TECHNICAL REVIEW AND ADVISORY PANEL

ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS

ADVISORY TO THE DEPARTMENT OF HEALTH

AUTHORITY: SECTION 381.0068, FLORIDA STATUTES

TECHNICAL REVIEW AND ADVISORY PANEL (TRAP) MEETING

DATE: Thursday, September 25, 2014
TIME: 9:00 a.m.
PLACE: Orlando Airport Marriott
7499 Augusta National Drive
Orlando, Florida 32822
407-851-9000

THIS MEETING IS OPEN TO THE PUBLIC.

Agenda

1. Introductions

2. Election of Chair and Vice-Chair

3. Review minutes of last meeting

4. Research Update
   Hazen and Sawyer regarding Passive Nitrogen Study

5. Rule Issues

   Old Business
   10-04 Sand Lined Trenches (for final TRAP vote)

   New Business
   12-01 ATU Sizing

   12-05 Tank Compartment Walls

   12-06 Filter Cleaning During Tank Service

   12-07 ATU Maintenance Versus Drainfield Maintenance

   14-01 Rule Reduction

6. Other items of interest to the Technical Review and Advisory Panel

7. Public Comment

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TECHNICAL REVIEW AND ADVISORY PANEL (TRAP) MEETING MINUTES

DATE: Thursday, September 25, 2014
PLACE: Orlando Airport Marriott, Orlando, Florida

Members present were:

Glenn Bryant, *County Health Department*
Scott Franz, *Soil Scientist*
Victor Godlewski, *Local Government*
Martin Guffey, *Septic Tank Industry*
Scott Johnson, *Florida Engineering Society*
Russ Melling, *Consumer Representative*
Ken Odom, *Home Building Industry, Chair*
Roy Pence, *Home Building Industry, Vice Chair*
Pamela Tucker, *Real Estate Professional (via teleconference)*

Alternate members present:

Edward Cordova, *Local Government*
Ron Davenport, *Septic Tank Manufacturer*
Mary Howard, *Environmental Health*
Oren Reedy, *Soil Scientist*
Clay Tappan, *Florida Engineering Society*
Johanna Whelan, *County Health Department*

Department of Health staff present:

Gerald Briggs, *Environmental Administrator, Water and Onsite Sewage Programs*
Dale Holcomb, *Environmental Administrator*
Elke Ursin, *Environmental Health Program Consultant*
Kim Duffek, *Environmental Health Program Consultant*

Absent members and alternates:

Robert Baker, *Septic Tank Manufacturer*
Mark Cotton, *Home Building Industry*
Wayne Crotty, *Septic Tank Industry*
Sonia Cruz, *Environmental Health*
Tony Macaluso, *Real Estate Professional*

Others present:

Damann Anderson, *Hazen and Sawyer*
Eric Anderson, *Anderson Rentals*
Quentin Beitel, *Research Review and Advisory Committee*
Dominique Buhot, *Green's Environmental Services*
Jessica Crawford, *Senator Alan Hays*
Doug Everson, *Plastic Tubing Inc.*
Josefin Hirst, *Hazen and Sawyer*
Mark Repasky, *Wastewater Technologies*
Sean Rochette, *Florida DOH – Orange County*
Chris Rowe, *Plastic Tubing Inc.*
Andrea Sampson, *Coalition for Property Rights*
Gary Smith, *GDSMITH Construct.*
Marty Wanielista, *UCF*

Scott Johnson ***PROFESSIONAL ENGINEER***	Pam Tucker ***REAL ESTATE INDUSTRY***	Martin Guffey ***SEPTIC TANK INDUSTRY***	Robert Baker ***SEPTIC TANK MANUFACTURER***
Glenn Bryant ***COUNTY HEALTH DEPARTMENT***	Russ Melling ***CONSUMER***	Scott Franz ***SOIL SCIENTIST***	Sonia Cruz ***ENVIRONMENTAL HEALTH***
Victor Godlewski ***LOCAL GOVERNMENT***	Ken Odom, Chair ***HOME BUILDING INDUSTRY***	Roy Pence, Vice Chair ***HOME BUILDING INDUSTRY***	

1. INTRODUCTIONS

Chairman Odom called the meeting to order at 9:07 a.m. Mr. Odom gave a brief overview of the purpose of the Technical Review and Advisory Panel (TRAP). The TRAP members and alternates introduced themselves. Eleven out of eleven groups were present, representing a quorum.

2. ELECTION OF CHAIR AND VICE-CHAIR

Motion by Roy Pence and seconded by Pam Tucker, to elect Ken Odom as Chairman of the TRAP. All were in favor, none opposed, and the motion passed unanimously.

Motion by Victor Godlewski and seconded by Scott Franz, to elect Roy Pence as Vice-Chairman of the TRAP. All were in favor, none opposed, and the motion passed unanimously.

3. REVIEW MINUTES OF LAST MEETING

The TRAP reviewed the minutes of the December 12, 2014 meeting.

Motion by Scott Johnson and seconded by Mary Howard, for the TRAP to approve the minutes from the December 12, 2014 teleconference meeting as submitted. All were in favor, none opposed, and the motion passed unanimously.

4. RESEARCH UPDATE

Damann Anderson provided an overview of the nitrogen study. The last time Mr. Anderson presented to the TRAP on this project was in 2009. He recognized the project team, which includes nationally recognized experts in the fields of onsite sewage and soil science.

Mr. Anderson discussed the impacts of nitrogen to water quality to public health and the environment. He said that nitrogen loading is variable between watersheds and there are multiple contributors. He presented examples of this from Wakulla Springs and from the Wekiva area of central Florida. Nitrogen reduction of wastewater is a two-step process, he explained, with first an aeration stage to nitrify the effluent and second an anoxic stage to denitrify. This converts the nitrogen from a liquid form to a gas. Next, Mr. Anderson went over current nitrogen reducing technologies. Most of the systems on the market are active with multiple mechanical and moving parts, and the field performance of these advanced systems is inconsistent. The Florida Legislature mandated the Florida Onsite Sewage Nitrogen Reduction Strategies (FOSNRS) project to further develop more passive and cost-effective nitrogen reduction strategies for onsite sewage treatment and disposal systems (OSTDS).

The FOSNRS project has four primary study areas:

A. **Review available nitrogen treatment options:** The project team constructed a pilot facility at the Gulf Coast Research and Education Center, a University of Florida facility in Wimauma, Florida. Mr. Anderson presented results from the small-scale pilot biofilters, which the team constructed to help determine the best performing options to use in full-scale systems. The results showed that they consistently received 95% reduction of nitrogen for both single pass and recirculating wastewater effluent. The team also constructed vertically stacked biofilters, which put the two-stage nitrogen treatment underneath the drainfield. These systems received a 94% reduction in total nitrogen, with a nitrogen concentration of 3.5 mg/L prior to drainfield dispersal. Some of the lessons learned from the pilot testing were that these passive technologies can receive greater than 95% nitrogen reduction, that sulfate is a byproduct produced in the systems that used sulfur, and that the best design option for full-scale systems is using a combination of lignocellulosic material (wood-chips) and elemental sulfur.

B. **Develop, install, and monitor full-scale systems:** Mr. Anderson said that they have installed seven full-scale systems throughout the state. He presented some of the design configurations and results from the systems. For the installed systems, the project team attempted to utilize as much of the existing system as possible. The definition of passive, as provided by the Department of Health (DOH or Department) allows for the use of one pump for lift dosing. The project team found that allowing a pump for lift dosing purposes provided a significant cost savings when working with existing drainfields. Mr. Anderson gave results for one of the seven systems, stating that after 535 days of operation, the average total nitrogen coming in was 54.7 mg/L, the reduction is 44% (30.7 mg/L) from the aeration/nitrification stage of the process, and 95% (2.5 mg/L) from the final anoxic/denitrification stage prior to dispersal to the drainfield. The average energy consumption came to about 0.31 kWh/day, which is equivalent to an operation cost of about $1 per month. No surficial biomat or clogging was present and the reactive media showed very little reduction in volume. Mr. Anderson also discussed system configuration and performance for some of the other installed systems.

C. **Evaluate Nitrogen reduction in Florida soils:** Mr. Anderson provided a summary of this task, which is to evaluate how nitrogen behaves in Florida soils. He provided results from one field site that they monitored for over a year and then had a passive nitrogen reducing system installed. He showed before and after images of measured and extrapolated nitrogen concentrations in the groundwater, which showed a marked improvement in groundwater quality.

D. **Develop a user tool/model to estimate nitrogen reduction:** Damann Anderson briefly discussed the tool/model that will evaluate different scenarios for nitrogen fate and transport. He showed one of the model simulations, which had variables for trench/bed, equal/unequal distribution, soil type, loading rate, depth to water table, and nitrogen concentration.

After this project summary, Damann Anderson answered some questions and received comments from the TRAP and the public. Russ Melling said that the results were impressive and wanted to know what the projections are for system longevity. Mr. Anderson said that the media does get consumed, but that there was very little decrease in volume for the system that had been in operation for two years. He will have a better estimate when they have completed the project, but preliminarily he estimates the system could last ten to twenty years or even more. The reduction in BOD (biological oxygen demand) should help extend the drainfield life. Ed Cordova asked what the long-term maintenance requirements might be, and Mr. Anderson said that it operates no different from a pressure-dosed system. He said that for the tank-based systems, it could be as easy as adding a bag of mulch and/or sulfur. The in-ground systems would be harder to replenish but the initial volume of media material is greater than the tank-based systems, to help compensate for this. Victor Godlewski asked what the anticipated costs would be, and Mr. Anderson said that they are still developing the cost estimates for the systems. He said that at this point the systems are expensive because some of the components (i.e. the tanks) have been custom designed, manufactured, and tested for each system. He also said that much of the system cost depends on the home site. He estimated the cost could be between $10,000-$20,000. Dominique Buhot, a septic contractor that helped install the three Seminole County nitrogen reduction systems, said that he estimates the cost to be more around $25,000.

5. RULE ISSUES

OLD BUSINESS

12-02 – HB 1263 changes

Pam Tucker asked to bring issue 12-02 up as old business. During the December 14, 2012 TRAP meeting a motion was made to have a provision in the rule that would require that the homeowner receive final documentation in a specific situation. *Gerald Briggs indicated that staff would review the tapes from the meeting for clarification of the request and bring this back to the TRAP before the issue is included in the rule.*

10-04 Sand Lined Trenches (for final TRAP vote)

There was clarification that the rule reduction does not include this issue. TRAP discussed the comments from the Variance Committee. Scott Franz said that he did not support this issue. He said that sand lined trenches could result in a significant difference between the water table below natural grade, and the water table below the drainfield. The reason for this, Mr. Franz said, was that the wastewater would encounter the different texture at the bottom and sides of the excavation and fill up the drainfield area until the head pressure pushes the wastewater down into the soil. Several TRAP members agreed that this was not a good idea. Ron Davenport said that North Carolina allows sand lined trenches and that these systems have high failure rates. Pam Tucker asked for clarification on whether there is any associated cost savings and Scott Franz said there is no documentation to support this.

Motion by Scott Franz and seconded by Mary Howard, not to support inclusion of this issue in Chapter 64E-6 of the Florida Administrative Code. All were in favor, none opposed, and the motion passed unanimously.

Update on Onsite Sewage Program Research Priorities

Ken Odom asked for an update on the Research Priorities approved by the TRAP during the October 11, 2011 meeting.

Gerald Briggs and Elke Ursin presented brief status updates:

Continuation of Inventory of OSTDS in Florida – This project is making good progress due to funding from CDC Disaster Preparedness Funds and the Onsite Sewage Research Fund. Information is on the Department's website: http://floridahealth.gov/flwmi.

Effectiveness of Outlet Filters – NSF is developing field standards for outlet filters that will help to direct this project and reduce any duplication of effort.

Life Expectancy of Onsite Systems – This project is on hold until staff time is available to work on this.

Drip Disposal With Septic Tank Quality Effluent – The Nitrogen Reduction Strategies Study includes an evaluation of this, and the Research Review and Advisory Committee will discuss the results at a future meeting.

Correlations between Water Quality, OSTDS, and Health Effects – A volunteer intern worked on this project and Department staff are reviewing the final report.

11-01 Drainlines the Same Length

Pam Tucker asked to bring issue 11-01 up as old business. TRAP previously approved this issue and the Variance Committee commented on it, but it has not come back to TRAP. Dale Holcomb said that the rule reduction language includes this language (lines 2285-2287). TRAP discussed this and decided that this issue needs more input. Chairman Odom said that if the drainline exceeds10 feet from the length of the other drainlines, the option would be to pressure dose the system. *Gerald Briggs said that staff would look into this and come back to the TRAP with options (i.e. consider the length of the drainlines and have a percent difference instead of a fixed 10 feet).*

NEW BUSINESS

12-01 ATU Sizing

TRAP discussed this issue and the consensus was to make the sizing consistent with national standards.

Motion by Roy Pence and seconded by Scott Franz, not to support inclusion of this issue in Chapter 64E-6 of the Florida Administrative Code. All were in favor, none opposed, and the motion passed unanimously.

12-05 Tank Compartment Walls

TRAP discussed this issue. Scott Franz said that this would increase the TSS in the second compartment, which defeats the purpose of a dual compartment tank. Ken Odom said that he understands where the contractor that originated the issue is coming from, but that homeowner education on what products are appropriate to flush might be the better solution.

Motion by Scott Franz and seconded by Russ Melling, not to support inclusion of this issue in Chapter 64E-6 of the Florida Administrative Code. All were in favor, none opposed, and the motion passed unanimously.

12-06 Filter Cleaning During Tank Service

TRAP discussed this possible financial impact of this issue and the consensus was that cleaning the outlet filter is included in the process of pumping the tank. Will Bryant suggested a change to the proposed language to allow a contractor the option to replace a filter in lieu of cleaning it. The updated language was:

(c) When the contents are removed from a tank containing an outlet filter device, the filter shall be cleaned ~~and put back into place~~ or replaced as part of the service visit.

Motion by Roy Pence and seconded by Mary Howard, to support inclusion of this issue in Chapter 64E-6 of the Florida Administrative Code. All were in favor, none opposed, and the motion passed unanimously.

12-07 ATU Maintenance versus Drainfield Maintenance

TRAP discussed this issue originated by the Florida Onsite Wastewater Association (FOWA). There was a discussion to clarify that a homeowner can be a maintenance entity and that the rule specifies that maintenance entities service the system and not just the unit. Scott Franz said that several ATUs have drainfields that go specifically with the unit. There was a suggestion to add clarification to the language that the maintenance entity could approve someone else to do the work, and Scott Franz said that he has an issue with installers replacing drip irrigation systems. Some TRAP members had mixed opinions on this issue. *Gerald Briggs made a note to add clarification to the language that the maintenance entity can subcontract work that they do not have capacity to perform.* Kim Duffek brought up the point that the installer might need to shut the system down to work on the drainfield, and this could be problematic if the installer is not familiar with the system.

Motion by Scott Johnson and seconded by Ron Davenport, to table this issue until FOWA can be available to participate in the discussion. Ten out of eleven voting members were in favor, with Scott Franz opposed, and the motion passed.

The TRAP broke for lunch at 11:41 a.m. and reconvened with Chairman Odom calling the meeting back into order at 1:04 p.m.

14-01 Rule Reduction

Gerald Briggs introduced this section of the agenda and provided some background as to the reason behind this rule reduction exercise. The Florida Joint Administrative Procedures Committee asked that the Department reduce rule language already stated in the statute. The proposed rule reduction includes previous approved TRAP issues in addition to this repetitive language reduction. The TRAP proceeded to comment and discuss by line item per the strikethrough version of the rule included in the meeting packet.

Some of the line items with discussion points included:

A. Line 210: There was a suggestion to add the definition of a tank failure in the future. *This could be brought back to the TRAP as a future issue for discussion.*

B. Line 422: Replace "Maintenance entity" with "System owner" to match the statute. *Dale Holcomb said that he would clarify this language, and may take this out if it is duplicating statute language.*

C. Line 485: Ken Odom asked that the Department consider removing the requirement to show non-potable water lines on the site plan if double check valves or vacuum breakers are installed. *Gerald Briggs said that he will have staff look at the statute to see if this is something that could be changed.*

D. Line 488: TRAP discussed how excavated areas for onsite sewage systems cannot be shown until the site evaluation is done. There was a suggestion to take this line out and combine it with line 482.

E. Line 543: TRAP discussed that this language should line up with language in lines 2194 and 2206.

F. Lines 592-594: TRAP discussed removing this proposed language.

G. Line 658: TRAP discussed whether the tank receptacle was also required to be traffic rated if it is located beneath a driveway, or whether it was just the lid and the tank could remain a standard tank. *Gerald Briggs said he would check with staff about this and provide clarification if needed.*

H. Line 794 (Table I): There was a suggestion to add the definition of routine basis in the future when referring to institutional churches preparing meals. *This could be brought back to the TRAP as a future issue for discussion.*

I. Lines 1329-30: Eric Anderson, the owner of a portable sanitation company, suggested taking out the requirement for service persons to carry proof of a current operating permit. He said that he has never been asked for it, and the number is on the truck.

