Development of
Survey and Assessments
for Coastal Headwater Streams

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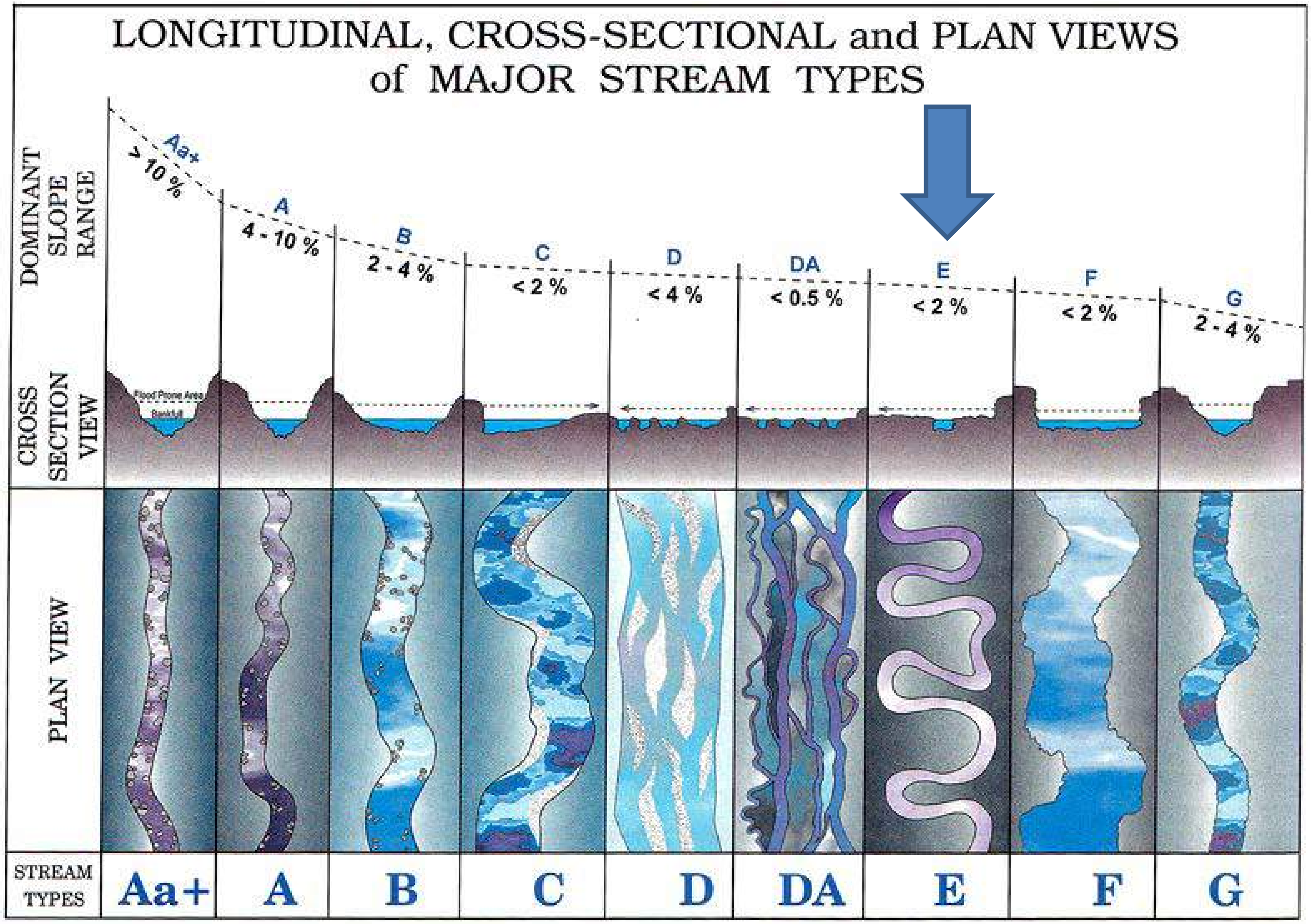
The **Coastal Alabama Pilot Headwater Stream Survey was developed to locate, identify, document and assess baseline data for natural stream conditions, while also comparing any observed LAND USE impacts in close proximity to selected headwater streams within the Mobile and Baldwin County area.**

1. **Survey, Document and Comparatively Assess low impact "natural" headwater reference streams.**
2. **Survey, Document and Comparatively Assess higher impacted headwater stream segments.**
3. **Assess and correlate Land Use/Cover valuations with surveyed fluvial geomorphology and water quality parameters present in order to gage a new coastal headwaters assessment tool for these systems.**
4. **Derive new data and amend the 2005 *Coastal Alabama Regional Curve and Reference Reach* designs for Natural Stream Design and Restoration projects.**

To expand our Coastal Alabama Regional Curve information we surveyed data from selected Rosgen E-Type Streams.

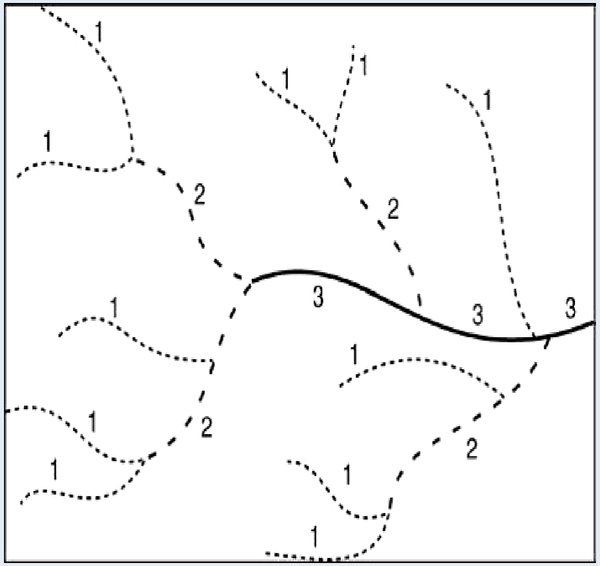
Single Channel , Low Gradient ~ <2% , High Meander/Width Ratio, Riffle/Pool Sequences



http://www.fgmorph.com/fg_5_38.php

HEADWATER vs. FIRST ORDER: Nomenclature & Quantification

ORIGINAL IDEA: TO STUDY "FIRST ORDER" COASTAL STREAMS



Strahler Ordination of Streams

There was a lot of talk about how to describe this **designation**.
It seemed difficult to quantify.
Some scientists include ephemeral stream types, others only count perennial streams in their counting order.

Other research seems to favor the term "**Headwaters**" for areas of less <u>than **1 Square Mile** in drainage area</u>.
This was **easier to quantify** and was much less confusing for selecting natural streams in the coastal area.

So ADEM decided to use the latter <u>"Headwater Streams"</u> designation, with an eye toward <u>a low stream order</u> , observed by walking the target sites.

A Quick Guide to the HDWTRSS Assessment Processes

The following tasks presents a general summary of the various steps involved in developing this stream assessment project:

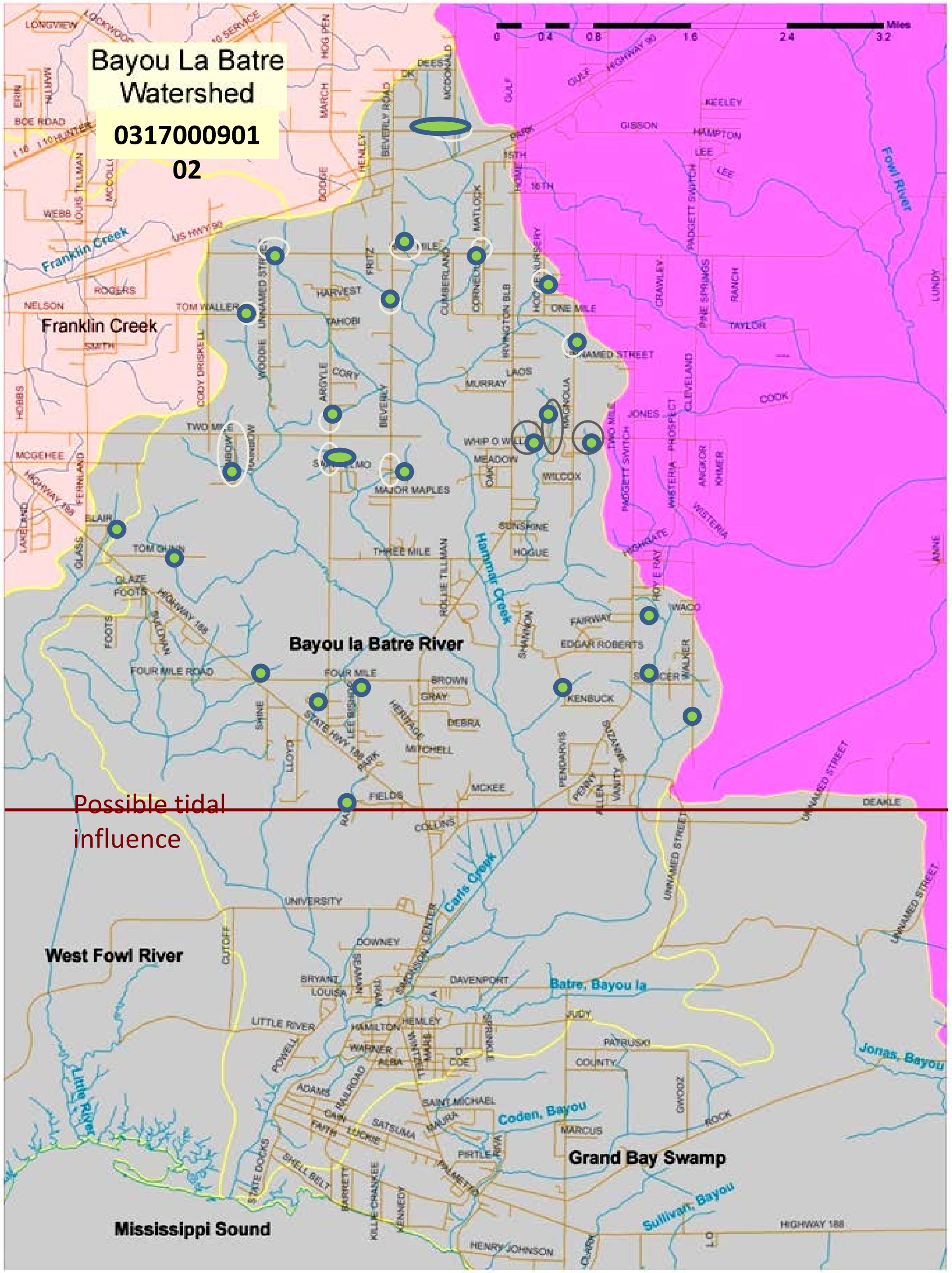
A. Gross Determination Mapping

Step 1. Using Desktop Evaluation*

***(Select Sample HUC to develop these initial project items).**

Task 1 -Use of 2008 NRCS 12-digit HUC overlay with secondary roads and topography layers to develop individual HUC HDWTRSS maps for both Mobile and Baldwin Counties, creating 76 HUC HDWTRSS Recon Maps for Southwestern Alabama.

[HUC areas that were below the *Coastal Management Zone* elevation were considered as "tidally influenced" and many were not useable for this Study]

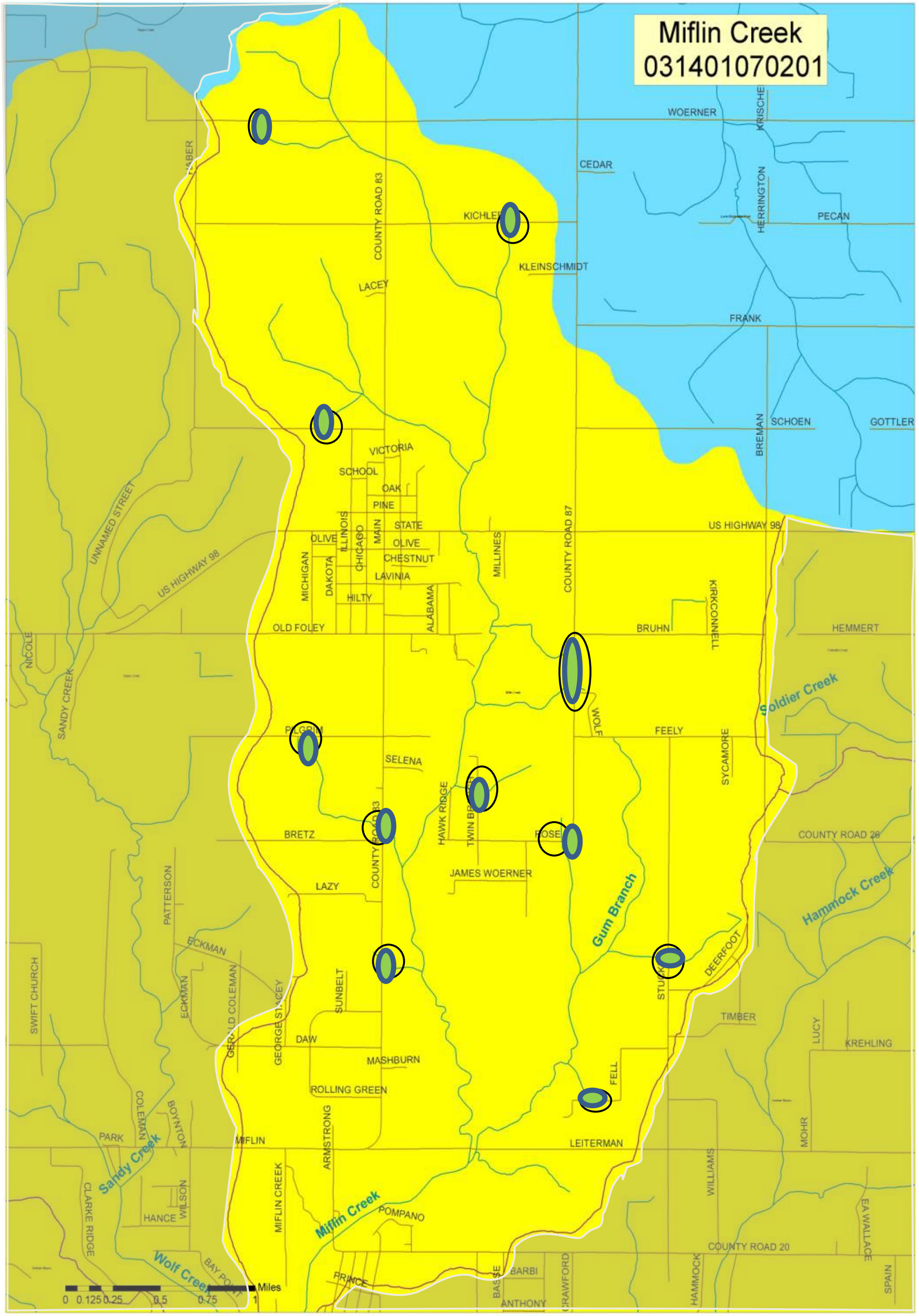


Select possible sites for Initial Roadside Recon.

Possible Tidal Influence

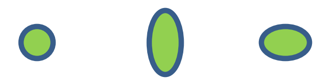
<u>Task 2</u> - Individually review each HUC map and indicate possible road crossings at or near the 'supposed headwater stream sections' **<u>to ID potential field recon sites</u>**.

ADEM has the ability to request access to inspect "Waters of the State".



<u>Task 3</u> **-Obtain the USGS topographic map, NRCS county tax plat book and companion soil map for <u>comparison</u> of the selected watershed areas.**

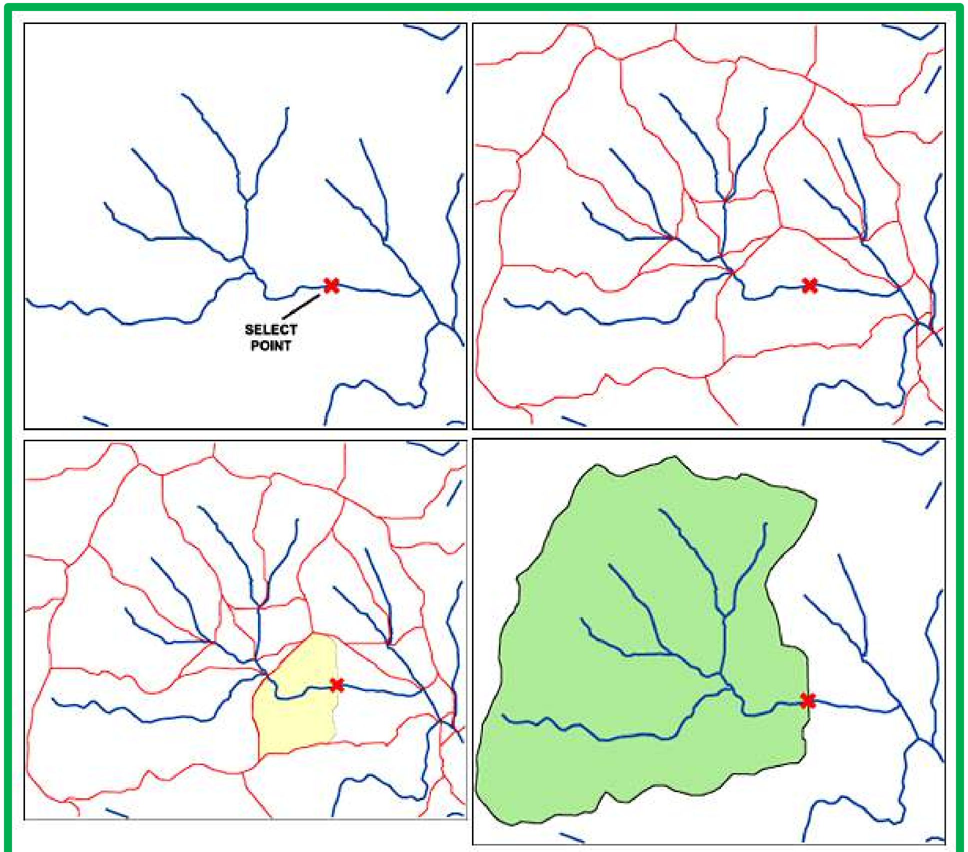
<u>Often 5 to 30 potential sites per HUC!</u>



Note names of key <u>landowners</u> for sites. Ascertain physical boundaries for target HUC, If possible.

