



**GENESIS GROUP**  
FROM VISION TO REALITY

**Community Planning**

**Community Redevelopment**

**Urban Design**

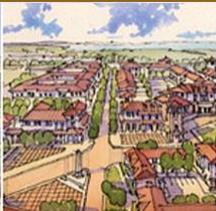
**Landscape Architecture**

**Civil Engineering**

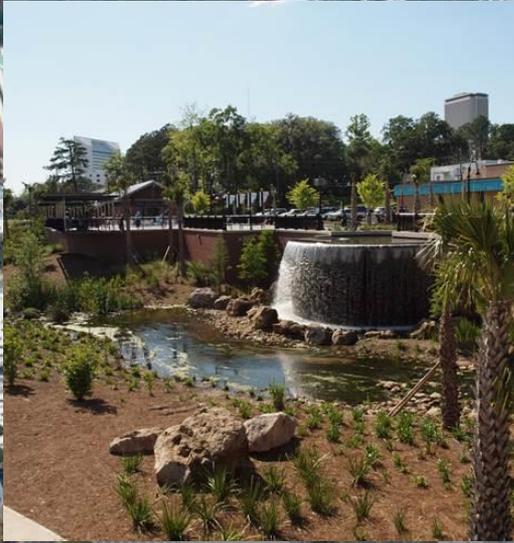
**Transportation Engineering**

**Applied Sciences**

**Market Economics**



# Surface Water – Urban Treatment Systems – Capital Cascades





# Surface Water – Urban Treatment Systems – Atlanta Beltline



**Terrestrial Systems**

**Sandy Soil Backfill**

**Container Grown**

**Landscape BMP's**

**Irrigation w/ Sensor**

**Under Drainage**

**CMU Wall Systems**

**Aquatic Systems : BMP's**

**Stormwater Retention – Water Quality & Attenuation**

**Littoral Shelf Design & Aeration Fountain**

**Continuing Aquatic Maintenance Contract**

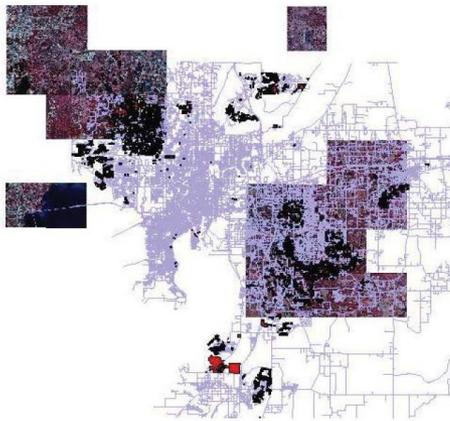
**Continuing  
Maintenance  
Contract**

# Surface Water – Urban Treatment Systems – Atlanta Beltline



# Best Management Practices in Florida

## The Community Benefits of Large-scale Development



Wayne Archer  
Professor of Real Estate  
University of Florida

December 7, 2004

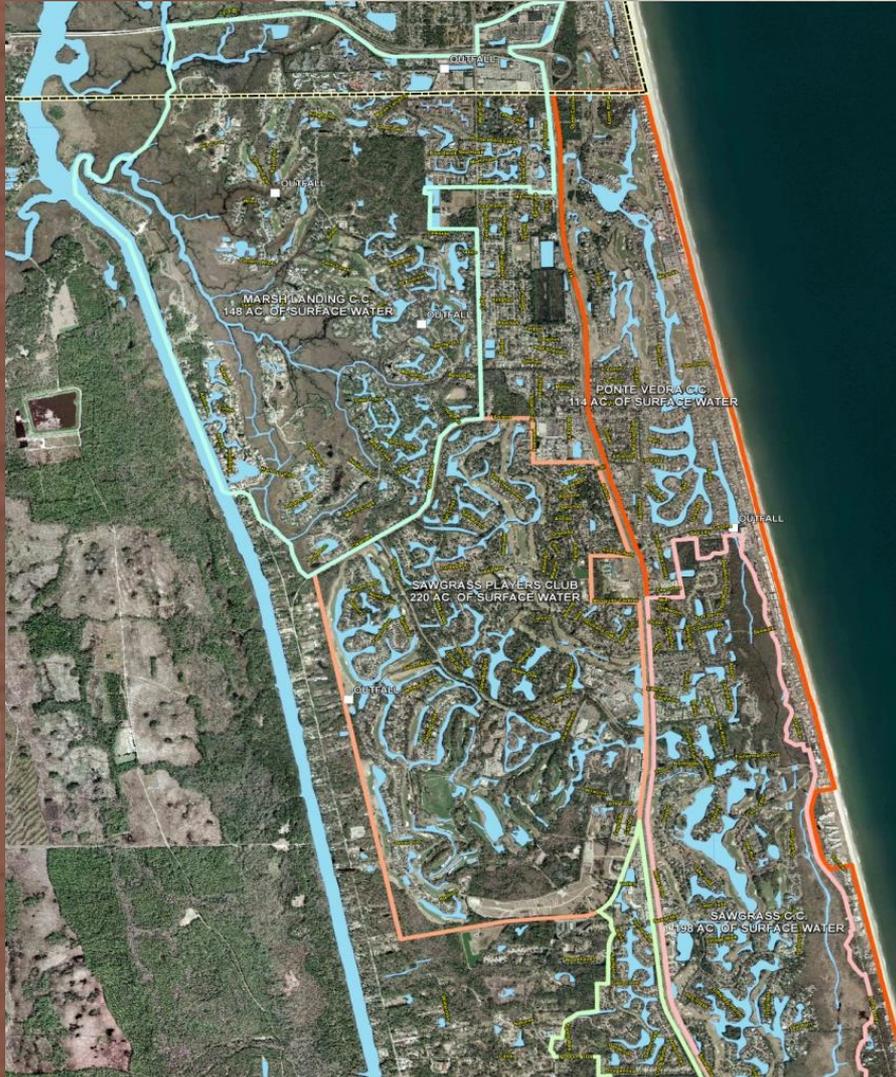


- **Sophisticated and creative land planning techniques**
- **Purchasing advantages (scale) to enable higher quality construction practices**
- **Public permitting and controls are a fixed cost of the review process**
- **Effective management of storm water**
- **Efficient water conservation**

Community Water Quality

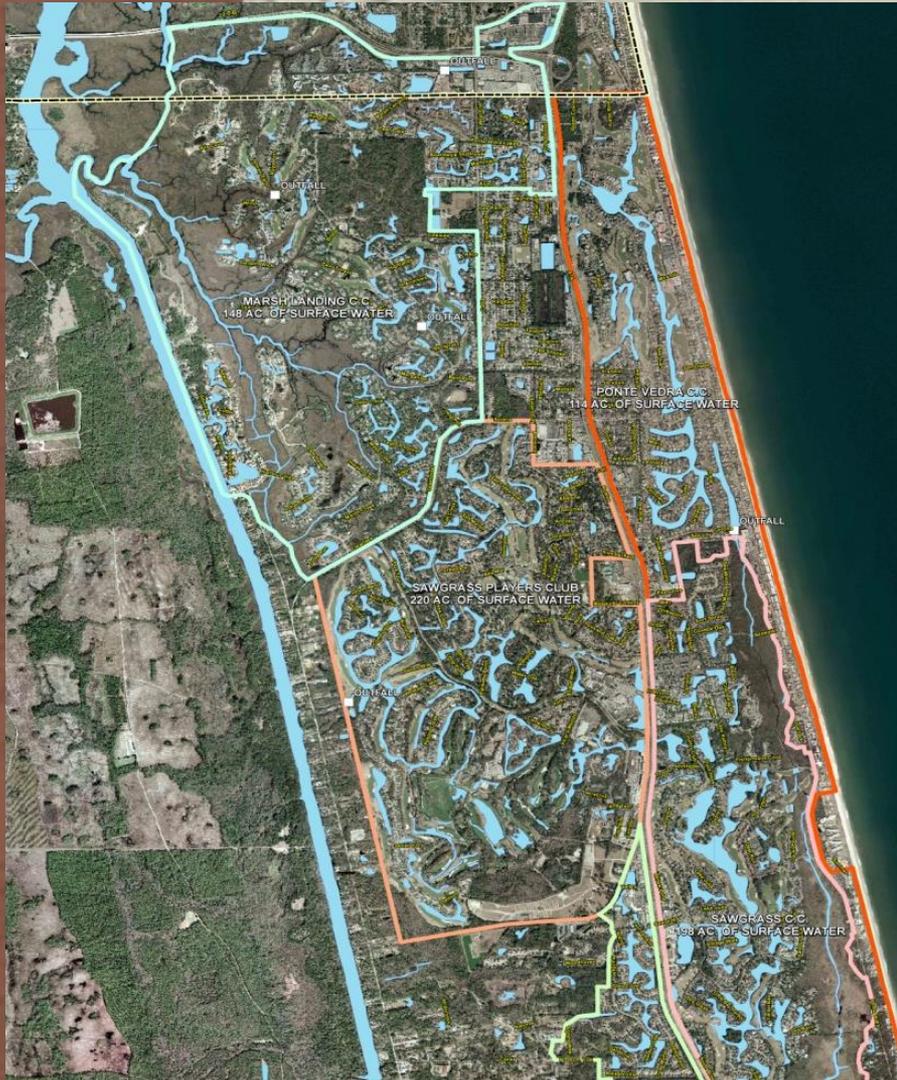
# Best Management Practices in Florida

## Florida's First DRI - Caballos del Mar



- The Original ADA (1975) states that a large network of surface storm water ponds will recycle runoff to provide irrigation water sources for Golf, and all Common Area Green Spaces.
- Although implemented, surface water fouling from algae & herbicides began to damage & kill street trees, shrubs & turf.
- All Irrigation surface water intake pumps were converted to wells via CUP.

# Community Water Quality Best Management Practices in Florida Florida's First DRI - Caballos del Mar



- Over 680 surface acres of storm water lakes were not enough to supply approximately 2400 acres of Suburban Neighborhood Common Area due to degraded water quality.



# Community Water Quality

## Ponds & Lakes - Best Management Practices : DESIGN

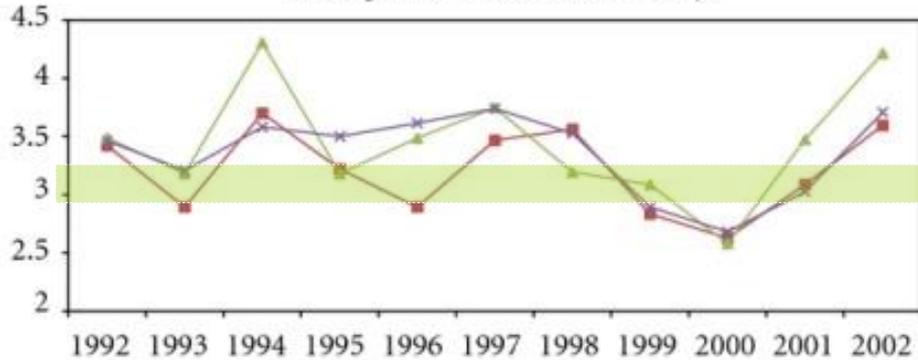
	A	B	C	D	E	F	G	H	I	J
1		0- 0.5"	0.5-1.0"	1"-2"	2"-3"	3-4"	4"+	total rain days/month	total inches/month	
2	Jan-00	7	0	1	0	0	0	8	2.77	
3	Feb-00	1	1	0	0	0	0	2	1.17	
4	Mar-00	7	1	0	0	2	0	10	8.48	
5	Apr-00	2	1	1	0	0	0	4	2.6	
6	May-00	6	0	1	0	0	0	7	1.15	
7	Jun-00	11	1	0	0	0	0	12	2.43	
8	Jul-00	7	0	3	0	0	0	10	5.69	
9	Aug-00	10	1	2	1	0	0	14	7.4	
10	Sep-00	8	5	2	0	0	1	16	11.64	
11	Oct-00	5	0	0	0	0	0	5	0.23	
12	Nov-00	4	1	0	0	0	0	5	1.55	
13	Dec-00	2	0	1	0	0	0	3	1.37	
14	Jan-01	7	0	0	0	0	0	7	0.91	
15	Feb-01	6	0	0	0	0	0	6	0.69	
16	Mar-01	10	2	1	0	0	0	13	5.48	
17	Apr-01	3	0	0	0	0	0	3	0.62	
18	May-01	2	1	1	0	0	0	4	2.56	
19	Jun-01	17	1	1	0	0	0	19	5.59	
20	Jul-01	10	2	3	1	0	0	16	8.31	
21	Aug-01	10	1	2	0	0	0	13	3.58	
22	Sep-01	10	5	2	1	0	1	19	16.06	
23	Oct-01	8	0	0	0	0	0	8	0.84	
24	Nov-01	9	0	1	0	0	0	10	1.49	
25	Dec-01	10	0	0	1	0	0	11	3.2	