J. Line 1326: Eric Anderson provided extensive edits to this section of the rule. Chairman Odom asked that he submit comments to Dale Holcomb. *Mr. Anderson and Mr. Holcomb both indicated that they would work together to discuss this section*

and then staff will provide comments and/or edits back to the TRAP for consideration.

K. Line 1351: TRAP discussed and agreed to strike the line about trucks hauling waste across property lines requiring inspection and labeling.

L. Lines 2401-2568 (Table V): There was some disagreement among the TRAP regarding the removal of Table V. Dominique Buhot, a septic contractor, spoke to the TRAP about his main issue with removal of this table. He said that it is a useful educational tool for system owners, installers, and others.

Gerald Briggs asked the TRAP and public to submit comments to Dale Holcomb by the following week (week of September 29, 2014). He reminded TRAP members and alternates of the Sunshine Law, which states that they are not to communicate with members or alternates of other interest groups on the committee about any voting issue. Mr. Briggs clarified that members and alternates within the same interest group can speak to each other.

TRAP discussed the best date and time for the next meeting and agreed on October 16, 2014 at 9:00 a.m. Eastern Daylight Time.

Gerald Briggs outlined the schedule for implementation for this rule reduction issue, which could be altered due to complications and/or delays:

Step 1. TRAP completes the initial review [*October 16, 2014; to be scheduled*]
Step 2. Variance Committee provides comments [*November 7, 2014; scheduled*]
Step 3. TRAP is able to reach a final decision [*mid to late November 2014; not scheduled*]
Step 4. Rule promulgation [*90 days*]

This would put the earliest possible implementation for this rule sometime around mid-February 2015. Dale Holcomb mentioned that the Department has many other proposed rule reductions, and by proactively bringing this to TRAP now means that staff can implement quickly when given the green light.

6. OTHER ITEMS OF INTEREST TO THE TECHNICAL REVIEW AND ADVISORY PANEL

There was no discussion on this agenda item.

7. PUBLIC COMMENT

The public commented throughout the meeting.

Motion by Mary Howard and seconded by Martin Guffey, to adjorn. All were in favor, none opposed, and the motion passed unanimously.

The meeting adjourned at 3:00 p.m.

FLORIDA ONSITE SEWAGE NITROGEN REDUCTION STRATEGIES (FOSNRS) STUDY: Overview and Status

Presentation to the FDOH Technical Review and Advisory Panel (TRAP)

September 25, 2014

by

Damann L. Anderson, P.E.

PROJECT TEAM ACKNOWLEDGEMENTS

Florida HEALTH

HAZEN AND SAWYER
Environmental Engineers & Scientists

SCHOOL OF MINES 1874 COLORADO

UF UNIVERSITY of FLORIDA Gulf Coast Research and Education Center

AET Applied Environmental Technology

OTIS ENVIRONMENTAL CONSULTANTS

And many support firms and staff!

Presentation Outline

- Nitrogen Impacts to Water Quality
- Nitrogen reducing OSTDS
- FOSNRS Background
- Passive Nitrogen Reduction System (PNRS) Pilot Studies
- Passive Nitrogen Reduction System (PNRS): Full Scale Implementation
- Overview of Tasks C and D, N Fate & Transport
- Summary & Questions

Nitrogen Impacts to Water Quality

Adverse effects of nitrogen

Human Health

- SDWA Limit of 10 mg/L NO_3 – N
- Harmful algal blooms (HABs)

Ecosystem Health

- Nitrogen is the limiting nutrient for eutrophication of many coastal waters and some freshwater systems
- Increased watershed N loading can be linked to:
  - Algal blooms
  - Loss of seagrass and shellfish habitat
  - Hypoxia

Nitrogen impacts to water quality

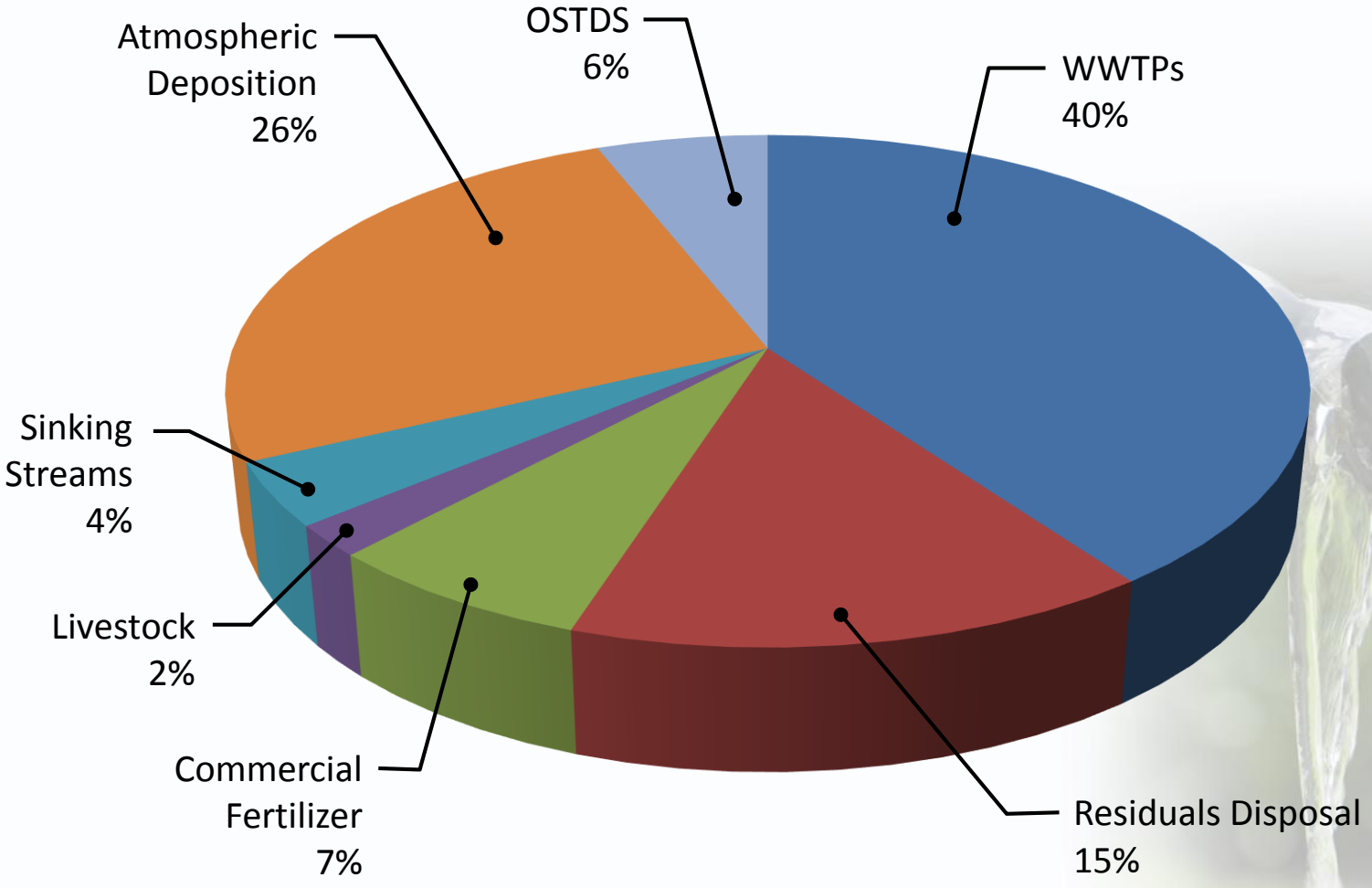
- Impacts of excess nitrogen on water quality have been documented in many areas of Florida and nationwide:
  - Tampa Bay, Sarasota Bay
  - Florida Keys
  - Wekiva Study Area
  - Wakulla County
  - Florida's Freshwater Springs
  - Chesapeake Bay
  - Cape Cod

In Florida, nitrogen loading has resulted in water quality problems for our freshwater springs…

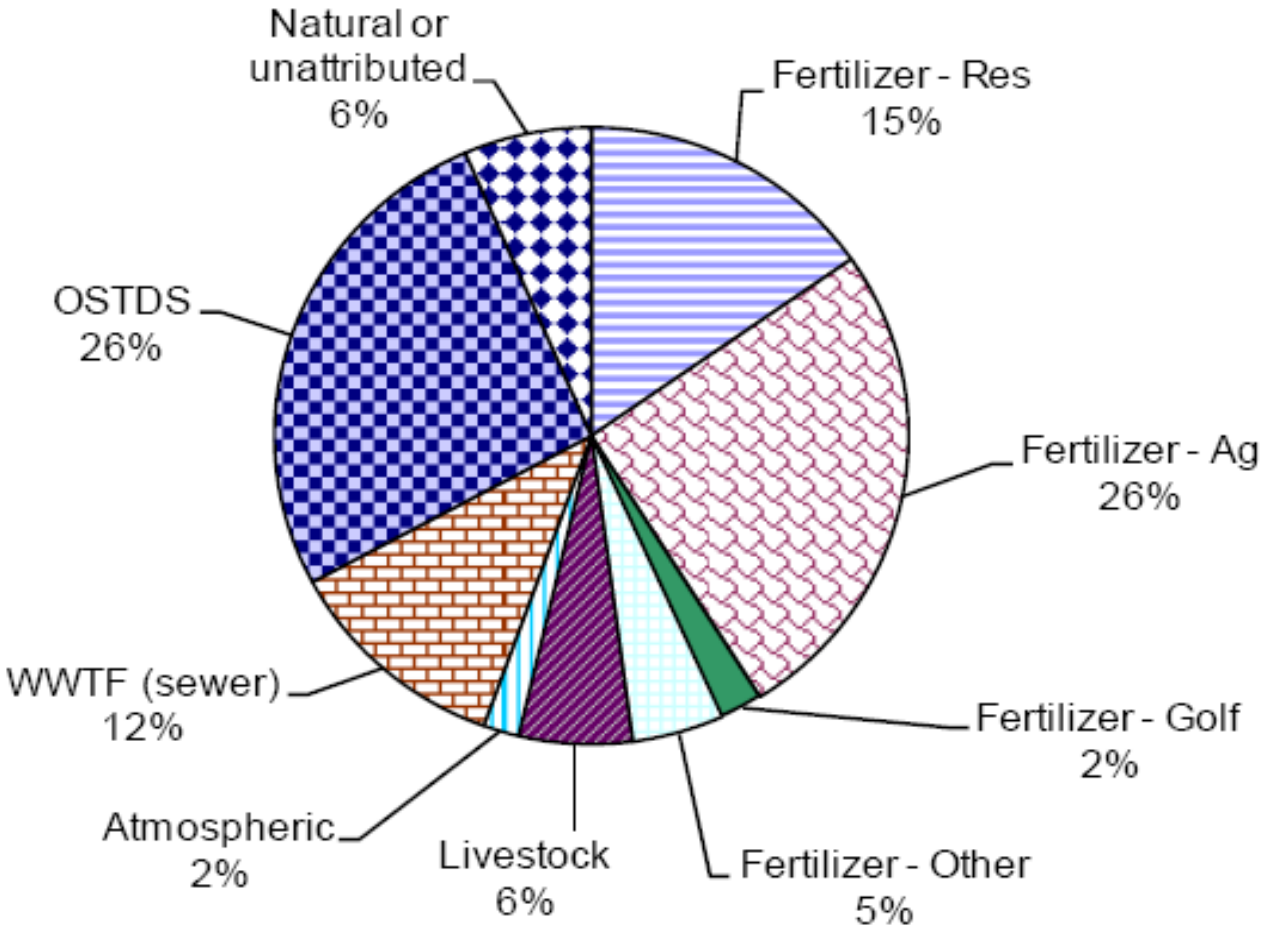
Photos courtesy of John Moran - SpringsEternalProject.org

Photos courtesy of John Moran - SpringsEternalProject.org

In some watersheds OSTDS nitrogen loading is relatively low (Wakulla Springs 1990-1999)



In other watersheds OSTDS nitrogen loading is relatively high (Wekiva Study Area)



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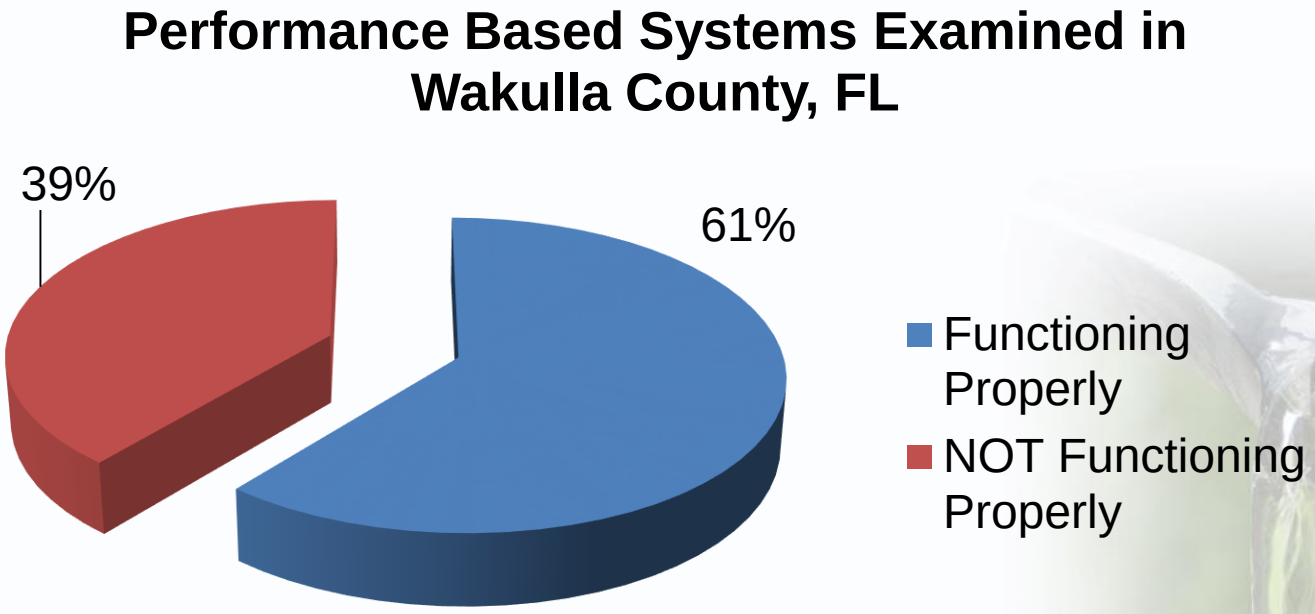
Nitrogen reducing OSTDS

Nitrogen reducing OSTDS

- Concerns over nitrogen loading have led to requirements for OSTDS designed to reduce nitrogen, typically to 10 mg/L total nitrogen, prior to discharge to the soil
- Currently, most are mechanical treatment units utilizing an activated sludge biological (BNR) process, similar to a municipal treatment plant
- Two step process:
  1. Aeration to “nitrify” nitrogen compounds to NO_3 (nitrification)
  2. Anoxic conditions to “denitrify” NO_3 to nitrogen gas (denitrification)

Recent evaluation in Florida showed inconsistent results for these performance based treatment (PBTS) systems…



"Of a total of 59 performance based treatment systems (PBTS) inspected in Wakulla County, 23 (39%) of these systems were not functioning properly at the time of inspection" Harden et al. (2010)

