Appendix V
Floodplain & Spring-Run Data Collection Summarization Report

MIDDLE SUWANNEE RIVER FLOODPLAIN & SPRING-RUN
DATA COLLECTION SUMMARIZATION REPORT

Prepared for

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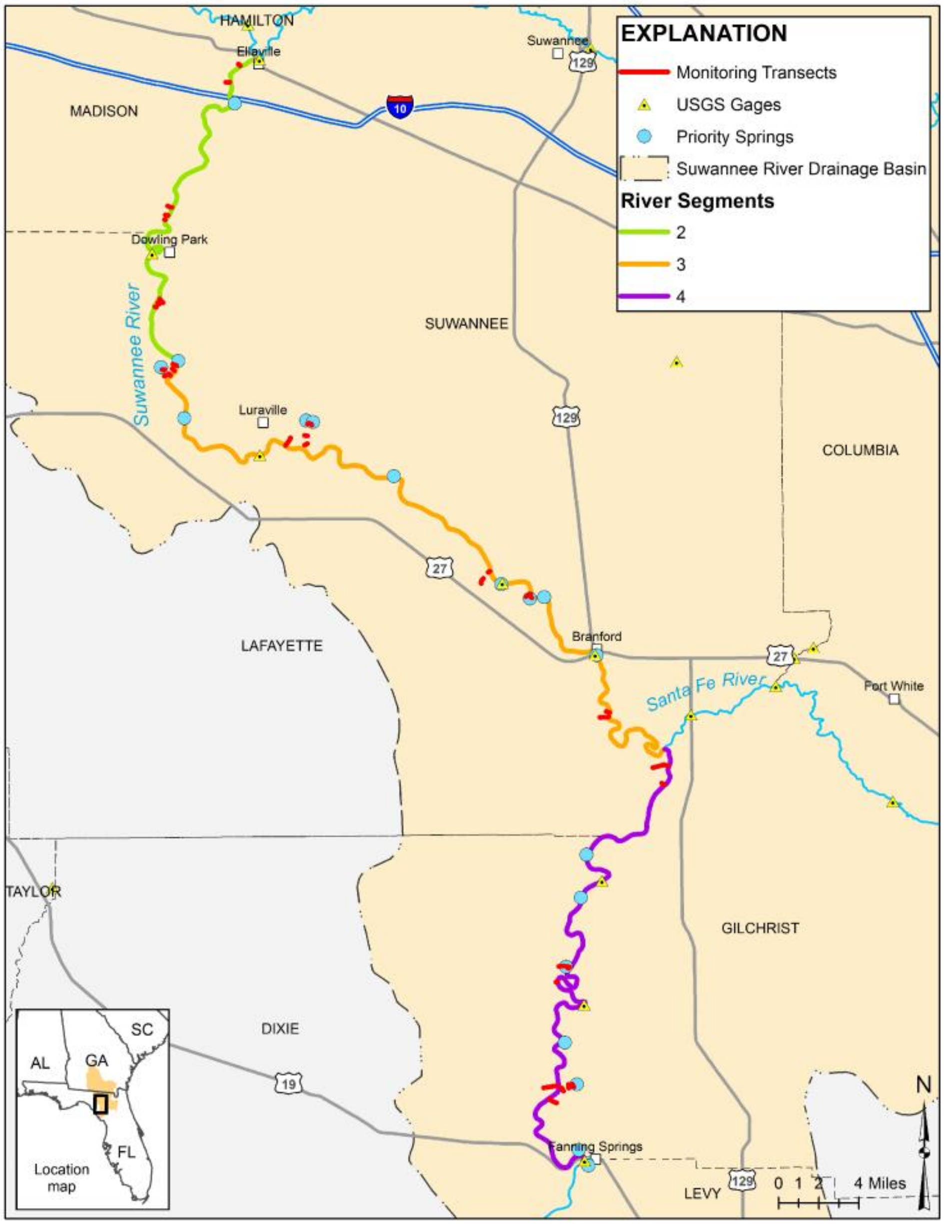
1.0 INTRODUCTION

1.1 Background

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) is assisting the Suwannee River Water Management District (SRWMD) with developing minimum flows and levels (MFLs) for the Middle Suwannee River (MSR). SRWMD Work Order 10.11-065.07 tasked Amec Foster Wheeler with collecting field data from riverine floodplain and priority spring-run communities throughout the MSR project area, which comprises approximately 80 river miles (**Figures 1 and 2)**. Because of the dynamic fluvial processes occurring within this section of the river, it is important to assess the combined effects of hydrology, soils, vegetation, and fluvial geomorphology and thus collect data in all four disciplines. The data collection effort, which is presented and summarized in this report, sets itself up for future multivariate exploratory statistics and validation of communities associated with the MSR, how they relate to river hydrology, and how they are affected by groundwater or surface water withdrawals.

Figure 1
MSR Study Area

Figure 2
MSR Study Area Detail



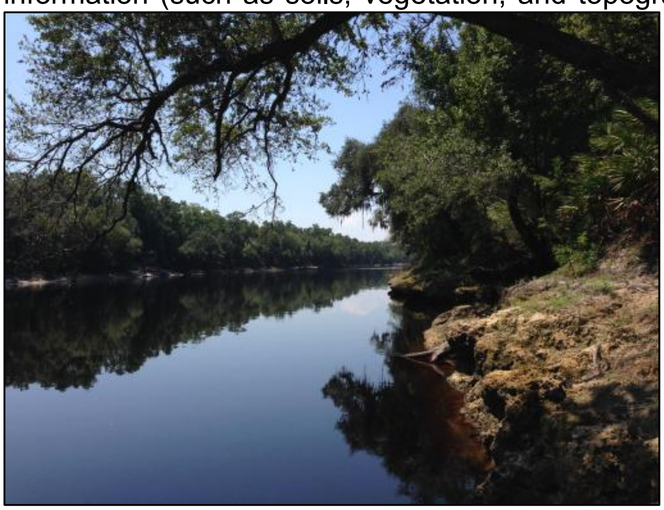
This data summarization report is divided into the following sections: **Section 1** provides an introduction to the project including background information and field study rationale; **Section 2** describes methods for data collection and summarization; **Section 3** describes where and how the data is being provided to the SRWMD; **Section 4** summarizes the data and preliminary observations; **Section 5** provides a brief summary of the work and discusses some of the future data analysis efforts; and **Section 6** provides a list of references. This report simply comprises a data summary and is not intended to determine MFL thresholds. Any conclusions discussed are preliminary, subject to statistical assessments and further synthesis under a separate scope of analyses.

1.2 Floodplain Study Rationale

Riverine floodplain communities perform several vital functions in maintaining the ecological integrity of a watershed. Floodplain wetland communities provide diverse habitat for vegetation and wildlife as well as storage and filtration of surface and ground water. Their ability to absorb and retain floodwaters and improve water quality makes floodplain wetlands a vital component of riverine systems. Hydrology is generally recognized as the primary driving force defining the structure and function of wetland communities. Protecting these communities from significant harm due to hydrologic changes is the overarching objective of the MFL program.

The goal of the floodplain study is to describe the vegetation communities, soil characteristics, and compare hydrologic conditions of representative floodplain surfaces found in the MSR. Amec Foster Wheeler and SRWMD scientists collected field data to help define distinct floodplain communities based on vegetation structure, soil characteristics, geomorphology, and hydrologic conditions that range from aquatic to upland habitats. Floodplain wetland communities within the study area generally lie within the river's 10-year floodplain. Emphasis was placed on the wetland communities likely to be affected by river flow and its associated above-bank water levels. These distinct communities will be the foundation in defining hydrologic criteria that can assist SRWMD in the development of MFLs for the MSR.

Based on a review of SRWMD's recommended sites and of readily available relevant information (such as soils, vegetation, and topographic maps; aerial photography; reports and



literature pertinent to the system under study), Amec Foster Wheeler visited several transect locations for identifying in-channel and floodplain habitats with SRWMD staff during an initial week-long field visit on April 24 through 26, 29, and 30, 2013. During the field visit, team scientists noted important features at each site such as vegetation, geomorphic surfaces (alluvial ridges, valley flats, backswamps, swales, lateral accretions, crevasse splays, bank breaches or entry/exit points, flow-ways), karst features (karst windows, springs, spring runs, limestone outcrops, partially-filled solution sinks, lineaments), soils, and hydrologic conditions. Amec Foster Wheeler found that the general vegetative communities described by previous USGS studies conducted on the lower portion of the project area do not vary significantly from those observed in the upper portions of the project area (Light et al., 2002; Darst et al., 2002, 2003); however, wetland communities in the floodplain are less extensive in the upper reaches of the study area and surface karst expressions more common.

The initial field reconnaissance also provided insight to the connectivity of the MSR to the dynamic floodplain landscape. Based on visual observations, it appears that two types of hydrologic connectivity between the river and floodplain may be responsible for floodplain inundation. One type involves overbank flooding events and inundation via intermittent tributaries connecting the river with inland floodplains. These openings tend to occur at concentrated focal points that are opened and maintained by river hydraulics in some cases and by the discharge from floodplain springs in others. The other type of conveyance between the floodplain and river may be sub-surface conduits in the limestone, which are likely to be more prevalent in the upper-most portion of the study area (Reach 2) where greater frequency of open karst windows were observed in the floodplain and wetlands were often constrained within karst lineaments pocked with numerous small alluvium-filled dolines. As part of the field data collection, Amec Foster Wheeler instrumented a variety of floodplain features throughout the study area to further assess the hydroecology of the MSR.

The MSR was characterized longitudinally and stratified into relatively homogenous study units such that the number and locations of transects are carefully targeted to capture the river's variability in the most cost-effective manner (**Figure 2**). Based on the literature review (Hornsby et al. 2000) and field reconnaissance, the team identified three logical reaches along the MSR valley based largely on the relative amounts of karst versus alluvial surfaces in the floodplain and along the river channel, the width of the wetland communities, the presence of rocky shoals, the occurrence of priority springs, and water quality descriptions[1]:

- **Reach 2**: Withlacoochee River to Charles Springs – this uppermost stretch of the river is approximately 21 river miles and, with just two priority springs, has much lower spring input than downstream reaches. The banks in this reach are relatively high and steep and are often situated well above the water surface (even during periods of high flow). Karst windows and surface depressions can be found throughout the floodplain, suggesting that the wetland distribution in this reach may be more affected by the underlying geology and groundwater levels than are the downstream areas. Aquifer recharge from flood flows may be an important process in this Reach.
- **Reach 3**: Charles Spring to Santa Fe River – this middle stretch of the river is approximately 41 river miles, and has significantly higher spring inputs, with nine priority springs. While the banks in this reach are still high, there appears to be more interaction between the river and the floodplain, often through openings in the alluvial ridge maintained by spring discharge. Dynamic reversals of spring discharge to the river during low-flow, versus aquifer recharge from the river during high flow, appear to be a defining process in this reach. Wetlands are often narrow and linear, associated with karst lineaments covered by relatively thin alluvial layers or within confined swale and ridge complexes formed from riverine alluvial deposits made during bend migration. Some wetlands are wholly associated with floodplain spring discharges along runs ranging from a few hundred to a few thousand feet long.
- **Reach 4**: Santa Fe River to Fanning Springs – the downstream-most stretch of the study area is approximately 33 river miles long and contains six priority springs. This reach is relatively wider and the banks are relatively lower, potentially allowing for more frequent interaction between the river and the floodplain. Some sections of this Reach have high densities of openings called crevasse splays that formed when sudden rises in high river flows broke through the alluvial ridges. Bend migration features from lateral accretions of swale and ridge complexes and alluvial flats supporting wide bottomland wetlands or backswamps appear to be more frequent and are widest in this Reach. It is the most alluvial of the reaches and its wetland surfaces and hydrology are highly dependent on river hydrology and sediment transport processes.

These Reaches simply identify convenient points of reference along a progression of increasing alluviation and spring discharge as one moves downstream. The transition between Reaches 2

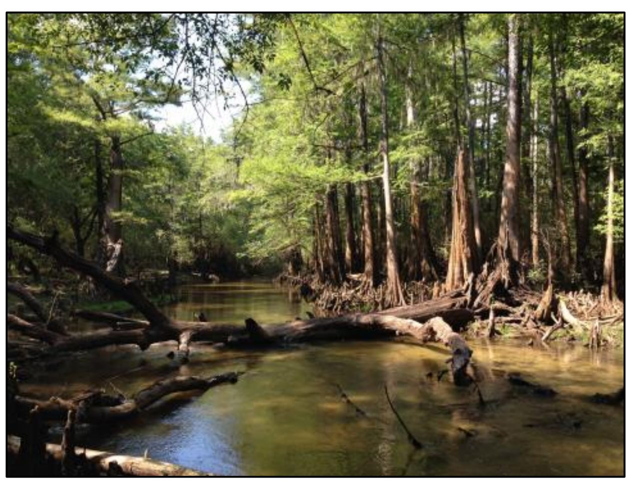
[1] The study units commence with Reach 2 because Reach 1 occurs entirely upstream of the MSR study area (per Hornsby et al. 2000).

and 3 is largely clinal, based on the commencement of serial increases in groundwater discharge that grow as one moves downstream through Reach 3. Conversely, the transition between Reaches 3 and 4 is rather distinct and abrupt near the Santa Fe confluence, representing a threshold increase in alluvial valley fill and river discharge that greatly structure the floodplain form and hydrologic function.

Reach 4 has a more sinusoidal shape in the river planform versus that occurring in the two upstream Reaches, which have a more rectilinear meander pattern. The sinusoidal pattern is consistent with river channels formed by sediment transport, while more angular bend geometry suggests a river following fractures in underlying bedrock. This latter condition is most-prevalent in Reaches 2 and 3 where karst depressions are also more common in the floodplain, frequently arranged in lineaments corresponding to linear wetland swales. This implies significant and widespread geologic control on the occurrence and dimensions of wetlands in the upper two Reaches, with the underlying geology likely to be mantled by comparatively thick alluvial layers in Reach 4. This implies that surfaces in Reach 4 are more susceptible to being re-worked by river flow, a dynamic that should be considered in any long-term forest trend studies. Consistent with these concepts, fresh sand deposits were observed during 2014 field monitoring following the 5-year flood (as determined from the annual maximum series of long-term Suwannee River gage records) extending well into some of the deeper swamps in Reach 4, and similar thicknesses of accumulation were restricted to the alluvial ridges closer to river channel margins in Reaches 2 and 3.

1.3 Spring Study Rationale

Springs are valuable natural and scenic ecosystems that constitute a major economic and ecological resource in North-Central Florida. The SRWMD is known to have more first and second magnitude springs that any other comparable area in North America. There are 17 identified priority springs within the MSR, 16 of which Amec Foster Wheeler was scheduled to investigate (Anderson Springs will be assessed by another consultant by 2015) (**Table 1**). In recent years, the springs of Florida have received considerable attention due to decreased aquifer levels, water flows, and increased nitrate concentrations within the springshed as well as in connecting watersheds. Studies have been conducted in recent years that have investigated eutrophication of springs, spring runs, and receiving water bodies (Upchurch et al., 2007). Amec Foster Wheeler's investigations are intended to focus on values driven primarily by flow and water levels that could be adversely affected by groundwater or surface water withdrawals.



The objective of the springs study is to describe in-stream habitat of the spring runs as well as the vegetation communities, soil characteristics, and hydrologic conditions of representative floodplain communities found within the spring's valley. In most cases, the floodplain communities and soils of the runs will be studied as part of clusters of other wetland types nearby because of their direct interaction with water on those surfaces.

The field data collection efforts described in this report focused on the following spring runs: Allen Mill Pond, Ruth/Little Sulfur, Peacock/Bonnet, Rock Sink, and Otter. All of the spring runs originate within, and are fully-contained by, the riverine floodplain. The runs thus maintain perennial stream channels across otherwise seasonally-inundated surfaces. Some of the runs have carved substantial channels flanked by floodprone terraces at lower elevations than the prevailing riverine floodplain surfaces nearby. In other words, these systems are not merely secondary channel systems, but represent valleys within a valley. For example, the Peacock/Bonnet and Otter runs are comparatively long, forming their own valleys within the Suwannee River valley. The spring runs may be establishing hydrologic and geomorphic gradients that would be locally absent, absent the spring. This suggests that MFLs for these systems should be established viewing them as independent features that also interact with river flow. Amec Foster Wheeler also investigated the aquatic vegetation of the Lafayette Blue Spring bowl as an example of a near–river vent.

The field data will help define distinct spring run communities based on vegetation structure, soil characteristics, and hydrologic conditions that range from in-stream communities to upland habitats. These distinct communities will be the foundation in defining hydrologic criteria that can assist SRWMD in the development of MFLs for the priority springs in the MSR.

Table 1
List of Priority Springs within the MSR Basin

Spring Name	Magnitude	Distance from River
Anderson	2	Adjacent to river
Charles	2	~175 LF spring run draining west
Allen Mill Pond	2	~2355 LF spring run draining south/southeast
Lafayette Blue	1	~150 LF spring run draining east
Bonnet	2	~8640 LF spring run draining south
Peacock	2	~8640 LF spring run draining south
Royal	3	~175 LF spring run draining south
Troy	1	~128 LF spring run draining northeast
Ruth/Little Sulfur	2	~570 LF spring run draining northeast
Little River	2	~125 LF spring run draining south
Branford	2	Adjacent to river
Pothole	2	Adjacent to river
Guaranto	2	~100 LF spring run draining east
Rock Sink	2	~1260 LF spring run draining southeast
Hart	2	~961 LF spring run draining north and then west
Otter	2	~4575 LF spring run draining southwest
Bell	3	~2048 LF spring run draining southeast

2.0 FIELD SAMPLING PROCEDURES

Data collection efforts for communities within the MSR floodplain and priority spring-runs were conducted by Amec Foster Wheeler and SRWMD staff during 2013 and 2014, and included the following tasks: transect selection, community break establishment, plot selection, vegetation sampling, soil sampling, bankfull indicators identification, land surveying, hydroecological monitoring, in-stream springs sampling, and data post-processing. The methods employed for each of these tasks are described in the sections below.

2.1 Transect Selection

Based on observations that were made during the initial site visits conducted in April 2013, transect locations were identified for both the floodplain and spring-run studies. Transects were selected based on their suitability for capturing interactions between the river water elevations and floodplain surfaces, in-stream habitat monitoring for priority springs, physical structures (shoals, bridges, etc.), long-term accessibility, and for unique vegetation and soil characteristics. The purpose of transect selection is to collect the data necessary to characterize the relationships among vegetation communities, soil characteristics, and hydrology in wetlands found at variable landscape positions and elevations along the MSR riparian corridor.

Floodplain Transects

The team chose 13 floodplain study areas within the MSR (**Table 2, Figure 2**). These study areas were chosen because: 1) they corresponded to transects that were used for HEC-RAS modeling of river hydraulics, 2) they bisected significant and characteristic floodplain wetland habitats across the river valley thus capturing the lateral variability of the floodplain surfaces, 3) they were located on SRWMD lands and therefore would provide both ease of access as well as protection from future development, and 4) they were distributed rather equitably among the study area's three reaches to capture the longitudinal variability of the river corridor.

Amec Foster Wheeler established 1 to 3 transects at each study area based on size of area, diversity of key features observed during the initial field reconnaissance, and longitudinal distribution of river-floodplain interactions. Often times in the MSR, river-floodplain exchanges occur at narrow openings through alluvial ridges and inundation progresses longitudinally following swales that parallel the river. In fact, flow direction in these swales is upstream during flood rise and downstream during recession. This pattern is opposed to that occurring in rivers with low ridges where floods progress across the river bank and expand laterally over a flat, wide floodplain surface. Longitudinal flooding is especially prevalent in Reaches 2 and 3 where high banks/natural levees occur. The establishment of multiple transects within a study area enables the characterization of longitudinal river-floodplain interactions. **Figure 3** provides an example of a study area with multiple transects where river-floodplain exchanges are predominantly longitudinal.

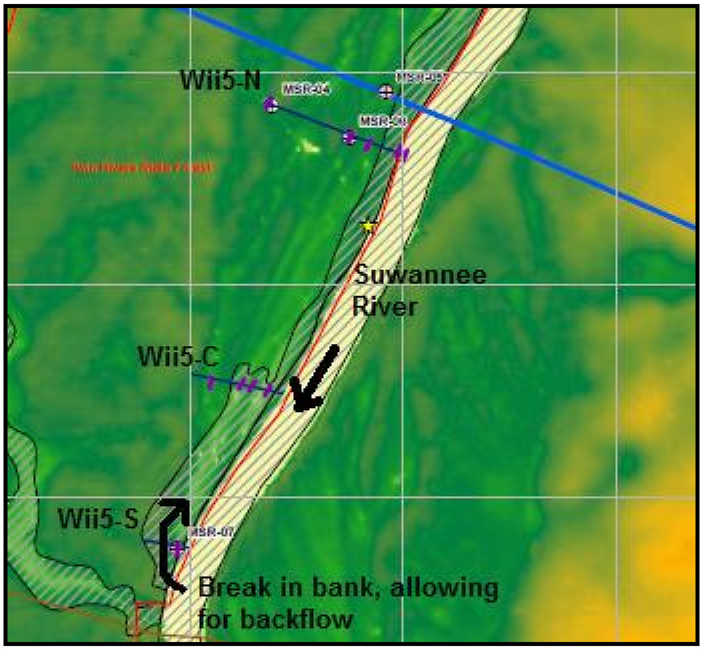
Further, a subset of the 13 study areas were designated as "cluster" sites where hydrologic data would be gathered along with vegetation community and soil characterization data (**Table 2**). At cluster areas, roughly one year of quarterly hydrological monitoring was conducted in addition to detailed vegetation, soil, and elevation sampling. This short-term hydrological monitoring data can be compared to contemporaneous data at USGS gages and can also be placed in long-term context with the full period of record. The monitoring data can also be used to assess the extent to which the overall wetland hydropatterns are represented by the HEC-RAS simulations which typically represent riverine surface water processes. Having local water level data will help determine how much comparative weight to place on river flows for the structure and hydrologic function of the riparian wetlands. Cluster areas were selected based on their suitability for capturing surface and subsurface interactions between river water and floodplain surfaces, representative floodplain vegetation communities, and soil characteristics. Site Maps for floodplain study areas and cluster sites are found in **Appendix A**.

Floodplain transects generally run perpendicular to the river and span a portion of the floodplain on one side of the river. Transects for floodplain surfaces adjacent to the river begin within the river (on the streambank) and extend into the exterior upland habitat. The number of transects for each study area is summarized in **Table 2** and shown in **Appendix A** (Site Maps). **Figure 3** provides a general depiction of a typical floodplain study area's transect and sampling plot layout.

Table 2
Floodplain Study Areas Chosen for Detailed Vegetation, Soil, and Hydroecological Monitoring

Study Area	Reach	Cluster Area	# of Transects	# of MSR Hydro Stations	# of Sample Plots	Key Features
Wii16	2	No	1	0	2	Ridge, swale
Wii15	2	Yes	1	3	5	Ridge, swale, karst window
Wii5	2	Yes	3	4	7	Ridge, swale, karst window, slough
Wi71	2	Yes	3	3	6	Ridge, swale, karst
Wi65	3	Yes	3	2	7	Ridge, swale
Wi50	3	Yes	1	3	6	Ridge, swale, swamp (historic spring run)
Wi34	3	No	2	0	7	Ridge, swale, swamp
Wi30	3	Yes	1	2	9	Ridge, swale, swamp
Wi10	3	Yes	2	3	9	Ridge, swamp
Wi4/Wi3	4	Yes	2	2	14	Ridge, swamp
X26	4	Yes	2	3	4	Ridge, Active splay, swamp, spring run
X22-N (USGS)	4	No	1	1	3	Ridge, swamp
X22	4	No	1	0	0	Ridge, swamp
Total	**--**	**--**	**23**	**26**	**79**	**--**

Figure 3
Example of Study Area Transects and Sampling Plots



<u>Spring Transects</u>

For selected priority springs with an associated spring run, additional study areas were selected to capture in-stream spring run habitat as well as spring run floodplain vegetation community structure and soil characteristics. Amec Foster Wheeler chose 6 springs from the Priority Springs list within the MSR (**Table 3**). These spring study areas were chosen because: 1) they were characterized by a spring-run with a direct connection to the river, often also in direct interaction with other floodplain hydraulic features, 2) they were located on SRWMD lands and therefore would provide both ease of access as well as protection from future development, and 3) they were characterized as having in-stream and floodplain wetland vegetation communities seemingly dependant on the spring's hydrology.

Amec Foster Wheeler established 1 to 4 transects at each spring study area based on size (or length) of area and diversity of key features observed during the initial field reconnaissance. Transects were generally established perpendicular to the spring-run and extended from the exterior upland on one side of the run to the exterior upland on the other side of the run, thus spanning and encompassing the spring-run itself. The number of transects for each study area is summarized in **Table 3** and shown in **Appendix A**.

Similar to that described for the Floodplain Study, it was determined that an intensive characterization of study area "clusters", that incorporated a subset of the spring study areas, should be the focus of the data gathering efforts in order to couple hydrologic data with vegetation community, soil characteristic, and in-stream survey data (**Table 3**). Cluster areas were selected based on their suitability for capturing interactions between river water and spring run habitats, representative floodplain vegetation communities, and soil communities.

Table 3
Priority Springs Chosen for Detailed Vegetation, Soil, and Hydroecological Monitoring

Study Area	Reach	Cluster Areas	# of Transects	# of MSR Hydro Stations	# of Sample Plots	Key Features
Allan Mill Pond**	3	Yes	2	2*	7	Spring run, valley flat
Lafayette Blue	3	No	0	1*	0	Spring outlet
Peacock/Bonnet	3	Yes	4	2*	8	Spring run, valley flat
Ruth/Sulfur***	4	Yes	1	1	0	Spring run
Rock Sink****	4	Yes	1	1	0	Spring run
Otter	4	Yes	3	1	6	Spring run, valley flat
Total	**--**	**--**	**11**	**8**	**21**	**--**

Notes: *SRWMD installed gages at the headspring; **Associated with Wii65; ***Associated with Wi30; ****Associated with X26

2.2 Establishing Community Breaks

Transects established perpendicular to the MSR and priority spring runs often span a variety of ecological communities as they transition from aquatic to upland habitats. Transects are a commonly used sampling technique for plant communities and are particularly useful when the objective is to illustrate a particular environmental gradient or linear pattern along which communities of plants or soils change (e.g., elevation and hydrology). The spatial extent of plant communities or transition zones (i.e., ecotones) between plant communities is determined using reasonable scientific judgment. Reasonable scientific judgment involves the ability to collect and analyze information using technical knowledge, skills, and experience to serve as a basis for decision making (Gilbert et al. 1995). In this case, such judgment was based primarily upon field observations of changes in land slope or elevation, key geomorphic surfaces (i.e., alluvial ridges, swales, backswamps, slopes, karst windows), the relative abundance of dominant plant species, occurrence and distribution of alluvial soils, and hydric soil indicators.

The position of such transitions was determined by an interdisciplinary team experienced in wetland science, wetland vegetation, soil science, fluvial geomorphology, and floodplain hydrology during April, August, and September 2014 (flooding between those months prevented the ability to conduct fieldwork). Ecological community break locations along each transect were marked with flagging, located with a handheld GPS, and subsequently surveyed by a Professional Surveyor and Mapper. The breaks, which bracket distinct communities, were labeled as T1-X, T2-X, T3-X, etc, (T standing for transition, numbering typically starting from the riverbank and increasing towards the exterior uplands, and X the type of break) and flagged using different colors based on the type of break. Type of breaks included soil breaks (S), vegetative breaks (V), and alluvial breaks (A). While the breaks generally fell within a few lateral feet of one another, the soil break (determined by the presence or absence of hydric indicators) was typically the “highest” break for a given transition and was deemed to be the true break since vegetation was usually transitional at the ecotones.

Based on the qualitative observations made during the community break field visits, four general ecological communities were distinguished within the MSR floodplain transects based on similarities in relative elevation, soils, and vegetation: swamps (sw), low bottomland hardwood forests (blh-l), high bottomland hardwood forests (blh-h), and uplands (up) (**Table 4, Appendix A**). These four general community categories were then broken up even further based on the geomorphic surfaces observed throughout the MSR floodplain, which included active splays, alluvial ridges (AR), bankfull benches (BB), backswamps (BS), karst windows, broad ridges (RB), ridges in ridge-swale complexes (RS), transitional slopes (SL), spring runs within the floodplain (SprRn), swales (SW), and exterior uplands. This resulted in 18 distinct floodplain community types. The rationale for arraying communities not only by their vegetation and soils, but also by their underlying geomorphic surfaces centers on a concept that communities can be affected by dynamic hydrologic and geomorphic processes. Viewing the ground elevation as being static compared to forest composition and structure dynamics may be a poor assumption on the alluvially-active Suwannee river system. There were also some areas that were too disturbed (Dst) to appropriately define a community type.

Community breaks were also established along spring-run transects. Spring transects spanned both sides of the spring-run, and communities on either side of the run frequently mirrored each other. Seven distinct preliminary spring communities were determined based on qualitative observations of soils, vegetation, and geomorphic surfaces: hydric hammocks (HydHmk), spring runs (SprRn), slope swamps (SSw), upland hammocks (UpHmck), uplands with an understory dominated by saw palmetto (UpPP), valley flat swamps (VFS), and heavily vegetated spring-runs with no defined banks (VFS/SprRn) (**Table 5, Appendix A**). There were also some areas that were too disturbed (Dst) to appropriately define a community type.

A list of the communities observed throughout the study area and their frequency of occurrence, along with the number of each of those communities that were sampled in this study, can be found in **Tables 4 and 5** for floodplain and springs, respectively. More detailed descriptions of the communities encountered are provided in the Results section. Community breaks are shown on the Site Maps provided in **Appendix A**.

Table 4
List of Floodplain Communities and Frequencies

Preliminary Community	Total Occurrence	Number Sampled
Active Splay	1	0
AR-blh-l	4	3
AR-up	16	9
BB-sw	2	2
BS-blh-h	2	2
BS-sw	20	10
Dst	1	0
Karst Window	3	0
RB-blh-h	1	1
RB-blh-l	7	3
RB-up	7	3
RS-blh-h	2	2
RS-up	10	6
SL-blh-h	11	6
SL-blh-l	11	6
SL-up	6	4
SprRn	1	0
SW-blh-l	19	11
Up-exterior	24	11
Total	**148**	**79**

Table 5
List of Spring Communities and Frequencies

Preliminary Community	Total Occurrence	Number Sampled
Dst	2	0
HydHmk	10	5
SprRn	5	0
SSw	12	5
UpHmck	9	4
UpPP	2	1
VFS	13	4
VFS/SprRn	4	2
Total	**57**	**21**

2.3 Monitoring Plot Selection

Once the various preliminary ecological communities had been defined along each transect, 100 monitoring plot locations were selected for detailed, quantitative sampling. Of the 100 selected plot locations, 79 occurred within floodplain transects and 21 occurred within spring-run transects. Monitoring plot locations were selected to cover a representative number of plots per preliminary community type and to cover a representative geographic range (**Tables 4 and 5**). Plot sampling locations and names are provided in **Tables 6 and 7** for floodplain and spring-run plots, respectively. Locations can be seen in **Appendix A** (**Site Maps**).

Table 6
Floodplain Monitoring Plots

Transect	# of Plots	AR-up	AR-blh-l	BB-sw*	BS-sw	BS-blh-h	Karst Windows	SW-blh-l	SL-up	SL-blh-l	SL-blh-h	RS-up	RS-blh-h	RB-up	RB-blh-h	RB-blh-l	Up-Exterior
Wii16	2							Wii16-1				Wii16-2					
Wii15*	5	Wii15-1						Wii15-3			Wii15-4				Wii15-2		Wii15-5
Wii5-N*	3	Wii5-N-1						Wii5-N-3					Wii5-N-2				
Wii5-C	2							Wii5-C-1				Wii5-C-2					
Wii5-S*	2							Wii-S-1									Wii5-S-2
Wi71-N*	1					Wi71-N-1											
Wi71-C*	5	Wi71-C-1				Wi71-C-3			Wi71-C-4		Wi71-C-2						Wi71-C-5
Wi65-N*	3	Wi65-N-1						Wi65-N-2									Wi65-N-3
Wi65-S*	4	Wi65-S-1						Wi65-S-3				Wi65-S-2					Wi65-S-4
Wi50*	6	Wi50-1			Wi50-4			Wi50-2			Wi50-5	Wi50-3					Wi50-6
Wi34-E	3				Wi34-E-2				Wi34-E-3		Wi34-E-1						
Wi34-W	4								Wi34-W-3		Wi34-W-2			Wi34-W-1			Wi34-W-4
Wi30*	9	Wi30-1			Wi30-7			Wi30-2 Wi30-3 Wi30-6	Wi30-8			Wi30-4	Wi30-5				Wi30-9
Wi10-N*	3				Wi10-N-1					Wi10-N-2							Wi10-N-3
Wi10-S	6		Wi10-S-2	Wi10-S-1							Wi10-S-4	Wi10-S-3		Wi10-S-5			Wi10-S-6
Wi4*	10	Wi4-2		Wi4-1	Wi4-4 Wi4-7 Wi4-8					Wi4-3 Wi4-6 Wi4-9				Wi4-5			Wi4-10
Wi3*	4	Wi3-1			Wi3-3					Wi3-2						Wi3-4	
X26*	4		X26-1		X26-2											X26-3 X26-4	
X22-N*	3		X22-N-1		X22-N-2					X22-N-3							
TOTAL	**79**	**9**	**3**	**2**	**10**	**2**	**0**	**11**	**4**	**6**	**6**	**6**	**2**	**3**	**1**	**3**	**11**

*Transect has hydroecological monitoring station

Table 7
Spring Monitoring Plots

Transect	# of Plots	UpPP	UpHmck	HydHmk	SSw	VFS	SprRn	VFS/SprRn
AMP-US	4		AMP-US-1	AMP-US-4	AMP-US-2	AMP-US-3		
AMP-DS*	3		AMP-DS-3		AMP-DS-1	AMP-DS-2		
BS	1			BS-1				
PS-N	2			PS-N-1				PS-N-2
PS-C	3	PS-C-3			PS-C-1			PS-C-2
PS-S*	2		PS-S-2		PS-S-1			
OS-U	1					OS-U-1		
OS-C	1			OS-C-1				
OS-D*	4		OS-D-4	OS-D-1	OS-D-3	OS-D-2		
TOTAL	**21**	**1**	**4**	**5**	**5**	**4**	**0**	**2**

*Transect has hydroecological monitoring station

2.4 Vegetation Sampling

Vegetation in the project area was quantified in plots between community breaks located on pre-determined transects during the months of August and September 2014. The methodologies for the selection of transects, community breaks, and plots are discussed in Sections 2.1 through 2.3. Specific field dates for vegetative observations were:

- August 20 – 23 and 25 – 30, 2014
- September 8 – 11 and 22 – 23, 2014

As per the project *Field Plan for Plant Community Composition and Soil Characterization Procedure for Middle Suwannee River MFLs Development: Floodplain Study and Spring-Run Study* (Field Plan) (AMEC 2013), vegetation in each stratum (i.e. groundcover, shrubs, trees, and vines) was observed during one growing season, when plant structures such as leaves, fruit, and/or flowers were evident.

Metrics recorded for each plot during the vegetative surveys included:

- Plot size
- Tree diameter
- Tree counts, and
- Percent cover

This data was recorded on the "Vegetation Plot Survey" field form (Veg Field Form). The Veg Field Form included the following information:

- field date and name of team member completing the form;
- transect and plot documentation (transect and plot identification name and plot size);
- record of photo documentation (representative view of community, view of canopy cover, and view of ground cover); and
- community data (common and scientific plant name, tree DBH, vegetation percent cover estimates).

Plot Size

Once in the field, plots were established between defined ecological community breaks in areas that best represented the vegetative strata of the particular community (i.e. swamp, bottomland hardwood, alluvial ridge, swale, etc.) and associated soil characteristics. These sample blocks, similar to quadrats, established perpendicular to the line transect (and thus parallel to the river) provided the basis for all field collection of vegetation communities and soil characteristics. For consistency, a "goal" plot size of 30 x 100 feet was established, and was utilized in the majority of plots for vegetation quantification. However, the sample block size would occasionally vary depending upon the community type and position of the community within the landscape. For example, a typical sample block, 30 x 100 feet, could be located on either side of the transect line in order to adequately capture the landscape features and vegetation community structure. In other cases such as a narrow community, a sample block of 25 x 50 feet may be all that was available to adequately represent a floodplain community. The sample block size was determined based on site conditions and reasonable scientific judgment regarding capture of the dominant and characteristic species of the community in a representative area. During monitoring, temporary stakes were set to define the plot and the two far corners of the plot were located with a handheld GPS. A full list of vegetative plots, plot size, and locations are provided in **Tables 8 and 9**. A total of 100 plots (79 floodplain plots, 21 spring plots), covering 294,850 square feet (6.8 acres) were sampled throughout the project area.

Table 8
Floodplain Sample Plot Information

Plot	Transect	River Reach	Preliminary Community Designation	Plot Width (ft)	Plot Length (ft)	Plot Area (sq ft)	Upstream Corner GPS		Downstream Corner GPS	
							Lat	Lon	Lat	Lon
Wii16-1	Wii16	2	SW-blh-l	30	100	3000	30.3812	-83.1862	30.3810	-83.1864
Wii16-2	Wii16	2	RS-up	30	100	3000	30.3816	-83.1865	30.3813	-83.1867
Wii15-1	Wii15	2	AR-up	30	100	3000	30.3688	-83.1934	30.3685	-83.1933
Wii15-2	Wii15	2	RB-bhl-h	50	100	5000	30.3689	-83.1950	30.3686	-83.1949
Wii15-3	Wii15	2	SW-blh-l	30	100	3000	30.3688	-83.1958	30.3685	-83.1956
Wii15-4	Wii15	2	SL-blh-h	30	100	3000	30.3689	-83.1960	30.3686	-83.1960
Wii15-5	Wii15	2	up-exterior	30	100	3000	30.3687	-83.1963	30.3685	-83.1963
Wii5-N-1	Wii5-N	2	AR-up	20	100	2000	30.2781	-83.2352	30.2784	-83.2351
Wii5-N-2	Wii5-N	2	RS-blh-h	30	100	3000	30.2783	-83.2358	30.2780	-83.2359
Wii5-N-3	Wii5-N	2	SW-blh-l	30	100	3000	30.2785	-83.2362	30.2783	-83.2364
Wii5-C-1	Wii5-C	2	SW-blh-l	30	100	3000	30.2727	-83.2383	30.2724	-83.2383
Wii5-C-2	Wii5-C	2	RS-up	30	100	3000	30.2728	-83.2385	30.2725	-83.2386
Wii5-S-1	Wii5-S	2	SW-blh-l	30	100	3000	30.2696	-83.2401	30.2693	-83.2401
Wii5-S-2	Wii5-S	2	up-exterior	30	100	3000	30.2697	-83.2404	30.2694	-83.2404
Wi71-N-1	Wi71-N	2	BS-blh-h	30	100	3000	30.2103	-83.2423	30.2101	-83.2424
Wi71-C-1	Wi71-C	2	AR-up	30	100	3000	30.2094	-83.2450	30.2092	-83.2452
Wi71-C-2	Wi71-C	2	SL-blh-h	30	100	3000	30.2091	-83.2447	30.2089	-83.2449
Wi71-C-3	Wi71-C	2	BS-blh-h	30	150	4500	30.2091	-83.2444	30.2088	-83.2446
Wi71-C-4	Wi71-C	2	SL-up	30	100	3000	30.2087	-83.2442	30.2085	-83.2444
Wi71-C-5	Wi71-C	2	Up-exterior	30	100	3000	30.2086	-83.2441	30.2084	-83.2442
Wi65N-1	Wi65-N	3	AR-up	30	100	3000	30.1646	-83.2330	30.1643	-83.2330
Wi65N-2	Wi65-N	3	SW-blh-l	30	100	3000	30.1649	-83.2342	30.1647	-83.2339
Wi65N-3	Wi65-N	3	Up-exterior	30	100	3000	30.1651	-83.2344	30.1648	-83.2343
Wi65S-1	Wi65-N	3	AR-up	30	100	3000	30.1569	-83.2361	30.1569	-83.2364
Wi65S-2	Wi65-N	3	RS-up	30	100	3000	30.1575	-83.2366	30.1573	-83.2369
Wi65S-3	Wi65-N	3	SW-blh-l	30	100	3000	30.1580	-83.2372	30.1579	-83.2376
Wi65S-4	Wi65-N	3	Up-exterior	30	100	3000	30.1583	-83.2376	30.1581	-83.2378
Wi50-1	Wi50	3	AR-up	30	100	3000	30.1065	-83.1530	30.1064	-83.1527
Wi50-2	Wi50	3	SW-blh-l	30	100	3000	30.1070	-83.1527	30.1068	-83.1524
Wi50-3	Wi50	3	RS-up	30	100	3000	30.1074	-83.1524	30.1072	-83.1522
Wi50-4	Wi50	3	BS-sw	30	100	3000	30.1110	-83.1498	30.1111	-83.1495
Wi50-5	Wi50	3	SL-blh-h	30	100	3000	30.1114	-83.1498	30.1115	-83.1495
Wi50-6	Wi50	3	Up-exterior	30	100	3000	30.1117	-83.1498	30.1117	-83.1494
WI34-E-1	Wi34-E	3	SL-blh-h	30	100	3000	30.0153	-83.0060	30.0151	-83.0058
WI34-E-2	Wi34-E	3	BS-sw	30	100	3000	30.0152	-83.0063	30.0149	-83.0062
WI34-E-3	Wi34-E	3	SL-up	15	100	1500	30.0148	-83.0067	30.0146	-83.0065
WI34-W-1	Wi34-W	3	RB-up	30	100	3000	30.0098	-83.0109	30.0097	-83.0106
WI34-W-2	Wi34-W	3	SL-blh-h	30	100	3000	30.0096	-83.0111	30.0095	-83.0108
WI34-W-3	Wi34-W	3	SL-up	15	100	1500	30.0091	-83.0117	30.0090	-83.0114
WI34-W-4	Wi34-W	3	Up-exterior	30	100	3000	30.0073	-83.0122	30.0073	-83.0119
Wi30-1	Wi30	3	AR-upl	30	100	3000	29.9990	-82.9762	29.9985	-82.9761
Wi30-2	Wi30	3	SW-blh-l	30	100	3000	29.9989	-82.9764	29.9986	-82.9764
Wi30-3	Wi30	3	SW-blh-l	30	100	3000	29.9988	-82.9766	29.9985	-82.9766
Wi30-4	Wi30	3	RS up	30	100	3000	29.9989	-82.9770	29.9986	-82.9769
Wi30-5	Wi30	3	RS blh-h	30	100	3000	29.9983	-82.9777	29.9980	-82.9777
Wi30-6	Wi30	3	SW-blh-l	30	100	3000	29.9978	-82.9787	29.9975	-82.9786
Wi30-7	Wi30	3	BS-sw	30	100	3000	29.9975	-82.9792	29.9972	-82.9791
Wi30-8	Wi30	3	SL-up	30	100	3000	29.9973	-82.9795	29.9971	-82.9792
Wi30-9	Wi30	3	upl-exterior	30	100	3000	29.9971	-82.9796	29.9970	-82.9793
Wi10-N-1	Wi10-N	3	BS-sw	30	100	3000	29.9140	-82.9212	29.9141	-82.9215
Wi10-N-2	Wi10-N	3	SL-blh-l	30	100	3000	29.9138	-82.9215	29.9138	-82.9212
Wi10-N-3	Wi10-N	3	Up-exterior	30	100	3000	29.9143	-82.9217	29.9141	-82.9218
Wi10-S-1	Wi10-S	3	BB-sw	30	100	3000	29.9103	-82.9199	29.9101	-82.9199
Wi10-S-2	Wi10-S	3	AR-blh-l	20	100	2000	29.9102	-82.9201	29.9100	-82.9200
Wi10-S-3	Wi10-S	3	RS-up	30	100	3000	29.9102	-82.9206	29.9099	-82.9204
Wi10-S-4	Wi10-S	3	SL-blh-h	30	100	3000	29.9102	-82.9223	29.9099	-82.9222
Wi10-S-5	Wi10-S	3	RB-up	30	100	3000	29.9102	-82.9225	29.9100	-82.9223
Wi10-S-6	Wi10-S	3	Up-exterior	30	100	3000	29.9100	-82.9234	29.9098	-82.9232
Wi4-1	Wi4	4	BB-sw	20	130	2600	29.8750	-82.8768	29.8747	-82.8769
Wi4-2	Wi4	4	AR-up	20	130	2600	29.8752	-82.8768	29.8748	-82.8768
Wi4-3	Wi4	4	SL-blh-l	30	100	3000	29.8751	-82.8770	29.8748	-82.8771
Wi4-4	Wi4	4	BS-sw	30	100	3000	29.8752	-82.8772	29.8749	-82.8773
Wi4-5	Wi4	4	RB-up	30	100	3000	29.8754	-82.8779	29.8751	-82.8780
Wi4-6	Wi4	4	SL-blh-l	30	100	3000	29.8754	-82.8786	29.8753	-82.8784
Wi4-7	Wi4	4	BS-sw	30	100	3000	29.8755	-82.8788	29.8752	-82.8787
Wi4-8	Wi4	4	SL-blh-l	30	100	3000	29.8742	-82.8863	29.8739	-82.8861
Wi4-9	Wi4	4	BS-sw	30	100	3000	29.8740	-82.8869	29.8737	-82.8869
Wi4-10	Wi4	4	Up-exterior	30	100	3000	29.8739	-82.8876	29.8736	-82.8877
Wi3-1	Wi3	4	AR-up	20	120	2400	29.8615	-82.8796	29.8613	-82.8799
Wi3-2	Wi3	4	SL-blh-l	30	100	3000	29.8616	-82.8797	29.8614	-82.8800
Wi3-3	Wi3	4	BS-sw	30	100	3000	29.8617	-82.8800	29.8615	-82.8802
Wi3-4	Wi3	4	RB-blh-l	30	100	3000	29.8620	-82.8805	29.8619	-82.8808
X26-1	X26-N	4	AR-blh-l	30	100	3000	29.7297	-82.9489	29.7296	-82.9487
X26-2	X26-N	4	BS-sw	30	100	3000	29.7302	-82.9523	29.7301	-82.9523
X26-3	X26-N	4	RB-blh-l	30	100	3000	29.7302	-82.9539	29.7300	-82.9538
X26-4	X26-N	4	RB-blh-l	30	100	3000	29.7302	-82.9557	29.7300	-82.9556
X22-N-1	X22-N	4	AR-blh-l	30	100	3000	29.6440	-82.9574	29.6437	-82.9573
X22-N-2	X22-N	4	BS-sw	30	100	3000	29.6438	-82.9588	29.6437	-82.9586
X22-N-3	X22-N	4	SL-blh-h	30	100	3000	29.6424	-82.9666	29.6422	-82.9665
TOTAL						**234100**				

Table 9
Spring Sample Plot Information

Plot	Transect	River Reach	Preliminary Community Designation	Plot Width (ft)	Plot Length (ft)	Plot Area (sq ft)	US Corner GPS		DS Corner GPS	
							Lat	Lon	Lat	Lon
AMP-US-1	AMP-US	2	UpHmck	30	100	3000	30.1611	-83.2406	30.1608	-83.2405
AMP-US-2	AMP-US	2	SSw	30	100	3000	30.1612	-83.2408	30.1610	-83.2408
AMP-US-3	AMP-US	2	VFS	30	100	3000	30.1610	-83.2415	30.1608	-83.2413
AMP-US-4	AMP-US	2	HydHmk	30	100	3000	30.1610	-83.2421	30.1608	-83.2420
AMP-DS-1	AMP-DS	2	SSw	30	100	3000	30.1570	-83.2394	30.1568	-83.2393
AMP-DS-2	AMP-DS	2	VFS	30	100	3000	30.1571	-83.2397	30.1569	-83.2395
AMP-DS-3	AMP-DS	2	UpHmck	30	100	3000	30.1565	-83.2406	30.1563	-83.2404
BS-1	BS	3	HydHmk	30	100	3000	30.1224	-83.1363	30.1222	-83.1362
PS-N-1	PS-N	3	HydHmk	30	100	3000	30.1211	-83.1341	30.1209	-83.1343
PS-N-2	PS-N	3	VFS/SprRn	30	100	3000	30.1214	-83.1342	30.1211	-83.1344
PS-C-1	PS-C	3	SSw	30	100	3000	30.1134	-83.1375	30.1130	-83.1375
PS-C-2	PS-C	3	VFS/SprRn	30	100	3000	30.1136	-83.1386	30.1133	-83.1385
PS-C-3	PS-C	3	UpPP	30	100	3000	30.1137	-83.1394	30.1134	-83.1393
PS-S-1	PS-S	3	SSw	30	100	3000	30.1069	-83.1391	30.1067	-83.1389
PS-S-2	PS-S	3	UpHmck	30	100	3000	30.1067	-83.1396	30.1067	-83.1393
OS-U-1	OS-U	4	VFS	30	125	3750	29.6440	-82.9452	29.6438	-82.9455
OS-C-1	OS-C	4	HydHmk	30	100	3000	29.6449	-82.9488	29.6447	-82.9491
OS-D-1	OS-D	4	HydHmk	30	100	3000	29.6421	-82.9536	29.6421	-82.9539
OS-D-2	OS-D	4	VFS	30	100	3000	29.6413	-82.9532	29.6412	-82.9535
OS-D-3	OS-D	4	SSw	30	100	3000	29.6405	-82.9525	29.6403	-82.9527
OS-D-4	OS-D	4	UpHmck	30	100	3000	29.6403	-82.9525	29.6400	-82.9526
TOTAL						**60750**				

Diameter Breast High (DBH) Measurements

Within each plot, the diameter breast height (DBH) was recorded for each tree. For purposes of this study, a specimen with DBH measure of ≥ 4 inches was considered a tree (if less than 4 inches, the specimen was included in the shrub stratum). A DBH of ≥ 4 inches (10 centimeters) was also used by Helen Light to characterize a canopy tree during a study in the lower Suwannee River (Light et al., 2002) To determine DBH, the tree trunk was measured with a steel tree diameter tape specifically designed to measure DBH. The measurement was taken by encircling the tree trunk with the tree diameter tape at 4.5 feet above ground level on the uphill side of the tree. Personnel measuring tree DBH determined where 4.5 feet above the ground fell on their body, and used this reference to determine breast height location on trees when in the field. In the event the tree trunk at DBH height presented an irregularity, such as a protruding knot or ring of knots, swelling, or other deformity, the DBH was taken at another point; typically at a point higher on the tree trunk, where the deformity is no longer affecting the DBH measurement. If a tree was forked at the DBH height, the widest trunk DBH was recorded.

Tree Counts

As indicated above, for the purpose of this study, a tree with a DBH measure of ≥ 4 inches was characterized as a canopy (tree) species, and if less than 4 inches DBH, the plant specimen was included in the shrub stratum. Shrubs were not included in tree counts. Trees growing (rooted) within the plot were identified to the lowest taxonomic level, the number of each tree species was counted, and the counts were recorded on the Veg Field Form. Trees growing outside of the plot which had canopy overhanging the plot area were not included in the tree counts, with one exception. If a tree species representative of the community was not observed growing within the plot, but was observed near the plot, this tree specimen was included in the tree count in the interest of obtaining representative vegetative community data. This exception was a rare occurrence. Trees with multiple trunks (e.g. *Fraxinus caroliniana*) arising from the base of the tree trunk were counted as one tree, and the trunk with the widest girth was measured for DBH. Multiple trunks usually occur as a result of natural coppicing.

Cover Estimates

For the purpose of this study, percent vegetative cover is defined as the vertical projection of the crown or shoot area of a plant to the ground surface expressed as a percentage of the sample plot area. For the plants rooted within the plots, the percent areal cover by plant species was estimated visually for the sub-canopy (shrub) and ground cover strata. The estimated percent areal cover of tree species was combined (i.e. was not determined by species) and was estimated visually. Note that it was often difficult to determine if the cover in the tree canopy was only for trees rooted within the plot, so the estimated percent of tree canopy cover may include trees that are not rooted within the plot. The areal cover of the plants in the various strata within the plot often overlapped, so the total percent cover of plants in a single sample block often added up to more than 100%. Percent cover data was recorded on the Veg Field Form. Cover estimates were based on a concensus of the two to three field biologists working the quadrat. Double-checks were employed for the shrub and ground cover strata by: comparing the percentage of bare ground to the total percent cover for the ground cover stratum; and comparing the total percentage of shrub species cover to the estimated total of open canopy in the shrub stratum.

Vegetation Identification

Amec Foster Wheeler scientists identified vegetative species in the field, and in the office when additional research was necessary. Digital photographs and/or plant specimens were used for identifications conducted in the office. Additionally, botany expert, Dr. David Hall, provided field identification of plants observed in the field on two field dates and provided identification/confirmation via email with the use of digital photographs (D. Hall, personal communication, 2014 and 2015). A variety of field guides were utilized to confirm the identification of vegetative species observed during the fieldwork (Godfrey and Wooten, 1981; Little, 1980; Nelson 2000; Nelson 1996; Taylor 1992; Tobe et al., 1998; and Wunderlin, 1982).

Data analysis

All vegetative data were tabulated into a spreadsheet for data analysis. Each observed plant was given a wetland indicator status. The Florida Department of Environmental

Protection (FDEP) vegetative index list (section 62-340.450, F.A.C)[2] was used in this summary report to categorize the wetland plant species observed within the project area. The FDEP vegetative index list is used for the identification and delineation of wetlands within Florida, and plants on the vegetative index are specifically listed as Obligate (OBL), facultative wet (FACW), and facultative (FAC). Any plant not specifically listed is considered an upland plant except vines, aquatic plants, and plant species introduced to the state of Florida. Therefore, upland species are reflected as NL (Not Listed). Total species lists were generated for each stratum (tree, shrub, ground cover) for each preliminary general community type.

For the canopy, further analysis was conducted to determine species importance values within preliminary community types (Mueller-Dombois and Ellenberg, 1974). The following metrics were calculated and added together to determine species importance values:

- Relative basal area is defined as the area of the cross-section of a tree inclusive of bark at breast height (4.5 feet above the ground) within the plots of that community category (total basal area covered by species i/total basal area covered by all species);
- Relative density is defined as the number of a tree species relative to all tree species per the number of plots in that community category (# of individuals of species i/total number of individuals of all species) and,
- Relative frequency is defined as the number of plots that a tree species occurs relative to all tree species occurrence in the community category plots (frequency of species i/total frequencies of all species).

2.5 Soil Sampling

The Soil Criteria was based on water table characteristics as well as alluvial/depositional soil characteristics observed as part of the ecosystem characterization. Soil samples from the MSR watershed were collected within each of the monitoring plots and characterized to better understand the interactions between groundwater and surface water flow on MSR soils, and to ultimately understand the hydrologic controls that influence ecosystem function and stability.

Soil Sampling Methods

A three-inch diameter, stainless steel, closed bucket auger with a “T” handle was used to retrieve soil cores from within monitoring plots along each transect. Detailed procedures used for soil sampling, which was conducted during the same dates as the vegetative sampling, were as follows:

- An area within the center of each community plot was selected for boring. These areas showed characteristics (e.g. vegetation community) typical to the majority of the plot;
- Soil surface was cleared of any surface debris such as twigs, rocks, and litter;

[2] FDEP Delineation Program Vegetative Index (Plant List) website:
http://www.dep.state.fl.us/water/wetlands/delineation/vegindex/vegindex.htm

- The auger was placed at the top of the soil and turned clockwise to dig into the ground while preventing soil compaction;
- The auger with the soil sample was removed from the hole and accumulated soils were gently deposited over a plastic sheet spreader near the hole;
- For subsequent soil samples the fist 2 inches of soil were removed from the auger before placing just below the bottom of the previous sample in the plastic sheet spreader;
- Soil samples were extracted in depth increments of approximately 10 inches;
- The depth of the hole was measured after every soil extraction with a metric stick and the sample was adjusted to reflect the correct depth;
- Soil profiles were excavated as deep as necessary to make reliable interpretations; and when soil conditions allowed, soil profiles reached the water table;
- The depths at which differences in soil properties were observed were used to identify the different soil horizons;
- Detailed soil profile descriptions were made within each plot, following standard Natural Resources Conservation Service (Schoeneberger et al., 2012) procedures and included description of texture, thickness, color, structure, consistence, boundary, and presence of roots;

- Soils data was documented on field data sheets that included a full description of each horizon, soil classification (hydric or upland soils), and respective indicators;
- Pictures were taken for each soil profile and of any particular feature of the profiles.

Classification of Hydric Soils

Hydric soil indicators are formed predominantly by the accumulation or loss of iron, manganese, sulfur, or carbon compounds in a saturated and anaerobic environment. These processes produce characteristic morphologies that persist in the soil during both wet and dry periods, making them particularly useful for identifying hydric soils (USDA – NRCS, 2010). Soil processes, including characteristic features taken into account during field monitoring and soil characterization, are described in **Table 10**.

Table 10
Processes and Characteristic Features of Hydric Soils

Process	Characteristic Features
Organic-Matter Accumulation	In saturated soils, partially decomposed organic matter may accumulate resulting in the development of thick organic surface horizons, such as peat or muck, or dark organic-rich mineral surface layers
Iron and Manganese Reduction, Translocation, and Accumulation	Areas in the soil where iron is reduced often develop characteristic bluish gray or greenish gray colors known as gley. Areas that have lost iron typically develop characteristic gray or reddish gray colors
Sulfate Reduction	Conversion of SO_4^{2-} to H_2S, results in a very pronounced "rotten egg" odor. The presence of hydrogen sulfide is a strong indicator of a hydric soil, but this indicator occurs only on the wettest sites, in soils that contain sulfur-bearing compounds.
Soil Texture	Texture is determined by gently rubbing the wet soil material between the forefinger and thumb. If upon the first or second rub the material feels gritty, it is mineral soil material. If after the second rub the material feels greasy, it is either mucky mineral or organic soil material. Proceed to gently rub the material two or three more times. If after these additional rubs it feels gritty or plastic, it is mucky mineral soil material; if it still feels greasy, it is organic soil material.

Terminology of hydric soil features used for consistency during soil sampling and characterization of soil profiles includes:

- Histosols (hydric soil indicator alpha-numeric listing, A1)
- Histic epipedon (A2)
- Black histic (A3)
- Hydrogen sulfide (A4)
- Stratified layers (A5)
- Organic bodies (A6)
- 5 cm Mucky mineral (A7)'
- Muck presence (A8)
- Sandy gleyed matrix (S4)
- Sandy redox (S5)
- Stripped matrix (S6)
- Dark surface (S7)
- Loamy gleyed matrix (F2)
- Depleted matrix (F3)
- Depleted below dark surface (F4)
- Thick dark surface (F5)
- Redox dark surface (F6)
- Umbric surface (F13)

Evaluation of Soil Texture

Soil texture refers to the size of the particles that make up the soil. A soil can be composed of sand, silt, clay or a combination of them. Soil texture was evaluated in the field through feel-analysis. Sand, being the larger size of particles, feels gritty. Silt, being moderate in size, has a smooth or floury texture. Clay, being the smaller size of particles, feels sticky.

2.6 Bankfull Indicator Identification

Bankfull stage is defined as the elevation along a streambank at which the breakpoint between fluvial processes of erosion (channel maintenance) and deposition (floodplain building) occurs. Amec Foster Wheeler identified and flagged indicators at 20 bank locations along the MSR during August and September 2014 (during the same dates as the vegetative and soils monitoring). Due to the river's high banks and wide-ranging flow regime, a number of potential field indicators were identified and flagged, including: lowest extent of the tree line (BKF-TREE), top of rock outcroppings (BKF-ROCK), inflections in the bank (BKF-I), dominant scour line (BKF-S), dominant saw palmetto line (BKF-PALM), and the valley flat (BKF-F). A typical example of bankfull indicators along the Suwannee River is provided in **Figure 4**.

Bankfull indicators were also flagged at 9 spring-run transects. Spring-run banks are relatively low and the flow regime relatively constant; therefore, only two bankfull indicators were typically identified and flagged at spring runs: BKF-I and BKF-F. BKF-F was then used to define the community break between the open spring-run channel and the spring-run's valley flat.

All flagged locations were surveyed by a professional land surveyor, and their respective elevations were then related to distance along the river in order to determine if a consistent indicator emerged. Consistency may be expressed as a downward trend when bankfull indicators are plotted as the dependent variable against distance. Note that distance along the river is measured in feet along the river centerline from the beginning of the project area (0 = the confluence of the Withlacoochee and Suwannee Rivers). The resulting model from a consistent bankfull indicator can be used to predict the bankfull stage at any given location along the river. This predicted elevation can be used in turn to estimate the associated bankfull flow (or discharge) using the HEC-RAS model [3]. The bankfull discharge is an important flow event for channel maintenance and should be considered in the establishment of MFLs.

[3] US Army Corps of Engineers, Hydrologic Engineering Centers River Analysis System (HEC-RAS); http://www.hec.usace.army.mil/software/hec-ras/

Figure 4
Typical Example of Bankfull Indicators along the MSR

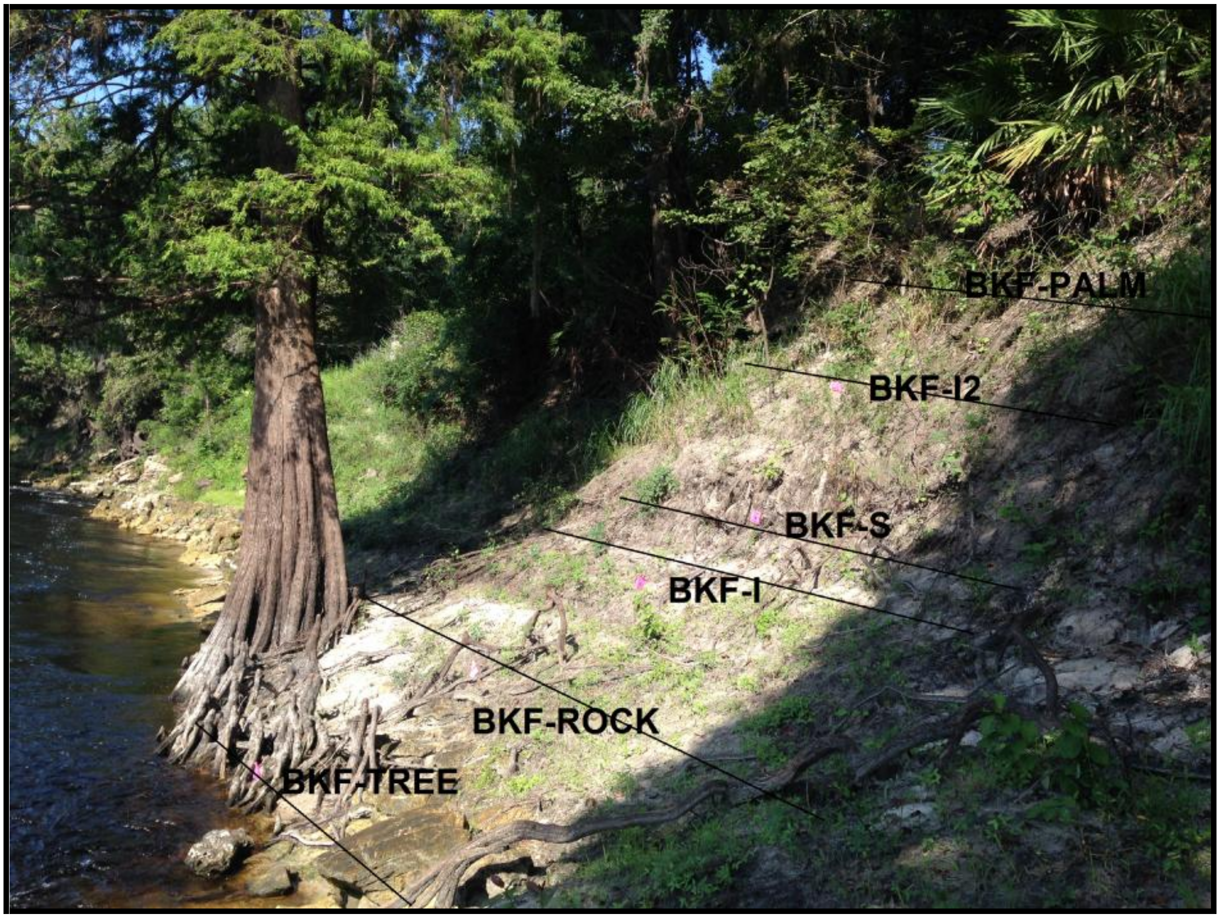


*Photo taken at Transect Wi16

2.7 Land Survey

Ground elevations along each floodplain and spring transect were surveyed by Land & Sea Surveying (Land & Sea) of Cape Canaveral, Florida. Using a combination of GPS, total station and spirit level instruments, Land & Sea traversed each transect and measured spot elevations at approximate 25-foot intervals, with shorter interval lengths tailored to capture topographic facets at transitions and longer intervals across extensive valley flatlands. Land & Sea also surveyed all ecological community breaks identified and marked by Amec Foster Wheeler during monitoring activities, as well as all hydroecological monitoring stations installed as part of this study.

To ensure that this survey is on a common horizontal and vertical datum, Land & Sea Surveying measured a geodetic network across the project area to verify existing National Geodetic control stations using GPS and established secondary and tertiary control at each site and transect relative to the North American Datum of 1983 (horizontal) and North American Vertical Datum of 1988. The survey team marked the ends of each transect, a tertiary control monument, with a 2-foot+ long 5/8 in. diameter metal rebar with a cap. State plane coordinates and elevations were established on each of these benchmarks.

Survey data were processed and formatted for mapping in an ESRI GIS shape file format. Land & Sea provided Amec Foster Wheeler and SRWMD with ASCII files and pdf maps with coordinates and elevations for each control point and feature surveyed along the transects. Survey cross-sections (station distance versus elevation) were generated for each transect by Amec Foster Wheeler using Rivermorph v4.3[4] software. Elevation data were used to determine minimum, maximum, and average elevations for each ecological community type found within MSR floodplains and spring-runs, as well as associated water level elevations and durations.

2.8 Hydroecological Monitoring

One component of this field study is to collect data useful for assessing the hydroecology of communities within the MSR floodplain and priority spring-runs and how they relate to river stage, which involved the installation of localized hydroecological monitoring stations. Amec Foster Wheeler installed a network of 31 hydroecological monitoring stations comprised of wells and/or staff gages equipped with continuously-recording pressure transducers between November 18 and 23, 2013, to collect localized water level data at various monitoring transects. Additionally, SRWMD installed three gages at headsprings within the project area just prior, including Allen Mill Pond, Lafayette Blue, and Peacock springs. Monitoring locations were selected to represent a variety of geomorphic surfaces such as floodplain entry/exit points, backswamps, swales, sloughs, springs, and spring-runs longitudinally along the MSR study area. Land & Sea surveyed in all hydroecological monitoring stations to a common horizontal and vertical datum (NAD'83 SPC FL North and NAVD'88, respectively). Monitoring station locations are summarized in **Table 11** and shown on an overview map and detailed maps in **Appendix A**.

[4] Information regarding Rivermorph software may be accessed online at: http://rivermorph.com/

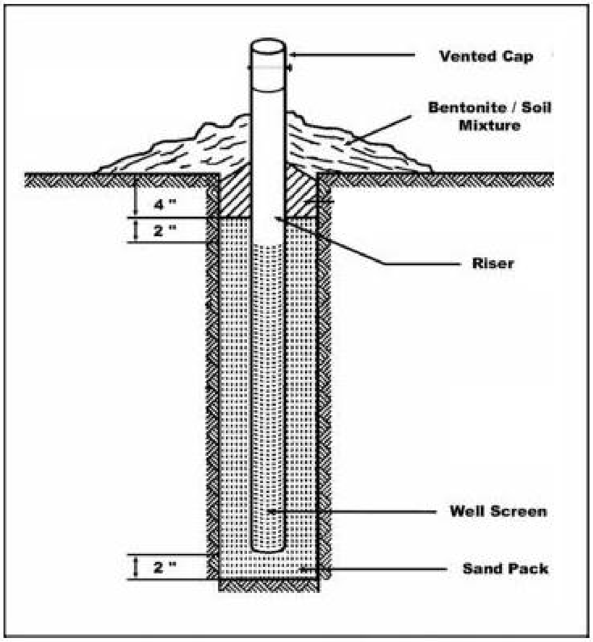
Table 11
Hydroecological Monitoring Stations Summary

Transect	Study Area Type	Number of Wells/Gages	Station ID	Feature	Type	Lat	Lon	Logger Serial #	Date Installed	Logger Depth from TOC (ft)	Well Depth (ft below ground surface)
WI115	Floodplain	3	MSR-1	Swale	Well	30.3686	-83.1958	0032027515	11/18/13	5.9	2.1
			MSR-2	Mesic wetland	Well	30.3693	-83.1948	0032027521	11/18/13	6.5	2.3
			MSR-3	Karst window	Well + gage plate (0-8)	30.3685	-83.1939	0032027530	11/18/13	12.4	8.2
WII5	Floodplain	4	MSR-4	Karst window	Gage	30.2782	-83.2372	0032028462	11/19/13	10.7	na
			MSR-5	Mesic Wetland	Well	30.2776	-83.2361	0032028465	11/19/13	10.4	6.5
			MSR-6	Swale	Well	30.2787	-83.2361	0032028471	11/19/13	8.0	4.2
			MSR-7	Swale nr inlet	Well	30.2689	-83.2403	0032028472	11/19/13	13.5	9.6
WI71	Floodplain	3	MSR-8	Karst window	Well + gage plate (0-8)	30.2115	-83.2433	0032028477	11/18/13	9.3	5.0
			MSR-9	Deep swamp	Well	30.2090	-83.2446	0032028479	11/18/13	6.0	1.9
			MSR-10	Inlet/outlet	Well	30.2077	-83.2465	0032028480	11/18/13	14.0	10.2
WI65	Floodplain	2	MSR-11*	Swale	Well	30.1652	-83.2341	0032028481	11/19/13	7.4	3.9
			MSR-12	Swale	Well	30.1580	-83.2373	0032028484	11/21/13	5.9	2.1
Allen Mill Pond	Spring	2		Spring	Gage	30.1628	-83.2426	N/A	SRWMD Installed	N/A	N/A
			MSR-13	Spring run mouth	Gage	30.1551	-83.2380	0032028485	11/21/13	5.5	na
Lafayette Blue Spring	Spring	1		Spring	Gage	30.1259	-83.2262	N/A	SRWMD Installed	N/A	N/A
WI50	Floodplain	3	MSR-14	Historic spring run	Well	30.1113	-83.1499	0032028486	11/19/13	5.2	1.8
			MSR-15	Swale	Well	30.1070	-83.1529	0032028487	11/19/13	5.7	2.6
			MSR-16	Inlet/outlet	Well	30.1050	-83.1436	0032028488	11/19/13	6.0	2.3
Peacock/Bonnet	Spring	2		Spring run US of fork	Gage	30.1232	-83.1332	N/A	SRWMD Installed	N/A	N/A
			MSR-17	Spring run	Gage	30.1062	-83.1375	0032028489	11/23/13	na	na
WI30	Floodplain	2	MSR-18	Swale	Well	29.9987	-82.9767	0032028490	11/20/13	13.8	10.2
			MSR-19	Deep swamp	Well	29.9977	-82.9788	0032028491	11/20/13	9.5	5.3
Ruth/Little Sulfur Spring	Spring	1	MSR-20	Spring run mouth	Gage	29.9965	-82.9756	0032028492	11/20/13	5.0	na
Wi10	Floodplain	3	MSR-21	Outlet	Well	29.9135	-82.9194	0032028493	11/21/13	14.2	11.0
			MSR-22	Deep swamp	Gage	29.9140	-82.9205	0032028494	11/21/13	4.8	na
			MSR-23	road culvert nr outlet	Gage	29.9099	-82.9255	0032028495	11/21/13	4.8	na
WI4	Floodplain	2	MSR-24**	Deep swamp	Gage	29.8737	-82.8867	0032028496	11/21/13	4.7	na
			MSR-25	Swale? nr outlet	Well	29.8642	-82.8780	0032028497	11/21/13	9.8	5.8
XS-26	Floodplain	3	MSR-26	Deep Swamp	Gage	29.7305	-82.9506	0032028498	11/22/13	N/A	N/A
			MSR-27	Mesic wetland	Well	29.7285	-82.9556	0032028501	11/22/13	9.2	5.0
			MSR-28	Outlet/inlet?	Gage	29.7191	-82.9574	0032028502	11/22/13	N/A	N/A
Rock Sink Spring	Spring	1	MSR-29	Spring run outlet	Gage	29.7288	-82.9490	0032028503	11/22/13	N/A	N/A
XS-22	Floodplain	1	MSR-30	Swamp	Well	29.6434	-82.9586	0032028506	11/22/13	7.6	3.4
Otter Spring	Spring	1	MSR-31	Spring run nr outlet	Gage	29.6407	-82.9531	0032028507	11/22/13	N/A	N/A

* Baralogger with serial number 0012028572 hung in nearby tree to compensate northern gages (MSR-1 through MSR-17); ** Baralogger with serial number 0012028575 hung in nearby tree to compensate southern gages (MSR-18 through MSR-31); *** Additional baralogger with serial number 0012028573 hung at SRWMD office as a backup.

The 31 stations Amec Foster Wheeler installed consisted of 11 staff gages and 20 monitoring wells. Generally, staff gages were installed at locations with flowing or standing water (i.e. spring runs, flow-ways, backswamps) while wells were installed at sites that were dry during the time of installation (i.e. higher elevation wetlands, karst windows). Monitoring wells were dug with hand augers, typically to the depth at which a low hydraulic conductivity layer was encountered (i.e. clay layer). Wells were installed as 2-inch diameter PVC, with a screened interval (surrounded by sand) extending below the ground surface and a vented riser above the ground surface (**Figure 5A**). The riser was capped and enclosed by a 4-inch square aluminum locking well casing. Well depths below the ground surface averaged 5 feet throughout the project area. Data loggers were hung with wire from the well cap to several inches above the bottom of the well.

Figure 5A
Typical Monitoring Well Installation



Staff gages were installed by sinking a metal fence post into the ground and attaching (with U-bolts) a 2-inch diameter PVC with well cap and a gage plate bolted to a wooden board. Data loggers were hung with wire from the well cap to several inches above the bottom of the PVC. **Figure 5B** shows a typical staff gage installation.

Figure 5B
Typical Staff Gage Installation

Each monitoring station was equipped with a Solinst Edge data logger, programmed to record water levels every 15 minutes. The loggers are compensated for atmospheric pressure fluctuations by using a common baralogger (rather than a desiccant), 3 of which were installed throughout the project area, including: one at MSR-11 to compensate the northern sites (MSR-1 through MSR-17), one at MSR-24 to compensate the southern sites (MSR-18 through MSR-31), and one at the District's Live Oak office as a back-up. SRWMD staff visited the monitoring stations on a roughly monthly basis from November 2013 to November 2014, to download data from the loggers, take manual water level readings (either visually from the gage plate or by measuring depth to water with a water level indicator), take flow readings (if applicable), take photographs, and note general observations such as flow direction and water color.

Data were then post-processed and stored in a master database to aid in MFL analyses. Specifically, raw data recorded every 15 minutes were imported into a software tool developed by Amec Foster Wheeler that then exports compensated water levels (level logger value minus baralogger value) as daily mean water elevations. Daily mean water elevations (in ft NAVD) were plotted over time to create hydrographs for each monitoring station. In addition to graphing the monitoring station's recorded daily mean water levels, river stage data from the nearest long-term USGS station and precipitation data provided by the SRWMD were plotted on hydrographs to see water level responses in floodplain or spring communities to both river flow and rainfall effects. **Table 12** provides a summary of USGS stations located within the Middle Suwannee River. **Table 13** provides a list of rainfall stations in the project area, and which hydrecological station they are associated with. The rainfall station IDs in **Table 13**, correspond to individual pixels in a mosaic generated for the SRWMD under a separate contract. Each pixel is assigned a precipitation rate generated from a combination of SRWMD rain gage data and National Weather Service (NWS) radar reflectivity data[5].

Based on the water level data, the stages associated with various threshold percentiles (maximum level, 85th, median, 15th, minimum level) were determined and plotted directly onto the survey cross-sections in order to see which communities were inundated during particular events. These values are the inverse of percent exceedance values, which were plotted on stage duration curves to estimate and compare hydroperiods for specific ecological communities.

Table 12
USGS Stations Summary

USGS Gage Name	Gage Number	Drainage Area (sq mi)	Period of Record	Associated MSR Hydroecological Monitoring Station
Suwannee River at Ellaville	2319500	6970	1927-current	MSR-1 through MSR-3
Suwannee River at Dowling Park	2319800	7190	1996-current	MSR-4 through MSR-13
Suwannee River at Luraville	2320000	7280	1927-current	MSR-14 through MSR-17
Suwannee River at Branford	2320500	7880	1931-current	MSR-18 through MSR-23
Suwannee River nr Bell	2323000	9390	1932-current	MSR-24 through MSR-31
Suwannee River nr Wilcox	2323500	9640	1930-current	N/A

[5] NWS Level II and III radar reflectivity data is available on-line from: http://www.roc.noaa.gov/WSR88D/.

Table 13
Rainfall Stations Summary

Rainfall Station ID	Associated MSR Hydroecological Monitoring Station
161909	MSR-1, MSR-2, MSR-3
159537	MSR-4, MSR-5, MSR-6
159063	MSR-7
157641	MSR-8, MSR-9, MSR-10
156219	MSR-11, MSR-12, MSR-13
154802	MSR-14, MSR-15, MSR-16, MSR-17
151967	MSR-18, MSR-19, MSR-20
149600	MSR-22
149126	MSR-23
148654	MSR-24
148180	MSR-25
144858	MSR-26, MSR-27, MSR-28, MSR-29
142488	MSR-30, MSR-31

2.9 In-Stream Springs Sampling

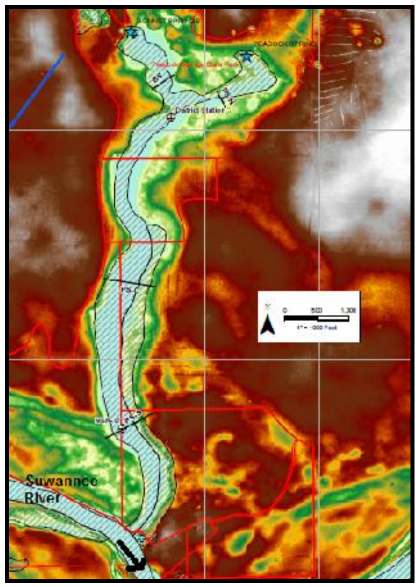
In-stream habitat characterization was conducted in six spring systems between September 15 and 19, 2014: Allen Mill Pond, Lafayette Blue, Peacock/Bonnet, Ruth/Little Sulfur, Rock Sink, and Otter Springs (in latitudinal order). The sites are located within the MSR between Dowling Park and Fanning Springs. The approximate location of the spring run mouth of each site corresponds to the hydrologic monitoring stations as shown in **Table 14**.

Table 14
Spring System List and Location

Spring System	Gage Name	Gage Location		County
		Latitude	Longitude	
Allen Mill Pond	MSR-13	30.1551	-83.2380	Lafayette
Lafayette Blue	SRWMD Gage	30.1256	-83.2258	Lafayette
Peacock/Bonnet	MSR-17	30.1062	-83.1375	Suwannee
Ruth/Little Sulfur	MSR-20	29.9965	-82.9756	Suwannee
Rock Sink	MSR-29	29.7288	-82.9490	Gilchrist
Otter	MSR-31	29.6407	-82.9531	Gilchrist

The Otter and Peacock/Bonnet Spring Runs are comparatively long (approximately 4,575 linear feet and 8,640 linear feet, respectively), forming their own valleys within the Suwannee River valley. The Peacock/Bonnet Run forms from the spring head runs of Peacock Springs and Bonnet Springs. Both of these spring runs are relatively short, but merge to form a shared run of approximately 8,640 linear feet (**Figure 6**). During the sampling period, the Peacock Spring Run width was narrow (≈ 50 ft) and confined within its banks. In contrast, the width of the shared run, which measured approximately 160 feet, was braided throughout and flows through a cypress strand. At the time of sampling, the Otter Spring Run water surface elevation was approximately 2.5 feet above the mean experienced during this study, and had expanded into the adjoining floodplain. When within its channels, the width of the run measures approximately 35 feet. Lafayette Blue Spring pool represents a near-river vent; it originates approximately 150 feet from the Suwannee River and is confined within steep banks. At the time of sampling, the 20 foot limestone land bridge that runs north and south across the short spring run was covered with a foot of water.

Figure 6
Peacock and Bonnet Springs



The remaining spring runs, Ruth/Little Sulfur, Rock Sink, and Allen Mill Pond, occupy comparatively shallow depressions within the riverine floodplain communities. Little Ruth/Sulfur is entrenched along the entire spring run of approximately 570 feet; the bank slope was greater than 60 degrees. The run has little sinuosity. At the time of sampling, the water level within the run was 3.9 feet. The channel width was approximately 25 feet. Rock Sink Run measures approximately 1,260 feet. Near the outlet, the run is deeply entrenched (bank gradient > 60°). Further upstream, the slope of the bank decreases and the run expands into the floodplain; at this point it is extensively braided. The location of the spring group feeding this run was not apparent. The team found one boil at coordinates 29.730255, -82.951751. Previous reports (Scott et al. 2004) put a boil location at the coordinates 29.727903, -82.949278, which actually correlates with the mouth of the spring run. At the time of sampling, Allen Mill Pond was contained within the spring run channel, which had a width of approximately 40 feet. The spring run depth was shallow, averaging a foot in depth.

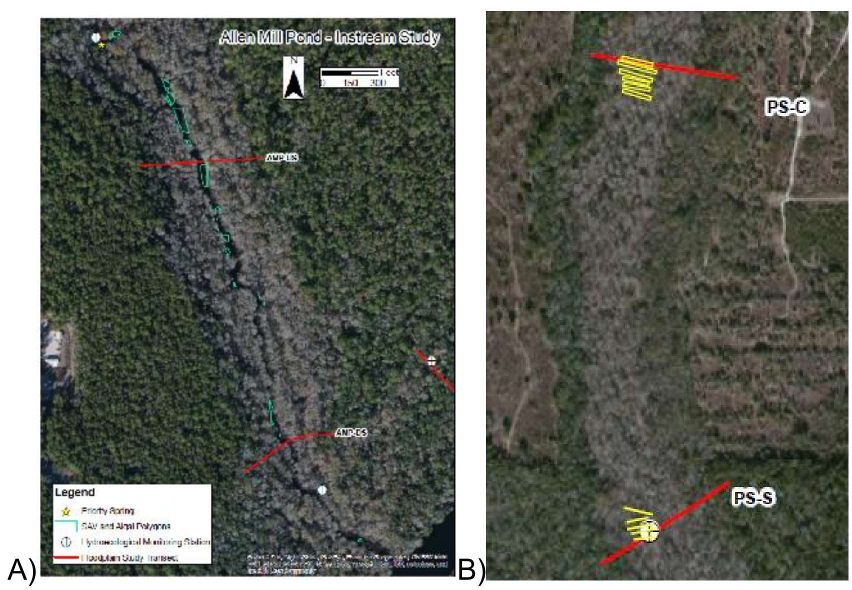
<u>SAV and Algal Survey</u>

A number of factors dictated the methodology employed at each spring run at the time of sampling, including spring run morphometry, water depth, and water clarity. For Allen Mill Pond, Lafayette Blue, Ruth/Little Sulfur, and Otter Spring Run, team members walked, swam, and/or paddled the entire spring run starting from the downstream outlet and captured GPS polygon points around significant SAV or algal mats (see **Figure 7A** for example of polygons mapping). The scientists were unable to conduct mapping at Rock Sink Spring Run due to severe limitations in visibility within the downstream portion of the run.