1905 to present data - NOAA Jacksonville Station

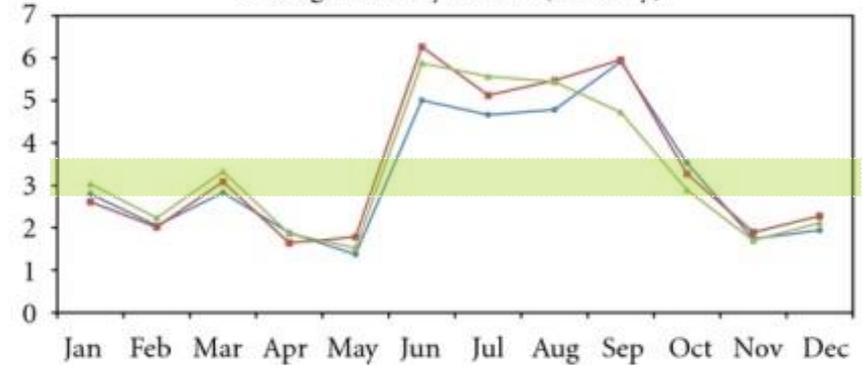
# Community Water Quality

## Ponds & Lakes - Best Management Practices : DESIGN

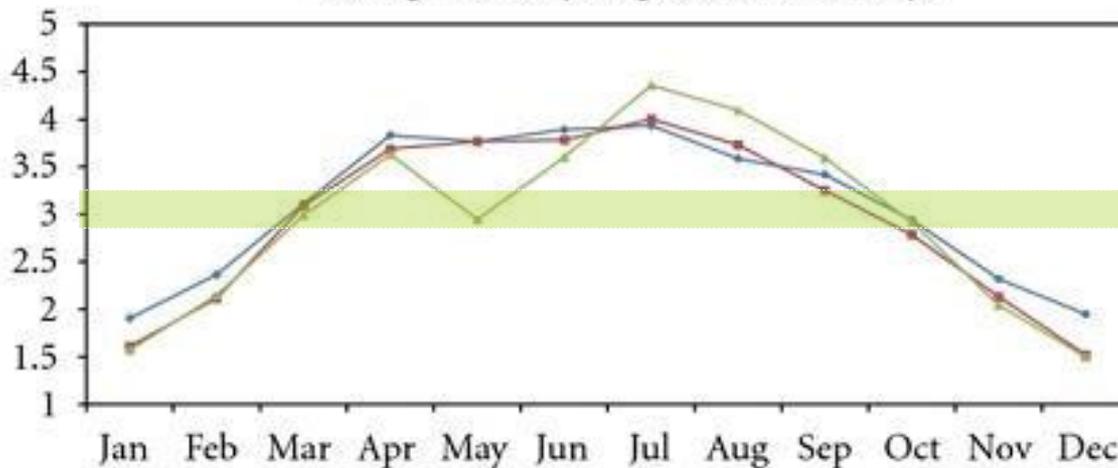
Average annual rainfall (mm/day)



Average monthly rainfall (mm/day)



Average monthly evaporation (mm/day)



Average N.E. Florida Weather Stations

# Community Water Quality

## Ponds & Lakes - Best Management Practices : DESIGN

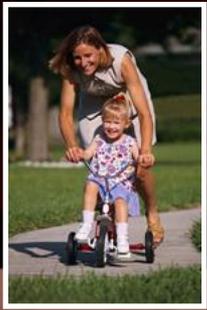
Rain Events @ 5"  
Rain Events @ 4"

Rain Events @ 0-3"

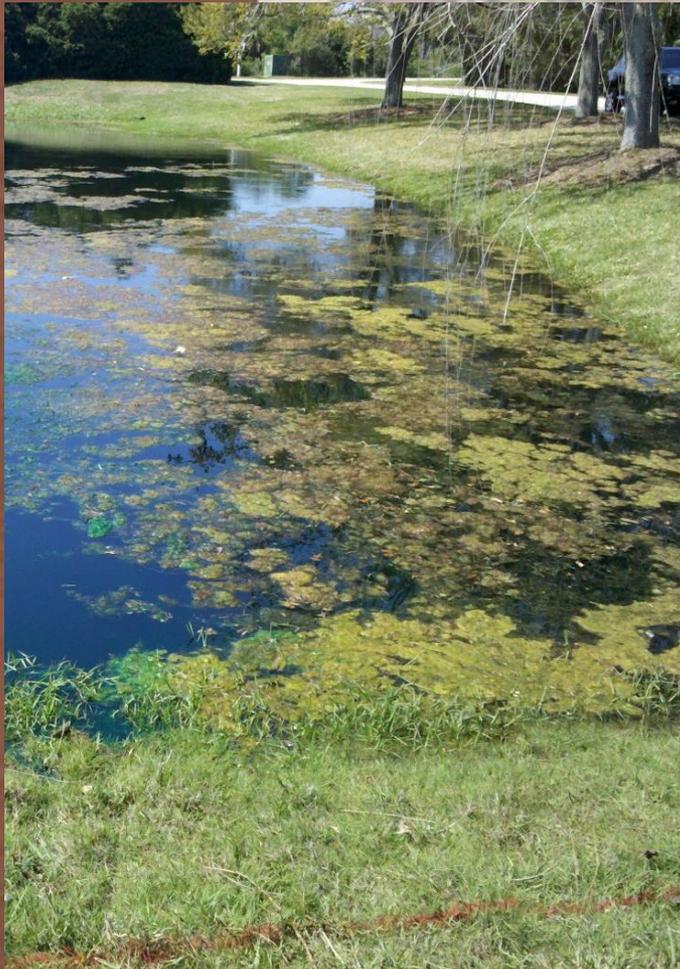
M	N	O	P	Q	R	S	T	U
	0-.49	.5-.99	1-1.99	2-2.99	3-3.99	4 +	Total Events	Total Inches
total 00	70	11	11	1	2	2	96	46.48
total 01	102	12	11	3	0	1	129	49.33
total 02	101	21	10	3	0	2	137	57.35
total 03	108	13	9	2	0	1	132	44.47
total 04	98	22	7	4	2	2	135	69.47
total 05	97	23	16	1	1	2	140	64.45
total 06	62	11	6	3	1	1	84	38.07
total 07	72	19	8	3	1	0	103	46.01
total 08	75	19	12	2	0	1	108	57.18
total 09	75	15	15	1	1	2	108	59.7
total 10	67	12	5	2	0	0	86	33.4
total 11	63	15	14	2	0	0	95	47.96
total 12	74	17	9	2	0	2	104	53.14
total 13	89	16	7	3	1	0	116	45.24

Time of concentration varies up to 20 hours after peak rain values





## Community Surface Water – Sustainability Aquatic Nutrient Loading



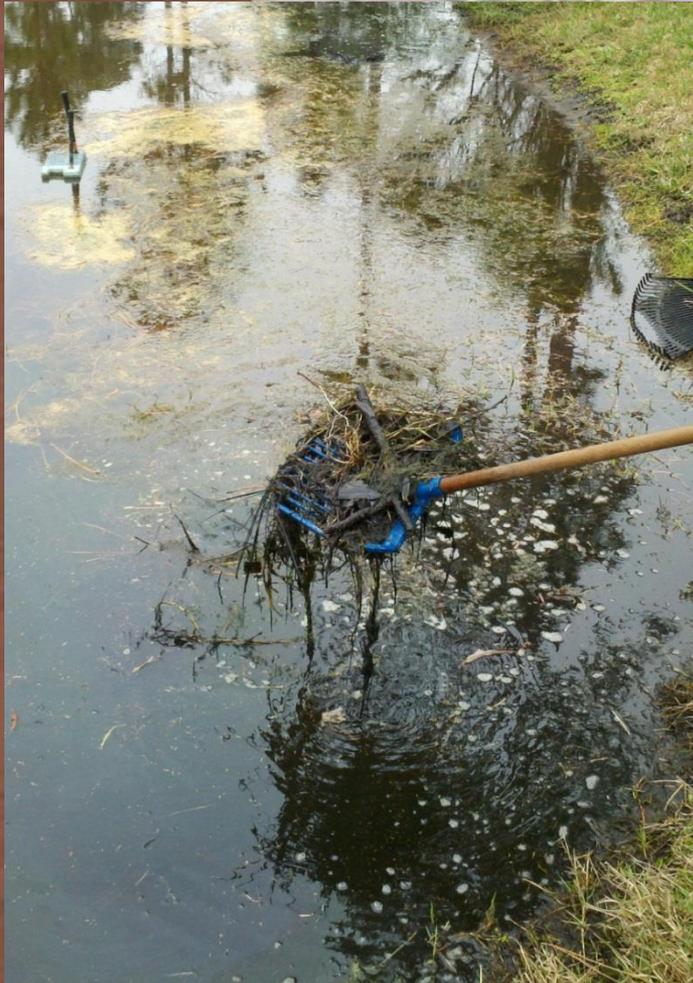
### Terrestrial Sources :

- Clippings & Leaf Drop
- Edge Zone Vegetation
- SAV (Submerged Aquatic Vegetation)
- Storm Water Quality
- Fertilizer Type & Application
- Conveyance Path to Lake

### Aquatic - Biologic Sources :

- Sludge & Sediment – Benthic Zone
- Resident Organic Life
- Algae Growth & Decay
- Leaching via Soil Strata
- Bacterial Processing – Food Chain

# Aquatic Nutrient Loading



## Annual Manual Removal

- Jan. 15<sup>th</sup> – Feb. 15<sup>th</sup> Ideal
- 2 workers = 800 to 1,200 l.f./hr.
- Split Responsibility - Frontage
- Golf Course by Force Account
- Golf Course by \$ Contribution
- Common Areas by Landscape Management Contractor
- Residential Lot Frontage by :  
Neighborhood/Unit HOA  
Lot Owners  
Aquatic Contractor
- Master Association Responsibility

# Aquatic Nutrient Loading – Sediment & Benthic



**Aquatic Treatments & Landscape Maintenance practices typically increase the rate of sludge & sedimentation.**



# Community Surface Water – Sedimentation Control & Treatment Systems



## **Community Surface Water Aquatic Management - Treatment**

### **Copper Sulfate: Temporary Cover-up**

- **Class I toxicity , Cu is a base metal element**
- **Leaches through sand and binds to sediment/clay**
- **Does not break down in environment**
- **Toxic to fish, snails, amphibians, Zooplankton,**
- **Kills beneficial microbes-normal pond Biology**
- **Disrupts cellular photosynthesis**
- **Algae strains are becoming resistant**
- **Dead Algae release nutrients to repeat cycle**
- **Allows Organic material to accumulate**

# Community Water Quality Best Management Practices in Florida

- **Storm Water Management Practices are outdated**
- **BMP's do not improve water quality**
- **BMP's do not address sediment reduction**
- **Commercial Treatment Practices treat symptoms**



# Ponds & Lakes - Best Management Practices : Materials

	Algaecide/Aquatic Herbicide	\$ per Acre*	Trade Names
<b>Active Treatment</b>	Glyphosate	\$300*	Roundup, Rodeo, AquaMaster, AquaPro
	Endothall	\$650*	Aquathol K, Hydrothol 191
	2, 4-D	\$300-600*	Navigate, Aquakleen
	Diquat	\$300-400*	Reward
	Cu So 4	\$85*	Copper, Komeen, Nautique
	Fluridone	\$900-1000*	Sonar AS, WhiteCap SC
<b>Reserve Treatment</b>	Triclopyr-TEA	\$875*	Renovate 3
	Imazapyr	\$160-175	Habitat***
	Peroxygen**	\$135**	GreenClean, Pak 27

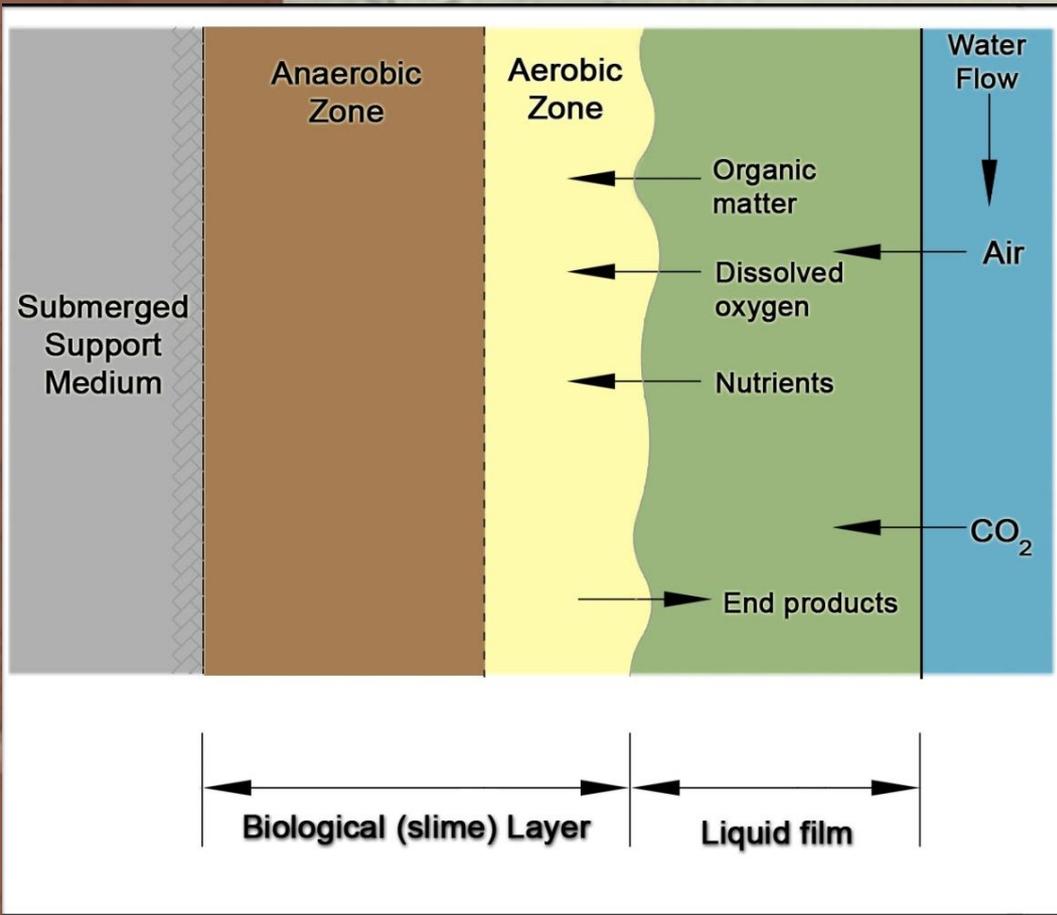
## Available Commercial Treatment Chemicals