Properly Functioning Systems Mean TN = 29 ± 19 mg N/L

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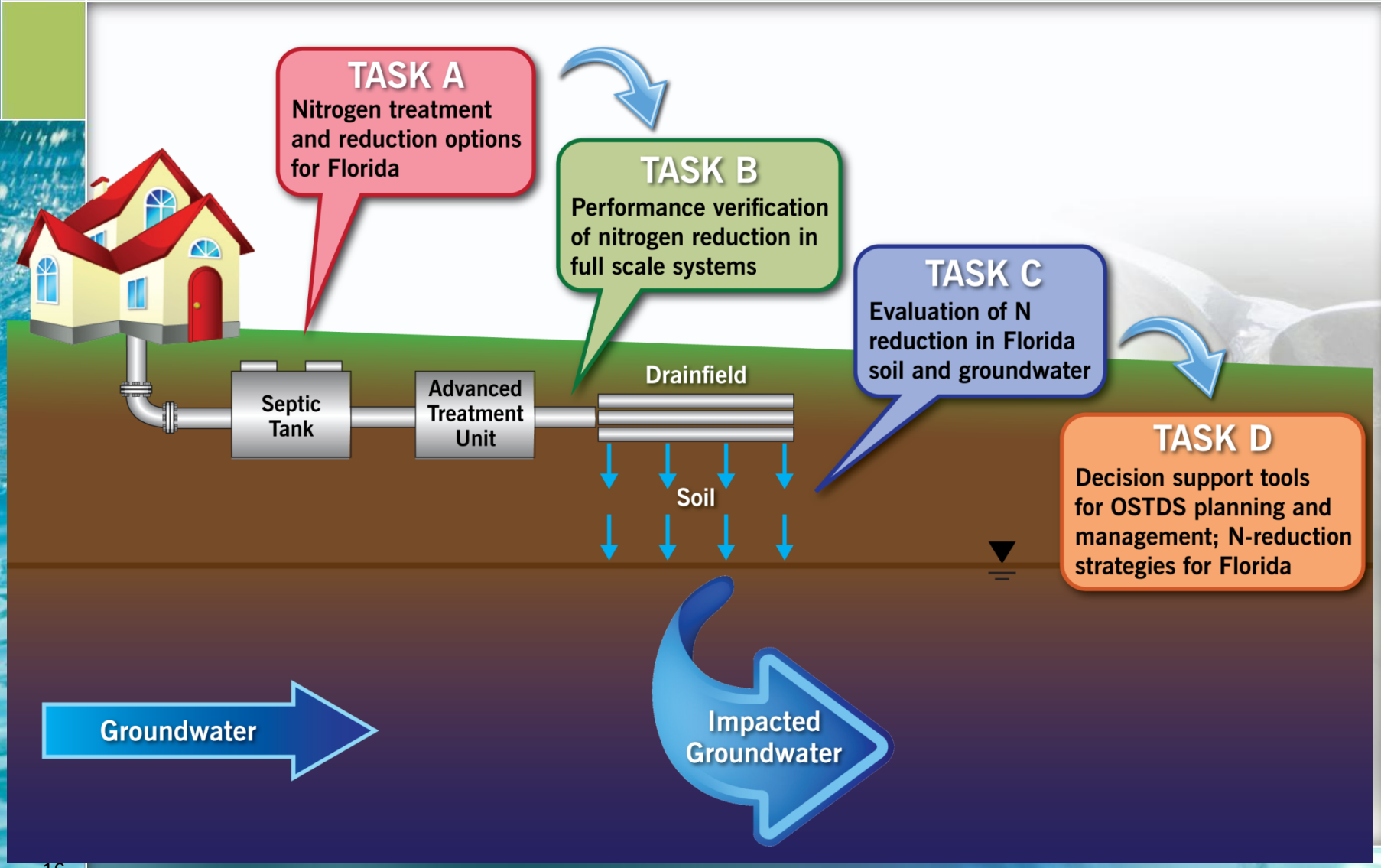
FOSNRS Background

40614-000

FOSNRS project initiated by Florida legislature

- Laws of Florida, 2008-152, directed FDOH to conduct a study to further develop more “passive” & cost-effective nitrogen reduction strategies for OSTDS
- Initiated the Florida Onsite Sewage Nitrogen Reduction Strategies (FOSNRS) Project in 2009
- RFP identified four primary study areas

Four primary study areas



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Passive Nitrogen Reduction System (PNRS) Pilot Studies

What are “passive” nitrogen reduction systems?

- Passive nitrogen reduction systems (PNRS) are OSTDS that reduce effluent N using reactive media for denitrification and a single liquid pump, if necessary.
- Two stage process:
  - Stage 1: “nitrify” nitrogen compounds to NO_3 (nitrification)
  - Stage 2: “denitrify” NO_3 to nitrogen gas (denitrification)

nitrification media: expanded clay

denitrification media: lignocellulosics

denitrification media: elemental sulfur

Two stage single pass pilot-scale biofilters

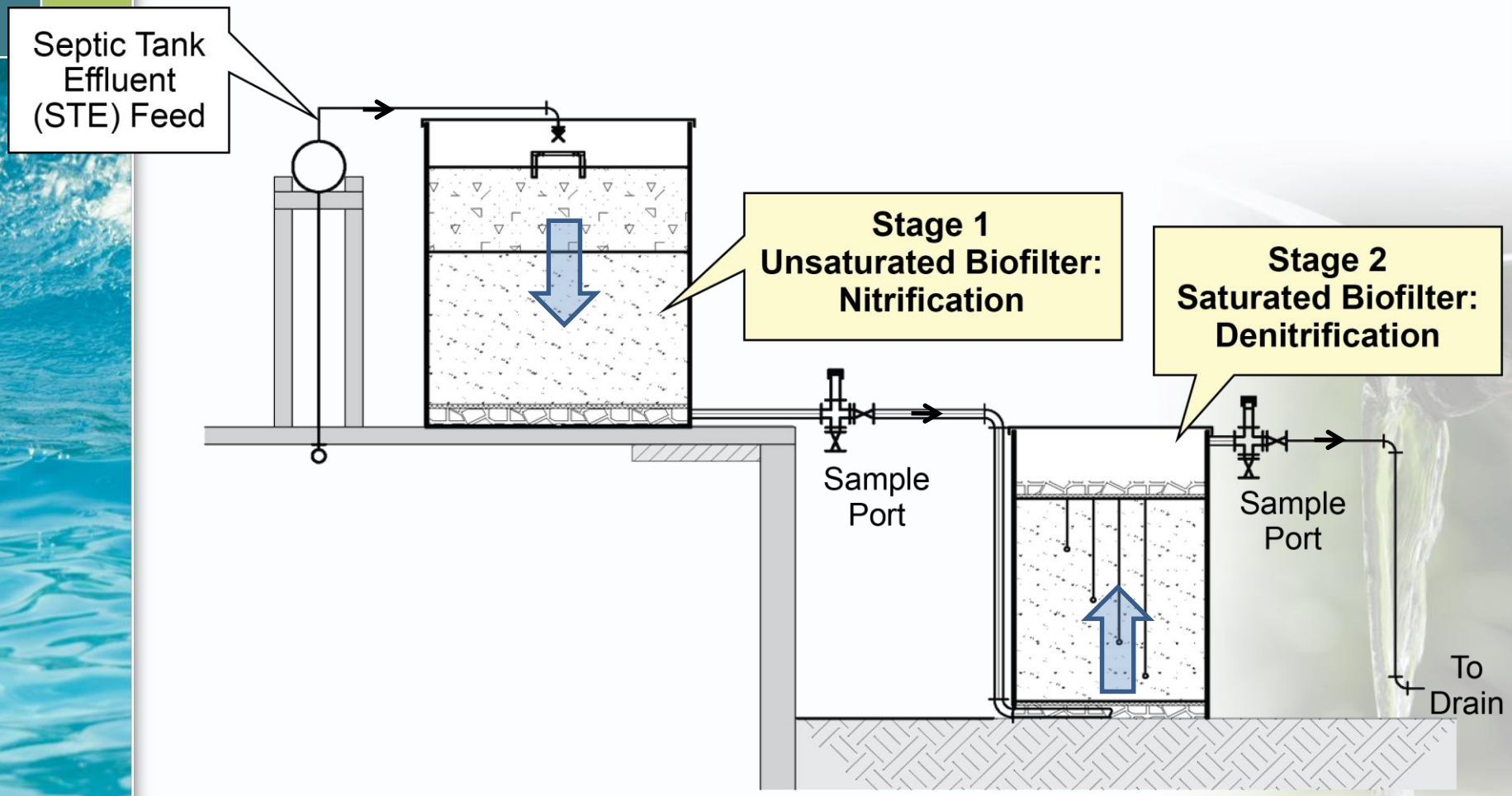
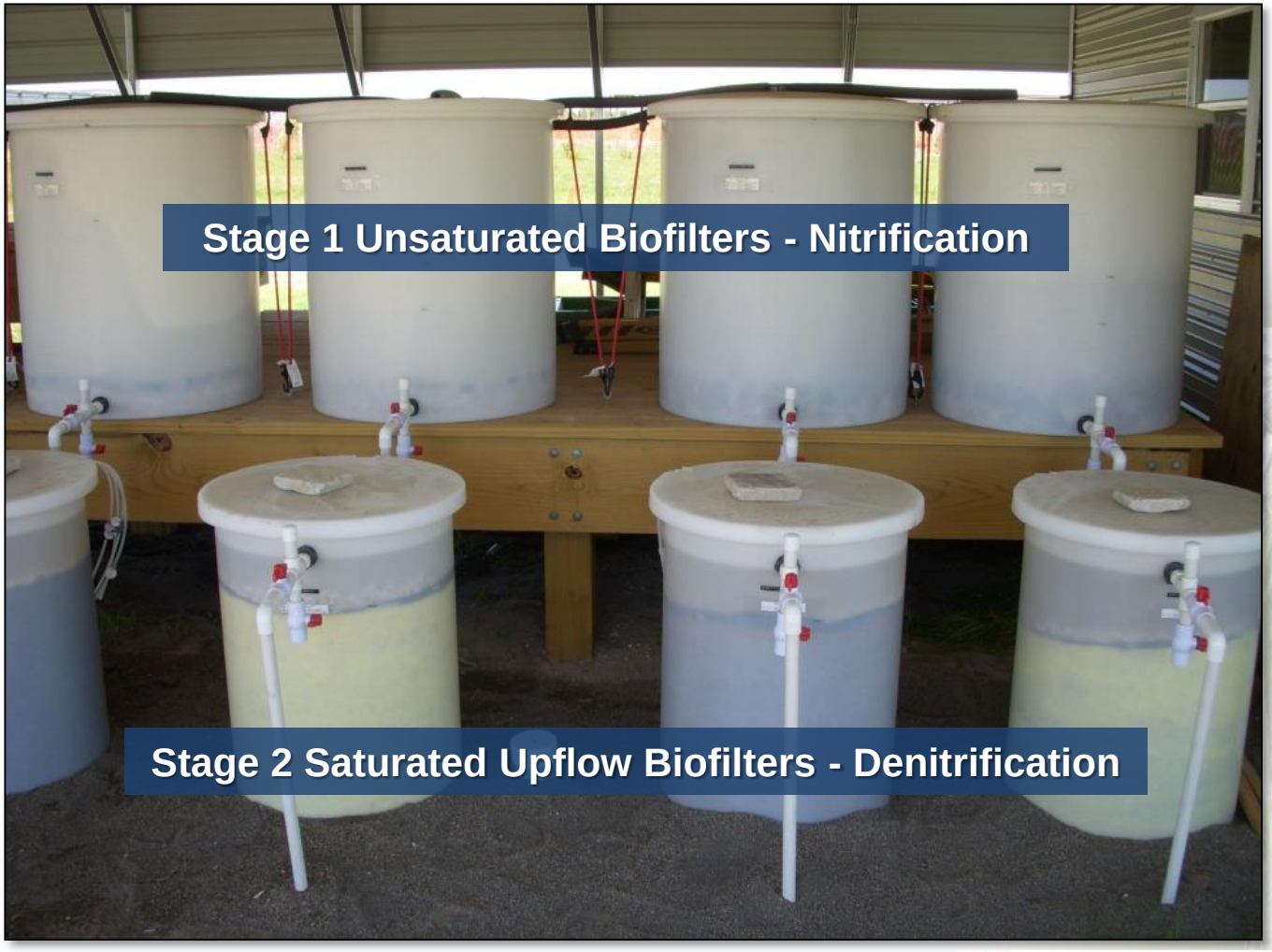


Photo of Two-stage single pass biofilter pilot units



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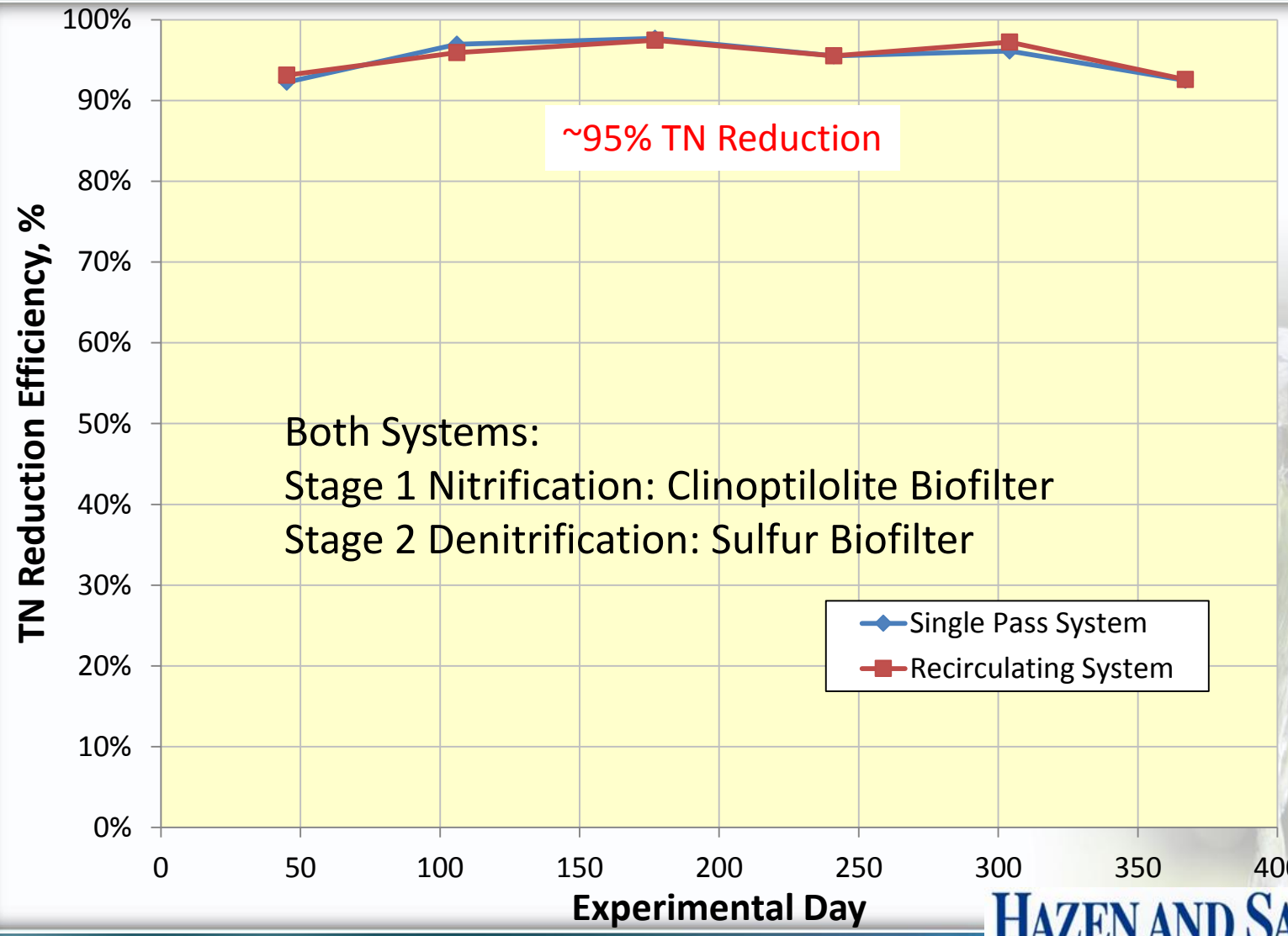
PNRS pilot-scale test results