Step 2. GIS-based sub-HUC Drainage Calculations:

Task 1 - Now calculate the drainage area using the HUC boundary on the NRCS maps. Using available GIS tools (e.g. USGS-NHD) you may estimate the Total linear feet of all potential HDWTRSS streams for each drainage selected.

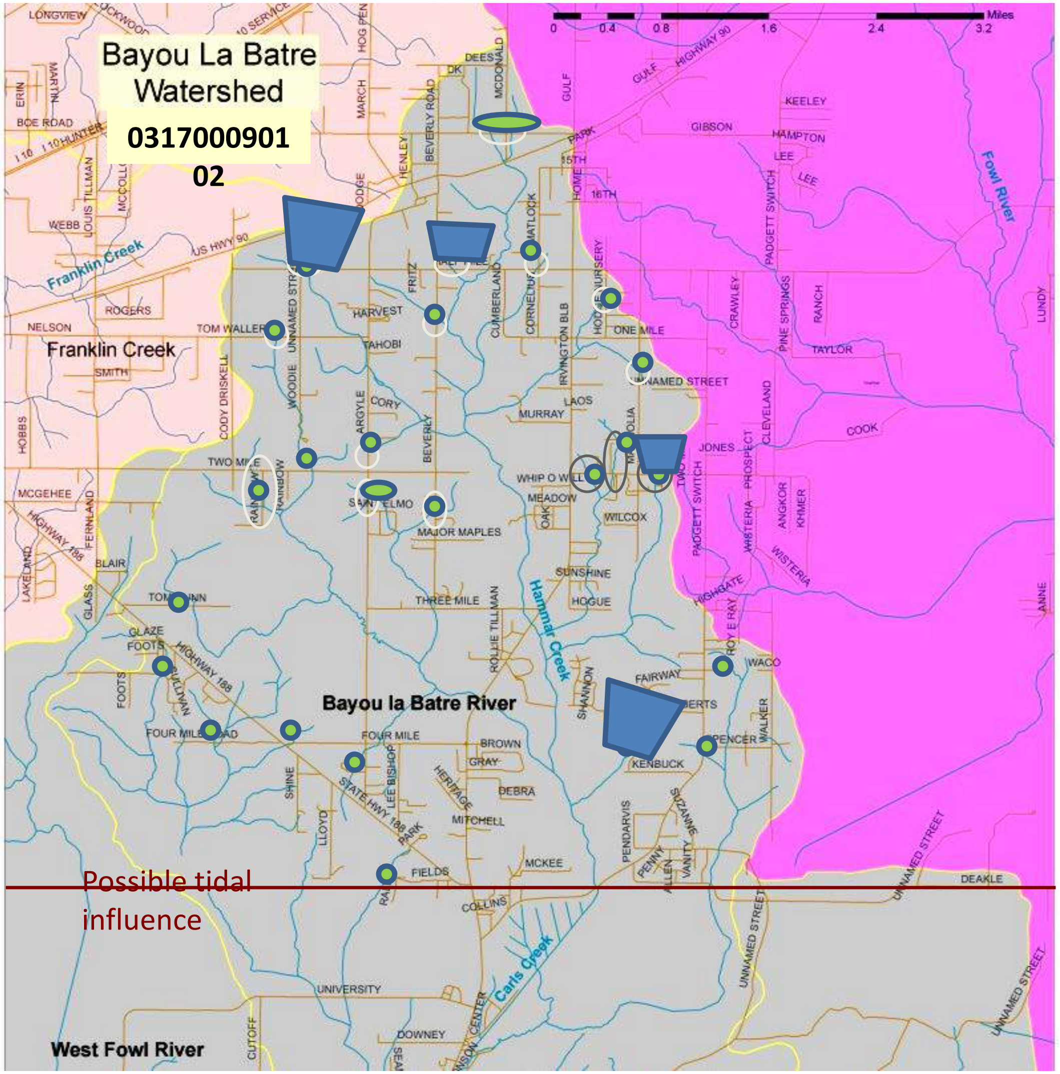


http://nhd.usgs.gov/

http://water.usgs.gov/osw/streamstats/

Task2 -Determine the total watershed area for each designated stream at the most downstream location of the property boundary using suitable GIS tools. Examples include the USGS NHD or STREAMSTATS web pages, the USGS topographic maps, USDA-NRCS soil map, or other mapping tools at the appropriate scale.

We found it useful to record both ACRES and SQ. MILES for these drainage areas.



<u>Task 3</u> Determine Max Drainage @ *$1M^2$*

Prepare your sub-HUC data.
Select potential sites for an on-site secondary RECON and to initiate the Headwater Stream Survey field evaluations. <u>Reference Streams</u> were selected for those with a sub-HUC watershed area of less than 1 sq.mi. (259 ha).

Note: "Where determined to be appropriate by a qualified environmental scientist", a HDWTRSS evaluation can be conducted for impacted streams with watershed areas greater than 1 sq.mi. There were 2 Urban Streams that exceeded this size: 3 Mile and 12 Mile Creeks.

Set up a meeting to contact your key people,
for determination of access to selected site properties.

B. FIELD RECON EVALUATIONS

As we began the field verification process,
It was soon realized that we needed a standardized

Recon 1 Field Sheet

to conduct our
initial field reconnaissance efforts for locating these potential headwater streams.

Coastal Headwater Stream Recon 1 Field Sheet

SITE SKETCH

SUBWATERSHED NAME:

SITE DESCRIPTION:

WATERBODY NAME:

LATITUDE/LONGITUDE (DECIMAL DEGREES):

WAYPOINT NAME/NUMBER:

ACCURACY OF GPS LOCATION:

TIME/DATE:

NOTES:

ACCESSIBLE	AREA LANDUSE	LANDOWNER INFO
Y N ? NOTES:	Agricul. Dirt pit Wetland Forestry Park Industrial **Urban** **Residential:** **low density**/high density Other	

WATER PRESENT	WATER FLOWING	APPROX. BANKFULL WIDTH(FT)
Y N	Y **N**	

ENOUGH MEANDERS FOR STUDY? (20 TIMES BANKFUL WIDTH w 6 BENDS)	POSSIBLE SITE?	PHOTOS
Y N ? STREAM BED TYPE **Single Channel / Braided / Armored** **Rip-rap** Concrete	Y N **?**	**Y** N ?

2008HDKRCS

Contact your key people, for determination of access to these selected properties

Task 1 - Review access permissions for ALL selected Headwater Stream Sites with local contacts from Soil & Water Districts, State Forestry, or NRCS-DC:

1. Some Sites have no suitable access. Some Sites are "OFF LIMITS"! [Dangers, Cows, Guns]
2. Some Sites have limited access due to physical restrictions.
   Ex: Setting up "beeners and rope" to access deeply incised stream banks!
3. Some sites have permitted access, if approached correctly with good manners.
4. Some sites are lost permanently -if approached otherwise!
5. ALL SITES REQUIRE PERMISSION FROM THE LANDOWNER ! NO EXCEPTIONS!

=

<u>ANY</u> of these other
"INDICATORS"
should be noted on Recon Sheets!
These are NOT to be ignored!
<u>ALWAYS contact the landowner</u>
before entering their property.
NRCS or Forestry contacts will
usually assist you to gain access,
In order, to sample a site.