For those polygon locations at which SAV or algae were present, coverage within each polygon was estimated using 1 m^2 quadrats placed throughout the bed. A quadrat was placed within the center of the bed/mat. Within each quadrat, the number of 100 quadrants in which SAV species or algae are located were counted and a percent cover calculated (Brower et al. 1989; Morris et al. 2000). If data from more than one quadrat was collected, cover for each quadrat was averaged per polygon. The median vertical height for each species and algal mat was recorded to represent the distance to which the bed or mat extended from the sediment into the water column. SAV was identified in the field; algae samples were collected for identification via microscopy. Areas for which no algae or SAV polygons were mapped indicate sections bare of SAV/algae or indicate insignificant coverage (< $2m^2$). Corresponding to each quadrat, observations related to substrate type, water depth, and canopy cover of overhanging trees/shrubs were recorded; data corresponding to a subset of sites without SAV or algae were also recorded.

An adaptation of the methodology was employed for Peacock-Bonnet Spring because of the braided nature and length of the run (8,640 ft). Peacock-Bonnet Spring was divided into two non-contiguous sampling sites. A 100 m segment of the spring run, corresponding to vegetation transect PS-N, was completely mapped (i.e. SAV and algal mat polygons captured by GPS). At the other two locations, associated with vegetation transect PS-C and PS-S, SAV and algae cover were determined within band transects (approximately 150 ft in length) placed perpendicular to the spring run flow (see **Figure 7B** for example of belt transect mapping). Five transects were spaced at 10 m intervals. Within each band transect, SAV and algae cover were determined within five to seven equally spaced quadrats.

Figure 7
In-Stream Spring Mapping Methodology



A) Preferred methodology - Polygons along entire spring run (image from Allen Mill Pond).
B) Adapted methodology - Belt transects (image from Peacock Central and South).

Habitat Assessment

Conditions were suitable for FDEP Habitat Assessments in Allen Mill Pond, Peacock, and Ruth/Little Sulfur Spring Runs. A summary of sites and locations of the Habitat Assessment are shown in **Table 15**. Two Habitat Assessments were conducted at Allen Mill Pond. One corresponded to the vegetation and soils transect AMP-DS and the second corresponded to transect AMP-US. Habitat Assessments were conducted at Peacock Spring Run and Ruth/Little Sulfur Spring Run, corresponding with vegetation transects PS-N and the downstream gage, MSR-20, respectively.

Table 15
Habitat Assessment and Water Quality Sampling Locations Corresponding with Vegetation Transects

Spring System	Sampling Location Habitat Assessment	Sampling Location Water Quality
Allen Mill Pond	AMP-US	AMP-DS
Allen Mill Pond	AMP-DS	AMP-DS
Lafayette Blue	ND	Headspring Gauge
Peacock/Bonnet	PS-N	PS-N
Peacock/Bonnet	ND	PS-C
Peacock/Bonnet	ND	PS-S
Ruth/Little Sulfur	MSR-20	ND
Rock Sink	ND	MSR-29
Otter Springs	ND	Headspring Gauge
Otter Springs	ND	Relict Spring
Otter Springs	ND	OS-U
Otter Springs	ND	OS-C
Otter Springs	ND	OS-D

ND = No Data

Water Quality

Water quality measurements were taken at mid-depth corresponding to all Habitat Assessment sites (**Table 15**). Water quality was also measured at the two Peacock/Bonnet Spring Run locations, and at Lafayette Springs. **Table 15** shows the locations where water quality measurements were obtained. Temperature (°C), pH, dissolved oxygen (mg/L), dissolved oxygen (%), conductivity (UMHO/cm), and salinity (ppt) were recorded with a calibrated multiprobe YSI.

Algal Taxonomy

Macroalgal samples were taken to Amec Foster Wheeler's Biology-Toxicology Laboratory, in Gainesville, FL, where they were logged in and processed for taxonomic determinations. Each sample was homogenized and evaluated under both the dissecting scope at 40X and an inverted microscope at 600X to identify the dominant taxa to lowest practical taxon. Species that are predominant in the field of view during the identification process are classified as the dominant species. Samples with co-dominant species contain multiple species that each make up a relative 30-60% of the total sample. A complete species list is included in **Appendix B**. A list of references used to identify macroalgae is included in the bibliography of this report.

2.10 Data Post-Processing

Following field activities, all data were entered into spreadsheets and reviewed by the data collection team and by SRWMD staff. Field forms were reviewed in conjunction with GIS shapefiles to finalize plot locations and information. Survey elevations were checked against LiDAR-derived topography provided by SRWMD. Once all data had been validated, initial summary tables were created and analyzed for purposes of this data summarization report.

3.0 DATA ORGANIZATION

The post-processed MSR field data summarized in this report are provided in **Appendix B** as a series of spreadsheet databases containing raw and sorted/summarized data, as well as formatted report tables. **Appendix B** also provides field photographs and GIS shapefiles. Each of the **Appendix B** contents is described below.

3.1 Vegetation Database

The MSR Vegetation Database is an Excel spreadsheet containing 20 tabs, each of which is described below (though some tabs are grouped together):

- Metadata tab – This tab defines abbreviations found throughout the spreadsheet.
- Study Areas / Plot Locations tabs – These tabs contain formatted tables that provide information on MSR study transects, community breaks, and monitoring plots.
- Full Vegetation tab – This tab contains all the vegetation sampling data that were entered from the Field Veg Forms. These data can be sorted by transect, plot, stratum (i.e., tree, understory, herbaceous, vine), community type, etc. for various statistical purposes. Total counts and various DBH measurements for trees and total percent cover for shrubs and groundcover are provided by plot per plant species in a particular stratum. There is also a record for each plot that contains total percent tree cover (TreeCanTP) and total tree counts (Count). For example, at AMP-US-2 there were six tree species, with a total coverage of 70% and 15 individual trees (four of which were *Taxodium distichum* with DBH 11.0, 15.0, 7.4, and 15.2 inches).
- Summary tab – This tab contains a full list of all the plant species, by stratum that were found within the various floodplain and spring MSR communities. Note that to come up with these total counts, species coverages from individual plots of a similar community type were added together. This tab also contains formatted report tables summarizing the data.
- Total FP Summary Table by Comm tab – This tab contains all vegetative data for each individual floodplain monitoring plot organized by stratum and by community. The green highlighted columns represent the totals of all the plots of a partciular community added together.
- FP Complete List (Swamp, BLH-L, BLH-H, UP) tabs: These tabs contain all vegetative data for each individual floodplain monitoring plot only for the community labeled in the specific tab. Any species not found in that particular community has been removed. Data summaries are provided in the rows at the bottom of the species list. Totals/percentages from the FP Complete Lists were used to create **Tables 18 and 20**, in the worksheet accessed by the Summary tab.
- Total Spring Summary Table by Comm tab – This tab contains all vegetative data for each individual spring monitoring plot organized by stratum and by community. The green highlighted columns represent the totals of all the plots of a particular community added together.
- Spring List (VFS-SprRn, VFS, SSw, HydHmk, Upland) tabs: These tabs contain all vegetative data for each individual spring monitoring plot only for the community labeled in the specific tab. Any species not found in that particular community has been removed. Data summaries are provided in the rows at the bottom of the species list.
- Spp Imp summary FP general and detail tabs – Species importance values were determined for each tree species found within each community for the floodplain plots. The detail tab contains all the ecological+geomorphic surface communities (15 total),

while the general tab contains only the ecological communities (four total). The general tab also contains formatted report tables.

- Spp Imp summary Spring tab – Species importance values were determined for each tree species found within each community for the spring plots. This tab also contains formatted report tables.
- Spp Imp WORKING tab – This tab contains the raw data used to determine species importance values, including frequency, density, and basal area data by community. It also shows which plots were used for each community.

3.2 Soils Database

The MSR Soils Database is an Excel spreadsheet containing 13 tabs, each of which is described below (though some tabs are grouped together):

- Metadata tab – This tab defines abbreviations found throughout the spreadsheet.
- Soil Characterization tab – This tab contains all the soil sampling data that were entered from the Soil Field Forms. These data can be sorted by transect, plot, community, soil texture, hydric indicator, hydric vs upland, etc. for various statistical purposes.
- Remaining tabs – These tabs contain various pivot tables, data summaries, and formatted report graphs.

3.3 Survey Database

The MSR Survey Database is an Excel spreadsheet containing approximately 40 tabs, each of which is described below (though some tabs are grouped together):

- Elevation Summary Table tab – This tab contains formatted report tables showing floodplain and spring transect information, including length, community types found along transects, number of sample plots along each transect, and transect endpoints. This tab also contains elevation data used to generate a formatted report graph.
- Bankfull ID tab – This tab contains elevation data associated with bankfull indicators for all the transects in one place, allowing for generation of bankfull profiles (formatted report table and graphs).
- Hydro Monitoring Station Elev and Hydro Duration Summary tabs – These tabs contain elevation data relating to the various hydroecological monitoring stations installed for this study. The first tab contains summarized and raw elevation survey data for each station in one place. The second tab contains preliminary data regarding hydroperiods across various community types for floodplain and spring transects. This tab contains some formatted report tables and also contains some preliminary graphs that were not included in the report.
- ALL XS tab – This tab contains elevation data for each surveyed transect in one place. These data were used to generate report graphs showing transects plotted onto one graph by river reach. This allows instant comparison of various transect types at various locations.
- FINAL XS Graphs tab – This tab contains all the formatted cross-sections for each transect in the study area in one place.
- Individual transect tabs – The remaining tabs contain all raw survey data for each transect, data post-processed in Rivermorph to determine stationing along the transect

and develop cross-section graphs, and community break and hydrological data used to add pertinent information to the cross-section graphs.

3.4 Hydroecological Monitoring Database

The MSR Hydroecological Monitoring Database is an Excel spreadsheet containing approximately 40 tabs, each of which is described below (though some tabs are grouped together):

- Station Info tab – This tab contains information related to each monitoring station (i.e., station type, lat/long, logger serial #, data installed, depth of logger, depth of well) and is included as a report table.
- Site Visit Log tab – This tab lists dates team members visited various monitoring stations.
- Precipitation tab – This tab lists the rainfall station IDs used to determine local rainfall for individual monitoring stations.
- USGS tab – This tab lists the USGS stations used to determine river stage for individual monitoring stations.
- Data Summary tab – This tab shows all of the post-processed water level for all of the monitoring stations on one tab. These data were used to make hydrographs containing all stations on two graphs for instant comparison among stations.
  Individual monitoring station tabs – The remaining tabs contain daily mean logger and baralogger data and elevation data used to determine a final compensated water level elevation in feet NAVD. The tab also contains field observations during site visits. Further to the right in the tab, the data were sorted to develop stage duration curves to ultimately help determine preliminary hydroperiods for various community types and individual transect cross-sections (as seen on the cross-section graphs in the Land Survey spreadsheet).

3.5 Instream Springs Database

The MSR Instream Springs Database is an Excel spreadsheet containing ten tabs, each of which is described below (though some tabs are grouped together):

- Metadata tab – This tab defines abbreviations found throughout the spreadsheet.
- SAV tab – This tab contains all the instream spring sampling data, including site, date, quadrat, type, species, percent cover, substrate, and various field parameters. These data can be sorted for various statistical purposes.
- Table tabs - The remaining tabs contain formatted report tables.

3.6 GIS Files

The GIS folder contains various shapefiles that were updated following field monitoring activities, including transect locations (with community breaks), monitoring plot locations, hydroecological monitoring station locations, and in-stream springs data.

3.7 Photographs

The photographs folder is organized by MSR transect. Each transect folder contains the following subfolders:

- Folders for each monitoring plot sampled during 2014, containing photographs of general plot conditions, plants found within the particular plot, and soil samples.
- A Streambanks folder containing photographs of the streambank with flagged bankfull indicators.
- A Transitions folder containing photographs taken at community break transitions to gain a general understanding of ecotone conditions along each transect.

4.0 PRELIMINARY RESULTS

This section presents the preliminary results of the field data collection efforts conducted in the MSR study area during 2013/2014, which involved establishing community breaks along transects, sampling soil and vegetation within designated monitoring plots, identifying bankfull stage, surveying land elevations along transects, monitoring hydroecological stations installed throughout the study area, and in-stream sampling at selected priority spring runs. Community characterizations may be refined after more extensive, multivariate statistical assessments to be conducted under a separate scope.

4.1 Communities of MSR Floodplains and Springs

Preliminary community types were assigned along each floodplain and spring transect based on qualitative observations of changes in soil, vegetation, elevation, and geomorphic surface. Communities observed along each transect are depicted in **Tables 16 and 17**, **Appendix A** (Site Maps), and **Appendix D** (Surveyed Cross-Sections). Community designations, which are described in the sections below, may change or may be grouped or separated based on future statistical analyses.

Table 16
Community Designations by Floodplain Transect

Transect	River Reach	Transect Length (ft)	# of Breaks Along Transect	# of Distinct Community Types Along Transect	# of Sample Plots Along Transect	Communities Observed Along Transect (from riverbank landward)	Transect Endpoint Locations			
							X	Y	X	Y
Wii16	2	613	5	4	2	AR-up, SW-blh-l, RS-up, SW-blh-l, Upland	2382464.42	504890.38	2382865.09	504448.31
Wii15	2	990	5	5	5	AR-up, RB-blh-h, SW-blh-l, SL-blh-h, Upland	2379627.63	500078.41	2380590.37	500137.77
Wii5-N	2	1117	5	5	3	AR-up, RS-blh-h, SW-blh-l, Upland, Karst Window	2366704.42	467472.28	2367732.22	467048.84
Wii5-C	2	699	7	4	2	AR-up, SW-blh-l, RS-up, SW-blh-l, RS-up, SW-blh-l, Upland	2366308.87	465092.63	2366898.91	464946.24
Wii5-S	2	155	3	3	2	AR-up, SW-blh-l, Upland	2366111.80	463849.58	2366264.95	463806.88
Wi71-N	2	1299	5	5	1	AR-up, Karst Window, RB-up, BS-blh-h, Upland	2365219.25	443002.06	2365963.17	442045.85
Wi71-C	2	563	5	5	5	AR-up, SL-blh-h, BS-blh-h, SL-up, Upland	2364781.17	442053.69	2365188.01	441678.70
Wi71-S	2	317	3	3	0	AR-up, SW-blh-l, Upland	2364204.53	440920.86	2364363.25	440878.24
Wi65-N	3	938	3	3	3	AR-up, SW-blh-l, Upland	2368429.04	425892.61	2369283.74	425587.22
Wi65-C	3	750	3	3	0	AR-up, SW-blh-l, Upland	2368335.55	424664.46	2368785.72	424173.81
Wi65-S	3	686	4	4	4	AR-up, RS-up, SW-blh-l, Upland	2367432.58	423400.70	2367863.17	422912.65
Wi50	3	2322	10	7	6	AR-up, SW-blh-l, RS-up, SW-blh-l, Upland, SL-blh-h, BS-sw, SL-blh-h, SL-up, Upland	2394418.67	404866.88	2395470.59	406821.23
Wi34-E	3	523	6	5	3	AR-up, SL-blh-h, BS-sw, SL-blh-h, SL-up, RB-up	2441053.17	372078.26	2441473.71	372363.75
Wi34-W	3	1522	8	6	4	RB-up, SL-up, SL-blh-h, BS-sw, SL-blh-h, SL-up, Upland-low, Upland	2439531.27	369155.38	2439802.93	370272.12
Wi30	3	1236	14	7	9	AR-up, SW-blh-l, SW-blh-l, RS-up, SW-blh-l, RS-up, RS-blh-h, RS-up, SW-blh-l, RS-up, SW-blh-l, BS-sw, SL-up, Upland	2449755.47	365786.56	2450836.44	366470.11
Wi10-N	3	809	5	5	3	Dst, SL-blh-h, BS-sw, SL-blh-l, Upland	2468489.67	335906.81	2469258.41	335639.71
Wi10-S	3	2087	16	9	6	BB-sw, AR-blh-l, BS-sw, RS-up, SL-blh-l, BS-sw, SL-blh-h, RB-up, SL-blh-l, BS-sw, SL-blh-h, Upland, SL-blh-l, BS-sw, SL-blh-l, Upland	2467090.74	334323.36	2469118.39	334480.31
Wi4	4	3733	16	7	10	BB-sw, AR-up, SL-blh-l, BS-sw, SL-blh-l, RB-up, SL-blh-l, BS-sw, SL-blh-l, RB-up, RB-blh-l, RB-up, SL-blh-l, BS-sw, SL-blh-l, Upland	2479492.38	321340.12	2482913.99	321852.73
Wi3	4	717	5	5	4	AR-up, SL-blh-l, BS-sw, RB-blh-l, Upland	2481516.17	317270.37	2482042.02	316877.70
X26-N	4	2531	8	5	4	AR-blh-l, Active Splay, BS-sw, SprRn, BS-sw, RB-blh-l, BS-sw, RB-blh-l	2458627.15	268827.18	2461102.21	268733.30
X22-N	4	3218	4	4	3	AR-blh-l, BS-sw, SL-blh-l, Upland	2455542.71	236862.57	2458664.05	237481.92
X22-S	4	1798	8	4	0	AR-blh-l, BS-sw, RB-blh-l, BS-sw, RB-blh-l, BS-sw, RB-blh-l, Upland	2457061.71	233808.21	2458604.49	232973.86

Table 17
Community Designations by Spring Transect

Transect	River Reach	Transect Length (ft)	# of Breaks Along	# of Distinct Communi	# of Sample Plots	Communities Observed Along Transect (from riverbank landward)	Transect Endpoint Locations			
							X	Y	X	Y
AMP-US	2	9	0	6	4	UpPP, UpHmck, SSw, VFS, SprRn, VFS, SSw, HydHmk, UpHmck	2365972.11	424319.48	2366579.41	424440.73
AMP-DS	2	7	0	5	3	UpHmck, SSw, VFS, SprRn, SSw, HydHmk, UpHmck	2366531.87	422747.62	2367014.84	422957.87
BS	3	3	0	2	1	HydHmk, VFS/SprRn, HydHmk	2399278.31	410516.80	2399674.74	410716.53
PS-N	3	3	0	2	2	HydHmk, VFS/SprRn, HydHmk	2400180.70	410503.70	2400384.53	410276.97
PS-C	3	8	0	6	3	Dst, SSw, VFS, VFS/SprRn, VFS, SSw, UpHmck, UpPP	2398677.68	407566.56	2399413.65	407368.08
PS-S	3	8	0	5	2	UpHmk, SSw, VFS, VFS/SprRn, VFS, SSw, UpHmck	2398712.22	405010.47	2399368.20	405406.69
OS-U	4	5	0	5	1	UpHmck, SSw, VFS, SprRn, Dst	2462172.03	237726.17	2462453.95	237350.05
OS-C	4	6	0	4	1	HydHmk, Ssw, VFS, SprRn, VFS, HydHmk	2461297.29	237906.85	2461301.68	236798.91
OS-D	4	7	0	5	4	HydHmk, SSw, VFS, SprRn, VFS, SSw, UpHmck	2459663.62	236902.53	2460111.80	236138.34

Floodplain Communities

Four general ecological communities were observed within the MSR floodplain, determined based on similarities in vegetation, soils, and relative elevation:

- **Swamp (sw)** – A low-lying, typically inundated wetland with predominantly OBL species and organic soils. Common swamp tree species include bald cypress, planer tree, pop ash, and overcup oak. Swamps are most prevalent and extensive in the downstream-portion of the study area, and were completely absent from study transects upstream of Wi50.
- **Low Bottomland Hardwood (blh-l)** – A wetland community comprised of a mix of FACW and OBL species, with a higher number of OBL species than typically found in a high bottomland hardwood community. These wetlands have hydric soils, but are less frequently inundated because they sit at higher elevations relative to swamps. This community was found throughout the project area.
- **High Bottomland Hardwood (blh-h)** – A wetland community comprised of a mix of FACW and OBL species, with a higher number of FACW species than typically found in a low bottomland hardwood community. These wetlands have hydric soils, but are less frequently inundated because they sit at higher elevations relative to swamps. This community was found throughout the project area.
- **Upland (up)** – A community with non-hydric soils and a predominance of upland species, such as live oak and saw palmetto. This community sits at higher elevations relative to both swamps and bottomland hardwood communities.

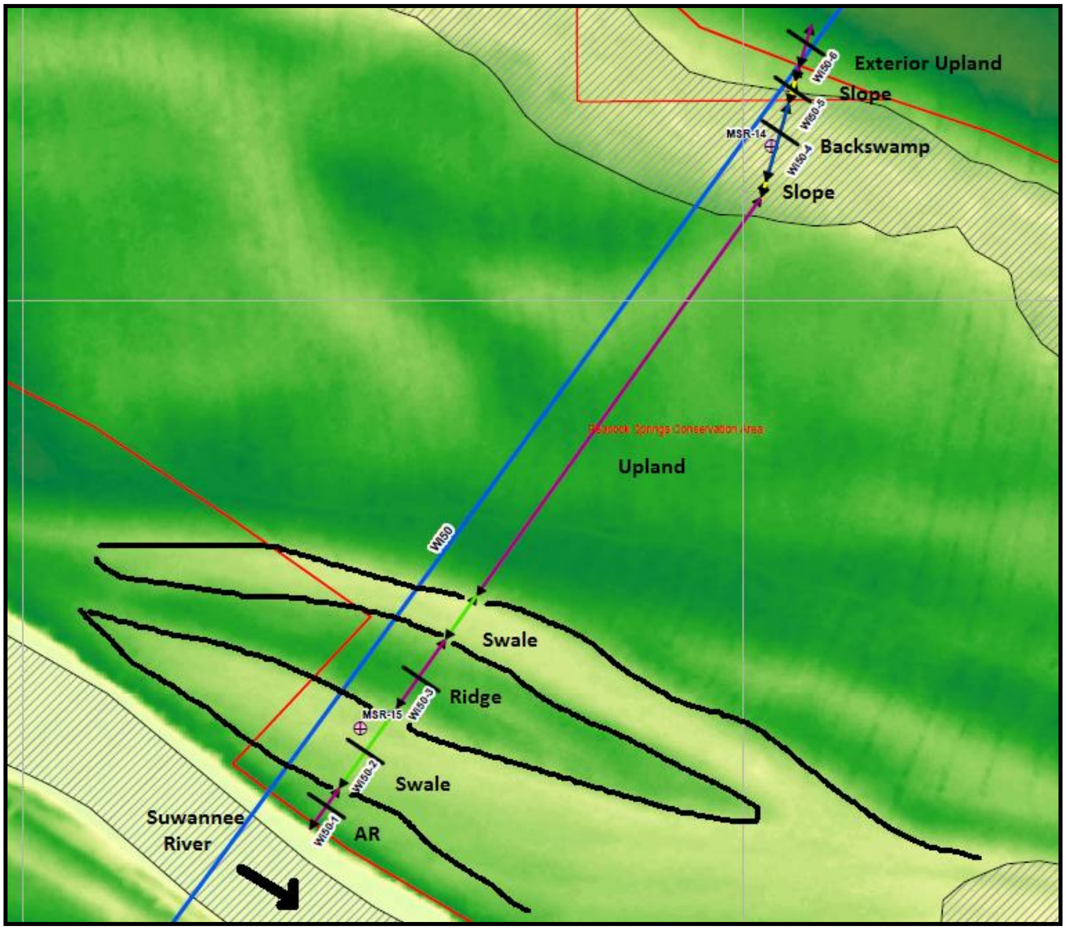
These general communities can then be further broken down based upon the geomorphic surface they occupy, including:

- **Alluvial Ridge (AR)** – A feature adjacent to the river where the river has deposited sediments, forming a natural levee. This feature is typically high (relative to the floodplain), narrow, and linear (running along the river). This feature is typically associated with an upland community in the upper portion of the study area (Reaches 2 and 3). Downstream of the confluence of the Santa Fe River (Reach 4), alluvial ridges are noticeably lower and are typically occupied by a “wetter” assemblage of species due to more frequent inundation.

- **Bankfull Bench (BB)** – A shelf (or bench) built by river deposits that occurs on the streambank below the top of bank. Only two bankfull benches occurred within the study transects, both of which were occupied by a swamp community. Note that these communities are relatively “young” because they were more recently built by the river.
- **Backswamp (BS)** – A broad low-lying area within the floodplain where water and fine sediments typically settle following a high flow event. Backswamps were common throughout Reaches 3 and 4, but were notably rare in Reach 2. Backswamps were occupied by a swamp community, with the exception of W71 (Reach 2) which was occupied by a high bottomland hardwood.
- **Ridge (RS) and Swale (SW)** – A series of relatively narrow high and low features, often occurring in an undulating pattern across the floodplain. Typically uplands (with saw palmetto) occupy the ridges and low bottomland hardwood forests occupy the swales. Ridge and swale sequences seem limited to the upper and middle portions of the project area, where the banks are higher and water from the river likely backflows into the floodplain via breaks in the bank forming “fingers” where water sits in the lower swales (favoring wetland conditions).
- **Broad Ridges (RB)** – These are wider, relatively homogenous areas not typically associated with a series of narrower ridges and swales. Of the broad ridges encountered within the MSR floodplain, approximately half were occupied by uplands and half occupied by low bottomland hardwoods.
- **Slope (SL)** – This feature is a transitional, sloping, often narrow band typically found between higher uplands and lower swamps. Slopes were usually occupied by bottomland hardwoods (high or low).
- **Upland exterior** – Occurring at variable distances from the river, the upland exterior (often comprised of dense saw palmetto), defines the lateral extent to which wetland communities associated with the river are found. These occur at higher elevations relative to the general floodplain.
- **Karst Window** – This is a solution hole occurring within the floodplain of the MSR that does not have a spring run to the river. Karst windows are typically unvegetated, and can be wet or dry and contain clear or tannic water depending on elevation and hydrologic conditions in the floodplain. This feature was only observed along transects in the upper-most portion of the study area (Reach 2).
- **Active Splay and Spring Run (SprRn)** – These features were limited to one transect (X26-N). An active splay (or crevasse splay) is an extremely dynamic area where sediments are deposited when the river breaks through the bank. Although limited to one transect, they can be found throughout the lowest portion of the study area (Reach 4). A spring run flows through the backswamp of this transect, and multiple small boils were found within the backswamp.

It should be noted that for this project, field maps with digital elevation models (DEMs) generated from LiDAR-derived topography were extremely helpful in identifying the various geomorphic features because the deeper areas could be readily observed by changes in color. **Figure 8** below depicts the DEM for Wi50, which had a wide variety of geomorphic surfaces. Further, the DEM proved to be a much better way to predict the occurrence of wetland communities than the National Wetland Inventory (NWI), which was not found to reliably identify wetlands within the complex MSR floodplain. For example, in **Figure 8**, the low-lying swale community is a wetland (thick black outline), but it is not mapped by the NWI (hashed lines).

Figure 8
Examples of Geomorphic Surfaces along a Floodplain Transect



<u>Spring Communities</u>

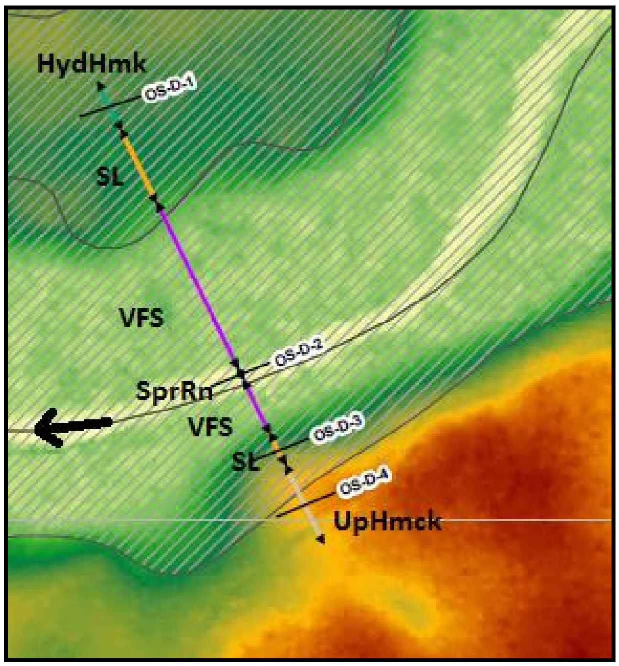
The spring run transects at Allen Mill Pond, Bonnet, Peacock, and Otter Springs were all found to follow the same general pattern of community distribution from end to end: higher exterior community, transitional wetland on a slope, valley flat, spring run (open channel), valley flat, transitional wetland on a slope, and higher exterior community. This pattern is shown in **Figure 9**. The spring communities are described below:

- **Spring Run (SprRn)** – The main, open channel of the spring run has a relatively constant flow from the headspring, but is subject to backflow from the Suwannee River during high flow events. In cases where the run is heavily vegetated with trees and lacks defined banks, such as in Peacock Springs which is wide and relatively shallow, a designation of SprRn/VFS was given.
- **Valley Flat Swamp (VFS)** – This is the flat area adjacent to the spring run, typically occupied by a swamp community and mucky soils. The VFS was distinguished from the open channel by the location at which the banks flatten out (BKF-F).
- **Slope Swamp (SSw**) – This is a transitional wetland community typically located between the valley flat swamp and higher exterior communities. This community typically has a higher percentage of FACW (versus OBL) species than the VFS.

- **Hydric Hammock (HydHmk)** – Another transitional wetland community, but one that occurs higher in elevation (on the upper slope) than the SSw or VFS and has a more mesic vegetative community.
- **Upland hammock (UpHmck)** – An upland community, based on the lack of hydric soil indicators, that is transitional and typically occupies upper slopes. This community may have a number of wetland as well as upland canopy species.
- **Upland palmetto (UpPP)** – An upland whose understory is dominated by saw palmetto.

Note that these spring communities all technically fall within the floodplain of the MSR and further data analysis may find reason to lump the spring communities with the floodplain communities, especially those on higher elevation surfaces.

Figure 9
Examples of Geomorphic Surfaces along a Spring Transect



4.2 Vegetation of MSR Floodplains and Springs

As indicated above in Section 4.1, vegetation was observed in the Suwannee River floodplain and in or adjacent to spring runs associated with the River. Photographs taken at each floodplain or spring monitoring plot are provided in **Appendix C**. For the purpose of this summary report, the vegetation discussion is focused primarily on canopy species, as the top vegetative stratum is typically the best indicator of long-term hydrologic conditions.

Floodplain Communities

The previously identified floodplain communities were combined into four general community categories for this floodplain discussion:

- Swamp (sw),
- Low bottomland hardwood (blh-l),

- High bottomland hardwood (blh-h), and
- Upland (up).

A full list of all vegetative species observed and quantified within monitoring plots throughout the MSR floodplain communities, which includes 39 canopy species, 60 understory species, 137 groundcover species, and 4 aquatic species, is provided in **Appendix B**. **Table 18** summarizes these findings by community and by stratum. Based on this table, floodplain swamps had the highest percent of species coverage by FACW or OBL plants, while floodplain uplands had the lowest (as would be expected). Species diversity was highest for all strata in the upland community. Forest structure differed among the apparent community types as well, with some communities varying widely in their understory and groundcover density and proportion of wetland species.

Canopy species were further analyzed by combining data from plots of the same pre-designated community types to determine species importance values for each observed tree species. Depictions of summarized canopy species importance values by community (general and detailed) are provided in **Figures 10 and 11**, respectively. Vegetative monitoring results by general floodplain community type are described in more detail in the following sections.

Table 18
Summary of Floodplain Vegetative Monitoring by Community and Stratum

Stratum	SW	BLH-L	BLH-H	UP
# of Plots	12	22	12	33
Avg # of Trees per plot	19	12	12	11
Avg % Trees FACW or OBL per plot	97%	92%	93%	66%
Avg # of Tree Species per plot	5	5	5	5
Total # of Tree Species among plots	18	17	19	25
Avg % Understory Cover per plot	39	33	26	70
Avg % Understory Cover FACW or OBL per plot	99%	90%	75%	32%
Avg # of Understory Species per plot	5	6	7	8
Total # of Understory Species among plots	19	34	32	54
Avg % Herbaceous Cover per plot	8	26	47	34
Avg % Herbaceous Cover FACW or OBL per plot	49%	42%	15%	12%
Avg # of Herbaceous Species per plot	7	17	18	15
Total # of Herbaceous Species among plots	45	76	71	109
Avg % Bare Ground per plot	NA	78%	67%	66%

Figure 10
Species Importance by Preliminary Floodplain Community (General)

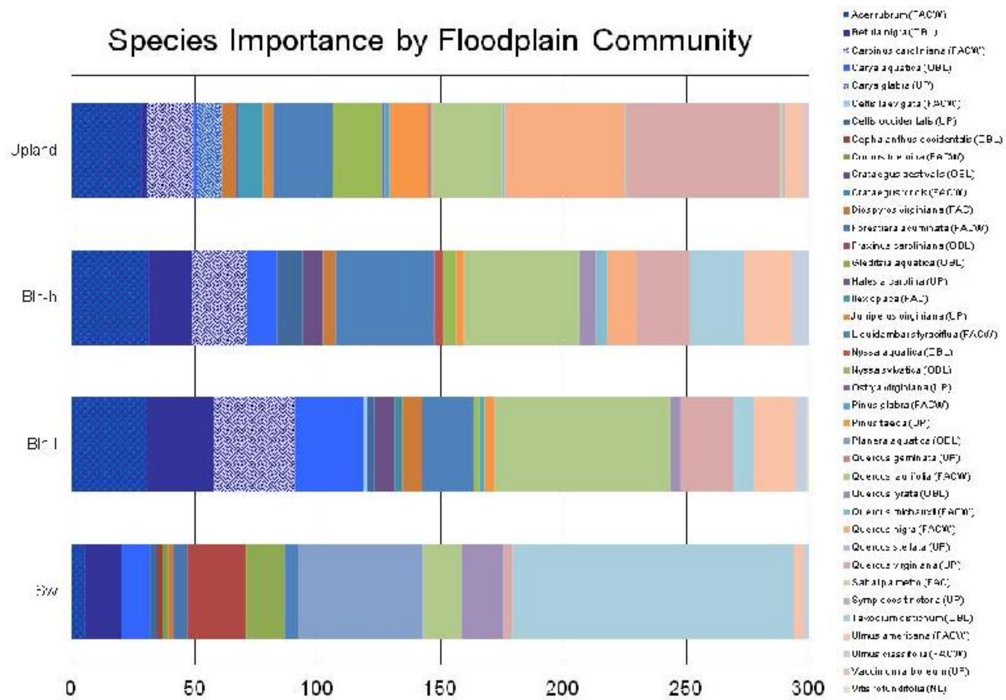
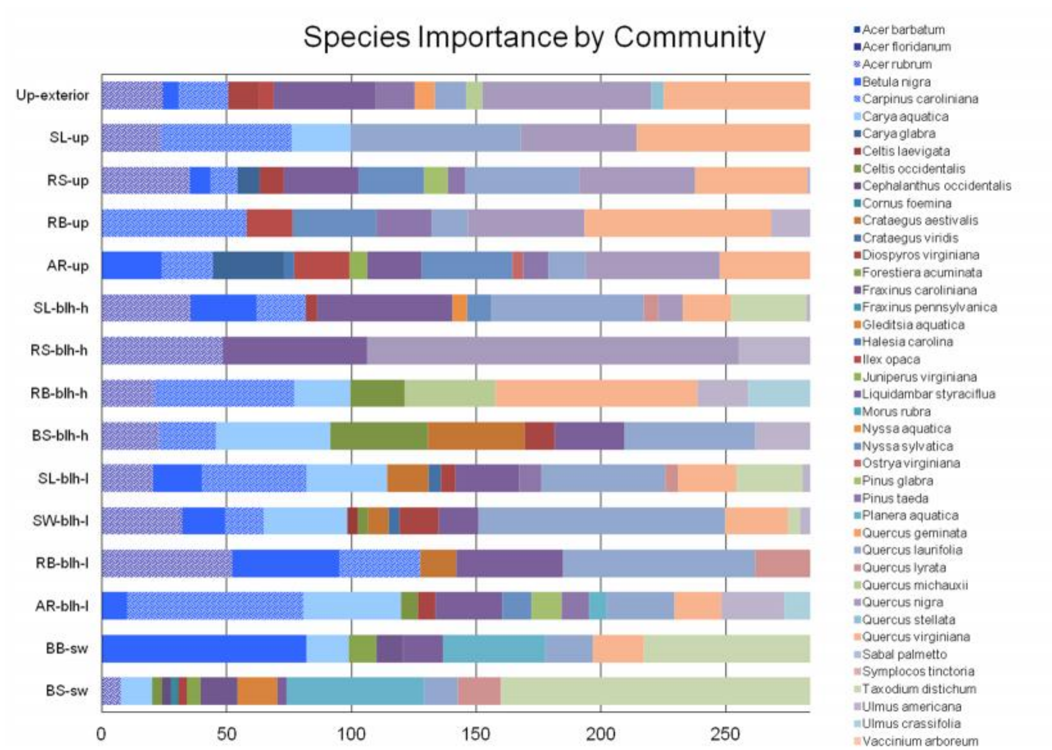


Figure 11
Species Importance by Preliminary Floodplain Community (Detailed)



Swamp Floodplain Community

In the swamp communities, 18 tree species were identified, and the majority of these trees were categorized as obligate (OBL) wetland plant species (**Table 19A**). Based on the metrics provided in **Table 19A**, the three tree species with greatest species importance for the floodplain swamp community were the OBL species: bald cypress (*Taxodium distichum*), planer tree (*Planera aquatica*), and Carolina ash (*Fraxinus caroliniana*) (**Figure 10**). Bald cypress and the planer tree had the highest relative basal area and relative density, and although the Carolina ash had a lower relative basal area when compared to remaining species listed in **Table 19A**, the combination of the three metrics (relative basal area, relative density and relative frequency) of the Carolina ash was higher (23.5) than the remaining species listed. The combined metrics data from **Table 19A** are depicted graphically by species in **Figure 10**.

Table 19A
Important Canopy Species in Swamp Floodplain Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Taxodium distichum	bald cypress	OBL	69.65	27.93	16.95
Planera aquatica	planer tree	OBL	8.65	25.23	16.95
Quercus lyrata	overcup oak	OBL	5.27	5.41	6.78
Quercus laurifolia	laurel oak	FACW	3.34	3.60	8.47
Gleditsia aquatica	water locust	OBL	2.71	6.31	6.78
Betula nigra	river birch	OBL	1.99	9.46	3.39
Carya aquatica	water hickory	OBL	1.95	3.15	6.78
Fraxinus caroliniana	Carolina ash	OBL	1.74	9.91	11.86
Quercus virginiana	live oak	NL	1.34	0.45	1.69
Liquidambar styraciflua	Sweetgum	FACW	1.10	0.90	3.39
Acer rubrum	red maple	FACW	0.61	1.35	3.39
Ulmus Americana	American elm	FACW	0.51	1.35	1.69
6 other species[6]			1.13	4.95	11.86
TOTAL			**100.00**	**100.00**	**100.00**

Low Bottomland Hardwood Floodplain Community

In the low bottomland hardwood (blh-l) communities, 20 tree species were identified (**Table 19B**). The identified canopy species were a mixture of OBL, facultative wetland (FACW), Facultative (FAC), and upland plant species (**Table 19B**).

Based on the metrics provided in **Table 19B**, the three tree species with greatest species importance for the floodplain low bottomland hardwood community were the FACW species: laurel oak (*Quercus laurifolia*), musclewood (*Carpinus caroliniana*), and red maple (*Acer rubrum*) (**Figure 10**). Of the three species, laurel oak had the highest relative basal area, musclewood had the highest relative density, and the combination of the three metric values for

[6] Species importance tables list the 12 most important species and lump remaining species, with low importance values, together. Light et al. (2002) had a similar approach.

the red maple was higher (30.9) than the remaining species identified in **Table 19B**. The combined metrics data from **Table 19B** are depicted graphically by species in **Figure 10**.

Table 19B
Important Canopy Species in Low Bottomland Hardwood Floodplain Community

Scientific Name	**Common Name**	**FDEP Status**	**Relative Basal Area**	**Relative Density**	**Relative Frequency**
Quercus laurifolia	laurel oak	FACW	39.55	17.12	14.55
Quercus virginiana	live oak	NL	14.02	2.72	4.55
Carya aquatica	water hickory	OBL	11.82	7.39	9.09
Acer rubrum	red maple	FACW	8.05	12.84	10.00
Liquidambar styraciflua	sweetgum	FACW	5.28	6.23	9.09
Carpinus caroliniana	musclewood	FACW	4.65	19.84	8.18
Betula nigra	river birch	OBL	4.52	14.40	8.18
Ulmus americana	American elm	FACW	2.25	5.84	9.09
Taxodium distichum	bald cypress	OBL	1.67	2.72	3.64
Pinus taeda	loblolly pine	NL	1.62	0.78	1.82
Quercus lyrata	overcup oak	OBL	1.55	0.78	1.82
Ulmus crassifolia	cedar elm	FACW	1.46	1.17	1.82
8 other species			3.55	8.17	18.18
TOTAL			**100.00**	**100.00**	**100.00**

High Bottomland Hardwood Floodplain Community

In the high bottomland hardwood (blh-h) communities, 19 tree species were identified (**Table 19C**). The identified canopy species were a mixture of OBL, FACW, FAC, and upland plant species (**Table 19C**). The most important canopy species observed within the floodplain high bottomland hardwood community were the FACW species: laurel oak, red maple, and musclewood; the same species as the low bottomland hardwood community. In the high bottomland hardwood community, laurel oak had the highest relative basal area, red maple the highest relative frequency of the three species, and the combination of the three metric values for the musclewood was higher (22.0) than the remaining species identified in **Table 19C**. Data from **Table 19C** are depicted graphically in **Figure 10**.

Although the canopy composition overlaps significantly between the blh-h and blh-l communities, they differ in their percent herbaceous cover and wetland taxa proportions **(Table 18**). These differences may reflect potential variances in sensitivity to hydrologic conditions, indicating some value to utilizing forest structure as well as species composition when defining and assessing floodplain communities for MFL studies.

Table 19C
Important Canopy Species in High Bottomland Hardwood Floodplain Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Quercus laurifolia	laurel oak	FACW	23.12	14.86	8.77
Quercus virginiana	live oak	NL	16.76	2.03	3.51
Liquidambar styraciflua	sweetgum	FACW	14.73	14.86	10.53
Taxodium distichum	bald cypress	OBL	10.29	6.08	5.26
Acer rubrum	red maple	FACW	8.29	10.81	12.28
Carya aquatica	water hickory	OBL	4.19	4.05	3.51
Betula nigra	river birch	OBL	4.03	8.78	5.26
Ulmus americana	American elm	FACW	2.74	8.11	8.77
Carpinus caroliniana	musclewood	FACW	2.69	8.78	10.53
Quercus nigra	water oak	FACW	2.66	3.38	5.26
Quercus michauxii	swamp chesnut oak	FACW	2.18	0.68	1.75
Celtis occidentalis	hackberry	NL	2.17	3.38	5.26
7 other species			6.14	14.19	19.30
TOTAL			**100.00**	**100.00**	**100.00**

Upland Floodplain Community

The upland communities observed in the project area during the study revealed the greatest vegetative diversity in the canopy stratum with a total of 25 species observed (**Table 19D**). While the majority of canopy species were upland species, there were also OBL, FACW, and FAC species observed in the upland communities. Based on the relative basal area, relative density, and relative frequency of occurrence metrics, the three most important canopy species for this community were the live oak (upland species), water oak (*Quercus nigra*), and laurel oak; the water oak and laurel oak are FACW category species. Data from **Table 19D** are depicted graphically in **Figure 10**.

Table 19D
Important Canopy Species in Upland Floodplain Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Quercus virginiana	live oak	UP	35.01	14.16	12.58
Quercus nigra	water oak	FACW	15.42	18.79	14.57
Quercus laurifolia	laurel oak	FACW	11.63	6.94	9.93
Liquidambar styraciflua	sweetgum	FACW	7.32	8.09	8.61
Pinus taeda	loblolly pine	UP	7.27	2.89	5.30
Nyssa sylvatica	swamp tupelo	OBL	5.10	5.49	9.27
Acer rubrum	red maple	FACW	4.98	13.87	9.27
Carya glabra	pignut hickory	UP	3.52	3.76	2.65
Carpinus caroliniana	musclewood	FACW	2.32	9.83	6.62
Juniperus virginiana	red cedar	UP	1.38	1.45	1.32
Ilex opaca	American holly	FAC	1.36	4.34	4.64
Ulmus Americana	American elm	FACW	1.19	2.60	2.65
13 other species			3.51	7.80	12.58
TOTAL			**100.00**	**100.00**	**100.00**

General Comments, Floodplain Communities

Eight canopy species appear in all four floodplain communities (swamp, low bottomland hardwood, high bottomland hardwood, and upland) (**Figure 10**):

- Water hickory (*Carya aquatica*) and river birch (*Betula nigra*) (OBL species);
- Laurel oak, red maple, sweetgum (*Liquidambar styraciflua*), and American elm (*Ulmus americana*) (FACW species);
- Common persimmon (*Diospyros virginiana*) (FAC);
- Live oak (upland).

As anticipated, there are more OBL species in the canopy of the swamp community; more FAC and upland tree species in the upland community; and a mix of OBL, FACW, FAC, and upland trees in the BLH-L and BLH-H communities. The important canopy species for each community correspond accordingly, e.g. the top three important species for the swamp community are OBL species.

Spring Communities

The previously identified six communities associated with the spring runs are discussed below:

- Spring run/Valley flat swamp,
- Valley flat swamp,
- Slope swamp,

- Hydric hammock/Upper slope swamp,
- Upland hammock, and
- Upland palmetto.

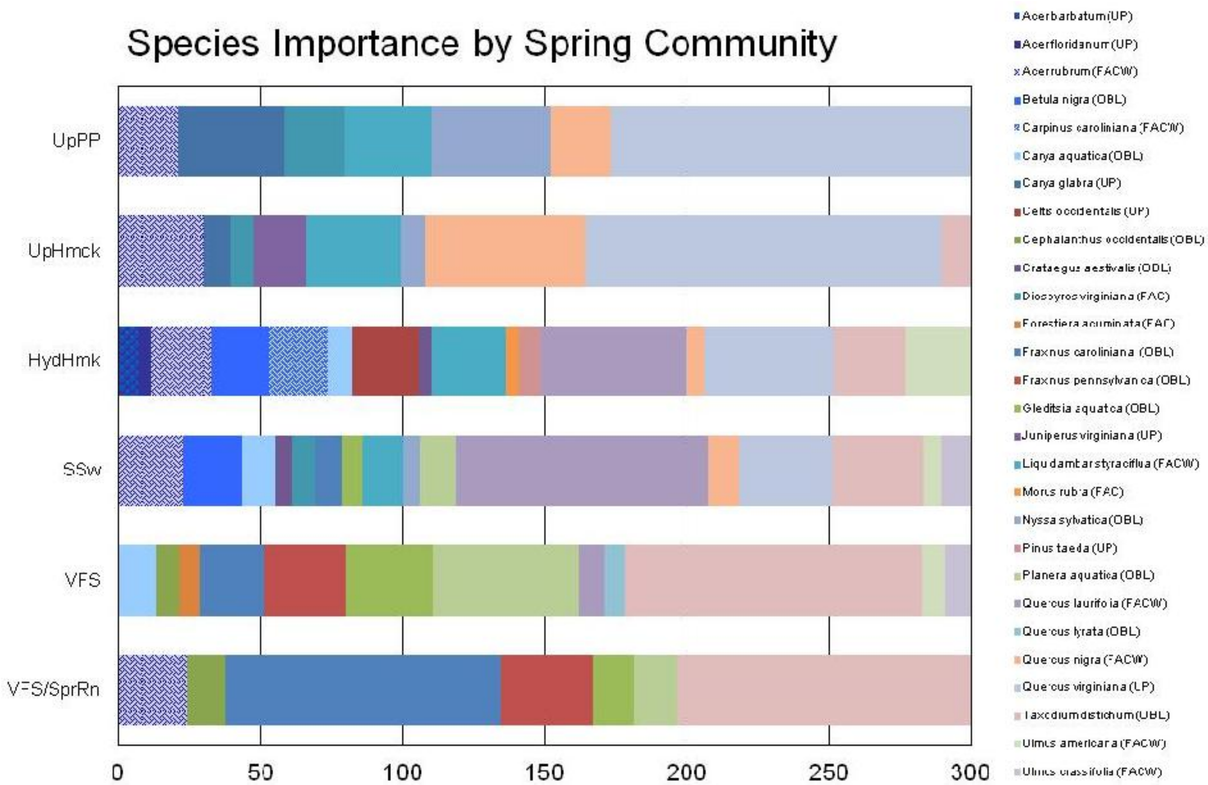
A full list of all vegetative species observed within monitoring plots throughout the MSR spring communities, which includes 28 canopy species, 54 understory species, and 80 groundcover species, is provided in **Appendix B**. **Table 20** summarizes these findings by spring community and by stratum. Based on this table, valley flat swamps/spring runs had the highest percent of species coverage by FACW or OBL plants, while spring uplands had the lowest (as would be expected). Species diversity was highest in the uplands for both understory and groundcover species, but was highest in the slope swamp and hydric hammock communities for the tree stratum.

Canopy species were further analyzed by combining data from plots of the same pre-designated community types to determine species importance values for each observed tree species. Depictions of summarized canopy species importance values by spring community are provided in **Figure 12**, respectively. Vegetative monitoring results by each community type are described in more detail in the following sections.

Table 20
Summary of Spring Vegetative Monitoring by Community and Stratum

Stratum	VFS/SprRn	VFS	SSw	HYDHMK	UP
# of Plots	2	4	5	5	5
Avg # of Trees per plot	27	19	14	16	13
Avg % Trees FACW or OBL per plot	100%	98%	91%	76%	48%
Avg # of Tree Species per plot	5	5	5	7	5
Total # of Tree Species among plots	7	12	16	16	9
Avg % Understory Cover per plot	35	42	20	28	71
Avg % Understory Cover FACW or OBL per plot	100%	97%	83%	71%	40%
Avg # of Understory Species per plot	5	5	10	9	13
Total # of Understory Species among plots	6	11	24	25	32
Avg % Herbaceous Cover per plot	5	14	24.2	28.2	16.8
Avg % Herbaceous Cover FACW or OBL per plot	62%	55%	26%	24%	22%
Avg # of Herbaceous Species per plot	5	10	17	16	15
Total # of Herbaceous Species among plots	7	30	43	38	47
Avg % Bare Ground per plot	NA	NA	80%	78%	83%

Figure 12
Species Importance by Preliminary Spring Community



<u>Spring-Run/Valley Flat Swamp Spring Community</u>

The SprRn/VFS designation was given to plots sampled within Peacock Springs, which did not have a well-defined spring run channel but rather a diffuse, fully-vegetated channel. Seven tree species were identified in the SprRn/VFS community (**Table 21A**); all the species are categorized as OBL species, except for red maple, which is a FACW species. The three most important canopy species observed in this community within the project area were: bald cypress, Carolina ash, and green ash (*Fraxinus pennsylvanica*), all OBL plant species (**Table 21A**). Data from **Table 21A** are depicted graphically in **Figure 12**.

Table 21A
Important Canopy Species in Spring Run/Valley Flat Swamp Spring Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Taxodium distichum	bald cypress	OBL	60.55	20.75	22.22
Fraxinus pennsylvanica	green ash	OBL	13.73	7.55	11.11
Acer rubrum	red maple	FACW	11.35	1.89	11.11
Fraxinus caroliniana	Carolina ash	OBL	10.68	64.15	22.22
Planera aquatica	planer tree	OBL	2.01	1.89	11.11
Gleditsia aquatica	water locust	OBL	1.52	1.89	11.11
Cephalanthus occidentalis	buttonbush	OBL	0.16	1.89	11.11
TOTAL			**100.00**	**100.00**	**100.00**

Valley Flat Swamp Spring Community

Eleven tree species were identified in the VFS community (**Table 21B**); a mixture of OBL and FACW categorized plant species. The three most important canopy species observed in the VFS community were bald cypress, planer tree, and water locust (*Gleditsia aquatica*), all OBL plant species (**Table 21B**). Data from **Table 21B** are depicted graphically in **Figure 12**.

Table 21B
Important Canopy Species in Valley Flat Swamp Spring Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Taxodium distichum	bald cypress	OBL	49.37	35.14	20.00
Planera aquatica	planer tree	OBL	33.47	8.11	10.00
Fraxinus pennsylvanica	green ash	OBL	5.85	17.57	5.00
Gleditsia aquatica	water locust	OBL	3.42	12.16	15.00
Quercus laurifolia	laurel oak	FACW	2.71	1.35	5.00
Ulmus crassifolia	cedar elm	FACW	1.31	2.70	5.00
Fraxinus caroliniana	Carolina ash	OBL	1.15	12.16	10.00
Carya aquatica	water hickory	OBL	0.84	2.70	10.00
Ulmus Americana	American elm	FACW	0.76	2.70	5.00
Cephalanthus occidentalis	Buttonbush	OBL	0.45	2.70	5.00
Quercus lyrata	overcup oak	OBL	0.38	1.35	5.00
Forestiera segregate	swamp privet	FAC	0.29	1.35	5.00
TOTAL			**100.00**	**100.00**	**100.00**

Slope Swamp Spring Community

In the SSw community, 16 canopy species were identified (**Table 21C**); a mixture of OBL, FACW, and upland species. The three most important canopy species observed in the SSw community were laurel oak, live oak, and bald cypress; FACW, upland, and OBL species, respectively (**Table 21C**). Data from **Table 21C** are depicted graphically in **Figure 12**.

Table 21C
Important Canopy Species in Slope Swamp Spring Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Quercus laurifolia	laurel oak	FACW	35.75	36.23	16.67
Quercus virginiana	live oak	NL	21.42	2.90	8.33
Taxodium distichum	bald cypress	OBL	8.09	11.59	12.50
Planera aquatica	planer tree	OBL	6.99	1.45	4.17
Carya aquatica	water hickory	OBL	6.16	1.45	4.17
Betula nigra	river birch	OBL	4.68	11.59	4.17
Acer rubrum	red maple	FACW	4.53	10.14	8.33
Quercus nigra	water oak	FACW	3.99	2.90	4.17
Ulmus crassifolia	cedar elm	FACW	2.06	4.35	4.17
Liquidambar styraciflua	Sweetgum	FACW	1.80	4.35	8.33
Gleditsia aquatica	water locust	OBL	1.38	1.45	4.17
Fraxinus caroliniana	Carolina ash	OBL	1.09	4.35	4.17
4 other species			2.06	7.25	16.67
TOTAL			**100.00**	**100.00**	**100.00**

Hydric Hammock/Upper Slope Swamp Spring Community

In the HydHmk community, 16 canopy species were identified (**Table 21D**); a mixture of OBL, FACW, and upland categorized plant species. The three most important canopy species observed in the HydHmk community were laurel oak, live oak, and sweetgum; FACW, upland, and FACW species, respectively (**Table 21D**). Data from **Table 21D** are depicted graphically in **Figure 12**.

Table 21D
Important Canopy Species in Hydric Hammock Spring Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Quercus virginiana	live oak	NL	31.43	4.88	9.09
Quercus laurifolia	laurel oak	FACW	20.85	18.29	12.12
Taxodium distichum	bald cypress	OBL	9.18	7.32	9.09
Liquidambar styraciflua	sweetgum	FACW	8.16	12.20	6.06
Ulmus Americana	American elm	FACW	6.31	7.32	9.09
Betula nigra	river birch	OBL	4.11	9.76	6.06
Acer rubrum	red maple	FACW	3.73	8.54	9.09
Celtis occidentalis	hackberry	NL	3.60	10.98	9.09
Pinus taeda	loblolly pine	NL	3.47	1.22	3.03
Carya aquatica	water hickory	OBL	2.82	2.44	3.03
Acer barbatum	Florida maple	NL	2.73	1.22	3.03
Carpinus caroliniana	musclewood	FACW	1.91	9.76	9.09
4 other species			1.70	6.10	12.12
TOTAL			**100.00**	**100.00**	**100.00**

<u>Upland Hammock Spring Community</u>

In the UpHmk community, nine canopy species were identified (**Table 21E**); a mixture of OBL, FACW, FAC, and upland categorized plant species. The three most important canopy species observed in the UpHmk community were laurel oak, water oak, and sweetgum; all FACW species (**Table 21E**). Data from **Table 21E** are depicted graphically in **Figure 12.**

Table 21E
Important Canopy Species in Upland Hammock Spring Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Quercus virginiana	live oak	NL	76.58	29.79	18.75
Quercus nigra	water oak	FACW	10.04	27.66	18.75
Liquidambar styraciflua	sweetgum	FACW	3.90	17.02	12.50
Juniperus virginiana	red cedar	NL	3.43	8.51	6.25
Acer rubrum	red maple	FACW	2.90	8.51	18.75
Taxodium distichum	bald cypress	OBL	2.12	2.13	6.25
Carya glabra	pignut hickory	NL	0.63	2.13	6.25
Diospyros virginiana	common persimmon	FAC	0.21	2.13	6.25
Nyssa sylvatica	swamp tupelo	OBL	0.19	2.13	6.25
TOTAL			**100.00**	**100.00**	**100.00**

Upland Palmetto Spring Community

In the UpPP community, seven canopy species were identified (**Table 21F**); a mixture of OBL, FACW, FAC, and upland categorized plant species. The three most important canopy species observed in the UpPP community were live oak, swamp tupelo, and pignut hickory (*Carya glabra*); upland, OBL, and upland species, respectively (**Table 21F**). Data from **Table 21F** are depicted graphically in **Figure 12.**

Table 21F
Important Canopy Species in Upland Palmetto Spring Community

Scientific Name	Common Name	FDEP Status	Relative Basal Area	Relative Density	Relative Frequency
Quercus virginiana	live oak	NL	67.76	44.44	14.29
Carya glabra	pignut hickory	NL	11.84	11.11	14.29
Nyssa sylvatica	swamp tupelo	OBL	10.94	16.67	14.29
Liquidambar styraciflua	sweetgum	FACW	5.36	11.11	14.29
Quercus nigra	water oak	FACW	1.53	5.56	14.29
Acer rubrum	red maple	FACW	1.33	5.56	14.29
Diospyros virginiana	common persimmon	FAC	1.24	5.56	14.29
TOTAL			**100.00**	**100.00**	**100.00**

4.3 Soils of MSR Floodplains and Springs

From a total of 101 plots, 73% were classified as hydric soils and 27% were classified as upland soils. **Figure 13** provides a summary of the distribution of hydric and upland soils within each transect. As expected, the MSR has a higher concentration of upland soils in the upper portion of the project area and a higher concentration of hydric soils in the lower portion. The most predominant indicator of hydric soils was redox of iron, followed by stripping of carbon and presence of organic bodies **(Appendix B**, Soils Database). A detailed description of each plot within each transect is provided in **Appendix B** (Soils Database). Peat and thick muck layers were largely absent. This is largely a floodplain surface developed from alluvial rather than biological genesis.

The distribution of soil types, based on texture (particle size), within each community and transect are provided in **Figures 14 and 15**, respectively. Overall, **Figure 14** shows sandy soils are the most predominant soil type across all communities. Specifically for the upland hammocks (UpHmck) and the uplands with an understory dominated by saw palmetto (UpPP) spring run communities, where the transects were exclusively composed of sandy soils. Higher concentration of clays, or a combination of clay with sand and silt, was found on swamps (sw) and low bottomland hardwood forests (blh-l).

In general, **Figure 15** shows a higher abundance of sandy and clay soils in the upper portions of the MSR and a higher abundance of silty soils (silt, loam, silty clay) in the lower portions of the MSR. Spring run transects also showed a higher abundance of silty soils.

Figure 13
Distribution of Hydric and Upland Soils within Transects

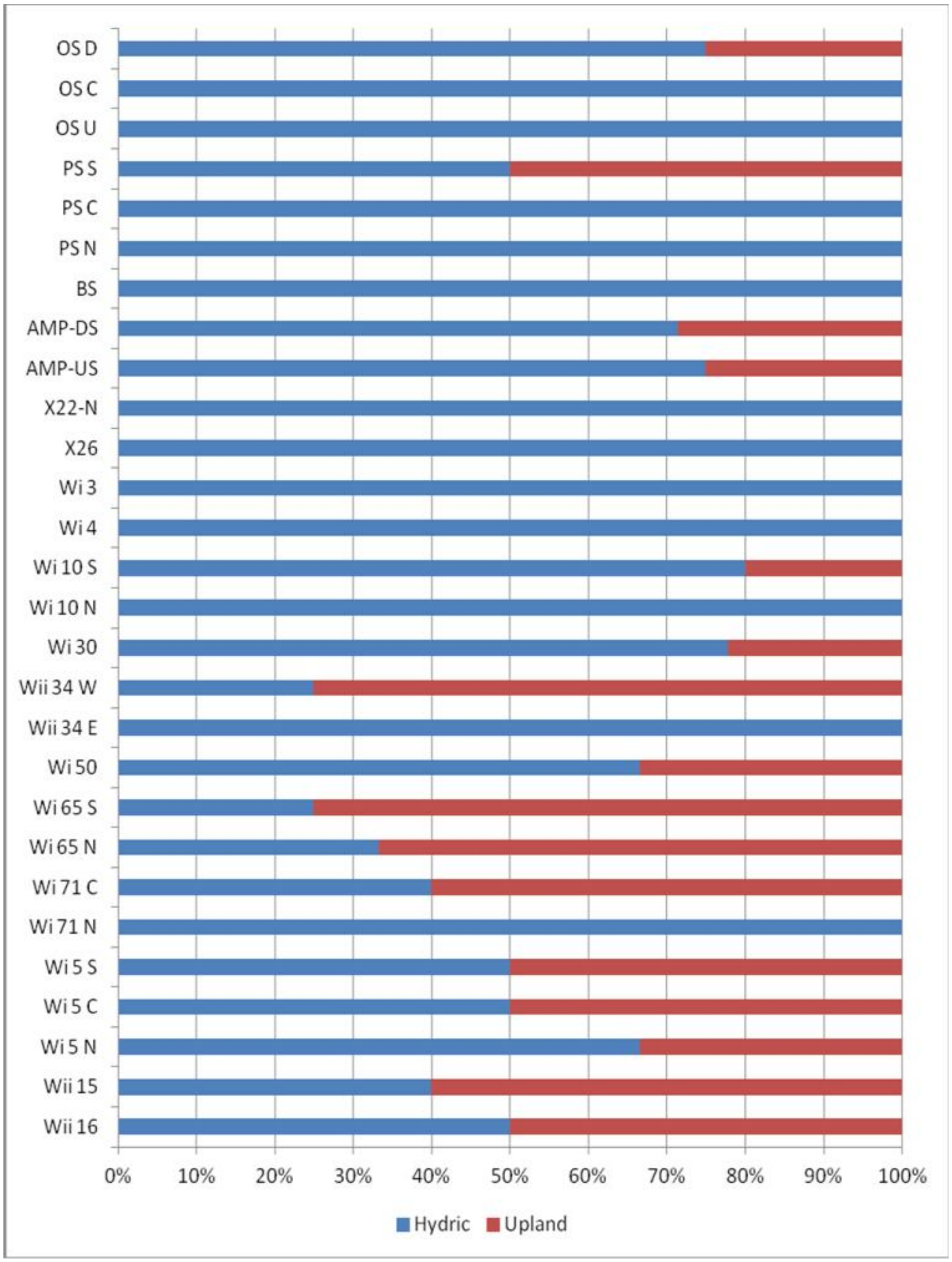


Figure 14
Distribution of Soils within Each Community

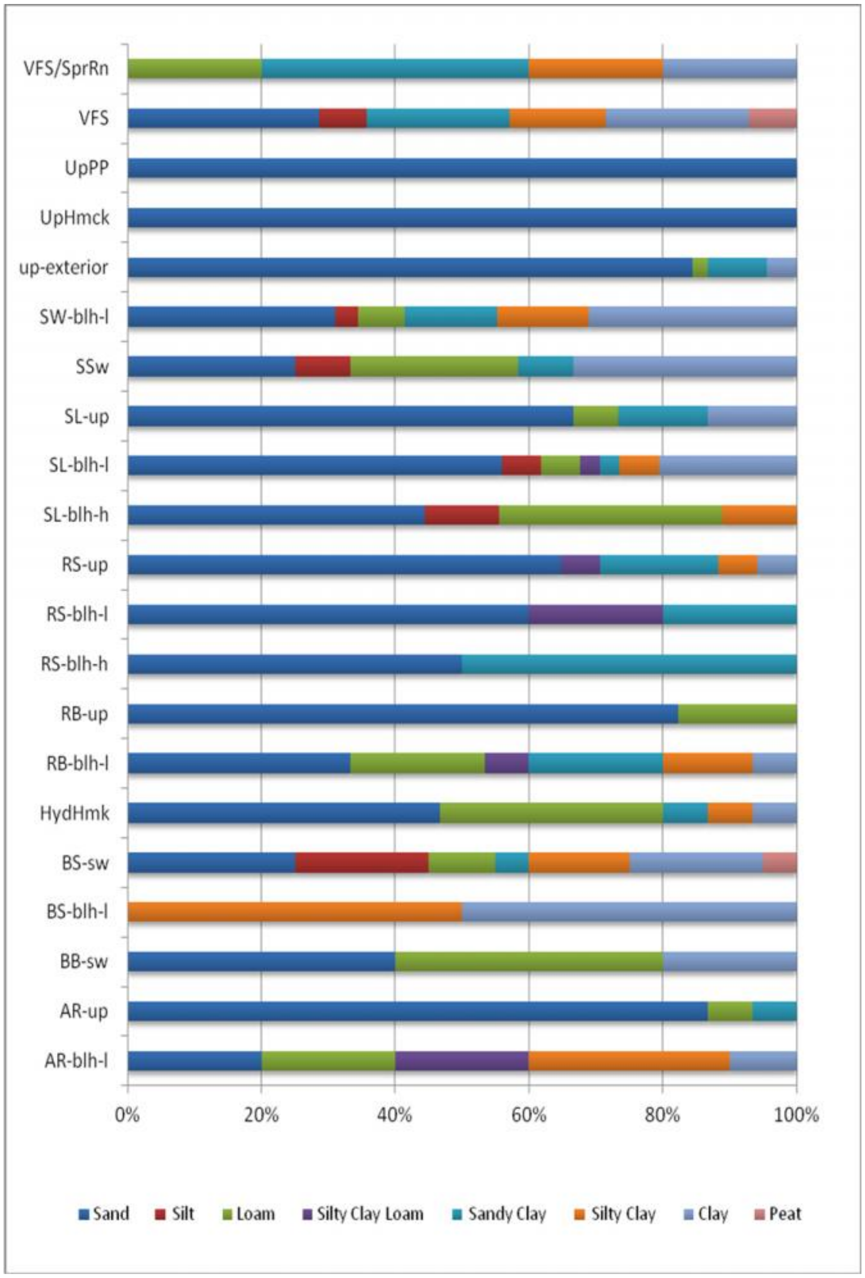
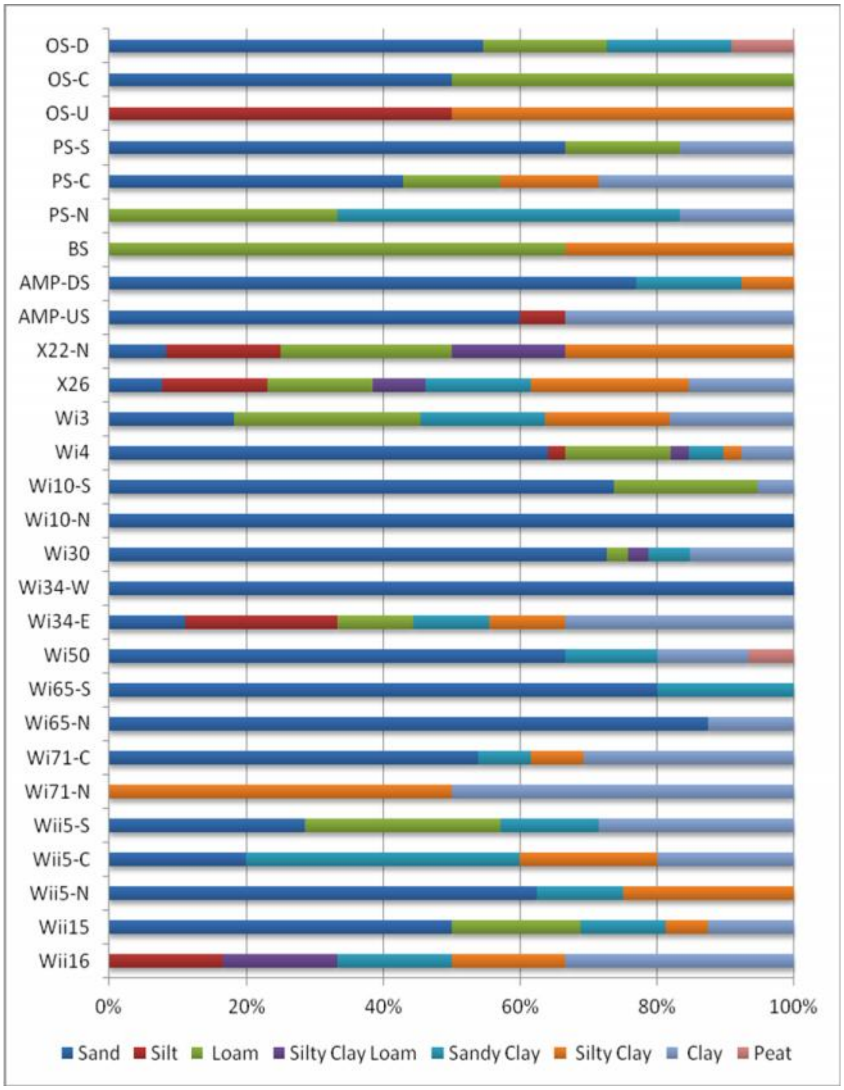


Figure 15
Distribution of Soils within Each Transect



4.4 Bankfull Indicators of MSR Streambanks

A summary of the bankfull indicators identified and surveyed on the banks of the MSR is provided in **Table 22**. Photographs of the streambanks with the indicators flagged are provided in **Appendix C**, and **Appendix D** provides transect cross-sections with the bankfull indicators plotted. Lower inflections (BKF-I) and scour lines (BKF-S) on the bank were the most prevalent/consistent bankfull indicator observed along the banks of the MSR. The elevation of rock outcroppings (BKF-ROCK) was limited to the upper portion of the study area (Reach 2) where exposed karst features are more dominant. The lower extent of the tree line (BKF-TREE) and the lower extent of the saw palmetto (BKF-PALM) were both fairly consistent indicators, though are too low and too high on the bank, respectively, to be considered the breakpoint between erosion and deposition. During bankfull identification fieldwork, Amec Foster Wheeler observed in the upper reaches of the MSR that when rock out-croppings occurred on one side of the river, they did not occur on the other.

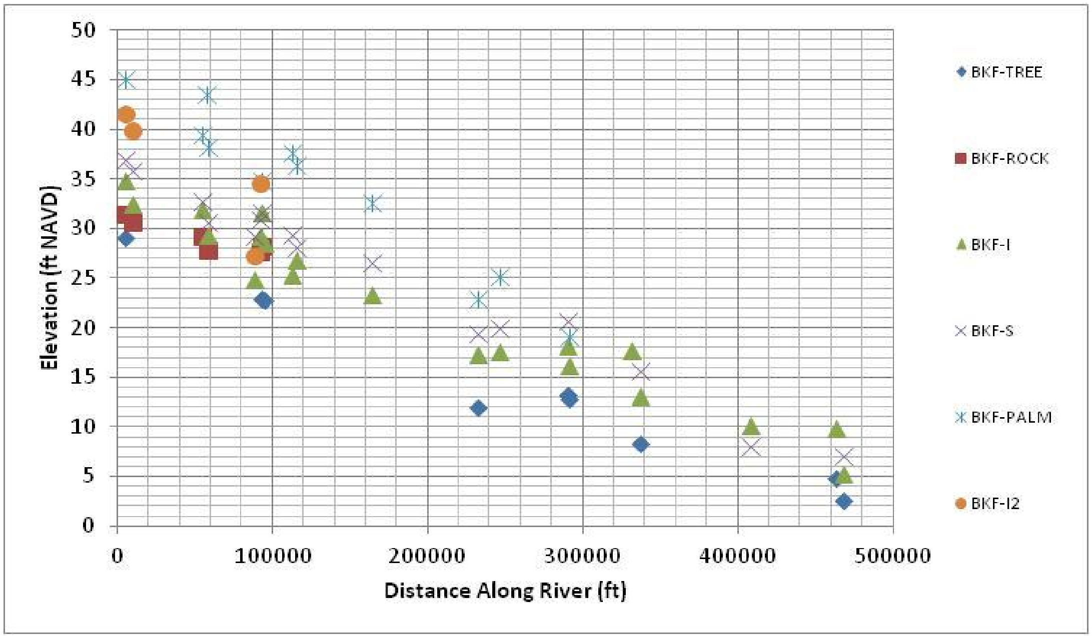
Table 22
Floodplain Bankfull Indicators Elevation Summary

Transect	Distance Along River (ft)	BKF-TREE Elevation (ft NAVD)	BKF-ROCK Elevation (ft NAVD)	BKF-I Elevation (ft NAVD)	BKF-S Elevation (ft NAVD)	BKF-I2 Elevation (ft NAVD)	BKF-PALM Elevation (ft NAVD)	BKF-F Elevation (ft NAVD)
Wii16	4915	29.01	31.48	34.74	36.84	41.49	45.00	
Wii15	10072		30.52	32.34	35.70	39.80		
Wii5N	55115		29.20	31.77	32.73		39.41	
Wii5C	57392						43.46	
Wii5S	58687		27.81	29.29	30.55		38.19	
Wi71N	92187		27.58	29.22	30.90	34.46		
Wi71C	93278	22.86	28.24	31.51	31.51		34.77	
Wi71S	94612	22.78		28.48				
Wi65N	112560			25.28	29.36		37.65	
Wi65S	115729			26.82	28.05		36.33	
Wi50	163890			23.27	26.55		32.54	
Wi34E	232815	11.98		17.22	19.31		22.85	
Wi30	246347			17.52	19.86		25.04	
Wi10N	290328	13.15		18.14	20.55			
Wi10S	291465	12.83		16.12			19.07	
Wi4	331799			17.71				
Wi3	337287	8.32		13.03	15.63			
X26N	408336			10.05	7.98			14.08
X22N	463165	4.81		9.83				
X22S	467671	2.59		5.16	7.03			
TOTAL		**9**	**6**	**19**	**15**	**3**	**11**	**1**

The various bankfull elevations were plotted versus distance along the river (**Figure 16**). Based on this graph, the indicator elevations generally decrease as one goes down the river, which is expected; however, there is not one indicator that can be deemed the most reliable indicator. In an effort to develop a “best fit” equation, the average of the two most consistent indicators (BKF-I and BKF-S) was plotted for each station (**Figure 17**). This is a reasonable estimate of the breakpoint between deposition and erosion, because this transition is where perennial vegetation (grasses) typically became present (below this, groundcover was generally void). The equation of this best fit line can be used to predict bankfull stages at various locations along the river. This best fit line will be entered into the HEC-RAS model in future analyses to estimate the bankfull discharge. The bankfull discharge is an important flow event for channel maintenance and should be considered in the establishment of MFLs.

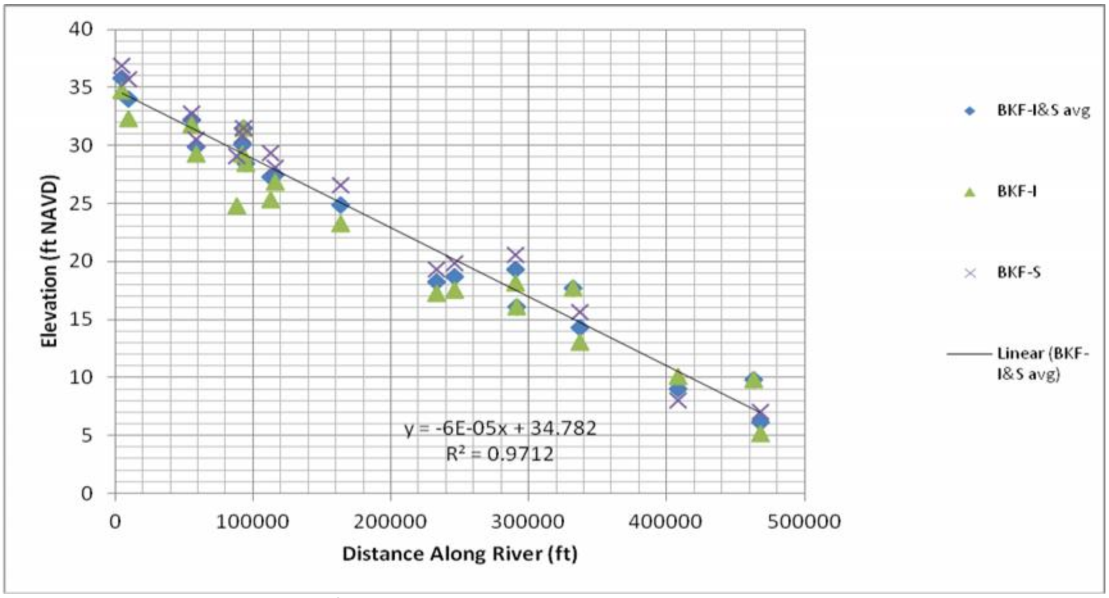
Bankull elevations may also provide a good baseline from which to determine “relative elevations” for each transect so that comparisons can be made among transects occurring at different locations and elevations along the river. Various methods for determining relative elevations include setting the “zero” as the lowest point on the transect or using the elevation of the streambed as the zero. Both of these latter methods may problematic for the MSR, however, because 1) the minimum elevation for one transect along the MSR may be within a deep backswamp, whereas the minimum elevation for another transect may be within a shallow swale, resulting in inconsistent zero elevations; 2) streambeds are dynamic (constantly changing) and selected points may not be consistently located at riffles or pools, resulting in inconsistent zero elevations. Therefore, the bankfull profile should provide a constant slope down the river that will allow for a consistent zero for determining relative elevations. This approach will be tested in future analyses.

Figure 16
Floodplain Bankfull Indicator Elevations



Note: Distance along river is from upstream (0) to downstream

Figure 17
Floodplain Bankfull Indicator Elevations – Best Field Fit

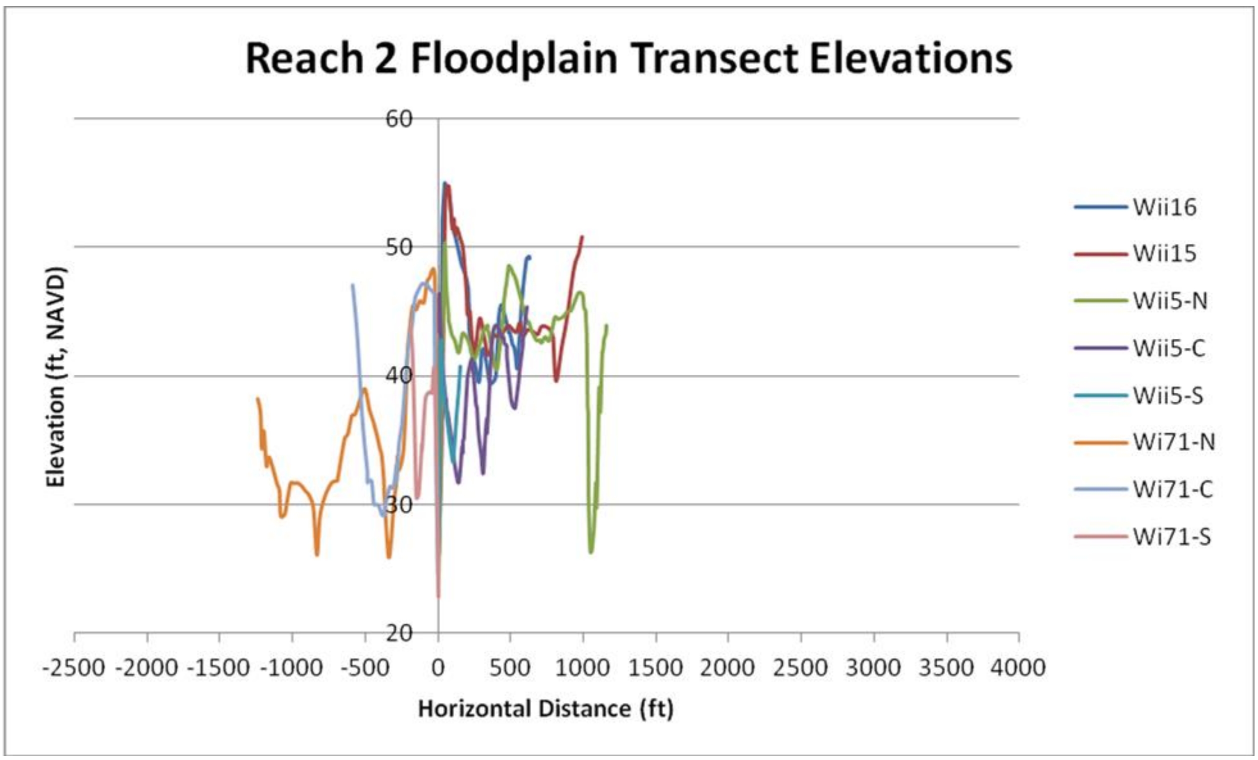


Note: Distance along river is from upstream (0) to downstream

4.5 Elevations of MSR Floodplains and Springs

Cross-sections developed for each transect are available in **Appendix D**, and graphs showing all cross-sections together are provided below (**Figures 18 and 19**). Elevations in the project area ranged from a minimum of 0.36 ft NAVD at Otter Springs (the downstream-most location) to 55.03 ft NAVD at Wii16 (the upstream-most location). **Figure 20** shows the range of floodplain transect elevations versus distance along the river, indicating that the transects consistently provided relief spanning about 15 feet. As previously mentioned, future analyses will attempt to put all floodplain transects into a relative elevation based on bankfull stage so that transects and associated communities can be compared to each other. **Figure 21** shows the range of spring transect relative elevations by community type. Relative elevations were determined by setting the lowest observed elevation along each transect to zero. This was an appropriate approach for spring transects because the minimum elevation on all transects corresponded to the same community type (SprRn). As can be seen in **Figure 21**, the lower the elevation, the "wetter" the community; and the higher the elevation, the "drier" the community (as expected). Floodplain community types should follow that same pattern.

Figure 18A
Floodplain Transect Elevations – All Floodplain Transects Combined (Reach 2)



Note: Zero on the x-axis represents the riverbank. Positive horizontal distances indicate a right bank transect (when facing downstream); negative horizontal distances indicate a left bank transect (when facing downsteam).