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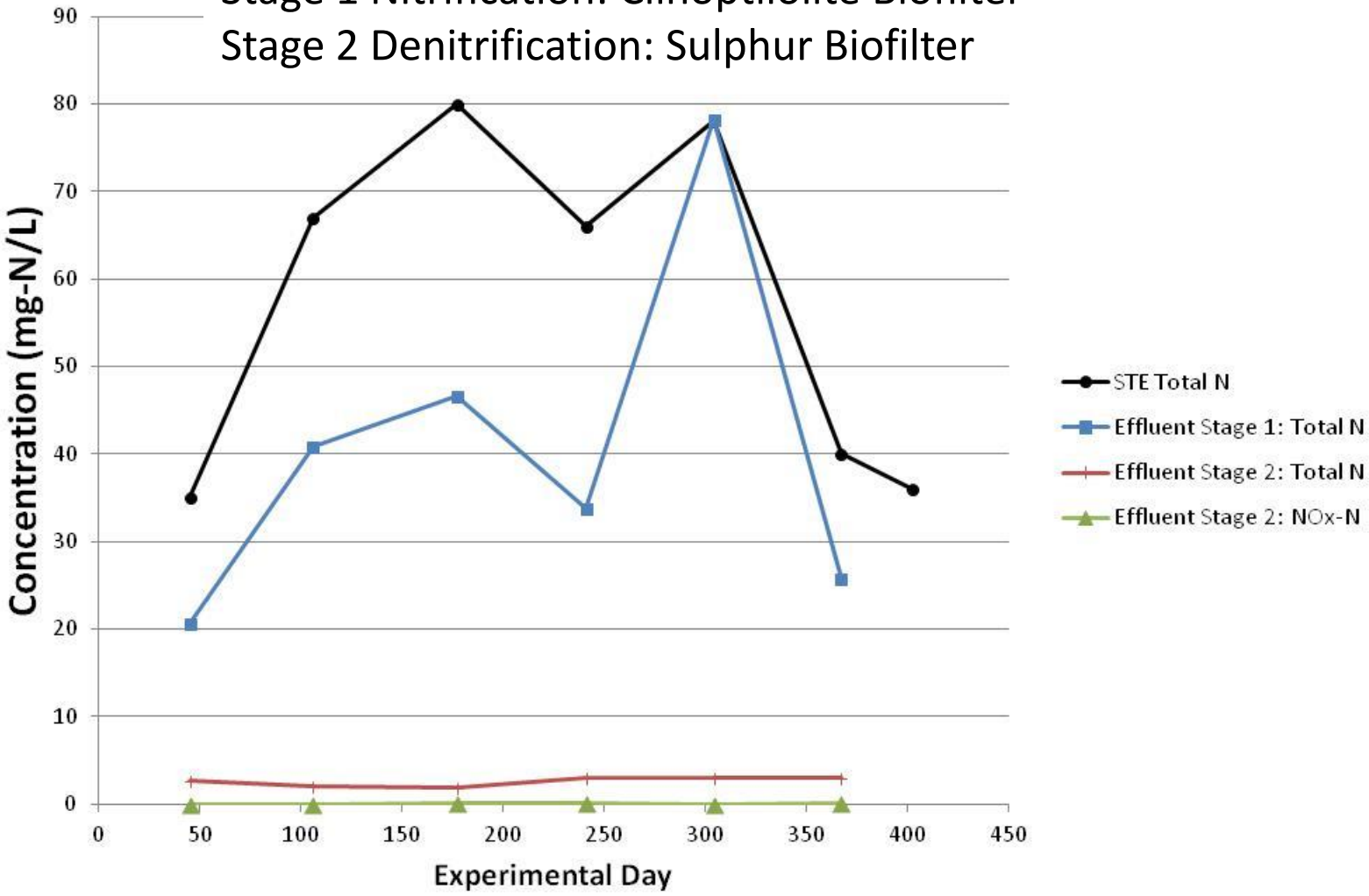
Single Pass System

Stage 1 Nitrification: Clinoptilolite Biofilter
Stage 2 Denitrification: Sulphur Biofilter



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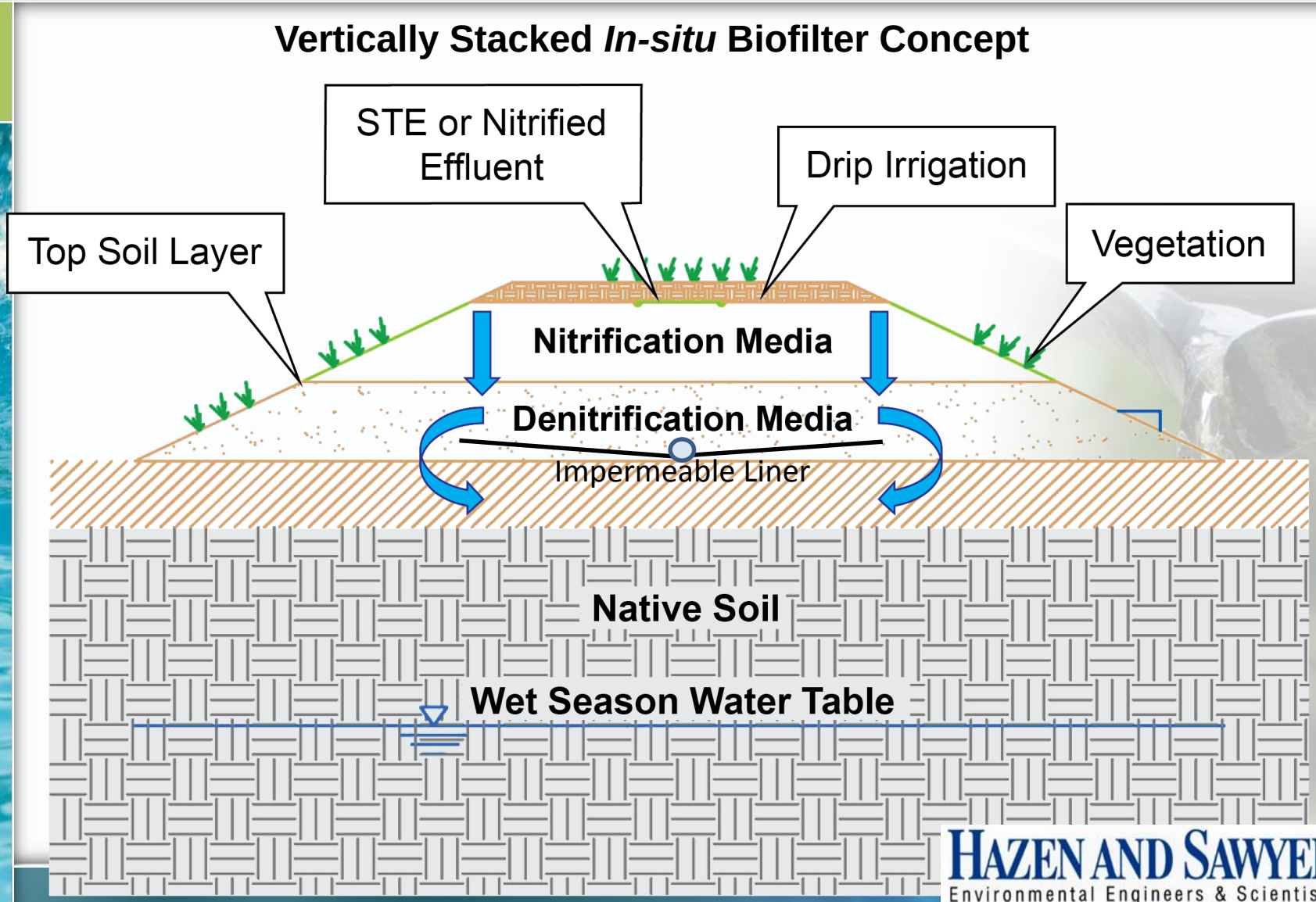
Also investigating *in-situ* stacked biofilters



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In situ Stacked Biofilter Construction

Pilot vertically stacked biofilter system performance

Mean results over 8 sample events, 523 days of operation

	n	TKN mg N/L	NH_3 mg N/L	NO_x mg N/L	TN mg N/L	Sulfate mg/L	Fecal Coliform (Ct/100 mL)	% TN Reduction
		mean	mean	mean	mean	mean	geomean	
STE Drip	8	65.1	55.60	0.29	65.4	40.6	13,273	
Stage 1 18" Sand	8	3.2	0.03	33.13	36.3	49.4	Non-detect	44%
Stage 2a ligno/sand	9	3.0	0.36	3.55	6.5	115.7	2.3	90%
Stage 2b sulfur tank	8	3.4	0.95	0.06	3.5	292.9	6.5	94%

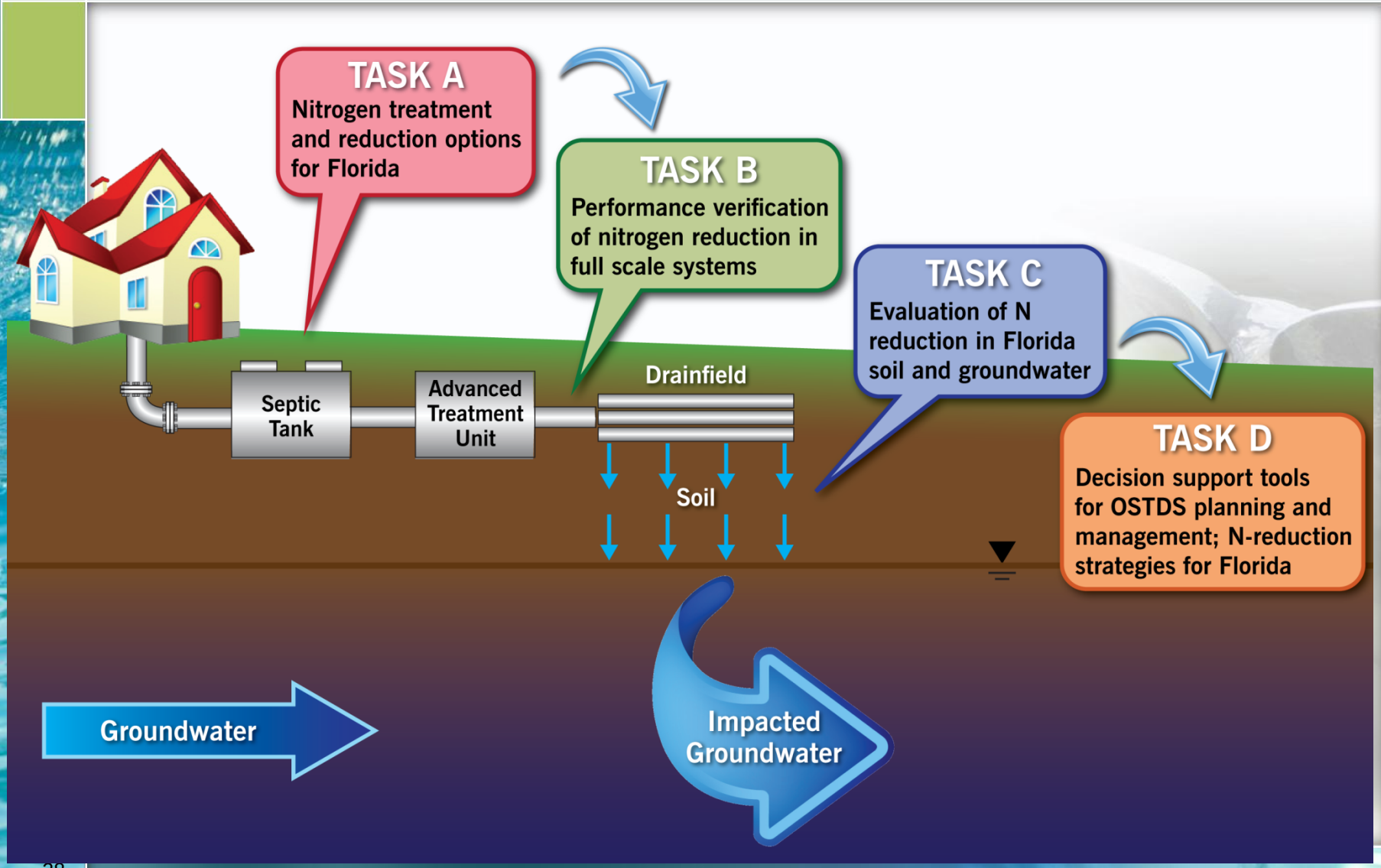
40614-000

Lessons learned from pilot test

- Encouraging results from pilot PNRS; several system configurations capable of ≥ 95% N reduction
- Sulfate production vs nitrate reduction
- Highly reactive elemental sulfur media
- Lignocellulosic retention time issues
- Recommended evaluation of combination lignocellulosic and elemental sulfur denitrification systems for full-scale treatment units

Passive Nitrogen Reduction Systems (PNRS): Full-scale Implementation

Task B Overview



7 PNRS systems installed

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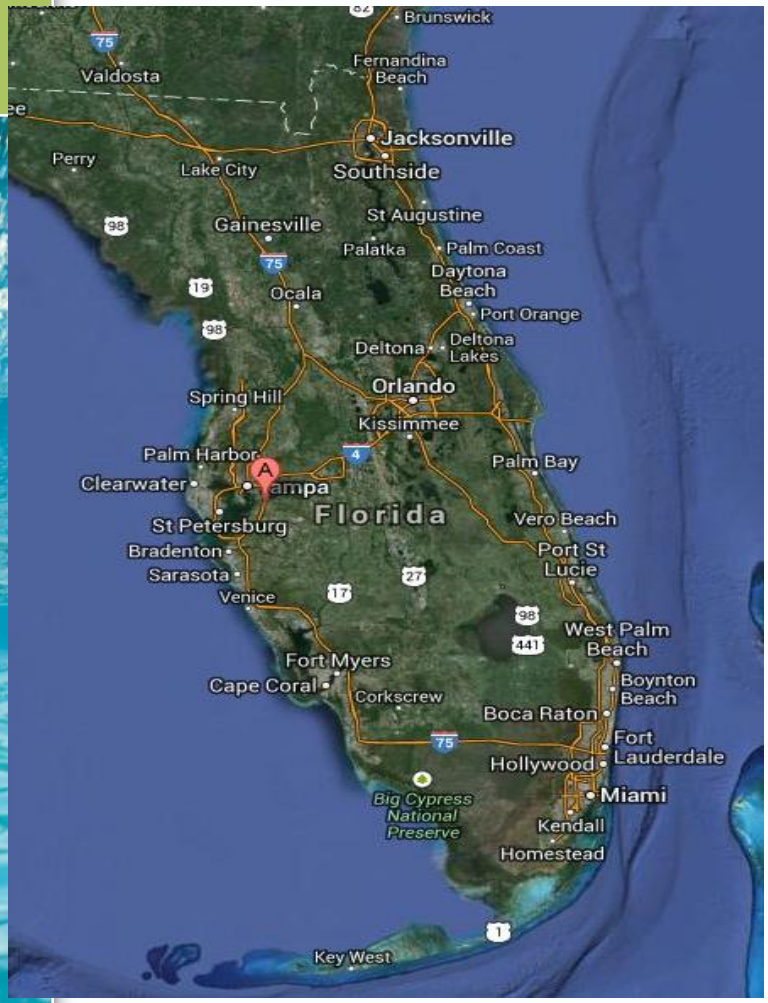
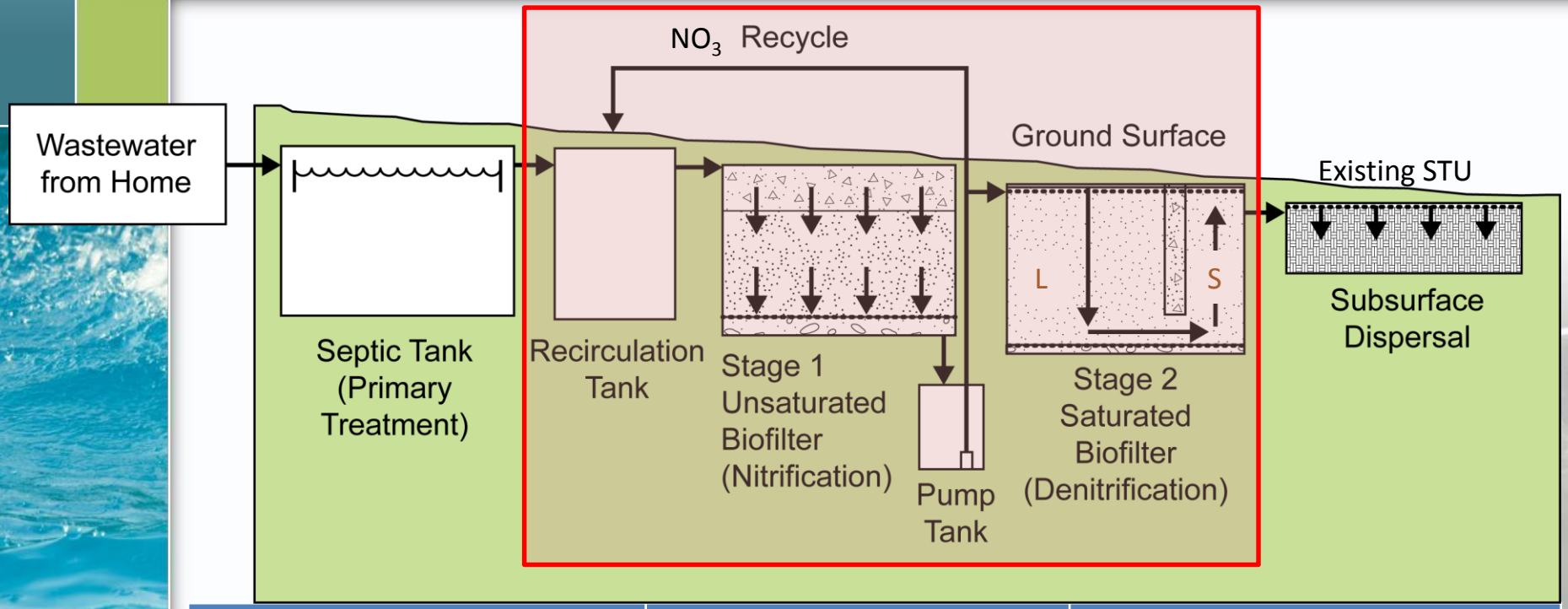
Hillsborough County PNRS: Tank System with Recirculation