Task 2. **Conduct the Initial FIELD RECON-1 EVALS to determine if the streams in question exhibit flow , esp. for the periods of the year that the survey is being conducted.**

For Coastal Streams it is very important that the flow for these sites be inspected periodically to determine if the selected streams are at perceptible flow or above during most of the year. The DWH Oil Spill delay afforded us the time to make needed flow observations (most site have NO associated USGS gage).

Conduct field intensive roadside survey for selected HUC sites, especially noting address, county road markers, landmarks, compass point access corridors, photos, notes, etc. We conducted a **large** number of initial Recons.

Unfortunately many of our coastal headwater streams now begin their existence like this!

These are typical of the majority of sites that were discovered during the initial RECON!

<u>Task 3</u> -Evaluate results of initial HUC Recon. Suitability of sites for study.

In this study over <u>80% of sites per HUC were unsuitable</u> for secondary field RECON <u>due to **E-type stream requirement and flow conditions**</u> for the **Regional Reference Curve Survey** component of this project.

C. Site Determination and RECON Results:

Over 400 sites were reviewed in the RECON-1 phase for Mobile and Baldwin Counties.

Approximately 225 waterbodies were initially deemed possible sites using this data.

Based upon drainage areas and continued flow observations, only 75 Sites were selected for access and entry by our HDWTRSS Team. Access was coordinated with NRCS for a more intensive RECON to determine actual reach conditions onsite.

Ultimately 5 final reference sites were determined as suitable, based upon their annual flow observations, reach conditions, and survival.

Additionally 9 non-reference sites were selected to show comparisons for LUC impacts.

D. LAND USE and COVER EVALUATION and ASSESSMENTs for HEADWATER STREAMS

Land Use is a critical factor that impacts Headwater Streams.

Step 1. LAND USE EVALUATION : ASSESSMENT for HEADWATER STREAMS

In these locations prior headwaters have been <u>changed into ephemeral swales</u>,
Even though the original stream <u>channel has been altered completely</u>, it still serves to drain these fields and limits production along <u>the old footprint</u> of this former headwater stream.

Often these are able to be traced with comparison of old FSA aerials and USGS topo-maps with current GIS.

Task 1.

Using the original **Recon 1 Field Sheet** observations and coordinating with our staff, we developed a final **LAND USE/ LAND COVER ASSESSMENT** Field Form.

This **LUC Form** enables us to document headwater field site conditions and use this template as an accurate basis for the Final GIS analysis and calculation for each site.

Alabama Coastal Nonpoint Pollution Control Program

ADEM- Coastal Headwater Stream Survey

FORM #6 - HDWTR STREAM LUC HABITAT ASSESSMENT

rcs2009-rform6.3-JAN 2012

2012 Stream Survey LUC Habitat Assessment (*) * -Within 500ft Radius-

Stream Site: ____________________-___________________________

HUC: ____

Date: _____________ **Area Elevation:** ______**ft.**

Site Lat: _____________ **Site Long:** ______________

Characterize Surrounding Stream Site Habitat:

[500' radius-use stream reach midpoint as reference] (circle primary use)

res density <.25 ac. .25 – 1.0 > 1.0 ac.

Urban	UrbanRes	Suburban	RuralRes	Agriculture	Forestry	Undeveloped
0	0.5	1	1.5	2.5/3	3/3.5/4/4.5	5

____

____

____

____

____

Adjacent Site Land Uses [within 500ft radius]: (note %)

URBAN AREAS

- ☐ Commerce/Industrial ____
- ☐ Transportation/Parking ____
- ☐ ROW/ Pipeline ____
- ☐ Recreation/Greenspace ___
- ☐ Residential: MF-HD____ SFHD___SFLD ____
- ☐ Agriculture / Cattle /Orchard ____/ ____/ ___
- ☐ Forestry: Cleared __ / Select Cut __ ReGen __ / Natural 20yrs+ ___
- ☐ Undeveloped / Natural ____
- ☐ Waterbody ____
- Other_____________________

TOTAL LUC SCORE: ______________________________

☐ **-Review Sheet: Using Most Current Visual GIS Tool to Approximate Site Features____**

<u>Task 2.</u> KEY COMPONENTs for DEVELOPING THE LUC ASSESSMENT:

A. Set Area for Observation / determine extent of polygon metrics for assessment.

-We chose a 500 Foot radius of the stream segment midpoint.

B. Determine broad Land Use Types to document / assign descriptors or densities as needed to communicate these differences.

EX: **Urban / Residential / Agriculture / Forestry / Undeveloped or Natural**

C. Develop suitable impact scores for each application. Here we wish to measure the impact of Land Use/Cover on headwater stream habitat as a measure of comparable health. Reference similar studies to gain insight into this process, but the literature rarely has the exact answer or calibration needed for your application.

D. Comparative field trials on divergent sample sites (~3) will help fine tune these assessment criteria -in short order. Experience in applied field research does not hurt this process. Keep an open mind!

<u>Detail of Coastal Headwater Stream LUC Form 6.3:</u>

Characterize Surrounding Stream Site Habitat:

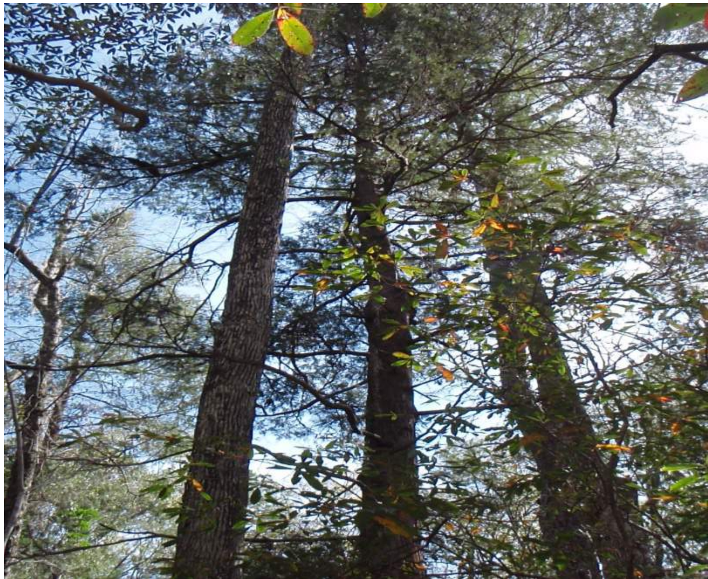
[500' radius-use stream reach midpoint as reference] **(circle primary use)**

Residential Density <.25 ac. .25 – 1.0 > 1.0 ac.

Urban	UrbanRes	Suburban	RuralRes	Agriculture	Forestry	Undeveloped
0	0.5	1	1.5	2.5/3.0	3/3.5/4/4.5	5.0

Guide for Form #6 -Valuation of Land Use/ Cover Impacts

Coastal Alabama Pilot Headwater Stream Survey Project		
ASSIGNMENT OF LAND USE/COVER	PROPOSED VALUES/ IMPACTS within 500ft radius.	LUC DESCRIPTORS
URBAN Relative Impact @ 100%	0	COMMERCIAL, TRANSPORTATION, PARKING
Relative Impact @ 90%	0.5	RIGHT OF WAY, PIPELINE
Relative Impact @ 80-90%	0.5 - 1.0	RECREATIONAL
Relative Impact @ 80-90%	0.5 - 1.0	GREENSPACE
RESIDENTIAL		
<0.25 Acres URBAN Relative Impact @ 90%	0.5	<0.25 Acre per unit
0.25 -1.0 Acre SUBURBAN Relative Impact @ 80%	1.0	0.25 -1.0 Acre per unit
>1.0 Acres RURAL RESIDENT Relative Impact @ 70%	1.5	>1.0 Acres per unit
AGRICULTURE		
CROP /ORCHARD/CATTLE Relative Impact @ 40 to 50%	2.5 – 3.0	Value scaled upon impact observed.
FORESTRY Relative Impact @ 10 to 40%	3.0 to 4.5	Value scaled upon impact observed.
NATURAL or UNDEVELOPED Relative Impact < 10%	5.0	Largely Undisturbed
		01-2009rcs