\*Single treatment

\*\* Needs weekly treatments to clear

\*\*\* 14 day draw down recommended for emergent littoral zone vegetation

# Community Surface Water Stormwater & Aquatic Management



Schematic diagram of attached-growth

## Aquatic Bacteria Benefits

- **Creates Bio-film**
- **Converts NPK**
- **Completes Carbon Cycle**
- **Completes Nitric Cycle**
- **Reduces Sedimentation**

## Secondary Benefits

- **Pathogen Suppression**
- **Algae Suppression via competition**
- **Turbidity Reduction**

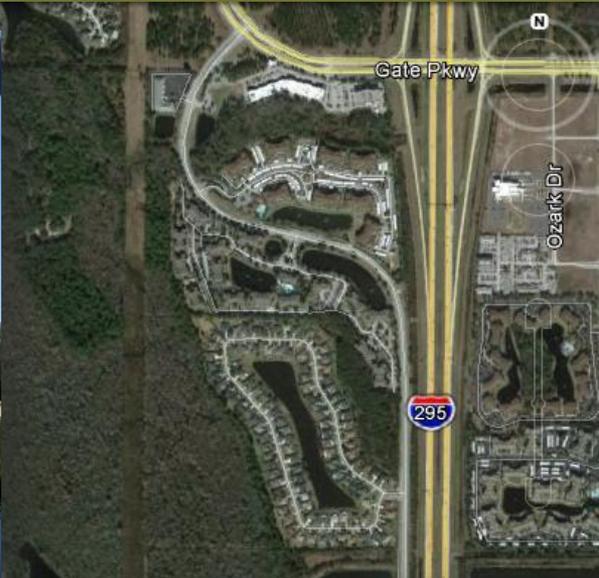
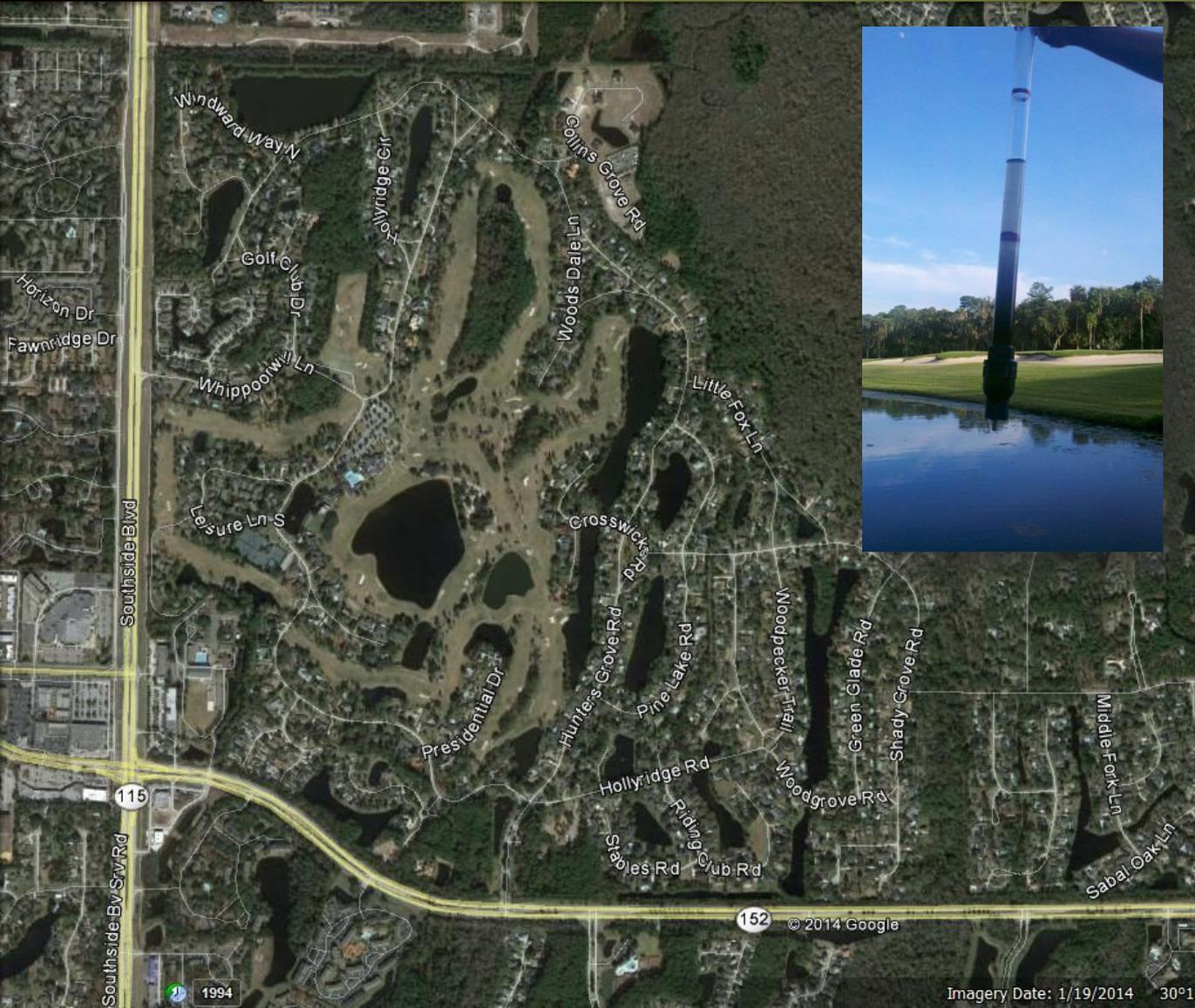
# Community Sustainability Programming & Management

## Stormwater & Aquatic Management

- **Bacteria Dominant system vs Algae Dominance**
- **May be applied on a single drainage basin or Community Scale**
- **Bio-degradable (not heavy metals)**
- **Non-toxic, no application restrictions**
- **Causes algae to “off gas” cellular activity**
- **Loss of buoyancy causes algae to sink in water column**
- **Algae hydrolyzes on bottom with low light levels**
- **Introduce microbes to sediment layer & littoral zones**
- **Convert algae/nutrients**
- **NPK converted to cellular ATP & cellular proteins**
- **Move nutrients up food chain!**

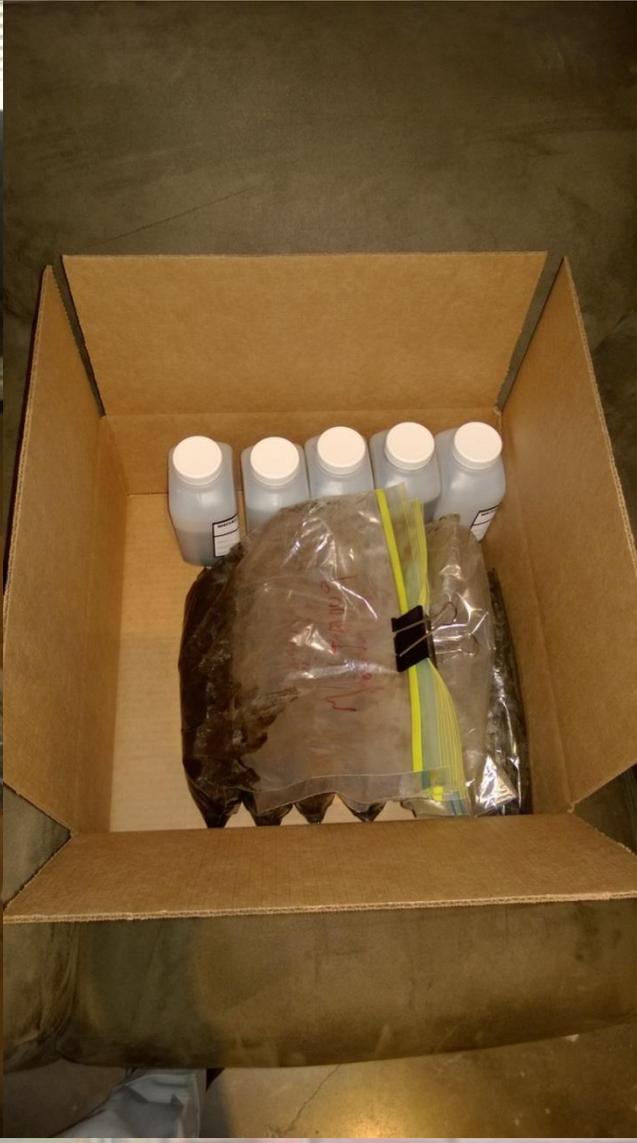


# Deerwood Sustainable Community Programming & Management Data Collection & Analysis – Field Sampling





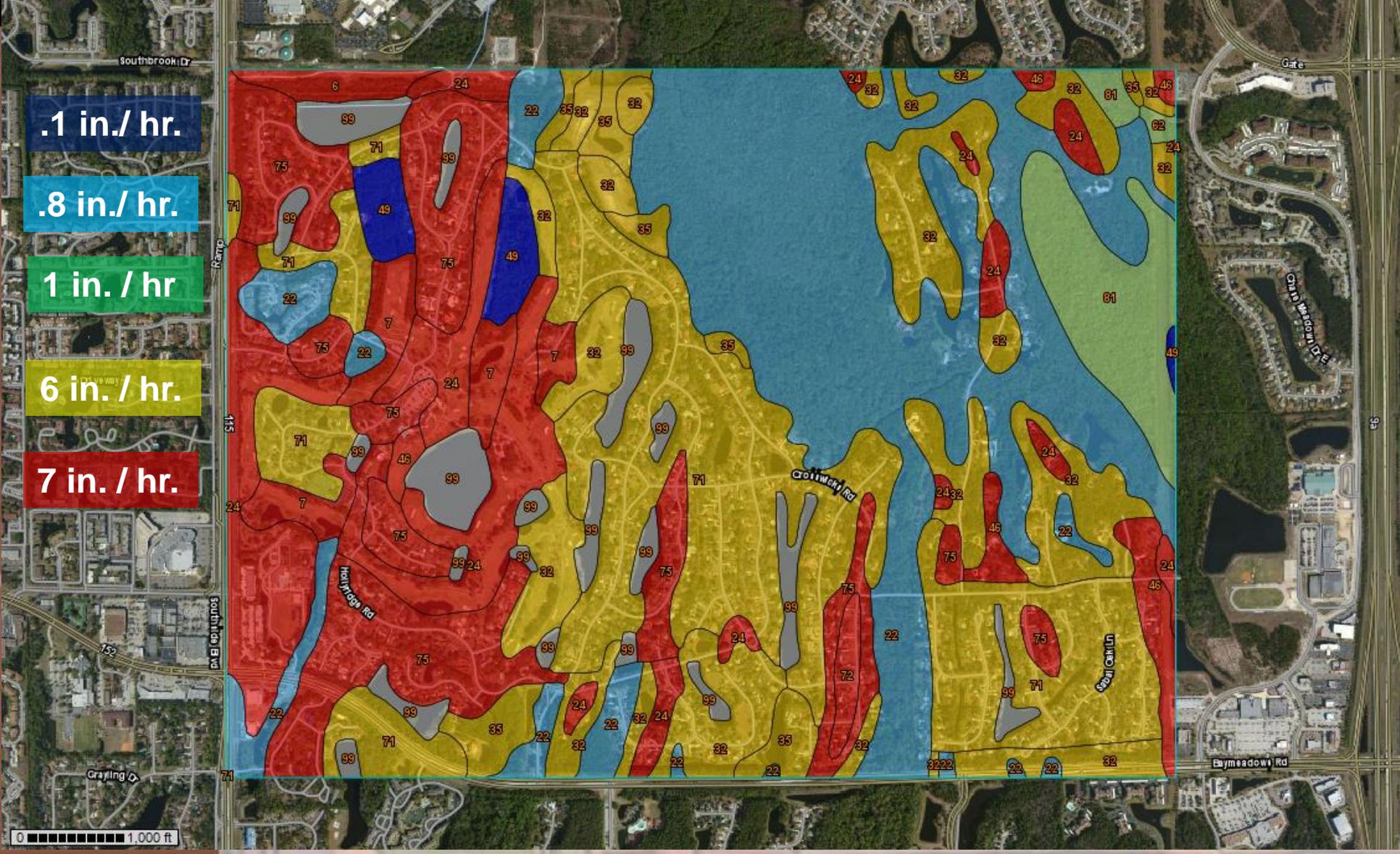
# Deerwood Sustainable Community Programming & Management Data Collection & Analysis - Lab







# Deerwood Sustainable Community Programming & Management Data Collection & Analysis – exfiltration rate



.1 in./ hr.

.8 in./ hr.

1 in. / hr

6 in. / hr.