Figure 18B
Floodplain Transect Elevations – All Floodplain Transects Combined (Reach 3)

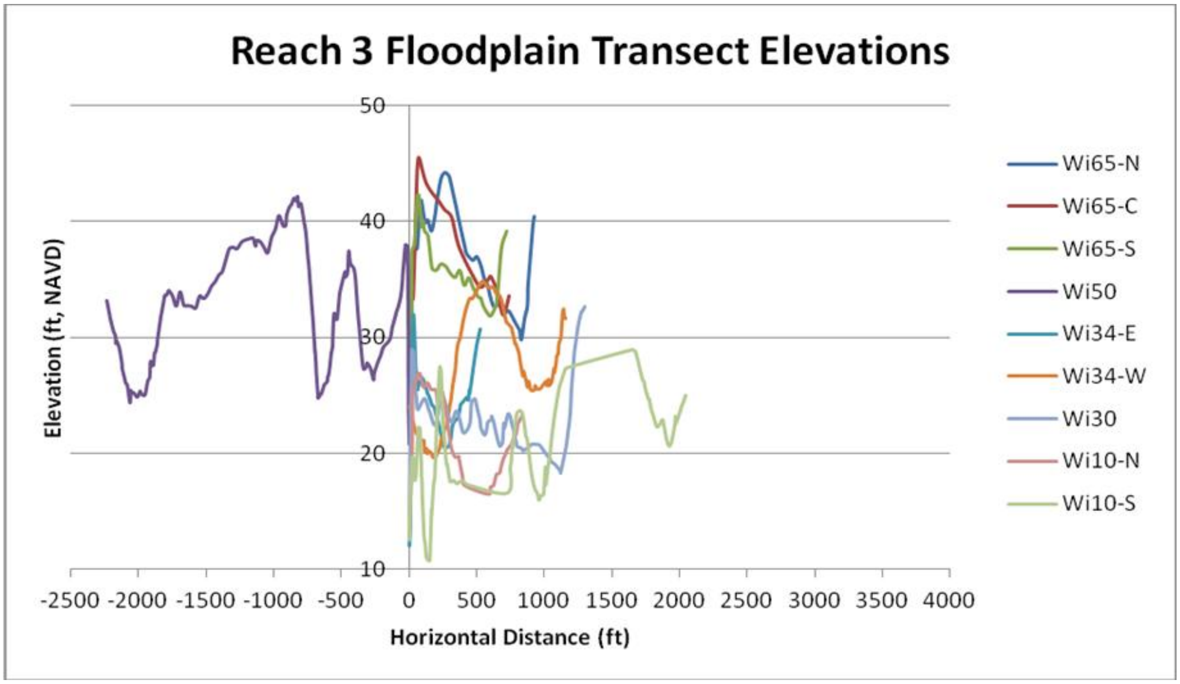


Figure 18C
Floodplain Transect Elevations – All Floodplain Transects Combined (Reach 4)

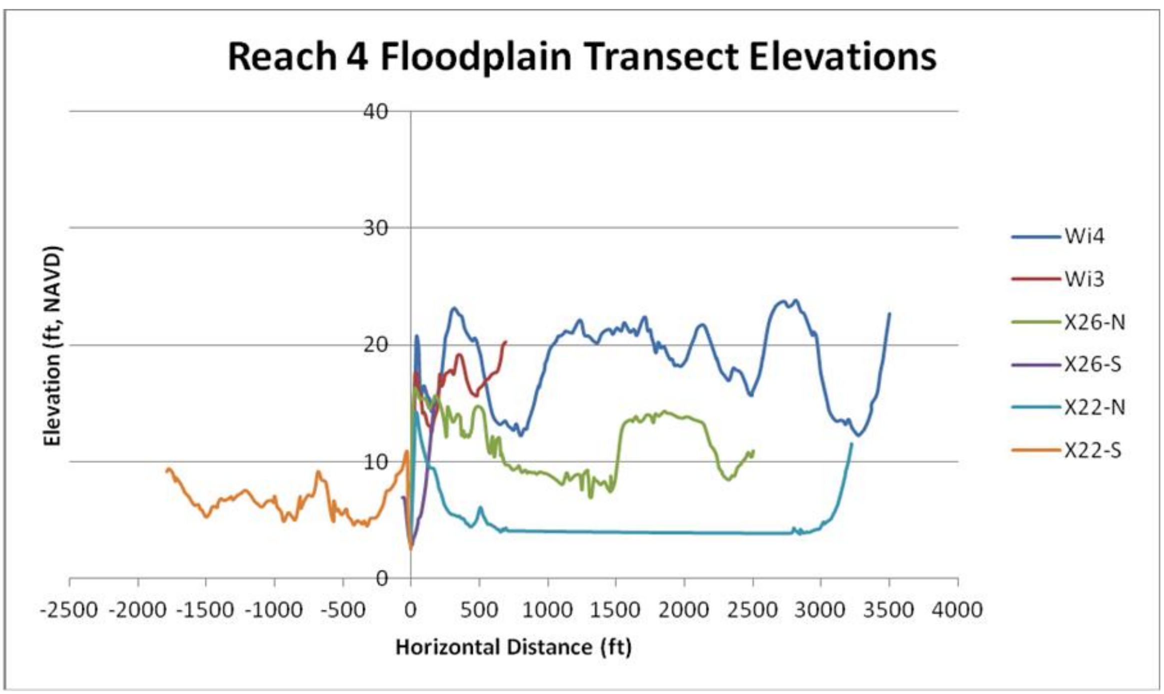
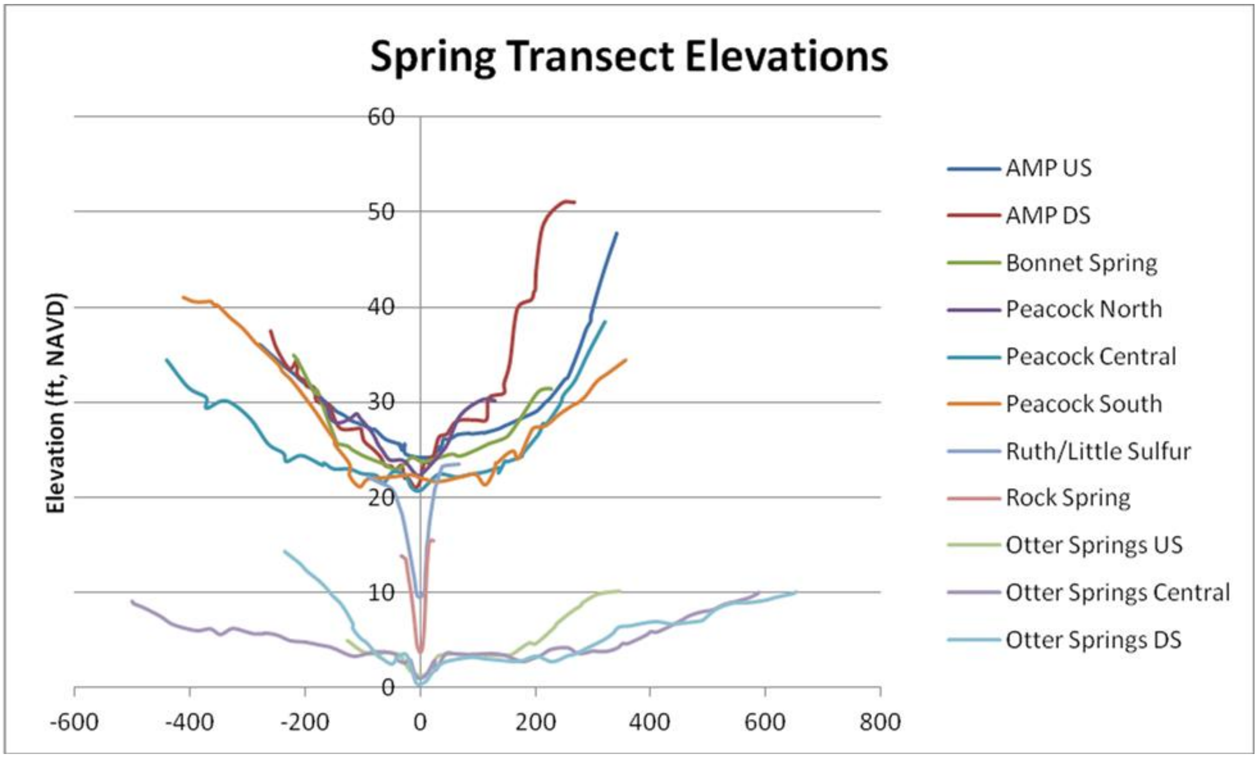
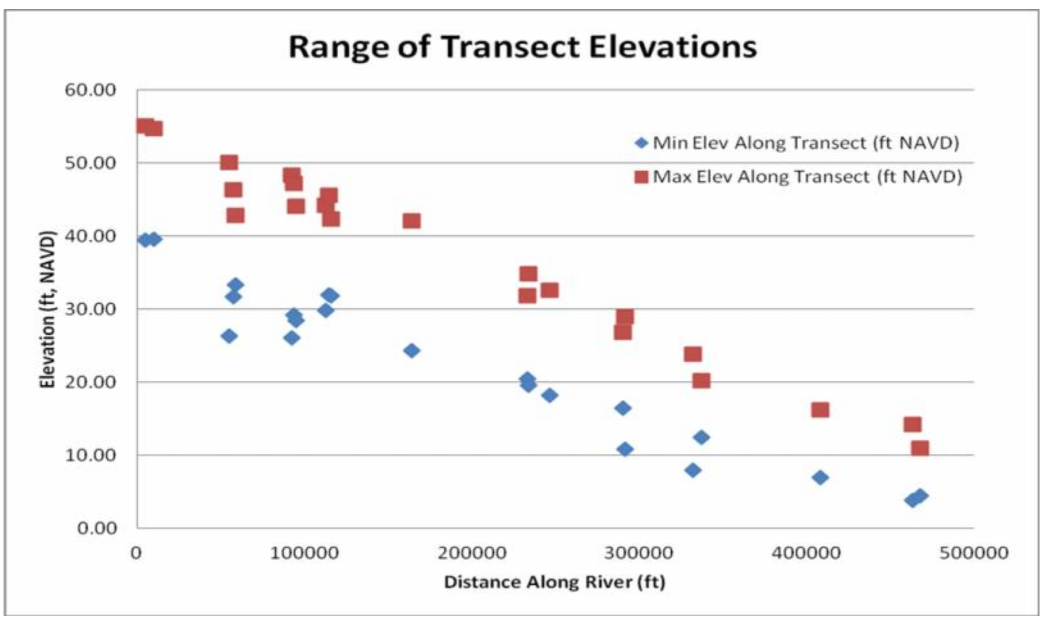


Figure 19
Spring Transect Elevations – All Transects Combined



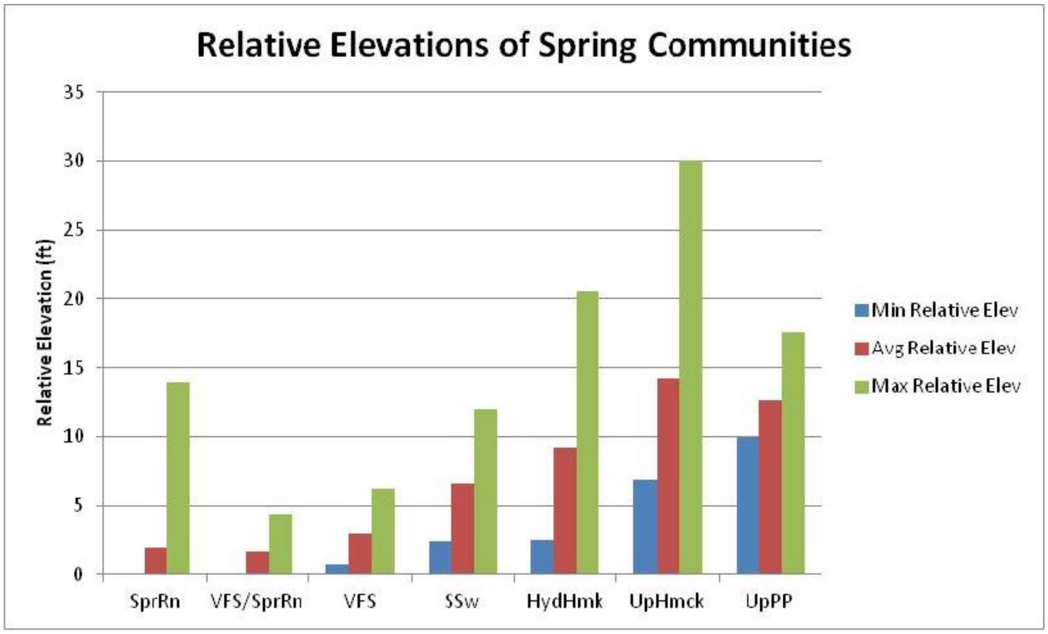
Note: Zero on the x-axis represents the center of the spring run. Positive horizontal distances indicate the right side of the transect (when facing downstream); negative horizontal distances indicate the left side of the transect (when facing downstream).

Figure 20
Range of Floodplain Transect Elevations



Note: Distance along river is from upstream (0) to downstream

Figure 21
Range of Elevations by Spring Community



4.6 Hydrology of MSR Floodplains and Springs

Hydrographs and stage duration curves were developed for each of the 31 hydrecological monitoring stations using daily mean water level data collected between November 2013 and November 2014 (**Appendix E**). Summary graphs showing water level data from the "north" (upstream of Wi30) and "south" (downstream of Wi30) stations are provided in **Figures 22A and 22B**. During the period of record, the MSR experienced an approximate 5-year flood in late April 2014, and water levels recorded in the hydroecological monitoring stations fluctuated by as much as 28 feet. Note that the north sites have a higher "peak" than the south sites. This is likely the result of a more constricted floodplain in the upstream (north) reaches, causing the water surface to respond more dramatically to discharge. In the downstream (south) reaches, the floodplain is more extensive and water surface elevation has a dampened peak because the water can spread out further over the floodplain. Energy is also generally dissipated as the flood wave progresses downstream, which further reduces flood stage, especially when the event is sourced from rainfall occurring in the upper watershed.

To determine if local rainfall (from rainfall data) or if river stage (from the nearest long-term USGS gage) had a greater influence on water surface elevations within MSR floodplain and spring communities, these data were plotted on the MSR hydrographs to visualize responses of wetland water levels to those factors (**Appendix E**). It appears that wetland water levels respond to both factors, but correspond exceptionally well with river stage. Future hydrologic data analyses will be conducted to further investigate wetland water level responses.

Figure 22A
Hydroecological Monitoring Stations Water Level Summary – North Sites

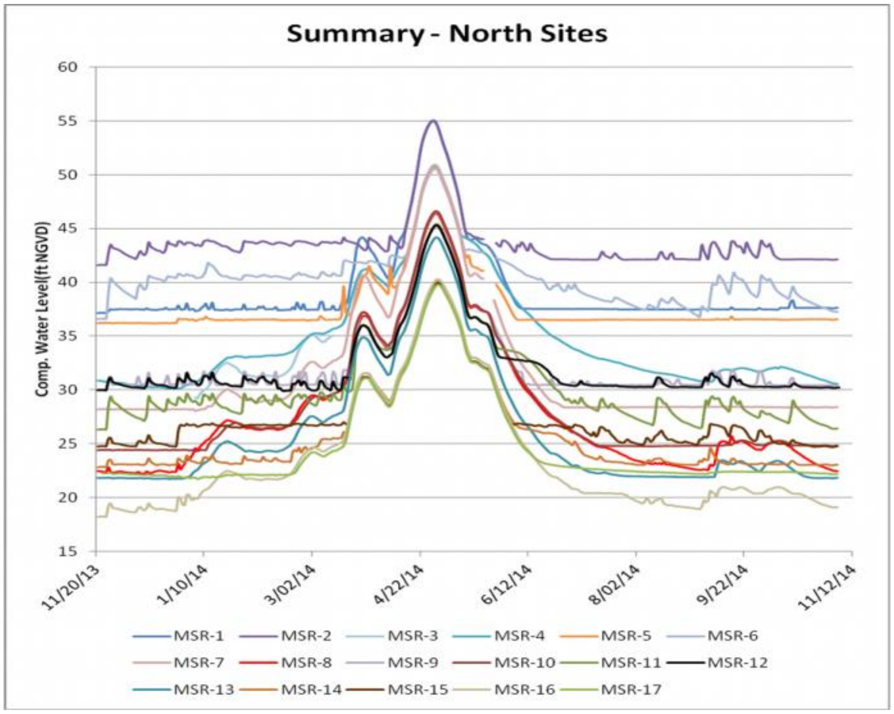
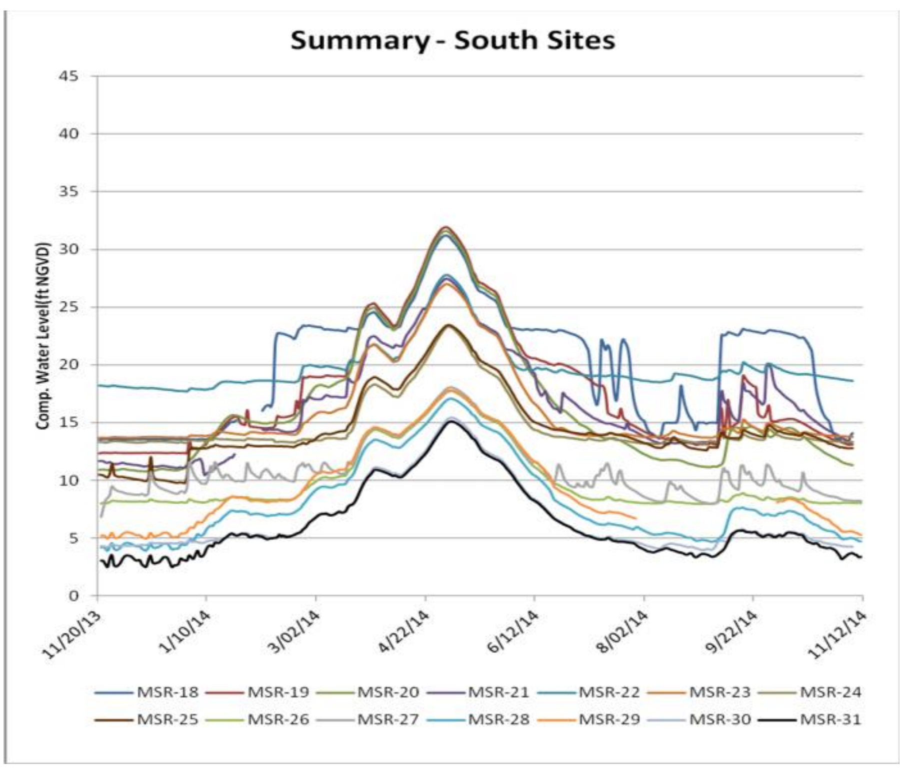


Figure 22B
Hydroecological Monitoring Stations Water Level Summary – South Sites



Stage duration curves created from the short-term gage data were utilized to determine hydroperiods within the various ecological communities along monitored transects. Various stage percentiles were plotted onto the surveyed cross-sections to visualize which communities were wetted at certain cumulative frequencies (i.e. maximum, 85th percentile, median, 15th percentile, minimum) (**Appendix D**). An example graph is provided in **Figure 23** below. As was the trend at all transects, only the maximum stage was the result of an overbank event (i.e. water coming into the floodplain laterally from the Suwannee River). Because the bank is only topped in uncommon flood events, this suggests that wetland floodplain communities receive water from the river in other ways, such as: 1) backflow from the river into the floodplain via low spots/breaks in the banks or via perennial openings of tributary spring runs; or 2) subsurface hydrogeologic connections. The former phenomena (water backflowing via openings in the bank) was observed directly during monitoring. Observations of darker (tannic) water within karst windows during periods of high flow in the river may be evidence of the latter phenomena occurring. Future hydrologic analyses will attempt to parse out these influences. Also, future hydrologic analyses will use long-term gage records to generate percent exceedances and compare to ecological community types. In the example below (**Figure 24**), the long-term flow record at Branford (1931-present) was used to generate percent exceedances which were plotted relative to the average daily flow during water year 2013-2014.

Figure 23
Example Cross-Section with Stage Duration Percentiles

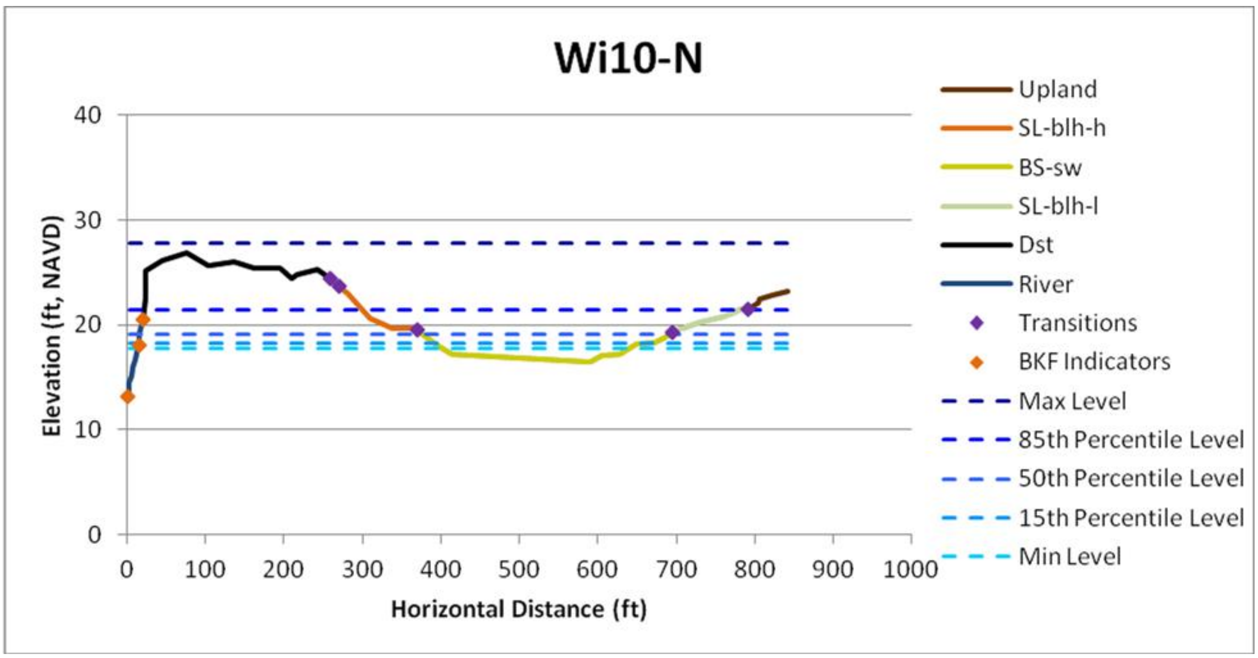
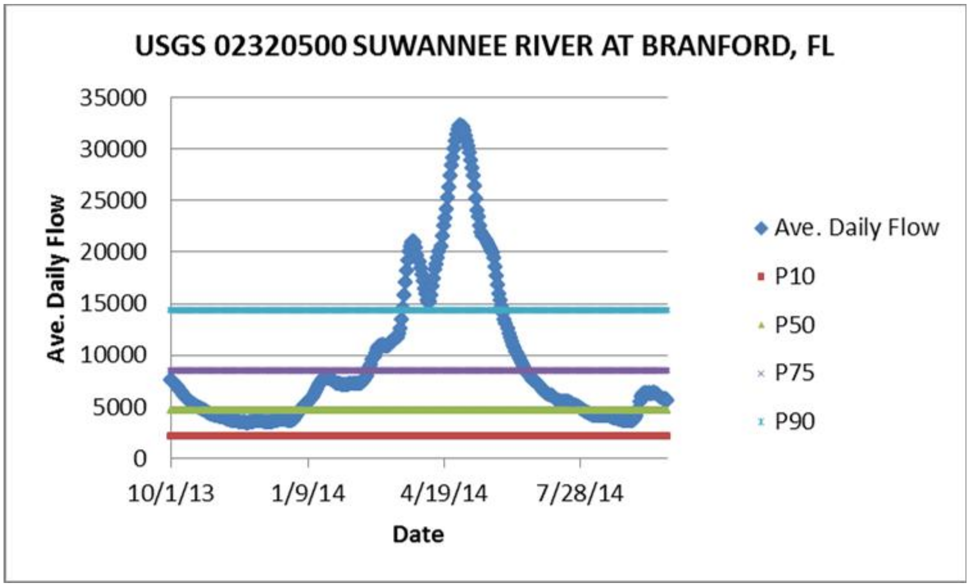


Figure 24
Long-Term USGS Flow Record Showing Percent Exceedances and Average Daily Flow



Stage duration curve data were then used to determine inundation durations for specific community types. **Tables 23 and 24** summarize these durations for the period of record and indicate, as suspected, that lower/wetter communities have longer durations than higher/drier communities. For example, during the study's annual period of record, floodplain backswamps were wetted up to 77% of the time while floodplain exterior uplands were only wetted up to 15% of the time. Further hydrologic analysis will examine cluster areas more closely to determine how long stations situated at different locations within a study area are inundated (i.e. downstream cluster stations near a break in the bank that receive the "first flush" versus upstream cluster stations where river water may only reach at certain levels).

Another trend observed at the monitored transects was that the 85th percentile level, which approximates an 8-week hydroperiod as an estimate for wetland limits, corresponded well with the observed upland/wetland jurisdictional break. Note that all results are from one year of hydrologic data. Further analysis will need to be conducted to determine how typical this year of data is relative to long-term hydrological records.

Table 23
Stage Durations by Floodplain Community Type for POR

Community	Range of Duration (% of time equaled or exceeded)	Range of Duration (weeks per year in 2014)
Karst Window	13 to 74%	7 to 37 weeks
BS-sw	26 to 77%	13 to 39 weeks
BB-sw	21 to 100%	10 to 50 weeks
Active Splay	12 to 27%	6 to 14 weeks
SW-blh-l	16 to 40%	8 to 20 weeks
SL-blh-l	15 to 27%	8 to 14 weeks
AR-blh-l	5 to 24%	3 to 12 weeks
RB-blh-l	16 to 32%	8 to 16 weeks
RS-blh-h	12 to 40%	6 to 20 weeks
RB-blh-h	8 to 18%	4 to 9 weeks
SL-blh-h	12 to 27%	6 to 13 weeks
BS-blh-h	21 to 74%	11 to 37 weeks
AR-up	5 to 22%	2 to 11 weeks
RB-up	3 to 16%	2 to 8 weeks
RS-up	16 to 29%	8 to 14 weeks
SL-up	13 to 28%	7 to 14 weeks
Upland	6 to 15%	3 to 8 weeks

Table 24
Stage Durations by Spring Community Type for POR

Community	Range of Duration (% of time equaled or exceeded)	Range of Duration (weeks per year)
SprRn	50 to 100%	25 to 50 weeks
VFS/SprRn	31 to 100%	16 to 50 weeks
VFS	29 to 64%	14 to 32 weeks
SSw	18 to 30%	9 to 15 weeks
HydHmk	8 to 18%	4 to 9 weeks
UpHmck	3 to 12%	2 to 6 weeks
UpPP	NA	NA

4.7 In-Stream Springs

SAV and Macroalgal Mapping

In-stream habitat characterization was conducted in six spring systems: Allen Mill Pond, Lafayette Blue, Peacock/Bonnet, Ruth/Little Sulfur, Rock Sink, and Otter Springs (in latitudinal order). Of these six, four had appreciable benthic habitats of algae, SAV, or both (**Table 25**). Within sampled quadrats, four species of SAV were found in these four systems: *Eleocharis vivipara*, (sprouting spikerush), *Fontinalis* sp. (water moss), *Najas guadalupensis* (water naiad), and *Potamogeton pusillus* (small pondweed). Algae identified included the charophyte, *Nitella* sp.; the diatoms, *Eunotia* sp., *Pleurosira laevis*, and *Terpsinoe musica*; the green algae *Closterium* sp., *Oedogonium* sp., *Rhizoclonium* sp., and *Spriogryra* sp.; the red alga *Batrachospermum* sp.; and the Yellow-green alga, *Vaucheria* sp. Algal communities were more prevalent than SAV; they were associated with 81% to 100% of the polygons. *Vaucheria* sp. was the most common algae; it was found within 13% to 86% of the polygons and was encountered at every site at which algae was present. Photographs of encountered species are provided in **Appendix C**. Maps providing the locations of mapped polygons or belt transects are provided in **Appendix F**.

A total of 27 polygons were mapped in Allen Mill Pond, 21 of these polygons contained either SAV and/or algae and totaled 1,725 m^2 of habitat. Very coarse estimates of the total spring run area were used to estimate percentage of total SAV and/or algae habitat; for Allen Mill Pond, it was estimated that 20% of the spring run bottom was colonized by SAV and/or algae. *Fontinalis* sp. was most common; it appeared on 19% of the polygons. *Vaucheria* sp. was the most common algae; it appeared on 33% of the polygons.

Lafayette Blue had negligible coverage of both SAV and algae, but a grab sample was collected. Scott et al. (2004) described Lafayette Blue saying “algae are very thick on limestone and sand substrates within the spring pool and run.”

Six polygons, containing only algae, were mapped at Ruth/Little Sulfur. This represented an area of 398 m^2 or approximately 30% of the potential benthic habitat. Of the samples taken, *Vaucheria* sp. was the only dominant algal species observed.

As described in the methods, it was not possible for Amec Foster Wheeler personnel to conduct mapping of the Rock Sink outlet because of the highly colored water (black and turbid). However, our professional judgment given high color which is known to extinguish light, was that neither, SAV or algae could be inhabiting the spring run near the outlet.

SAV and algal benthic habitats were characterized in three segments of the Peacock/Bonnet Spring System. Within the mapped area of the 100 m segment of Peacock Spring Run (PSN), ten polygons, totaling 627 m^2 of benthic habitat, were identified. This included polygons with mixed assemblages of SAV and algae as well and some containing only algae. The SAV encountered included *E. vivipara*, *Fontinalis* sp., and *N. gudalupensis*. Algae included *Rhizoclonium* sp., *Vaucheria* sp., and *Spirogyra* sp. Downstream, in the shared Peacock/Bonnet Run (PBC), neither SAV or algal mats were encountered in any of the five transects. Further downstream at PSS, algal mats were not encountered, instead benthic habitats were dominated by periphyton associated with exposed roots. In each sample of the periphyton identified by Amec Foster Wheeler taxonomists, *Terpsinoe musica* was the only dominant algae present. SAV, *Fontinalis* sp. only, was found on 13% of the 30 quadrats sampled.

Large segments of the spring run of Otter Springs were covered with algal mats, which totaled 7,440 m^2 and represented approximately 50% coverage of potential benthic habitat. Algae encountered included *Chara* sp., *Nitella* sp., *Oedogonium* sp., *Spirogyra*, and *Vaucheria* sp. Sparse and small species of SAV were usually smothered by the algae and were not visible unless the mat was physically removed and examined out of the water. SAV encountered included *E. vivipara*, *N. guadalupensis*, and *P. pusillus*.

Table 25
Summary of SAV and Algae Occurring within Spring Runs

Spring Name	Site	Sampling Date	Number of Polygons with SAV and/or Algae	Total Polygon Area (m^2)	SAV Species	Percentage of Polygons with Species Present	Algae Species*	Percentage of Polygons with Species Present
Allen Mill Pond	AMP	9/15/2014	21	1725	*Eleocharis vivipara*	5	*Batrachospermum sp.*	5
					Fontinalis sp.	19	*Chara sp.*	5
					Potamogeton pusillus	5	*Closterium sp.*	5
							Eunotia sp.	5
							Pleurosira laevis	5
							Terpsinoe musica	5
							Vaucheria sp.	33
					Total SAV	**29**	**Total Algae**	**81**
Lafayette Blue	LAF	9/15/2014	0	NA	Bare		Bare	
Ruth/Little Sulfur	LRS	9/16/2014	6	398	Bare		Vaucheria sp.	86
							Total Algae	100
Rock Sink	RSS	9/16/2014	0	NA	Bare		Bare	
Peacock/Bonnet	PSN	9/17/2014	15	627	*Eleocharis vivipara*	13	*Chara sp.*	7
					Fontinalis sp.	47	*Rhizoclonium sp.*	13
							Spirogyra sp.	7
							Terpsinoe musica	27
							Vaucheria sp.	13
					Total SAV	**53**	**Total Algae**	**100**
Otter	OS	9/18/2014	6	7440	*Eleocharis vivipara*	17	*Chara sp.*	17
					Najas guadalupensis	83	*Nitella sp.*	50
					Potamogeton pusillus	33	*Oedogonium sp.*	17
							Spirogyra sp.	33
							Vaucheria sp.	67
					Total SAV	**83**	**Total Algae**	**100**

*Algae occurred within some polygons but were not identified per the project scope. Twenty-four composited samples were identified.

<u>Habitat Assessment and Available Substrates</u>

A total of four FDEP Habitat Assessments were conducted at three of the springs: two were conducted at Allen Mill Pond, one in the Peacock Spring Run, and one in Ruth/Little Sulfur. The Allen Mill Pond sites scored in the "optimal" habitat range: 126 and 139, as did the Peacock Spring run (score = 139). Habitat in the Ruth/Little Sulfur Spring Run scored in the upper "marginal" range (score = 79). At both sites at Allen Mill Pond three major "productive" habitats were present. Estimates of "productive" benthic habitat ranged from 15% to greater than 30%, and included substrates such as SAV, snags, limestone rocks, and roots. Ruth Little Sulfur had only two major "productive" habitat types present (snags and leaf packs) that represented less than 5% of benthic habitat. Peacock Spring Run had four major "productive" habitats, representing 16% to 30% of potential benthic habitat, which included snags, SAV, leaf packs, trees, and rocks. Periphyton dominated the biota in the shared run of

Peacock/Bonnet at site PSS. This periphyton was associated with roots. Of the 30 quadrats sampled at this location, 18 had root substrate present at coverages ranging from 1% to 37%.

Water Quality

Water quality parameters recorded at each spring run are listed in Table 26. No latitudinal trends in water quality parameters were apparent across sites, however, certain parameters decreased or increased as distance from the spring head increased. Temperature and pH ranged from 20.49 to 22.95 °C and 6.7 to 8.05, respectively; neither parameter showed any trends within those spring runs where measurements were recorded at multiple locations. Otter Spring showed a trend toward decreasing pH farther downstream where greater influence of the Suwannee River surface waters, and the associated tannic acids, likely resulted in lower pH. Dissolved oxygen (mg/L) readings ranged from 1.36 to 7.65 mg/L. Dissolved oxygen was higher in the shared spring run of Peacock/Bonnet Spring Run than as measured nearer Peacock Spring. Otter Spring did not show a trend toward increasing oxygen concentrations from spring head to downstream reaches. Conductivity ranged from 352 to 494 UMHO/cm. Both Otter Springs and Peacock/Bonnet showed decreasing conductivity corresponding to downstream locations. Salinity ranged from 0.17 to 0.25 ppt. All water quality parameters were within ranges seen in spring systems, in general, and as recorded at specific spring locations during other monitoring events (Scott et al. 2004, SRWMD) (Table 27).

Table 26
Summary of Water Quality in Spring Systems

Spring System	Sampling Location Water Quality	Date	Water Quality Depth (m)	Temp (°C)	pH	DO (mg/L)	DO (% Sat)	Conductivity (UMHO/CM)	Salinity (PPT)	Secchi (m)
Allen Mill Pond	AMP-DS	9/15/2014	0.25	20.68	7.13	4.08	45.6	394	0.17 -	Bottom
Lafayette Blue	Headspring Gauge	9/15/2014	1.0	21.24	7.54	2.22	25.3	437	0.23	Bottom
Ruth/Little Sulfur	ND	9/16/2014	ND	ND	ND	ND	ND	ND	ND	Bottom
Rock Sink	MSR-29	9/16/2014	0.7	22.95	7.96	3.24	38.9	352	0.17	ND
Peacock/Bonnet	PS-N	9/17/2014	0.61	21.68	7.40	4.53	51.6	414	0.21	Bottom
Peacock/Bonnet	PS-C	9/15/2014	0.30	22.10	8.05	7.5	94.6	412	0.21	Bottom
Peacock/Bonnet	PS-S	9/17/2014	ND	20.49	7.40	7.65	84.3	408	0.22	Bottom
Otter	Headspring Gauge	9/18/2014	1.0	22.30	7.21	2.51	29.0	494	0.25	ND
Otter	Relict Spring	9/18/2014	1.0	22.20	7.20	1.36	15.7	493	0.25	Bottom
Otter	OS-U	9/18/2014	1.1	22.20	7.23	2.53	29.2	493	0.25	Bottom
Otter	OS-C	9/18/2014	1.21	21.50	6.84	1.74	19.9	488	0.25	Bottom
Otter	OS-D	9/18/2014	1.22	22.90	6.70	2.32	28.1	478	0.24	Bottom

Table 27
Spring Water Quality Summarized from Various Sources

Spring System	Citation	WQ Location	Temp (°C)	pH	DO (mg/L)	DO (% Sat)	Conductivity (UMHO/CM)	Salinity (PPT)
Allen Mill Pond	Scott et al. 2004	Vent	21.0; 21.49	7.2; 7.06	1.9; 0.24	ND	379	ND
Allen Mill Pond	SRWMD 2013 - 2015	ND	ND	ND	ND	ND	58.1 - 561.8	ND
Lafayette Blue	Scott et al. 2004	Vent	21.5; 21.7	7.2; 7.17	2.0; 0.92	ND	400; 382	ND
Lafayette Blue	SRWMD 1995 - 2013	ND	20.2 - 22.3	6.38 - 8.21	0.1 - 5.9	ND	266 - 455	0 - 0.5
Ruth/Little Sulfur	Scott et al. 2004	Vent	21.5; 21.58	7.3; 6.99	1.5; 0.68	ND	388	ND
Ruth/Little Sulfur	SRWMD 1996 - 2013	ND	15.1 - 25.9	6.58 - 8.09	0.1 - 7.7	ND	89 - 490	0.0 - 0.2
Rock Sink	ND	ND	ND	ND	ND	ND	ND	ND
Peacock/Bonnet	Scott et al. 2004	Vent	ND	ND	ND	ND	ND	ND
Peacock/Bonnet	SRWMD (via USGS) 2013 - 2015	ND	ND	ND	ND	ND	53.1 - 425.2	ND
Otter	Scott et al. 2004	At Vent	22.5; 22.63	7.5; 6.88	3.8; 1.47	ND	451	ND
Otter	SRWMD 2010 - 2013	ND	19.2 - 27	6.96 - 7.94	0.5 - 3.9	ND	174 - 485	0 - 0.2

Summarized from Scott et al. 2004 and SRWMD Water Data Portal

5.0 SUMMARY

This report summarizes various data collection efforts conducted within MSR floodplain and spring communities during 2013/2014. Thirty-four transects were established and surveyed throughout the 80-mile study area for the collection of elevation, hydrologic, vegetative, soils, and geomorphic data that will be used to assist in the development of MFLs (**Figure 2**). Transects spanned a number of ecological communities (i.e. swamps, low and high bottomland hardwoods, uplands) occupying various geomorphic surfaces (i.e. alluvial ridges, ridges and swales, backswamps, transitional slopes) (**Appendix A**). Detailed vegetative and soils data (**Appendix B**) were collected within the transects at 100 monitoring plots (typically 30 ft wide x 100 ft long) covering a representative number of community types and spatial distributions. Hydrologic data were collected throughout the study area from a network of 31 hydroecological stations installed in November 2013, and monitored until November 2014 (**Appendix E**). In-stream spring data were also collected from six priority stream systems.

Data collection efforts confirmed that surfaces in the uppermost reach (Reach 2), which is under more geologic control, are more linear in nature and less frequently inundated than the deep, extensive swamp communities found in lowermost reach (Reach 3), which is under more alluvial control. High alluvial ridges/banks found in the upper reaches (Reaches 2 and 3) are rarely overtopped and restrict the direct surface entry of water into the floodplain to breaks in the bank. Spring runs maintain some of these openings that would otherwise not exist, especially in Reach 3 which as a result has more frequently inundated floodplain communities than Reach 2. Downstream of the entry of the Santa Fe River to the Suwannee (Reach 4), alluvial ridges are lower relative to the bankfull elevation, resulting in even more extensive wetland communities. Water surface elevations measured in wetland communities throughout the study area were found to correspond highly with river stages, suggesting either a direct surface water connection with the river via openings in the bank or a subsurface connection with the river. Further, observations of different optical water quality over time in karst windows (based on river stages) (Wii15, Wii5) and unmapped boils in lower-lying surfaces of major riverine swamps (X26), indicate important groundwater-surface water interactions that appear to be different in the upper and lower sections of the river. The differences observed and quantified imply there may be sensitivity to different types of withdrawals in the upper versus the lower river.

The next phase of work will establish MFLs for the Middle Suwannee River. Future analyses will focus on some of the following areas: statistical validation of community types (some communities may be lumped or split); further investigation of hydrology at cluster sites compared to river stages to better understand how floodplain wetland communities are maintained in different parts of the river (via direct surface connection or via subsurface conduits); further investigation concerning how representative the hydrology data collected at the MSR stations is of prevailing conditions in the long-term (multidecadal) record; determination of the bankfull discharge (based on the bankfull indicator identification fieldwork) as this is an important flow event for channel maintenance; and determination of relative elevations for floodplain communities so community “depths” relative to a particular elevation (such as the bankfull stage) can be compared throughout the study area.

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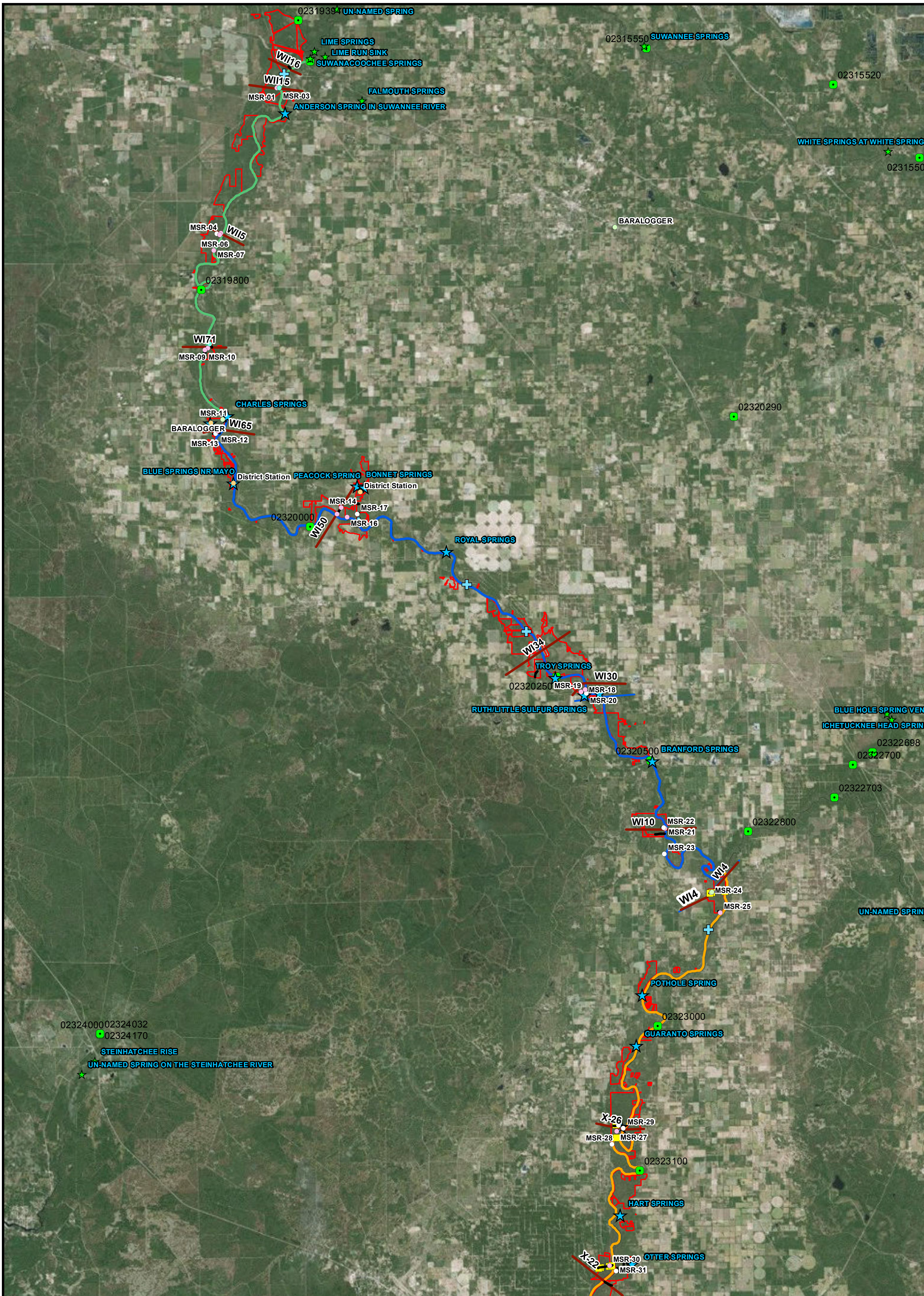
Appendix A



Notes:
1- Project No.: 600245
2- Data Sources - SRWMD, ESRI Aerial Imagery
3- This map is intended to be used for planning purposes only. It is not a survey.

Explanation of Features

- Reach 2 - Withlacoochee River to Charles Springs
- Reach 3 - Charles Springs to Santa Fe River
- Reach 4 - Santa Fe River to Fanning Springs
- AMEC Monitoring Transects
- Selected HEC-RAS
- USGS Transect Endpoints
- SRWMD Gage
- Other SRWMD Priority Springs
- MSR Priority Springs
- USGS Gage
- Public Ownership (10-yr FP)

MFL Monitoring Station
- District Station
- Gage
- Well
- Well + Gage
- Baralogger

N

0 2.5 5
Miles

amec

Monitoring Locations
Aerial Map
Middle Suwannee River MFL

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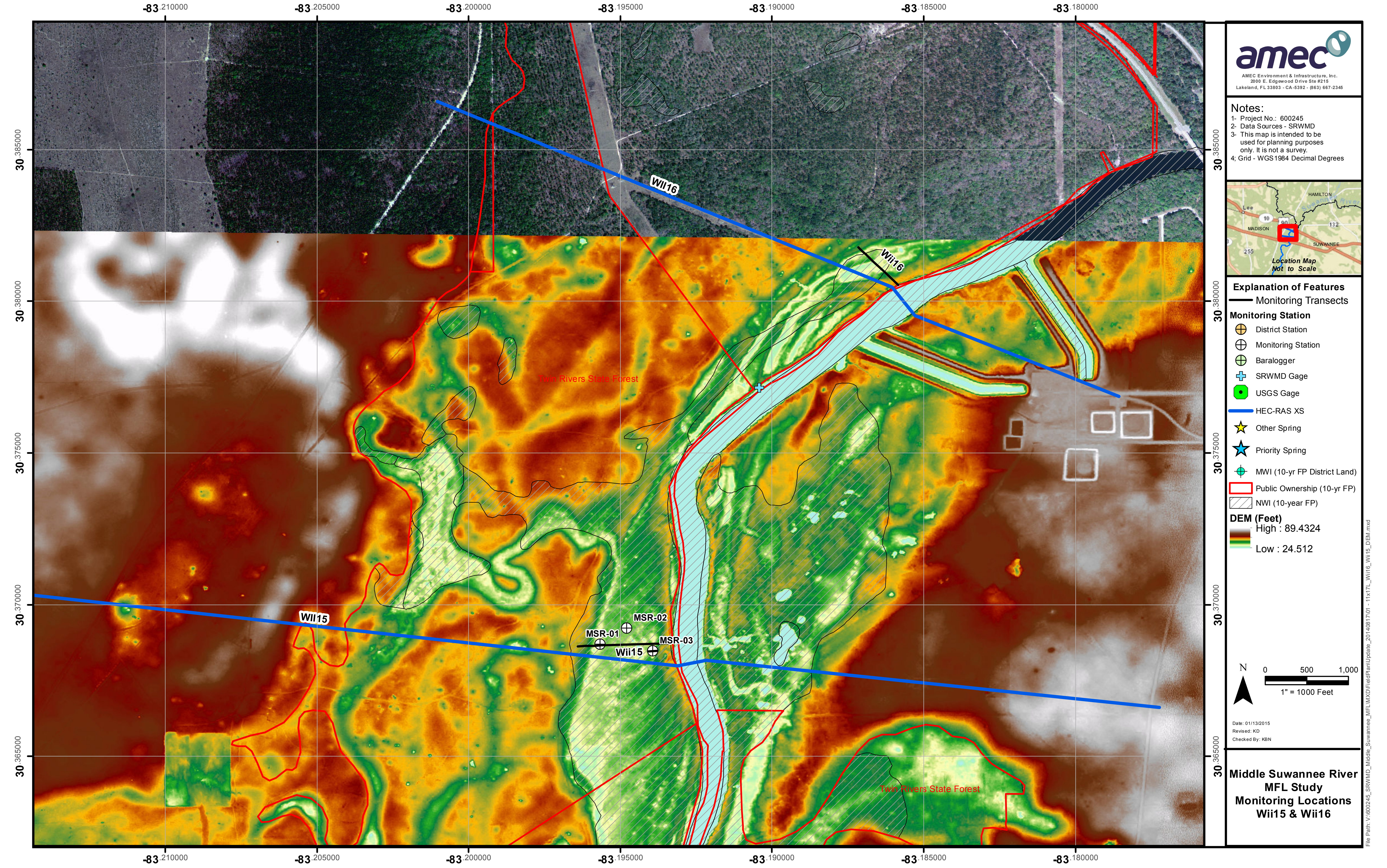
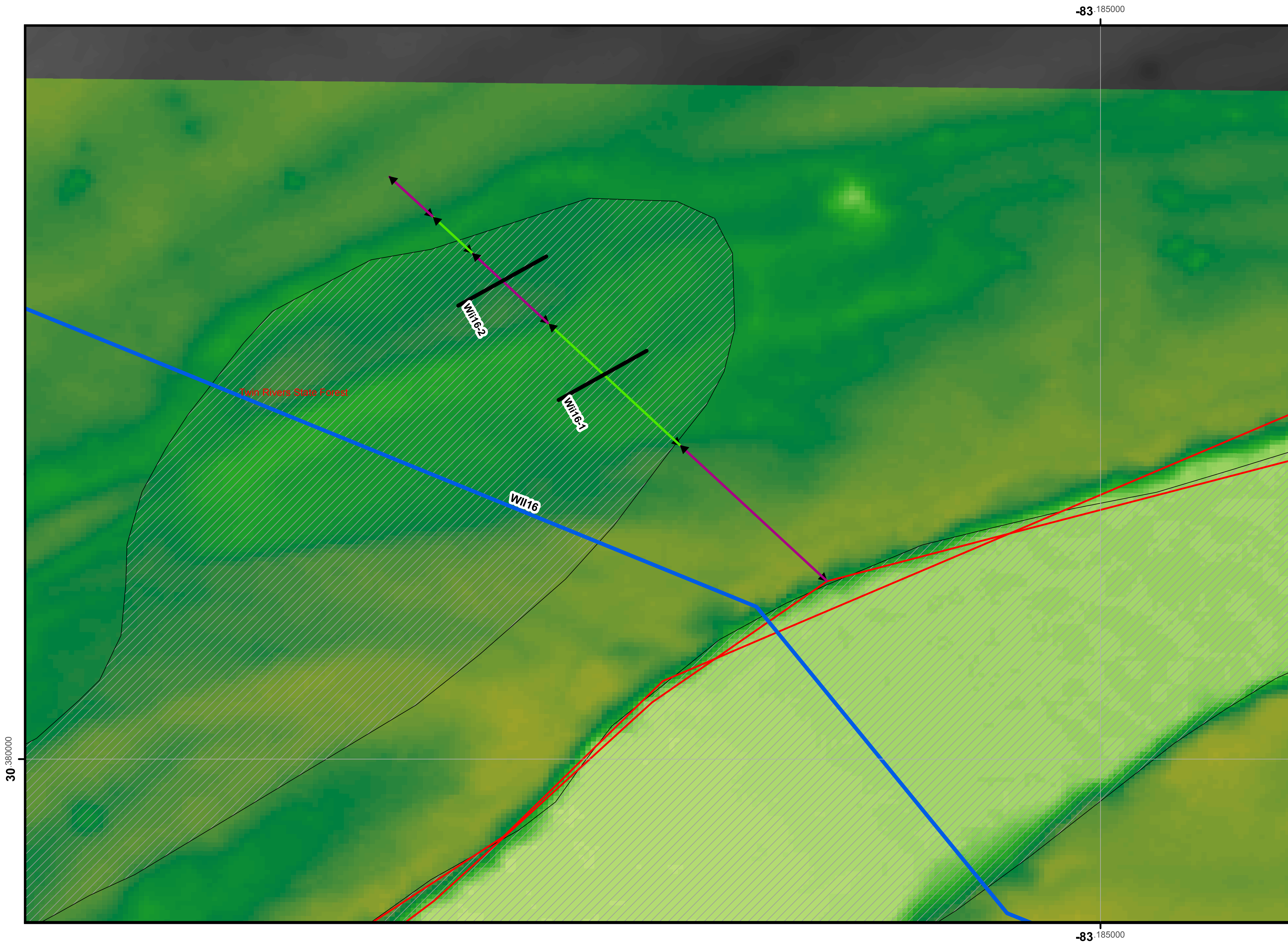


-83.210000
-83.205000
-83.200000
-83.195000
-83.190000
-83.185000
-83.180000
30.385000
30.380000
30.375000
30.370000
30.365000
Wii16
Wii15
Twin Rivers State Forest
MSR-01
MSR-02
MSR-03
amec
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
HAMILTON
MADISON
SUWANNEE
Location Map
Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Monitoring Station
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 89.4324
Low : 24.512
N
0 500 1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
Wii15 & Wii16



amec
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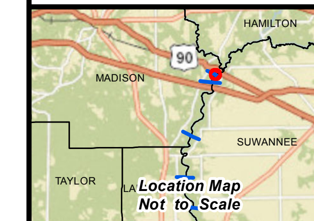
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland

USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

Selected HEC-RAS XS

HEC-RAS XS

Other Spring

Priority Spring

MWI (10-yr FP District Land)

Public Ownership (10-yr FP)

NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

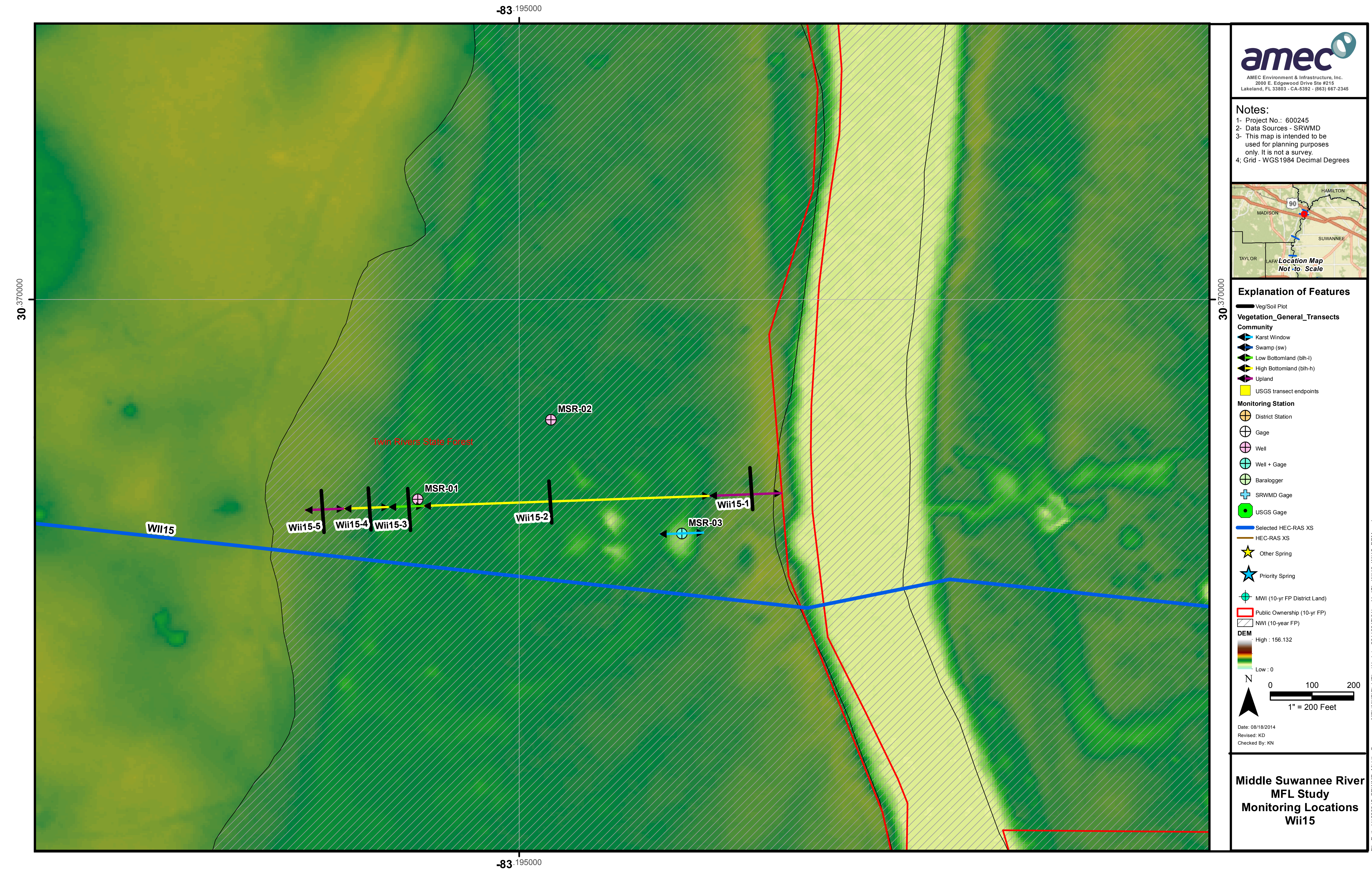
0 50 100

1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wii16

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\01a - 11x17L_Wii16_Wii15_DEM.mxd



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30.370000
Twin Rivers State Forest
MSR-01
MSR-02
MSR-03
Wii15-1
Wii15-2
Wii15-3
Wii15-4
Wii15-5
WII15
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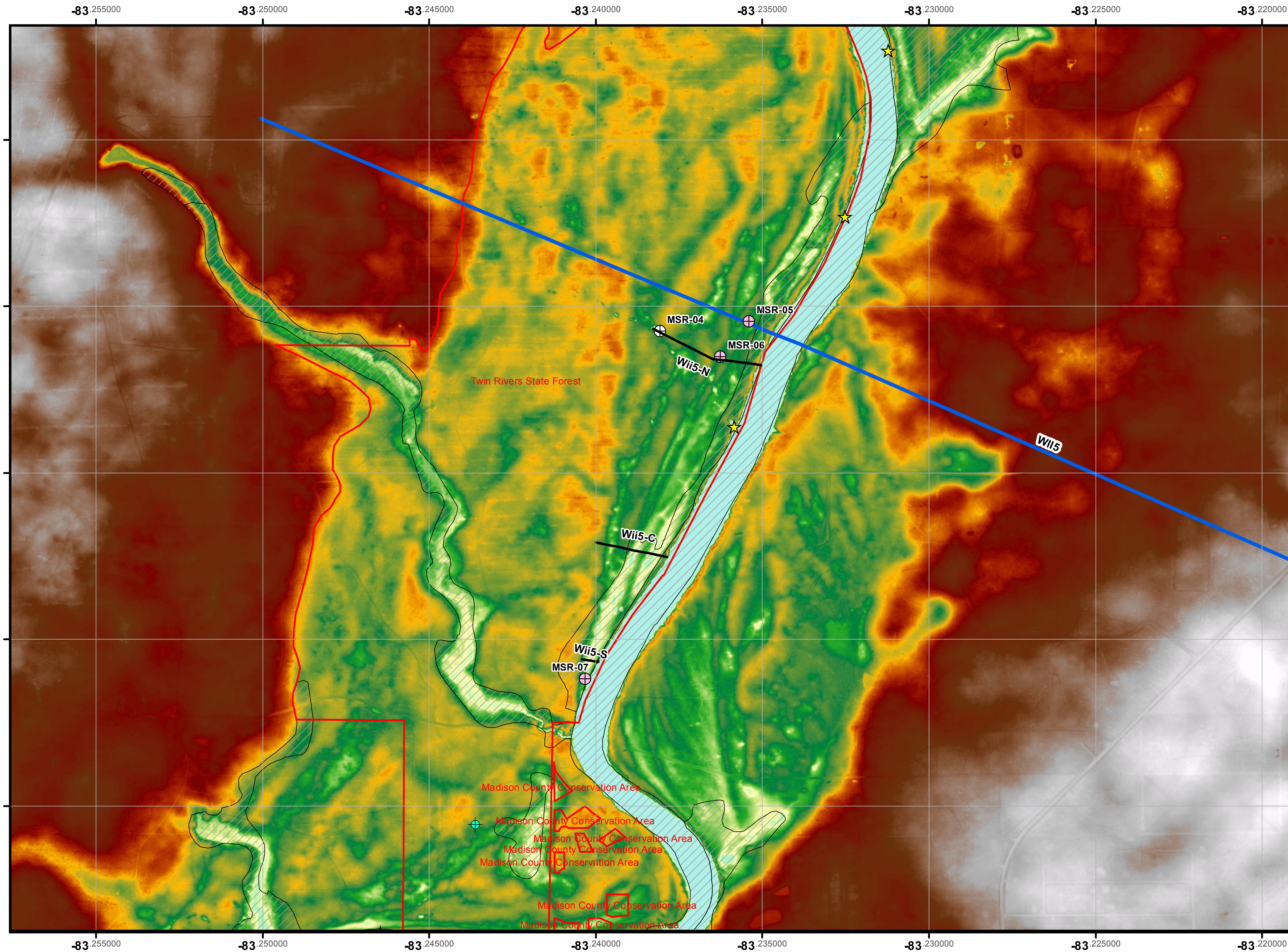
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
HAMILTON
90
MADISON
SUWANNEE
TAYLOR
LAFA
Location Map
Not to Scale
Explanation of Features
Veg/Soil Plot
Vegetation_General_Transects
Community
Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM
High : 156.132
Low : 0
N
0
100
200
1" = 200 Feet
Date: 08/18/2014
Revised: KD
Checked By: KN
Middle Suwannee River
MFL Study
Monitoring Locations
Wii15
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\01b - 11x17L_Wii16_Wii15_DEM.mxd



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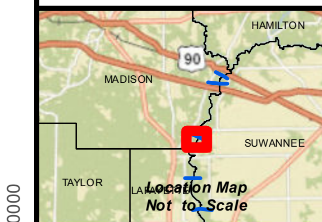
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

- Monitoring Transects

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM (Feet)

High : 82.7795

Low : 22.686

N

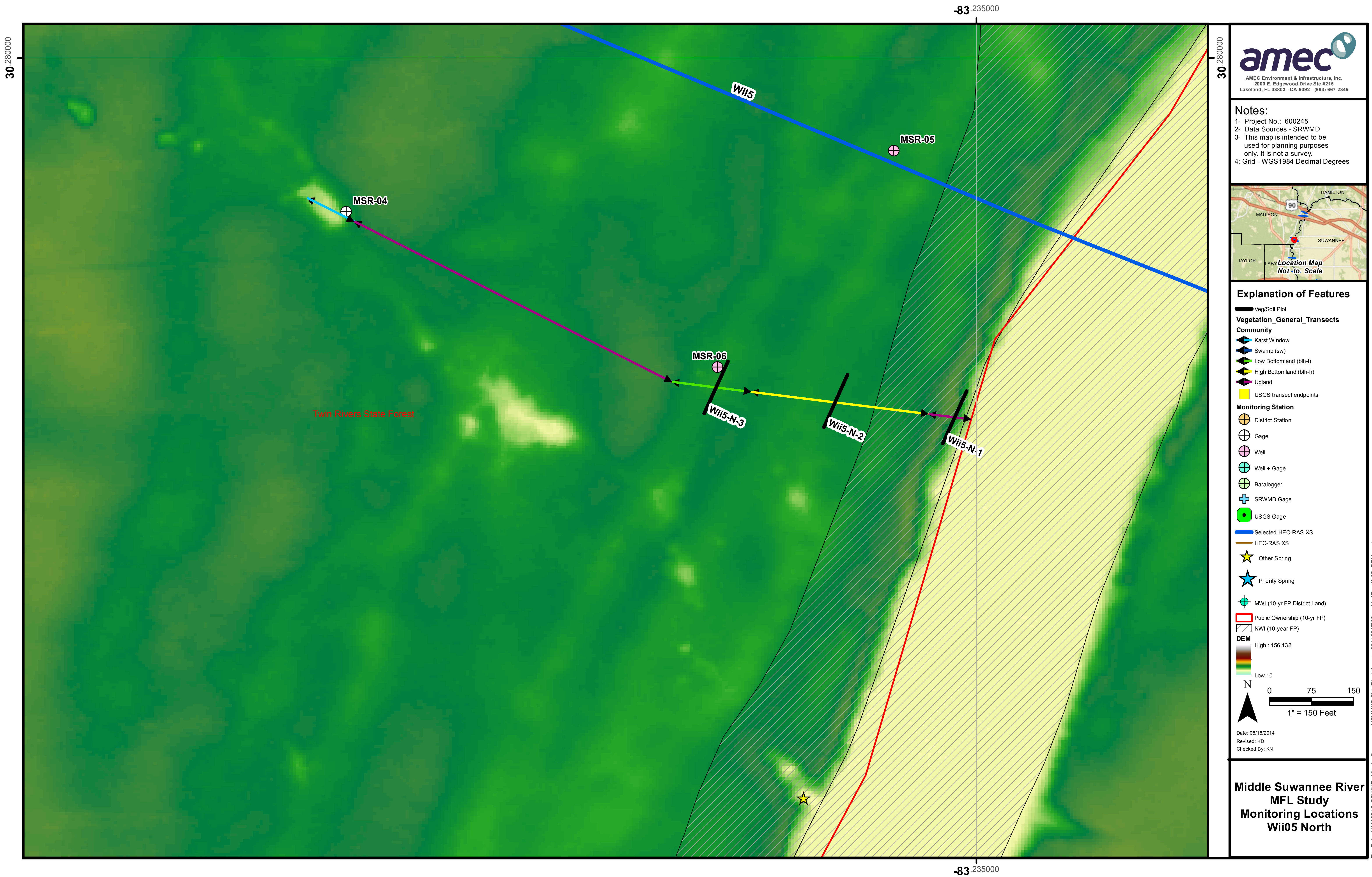
0 500 1,000

1" = 1000 Feet

Date: 01/13/2015
Revised: KD
Checked By: KBN

Middle Suwannee River MFL Study Monitoring Locations Wii05

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\02 - 11x17L_Wii05_DEM.mxd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30.280000
Wii5
MSR-05
MSR-04
MSR-06
Twin Rivers State Forest
Wii5-N-3
Wii5-N-2
Wii5-N-1
-83.235000
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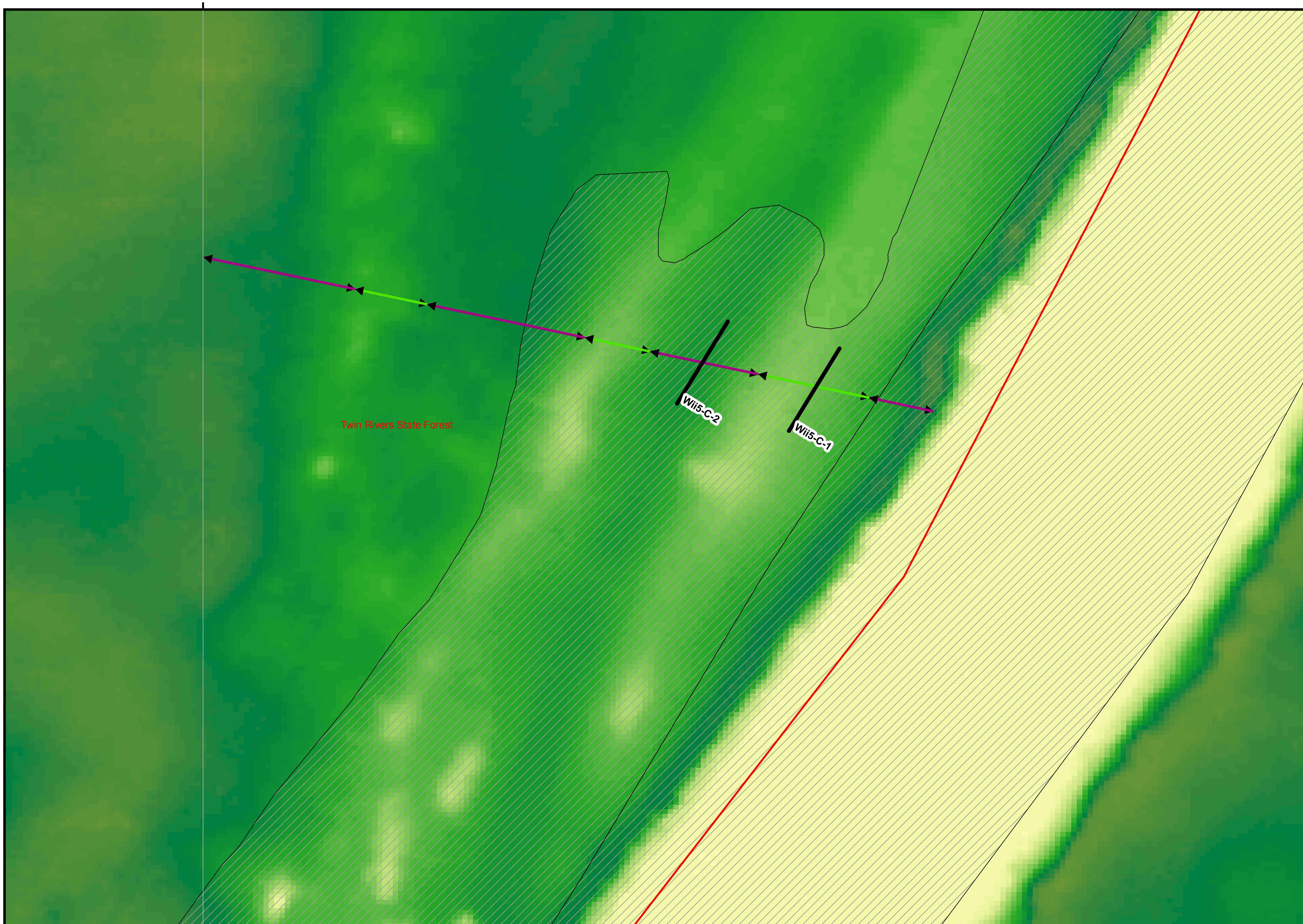
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
HAMILTON
MADISON
SUWANNEE
TAYLOR
LAFA
Location Map
Not to Scale
Explanation of Features
Veg/Soil Plot
Vegetation_General_Transects
Community
Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM
High : 156.132
Low : 0
N
0 75 150
1" = 150 Feet
Date: 08/18/2014
Revised: KD
Checked By: KN
Middle Suwannee River
MFL Study
Monitoring Locations
Wii05 North
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlanUpdate_20140817\02a - 11x17L_Wii05_DEM.mxd

-83.240000



-83.240000

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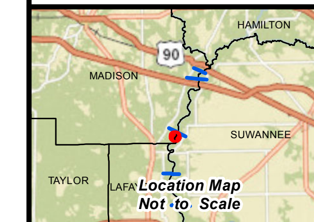
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community
- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland

USGS transect endpoints

Monitoring Station
- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

DEM
High : 156.132
Low : 0

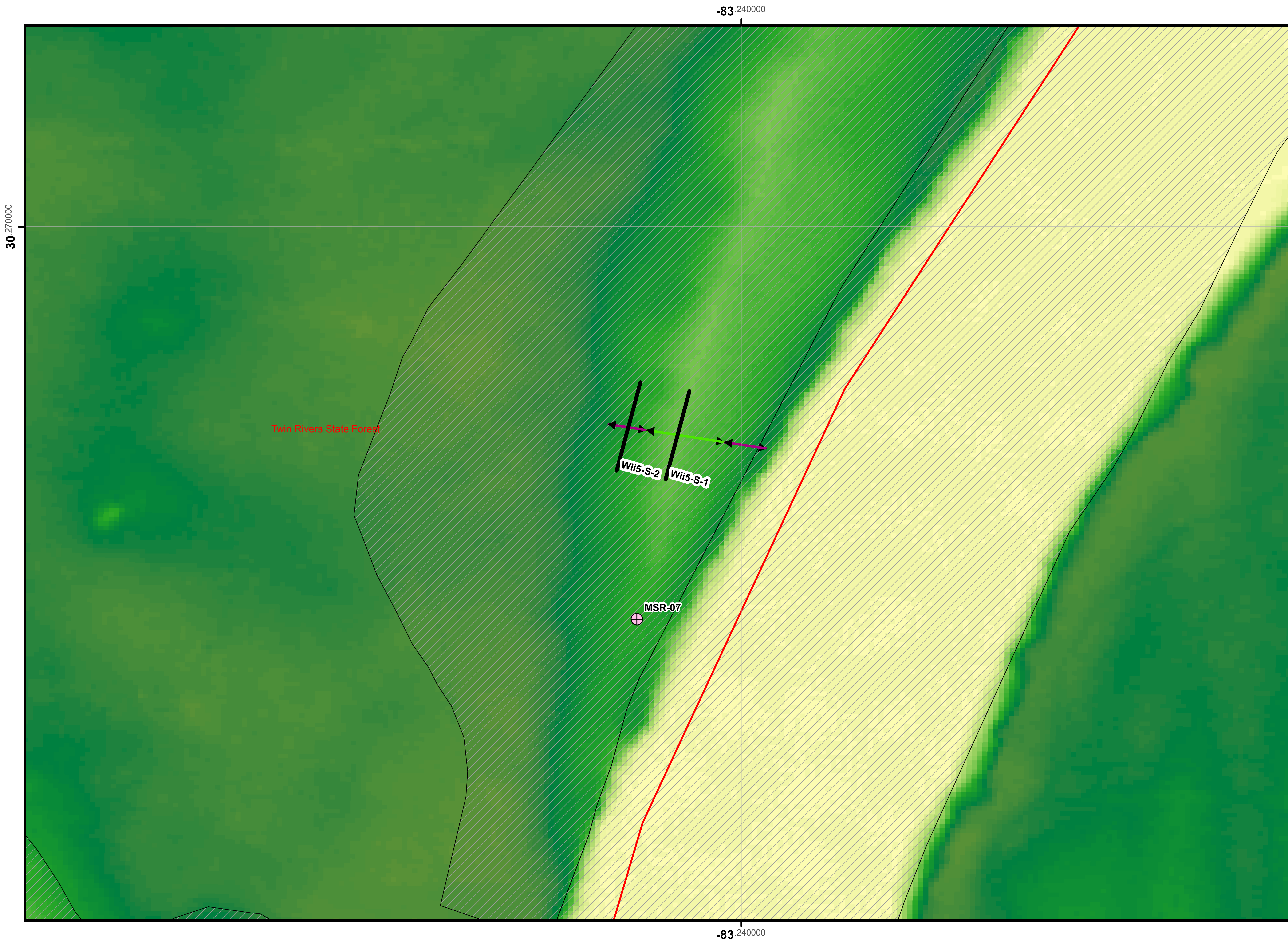
N

0 50 100
1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wii05 Central

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\02b - 11x17L_Wii05_DEM.mxd



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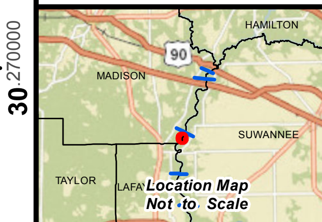
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community
- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station
- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

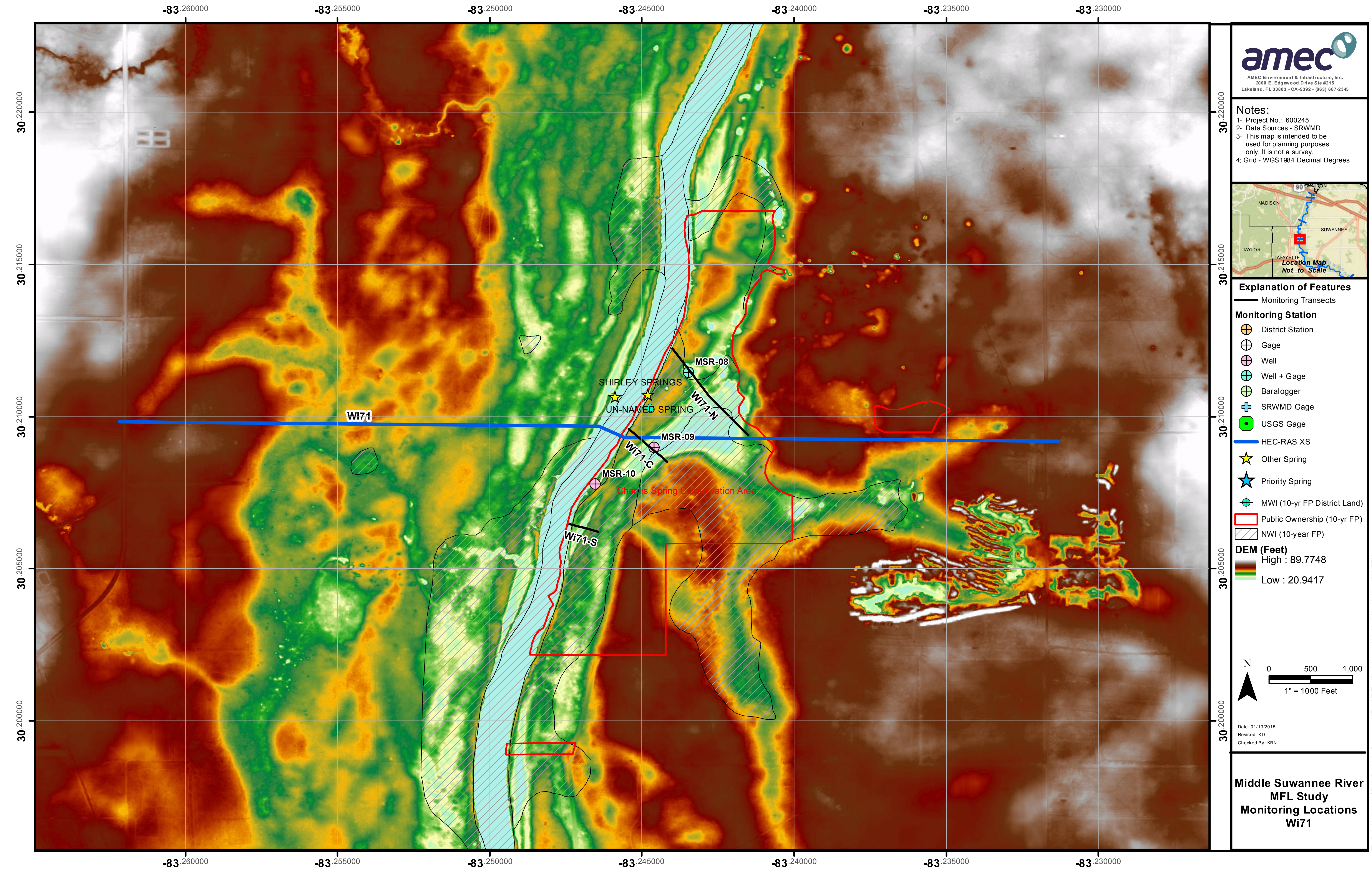
DEM
High : 156.132
Low : 0

N
0 50 100
1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wii05 South

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\02c - 11x17L_Wii05_DEM.mxd



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-83.250000
-83.245000
-83.240000
-83.235000
-83.230000
30.220000
30.215000
30.210000
30.205000
30.200000
SHIRLEY SPRINGS
UN-NAMED SPRING
MSR-08
MSR-09
MSR-10
Wi71
Wi71-N
Wi71-C
Wi71-S
Charles Spring Conservation Area
amec
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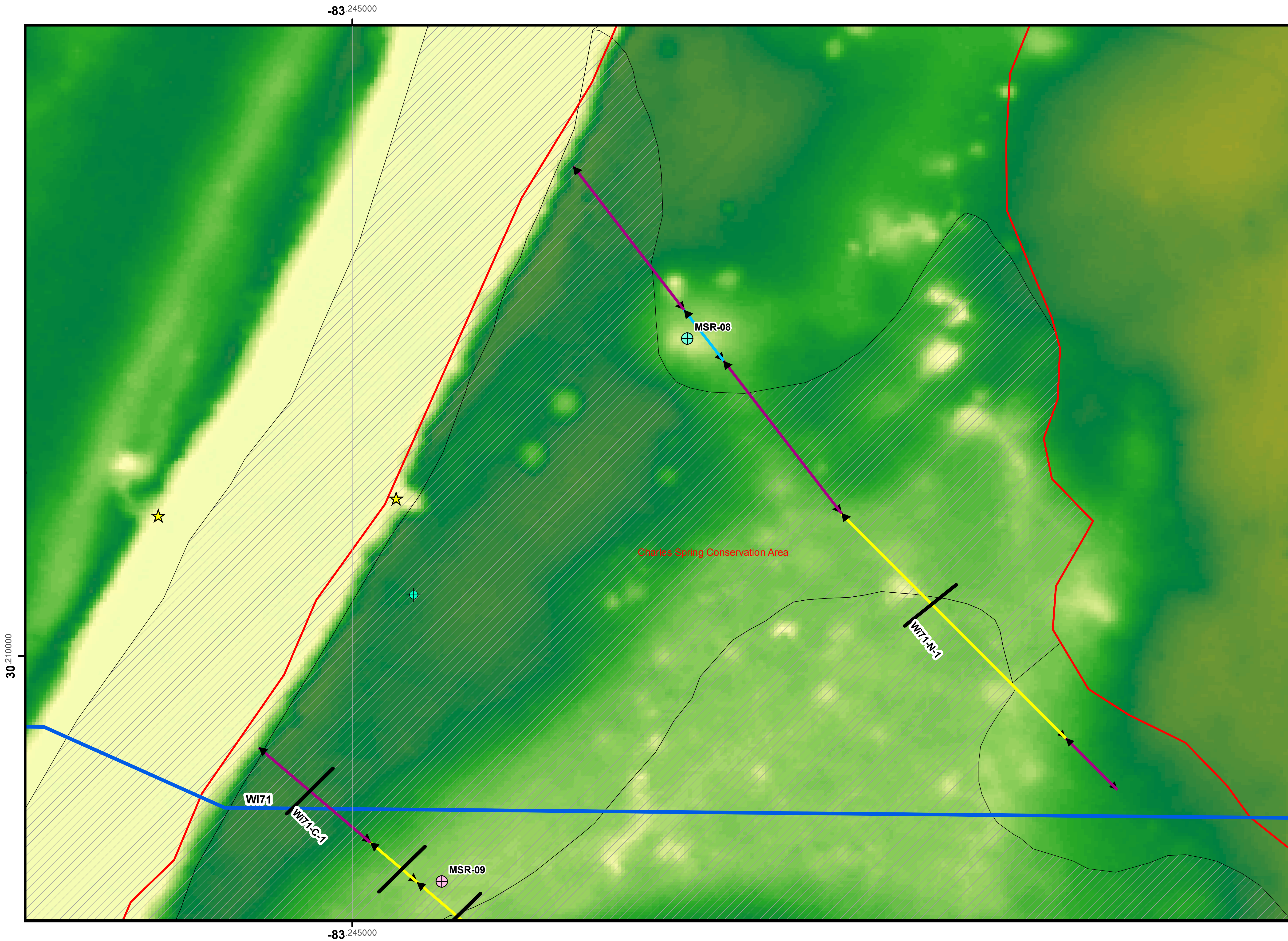
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
HAMILTON
MADISON
SUWANNEE
TAYLOR
LAFAYETTE
Location Map
Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 89.7748
Low : 20.9417
N
0
500
1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
Wi71
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\03 - 11x17L_Wi71_DEM.mxd



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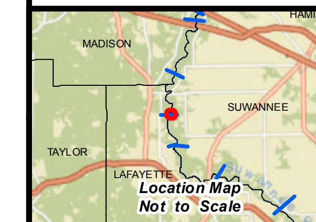
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints

Monitoring Station

District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

DEM

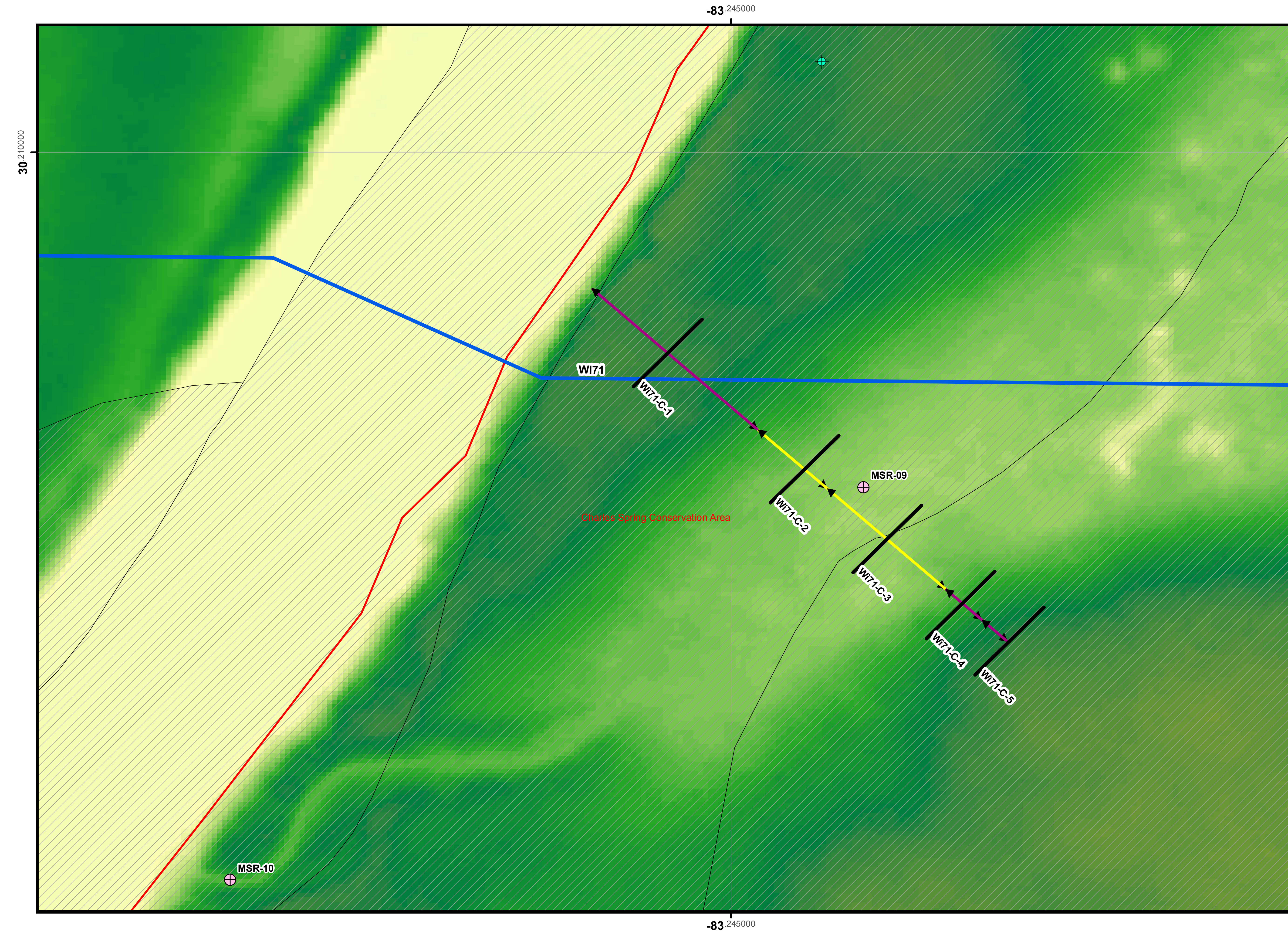
High : 156.132
Low : 0

N
0 50 100
1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi71 North

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\03a - 11x17L_Wi71_DEM.mxd



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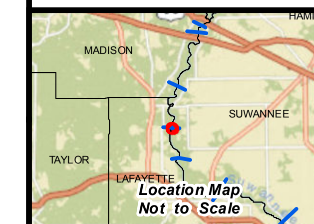
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

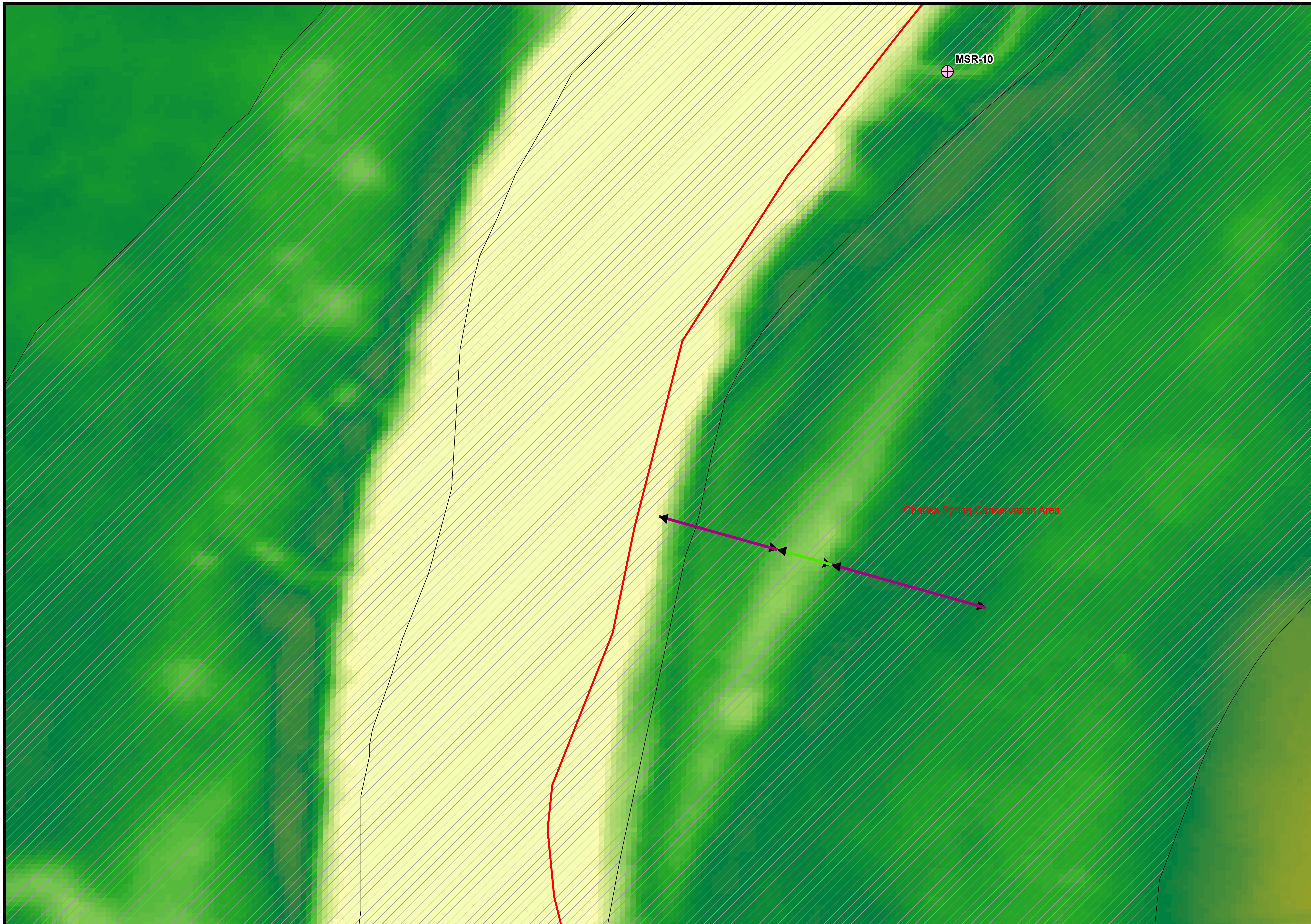
DEM
High : 156.132
Low : 0

N

0 50 100
1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River
MFL Study
Monitoring Locations
Wi71 Central



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Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees

Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

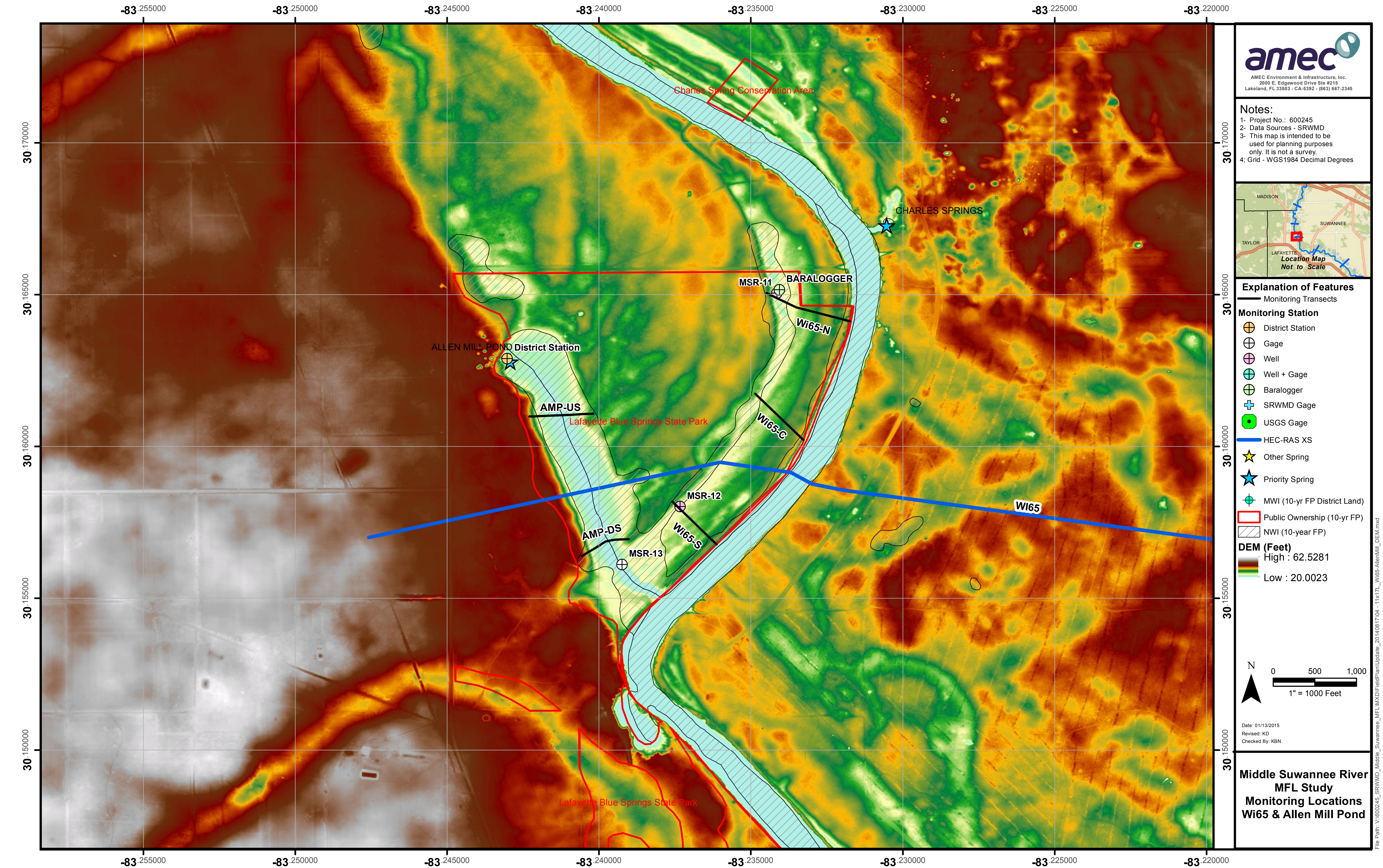
0 50 100

1" = 100 Feet

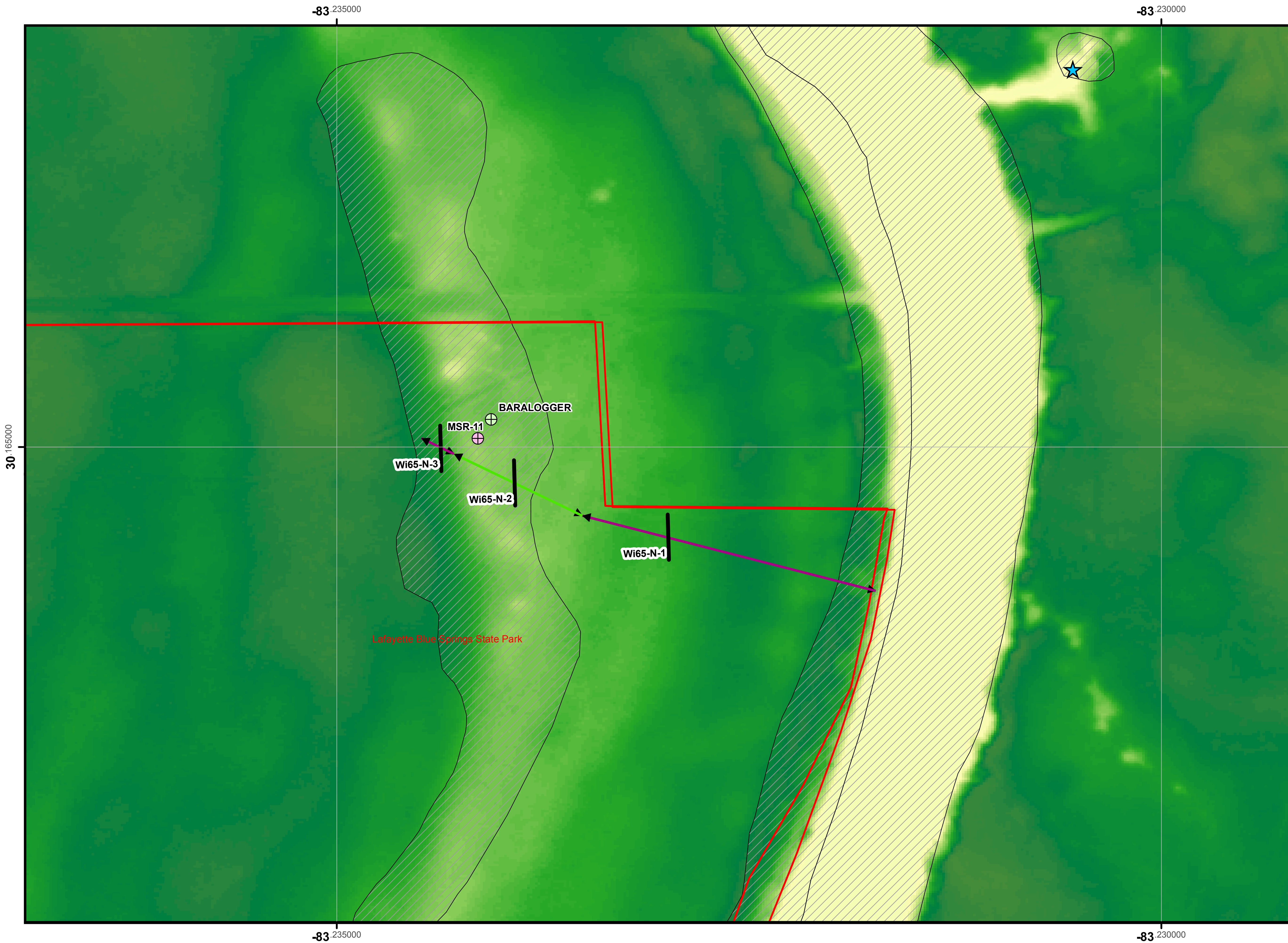
Date: 08/18/2014
Revised:KD
Checked By:KN

Middle Suwannee River MFL Study Monitoring Locations Wi71 South

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\03c - 11x17L_Wi71_DEM.mxd



Charles Spring Conservation Area
CHARLES SPRINGS
BARALOGGER
MSR-11
Wi65-N
ALLEN MILL POND
District Station
AMP-US
Lafayette Blue Springs State Park
Wi65-C
MSR-12
Wi65-S
WI65
AMP-DS
MSR-13
Lafayette Blue Springs State Park
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
MADISON
SUWANNEE
TAYLOR
LAFAYETTE
Location Map
Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 62.5281
Low : 20.0023
N
0
500
1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
Wi65 & Allen Mill Pond



AMEC Environment & Infrastructure, Inc.
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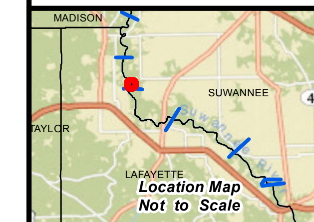
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

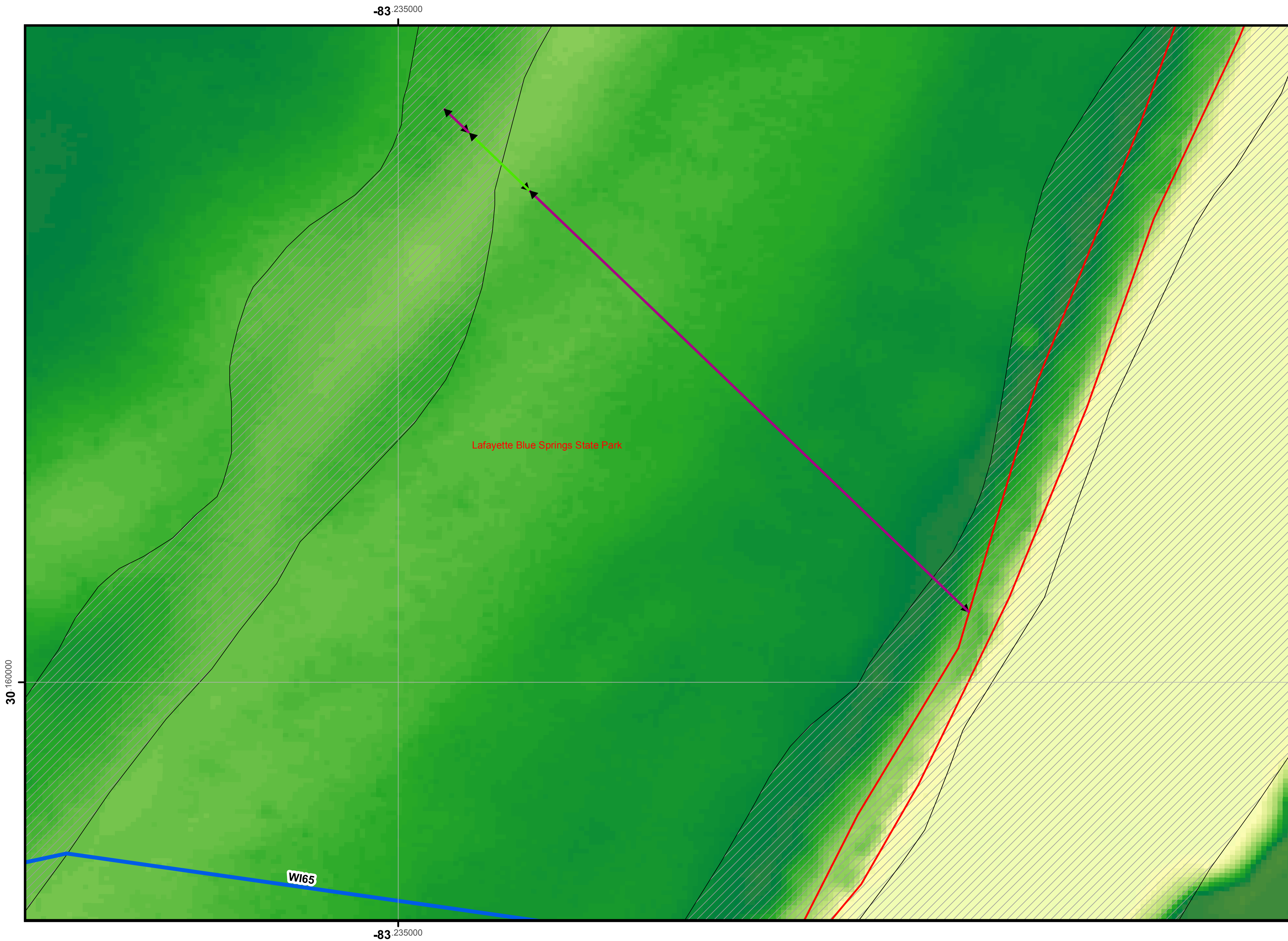
0 100 200

1" = 200 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

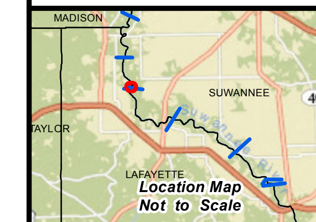
Middle Suwannee River MFL Study Monitoring Locations Wi65 North

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\04a - 11x17L_Wi65-AllenMill_DEM.mxd



AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

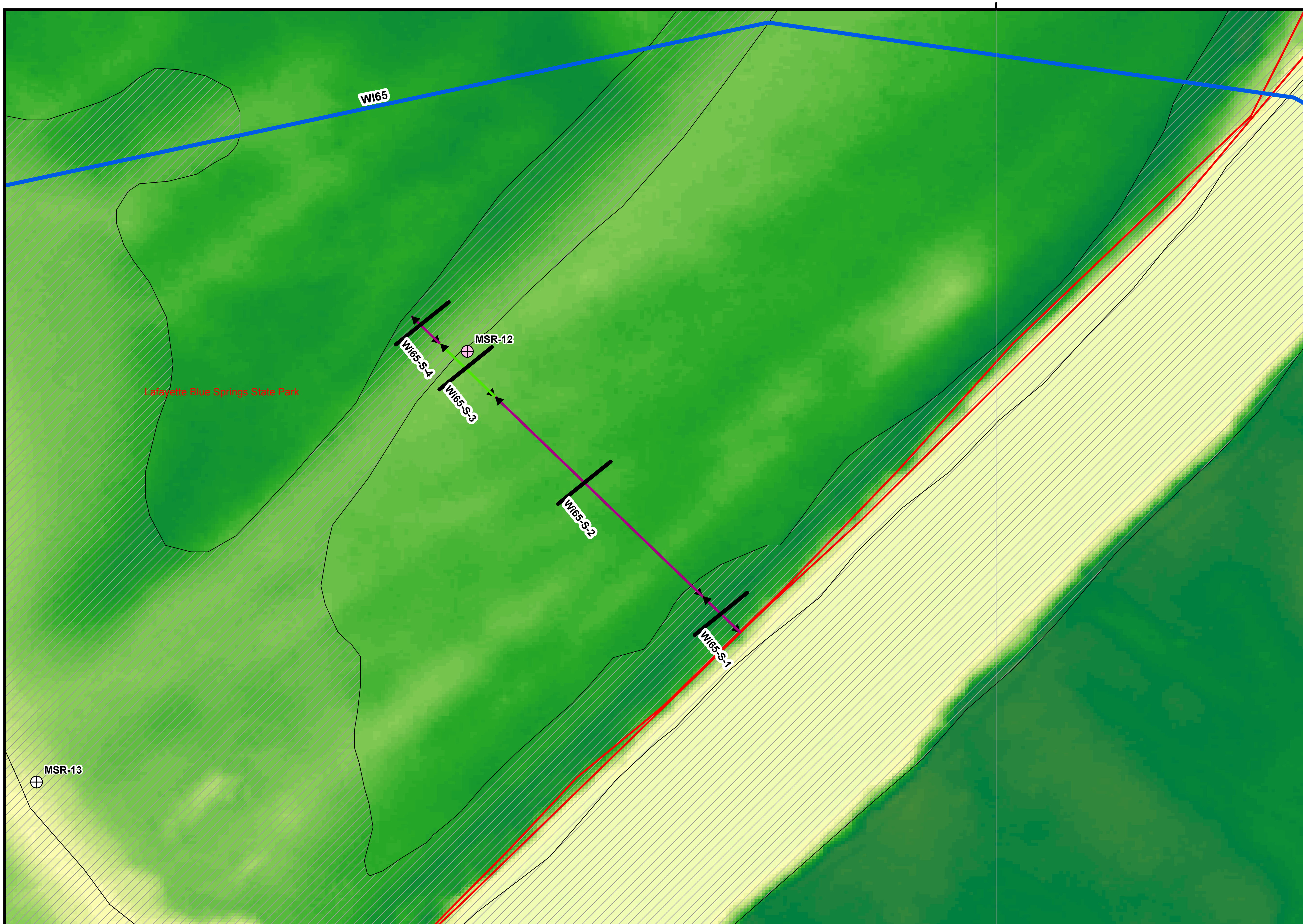
0 50 100

1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi65 Central

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\04b - 11x17L_Wi65-AllenMill_DEM.mxd



amec

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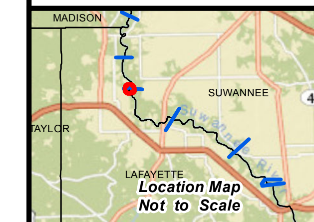
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

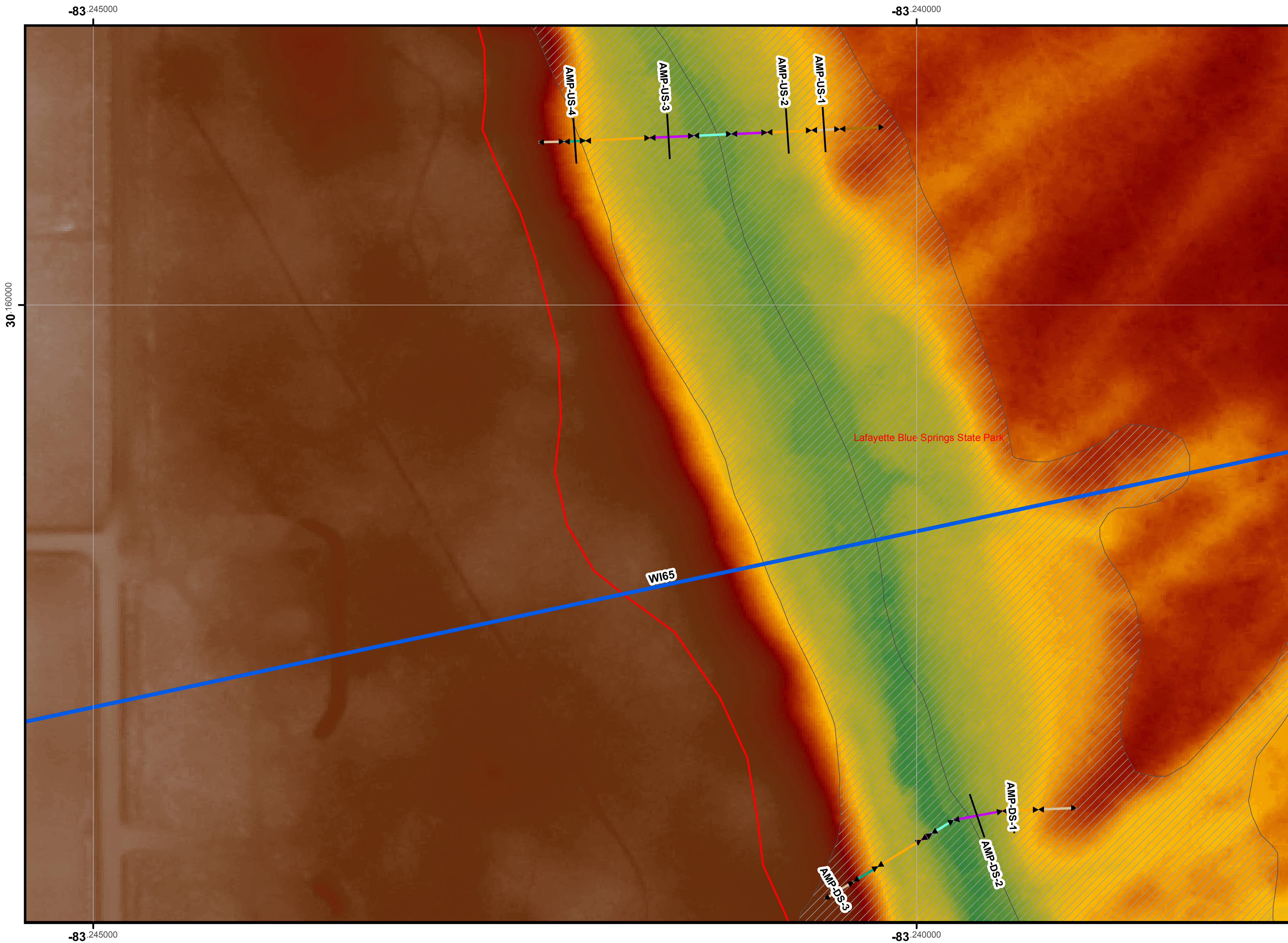
0 75 150

1" = 150 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi65 South

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\04c - 11x17L_Wi65-AllenMill_DEM.mxd



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Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees

Date: 09/30/2014
Revised: AB
Checked By: KN

Explanation of Features

Vegetation_General_Transects

<all other values>

Community
- SprRn
- UpPP
- UpHmck
- VFS
- VFS/SprRn
- HydHmk
- Karst Window
- Swamp (sw)
- Slope Swamp
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station
- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

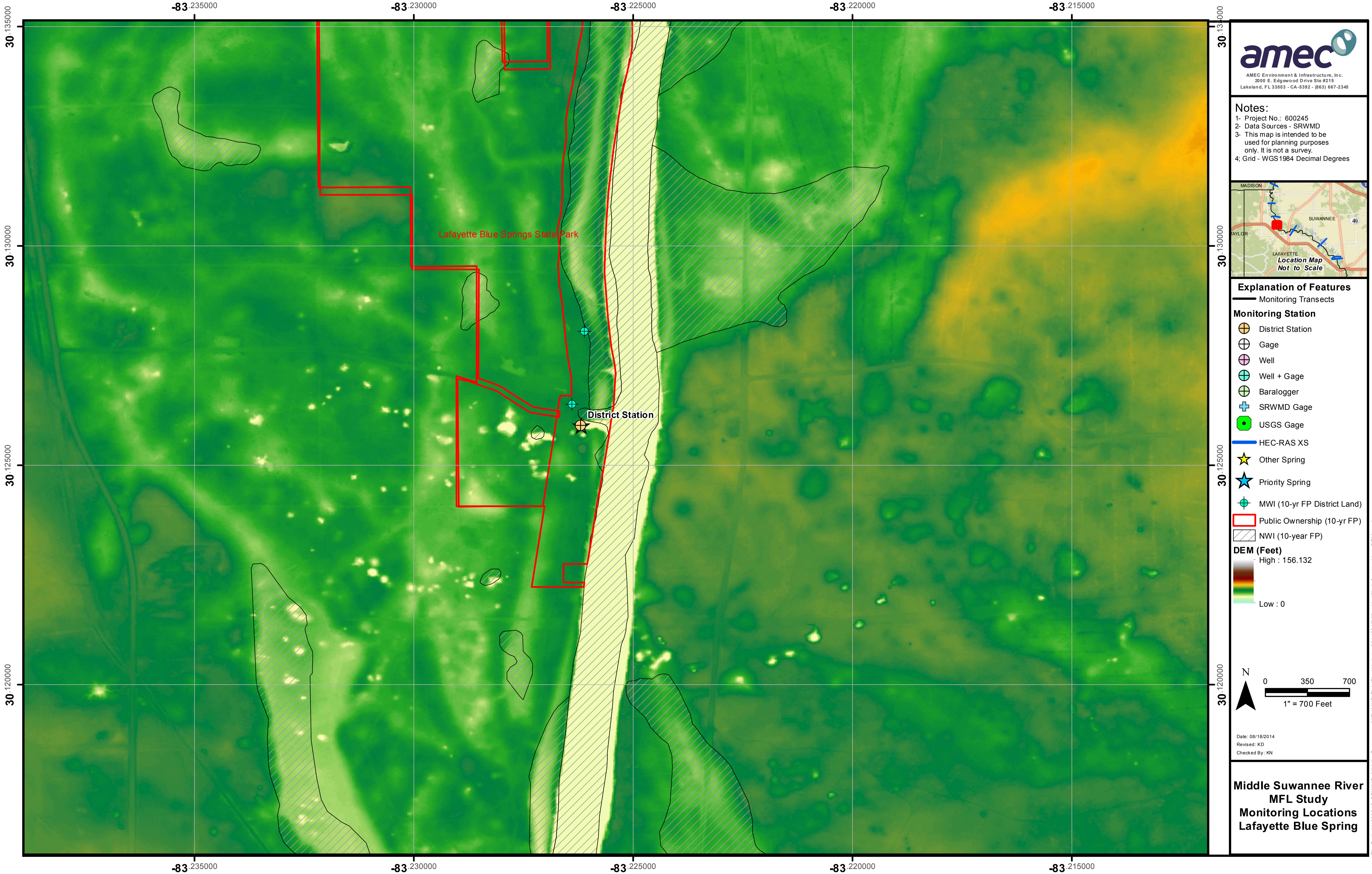
DEM
High : 211.8
Low : 0

N

0 100 200
Feet

Middle Suwannee River MFL Study Monitoring Locations Allen Mill Pond

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\04d - 11x17L_AMP_Springs.mxd



-83.235000
-83.230000
-83.225000
-83.220000
-83.215000
30.135000
30.130000
30.125000
30.120000
Lafayette Blue Springs State Park
District Station
amec
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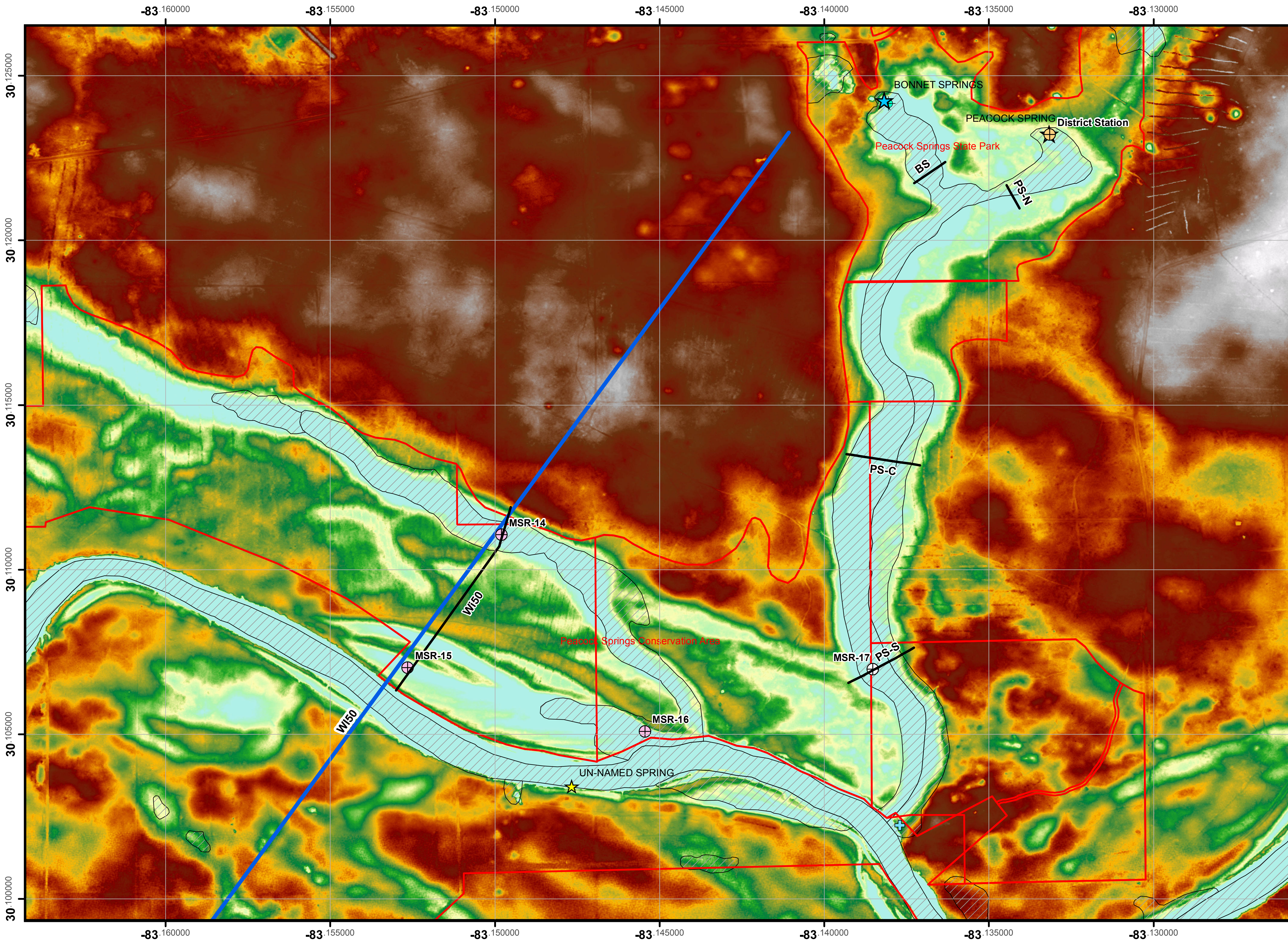
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
MADISON
SUWANNEE
TAYLOR
LAFAYETTE
Location Map Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 156.132
Low : 0
N
0 350 700
1" = 700 Feet
Date: 08/18/2014
Revised: KD
Checked By: KN
Middle Suwannee River
MFL Study
Monitoring Locations
Lafayette Blue Spring



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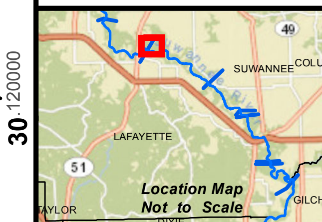
Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

- Monitoring Transects

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

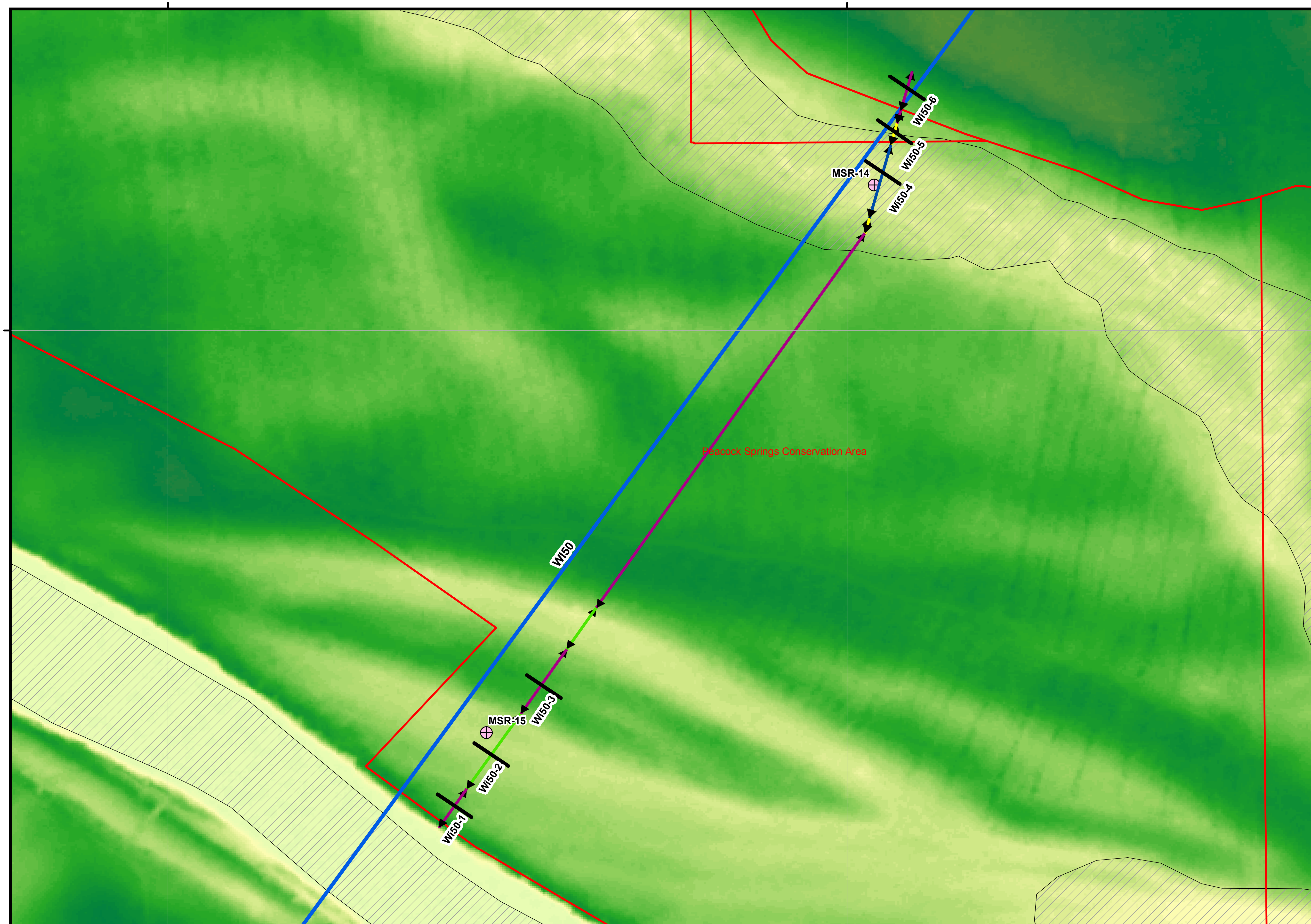
DEM (Feet)
High : 64.6888
Low : 15.5965

N
0 500 1,000
1" = 1000 Feet

Date: 01/13/2015
Revised: KD
Checked By: KBN

Middle Suwannee River MFL Study Monitoring Locations Wi50, Peacock Springs, & Bonnet Springs

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\06 - 11x17L_Wi50-Peacock-Bonnet_DEM.mxd



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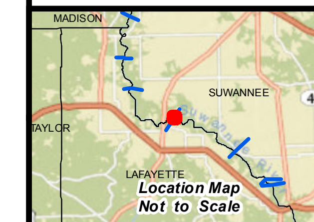
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints

Monitoring Station

District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

DEM

High : 156.132
Low : 0

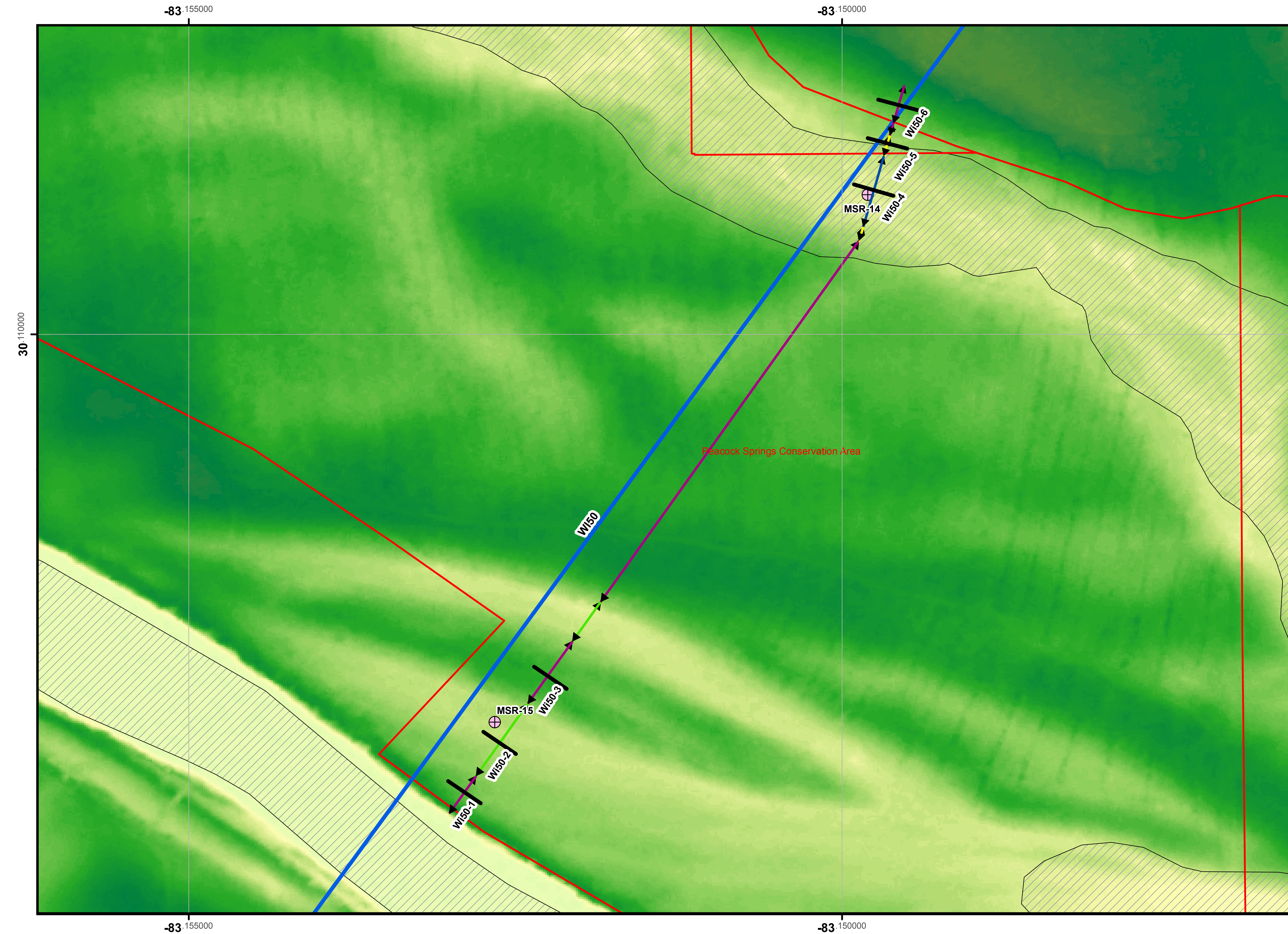
N

0 125 250
1" = 250 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi50, Peacock Springs, & Bonnet Springs North

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\06a - 11x17L_Wi50-Peacock-Bonnet_DEM.mxd



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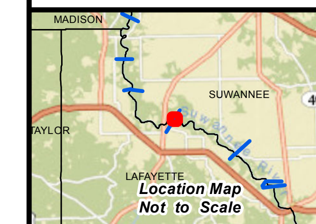
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

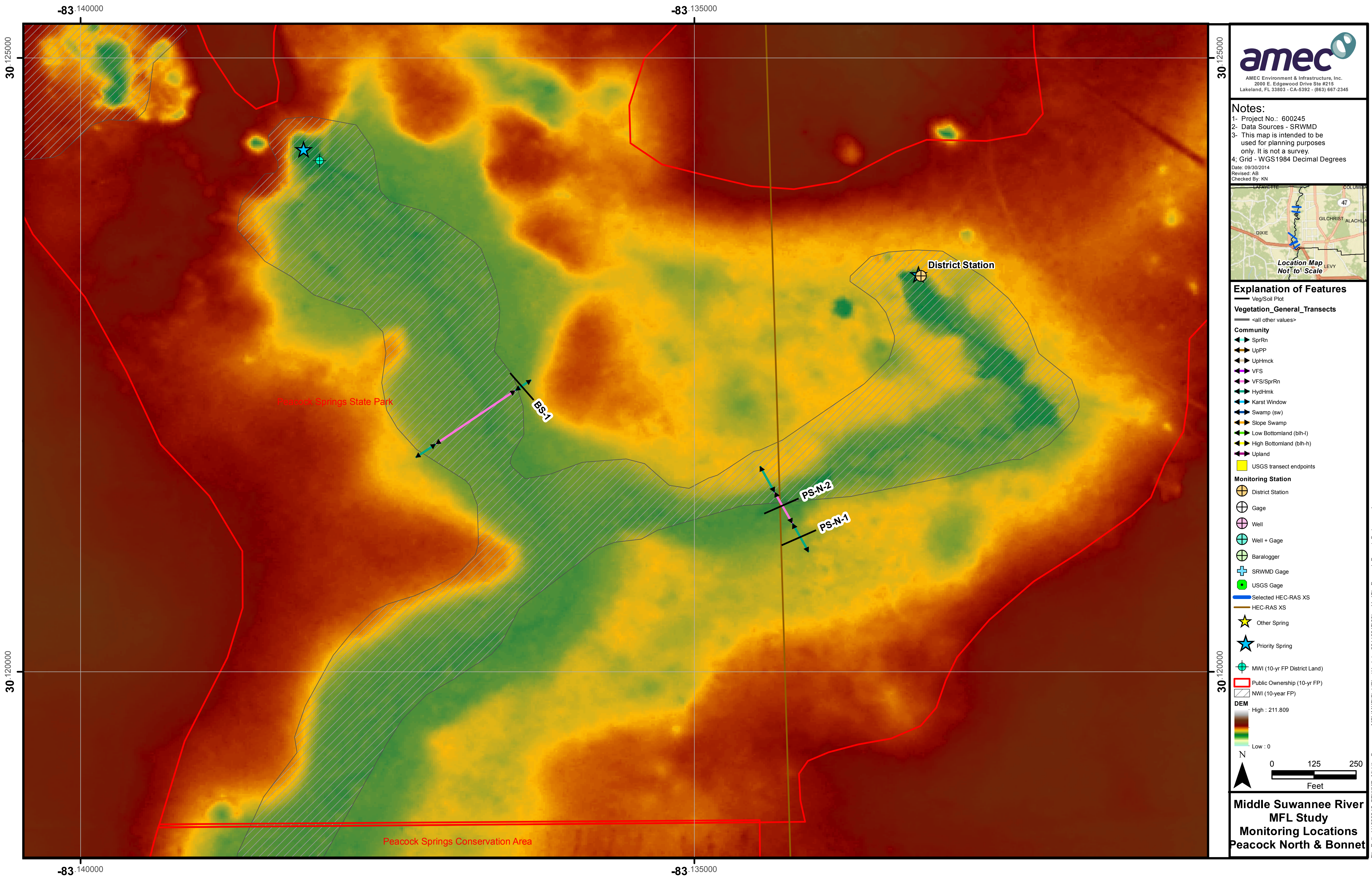
0 125 250

1" = 250 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi50

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\06a - 11x17L_Wi50-Peacock-Bonnet_DEM.mxd



-83.140000
-83.135000
30.125000
30.120000
Peacock Springs State Park
Peacock Springs Conservation Area
District Station
BS-1
PS-N-2
PS-N-1
amec
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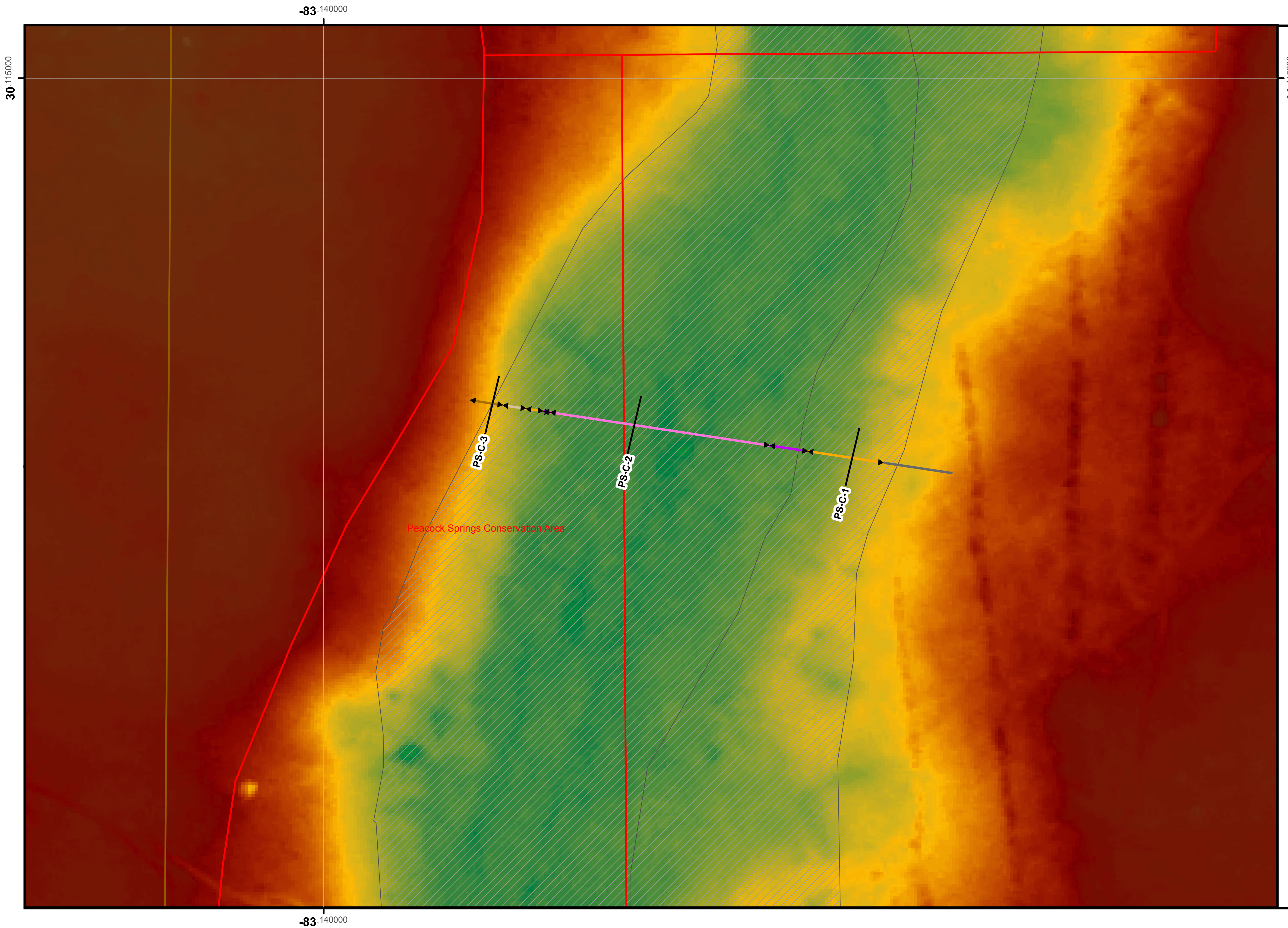
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
Date: 09/30/2014
Revised: AB
Checked By: KN
LAFAYETTE
COLUMBIA
47
GILCHRIST
ALACHUA
DIXIE
LEVY
Location Map Not to Scale
Explanation of Features
Veg/Soil Plot
Vegetation_General_Transects
<all other values>
Community
SprRn
UpPP
UpHmck
VFS
VFS/SprRn
HydHmk
Karst Window
Swamp (sw)
Slope Swamp
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM
High : 211.809
Low : 0
N
0 125 250
Feet
Middle Suwannee River
MFL Study
Monitoring Locations
Peacock North & Bonnet
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\06b - 11x17L_Peacock-Bonnet_Springs.mxd



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Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees

Date: 09/30/2014
Revised: AB
Checked By: KN

Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

<all other values>

Community

- SprRn
- UpPP
- UpHmck
- VFS
- VFS/SprRn
- HydHmk
- Karst Window
- Swamp (sw)
- Slope Swamp
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland

USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

Selected HEC-RAS XS

HEC-RAS XS

Other Spring

Priority Spring

MWI (10-yr FP District Land)

Public Ownership (10-yr FP)

NWI (10-year FP)

DEM

High : 211.809

Low : 0

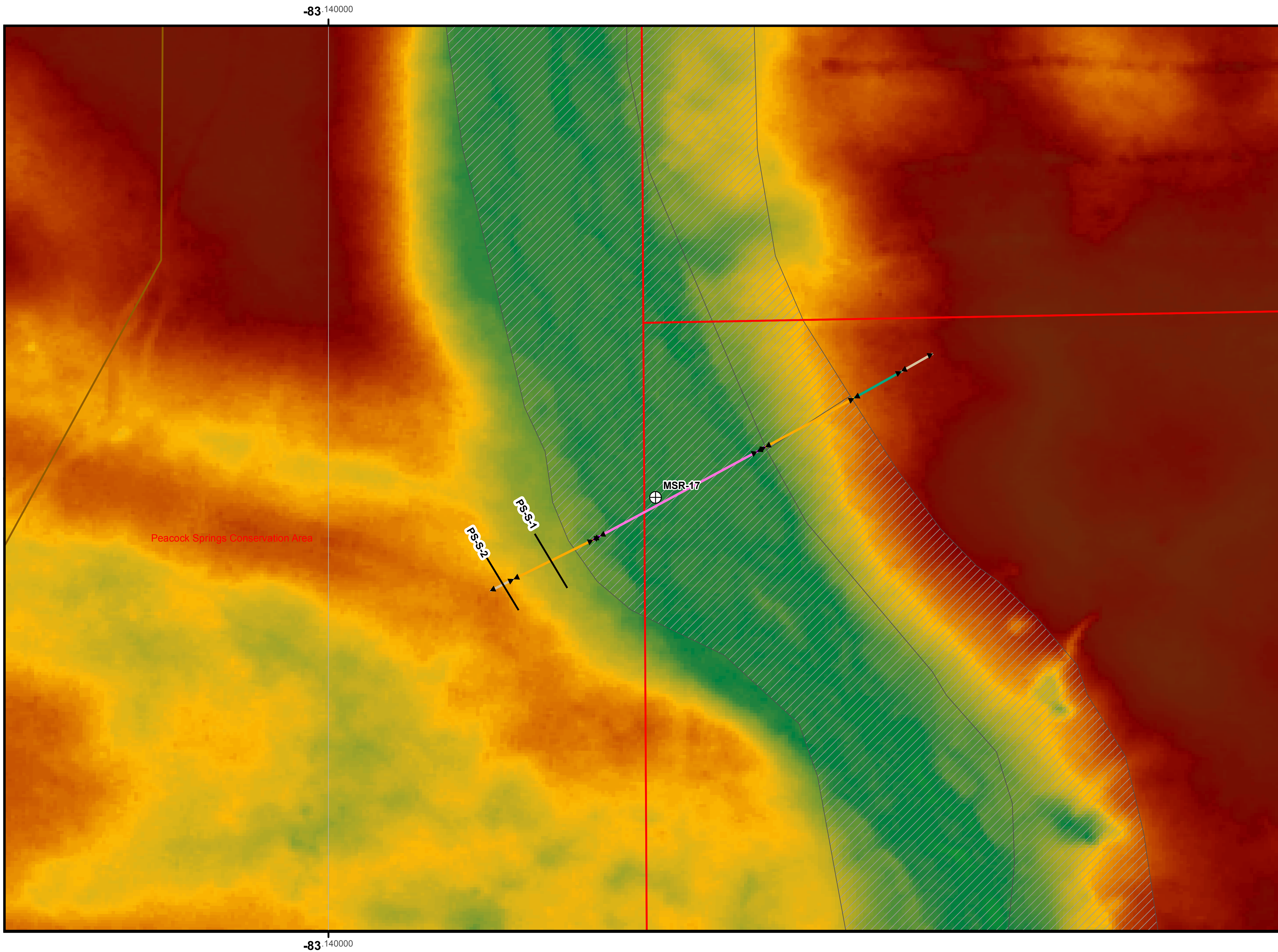
N

0 75 150

Feet

Middle Suwannee River MFL Study Monitoring Locations Peacock Central

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\06c - 11x17L_Peacock-Bonnet_Springs.mxd



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Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
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4; Grid - WGS1984 Decimal Degrees

Date: 09/30/2014
Revised: AB
Checked By: KN

Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

<all other values>

Community

- SprRn
- UpPP
- UpHmck
- VFS
- VFS/SprRn
- HydHmk
- Karst Window
- Swamp (sw)
- Slope Swamp
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland

USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

Selected HEC-RAS XS

HEC-RAS XS

Other Spring

Priority Spring

MWI (10-yr FP District Land)

Public Ownership (10-yr FP)

NWI (10-year FP)

DEM

High : 211.809

Low : 0

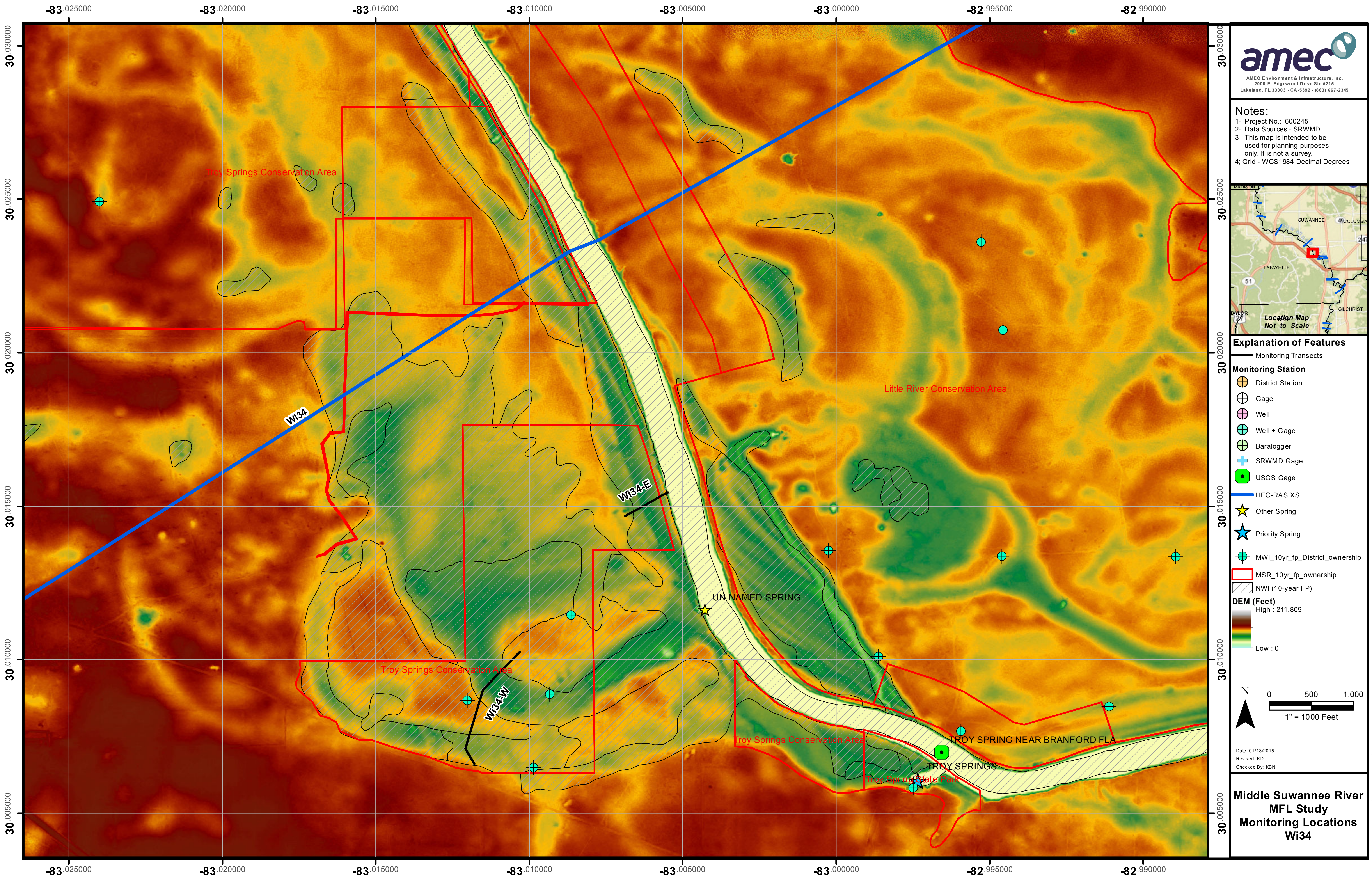
N

0 75 150

Feet

Middle Suwannee River MFL Study Monitoring Locations Peacock South

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\06d - 11x17L_Peacock-Bonnet_Springs.mxd



Troy Springs Conservation Area
Wi34
Wi34-E
Wi34-W
Little River Conservation Area
UN-NAMED SPRING
Troy Springs Conservation Area
TROY SPRING NEAR BRANFORD FLA
TROY SPRINGS
Troy Spring State Park
-83.025000
-83.020000
-83.015000
-83.010000
-83.005000
-83.000000
-82.995000
-82.990000
30.030000
30.025000
30.020000
30.015000
30.010000
30.005000
amec
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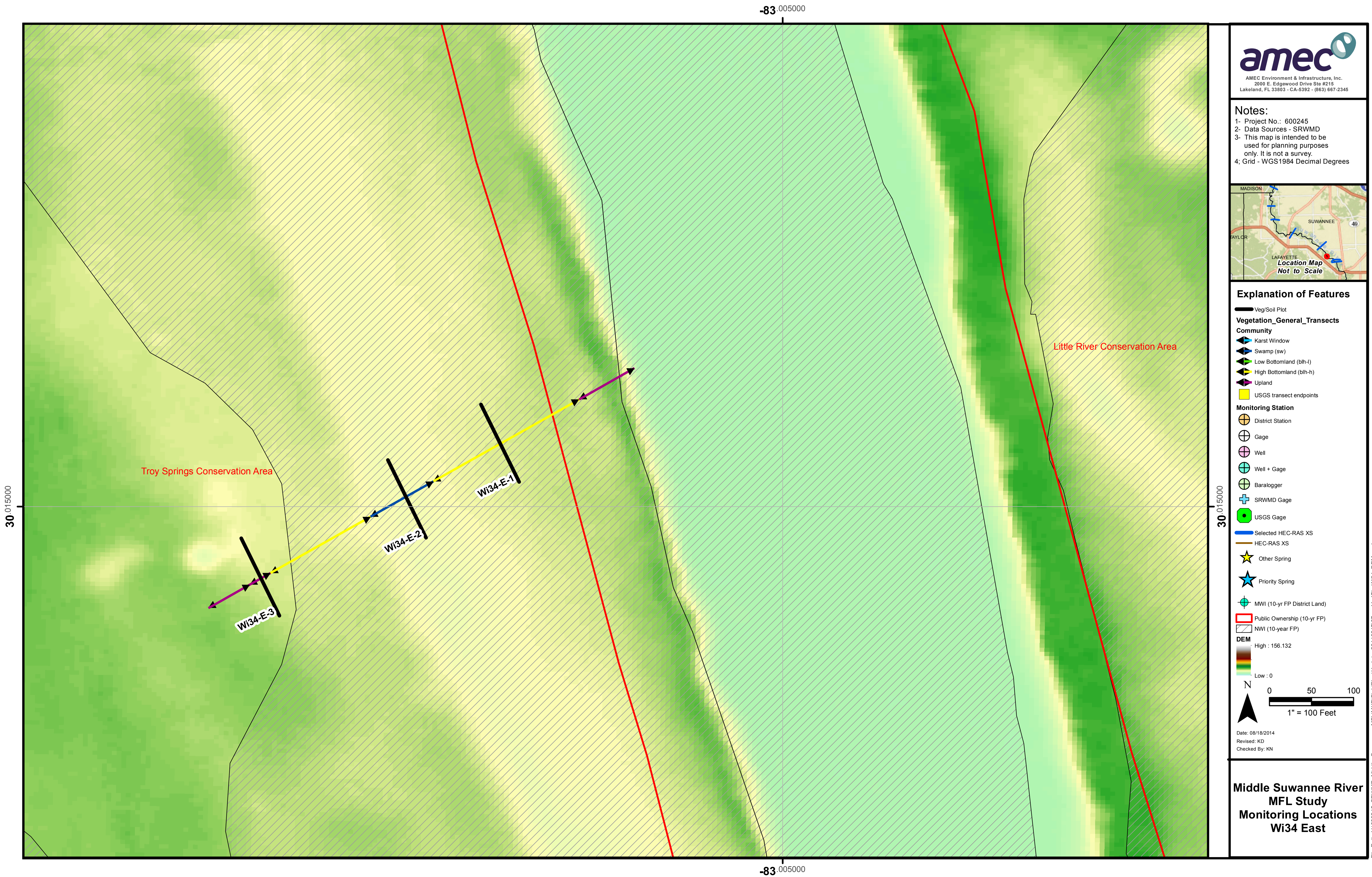
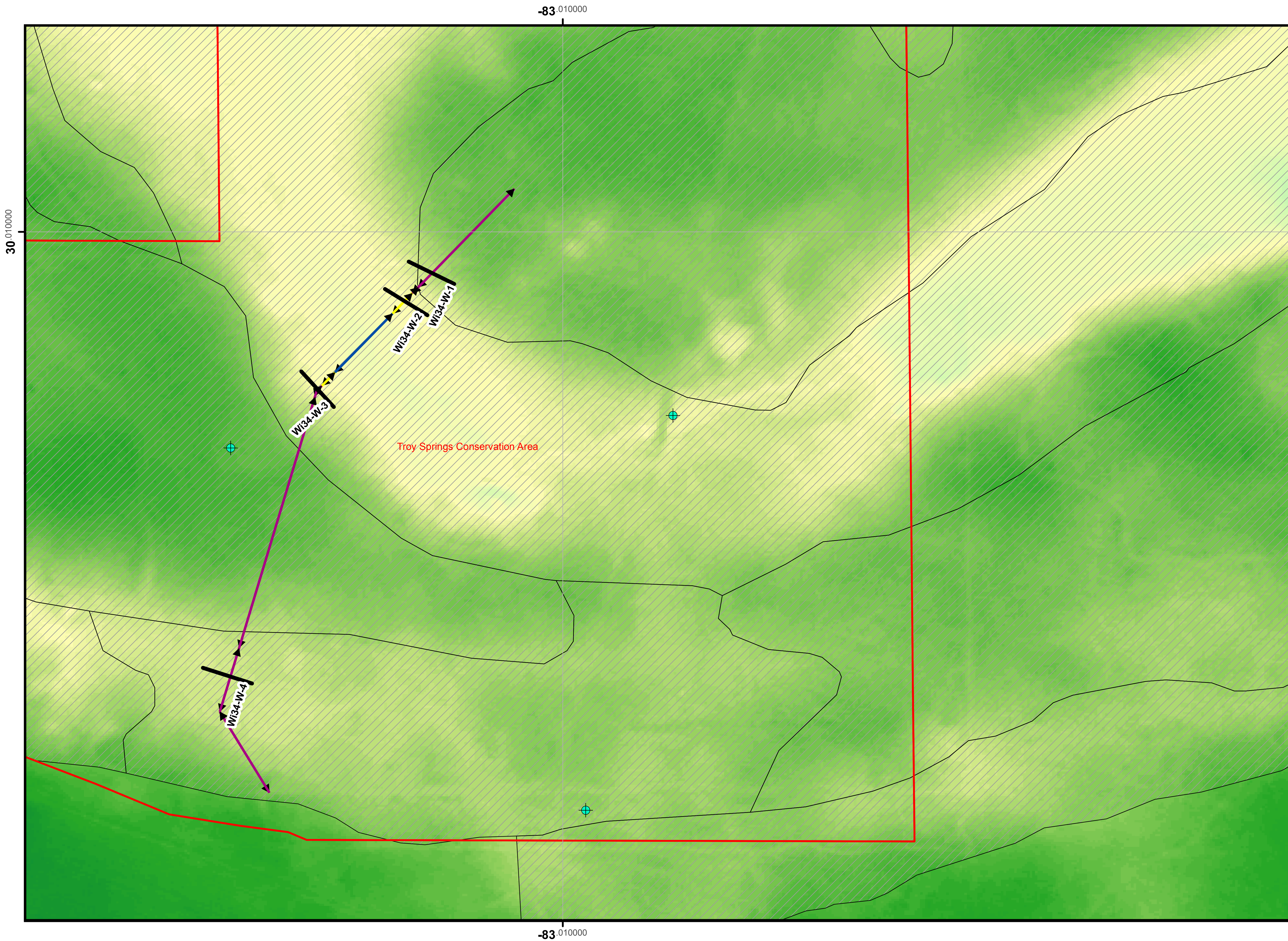
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
MADISON
SUWANNEE
COLUMBIA
LAFAYETTE
GILCHRIST
TAYLOR
DIXIE
Location Map
Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI_10yr_fp_District_ownership
MSR_10yr_fp_ownership
NWI (10-year FP)
DEM (Feet)
High : 211.809
Low : 0
N
0
500
1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
Wi34
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\07 - 11x17L_Wi34_DEM.mxd


-83.005000
30.015000
Troy Springs Conservation Area
Little River Conservation Area
Wi34-E-1
Wi34-E-2
Wi34-E-3
amec
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
MADISON
SUWANNEE
TAYLOR
LAFAYETTE
Location Map Not to Scale
Explanation of Features
Veg/Soil Plot
Vegetation_General_Transects
Community
Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM
High : 156.132
Low : 0
N
0 50 100
1" = 100 Feet
Date: 08/18/2014
Revised: KD
Checked By: KN
Middle Suwannee River
MFL Study
Monitoring Locations
Wi34 East
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\07a - 11x17L_Wi34_DEM.mxd



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Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
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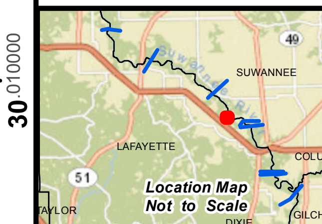
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

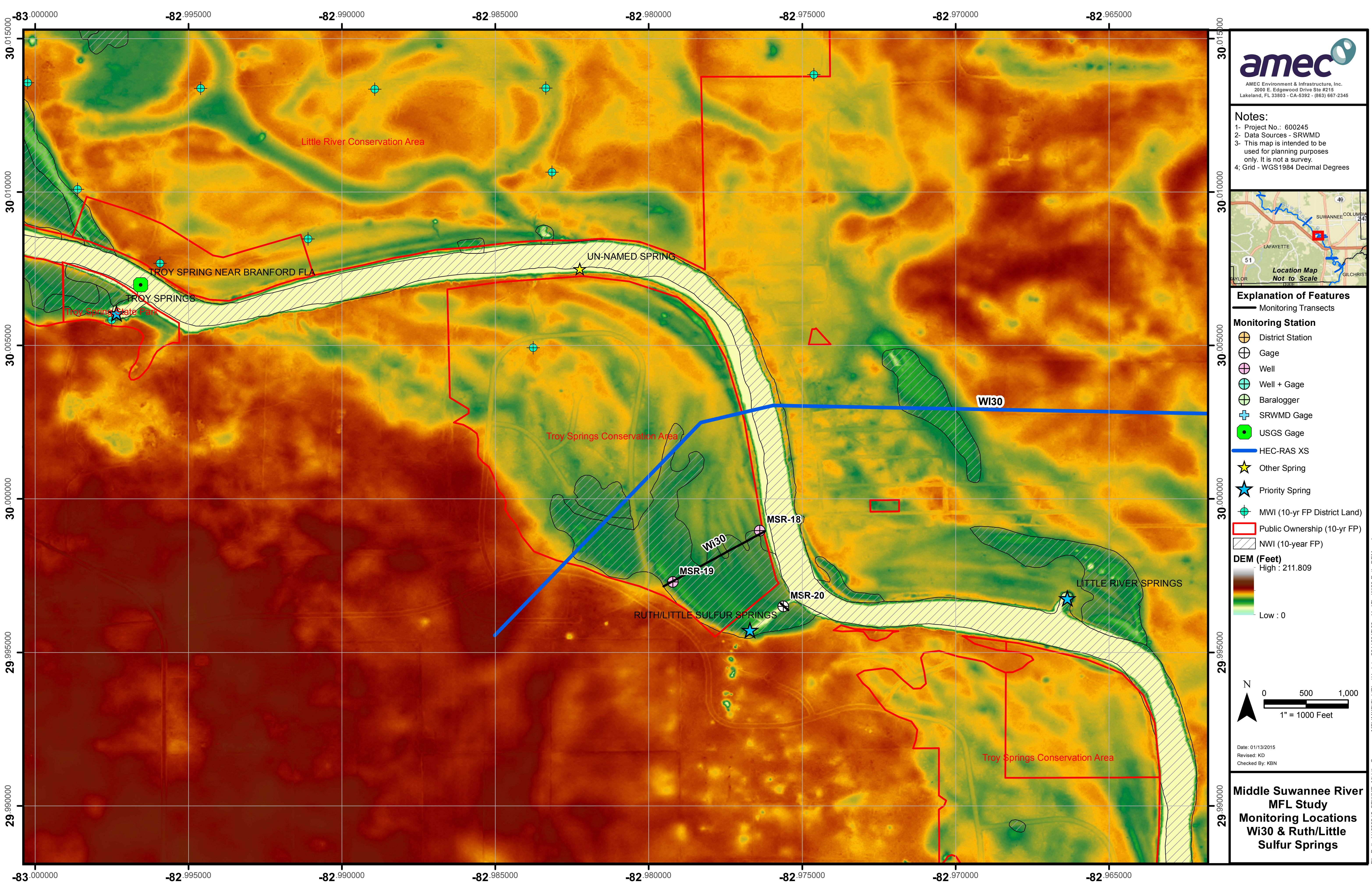
0 100 200

1" = 200 Feet

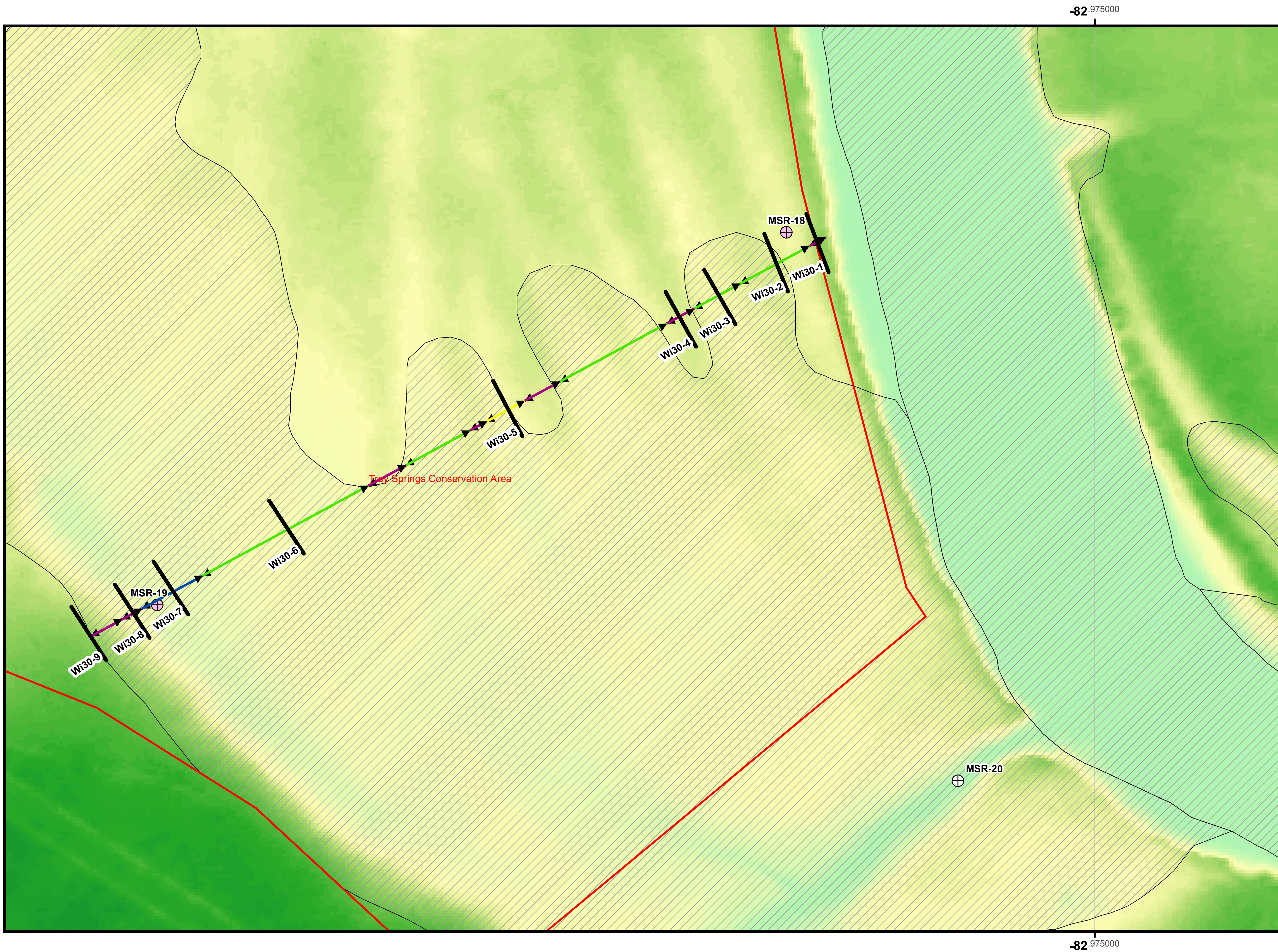
Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi34 West

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\07b - 11x17L_Wi34_DEM.mxd



Little River Conservation Area
TROY SPRING NEAR BRANFORD FLA
TROY SPRINGS
Troy Spring State Park
UN-NAMED SPRING
Troy Springs Conservation Area
WI30
Wi30
MSR-18
MSR-19
MSR-20
RUTH/LITTLE SULFUR SPRINGS
LITTLE RIVER SPRINGS
Troy Springs Conservation Area
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
SUWANNEE
COLUMBIA
LAFAYETTE
GILCHRIST
Location Map Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 211.809
Low : 0
N
0 500 1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River MFL Study Monitoring Locations Wi30 & Ruth/Little Sulfur Springs
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\08 - 11x17L_Wi30-Ruth_DEM.mxd



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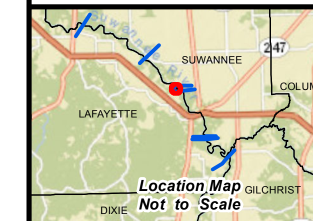
Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

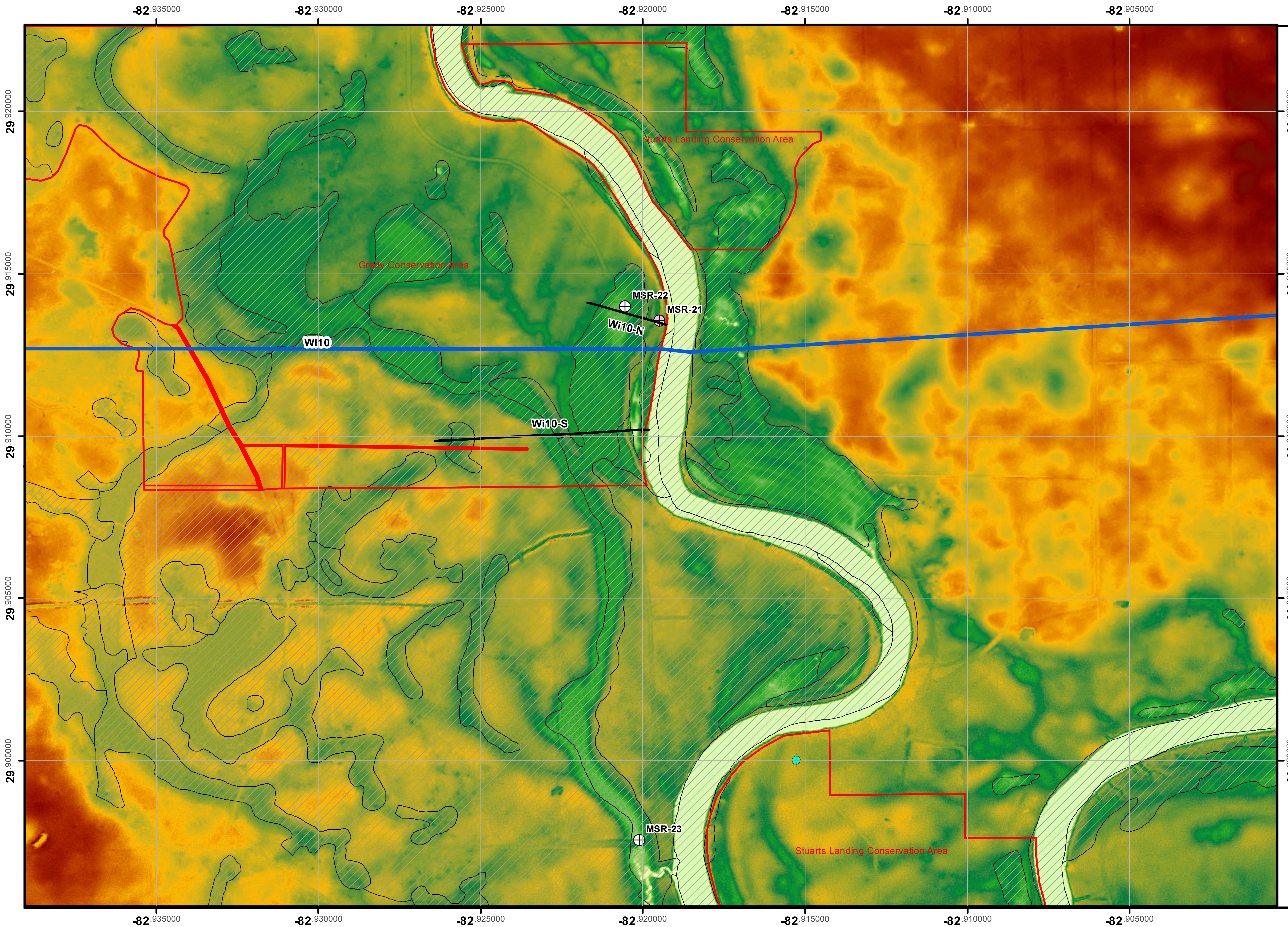
0 75 150

1" = 150 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi30 & Ruth/Little Sulfur Springs

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\08a - 11x17L_Wi30-Ruth_DEM.mxd



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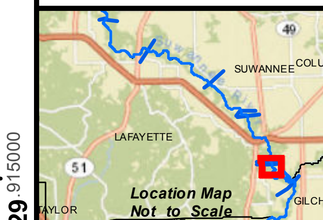
Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Monitoring Transects

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM (Feet)