Step 2. FORESTRY CANOPY COVER EVALUATION: HDWTRSS

Using a Model C Concave Spherical Densiometer

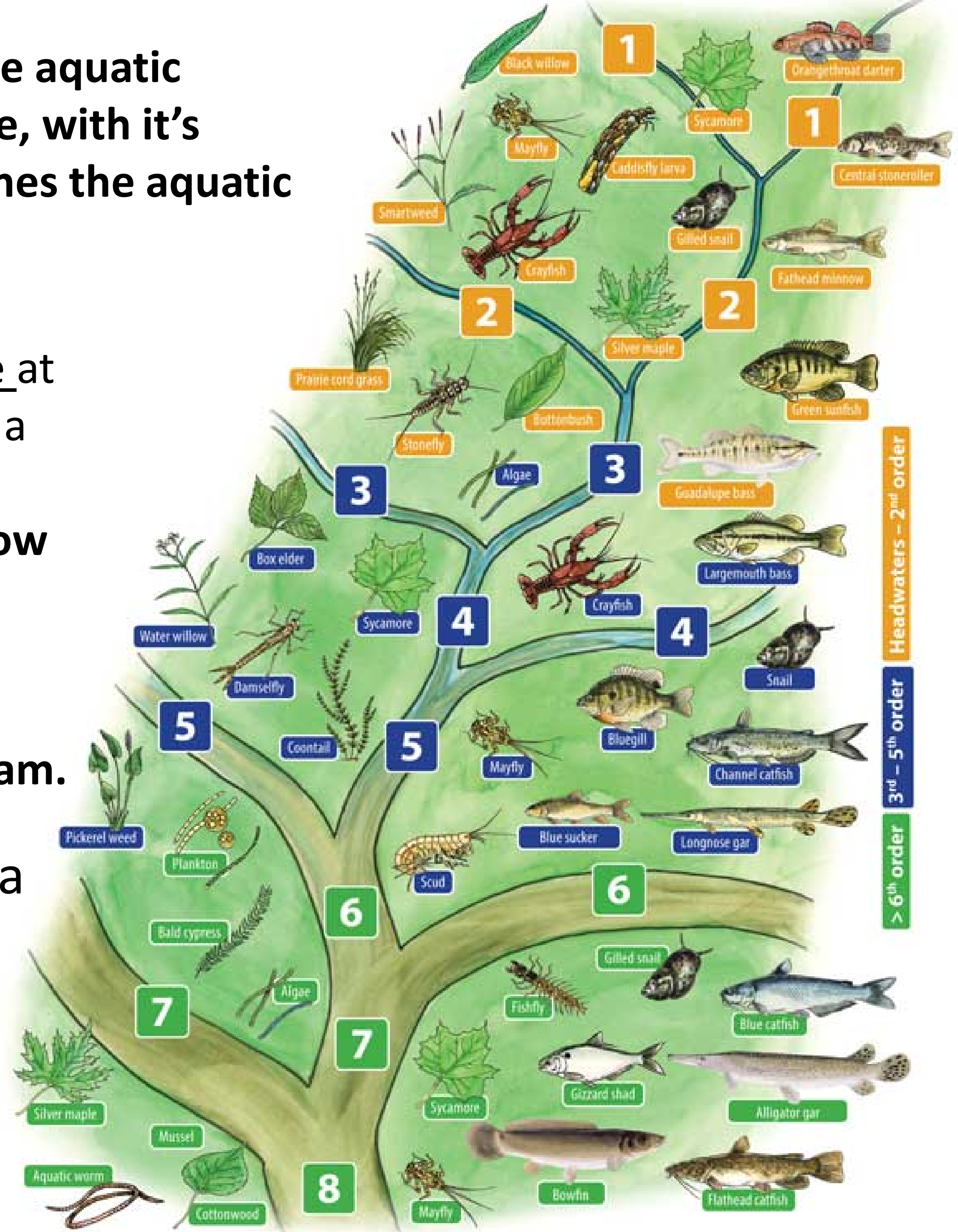
This spherical densiometer has been found adaptable to determine repeatable percentage estimates of relative canopy closure or density in forests and a range of ecological studies. Riparian canopy cover plays a direct role in moderating stream temperatures through shading. The extent of riparian canopy cover as measured by a densiometer is an important covariate for stream assessment.

[adapted SOP courtesy of Washington State Department of Ecology , Environmental Assessment Program: *Standard Operating Procedure for Determining Canopy Closure using a Concave Spherical Densiometer – Model C for the Extensive Riparian Status and Trends Monitoring Program* , Version 1.0 . Liz Werner /2009]

<u>Stream flow</u> strongly determines the aquatic community. A stream's order or size, with it's position on the landscape, determines the aquatic community it can support.

<u>Stream flows were measured onsite</u> at designated instream locations using a **<u>USGS Pygmy Meter</u> Model 6205.**
This instrument was ideal for shallow streams and field conditions.
Stream flows were calculated using EPA-approved ADEM 's SOPs with a certified Water Assessment Unit Team.

Knowing whether a stream has a **perennial** , **intermittent,** or **ephemeral** flow can help you understand what aquatic life it can support.



http: //texasaquaticscience.org (**Rudolph Rosen**)

Step 3. STREAM TYPE ASSESSMENT:

Being involved as a member of the EPA-R4 Regional Project Development Team in 2009, we adopted the

<u>Identification Methods for the Origins of Intermittent and Perennial Streams, Version 4.0</u>. North Carolina Department of Environment and Natural Resources, NC Division of Water Quality. 2009. Raleigh, NC.

This provided our project with an EPA-recognized assessment tool to identify *quantifiable* Stream Types: <u>Perennial , Intermittent, and Ephemeral</u>.

Based upon 3 key indicators: <u>Geomorphology, Hydrology, and Biology</u> of each stream site.

ADEM-Coastal Headwater Stream Survey Form

North Carolina Division of Water Quality – Stream Identification v. 4.0

Date:	Project:	Latitude:
Evaluator:	Site:	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	County:	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = ________)	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	3
2. Sinuosity	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool sequence	0	1	2	3
4. Soil texture	0	1	2	3
5. Stream sediment sorting	0	1	2	3
6. Active/relic floodplain	0	1	2	3
7. Depositional bars or benches	0	1	2	3
8. Braided channel	0	1	2	3
9. Recent alluvial deposits	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. Second or greater order channel on <u>existing</u> USGS or NRCS map or other documented evidence.	No = 0		Yes = 3	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = ________)				
14. Groundwater flow or discharge	0	1	2	3
15. Water in channel and > than 48 hrs since rain	0	1	2	3
16. Leaflitter	1.5	1	0.5	0
17. Sediment on plants or debris	0	0.5	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	1.5
19. Soil-based Evidence of seasonal high water table?	0	1	2	3

C. Biology (Subtotal = ________)				
20[b]. Fibrous roots in channel	3	2	1	0
21[b]. Rooted plants in channel	3	2	1	0
22. Crayfish	0	0.5	1	1.5
23. Bivalves/mollusks	0	1	2	3
24. Fish	0	0.5	1	1.5
25. Amphibians	0	0.5	1	1.5
26. Macrobenthos (note diversity and abundance)	0	1	2	3
27. Filamentous algae; periphyton	0	1	2	3
28. Iron oxidizing bacteria/fungus.	0	0.5	1	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5 SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.
*perennial streams may also be identified using other methods. See p. 30 of manual.

Notes: (use back side of this form for additional notes.)

Sketch:

ADEM-Coastal Headwater Stream Survey Form

ADEM - FIELD OPERATIONS DIVISION

WATER QUALITY FIELD DATA SHEET

*Trip Name*__________ *Station #*__________

*Visit Date*________ *Visit Time*________ *Collector Names*__________

☐ TRIP BLANK COLLECTED Date: Time (24hrs): Comments:

COMMENTS	(For COC Purposes: D.O =)
ALAWADR ACTIVITIES	☐ Field Form: *This Form* ☐ Sample Collection ☐ Field Form: *Field Blank* ☐ Field Form: *Replicate (# 1)* ☐ Sample Collection *Replicate (# 1)* ☐ Sample Collection: *Field Blank*
WATER QUALITY INDICATORS	***Water Odors*** (Select One): ☐ Normal/None ☐ Chemical ☐ Raw Sewage ☐ Treated Sewage ☐ Fishy ☐ Anaerobic ☐ Petroleum ***Surface Oils*** (Select One): ☐ None ☐ Slick ☐ Flecks ☐ Globs ☐ Sheen ***Water Color*** (Select One): ☐ Clear ☐ Grey ☐ Lt. Tannic ☐ Green ☐ Purple ☐ Dk. Tannic ☐ Muddy ☐ Red (Dye) ☐ Chalky ☐ Blue

WEATHER & FLOW CONDITIONS

Now	*Weather*	*Past 24 hrs*
☐	Clear / Cloudless	☐
☐	Partly Cloudy	☐
☐	Mostly Cloudy	☐
☐	Cloudy	☐
☐	Fog	☐
☐	Light Rain / Drizzle	☐
☐	Rain	☐
☐	Thunderstorms	☐
☐	Freezing Precipitation	☐

Flow Stage: ☐ Flood (out of banks) ☐ Above Normal ☐ Normal ☐ Low ☐ Dry ☐ Unknown

Heavy Rain in last 7 Days? ☐ Yes ☐ No ☐ Unknown

Velocity: ☐ Swift >3 ft / Sec ☐Moderate 1.5 – 3 ft / Sec ☐ Slow <1.5 ft / Sec ☐ Not Flowing