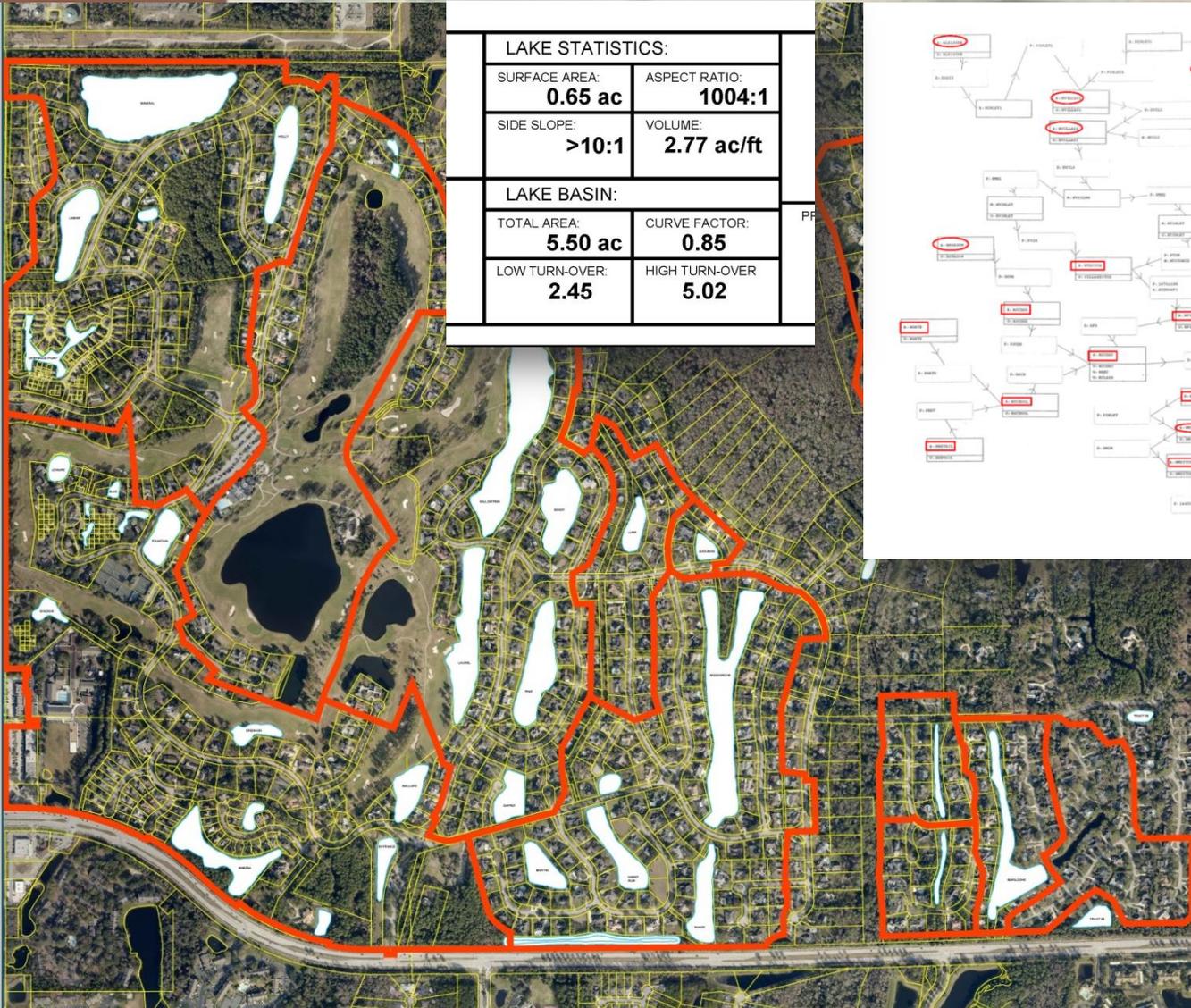
7 in. / hr.

0 1,000 ft

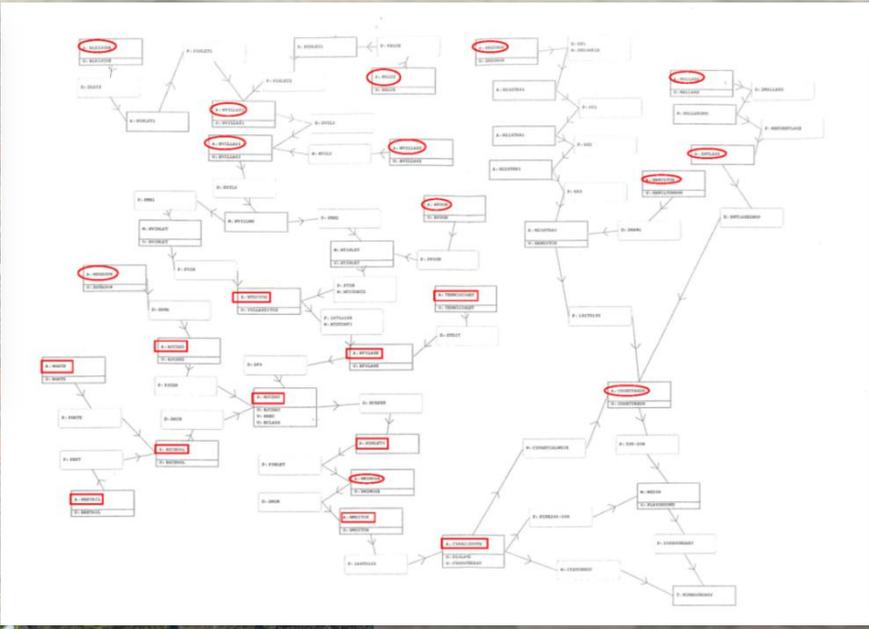




# Deerwood Sustainable Community Programming & Management Data Collection & Analysis Mimosa Basin



LAKE STATISTICS:	
SURFACE AREA: <b>0.65 ac</b>	ASPECT RATIO: <b>1004:1</b>
SIDE SLOPE: <b>&gt;10:1</b>	VOLUME: <b>2.77 ac/ft</b>
LAKE BASIN:	
TOTAL AREA: <b>5.50 ac</b>	CURVE FACTOR: <b>0.85</b>
LOW TURN-OVER: <b>2.45</b>	HIGH TURN-OVER: <b>5.02</b>

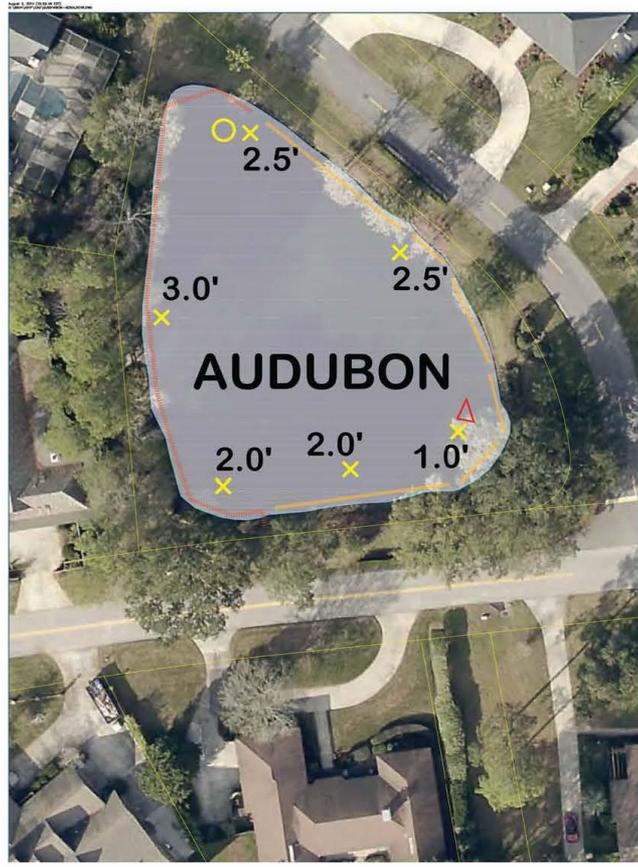




# Deerwood Sustainable Community Programming & Management

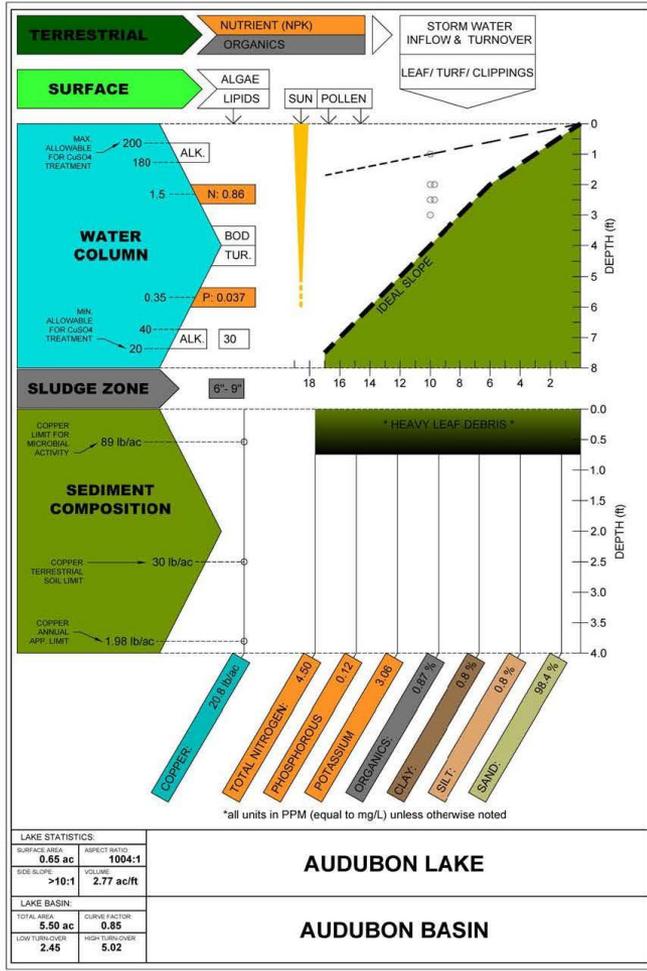
## Data Collection & Analysis Audubon Lake

LAKE SYSTEM ANALYSIS REPORT 2014



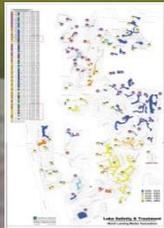
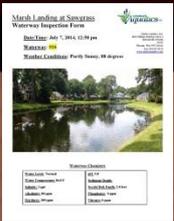
- 3.0' - SLOPE DEPTH CHECK POINT
- x - SLUDGE SAMPLING POINT
- o - SLUDGE SAMPLING POINT
- SEDIMENT SAMPLING POINT
- EXCAVATION ZONE
- BULK HEAD INSTALLATION
- SPECIAL RECOMMENDATION

AUDUBON LAKE = D	
<ul style="list-style-type: none"> <li>Bulkhead addition</li> <li>Slope excavate zones</li> <li>Add clay layer</li> <li>Add coquina shell</li> </ul>	<ul style="list-style-type: none"> <li>Annual manual removal</li> <li>Microbe program</li> <li>Flocculant treatment (10 years)</li> </ul>





