LID CASE STUDY DESIGN WORKSHOP
HSG B/D SOIL EXAMPLE
SINGLE FAMILY SUBDIVISION WITH OUTPARCEL

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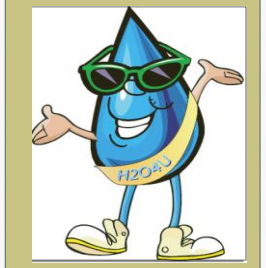

August, 2016

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SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL

Existing Site

- 20.9 acres of agricultural-estate land use
- 1.92 acres of wetlands, 0.63 acres of upland conservation open space
- 1.83% impervious with single family residence (remain) and agricultural building (demolish). 10,884 sf bldg, 6,014 sf pavement

Redevelopment

- Subdivision with 11 SF lots (includes existing house) and 2.96 acre commercial lot (Vet office)
- 24' wide road with cul-de-sac

Level of Treatment – Impaired water body with TMDL

- Net improvement = post-development < pre-development – 10%

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL

Residential Site Information with Stormwater BMP Options							
Land Use	**Site Area (acres)**	**Impervious Area (acres)**	**Directly Connected Impervious Area (acres)**	**Non-DCIA Pervious Area (acres)**	**Soil Types**	**SHGWT**	**Stormwater BMPs**
Existing agricultural SF house	20.9	0.38 1.81%	0.38 1.81%	20.52 CN=70	B/D	2 feet below	None
Proposed Single Family and Commercial	17.94 Residential	4.51 25.1%	4.51 25.1%	13.43 CN=70	**A/B C/D**	**Varies**	2 acre harvesting pond with 4.5 acres of irrigation on landscaped areas or an up-flow filter
	2.96 Vet Office	2.22	2.22	0.74 CN=70	**A/B**	**5 feet below**	

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL

Existing Stormwater Infrastructure: None

Soils:

- **HSG A/B soils on east and south side**
- **HSG C/D soils on west side**

Out-parcel is along East Lake Road

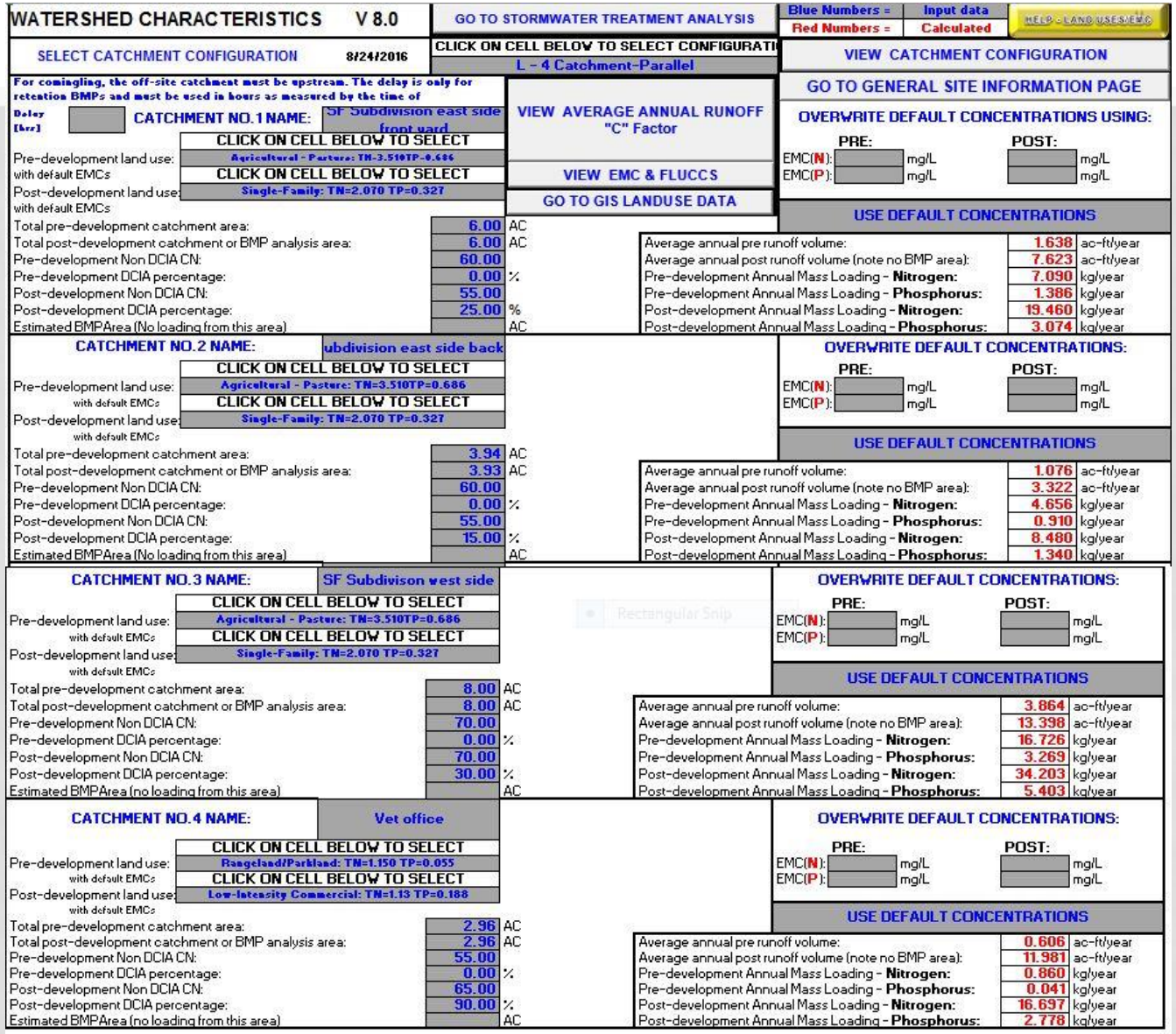
Subdivision road is 1800 ft long

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL

Conventional ERP stormwater: Two wet detention ponds with 14 day residence time totalling 2.66 acres

However, this only provides 33% TN and 61.5% TP load reduction. Not meet goal

WATERSHED CHARACTERISTICS & LOADS



WATERSHED CHARACTERISTICS V 8.0

GO TO STORMWATER TREATMENT ANALYSIS

Blue Numbers = Input data

Red Numbers = Calculated

HELP - LAND USES/EMCs

SELECT CATCHMENT CONFIGURATION 8/24/2016

CLICK ON CELL BELOW TO SELECT CONFIGURATI

L - 4 Catchment-Parallel

VIEW CATCHMENT CONFIGURATION

GO TO GENERAL SITE INFORMATION PAGE

For comingling, the off-site catchment must be upstream. The delay is only for retention BMPs and must be used in hours as measured by the time of

Delay [hrs]

CATCHMENT NO.1 NAME: SF Subdivision east side front yard

VIEW AVERAGE ANNUAL RUNOFF "C" Factor

VIEW EMC & FLUCCS

GO TO GIS LANDUSE DATA

OVERWRITE DEFAULT CONCENTRATIONS USING:

PRE: POST:

EMC(N): mg/L mg/L

EMC(P): mg/L mg/L

USE DEFAULT CONCENTRATIONS

CLICK ON CELL BELOW TO SELECT

Pre-development land use: Agricultural - Pasture: TN=3.510TP=0.686

with default EMCs

CLICK ON CELL BELOW TO SELECT

Post-development land use: Single-Family: TN=2.070 TP=0.327

with default EMCs

Total pre-development catchment area:	6.00	AC
Total post-development catchment or BMP analysis area:	6.00	AC
Pre-development Non DCIA CN:	60.00	
Pre-development DCIA percentage:	0.00	%
Post-development Non DCIA CN:	55.00	
Post-development DCIA percentage:	25.00	%
Estimated BMPArea (No loading from this area)		AC

Average annual pre runoff volume:	1.638	ac-ft/year
Average annual post runoff volume (note no BMP area):	7.623	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**	7.090	kg/year
Pre-development Annual Mass Loading - **Phosphorus:**	1.386	kg/year
Post-development Annual Mass Loading - **Nitrogen:**	19.460	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	3.074	kg/year

CATCHMENT NO.2 NAME: ubdivision east side back

OVERWRITE DEFAULT CONCENTRATIONS:

PRE: POST:

EMC(N): mg/L mg/L

EMC(P): mg/L mg/L

USE DEFAULT CONCENTRATIONS

CLICK ON CELL BELOW TO SELECT

Pre-development land use: Agricultural - Pasture: TN=3.510TP=0.686

with default EMCs

CLICK ON CELL BELOW TO SELECT

Post-development land use: Single-Family: TN=2.070 TP=0.327

with default EMCs

Total pre-development catchment area:	3.94	AC
Total post-development catchment or BMP analysis area:	3.93	AC
Pre-development Non DCIA CN:	60.00	
Pre-development DCIA percentage:	0.00	%
Post-development Non DCIA CN:	55.00	
Post-development DCIA percentage:	15.00	%
Estimated BMPArea (No loading from this area)		AC