Hillsborough County PNRS Location



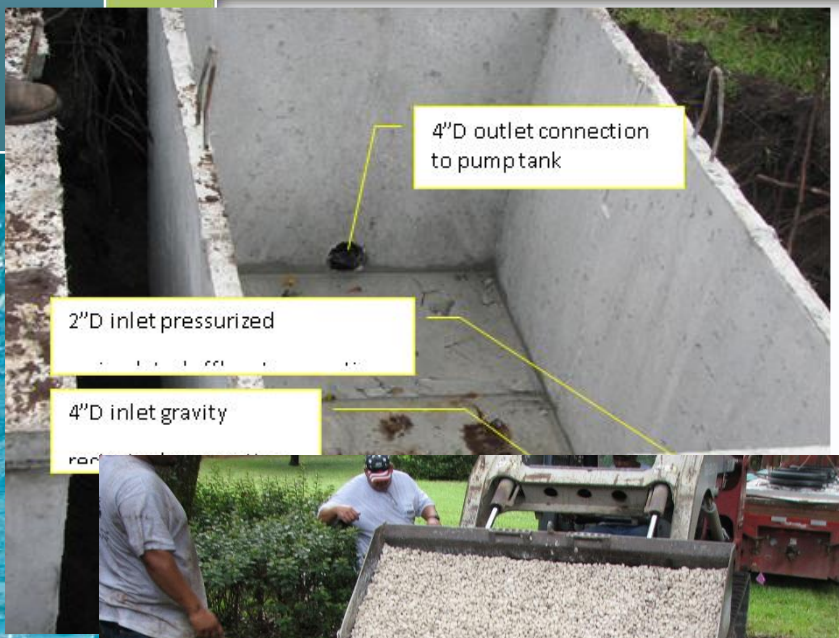
- Single family home
- 3 bedroom
- 2 residents
- Flow of 108 gpd

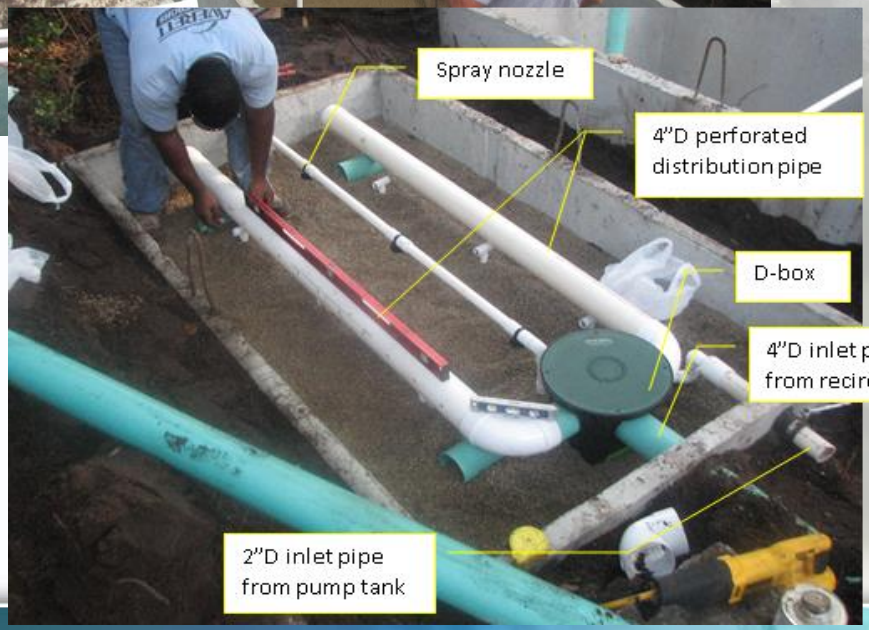
PNRS Flow Schematic and Basic Design Criteria



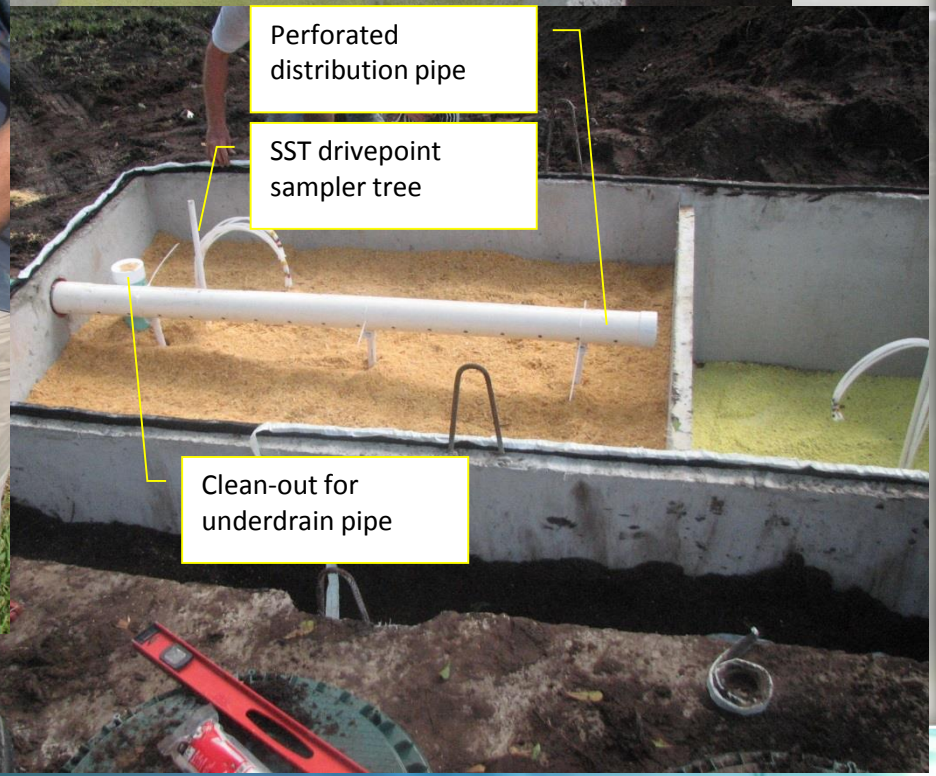
ID	HLR	Flow
Stage 1	3.0 gal/ft^2-d forward flow	108 gpd forward flow 450 gpd total w recycle (3.2:1 recycle ratio R/Q)
Stage 2, lignocellulosic	3.0 gal/ft^2-d	108 gpd
Stage 2, sulfur	6.1 gal/ft^2-d	108 gpd

Stage 1 Recirculating Biofilter Construction

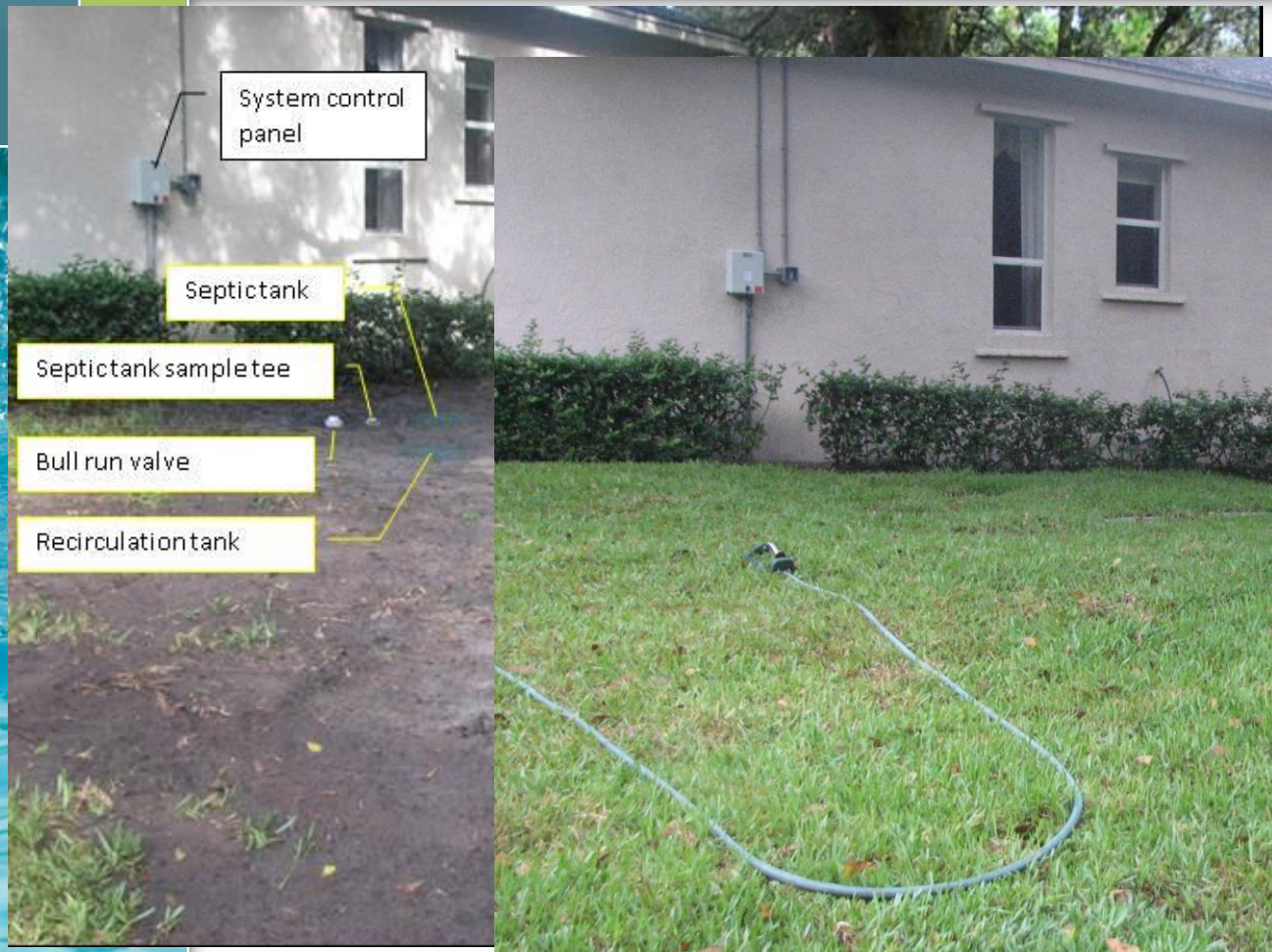




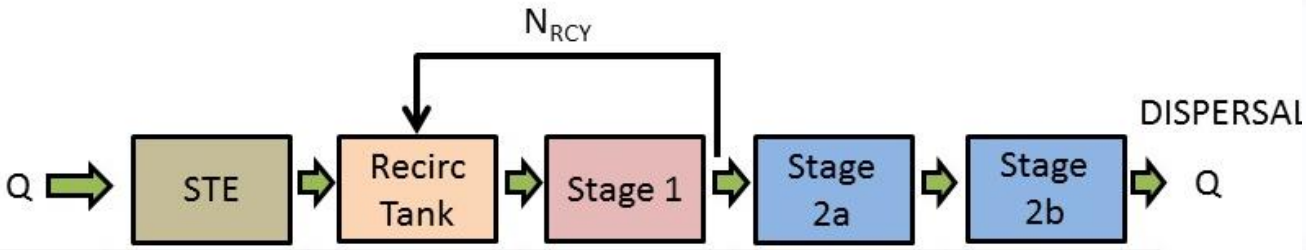
Stage 2 Denite Biofilter Construction



Completed Two-stage PNRS



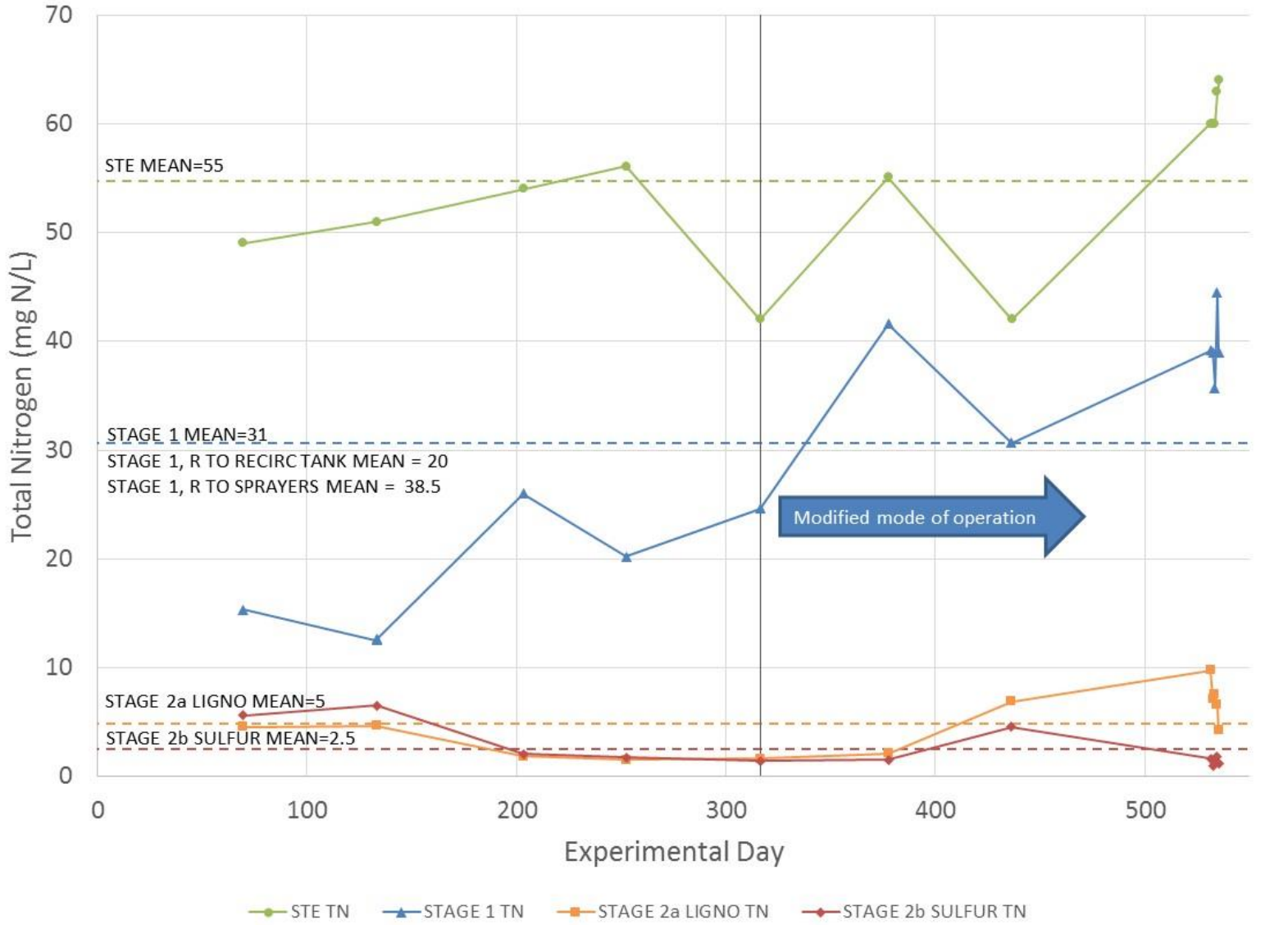
Hillsborough County PNRS
Results through Experimental Day 535



		Septic tank effluent		Stage 1 effluent	Stage 2 Lignocellulosic Effluent	Stage 2 Sulfur Effluent
n		12		12	12	12
$CBOD_5$ mg/L	mean	192.3		11.3	27.5	60.2
TKN mg N/L	mean	54.7		3.9	2.5	2.5
NH_3 mg N/L	mean	41.3		0.9	1.1	1.3
NO_x mg N/L	mean	0.05		26.8	2.3	0.02
TN mg N/L	mean	54.7		30.7	4.9	2.5
Sulfate mg/L	mean	53.6		154	156	202
Fecal Coliform (Ct/100 Ml)	geomean	90,160		1,297	19	31

TN Reduction
Stage 1, 44%
Stage 2b, 95%
prior to STU/drainfield

Hillsborough County PNRS: Time series of nitrogen data



Hillsborough County PNRS: Operation and maintenance

- Average energy consumption of 0.31 kWh/day or 2.7 kWh/1000 gal treated
- Stage 1 biofilter – no surficial biomat or clogging present
- Stage 2 biofilter – reactive media shows very little reduction in volume