Biological Indicators (Select all that apply): ☐ Macroinvertebrates ☐ Fresh Beaver Sticks ☐ Fish ☐ Snails ☐ Mussels ☐ Crayfish

Only Need to Enter Checked entries into ALAWADR

FIELD MEASURES (FM) (REP @ 10% OF STATIONS)

Parameter	*Value*	*Replicate*	*Blank*	*Unit*
Time of FM				*hrs (24hrs)*
Time of Sample Collection				*hrs (24hrs)*
Air Temp.		*N/A*	*N/A*	°C
Datalogger Serial#		*N/A*	*N/A*	*N/A*
Depth of FM	☐ Surface	☐ Mid-Depth	☐ _____	ft
Water Temp.			*N/A*	°C
pH			*N/A*	*s.u.*
D.O.			*N/A*	*mg/L*
Conductivity				*umhos/cm @25 C*
Total Depth @ FM Point			*N/A*	*ft*
Tubidity Meter #		*N/A*	*N/A*	*N/A*
Turbidity				*NTU*
Volume Chl a Filtered				*mL*

SAMPLES COLLECTED (FYI ONLY -NO ENTRY INTO ALAWADR NEEDED): ☐ Conventional Lab Parameters ☐ Metals ☐ Hardness ☐ Chlorophyll_a ☐ TOC ☐ Fecal Coliform ☐ Ecoli ☐ Enterococcus ☐ Organics ☐ AGPT

Was Flow Measured?

☐ Yes - ADEM: Abbrev Meter (cft) ☐ Yes -USGS: Gauge (cft) ☐ Yes - Facility (mgd) **Flow—Meter #**

☐ No - Not wadeable (too deep) ☐ No -Flow conditions hazardous ☐ No - Flow not visible

☐ No - Pools/Dry Streambed ☐ No -Visible but not measurable ☐ No - Braided/Swamp **Flow (cft) or (mgd)**

☐ Data Collected but Lost/Deleted/Corrupted ☐ No -Meter Malfunctioned ☐ No - Not Required

SAMPLE COLLECTION (SELECT ONE PER COLLECTION METHOD) (REP @ 5% OF STA)

GRAB SAMPLE: ☐ Direct to Jug/Jar ☐ Using Sampler ☐ Using Pump

Relative Sampling Depth: ☐ Surface ☐ Mid-Depth ☐ Bottom

Actual Sampling Depth: ☐ _____ ft

COMPOSITE SAMPLE: ☐ Integrated Vertical ☐ Discrete Horizontal ☐ Discrete Vertical

Collection Depth Zone: ☐ Photic Zone ☐ Halocline

Actual Sampling Depth: ☐ _____ ft

Relative Sampling Depth: ☐ Surface ☐ Mid-Depth ☐ Bottom ☐ Surf/Mid/Bottom

FOD I – Form 8 (Rev 03/10/2010)

Step 4. ADEM WQ FIELD DATA SHEET:

Stream Flow and Water Quality Data collection were conducted by ADEM's certified Water Assessment Unit staff, housed at the Mobile Branch Office.

Step 5. ADEM FIELD DATA SURVEY SITE SHEET:

Each Stream Site in the HDWRTSS project was <u>surveyed for fluvial and geomorphic measurements</u> that would allow calculation of new <u>Regional Curve data</u> from the identified Reference Reaches in this study. To further our comparisons, this same data was collected for impacted Stream Sites as well.

An experienced stream surveyor was sub-contracted by the Mobile County Soil& Water District to conduct these field surveys with the ADEM HDWTRSS Team at each site.

Coastal Alabama Headwater Stream Survey Data

Ver2.4 2009rcs

Station Name/#	Date	Time	Latitude	Longitude
HUC #	Stream Name		County	State
			MoCo / BaCo WaCo / EsCo	AL / MS / FL
Watershed Name				
TURNER FLUOROMETER READING			WayPoint #:	Accuracy/ Elevation/
Site Description:				
Habitat: Wooded / Forestry / Ag / Urban - Residential - Commercial - Park / Other ______				
Observed Stream Order: 1ST / 2ND / 3RD / SPRING /Other				
Site Set Pin	BenchSetting		UpStream Pin	DwnStream Pin
Y / N				
Valley Length (VL)	Stream Length (SL)		Meander λ (#)	# Riffle / Pools*
*	*		*	/
Meander Radii (0.0ft.)	[Set Pin @ Bankfull and measure radius @ opposite Bankfull curvature in feet- use at least 3 measures and calculate $\bar{X}$.]			
# 1				
# 2				
# 3				
# 4				
# 5				
Stream Meander Band Width XS = $\bar{X}$				
Canopy Measure	[Measure number of 'cells' with Canopy Cover –> US & DS @ XS]			
	#1	#2	#3	#4
US				
DS				
Canopy Composition:	Trees____ Shrubs____ Herb____			Estimate%______
Observed Stream Inputs: Y / N Type: __ Pipes @ __ dia. / Road – G – P / DfS: ____				
Other Impacts:				






Step 6. ADEM FIELD DATA - Coastal HDWTRSS Assessment Form:

Using the knowledge gained, we developed a **HDWTRSS Assessment** in a form that complemented the existing ADEM "Wadeable Stream" criteria.

FY09 COASTAL ALABAMA **HDWTR STREAM ASSESSMENT**				/ /
Stream Site:			**Photos Taken:Y/N**	**US / DS**
Stream Name:			**HUC:**	
Observed Stream Order: 1ST / 2ND / 3RD / SPRING / Other:				
StreamFlowStatus:	**NotPresent 0**	**P-Pools-NF 1**	**P-NMsr Flow 3**	**P- Flowing 5**
SubjWater Clarity:	**CSB 0**	**Clouded 1-2**	**Tannic 3-4**	**Clear 5**
HYDROMODIFICATION: (Score x 2)				
NATURAL	**5**	**WOODED, LIGHT INCISION w RIPARIAN BUFFER INTACT**		
LIGHT	**4**	**SOME INCISION/SOME STRAIGHTENING, SOME BUFFER IMPACTS**		
MODERATE	**3**	**MOD. BUFFER IMPACTS, MODERATE INCISION &/OR MODERATE STRAIGHTENING**		
STRONG	**2**	**STRONG BUFFER IMPACTS, HEAVY INCISION & CHANNEL STRAIGHTENING; -RESIDENTIAL/LT.COMM/URBAN**		
SEVERE	**1**	**ENGINEERED TRAPEZOID CANAL-ARMORED; -HEAVY RESIDENTIAL/COMM/URBAN**		
RIPARIAN BUFFER:	**LB-Buffer Width**		**RB-Buffer Width**	
(x2) 5	**3**	**2**	**1**	**0**
NATURAL MAST Spp/ SHRUB / HERBACEOUS/ GRAVEL or STONE / CURB, SIDEWALK /CONCRETE, ASPHALT				
% _____ _____ _____		____	____ ____	_____ ____
BANK COVER: (%)	**VEG------------------------------> LESS VEG-------------------------------->NO VEG**			
ROOTWEB/ ROOTWEBwSCOUR(H,M,L) / INCISION&orSCOUR / GABBION / RIPRAP / CONCRETE				
5 4.5 / 4 / 3.5 3 / 2.5 / 2 1.5 / 1.25 0.5 0				
% ___ ___ ___ ___ ___ ___ LB				
% ___ ___ ___ ___ ___ ___ RB				
STREAMBED: (%)	**5 NATURAL ___**	**CS CHANNELCOMP:**	**5 -Natural SINGLE Channel**	
	3 SHAPED ___		**4 -Natural Channel w/ some Braids**	
	2 RIPRAP ___		**3 –OverWide/Multi-Braided Channels**	
	1 ARMORED___		**2 - Incised/Shaped Single Channel**	
			1 -Armored SINGLE Channel	
CHANNEL SUBSTRATES: (%)	**5** **EvenSorted/ Gravel- Sand-Clay /SAVs**	**4** **LessSortedBed/ Sand- Clay/ Less SAVs**	**2** **UnsortedBedLoads/ or Scoured Channel**	**1** **Armored**
				Total=