# Marsh Landing Sustainable Community Program & Management Treatment & Remediation Program



Timestamp	Pond Keeper Report	Visual Condition Change	What is the closest street address to	What Lake Nun Name of Pond Keeper ?
6/29/2015 17:10:42	clarity normal, color has changed	6/29/2015 clarity normal, color has changed	113 osprey cove	51 Ken Clark
7/3/2015 14:28:44	7/3/2015 clarity normal, color has changed, debris, leaves or clippings floating on surface	7/3/2015 clarity normal, color has changed, debris, leaves or clippings floating on surface	Whole pond	49 Herb Fischer
7/3/2015 14:32:53	7/3/2015 Drained bulkhead cost in prog	7/3/2015 Drained bulkhead cost in prog	Whole pond	64 Herb Fischer
7/3/2015 14:36:27	7/3/2015 clarity normal, color has changed, debris, leaves or clippings floating on surface	7/3/2015 clarity normal, color has changed, debris, leaves or clippings floating on surface	Whole pond	40 Herb Fischer
7/3/2015 14:37:30	7/3/2015 clarity normal, color has changed, debris, leaves or clippings floating on surface	7/3/2015 clarity normal, color has changed, debris, leaves or clippings floating on surface	Whole pond	47 Herb Fischer
7/3/2015 14:42:05	7/3/2015 color normal, water is cloudy, debris, leaves or clippings floating on surface, perimeter vegetation	7/3/2015 color normal, water is cloudy, debris, leaves or clippings floating on surface, perimeter vegetation	121 lamplighters ln	46 Herb Fischer
7/3/2015 15:06:41	7/3/2015 Fountain working	7/3/2015 Fountain working	Whole pond	94 Herb Fischer
7/3/2015 15:09:20	7/3/2015 debris, leaves or clippings floating on surface, perimeter vegetation above surface	7/3/2015 debris, leaves or clippings floating on surface, perimeter vegetation above surface	Whole pond	95 Herb Fischer
7/3/2015 15:17:02	7/3/2015 Fountain working	7/3/2015 Fountain working	Whole pond	97 Herb Fischer
7/3/2015 15:18:44	7/3/2015 debris, leaves or clippings floating on surface	7/3/2015 debris, leaves or clippings floating on surface	Whole pond	96 Herb Fischer
7/3/2015 15:21:40	7/3/2015 debris, leaves or clippings floating on surface, perimeter vegetation above surface	7/3/2015 debris, leaves or clippings floating on surface, perimeter vegetation above surface	Whole pond	98 Herb Fischer
7/6/2015 10:16:42	7/6/2015 all looks well	7/6/2015 all looks well	24472 Harbour View Drive	2 & 4 & 5 Jim Moore
7/20/2015 21:04:36	7/18/2015 surface algae or surface growth, Grass clippings	7/18/2015 surface algae or surface growth, Grass clippings	Whole pond	16 Gil Barnera
7/20/2015 21:06:03	7/18/2015 surface algae or surface growth, Grass clippings	7/18/2015 surface algae or surface growth, Grass clippings	Whole pond	16 Gil Barnera
7/20/2015 21:06:59	7/18/2015 surface algae or surface growth	7/18/2015 surface algae or surface growth	As viewed from Marsh landing pkwy	20 Gil Barnera
7/31/2015 18:00:11	7/30/2015 surface algae or surface growth	7/30/2015 surface algae or surface growth	101 Linkside Circle	37 Dan Hofacker
8/1/2015 14:00:02	8/1/2015 color normal, water is cloudy, debris, leaves or clippings floating on surface, surface algae or surface growth, perimeter vegetation above surface	8/1/2015 color normal, water is cloudy, debris, leaves or clippings floating on surface, surface algae or surface growth, perimeter vegetation above surface	Deer Haven at the end of the cup de sac	6 Dan Hofacker
8/1/2015 14:15:07	8/1/2015 color normal, water is cloudy, debris, leaves or clippings floating on surface, surface algae or surface growth, perimeter vegetation above surface	8/1/2015 color normal, water is cloudy, debris, leaves or clippings floating on surface, surface algae or surface growth, perimeter vegetation above surface	Deer Haven at the end of the cup de sac	8 Dan Hofacker
8/1/2015 14:27:13	8/1/2015 surface algae or surface growth, perimeter vegetation above surface, Brown 'algae' along the shore	8/1/2015 surface algae or surface growth, perimeter vegetation above surface, Brown 'algae' along the shore	112 osprey cove lane	63 jim lewandowski
8/3/2015 14:18:42	8/3/2015 color normal, water is cloudy, Weeds growing into pond from shore	8/3/2015 color normal, water is cloudy, Weeds growing into pond from shore	113 osprey cove	51 lewandowski
8/3/2015 14:20:40	8/3/2015 color normal, water is cloudy, Lake looks good	8/3/2015 color normal, water is cloudy, Lake looks good	109 deer lake	61 jim lewandowski
8/3/2015 14:26:14	8/3/2015 color normal, water is cloudy, surface algae or surface growth, Water level good, floating algae	8/3/2015 color normal, water is cloudy, surface algae or surface growth, Water level good, floating algae	133 deer cove	62 jim lewandowski
8/3/2015 14:33:51	8/3/2015 color normal, water is cloudy, surface algae or surface growth, perimeter vegetation above surface	8/3/2015 color normal, water is cloudy, surface algae or surface growth, perimeter vegetation above surface	133 deer cove	62 jim lewandowski
8/3/2015 14:34:00	8/3/2015 color normal, water is cloudy, surface algae or surface growth, perimeter vegetation above surface	8/3/2015 color normal, water is cloudy, surface algae or surface growth, perimeter vegetation above surface	Whole	No 6 Bud Roemhild
8/5/2015 13:44:40	8/5/2015 perimeter vegetation above surface, Large submerged tree branch removed Aug. 2	8/5/2015 perimeter vegetation above surface, Large submerged tree branch removed Aug. 2	113 osprey cove	51 Ken Clark
8/5/2015 16:41:34	8/5/2015 Text Message	8/5/2015 Text Message		



**PIPE LEGEND**

- 24" PIPE W/ INLET
- PIPE W/ STORM MANHOLE
- PIPE W/ MITERED END SECTION
- PIPE W/ END WALL
- LAKE CONTROL STRUCTURE
- STORM WATER PUMP STATION
- LAKE FLOW ARROW

**AERATOR LEGEND**

- 1 AIR 1
- 5 AIR 3
- 7 & 8 AIR 6
- 15 AIR 4
- 16 AIR 7 (Custom)
- 18 AIR 1 Plus
- 20 AIR 3
- 40 AIR 3
- 66 AIR 4
- 89 AIR 2XL

ATLANTIC OCEAN



# Marsh Landing Sustainable Community Program & Management Resident & Vendor Education Program



As a commercial fertilizer/pesticide technician or lawn care specialist, many of you have noticed the many ponds that wind their way through Marsh Landing. What is not readily apparent is that these ponds have been under stress caused by excess pollutants in the form of fertilizer and yard waste entering the water. The most visible effect of this nutrient loading is algal blooms that lead to other serious issues within our pond system.

To address this growing problem, the Marsh Landing Master Association has established community landscape and fertilizer standards for residents and vendors. Your compliance is essential to the success of our enhanced pond maintenance and rehabilitation project. This is especially important when working on properties adjacent to a pond.

To ensure compliance with these standards, a Pond Keeper program has been established to actively monitor the system of ponds within Marsh Landing. The responsibilities of the Pond Keeper volunteers include reporting issues with pond appearance and non-compliance with landscaping maintenance practices.

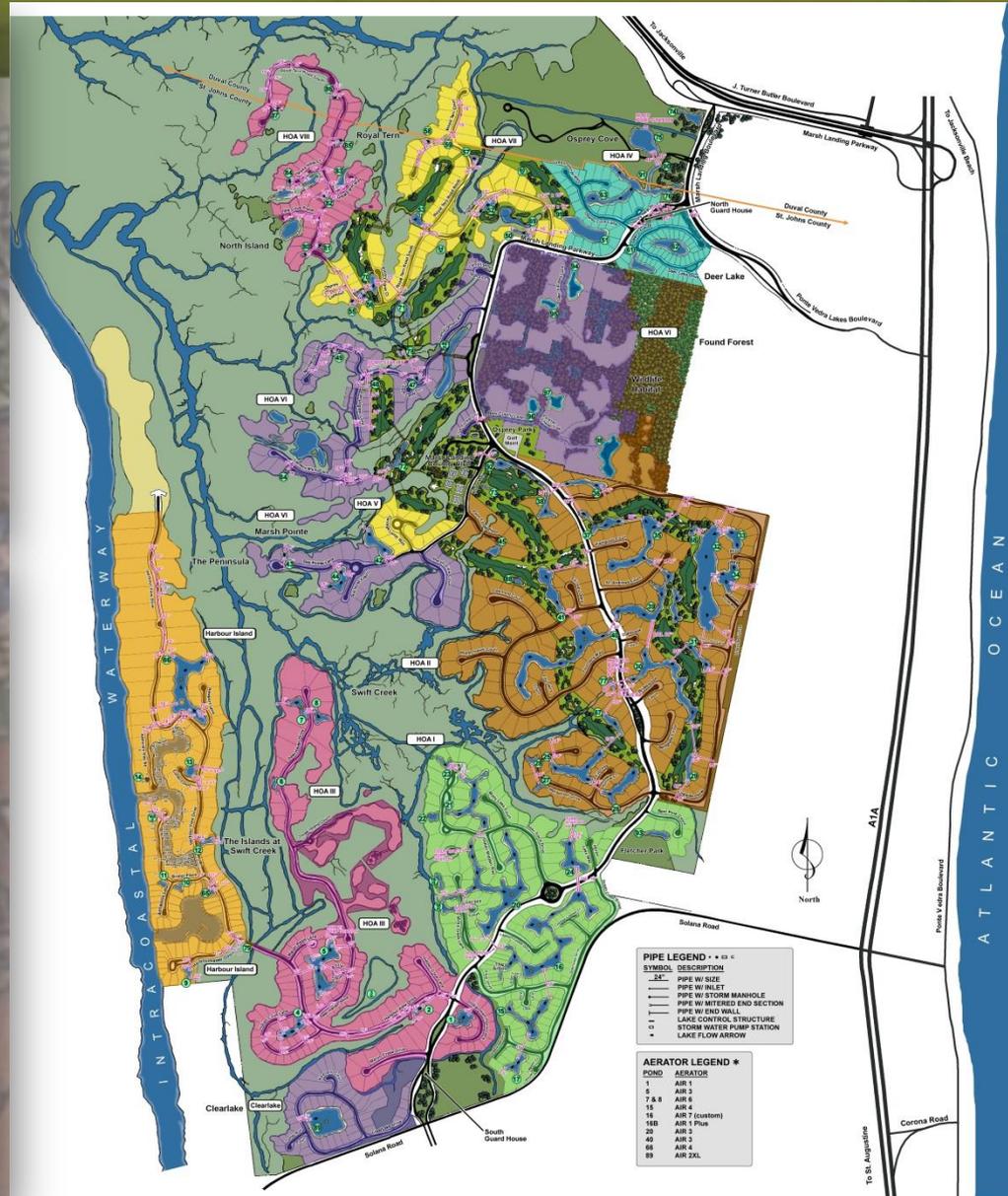
We ask that you take the time to become familiar with these standards and that you adhere to and comply with them. Your efforts will be greatly appreciated by all of our residents!

**DO NOT**  
DISPOSE OF LANDSCAPING WASTE  
IN DRAINS OR WATERWAYS

NO BLOWING, SPRAYING, OR MOWING  
INTO DRAINS OR WATERWAYS

### Landscape & Fertilizer Vendor Standards

- Do not allow grass clippings or any yard debris to fall into the ponds; any debris falling into the ponds must be promptly removed and disposed of properly.
- Do not dispose of or allow yard debris to fall into storm drains or yard drains.
- Do not apply Fertilizers, herbicides, or pesticides within ten feet of the water's edge.
- Do not allow fertilizers to remain on non-permeable surface such as driveways, roads, or sidewalks. Blow remaining fertilizer back onto the grass.
- Exercise caution when applying fertilizers or pesticides near storm drains or yard drains to ensure they are not introduced into the pond system.
- Do not place yard trash or tree debris next to the street. Marsh Landing rules prohibit the curbside placement of yard trash no earlier than Sunday.
- Landscape vendors must follow the adopted Model Ordinance for Florida-Friendly Fertilizer Use on Urban Landscapes  
<http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/dep-fert-modelord.pdf>
- Consider the use of Bio-fertilization practices utilizing non-chemical biochar and microbial soil inoculants as an alternative to conventional fertilization and pesticide protocol.



ATLANTIC OCEAN

North

To St. Augustine

Palms Vista Boulevard

Corona Road

41A

Deer Lake

Found Forest

Walden Estates

Deer Lake

North Guard House

Osprey Cove

Royal Terr

North Island

Harbour Island

The Peninsula

Marsh Pointe

Swift Creek

The Islands at Swift Creek

Harbour Island

Clearlake

Clearlake

Juliana Road

South Guard House

Palms Vista Boulevard

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Osprey Cove

Royal Terr

North Island

Harbour Island

The Peninsula

Marsh Pointe

Swift Creek

The Islands at Swift Creek

Harbour Island

Clearlake

Clearlake

Juliana Road

South Guard House

Palms Vista Boulevard

Corona Road

Deer Lake

Found Forest

Walden Estates

Deer Lake

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Clearlake

Community Water Quality  
**Best Management Practices in Florida**  
**Florida's First DRI - Caballos del Mar**



- The annual budget for herbicide, pesticide, & fertilizer for 114 acres of lakes, 80 acres of common area and 220 acres of golf turf is \$1,200,000.



# Community Surface Water Quality Best Management Practices in Florida

- Lawn & Vegetation Treatment is indiscriminate
- Lawn & Vegetation Treatment is also targeted
- Lawn & Vegetation Treatment is big business \$\$\$



Know the Sign.



## How to take control to the next level.

For the highest standards in complete control for your lawns, contact your local FMC sales representative or your authorized FMC Distributor or Sales Agent.

Homeowners: They're too busy. And they're forgetful. Fortunately, Meridian® insecticide, the fast-acting grub and foliar insect controller, allows twice as long for watering or rain as the most common brand. So even with little cooperation from homeowners or Mother Nature, you can help create noticeably beautiful lawns.

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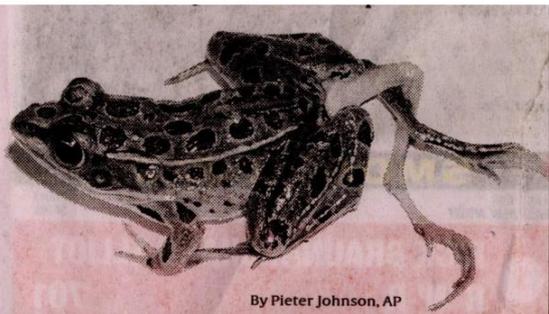
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# Best Management Practices in Florida



By Pieter Johnson, AP

**A leg up:** Nitrogen and phosphorous cause infections in tadpoles, resulting in deformities such as extra legs.

## Report blames runoff for deformed frogs

The growing number of deformed frogs in recent years is caused at least partly by runoff from farming and ranching, new research indicates. Nitrogen and phosphorous in the runoff fuel lead to a parasitic infection of tadpoles, resulting in loss of legs, extra legs or other deformities, report researchers led by Pieter Johnson of the University of Colorado-Boulder, in the online edition of *Proceedings of the National Academy of Sciences*. The deformed frogs have been a puzzle for more than a decade, since a group of Minnesota children discovered a pond where more than half the leopard frogs had missing or extra limbs.

- **NPK fertilization methods exceed plant nutrient uptake**
- **Various “release” & control agents exist but have limits**
- **Water Resource Treatment Costs Big Public \$\$\$ while attempts at consumer regulation are met with resistance**

Introducing... More Control Than You Ever Thought Possible

**HYDREXX**  
Professional Nitrogen Stabilizer

Nitrogen Performance

28 DAYS  
21 DAYS  
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HYDREXX helps allow you to manage nitrogen for your specific conditions and needs. For Stabilized Nitrogen research, visit us at [www.stabilizednitrogen.com](http://www.stabilizednitrogen.com).