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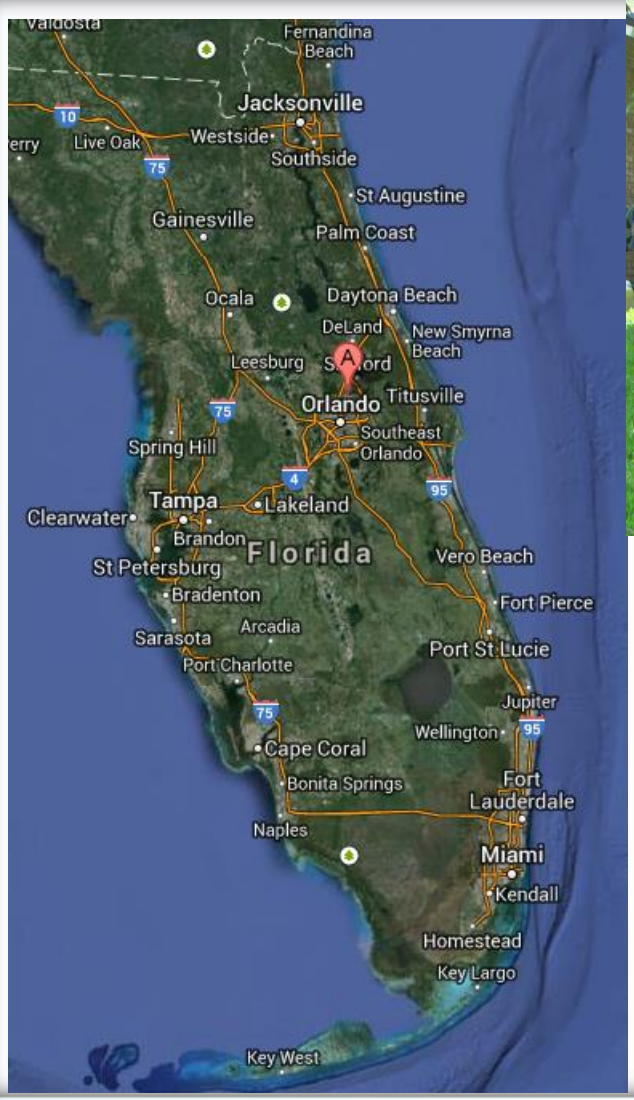
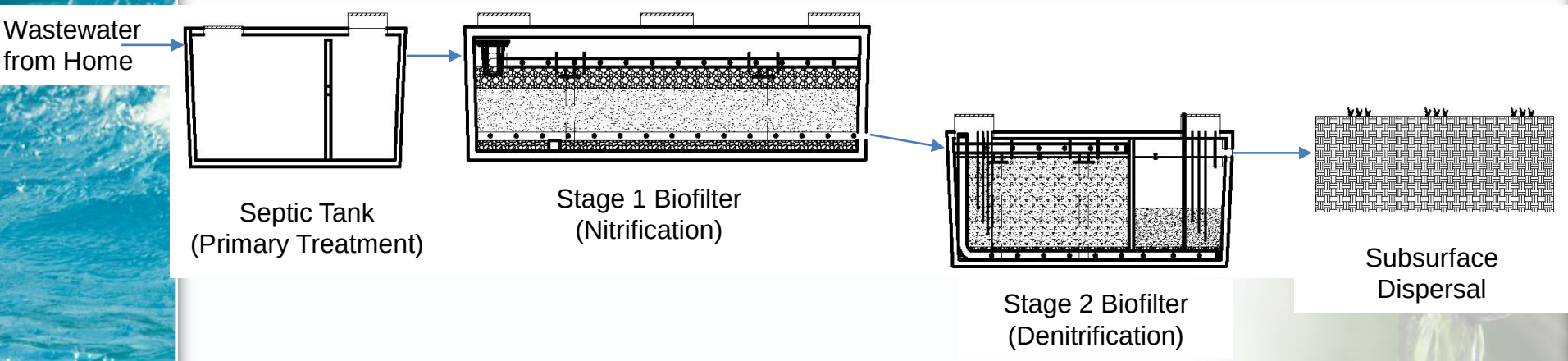
Seminole County PNRS: Single pass tank system

Seminole County, FL PNRS Location



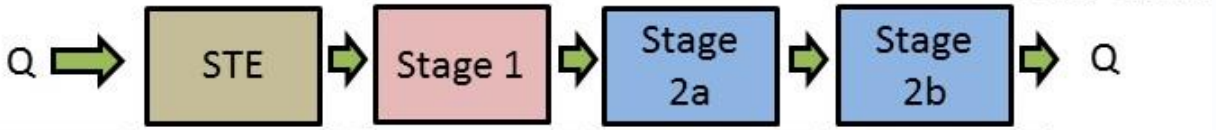
- Single family home
- 4 bedroom
- 5 residents
- Flow of ~287 gpd

PNRS Flow Schematic and Basic Design Criteria



ID	Surface Area	HLR
Stage 1	113.2 ft^2	2.5 gal/ft^2-d
Stage 2a Ligno	36.2 ft^2	7.9 gal/ft^2-d
Stage 2b Sulfur	18.1 ft^2	15.8 gal/ft^2-d

Seminole County PNRS
Preliminary results through Experimental Day 321



		Septic tank effluent	Stage 1 effluent	Stage 2 Lignocellulosic Effluent	Stage 2 Sulfur Effluent
n		9	9	9	9
$CBOD_5$ mg/L	mean	149	9.6	13.2	13.8
TKN mg N/L	mean	67.8	14.1	10.4	7.8
NH_3 mg N/L	mean	60.4	9.6	7.1	5.2
NO_x mg N/L	mean	0.05	29.4	1.4	0.04
TN mg N/L	mean	67.8	43.5	11.8	7.9
Sulfate mg/L	mean	2.0	18.1	11.8	31.7
Fecal Coliform (Ct/100 Ml)	geomean	37,811	4,279	1,140	357

TN Reduction
Stage 1, 36%
Stage 2b, 88%
prior to STU/drainfield

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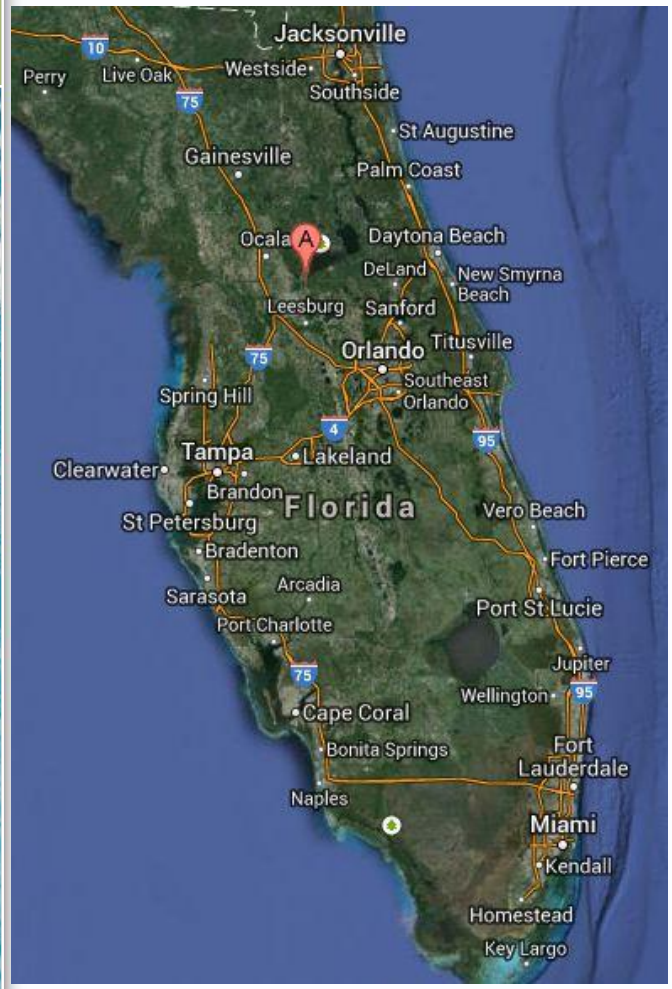
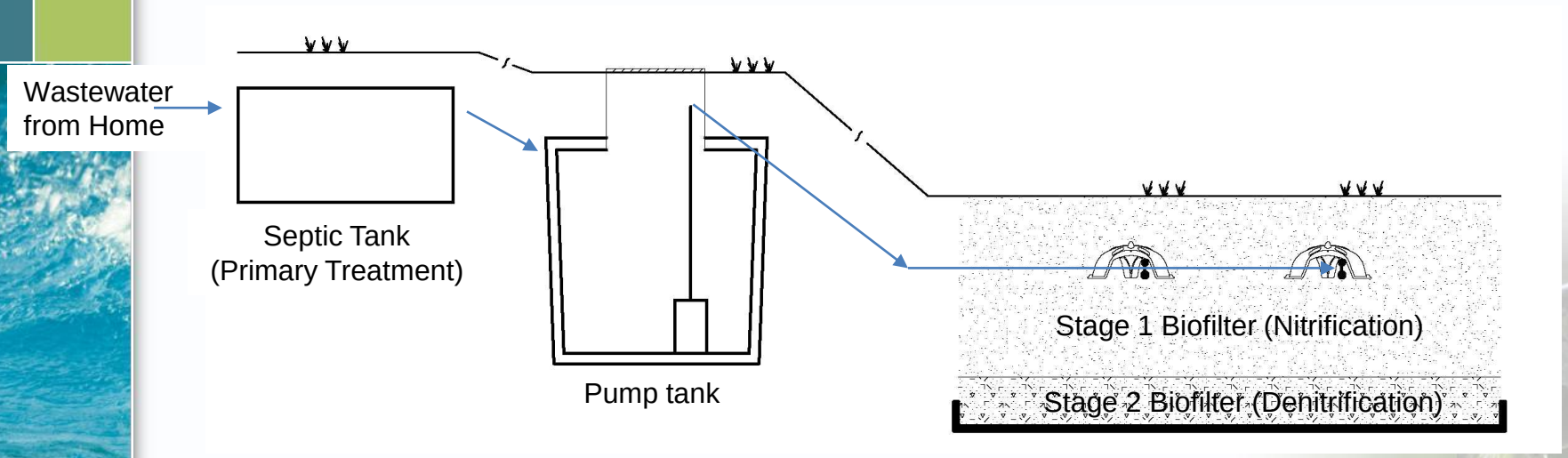
Marion County PNRS:
In ground, vertically stacked biofilter system

Marion County, FL PNRS



- Single family home
- 2 bedroom
- 2 residents
- Flow of ~120 gpd

PNRS Flow Schematic and Basic Design Criteria



ID	Surface Area	Design HLR
Stage 1 Sand	375 ft^2	0.8 gal/ft^2-d
Stage 2 Lignocellulosic	792 ft^2	

Marion County, FL PNRS

Marion County, FL PNRS

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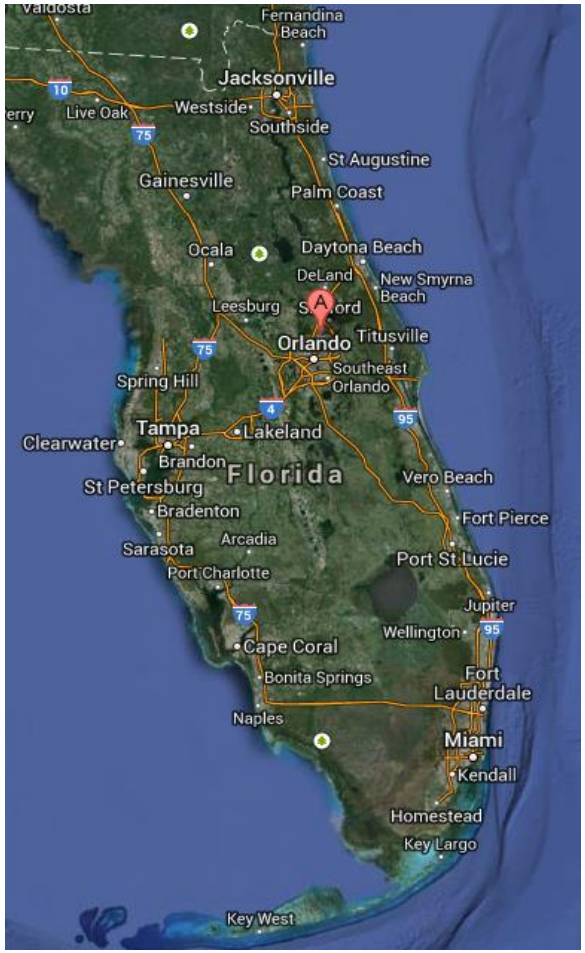
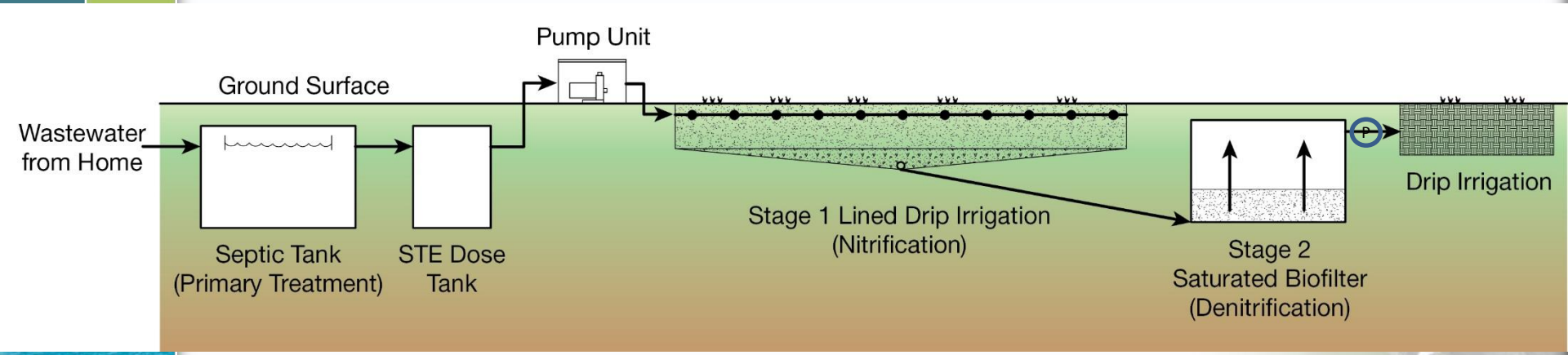
Seminole County PNRS: Drip system with reuse

Seminole County, FL PNRS Location



- Single family home
- 5 bedroom (2 residents)
- Flow of ~142 gpd
- Mounded drainfield
- Myakka and EauGallie fine sands

PNRS Flow Schematic and Basic Design Criteria



ID	Surface Area	Design HLR
Stage 1	728 ft^2	0.8 gal/ft^2-d
Stage 2	32.3 ft^2	18 gal/ft^2-d
Drip irrigation	615 ft^2	0.94 gal/ft^2-d