Form #4
rcs 2009
ver. 3.3

D. Resulting Data Comparisons:

LAND USE and COVER EVALUATION with ASSESSMENTs for Coastal Headwater Streams






Coastal Alabama HDWTRSS — STREAM SITE ASSESSMENT SCORES

	Site Names	Canopy	Land Use/Cover	NC Stream 4.0	ADEM Habitat	AL Coastal HDWTR	*New Score GIS Adjusted
Coastal Reference Sites	UT 2 Halls Creek	0.8038	0.865*	0.752	0.9208	0.9267	**0.854***
	UT 2 Perdido River #1	0.9338	0.937*	0.720	0.9333	0.960	**0.897***
	UT 2 Perdido River #2	0.880	0.887*	0.712	0.9125	0.910	**0.860***
	UT 2 Wolf Creek	0.965	0.935*	0.705	0.9583	0.948	**0.902***
	UT 2 Borrow Creek	0.936	0.870*	0.7626	0.9625	0.981	**0.902***
Urban Sites	North Yancey Branch	0.8438	0.500*	0.748	0.7083	0.760	**0.712***
	UT 2 Joe's Branch	0.875	0.450*	0.694	0.908	0.928	**0.771***
	UT 2 Red Creek #1	0.840	0.300*	0.475	0.5542	0.606	**0.555***
	UT 2 Red Creek #2	0.860	0.360*	0.629	0.5833	0.772	**0.640***
	UT 2 Perch Creek	0.0125	0.230*	0.6475	0.529	0.525	**0.388***
	Three Mile Creek	0.0262	0.354*	0.7266	0.5917	0.5856	**0.456***
	Twelve Mile Creek	0.020	0.200*	0.795	0.3208	0.366	**0.340***
AG Sites	UT 2 Cowpen Creek	0.0762	0.55*	0.5035	0.554	0.523	**0.440***
	UT 2 Page Creek	0.000	0.585*	0.475	0.333	0.507	**0.380***

*2009 GIS Review

REVIEW of ASSESSMENT SCORES for COASTAL HDWTRSS SITES:

ALL Stream Assessments were calculated to scale from 0.0 to 1.0.

These component scores were combined as a Total Average Assessment Score

REFERENCE STREAMS were distinctive with a Total Average of 0. 883, within an averaged range of 0.854 to 0.902.

URBAN STREAMS exhibited a lower combined Average of 0.551, with a wider range of 0.340 to 0.771.

AGRICULTURE STREAMS were fewer in number to sample. Those few surveyed averaged low assessment scores as well at 0.410, with a range of 0.380 to 0.440.

E. Seasonal HDWTRSS Water Quality Testing and Flow Data

These parameters were collected at each site at least 3X.

Coastal Alabama HDWTRSS		SPRING-R1						
Site Names	Air Temp (°C)	Water Temp. (°C)	pH	Dissolved Oxygen (mg/L)	Specific Cond. (umhos/cm)	Salinity (ppt)	Turbidity (NTU)	Flow Pygmy (cfs)
UT 2 Halls Creek	29	22.2	4.7	7.8	29	0.01	2.7	0.221
UT 2 Perdido River #1	29	21.3	3.6	6.4	29	0.01	0.7	0.904
UT 2 Perdido River #2	31	22.8	3.9	6.1	30	0.01	1.3	0.632
UT 2 Wolf Creek	29	29.1	5.3	4.5	46	0.02	2.1	0.201
UT 2 Borrow Creek	29	22.1	4.4	7.9	22	0.01	1.3	0.177
North Yancey Branch	26	23.2	5.7	7	54	0.02	11.4	1.647
UT 2 Joe's Branch	27	25.1	7	5.4	176	0.08	5.3	0.015
UT 2 Red Creek #1	27	23.6	5.9	0.6	309	0.15	9.5	0.01
UT 2 Red Creek #2	28	23.7	6.4	2.4	243	0.11	11.4	0.024
UT 2 Perch Creek	30	25.9	6.55	5.43	127	0.06	13.7	0.91
Three Mile Creek	32	29.3	6.3	12.3	76	0.03	3.5	0.385
Twelve Mile Creek	30	30.5	7.9	10.8	220	0.1	3.2	0.265
UT 2 Cowpen Creek	31	31.2	6.5	6.5	47	0.02	27.2	0.772
UT 2 Page Creek	25	26	6.7	6.9	116	0.05	13.7	0.025

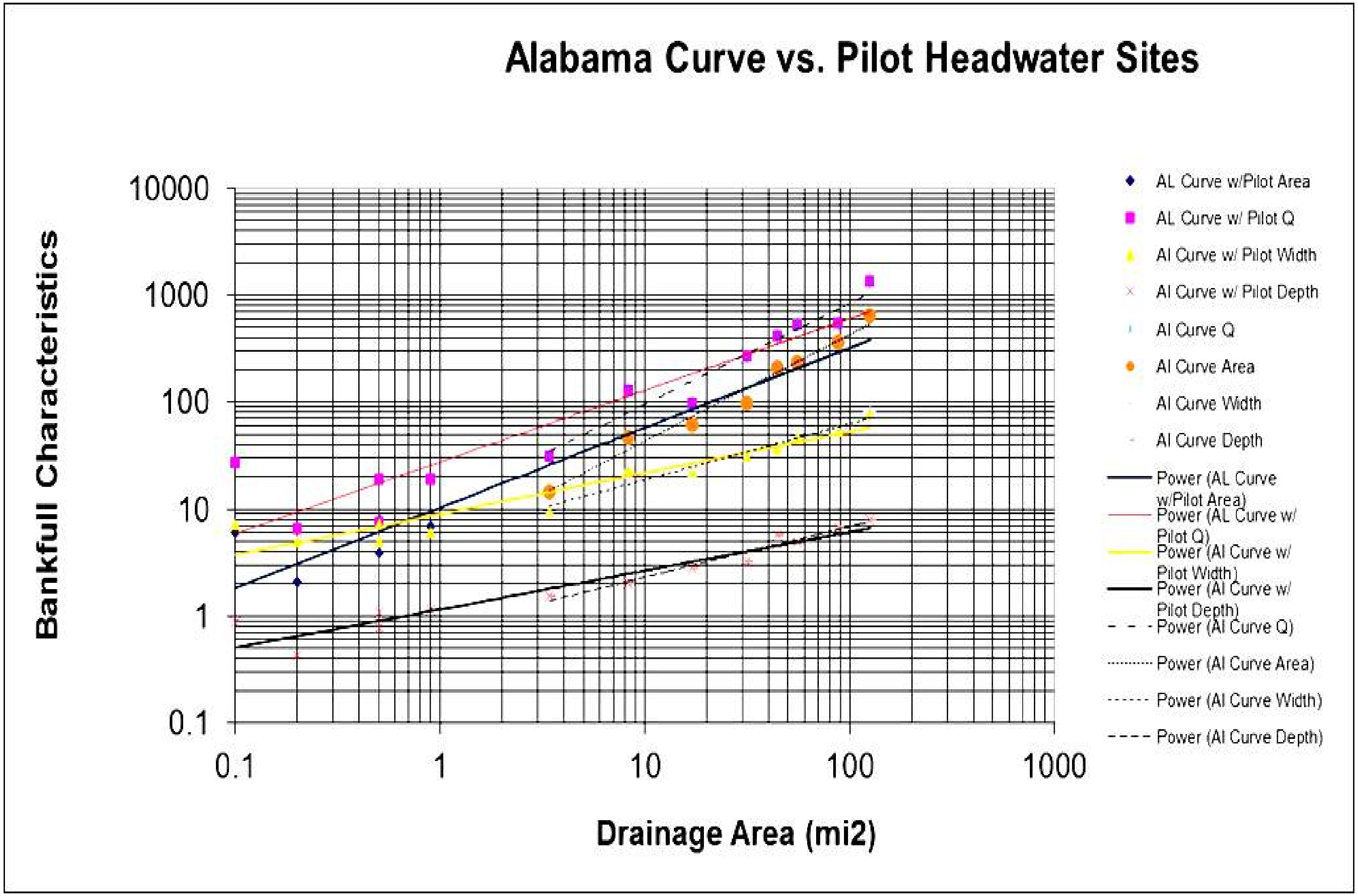
Final WQ Statistics and other HDWTRSS data are being processed to determine the significance of Land Use impacts and other stressors.

1. **Using Turbidity as an example of one indicator for the <u>Reference Stream</u> Sites, the seasonally averaged samples were at only 1.56 ntus.**
The <u>Urban Sites</u> seasonal averages equaled 10.31 ntus.
The <u>Agriculture Sites</u> were calculated at 21.61 ntus.

2. **In the initial analysis Specific Conductivity is another measurement that seems to be following a similar pattern of distribution. This may provide a quick test to determine the health of a Stream.**

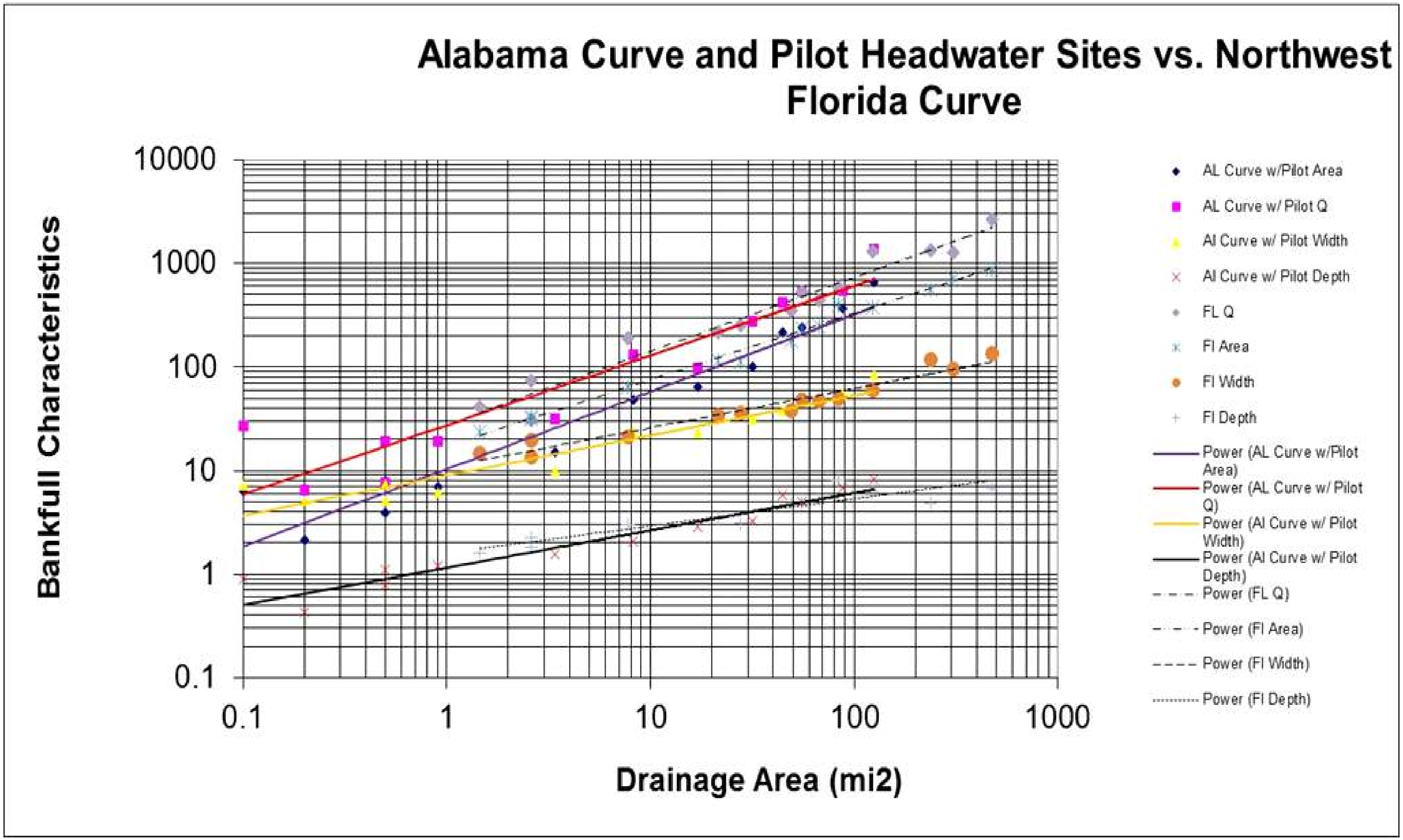
3. **We are working to conclude the QA/QC for this project and have scheduled to make this data available in <u>December of 2014</u>.**

The HDWTRSS Project has developed preliminary DRAFT graphs to depict the integrated data. Once the QA/QC is finished we will be able to present the NEW Coastal Alabama Regional Curve, which includes these new Coastal Headwater Sites.



Here is a DRAFT Bankfull comparison of the NEW Coastal Alabama Regional Curve with the previous Coastal Alabama Curve

The HDWTRSS Project developed 5 new Stream Sites that represent smaller Drainages down to 0.2 sq mi. that are being integrated into the Coastal Alabama Regional Curve data.



Here is a DRAFT Bankfull comparison of the new Coastal Alabama Curve with the Northwest Florida Regional Curve

This COASTAL HDWTRSS Project has given us a better understanding of our coastal processes, especially how Land Use conditions relate to these Coastal Headwater Streams .

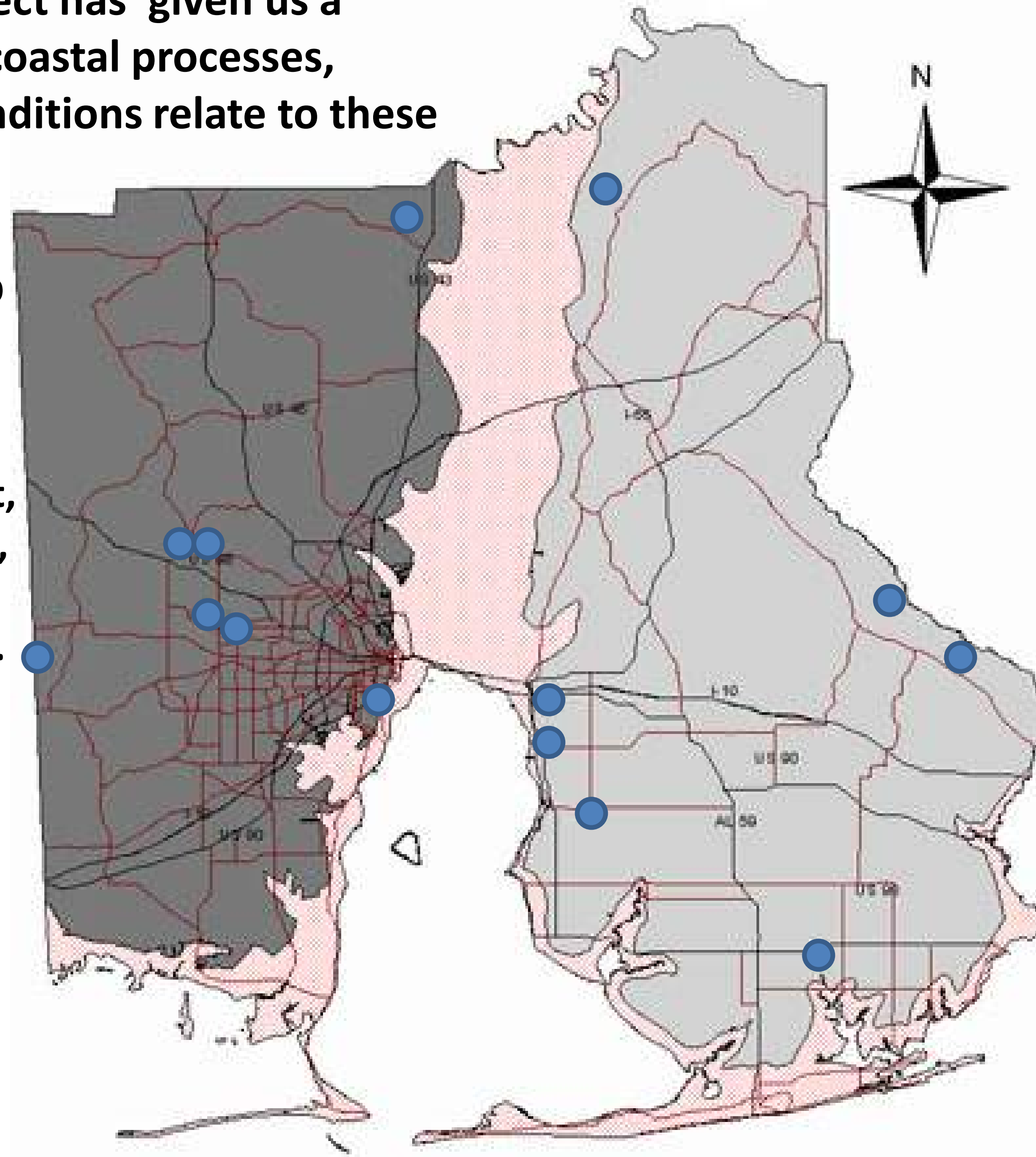
Acknowledgement for the help given to make this Project go forward:

Mobile County Soil & Water District, Our local NRCS-DCs, ADEM-Mobile, Alabama Forestry Commission, WBNERR, and the HDWTRSS Team.

This project was funded by USEPA through ADEM-319, In support of Alabama's Coastal Nonpoint Pollution Control Program.

ADEM

Alabama Department of Environmental Management



Coastal Alabama Headwater Stream Survey