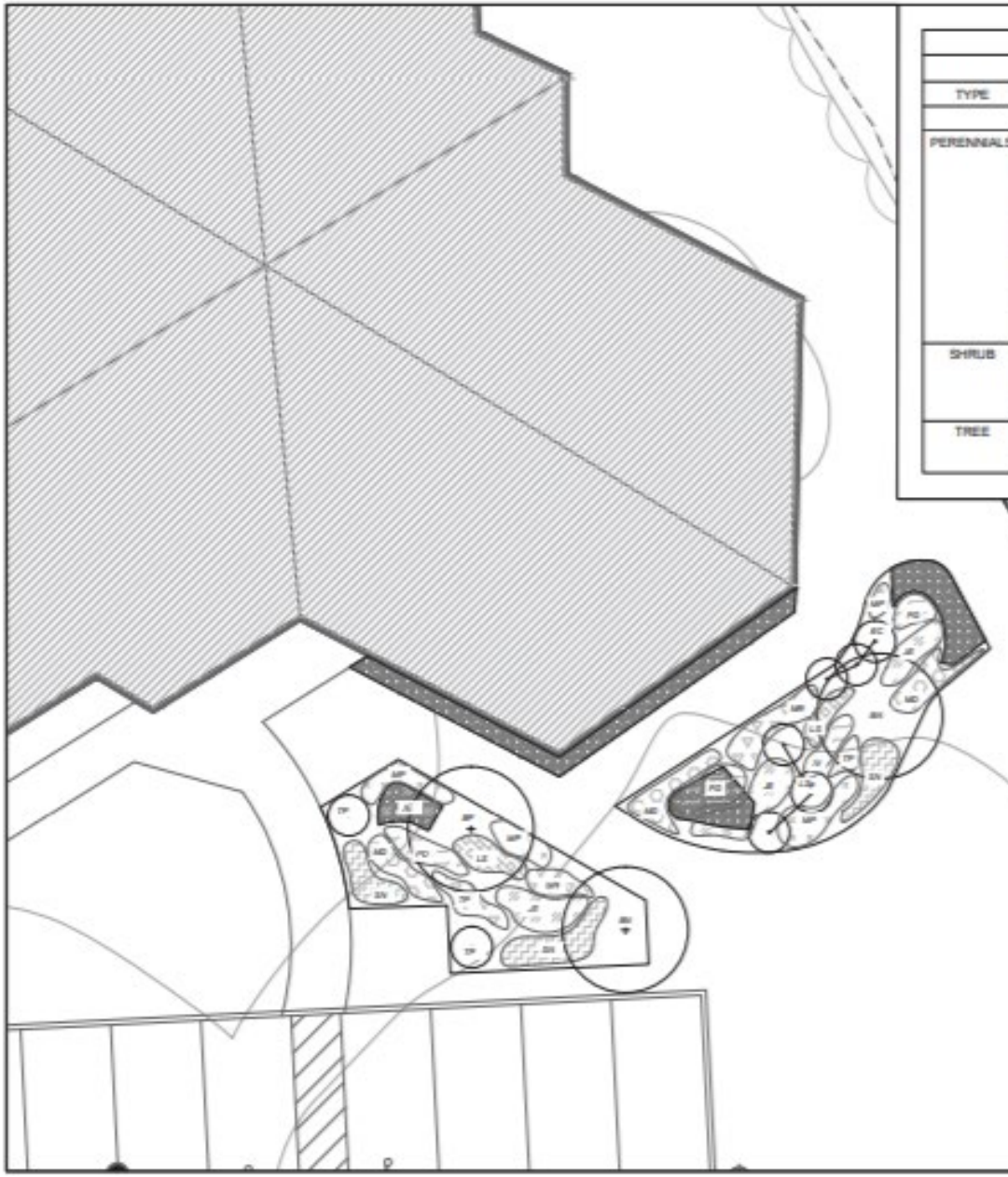
607 INMAN AVENUE, WOODBRIDGE
MIDDLESEX COUNTY, NJ

AS BUILT SITE PLAN

CHRISTOPHER C. OBROPTA, Ph.D., P.E.



PLANTING SCHEDULE

PLANT SPECIES				QUANTITY	SIZE
TYPE	KEY	BOTANICAL NAME	COMMON NAME		
RAIN GARDEN					
PERENNIALS	JE	*Juncus effusus*	SOFT RUSH	100	1 QUART
	LS	*Lobelia siphilitica*	BLUE LOBELIA	50	1 QUART
	MR	*Mimulus ringens*	MONKEY FLOWER	50	1 QUART
	MD	*Monarda didyma*	SCARLET BEEBALM	50	1 QUART
	MP	*Monarda punctata*	SPOTTED BEEBALM	100	1 QUART
	PD	*Penstemon digitalis*	FOXGLOVE BEARDTONGUE	50	1 QUART
	SN	*Solidago nemoralis*	GRAY GOLDENROD	50	1 QUART
SHRUB	EC	*Eupatorium coelestinum*	BLUE MISTFLOWER	15	1 QUART
	LSp	*Liatris spicata*	BLAZING STAR	5	1 QUART
	TP	*Thelypteris palustris*	MARSH FERN	15	1 QUART
TREE	BN	*Betula nigra*	RIVER BIRCH	2	1 QUART
	BP	*Betula populifolia*	GRAY BIRCH	1	1 QUART

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MIDDLESEX COUNTY, NJ

AS BUILT PLANTING PLAN

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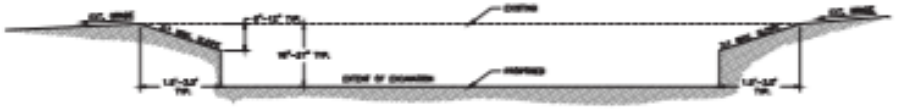
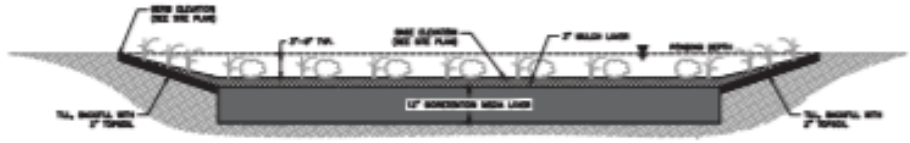
PLANTING PLAN

P-3



1 DT-1 RAIN GARDEN EXCAVATION SECTION
N.T.S.



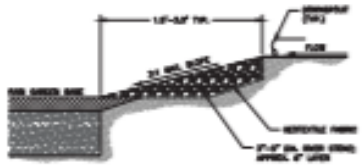
2 DT-1 RAIN GARDEN CROSS-SECTION
N.T.S.