Average annual pre runoff volume:	1.076	ac-ft/year
Average annual post runoff volume (note no BMP area):	3.322	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**	4.656	kg/year
Pre-development Annual Mass Loading - **Phosphorus:**	0.910	kg/year
Post-development Annual Mass Loading - **Nitrogen:**	8.480	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	1.340	kg/year

CATCHMENT NO.3 NAME: SF Subdivison west side

OVERWRITE DEFAULT CONCENTRATIONS:

PRE: POST:

EMC(N): mg/L mg/L

EMC(P): mg/L mg/L

USE DEFAULT CONCENTRATIONS

CLICK ON CELL BELOW TO SELECT

Pre-development land use: Agricultural - Pasture: TN=3.510TP=0.686

with default EMCs

CLICK ON CELL BELOW TO SELECT

Post-development land use: Single-Family: TN=2.070 TP=0.327

with default EMCs

Total pre-development catchment area:	8.00	AC
Total post-development catchment or BMP analysis area:	8.00	AC
Pre-development Non DCIA CN:	70.00	
Pre-development DCIA percentage:	0.00	%
Post-development Non DCIA CN:	70.00	
Post-development DCIA percentage:	30.00	%
Estimated BMPArea (no loading from this area)		AC

Average annual pre runoff volume:	3.864	ac-ft/year
Average annual post runoff volume (note no BMP area):	13.398	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**	16.726	kg/year
Pre-development Annual Mass Loading - **Phosphorus:**	3.269	kg/year
Post-development Annual Mass Loading - **Nitrogen:**	34.203	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	5.403	kg/year

CATCHMENT NO.4 NAME: Vet office

OVERWRITE DEFAULT CONCENTRATIONS:

PRE: POST:

EMC(N): mg/L mg/L

EMC(P): mg/L mg/L

USE DEFAULT CONCENTRATIONS

CLICK ON CELL BELOW TO SELECT

Pre-development land use: Rangeland/Parkland: TN=1.150 TP=0.055

with default EMCs

CLICK ON CELL BELOW TO SELECT

Post-development land use: Low-Intensity Commercial: TN=1.13 TP=0.188

with default EMCs

Total pre-development catchment area:	2.96	AC
Total post-development catchment or BMP analysis area:	2.96	AC
Pre-development Non DCIA CN:	55.00	
Pre-development DCIA percentage:	0.00	%
Post-development Non DCIA CN:	65.00	
Post-development DCIA percentage:	90.00	%
Estimated BMPArea (no loading from this area)		AC

Average annual pre runoff volume:	0.606	ac-ft/year
Average annual post runoff volume (note no BMP area):	11.981	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**	0.860	kg/year
Pre-development Annual Mass Loading - **Phosphorus:**	0.041	kg/year
Post-development Annual Mass Loading - **Nitrogen:**	16.697	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	2.778	kg/year

	TN (Kg)	TP (Kg)
Pre-development	**29.3**	**5.61**
Post-development	**78.8**	**12.6**
Target discharge	**26.0**	**5.0**
% Reduction	**67%**	**60%**

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL

For the Single family subdivision:
What combination of LID BMPs do you want to use for stormwater treatment?
What other BMPs are needed?

For the Commercial Outparcel (Vet Office):
What combination of LID BMPs do you want to use for stormwater treatment?

- Preserve Open Space
- Natural Area Conservation
- Minimize clearing, compaction
- Retain natural landscapes
- Florida-friendly landscaping
- Minimize impervious area
- Disconnect impervious area
- Rainfall Interception trees
- Retention basin
- Rain garden (bioretention)
- Vegetated Natural Buffer
- Swales
- Pervious pavement
- Stormwater harvesting
- Biofiltration
- Up-flow filter

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL - LOADINGS

Table 2.3.2 Residential Site Annual Stormwater Loadings and % Reduction

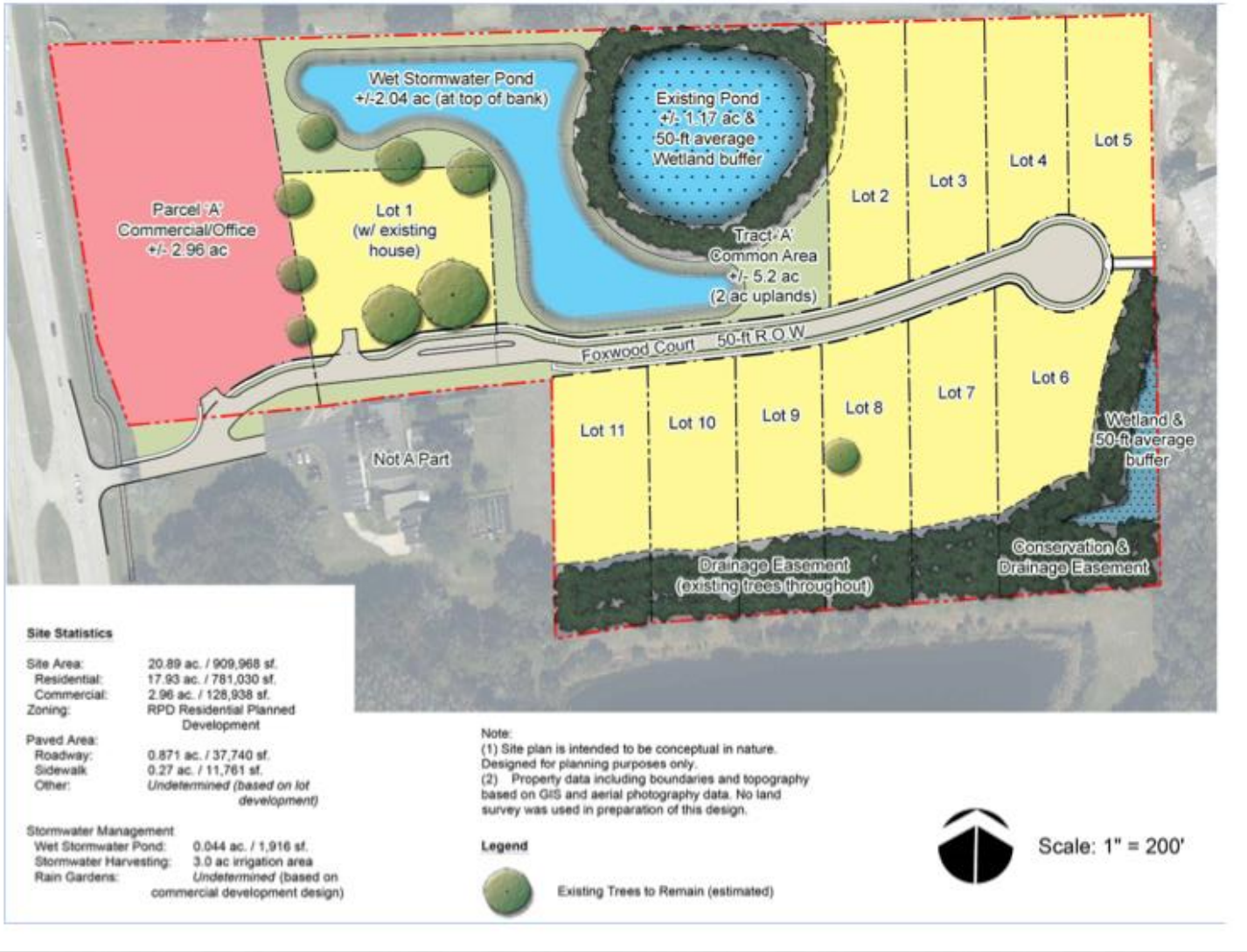
Row #		TN Loadings (kg/year)	TP Loadings (kg/year)	TN % Reduction	TP % Reduction
(1)	Existing Land Use (pre)	27.30	5.34		
(2)	Proposed Land Use no stormwater management	66.78	10.80		
(3)	Proposed Land Use with stormwater management credit (no loading from wet pond)	62.52	9.87		
(4)	Proposed development with a 31 day annual residence time for wet pond and swales	35.22	5.45	47	50
(5)	Proposed Land Use (post) Target Load for Post = 10% reduction from Pre	24.57	4.81	10	10
(6)	Proposed Land Use (post) Manual BMPs – 31 day residence time Wet Detention and Harvesting	24.75	1.96	60	80
(7)	Proposed Land Use (post) Manual BMPs – 21 day residence time Wet Detention and Up-flow Bio-Filtration	23.58	1.47	62	85

Notes: Section 3 lists the assumptions and results in the worksheets from the BMPTRAINS model.

TN loadings = Total Nitrogen stormwater pollutant loadings

TP loadings = Total Phosphorus stormwater pollutant loadings

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL – LID BMPS



SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL COST COMPARISON

Residential Subdivision: Cost Comparison of current stormwater standards and meeting 10% Net Improvement performance standard					
Item No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extended Cost**
Conventional Stormwater Management System – meeting current ERP design criteria					
CON-1	Regular Excavation (Retention Area - 2.6 ac.)	24,380	CY	$5	$121,900
CON-2	Grade / Compact	24,380	CY	$9	$207,230
CON-3	Pinellas Co Type A Curb and Gutter	2,500	LF	$18	$45,000
CON-4	15" ADS Storm Pipe	315	LF	$18	$5,670
CON-5	15" RCP Storm Pipe	89	LF	$62	$5,518
CON-6	14"x23" RCP Storm Pipe	88	LF	$54	$4,752
CON-7	18" RCP Storm Pipe	52	LF	$53	$2,756
CON-8	24" RCP Storm Pipe	792	LF	$90	$71,280
CON-9	Pinellas Co Curb Inlet < 10'	6	EA	$3,500	$21,000
CON-10	FDOT Type C Ditch Bottom Inlet, < 10'	2	EA	$2,600	$5,200
CON-11	Underdrain	2,500	LF	$30	$75,000
CON-12	Storm Manhole, 4' dia, < 10'	2	EA	$3,500	$7,000
CON-13	Swale, 10' wide grassed	306	CY	$9	$2,750
CON-14	Mitered End Section	7	EA	$900	$6,300
CON-15	Rip Rap	1	LS	$2,500	$2,500
CON-16	Concrete Pipe Collar	6	EA	$850	$5,100
CON-17	Sod, Retention Area	12,056	SY	$2	$25,919
				Conventional Total Cost:	$614,875

Residential Subdivision: Cost Comparison of current stormwater standards and meeting 10% Net Improvement performance standard					
Item No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extended Cost**
LID Stormwater Management Systems - meeting 10% Net Improvement Performance Standard					
LID-1	Regular Excavation (Retention Area - 2.0 ac.)	16,133	CY	$5	$80,667
LID-2	Grade / Compact	16,133	CY	$9	$137,133
LID-3	Pinellas Co Type A Curb and Gutter	2,500	LF	$18	$45,000
LID-4	15" ADS Storm Pipe	315	LF	$60	$18,900
LID-5	15" RCP Storm Pipe	43	LF	$62	$2,666
LID-6	14"x23" RCP Storm Pipe	88	LF	$54	$4,752
LID-7	18" RCP Storm Pipe	52	LF	$53	$2,756
LID-8	24" RCP Storm Pipe	759	LF	$90	$68,310
LID-9	Pinellas Co Curb Inlet < 10'	4	EA	$3,500	$14,000
LID-10	FDOT Type C Ditch Bottom Inlet, < 10'	1	EA	$2,600	$2,600
LID-11	Underdrain	2,500	LF	$30	$75,000
LID-12	Storm Manhole	2	EA	$3,500	$7,000
LID-13	Swale, 10' wide grassed	306	CY	$9	$2,750
LID-14	Mitered End Section	5	EA	$900	$4,500
LID-15	Rip Rap	1	LS	$2,500	$2,500
LID-16	Concrete Pipe Collar	6	EA	$850	$5,100
LID-17	Sod, Retention Area	9,680	SY	$2	$20,812
LID-18	Stormwater Harvesting (3 ac irrigation system)	1	LS	$50,000	$50,000
				LID Total Cost:	$544,446
Estimated premium cost differential for LID verses Conventional Stormwater Management:					-11%

Notes:

1. Quantities based on Pinellas County plan submittal.
2. Unit cost based on current local costs and readily available published data. Cost estimates include material and labor for installation.
3. Stormwater collection system cost for the LID scenario are based on existing system minus infrastructure required for smaller pond.
4. Irrigation lump sum includes all components for functioning system including pumps, controls, wiring, valves and distribution pipes and heads.

SINGLE FAMILY SUBDIVISION WITH COMMERICAL OUT-PARCEL ADDITIONAL BENEFITS

- Required load reductions were met with LID BMPs
- LID BMP Treatment Train included 2.6 wet detention pond with stormwater harvesting of 3 acres of residential and commercial land. This can save 3.2 MGY of potable water and $10,000/yr. Alternatively, an upflow filter can be used.
- Florida-friendly landscaping provides additional 3% TN load reduction. The Natural Area Conservation Credit can be used. Depending on SHGWT, back yard VNB could be used.
- The LID BMP Treatment Train cost 11% less than the conventional system.