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Nitrogen management is too important to leave to chance. HYDREXX® Professional Nitrogen Stabilizer is a new fertilizer additive that gives you the power to hold onto bound soluble nitrogen to make it last in the soil for longer periods of time, regardless of environmental factors. You control the rate. You control the length of performance.

**AGROTAIN**

- Better Color and Quality
- Increased Nitrogen Efficiency
- Extended Nitrogen Availability
- More Environmentally Sound for Soil and Turf



# Community Surface Water Terrestrial + Stormwater + Aquatic Management



# Community Surface Water Terrestrial + Stormwater & Aquatic Management

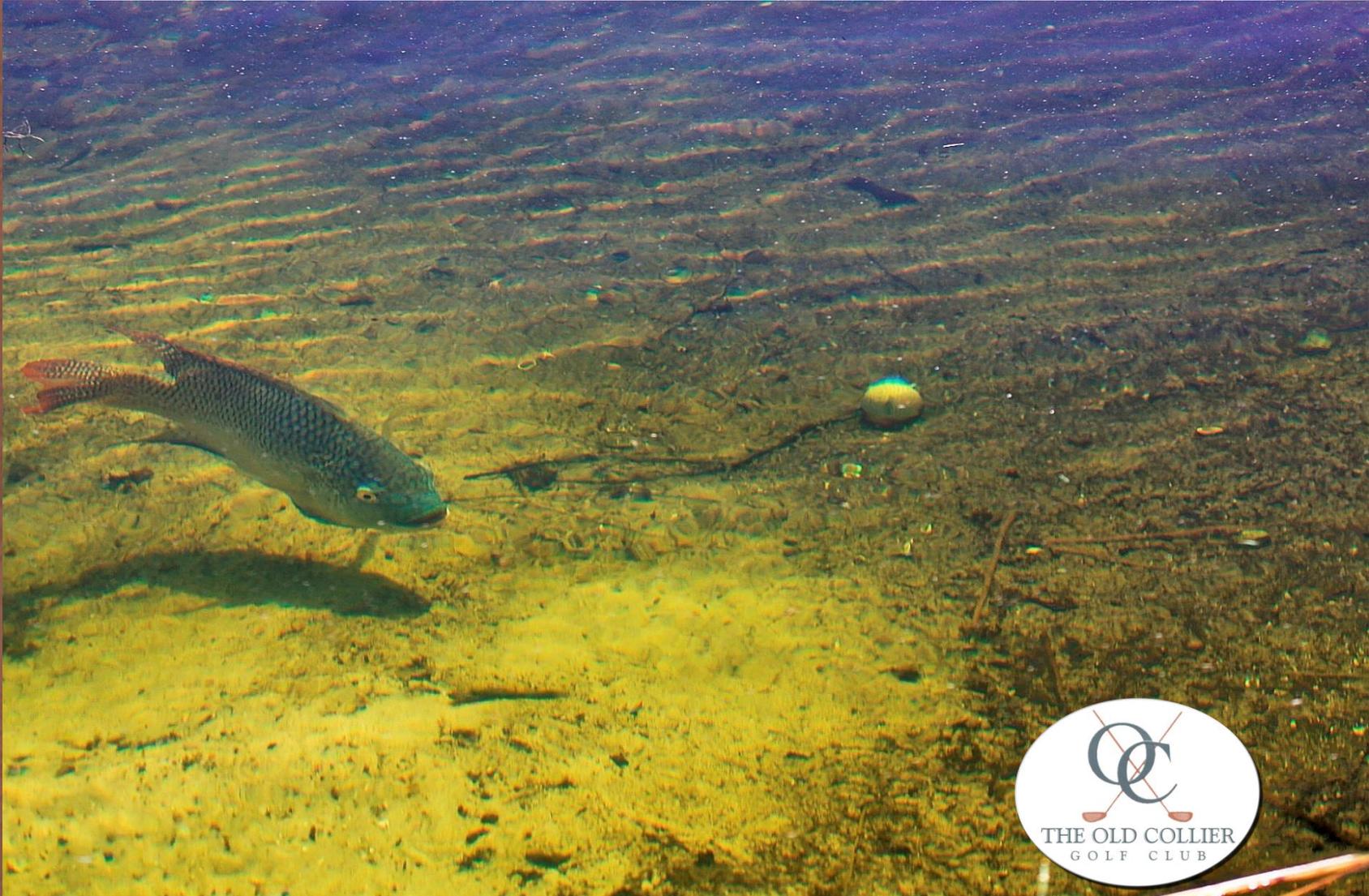


# Photosynthetic Micro-organisms + Nutrient Storage & Transfer = Bio-Fertilization



- **The Old Collier Golf Course in Naples, FL is The First Audubon Gold Course**
- **Paspalum turf watered with Brackish water**
- **Turf on the left is: "Control" USGA "best practice" @ 7-12 lbs. NPK / 1000 s.f. + H-P Protocols**
- **Turf on the right is: inoculated with photosynthetic bacteria + 1 lb. NPK / 1000 s.f. No Herbicide or Pesticide**

# Community Surface Water Stormwater & Aquatic Management

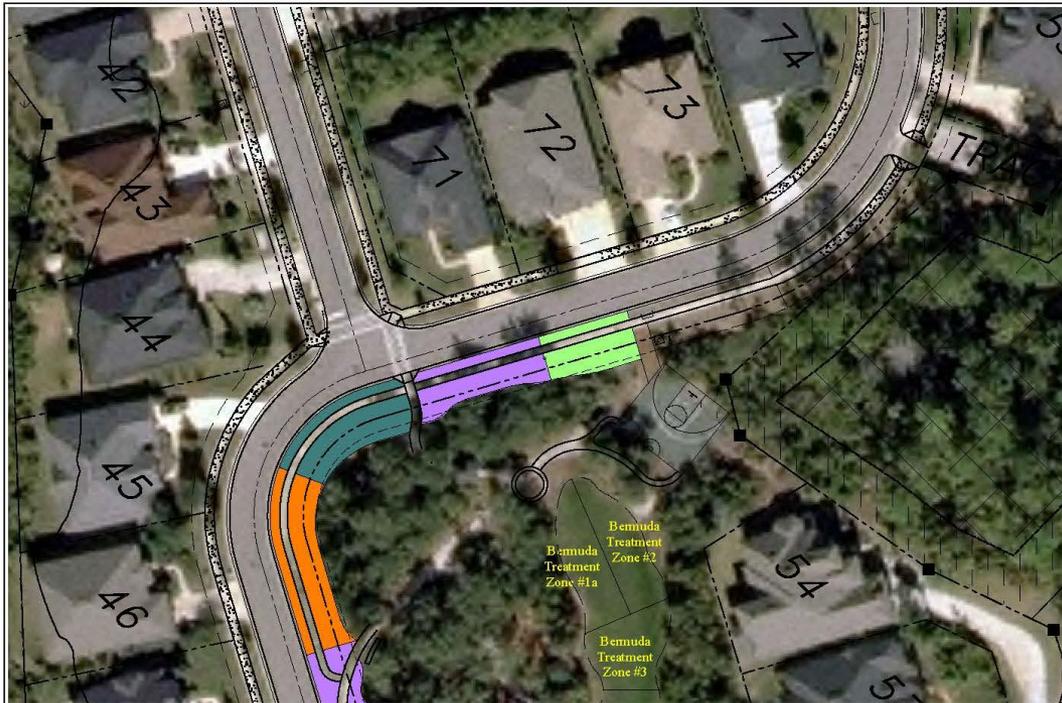


# Photosynthetic Microbe Matrix + Nutrient Storage & Transfer = Bio-Fertilization





# Community Sustainability Pilot Palencia St. Augustine, Florida



## Community Sustainability Pilot Program

### Oak Common St. Augustine Protocol:

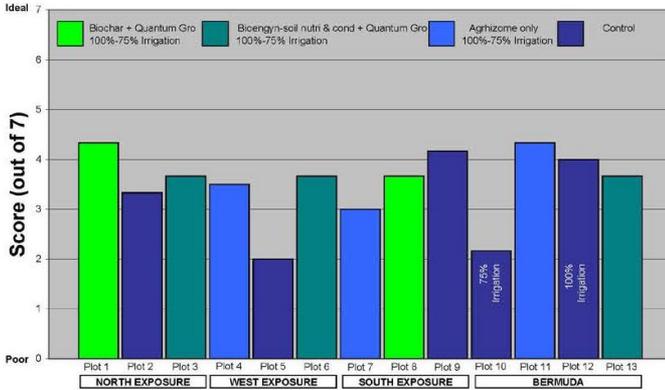
- **Treatment Zone #1:**  
One Bio-Char Application at .1 lbs per square foot  
Broadcast with Rake/Roller at installation  
Photosynthetic microbe matrix applied at a rate of 64 oz / acre - dilution rate not to exceed 4 oz. / gal.  
2010 Application: Sept. 15, Oct. 15, Nov. 15  
2011 Application: Feb. 15, April 15, June 15  
2012 Application: April 15, Aug. 15  
**Irrigation:**  
2010 -- 100% Control  
2011 / 2012 -- 75% Control  
No fertilizer, no herbicide, no pre-emergent.  
Spot treat with Nature's Avenger Weed Killer (or Approved Equal) as required.
- **Treatment Zone #2:**  
One Application of Lignin-Glycerol 6% Solution at the rate of 40 gal. / acre  
ELI Photosynthetic microbe matrix applied at a rate of 64 oz. / acre - dilution rate not to exceed 4 oz. / gal.  
2010 Application: Sept. 15, Oct. 15  
2011 Application: April 15, July 15  
2012 Application: Apply one application of Osmocote Plus 15-9-12  
Southern Stock 90330 fertilizer at rate of 2 lbs. per 1000 square ft.  
**Irrigation:**  
Adjust to 75% of Control for 2011 and 2012  
No herbicide, pesticide  
Spot treat with Nature's Avenger Weed Killer (or Approved Equal) as required.
- **Treatment Zone #3:**  
Similar to Treatment #2  
No Lignin-Glycerol  
Use Michigan State microbe matrix applied at a rate of 32 oz. / acre - dilution rate not to exceed 4 oz. / gal.  
No fertilizer.
- **Treatment Zone #4:**  
Control treatment to match existing Palencia turf treatment standards

Oak Common Amendment Volumes

	Area (sf)	Bio-Char App. Rate (lbs/sf)	Net Vol. Bio-Char (lbs)	Microbe App. Rate (oz/ac)	Vol. Microbes per Treatment (oz)	Number of Treatments	Net Vol. Microbes (oz)	Lignin-Glycerol 6% Sol. App. Rate (gal/ac)		Vol. Lignin-Glycerol per Treatment (gal)		Number of Treatments	Net Vol. Lignin-Glycerol (gal)		Fertilizer App. Rate (lbs/1000sf)	Vol. Fertilizer per Treatment (lbs)	Number of Treatments	Net Vol. Fertilizer (lbs)
								Lignin	Glycerol	Lignin	Glycerol		Lignin	Glycerol				
<b>St. Augustine Turf</b>																		
Treatment Zone #1	3016	0.1	301.6	64	4.4	8	35.4											
Treatment Zone #2	3172			64	4.7	4	18.6	40	40	0.2	0.2	1	0.2	0.2	2	6.3	1	6.3
Treatment Zone #3	3162			32	2.3	4	9.3											
Treatment Zone #4	3173																	
<b>Bermuda Turf</b>																		
Treatment Zone #1a	1512																	
Treatment Zone #1b	1512																	
Treatment Zone #2	1512			64	2.2	4	8.9	40	40	0.1	0.1	1	0.1	0.1	2	3.0	1	3.0
Treatment Zone #3	1512			32	1.1	4	4.4											
<b>Bioswales</b>																		
	1728	0.2	345.6	64	2.5	8	20.3											
<b>Total:</b>			<b>647.2</b>										<b>0.3</b>	<b>0.3</b>				<b>9.4</b>

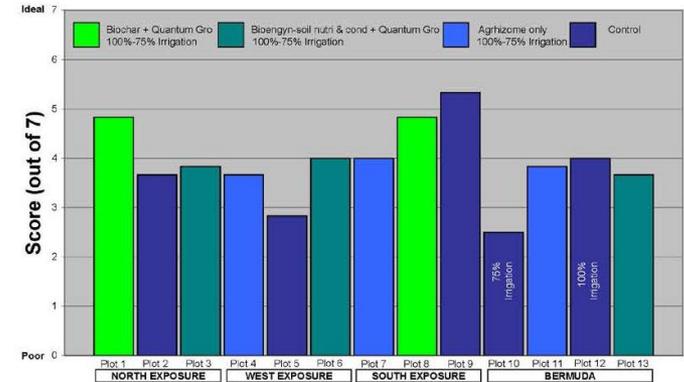
# Community Sustainability Pilot Palencia St. Augustine, Florida

### Observed Overall Appearance

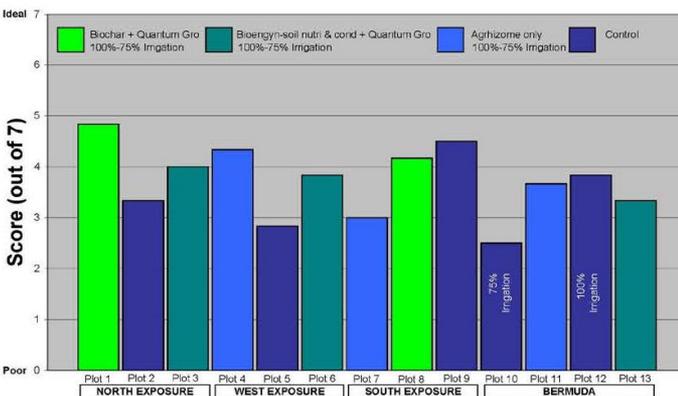


### Community Sustainability Pilot Program

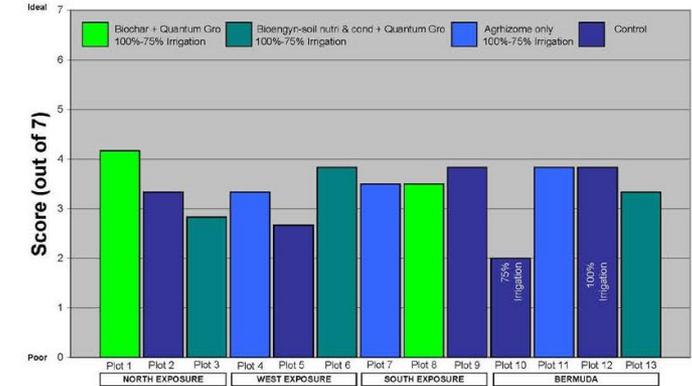
### Observed Growth Consistency



### Observed Turf Color

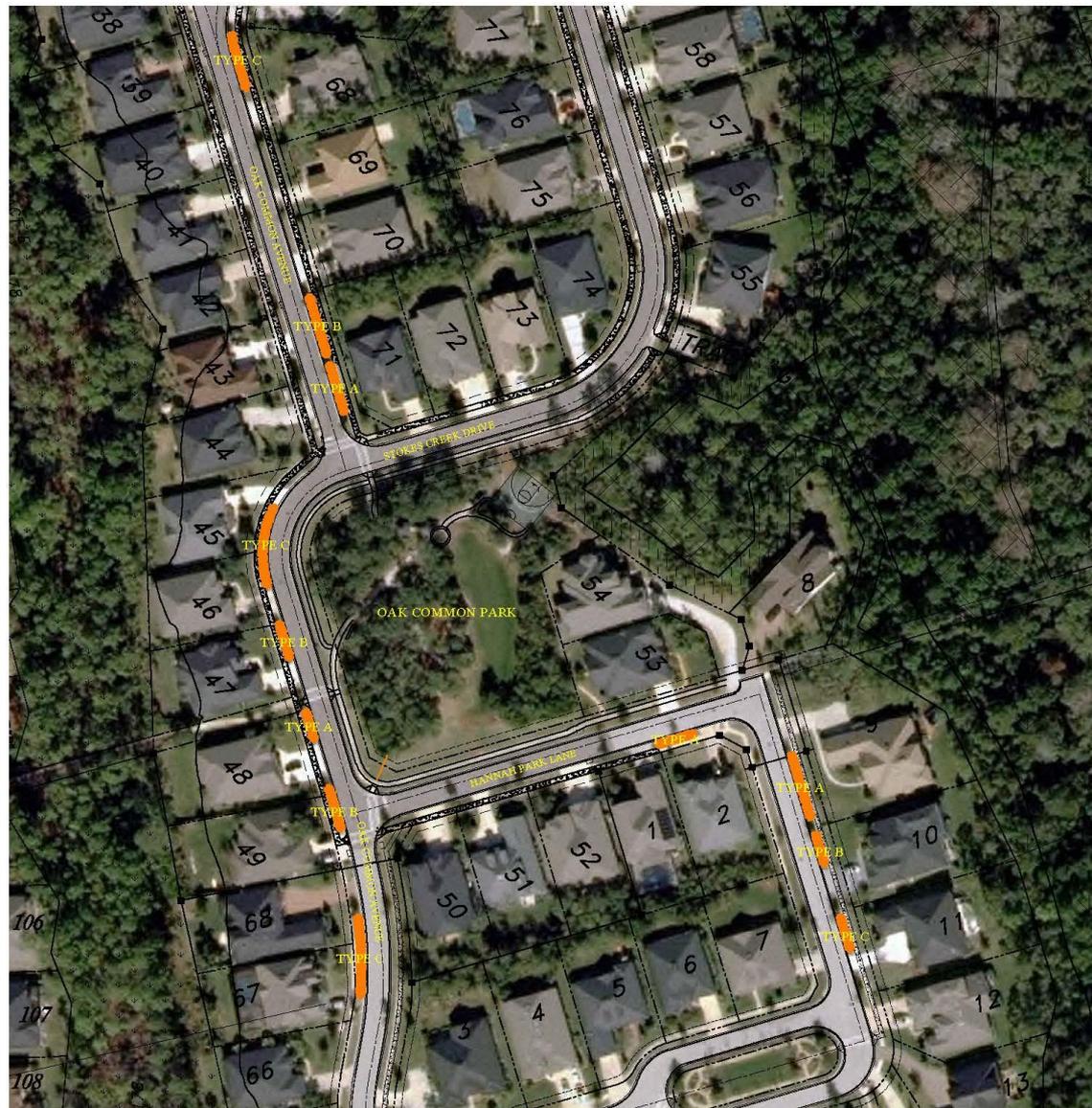


### Observed Turf Hardiness



### Oak Common Turf Treatment Protocols

# Community Sustainability Pilot Palencia St. Augustine, Florida



## Community Sustainability Pilot Program

### BioSwale (Photos)



Typical Before Condition



Bioswale Landscape Installation



Typical Completed Bioswale - 60 Days After Planting

### Proposed Bioswale Locations

**PALENCIA**  
A Story of Discovery, Exploration and Settlement

0 50' 100'  
SCALE IN FEET



**GENESIS GROUP**  
ENGINEERING • LANDSCAPE ARCHITECTURE • PLANNING • SURVEY • GIS

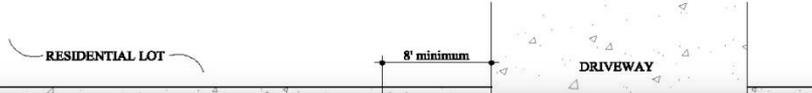
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# Community Sustainability Pilot Palencia St. Augustine, Florida



# Community Sustainability Pilot Palencia St. Augustine, Florida

## Community Sustainability Pilot Program



### PALENCIA COMMUNITY - Terrestrial Management Using Bioswales

**Test Point #1:**  
 4.5 lots  
 300 L.F. side yards  
 202 L.F. front yards  
 0 L.F. bioswale

**Test Point #2:**  
 5.0 lots  
 159 L.F. side yards  
 300 L.F. Front yards  
 0 L.F. bioswales

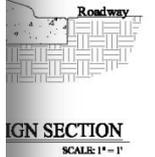
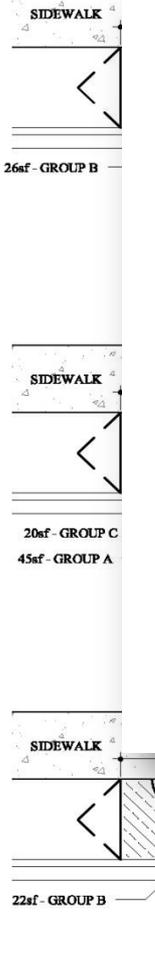
**Test Point #3:**  
 7.0 lots  
 0 L.F. side yards  
 495 L.F. front yards  
 266 L.F. bioswales

\*Road crown is assumed to separate residential runoff sub-basins

EPA Proposed Criteria for Rivers and Streams (North Central FL)	
Total Nitrogen (N)	1.479 mg/L
Total Phosphorus (P)	359 µg/L

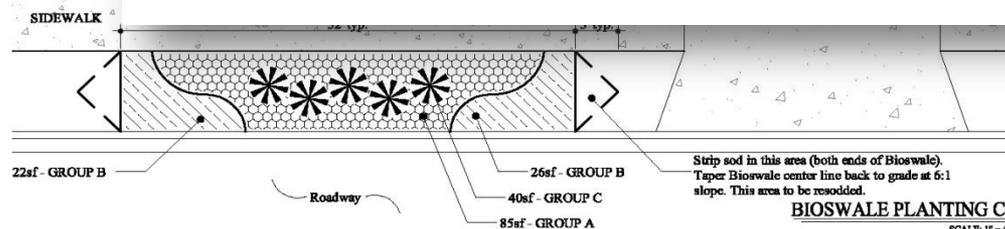
#### Curb Line Water Quality Test Data: 2/19/2011

	POINT #1	POINT #2	POINT #3
TOTAL Nitrogen (N)	1.1 mg/L	6.0 mg/L	1.3 mg/L
TOTAL Phosphorus (P)	150 µg/L	800 µg/L	190 µg/L
TOTAL Potassium (K)	.612 mg/L	3.06 mg/L	1.69 mg/L



MARKS

1 plant
24" ht. and spr.
30" ht. and spr.
24" ht. and spr.
26" ht., 28-34" spr.



- 5) CAP OR ADJUST EXISTING IRRIGATION HEADS 12 MONTHS AFTER INSTALLATION UNLESS CONDITIONS ALLOW FOR MORE GRADUAL PHASE OUT.
- 6) HAND WEED PLANTING AREAS AS NEEDED OR SPOT TREAT WITH NATURE'S AVENGER WEED KILLER (OR APPROVED EQUAL).

#### Bioswale Planting Details

# Best Management Practices

## Community Sustainability Expense Formula

$$\begin{array}{ccccccccccc} \boxed{\$} & = & \boxed{P} & \times & \boxed{S} & \times & \boxed{E} & \times & \boxed{R} & \times & \boxed{T} & \times & \boxed{CT} \\ \text{Expenses} & & \text{People/} & & \text{Services per} & & \text{Energy} & & \text{Resource} & & \text{Tax on} & & \text{CO}_2 \text{ per Unit} \\ & & \text{Property} & & \text{Person/} & & \text{Footprint} & & \text{Expenditure} & & \text{Service} & & \text{of Energy} \\ & & & & \text{Property} & & \text{per Unit of} & & \text{per Unit of} & & & & \text{(Pending)} \end{array}$$

**Saves CDD/HOA/Residents Unproductive Aquatic/Terrestrial Expenses**

**Conserves Energy Usage & Associated Material & Labor Expense**

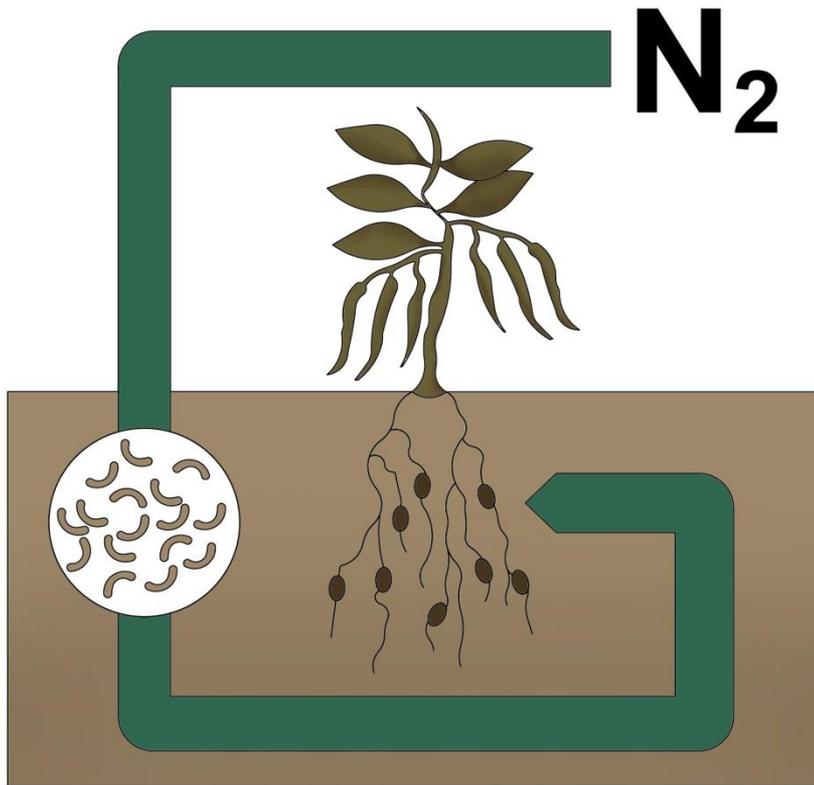
**Reduces Health Risks to Residents, Recreational Users, Workers**

**Improves Landscape Resilience & Environmental Balance over time**

**Reduces Major Repair Reserves related to Landscape/Irrigation/Sediment**

**Provides Solutions to New Environmental Regulations & Restrictions**

# Overview – Photosynthetic Micro-organisms



## Primary Benefits

1. Nitrogen Fixation
2. Oxygen Release
3. Carbon Sequestration
4. Nutrient Transformation
5. Bio-films at root zone

## Secondary Benefits

6. Pathogen Suppression
7. Fertilizer Elimination
8. Irrigation Reduction



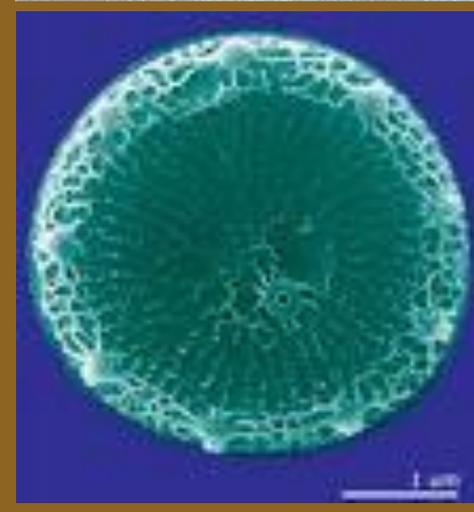
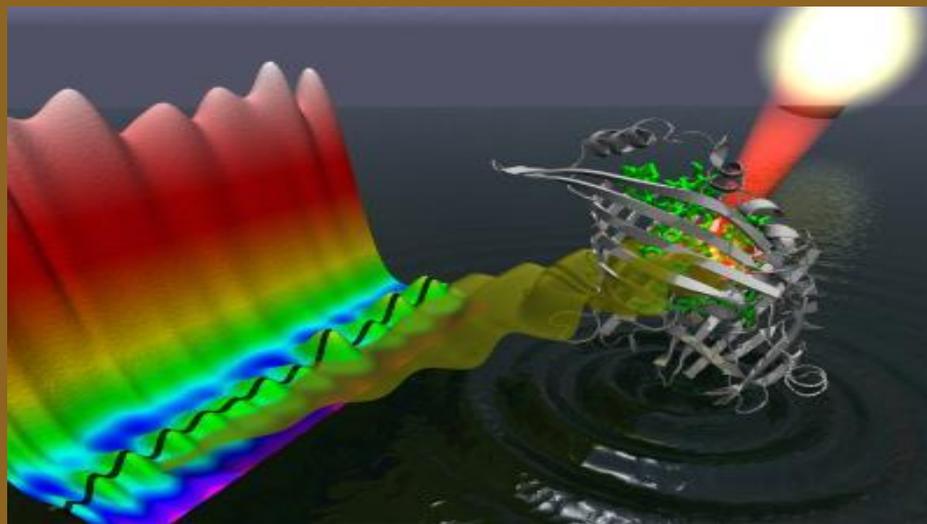
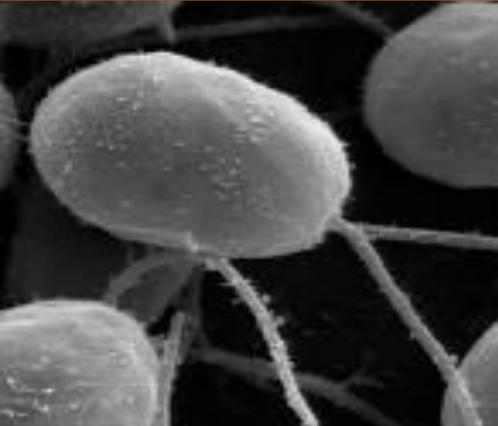
# Community Surface Water Retrofit Techniques: Building Healthy Soil

- **Reduced fertilizer needs**
- **Enhanced water retention**
- **Bio-diverse soil profile**
- **Reduced nutrient loading**
- **Erosion control**

EMPL / RMAP

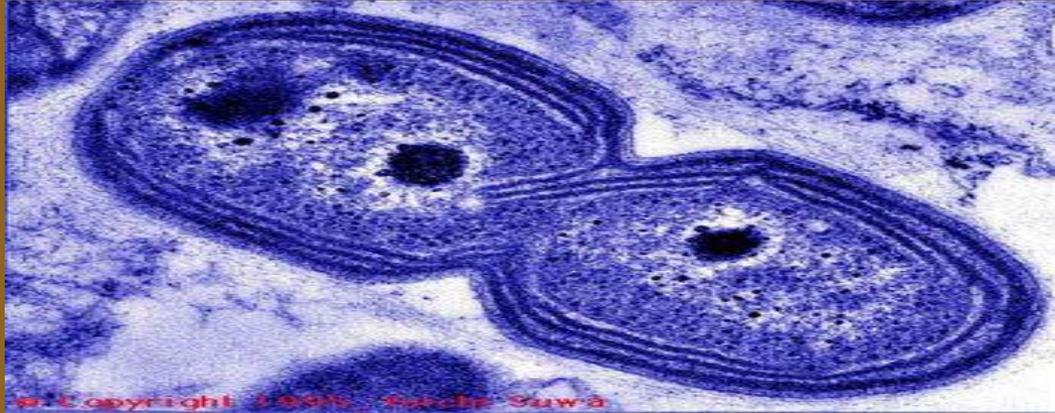


# Photosynthetic Micro-organisms = Light to Energy



- **Micro-organism absorbing a photon @ 95% efficiency.**
- **Applied Physics**
- **Plants require energy, not just food.**
- **Bio-remediation requires energy at many levels.**

# Photosynthetic Micro-organisms = Reproduction



- **Reproduction via Mitosis is a significant benefit.**
- **The microorganisms double in population approximately every five minutes.**
- **Many pathogens double in population every 48 to 72 hours.**
- **Photosynthetic microorganisms and pathogens desire the same growing conditions. Many times, photosynthetic microorganisms prevail which eliminates the need for Herbicides & Pesticides.**



# Photosynthetic Micro-organisms = Nutrient Transfer & Storage

- **These microorganisms consume organic pollutants, CO<sub>2</sub> and atmospheric nitrogen.**
- **The microorganisms degrade and aid in detoxifying many pollutants.**
- **The microorganisms store CO<sub>2</sub> and nitrogen in the form of sugar , ATP and protein.**
- **Photosynthetic microorganisms are the foundation of a natural food chain.**



# Photosynthetic Micro-organisms = Nutrient Transfer & Storage

## **Rhodospirillum rubum**

**“Purple Sulfur Photosynthetic Bacteria**

**Have been unequivocally established as Nitrogen fixing  
organisms.”**

**E.E.Lindstrom PhD**

**Study funded by The Rockefeller Foundation and the United States Atomic Energy  
Commission. Data provided by The University of Wisconsin. Nitrogen fixation,  
Confirmed via: Kjeldahl and Radioactive Isotope Assays**



# Photosynthetic Micro-organisms = Oxygen Release & Carbon Sequestration

## Rhodospirillum rubum

**“Purple Sulfur Photosynthetic Bacteria constitute a group of versatile organisms, that can grow as photoheterotrophs or photoautotrophs, chemoheterotrophs - switching from one mode to another, dependant on conditions.”**

**Bacteriology 102**

**“Photosynthetic bacteria  
are known to carry out the reaction:**



**John Lindstrom PhD**

# Photosynthetic Micro-organisms + Nutrient Storage & Transfer = Bio-Fertilization



0 ppm

40 ppm

80 ppm

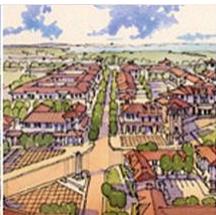
Nitrogen Only (N)

0 ppm

40 ppm

80 ppm

N + Photosynthetic  
Microorganisms



# Photosynthetic Micro-organisms + Nutrient Storage & Transfer = Bio-Fertilization

- **Seedlings treated at a commercial nursery in Georgia.**
- **Seedling on right treated with photosynthetic microorganisms.**
- **The visual evidence would indicate root mass increase on photosynthetic microorganism treated tree is greater than 50%**
- **Numerical quantification and qualification of these effects are being validated at Auburn University, and North Carolina State University.**



# Photosynthetic Micro-organisms = Pathogen Suppression

## Gause's Law of Competitive Exclusion

**“Two species competing for the same resources, can not stably coexist. Either of the two competitors will always take over the other, which leads to the extinction of one of the competitors.”**

**G.F. Gause, M.D.**

## Nematode Population

<b>Control</b>	<b>December</b>	<b>February</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>
Spiral	1069	0	0	0	839	989
Lance	53	117	113	149	54	146
Sting	0	11	12	38	61	5
Root knot	0	0	0	0	0	0
Ring	0	0	0	0	0	142
Sheathoid	0	0	0	0	0	239
Stubby root	0	133	68	163	106	11

# Photosynthetic Micro-organisms = Pathogen Suppression

The Old Collier Golf Course Assays provided by Dr. Crow, University of Florida

<b>Control – Std. Treatment</b>	<b>December</b>	<b>February</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>
Spiral	1069	0	0	0	839	989
Lance	53	117	113	149	54	146
Sting	0	11	12	38	61	5
Root knot	0	0	0	0	0	0
Ring	0	0	0	0	0	142
Sheathoid	0	0	0	0	0	239
Stubby root	0	133	68	163	106	11

<b>Photosynthetic Microorganisms only</b>	<b>December</b>	<b>February</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>
Spiral	1069	0	0	0	922	1195
Lance	53	0	0	0	0	0
Sting	0	0	26	0	15	0
Root knot	0	0	0	0	0	0
Ring	0	0	0	0	0	63
Sheathoid	0	0	0	0	0	296
Stubby root	0	0	49	0	0	0

# Photosynthetic Micro-organisms

## Soybean Crop Tissue Analysis

Acres Research, Inc.

### PLANT ANALYSIS

SAMPLE ID	REPORT OF ANALYSIS-PERCENT							REPORT OF ANALYSIS - PARTS PER MILLION					
	N NITRO- GEN	P PHOS- PHORUS	K POTAS- SIUM	Mg MAG- NESIUM	Ca CALCIUM	S SULFUR	Na SODIUM	Fe IRON	Mn MANGA- NESE	B BORON	Cu COPPER	Zn ZINC	
200946-101	6.50	0.45	2.38	0.58	1.39	0.43	0.006	178	69	64	21	62	FL
BEANS-2	E	H-E	H	H-E	H	H-E	S	H-E	H	E	E	E	Tr
3111802 NORMS	4.40	0.32	1.87	0.42	1.02	0.30	0.017	80	49	35	11	33	
200946-102	7.08	0.51	2.62	0.57	1.25	0.46	0.004	215	98	55	17	57	Y4
BEANS-2	E	E	H-E	H-E	S-H	H-E	S	E	E	H-E	H-E	E	
3111803 NORMS	4.40	0.32	1.87	0.42	1.02	0.30	0.017	80	49	35	11	33	
200946-103	6.89	0.50	2.50	0.60	1.20	0.47	0.003	322	71	62	15	54	In
BEANS-2	E	E	H	H-E	S	H-E	S	E	H	E	H	E	
3111804 NORMS	4.40	0.32	1.87	0.42	1.02	0.30	0.017	80	49	35	11	33	

D or Deficient    L or Low    S or Sufficient    H or High    E or Excessive

# Micro-organisms / Humic Matrix

## General Crop Yield Analysis

Michigan State University

CROP	Plant height(inches)			Chlorophyll content			Total yield(g)		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
CORN	90*	56.3	96.25*	40.3	33.8	47.4	384.9*	119	563*
SOYBEAN	38	40	42	42	40	47	71.2*	44.4	71*
GARDEN BEAN	83.3*	54.5	104*	39.6	35.2	46.13	299*	192.8	504.5*
TOMATO	31.5	31.2	42	42	34	47	400*	140	720*
CLOVER	23.2	18	23.7	43.1	37.3	46.7	133*	107	159*

**MEAN OF 4 REPLICATIONS \* significant, P = 0.022 Clover=Shoot biomass**

**T1 -> F2 with NPK 50% (20-20-20)**

**T2 -> NPK 50% (20-20-20)50% ©**

**T3 -> F2 ONLY**

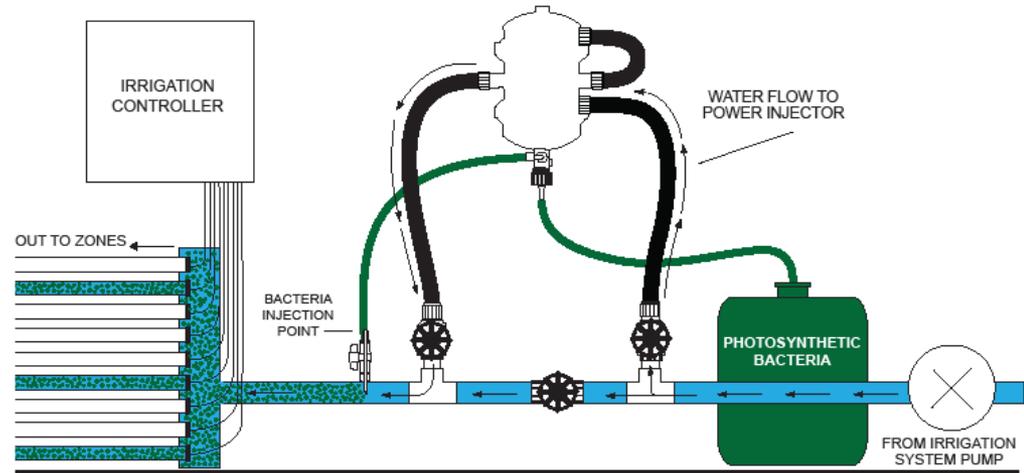
# Photosynthetic Micro-organisms = Irrigation Reduction



**The Vinca on the right was given water and photosynthetic bacteria. The Vinca on the left received just water.**

**( 6 Days Later)  
With No additional water or photosynthetic microorganisms for either plant.**

# Community Water Quality Microbial Inoculant Treatment – Suburban Retrofit





**GENESIS GROUP**  
FROM VISION TO REALITY

**Community Planning**

**Community Redevelopment**

**Urban Design**

**Landscape Architecture**

**Civil Engineering**

**Transportation Engineering**

**Applied Sciences**

**Market Economics**