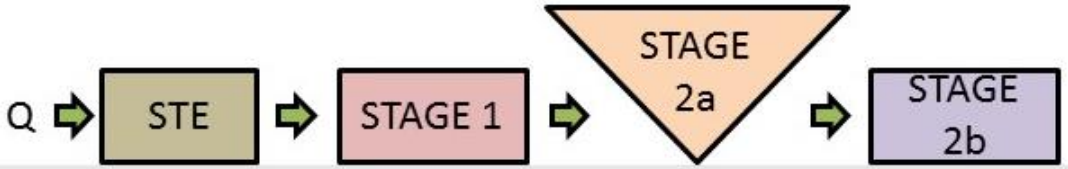
Stage 1 Lined Drip Irrigation

Pipe boot

Gravel Underdrai

Stage 2 Denite Biofilter Construction

Seminole County PNRS
Preliminary results through Experimental Day 321

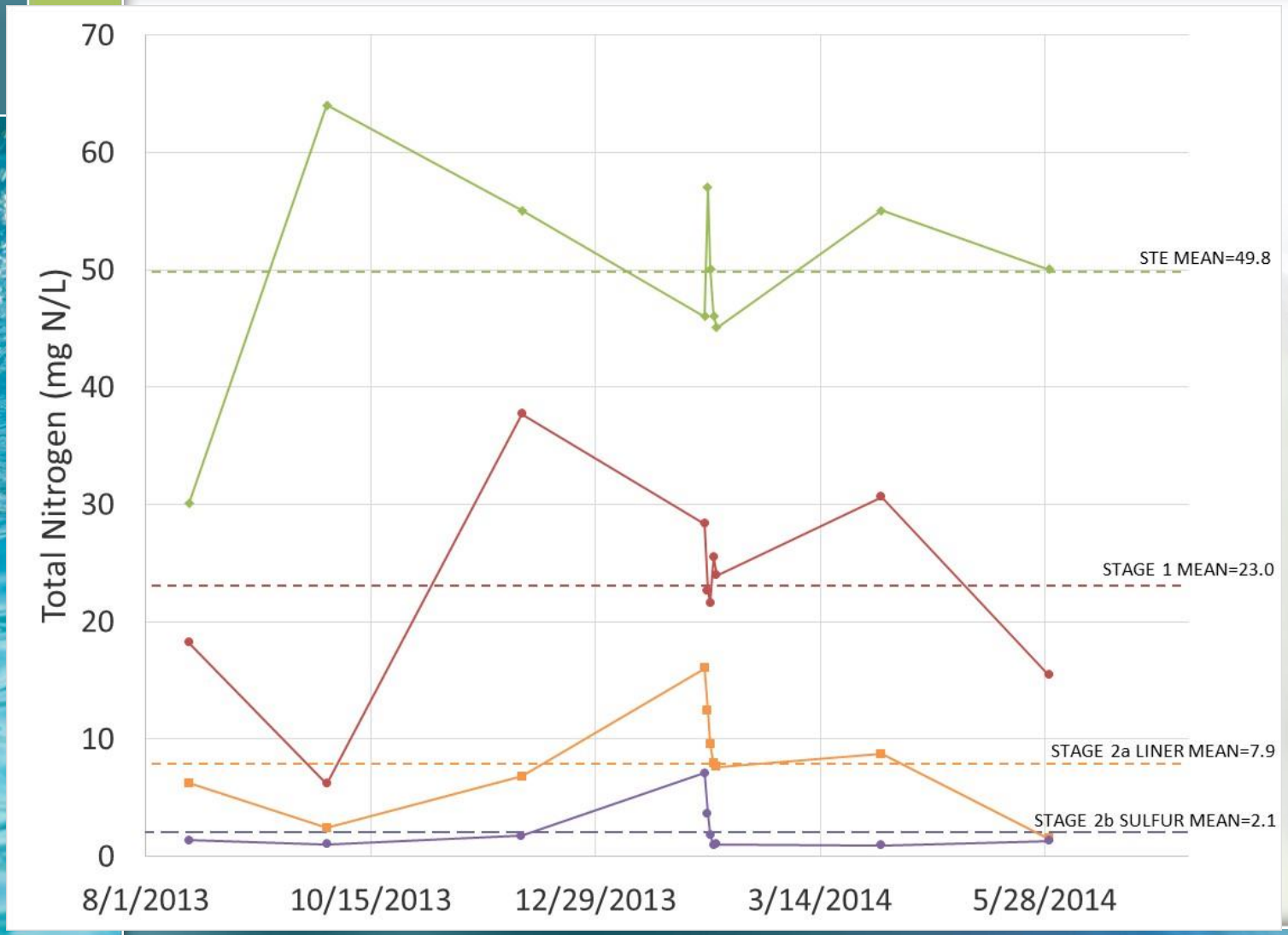


		Septic tank effluent	Stage 1 effluent	Stage 2 Lignocellulosic Effluent	Stage 2 Sulfur Effluent
n	mean	9	9	9	9
$CBOD_5$ mg/L	mean	77.2	3.8	3.6	14.9
TSS, mg/L	mean	22.6	2.6	20.4	5.0
TKN mg N/L	mean	49.8	1.8	2.0	1.3
NH_3 mg N/L	mean	38.9	0.2	0.2	0.3
NO_x mg N/L	mean	0.03	21.2	5.9	0.8
TN mg N/L	mean	49.8	23.0	7.9	2.1
Sulfate mg/L	mean	21	40	25	104
Fecal Coliform (Ct/100mL)	geomean	66,086	1,000	38	6

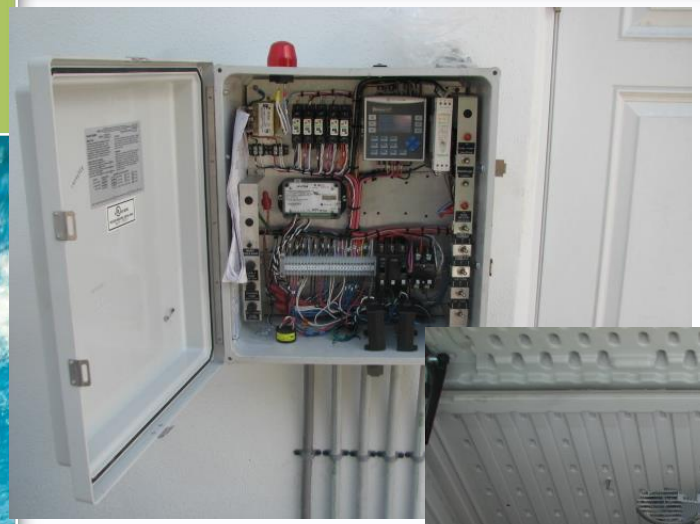
NA=not analyzed

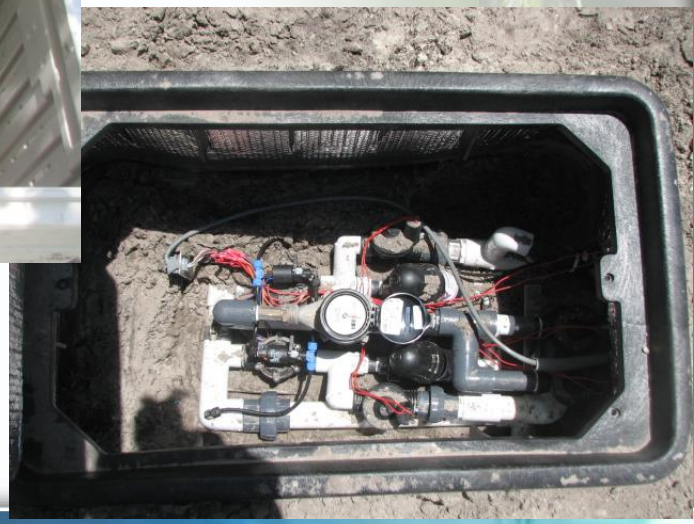
TN Reduction
Stage 1, 54%
Stage 2b, 96%
prior to STU/drainfield