CONSTRUCTION NOTES

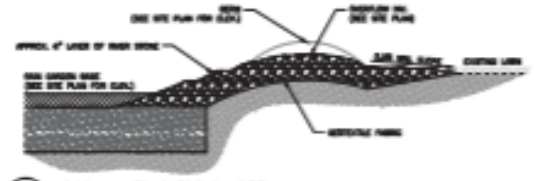
1. THE CONTRACTOR SHALL VERIFY ALL INFORMATION PRIOR TO EXCAVATION INCLUDING ELEVATIONS AND LOCATIONS OF EXISTING UTILITIES.
2. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY IF ANY FIELD CONDITIONS DIFFER MATERIALLY FROM THOSE REPRESENTED ON THESE DRAWINGS AND THE SPECIFICATIONS OR IF, IN THE CONTRACTOR'S OPINION, SAID CONDITIONS CONFLICT WITH THE DESIGN SHOWN HEREIN.
3. THE ENGINEER SHALL INSPECT ALL PLANTING BED AREAS BEFORE MULCHING TO ENSURE THAT ADEQUATE DRAINAGE EXISTS. IF ANY AREAS TO BE MULCHED SHOW EVIDENCE OF POOR DRAINAGE, THE CONTRACTOR SHALL TAKE CORRECTIVE ACTION.
4. THE CONTRACTOR SHALL AVOID DISTURBING ALL EXISTING TREES. ANY DISTURBANCE TO TREES ON THE NORTH MUST BE COORDINATED WITH THE PROPERTY OWNER.
5. DIMENSIONS AND GRADE WILL VARY, REFER TO SITE PLAN.
6. RIVER STONE PROTECTION DIMENSIONS ARE TYPICAL AND MAY VARY PER SITE, CONSULT THE ENGINEER AND SITE PLAN FOR DIMENSIONS ON A PER SITE BASIS.
7. RIVER STONE PROTECTION SHALL SLOPE TO RAIN GARDEN BASE.
8. REFER TO SITE PLAN TO DETERMINE OUTLET TYPE (ROCK-LINED OVERFLOW OR DRAINTECH ORIFICE).
9. REFER TO SITE PLAN FOR ALL ELEVATIONS AND GRADES.
10. THE CONTRACTOR SHALL EXCAVATE 12" LOWER THAN THE BASE ELEVATION SHOWN ON THE SITE PLANS. THE SLOPES OF THE RAIN GARDEN SHALL BE AT A 3H: MINIMUM.
11. THE SUBGRADE OF THE RAIN GARDEN SHALL BE LEVEL TO ENSURE PROPER DRAINAGE. CONTRACTOR SHALL OBTAIN ENGINEER APPROVAL PRIOR TO BACKFILLING WITH 12" OF BIORETENTION MEDIA.
12. THE CONTRACTOR SHALL INSTALL OVERFLOW IF SPECIFIED IN SITE PLANS PRIOR TO BACKFILLING WITH BIORETENTION MEDIA.
13. THE BIORETENTION LAYER SHALL BE LEVEL TO ENSURE PROPER DRAINAGE. CONTRACTOR SHALL OBTAIN ENGINEER APPROVAL PRIOR TO SPREADING MULCH AND PLANTING.
14. INLET AND OUTLET PROTECTION SHALL BE UNDERLAIN WITH GEOTEXTILE FABRIC.
15. INLETS AND OUTLETS SHALL NOT INHIBIT THE FLOW OF WATER FROM THE STREET. THE RIVER STONE SHALL BE PLACED BELOW THE BOTTOM OF THE PIPE.
16. THE CONTRACTOR SHALL TILL THE BERM SECTION AND BACKFILL WITH TOPSOIL.
17. ALL DISTURBED AREAS EXCLUSIVE OF RAIN GARDEN AND SLOPED BERM SHALL BE RESTORED TO ORIGINAL CONDITIONS BY CONTRACTOR.
18. THE CONTRACTOR SHALL HAVE A PRE-CONSTRUCTION MEETING WITH THE PROJECT ENGINEER PRIOR TO ANY WORK ON SITE.
19. CONTRACTOR SHALL PERFORM INFILTRATION TESTING TO DETERMINE SOIL PERMEABILITY AND SEASONAL HIGH WATER TABLE ELEVATION AT THE SITE TO VERIFY INFILTRATION CAPABILITIES. TESTING SHALL BE DONE PRIOR TO EXCAVATION AND INSTALLATION OF THE PROPOSED PROJECTS. PROJECT ENGINEER SHALL BE PRESENT DURING TESTING AND SHALL BE INFORMED OF THE RESULTS.

SPECIFICATIONS

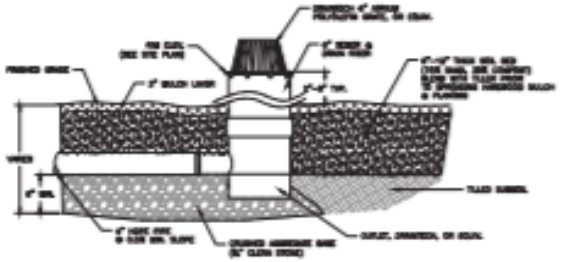
1. MIN. COVER OVER TOP OF PIPE IS 4 FT. CONSULT ADS IF COVERAGE GREATER.
2. THE APPROVAL OF MATERIALS AND METHOD OF SHAPE, GRADING, AND SEAL SHALL BE DONE UNDER THE SUPERVISION OF THE PROJECT ENGINEER/LANDSCAPE ARCHITECT. BIORETENTION MEDIA SHALL CONSIST OF TOPSOIL AND SOIL COMPOST MIXTURE.
3. SAND SHALL BE THE MINIMUM CONFORM TO THE MESH ANALYSIS FOR CONCRETE AGGREGATE SAND (ASTM C-33). HIGH TSS/GREEN SAND (MINIMUM MIX IS PREFERABLE WHERE AVAILABLE.
4. UNDERLYING SOILS SHALL BE TILLED/SCARIFIED PRIOR TO SPREADING/MIXING OF BIORETENTION MEDIA.
5. ALL BIORETENTION MEDIA SHALL BE PLACED FROM THE SIDES OF THE FACILITIES, AND IN NO EVENT SHALL ANY TRACKED OR WHEELED EQUIPMENT BE PERMITTED TO CROSS THE RAIN GARDEN.
6. RAIN GARDEN SHALL BE CONSTRUCTED TO DIMENSIONS INDICATED ON THE SITE PLAN.
7. 3-4 INCH (CLEANING) RIVER STONE SHALL BE USED FOR STONE CHANNEL AND INLET/OUTLET PROTECTION.
8. NON-DYED, TRIPLE-SHREDDED HARDWOOD MULCH SHALL BE USED.
9. PLANTING OF RAIN GARDEN AND SLOPED BERM SHALL BE COMPLETED AS INDICATED ON THE SITE PLAN.
10. THE CONTRACTOR SHALL PERFORM ALL WORK IN CONFORMANCE WITH THE NJDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2007 OR LATEST VERSION.



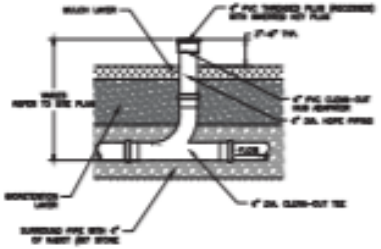
3 DT-1 INLET PROTECTION CROSS-SECTION
N.T.S.



4 DT-1 ROCK-LINED OVERFLOW DETAIL
N.T.S.



5 DT-1 DRAINTECH OUTLET DETAIL
N.T.S.



6 DT-1 CLEAN OUT DETAIL
N.T.S.

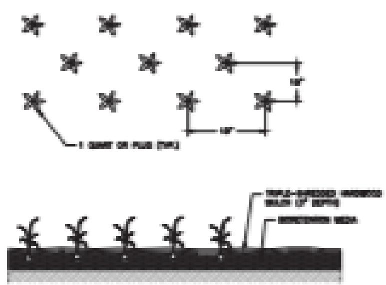
CHRISTOPHER G. OBROPTA, Ph.D., P.E.

NO.	DESCRIPTION	DATE
1		
2		
3		
4		

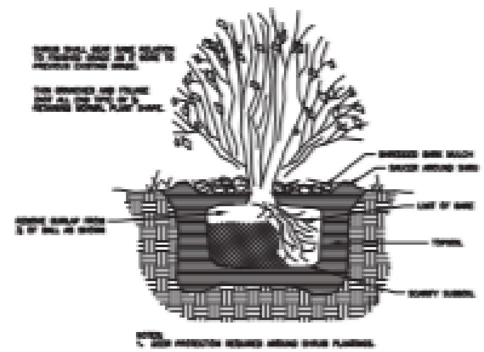
HENRY RAUH LIBRARY
RAIN GARDEN DEMONSTRATION PROJECT
607 RAMAPO AVENUE, WOODBRIDGE
MIDDLESEX COUNTY, NJ
RAIN GARDEN DETAILS