High : 211.809

Low : 0

N

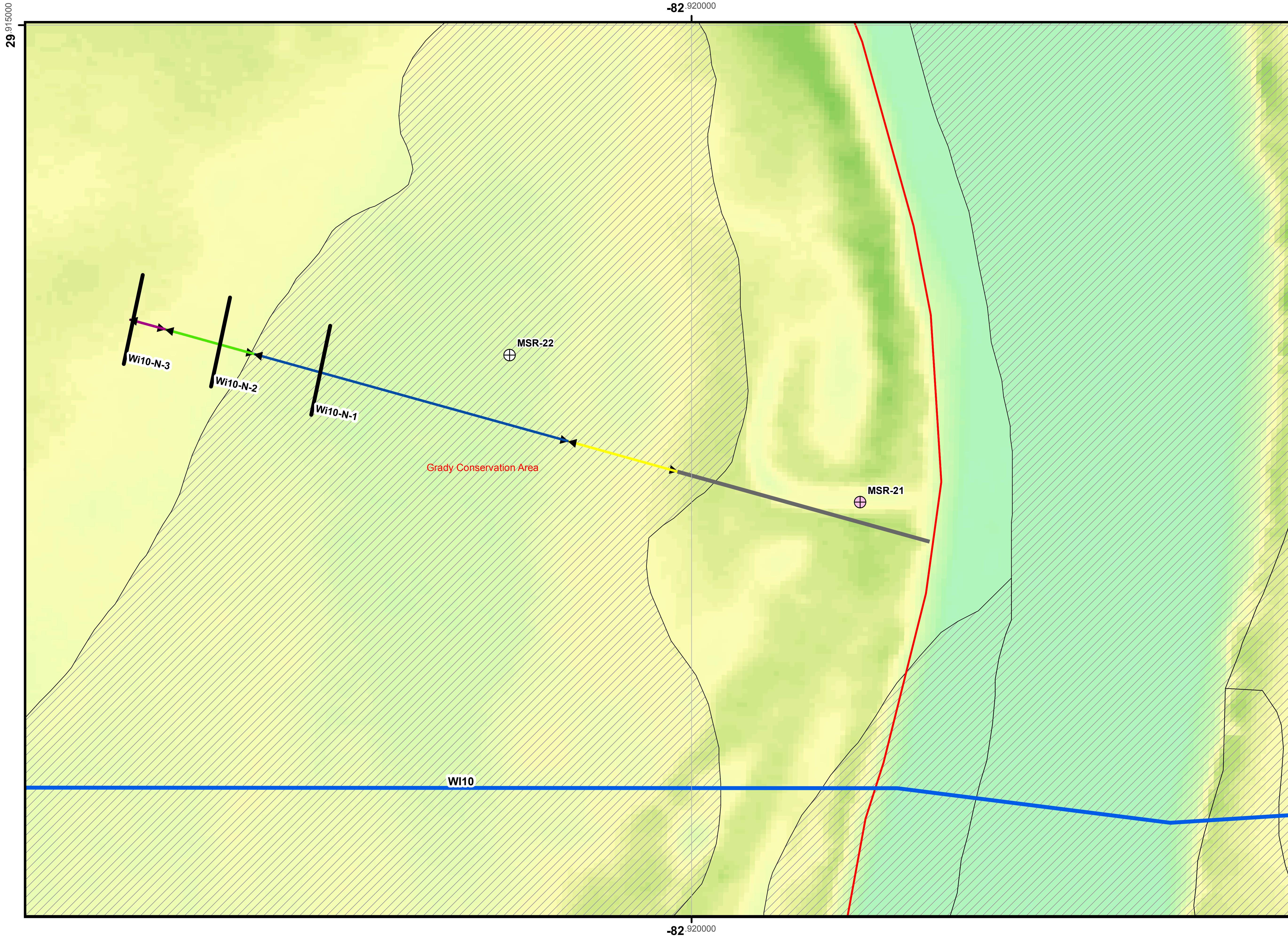
0 500 1,000

1" = 1000 Feet

Date: 01/13/2015
Revised: KD
Checked By: KBN

Middle Suwannee River
MFL Study
Monitoring Locations
Wi10

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlanUpdate_20140817\09 - 11x17L_Wi10_DEM.mxd



amec

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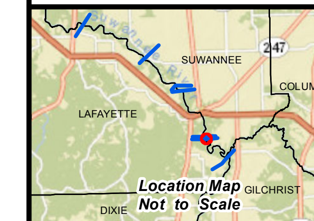
Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Disturbed

Community

Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints

Monitoring Station

District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage

Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

DEM

High : 156.132
Low : 0

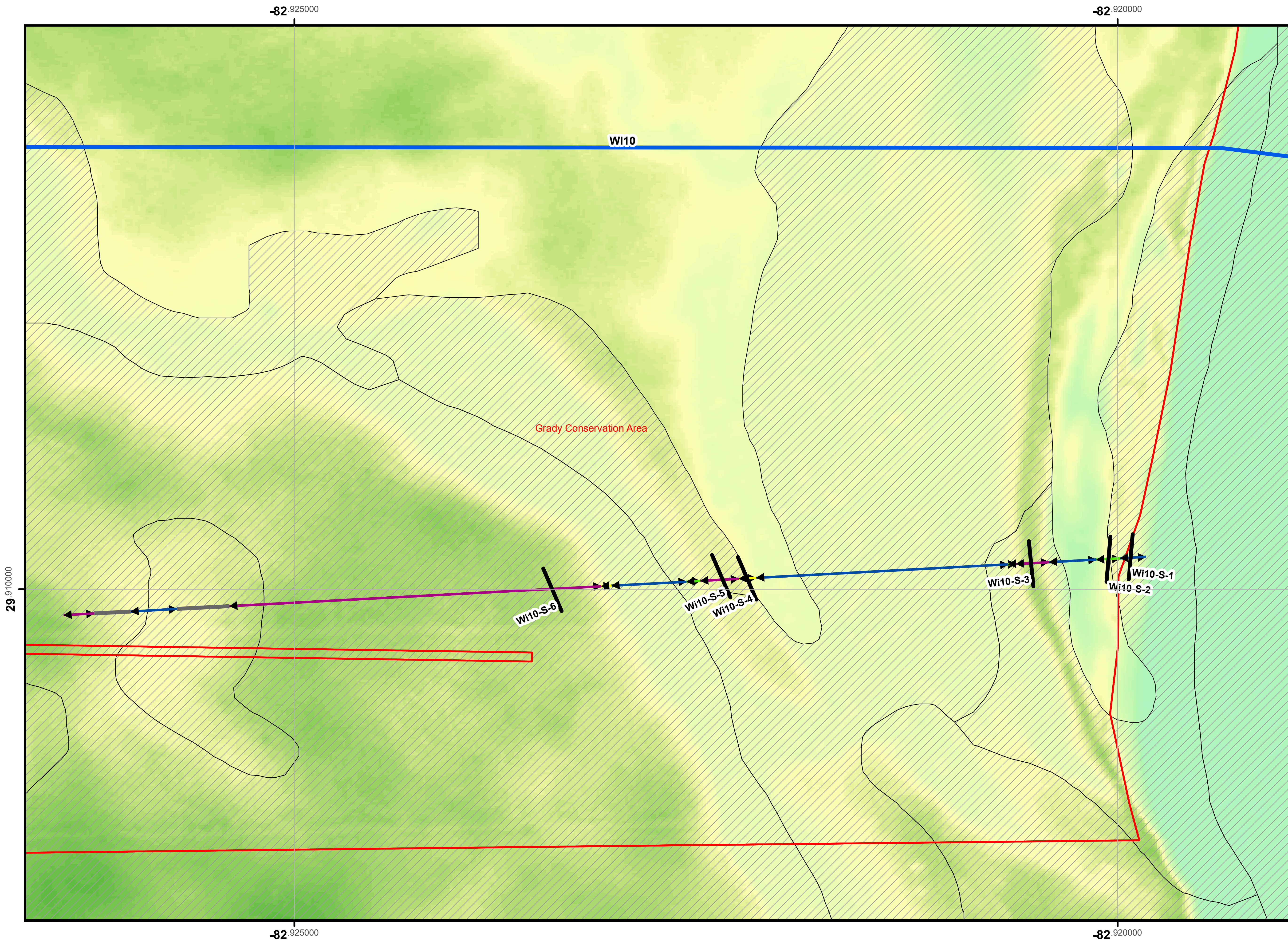
N

0 50 100
1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi10 North

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\09a - 11x17L_Wi10_DEM.mxd



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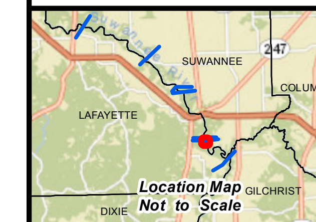
Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Not Classified

Community

Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints

Monitoring Station

District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

DEM

High : 156.132

Low : 0

N

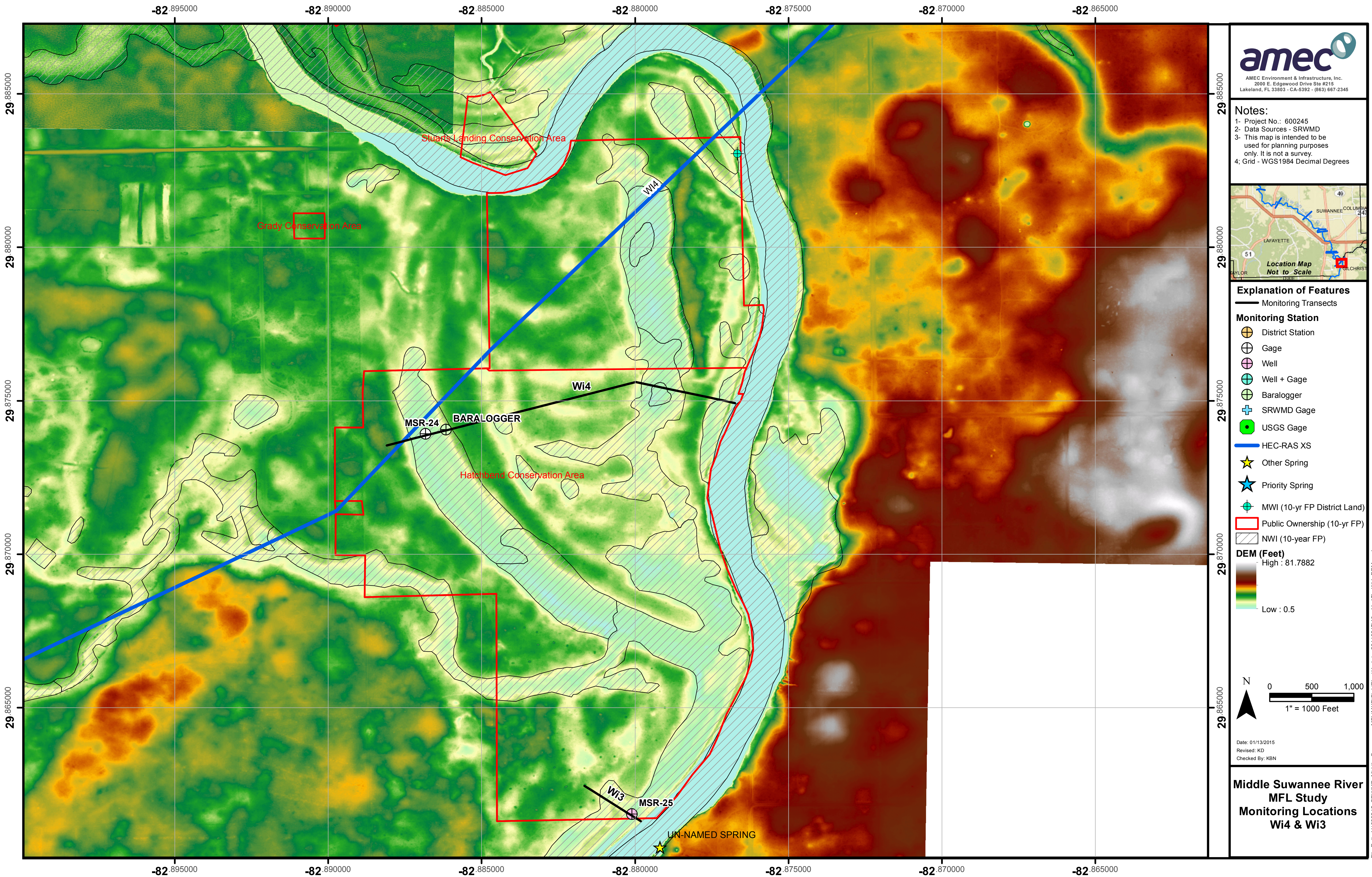
0 100 200

1" = 200 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi10 South

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\09b - 11x17L_Wi10_DEM.mxd



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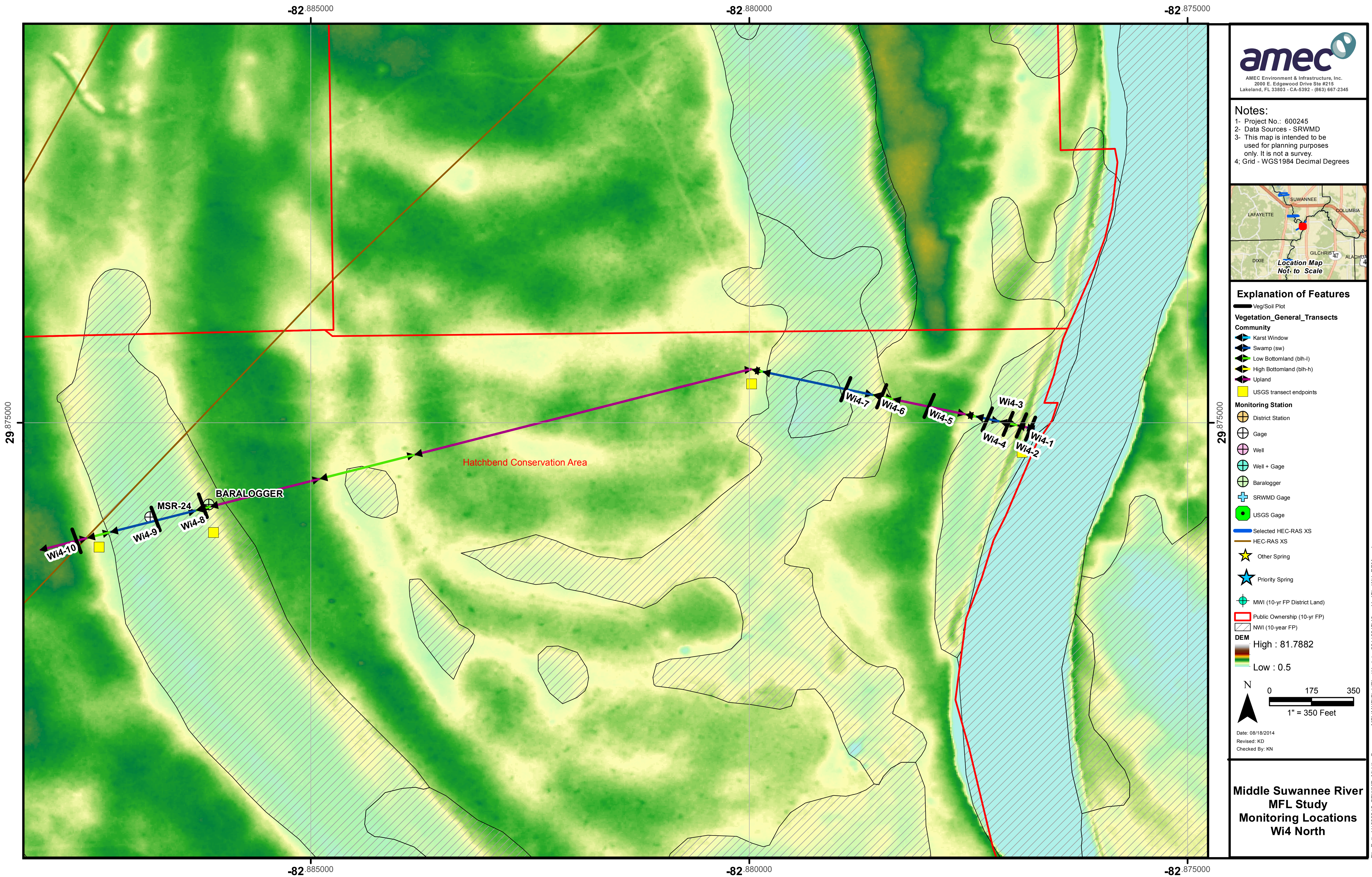
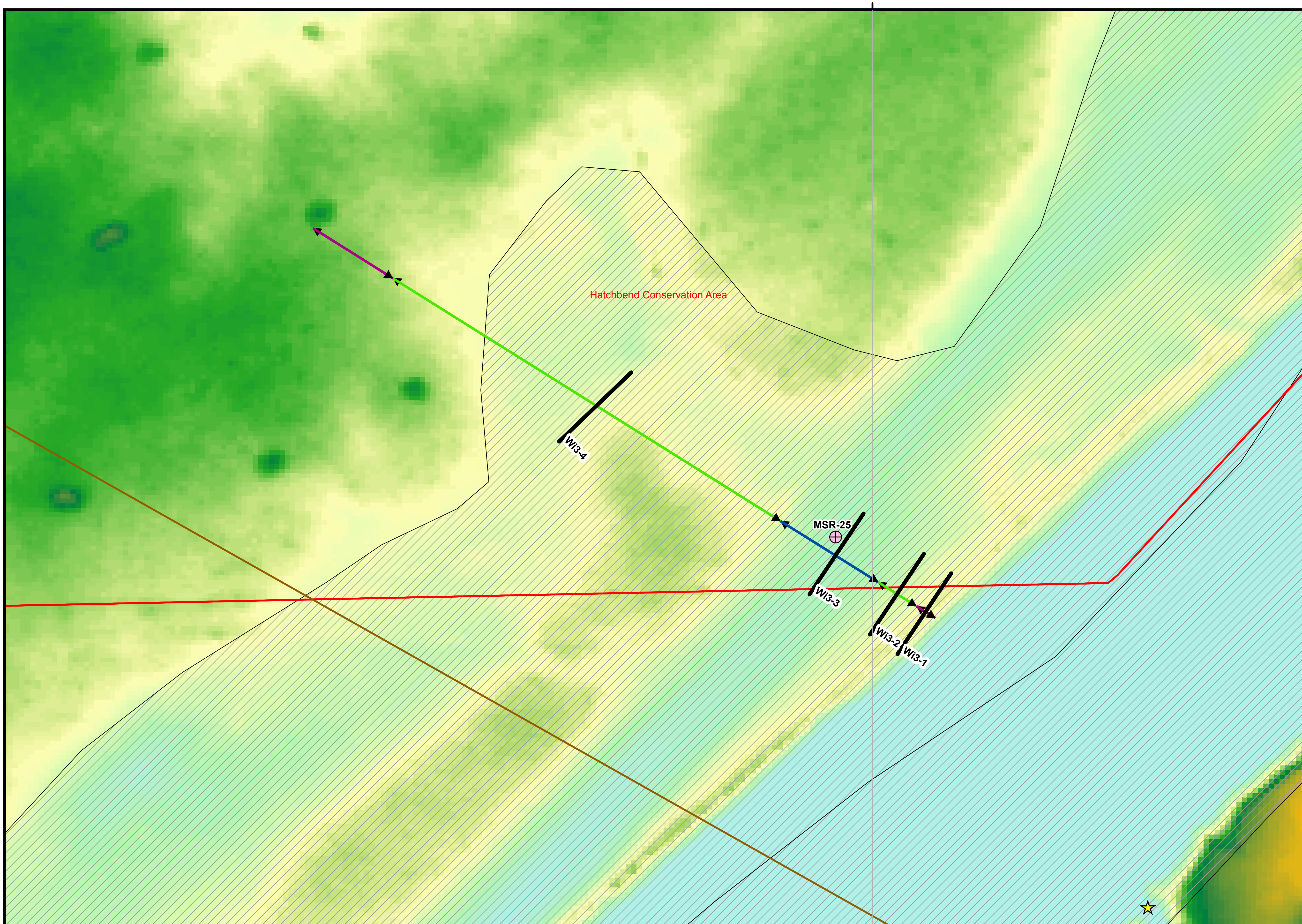
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
Location Map
Not to Scale
SUWANNEE
COLUMBIA
LAFAYETTE
TAYLOR
GILCHRIST
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 81.7882
Low : 0.5
N
0 500 1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
Wi4 & Wi3
Stuarts Landing Conservation Area
Grady Conservation Area
Hatchbend Conservation Area
Wi4
MSR-24
BARALOGGER
Wi3
MSR-25
UN-NAMED SPRING
-82.895000
-82.890000
-82.885000
-82.880000
-82.875000
-82.870000
-82.865000
29.885000
29.880000
29.875000
29.870000
29.865000



Middle Suwannee River MFL Study Monitoring Locations Wi4 North

-82.880000



-82.880000

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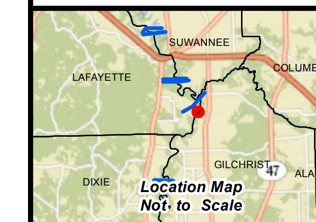
Notes:

1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees



Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints

Monitoring Station

District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

DEM

High : 81.7882

Low : 0.5

N

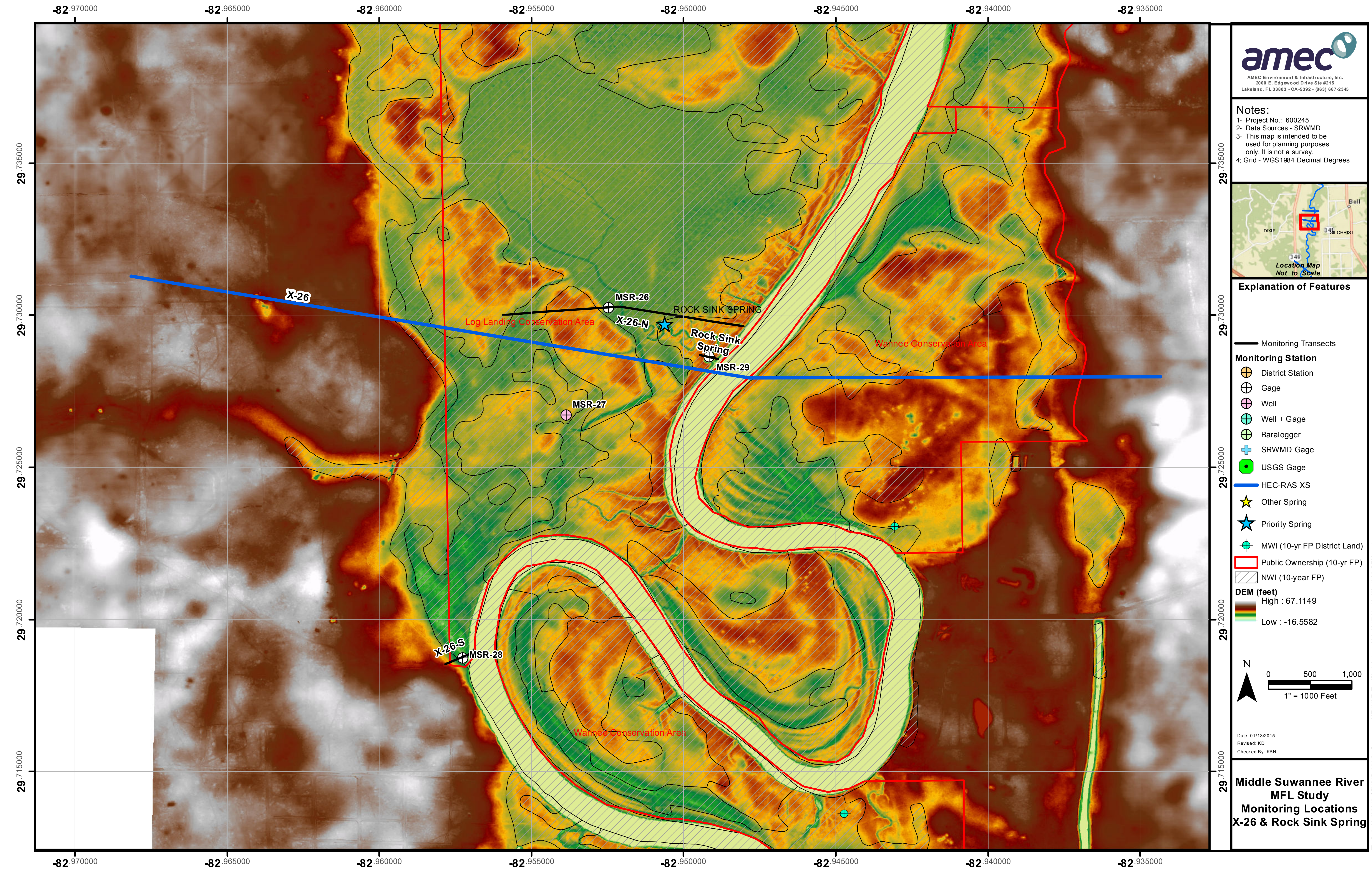
0 50 100

1" = 100 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations Wi3

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\10b - 11x17L_Wi3_DEM.mxd


X-26
MSR-26
ROCK SINK SPRING
X-26-N
Log Landing Conservation Area
Rock Sink Spring
MSR-29
Wannee Conservation Area
MSR-27
X-26-S
MSR-28
Wannee Conservation Area
-82.970000
-82.965000
-82.960000
-82.955000
-82.950000
-82.945000
-82.940000
-82.935000
29.735000
29.730000
29.725000
29.720000
29.715000
amec
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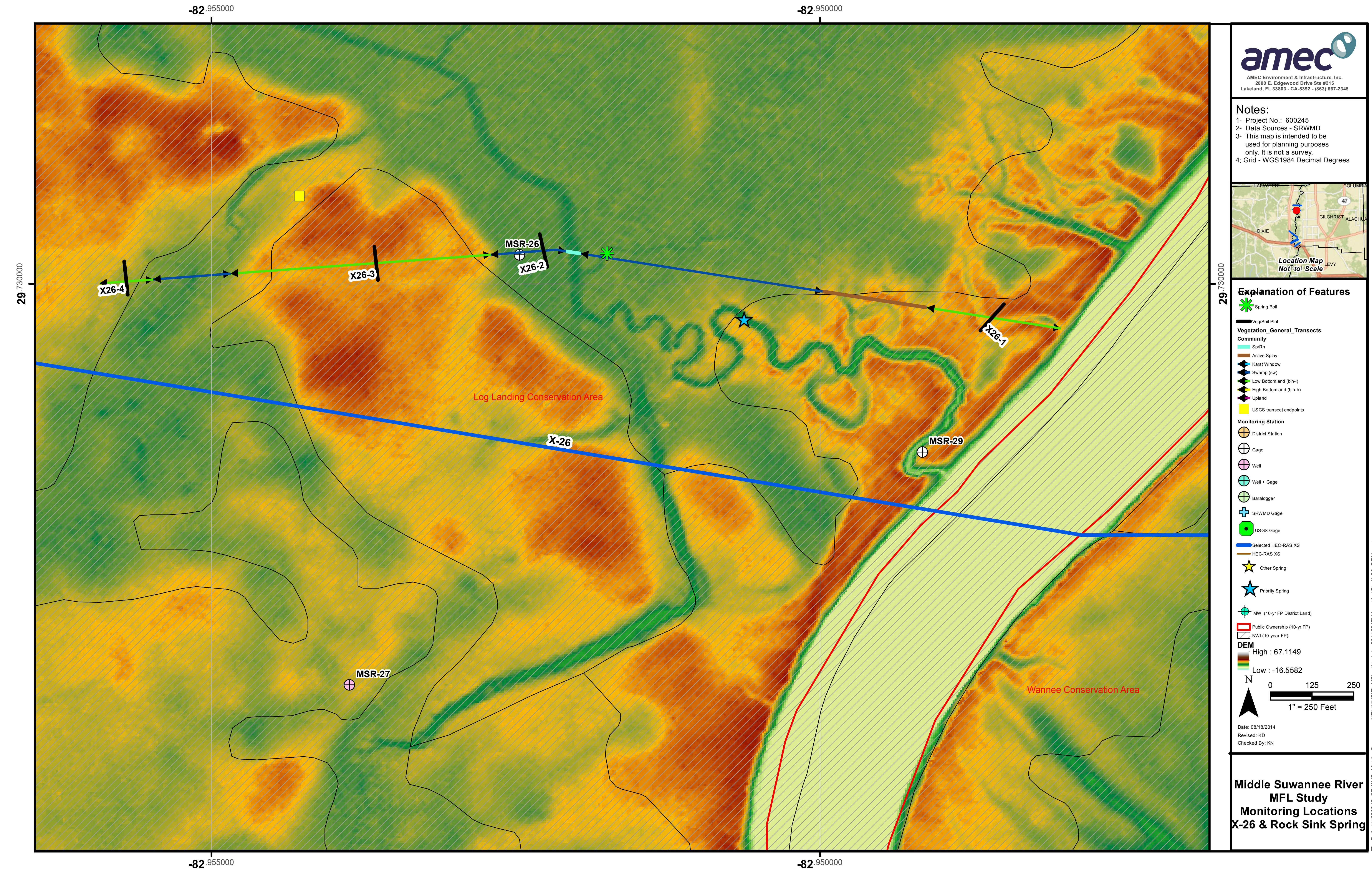
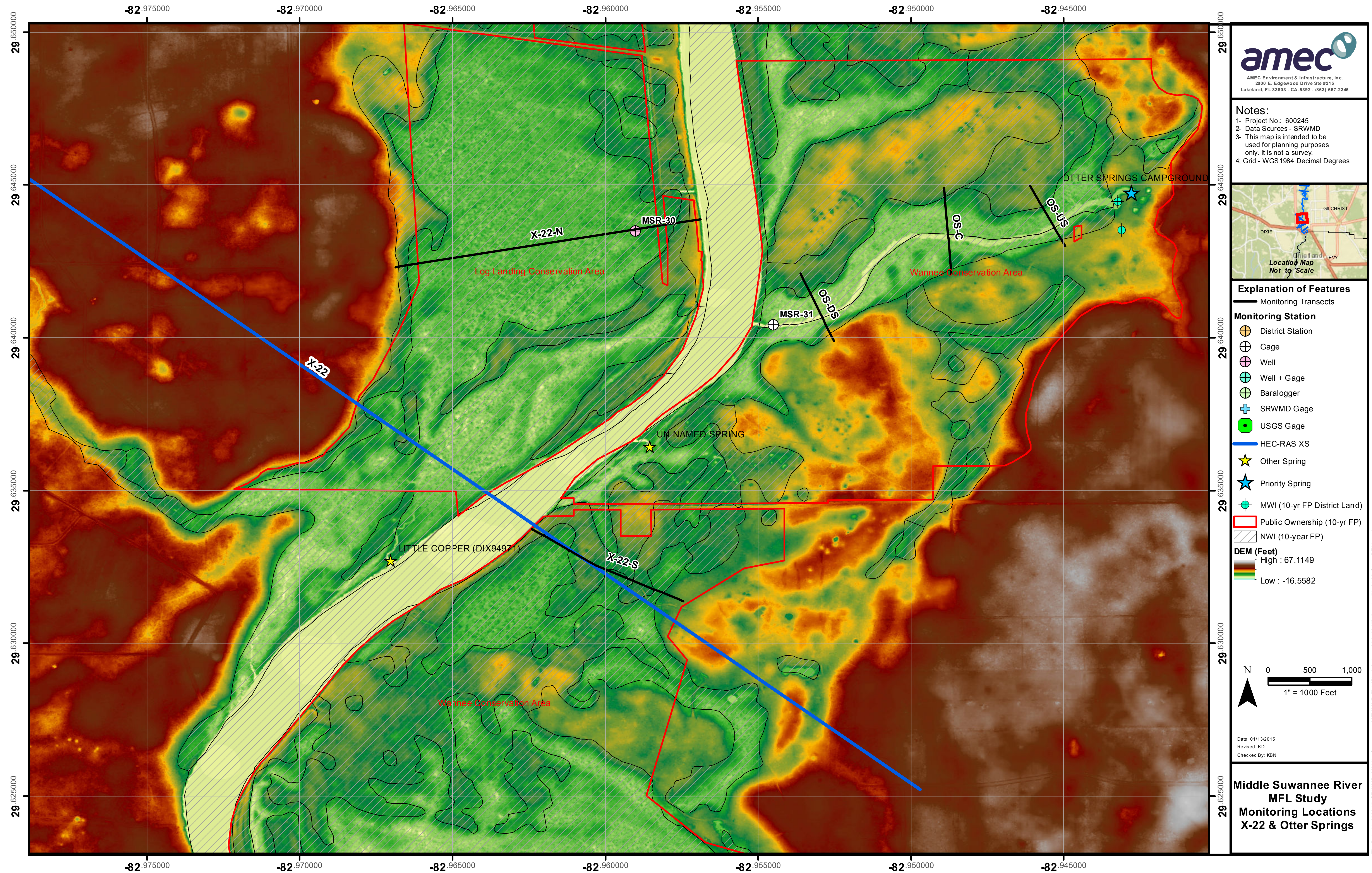
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
Bell
DIXIE
341
GILCHRIST
349
Location Map
Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (feet)
High : 67.1149
Low : -16.5582
N
0
500
1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
X-26 & Rock Sink Spring
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlanUpdate_20140817\11 - 11x17L_X26_DEM.mxd



-82.955000
-82.950000
29.730000
MSR-26
X26-2
X26-3
X26-4
X26-1
Log Landing Conservation Area
X-26
MSR-29
MSR-27
Wannee Conservation Area
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
LAFAYETTE
COLUMBIA
47
GILCHRIST
ALACHUA
DIXIE
LEVY
Location Map Not to Scale
Explanation of Features
Spring Boil
Veg/Soil Plot
Vegetation_General_Transects
Community
SprRn
Active Splay
Karst Window
Swamp (sw)
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM
High : 67.1149
Low : -16.5582
N
0 125 250
1" = 250 Feet
Date: 08/18/2014
Revised: KD
Checked By: KN
Middle Suwannee River
MFL Study
Monitoring Locations
X-26 & Rock Sink Spring
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\11a - 11x17L_X-26_DEM.mxd


X-22-N
MSR-30
Log Landing Conservation Area
X-22
UN-NAMED SPRING
LITTLE COPPER (DIX94971)
X-22-S
Wannee Conservation Area
MSR-31
OS-DS
OS-C
OS-US
OTTER SPRINGS CAMPGROUND
Wannee Conservation Area
-82.975000
-82.970000
-82.965000
-82.960000
-82.955000
-82.950000
-82.945000
29.650000
29.645000
29.640000
29.635000
29.630000
29.625000
amec
AMEC Environment & Infrastructure, Inc.
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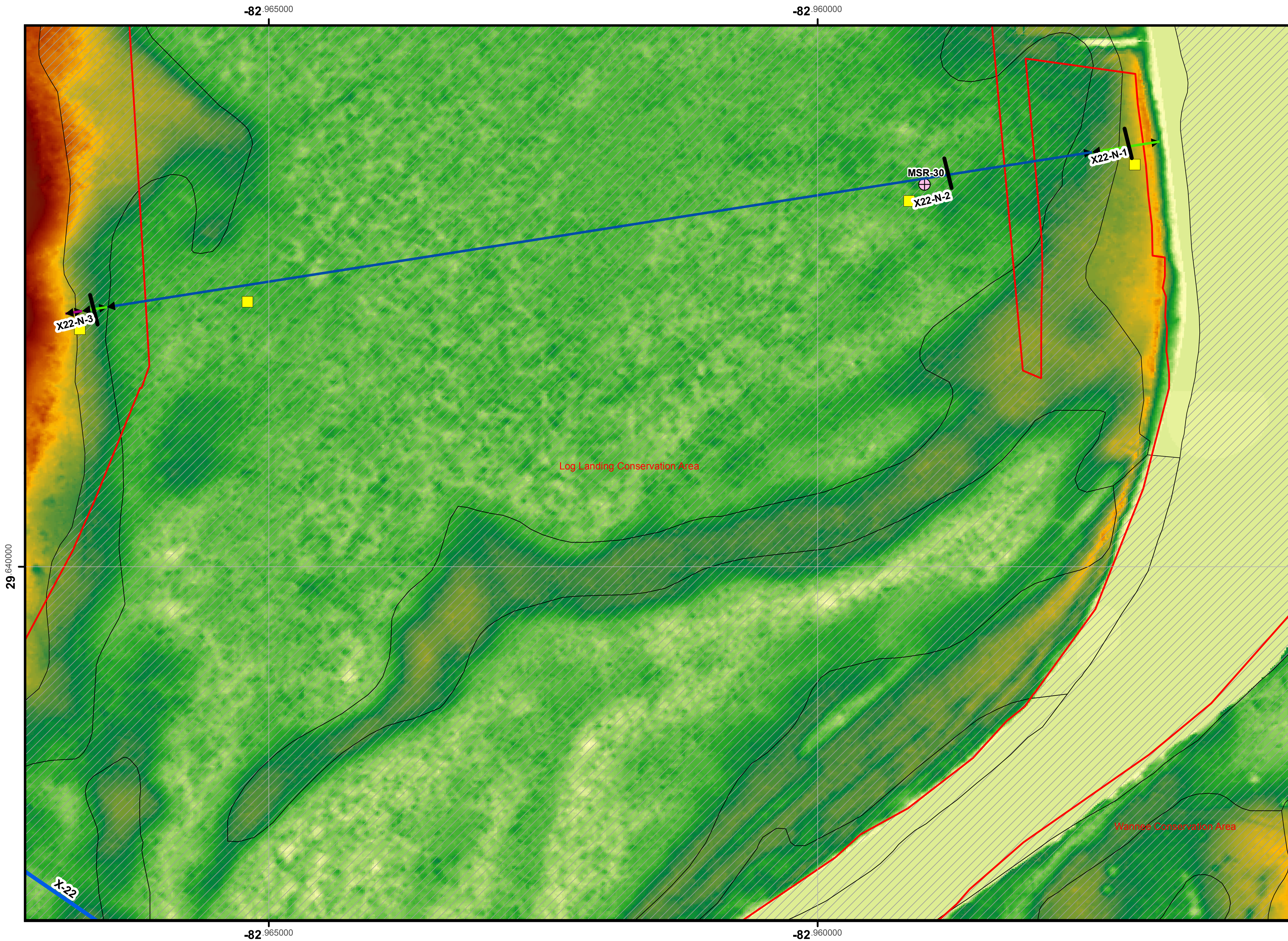
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
GILCHRIST
DIXIE
Chiefland
LEVY
Location Map Not to Scale
Explanation of Features
Monitoring Transects
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM (Feet)
High : 67.1149
Low : -16.5582
N
0
500
1,000
1" = 1000 Feet
Date: 01/13/2015
Revised: KD
Checked By: KBN
Middle Suwannee River
MFL Study
Monitoring Locations
X-22 & Otter Springs
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\12 - 11x17L_X-22-Otter_DEM.mxd



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Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees

Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage
- Selected HEC-RAS XS
- HEC-RAS XS
- Other Spring
- Priority Spring
- MWI (10-yr FP District Land)
- Public Ownership (10-yr FP)
- NWI (10-year FP)

DEM

High : 67.1149

Low : -16.5582

N

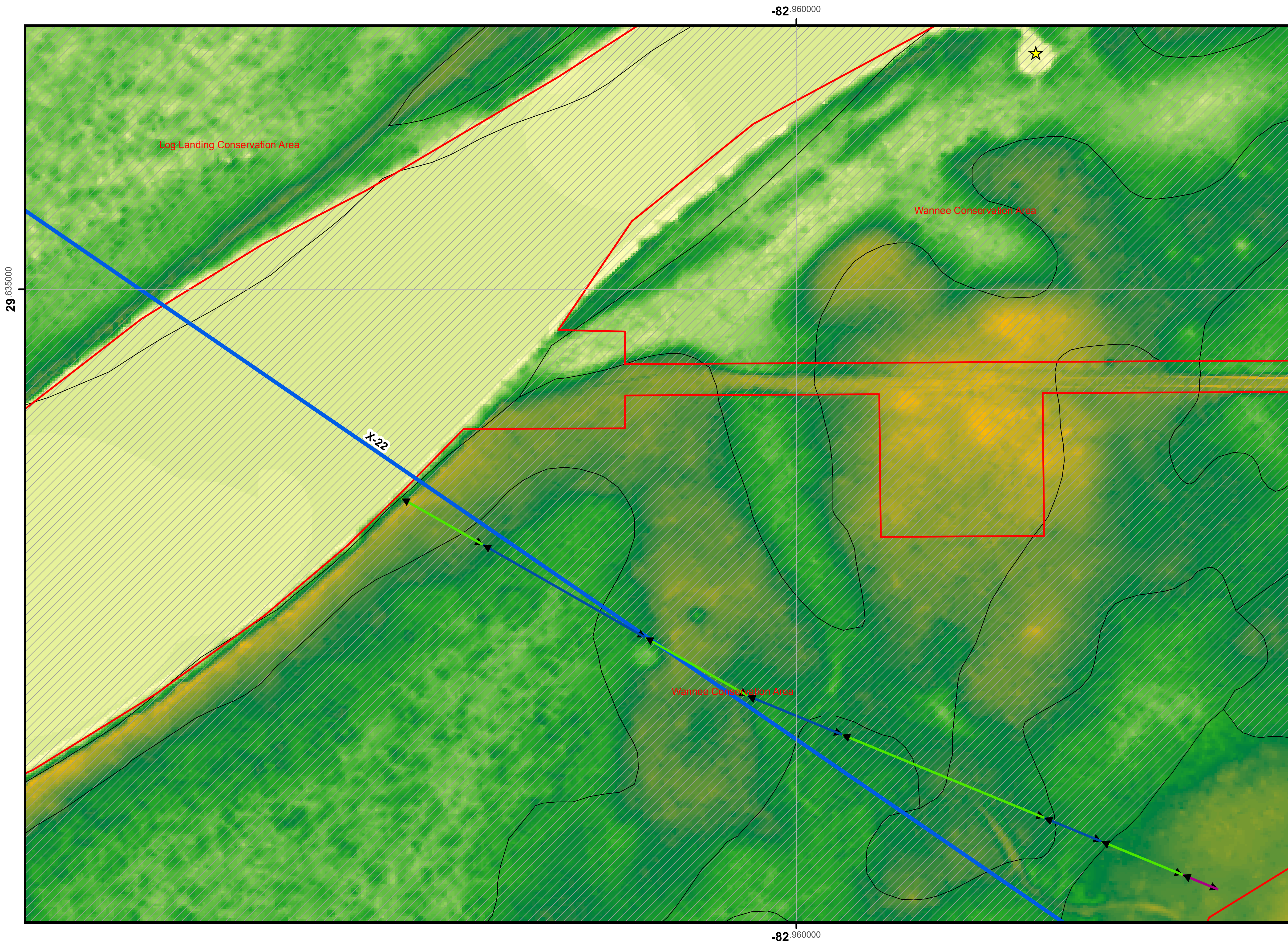
0 150 300

1" = 300 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations X-22 North

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\12a - 11x17L_X-22-Otter_DEM.mxd



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Lakeland, FL 33803 - CA-5392 - (863) 667-2345

Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees

Explanation of Features

Veg/Soil Plot

Vegetation_General_Transects

Community

- Karst Window
- Swamp (sw)
- Low Bottomland (blh-l)
- High Bottomland (blh-h)
- Upland
- USGS transect endpoints

Monitoring Station

- District Station
- Gage
- Well
- Well + Gage
- Baralogger
- SRWMD Gage
- USGS Gage

Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)

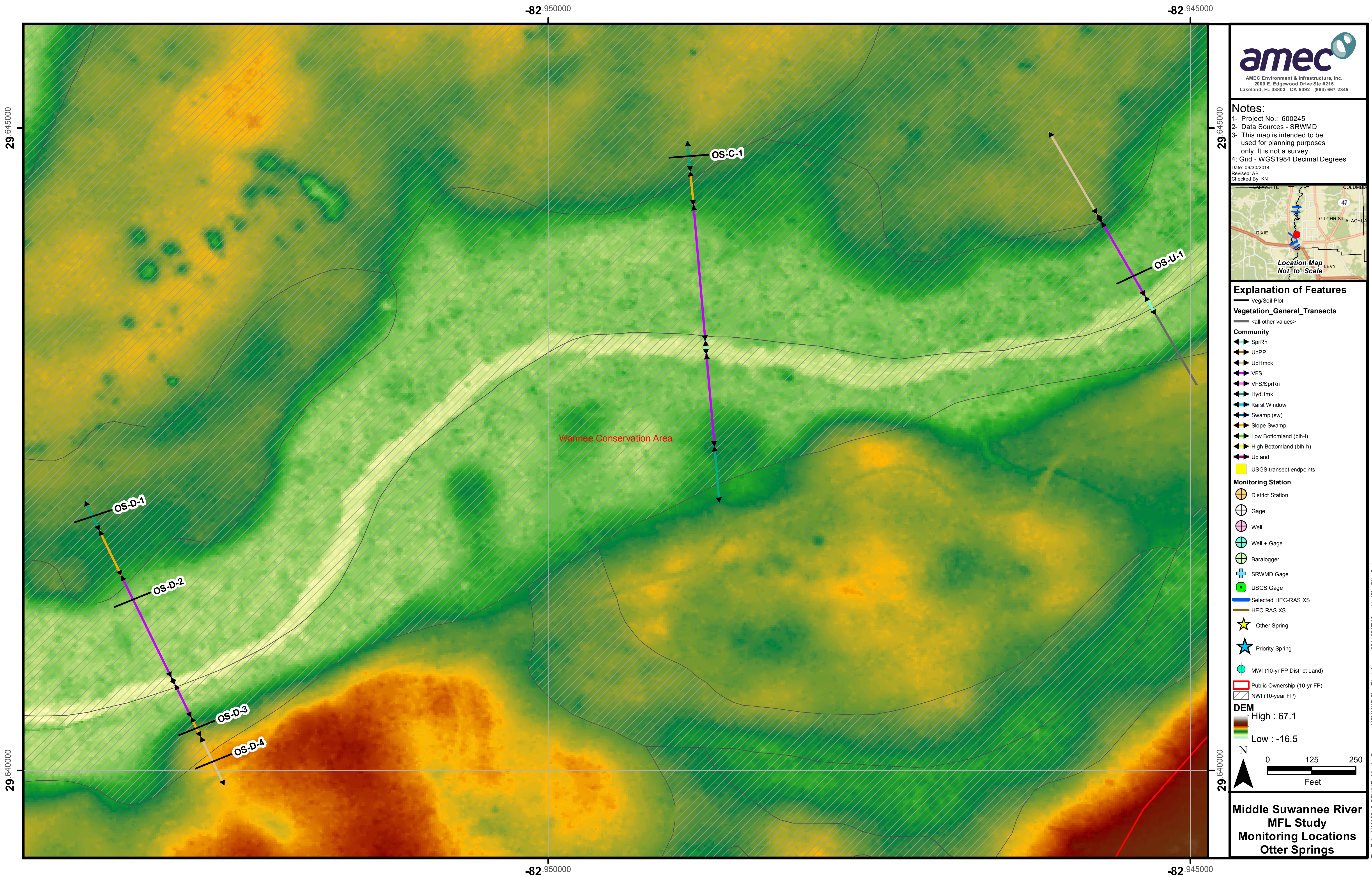
DEM
High : 67.1149
Low : -16.5582

N
0 100 200
1" = 200 Feet

Date: 08/18/2014
Revised: KD
Checked By: KN

Middle Suwannee River MFL Study Monitoring Locations X-22 South

File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlan\Update_20140817\12b - 11x17L_X-22-Otter_DEM.mxd



-82.950000
-82.945000
29.645000
29.640000
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215
Lakeland, FL 33803 - CA-5392 - (863) 667-2345
Notes:
1- Project No.: 600245
2- Data Sources - SRWMD
3- This map is intended to be used for planning purposes only. It is not a survey.
4; Grid - WGS1984 Decimal Degrees
Date: 09/30/2014
Revised: AB
Checked By: KN
LAFAYETTE
COLUMBIA
GILCHRIST
ALACHUA
DIXIE
LEVY
47
Location Map Not to Scale
Explanation of Features
Veg/Soil Plot
Vegetation_General_Transects
<all other values>
Community
SprRn
UpPP
UpHmck
VFS
VFS/SprRn
HydHmk
Karst Window
Swamp (sw)
Slope Swamp
Low Bottomland (blh-l)
High Bottomland (blh-h)
Upland
USGS transect endpoints
Monitoring Station
District Station
Gage
Well
Well + Gage
Baralogger
SRWMD Gage
USGS Gage
Selected HEC-RAS XS
HEC-RAS XS
Other Spring
Priority Spring
MWI (10-yr FP District Land)
Public Ownership (10-yr FP)
NWI (10-year FP)
DEM
High : 67.1
Low : -16.5
N
0 125 250
Feet
OS-C-1
OS-U-1
OS-D-1
OS-D-2
OS-D-3
OS-D-4
Wannee Conservation Area
Middle Suwannee River
MFL Study
Monitoring Locations
Otter Springs
File Path: V:\600245_SRWMD_Middle_Suwannee_MFL\MXD\FieldPlanUpdate_20140817\12c - 11x17L_OtterSprings.mxd

Appendix B

See File

Appendix C

Site Photographs - Floodplain Transects

Wii16 Streambank

Wii16-1 Plot (SW-blh-I)

Wii16-2 plot (RS-up)

Wii15 Streambank

Wii15-1 Plot (AR-up)

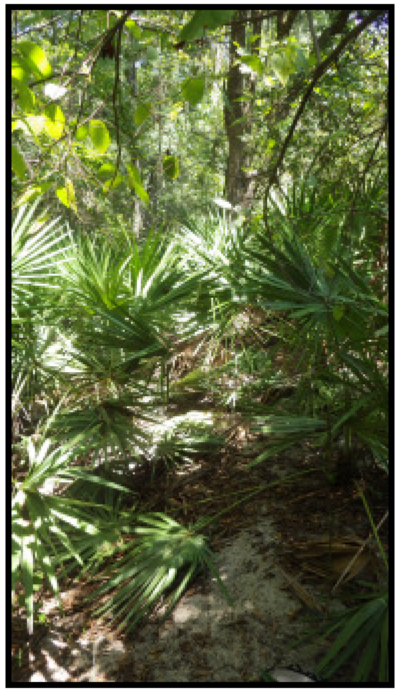
Wii15-2 Plot (RB-blh-h)

Wii15-3 Plot (SW-blh-l)

Wii15-4 Plot (SL-blh-h)

Wii15-5 Plot (Up-exterior)

Wii5-N Streambank



Wii5-N-1 Plot (AR-up)

Wii5-N-2 Plot (RS-blh-h)

Wii5-N-3 (SW-blh-l)

Wii5-C Streambank

Wii5-C-1 Plot (SW-blh-l)

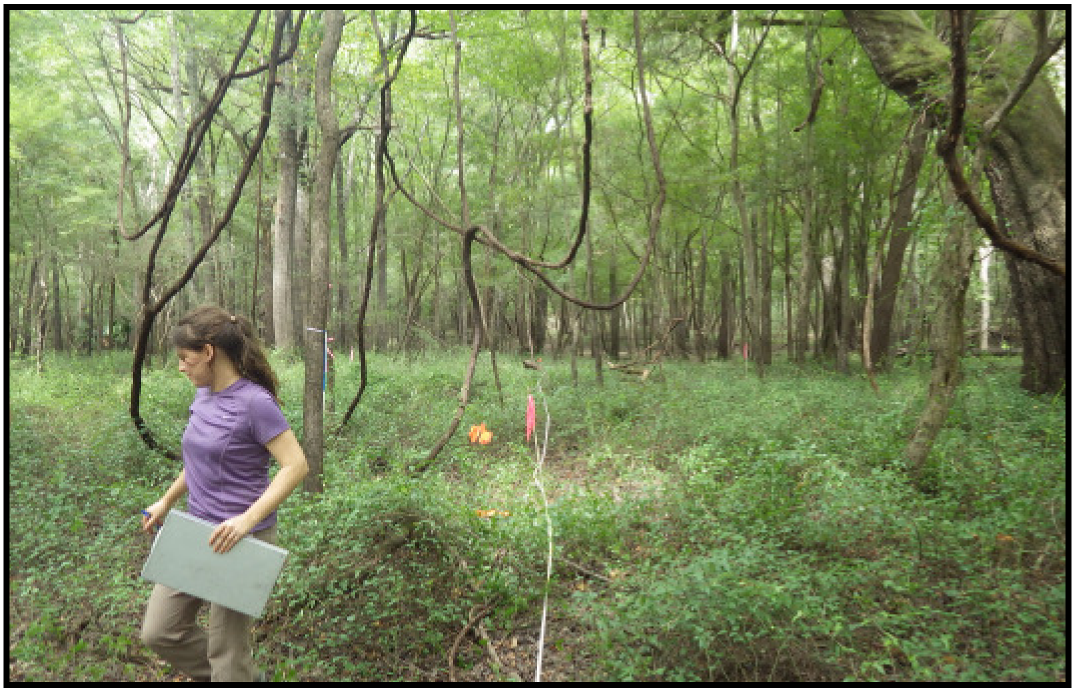
Wii5-C-2 Plot (RS-up)

Wii5-S Streambank

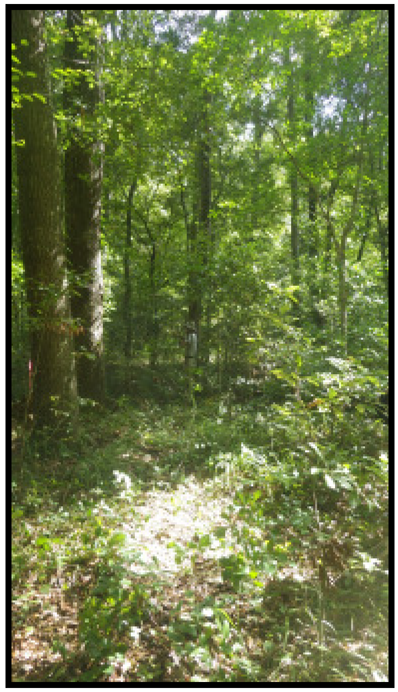
Wii5-S-1 Plot (SW-blh-I)

Wii5-S-2 Plot (Up-exterior)

Wi71-N Streambank



Wi71-N-1 Plot (BS-blh-h)



Wi71-C-1 Plot (AR-up)

Wi71-C-2 Plot (SL-blh-h)

Wi71-C-3 Plot (BS-blh-h)

Wi71-C-4 Plot (SL-up)

Wi71-C-5 Plot (Up-exterior)

Wi65-N Streambank

Wi65-N-1 Plot (AR-up)

Wi65-N-2 Plot (SW-blh-l)

Wi65-N-3 Plot (Up-exterior)

Wi65-S Streambank

Wi65-S-1 Plot (AR-up)

Wi65-S-2 Plot (RS-up)

Wi65-S-3 Plot (SW-blh-I)

Wi65-S-4 Plot (Up-exterior)

Wi50 Streambank

Wi50-1 Plot (AR-up)

Wi50-2 Plot (SW-blh-l)

Wi50-3 Plot (RS-up)

Wi50-4 Plot (BS-sw)

Wi50-5 Plot (SL-blh-h)

Wi50-6 Plot (Up-exterior)

Wi34-E Streambank

Wi34-E-1 Plot (SL-blh-h)

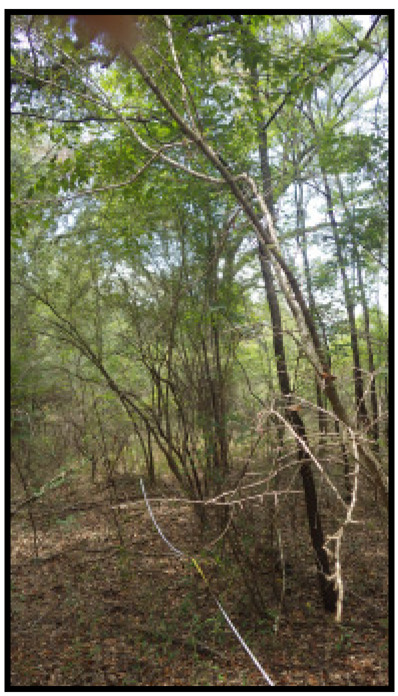
Wi34-E-2 Plot (BS-sw)

Wi34-E-3 Plot (SL-up)

Wi34-W-1 Plot (RB-up)

Wi34-W-2 Plot (SL-blh-h)

Wi34-W-3 Plot (SL-up)



Wi34-W-4 Plot (Up-exterior)

Wi30 Streambank

Wi30-1 Plot (AR-up)

Wi30-2 Plot (SW-blh-I)

Wi30-3 Plot (SW-blh-I)

Wi30-4 Plot (RS-up)

Wi30-5 Plot (RS-blh-h)

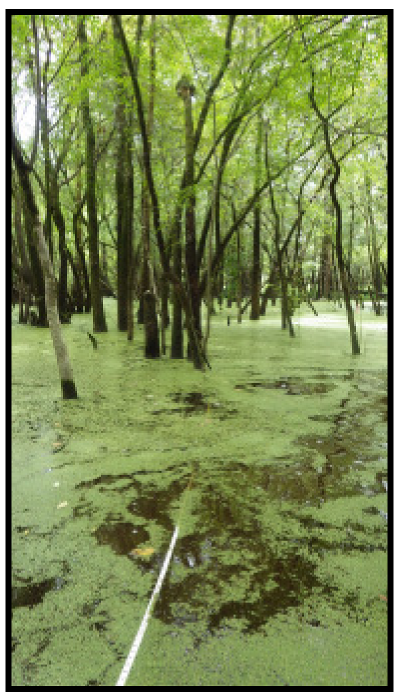
Wi30-6 Plot (SW-blh-l)

Wi30-7 Plot (BS-sw)

Wi30-8 Plot (SL-up)

Wi30-9 Plot (Up-exterior)

Wi10-N Streambank



Wi10-N-1 Plot (BS-sw)

Wi10-N-2 Plot (SL-blh-I)

Wi10-N-3 Plot (Up-exterior)

Wi10-S Streambank

Wi10-S-1 Plot (BB-sw)

Wi10-S-2 Plot (AR-blh-I)

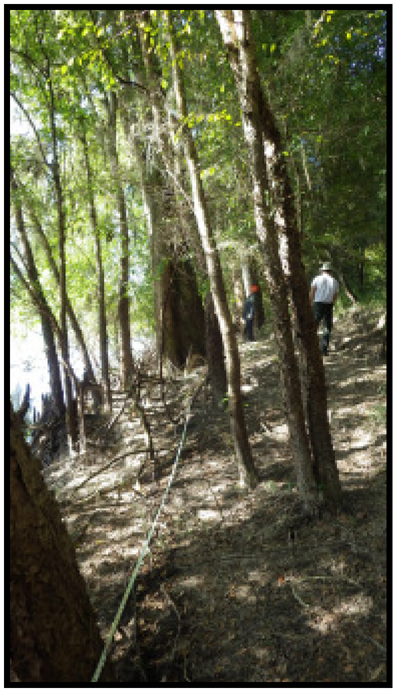
Wi10-S-3 Plot (RS-up)

Wi10-S-4 Plot (SL-blh-h)

Wi10-S-5 Plot (RB-up)

Wi10-S-6 Plot (Up-exterior)

Wi4 Streambank



Wi4-1 Plot (BB-sw)

Wi4-2 Plot (AR-up)

Wi4-3 Plot (SL-blh-l)

Wi4-4 Plot (BS-sw)

Wi4-5 Plot (RB-up)

Wi4-6 Plot (SL-blh-I)

Wi4-7 Plot (BS-sw)

Wi4-8 Plot (SL-blh-l)

Wi4-9 Plot (BS-sw)

Wi4-10 Plot (Up-exterior)

Wi3 Streambank

Wi3-1 Plot (AR-up)

Wi3-2 Plot (SL-blh-l)

Wi3-3 Plot (BS-sw)

Wi3-4 Plot (RB-blh-l)

X25 Streambank

X26-1 Plot (AR-blh-l)

X26-2 Plot (BS-sw)

X26-3 Plot (RB-blh-l)

X26-4 Plot (RB-blh-l)

X22-N Streambank

X22-N-1 Plot (AR-blh-I)

X22-N-2 Plot (BS-sw)

X22-N-3 Plot (SL-blh-h)

X22-S Streambank

Site Photographs – Spring Transects

AMP-US-1 Plot (UpHmck)

AMP-US-2 Plot (SSw)

AMP-US-3 Plot (VFS)

AMP-US-4 Plot (HydHmk)

AMP-DS-1 Plot (SSw)

AMP-DS-2 Plot (VFS)

AMP-DS-3 Plot (UpHmck)

BS-1 Plot (HydHmk)

PS-N-1 Plot (HydHmk)

PS-N-2 Plot (VFS/SprRn)

PS-C-1 Plot (SSw)

PS-C-2 Plot (VFS/SprRn)

PS-C-3 Plot (UpPP)

PS-S-1 Plot (SSw)

PS-S-2 Plot (UpHmck)

OS-U-1 Plot (VFS)

OS-C-1 Plot (HydHmk)

OS-D-1 Plot (HydHmk)

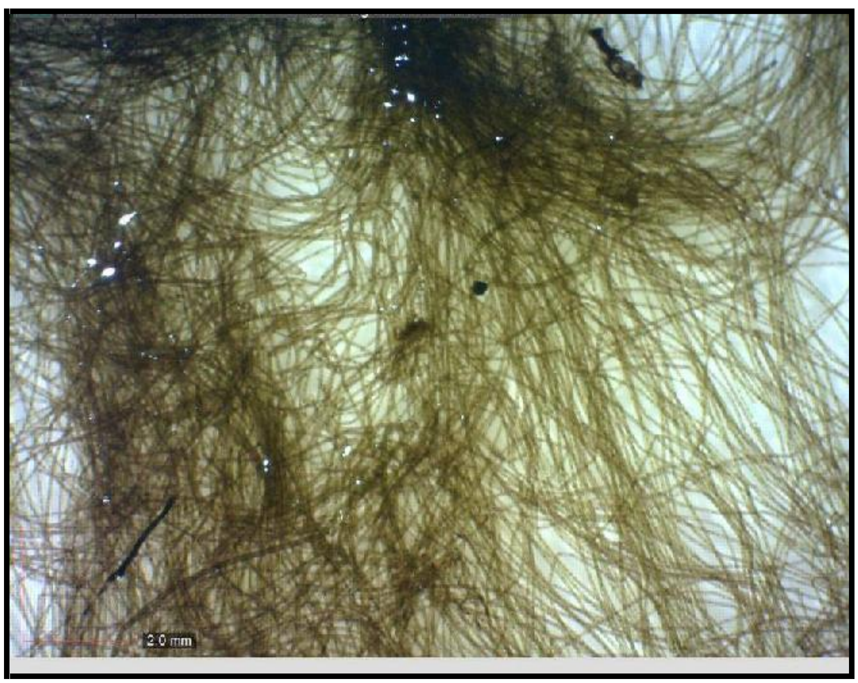
OS-D-2 Plot (VFS)

OS-D-3 Plot (SSw)

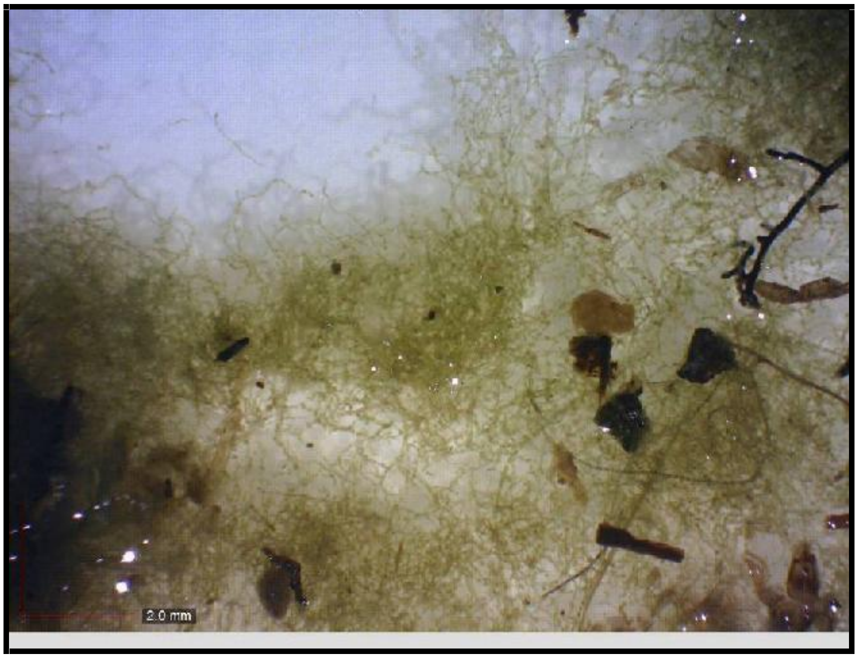
OS-D-4 Plot (UpHmck)

Site Photographs – In-Stream Spring Study

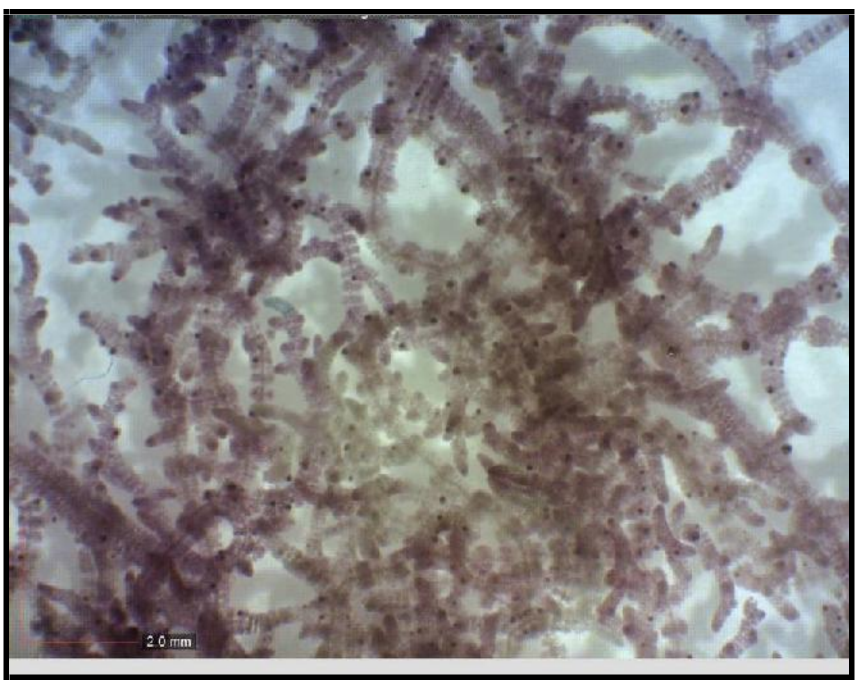
Vaucheria sp. AM06 5.5x (Scale bar = 2.0mm)



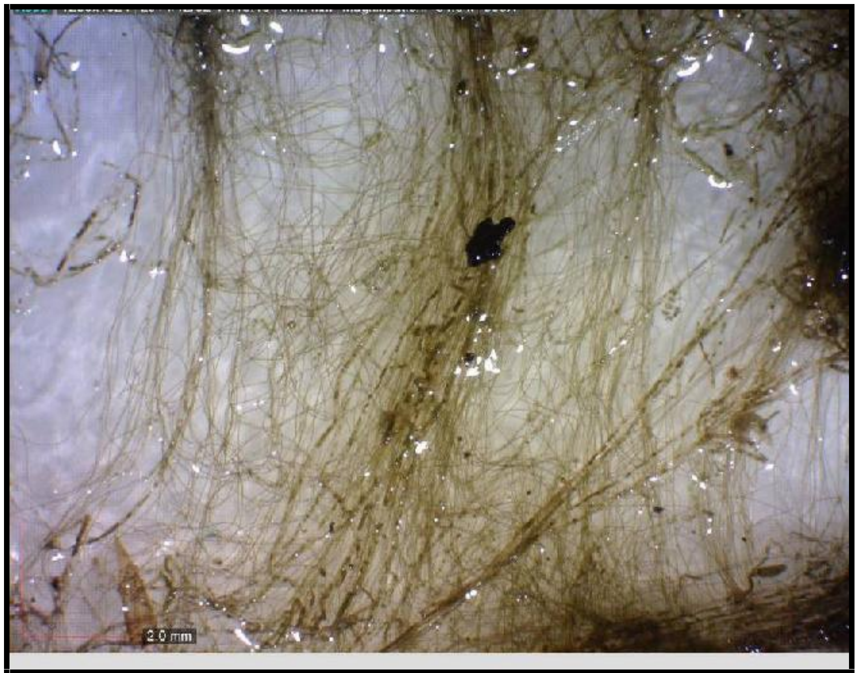
Spirogrya sp. OSHeadspring 5.5x (Scale bar = 2.0mm)



Terpsinoe musica PSS03 5.5x (Scale bar = 2.0mm)

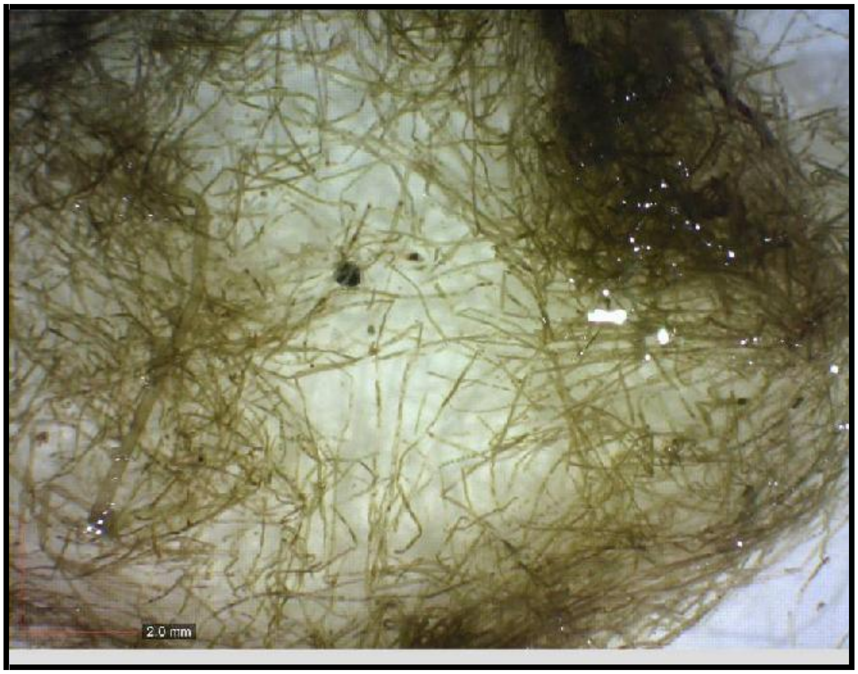


Batrachospermum sp. AM21 5.5x (Scale bar = 2.0mm)



Vaucheria sp. and *Rhizoclonium* sp. PSN02 5.5x (Scale bar = 2.0mm)

Spirogrya sp. A, Spirogyra sp. B, Vaucheria sp. and *Rhizoclonium* sp. PSN03 5.5x (Scale bar = 2.0mm)

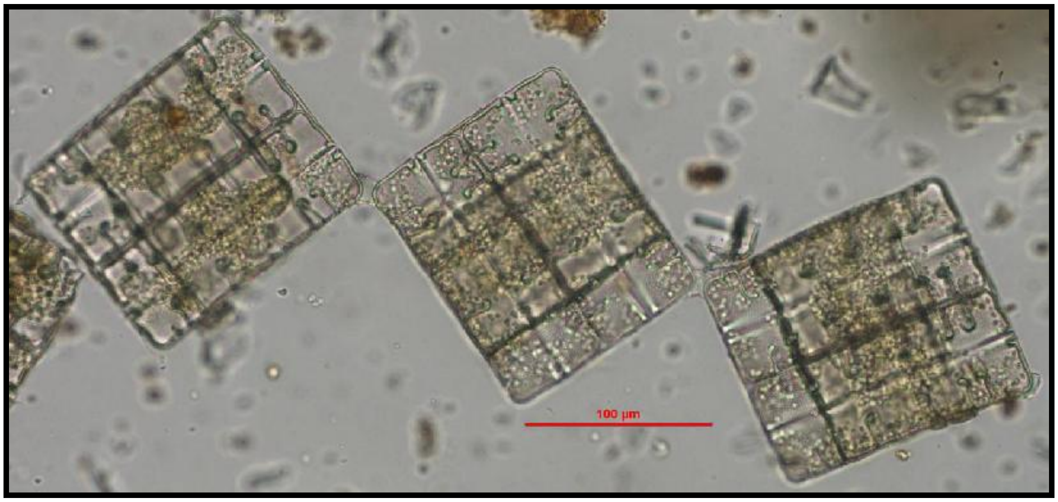


Vaucheria sp. and *Oedogonium* sp. OS01 5.5x (Scale bar = 2.0mm)

Vaucheria sp. PSN02 5.5x (Scale bar = 2.0mm)

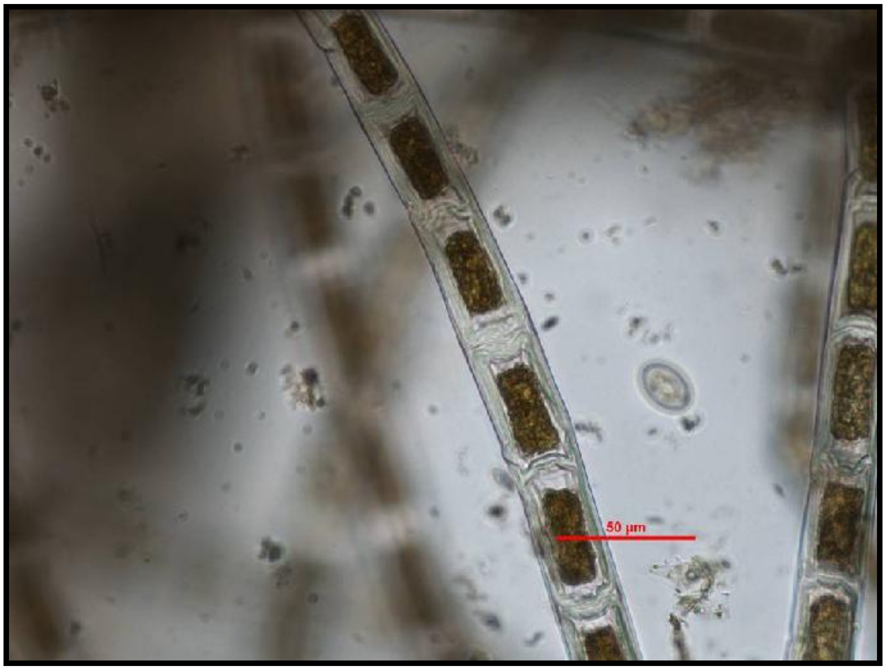
Vaucheria sp. LAFHeadspring 200x (scale bar = 50µm)

Spirogyra sp. LAFHeadspring 200x (scale bar = 50µm)

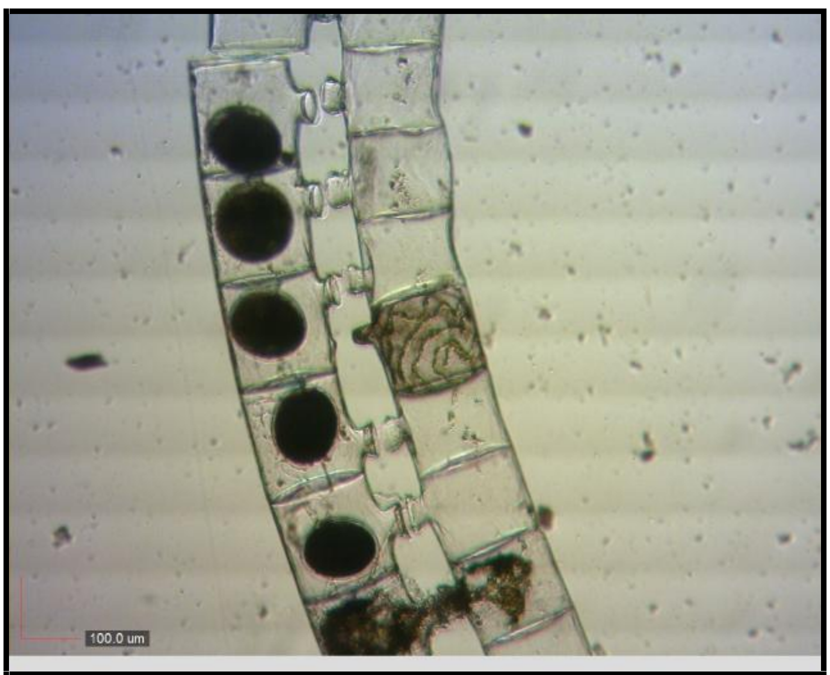


Terpsinoe musica AMPHeadspring 200x (scale bar = 100µm)

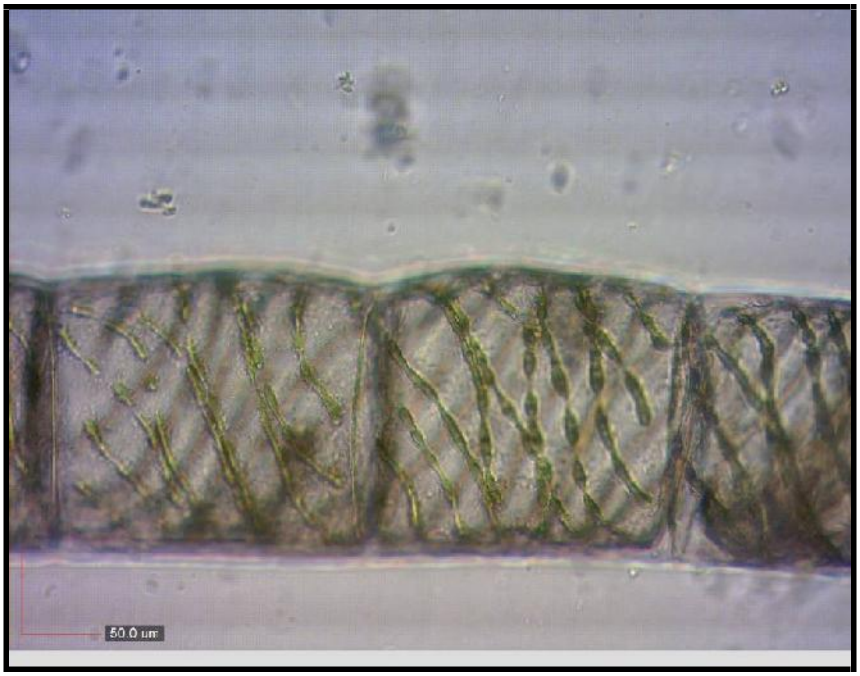
Batrachospermum sp. LAFHeadspring 200x (scale bar = 50µm)



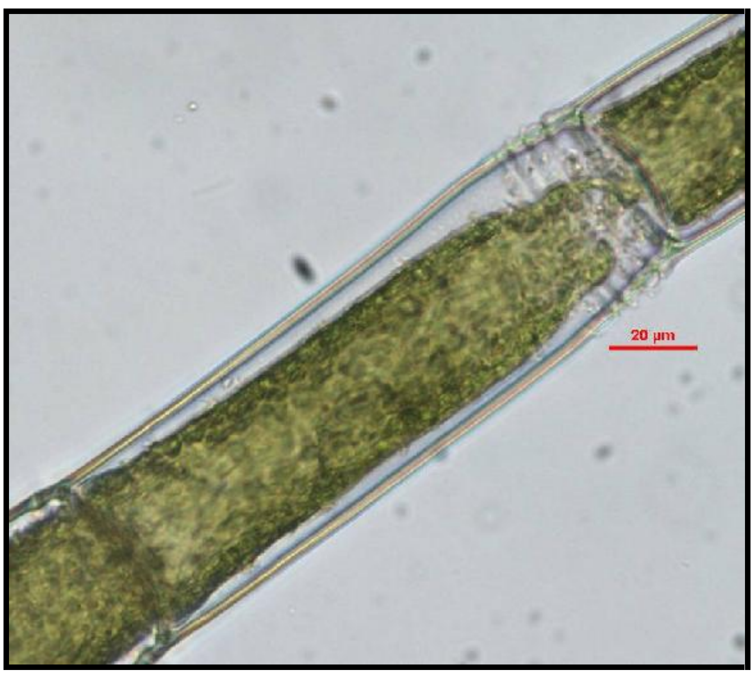
Rhizoclonium sp. PSNO2 400xa (scale bar = 50µm)



Spirogrya sp. (conjugating), PSN03 60x (Scale bar = 100µm)



Spirogrya sp. B, PSN03 60x (Scale bar = 50µm)

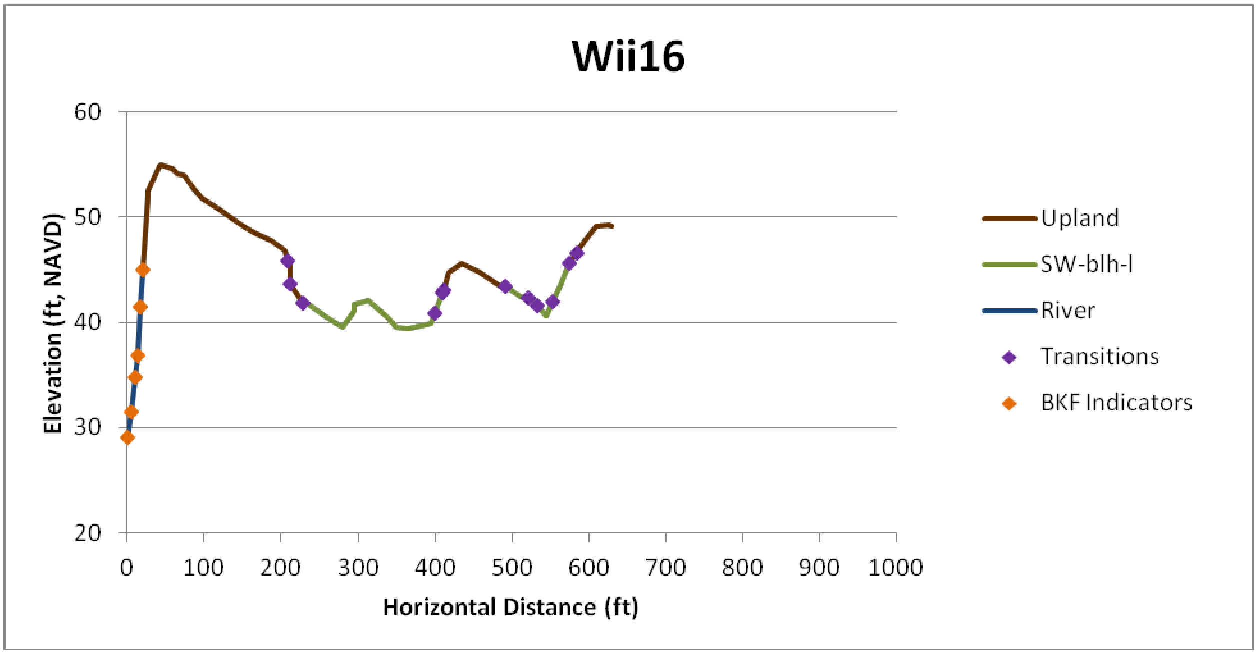


Oedogonium sp. OS04 400xa (scale bar = 20µm)

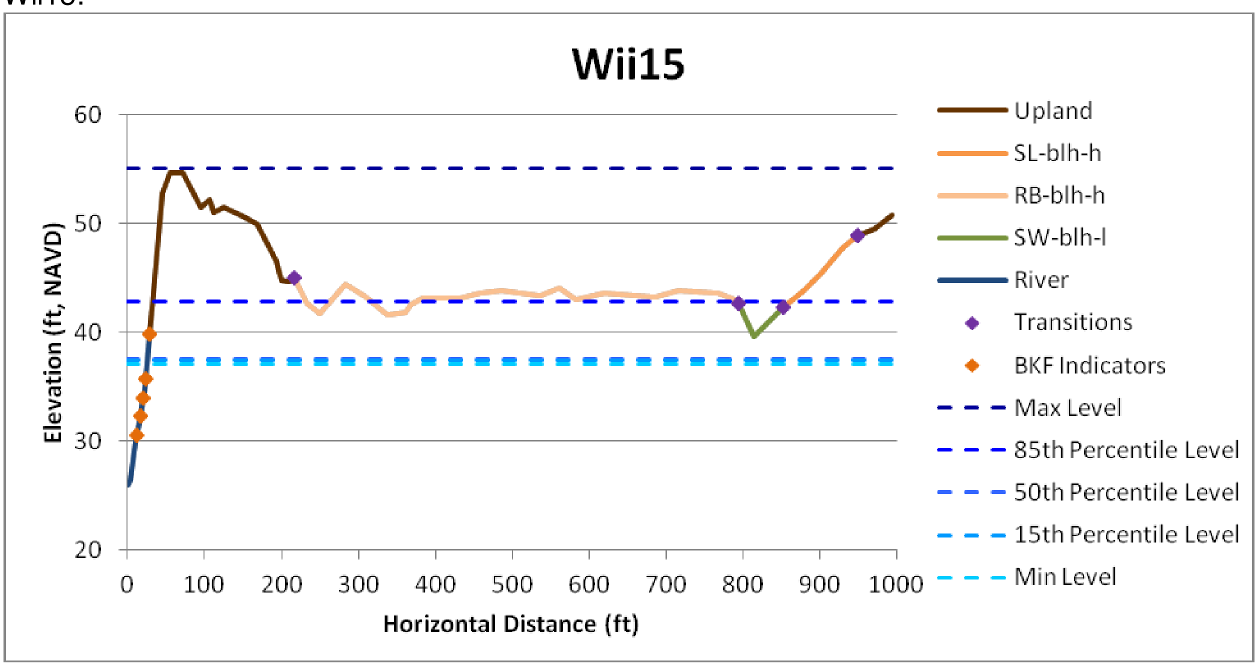
Nitella sp. OS01 100xb (scale bar = 100µm)