Seminole County PNRS: Time series of nitrogen data



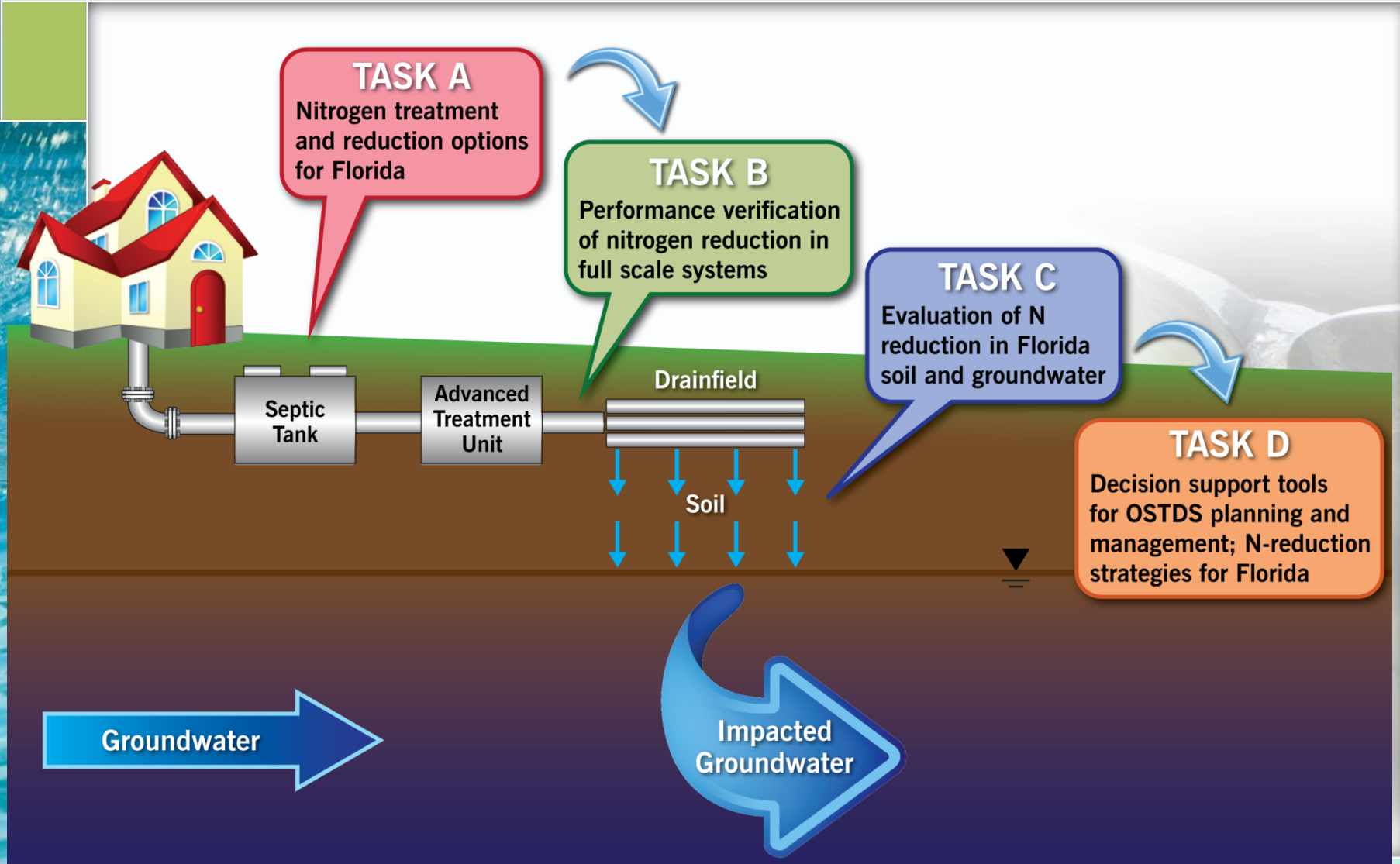
Drip Irrigation System



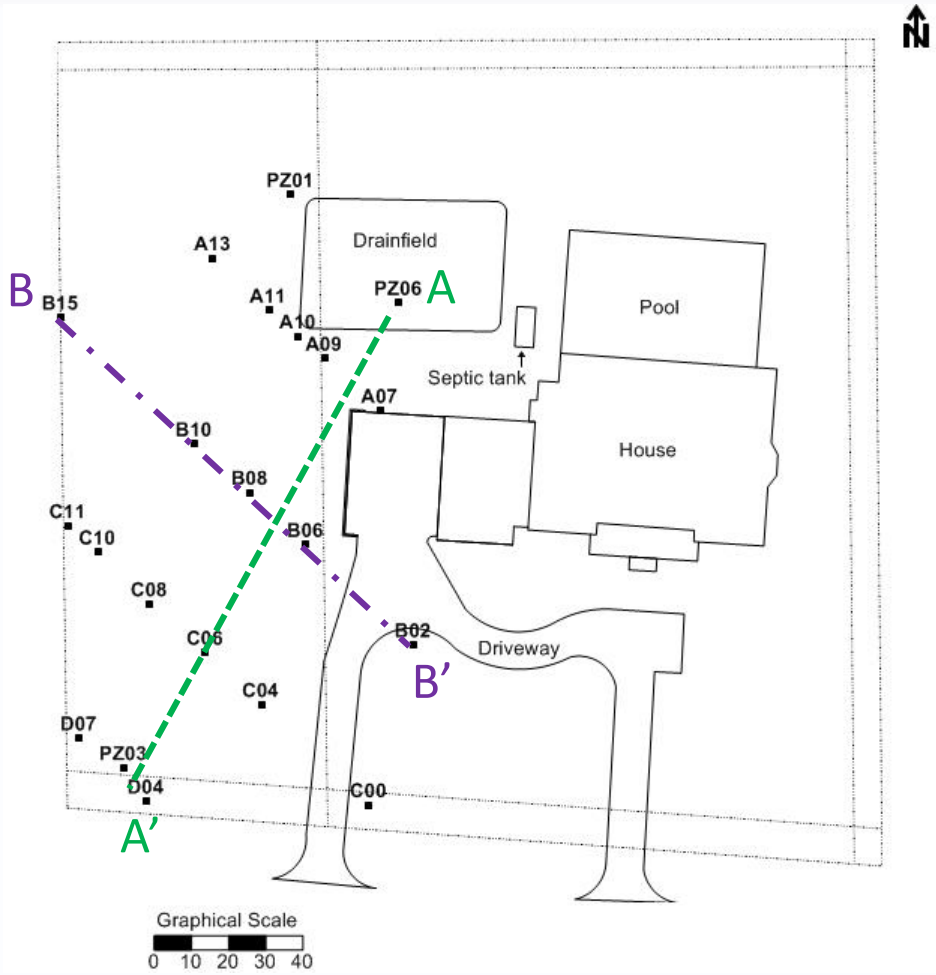


Subsurface Drip Irrigation Construction

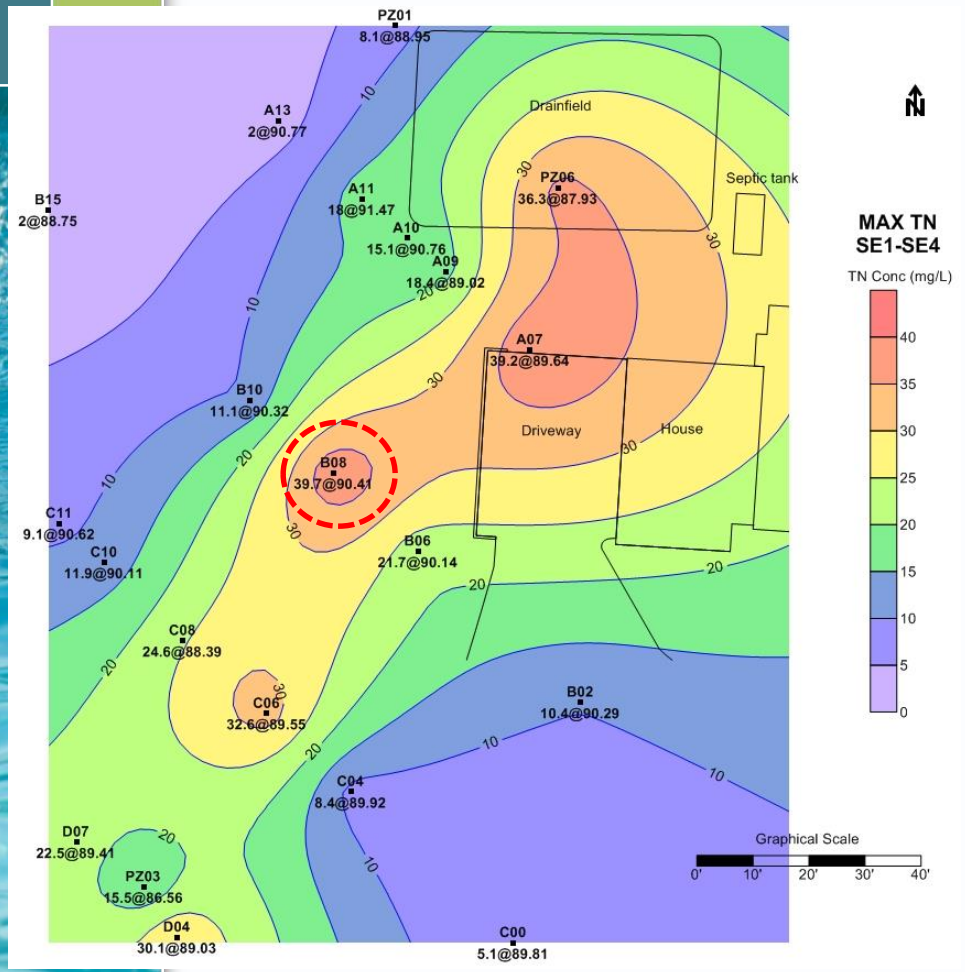
Task C Overview

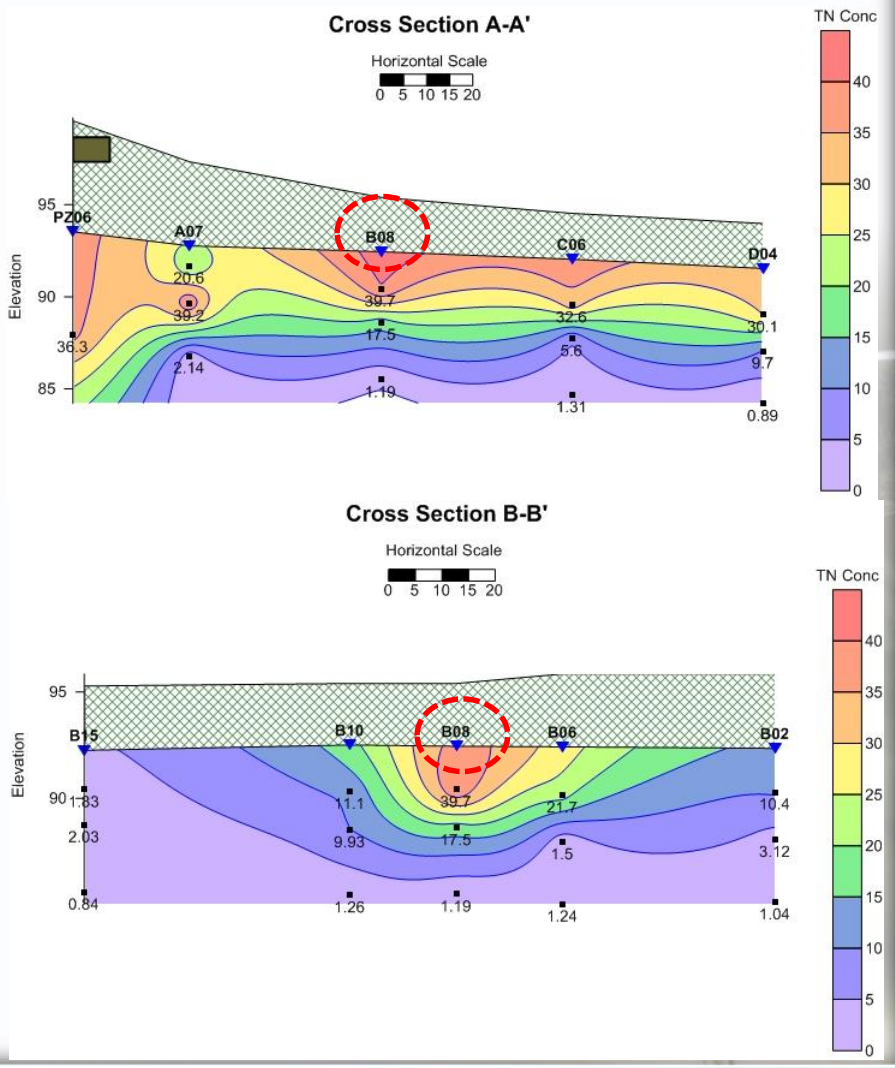


C-HS2 Longwood, FL

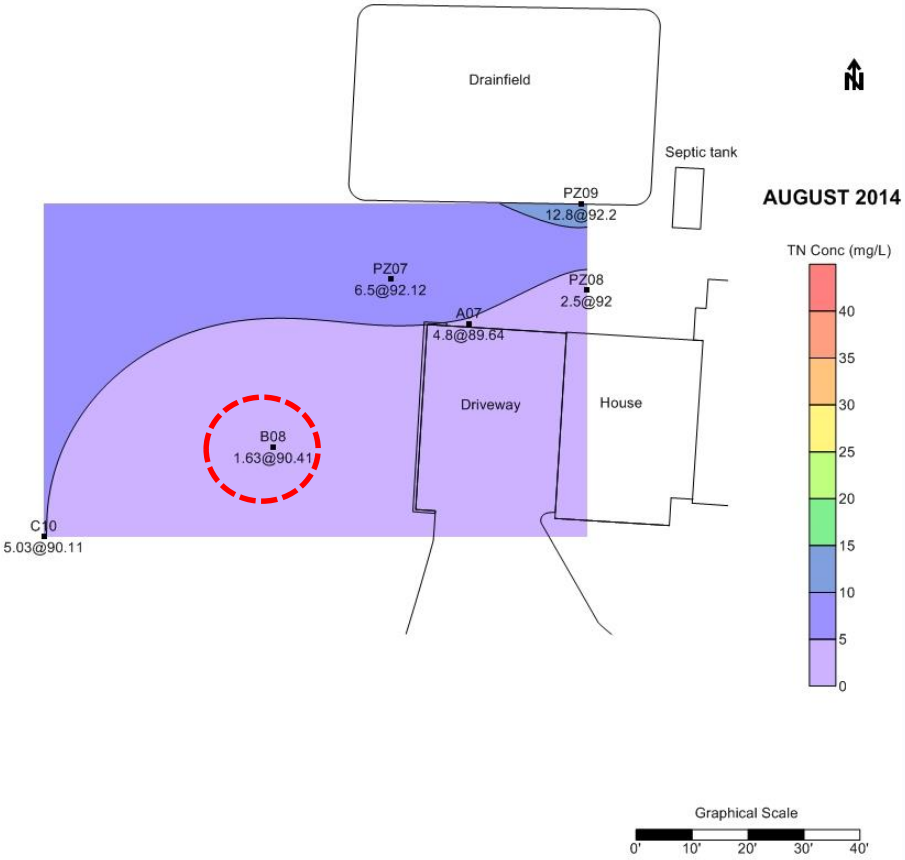


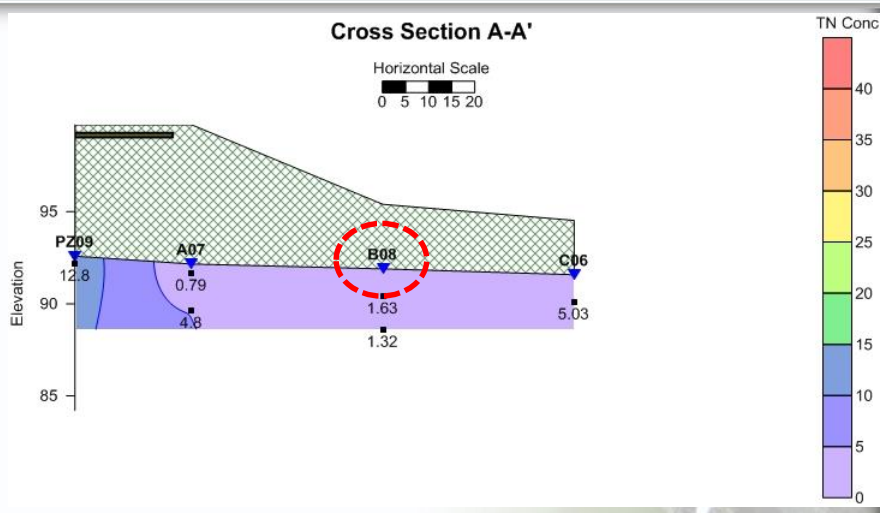
Task C monitoring – before PNRS installed



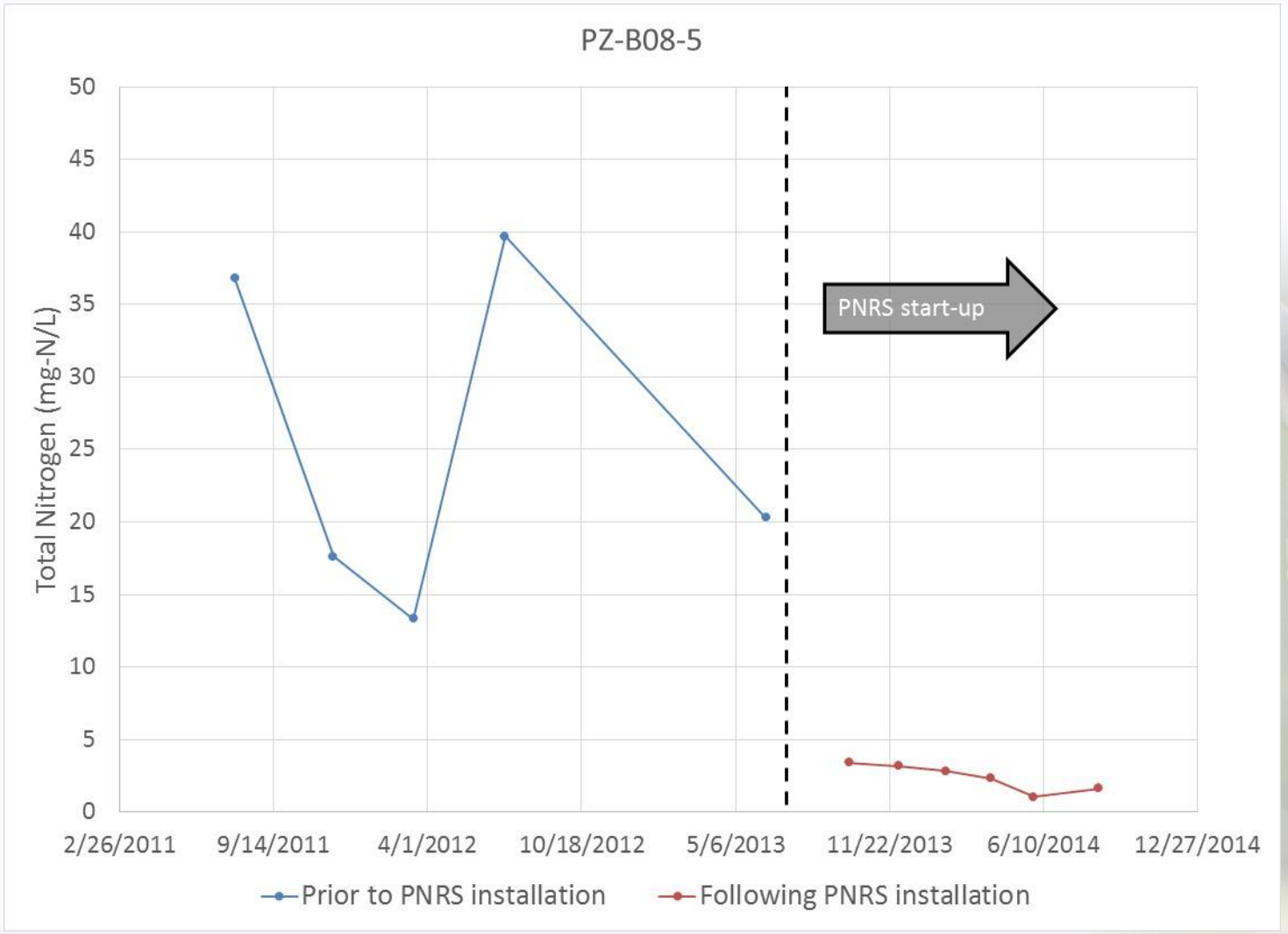


Task C monitoring – after PNRS installed



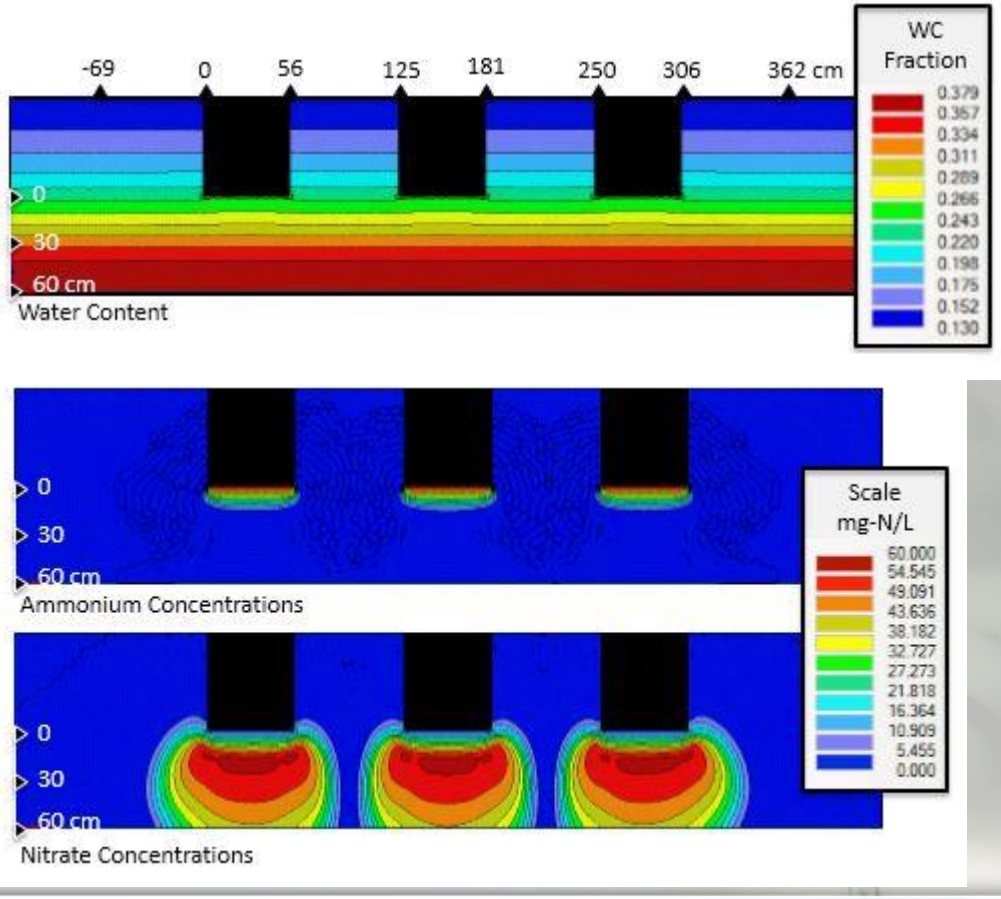


Task C monitoring – after PNRS installed

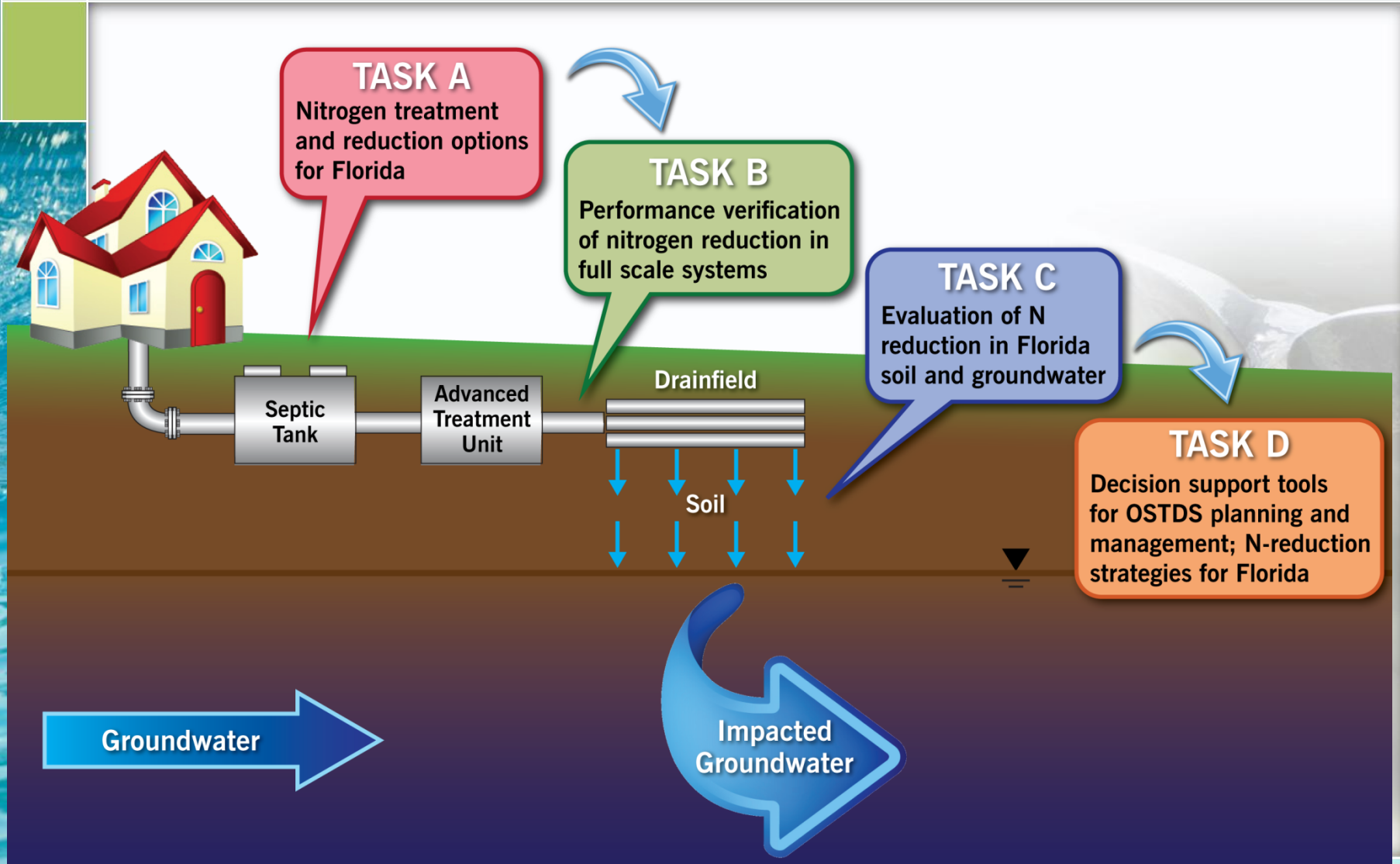


Task D is evaluating nitrogen fate and transport scenarios

Configuration: trench, equal distribution
Soil Type: less permeable sand
Loading Rate: 2.67 cm/d (0.65 gpd/ft^2)
Effluent Nitrogen: 60 mg-N/L as NH_4
Depth to Water Table: 60 cm (2 ft)



Putting it all together…



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Summary & Questions

FOSNRS Summary

- Multi-prong project underway to reduce nitrogen from Florida's Onsite Sewage Treatment and Disposal Systems
- Integrated tasks of:
  - Treatment technology evaluation including new passive systems
  - Full-scale field testing of PNRS treatment technologies
  - Monitoring of nitrogen fate and transport in subsurface
  - Modeling and planning tools to support regulatory decision making
- Successful results would allow OSTDS to achieve nitrogen removal similar to wastewater treatment plants and play a role in nitrogen reduction in sensitive watersheds.

QUESTIONS ?

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