RUTGERS
New Jersey Agricultural Experiment Station

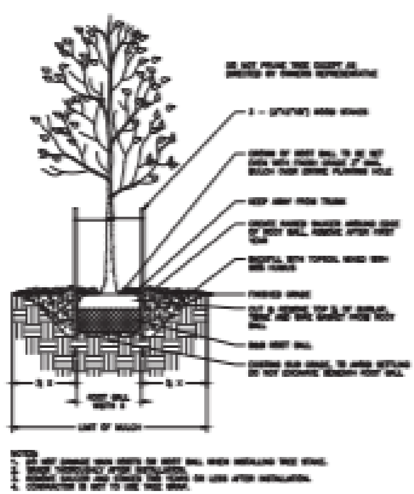
DT-1



1 DT-2 HERBACEOUS PLUG PLANTING DETAIL
N.T.S.



2 DT-2 SHRUB PLANTING DETAIL
N.T.S.



2 DT-2 TREE PLANTING DETAIL
N.T.S.

PLANTING SCHEDULE					
PLANT SPECIES				QUANTITY	SIZE
TYPE	KEY	BOTANICAL NAME	COMMON NAME		
RAIN GARDEN					
PERENNIALS	IV	*Iris versicolor*	BLUE FLAG IRIS	100	1 QUART
	JE	*Juncus effusus*	SOFT RUSH	100	1 QUART
	LS	*Lobelia siphilitica*	BLUE LOBELIA	50	1 QUART
	MD	*Monarda didyma*	SCARLET BEEBALM	50	1 QUART
	MP	*Monarda punctata*	SPOTTED BEEBALM	50	1 QUART
	TP	*Thelypteris palustris*	EASTERN MARSH FERN	50	1 QUART
SHRUB	RV	*Rhododendron viscosum*	SWAMP AZAELA	3	1 QUART
	VC	*Vaccinium corymbosum*	HIGH BUSH BLUEBERRY	3	1 QUART
TREE	BN	*Betula nigra*	RIVER BIRCH	2	1 QUART
	TP	*Betula populifolia*	GRAY BIRCH	1	1 QUART

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RAIN GARDEN DEMONSTRATION PROJECT
607 INMAN AVENUE, WOODBRIDGE
MIDDLESEX COUNTY, NJ

PLANTING DETAILS

RUTGERS
New Jersey Agricultural Experiment Station

SHEET NAME
DT-2

Back to Costs – Simple Sketch

- Rain Garden Rebate Program ($5,000 per session)
  - One 45-minute educational session
  - One technical session (5 to 20 simple design sketches created)
- Rain Garden Sketch for individual project
  - Rain Garden Manual (Self-design) ($0)
  - Rain Garden App (Self-design) ($0)
  - RCE Water Resources Program ($500)
- Cistern Design
  - Contractor typically will size the cistern and provide a simple sketch for free
  - RCE Water Resources Program ($500)

Back to Costs – Single sheet engineering drawing

- RCE Water Resources Program ($750 to $1,000)
- Private contractor ($1,500 to $2,000)

Back to Costs – Full engineering drawing set

- RCE Water Resources Program ($2,500 to $5,000)
  - Includes site survey
  - Includes grading plan and landscape design
  - Includes detail sheet
  - Includes soil erosion and sediment control plan (if needed)
  - Signed and sealed by a professional engineer
- Private contractor ($5,000 to $10,000)

Back to Costs – Construction Specifications and Bid Documents

- RCE Water Resources Program ($5,000 to $10,000)
- Private contractor ($10,000 to $20,000)

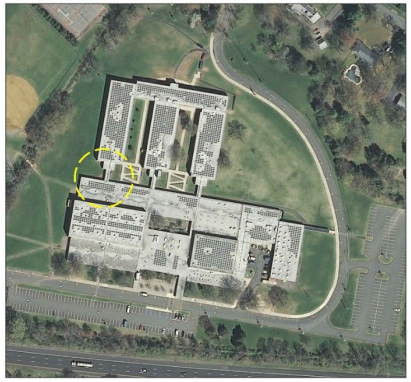
What does it cost to build green infrastructure?

Rain Gardens ($0.50 to $25 per square foot)

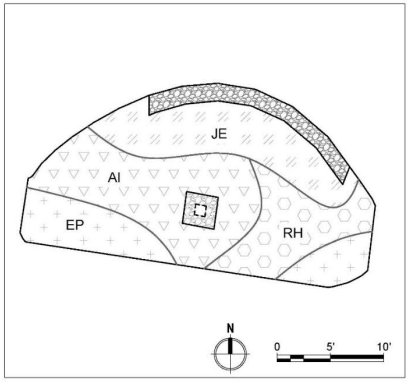
- Excavation costs
- Soil removal
- Soil replacement
- Underdrain system (piping and stone)
- Mulch (one yard per 100 square feet of garden)
- Plants (big or small)

Let's cost it out . . .

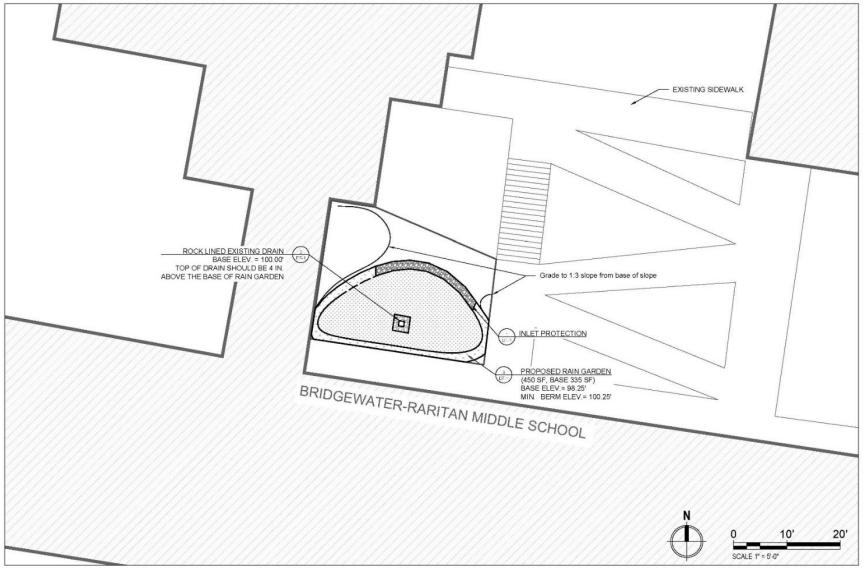
LOCATION MAP (N.T.S)



PLANTING PLAN (N.T.S)



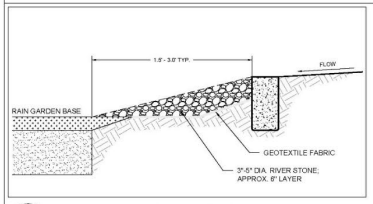
SITE PLAN



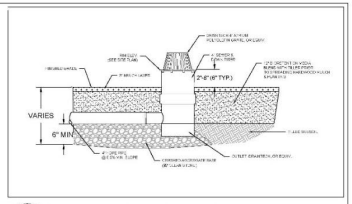
PLANTING SCHEDULE

PLANT SPECIES				QUANTITY	SIZE
TYPE	KEY	BOTANICAL NAME	COMMON NAME		
RAIN GARDEN					
PERENNIALS	**AI**	*Asclepias incarnata*	SWAMP MILKWEED	25	1 QUART
	EP	*Echinacea purpurea*	PURPLE CONEFLOWER	15	1 QUART
	JE	*Juncus effasus*	SOFT RUSH	20	1 QUART
	RH	*Rudbeckia hirta*	BLACKEYED SUSANS	15	1 QUART