Appendix D

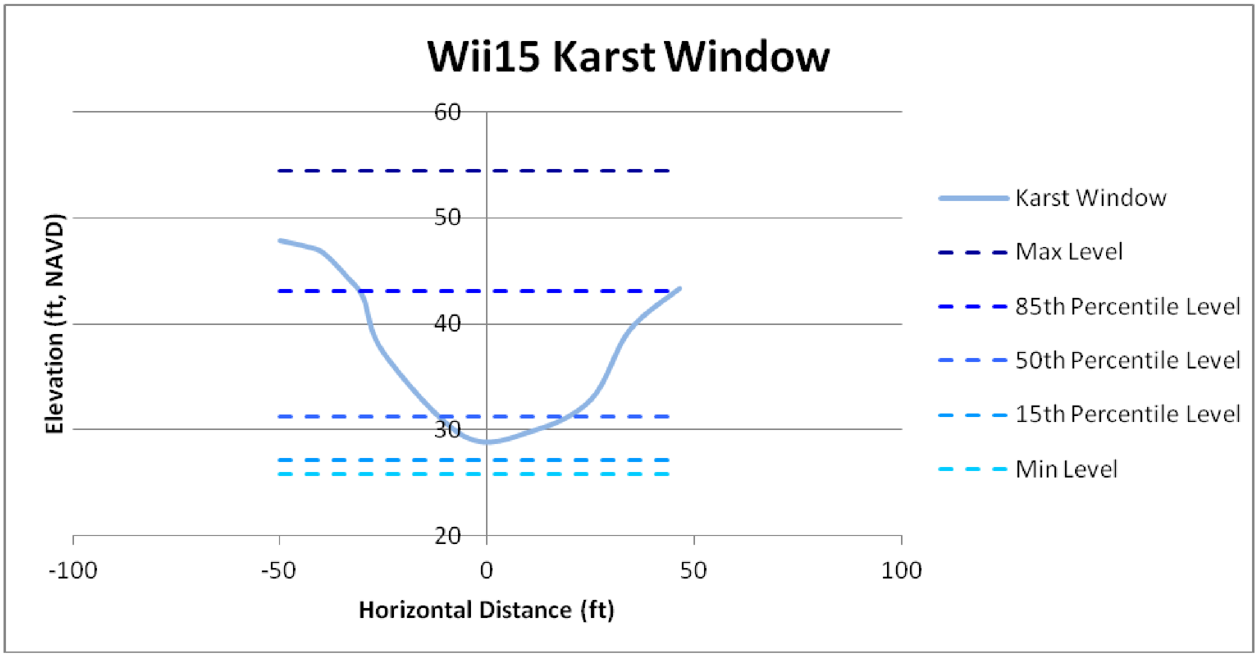
Wii16:


Wii16
Elevation (ft, NAVD)
Horizontal Distance (ft)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
Upland
SW-blh-l
River
Transitions
BKF Indicators

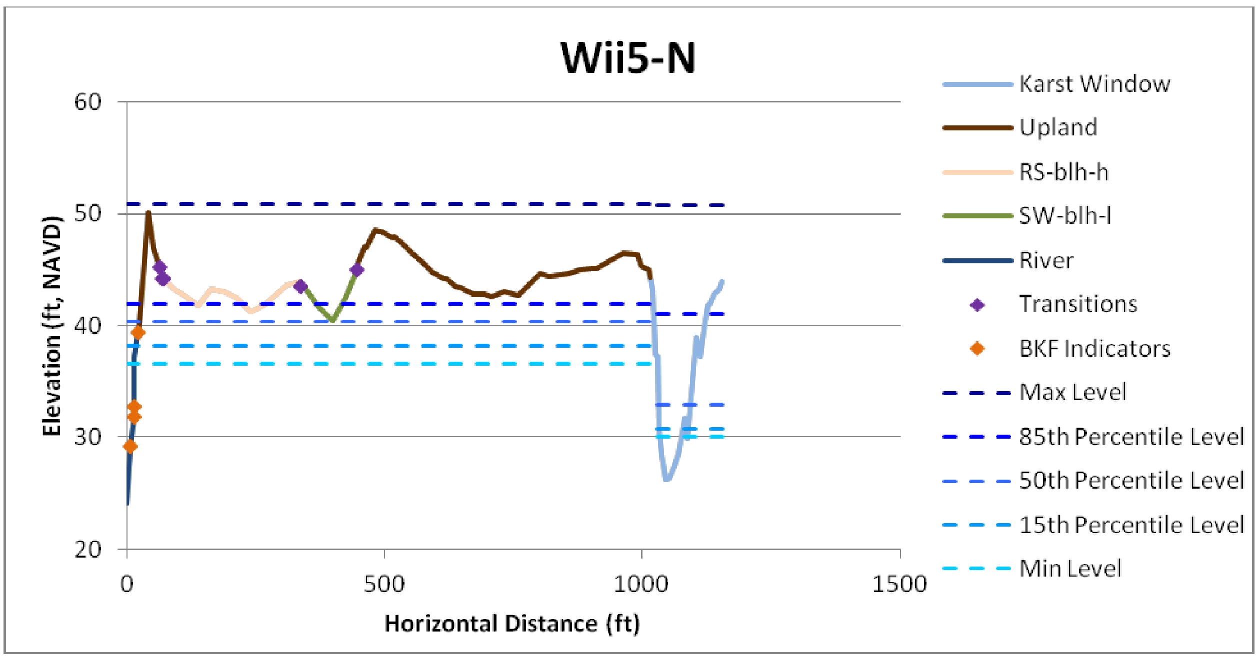
Wii15:


Wii15
Elevation (ft, NAVD)
Horizontal Distance (ft)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
Upland
SL-blh-h
RB-blh-h
SW-blh-l
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

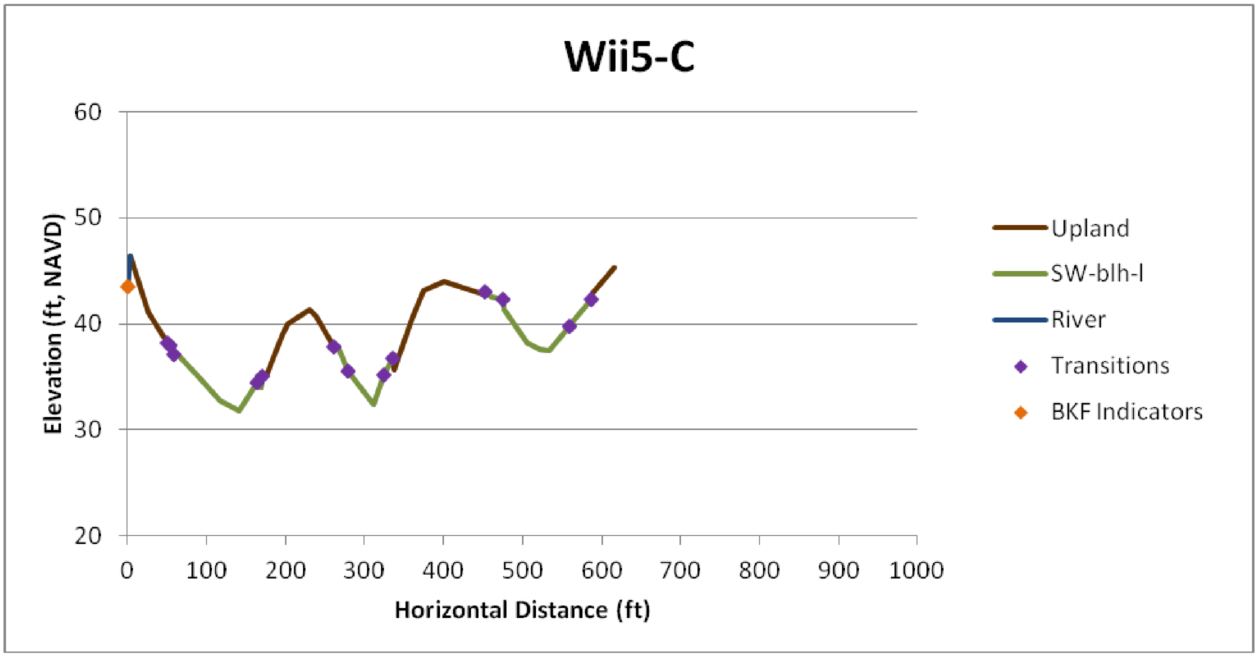
Wii15 Karst Window:



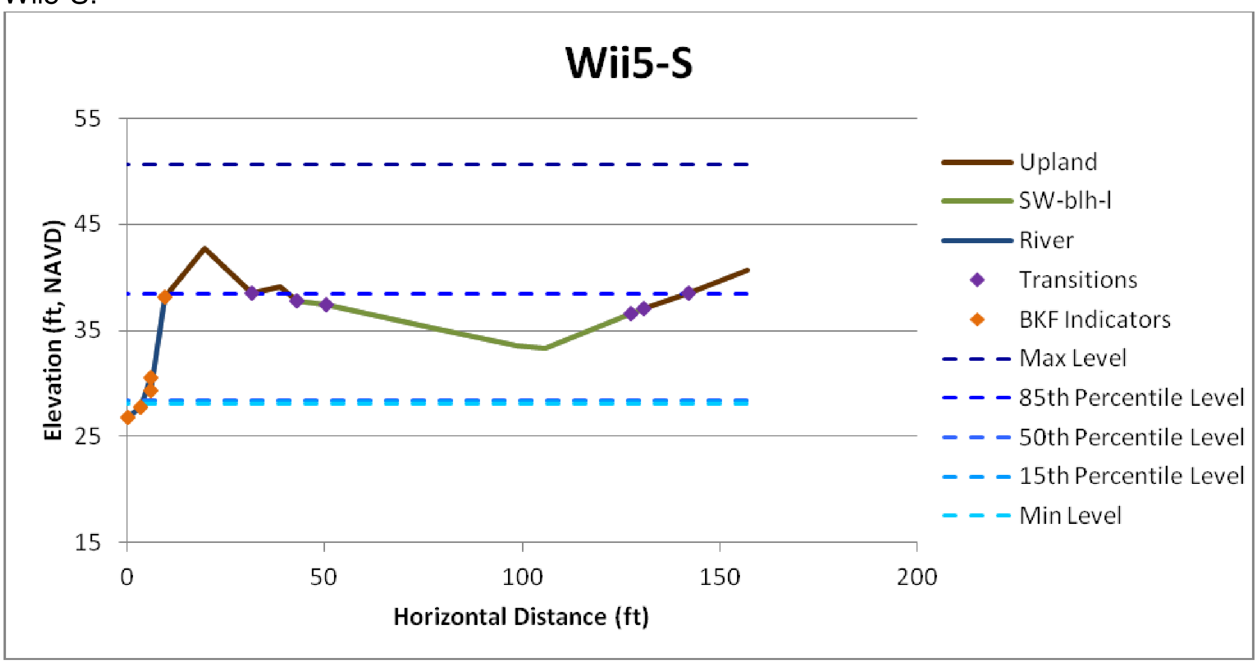
Wii5-N:



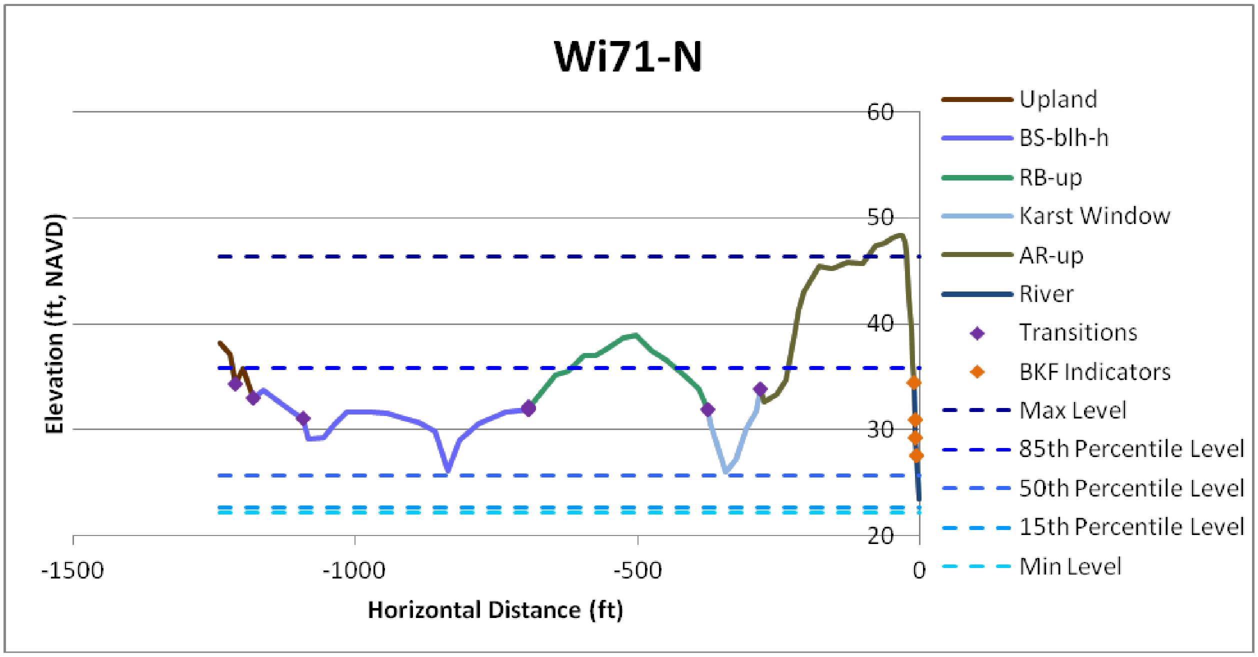
Wii5-C:


Wii5-C
60
50
40
30
20
Elevation (ft, NAVD)
0
100
200
300
400
500
600
700
800
900
1000
Horizontal Distance (ft)
Upland
SW-blh-I
River
Transitions
BKF Indicators

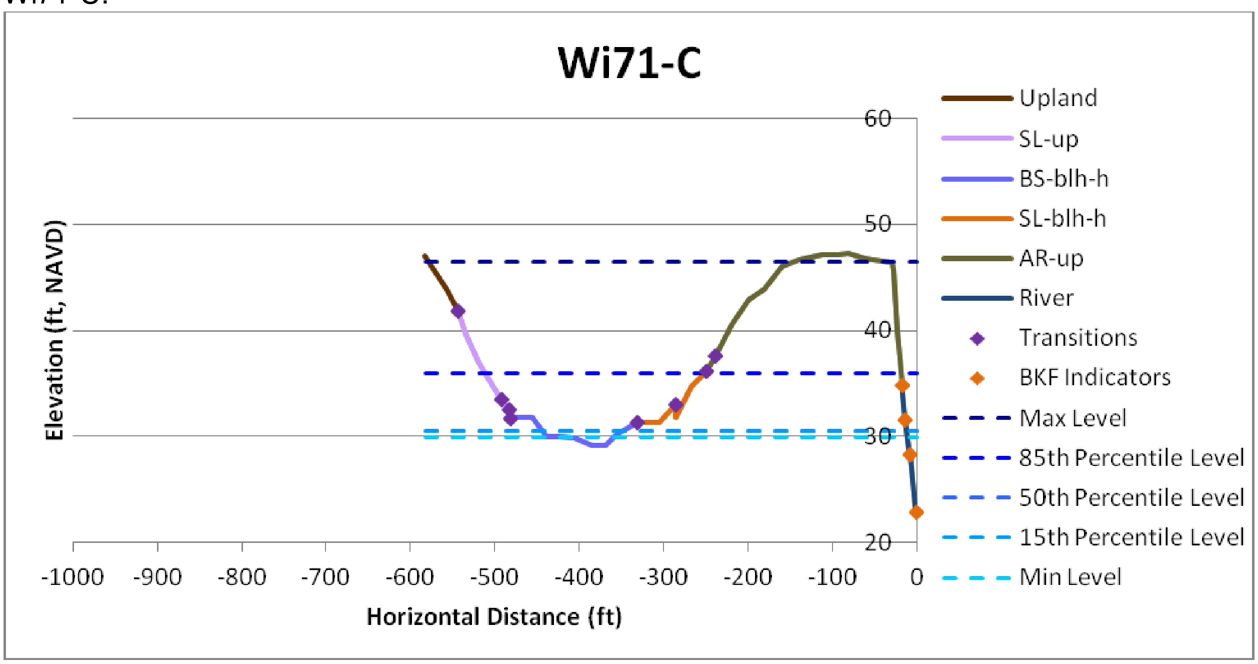
Wii5-S:


Wii5-S
55
45
35
25
15
Elevation (ft, NAVD)
0
50
100
150
200
Horizontal Distance (ft)
Upland
SW-blh-I
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

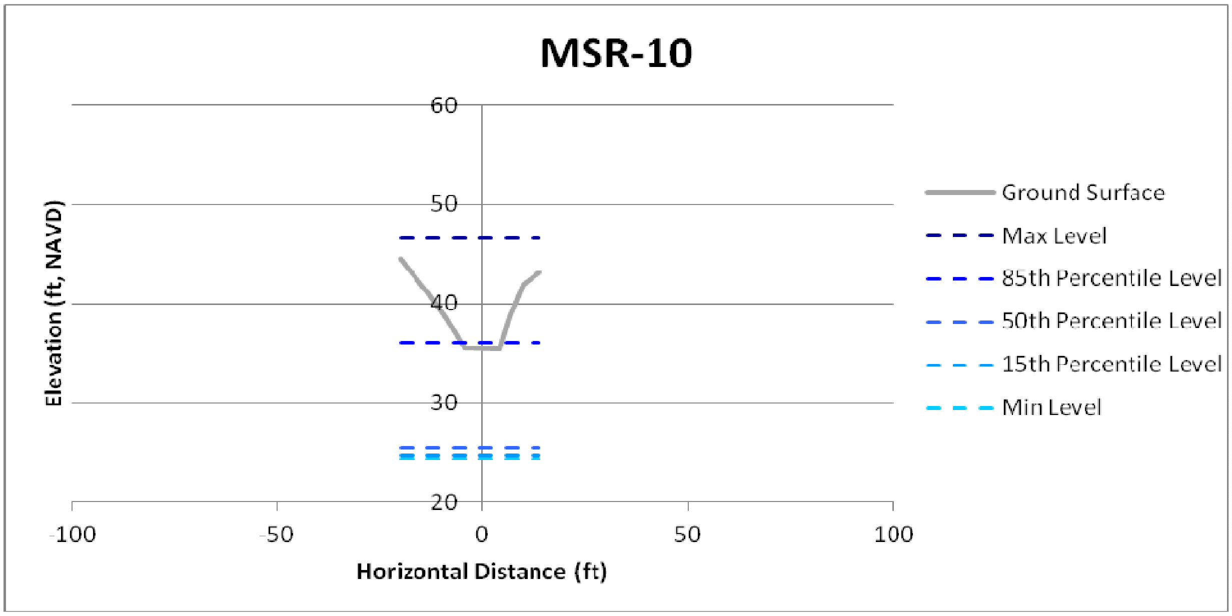
Wi71-N:

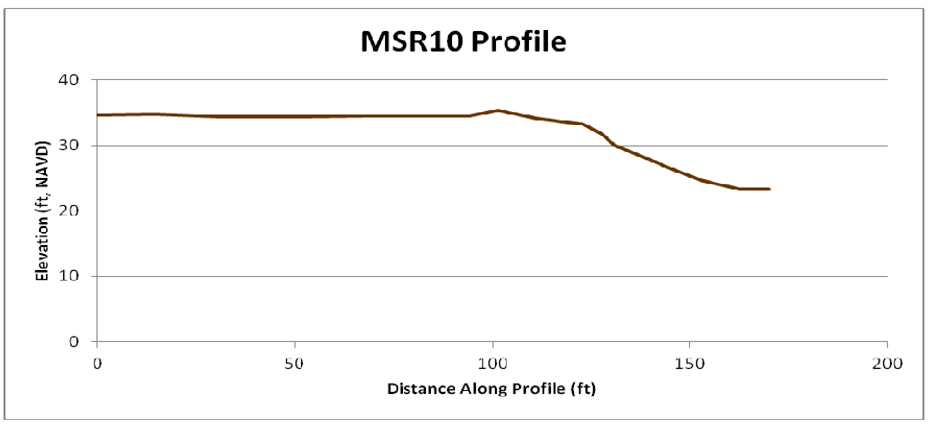

Wi71-N
Elevation (ft, NAVD)
60
50
40
30
20
-1500
-1000
-500
0
Horizontal Distance (ft)
Upland
BS-blh-h
RB-up
Karst Window
AR-up
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

Wi71-C:

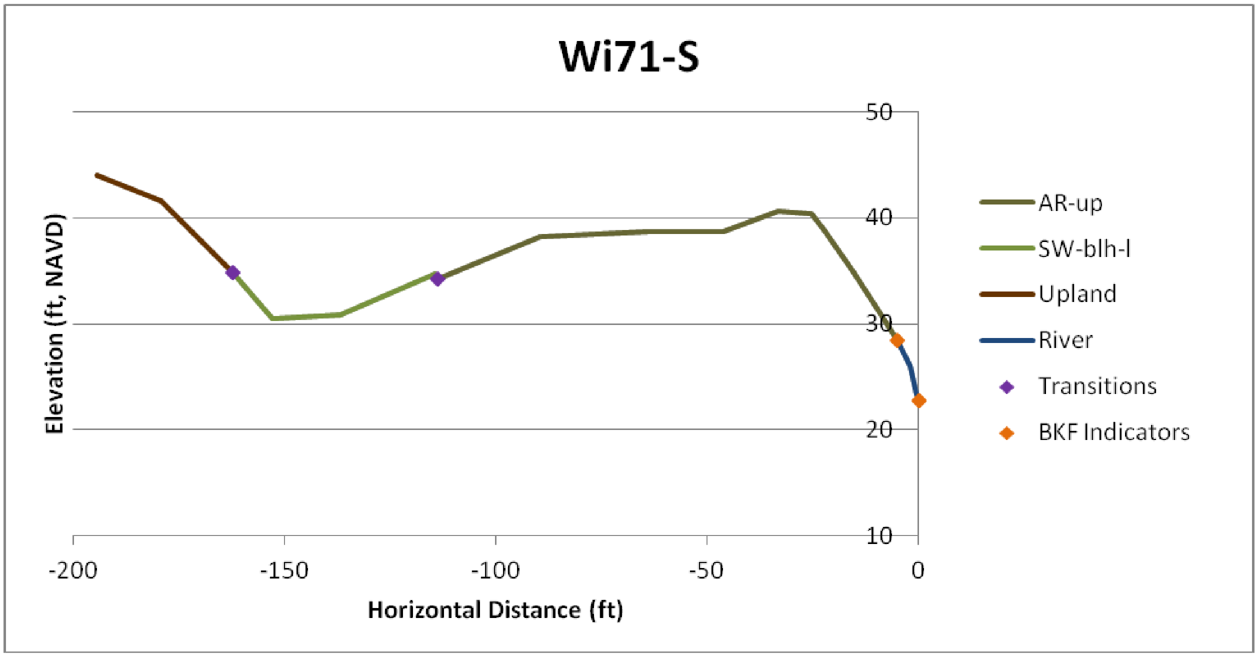

Wi71-C
Elevation (ft, NAVD)
60
50
40
30
20
-1000
-900
-800
-700
-600
-500
-400
-300
-200
-100
0
Horizontal Distance (ft)
Upland
SL-up
BS-blh-h
SL-blh-h
AR-up
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

Wi71 Outlet – MSR10:

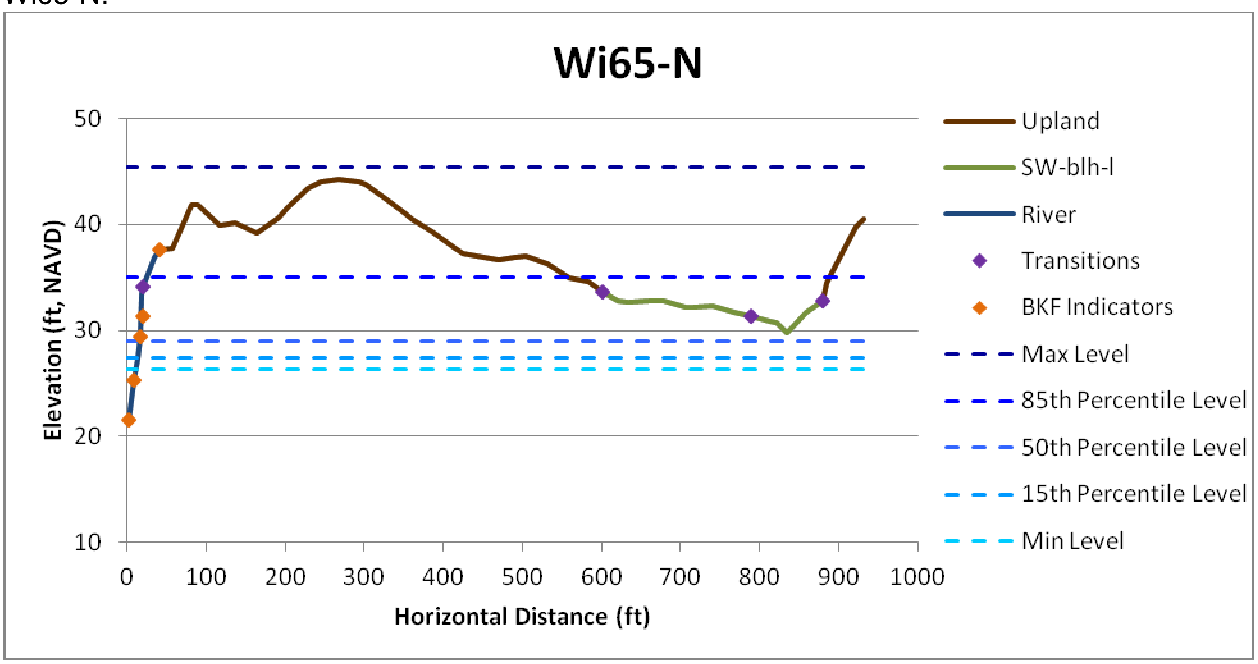




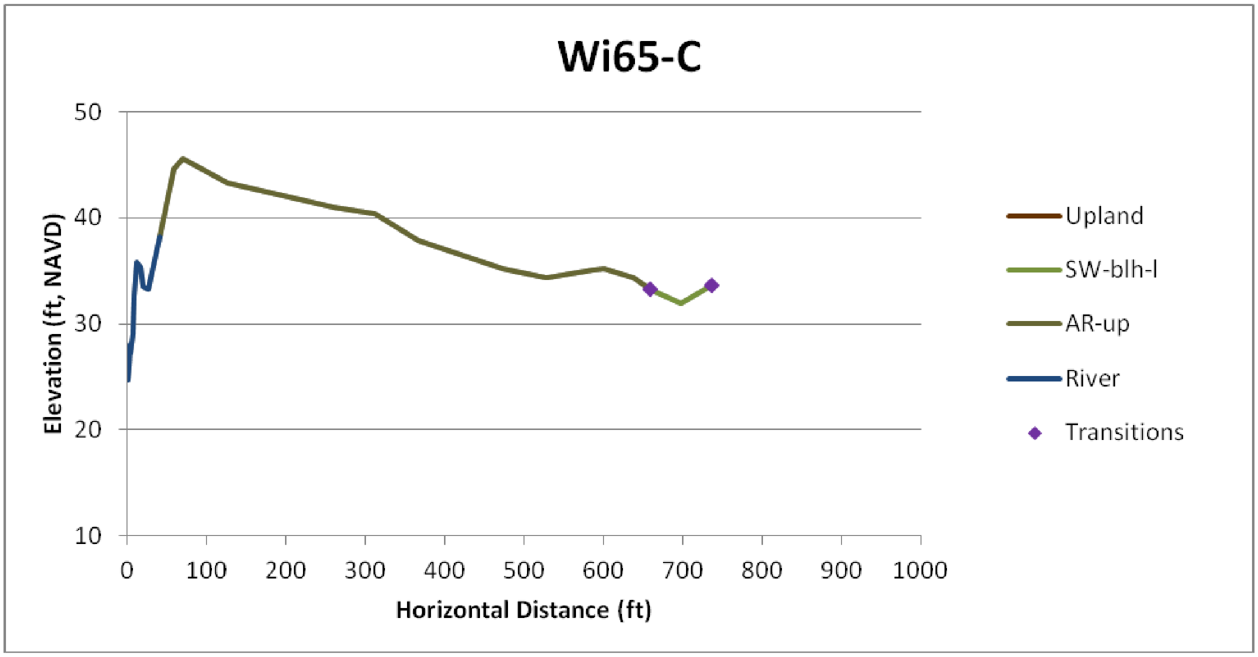
Wi71-S:


Wi71-S
Elevation (ft, NAVD)
Horizontal Distance (ft)
50
40
30
20
10
-200
-150
-100
-50
0
AR-up
SW-blh-l
Upland
River
Transitions
BKF Indicators

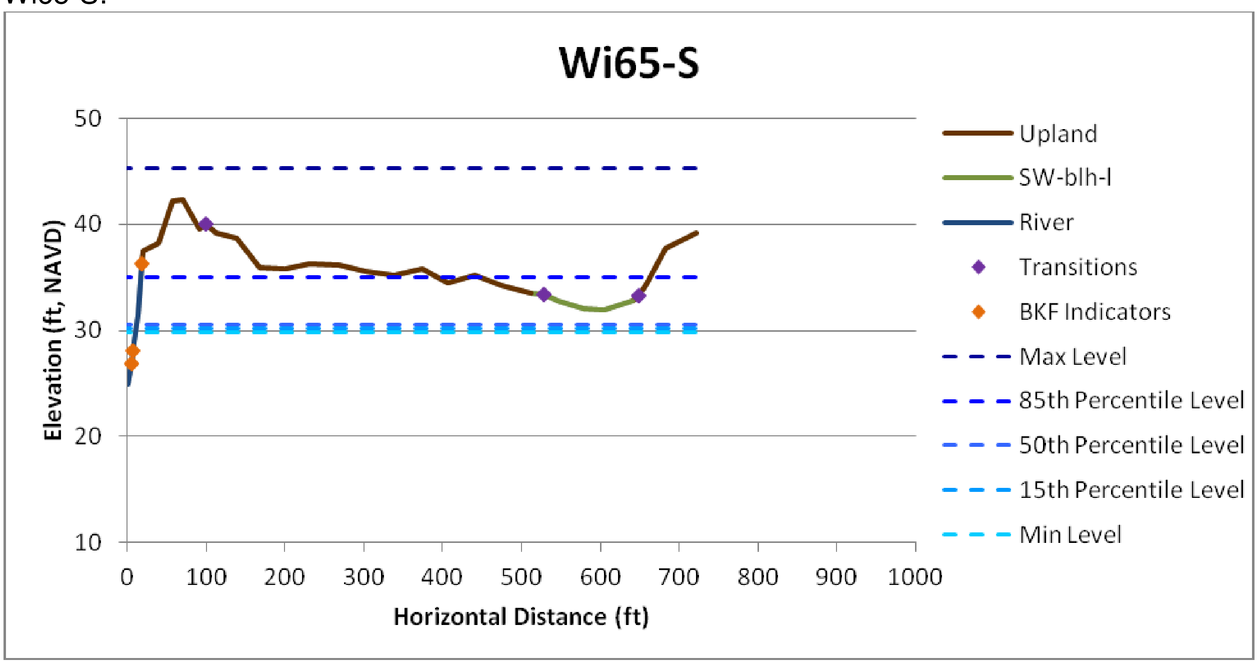
Wi65-N:


Wi65-N
Elevation (ft, NAVD)
Horizontal Distance (ft)
50
40
30
20
10
0
100
200
300
400
500
600
700
800
900
1000
Upland
SW-blh-l
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

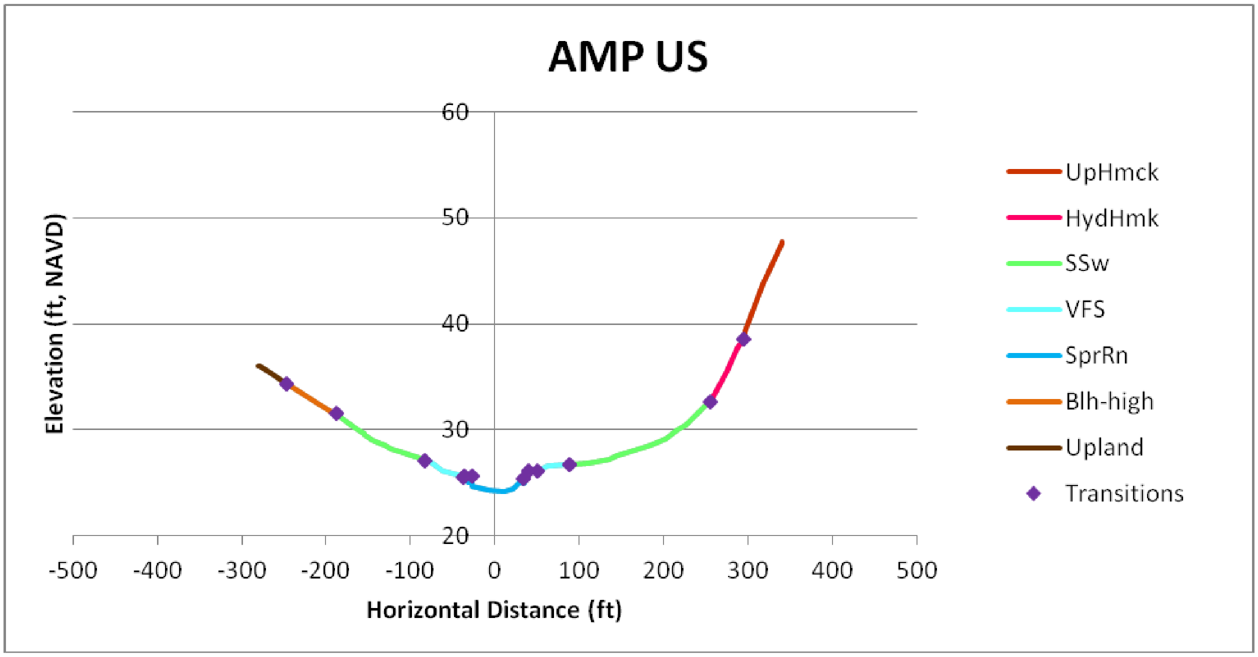
Wi65-C:


Wi65-C
Elevation (ft, NAVD)
50
40
30
20
10
0
100
200
300
400
500
600
700
800
900
1000
Horizontal Distance (ft)
Upland
SW-blh-l
AR-up
River
Transitions

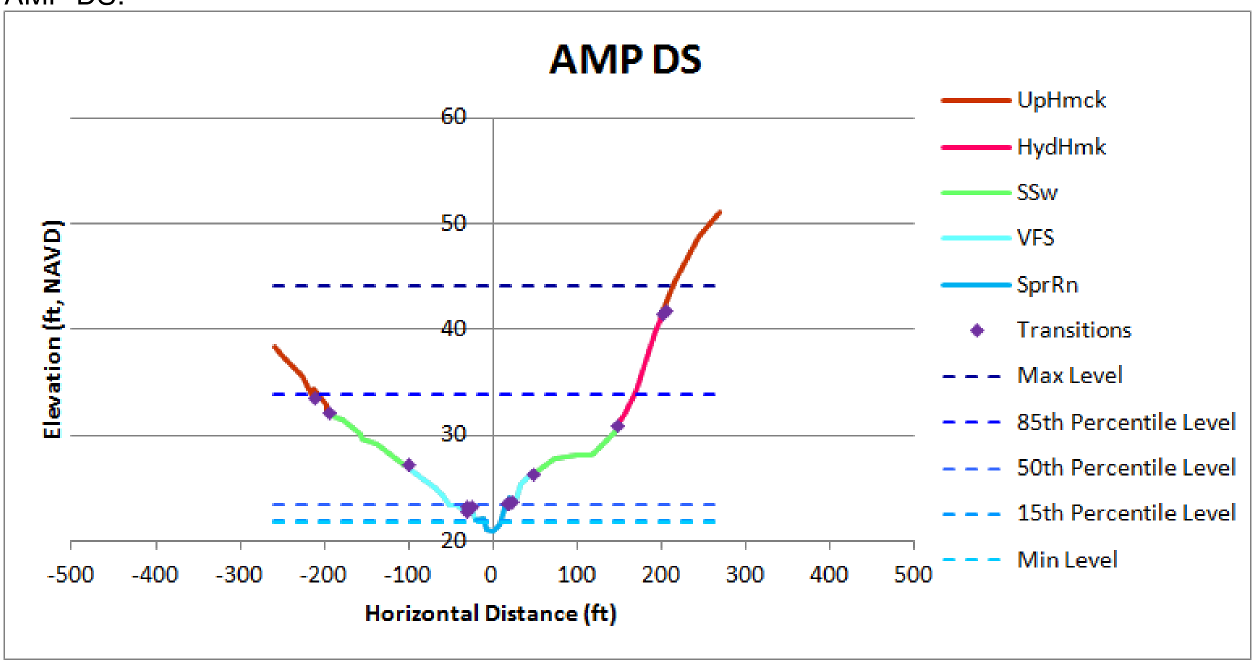
Wi65-S:


Wi65-S
Elevation (ft, NAVD)
50
40
30
20
10
0
100
200
300
400
500
600
700
800
900
1000
Horizontal Distance (ft)
Upland
SW-blh-l
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

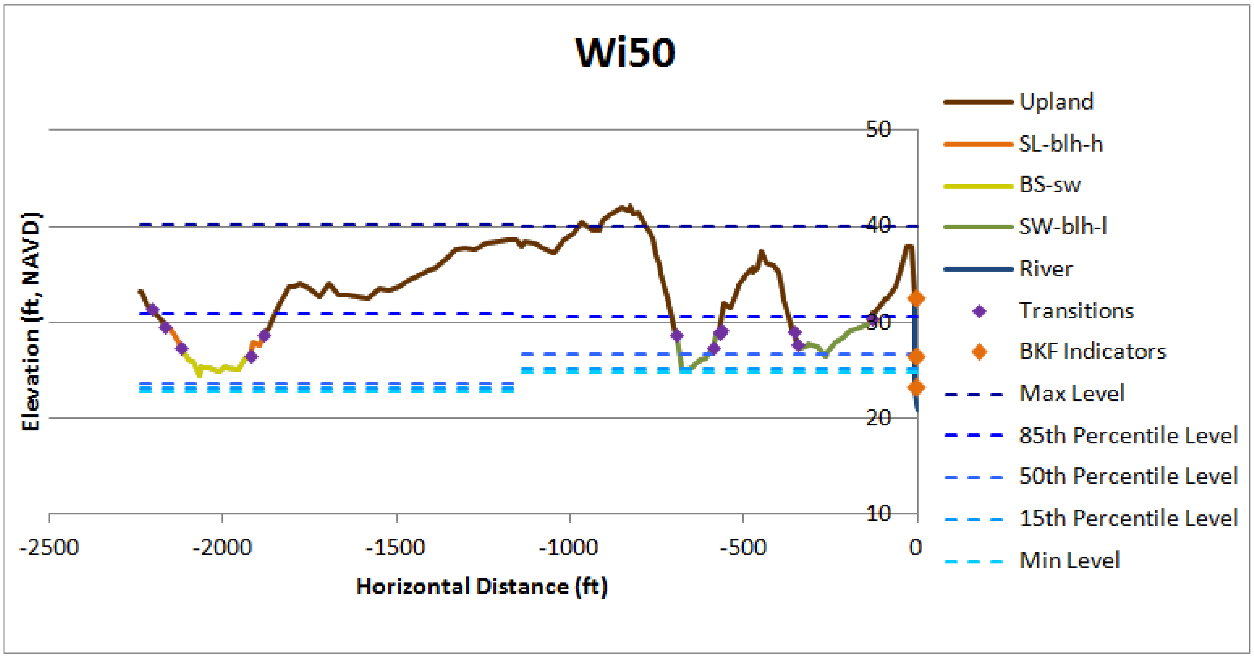
AMP US:


AMP US
60
50
40
30
20
-500
-400
-300
-200
-100
0
100
200
300
400
500
Horizontal Distance (ft)
Elevation (ft, NAVD)
UpHmck
HydHmk
SSw
VFS
SprRn
Blh-high
Upland
Transitions

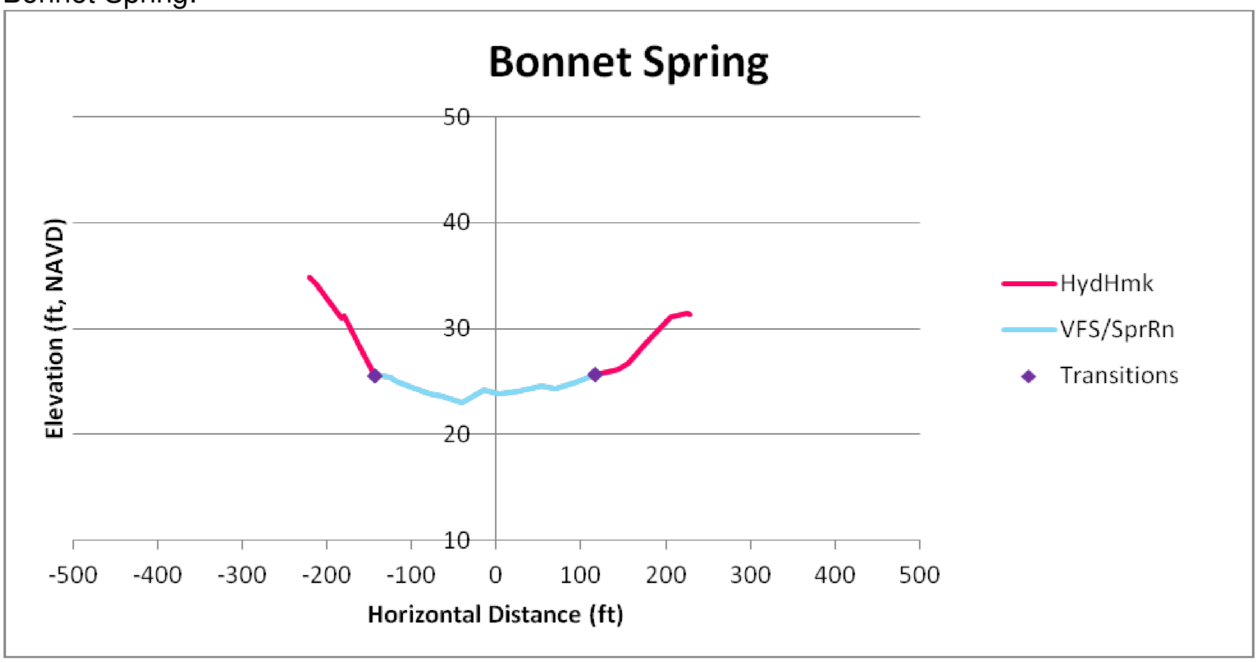
AMP DS:


AMP DS
60
50
40
30
20
-500
-400
-300
-200
-100
0
100
200
300
400
500
Horizontal Distance (ft)
Elevation (ft, NAVD)
UpHmck
HydHmk
SSw
VFS
SprRn
Transitions
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

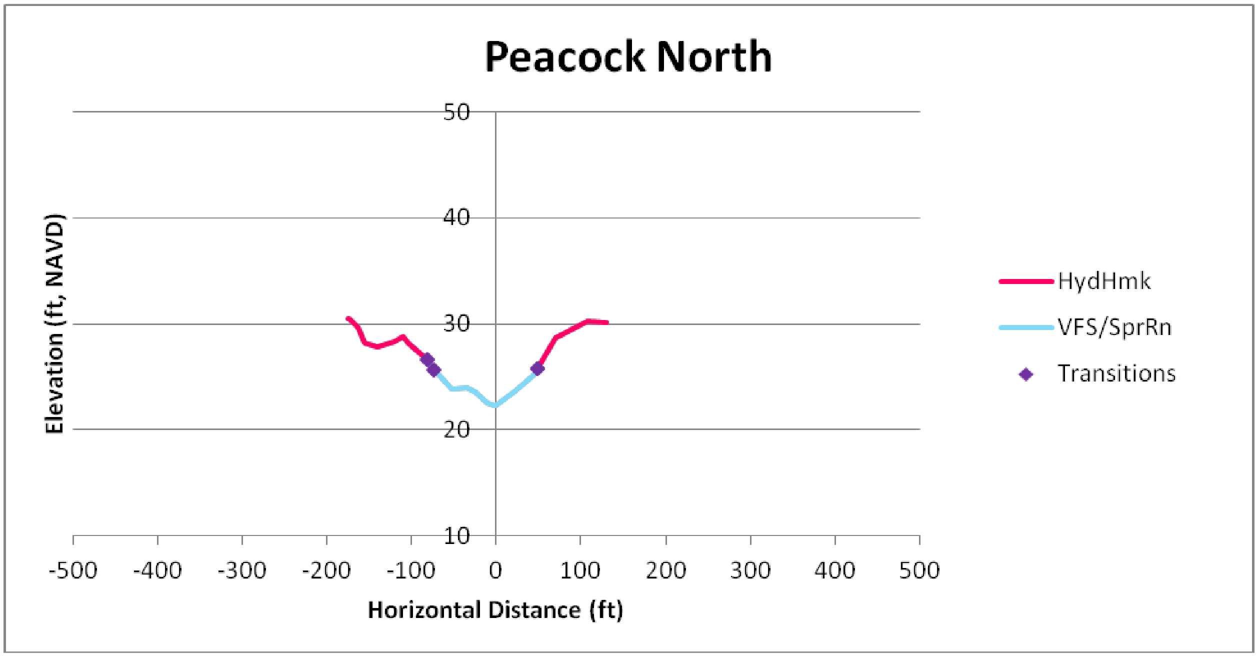
Wi50:



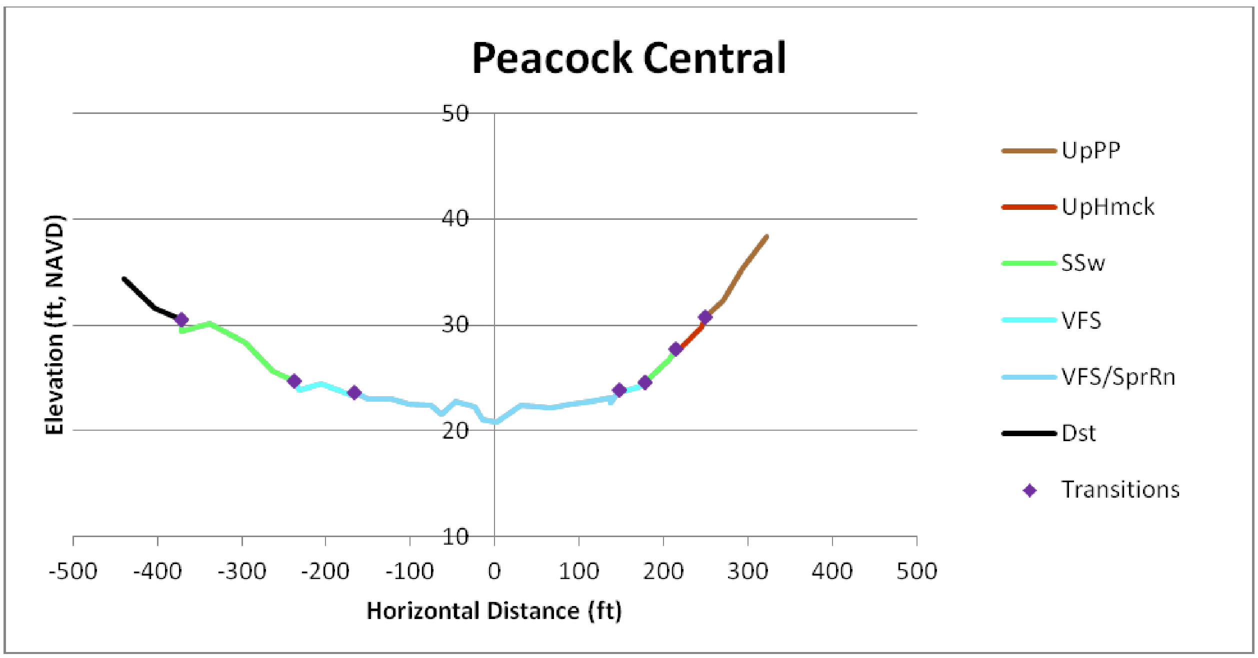
Bonnet Spring:



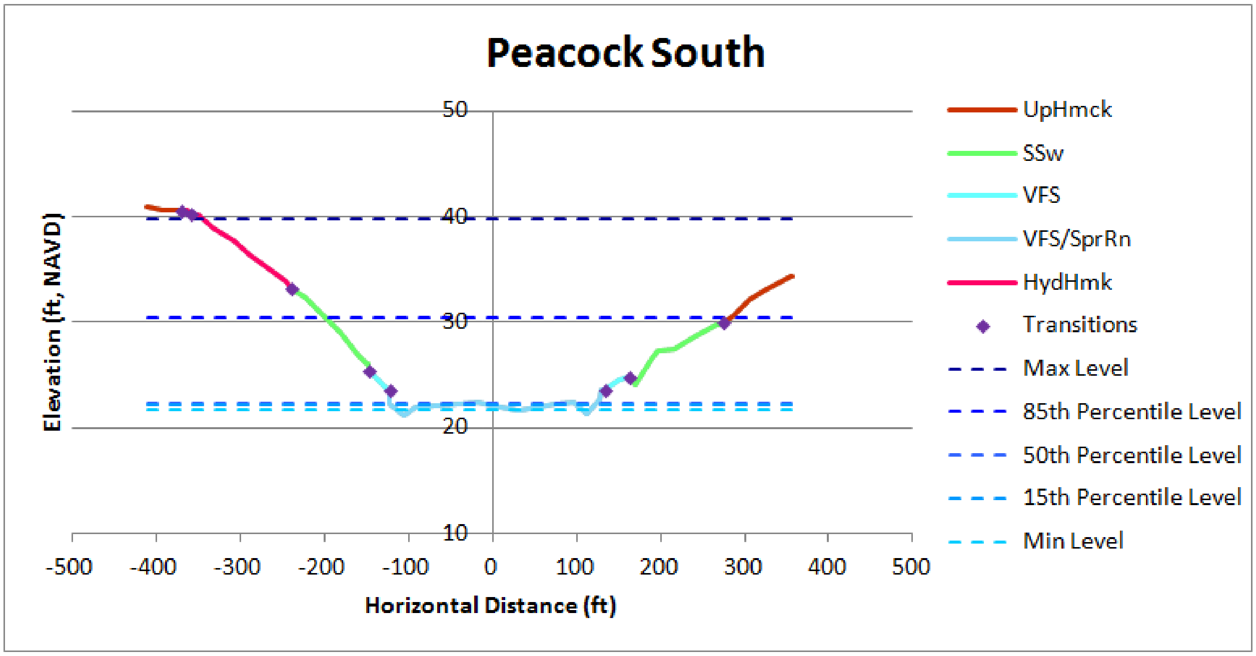
Peacock North:



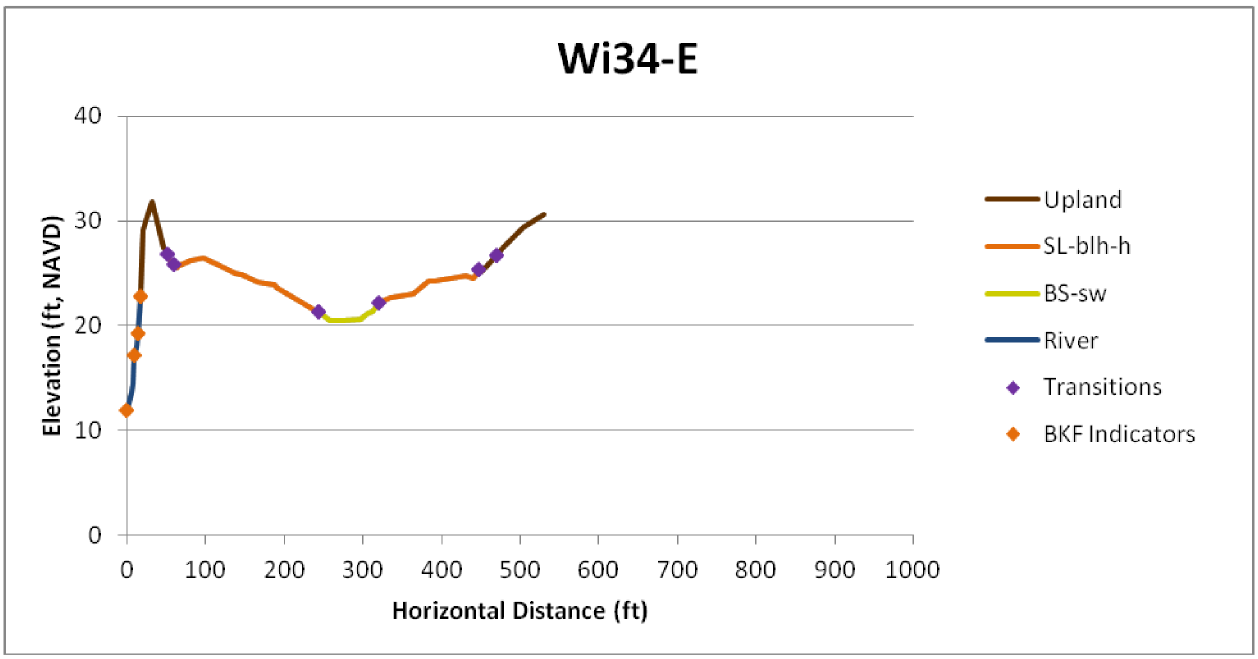
Peacock Central:



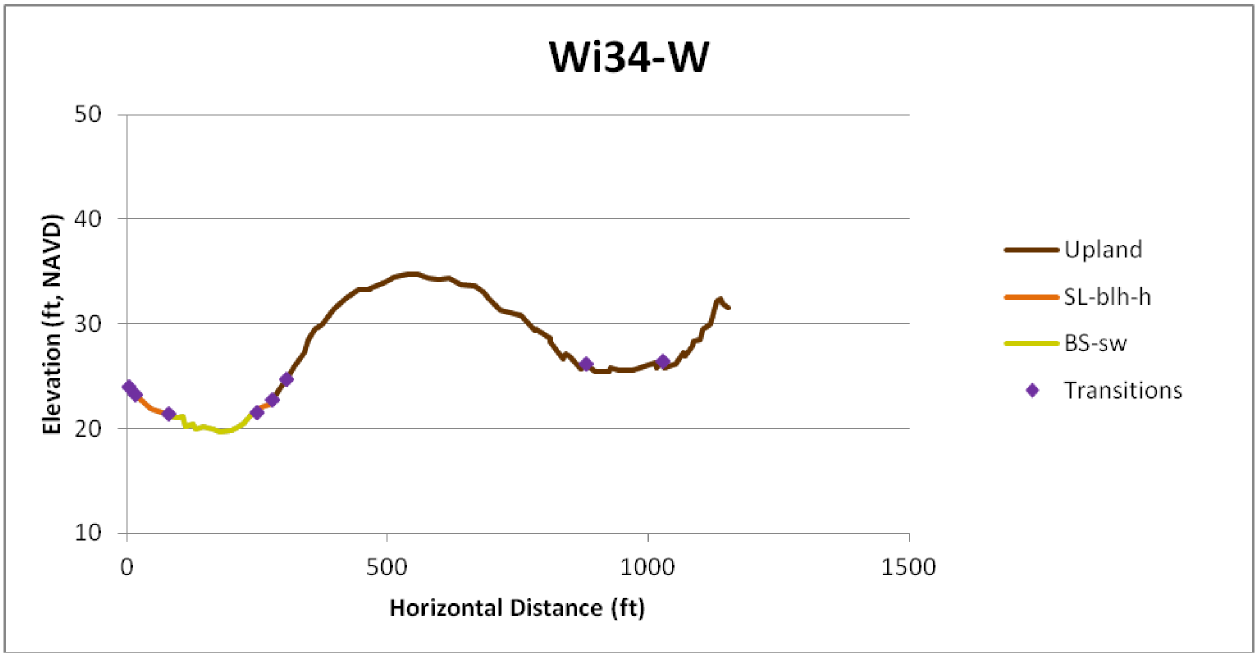
Peacock South:



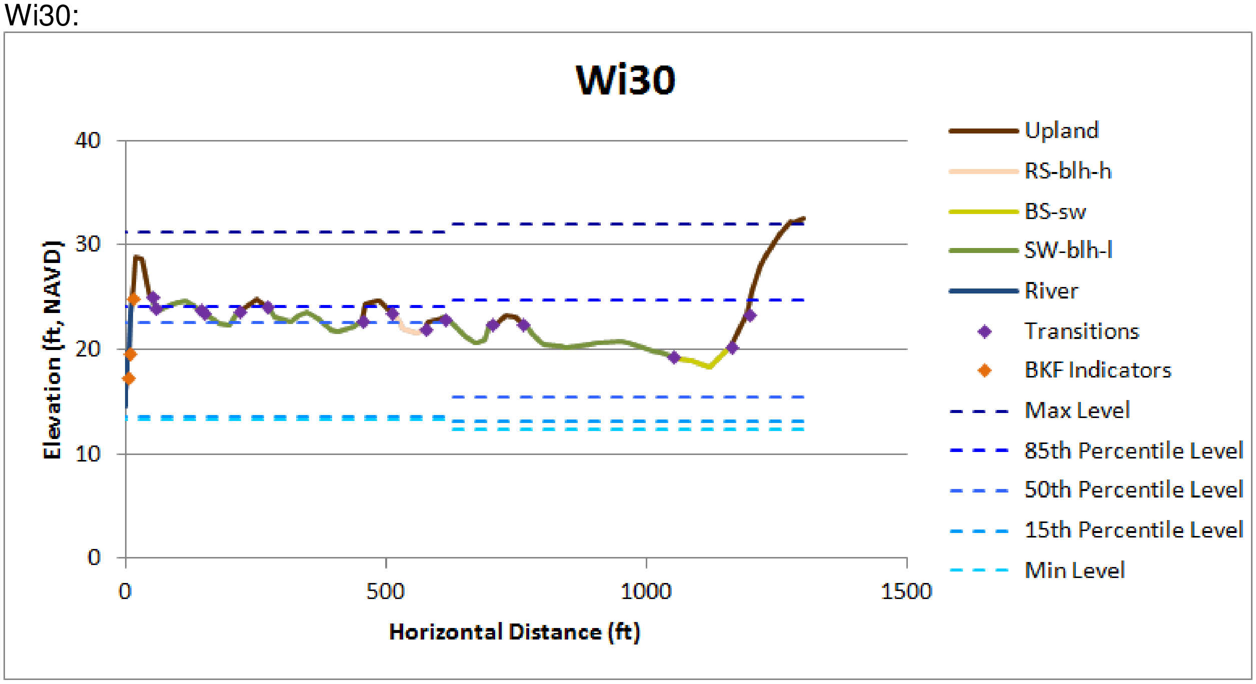
Wi34-E:



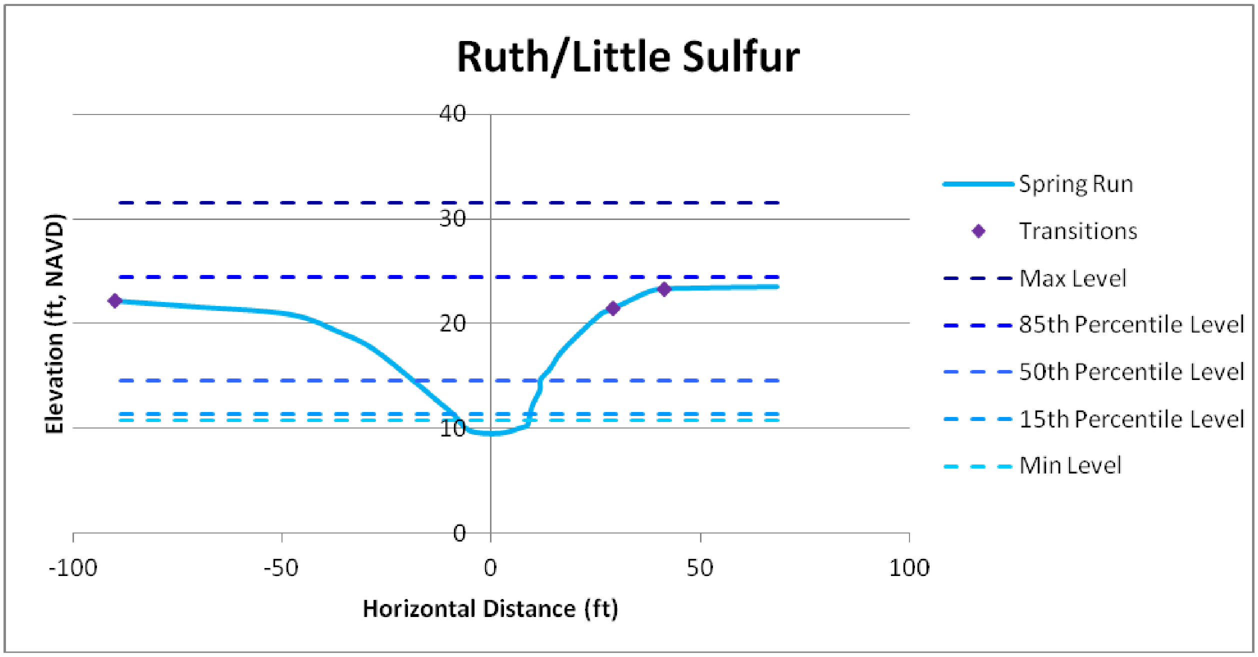
Wi34-W:


Wi34-W
Elevation (ft, NAVD)
50
40
30
20
10
0
500
1000
1500
Horizontal Distance (ft)
Upland
SL-blh-h
BS-sw
Transitions

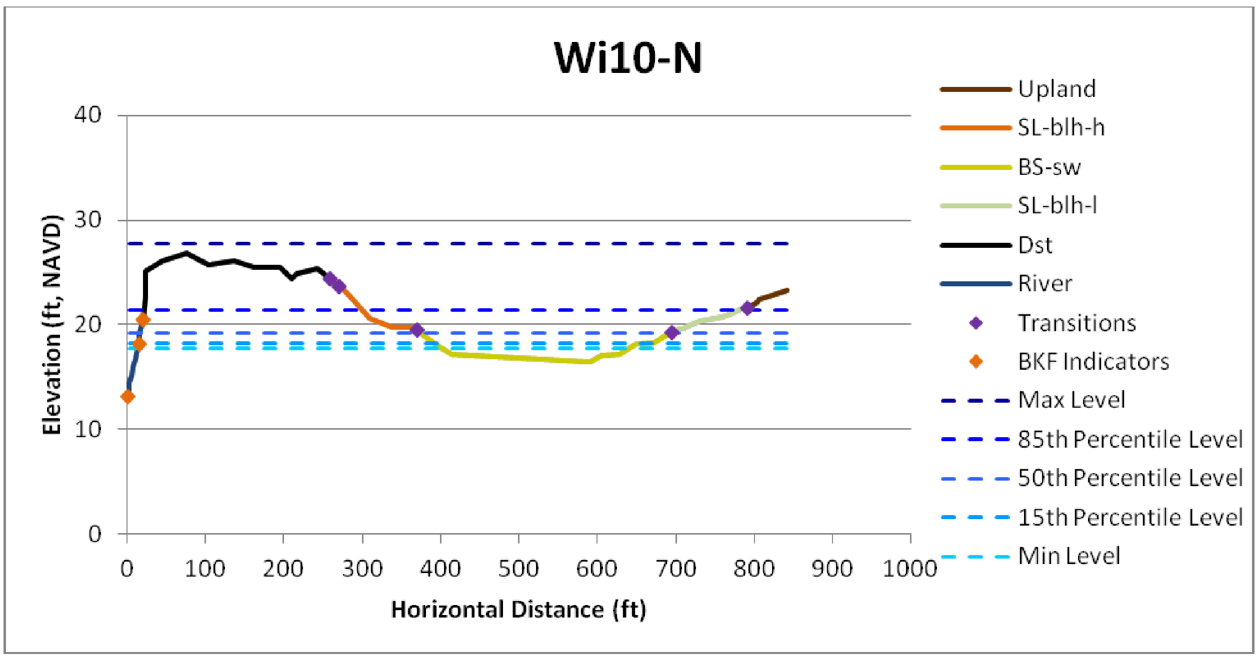
Wi30:


Wi30
Elevation (ft, NAVD)
40
30
20
10
0
0
500
1000
1500
Horizontal Distance (ft)
Upland
RS-blh-h
BS-sw
SW-blh-l
River
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

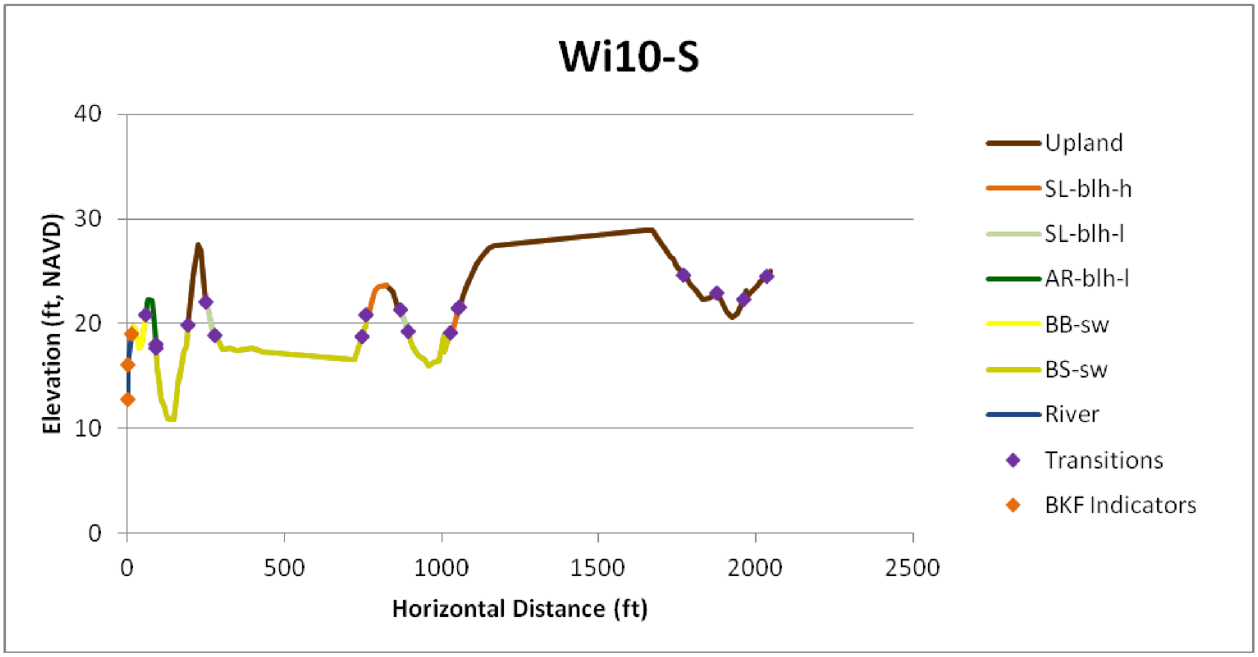
Ruth/Little Sulfur:



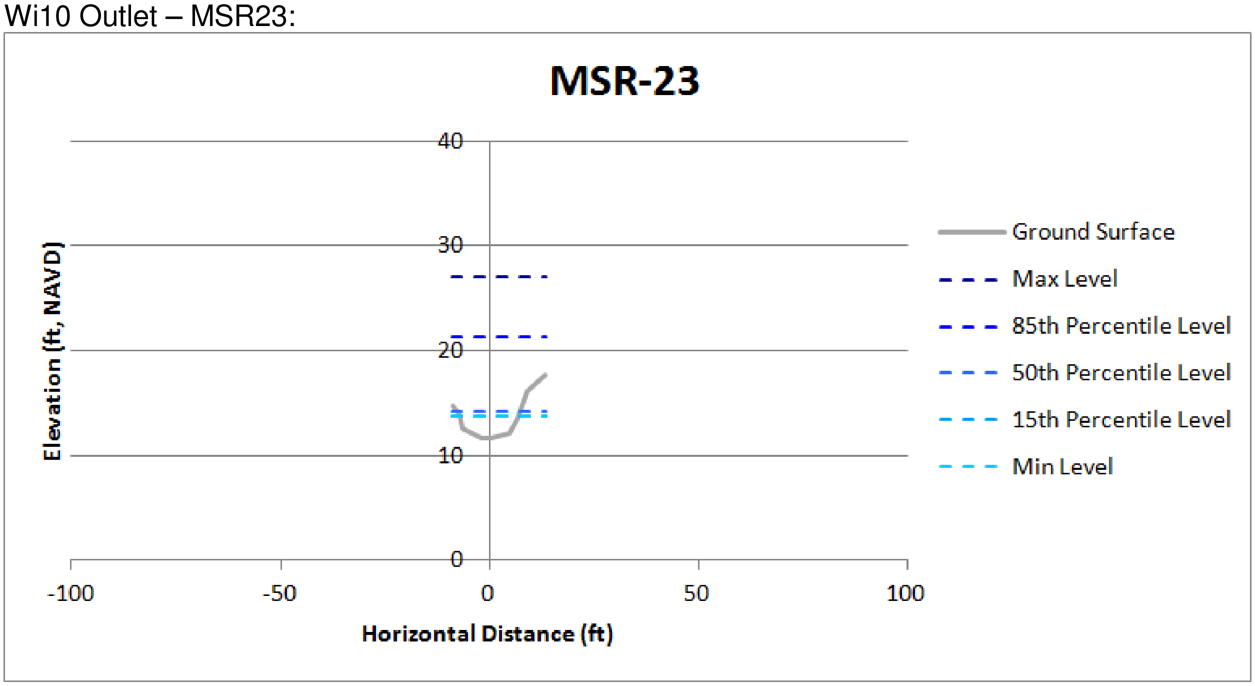
Wi10-N:



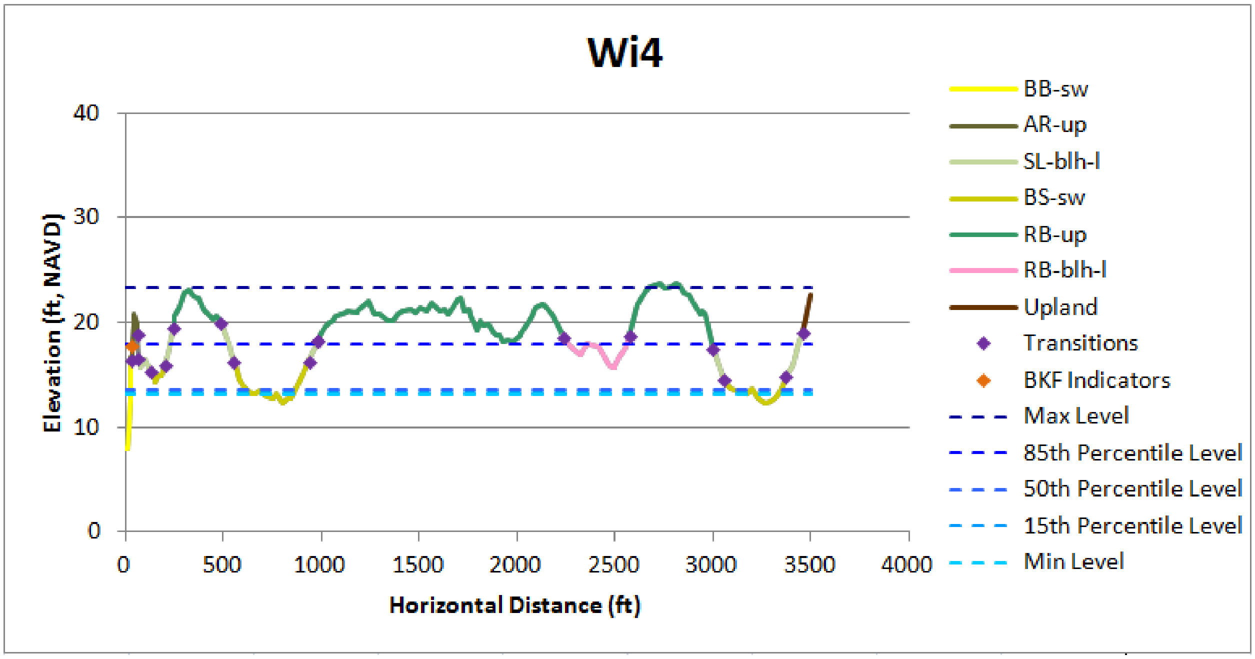
Wi10-S:



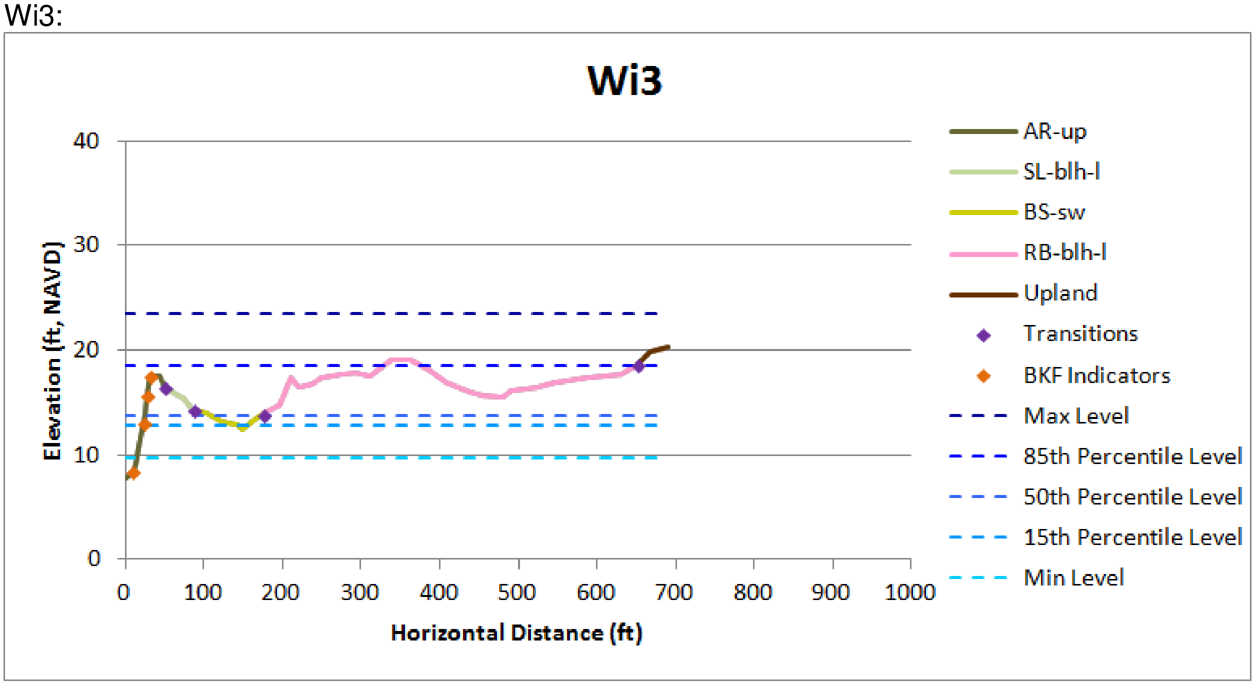
Wi10 Outlet – MSR23:



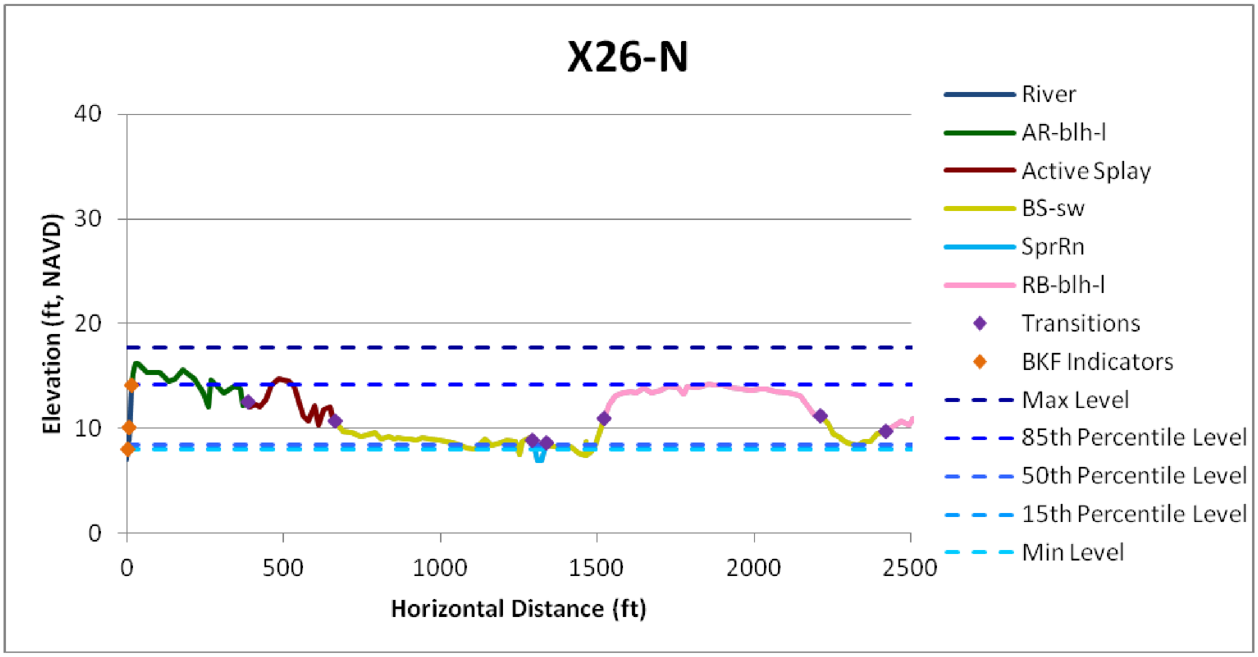
Wi4:


Wi4
Elevation (ft, NAVD)
Horizontal Distance (ft)
0
10
20
30
40
0
500
1000
1500
2000
2500
3000
3500
4000
BB-sw
AR-up
SL-blh-l
BS-sw
RB-up
RB-blh-l
Upland
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

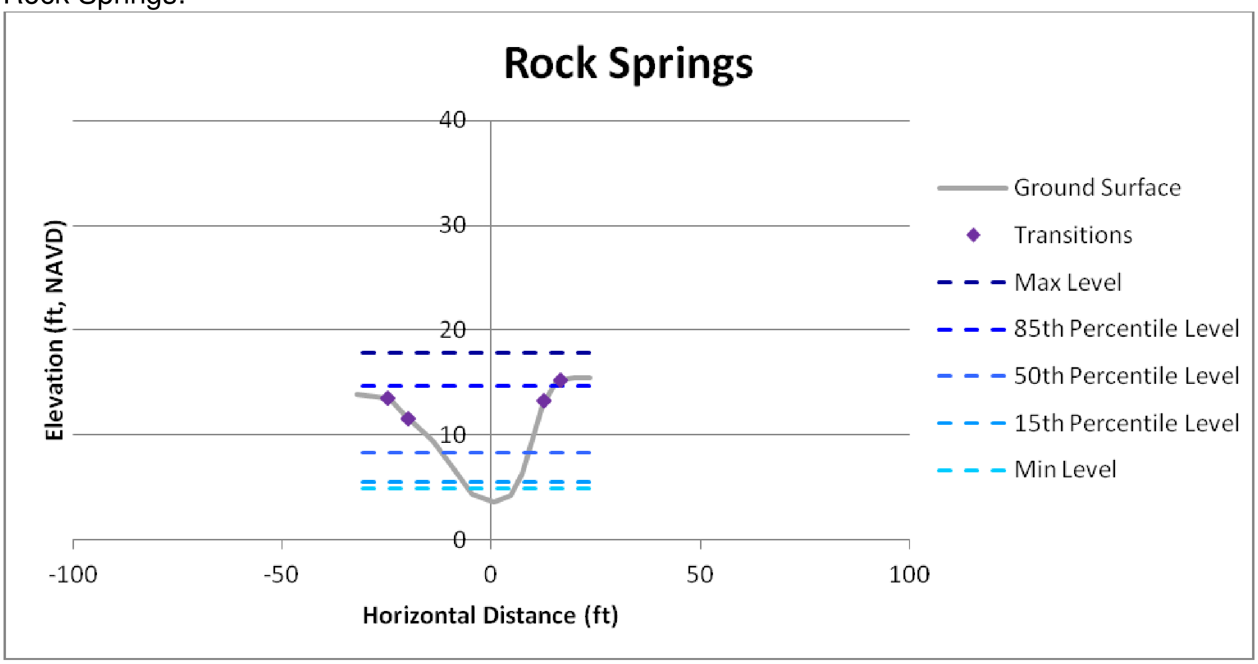
Wi3:


Wi3
Elevation (ft, NAVD)
Horizontal Distance (ft)
0
10
20
30
40
0
100
200
300
400
500
600
700
800
900
1000
AR-up
SL-blh-l
BS-sw
RB-blh-l
Upland
Transitions
BKF Indicators
Max Level
85th Percentile Level
50th Percentile Level
15th Percentile Level
Min Level

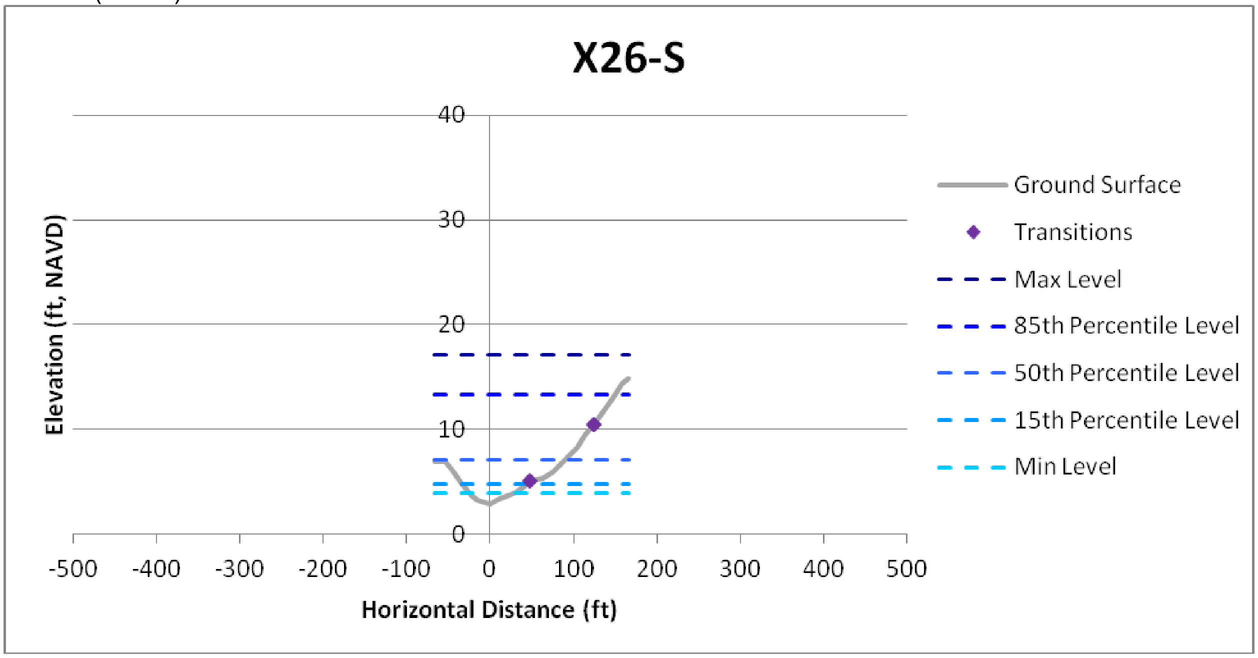
X26-N:



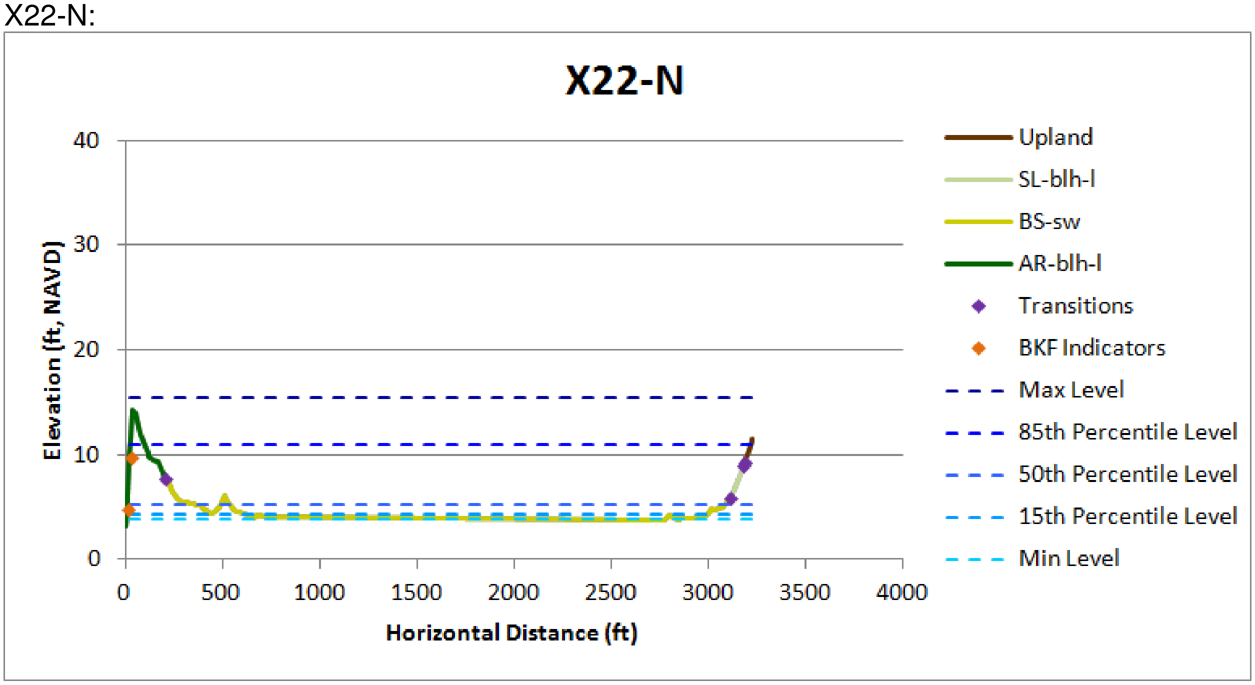
Rock Springs:



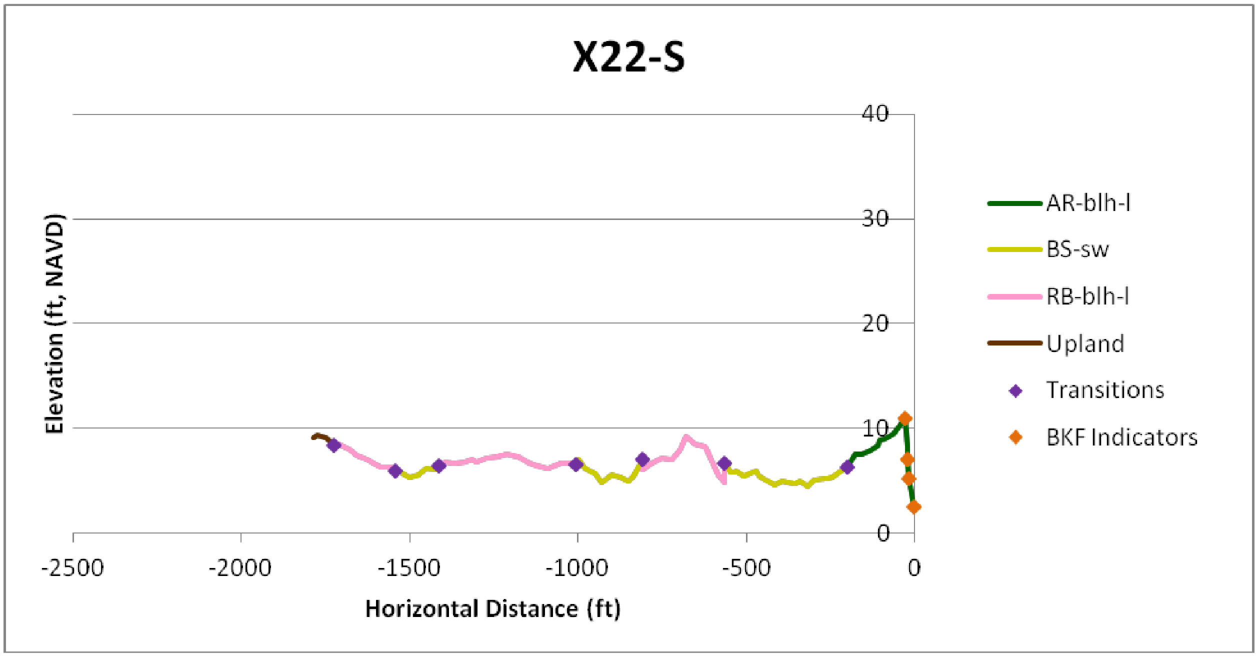
X26-S (outlet):



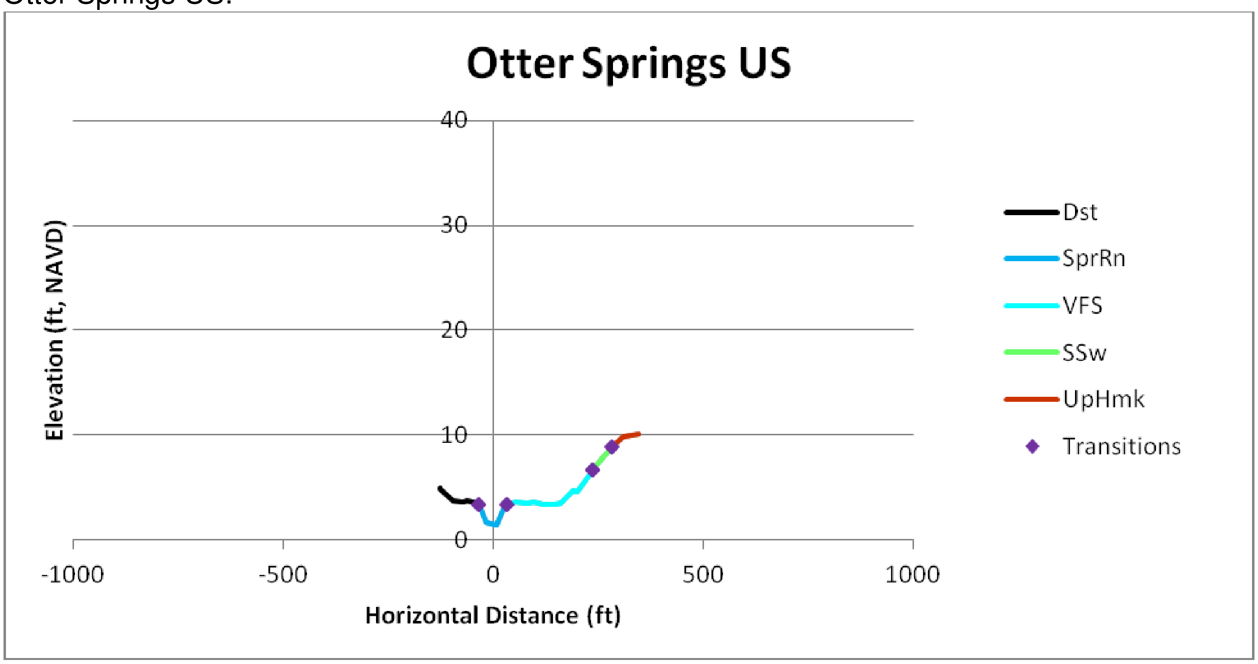
X22-N:



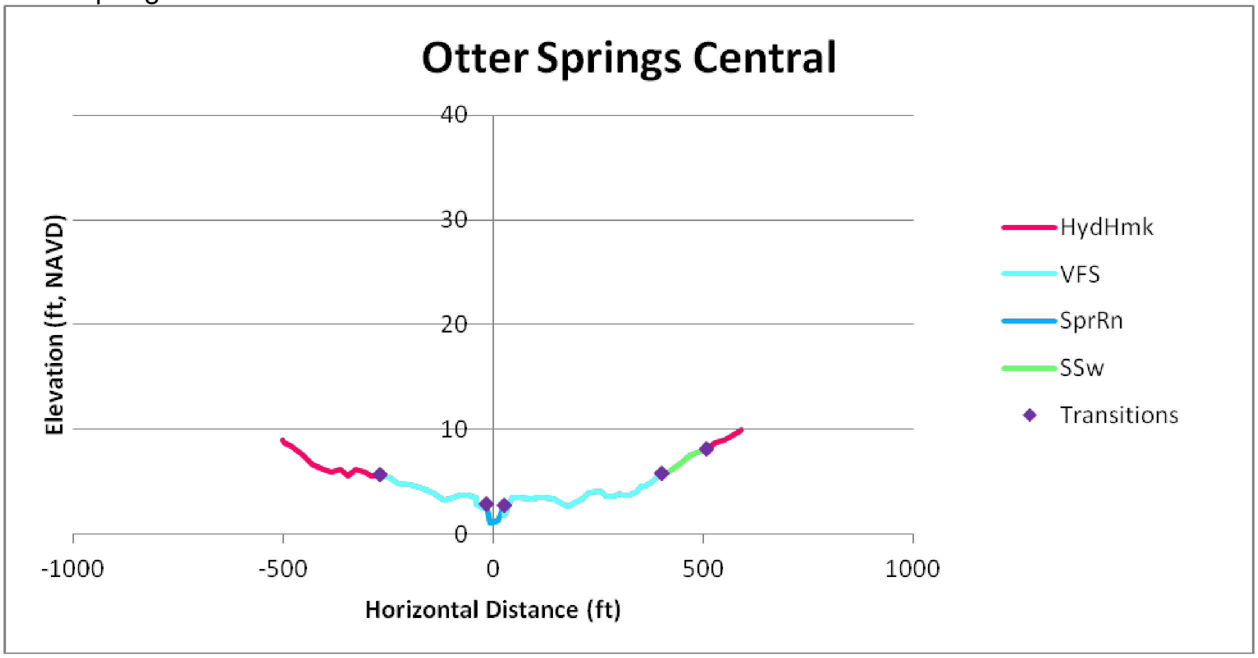
X22-S:



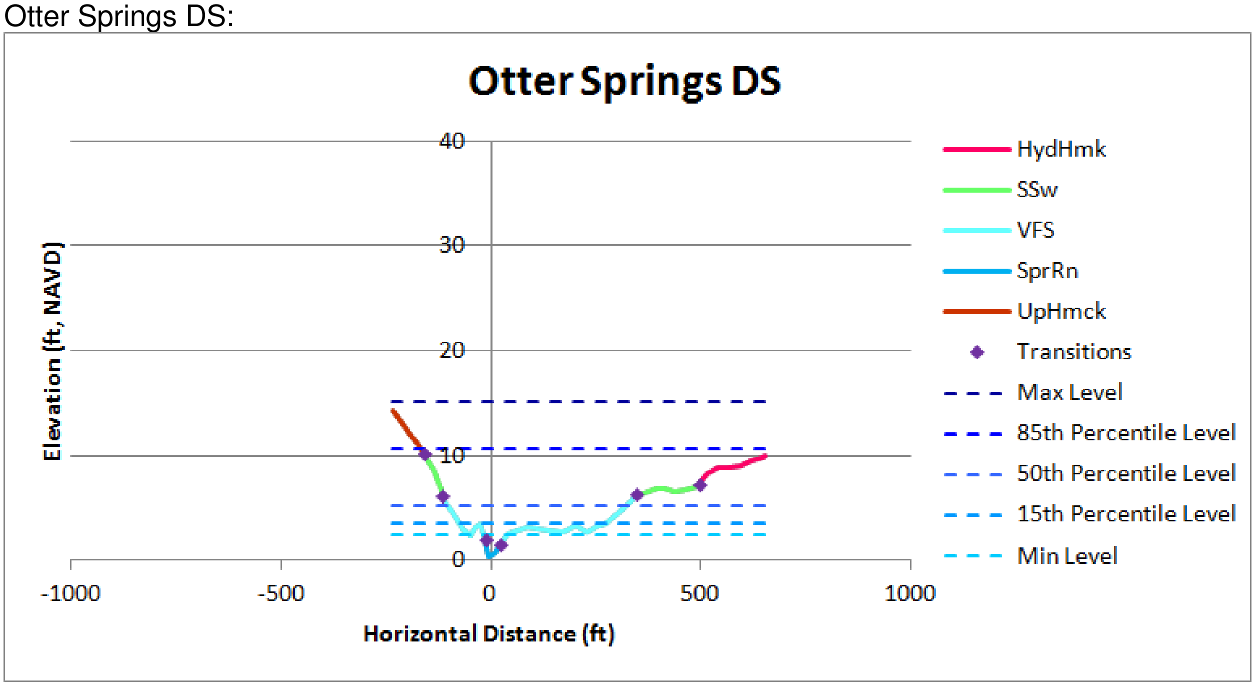
Otter Springs US:



Otter Springs Central:

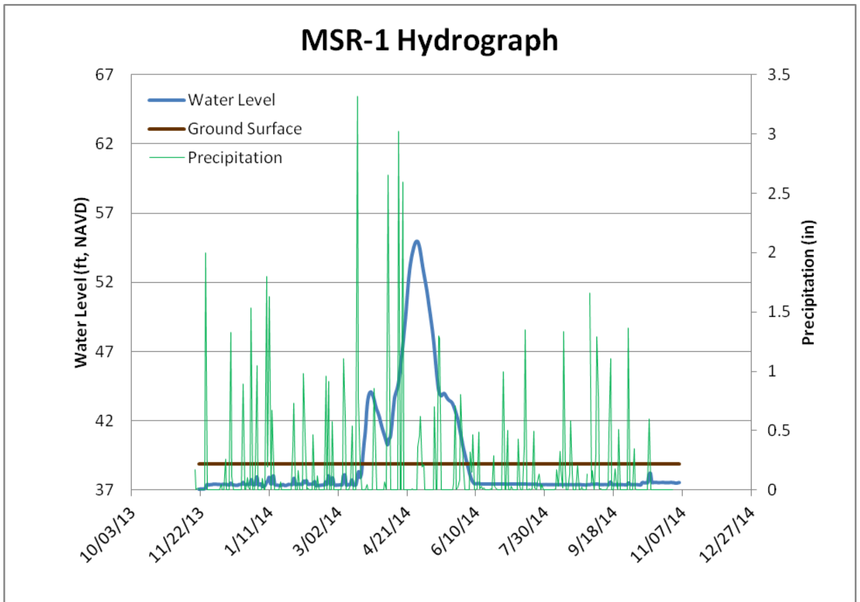


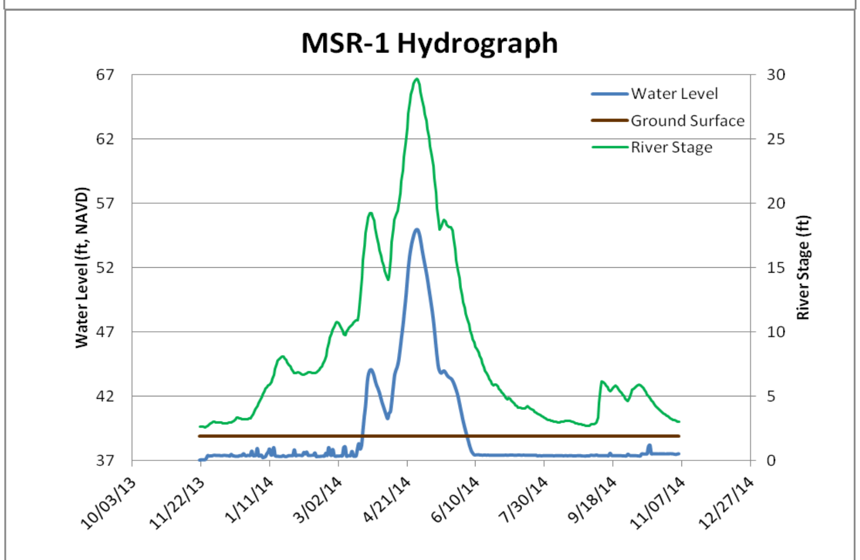
Otter Springs DS:

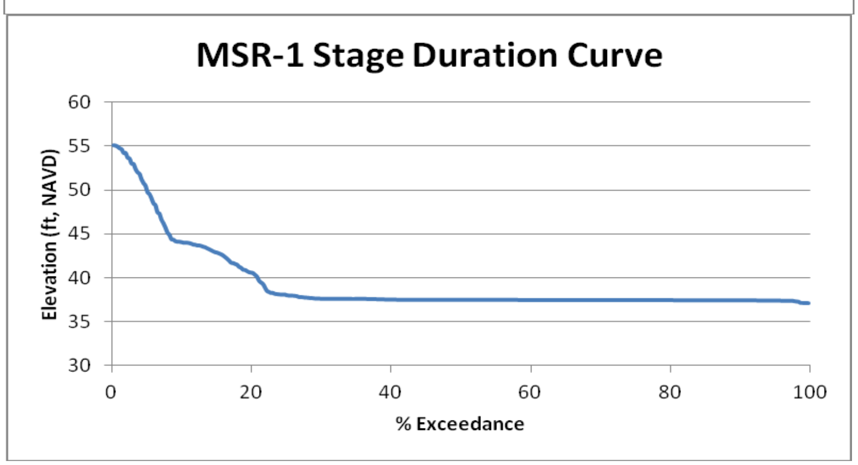


Appendix E

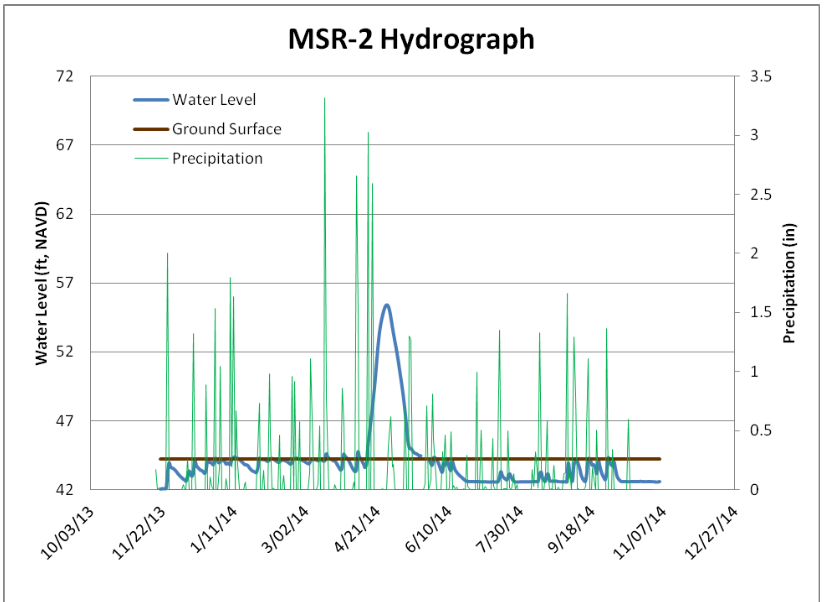
MSR-1:

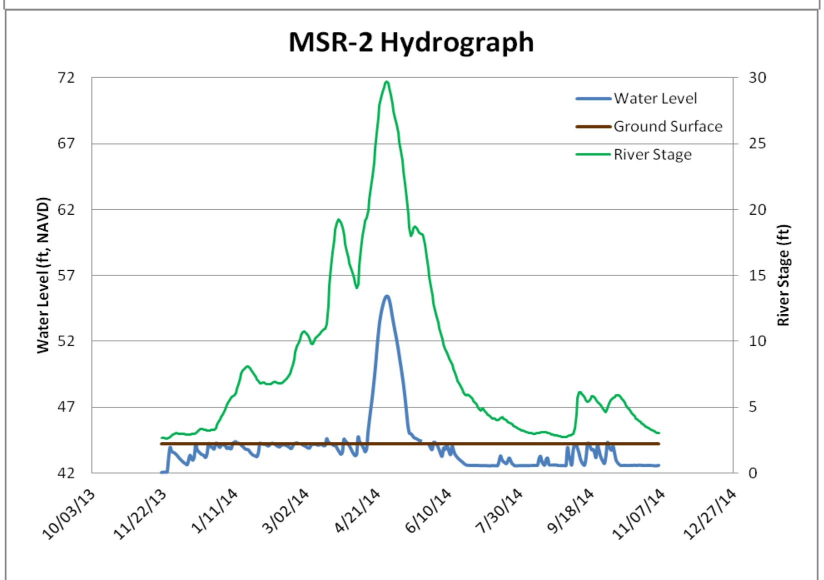

MSR-1 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
67
62
57
52
47
42
37
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

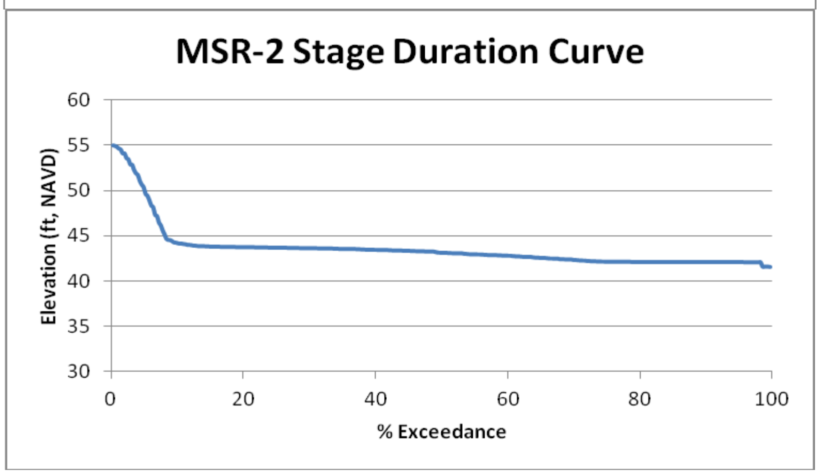

MSR-1 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
67
62
57
52
47
42
37
30
25
20
15
10
5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-1 Stage Duration Curve
Elevation (ft, NAVD)
60
55
50
45
40
35
30
0
20
40
60
80
100
% Exceedance

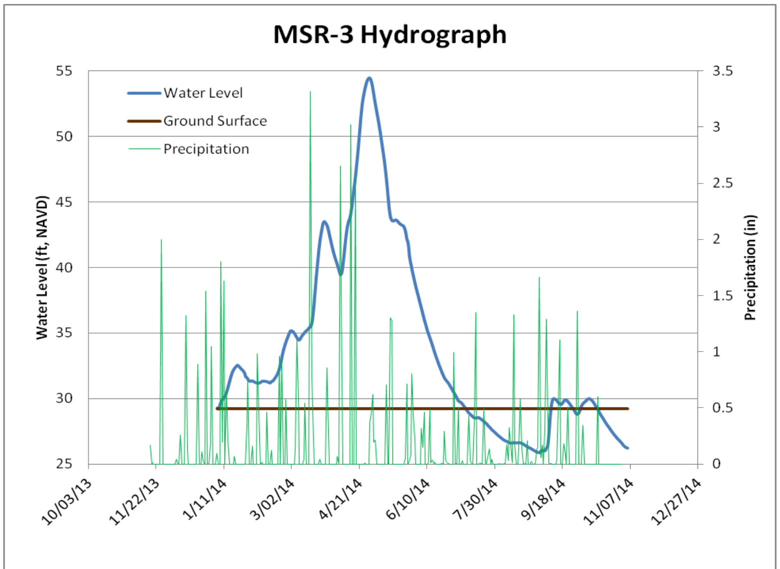
MSR-2:

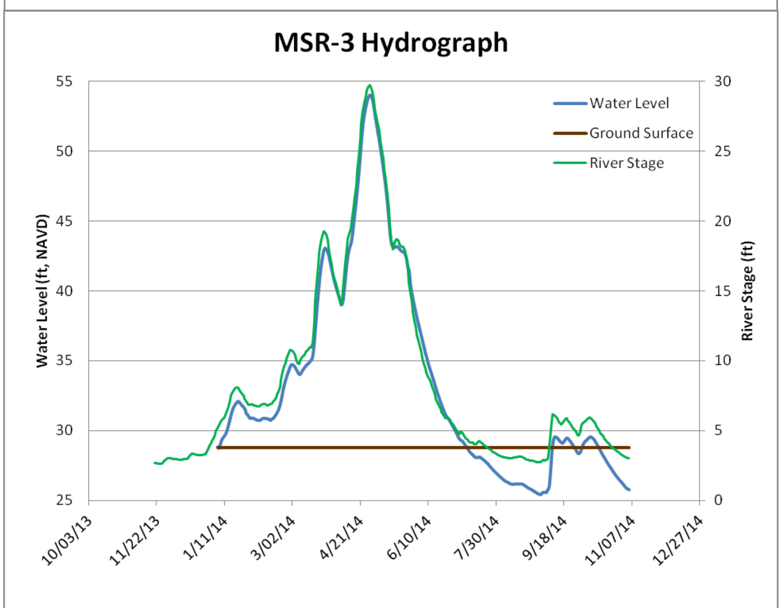

MSR-2 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
72
67
62
57
52
47
42
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

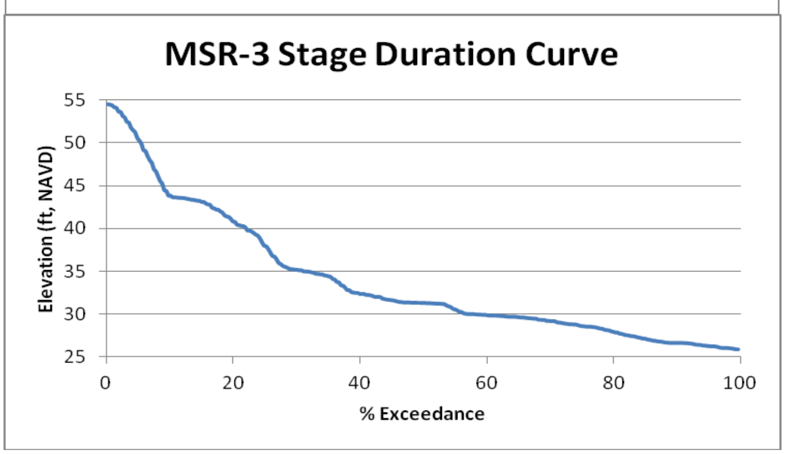

MSR-2 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
72
67
62
57
52
47
42
30
25
20
15
10
5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-2 Stage Duration Curve
Elevation (ft, NAVD)
60
55
50
45
40
35
30
0
20
40
60
80
100
% Exceedance

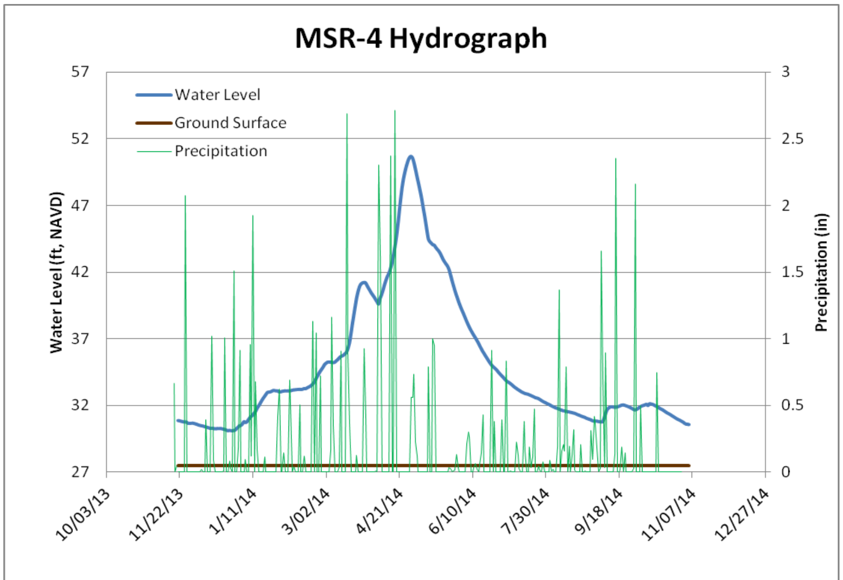
MSR-3:

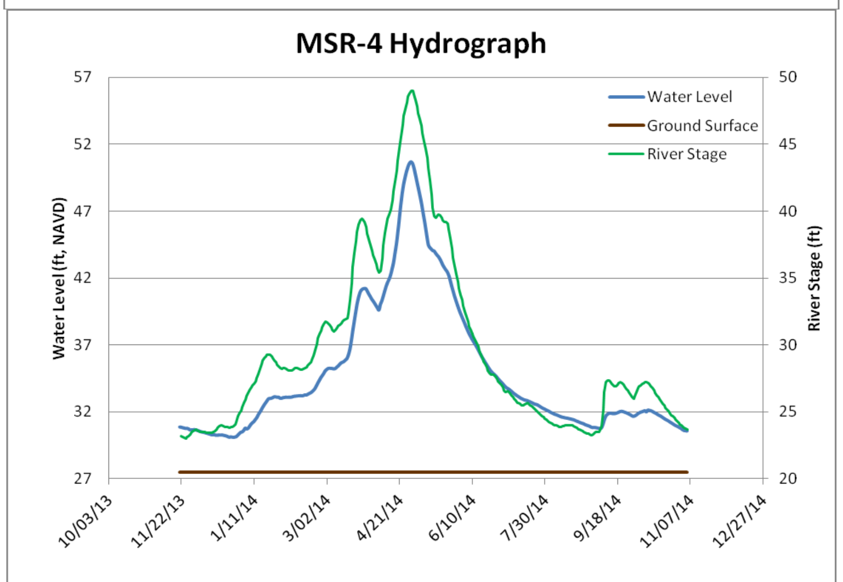

MSR-3 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
55
50
45
40
35
30
25
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

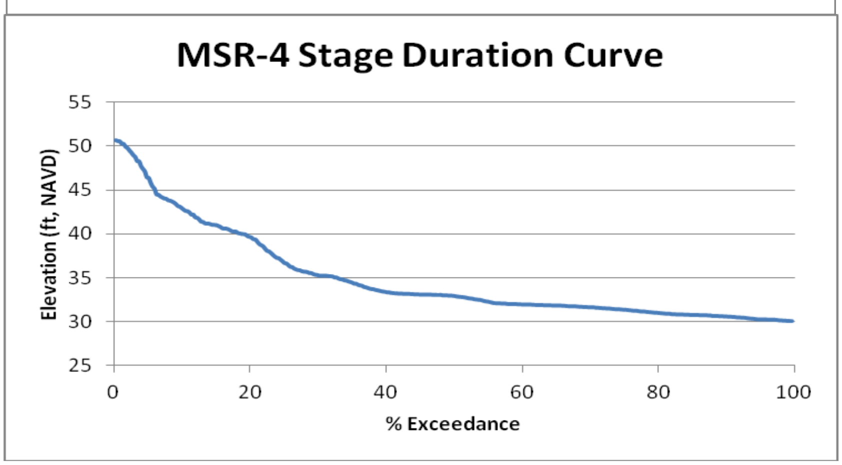

MSR-3 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
55
50
45
40
35
30
25
30
25
20
15
10
5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-3 Stage Duration Curve
Elevation (ft, NAVD)
% Exceedance
55
50
45
40
35
30
25
0
20
40
60
80
100

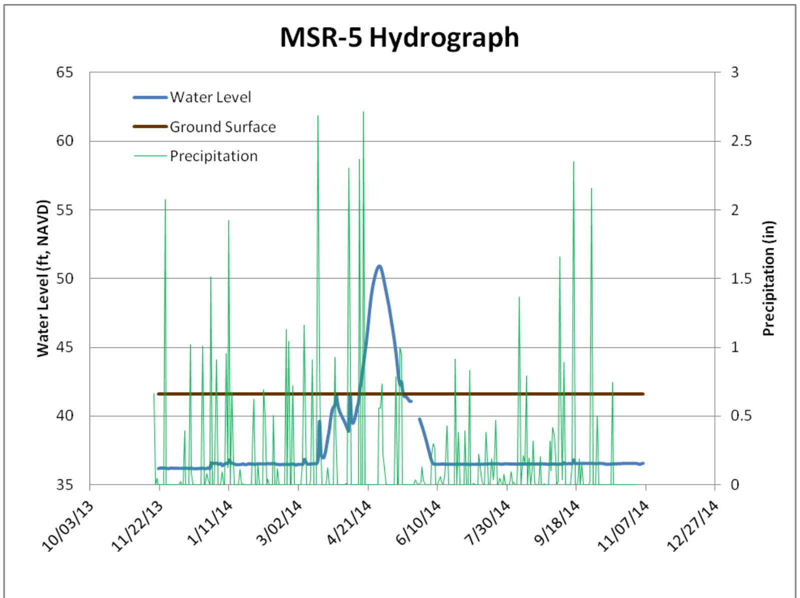
MSR-4:

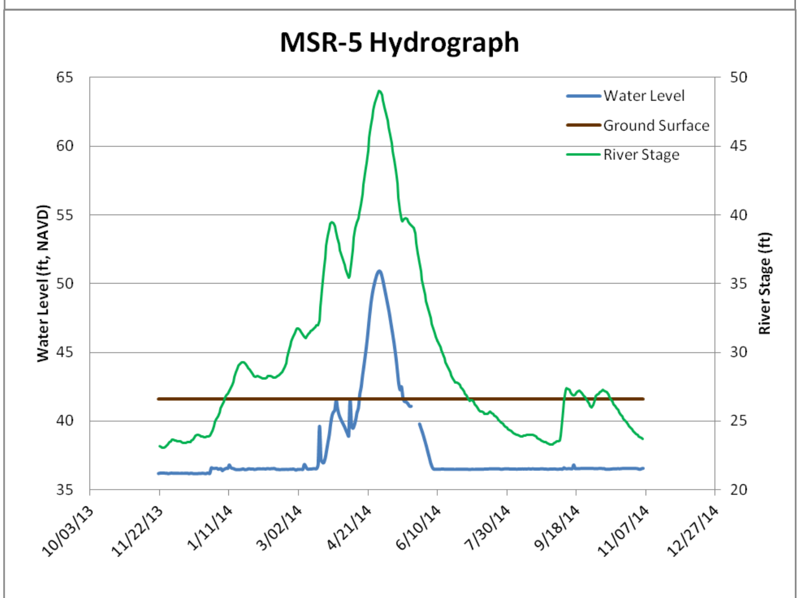

MSR-4 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
57
52
47
42
37
32
27
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

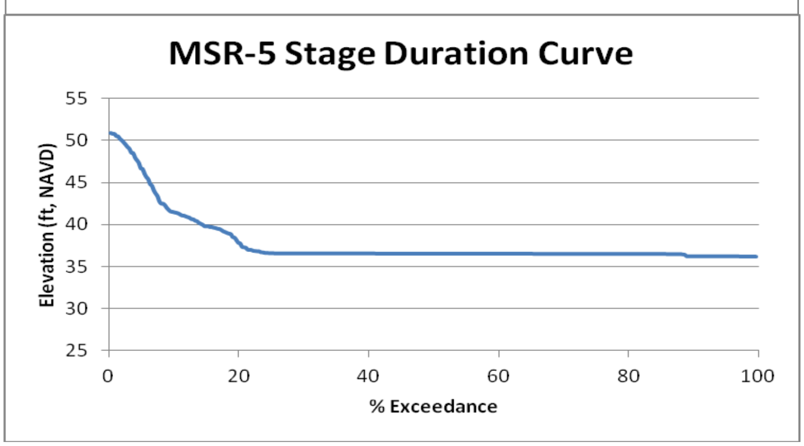

MSR-4 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
57
52
47
42
37
32
27
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-4 Stage Duration Curve
Elevation (ft, NAVD)
55
50
45
40
35
30
25
0
20
40
60
80
100
% Exceedance

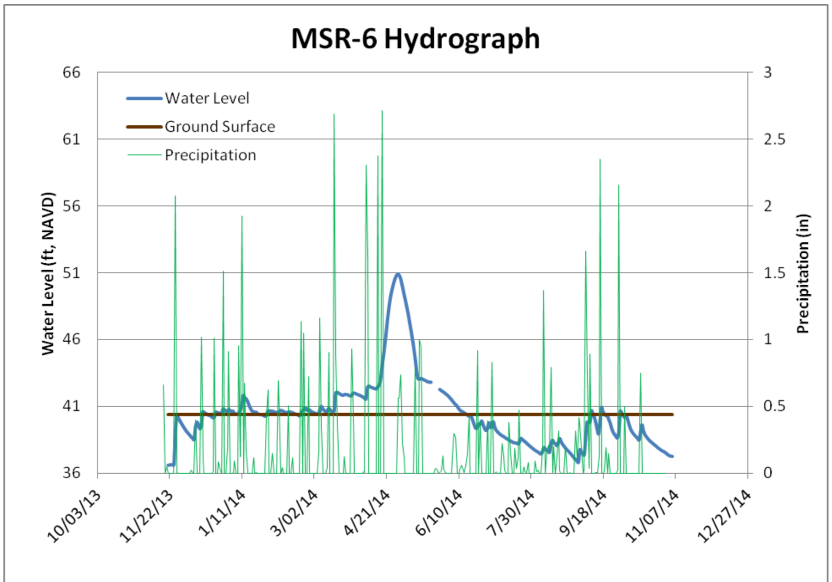
MSR-5:

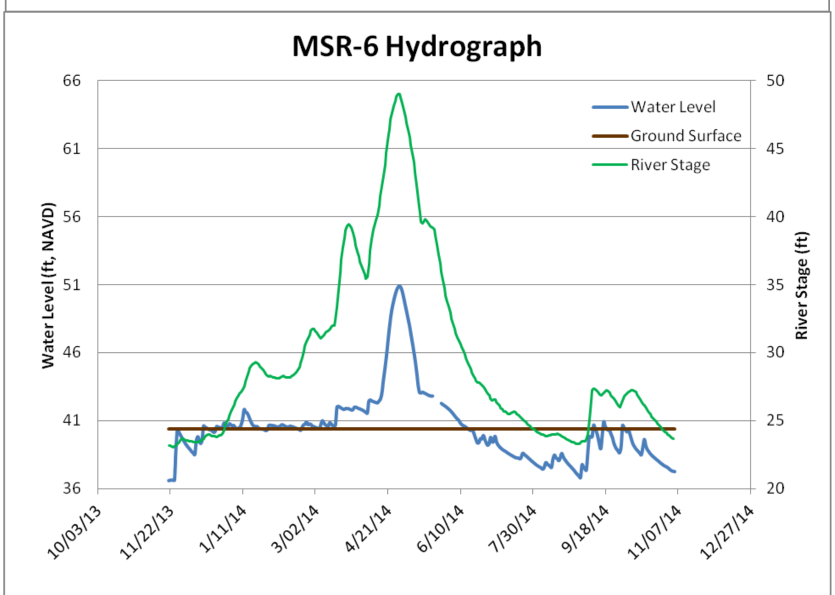

MSR-5 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
65
60
55
50
45
40
35
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

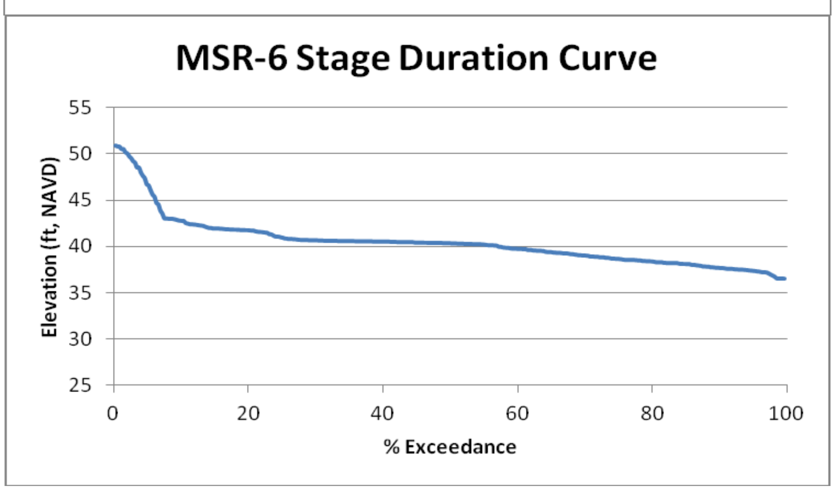

MSR-5 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
65
60
55
50
45
40
35
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-5 Stage Duration Curve
Elevation (ft, NAVD)
% Exceedance
55
50
45
40
35
30
25
0
20
40
60
80
100

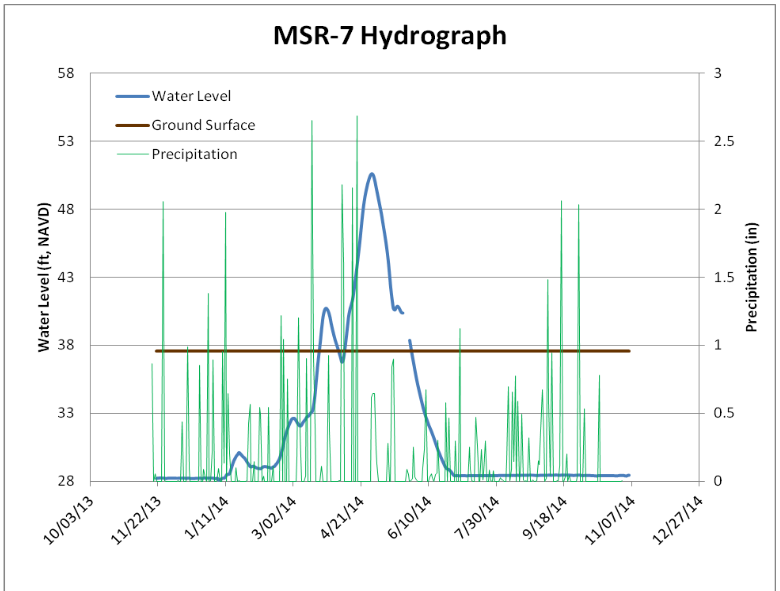
MSR-6:

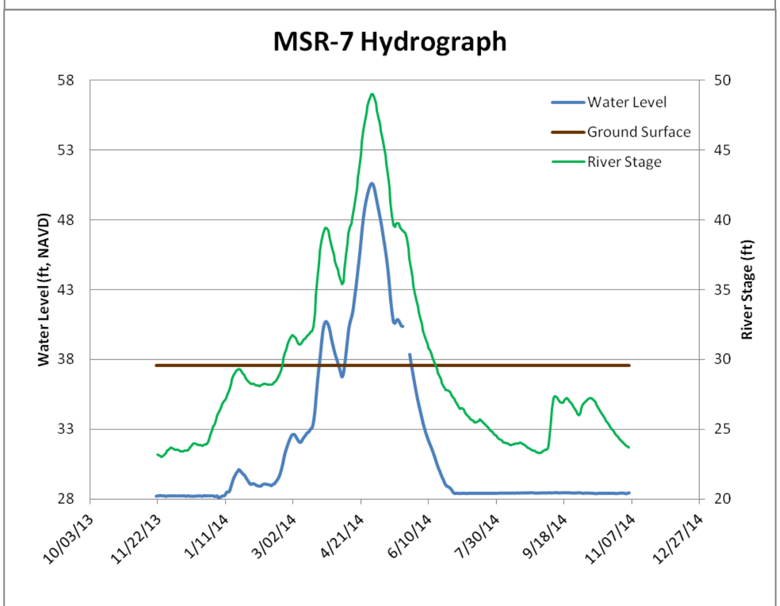

MSR-6 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
66
61
56
51
46
41
36
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

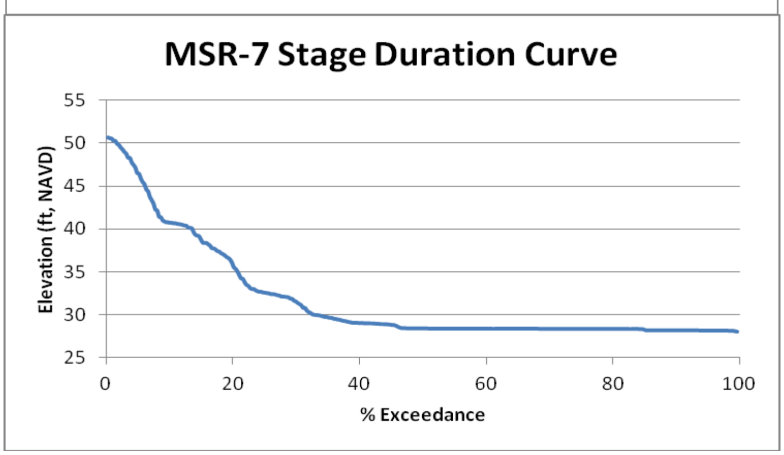

MSR-6 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
66
61
56
51
46
41
36
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-6 Stage Duration Curve
Elevation (ft, NAVD)
55
50
45
40
35
30
25
0
20
40
60
80
100
% Exceedance

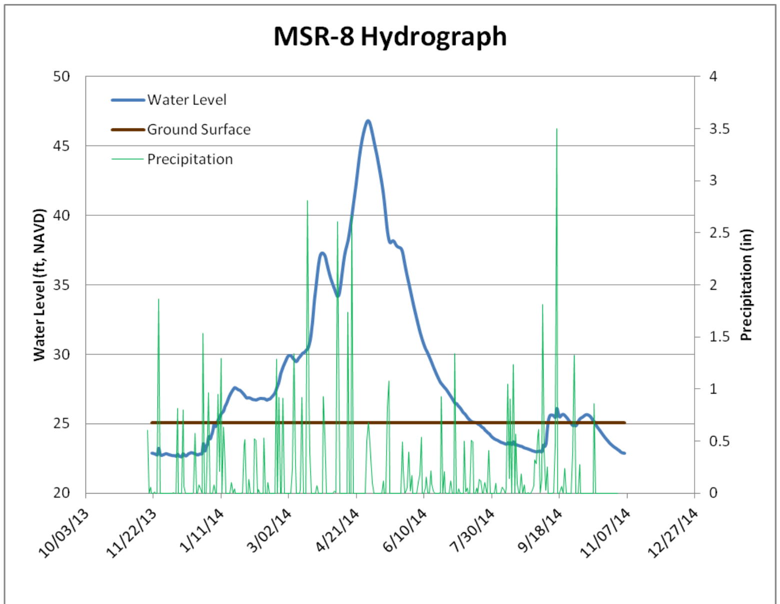
MSR-7:

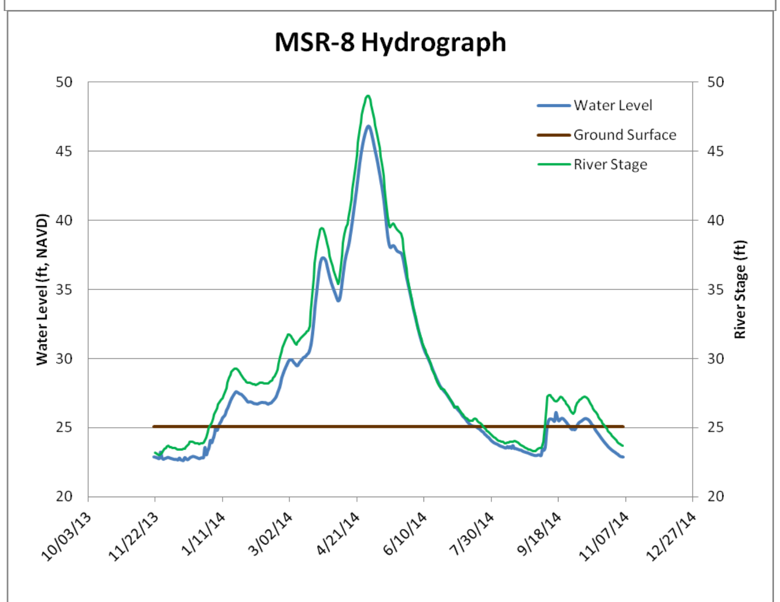

MSR-7 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
58
53
48
43
38
33
28
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

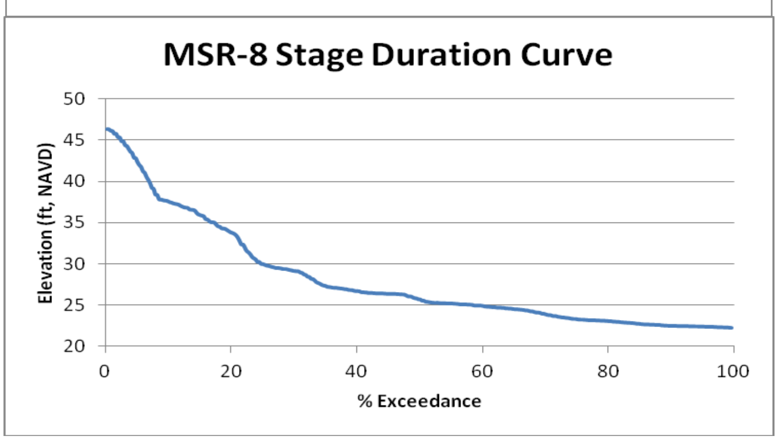

MSR-7 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
58
53
48
43
38
33
28
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-7 Stage Duration Curve
Elevation (ft, NAVD)
55
50
45
40
35
30
25
0
20
40
60
80
100
% Exceedance

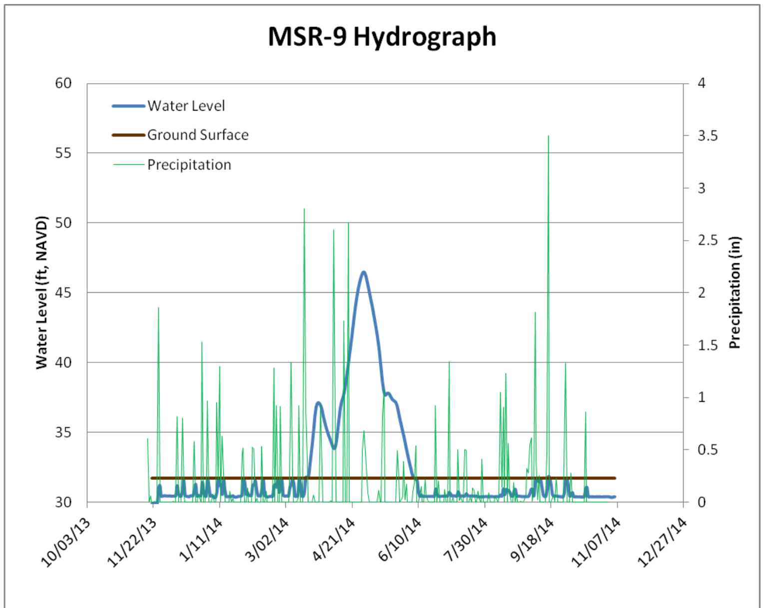
MSR-8:

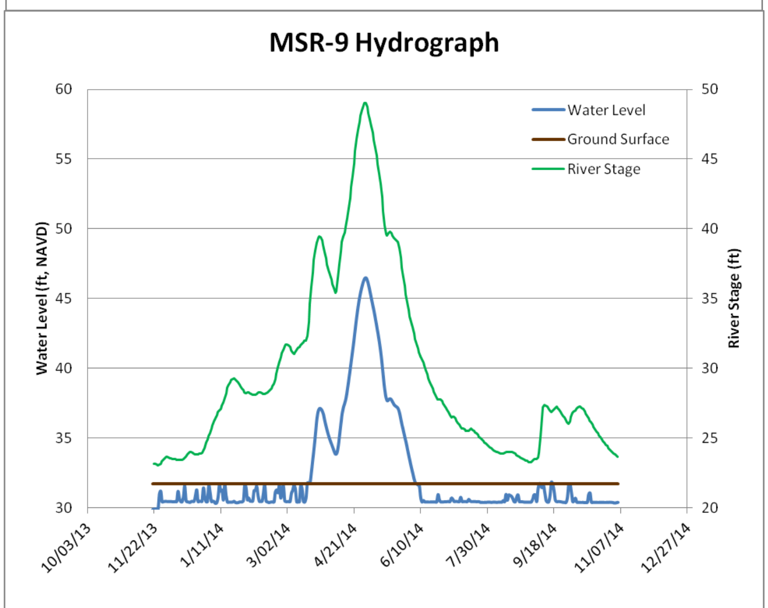

MSR-8 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
50
45
40
35
30
25
20
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

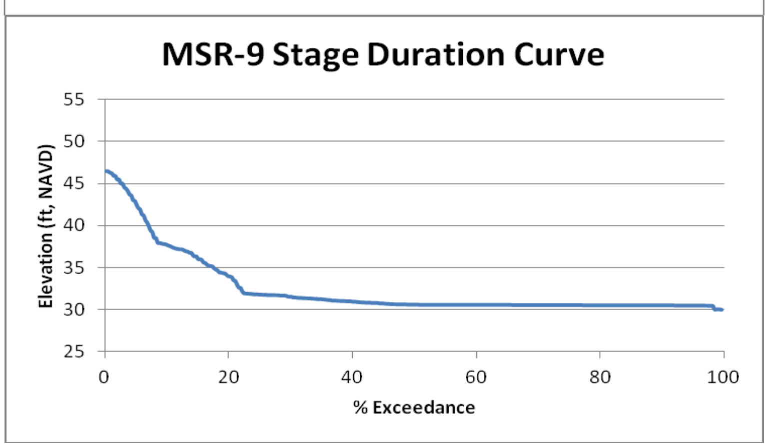

MSR-8 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-8 Stage Duration Curve
Elevation (ft, NAVD)
50
45
40
35
30
25
20
0
20
40
60
80
100
% Exceedance

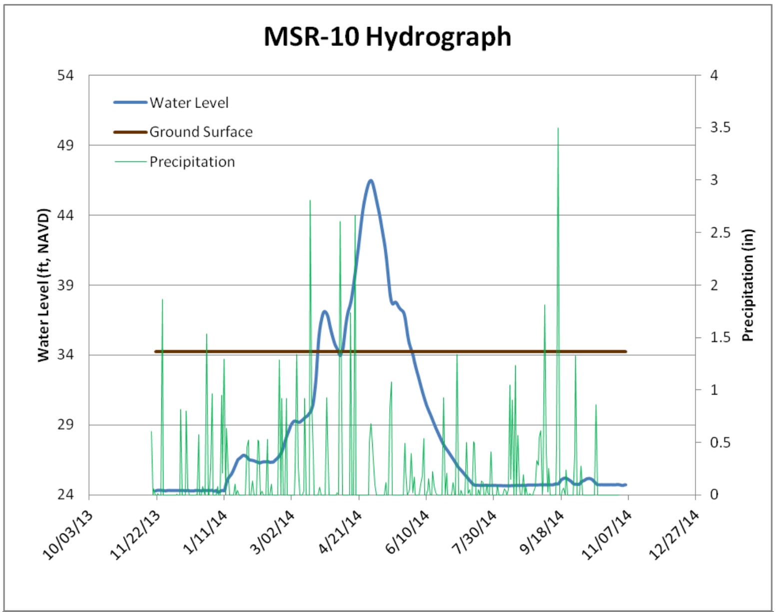
MSR-9:

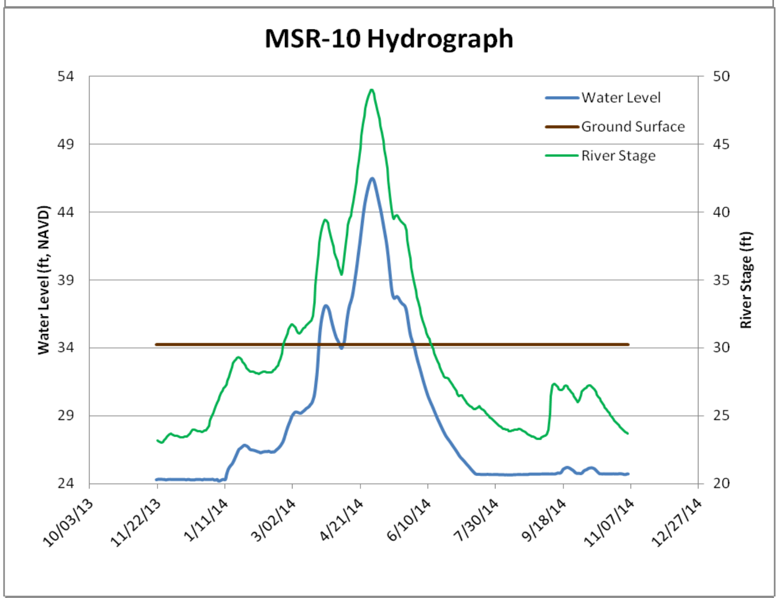

MSR-9 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
60
55
50
45
40
35
30
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

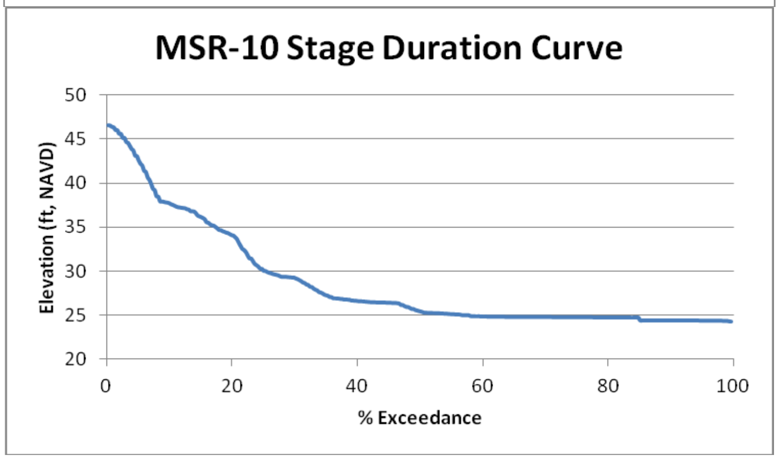

MSR-9 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
60
55
50
45
40
35
30
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-9 Stage Duration Curve
Elevation (ft, NAVD)
55
50
45
40
35
30
25
0
20
40
60
80
100
% Exceedance

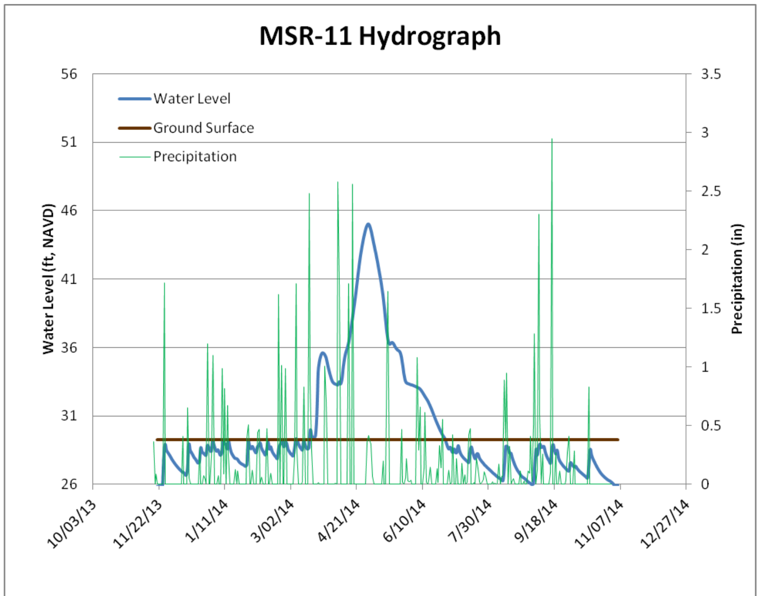
MSR-10:

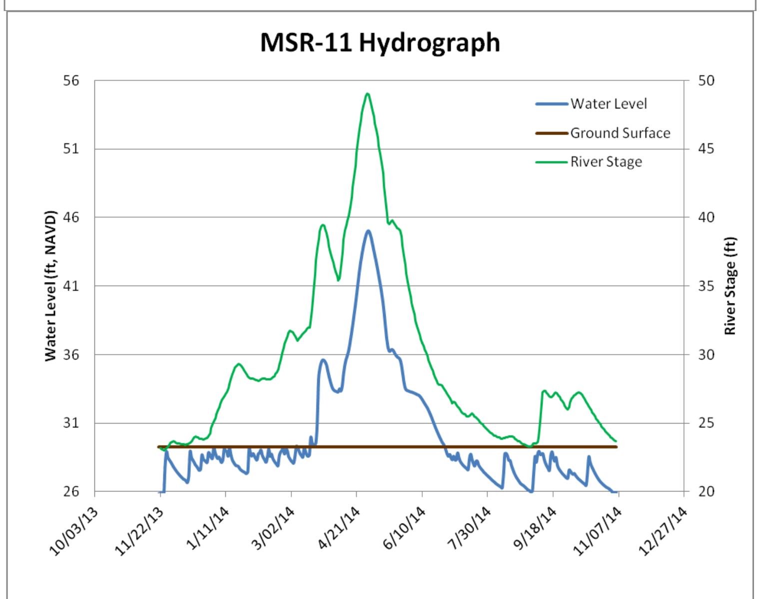

MSR-10 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
54
49
44
39
34
29
24
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

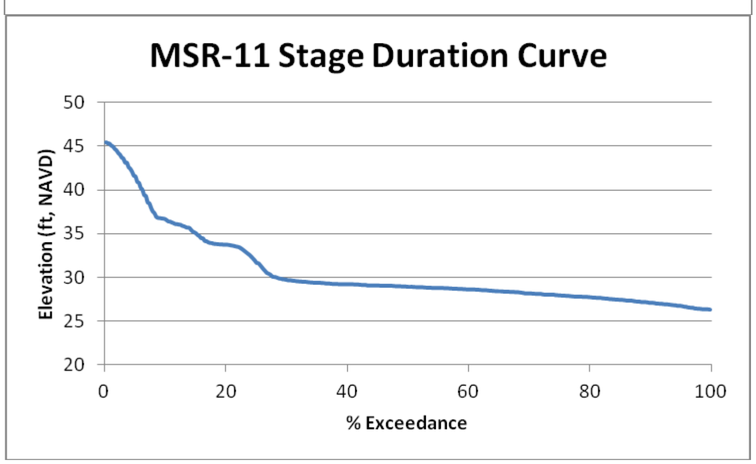

MSR-10 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
54
49
44
39
34
29
24
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-10 Stage Duration Curve
Elevation (ft, NAVD)
50
45
40
35
30
25
20
0
20
40
60
80
100
% Exceedance

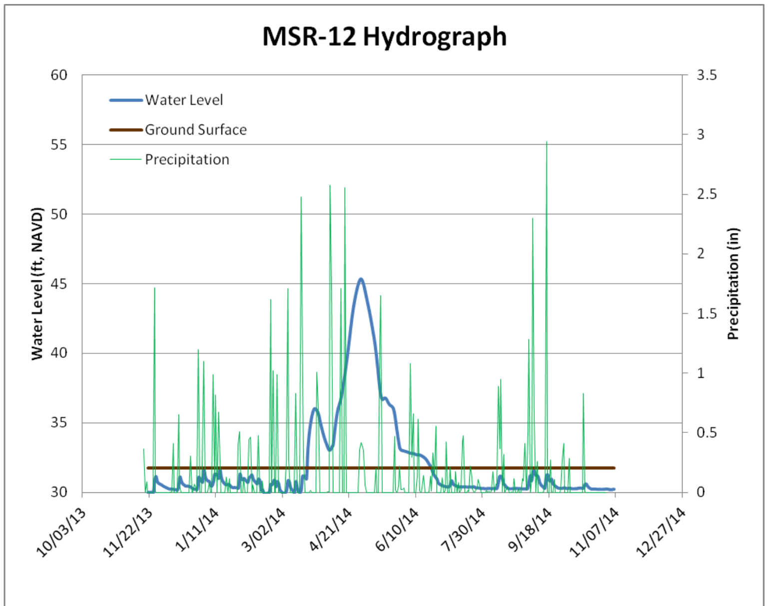
MSR-11:

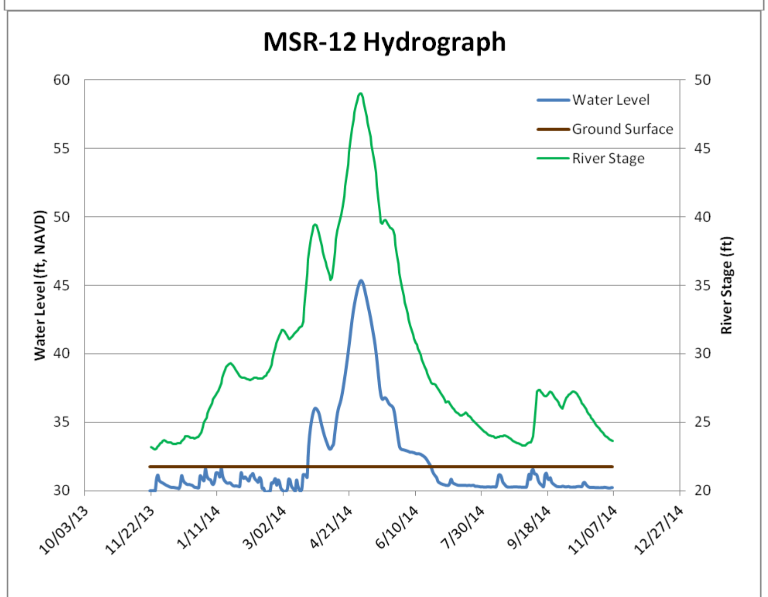

MSR-11 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
56
51
46
41
36
31
26
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

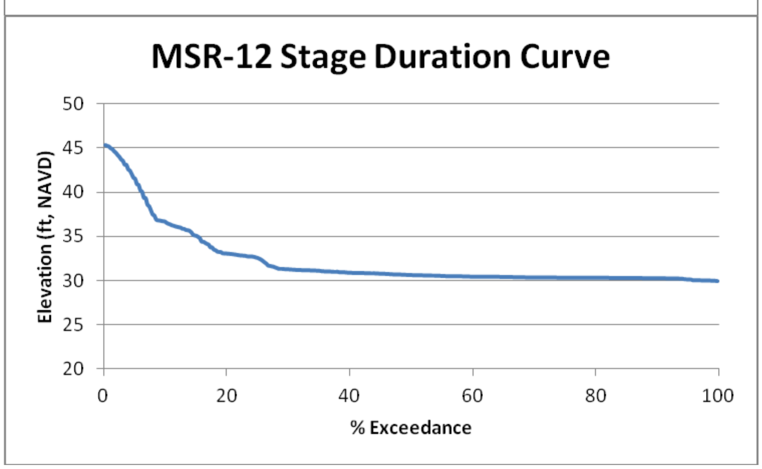

MSR-11 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
56
51
46
41
36
31
26
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-11 Stage Duration Curve
Elevation (ft, NAVD)
50
45
40
35
30
25
20
0
20
40
60
80
100
% Exceedance

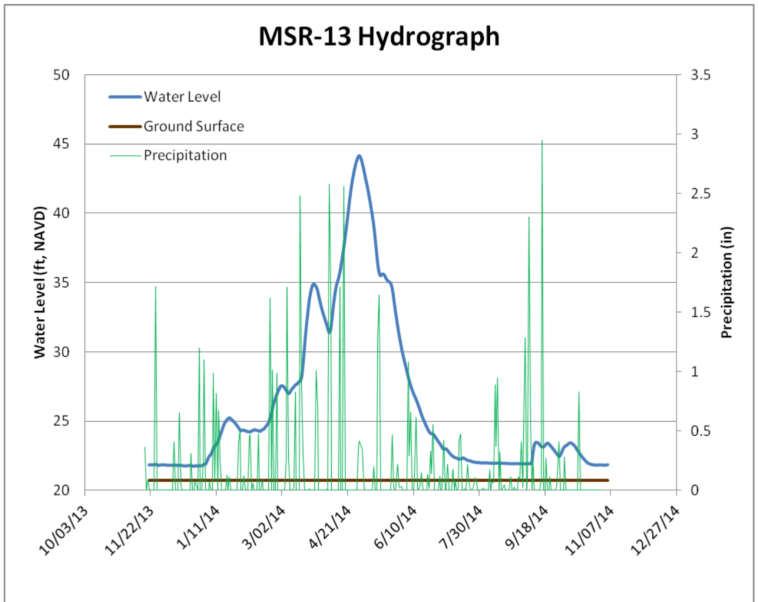
MSR-12:

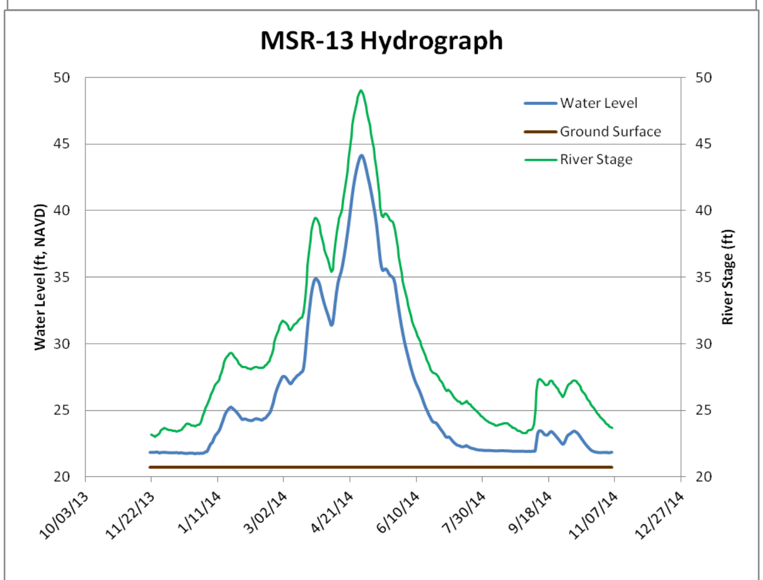

MSR-12 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
60
55
50
45
40
35
30
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

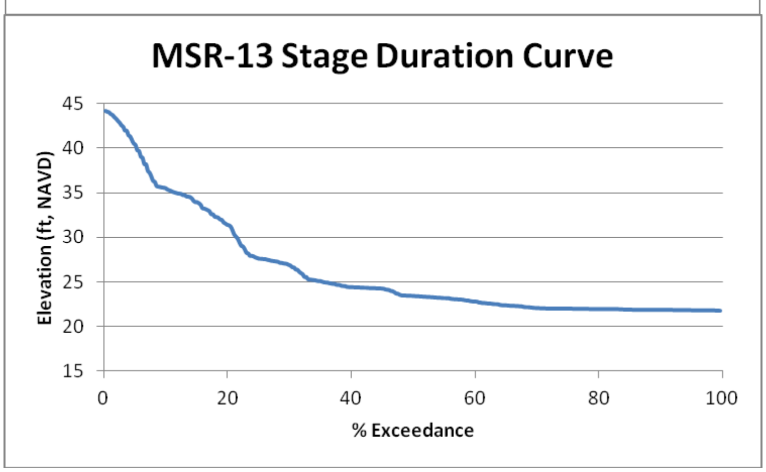

MSR-12 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
60
55
50
45
40
35
30
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-12 Stage Duration Curve
Elevation (ft, NAVD)
50
45
40
35
30
25
20
0
20
40
60
80
100
% Exceedance

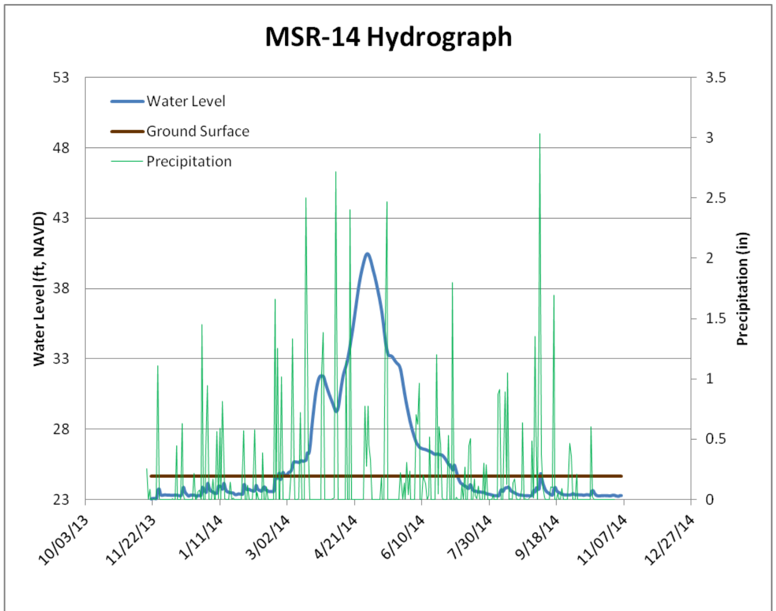
MSR-13:

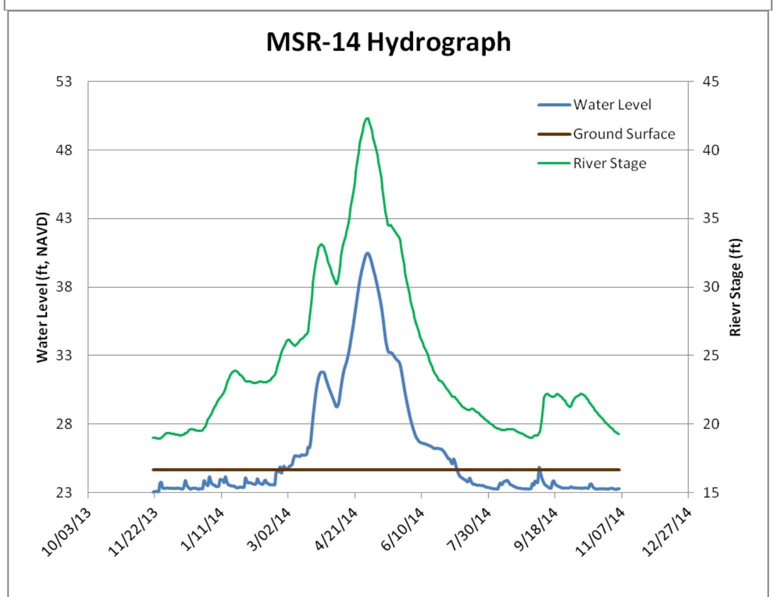

MSR-13 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
50
45
40
35
30
25
20
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

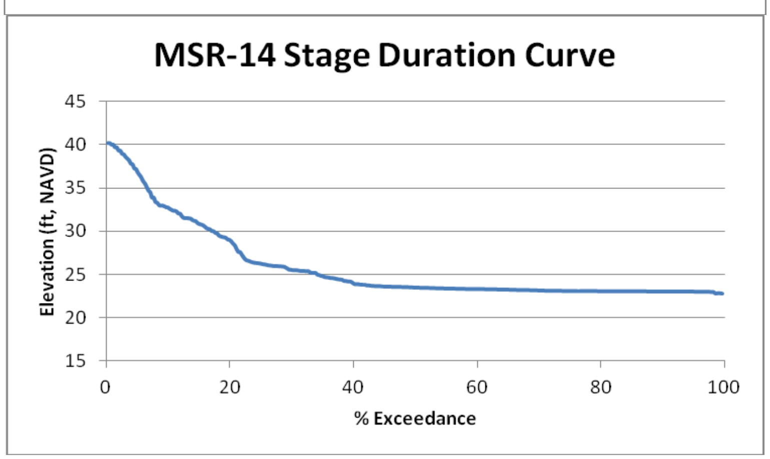

MSR-13 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
50
45
40
35
30
25
20
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-13 Stage Duration Curve
Elevation (ft, NAVD)
45
40
35
30
25
20
15
0
20
40
60
80
100
% Exceedance

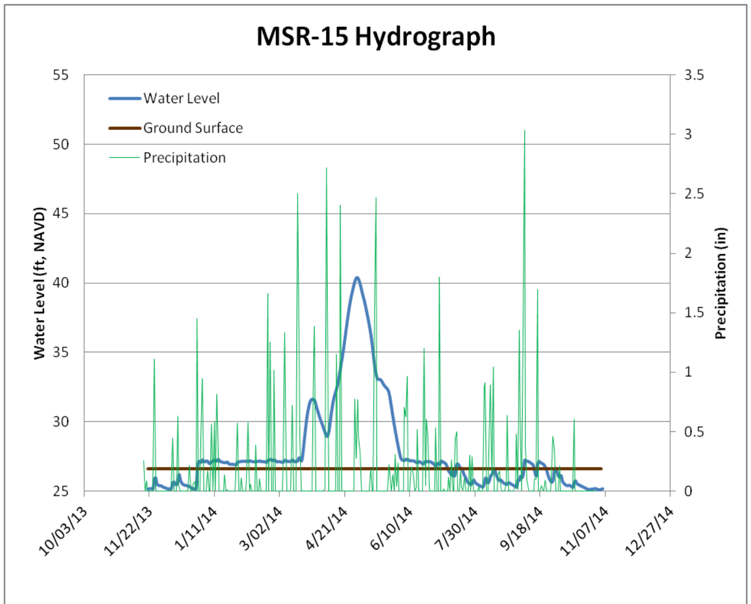
MSR-14:

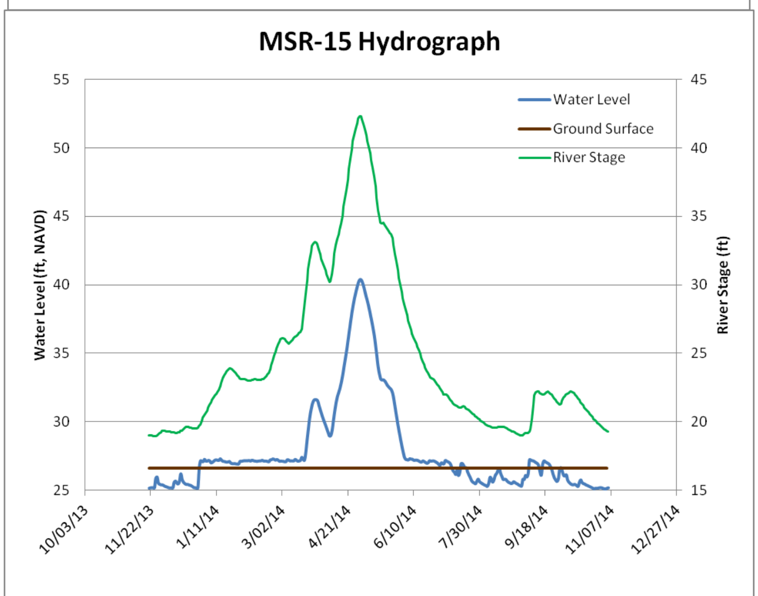

MSR-14 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
53
48
43
38
33
28
23
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

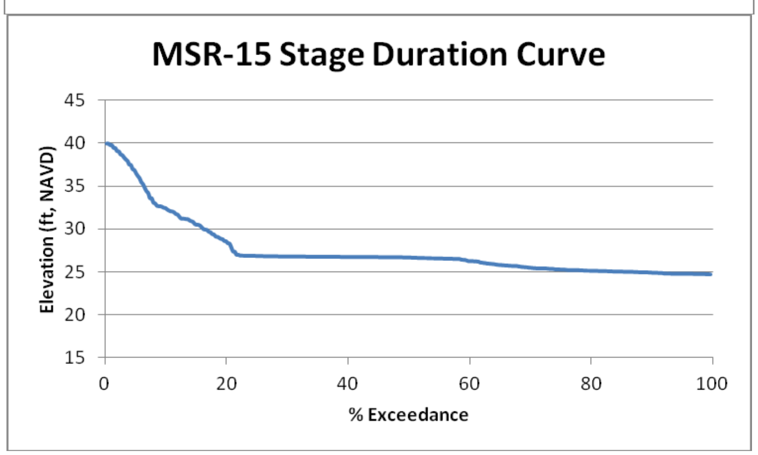

MSR-14 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
Rievr Stage (ft)
53
48
43
38
33
28
23
45
40
35
30
25
20
15
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-14 Stage Duration Curve
Elevation (ft, NAVD)
45
40
35
30
25
20
15
0
20
40
60
80
100
% Exceedance

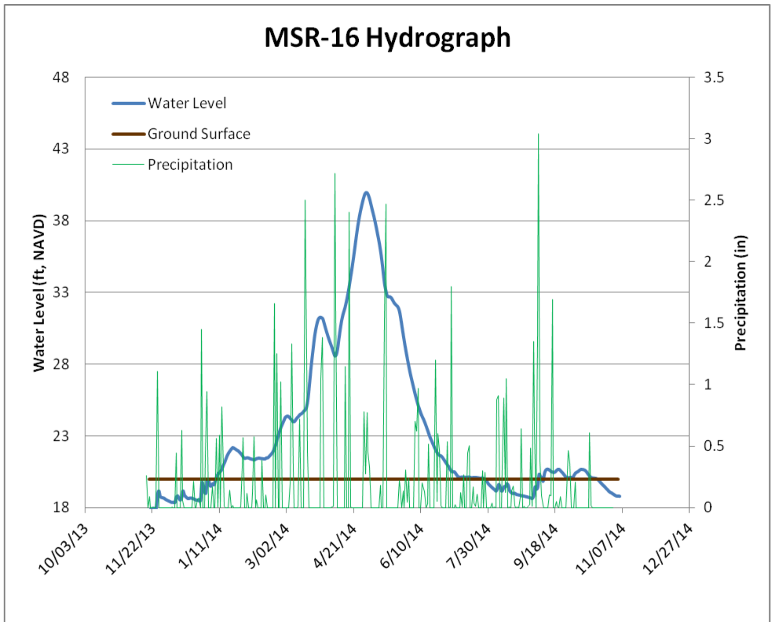
MSR-15:

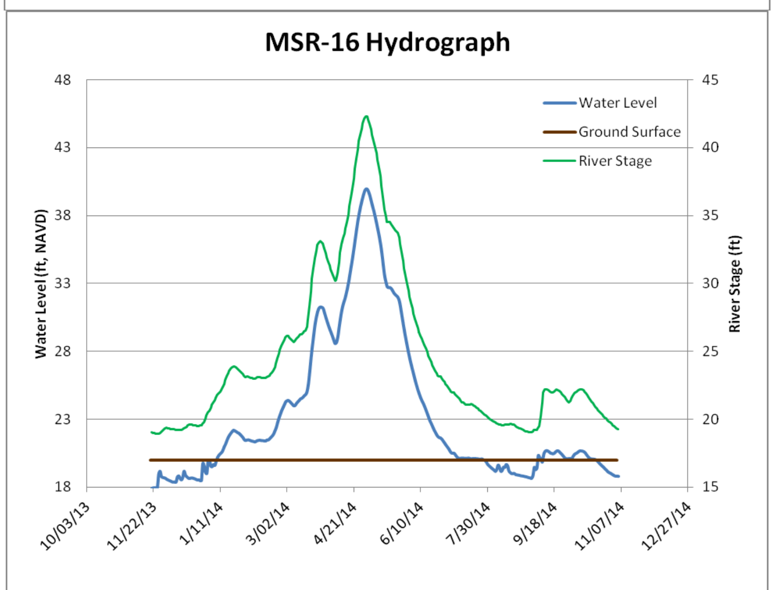

MSR-15 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
55
50
45
40
35
30
25
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

