AN INTRODUCTION TO SUSTAINABLE STORMWATER DESIGN

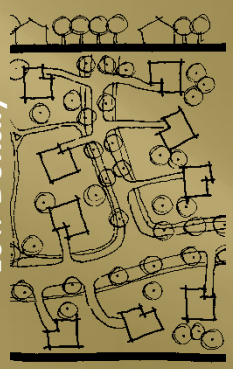
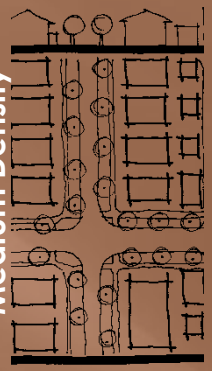
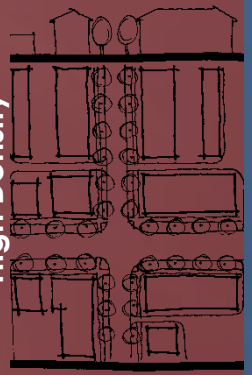
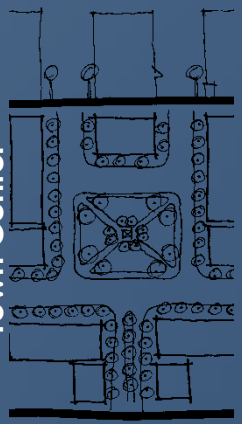
AND

THE BUSINESS CASE FOR GREEN INFRASTRUCTURE

designing to thrive | april 2, 2014

ensite

Typical Stormwater Management by Density

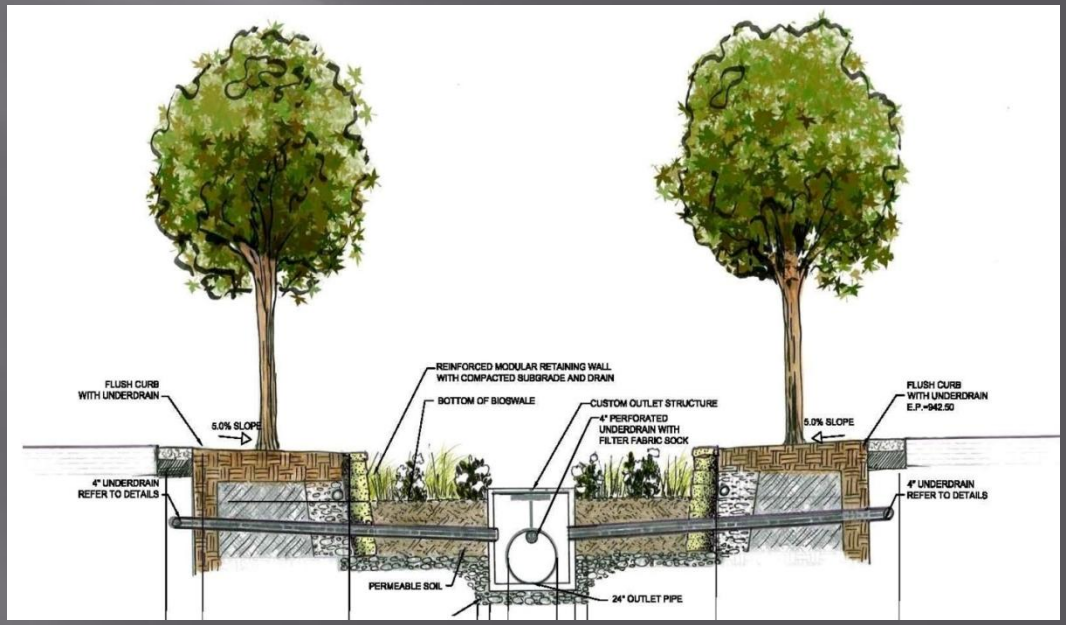
Green Infrastructure Best Management Practice (GI BMP)	 Low Density	 Medium Density	 High Density	 Town Center
Vegetated Swale (& Linear Basin)	X	X	X	X
Bioretention Swale	X	X	X	X
Bioretention Basin	X	X	X	
Rain Garden	X	X	X	X
Stormwater Wetland	X	X		
Stormwater Basin	X	X		X
Pemeable Pavement		X	X	X
Underground Storage			X	X
Manufactured Systems			X	X
Green Roof			X	X

Benefits of Sustainable Stormwater Design

- Reduce land clearing and excavation costs
- Reduce infrastructure costs (streets, curbs, gutters, pipes)
- Potential to reduce impact fees
- Increase premium lot yield
- Increase marketability
- Improve pedestrian connectivity
- Improve traffic management
- Create multi-functional open space
- Better connectivity

What is Green Infrastructure?

- Volumetric Stormwater Management,
- Street and Sidewalk Repair,
- Pedestrian Connectivity,
- Traffic Calming,
- Streetscape Improvement,
- Green Space Improvement,
- Public Health and Safety,
- Heat Island Effect Reduction,
- Carbon Sequestration,
- Infrastructure Cost Reduction,
- Economic Development,
- Creates Local Jobs,
- and More.



Green Infrastructure: Curb & Gutter

Storm Inlet with Standard Curb & Gutter

$1,500 each
+
$15/ LF

vs.

Pervious Curb & Gutter

$26 / LF

Green Infrastructure: Storage

Centralized Pipe & Pond

vs.

Distributed Storage

Centralized Amenity
Less opportunity for Premium Lots

Distributed/ Variety of Amenities
Increased Opportunity for Premium Lots

Green Infrastructure: Storage

Detention Pond

Loss of Developable Area

vs.

Residential Rain Garden

Minimal Loss of Developable Areas

Green Infrastructure: Streets

Impervious Parking

Increased Stormwater Runoff
Typical Environment

vs.

Pervious Parking

Decreased Stormwater Runoff
Engaging Environment

Parking Lot

Green Parking Lot – Standard Parking

Description

Filter strips treat sheet flow from adjacent impervious areas. Runoff velocity is slowed, and runoff volume is reduced by infiltration and storage in the soil. Water quality is improved by physical filtration and biological transformation of pollutants in soils and vegetation.

Potential Benefits

- Collects, stores and infiltrates stormwater
- Increase property value

Ref: Urban Eco Construction, rain garden

Ref: NRCS Urban Conservation Photo Gallery, rain garden

Green Streets – Flush Curb

Green Streets – Flush Curb

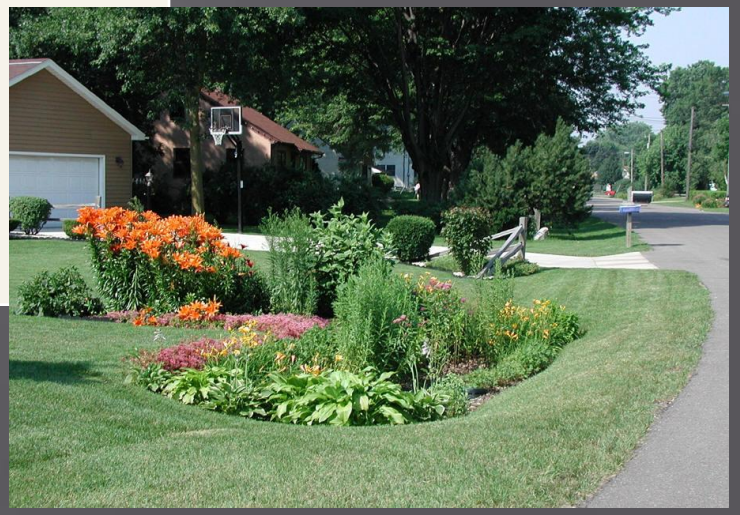
Description

Bioretention in existing areas of on street parking; generally located in areas where inlets are already present.
Existing impervious surface runoff with no pollutant treatment is directed into the rain garden. Rain gardens act as bioretention areas, which mitigate and filter stormwater runoff by allowing water to permeate the surface through plant and soil matter. Contaminants are removed through a variety of physical and biologial processes in the soil and vegetation.

Potential Benefits

- Decreased downstream flooding
- Groundwater recharge
- Extended stormwater peak time
- Stormwater filtration
- Mitigated CSO loads
- Increased curb appeal

Ref: CCE of Chautauqua County, rain garden



Green Streets – Bump Out

Green Streets – Bump Out

Description

Bioretention in existing areas of on street parking; generally located in areas where inlets are already present.
Runoff from impervious surfaces is directed into the rain garden, which acts as a bioretention area to mitigate and filter stormwater runoff. Contaminants are removed through a variety of physical and biologial processes in the soil and vegetation.

Potential Benefits

- Decreased downstream flooding
- Groundwater recharge
- Extended stormwater peak time
- Water quality improvement
- Mitigated CSO loads
- Increased curb appeal
- Increase property value

Ref: NE Fremont Street Green Street Program

Ref: NE Fremont Street Green Street Program

Residential Rain Gardens

Residential Rain Gardens

Description

Rain gardens are shallow depressed areas of landscape that act as bioretention areas, which mitigate and filter stormwater runoff by allowing water to permeate the surface through plant and soil matter. Contaminants are removed through a variety of physical and biological processes in the soil and vegetation.

Potential Benefits

- Mitigates stormwater runoff
- Improves community aesthetics
- Recharges aquifers
- Increase property value

Ref: Live Green Twin Cities, rain garden

Rain Barrel/Cistern

Rain Barrels

Description

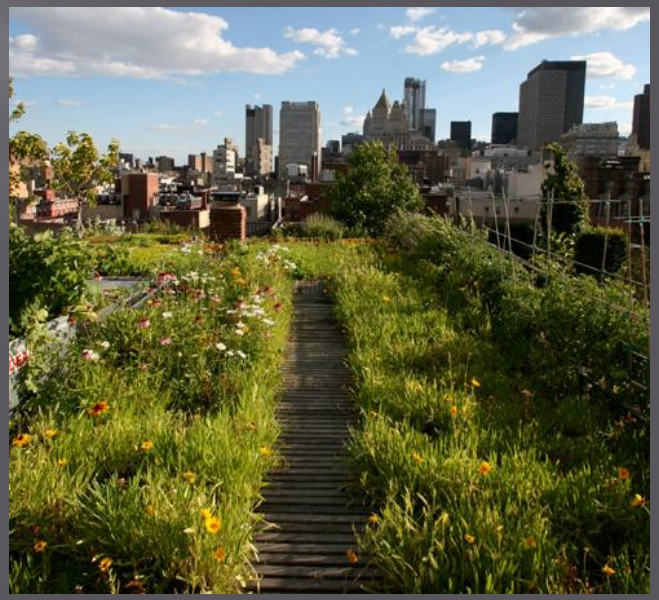
Intercepts and stores rainfall runoff from rooftops or other areas for future use. The contributing area draining to the barrel or cistern can be subtracted from the impervious cover. Stormwater may be used for irrigation, car washing, or other non potable demands. It may also be released at a controlled rate into a biofiltration area.

Potential Benefits

- Collect stormwater for practical uses i.e. water plants
- Reduce stormwater runoff

Functional Green Space

Green Space
Description
Existing turfgrass areas with high runoff coefficients are converted to rain gardens for bioretention. The bioretention areas mitigate and filter storm water runoff in soils and vegetation.
Potential Benefits
•Community Asset •Increase property value

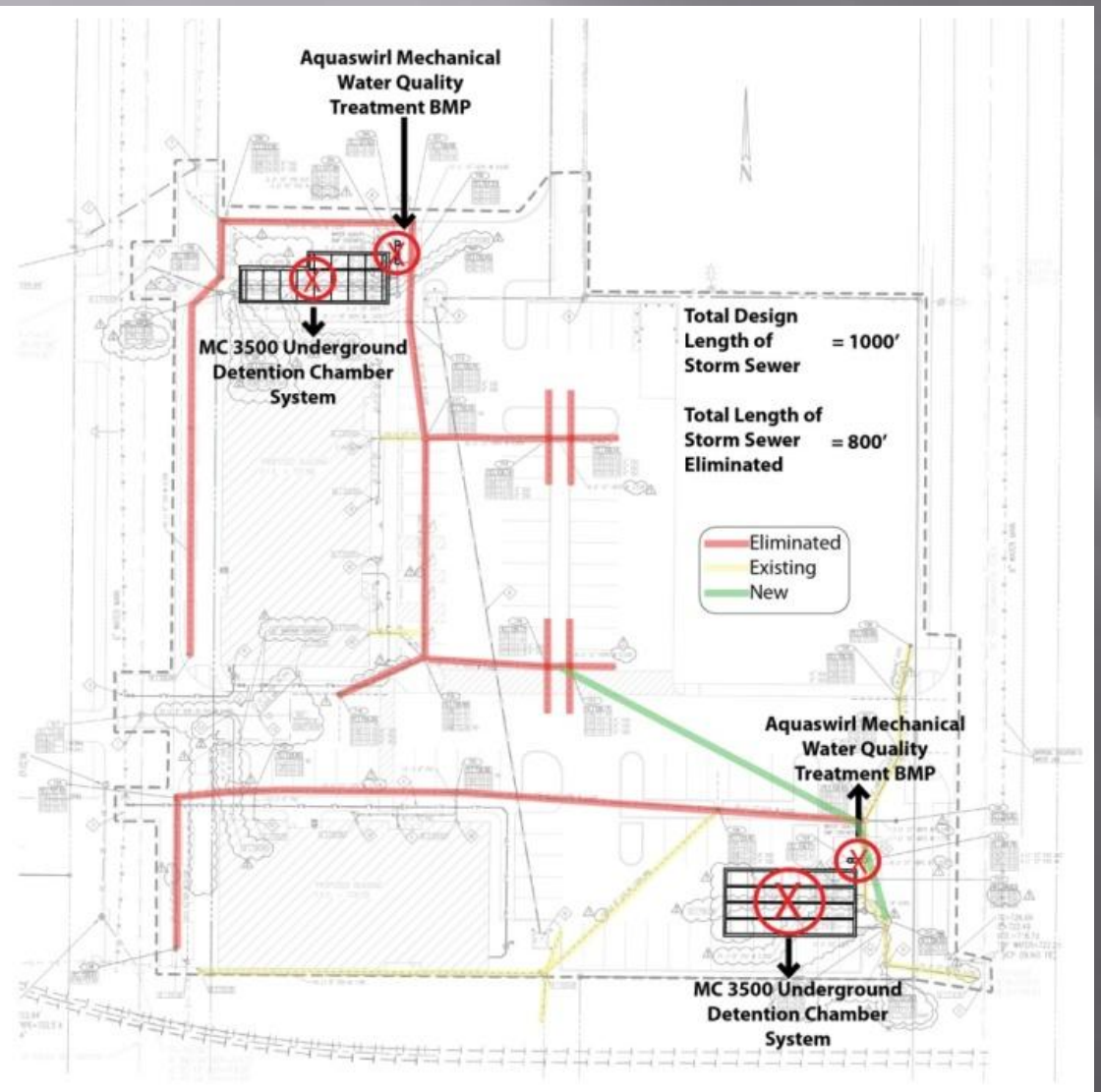


A CASE STUDY THAT MAKES BUSINESS SENSE

The National Apartments
Indianapolis, IN

WILLIAMS CREEK
CONSULTING

The National Apartments



Eliminated $112,000 in infrastructure cost
Reduced $40,000 in net project cost

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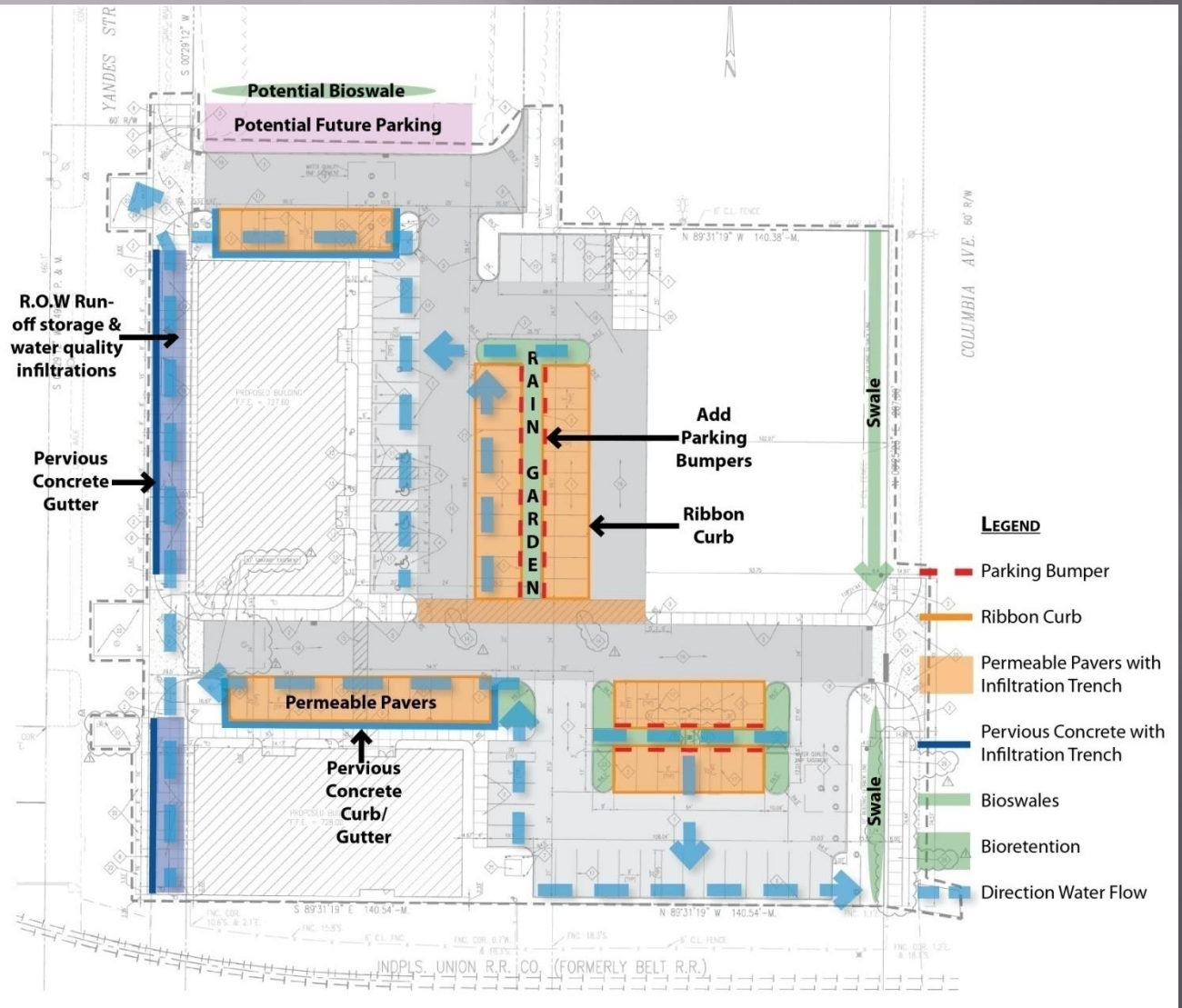
The National Apartments



- Remove 2.3 Million gallons of Stormwater Annually
- Added Aesthetic Benefits
- Added Pride/ Ownership in Community

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Traditional vs. Sustainable

47% reduction in cost

	Traditional Option National Apartments Site Redevelopment					Sustainable Infrastructure Option National Apartments Site Redevelopment				
	Quantity	Unit	$/Unit		$	Quantity	Unit	$/Unit		$
Storm Manhole	14	ea	2300	$	32,200.00	2	ea	2300	$	4,600.00
Catch Basin	3	ea	650	$	1,950.00	2	ea	650	$	1,300.00
Curb Inlet	12	ea	1500	$	18,000.00	0	ea	1500	$	-
12" RCP Storm (Yandes R.O.W.)	63	lf	55	$	3,465.00	0	lf	55	$	-
12" HDPE storm sewer	522	lf	44	$	22,968.00	0	lf	44	$	-
15" HDPE storm sewer	238	lf	50	$	11,900.00	0	lf	50	$	-
18" HDPE storm sewer	144	lf	58	$	8,352.00	0	lf	58	$	-
24" HDPE storm sewer	33	lf	75	$	2,475.00	0	lf	75	$	-
6" SSD	440	lf	20	$	8,800.00	0	lf	20	$	-
8" SSD	246	lf	24	$	5,904.00	446	lf	24	$	10,704.00
4" Concrete Walk	0	sf	5	$	-	no change	0	sf	5	$ -
Concrete Curb & Gutter (only length converted)	330	lf	12	$	3,960.00	0	lf	12	$	-
Pervious Concrete curb & gutter	0	lf	26	$	-	506	lf	26	$	13,156.00
Integral Curb/Walk (per lf savings for conversion to reg walk)	176	lf	2	$	352.00	0	lf			
18" Straight curb (only length converted to ribbon)	322	lf	16	$	5,152.00	0	lf	16	$	-
Ribbon Curb	0	lf	15	$	-	850	lf	15	$	12,750.00
Additional Parking Bumpers	0	ea	60	$	-	36	ea	60	$	2,160.00
Concrete Sidewalk/landscape planter section					no change					
Premium Landscaped Rain Garden	0	sf	10	$	-	800	sf	10	$	8,000.00
Subsurface Storm Chamber Storage System	0.24	ac-ft	250,000	$	60,000.00	0	ac-ft	250,000	$	-
Swirl chamber BMP	2	ea	18,000	$	36,000.00	0	ea	18,000	$	-
Light Duty Asphalt pvt (converted area only)(3.5" section @ $90/ton)	10,120	sft	1.93	$	19,531.60	0	sft	1.93	$	-
Permeable Paver Section	0	sft	6	$	-	10,120	sft	6	$	60,720.00
Add'l Stone Storage under Permeable Paver Section for Water Qual	0	cft	1.5	$	-	10,150	cf	1.5	$	15,225.00
Earthwork		cyd			no change		cyd			
				$	241,009.60				$	128,615.00
Potential Sustainable Infrastructure Savings					$ 112,394.60					

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The National Apartments

Function:

- Collect and infiltrate stormwater

Benefits:

- Recharge Aquifers
- Decrease storage/ treatment cost
- Improve landscape appeal

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Conclusions

- Owner and design team must go "ALL IN" for success
  - To maximize return, must start at conceptual design stage and must be collaborative
- Too many times we are trying to get the water away as fast as possible when it is more valuable remaining in place
- Research and know the local requirements
  - Work closely with local regulatory personnel
- Manage water at its source – **Quantity & Quality**
  - Reduce impervious area and direct connection
  - Increase infiltration
- Know the Facts: Understand the business case

Questions?