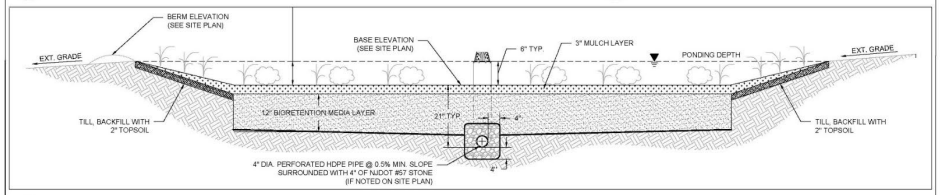
DETAILS



1 DT INLET PROTECTION CROSS-SECTION
N.T.S.



2 DT ROCK-LINED OUTLET DETAIL
N.T.S.



3 DT RAIN GARDEN CROSS SECTION
N.T.S.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL INFORMATION PRIOR TO EXCAVATION INCLUDING ELEVATIONS AND LOCATIONS OF EXISTING UTILITIES.
2. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY IF ANY FIELD CONDITIONS DIFFER MATERIALLY FROM THOSE REPRESENTED ON THESE DRAWINGS AND THE SPECIFICATIONS OR IF, IN THE CONTRACTOR'S OPINION, SAID CONDITIONS CONFLICT WITH THE DESIGNS SHOWN HEREON.
3. THE ENGINEER SHALL INSPECT ALL PLANTING BED AREAS BEFORE MULCHING TO INSURE THAT ADEQUATE DRAINAGE EXISTS. IF ANY AREAS TO BE MULCHED SHOW EVIDENCE OF POOR DRAINAGE, THE CONTRACTOR SHALL TAKE CORRECTIVE ACTION.
4. THE CONTRACTOR SHALL AVOID DISTURBING ALL EXISTING TREES. ANY DISTURBANCE TO TREES OR TREE ROOTS MUST BE COORDINATED WITH THE PROPERTY OWNER.
5. DIMENSIONS AND SHAPE WILL VARY, REFER TO SITE PLAN.
6. RIVER STONE PROTECTION DIMENSIONS ARE TYPICAL AND MAY VARY PER SITE. CONSULT THE ENGINEER AND SITE PLAN FOR DIMENSIONS ON A PER SITE BASIS.
7. RIVER STONE PROTECTION SHALL SLOPE TO RAIN GARDEN BASE.
8. REFER TO SITE PLAN FOR ALL ELEVATIONS AND INVERTS.
9. THE CONTRACTOR SHALL EXCAVATE 12" LOWER THAN THE BASE ELEVATION SHOWN ON THE SITE PLANS. THE SLOPES OF THE RAIN GARDEN SHALL BE AT A 2:1 MINIMUM.
10. THE SUBGRADE OF THE RAIN GARDEN SHALL BE LEVEL TO ENSURE PROPER DRAINAGE. CONTRACTOR SHALL OBTAIN ENGINEER APPROVAL PRIOR TO BACKFILLING WITH 12" OF BIORETENTION MEDIA.
11. THE CONTRACTOR SHALL INSTALL OVERFLOW IF SPECIFIED IN SITE PLANS PRIOR TO BACKFILLING WITH BIORETENTION MEDIA.
12. THE BIORETENTION LAYER SHALL BE LEVEL TO ENSURE PROPER DRAINAGE. CONTRACTOR SHALL OBTAIN ENGINEER APPROVAL PRIOR TO SPREADING MULCH AND PLANTING.
13. INLET AND OUTLET PROTECTION SHALL BE UNDERLAIN WITH GEOTEXTILE FABRIC.
14. THE CONTRACTOR SHALL TILL THE BERM SECTION AND BACKFILL WITH TOPSOIL.
15. ALL DISTURBED AREAS EXCLUSIVE OF RAIN GARDEN AND SLOPED BERM SHALL BE RESTORED TO ORIGINAL CONDITIONS BY CONTRACTOR.
16. THE CONTRACTOR SHALL HAVE A PRE-CONSTRUCTION MEETING WITH THE PROJECT ENGINEER PRIOR TO ANY WORK ON SITE.
17. ALL ELEVATIONS ARE RELATIVE TO ASSUMED DATUM DRIVEWAY EDGE OF PAVEMENT (100.00').

SPECIFICATIONS:

1. THE APPROVAL OF MATERIALS AND MIXING OF SAND, COMPOST, AND SOIL SHALL BE DONE UNDER THE SUPERVISION OF THE PROJECT ENGINEER/LANDSCAPE ARCHITECT. BIORETENTION MEDIA SHALL CONSIST OF 70% SAND AND 30% COMPOST MIXTURE.
2. SAND SHALL AT THE MINIMUM CONFORM TO THE SIEVE ANALYSIS FOR CONCRETE AGGREGATE SAND (ASTM C-33). USGA TEE/GREEN SIEVE GRADATION MIX IS PREFERABLE WHERE AVAILABLE.
3. UNDERLYING SOILS SHALL BE TILLED/SCARIFIED PRIOR TO SPREADING/MIXING OF BIORETENTION MEDIA.
4. ALL BIORETENTION MEDIA SHALL BE PLACED FROM THE SIDES OF THE BUILDING, AND IN NO EVENT SHALL ANY TRACKED OR WHEELED EQUIPMENT BE PERMITTED TO CROSS THE RAIN GARDEN.
5. RAIN GARDEN SHALL BE CONSTRUCTED TO DIMENSIONS INDICATED ON THE SITE PLAN.
6. 3-5 INCH DELAWARE RIVER STONE SHALL BE USED FOR STONE CHANNEL AND INLET/OUTLET PROTECTION.
7. NON-DYED, TRIPLE-SHREDDED HARDWOOD MULCH SHALL BE USED.
8. PLANTING OF RAIN GARDEN AND SLOPED BERM SHALL BE COMPLETED AS INDICATED ON THE SITE PLAN.

CHRISTOPHER C. OBROPTA, Ph.D., P.E.
PROFESSIONAL ENGINEER - NJ LICENSE # 37532

DATE 09/09/15 | DESIGNED MT | CHECKED CP | APPROVED CCO | DATE 06.06.16

REVISIONS
No. | DATE | DESCRIPTION

BRIDGEWATER-RARITAN MIDDLE SCHOOL
128 MERRIWOOD ROAD, BRIDGEWATER
SOMERSET COUNTY, NJ

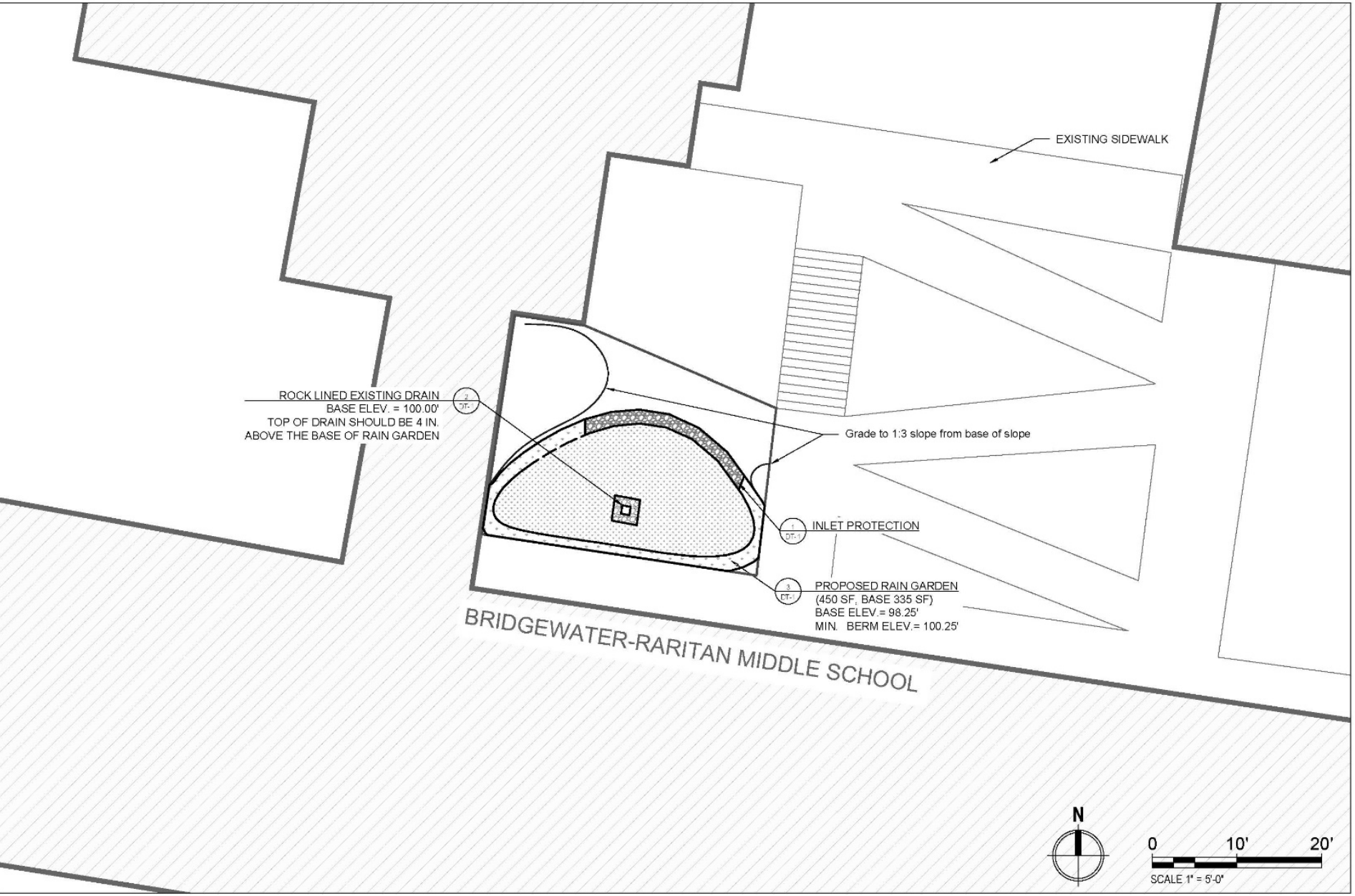
PROPOSED SITE PLAN AND DETAILS

RUTGERS New Jersey Agricultural Experiment Station

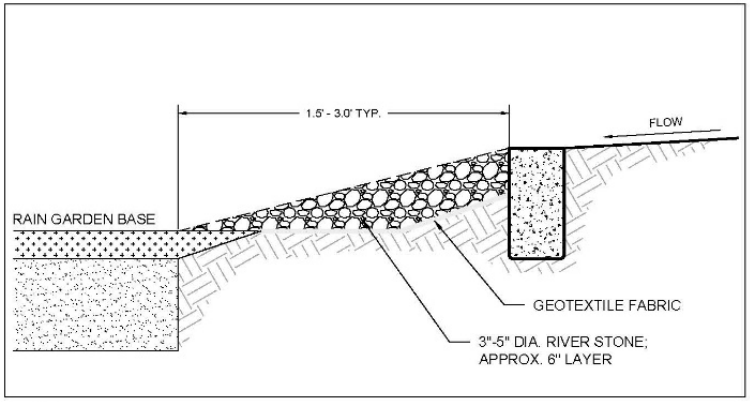
SHEET # P-1

TOTAL # OF SHEETS 1

SITE PLAN


EXISTING SIDEWALK
ROCK LINED EXISTING DRAIN
BASE ELEV. = 100.00'
TOP OF DRAIN SHOULD BE 4 IN.
ABOVE THE BASE OF RAIN GARDEN
2
DT-
Grade to 1:3 slope from base of slope
1
DT-1
INLET PROTECTION
3
DT-
PROPOSED RAIN GARDEN
(450 SF, BASE 335 SF)
BASE ELEV.= 98.25'
MIN. BERM ELEV.= 100.25'
BRIDGEWATER-RARITAN MIDDLE SCHOOL
N
0
10'
20'
SCALE 1" = 5'-0"

DETAILS



1 DT INLET PROTECTION CROSS-SECTION
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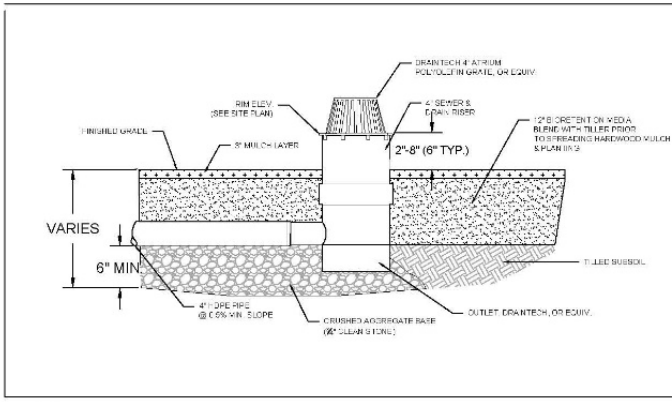
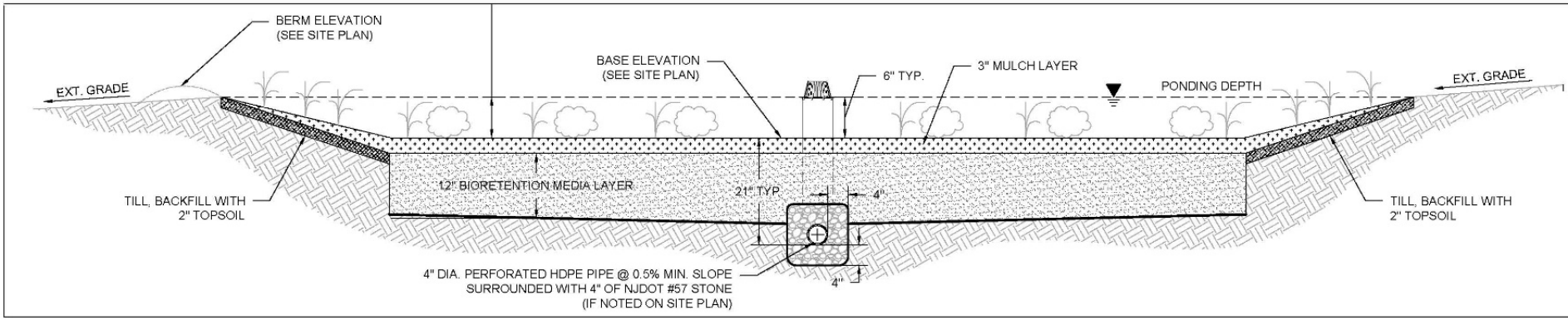
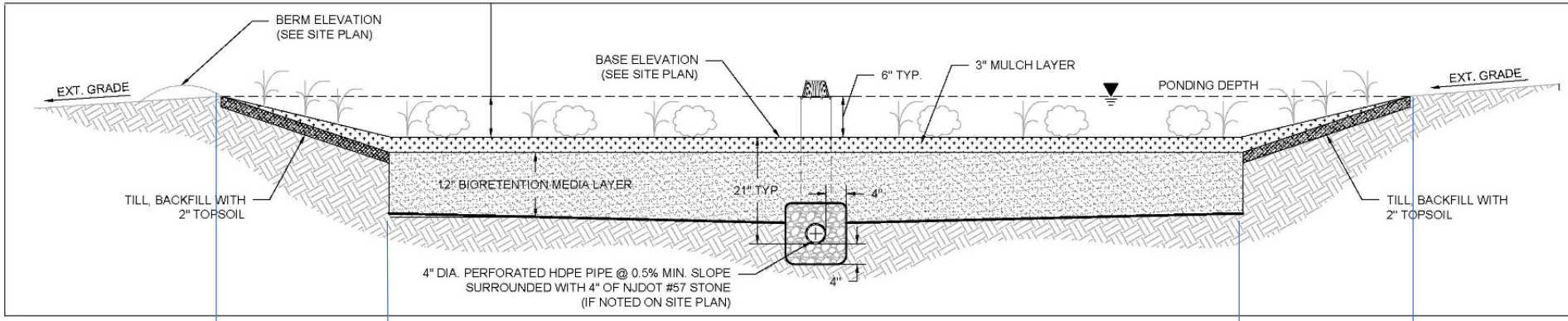


2 DT ROCK-LINED OUTLET DETAIL
N.T.S.



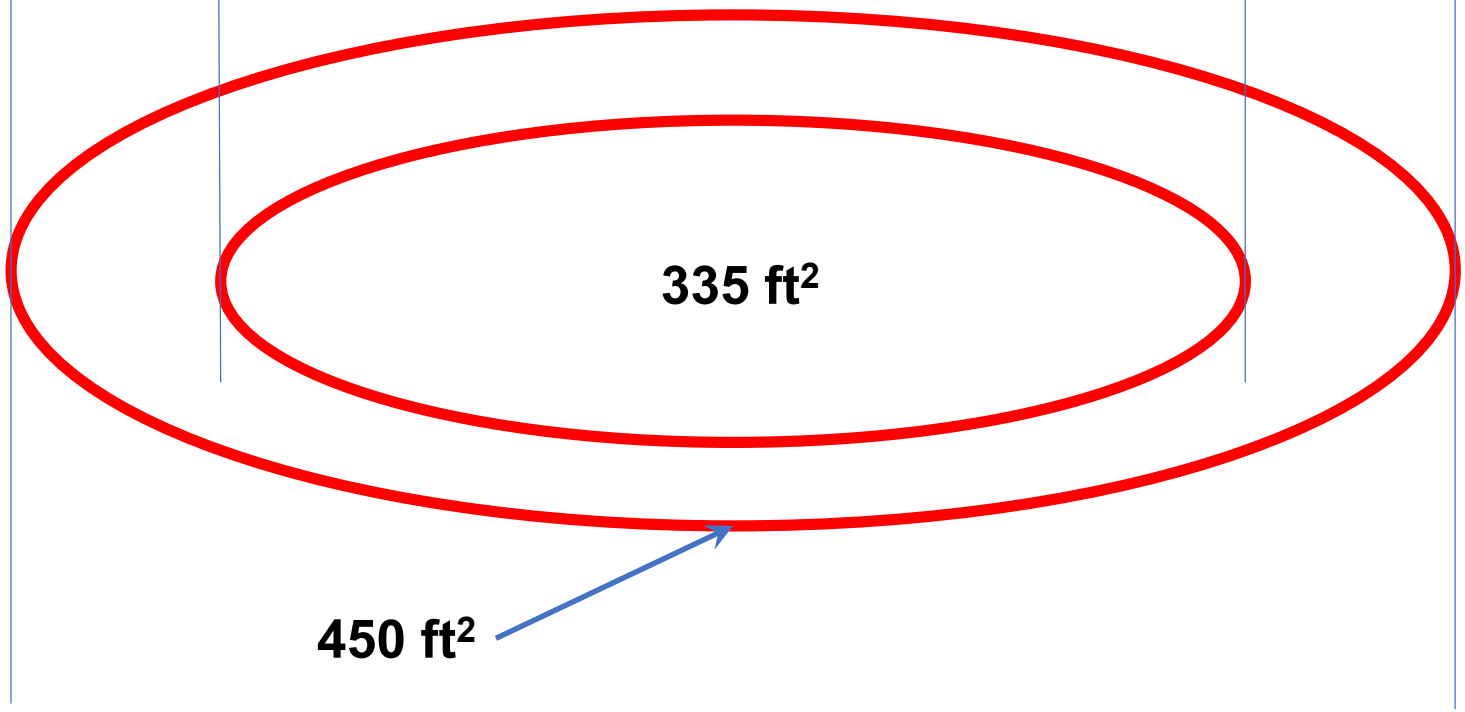
3 DT RAIN GARDEN CROSS SECTION
N.T.S.

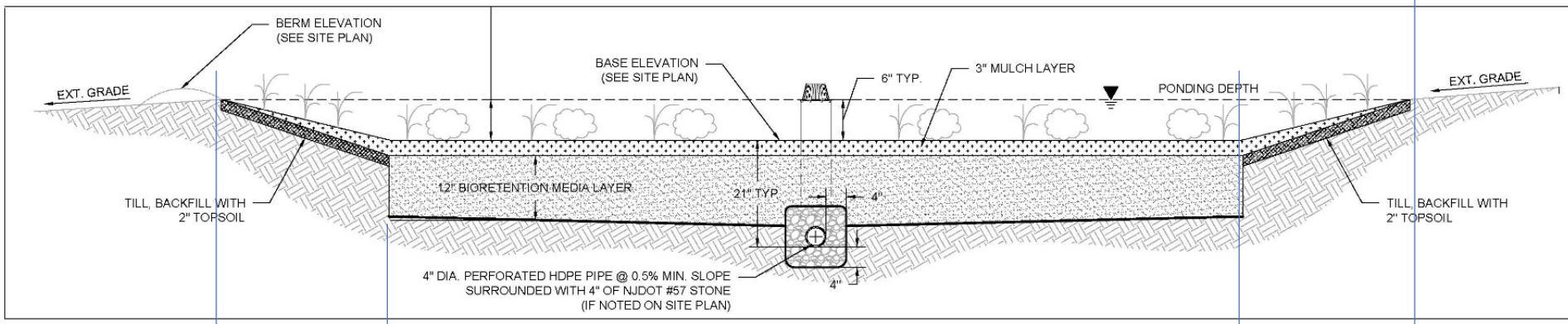


3
DT

RAIN GARDEN CROSS SECTION

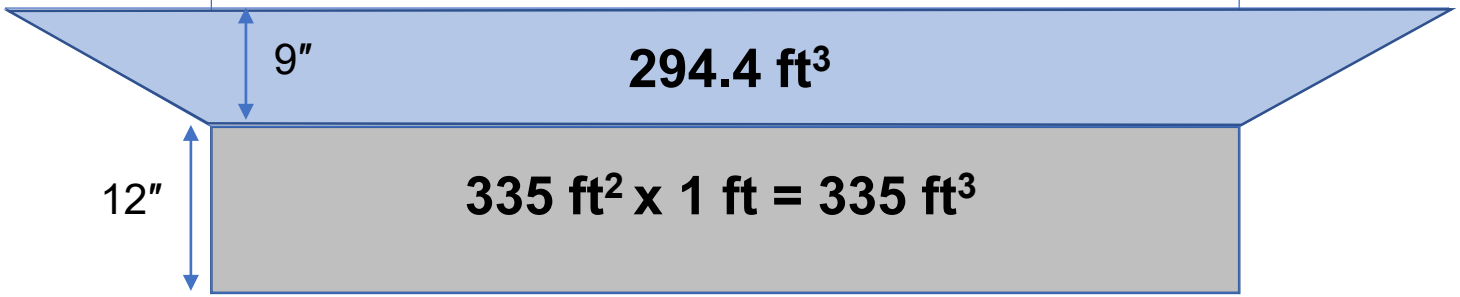
N.T.S.





3 DT RAIN GARDEN CROSS SECTION
N.T.S.

$$\frac{(335\ ft^2 + 450\ ft^2)}{2} \times 0.75\ ft =$$



Converting volume to be excavated and volume of soil needed

$$335\ ft^3 \times \frac{1\ \text{cubic yard}}{27\ ft^3} = 12.4\ \text{cubic yards}$$

$$294\ ft^3 \times \frac{1\ \text{cubic yard}}{27\ ft^3} = 10.9\ \text{cubic yards}$$

Notes:

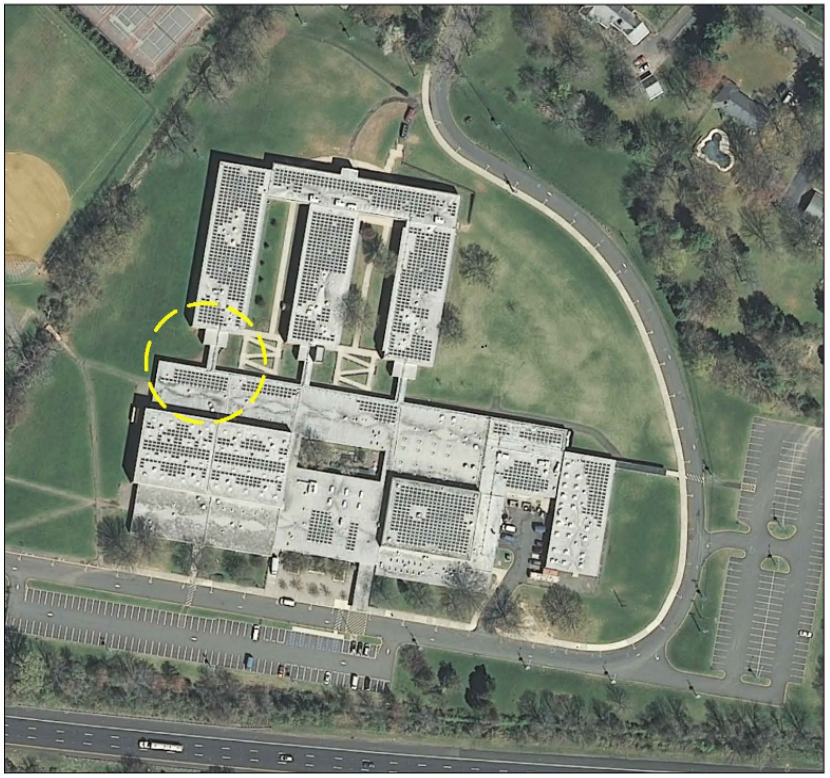
1 cubic yard (yd^3) = 27 cubic feet (ft^3)
cubic yard = CY = yd^3
cubic foot = CF = ft^3

One Rain Garden – 450 square feet

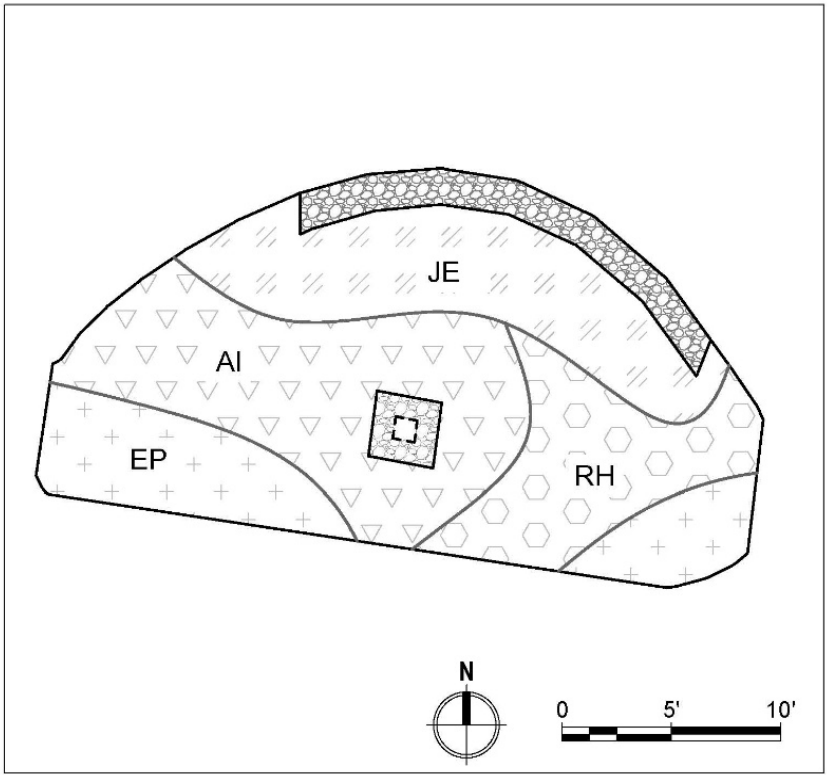
- Soil Excavation – 23.3 cubic yards at $30 to $50/cubic yard = $699 to $1,165
- Soil Replacement – 335 square feet at 1 foot deep = 335 cubic feet = 12.4 cubic yards = $35 per yard = $434
- Inlet = Home Depot = $35
- 20 feet of underdrain piping - $1 per foot = $20
- Stone for underdrain piping – 1 cubic foot per 1 foot of pipe = 20 cubic feet = 0.75 cubic yards = $35
- Mulch = 1 cubic yard per 100 square feet = 4.5 cubic yards = $30 per cubic yard = $135

Total = $1,358 to $1,824 plus plants

LOCATION MAP (N.T.S)



PLANTING PLAN (N.T.S)



PLANTING SCHEDULE					
PLANT SPECIES				QUANTITY	SIZE
TYPE	KEY	BOTANICAL NAME	COMMON NAME		
RAIN GARDEN					
PERENNIALS	**AI**	*Asclepias incarnata*	SWAMP MILKWEED	25	1 QUART
	EP	*Echinacea purpurea*	PURPLE CONEFLOWER	15	1 QUART
	JE	*Juncus effasus*	SOFT RUSH	20	1 QUART
	RH	*Rudbeckia hirta*	BLACKEYED SUSANS	15	1 QUART

Plants for One Rain Garden – 450 square feet

Swamp milkweed	quarts	25	$3	$ 75
Purple coneflower	quarts	15	$3	$ 45
Soft rush	quarts	20	$3	$ 60
Black-eyed Susan's	quarts	15	$3	$ 45
Total		**75**		**$225**

Grand Total = $1,583 to $2,049

Notes:

3-gallon container	=	$12 to $30/each
1-gallon container	=	$ 8 to $15/each
1-quart container	=	$ 3 to $6/each
2-inch plugs	=	$ 1 to $2/each

Cutting costs . . .

Grand Total = $1,583 to $2,049

If you get somebody to volunteer to excavate, the cost becomes $884.

If you used 2″ plugs instead of quarts, $75 instead of $225. Cost becomes $734.

If the soil is okay and you don’t have to replace it, cost would be further reduced by $434. Total cost = $300.

Cost of a Cistern

- Two to three dollars per gallon installed
- 2,500-gallon cistern costs $5,000 to $7,500
- Plus optional maintenance contract

Cost of Porous Asphalt

- Depends on depth of stone
- Each foot of stone can hold 4.8 inches of water
- $10 to $25 per square foot
- Big expense is removal of existing asphalt and underlying soil and properly disposing of this material

Notes:

6″ stone reservoir = $ 8/square foot

12″ stone reservoir = $ 11/square foot

24″ stone reservoir = $ 15/square foot

36″ stone reservoir = $ 20/square foot

Grant/Funding Opportunities

- Sustainable Jersey ($2K, $10K and $20K)
- ANJEC (Association of NJ Environmental Commissions)
- NJDEP (New Jersey Department of Environmental Protection)
- NJ American Waters
- Home and School Associations

Who should I partner with at the local level?

- RCE Environmental County Agents
- Municipal Department of Public Works
- Municipal Department of Parks and Recreation
- Municipal Green Teams (Sustainable Jersey)
- Green Teams for Schools (Sustainable Jersey)
- Environmental Commissions
- Boy Scouts and Girl Scouts
- Kiwanis Club
- Rotary Club
- Schools
- House of Worship
- AmeriCorps Watershed Ambassadors
- RCE Environmental Stewards
- RCE Master Gardeners

Who should I partner with at the state level?

- The Nature Conservancy
- Association of NJ Environmental Commissions
- Trust for Public Lands
- New Jersey Tree Foundation
- New Jersey Department of Environmental Protection

Be a Connector, Maven, or Salesman!

From the “Tipping Point” by Malcolm Gladwell

- **Connectors are people specialists.**
- **Mavens are information specialists.**
- **Salesmen are charismatic.**


WORMWOOD
2250

Grant Writing – The Most Important Thing:

CAREFULLY READ THE REQUEST FOR PROPOSALS (RFP)

Sample Requirement of RFPs "Format"

- Most RFPs provide a format for the proposal including maximum number of pages (font size and margins)
- Most require forms to be completed such as application sheet and budget table
- Most require resumes of the people who will be working on the project
- Mapping of area being studied

Short Clear Titles

- Green Infrastructure Planning and Implementation for Caldwell New Jersey
- Rain Garden Rebate Program for Somerset County
- Detention Basin Retrofits for Hamilton Township

Grant Abstract

- Stay within the word limit (250 words max)
- Inform readers about the problem to be addressed
- Inform readers about the general approach to be taken to address problem
- Discuss anticipated results
- Abstracts are often used as a screening tool by the reviewers

Priority Issues

- Most RFPs identify “priority issues”
- Focus on addressing one of the issues
- Briefly describe how your proposal helps contribute to the understanding and/or solution of the issue
- Include a brief literature review that places the proposed research in its scientific context

Eligibility Requirements

- Eligible Entities – most proposal list entities that can apply for the funding (e.g., universities, consultants, etc.)
- Eligible Entity Capabilities – must provide a description of how you are qualified to do the work
- Project Eligibility Requirements – most proposals list the projects that are eligible for funding
- Ineligible Activities – most proposals list the projects that are not eligible for funding

Goals

The goal statement(s) must identify the desired outcome(s) related to the identified problem or need and be stated in terms of results to be accomplished.

Example of Proposal Goals

The goals of this project are:

- to reduce pollutant loads to the Raritan River and its tributaries
- to reduce flooding in the Raritan River Watershed
- to enhance the resilience of the municipalities within the Raritan River Basin study area by implementing green infrastructure practices that have been identified in impervious cover assessments (ICAs) and reduction action plans (RAPs)

Objectives . . .

Describe the outcomes in a measurable way, specify the results to be achieved or criteria by which results will be measured (e.g., 25% reduction in phosphorus loading to the Muddy River), and the time frame for achieving the objective.

Example of Proposal Objectives

Objective 1: Prepare engineering designs for green infrastructure practices

- Impervious cover reduction action plans have been developed for the 54 municipalities. Each of these plans contain recommendations for green infrastructure practices at 20 to 40 sites. Ten green infrastructure designs will be completed within the first year of the project.

Tasks . . .

are concise statements of activities that need to take place to achieve the stated objectives.

Tasks should:

- describe the specific action that will be taken to achieve the project goals and objectives
- have a designated responsible party
- have a specified timeframe to accomplish the action

Example of Proposal Tasks

Task 1: Create preliminary engineering designs

- The RCE Water Resources Program will prepare preliminary engineering designs for the projects that are prioritized by municipalities. These designs will be provided to NJDEP for their review prior to completing final designs.

Deliverable: Preliminary engineering designs for NJDEP's approval

Task 2: Create final engineering designs

- The RCE Water Resources Program will prepare final engineering designs for the projects that are approved by NJDEP. These designs will include construction specifications and schedules so the project can be built.

Deliverable: Final engineering designs that are ready for construction

Example of Task Table

Objective 1: Prepare engineering designs for green infrastructure practices					
TASK	Responsible Party	Timeframe	Anticipated Start Month	Project Deliverable	Anticipated Completion Month
1	Rutgers	12 Months	1	Preliminary designs for green infrastructure projects for NJDEP's approval	12
2	Rutgers	18 Months	6	Final designs for green infrastructure projects	24

Budget

- Salary and fringe benefits
- Project supplies
- Equipment supplies
- Subcontractors/consultants
- Travel
- Publication costs
- Tuition and stipend for graduate students, and
- DON’T FORGET THE OVERHEAD

Bottom Line: Are Your Goals and Objectives Achievable and Measurable?

More Tips

- A good idea is nothing without a good leader and visa-a-versa
- Get the right project partners, and make sure they are all engaged
- If possible, have proof of concept
- If you have never received a grant before, you might want to team up with someone who has
- Make sure you read the Request for Proposals (RFP) or Request for Application (RFA) and address all the requirements
- Look at who and what was funded last year

Final Tips

- Get to know the grant funders – go to meetings, conferences, and other events – be strategic
- If you have questions on the RFP or RFA, call granting agency officer and ask them
- Don’t give them more than they are asking for – streamline your proposal
- If a match is desired but not required, provide one
- Don’t be afraid to piggyback grants together to fund a project
- Don’t waste too much of your time on the long-shots but also don’t be afraid to shoot for the stars – you might get lucky and hit it big

RESOURCES FOR YOU!

HOME PAGE
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Our green infrastructure initiative in urban centers focuses on capturing stormwater with cost-effective practices before it enters the combined sewer systems.

About Us

Rutgers Cooperative Extension
Water Resources Program

G.H. Cook Campus
14 College Farm Road
New Brunswick, NJ 08901

www.water.rutgers.edu

~Creating Solutions for
Water Resources Issues in New Jersey~

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.

News

- **CALENDAR OF UPCOMING EVENTS**
- In the News - January 20, 2021
- SEBS/NJAES Newsroom
- Registration is open for the 2021 Green Infrastructure Champions Program! Check it out! The next session is scheduled for January 29th!

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Projects & Programs

Agricultural Watershed Planning & Implementation	**Municipal/Community Training**
Green Infrastructure Program	**Rain Gardens & Rain Barrels**
Keep the Rain from the Drain ~ Impervious Cover Reduction Program	**Watershed Planning & Implementation**
Municipal Stormwater Management	

Agricultural Watershed Planning & Implementation

- Watershed Restoration & Protection Plan for Assiscunk Creek, Burlington County, NJ
- Assiscunk Creek Watershed Agricultural Mini-Grant Program
- Biofilter Wetland at Harrow Run, Water Quality Evaluation of Pollutant Removal Efficiency from a Tailwater Recovery System
- Watershed Restoration Plan for the Upper Cohansey River Watershed
- Upper Cohansey River Watershed Agricultural Mini-Grant Program
- Watershed Restoration Plan for the Upper Salem River Watershed
- Upper Salem River Watershed Agricultural Mini-Grant Program

Top of Page

Green Infrastructure Program

- Camden Green Infrastructure Initiative
- Fixing Flooding: One Community at a Time
  Innovative Solutions using Green Infrastructure Conference
- Green Infrastructure Education and Implementation Program
- Green Infrastructure Guidance Manual for New Jersey
- Green Infrastructure Solutions for New Jersey Conference

Keep the Rain from the Drain ~ Impervious Cover Reduction Program

- Green Infrastructure Planning and Implementation for Caldwell, NJ
- Impervious Cover Assessment and Impervious Cover Reduction Action Plan for Frenchtown
- Impervious Cover Assessment and Impervious Cover Reduction Action Plan for Monroe Township, Gloucester County
- Impervious Cover Assessment and Impervious Cover Reduction Action Plan for Red Bank
- Impervious Cover Assessment and Impervious Cover Reduction Action Plan for Winslow Township, Camden County
- Impervious Cover Assessment and Impervious Cover Reduction Action Plan for Westfield, Union County
- Impervious Cover Assessments and Impervious Cover Reduction Action Plans for Coastal Communities
- National Fish and Wildlife Foundation ~ Incorporating Green Infrastructure Resiliency in the Raritan River Basin
- Impervious Cover Assessments, Impervious Cover Reduction Action Plans, and Green Infrastructure Reduction Action Plans for New Jersey Future's Mainstreaming Green Infrastructure Program
- Regional Stormwater Management Planning for the Highlands Portion of Watershed Management Area 8 - North and South Branch Raritan
- Salem County and Cumberland County, NJ ~ Impervious Cover Assessments and Impervious Cover Reduction Action Plans
- William Penn Foundation - Technical Support Program for Municipalities and Watershed Partners
- William Penn Foundation - Delaware River Watershed Initiative - Phase 2

HUNTERDON COUNTY

Delaware Twp
- *ICA*
- *RAP*
- *RAP web map*

Franklin Twp
- *ICA*
- *RAP*
- *RAP web map*

East Amwell Twp
- *ICA*
- *RAP*
- *RAP web map*

Raritan Twp
- *ICA*
- *RAP*
- *RAP web map*

Flemington Boro
- *ICA*
- *RAP*
- *RAP web map*

Readington Twp
- *ICA*
- *RAP*
- *RAP web map*

MIDDLESEX COUNTY

Dunellen Boro
- *ICA*
- *RAP*
- *RAP web map*

North Brunswick Twp
- *ICA*
- *RAP*
- *RAP web map*

NEW JERSEY HIGHLANDS WATERSHED CLUSTER

Alpha
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Lopatcong
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Branchville
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Mount Arlington
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Greenwich
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Mount Olive
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*


QUESTIONS?