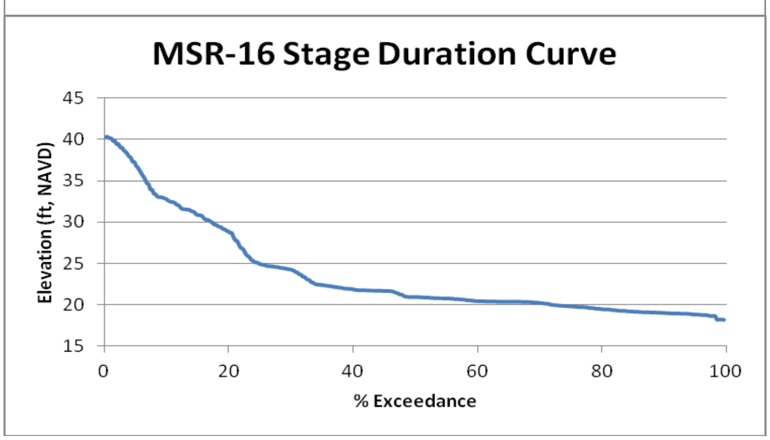

MSR-15 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
55
50
45
40
35
30
25
45
40
35
30
25
20
15
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-15 Stage Duration Curve
Elevation (ft, NAVD)
45
40
35
30
25
20
15
0
20
40
60
80
100
% Exceedance

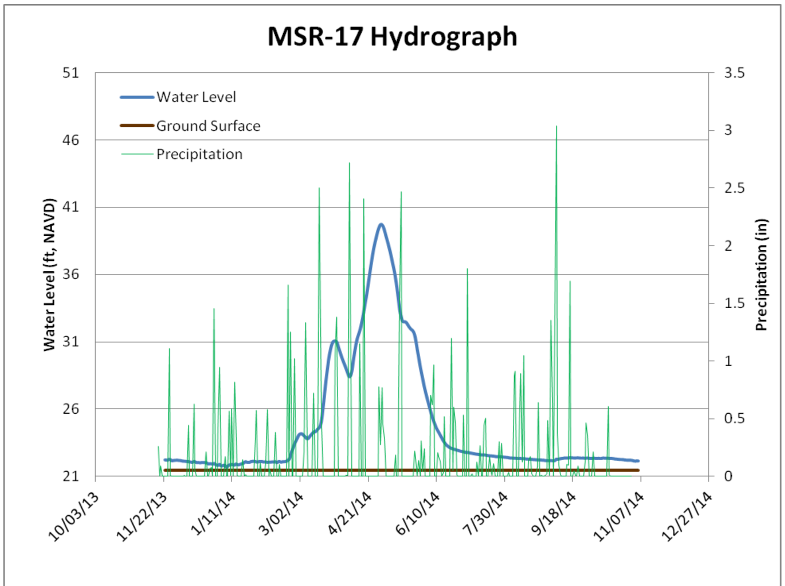
MSR-16:

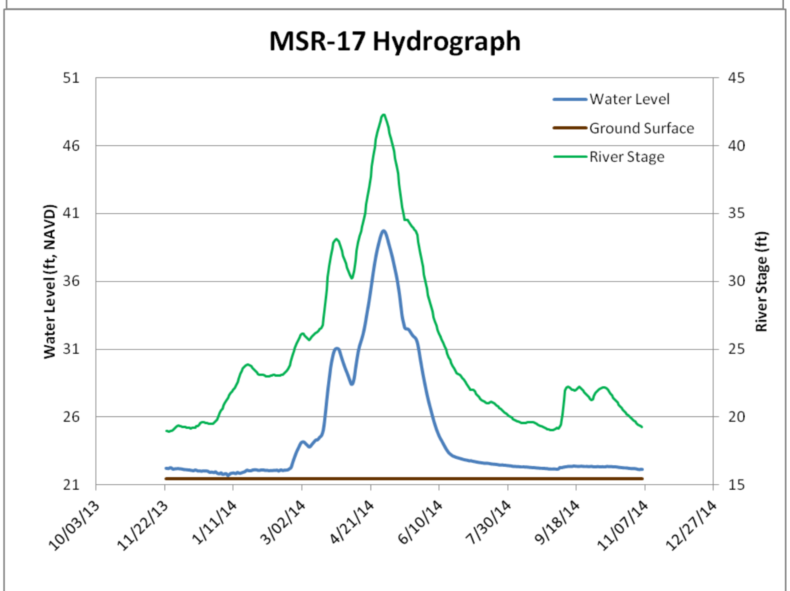

MSR-16 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
48
43
38
33
28
23
18
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

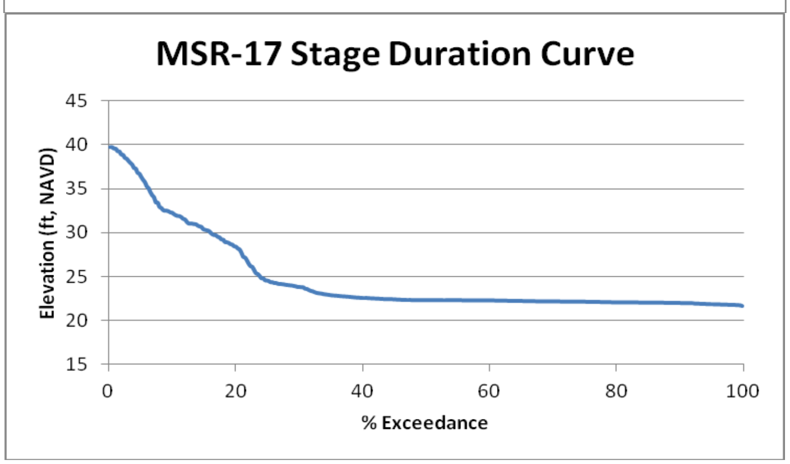

MSR-16 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
48
43
38
33
28
23
18
45
40
35
30
25
20
15
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-16 Stage Duration Curve
Elevation (ft, NAVD)
45
40
35
30
25
20
15
0
20
40
60
80
100
% Exceedance

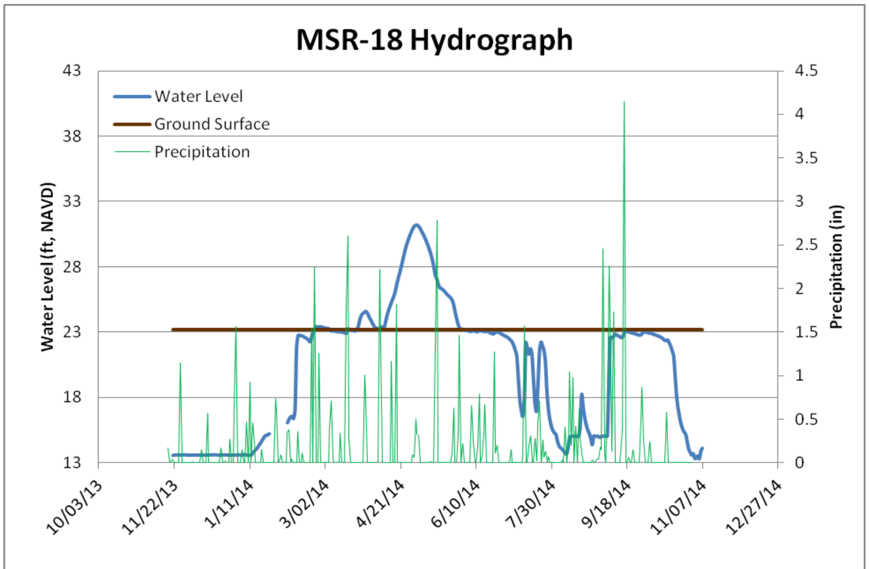
MSR-17:

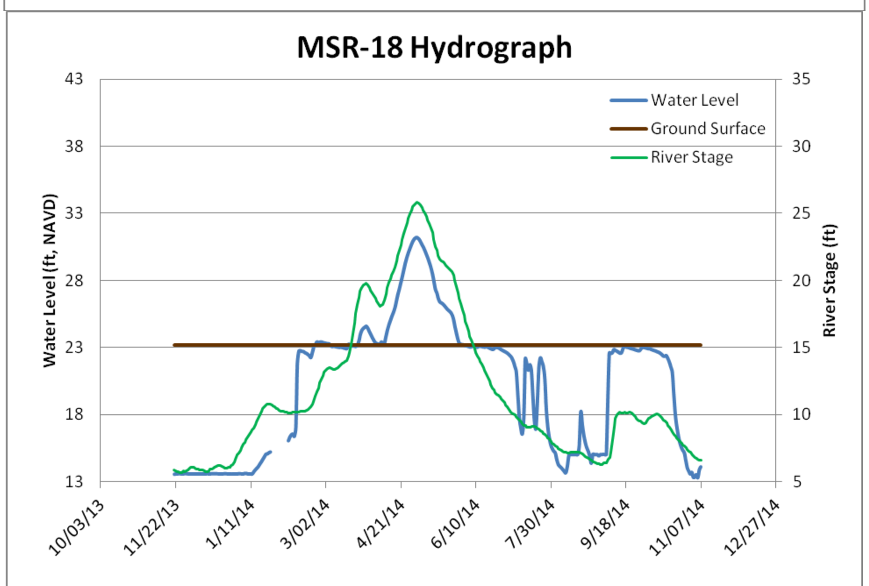

MSR-17 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
51
46
41
36
31
26
21
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

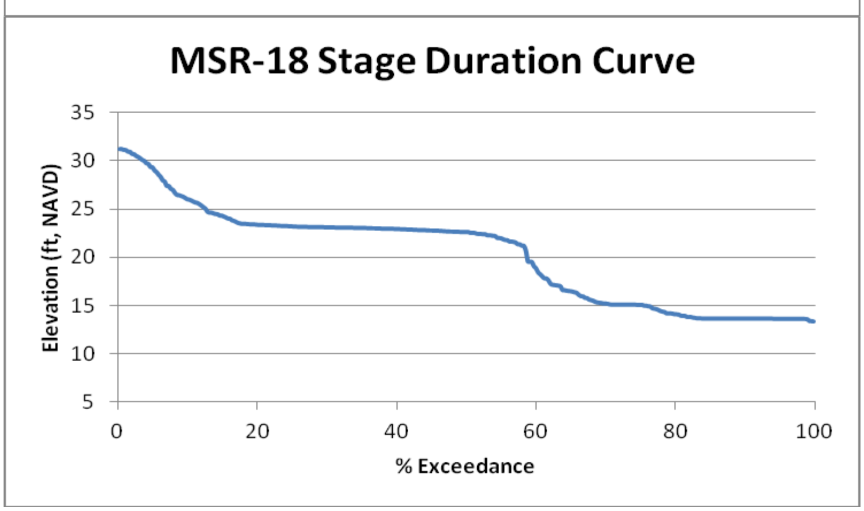

MSR-17 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
51
46
41
36
31
26
21
45
40
35
30
25
20
15
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-17 Stage Duration Curve
Elevation (ft, NAVD)
45
40
35
30
25
20
15
0
20
40
60
80
100
% Exceedance

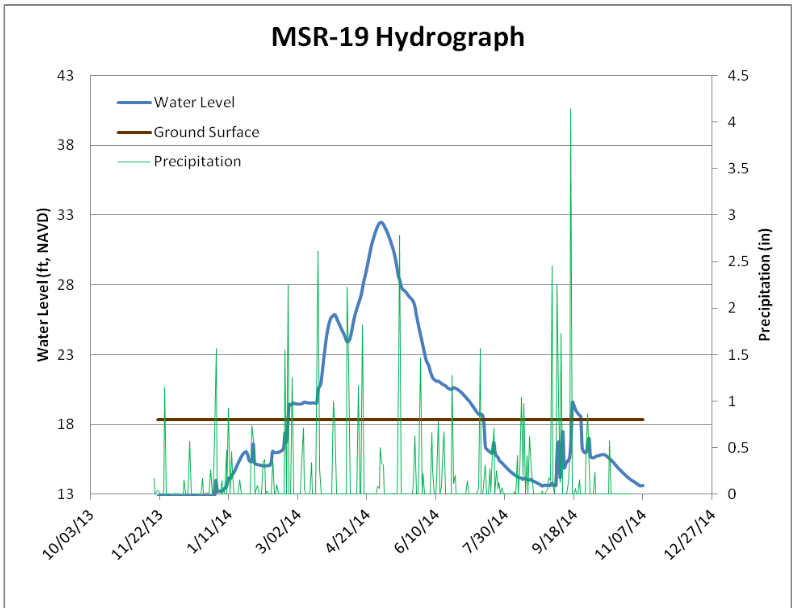
MSR-18:

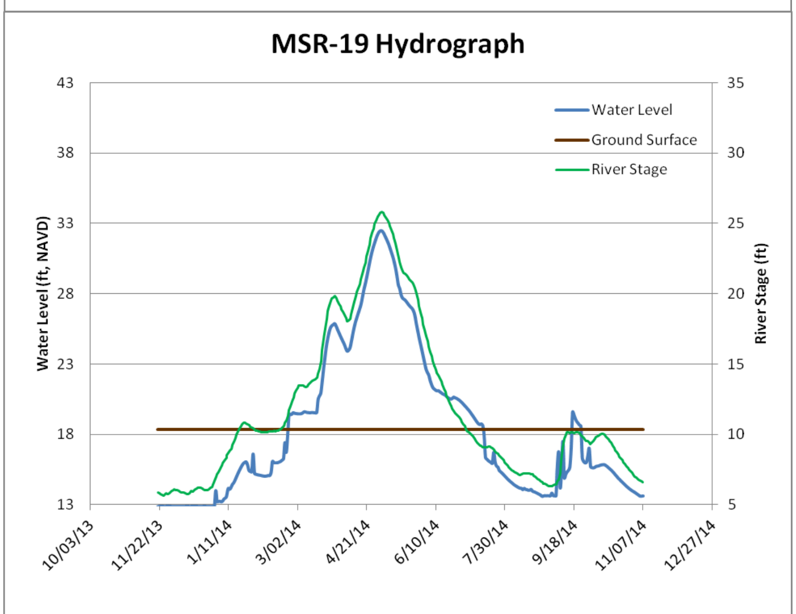

MSR-18 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
43
38
33
28
23
18
13
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

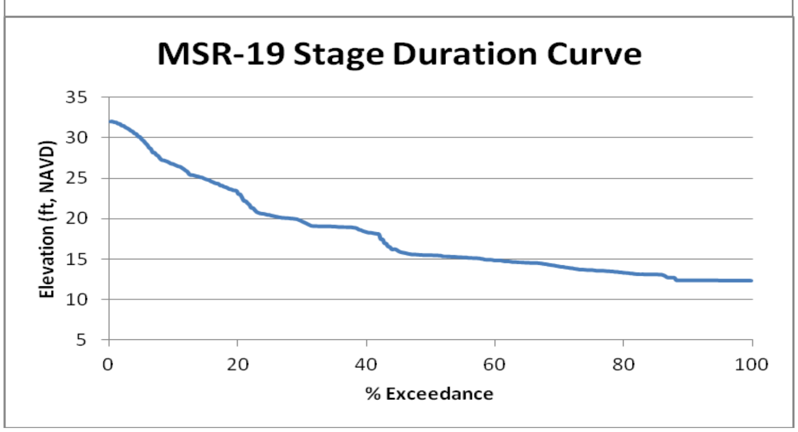

MSR-18 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
43
38
33
28
23
18
13
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-18 Stage Duration Curve
Elevation (ft, NAVD)
35
30
25
20
15
10
5
0
20
40
60
80
100
% Exceedance

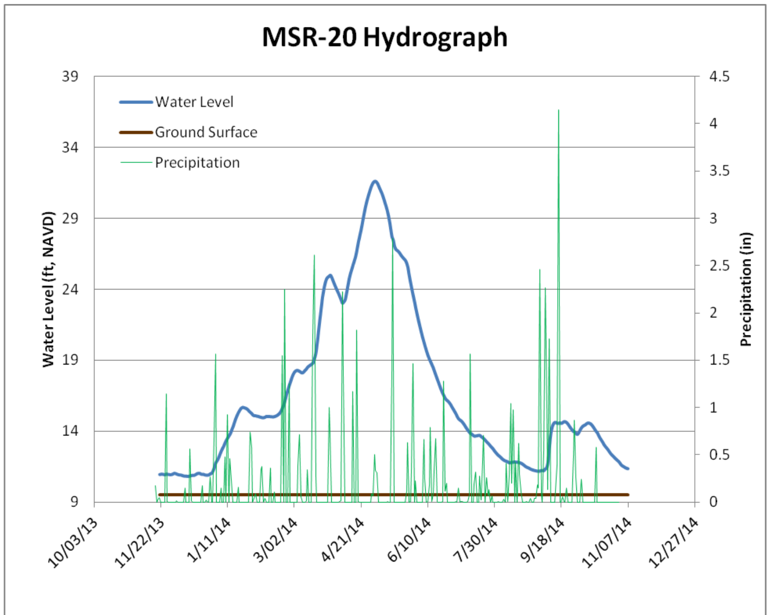
MSR-19:

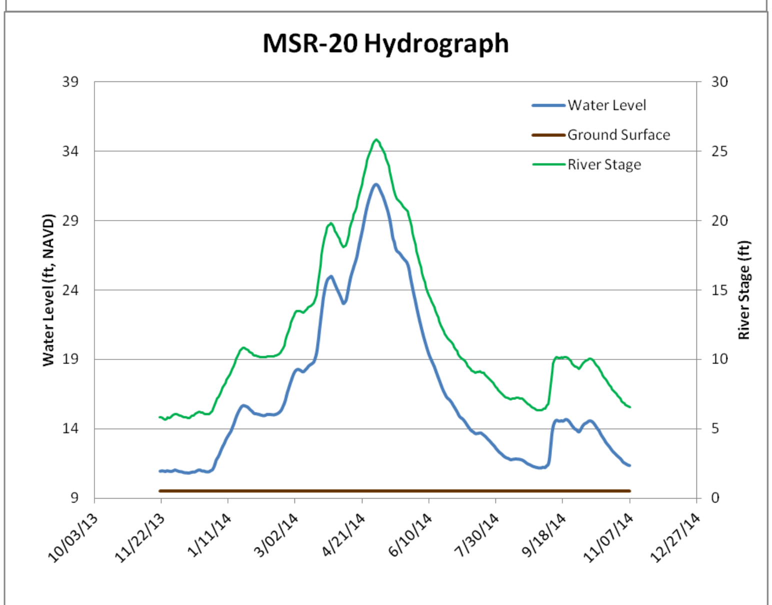

MSR-19 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
43
38
33
28
23
18
13
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

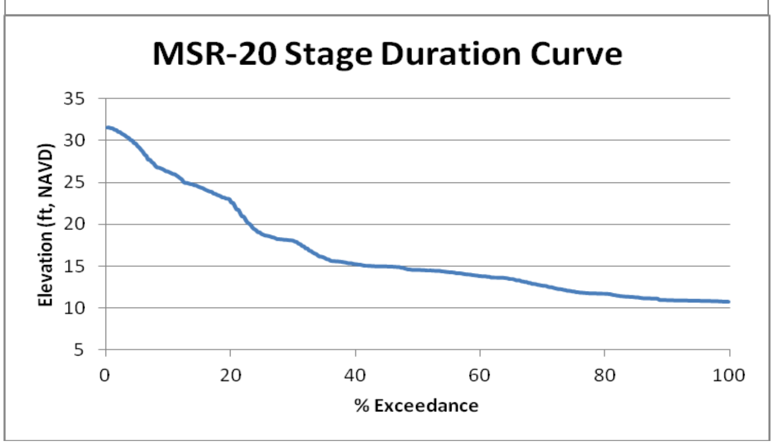

MSR-19 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
43
38
33
28
23
18
13
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-19 Stage Duration Curve
Elevation (ft, NAVD)
35
30
25
20
15
10
5
0
20
40
60
80
100
% Exceedance

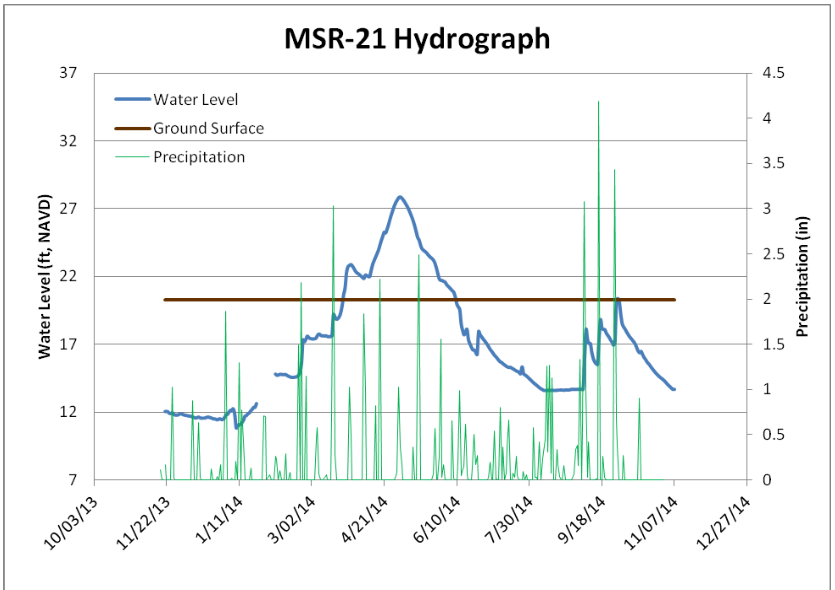
MSR-20:

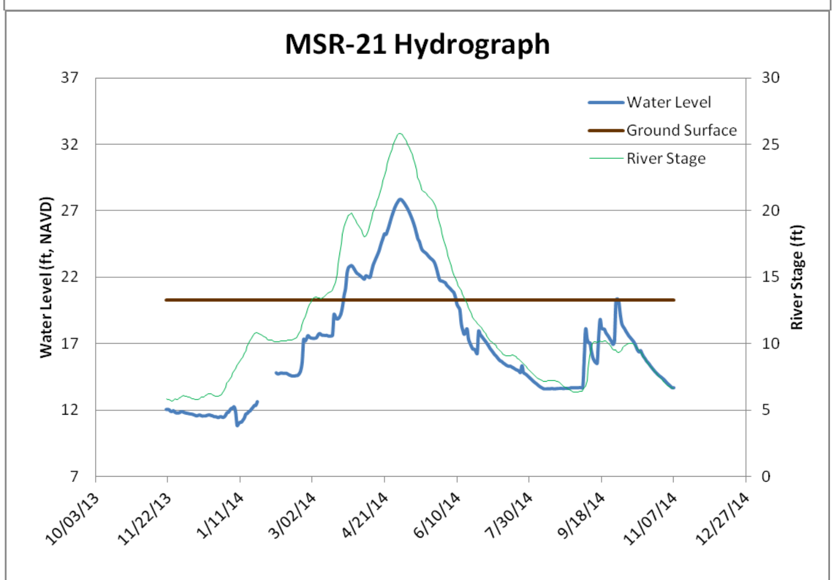

MSR-20 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
39
34
29
24
19
14
9
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

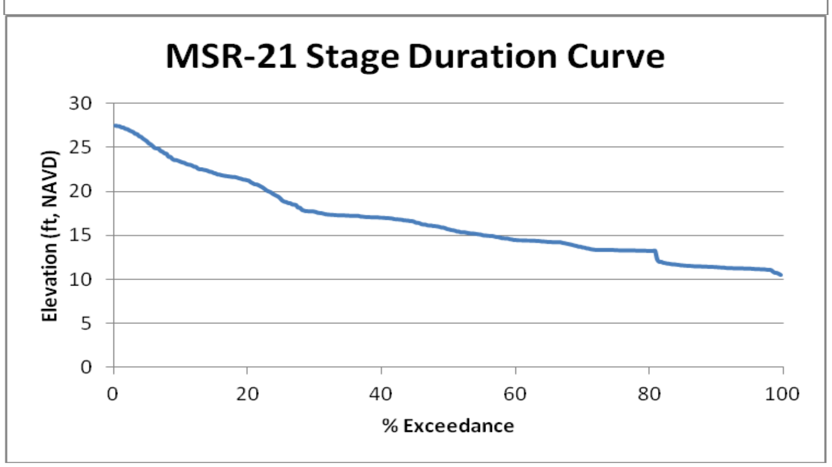

MSR-20 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
39
34
29
24
19
14
9
30
25
20
15
10
5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-20 Stage Duration Curve
Elevation (ft, NAVD)
35
30
25
20
15
10
5
0
20
40
60
80
100
% Exceedance

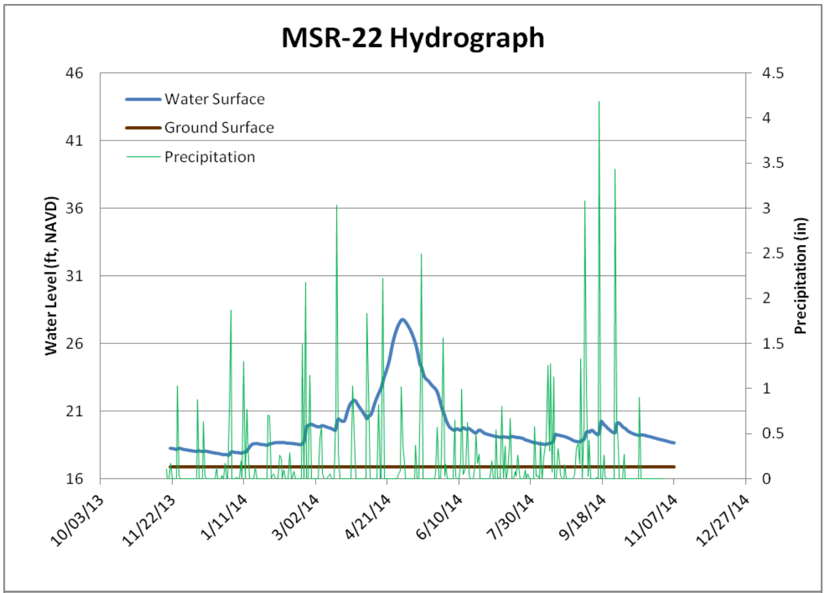
MSR-21:

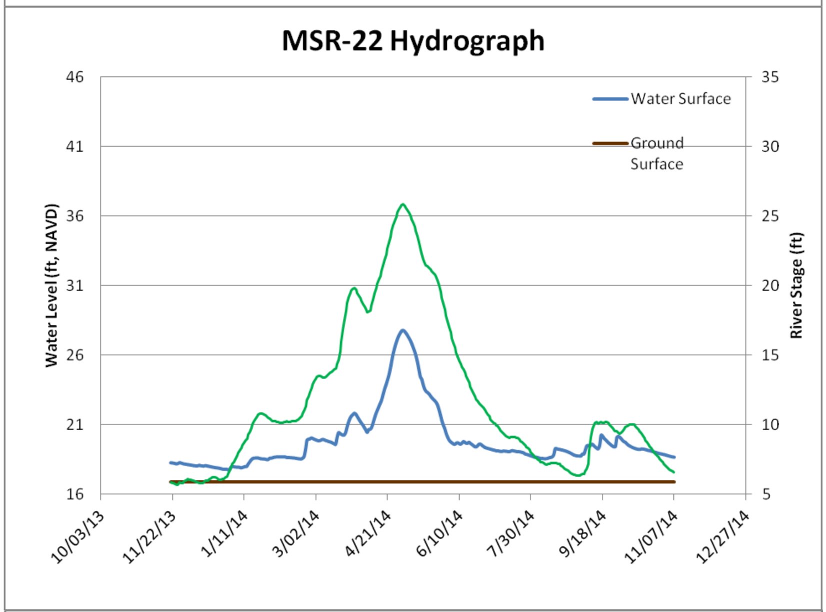

MSR-21 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
37
32
27
22
17
12
7
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

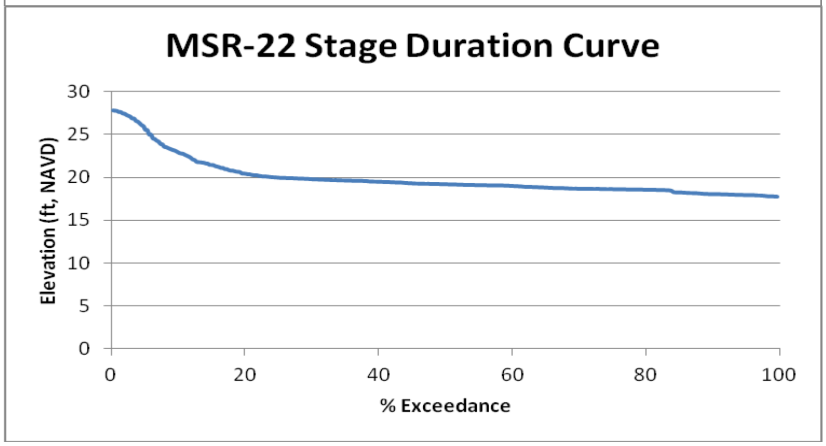

MSR-21 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
37
32
27
22
17
12
7
30
25
20
15
10
5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-21 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

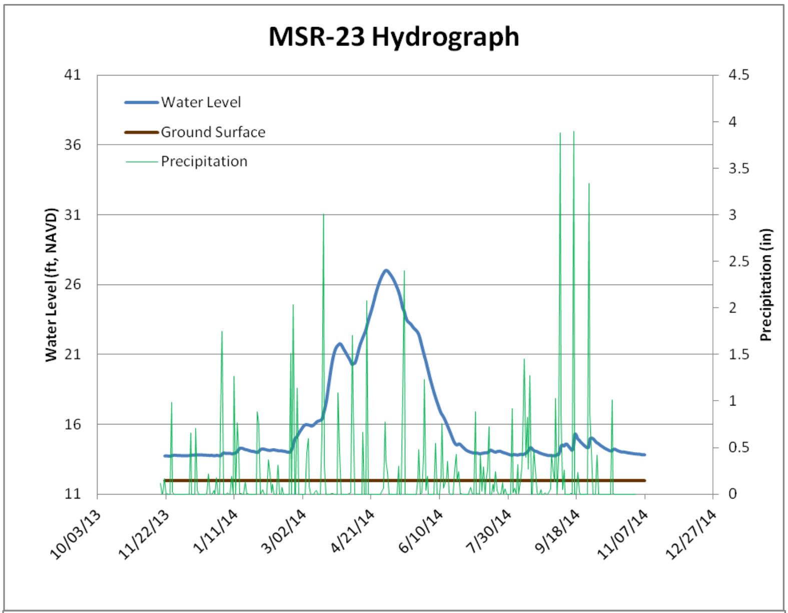
MSR-22:

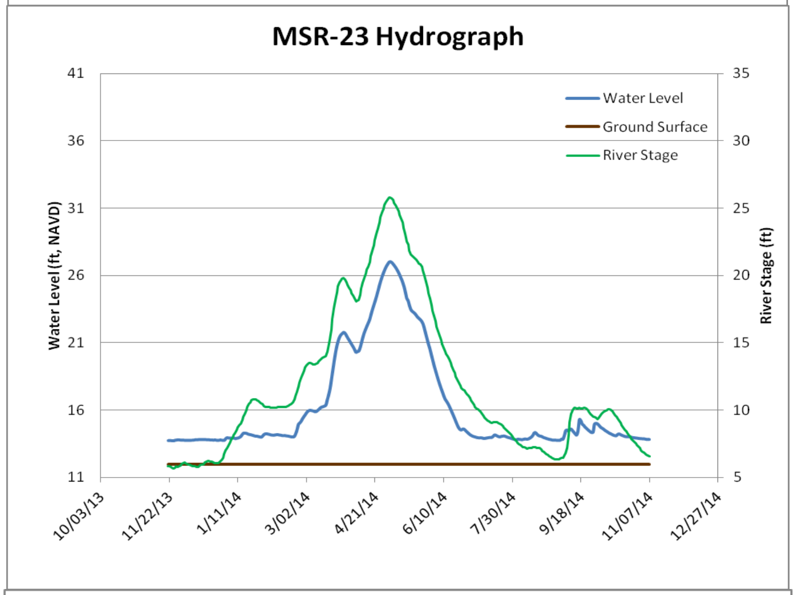

MSR-22 Hydrograph
Water Surface
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
46
41
36
31
26
21
16
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

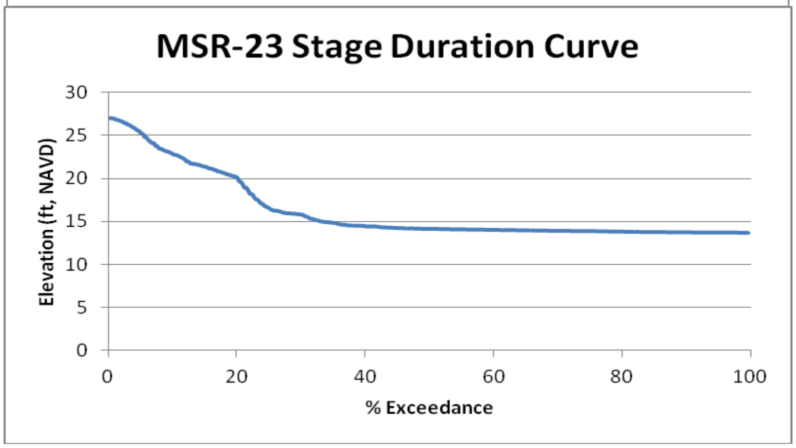

MSR-22 Hydrograph
Water Surface
Ground Surface
Water Level (ft, NAVD)
River Stage (ft)
46
41
36
31
26
21
16
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-22 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

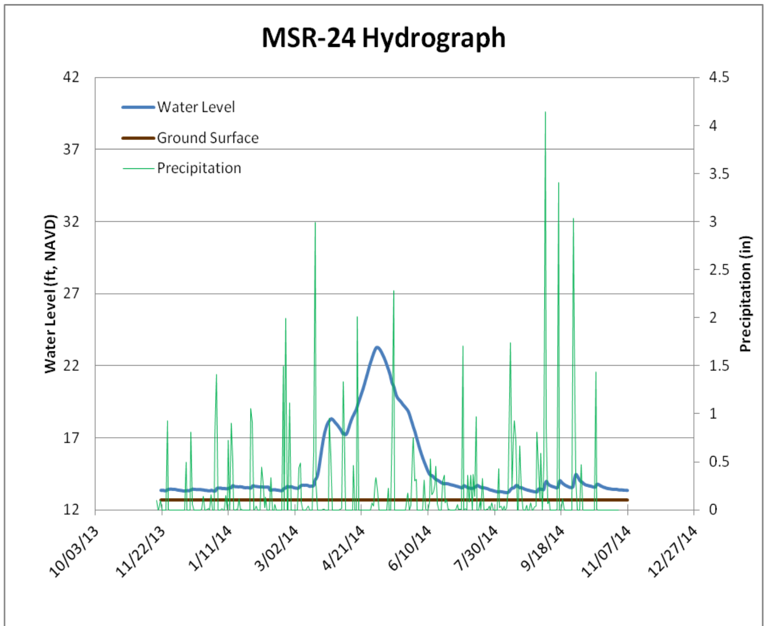
MSR-23:

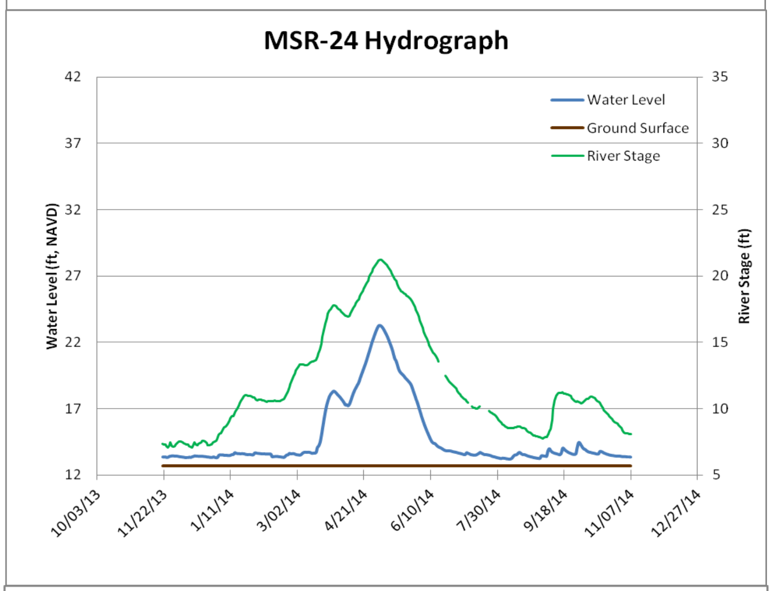

MSR-23 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
41
36
31
26
21
16
11
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

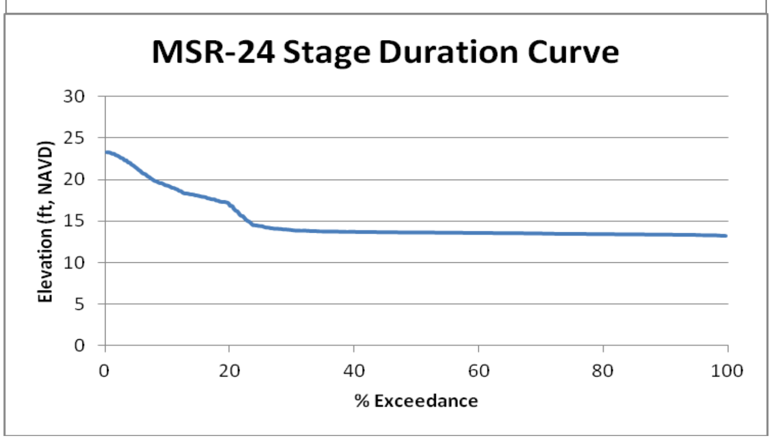

MSR-23 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
41
36
31
26
21
16
11
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-23 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

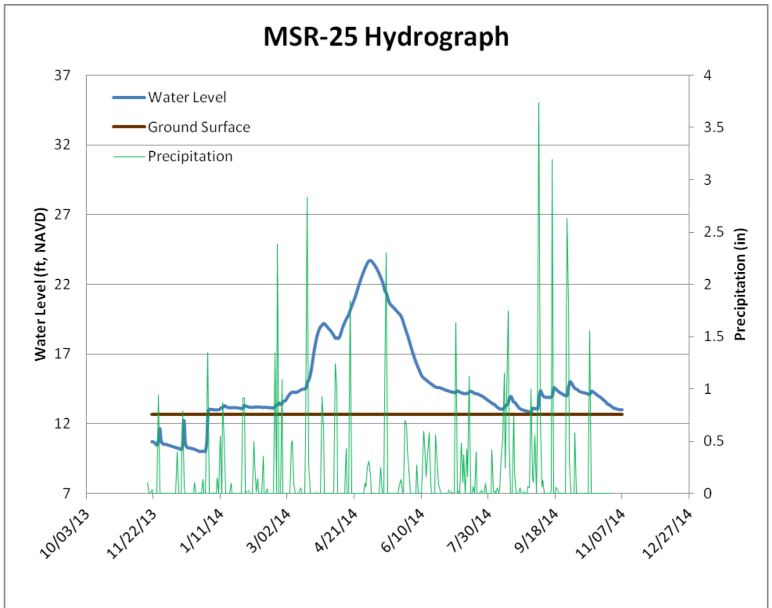
MSR-24:

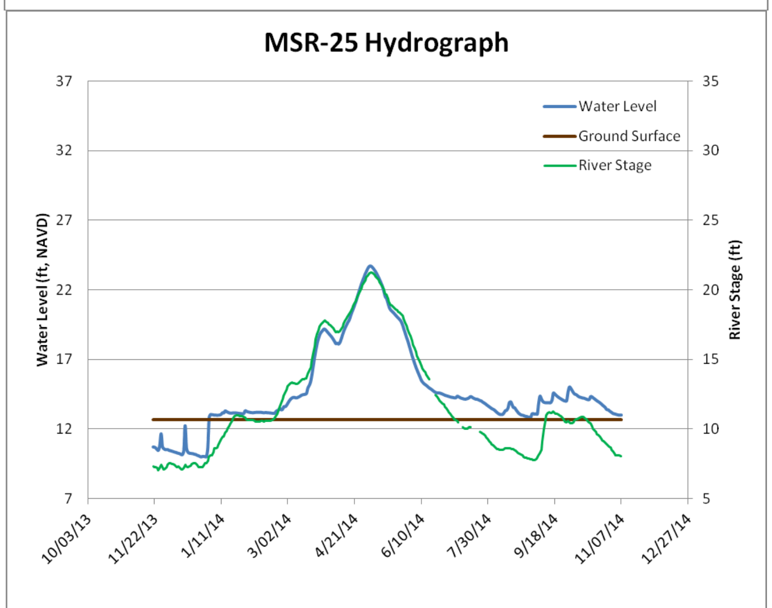

MSR-24 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
42
37
32
27
22
17
12
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

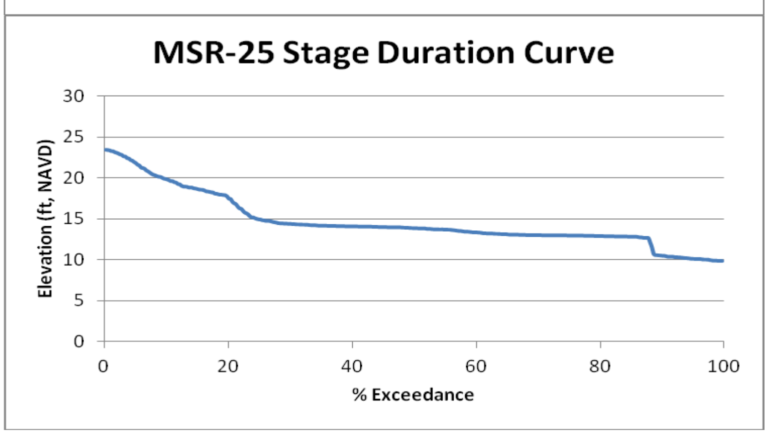

MSR-24 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
42
37
32
27
22
17
12
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-24 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

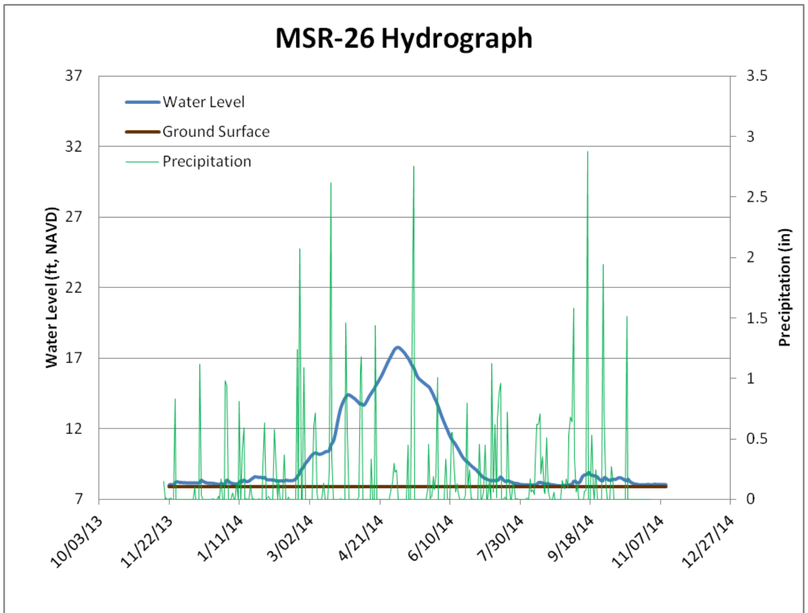
MSR-25:

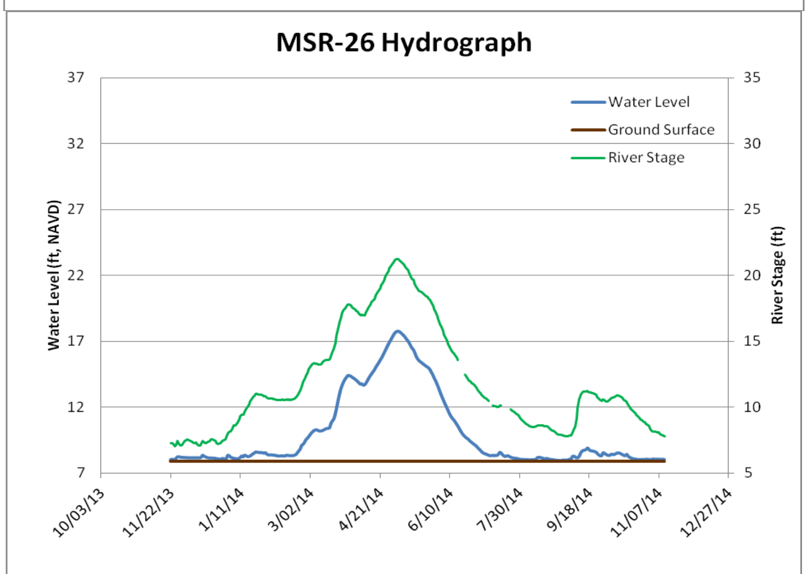

MSR-25 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
37
32
27
22
17
12
7
4
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

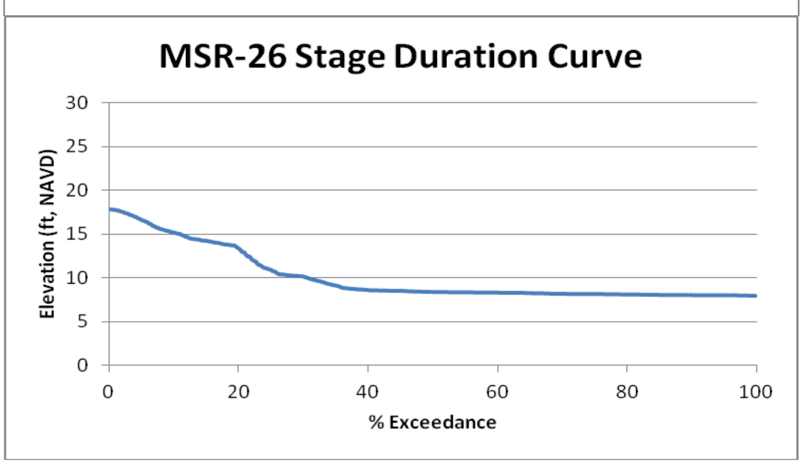

MSR-25 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
37
32
27
22
17
12
7
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-25 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

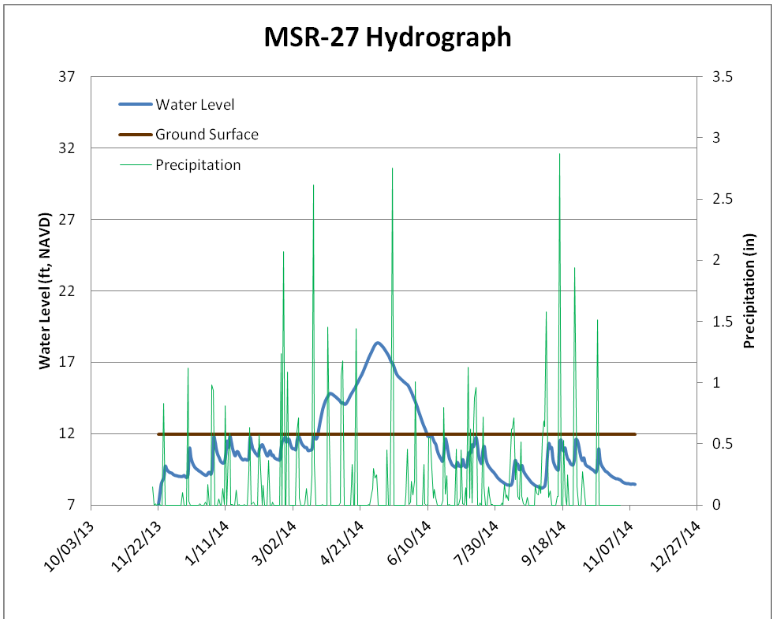
MSR-26:

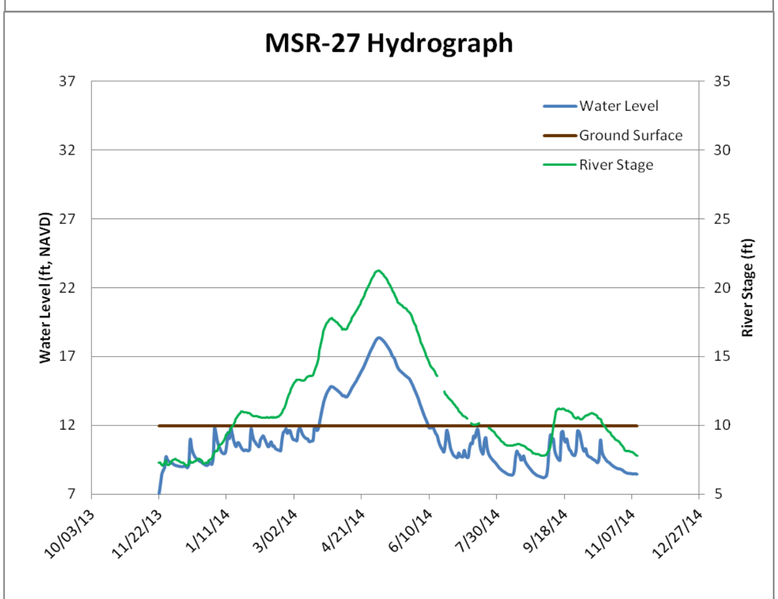

MSR-26 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
37
32
27
22
17
12
7
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

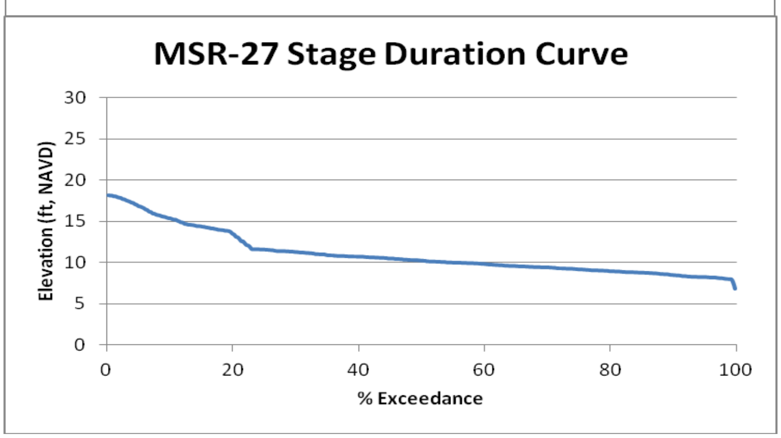

MSR-26 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
37
32
27
22
17
12
7
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-26 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

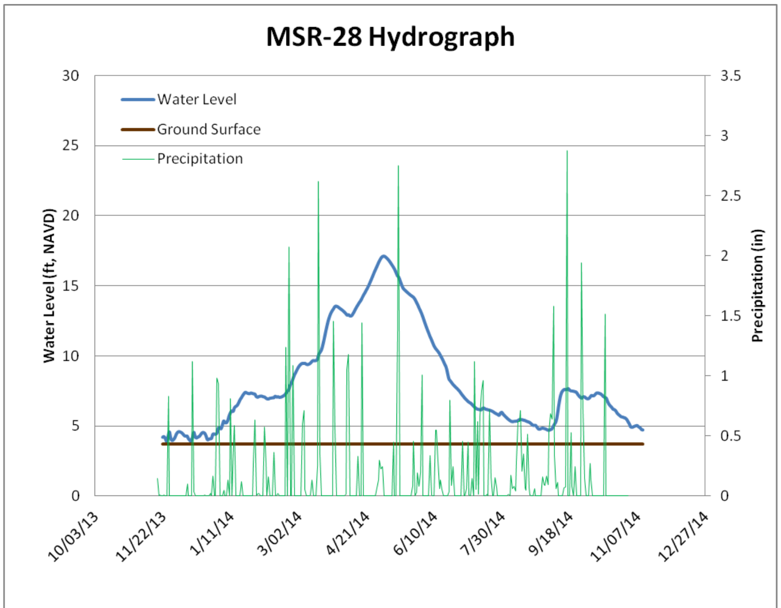
MSR-27:

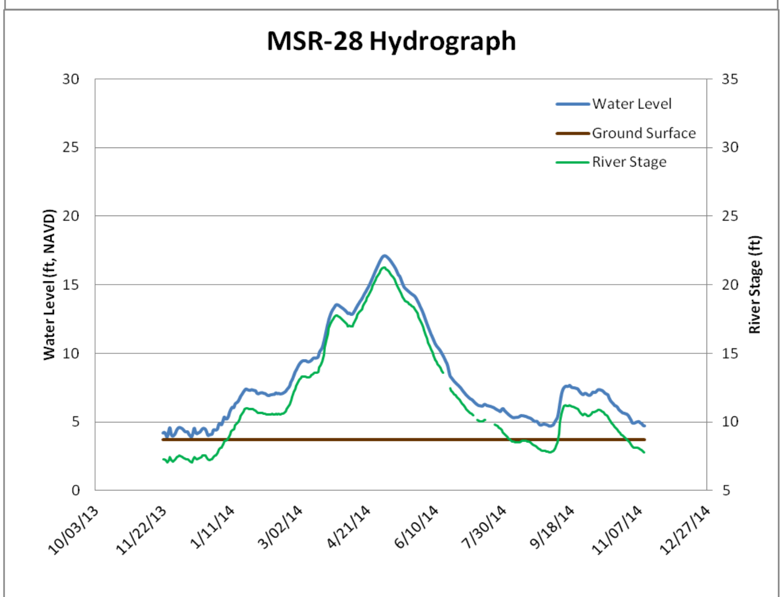

MSR-27 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
37
32
27
22
17
12
7
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

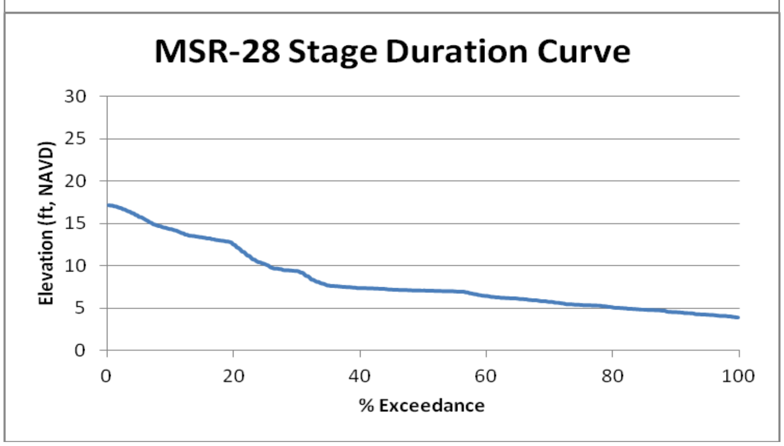

MSR-27 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
37
32
27
22
17
12
7
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-27 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

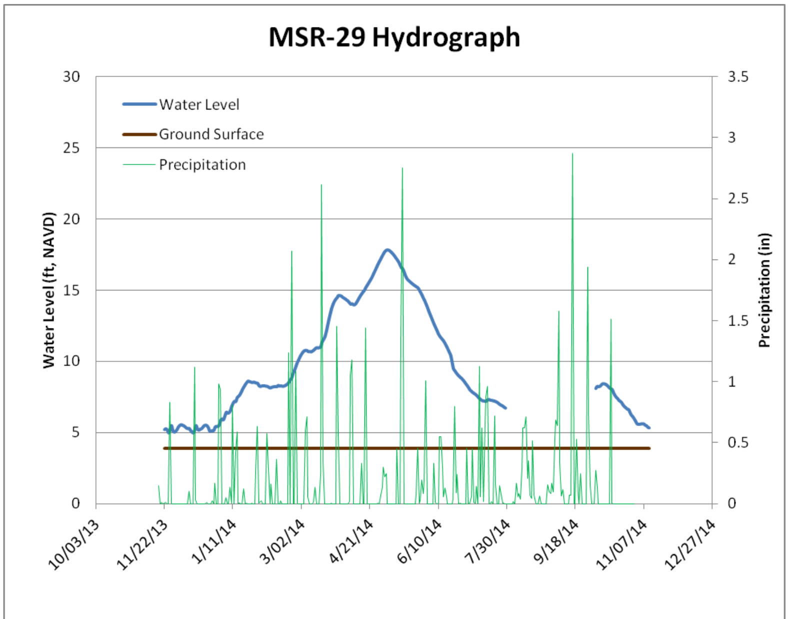
MSR-28:

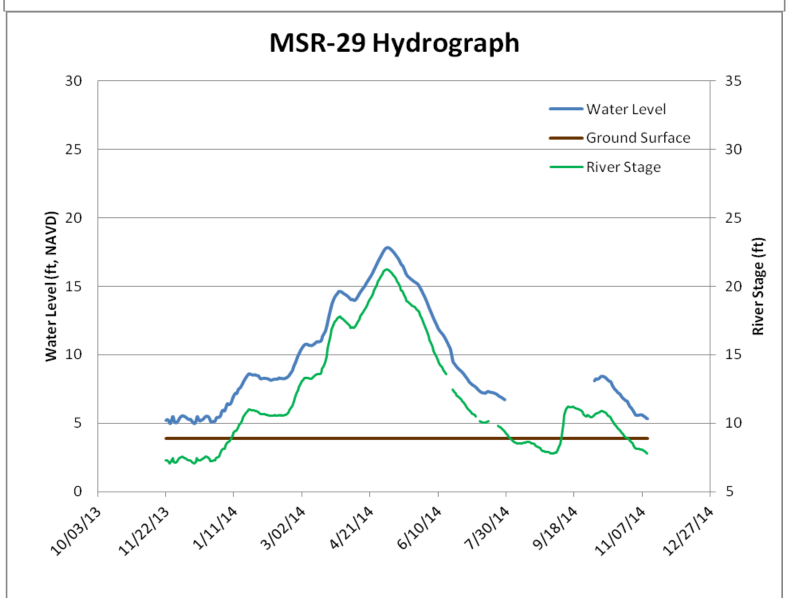

MSR-28 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
30
25
20
15
10
5
0
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

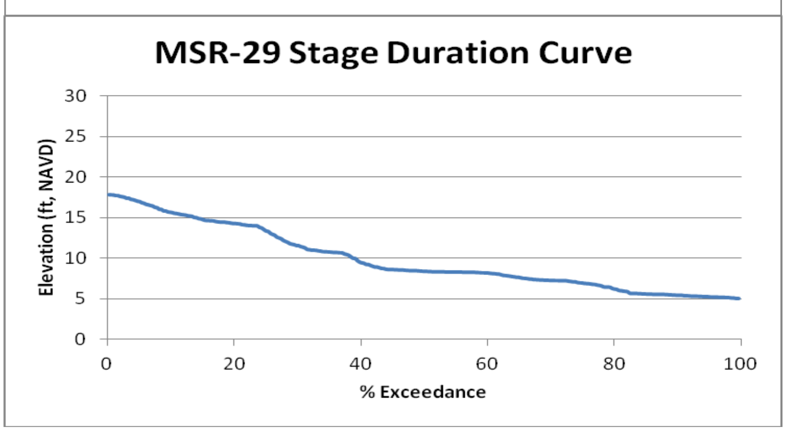

MSR-28 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
30
25
20
15
10
5
0
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-28 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

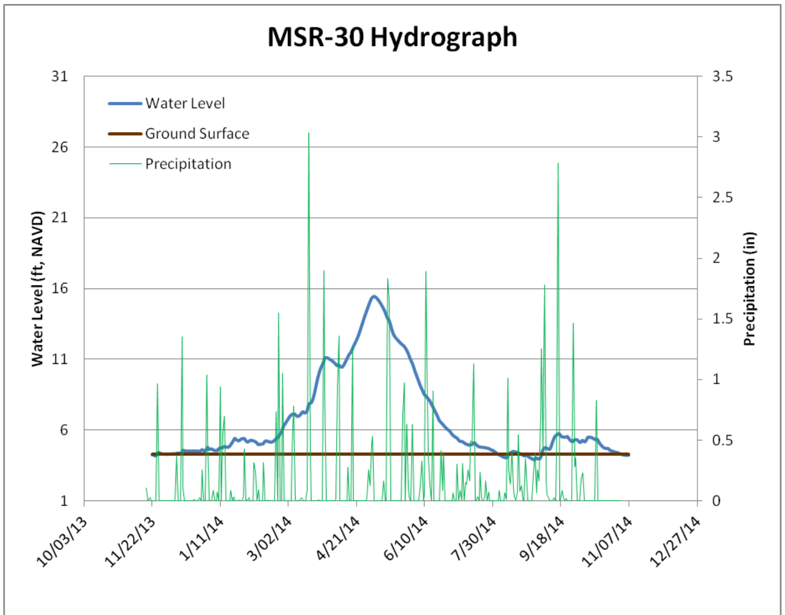
MSR-29:

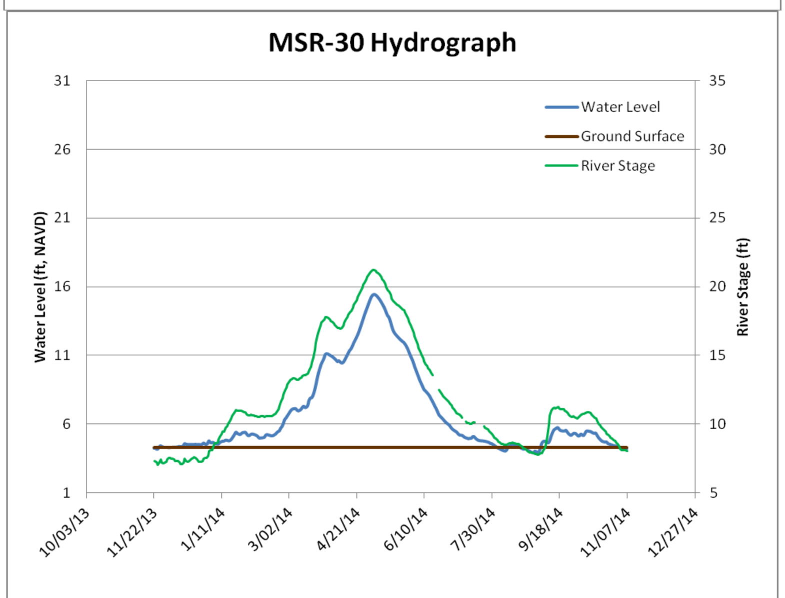

MSR-29 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
30
25
20
15
10
5
0
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

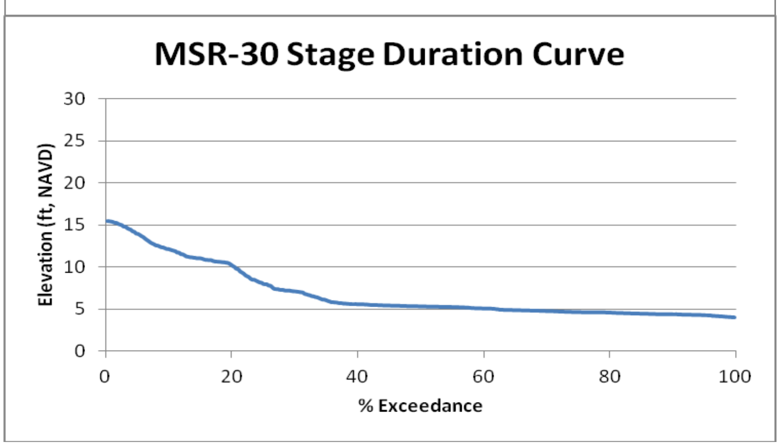

MSR-29 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
30
25
20
15
10
5
0
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-29 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

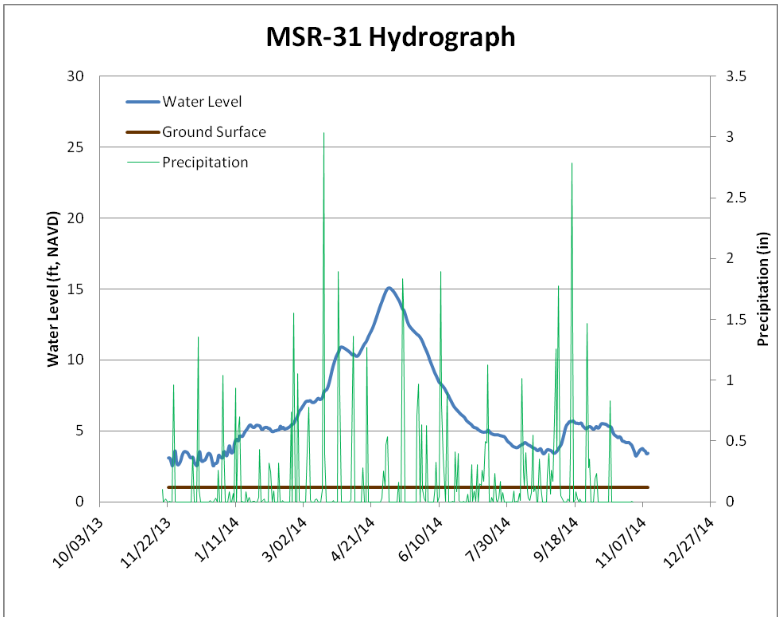
MSR-30:

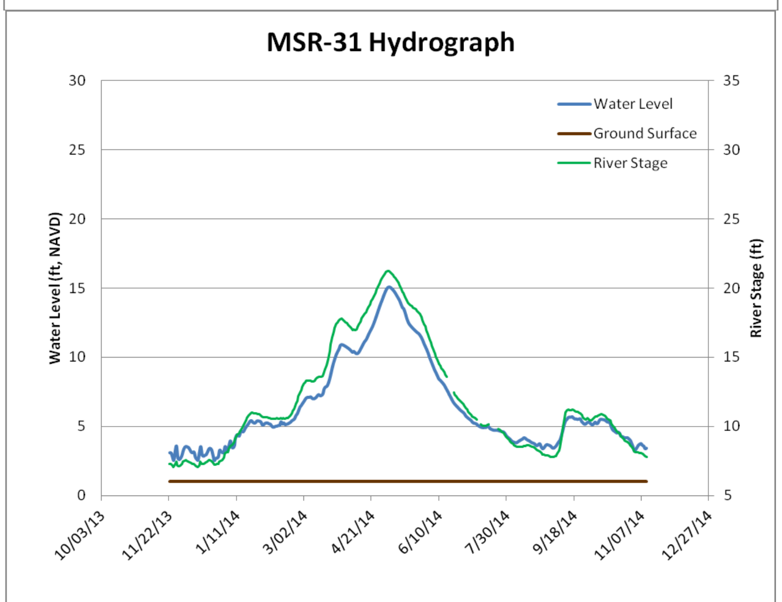

MSR-30 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
31
26
21
16
11
6
1
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

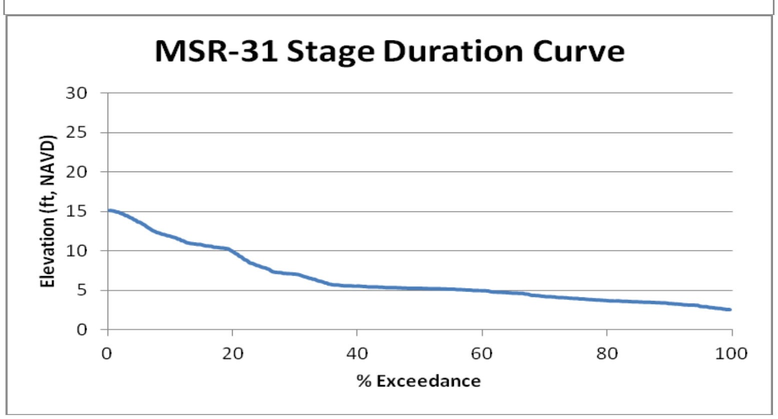

MSR-30 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
31
26
21
16
11
6
1
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14


MSR-30 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

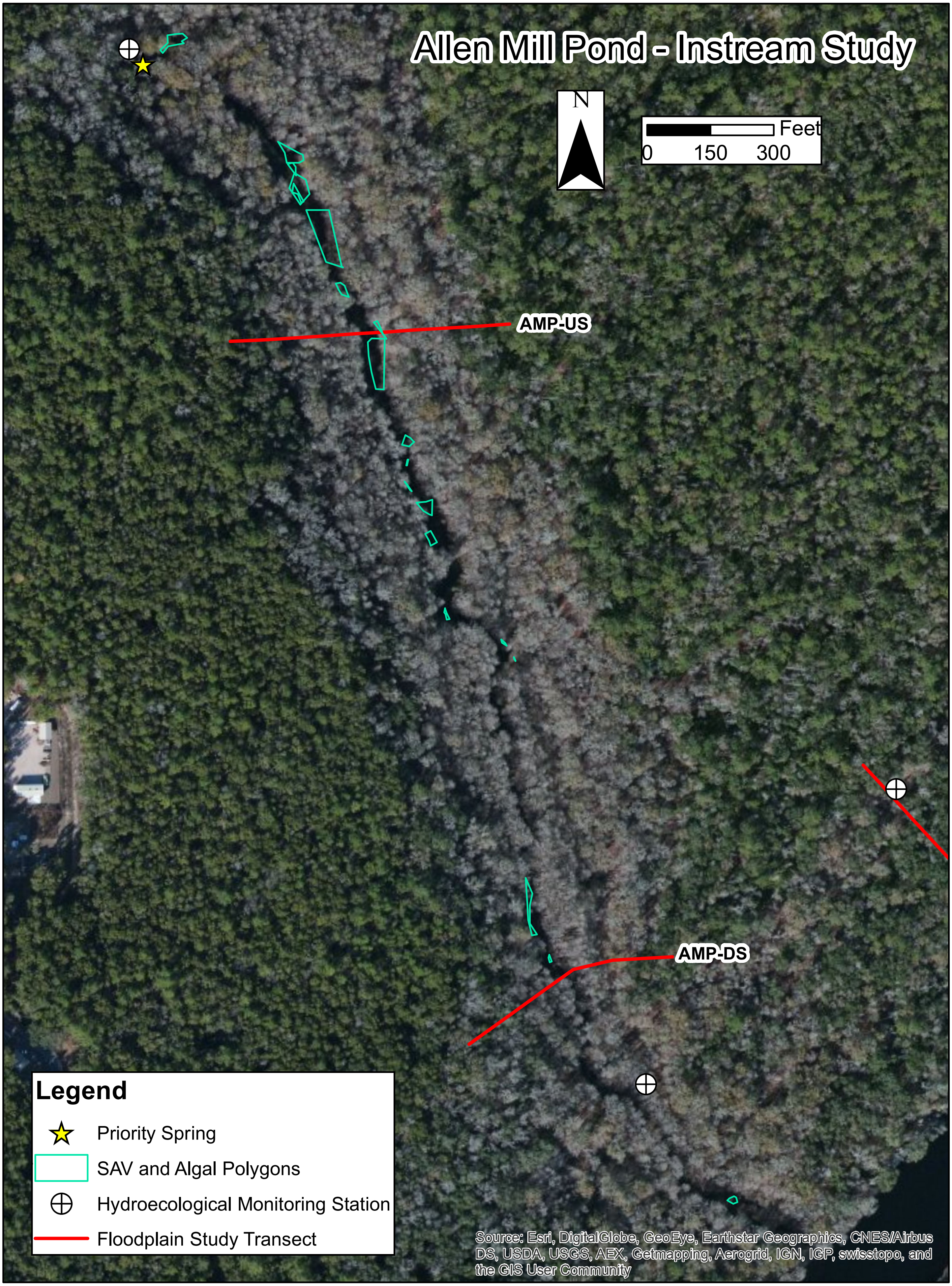
MSR-31:

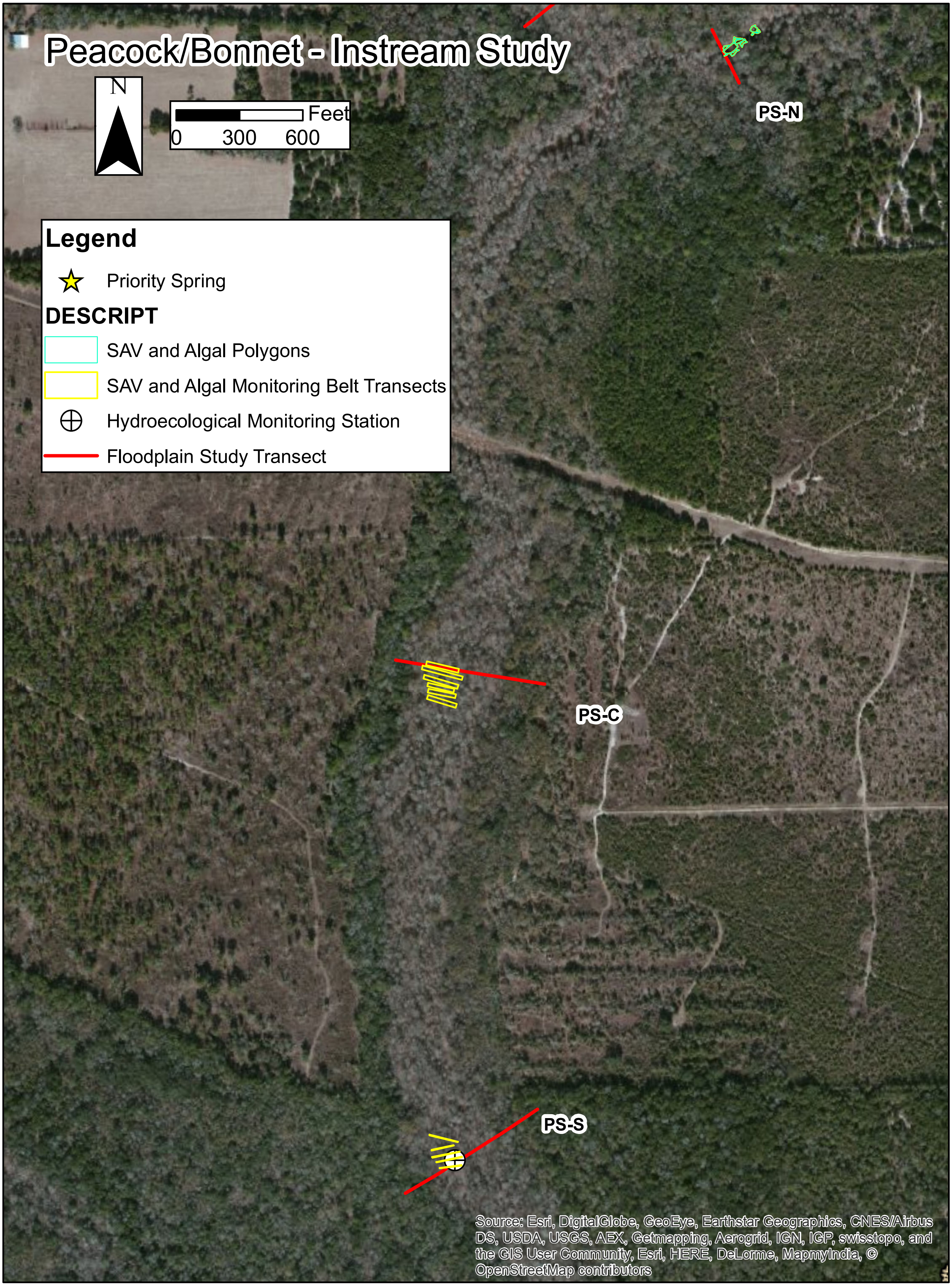

MSR-31 Hydrograph
Water Level
Ground Surface
Precipitation
Water Level (ft, NAVD)
Precipitation (in)
30
25
20
15
10
5
0
3.5
3
2.5
2
1.5
1
0.5
0
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

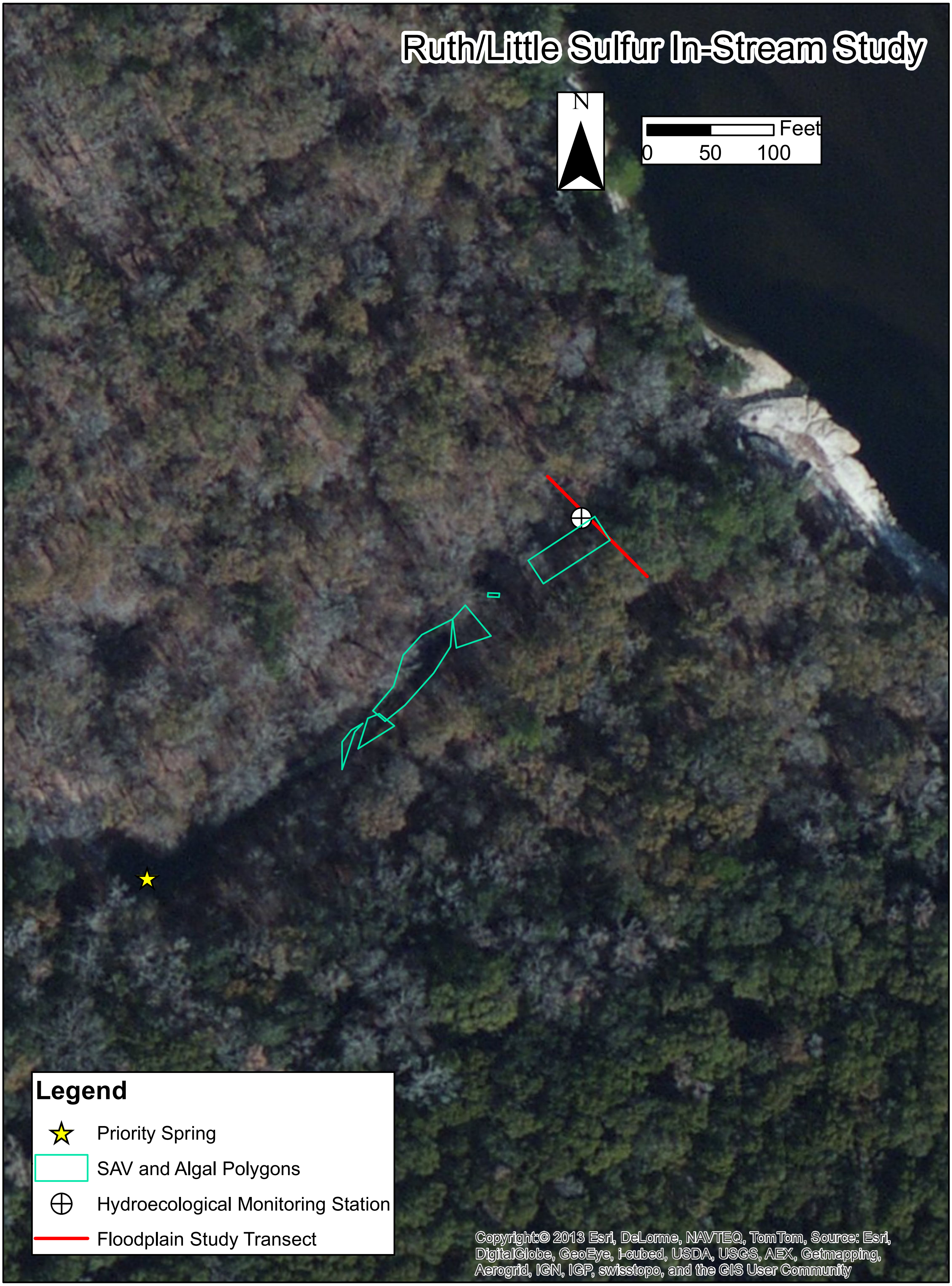

MSR-31 Hydrograph
Water Level
Ground Surface
River Stage
Water Level (ft, NAVD)
River Stage (ft)
30
25
20
15
10
5
0
35
30
25
20
15
10
5
10/03/13
11/22/13
1/11/14
3/02/14
4/21/14
6/10/14
7/30/14
9/18/14
11/07/14
12/27/14

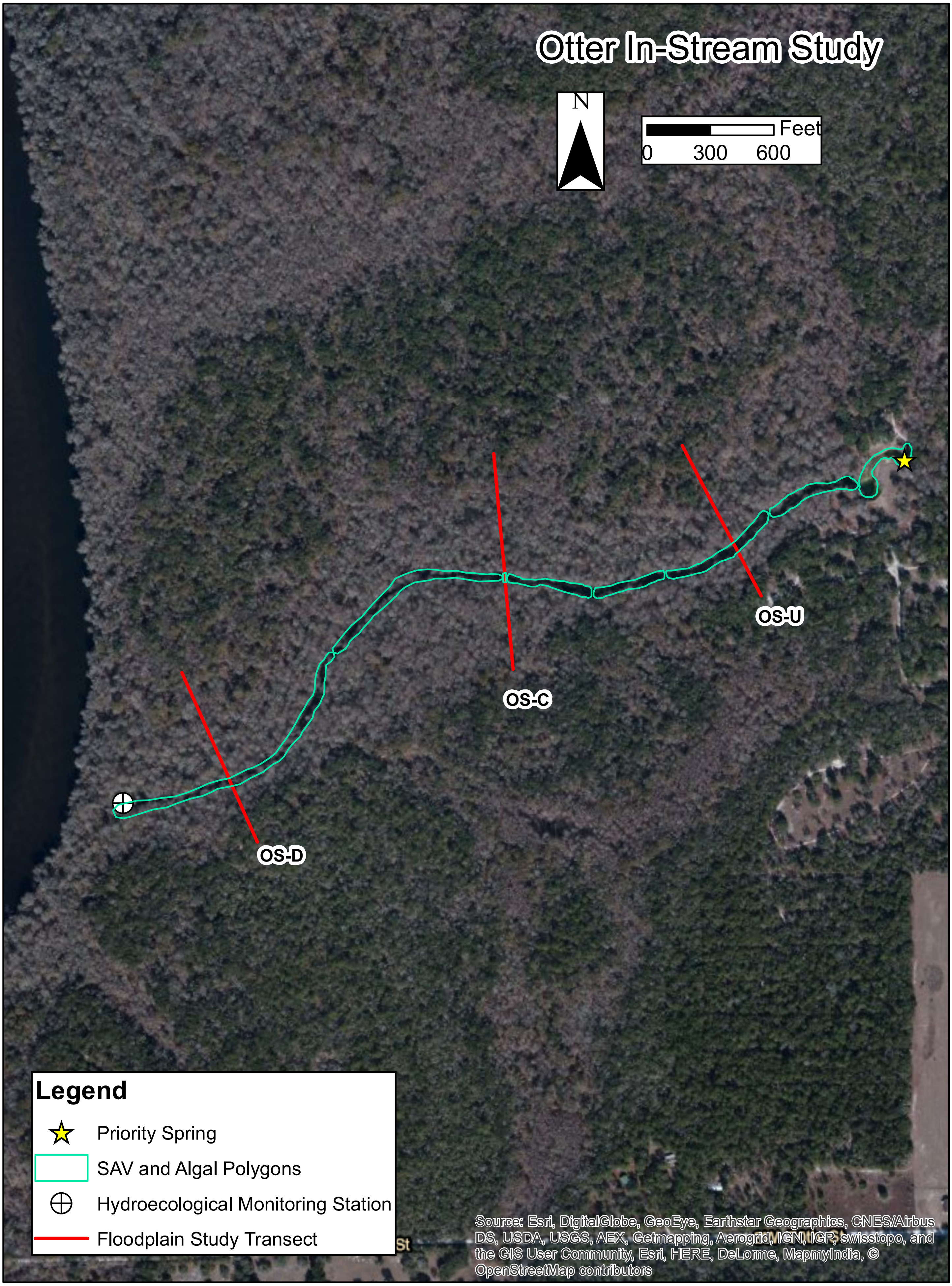

MSR-31 Stage Duration Curve
Elevation (ft, NAVD)
30
25
20
15
10
5
0
0
20
40
60
80
100
% Exceedance

Appendix F


Allen Mill Pond - Instream Study
N
Feet
0 150 300
AMP-US
AMP-DS
Legend
Priority Spring
SAV and Algal Polygons
Hydroecological Monitoring Station
Floodplain Study Transect
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


Peacock/Bonnet - Instream Study
N
Feet
0 300 600
Legend
Priority Spring
DESCRIPT
SAV and Algal Polygons
SAV and Algal Monitoring Belt Transects
Hydroecological Monitoring Station
Floodplain Study Transect
PS-N
PS-C
PS-S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors


Ruth/Little Sulfur In-Stream Study
N
Feet
0 50 100
Legend
Priority Spring
SAV and Algal Polygons
Hydroecological Monitoring Station
Floodplain Study Transect
Copyright:© 2013 Esri, DeLorme, NAVTEQ, TomTom, Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Otter In-Stream Study
N
Feet
0 300 600
OS-U
OS-C
OS-D
Legend
Priority Spring
SAV and Algal Polygons
Hydroecological Monitoring Station
Floodplain Study Transect
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors