

**FLUVIAL GEOMORPHIC INVESTIGATION OF THE UPPER SANTA FE RIVER,
LOWER SANTA FE RIVER, AND ICHETUCKNEE RIVER**

Prepared for:



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EXECUTIVE SUMMARY

The purpose of the study was to use scientific approaches in fluvial geomorphology, the study of how water shapes land, to describe how the flow regime maintains channel and floodplain dimensions and habitats in the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River and their sensitivity to hypothetical flow reductions. This is important because the habitats used by aquatic fauna and floodplain ecosystems are highly dependent on fluvial forces that move and organize sediments in ways that create the physical habitat diversity of the study area stream corridors.

The study identified the bankfull discharges and stages that currently maintain channel dimension and habitat structure and some thresholds necessary to maintain alluvial features in the floodplain. Examples of calculated bankfull discharges were 109 cubic feet per second (cfs) in the Upper Santa Fe River at Graham, 1,410 cfs in the Lower Santa Fe River at Ft. White, and 328 cfs in the Ichetucknee River at Hwy 27. The three rivers studied have variable amounts of surface water/groundwater interaction, increasing as one move downstream and affecting bankfull discharge durations, which were found to be equaled or exceeded from 13 to 32% of the time based on long-term gage records. These critical flow values represent mid- and high-flows. Therefore, the establishment of mid- and high-flow MFLs is recommended for the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River to protect bankfull flow events that wet the full extent of the open channel, and overbank events wetting the full lateral extent of the alluvial floodplain. These need to be crafted in a manner that specifically assures frequent bankfull discharges as channel maintenance discharges. Existing bankfull frequencies and their average durations per bankfull event are provided in the report. Typically, several events occur per year with average durations of at least two weeks per event. While bankfull events maintain the open channel, higher magnitude events are necessary to maintain the floodplain geomorphology. The flood pulses normally provided in high-flow MFLs to protect the hydroecology of riparian wetlands are likely to intrinsically allow for sufficient flood pulses in the floodplain necessary to maintain its alluvial features as these provide for extended, frequent overbank events.

The study also calculated potential reductions in bankfull channel habitat dimension associated with typical Minimum Flows and Levels (MFLs) reductions. All three rivers could be adversely affected by groundwater withdrawals, and incremental flow reductions will ultimately create incremental reductions in bankfull channel size and habitat distribution. For example, the Upper Santa Fe River near Graham seems to be in a multi-decadal decline in channel forming (or bankfull) flow, has exhibited 1.5 ft of bed erosion, and is increasingly divorced from its floodplain as a result. The Lower Santa Fe River has been inherently more geomorphically stable, but its channel form and dimension are even more directly sensitive to groundwater withdrawals than the Upper Santa Fe River due to an increased abundance of direct spring flow inputs. Groundwater withdrawals will lead to tangible reductions in bankfull channel habitat. Also, some key floodplain habitat features in the Lower Santa Fe River have unique calcareous (shell and marl) sediments derived from the hard water of the springs. These could be diminished if the balance of wet season soft water (from runoff) increases versus the spring flow. Further, the Lower Santa Fe River and Ichetucknee River floodplains are partially structured by hydraulic interactions during wet season floods occurring in the Suwannee River and Lower Santa Fe

River. This means that the wet block MFLs of these three systems must be evaluated in concert to assure sufficient overbank discharges occur to maintain floodplain building processes.

The Ichetucknee River is dominated by groundwater flow. It has geomorphic and habitat features highly-dependant on biologically-mediated sediment production from snails, periphyton, and the SAV meadows they live on that are in turn sensitive to flow reductions. These biologically-mediated processes are typically not found in runoff-dominated rivers, but are quite ubiquitous in large spring runs. The critical flow thresholds of these biologically mediated processes are not fully understood and any further substantial reductions in groundwater flow to the Itchetucknee River would constitute an experiment in the sensitivity of sediment production and habitat characteristics. Further research is needed to determine critical thresholds in channel velocity and associated oxygenation to maintain a balanced snail and periphyton community, especially given that those communities are interacting with artificially high nutrient concentrations.

The conceptual model used to predict bankfull channel changes in response to hypothetical flow reductions assumes that incremental changes in bankfull flow will be associated with incremental changes in habitat structure and dimension. A potentially more sophisticated approach would be to set an MFL that assures the minimum frequency of channel maintenance events will occur during a long-term period of several decades. To do this requires knowledge currently unavailable of how long a bankfull event needs to occur to reach a meaningful threshold of work, and the lower envelope of the return interval of such events in natural, stable perennial rivers in the region. Once that is known, the District could prescribe MFLs that allow the maximum withdrawals that lead to a no harm condition regarding the long-term maintenance of channel and floodplain geomorphic habitat features.

1.0 INTRODUCTION

1.1 Project Definition and Application of Fluvial Geomorphology

The Suwannee River Water Management District (District) tasked AMEC Environment & Infrastructure, Inc. (AMEC) with conducting a fluvial geomorphic investigation of the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River in support of the establishment of MFLs. The District has established MFLs pursuant to Chapter 373.042, Florida Statutes (F.S.) for the Upper Santa Fe River and is in the process of establishing MFLs for the Lower Santa Fe River and Ichetucknee River in north central Florida (**Figure 1**). The District has requested AMEC's assistance in investigating the three systems' fluvial geomorphology in order to provide an understanding of how the riparian corridor may adjust its size and form in response to adopted and proposed flow reductions. The discipline of fluvial geomorphology is the study of how flowing water shapes land, and it provides critical information for a variety of practical and applied riverine studies, including those related to environmental flows and levels (Gordon et al., 2004).

The study of fluvial geomorphology is important because channel systems are not static under altered flow regimes, but are deformable as a non-linear function of the discharge regime. The size and shape of a river cross-section is a function of the flow provided to the channel, the amount and character of the sediment provided to the channel, and the composition of the channel's bed and bank materials (Leopold et al., 1964). Surface water and groundwater withdrawals will cause adjustments in flow and sediment transport, thus AMEC explored the sensitivities of these systems to potential withdrawals related to MFL thresholds to determine: 1) if adverse impacts (such as channel entrenchment) will occur, or 2) if the systems are already in a changing state, if adverse impacts will be exacerbated.

Riparian corridors adjust to sustained changes in their fluvial forces and sediment loads with complex spatial and temporal response patterns. Some aspects of the corridor adjust much more readily and quickly to flow alterations than others. The changes can happen chronically or catastrophically once certain thresholds of forces or cumulative effects are achieved. The norm is for changes to occur in a stepped rather than smooth trend as threshold levels of intrinsic resistance to change are eventually overcome and then material in the system is re-worked by lesser forces (Schumm, 1977). A good example of such a stepped process would be an undercut bank that is held together for many years as it is progressively and steadily eroded below the tree root line. Eventually the bank can no longer support the weight of the trees and soil mass above the undercut and it suddenly collapses, thereby widening the channel.

Some forms of change are contingent on antecedent changes, leading to somewhat predictable sequences in channel evolution. For example, streams in urban settings often react to increased flow peaks first by downcutting the bed materials, then by widening and shallowing as the widening imports more sediment than can be readily transported, followed by a secondary reworking of the excessive sediments by downcutting through them before reaching a final phase of equilibrium with the new regime (Simon, 1989). Therefore, lag times and thresholds are important factors in the evolution of a drainage network and its associated riparian systems. These factors mean that stream systems reflect their past and often express "memory" conditions that are a legacy of past extrinsic conditions that now are not as active in the landscape (e.g. past sea

levels, paleo-climates, ancient and resistant geological strata). A good example of such a memory feature in the study area of this report is the Ichetucknee Trace, a paleo-valley that once was an active stream system that only flows during extreme floods today. These legacy, lag-time, and contingency effects greatly complicate fluvial geomorphology as a predictive science. Directive or trended changes can occur under time frames taking a matter of less than a few years (e.g. pools induced by debris jams) to millennia (e.g. drainage density or valley relief) (Knighton, 1998).

This study focuses on changes with comparatively short lag times (on the order of a few decades or less to achieve a new equilibrium), but with long-term legacies likely to last much longer. The idea is to address changes that can occur well-within a normal human generation, but that once made will leave a legacy lasting for at least several generations. For example, we are not interested in defining terrain subsidence related to dissolution of the Floridan aquifer because it represents a geomorphic process with gradual changes unfolding over long time frames, perhaps millennia, before any measurable biological effects may result and that the natural rate of change conceivably dwarfs any incremental response likely to be caused by water supply withdrawals. We are more keenly interested in how calcareous sediments precipitated in the river system are subsequently organized by fluvial forces into important habitat features such as alluvial ridges in the floodplain or riffles in the open channel. The reason we are interested in the latter is because they represent changes that could reasonably be expected to be altered quickly (e.g. 10 to 50 years) in response to water withdrawals and also have ramifications concerning the long-term plant and animal species composition and distribution within the system. The idea is to focus on trended changes to alluvially-derived habitat features that can conceivably adjust in less than a few decades, resulting in an adverse impact to the template conditions necessary to maintain the habitat functions and values in the existing system.

It is generally recognized that channel width and depth are among the most sensitive and rapid adjustments the system can make to altered hydrology (Rosgen, 1996). These changes can have lasting effect on the availability of habitat and associated biological functions. A wide range of flow conditions contribute some work to form and maintain channel dimension and pattern, but not all discharge quantities do equal work. One of the major points of emphasis in the field of applied fluvial geomorphology is to identify channel maintenance discharges that make the fundamentally important contributions to channel size and habitat features. The bankfull discharge, defined as the discharge that corresponds to the river stage at the interface between the open channel dominated by sediment transport and the alluvial floodplain dominated by sediment deposition, often corresponds to the discharge that is most effective at maintaining channel dimension (Leopold et al., 1964). As such, it typically leaves notable field indicators in Florida streams (Blanton et al., 2010).

The association between field-recognizable bankfull indicators and effective channel maintenance discharge applies best to perennial streams. It offers a powerful concept for targeting critical discharges or control points that must be protected to maintain the channel size and the size and distribution of alluvial habitat features such as riffles, pools, alluvial ridges (aka natural levees), linear backswamps, oxbow lakes, etc. This is doubly important not only because such aspects of the channel system can decline in size and distribution in response to flow declines at or near bankfull discharge but that all other components of a typical MFL assessment typically rely on an assumption that the changes in hydrology allowed will be interacting with an unaltered

geomorphology that is inherently non-deformable or non-trended in time. For that assumption to be valid, the channel maintenance discharges must be provided above some critical threshold of magnitude and cumulative exceedance using an equilibrium approach; or magnitude, duration, and frequency using an event approach. These two approaches are discussed in greater detail in **Section 5.0**, Summary and Recommendations.

It is readily conceivable that channel maintenance discharge is important to protect resource values related to template conditions regarding sediment transport, navigation, recreation, and aquatic fauna habitat. The main goal of the report is to examine the general sensitivity of the Lower Santa Fe River, Upper Santa Fe River, and Ichetucknee River geomorphology to some prospective flow declines well-within ranges typically allowed in Florida MFLs.

1.2 Project Objectives and Report Layout

This fluvial geomorphic investigation was undertaken to meet the following objectives:

- I. Determine the channel forming/maintaining flow (i.e. bankfull discharge) and the durations/percent exceedances at which this flow occurs for all three systems.
- II. Determine if aggradation or degradation is occurring within the channel using existing USGS at-a-station records and site observations.
- III. Determine which stage of channel evolution each system is in if the system is not stable.
- IV. Evaluate how adopted MFLs on the Upper Santa Fe River and selected flow reduction scenarios on the Lower Santa Fe River and Ichetucknee River will change the bankfull (or channel forming/maintaining) discharge and how the system will react to change.
- V. Characterize the sedimentation processes of the riverscape and floodscape both longitudinally and transversely (i.e. down and across the riparian corridor).
- VI. Identify major grade controls and sensitivities to flow alteration.
- VII. Explore potential effects of groundwater versus surface water withdrawals on channel morphology.
- VIII. Relate spring-run channel morphology to biochemical conditions associated with accrual times and nutrient loads that could affect sediment yield and sedimentation.

This report is divided into five sections. **Section 1.0** provides an introduction to the project, outlines project objectives, and provides background information on MFLs. **Section 2.0** describes the three river systems by breaking them up into various reaches based on their fluvial geomorphology to help provide a context for the following sections. **Section 3.0** describes the methodologies utilized to meet project objectives. **Section 4.0** presents study results and provides discussion regarding the results. **Section 5.0** provides a summary and recommendations. **Section 6.0** provides a glossary for technical terminology. **Section 7.0** provides references.

1.3 Minimum Flows and Levels Background Information

Chapter 373.042, F.S., provides the legal framework from which MFLs are based and states the following:

1) Within each section or the water management district as a whole, the Department (Florida Department of Environmental Protection) or the district Governing Board shall establish the following:

a) Minimum flow for all surface watercourses in the area. The minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

b) Minimum water level. The minimum water level shall be the level of groundwater in an aquifer and the level of surfacewater at which further withdrawals would be significantly harmful to the water resources of the area.

River systems are then prioritized and MFLs are scheduled to be set. The District previously set MFLs on the Upper Santa Fe River and is currently in the process of establishing MFLs on the Lower Santa Fe River and Ichetucknee River. Adopted MFLs for the Upper Santa Fe River and prospective MFLs for the Lower Santa Fe River and Ichetucknee River were used to test the sensitivity of geomorphology to theoretical, but realistic and typically otherwise allowable flow reductions and are summarized in **Table 1**. AMEC used these theoretical MFLs solely as a basis from which to make comparisons for this fluvial geomorphic study. It is also important to recognize that our analysis used the existing bankfull signatures as a baseline condition and that this baseline may reflect an already deteriorated condition resulting from flow declines already occurring. Notably, evidence exists for reduced average flow in the Ichetucknee River of approximately 100 cfs (Grubbs, 2011) and declining mean annual flows in the Upper Santa Fe River near Graham (AMEC-BCI Engineers & Scientists, 2011).

Table 1
MFL Summary

Flow Duration Frequency (% Exceedance)	Upper Santa Fe River						Lower Santa Fe River			Ichetucknee River		
	Graham Gage			Worthington Springs Gage			Ft. White Gage			Hildreth (Hwy 27) Gage		
	Existing Flow (cfs)	MFL Flow (cfs)*	Flow Reduction	Existing Flow (cfs)	MFL Flow (cfs)*	Flow Reduction	Existing Flow (cfs)	MFL Flow (cfs)**	Flow Reduction	Existing Flow (cfs)	MFL Flow (cfs)**	Flow Reduction
5	201	171	15%	1780	1513	15%	3200	2656	17%	497	477	4%
10	128	109	15%	1100	935	15%	2570	2218	14%	447	429	4%
25	52	44	15%	432	367	15%	1820	1692	7%	383	367	4%
50	15	13	15%	131	111	15%	1280	1184	8%	334	320	4%
75	2.3	2.3	0%	42	42	0%	997	950	5%	234	224	4%
90	0.4	0.4	0%	15	15	0%	814	776	5%	189	181	4%
95	0.2	0.2	0%	9	9	0%	700	667	5%	183	176	4%

* Adopted MFL flow

** Hypothetical MFL flow

Upper Santa Fe River

MFLs were adopted for the Upper Santa Fe River in 2007 and read as follows in Chapter 40B-8 of the Florida Administrative Code (F.A.C.):

The Governing Board hereby establishes the following minimum surfacewater flows. The Governing Board finds that the following minimum surfacewater flows are the limit at which further withdrawals would be significantly harmful to the water resources or ecology.

(1) The minimum surfacewater flows for the Santa Fe River Near Graham, FL, gage are the following points on the flow duration curve defined in “Technical Report – MFL Establishment for the Upper Santa Fe River, May 2007”:

- (a) 171 cubic feet per second (cfs) for a flow duration frequency of five percent;
- (b) 109 cfs for a flow duration frequency of 10 percent;
- (c) 44 cfs for a flow duration frequency of 25 percent;
- (d) 13 cfs for a flow duration frequency of 50 percent;
- (e) 2.3 cfs for a flow duration frequency of 75 percent;
- (f) 0.4 cfs for a flow duration frequency of 90 percent;
- (g) 0.2 cfs for a flow duration frequency of 95 percent.

(2) The minimum surfacewater flows for the Santa Fe River at Worthington Springs, FL, gage are the following points on the flow duration curve defined in “Technical Report – MFL Establishment for the Upper Santa Fe River, May 2007”:

- (a) 1,513 cfs for a flow duration frequency of five percent;
- (b) 935 cfs for a flow duration frequency of 10 percent;
- (c) 367 cfs for a flow duration frequency of 25 percent;
- (d) 111 cfs for a flow duration frequency of 50 percent;
- (e) 42 cfs for a flow duration frequency of 75 percent;
- (f) 15 cfs for a flow duration frequency of 90 percent;
- (g) 9 cfs for a flow duration frequency of 95 percent.

In summary, flow reductions up to 15% of the baseline flow duration curve can occur at flows greater than the established control point (75% flow duration frequency), which is 2.3 cfs at Graham and 42 cfs at Worthington Springs. The control point set in this MFL explicitly focused on in-channel discharges related to fish passage, wetted perimeter, and physical habitat modeling (Water Resources Associates, 2007). It is essentially a low-flow control point approach. The emphasis on just low-flow critical thresholds reflects an early phase in the application of environmental flow regulation. Since then, various agencies around North America, including the District, have found greater value in setting MFLs for low, mid, and high flow control points. In the case of the District, budgetary and schedule imperatives largely dictated the simplicity of MFL establishment, with high reliance on a statutory provision that permits MFL promulgation to be based on the “best information available” (373.042(1)(b), Florida Statutes) (J. Good - personal communication).

Lower Santa Fe River

MFLs have not yet been established or adopted for the Lower Santa Fe River. Studies and reporting have been or are currently being conducted with the goal of establishing MFLs that will not significantly harm the river’s water resources or ecology. In this part of the river, the District desires to set high flow, mid flow, and low flow MFLs. The high flow MFL will be aimed towards protecting wetland inundation, the mid flow MFL will be aimed towards protecting wetted perimeter, and the low flow MFL will be aimed towards protecting fish passage and habitat suitability. Other water resource metrics may also be reviewed for possible use, such as recreation and scenic/aesthetic values.

Ichetucknee River

As a tributary to the Lower Santa Fe River, the Ichetucknee River is considered part of the Lower Santa Fe River system. MFLs have not yet been established or adopted for the Ichetucknee River. Studies and reporting have been or are currently being conducted with the goal of establishing MFLs that will not cause significant harm to water resources or ecology. The District has indicated a desire to set MFLs aimed towards protecting wetted perimeter for mid flows and habitat suitability for low flows. Again, other metrics may also be examined for inclusion as the work progresses.

2.0 SITE DESCRIPTIONS

The rivers investigated in this study include the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River. These systems represent a wide gamut of water sources ranging from surface water runoff dominance in the Upper Santa Fe River to artesian springs providing copious groundwater discharge in the Ichetucknee River. The Lower Santa Fe River is sourced from a mixed regime of spring flow and runoff. These are important distinctions as Kiefer (2010) found fundamental differences in geomorphic processes and form between groundwater and runoff dominated streams in peninsular Florida. The streams in the study area are also noteworthy in that they occupy a transition zone between two hydro-physiographic regions with different monthly river flow patterns, based on relative effects and proximity to peninsular versus continental climates (Kelly, 2004) and degree of interaction with groundwater systems. AMEC divided each of these rivers up into distinct sub-reaches based on their fluvial geomorphology, as described below. Geomorphic cross-sections were surveyed within each reach near a USGS gage to determine bankfull elevations, as described in **Section 3.0** and photographs were taken at each cross-section (**Appendix A**). A summary of the reaches and their associated USGS gages and geomorphic cross-sections are provided in **Table 2**.

Table 2
River Reaches

River	Reach	Associated USGS Gage	Associated Geomorphic Cross-Section	Associated Report Figure
Upper Santa Fe	Santa Fe Lake to New River	Santa Fe River near Graham	XS-18, XS-17, XS-16	2A
	New River to Olustee Creek	Santa Fe River at Worthington Springs	XS-15, XS-14, XS-13	2B
	Olustee Creek to River Sink	Santa Fe River at O'Leno State Park	XS-12, XS-11, XS-10	2C
Lower Santa Fe	River Rise to Highway 27 gage	Santa Fe River at US HWY 441 near High Springs	XS-09, XS-08, XS-07	3A
	Highway 27 gage to Ichetucknee River	Santa Fe River near Fort White	XS-06, XS-05, XS-04	3B
	Ichetucknee River to Suwannee River	Santa Fe River near Hildreth	XS-03, XS-02, XS-01	3C
Ichetucknee	Ichetucknee Head Spring to Grassy Flats	N/A	N/A	4A
	Grassy Flats to Powerline	Ichetucknee River at Dampier's Landing near Hildreth	XS-04, XS-03	4B
	Powerline to Santa Fe River	Ichetucknee River at HWY 27 near Hildreth	XS-02, XS-01	4C

2.1 Upper Santa Fe River

The Upper Santa Fe River comprises 44.5 miles of river from Santa Fe Lake to the River Sink at O'Leno State Park (**Figure 2**). This river was divided into three reaches, based on its fluvial geomorphology, each of which is described below.

Santa Fe Lake to New River

The Upper Santa Fe River from Santa Fe Lake to the New River comprises approximately 29 miles (**Figure 2**). The valley through which this reaches courses is predominantly confined. A “confined valley” is one where the width of the alluvially-active valley floor located between two flanking valley hillslopes is similar to the meander width of the main channel system. In such a system, the main channel meanders across the entirety of the valley floor and the outermost bends will sporadically contact the valley hillslope at its inner edge. In this reach, the valley has alluvial features such as short secondary channels or chutes in the floodplain and a pronounced sandy alluvial ridge (or natural levee) flanking the main channel. The alluvial ridges support hardwood

trees and palmettos. The floodplain chutes vary in sediment composition from sandy material to heavily textured clays and most are vegetated with mixed cypress and hardwood bottomland species.

The dominant substrate in the main channel of the Upper Santa Fe River is sand and the channel is significantly larger, deeper and much more entrenched than the floodplain chutes with a variety of alluvial features dominated by large sandy shoals and bend pools. Large woody debris (LWD) and limestone and clay outcroppings are present. Systems fitting this description are common in northern Florida and southern Georgia. While the majority of this reach represents a valley type that comparatively concentrates flow energy due to its steep longitudinal slope and lateral confinement, there is an unconfined portion of this reach located downstream of the Sampson River. This unconfined portion, known as Mud Swamp, becomes more diffuse with lower banks and multiple channels of roughly equal dimension to each other, serves to dissipate energy, and is likely a sediment trap. An “unconfined valley” is broader than the meander belt width of the main channel. Unconfined valleys are common in Florida. Those with comparatively steep longitudinal slopes are typically associated with well-defined, single thread main channels while those with very low longitudinal slopes typically are associated with multi-threaded channel planforms or other semi-lotic forms with poorly defined channels such as vegetated sloughs or strands (Kiefer, 2010). Many ecologists refer to such systems as being “braided” but geomorphologists conventionally reserve that term for high energy mountain or piedmont valleys with extremely high sediment loads that cannot be continuously transported by a single channel. A more generic and cross-disciplinarily term for Florida systems with multiple equitable channels criss-crossing the valley floor is “multi-threaded.” The term multi-threaded is preferred for Florida streams because they are inherently stable channel forms occupying lower-gradient valleys with substantially less sediment transport than what occurs in annually-changing braided streams.

The USGS maintain two gages on this reach near Graham and near Brooker; however, the Brooker gage is only used to collect field measurements and is not used to collect stage and discharge data. Therefore, AMEC collected geomorphic data at three cross-sections straddling the Graham gage: XS-18, XS-17, and XS-16 (**Figure 2A**).

New River to Olustee Creek

The Upper Santa Fe River from New River to Olustee Creek comprises approximately 10 miles (**Figure 2**). The valley through which this reaches course is similar to the previous reach, with a predominantly upland confined valley with alluvial features such as secondary channels and a main open channel deeply entrenched in the valley. The channel banks alternate between high on one side and low on the other in this reach, providing spatially variable access and interaction with the narrow floodplain. The channel itself is larger than the upstream reach due to the additional input from the New River.

The USGS maintains one gage on this reach at the Highway 121 bridge near Worthington Springs. AMEC collected geomorphic data at three cross-sections straddling this gage: XS-15, XS-14, and XS-13 (**Figure 2B**).

Olustee Creek to River Sink

The Upper Santa Fe River from Olustee Creek to the River Sink at O'Leno State Park comprises approximately 5.5 miles (**Figure 2**). At the River Sink, the Upper Santa Fe River disappears underground for approximately three miles as the river crosses the Cody Escarpment. The valley through which this reach courses is best described as a perennially-wet gulley, as the river progrades (forward, downstream directional erosion that occurs in karst systems) towards the base level of the river sink. A prograding river is one that follows rock fractures or solution sinks. It erodes in a downstream direction over time, toward the sink. The process is controlled by the underlying geology and is resistant to changing flow regimes. This is opposed to a headcutting drainage network whereby the stream erodes alluvium in an upstream direction in a process called headcutting. Headcutting of alluvium is generally a form of grade adjustment that can be quite sensitive to changing flow regimes. It is likely that the Upper Santa Fe River drainage network has formed by combined prograding and headcutting mechanisms over recent millennia. The important consideration here is that the river and valley form at this location are governed by geologic controls, more so than alluvial controls. Both banks are upland confined, though there are a couple of short segments where the river is flanked by riverine wetland on one side. This section of the river is therefore predominantly under geologic control (as opposed to alluvial control).

The USGS maintains a gage on this reach within O'Leno State Park, which only collects stage data. AMEC collected geomorphic data at three cross-sections straddling this gage: XS-12, XS-11, and XS-10 (**Figure 2C**).

2.2 Lower Santa Fe River

The Lower Santa Fe River comprises 30.5 miles of river from the River Rise to the Suwannee River (**Figure 3**). This river was divided into three reaches, based on its fluvial geomorphology, each of which is described below.

River Rise to Highway 27 Gage

The Lower Santa Fe River from the River Rise to the Highway 27 gage comprises approximately 6 miles (**Figure 3**). The river in this section receives contributing flow from adjacent springs but also loses flow through several sinks/sucks. It is best described as a mixed regime as its water delivery is both runoff and karst derived. This river reach is flanked by a highly variable floodplain rapidly transitioning multiple times between narrower confined and broader unconfined valley forms. This variability in valley confinement also is common throughout many streams in Florida, and is particularly evident in landscapes with karst influences and in valleys draining relict dunescape complexes.

USGS gages are located on this reach at the 441 bridge and Highway 27 bridge. The Highway 27 gage does not currently collect data, thus AMEC collected geomorphic data at three cross-sections straddling the 441 gage: XS-09, XS-08, and XS-07 (**Figure 3A**).

Highway 27 Gage to Ichetucknee River

The Lower Santa Fe River from the Highway 27 gage to the mouth of the Ichetucknee River comprises approximately 17.5 miles (**Figure 3**). This reach of the river receives contributing flow from a higher abundance of springs than the previous reach. It is best described as a mixed regime gaining river (baseflow increases as heading downstream). The river is predominantly flanked by riverine wetlands with natural levees on the banks. This reach also receives variable amounts of flow from several tributaries, including Cow Creek.

The USGS maintain two gages on this reach, including the Fort White gage and the Three River Estates gage, the latter of which only collects stage data. AMEC collected geomorphic data at three cross-sections straddling the Fort White gage because it has a good, long term discharge record: XS-06, XS-05, and XS-04 (**Figure 3B**).

Ichetucknee River to Suwannee River

The Lower Santa Fe River from the mouth of the Ichetucknee River to the confluence of the Lower Santa Fe River and Suwannee River comprises approximately 7 miles (**Figure 3**). The Ichetucknee River is a major tributary to this reach, which also has several contributing springs. The reach is flanked by riverine wetlands with natural levees on the banks. The levees often have calcareous sediments with ample evidence of derivation from snail shells and shell fragments reworked by fluvial forces. This represents an interesting interaction between aspects of the mixed flow-regime. The karst groundwater supplies dissolved calcium which is precipitated by physical chemistry and biological mechanisms and then becomes alluvium as it is transported and sorted into classic alluvial floodplain features by pulsed flow forces mainly derived from watershed runoff. For this reason, reductions in spring flow could be expected to produce proportional reductions in an important source of sediment to this reach. Erosion was observed along the banks of this reach, likely a result of boat wakes. This segment of the river also has backwater effects from the Suwannee River and experiences reverse flows. It seems unlikely that groundwater withdrawals would cause threshold shifts in the floodplain hydraulics, which are largely controlled by riverine flood pulses associated with surface water runoff in the Suwannee River and Lower Santa Fe River. However, it is conceivable that groundwater withdrawals could reduce the total amounts of dissolved solids loaded to the system that are creating an important sediment source in this valley segment. That means that although the floodplain hydraulics will remain similar, the sediment source could be diminished, potentially leading to changes in the roughness and sediment composition of what is now a topographically and edaphically complex portion of the riparian ecosystem. It is beyond the scope of this study to calculate how much sediment reduction would occur under various groundwater withdrawal scenarios, but it would probably have to dilute the hardness such that the dominant aquatic macroinvertebrates would shift from one dominated by snails to one dominated by insects for an adverse threshold to occur.

The USGS maintain a gage at the Highway 129 bridge near Hildreth. AMEC collected geomorphic data at three cross-sections straddling this gage: XS-03, XS-02, and XS-01 (**Figure 3C**).

2.3 Ichetucknee River

The Ichetucknee River is a spring run comprising approximately 5.2 miles from the head spring to its confluence with the Lower Santa Fe River (**Figure 4**). This river was divided into three reaches, based on its fluvial geomorphology, each of which is described below. Prugh (1969) conducted a bathymetric survey of the river by measuring water depths and hydraulic parameters, including calculations of the hydraulic slope, at a variety of cross-sections along its length. The sections were not surveyed relative to any standard horizontal or vertical datum and are therefore only roughly positionable based on his descriptions relative to his reported average transect spacing and the positioning of some transects upstream or downstream of observable spring vents. His characterization divides the river into three main hydrogeomorphic zones that corresponded well to conditions present in seemingly similar locations today.

Head Spring to Grassy Flats

The Ichetucknee River from the head spring to an area referred to as the grassy flats comprises approximately 1.3 miles (**Figure 4A**). The river emerges from several headwater springs and forms a spring run that courses through a wetland floodplain valley. Approximately one mile downstream of the head spring, the river becomes wider and is flanked by wild rice (*Zizania aquatica*) through which the water takes multiple routes. Several springs contribute to this reach. The surface sediments in this reach were dug to about 18 inches and were predominantly fine-textured cohesive inorganics. This condition differs from many spring runs with similar littoral shelves which often have sediments dominated by flocculent organic materials (Odum, 1957; Kiefer, 2010). Hensley (2010) probed the soft sediments to bedrock at this location and their surface expressions generally conform to the pattern of the underlying limestone. These characteristics suggest that this part of the valley is under a high degree of geologic control and is likely resistant to changes in flow regime.

The USGS does not maintain any gages on this reach of the river, therefore AMEC did not collect geomorphic data at this reach.

Grassy Flats to Power Lines

The Ichetucknee River from the Grassy Flats to the power lines located just upstream of Highway 27 comprises approximately 1.8 miles (**Figure 4**). Based on the ratio of floodplain width versus meander belt width; technically the river courses through an unconfined wetland valley. It also exhibits some pronounced limestone exposures high along the banks. It is not necessarily correct to view the valleys of spring runs as being alluvial because many such runs rarely produce overbank floods to distribute inorganic sediments to the valley flat. The valley flat is more typically an accumulation of histosols to the elevation supportable by the local, sustained groundwater table.

Organic soil building is an important part of the maintenance of the valley bottomland form along this reach, but it also does flood due to backwater effects from the Lower Santa Fe River, which in turn also experiences backwater effects from the Suwannee River. The sediments also contained fine inorganics and some marl patches possibly deposited from uncommon floods. It is also conceivable that such materials washed into the valley from colluvial processes (e.g. valley

hillslope erosion) or phosphate mining activities that occurred within small portions of the valley prior to state acquisition.

This reach of the river has a combination of sandy and organic flocculent sediments on the bed, much of which supports dense meadows of submerged aquatic vegetation. In these aspects, the system is quite similar to other large-magnitude spring runs studied in Florida (Kiefer, 2010). The reach also encompasses a small alluvial shoal at the edge of the river at the outlet of small lateral spring; Coffee Spring, that supports the only known location of the endemic Ichetucknee siltsnail (*Cincinnatia mica*). Although it would be of significant interest to characterize the sediments of the shoal to determine their derivation and potential sensitivity of the alluvial feature to altered flow regimes, the sensitive nature of that work is beyond the scope of this study.

The USGS maintains a gage at Dampier's Landing within Ichetucknee River State Park. AMEC collected geomorphic data at two cross-sections straddling this gage: XS-04 and XS-03 (**Figure 4B**).

Power Lines to Lower Santa Fe River

The Ichetucknee River from the power lines to the confluence with the Lower Santa Fe River comprises approximately 2.1 miles (**Figure 4**). The river courses through an unconfined wetland valley; however, the elevation of the valley flat was noticeably higher above the present water level (14.55 ft NGVD, 270 cfs reported at Hwy 27 gage on 8/2/2011) in this reach (**Photograph #79**) than in the previous reach (17.95 ft NGVD, 280 cfs reported at Dampier's Landing gage on 8/1/2011) (**Photograph #75**). This indicates that the river is more entrenched as it meets the base level of the Lower Santa Fe River. The overall profile of this reach exhibits a convex shape as it joins the Lower Santa Fe River, meaning that it has a greater longitudinal slope than the upstream reach (**Appendix B**). Most rivers exhibit an overall concave profile. The convex profile suggests the presence of grade control via resistant rock strata close to the land surface that has retarded channel downcutting in this reach. Consistent with this, there are also several areas along this reach with limestone rapids. The backwater effects mentioned in the floodplain of the middle reach are more pronounced for this reach as it is lower in elevation and closer to the Lower Santa Fe River. Large parts of the floodplain in this reach are likely to be under greater influence from the Lower Santa Fe River's discharge than the Ichetucknee River's.

The USGS maintain a gage at the Highway 27 bridge near Hildreth. AMEC collected geomorphic data at two cross-sections straddling this gage: XS-02 and XS-01 (**Figure 4C**).

3.0 METHODOLOGY

To meet study objectives, AMEC evaluated existing information, calculated the bankfull discharge, and analyzed long-term gage records. Each task is described in further detail below.

3.1 Review Existing Information

AMEC reviewed existing data and reports provided by the District (e.g. the Upper Santa Fe River MFL report, draft or final HEC-RAS models for all three systems) and conducted a literature review of additional studies available at the University of Florida's library system to gain more in-depth project understanding. AMEC also compiled a GIS basemap with aerials, topography (e.g. LiDAR provided by the District), previous and proposed HEC-RAS survey cross-sections locations, shoal locations, and USGS gage locations. This review helped guide further investigative work.

3.2 Calculate Bankfull Discharge

Bankfull stage, or the elevation at which the stream just begins to overflow onto its floodplain, is considered an important threshold in geomorphology. Bankfull discharge, the stream flow associated with that stage is considered "the most effective stream flow for moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphological characteristics of channels" (Dunne and Leopold, 1978). Preliminary data collected by AMEC suggests that the bankfull flow occurs at durations which may be affected by MFLs; therefore, several tasks were completed to calculate the bankfull discharge for the various river reaches.

In May 10, 2011, AMEC and District staff conducted a field reconnaissance at various locations along the three river systems, which served to provide AMEC with a general overview of the systems' fluvial geomorphology. AMEC then returned to collect more detailed geomorphic data on the Upper Santa Fe River and Lower Santa Fe River in June 2011 and on the Ichetucknee River in August 2011.

AMEC used a Total Station to survey geomorphic facets at seven cross-sections along the Upper Santa Fe River, nine cross-sections along the Lower Santa Fe River, and four cross-sections along the Ichetucknee River (**Figures 2 through 4**). AMEC also used cross-sectional data from a previous survey completed by AMEC in 2008 on the Upper Santa Fe River upstream of the Graham gage (XS-18 and XS-17). Various field indicators of bankfull stage were surveyed at each cross-section, as field indicators are often used to estimate bankfull stage and the associated bankfull discharge. Field indicators typically found in Florida streams include the elevation of the valley flat where the slope becomes level (BKF-F), inflections or breaks in slope of the bank (BKF-I), and scour lines or undercuts in the bank found around plant roots (BKF-S). In general, these indicators are located in the following order along the bank: BKF-F (highest in elevation), BKF-I, and BKF-S (lowest in elevation) (**Appendix B**). In Florida streams with a wetland floodplain, the BKF-F indicator has been found to correlate strongly with the top of bank, while in streams without a wetland floodplain (which are often incised), BKF-F is often absent (Blanton, 2008). In streams with relatively high banks (such as the Upper Santa Fe River), two inflection signatures, a high (BKF-I2) and a low (BKF-I), can often be found. Although BKF-S

is generally associated with a flow duration that is too high to be considered the bankfull stage (Blanton, 2008), its elevation was captured for data analysis purposes. Other geomorphic facets such as the present water line, toe of bank, top of natural levees, and other floodplain features were also captured in the survey.

District staff accompanied AMEC during surveying efforts to assist in locating HEC-RAS stations. HEC-RAS stations located upstream, downstream, and near USGS gages with long-term records were chosen for the survey as these locations would allow a longitudinal profile to be drawn “through” the gage. For the majority of surveyed sites, the exact HEC-RAS station benchmarks could not be located; therefore, surveyed cross-sections were located as close to HEC-RAS stations as could be approximated. When possible, AMEC surveyed features on both banks. During site visits AMEC also noted typical geomorphic diagnostics, such as signs of degradation and aggradation and floodplain characteristics.

AMEC set 28 temporary benchmarks (TBMs) throughout the study area, which were initially surveyed to a relative datum. The District then contracted a professional land surveyor to tie temporary benchmarks to true positions and elevations. The surveyor was unable to locate two TBMs previously set by AMEC in 2008 in the Upper Santa Fe River near Graham; therefore, AMEC estimated the true elevations for these TBMs from LiDAR-derived topography. AMEC then converted all survey data from a relative datum to NGVD29 and generated cross-sections and longitudinal profiles for each river reach (**Appendix B**). A bankfull profile was generated for each river reach by fitting a best fit line to the surveyed bankfull indicators (**Appendix B**). Because cross-sections straddled gages, the bankfull profile best fit line intersected a gage height at an elevation that was determined to be the bankfull stage. The USGS rating curve was then used to relate this bankfull stage to an associated discharge, which was deemed the bankfull discharge. Calculated bankfull stage and discharges were then imported into existing HEC-RAS models for the three river systems to validate that the bankfull field indicator occurred at a stage most congruent with the base level of the adjacent floodplain in the model cross-section and provided the best visual fit to the water surface profile simulated at each reference reach. This method allowed for the most cost-effective use of the best available information with a comparatively minimal amount of original field-truthing.

Site-specific regional curves were then created by plotting bankfull width and depth (derived from survey and/or HEC-RAS data) against bankfull discharge on a log-log scale (**Appendix C**). A power function was then applied to the points to produce a regression equation that could be used to predict how channel shape may change in response to flow reductions. For example, if an MFL allows for a 15% reduction in bankfull flow, a site with a bankfull flow of 100 cfs will be reduced to 85 cfs. Both flows are then plugged into the site specific regional curve to obtain predicted and reduced/adjusted bankfull widths and depths. The difference between these values was then calculated to estimate the percentage by which channel shape would be expected to self-adjust in response to reduced flows. This calculation relies upon an assumption that the system will adjust dimensionally to a new equilibrium state in association with a sustained reduction in a single indicator variable, bankfull discharge. While clearly a simplification, the use of such curves is a common practice in applied fluvial geomorphology to provide a sense of the magnitude and direction of change and to screen various parts of the system for thresholds warranting further calculation and/or monitoring.

The tasks described in this section helped meet objectives I, II, III, IV, and VI.

3.3 Analyze Long-Term Gage Records

The USGS maintain gages with long-term records on each of the three river systems of interest (**Table 3, Figures 2** through **4**). AMEC obtained data from the USGS website, but found that many records contained data gaps. The USGS data was thus supplemented with data from an Access database provided by the District, which contained interpolated data (INTERA, 2011). AMEC only used interpolated data to fill in small data gaps (three months or less) in the gage record. Gage records were then used to complete various tasks described below.

Table 3
Gage Summary

River	Gage Name	ID Number	Period of Record	Drainage Area (sq mi)	Latitude	Longitude	County
Upper Santa Fe	Santa Fe River near Graham*	02320700	Sep-57 to Nov-98 Oct-09 to Current	94.9	29°50'46"	82°13'11"	Bradford
	Santa Fe River at Brooker	02320849	field measurements	245	29°52'43"	82°20'12"	Bradford
	Santa Fe River at Worthington Springs*	02321500	Nov-31 to Current	575	29°55'18"	82°25'35"	Alachua
	Santa Fe River at O'Leno State Park	02321898	Aug-10 to Current (stage)	820	29°54'51"	82°34'48"	Columbia
Lower Santa Fe	Santa Fe River at US HWY 441 near High Springs*	02321975	Oct-92 to Sep-02 Oct-02 to Sep-10 (collected by the District)	859	29°51'09"	82°36'31"	Alachua
	Santa Fe River nr High Springs	02322000	Feb-31 to Sep-71 (discharge) Jul-53 to Sep-71 (stage)	868	29°50'33"	82°37'52"	Columbia
	Santa Fe River near Fort White*	02322500	Oct-27 to current	1017	29°50'55"	82°42'55"	Gilchrist
	Santa Fe River above Ichetucknee River near Hildreth	02322703	Oct-98 to Current		29 55 57	82 47 57	Columbia
	Santa Fe River near Hildreth	02322800	Nov-00 to Sep-05 Oct-07 to Current	1374	29°54'41"	82°51'38"	Gilchrist
Ichetucknee	Ichetucknee River at Dampier's Landing near Hildreth	02322698	Feb-02 to Current	210	29°57'37"	82°46'20"	Columbia
	Ichetucknee River at HWY 27 near Hildreth*	02322700	Feb-02 to Current	213	29°57'09"	82°47'10"	Columbia

*Current or potential MFL compliance gage

AMEC first used gage records to develop hydrographs and flow duration curves (FDCs) for each gage site (**Appendix D**). FDCs were used to estimate flow durations (or percent exceedances) of calculated bankfull discharges. Similar to HEC-RAS analysis, flow duration analysis was used to help validate that field bankfull indicator readings were reasonable when comparing bankfull hydraulics of the three rivers to other streams in the region. Kiefer (2010) provides ranges of bankfull flow durations for streams in the region (Kiefer, 2010).

AMEC also used long-term gage records to compile a variety of statistics for each gage. Gage records were imported in the River Analysis Package (RAP) program version 3.0.2 (Marsh, 2004), which provided general summary statistics (i.e. mean, median, 90th percentile, 10th percentile) as well as spells analysis where the bankfull flow was used to define events and the duration of each event was used to define its spell (**Appendix E**). Multiple definitions of bankfull discharge exist, some of which are more process-oriented than others (Williams, 1978). Therefore it is important to keep in mind that this study uses a concept of bankfull discharge as a functional threshold occurring at a geomorphic facet existing between channel maintaining and floodplain building processes. Under that definition, discharges below bankfull are typically within the main open-water stream channel while those greater than bankfull are at least partially wetting the vegetated floodplain. Spells analysis was used to calculate the number of overbank flow events per year, the average duration (in days) of overbank flow events, and the total number of overbank flow days per year for each site, thus providing important information regarding flows occurring and subsequently doing work in the floodplain environment (versus the riverscape). These events allow for deposition to occur and are important for floodplain building and energy dissipation.

Similar statistics and spells analysis were also run for a “reduced flow record.” Adopted and conceptual flow reductions (as provided in **Table 1**) were applied to the entire gage record in order to produce a reduced flow record. This analysis was conducted to determine how flow reductions would affect overbank frequency and duration and if floodplain building events would be adversely impacted.

AMEC also examined field measurements of channel stage paired with wetted channel width and depth collected by the USGS to look for channel aggradations (narrowing/shallowing) or degradation (widening/deepening) trends. This was accomplished by plotting stage and width measurements taken during flow events falling within +/- 20% of either one-fourth or one-half the bankfull flow (whichever provided more data points) at Upper Santa Fe River and Lower Santa Fe River gage stations and between 70 and 90% of bankfull flow at Ichetucknee River gage stations over time. The philosophy is to use below bankfull flows as a selection criteria to choose stage and width points that were taken within the channel itself (versus extended into the floodplain). If the stage or width is shown to be decreasing over time, this indicates that the channel is deepening or narrowing, respectively. If the stage or width is shown to be increasing over time, this indicates that the channel is shallowing or widening, respectively. Regression statistics were then run using SigmaPlot version 11.0 to test if the slope (or trend) was significantly different than a zero slope ($p < 0.05$). This would indicate if stage or width are changing (increasing or decreasing) over time in a statistically significant matter. This analysis helps look at the greatest sensitivities in channel shape changes versus other analyses of field measurements.

As mentioned earlier, multiple definitions exist for bankfull discharge. An alternate definition of practical interest is the “effective” flow. Effective discharge is the flow or range of flows that transports the most sediment over the long term. This concept enables changes to the entire flow record to be examined for potential cumulative effects on channel or floodplain maintenance. AMEC was unable to locate any sediment discharge rating curves for northern Florida, rendering the application of this method subject to unknown errors associated with the use of uncalibrated

sediment transport equations, and such errors are typically large. Therefore, this method was not pursued further.

The tasks described in this section helped meet objectives I, II, III, IV, V, VII, and VIII.

4.0 RESULTS AND DISCUSSION

This section presents study results as they relate to project objectives and provides discussions regarding results.

4.1 Objective I: Determine the channel forming/maintaining flow (bankfull discharge) and the durations/percent exceedances at which this flow occurs for all three systems

Bankfull discharge, as determined from surveying field indicators of bankfull stage, ranged from 109 cubic feet per second (cfs) to 1,410 cfs in the various river reaches (**Table 4**). Bankfull discharge was found to increase from upstream to downstream gages, as would be expected as the contributing basins become larger. **Appendix B** provides the survey data from which bankfull stages were derived. Determined bankfull flows were found to fall between smaller values predicted by regional curves developed for peninsular Florida (Blanton, 2008; Kiefer, 2010) and the larger values of north Florida (Metcalf, 2009) (**Exhibit 1**). This finding suggests that the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River's locations between two major hydro-physiographic regions (the continental mass and the peninsula) influences bankfull flow relationships. Kelly (2004) also found that rivers in this transitional zone exhibit different flow patterns than rivers to the north (continental influence) or to the south (peninsular influence) (**Exhibit 2**). More specifically, transitional zone rivers have a bimodal flow pattern with two peak flows, while northern rivers have peak wet season flows in the winter and southern rivers have peak wet season flows in the summer. The relevancy of these facts is that it means the rivers of this study are clearly transitional in terms of their bankfull discharge and dimension and seasonal flow patterns between the geographic cores of two distinct hydro-physiographic regions, the Northeastern Florida Coastal Plain (NEFCP) and the Peninsular Florida Coastal Plain (PFCP).

Bankfull flow duration (or percent exceedance), as determined from long-term USGS gage records, ranged from 13% (48 days per year on average) to 52% (188 days per year on average) in the various river reaches (**Table 4**). Flow duration curves (FDCs) used to estimate bankfull flow durations are provided in **Appendix D**. The majority of bankfull flow durations fall within the typical range of Florida streams, which range from 7 to 40% with an average of 21% in blackwater streams and from 35 to 54% with an average of 41% in spring runs (Kiefer, 2010). Consistent with Kiefer's findings, the gage sites with the highest flow durations (Lower Santa Fe River Fort White and Ichetucknee River sites) also had the highest contributions from springs. Bankfull flow exceedances represent the total number of days per year work is being done in the floodplain. Further spells analysis, using the estimated bankfull flow as a threshold, was conducted to determine the frequency and duration of individual bankfull events that contribute to floodplain building. Bankfull frequency ranged from 2.2 to 5.0 events per year, with the average event lasting from 10 days (1.4 weeks) to 112 days (16 weeks) per year (**Table 4**).

Results and discussions specific to each particular river reach are provided below. It is important to note that field indicators of bankfull stage used to estimate bankfull flow and associated durations represent current conditions. Long-term FDCs have a memory, and further analysis of the flow record by decade (provided below) may indicate that bankfull flow durations have changed over time. The bankfull conditions observed represent an existing condition that may very well differ from a true pre-disturbance condition. Since a pre-disturbance landscape predates

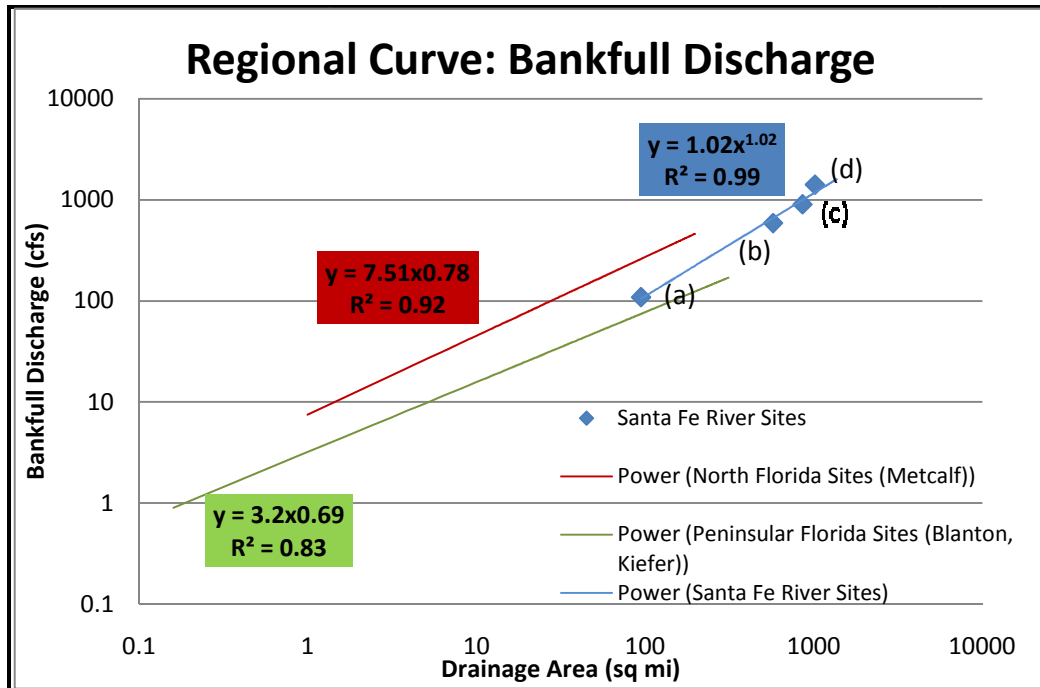
any of the available discharge records, it is beyond the scope of this study to establish a pristine background. As described below, the bankfull discharge amounts and flow durations appear to be appropriate for all of the systems studied in association with their drainage area size when compared to other rivers with relatively undisturbed watersheds in Florida. However, the Upper Santa Fe River at Graham may be on a declining trend that, if it continues at its rate from the past several decades, will result in conditions outside the range of what is deemed natural today.

Table 4
Bankfull Discharge and Duration Results Summary

River	Gage	Most Reliable Bankfull Indicator	Bankfull Discharge (cfs)	Duration (% Exceedance)	Duration (days per year)	Number of Bankfull Events per Year	Average Duration of Overbank Event (days per year)
Upper Santa Fe	Graham	Low bank inflection (BKF-I)	109	13	48	4.9	10
	Worthington Springs	High bank inflection (BKF-I2)	588	19	68	5.0	14
	O'Leno	No reliable indicator	748*	N/A	N/A	N/A	N/A
Lower Santa Fe	Hwy 441	Bank inflection (BKF-I)	901	12	65	2.4	34
	Ft. White	Bank inflection (BKF-I)	1410	39	143	2.2	73
	Hildreth	No reliable indicator	1891*	23	84	N/A	N/A
Ichetucknee	Dampier's Landing	Valley flat (BKF-F)	294	52	188	2.2	112
	Hwy 27	Bank inflection (BKF-I)	328	32	118	2.3	63

*Calculated from site specific regression (**Exhibit 1**), not based on field indicators

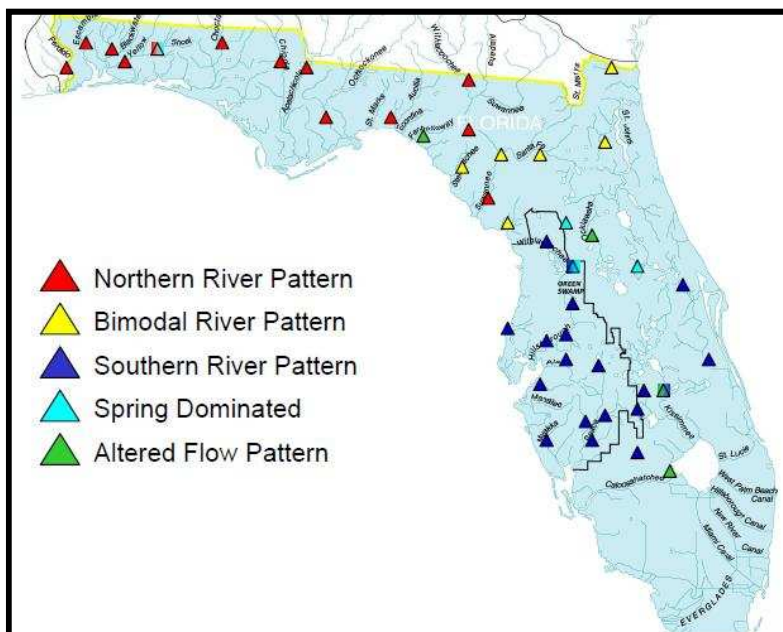
Exhibit 1
Florida Bankfull Discharge Regression



Note: Upper and Lower Santa Fe River sites used to generate site-specific Santa Fe River regional curve: (a) Graham gage; (b) Worthington Springs gage; (c) Hwy 441 gage; (d) Ft. White gage)

Exhibit 2

Geographic Distribution of Sites Exhibiting Various River Flow Patterns (Kelly, 2004)



Upper Santa Fe River

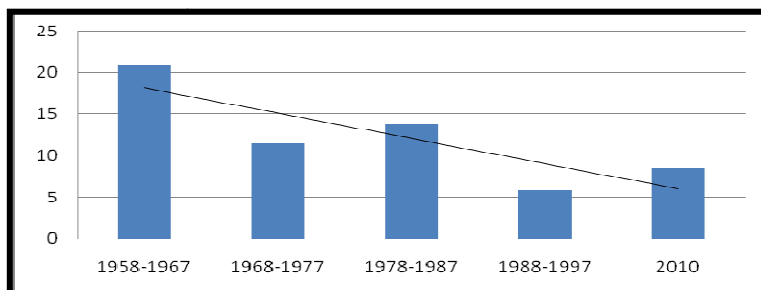
Santa Fe Lake to New River –The low bank inflection was the most reliable bankfull indicator in this reach, which corresponds to a bankfull discharge of 109 cfs at the Graham gage. This flow is equaled or exceeded approximately 13% of time (48 days per year) for the period of record. The period of record was further divided into 10-year intervals to determine if durations may be changing over time. This analysis shows that bankfull flow durations and mean annual flows visually decrease over time (**Table 5, Exhibit 3**).

Table 5
Upper Santa Fe River: Graham Gage Bankfull Duration and Mean Annual Discharge by Decade

Block	Q _{bkf} Duration (% Exceedance)	Q _{ma} (cfs)
1958-1967	21	73
1968-1977	11	49
1978-1987	14	51
1988-1997	6	32
2010	8	38
ALL	13	51

Exhibit 3

Upper Santa Fe River: Graham Gage Bankfull Duration (% Exceedance) by Decade



New River to Olustee Creek - The high bank inflection was the most reliable bankfull indicator in this reach and corresponds to a bankfull discharge of 588 cfs at the Worthington Springs gage. However, two distinct sets of facets commonly associated with bankfull signatures were observed: a high bank inflection, which allows access to the floodplain, and a low bank inflection, which creates a sparsely vegetated, discontinuous lower berm. The flow corresponding to the high bank inflection is equaled or exceeded approximately 19% of the time (68 days per year), while the low bank inflection is equaled or exceeded 46% of the time (169 days per year), falling outside of the normal range. The Upper Santa Fe River's geographic location in the bi-modal zone (Kelly, 2004) may explain the presence of two signatures as rivers in this zone have two wet season flows (one high and one low). The high bank inflection likely corresponds with the higher of the seasonal peaks and was chosen as the most reliable indicator in this reach. When analyzing flow duration data in 10-year intervals, there does not appear to be a distinct trend in flow durations or mean annual discharges over time (**Table 6, Exhibit 4**).

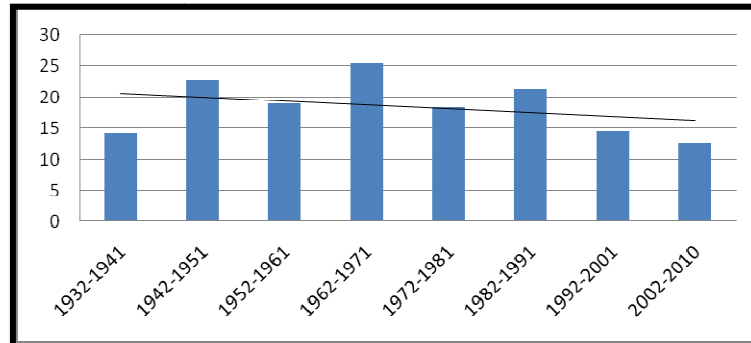
Table 6

Upper Santa Fe River: Worthington Gage Bankfull Duration and Mean Annual Discharge by Decade

Block	Q _{bkf} Duration (% Exceedance)	Q _{ma} (cfs)
1932-1941	14	344
1942-1951	23	532
1952-1961	19	408
1962-1971	25	514
1972-1981	18	395
1982-1991	21	432
1992-2001	14	336
2002-2010	13	291
ALL	19	408

Exhibit 4

Upper Santa Fe River: Worthington Gage Bankfull Duration (% Exceedance) by Decade



Olustee Creek to River Sink – Bankfull indicators were difficult to interpret in this reach, as the river is deeply entrenched as it progrades towards the river sink. The vast majorities of flows are contained within the v-shaped valley and are not building a continuous active alluvial floodplain. Although one readable cross-section did correspond to an active floodplain, which corresponded to an inflection following a hydraulic gradeline, reading bankfull solely from field indicators is dubious because this system is so entrenched. Further, only stage data is available for the gage at O’Leno. For these reasons, bankfull discharge and associated duration could not be directly calculated. In some such circumstances, bankfull discharge could be estimated for this reach using available regional associations with drainage area, but this is confounded by the fact that the stream exists between two different hydro-physiographic regions. The best possible calculation would therefore be to develop a river-specific bankfull discharge versus drainage area regression using 10 or more reliable alluvial locations upstream and then extrapolating that regression to the drainage area reporting to River Sink. It should then be verified that the discharge calculated in that manner corresponded to the scant alluvial floodplain indicators available during such an event by direct observation in the field. That combination of observations is beyond the scope of this study.

This reach is also likely to be under significantly resistant geological controls as opposed to more readily deformable alluvial controls due to the position of the river bed relative to the sink and its associated limestone bedrock near the land surface. Because the system is largely under geologic control, MFL reductions are not likely to have a large impact on this reach’s fluvial geomorphology unless withdrawals are substantial enough to influence the condition of the river sink itself (e.g. by inducing a sinkhole or solution pipe collapse, or by chronic subsidence).

Lower Santa Fe River

River Rise to US 27 Bridge Gage – The bank inflection at the inner toe of the alluvial ridge was the most reliable indicator in this reach and corresponds to a bankfull discharge of 901 cfs at the Hwy 441 gage. This flow is equaled or exceeded approximately 12% of the time (44 days per year). Other bankfull indicators observed in this reach were the elevation of the valley flat (which was only found on one bank at a time in this reach and had a flow duration of only 6%) and the scour line (which had a flow duration of 37%) (**Appendix D**). This reach is a mixed regime, with some alluvial floodplain and some spring influence. It is also affected by the river rise. No trends could be detected when breaking the flow record into 10-year time intervals because the period of record is too short (**Table 7, Exhibit 5**).

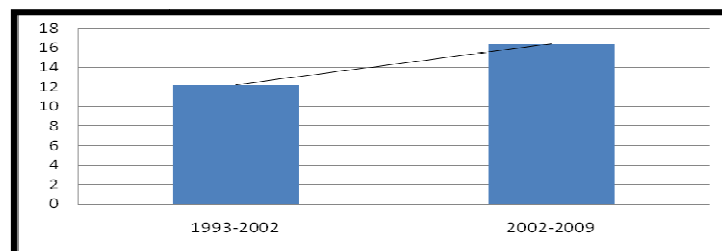
Table 7

Lower Santa Fe River: Hwy 441 Gage Bankfull Duration and Mean Annual Discharge by Decade

Block	Q _{bkf} Duration (% Exceedance)	Q _{ma} (cfs)
1993-2002	12	484
2002-2009	16	519

Exhibit 5

Lower Santa Fe River: Hwy 441 Gage Bankfull Duration (% Exceedance) by Decade

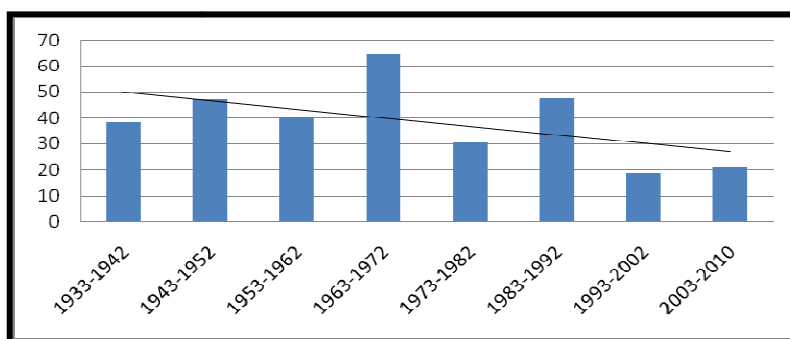


US 27 Bridge Gage to Ichetucknee River – The bank inflection was the most reliable bankfull indicator in this reach, the stage of which corresponds to a bankfull discharge of 1,410 cfs at the Ft. White gage. This flow is equaled or exceeded approximately 39% of the time (143 days per year). The reach's higher bankfull flow duration can be attributed to the cumulative effect of a higher abundance of springs providing steady flow to the system. This reach is best classified as a mixed regime (alluvial and spring). The bank inflection represents a channel forming flow above a scour line positioned along the margin of the channel edge and near the elevation of the linear backswamp located behind the alluvial ridge. When analyzing the flow record in 10-year intervals, it appears that bankfull flow durations and mean annual discharge have been decreasing over the last two decades, with a potential threshold shift in the decline occurring sometime in the early 1990's (**Table 8, Exhibit 6**).

Table 8
Lower Santa Fe River: Fort White Gage Bankfull Duration and Mean Annual Discharge by Decade

Block	Q _{bkf} Duration (% Exceedance)	Q _{ma} (cfs)
1933-1942	39	1503
1943-1952	47	1695
1953-1962	40	1495
1963-1972	65	1930
1973-1982	30	1331
1983-1992	48	1614
1993-2002	19	1152
2003-2010	21	1145
ALL	39	1492

Exhibit 6
Lower Santa Fe River: Fort White Gage Bankfull Duration (% Exceedance) by Decade



Ichetucknee River to Suwannee River – The bankfull profile created from field indicators in this section of the river was highly inconclusive, as the bankfull indicators “sloped” the wrong direction (**Appendix B**). This could be due to backwater effects and reverse flows resulting from high stages in the Suwannee River. In other words, as one progresses closer to the Suwannee River, which drains a watershed much larger than the Lower Santa Fe River, the larger river may be creating or influencing the development of geomorphic facets similar to those used to provide bankfull field indicators for the Lower Santa Fe River, confounding their interpretation. Further, all high flow events in this reach of the river also occurred when the Suwannee River was high, with pulses going backwards and likely doing some geomorphic work (**Appendix D**). Boat traffic wakes and subsequent erosion may also contribute to false bankfull indicators. Therefore, bankfull discharge and associated duration could not conclusively be calculated for the Hildreth gage from field indicators. Reactions to how the channel will react to MFL reductions are therefore geomorphically complex and difficult to predict and will likely be related to conditions in the Suwannee River and their interactions with the Lower Santa Fe River’s flow regime. However, such factors could be teased out with further study, particularly one that enabled the development of a site-specific catchment area (drainage area plus recharge area) versus bankfull

discharge regression. AMEC developed a preliminary regression and, from that, extrapolated a bankfull discharge of 1,890 cfs at Hildreth (**Exhibit 1**). This gives an approximate, non-verified, value for the channel maintenance flow in this reach of the Lower Santa Fe River. This discharge value's correspondence with field indicators will be difficult to verify during bankfull events, because the Suwannee is also typically high and fluctuates widely during such time periods.

Ichetucknee River

Headspring to Grassy Flats – AMEC did not survey any cross-sections along this reach, as there is no long-term USGS gage to which to tie survey results. Bankfull discharge thus was not estimated along this reach. Two shallow cores were excavated on the grassy flat to depths of 12 to 18 inches and both were dominated by fine textured inorganic sediments.

Grassy Flats to Powerline – The elevation of the valley flat was the most reliable field indicator in this reach, the stage of which corresponds to a bankfull discharge of 294 cfs at the Dampier's Landing gage. This flow is equaled or exceeded approximately 52% of the time (188 days per year). The bank inflection corresponded with the present water level (17.59 ft NGVD, 280 cfs reported at Dampier's Landing gage on 8/1/2011) during the time of survey and had a higher flow duration of 80%. Mean annual discharge was also calculated for this reach as this flow can be used to estimate channel forming flows in spring runs in the absence of additional data. The mean annual discharge was 314 cfs, which is equaled or exceeded 42% of the time. This value is close to the bankfull discharge derived from field indicators. The period of record at this gage is not long enough to determine if bankfull flow durations have changed over time.

Powerline to Lower Santa Fe River – The bank inflection was the most reliable field indicator in this reach and corresponds to a bankfull discharge of 328 cfs at the Hildreth (Hwy 27) gage. This flow is equaled or exceeded approximately 32% of the time (118 days per year) and is on the low end for karst systems studied by Kiefer (2010), which ranged from 35% to 54% with a mean of 41%, (n = 5). This suggests that some modest impacts are already occurring at the bankfull signature. The elevation of the valley flat was noticeably higher above the present water level (14.55 ft NGVD, 270 cfs reported at Hildreth Hwy 27 gage on 8/2/2011) in this reach than in the previous reach and corresponded to a flow duration of 15%. This may indicate that the river has been losing water over time. However, that latter aspect should be interpreted with caution because tributaries crossing a larger river valley also frequently have entrenched channels where they cross the scarp associated with the beginning of the bigger river's valley hillslope. Therefore, the seemingly low (15%) flow duration of the valley flat may simply be an artifact of the position of this reach along the Ichetucknee River's convex river profile as it headcuts up through the Lower Santa Fe River's valley scarp.

Mean annual discharge was calculated at 300 cfs, which is lower than the discharge calculated for the upstream reach and also suggests that the river may be slightly losing, perhaps further confounding interpretation of bankfull duration data in this reach. Important considerations along this reach include backwater effects from the Lower Santa Fe River, convex profile shape, and rapids which may indicate potential geologic controls. Floodplain soils in this reach consisted of marl and a mix of organic and inorganic materials, suggesting there may be some history of an alluvial floodplain or that deposition occurs during backwater events from the Lower Santa Fe

River. Upstream, the floodplain sediments appeared to be more organic. Because this reach already appears to be at least modestly affected by historic flow losses, and it already occupies a naturally entrenched position in the longitudinal profile, further withdrawals may exacerbate adverse impacts to the system's floodplain vegetation and geomorphic features. The period of record at this gage is not long enough to determine if bankfull flow durations have changed over time.

4.2 Objective II: Determine if aggradation or degradation is occurring within the channel using USGS at-a-station records and site observations

An analysis of existing USGS field measurements, selected for flows below bankfull (i.e. flows within the open channel), indicates that channel depth has been changing over time at several gage locations along the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River by either degrading (deepening) or aggrading (shallowing) (**Table 9**). Changes in elevation ranged from 0.5 to 1.5 feet, which could conceivably make a difference ecologically. For example, degradation may be approaching a threshold at which the bed material becomes bedrock versus alluvial in nature or the hydraulic geometry may change in a manner whereby overbank flooding becomes less frequent and of reduced duration. Aggrading reaches may be experiencing excessive habitat smothering such as snag burial and in-filling of pools.

No compelling temporal trends were found for width measurements at gage sites, indicating that the channel adjustments are likely to be early in a full suite of contingent changes that start with bed adjustments before progressing to width adjustments (Schumm, 1984) (**Exhibit 7**). **Appendix F** provides graphs depicting field measurements over time at both specified flow scenarios and at all measured flows and also provides regression analysis statistical test results derived in SigmaPlot.

Observed stage data trends may be the result of the channel self-adjusting to already-occurring changes at the watershed or regional scale that affect flow and/or sediment inputs. Land use changes such as urbanization or agricultural and logging practices may be affecting sediment yield, while increased groundwater pumping or climatic pattern shifts (such as the Atlantic Multidecadal Oscillation (AMO) may be affecting flow. Land use changes and their effects on sediment yield and flow delivery are more difficult to quantify than changes in flow, which can be seen in the long-term flow record. For example, mean and median annual flows for the majority of gage sites throughout the Upper Santa Fe River and Lower Santa Fe River are exhibiting decreasing trends (**Appendix D**). Ichetucknee River sites have a relatively short gage record (less than ten years), which may explain why similar decreasing flow trends were not observed.

If observed stage data trends are a result of already occurring flow reductions, further reductions may adversely impact channel shape and stream/wetland function. For example, further degradation to the streambed can lead to channel entrenchment to the point where the stream is effectively divorced from its floodplain. This can negatively impact riparian wetland function as well as the ability for the river to dissipate energy to the floodplain. Eventually, downcutting will also lead to bank failure and subsequent channel widening (**Exhibit 7**). Aggradation to the streambed, on the other hand, may lead to habitat smothering and increased flooding. Any MFL

program must include monitoring to detect these types of trends, and if trends are detected, appropriate adaptive management actions should be undertaken.

Detected trends, however, may also be misleading. Some may be a result of localized effects that are not indicative of system-wide changes or may be due to measurement errors. An example of a localized effect may be a sediment slug that is working its way through a system and happens to be picked up during measurement readings. Although these localized trends may be difficult to discern, it is important to attempt to rule them out when evaluating potential reasons trends are occurring. Results and discussions specific to each particular river reach are provided below.

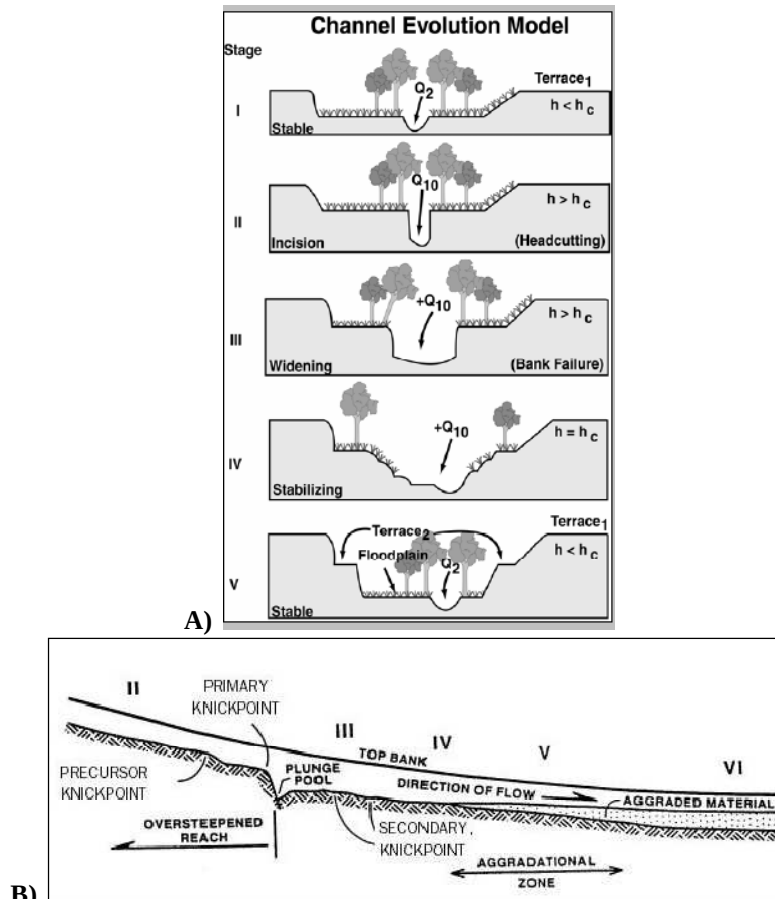
Table 9
Summary of USGS Field Measurement Trends

River	Gage	Flow Selective Criteria	Stage		Width	
			Trend (ft)	p-value	Trend	p-value
Upper Santa Fe	Graham	22 to 33 cfs (25% of Qbkf +/- 20%)	Degrading / Deepening (~1.5 ft since 1958, but evidence of stabilization)	<0.001	No trend	0.902
	Worthington Springs	235 to 353 cfs (25% of Qbkf +/- 20%)	Aggrading / Shallowing (~0.5 ft since 1985)	0.052	No trend	0.492
	O'Leno	162-325 cfs	Cannot determine*	0.013*	Degrading / Widening (~3 ft)*	0.066*
Lower Santa Fe	Hwy 441	168 to 372 cfs (25-50% Qbkf)	Aggrading / Shallowing (~0.5 ft since 1993)	0.047	No trend	0.411
	Ft. White	564 to 846 cfs (50% Qbkf +/- 20%)	Degrading / Deepening (~0.5 ft since 1989)	<0.001	No trend	0.173
	Hildreth	1,031 to 1,547 cfs (25th percentile flow +/- 20%)	No trend	0.333	No trend	0.270
Ichetucknee	Dampier's Landing	205 to 265 cfs (70-90% Qbkf)	No trend	0.729	No trend	0.913
	Hwy 27	229 to 296 cfs (70-90% Qbkf)	Degrading / Deepening (~1 ft since 1932)	0.013	No trend	0.138

Bold values represent statistical significance ($p < 0.05$)

* Measurements recorded using conflicting vertical datums, thus confidence in measurement data is low

Exhibit 7 Conceptual Channel Evolution Model



A) Five stages of CEM; B) Longitudinal profile of five stages (adapted from Schumm et al., 1984)

Upper Santa Fe River

Graham Gage – Stage measurements over time show signs of degradation of up to 1.5 feet over an approximate 50-year period from 1957 through 2007 (**Table 9, Appendix F**). This rather steady degradation period encompasses pre-1970 dry and post-1970 wet AMO periods and also unfolded during a period of steadily declining annual average discharge in this reach from 1958-1997 (**Table 5, Exhibit 3**). More recent measurements suggest that the bed degradation trend may have leveled off; however, this may be due to a sediment slug that has been observed in the vicinity of the gage that is making its way through the system. This degradation trend, in conjunction with the reach's already lower than average overbank flow durations (which also appear to be decreasing over time), suggests that this reach is sensitive to becoming excessively divorced from its floodplain and further withdrawals at or above bankfull thresholds should be approached with extreme caution. This caution also applies to further withdrawals that could reduce the frequency and duration of the above-bankfull thresholds.

While reduced runoff from the watershed may be reducing sediment yield to the stream, it is also important to consider that the causes of bed degradation may reflect land use changes in the watershed which could decrease the amount of sediment entering the system largely irrespective of changes in the runoff regime. Where sediment yields are even more greatly reduced and the remaining discharge is subsequently sediment-starved, it will consequently remove sediment from the bed. Such changes can be the result of a system engaged in a secondary adjustment to improved agricultural or silvicultural practices to manage soil erosion. It could be caused by systematic retrofits to waterbody outlet structures that increase water levels and lead to increased sediment trapping. If the flow reductions are caused by induced recharge from groundwater pumping, this could disproportionately reduce runoff events that can carry eroded soils to the stream valley as well.

Irrespective of anthropogenic causes, it is also possible that the bed is degrading in response to natural causes such as regional base level lowering and a subsequent aggressive natural phase of drainage network rejuvenation. Base level is the land surface elevation or water surface elevation the stream discharges into. When that is lowered, the channels upstream can headcut to a lower elevation, leading to channel bed degradation. For that kind of grade adjustment to occur, either sea level would have to go down or large scale subsidence of at least a couple feet would have to be unfolding in recent decades. These natural causes seem unlikely. Irrespective of the causes of degradation, it is important to recognize that the hydraulic interaction of this reach with its floodplain will be increasingly sensitive should this trend continue.

Worthington Gage – Stage measurements over time show signs of potential aggradation of half a foot since 1985. The aggradation may be local, as the gage is located just downstream of the confluence of the New River where local sediment deposits may occur. Although there were no width trends, it is notable that this reach has a lower than expected width-to-depth ratio based on site specific regional curves (**Appendix C**).

O'Leno Gage – Field measurements were collected at this gage from 1977 to 1991, with a seven year gap from 1982 to 1989. The available data was collected in two different elevational frameworks, and when corrected for using a datum provided by the District, the two sets of stage measurements were still five feet off (**Appendix F**). Therefore, stage over time trends in this reach could not be determined. Width measurements over time indicate a widening trend; however, this is based on a limited number of data points (n=5) thus confidence in this trend is low.

Lower Santa Fe River

Hwy 441 Gage – Stage measurements over time show signs of potential aggradation of half a foot since 1993. Debris from an old bridge was observed just downstream of the Highway 441 bridge and may cause sediments to accumulate in this reach. A limestone shoal is also located on this reach, which may influence sediment accumulation.

Ft. White Gage – Stage measurements over time show potential signs of degradation of up to half a foot since 1989. There are no trends in width measurements over time.

Hildreth Gage – No clear trends of aggradation or degradation were detected when analyzing field measurements. As previously mentioned, this reach of the river is affected by backwater and reverse flows from the Suwannee River as well as boat traffic.

Ichetucknee River

Dampier's Landing Gage – No clear trends of aggradation or degradation were detected when analyzing field measurements.

Hwy 27 Gage – Stage measurements over time show signs of potential degradation of one foot since 1932. The stream may be downcutting due to high velocities (potentially from bridge effects) or it may be downcutting as it meets the base level of the Lower Santa Fe River. This degradation trend, in conjunction with the reach's already low overbank flow durations and possibly losing mean annual discharge, suggests that this reach is sensitive to further flow losses.

4.3 Objective III: Determine which stage of channel evolution each system is in if the system is not stable

AMEC did not observe any systemic evidence of excessive channel instabilities (i.e. bank failures, excessively undercut banks, erosion on interior channel bends or straight sections, knickpoints) during field visits. However, analysis of USGS field measurements (described above) indicates that chronic degradation (deepening) has been occurring in the Upper Santa Fe River at the Graham gage, the Lower Santa Fe River at the Ft. White gage, and the Ichetucknee River at the Highway 27 gage (**Table 9**). These trends suggest that the aforementioned river reaches may be undergoing channel evolution. If the channels are in fact evolving, they would likely fall under the incision phase (Stage II) of Schumm et al.'s (1984) Channel Evolution Model (CEM) (**Exhibit 7**), as trends analysis did not indicate that these systems have also been widening (Stage III) yet.

4.4 Objective IV: Evaluate how adopted MFLs on the Upper Santa Fe River and conceptual MFLs on the Lower Santa Fe River and Ichetucknee River will change the bankfull (or channel forming/maintaining) discharge and how the system will react to change

Adopted and conceptual MFLs allow for higher reductions to occur in flow durations that affect the bankfull discharge (**Table 1**). The bankfull flow is important geomorphically as defined for this study because it represents the breakpoint between erosion (channel formation) and deposition (floodplain formation). Reductions in the bankfull flow are thus likely to affect both channel shape and floodplain building, as described below.

Channel Shape

Channel boundaries are not static and will self-adjust to changes in flow and sediment transport. Adopted and proposed MFLs could reduce the bankfull flow by up to 15%, resulting in predictable changes to bankfull channel dimension (**Tables 1** and **10**). Site specific regional curves relating channel width and depth (obtained from survey data and/or HEC-RAS model cross-sections) to bankfull flow (determined from field indicators) were developed to predict how reductions to the bankfull flow would most likely affect channel shape (**Appendix C**). Based on this analysis, reductions in bankfull flow are expected to cause the bankfull width to become more narrow (by as much as 12 feet) and bankfull mean depth to become only slightly more shallow (**Table 10**). This is because width exhibited a much more sensitive association with bankfull discharge overall than depth for the Upper and Lower Santa Fe River valley sections studied, as evidenced by a greater exponent in its power function equation and higher r-square value (**Appendix C**). Spring runs have more proportional width and depth sensitivities to bankfull discharge than those found on the Upper and Lower Santa Fe Rivers.

As a result, the bankfull wetted perimeter, which is a measure of habitat availability at bankfull flow, will also decrease. **Exhibit 8** shows how bankfull wetted perimeter is predicted to change under various bankfull flow reduction scenarios and indicates that a 15% loss in the bankfull wetted perimeter will not occur until bankfull flow is reduced by 17% in the Upper Santa Fe River and Lower Santa Fe River and 37% in the Ichetucknee River (from current observed and recorded conditions). Wetted perimeter losses are predicted to decrease at a much faster rate with increased flow reductions in the Upper and Lower Santa Fe Rivers than in the Ichetucknee River because bankfull width increases at a faster rate in relation to flow in the Upper and Lower Santa Fe Rivers (**Appendix C**). Wetted perimeter calculations are more sensitive to changes in width, as width is generally much greater than depth in these systems and thus have a greater influence on wetted perimeter calculations.

It is important to note that initial channel shape adjustments may be more likely to occur on the bed (depth) than on the banks (width), as the bed is likely to be more quickly adjustable because its geomorphology has much less interaction with slow-growing woody vegetation like that densely lining the banks. A typical progression may be a period of modest, but rapid aggradation, followed by a period of slower but greater channel narrowing concomitant with encroachment by the forested floodplain edge into the main channel. Sediment yields in Florida watersheds are lower than most national norms, and the open channel is maintained in part from hydraulic root pruning, limiting how far trees can become established and maintain a foothold along the shoreline. As bankfull discharge decreases, near-bank shear stresses are diminished thereby allowing the forest to encroach further into the channel.

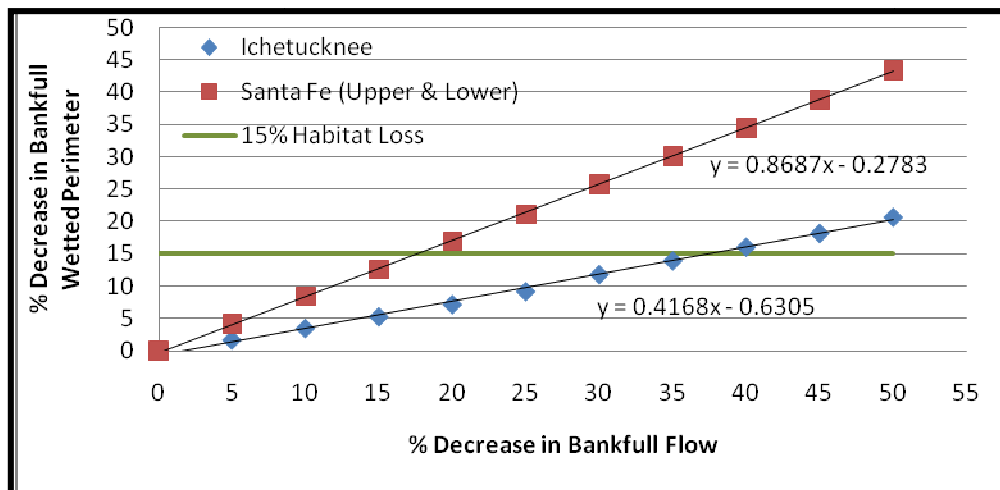
It is also important to note that these results are likely to take decades to fully adjust. For example, AMEC staff has observed conditions on several systems at phosphate mines in Polk, Hillsborough and Hardee Counties where it typically takes reclaimed headwater stream valleys two to three decades to fully-form an equilibrium channel when allowed to do so from natural rainfall and weathering subsequent to contouring of the new valley and its watershed. This gives a good first approximation for what the pace of change in channel width will be. The nominal 25-

year alluvial adjustment period corresponds well with how long it takes newly formed forests to reach a complex, multi-tiered closed canopy structure as well.

Table 10
Predicted Channel Changes

River	Gage	Bankfull Discharge (cfs)		Bankfull Width (ft)		Bankfull Mean Depth (ft)		Bankfull Wetted Perimeter (ft)		% Decrease in Bankfull Wetted Perimeter
		Current	Reduced	Predicted Channel	Adjusted Channel	Predicted Channel	Adjusted Channel	Predicted Channel	Adjusted Channel	
Upper Santa Fe	Graham (15% flow reduction)	109	93	21	18	3.4	3.3	28	25	10
	Worthington (15% flow reduction)	588	500	89	78	4.3	4.2	98	86	12
Lower Santa Fe	Hwy 441 (7% flow reduction)	901	838	129	121	4.5	4.5	138	130	5.7
	Ft. White (7% flow reduction)	1410	1311	190	178	4.8	4.8	199	188	5.8
Ichetucknee	Dampier's Landing (4% flow reduction)	294	282	82	80	3.7	3.7	89	88	1.4
	Hwy 27 (4% flow reduction)	328	315	84	83	3.9	3.8	92	91	1.4

Exhibit 8
Predicted Decrease in Bankfull Wetted Perimeter Under Various Flow Reduction Scenarios



Floodplain Building

Flow reductions at and above bankfull stage thresholds will inevitably decrease the number of days the river overtops its banks and does work (deposition) in the floodplain. Spells analysis comparing overbank events for the existing gage record and for the reduced flow record (applying flow reductions provided in **Table 1** to the existing record) indicates that the number of days per year the flow is overbank will decrease by 10% to 19% (**Table 11, Appendix E**). This number is indicative of the total work that can be done in the floodplain. However, it is unlikely that the full amount of time available for deposition is necessary, especially given that most of the sediment yield will be dispersed to the floodplain earlier rather than later during a flood pulse.

Furthermore, the floodplain can be roughly approximated as a plug-flow reactor with an idealized hydraulic residence time equal to the volume of the floodplain at a given sustained discharge rate divided by the discharge. Doing this using a range of overbank flows at the USGS Graham gage suggests that the average residence times have historically been 1 to 2 hours for a mile length of stream valley. That valley is about 29 miles long between Santa Fe Lake and the New River, giving residence times ranging from about 1 to 2.5 days. That is much lower than the existing average duration of a bankfull event calculated to be 10 days. It is also much lower than the projected future average overbank event duration of 8 days. Because the average overbank event duration remains inherently longer than the idealized hydraulic residence time of the system, as long as the frequency of events is similar, the potential for meaningful work in the floodplain is likely to remain reasonably intact.

Looking more closely at individual events shows that the average number of bankfull events per year will not be significantly reduced by flow reductions (**Table 11**). However, the average duration of individual overbank events will decrease by 4 to 20%, which can be as much as two weeks fewer per year that water will be overbank. Even so, reductions in flow are not expected to significantly influence the ability of the water to drop sediment onto the floodplain, because the frequency of fully-effective events (those in excess of the hydraulic residence times available to the system) seems unlikely to decrease. In other words, the available deposition time will likely still allow for sediments to routinely drop out onto the floodplain.

This analysis presumes that bankfull channel degradation will not progress, altering the stage-discharge relationships in a manner reducing overbank flood frequencies. That assumption may be problematic for the Upper Santa Fe River at Graham and for the Ichetucknee River at Hwy 27, which have already exhibited trends in degradation and lower than typical floodplain flow durations. In the case of the lower Ichetucknee River, the system is entrenched such that the bankfull stage does not represent the floodplain stage very well. Therefore, the bankfull durations reported in **Table 11** for the Hwy 27 Ichetucknee River gage do not represent the historic impacts that have already occurred to that system, which has a total long-term valley flat exceedance of 13% (compared to the bankfull exceedance of 32%). Despite the trend in degradation, the existing bankfull stage and associated discharge for the Upper Santa Fe River at Graham are still consistent with the floodplain entry elevations and the data in **Table 11** can be interpreted accordingly.

Table 11
Spells Analysis of Above Bankfull Events

River	Gage	Average # of Days per Year Above Bankfull			Average # of Above Bankfull Events Per Year			Average Duration of Above Bankfull Events (Days)		
		Existing Flow	Reduced Flow	% Change	Existing Flow	Reduced Flow	% Change	Existing Flow	Reduced Flow	% Change
Upper Santa Fe	Graham	48	39	-19%	4.9	4.6	-7%	10	9	-13%
	Worthington	68	59	-13%	5.0	4.7	-5%	14	13	-9%
Lower Santa Fe	Hwy 441	65	59	-8%	1.9	2.2	12%	26	21	-20%
	Ft. White	143	126	-12%	2.2	2.3	5%	65	54	-16%
Ichetucknee	Dampier's Landing	199	180	-10%	2.2	2.3	5%	90	77	-14%
	Hwy 27	118	100	-16%	2.3	1.9	-19%	51	53	4%

4.5 Objective V: Characterize the sedimentation processes of the riverscape and floodscape both longitudinally and transversely

This section provides an overview of the dominant sediment sources and sorting processes inherent to each section of the river systems included in the study area. Kiefer (2010) determined that spring run geomorphology relied heavily on autochthonous biological sources of sediments while runoff dominated rivers and streams were dominated by inorganic sediments and physical processes. The study area offers a broad array of spring run and runoff geomorphology with extensive mixed regime zones, especially in the Lower Santa Fe River. The two main headwater segments are the Ichetucknee River and the Upper Santa Fe River, both of which feed into different junctions with the Lower Santa Fe River.

Upper Santa Fe River

The Upper Santa Fe River riparian corridor has a complex valley geomorphology with several rapid transitions between unconfined and well-fit valley forms, but it predominantly exists as a well-fit (or confined) valley form, meaning that the outermost riverscape bends meander across the entire valley floor between the adjacent valley hillslopes. The system hydrology regime is dominated by surface water runoff, with flashy hydrology and large wet-season flood pulses. As a result of these flood pulses through a confined valley, the floodplain is a comparatively high-energy system with a dense and complex array of alluvial features including sandy alluvial ridges, chutes with a variety of inorganic sediments (clay, silt, sand) and narrow linear backswamps with fine textured inorganics and some mucky textured soils. This array of vertically and horizontally variably alluvial floodplain features creates a range of hydobiological conditions supporting a diverse array of forest types and plant species in a laterally compact corridor. The riverscape is also quite rough and complex with sandy alluvial features and with some small areas of exposed resistant limestone and stiff clay outcrops. The riverscape is deep with bend pools, sandy shoals or riffles, point bars, lateral bars, over-hanging root-scoured banks, and ample large woody debris which further induces alluvial complexities such as scour pools and debris jams into the channel bed.

Therefore, most of the Upper Santa Fe River fits the high-gradient alluvial floodscape river type (FW-AFS-HG) in Kiefer (2010). These systems are typically found in valleys that are approaching or crossing relict marine escarpments. In this case, the river is approaching the Cody Scarp. Two river segments do not fit the FW-AFS-HG description well. The first is found within the uppermost reaches of the system where the riverscape enters a broad low-gradient valley feature called the Mud Swamp. This part of the valley serves to dissipate energy and does so at a threshold whereby the riverscape takes on a multi-threaded channel form, with an interlaced network of smaller, shallower open channels running roughly parallel through the bottomland swamp. This feature likely serves as an effective sediment trap in an otherwise more effectively transporting corridor. Another exception to the general FW-AFS-HG type occurs in the most downstream reach before the river enters the O'Leno Sink. Here the system best fits a clay gully form (FW-CG). These systems occur where the receiving waterbody punctuates the valley terminus in a manner that creates a local low-lying base level which allows the valley floor to erode to a comparatively low elevation thereby forming a deeply entrenched channel system in a highly confined valley hillslope (Kiefer, 2010). These often occur in areas where a stream crosses the Hawthorn Group formation on its way to a sinkhole, as does the Upper Santa Fe River in this reach. FW-CG systems have limited alluvial interaction with their floodplains and are typically under a combination of alluvial and geologic control in the riverscape.

Overall, the alluvial riverscape and floodscape features of the Upper Santa Fe River are derived from the transport and self-organization of inorganic sediments worked by highly variable fluvial forces. Maintenance of these features, which much of the biological diversity of the corridor depends upon, will require attention to channel forming discharges (mid-flows) as well as the low- and high-flow regimes of the system. It has a temporally variable or flashy hydrology that drives a spatially complex, alluvially-derived, habitat mosaic.

Lower Santa Fe River

The Lower Santa Fe River is maintained by a wide array of fluvial geomorphic processes, making it one of the most complex riparian corridors in Florida. It is also a major river, draining a watershed in excess of 800 square miles in its upper reaches and expanding to more than 1,300 square miles at its confluence with the Suwannee River. The upper reach is fed predominantly from the River Rise where waters sourced from the O'Leno Sink mix with other sources and re-emerge into the valley downgradient of the Cody Scarp. Although it drains more than 800 square miles in this reach, it is receiving a negligible fraction of sediment transport from upstream sources, which are cutoff by the river sink. Therefore, the floodplain has not been extensively re-worked and many of the apparent alluvial features may have a long history or are relictual (relicts of processes no longer active under modern climate, land cover, and sea levels; e.g. formed during the Pleistocene) in the valley. The features tend to be rough and complex with an array of chutes, linear backswamps, valley flats, subtle terraces, and an alluvial ridge. Many of these features have stiff, fine textured inorganic soils and sands. The valley alternates rapidly between confined and unconfined forms.

The main difference between the upper segment and middle segment is a distinct increase in the amount of springs entering the middle riverscape. The middle reach is a well-mixed runoff and spring flow regime. Much of the riverscape's planform is quite straight, punctuated by erratic big looping bends that mirror the valley planform. The riverscape is basically confined within a meandering valley and is clearly under some large degree of underlying bedrock control. This is typical of some karst rivers, which tend to prograde toward sinkholes or follow lineaments.

The middle reach is influenced by backwater effects from the Suwannee River, but these effects are more pronounced in the lowest reach, downstream of the Ichetucknee River. The reach is influenced greatly by inorganic sediments transported from the rest of the Lower Santa Fe River between it and the River Rise, by organic and calcareous sediments transported from the Ichetucknee River, and by the interplay of water levels with the Lower Santa Fe River, Suwannee River, and Ichetucknee River flows which greatly extend overbank events in the lowermost two reaches of the Lower Santa Fe River. This latter effect, in conjunction with the high calcium concentrations in the mixed regime waters, creates a type of allochthonously-derived calcareous sediment source that contributes to the alluvial features in the lowest reach's floodscape and riverscapes. It is allochthonous because it forms from geochemical processes such as precipitation and biochemical processes via gastropods and their shell development. As a result, the riverscape and floodscape form some of their own sediments and then the fluvial forces organize and rework them into alluvial features. These features include shelly-marl on the alluvial ridges and fine-textured calcareous sediments in the backswamps. A unique "whitewash" of fine-textured precipitates coats the cypress trees along the routine flood elevations in the lowest reach. The maintenance of the alluvial features in the Lower Santa Fe River depends not only on maintenance flood pulses from the river itself, but also upon the steady delivery of spring run and spring vent discharges (including the massive influx from the Ichetucknee River) and the interplay of water levels from the Suwannee River downstream. Careful attention should be paid to low, mid and high flow regimes necessary to maintain this suite of characteristics related to sediment sources and transport.

Ichetucknee River

The Ichetucknee River riparian corridor consists of three main longitudinal zones or reaches with distinctly different valley morphologies and gradients as described earlier. Overall, the river is a "great magnitude, deep spring run" in the parlance of the hydrobiogeomorphic (HBG) stream classification system developed for peninsular Florida streams (Kiefer, 2010). These systems generally lack alluvial floodplain features and include a main channel (or riverscape) that gradually meanders through varied hillslope morphologies that can rapidly and repeatedly alternate among large unconfined wetland flats, seepage slopes, and well-adjusted to confining sandy upland bluffs. Floodplain (or floodscape) sediments are typically derived mainly from organic hydric soil development due to high local groundwater tables and shallow flooding. Sometimes colluvial (hillslope) processes also contribute inorganic sediments near the outer floodplain margin. Riverscape sediments consist of calcareous materials derived from snail shells and perhaps chemical precipitation, interlaced with alluvial sands and thick deposits of organic floc (referred to as 'gyttja' by Odum (1957)). Much of the riverscape sediments are therefore of biological derivation from the submerged aquatic vegetation (SAV) and its associated periphyton and gastropod communities. This means that the sediment yields and associated alluvial features

in the main channels of these kinds of systems depend heavily on a combination of bottom-up and top-down processes that can affect primary and secondary productivity and production in SAV communities. This aspect of these systems will be discussed more fully below in **Section 4.8**.

In essence, most great magnitude, deep spring run systems are perennially-wet gullies with largely allochthonous sediment sources of biological origin organized into alluvial features including lateral bars or shelves, shoals, and pools in the floodscape. They can be viewed as “gullies” because their amazingly steady flow regimes offer limited overbank flooding into the floodscape, meaning that the floodscape is not alluvially active and its sediments are derived from organic soil building processes or relict (pre-Holocene) alluvial features. These prototypical characteristics fit the Ichetucknee River quite well, with an added twist created by the substantial water level rises that occur in the Lower Santa Fe River, often in association with backwater effects from the massive Suwannee River, that essentially embay and backwater large areas of the Ichetucknee River’s floodscape. This means that parts of the Ichetucknee River’s floodscape receive sustained pulses of mixed regime waters, enabling the formation of some calcareous sediments in the mid-reaches and some fine-textured inorganics from the Lower Santa Fe River’s alluvial transport in the lower reach of the Ichetucknee River. In other words, all but the uppermost reaches of the Ichetucknee River’s floodscape belong as much to the Lower Santa Fe River as to the Ichetucknee River. Therefore, the complex interplay among the Suwannee River, Lower Santa Fe River, and Ichetucknee River flood stages must be maintained to fully support alluvial floodscape processes in the middle and lower Ichetucknee River segments. Furthermore, the Ichetucknee River receives rare overland flood pulses from the Ichetucknee Trace upstream, generally in response to hurricanes or tropical storms that provide many inches of rain in less than 24 hours (for example, Hurricane Frances delivered about 10 inches of rain that flooded much of the trace in 2004). The Trace is a usually dry paleo-river valley with the potential to carry sporadic inorganic alluvial loads into the upper Ichetucknee River. These are unlikely to comprise a significant part of the sediment budget, but the flood pulses could conceivably rework previously deposited alluvial features from time to time. The lowermost reach has some limestone outcrops and rapids that provide highly resistant, non-alluvial grade controls.

4.6 Objective VI: Identify major grade controls and sensitivities to flow alteration

Most of the total riverscape studied is deformable, and resistant layers are typically mantled by transportable alluvium. However, some limestone shoals occur sporadically on all three rivers, creating hydraulic critical points that offer high degrees of local base level control. This makes most sections of the river unlikely to cut much deeper than present levels and more likely to achieve final adjustments to altered flow or sedimentation regimes by adjusting width. This is consistent with the fact that the site-specific regional curves developed for the Upper and Lower Santa Fe Rivers showed greater sensitivity with width when regressed against bankfull discharge than did depth (**Appendix C**).

4.7 Objective VII: Explore potential effects of groundwater versus surface water withdrawals on channel morphology

Groundwater and surface water withdrawals are likely to affect channel morphology in different ways. Groundwater withdrawals are likely to decrease flow without having a large effect on the sediment yield. Thus a large part of sediment yield would likely be unaffected, which may lead to excess sediment in the system and subsequent channel aggradation. Surface water withdrawals would likely require an impoundment. The District Board has a policy of non-structural flood control; therefore surface water withdrawals are highly unlikely. Impoundments would inevitably alter the flow regime and make it less dynamic. River morphology and ecology are dependent upon a variety of flows, and much research has been done on the detrimental effects of dams. Dams may also lead to an accumulation of sediments at the dam wall, thereby starving downstream reaches of sediment and leading to channel degradation. Therefore, the District's non-structural policy offers an important layer of protection of the systems' fluvial geomorphology.

Groundwater withdrawals could reduce the overall frequency and duration of bankfull events for any of the river segments in the study area. However, the sensitivity of river flow to groundwater withdrawal is likely to vary among the segments because the direct amount of surface water and groundwater interaction varies among them. The Upper Santa Fe River has the least amount of groundwater influence on channel forming discharges of the three segments. The Ichetucknee River has the most, with the Lower Santa Fe River exhibiting an intermediate amount. As a result, the Upper Santa Fe River is flashier and exhibits a comparatively greater number of bankfull events per year, but with fewer cumulative overbank days per year than the Lower Santa Fe River.

The Upper Santa Fe River drains a watershed that was simulated to have about 9 to 18 inches of recharge during drought conditions (Schneider et al., 2008). This suggests that groundwater pumping could have a substantial effect on runoff by creating drier than normal antecedent soil moisture conditions and by increasing storage in wetlands and lakes in that watershed. This could also result in a greater fraction of river discharge being delivered via sources engineered and managed to reduce sediment loads (e.g. municipal wastewater or tailwater from agricultural irrigation) or as baseflow rather than as overland runoff. Larger overland runoff events can generate disproportionately large sediment yields to rivers, versus baseflow or low flow events. Thus the observed pattern of bankfull flow reductions in recent decades with concomitant sediment yield reductions suggested by bed lowering trends at the Graham gauge may be at least indirectly related to groundwater withdrawals affecting the upper basin.

The Lower Santa Fe River and Ichetucknee River receive copious amounts of direct groundwater discharge. Reductions in bankfull discharge frequency and durations can be very directly associated with increases in groundwater pumping in these two basins and their groundwater recharge areas. The Lower Santa Fe may also be experiencing indirect effects similar to those of the Upper Santa Fe River. For example, the Lower Santa Fe River at the Fort White gage has exhibited slight bed lowering concomitant with slight bankfull flow reductions.

4.8 Objective VIII: Relate spring-run channel morphology to biochemical conditions associated with accrual times and nutrient loads that could affect sediment yield and sedimentation

The Ichetucknee River experienced rising levels of dissolved nitrogen concentrations from watershed fertilization for several decades and, although watershed management has reduced the concentrations some in recent years, larger than normal standing crops of periphyton are generated in portions of the spring run. At the same time nutrient concentrations were rising, regional groundwater pumping may have shifted the groundwater basin flow boundary from its historic position northeast of the springshed to the west, effectively shrinking the potential capture zone and reducing the annual average groundwater discharge to the Ichetucknee River by 100 cfs based on one USGS study (Grubbs, 2011).

Recent research on the Ichetucknee River suggests that the excessive algal growth may be related not only to bottom-up process of cultural eutrophication, but may also be due to declines in the top-down process of algal grazing by snails (Evans, 2007; Politano, 2008; Hefferman et al., 2010). The dominant snail species require dissolved oxygen levels associated with higher flow velocities and volumes, and their prospective decline could be related to declines in dissolved oxygen related to the discharge decreases (Dormsjo, 2007). This complex chain of interactions has potential ramifications for MFLs since further discharge declines may affect the grazers beyond any critical thresholds already experienced. The tie to fluvial geomorphology is that these autochthonous biological processes generate major components of the alluvial sediments in spring runs (Kiefer, 2010; Odum, 1957). If the top-down biological processes, notably snail grazing, are in fact a key component limiting periphyton production and shifting some of that to snail shell production, it seems likely that the sediment composition will shift though time and perhaps the overall volume of sediment generated will as well.

Furthermore, the SAV meadows create substantial hydrodynamic quiescent zones and increase the overall friction in the stream channel (Odum, 1957). Any periphyton or snail shells that slough off into these meadows are likely to be more effectively captured or have comparatively long spiral distances through the system. This means the meadows are important geomorphic agents in at least two ways: 1) they provide the major substrates upon which periphyton colonies and snail communities naturally occur thereby functioning as sediment sources, and 2) they trap and probably also sequester sediments at much higher efficiencies than the open water parts of the in-stream system, thereby serving as sediment sorting agents. The SAV meadows are known to decline under pressure from excessive algal growth. Gross reductions of these meadows would almost assuredly alter the fluvial forces, sediment production, and sediment transport characteristics of the run in ways that would lead to potential threshold differences in in-stream habitat geomorphology and substrate composition.

Further changes to any of the bottom-up characteristics (e.g. nutrients or hydrology) that alter algal and snail production will have unintended and, based on the what we know today, uncertain consequences on the geomorphology and biology of the Ichetucknee River and perhaps some aspects of the most-downstream reach of the Lower Santa Fe River. For these reasons, it is safe to assume that any further reductions to flow in the Ichetucknee River constitute an experiment with complex biologically-driven sedimentation feedback loops, which we are only just beginning to explore, let alone fully understand. It is difficult to justify further flow reductions until more is known about the sensitivity of the system and its critical thresholds for stepped changes.

5.0 SUMMARY AND RECOMMENDATIONS

Chapter 373.042, F.S. allows the District to protect a wide variety of water resource values from significant harm. Some of these values are more directly dependant on channel maintenance discharges than others, with the most applicable being sediment loads, a fundamentally important value typically lacking very much attention in Florida's riverine MFLs. The reason for this importance is that rivers are conduits not only for water, but also sediment and achieve their equilibrium dimensions and many key habitat features in response to balancing the transport of both media. Shifts in sediment load and hydrology are inter-related and the channel adjusts its boundaries in size and shape to accommodate sustained changes in both (Lane, 1955). This is a well-documented and fundamental axiom in the field of applied fluvial geomorphology that applies to perennial streams under a wide variety of sediment loads and hydrologic regimes around the globe (Leopold, et al., 1964; Schumm, 1977; Rosgen, 1996; Knighton, 1998).

Alluvial features are formed by sediment loads being worked and distributed by fluvial forces into a variety of geomorphic facets, including sandy riffles, point bars, and lateral bars; pools; overhanging banks; sandy natural levees or ridges along the channel margin; valley flats and linear backswamps with fine textured sediments on the valley floor; chutes or secondary channels coursing through the floodplain; abandoned meanders or oxbow lakes; etc. These features provide necessary conditions for habitat and associated biodiversity throughout the riparian corridor (Gordon et al., 2004; Thorp et al., 2008; Allan and Castillo, 2007). This means that preventing significant harm associated with reductions in sediment transport will also help prevent long term declines related to alluvial habitat formation and maintenance important to fish and wildlife habitats, navigation, and recreation values.

Florida streams have comparatively low sediment yields from their watersheds versus those of the rest of North America, but because most of the available sediments are sand or other readily transportable materials, alluvial habitats are common and important features of the vast majority of stream types across the state (Kiefer, 2010). In fact, the number and characteristics of alluvial features were important for distinguishing the 15 types of streams recognized by Kiefer (2010) in peninsular Florida. Florida stream types occur along an increasing gradient of alluvial habitat complexity associated with increased energy and stream power regimes related to watershed size, soil drainage characteristics affecting groundwater versus runoff discharge, and longitudinal valley slope. This study of the Upper Santa Fe River, Lower Santa Fe River, and Ichetucknee River systems provides a framework for why attention to fluvial geomorphology is likely to be beneficial (perhaps even essential) to MFL objectives. It also provides a relatively simple method for quantifying the controlling discharge, and discussion of two methods to prevent significant harm from alterations to the channel maintenance discharge regime.

5.1 Geomorphic Sensitivity to Adopted and Hypothetical Flow Reductions by Reach

For most reaches studied, AMEC was able to use a combination of field indicators, long term daily flow records, and HEC-RAS modeling to calculate bankfull discharge rates associated with dominant channel-maintenance functions. The effects of reducing such discharge are a function of the amount of flow reduction and the nature of the geomorphic controls at each reach. In general, we can expect the channels throughout most of the Upper and Lower Santa Fe River to be more sensitive to flow reductions causing adjustments in width than depth based on regression analysis.

That analysis presumes the region will retain its predominantly rural watershed characteristics. Threshold shifts can be expected that would render the technique relatively unreliable once the watersheds become about 20% urbanized. The Ichetucknee River will likely have a complex reaction that is more difficult to predict because increased eutrophication may alter sediment production and emerging evidence exists suggesting that the trophic status may interact with flow reductions in biologically complicated ways. This section summarizes key findings and suggestions for protecting the fluvial geomorphic values of each system typically regulated by an MFL Rule.

- Effects of reducing bankfull flow are a function of the amount of reduction and the nature of geomorphic controls at each reach (i.e. alluvial versus geologic)
- In general, channels throughout the Upper and Lower Santa Fe River are expected to adjust width more sensitively than depth

Upper Santa Fe River

Santa Fe Lake to New River - This system is vulnerable to further flow reductions, in part, because it has apparent multi-decadal trends in declining annual average discharge, a further degrading bed (1.5 feet in 50 years) in an already naturally deep channel system, and a multi-decadal declining trend in the duration of overbank events. The existing annual bankfull exceedances averaged only 8% in 2010 and 6% from 1988-1997 versus 21% from 1958-1967 (**Table 5**). Existing exceedances appear to be at the low end of the range for normal Florida blackwater streams, which spanned 7% to 48% with a mean of 24% (n = 15) in Kiefer's (2010) study. Further reductions could risk the maintenance of in-stream and floodplain alluvial habitats. AMEC did not examine the potential hydraulic and hydroperiod effects on floodplain vegetation, but this system seems to warrant a detailed quantification of those effects as well.

The adopted MFL for the Upper Santa Fe River allows for up to a 15% reduction in the flow quantities encompassing bankfull discharge. Such a reduction would allow the channel to ultimately shrink by about 3 feet in width, reducing the bankfull wetted perimeter by approximately 10%. The adopted MFL was based on critical low-flows occurring at discharge quantities much lower than bankfull discharge. The low-flow analyses conducted in support of that MFL assume stable (non-trended) channel geomorphology. It is not certain that the predicted modest reductions in channel size would effectively invalidate that underlying assumption, but it is recommended that physical habitat modeling, wetted perimeter inflections, and fish passage characteristics be re-examined for potential sensitivity to that level of channel size reduction. It seems feasible that if significant harm was defined by an inflection in bankfull wetted perimeter, or a 15% reduction in the availability of suitable habitat conditions that even a modest reduction in channel size over time could change the hydraulic geometry such that critical low-flow thresholds would necessarily have to be re-defined.

Perhaps more importantly, AMEC recommends that the mid- and high-flow MFLs be re-visited for the Upper Santa Fe River. Bankfull discharge is currently 109 cfs at the Graham gage and it occurs with sufficient cumulative duration to qualify as either a mid- or high-flow depending on what exceedance threshold is used to define such ranges. Normally, bankfull exceedances are in excess of 10% and therefore could be viewed as a critical mid-flow quantity necessary to maintain channel geometry and alluvial habitats. Floodplain maintenance requires higher (overbank) flows and it seems probable that high flow regimes protective of organic soils and hydric vegetation would also be protective of alluvial floodplain maintenance events, as these flows would extend into the floodplain and likely do work in the floodplain. However, further research is needed to determine the duration necessary for an overbank event to conduct meaningful alluvial work. Thus this assumption should not be left untested, and maintenance of an alluvially-viable high-flow regime should be verified after setting the hydroperiod-based criteria for high flows.

- Multi-decadal trends in decreasing annual average discharge and bankfull discharge duration
- Degrading bed (1.5 feet in 50 years)
- 15% reduction in bankfull flow predicted to decrease bankfull wetted perimeter by 10%
- Bankfull discharge is currently 109 cfs at Graham gage
- Recommend revisiting mid- and high-flow MFLs

New River to Olustee Creek - This reach has not experienced the same kind of long-term bankfull duration declines or channel entrenchment apparent upstream. This suggests that the Upper Santa Fe River reach draining Santa Fe Lake is experiencing different temporal trends than that of the New River watershed. Differences in these watersheds, especially their hydrogeology, water resource management history, and land use histories may be worth exploring to determine why the Santa Fe Lake reach trends differ from those downstream of the New River and may provide valuable information for more robustly protecting or restoring the uppermost reach of the Upper Santa Fe River's hydrobiogeomorphology.

The adopted MFL's allowable 15% reduction in bankfull discharge would allow the channel to ultimately shrink by about 11 feet in width, reducing the bankfull wetted perimeter by approximately 12% in the vicinity of the Worthington gage. This appears to warrant the same kinds of low-flow re-examinations recommended for the upper reach.

Perhaps more importantly, AMEC recommends that the mid- and high-flow MFLs be re-visited for this reach of the Upper Santa Fe River. Bankfull discharge is currently 588 cfs at the Worthington gage and it occurs with sufficient cumulative duration to qualify as a mid-flow quantity necessary to maintain channel geometry and alluvial habitats. Floodplain maintenance requires higher (overbank) flows and it seems probable that high flow regimes protective of organic soils and hydric vegetation would also be protective of alluvial floodplain maintenance events, as these flows would extend into the floodplain and likely do work in the floodplain. However, further research is needed to determine the duration necessary for an overbank event to conduct meaningful alluvial work. Thus this assumption should not be left untested, and maintenance of an alluvially-viable high-flow regime should be verified after setting the hydroperiod-based criteria for high flows.

In summary:

- 15% reduction in bankfull flow predicted to decrease bankfull wetted perimeter by 12%
- Bankfull discharge is currently 588 cfs at Worthington Springs gage
- Recommend revisiting mid- and high-flow MFLs

Olustee Creek to River Sink - This section of the river is dominated by non-alluvial geologic controls and bankfull discharge could not be reliably ascertained using field indicators as in the other reaches. Although less dominant, alluvial features are present. Conceivably, the hydraulic conductivity of the river sink's inlet could be sensitive to sediment loads brought toward the sink by the river. As long as sufficient protection to channel and floodplain maintaining discharges are provided from upstream sources, this reach should be stable and in good geomorphic condition. In support of that objective, it might be prudent to establish a channel maintenance MFL for Olustee Creek, which is a major tributary to this reach of the Upper Santa Fe River and presumably is a major source of sediment transport to the reach.

In summary:

- Reach dominated by non-alluvial geologic control
- Not likely sensitive to bankfull flow reductions, though may be prudent to establish MFL protecting bankfull flow in Olustee Creek

Lower Santa Fe River

River Rise to Highway 27 Gage - No MFLs have been set for the Lower Santa Fe River. Therefore, any future flow reductions AMEC considered in this reach are purely hypothetical. An MFL allowing a 7% reduction in bankfull discharge would allow the channel to ultimately shrink by about 8 feet in width, reducing the bankfull wetted perimeter by approximately 6% in the vicinity of the Highway 441 gage. This appears to warrant the same kinds of low-flow examinations recommended for the upper reach.

AMEC also recommends that mid- and high-flow MFLs be established for this reach of the Lower Santa Fe River to preserve the riverscape and floodscape alluvial maintenance discharge regimes. Bankfull discharge is currently 901 cfs at the Highway 441 gage and it occurs with sufficient cumulative duration to qualify as a mid-flow quantity necessary to maintain channel geometry and alluvial habitats. Floodplain maintenance requires higher (overbank) flows and it seems probable that high flow regimes protective of organic soils and hydric vegetation would also be protective of alluvial floodplain maintenance events, as these flows would extend into the floodplain and likely do work in the floodplain. However, further research is needed to determine the duration necessary for an overbank event to conduct meaningful alluvial work. Thus this assumption should not be left untested, and maintenance of an alluvially-viable high-flow regime should be verified after setting the hydroperiod-based criteria for high flows.

This mixed-regime system is part of a small population of such river types in Florida, each likely to have unique characteristics dependent upon their variable degree of geologic versus alluvial control and the relative amounts of spring versus runoff discharge. It seems unlikely that general or prototypical conditions lending themselves to regional curves can be derived for such streams and it also seems unlikely that baseline conditions for degraded systems could be derived by comparing them to one another in a space-for-time replacement approach. What is clear is that this reach of the Lower Santa Fe River is currently exhibiting a small frequency of bankfull events per year (average 2.4 per annum) and that this is 3 to 10 times less frequent than most Florida blackwater rivers. This could very well be a natural state of affairs because the mixed flow regime's variability is greatly dampened by the steady input of groundwater discharge from springs and the attenuating effects of the discharge working its way through underground conduits between the river sink and river rise. The result is fewer bankfull events, but these occur with moderately long durations averaging about 1 month per event. The small frequency of these events makes each one valuable to the maintenance of the system's geomorphology, and it would be most appropriate to focus on maintaining the number of events and assuring that they are of similar duration to existing conditions.

In summary:

- 7% reduction in bankfull flow predicted to decrease bankfull wetted perimeter by 6%
- Bankfull discharge is currently 901 cfs at Hwy 441 gage
- Recommend setting mid- and high-flow MFLs, possibly focusing on maintaining the number of bankfull events

Highway 27 Gage to Ichetucknee River - This reach picks up an even greater amount of spring flow, as well as runoff contributing area than the upstream reach and the bankfull discharge of this mixed-regime segment of the river is 1,410 cfs at the Fort White gage. Average annual bankfull event frequency remains similar to the upstream reach at 2.2 times per annum, but the average bankfull duration more than doubles, averaging about 2.5 months per event. This increase in overbank duration is likely due to increased baseflow combined with backwater effects from the Suwannee River. A 7% hypothetical reduction in bankfull discharge at this location would reduce channel width by about 12 feet and wetted perimeter at bankfull conditions would decline by about 6%. As with the other reaches in the study it is recommended to take this kind of reduction into account during low-flow investigations. **Exhibit 8** provides a relationship between prospective bankfull flow reductions and channel dimension. Channel maintenance will rely on protecting the infrequent bankfull events and their typical range of long pulse durations as well as establishing a high-flow MFL that protects the potential for alluvial work in the floodplain, as with other reaches previously discussed.

In summary:

- 7% reduction in bankfull flow predicted to decrease bankfull wetted perimeter by 6%
- Bankfull discharge is currently 1,410 cfs at Fort White gage
- Recommend setting mid- and high-flow MFLs, possibly focusing on maintaining the number of bankfull events

Ichetucknee River to Suwannee River - Field indicators of bankfull discharge were greatly confounded by backwater effects from the Suwannee River for this reach. However, a site specific regional curve was developed for the Upper and Lower Santa Fe Rivers relating bankfull discharge to drainage area (**Exhibit 1**). Use of this regression suggests a tendency for the bankfull discharge at Hildreth to be approximately 1,890 cfs. This quantity should serve as a good channel maintenance flow to use for this reach. Floodplain maintenance requires attention to the interplay between Suwannee River water levels with the Lower Santa Fe River's range of over-bank discharge conditions. It also requires attention to the quality of water, especially that sourced by springs and spring runs to maintain allochthonous sources of biogeochemical sediment production rather unique to this river reach.

In summary:

- Backwater effects from Suwannee River
- Bankfull discharge is currently 1,890 at Hildreth gage

Ichetucknee River

Head Spring to Grassy Flats - This reach is not strongly alluvial, but has important sources of biologically-derived internal sediment loads that are worked into alluvial features by the sustained discharge and its hydraulic interaction with SAV meadows, woody debris, and limestone outcroppings. This reach is probably the most sensitive portion of the Ichetucknee River to the previously described interactions among nutrients, discharge, periphyton and grazers because it is the lowest discharge reach and the most likely to shrink at thresholds which could change canopy closure at thresholds likely to reduce SAV meadows. These interactions drive sediment production and characteristics and are likely altered versus pre-disturbance conditions by cultural eutrophication. In other words, it is probably less informative to use regional curves to predict channel dimension adjustments as single-variate associates of discharge, because the nutrient enrichment has altered sediment yields and these yields are likely to be a differential function of discharge via interactions with the grazer communities.

In summary:

- Reach sensitive to interactions among nutrients, discharge, periphyton, and grazers
- Flow reductions could cause channel dimension reductions susceptible to reaching thresholds that could decrease canopy closure and decrease SAV meadows

Grassy Flats to Power Lines - This reach forms the recreational core of one of the most visited state parks in Florida, and it represents one of the largest spring run rivers in the state. Bankfull discharge is currently 294 cfs at the Dampier's Landing gage, and it consists of 2 or 3 long sustained pulses that cumulatively occur for about half the year during most years. Overbank stages are typically controlled by backwater conditions in the Lower Santa Fe River. A hypothetical 4% reduction in bankfull discharge would have almost non-measurable long-term effect on overall channel dimension, perhaps about 2 feet in width at Dampier's Landing, representing about a 1% change in wetted perimeter. Under this threshold of change, it is probably safe to conduct low-flow assessments relying upon no trend in hydraulic geometry with time. It is important to protect bankfull discharge as a mid-flow regime control on channel

maintenance and in fact, it may be necessary to work to recover some of the apparent reduction in flow that has already occurred. High-flow pulses from the Ichetucknee River are probably not important to floodplain geomorphology, probably being trumped by backwater effects from the Lower Santa Fe River.

Complex hydrobiochemical interactions drive sediment production and characteristics and are likely altered versus pre-disturbance conditions by cultural eutrophication. In other words, although AMEC explored the effects of 4% bankfull reductions using regressions, it is probably less informative to use such regional curves to predict channel dimension adjustments as single-variate associates of discharge for this reach because the nutrient enrichment has altered sediment yields and these yields are likely to be a differential function of discharge via interactions with the grazer communities. More research is necessary, so the best available information warrants a cautious approach to allowing any further reductions in channel maintaining discharge frequencies or duration.

In summary:

- 4% reduction in bankfull flow predicted to have almost non-measurable effect on channel dimension
- Bankfull discharge is currently 294 at Dampier's Landing gage
- Recommend setting mid-flow MFL to protect bankfull flow
- High-flow pulses from Ichetucknee River probably not as important as backwater effects from the Lower Santa Fe River for floodplain maintenance
- Complex hydrobiochemical interactions require further research

Power Lines to Lower Santa Fe River - This reach has a greater degree of geologic control than the upstream reach, but alluvial features are present. Bankfull discharge is currently 328 cfs at the Hildreth gage, and it consists of 2 or 3 long sustained pulses that cumulatively occur for about one-third of the year during most years. Overbank stages are typically controlled by backwater conditions in the Lower Santa Fe River. A hypothetical 4% reduction in bankfull discharge would have almost non-measurable long-term effect on overall channel dimension, perhaps about 1 foot in width at Highway 27, representing about a 1% change in wetted perimeter. Under this threshold of change, it is probably safe to conduct low-flow assessments relying upon no trend in hydraulic geometry with time. It is important to protect bankfull discharge as a mid-flow regime control on channel maintenance and in fact, it may be necessary to work to recover some of the apparent reduction in flow that has already occurred. High-flow pulses from the Ichetucknee River are probably not important to floodplain geomorphology, probably being trumped by backwater effects from the Lower Santa Fe River.

Complex hydrobiochemical interactions drive sediment production and characteristics and are likely frameshifted versus pre-disturbance conditions by cultural eutrophication. In other words, although AMEC explored the effects of 4% bankfull reductions using regressions, it is probably less informative to use such regional curves to predict channel dimension adjustments as monotypic associates of discharge for this reach because the nutrient enrichment has altered sediment yields and these yields are likely to be a differential function of discharge via interactions with the grazer communities. More research is necessary, so the best available

information warrants a cautious approach to allowing any further reductions in channel maintaining discharge frequencies or duration.

In summary:

- Reach under greater degree of geologic control
- 4% reduction in bankfull flow predicted to have almost non-measurable effect on channel dimension
- Bankfull discharge is currently 328 at Hwy 27 gage
- Recommend setting mid-flow MFL to protect bankfull flow
- High-flow pulses from Ichetucknee River probably not as important as backwater effects from the Lower Santa Fe River for floodplain maintenance
- Complex hydrobiochemical interactions require further research

5.2 General Approaches for Preventing Adverse Effects Related to Channel Maintenance Flow Reductions

The equilibrium approach assumes an incremental biological response to an incremental adjustment in discharge. This is the approach typically taken by the Southwest Florida Water Management District (SWFWMD) when assessing hydrobiological aspects of river MFLs (Munson et al., 2005). Equilibrium approaches are often characterized using a summary expression of the flow regime and proposed alterations to it using period of record flow duration curves (FDC). The main advantage of the equilibrium approach is that it is generally straightforward in its derivation and the information necessary to calculate the effects is either readily available or straightforward to develop. The biggest disadvantage of the approach is that it requires the project team to determine what level of the modeled incremental change constitutes significant harm. By precedent, 15% is often deemed an acceptable threshold. AMEC is unaware of any scientific basis that could be used to justify a 15% reduction in channel dimension as a result of diminishing channel maintenance flows. Another disadvantage is that FDCs provide period of record summary statistics that lose potentially valuable information regarding the importance of the duration of individual events. For example, FDCs represent 90 one-day events the same way as one 90-day long event. For a macroinvertebrate with a 90-day aquatic life cycle requirement, a 15% reduction will have no effect in the former case because the species is already precluded, and it will provide significant harm (extirpation) in the latter. The effect is not incremental. It is either no harm or significant harm.

The event approach is more nuanced, recognizing that not all measurable changes in hydrology will result in subsequent changes to the biology or physical resource values of the system. This is often a valid assumption for riverine systems which are formed and maintained by combinations of frequent to infrequent events providing pulsed disturbances that structure the ecology of the system over a period of decades. Five aspects of these pulsed disturbances matter: magnitude, duration, frequency, rate-of-change, and seasonality (Poff, 1997). Three of these (magnitude, duration and frequency) are likely to be affected by most Florida water withdrawal systems while rate-of-change and seasonality are generally only concerns for large in-line dams not common in Florida use (Neuabauer et al., 2008).

The concept is to define a functional event or pulsed disturbance based on critical thresholds in the magnitude and duration of the discharge necessary to support a specific biological or physical component of the system. For example, upland trees may begin to encroach into a wetland during a prolonged natural drought, but are routinely killed whenever a foot of water occurs for a 45 day period, which is not lethal to the wetland species. Once the critical event has been defined, based on magnitude and duration; a long-term frequency can be established based on the recovery time of the component. In the case of the upland trees it is important to assure that they do not gain a reproductive advantage, so the long-term frequency of the event needs to be greater than the time it takes the species to reach reproductive age (e.g. 7 years). The MFL is set to achieve preventing a significant harm result by managing the frequency of the functional event. In other words, the new flow regime must maintain a long term return interval of the critical event that is shorter than the time would take for a harmful outcome to occur. This approach is typically favored by the St. Johns River Water Management District (SJRWMD) and is formulated by defining events based on a combination of magnitude, duration, and frequency thresholds known to be necessary to support the biological communities of greatest interest (Neubauer et al., 2008). The primary advantage of this approach is that it is aimed squarely at determining a condition by which only either no harm or significant harm conditions will exist. The biggest disadvantage is that it is comparatively complex in its derivation, requiring knowledge of event magnitude, event duration, and return interval thresholds that are not always available.

Both equilibrium (SWFWMD approach) and event (SJRWMD approach) approaches can be readily adapted for protecting resource values related to channel maintaining discharges. The regression methods taken for this report followed an equilibrium approach based on the best available and readily developable information. In general, equilibrium approaches make great screening tools for identifying potential problems and for arriving at order-of-magnitude estimates of trended changes. We observed potentially undesirable outcomes in some of the reaches using the equilibrium approach and that is part of the reason we further investigated aspects of the system using spells analysis in the RAP software, which is more akin to an event approach. The methods are not mutually exclusive, and as our preliminary assessment shows, they can be used in a complimentary manner.

It is important to recognize that bankfull channel maintenance concepts focus on a single threshold and risk neglecting the fact that a wide variety of flows above and below bankfull discharge contribute to the fluvial form of the main channel (riverscape) and that flows above bankfull are clearly necessary to maintain the alluvial floodplain (floodscape). The good news is that this risk is generally mitigated by riverine MFLs in Florida because they typically have focused on multiple flow thresholds, almost always including flows less than bankfull to protect resources associated with availability of suitable in-stream habitat for particular aquatic fauna, and more generic hydraulic habitat considerations related to wetted perimeter and fish passage. Critical discharges above bankfull also are routinely targeted to maintain hydroperiods necessary for wetland communities in the floodscape. Therefore, discharges straddling channel maintenance flows are typically well-represented, but the channel maintenance discharge has seldom been explicitly targeted itself.

AMEC recommends using equilibrium approaches as a screening tool and, when the District determines those results warrant further investigation, using an event approach to actually set the MFL requirement. This will require further research to develop meaningful channel forming event duration and frequency thresholds though.

In summary:

- Equilibrium approach (SWFWMD) based on proposing alterations to a summary expression of the flow regime (such as the flow duration curve); method is straightforward, but non-scientific basis for choosing thresholds and ignores duration of individual events
- Event approach (SJRWMD) based on critical thresholds in magnitude and duration of discharge known to affect biological communities, but method is complex and requires knowledge not always available
- Approaches are not mutually exclusive and both were used in the geomorphic study (i.e. regression methods = equilibrium, spells analysis = event)
- Recommend using equilibrium approach as a screening tool and event approach to set MFL

5.3 Future Research

Determine Minimum Durations and Frequencies for Defining Channel and Floodplain Maintenance Events

AMEC recommends this line of research because it would facilitate the development of MFLs that target no impact to channel geomorphology, while allowing for optimal withdrawals to occur during near-bankfull events. Analytical and statistical approaches could be engaged depending on schedules, budgets, and data availability. Once event duration and frequency thresholds are known, they could be applied to a wide range of river types to maximize allowable withdrawals without causing harm and without fear of violating traditional low- and mid-flow MFL investigations requiring an assumption of a non-trended deformation in channel dimension or alluvial habitat types. Separate thresholds will necessarily be determined for the riverscape and the floodscape.

Develop Sediment Rating Curves for Florida Rivers

One weakness of using bankfull discharge as a single channel-maintenance flow is that it is an oversimplification that may preclude the development of more desirable water supply alternatives that would still be protective of channel dimension and pattern. Discharges larger and smaller than bankfull can conduct much meaningful work on channels, especially those with highly mobile sand beds. It is conceivable that reductions in bankfull discharge could be offset by increasing the frequency of overbank events or cumulative duration of events somewhat less than bankfull discharge. Such effects can be tested by developing effective discharge curves and cumulative density diagrams for sediment transport for the existing versus proposed flow regimes. To do so, it is necessary to have sediment rating curves relating discharge to sediment transport.

This could be conducted by taking sediment transport measurements (bed material load equal to bedload plus suspended sediments) over a range of discharges in various reaches across the study area. This is generally an expensive, multi-year monitoring and laboratory research endeavor, typically tackled by federal organizations such as the USGS, BLM, or USFS. It may be of greater overall utility for agencies to pool resources to conduct a series of such studies across a variety of Florida river types and use those curves to develop dimensionless sediment rating curves that could be used to calibrate site-specific models, applicable to rivers where site-specific rating curves have not been developed.

Determine Critical Discharge/Velocity Thresholds for SAV Periphyton Communities and Their Grazers in the Ichetucknee Spring Run

We simply do not know enough about these relationships to adequately predict biological and associate geomorphic outcomes. What are the critical hydrodynamic thresholds to maintain snail populations at levels sufficient to provide top-down controls on periphyton? How much periphyton cover can an SAV meadow take before declining in aerial extent? An important corollary to this line of research may be the determination of the maintenance components necessary for the protection of the Ichetucknee siltsnail shoal near Coffee Spring.

Determine Causes of Long-Term Trends in Annual Average Flow Reductions and Bed Degradation in the Upper Santa Fe River at Graham

AMEC did not uncover much related information shedding light on why this reach appears to be experiencing long-term, sustained trends in annual flow volume reduction, bankfull flow duration, and bed elevation. Further watershed analysis is necessary to identify the causes of these potentially degrading conditions, and to determine ways to arrest or reverse them.

6.0 **GLOSSARY**

Aggradation – An increase in land elevation due to the deposition of sediment. Aggradation occurs in areas in which the supply of sediment is greater than the amount of material that the system is able to transport. Channel aggradation can occur in the form of shallowing (sediment accumulating on the stream bed) or narrowing (sediment accumulating on stream banks).

Alluvial – Soil or sediment which has been eroded, reshaped, and/or deposited by water/fluvial forces.

Allochthonous – Found in a place other than where they and their constituents were formed. The sediment in the Ichetucknee River is allochthonous because it is derived from geochemical processes such as precipitation and biochemical processes via gastropods and their shell development.

Bankfull discharge/flow – The flow that fills a stable alluvial channel to the elevation of the active floodplain; representing the breakpoint between forces of erosion (the open channel) and deposition (the alluvial floodplain). It is often referred to as the most effective streamflow for moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphological characteristics of channels (Dunne & Leopold, 1978).

Base Level - The land surface elevation or water surface elevation a stream discharges to.

Channel Evolution Model – Channels adjust to changes in their hydrology and sediment load. Shcumm et al. (1984) offers a model describing the various stages of channel evolution (**Exhibit 7**). The first stage of channel evolution in response to changes in the watershed involves channel incision and headcutting, generally associated with a knickpoint. Once the channel becomes too entrenched, bank failure will occur and the channel will widen. It will then develop a new floodplain as it stabilizes to its new hydrologic regime.

Colluvial – Soil or sediment accumulated through the action of gravity at the base of a cliff or slope, rather than through stream deposition.

Confined valley/floodplain – Confined valleys occur when streams have valley sides or hillslopes that are closer together and that exhibit greater lateral relief. This valley geomorphology provides a more U-shaped cross-section which at least partially confines the migration path of the open channel. In other words, the meander beltwidth of the channel is as wide as the valley bottom, with its shoreline frequently abutting the outer portion of the valley toe (**Exhibit 9**). This means that the riverscape has direct interaction with upland hillslope as well as its flat wetland bottomlands. These valleys can be associated with high-energy systems, so the alluvial floodpain features tend to based on heavier materials (e.g. sand levees) and scour (e.g. chutes and secondary channels) as opposed to finely textured sediments and depositionally driven features (e.g. oxbow swamps).

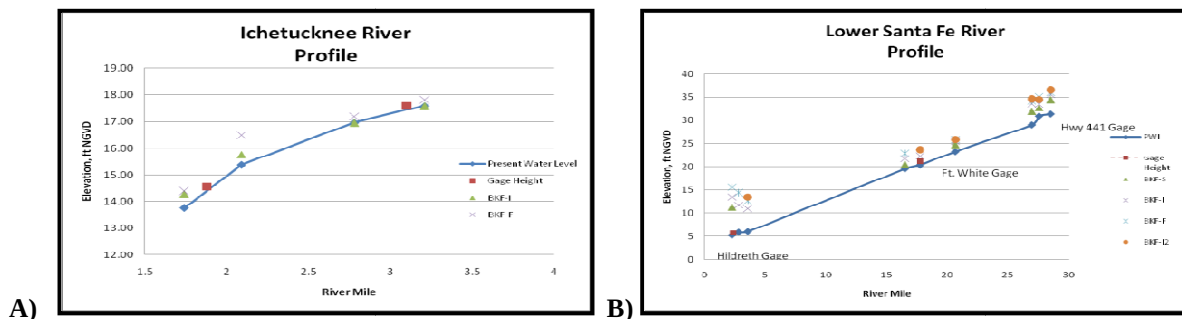
Exhibit 9 Confined Valley



A) Cross-section view of a confined valley; B) Photograph of an upland unconfined valley along the Upper Santa Fe River; C) Planform view of a confined valley

Concave/Convex river profile – Rivers generally exhibit an overall concave profile as they meet their base level (**Exhibit 10A**); a convex shape (**Exhibit 10B**) indicates that the river has a greater slope than the upstream reach, suggesting the presence of grade control via resistant rock strata close to the land surface that has retarded channel downcutting.

Exhibit 10 Convex versus Concave River Profile



A) Convex river profile from the Ichetucknee River; B) Concave river profile from the Lower Santa Fe River

Degradation - The decrease in land elevation due to the erosion of sediment. Degradation occurs in areas in which the supply of sediment is less than the amount of material that the system is able to transport. Channel degradation can occur in the form of deepening (sediment eroding/downcutting from stream beds) or widening (sediment eroding from stream banks).

Entrenchment/incision – This describes the degree of vertical containment of a channel within its floodplain. When a channel becomes too entrenched, it becomes effectively divorced from its floodplain, with the majority of flows being carried within the open channel rather than being dissipated throughout the floodplain.

Fluvial geomorphology – The study of how water shapes the land.

Headcut - When base level is lowered, the channel upstream can headcut to a lower elevation, whereby the stream erodes alluvial in an upstream direction. Headcutting of alluvium is generally a form of grade adjustment that can be quite sensitive to changing flow regimes and generally leads to channel bed degradation.

Inflection – A change or break in slope of the bank is a common bankfull indicator in Florida streams (BKF-I). In high-energy confined valley systems, such as the Upper Santa Fe River, two sets of inflection points can often be found. (**Exhibit 11**)

Exhibit 11
Inflection and Scour Line



Knickpoint – A location in a channel where a sharp change in channel slope occurs, resulting from differential rates of erosion above and below the knickpoint (**Exhibit 7**). Differential rates of erosion can occur from a change in the lithology of the river channel or due to a channel evolving to changes in its watershed (i.e. base level lowering, changes in hydrology and/or sediment load). Knickpoints often migrate in an upstream direction (headcutting) as the stream attempts to create a graded profile. No knickpoints were observed within the study area.

Meander belt width – The width of the valley through which a stream meanders as bends laterally migrate over long time frames. This can be viewed as the “wobble room” for the stream. (**Exhibit 12**)

Exhibit 12
Meander Belt Width



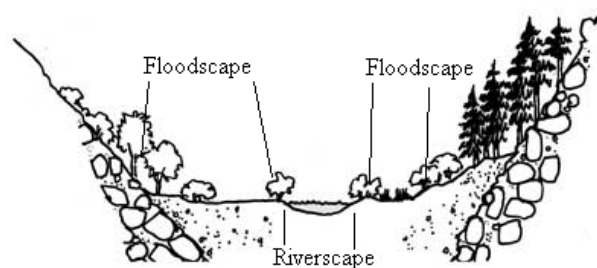
Multi-threaded – A stream where flow is distributed among multiple channels (versus a single channel). The term multi-threaded is preferred for Florida streams because they are inherently stable channel forms occupying lower-gradient valleys with substantially less sediment transport than what occurs in annually-changing braided streams.

Prograde - Forward, downstream directional erosion that occurs in karst systems. A prograding river is one that follows rock fractures or solution sinks. It erodes in a downstream direction over time toward the sink. The process is controlled by the underlying geology and is resistant to changing flow regimes. This is opposed to a headcutting whereby the stream erodes alluvium in an upstream direction. It is likely that the Upper Santa Fe River drainage network has formed by combined prograding and headcutting mechanisms over recent millenia.

Relictual - Relicts of processes no longer active under modern climate, land cover, and sea levels (e.g. formed during the Pleistocene)

Riverscape/Floodscape – The riverscape refers to the open channel, while the floodscape refers to the adjacent floodplain (**Exhibit 13**)

Exhibit 13 Riverscape versus Floodscape



Scour line – This feature is commonly seen in Florida streams where the flow has created an undercut bank exposing plant roots. This feature often reaches an interior elevation slightly below bankfull stage (BKF-S) (**Exhibit 11**).

Spells analysis – This analysis involves determining the frequency and duration of particular flow events. For example, spells analysis was conducted in the study to determine the number of times and the number of days flow was overbank and doing work in the floodplain. Spells analysis can also be used to determine the frequency and duration of other flow thresholds such as zero flow days, which may have repercussions on particular biota.

Unconfined valley/floodplain – This describes a valley in which the stream channel migrates freely through a broad relatively flat bottomland valley that is partially formed by fluvial forces and that has frequent overbank flooding. The valley bottom is wider than the meander beltwidth of the open channel, a condition which is called an “underfit” channel or an “unconfining” valley. An unconfined valley is broader than the meander belt width of the main channel and is a common valley type in Florida (**Exhibit 14**).

Exhibit 14 Unconfined Valley



A) Cross-section view of an unconfined valley; B) Photograph of an unconfined wetland valley along the Ichetucknee River; C) Planform view of an unconfined valley

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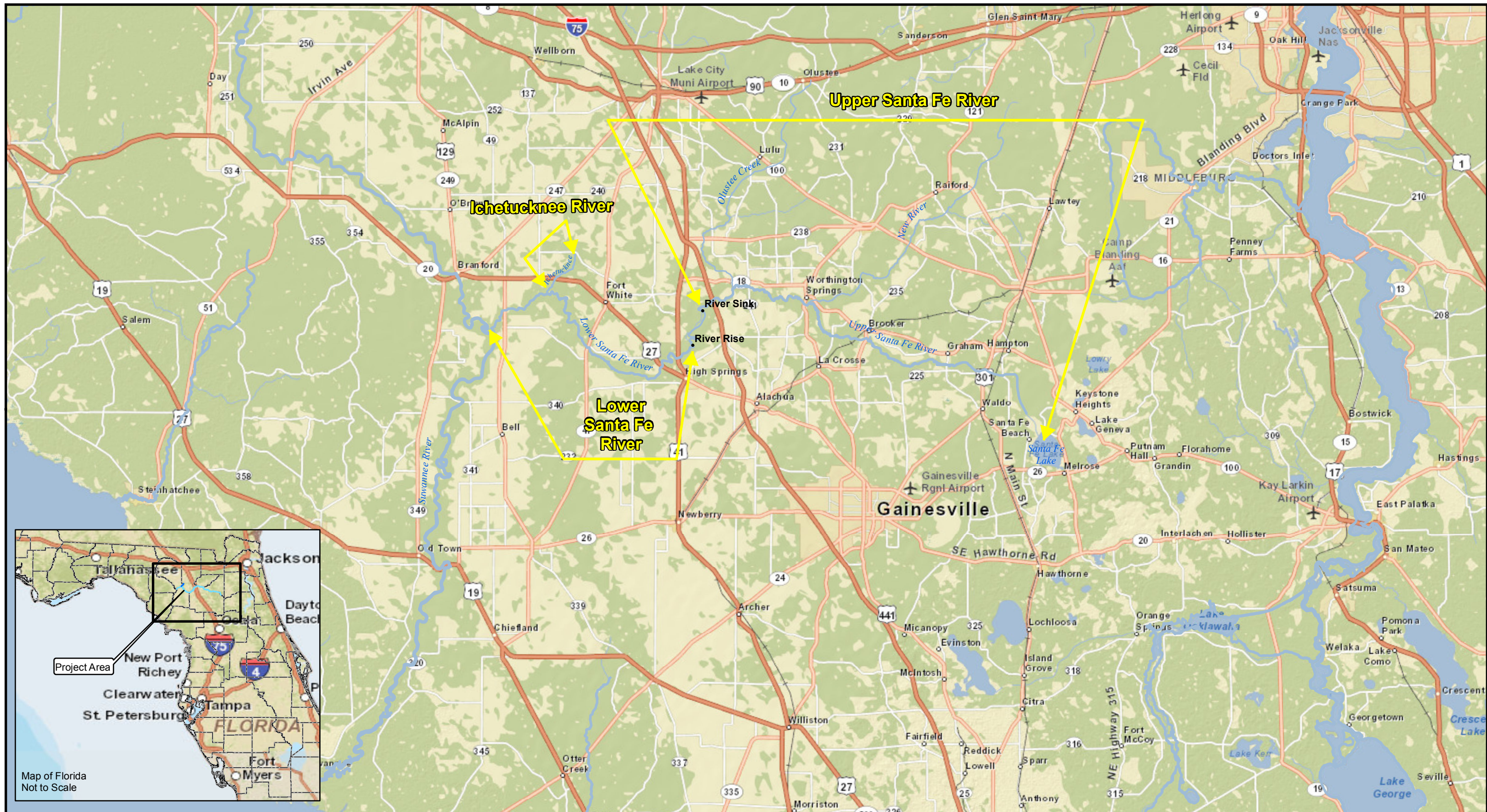
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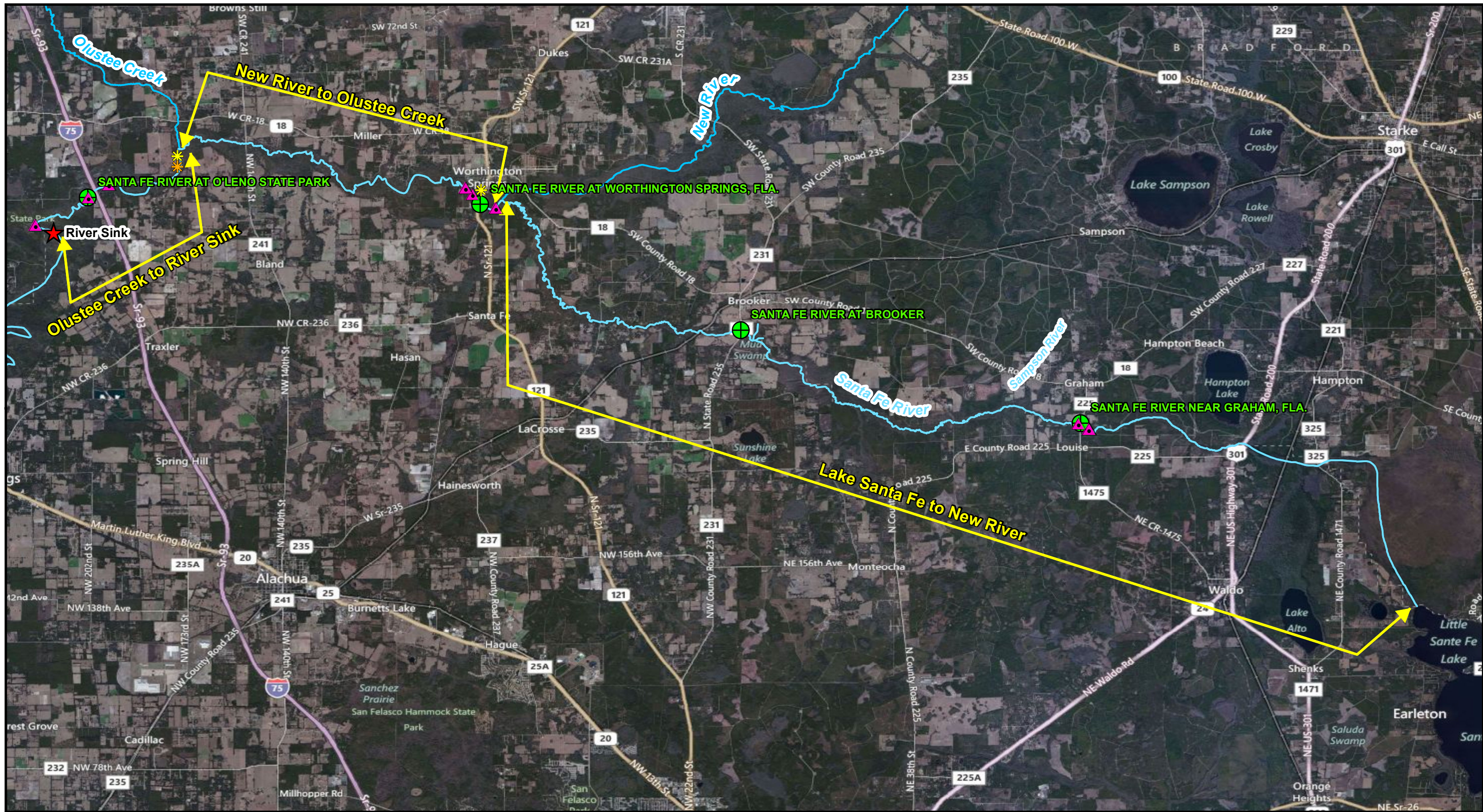
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FIGURES



Notes: 1- Project No.: 600050.1 2- Data Source - ESRI Street Map 3- This map is intended to be used for planning purposes only. It is not a survey. Date: 10/20/2011 Revised: Checked By: JHK	Explanation of Features • River Rise & River Sink 0 4 8 1" = 8 Miles	Figure 1 Location Map Fluvial Geomorphic Investigation Florida amec AMEC - 2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-0007867 - (863) 667-2345
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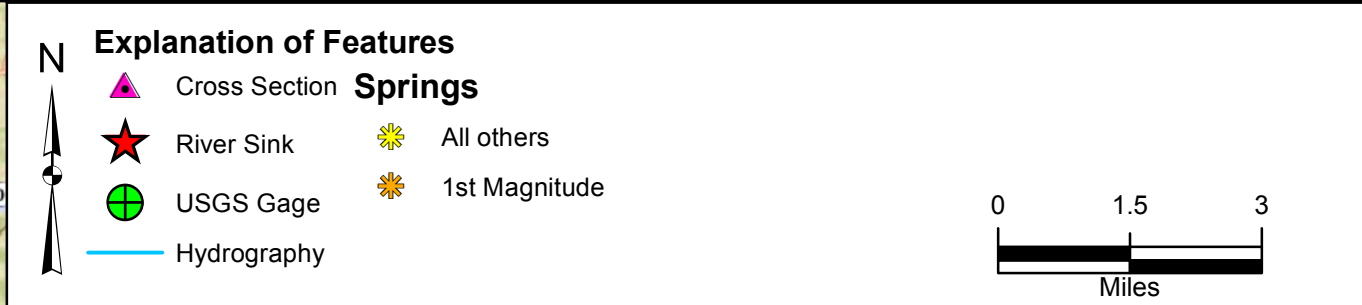
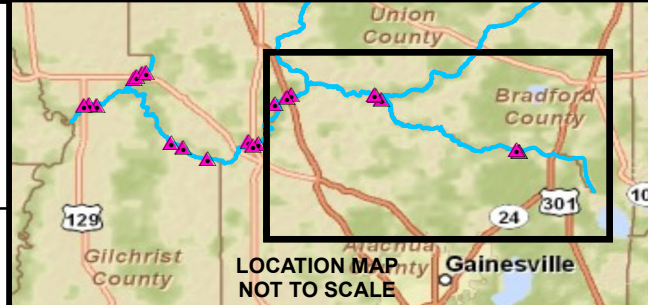


Figure 2
Upper Santa Fe River
Location Map
Fluvial Geomorphologic Investigation
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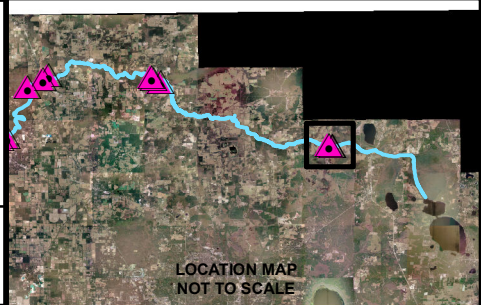
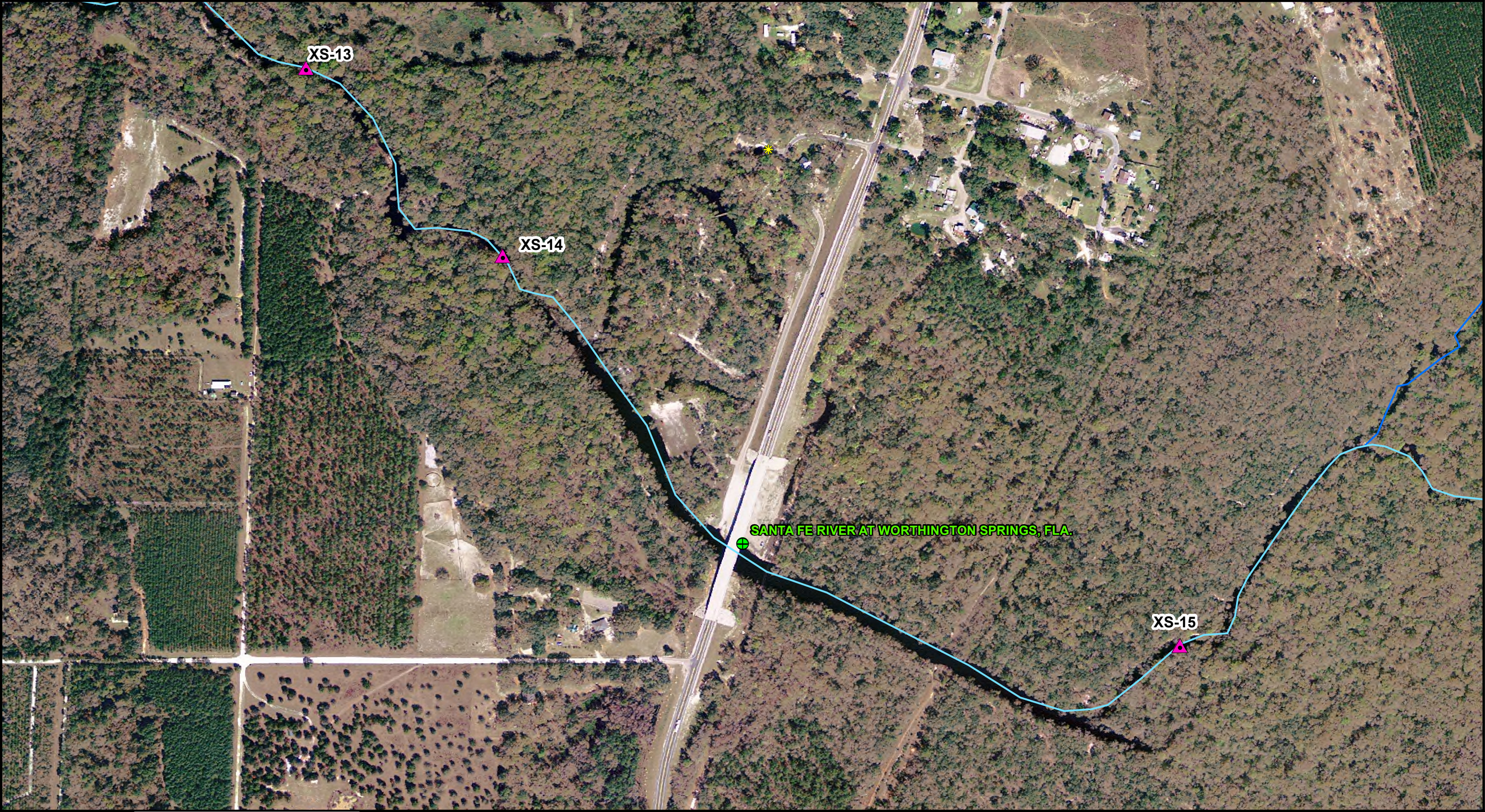


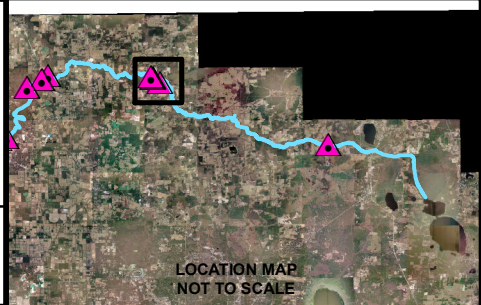
Figure 2A
Upper Santa Fe: Lake Santa Fe to New River
Cross Section Detail Map
Fluvial Geomorphic Investigation
Florida

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Explanation of Features

	Cross Section	Springs	
	USGS Gage		All others
	Santa Fe River		1st Magnitude
	New River		

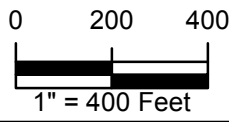
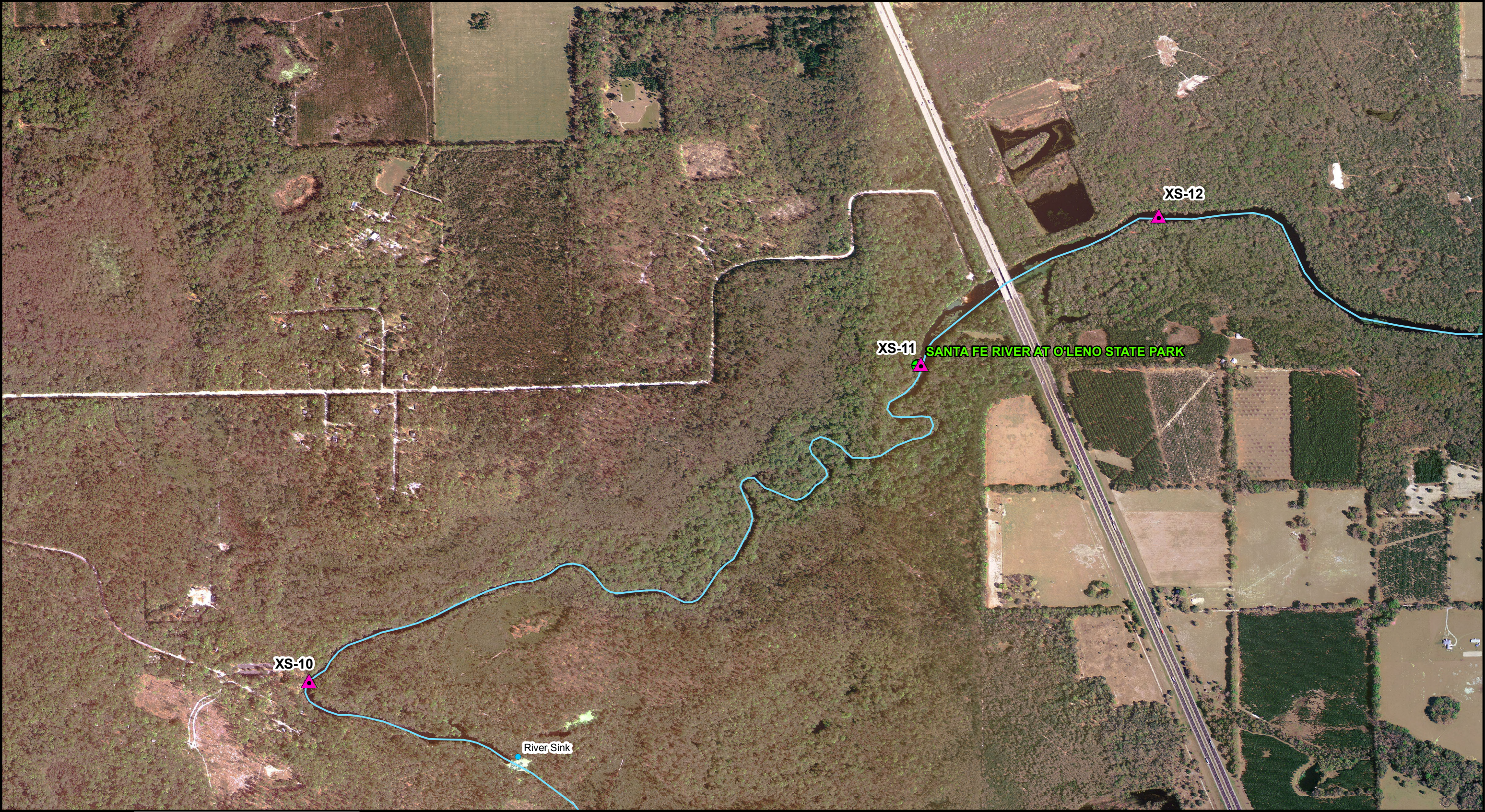


Figure 2B
Upper Santa Fe: New River to Olustee Creek
Cross Section Detail Map
Fluvial Geomorphic Investigation
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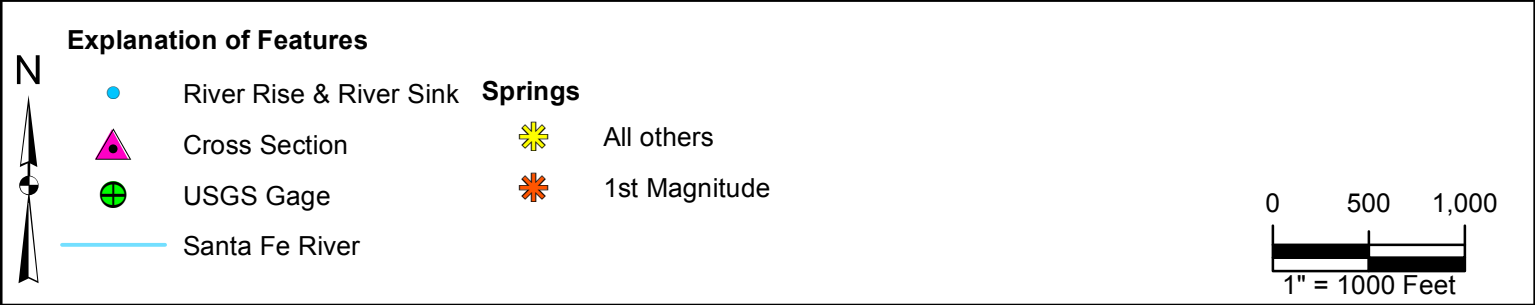
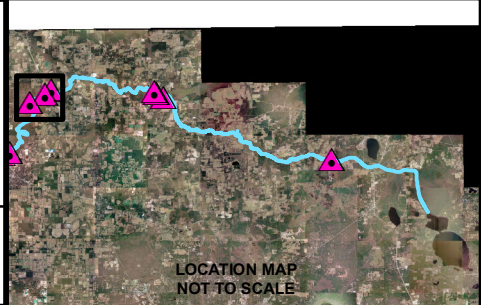
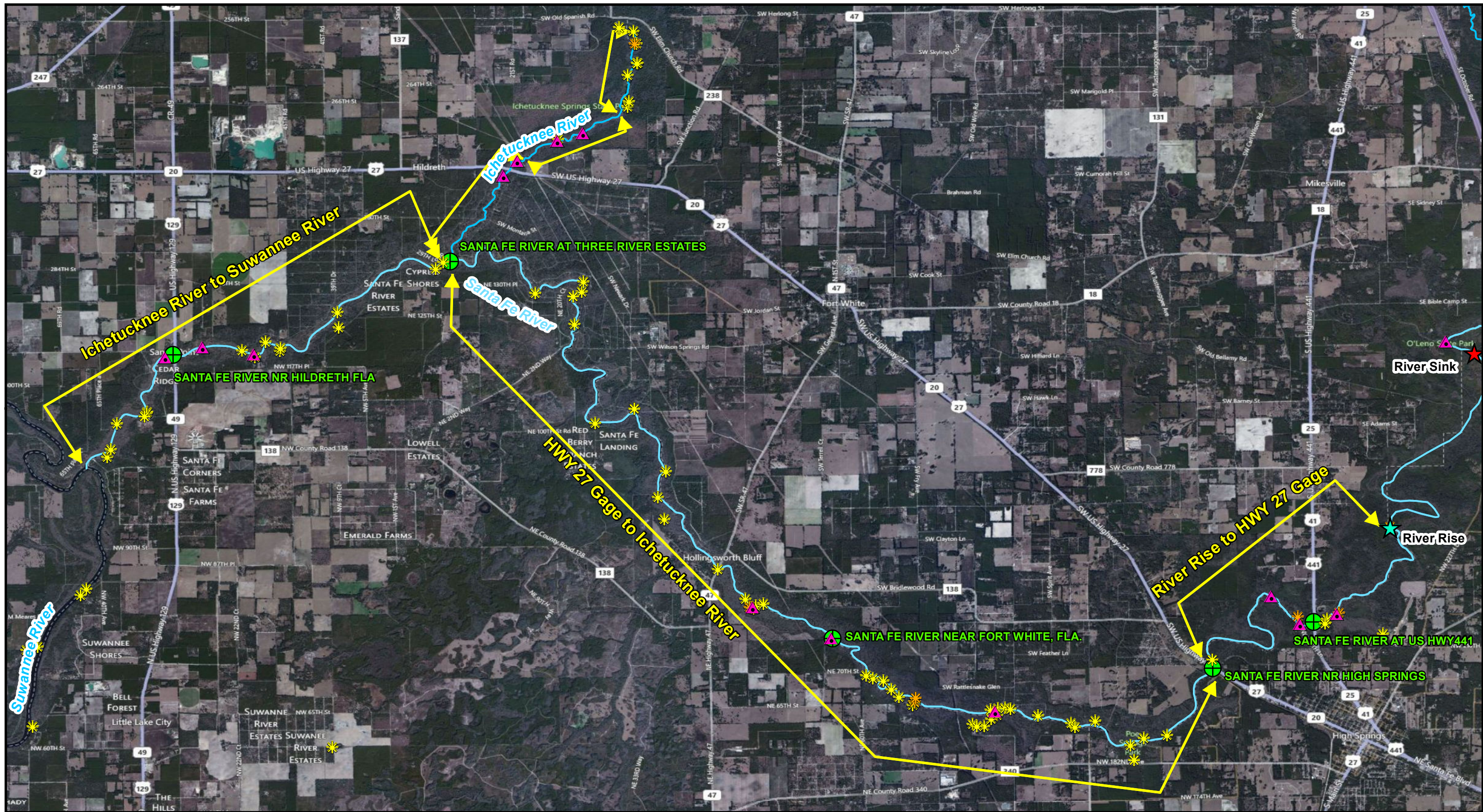


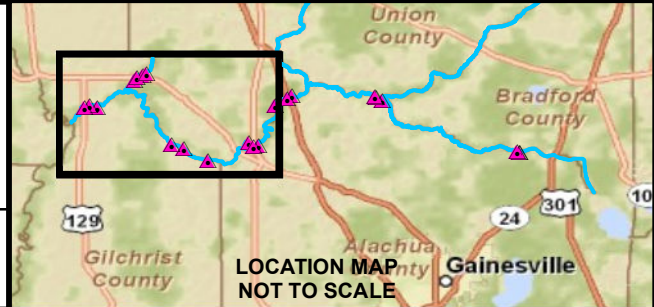
Figure 2C
Upper Santa Fe: Olustee Creek to River Sink
Cross Section Detail Map
Fluvial Geomorphic Invesatigation
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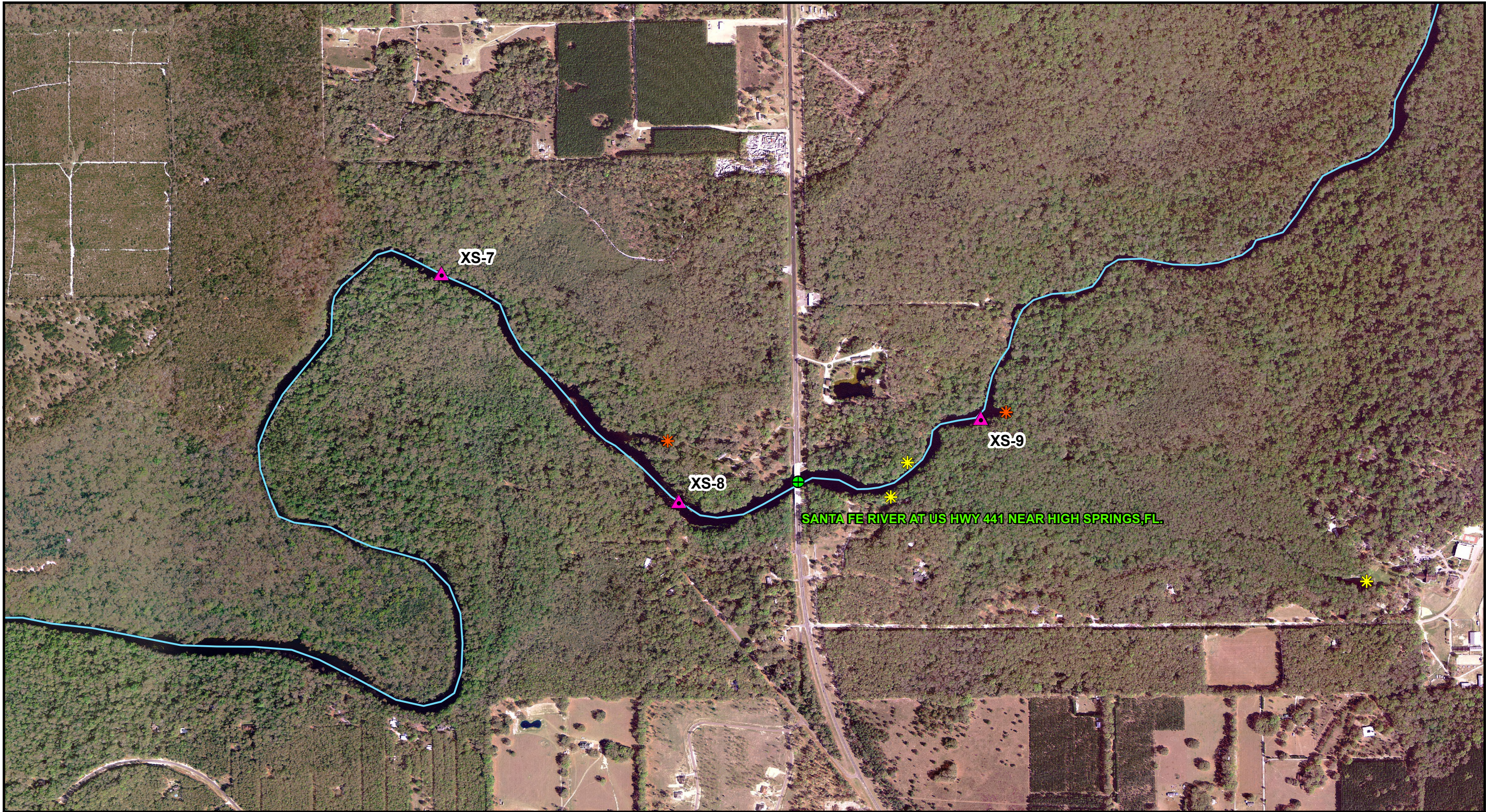
Explanation of Features

	Cross Section		Hydrography
	River Rise		USGS Gage
	River Sink	Springs	
			All others
			1st Magnitude



Figure 3
Lower Santa Fe River
Location Map
Fluvial Geomorphologic Investigation
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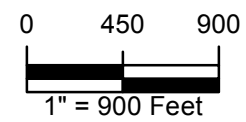
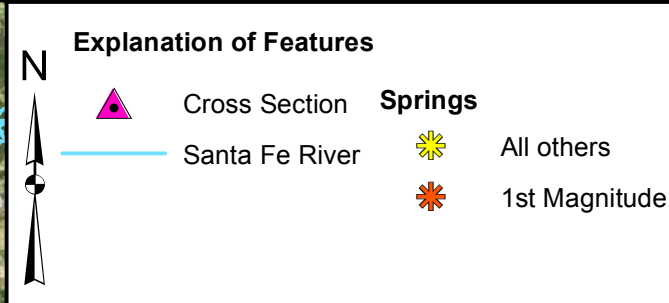
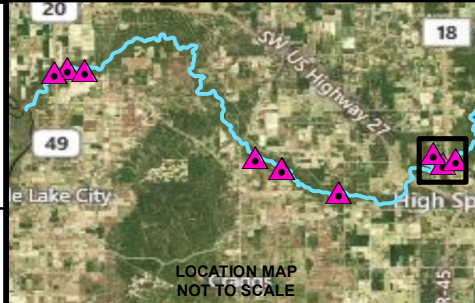
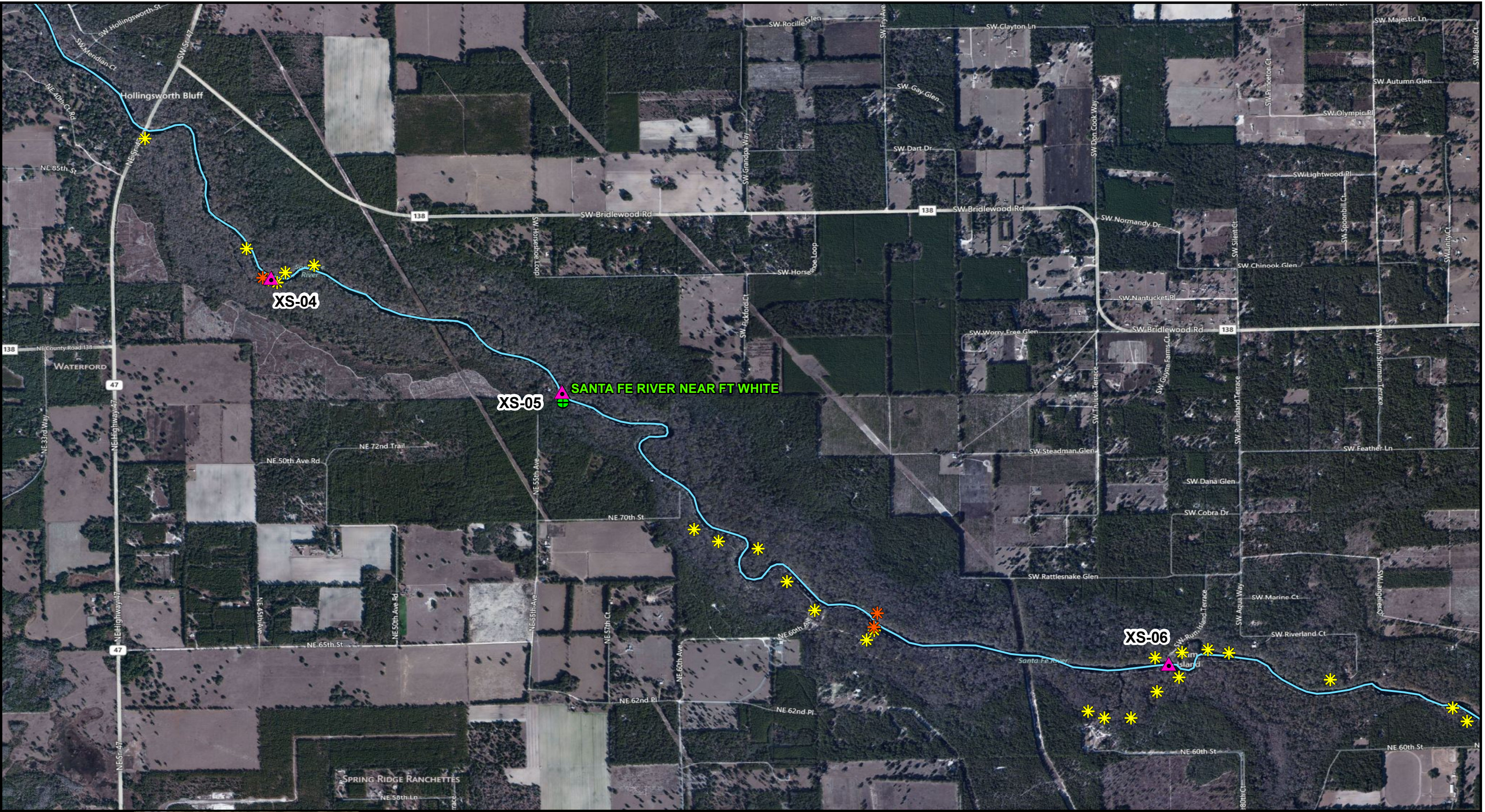


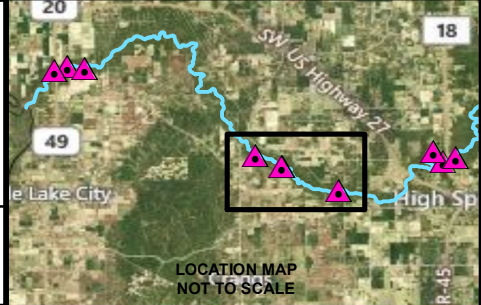
Figure 3A
Lower Santa Fe: River Rise to Highway 27 Gage
Cross Section Detail Map
Fluvial Geomorphic Investigation
Florida

AMEC - 2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-0007867 - (863) 667-2345



Notes:
1- Project No.: 600050.1
2- Data Source - Bing Aerials
FDEP
3- This map is intended to be
used for planning purposes
only. It is not a survey.

Date: 10/20/2011
Revised:
Checked By: JHK



Explanation of Features

	Cross Section		All others
	USGS Gage		1st Magnitude
	Santa Fe River		

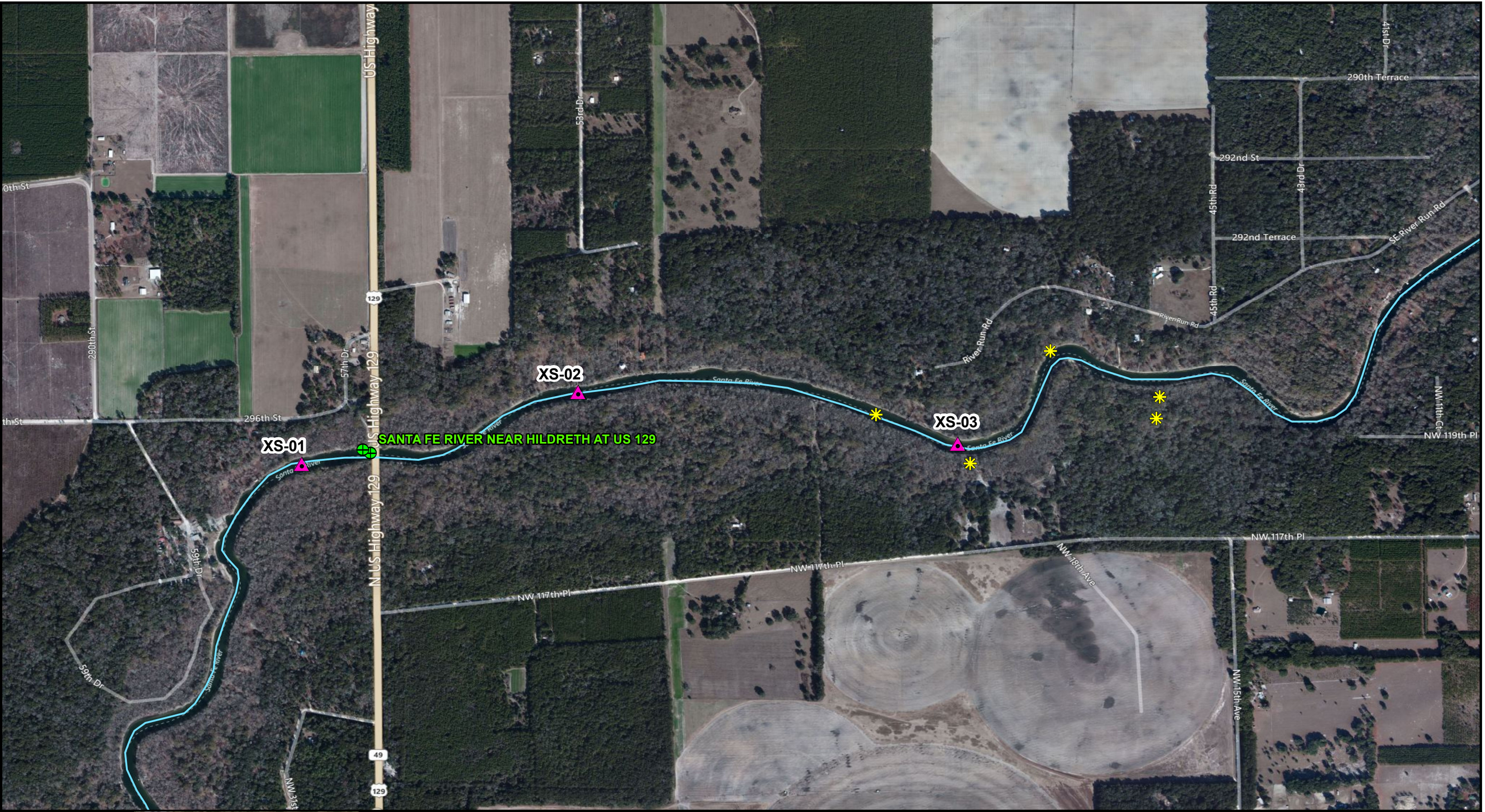
Springs

	All others
	1st Magnitude

0 1,000 2,000
1" = 2000 Feet

Figure 3B
Lower Santa Fe: Highway 27 Gage to Ichetucknee River
Cross Section Detail Map
Fluvial Geomorphic Investigation
Florida

AMEC - 2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-0007867 - (863) 667-2345



Notes:
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Date: 10/20/2011
Revised:
Checked By: JHK



Explanation of Features

	Cross Section		Springs
	USGS Gage		All others
	Santa Fe River		1st Magnitude

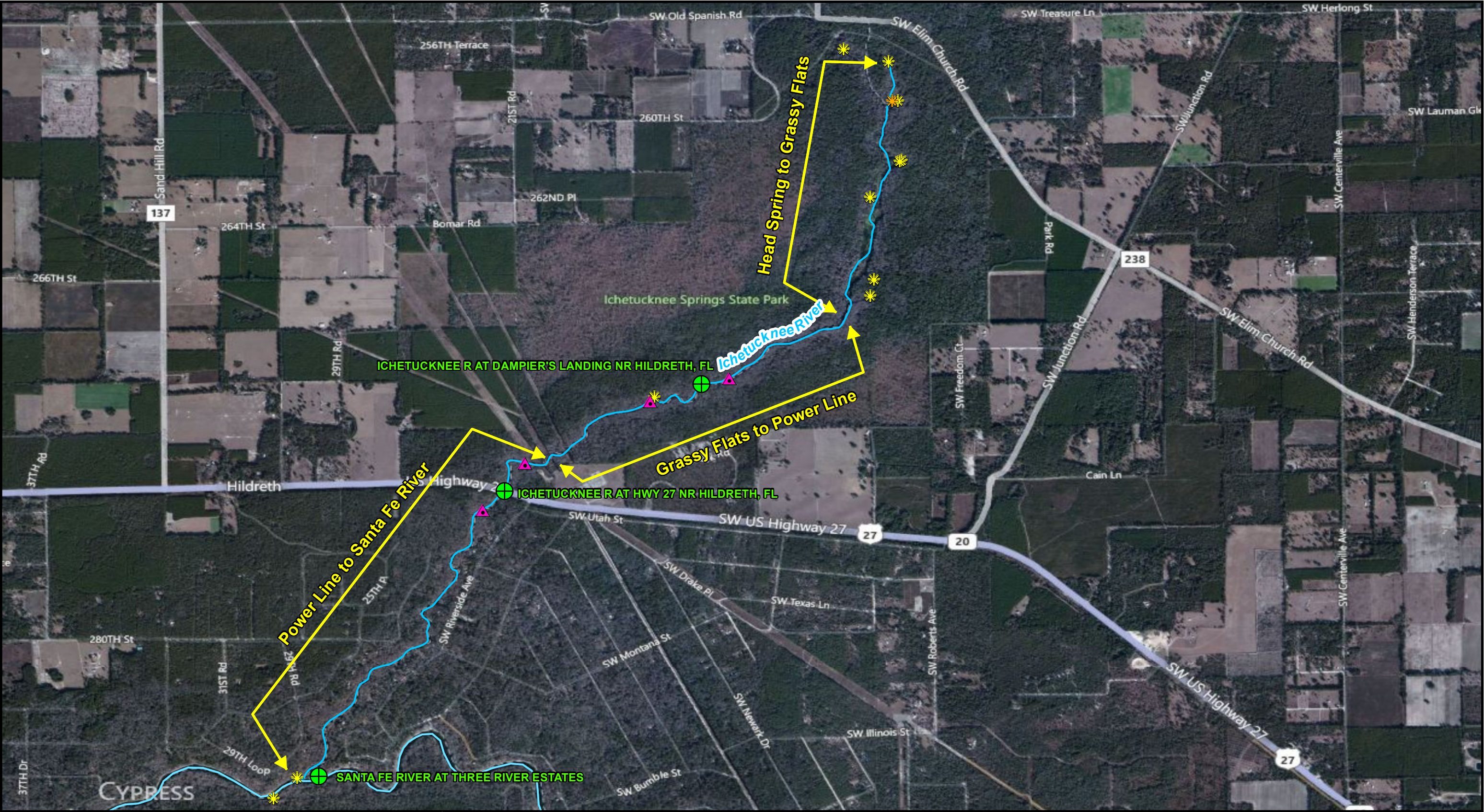
N

1" = 1000 Feet



Figure 3C
Lower Santa Fe: Ichetucknee River to Suwanee River
Cross Section Detail Map
Fluvial Geomorphic Investigation
Florida

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Notes:
1- Project No.: 600050.1
2- Data Source - Bing Aerials
FDEP
3- This map is intended to be
used for planning purposes
only. It is not a survey.

Date: 10/26/2011
Revised:
Checked By: JHK

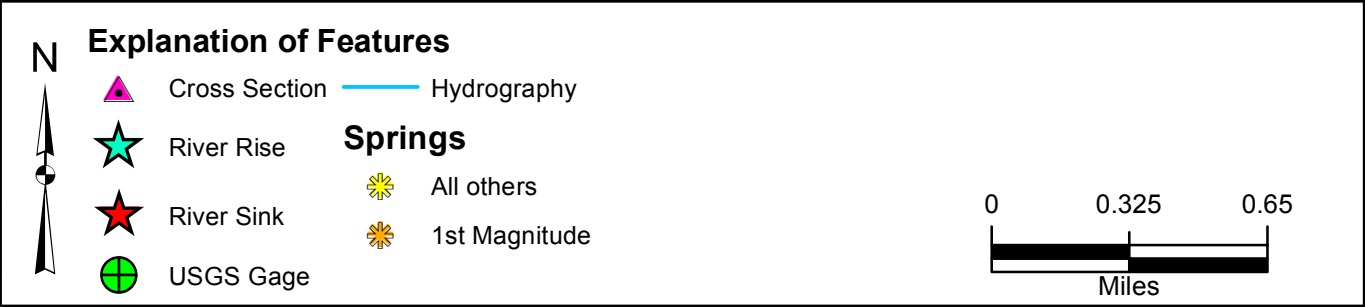


Figure 4
Ichetucknee River
Location Map
Fluvial Geomorphologic Investigation
Florida

amec

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Notes:

1- Project No.: 600050.1

2- Data Source - Bing Aerials
FDEP

3- This map is intended to be used for planning purposes only. It is not a survey.

Explanation of Features

	Cross Section		All others
	USGS Gage		1st Magnitude
			Santa Fe River
			Ichetucknee River

N

0 250 500

1" = 500 Feet

LOCATION MAP
NOT TO SCALE

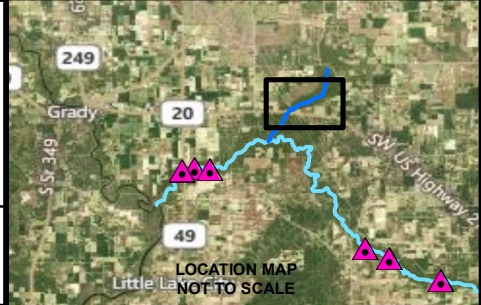
Figure 4A
Ichetucknee River: Head Spring to Grassy Flats
Detail Map
Fluvial Geomorphic Investigation
Florida

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Notes:
1- Project No.: 600050.1
2- Data Source - Bing Aerials
FDEP
3- This map is intended to be
used for planning purposes
only. It is not a survey.

Date: 10/20/2011
Revised:
Checked By: JHK



Explanation of Features

- Cross Section
- USGS Gage
- Springs**
 - All others
 - 1st Magnitude

N

Figure 4B
Ichetucknee River: Grassy Flats to Power Lines
Cross Section Detail Map
Fluvial Geomorphic Investigation
Florida

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Notes:

1- Project No.: 600050.1

2- Data Source - Bing Aerials
FDEP

3- This map is intended to be used for planning purposes only. It is not a survey.

Explanation of Features

	Cross Section		All others
	USGS Gage		1st Magnitude
			Santa Fe River
			Ichetucknee River

0 250 500

1" = 500 Feet

LOCATION MAP
NOT TO SCALE

Figure 4C
Ichetucknee River: Power Lines to Santa Fe River
Cross Section Detail Map
Fluvial Geomorphic Investigation
Florida

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APPENDIX A



Photograph #1: Upper Santa Fe River – Graham XS-16 facing Upstream



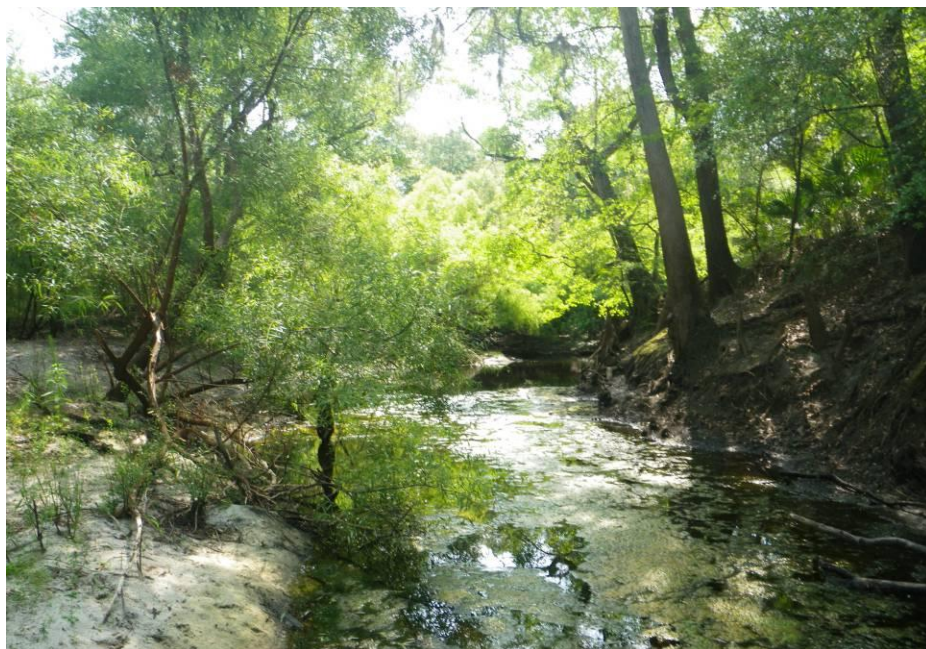
Photograph #2: Upper Santa Fe River – Graham XS-16 facing Downstream



Photograph #3: Upper Santa Fe River – Graham XS-16 facing Right Bank



Photograph #4: Upper Santa Fe River – Graham XS-16 facing Left Bank



Photograph #5: Upper Santa Fe River – Worthington Springs XS-15 facing Upstream



Photograph #6: Upper Santa Fe River – Worthington Springs XS-15 facing Downstream



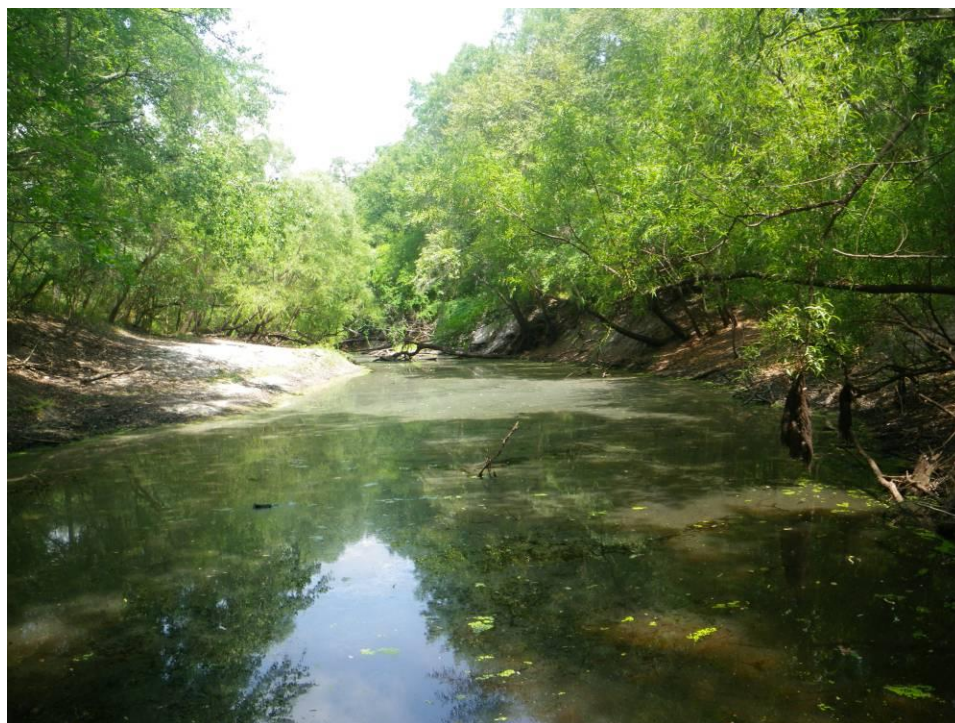
Photograph #7: Upper Santa Fe River – Worthington Springs XS-15 facing Right Bank



Photograph #8: Upper Santa Fe River – Worthington Springs XS-15 facing Left Bank



Photograph #9: Upper Santa Fe River – Worthington Springs XS-14 facing Upstream



Photograph #10: Upper Santa Fe River – Worthington Springs XS-14 facing Downstream



Photograph #11: Upper Santa Fe River – Worthington Springs XS-14 facing Right Bank



Photograph #12: Upper Santa Fe River – Worthington Springs XS-14 facing Left Bank



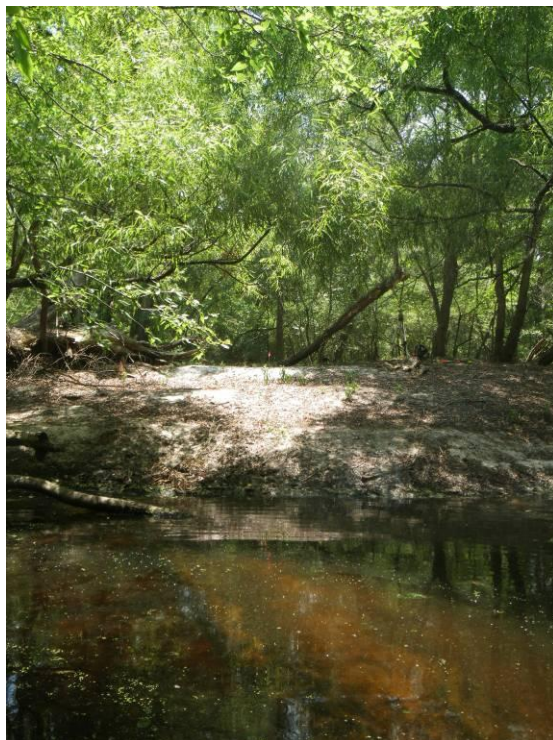
Photograph #13: Upper Santa Fe River – Worthington Springs XS-14 facing Upstream



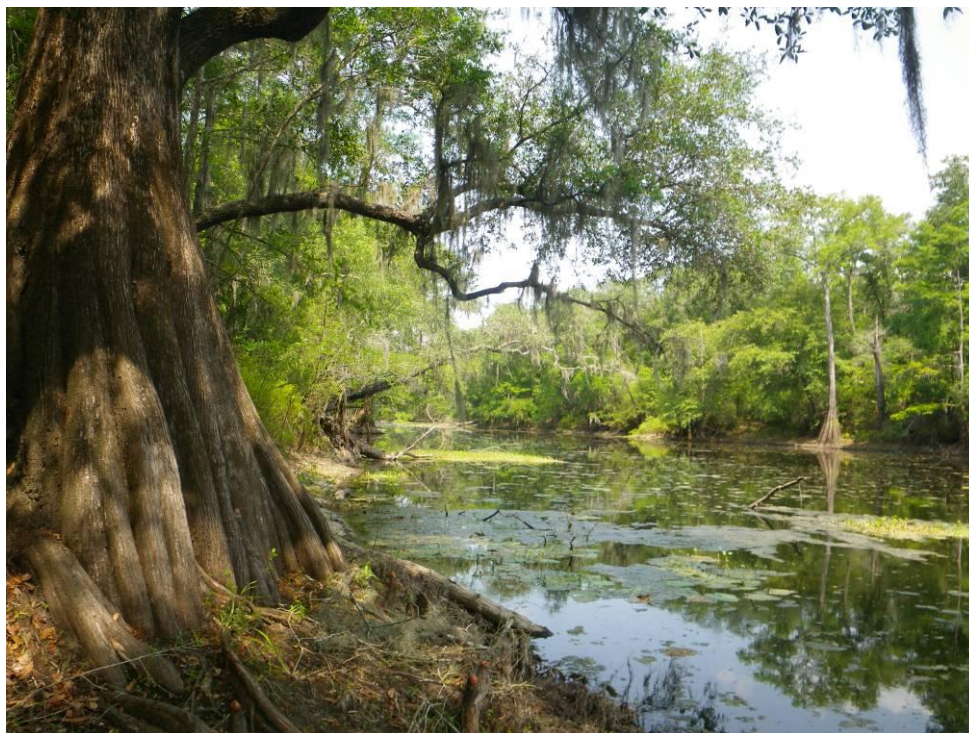
Photograph #14: Upper Santa Fe River – Worthington Springs XS-14 facing Downstream



Photograph #15: Upper Santa Fe River – Worthington Springs XS-13 facing Right Bank



Photograph #16: Upper Santa Fe River – Worthington Springs XS-13 facing Left Bank



Photograph #17: Upper Santa Fe River – O’Leno XS-12 facing Upstream



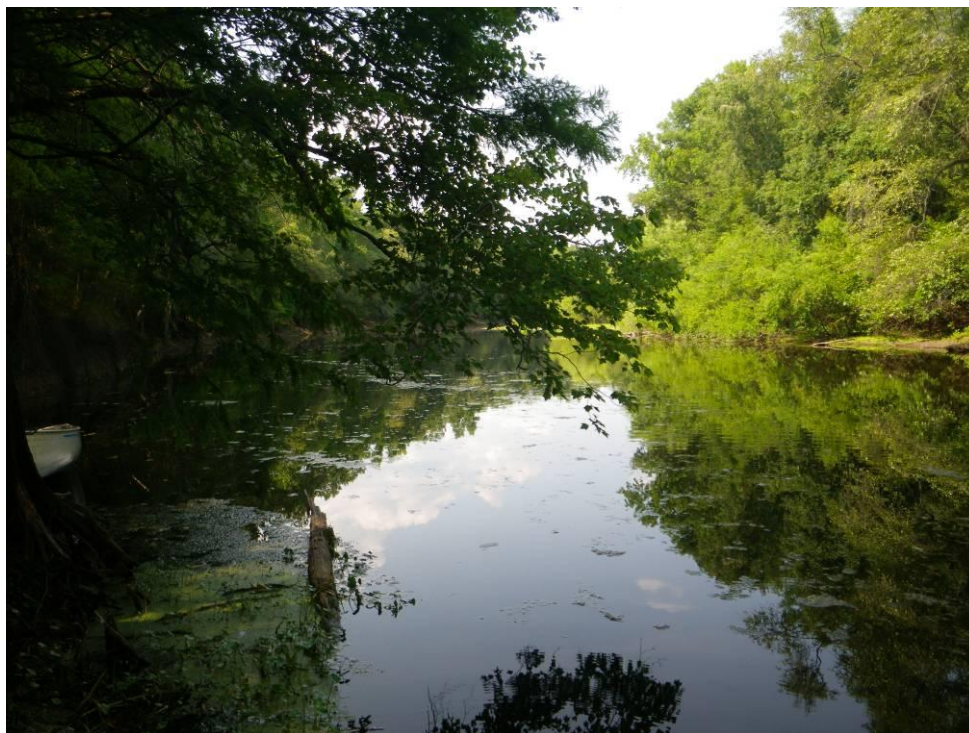
Photograph #18: Upper Santa Fe River – O’Leno XS-12 facing Upstream



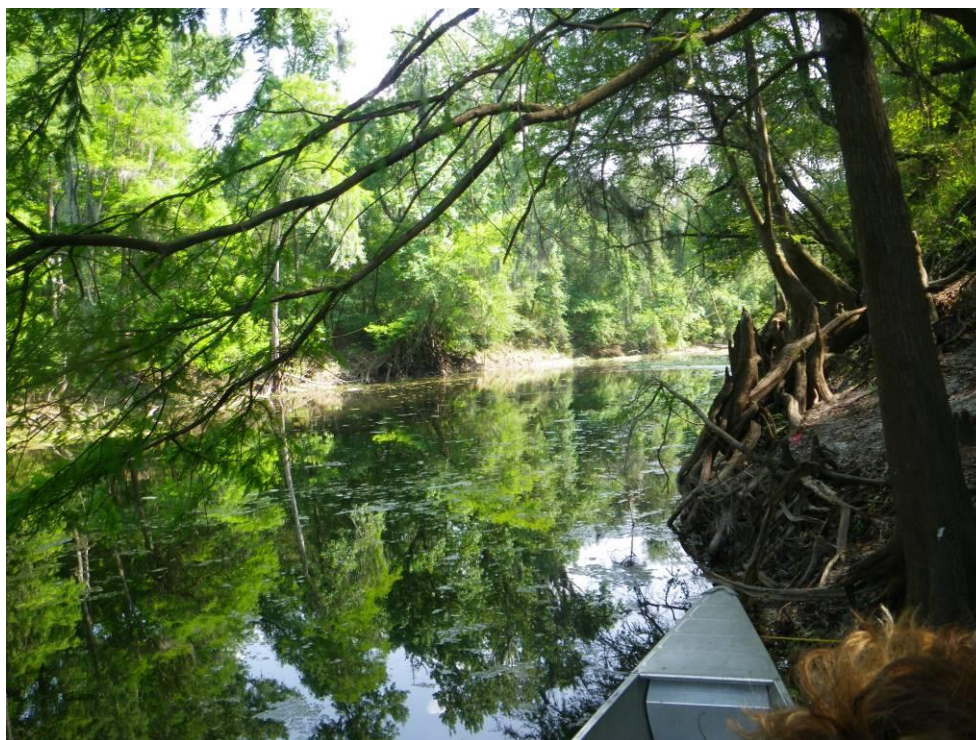
Photograph #19: Upper Santa Fe River – O’Leno XS-12 facing Right Bank



Photograph #20: Upper Santa Fe River – O’Leno XS-12 facing Left Bank



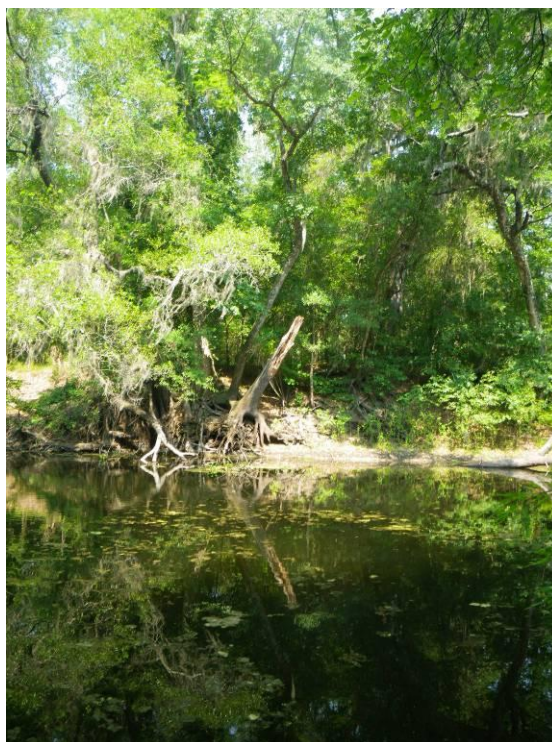
Photograph #21: Upper Santa Fe River – O’Leno XS-11 facing Upstream



Photograph #22: Upper Santa Fe River – O’Leno XS-11 facing Downstream



Photograph #23: Upper Santa Fe River – O’Leno XS-11 facing Right Bank



Photograph #24: Upper Santa Fe River – O’Leno XS-11 facing Left Bank



Photograph #25: Upper Santa Fe River – O’Leno XS-10 facing Upstream



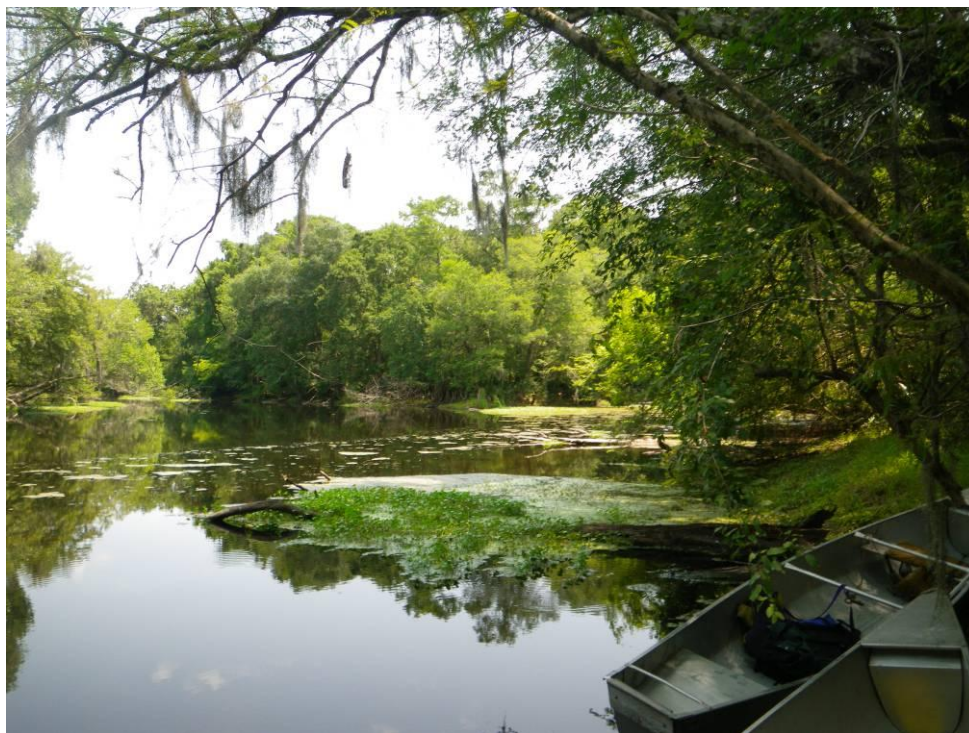
Photograph #26: Upper Santa Fe River – O’Leno XS-10 facing Downstream



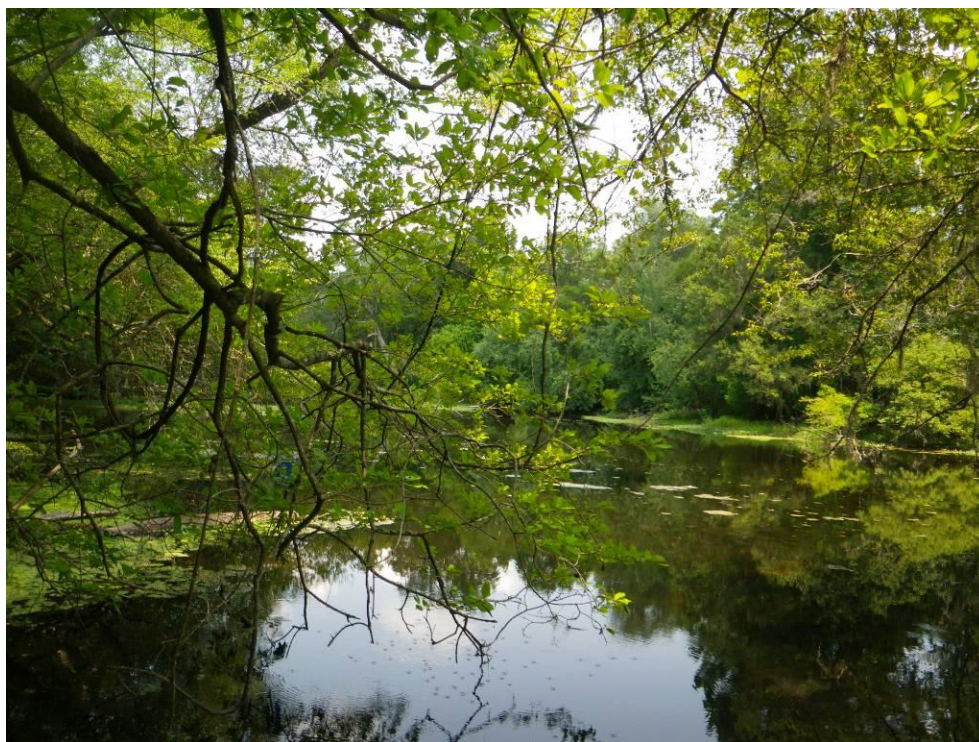
Photograph #27: Upper Santa Fe River – O’Leno XS-10 facing Right Bank



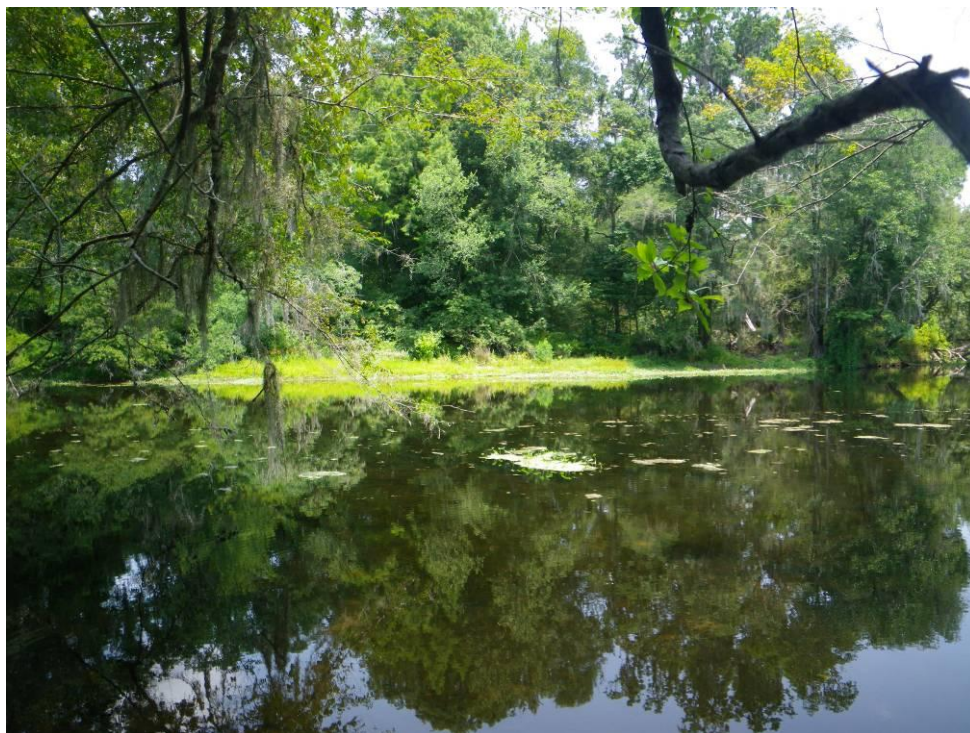
Photograph #28: Upper Santa Fe River – O’Leno XS-10 facing Left Bank



Photograph #29: Lower Santa Fe River – Hwy 441 XS-9 facing Upstream



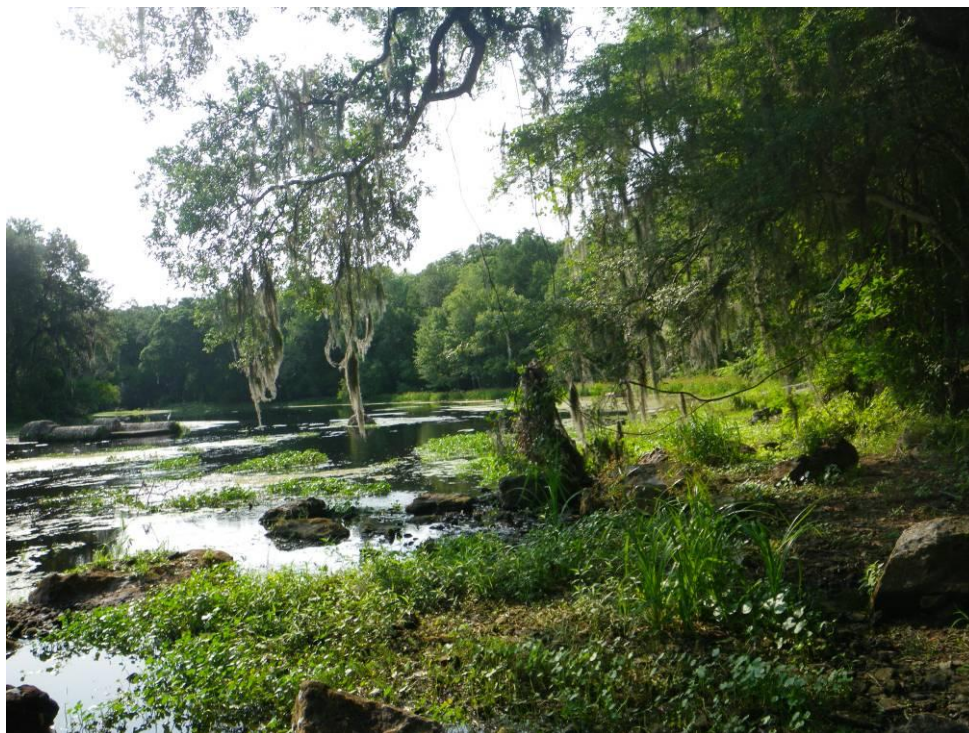
Photograph #30: Lower Santa Fe River – Hwy 441 XS-9 facing Downstream



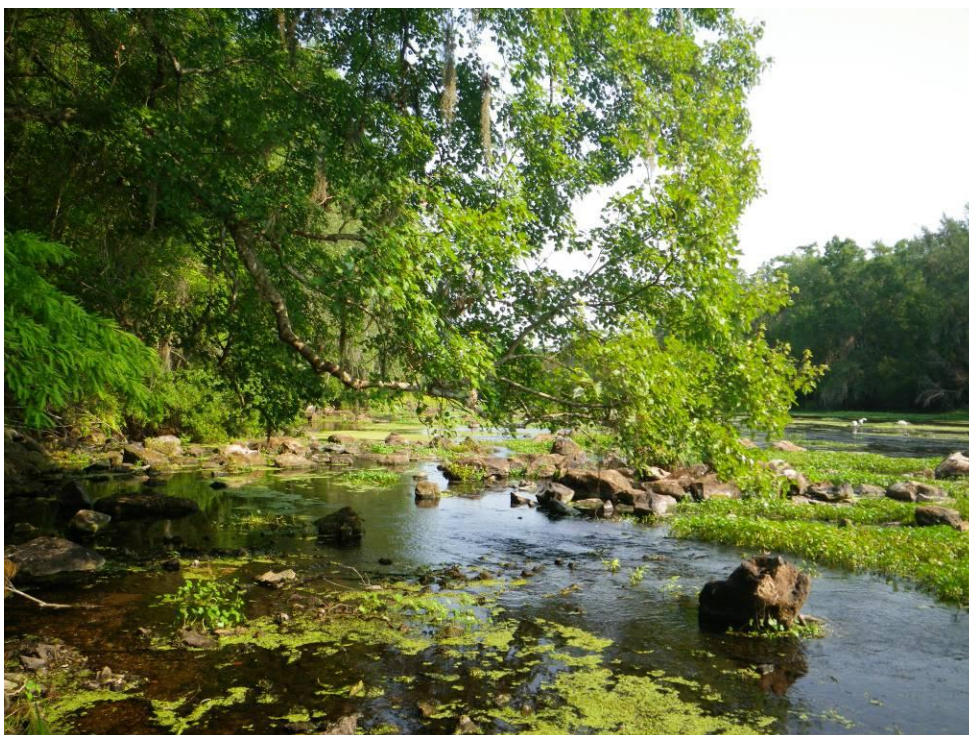
Photograph #31: Lower Santa Fe River – Hwy 441 XS-9 facing Right Bank



Photograph #32: Lower Santa Fe River – Hwy 441 XS-9 facing Left Bank



Photograph #33: Lower Santa Fe River – Hwy 441 XS-8 facing Upstream



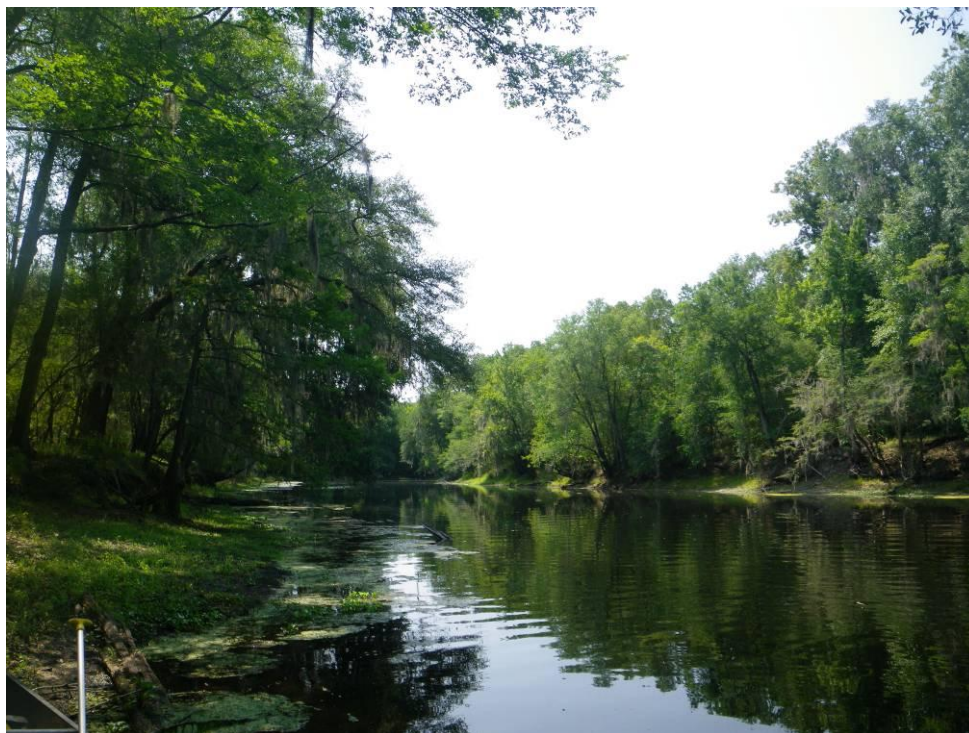
Photograph #34: Lower Santa Fe River – Hwy 441 XS-8 facing Downstream



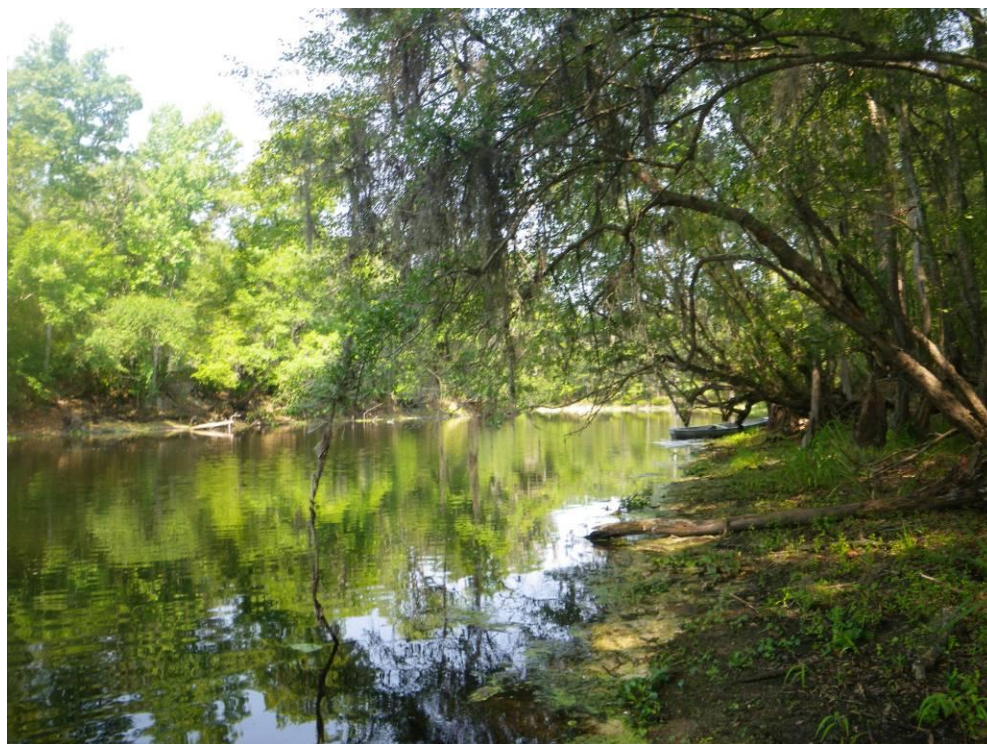
Photograph #35: Lower Santa Fe River – Hwy 441 XS-8 facing Right Bank



Photograph #36: Lower Santa Fe River – Hwy 441 XS-8 facing Left Bank



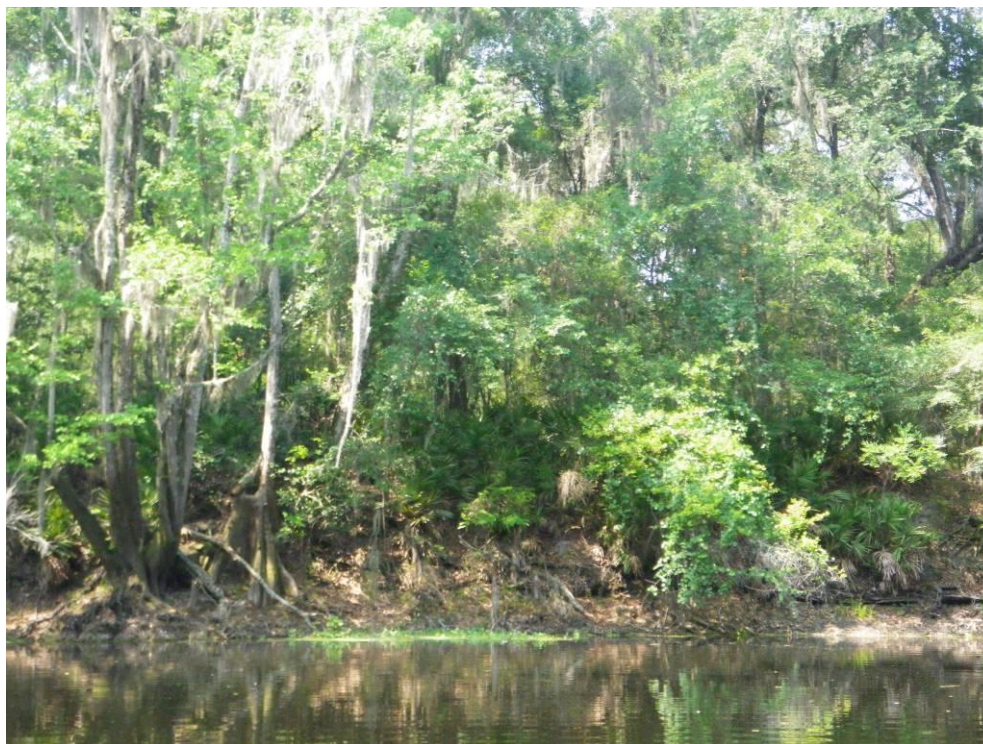
Photograph #37: Lower Santa Fe River – Hwy 441 XS-7 facing Upstream



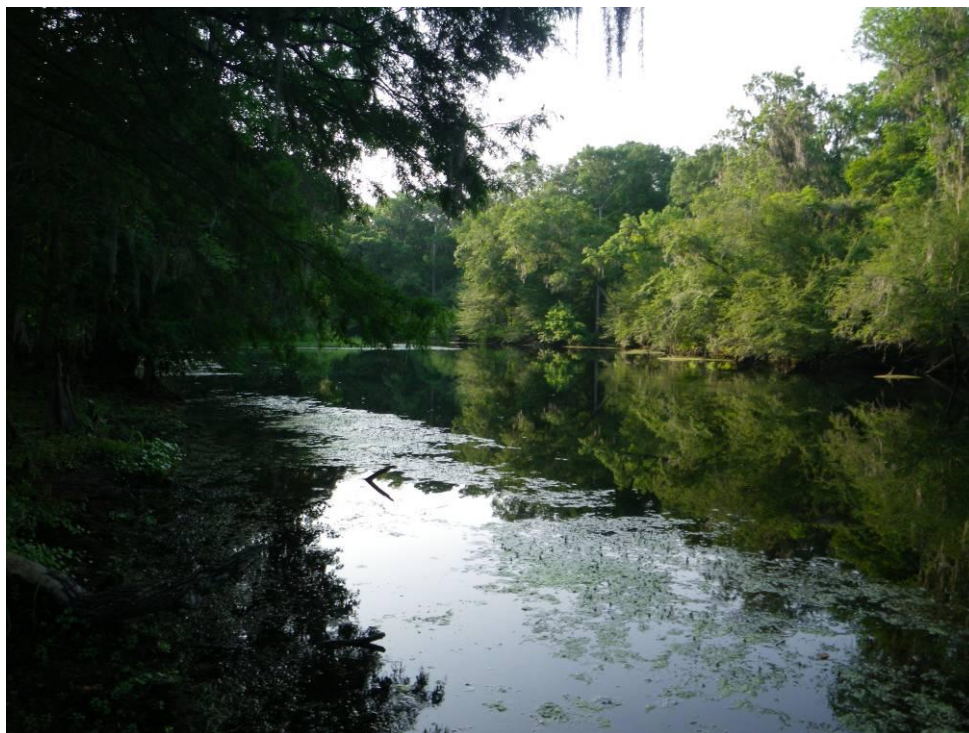
Photograph #38: Lower Santa Fe River – Hwy 441 XS-7 facing Downstream



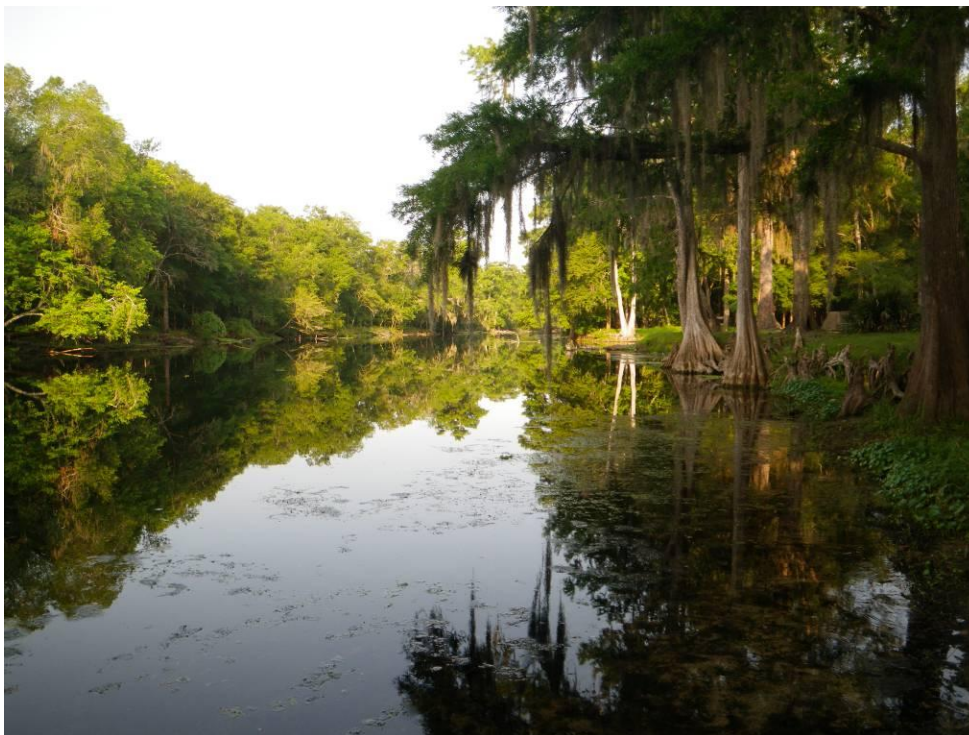
Photograph #39: Lower Santa Fe River – Hwy 441 XS-7 facing Right Bank



Photograph #40: Lower Santa Fe River – Hwy 441 XS-7 facing Left Bank



Photograph #41: Lower Santa Fe River – Ft. White XS-6 facing Upstream



Photograph #42: Lower Santa Fe River – Ft. White XS-6 facing Downstream



Photograph #43: Lower Santa Fe River – Ft. White XS-6 facing Right Bank



Photograph #44: Lower Santa Fe River – Ft. White XS-6 facing Left Bank



Photograph #45: Lower Santa Fe River – Ft. White XS-6 facing Upstream



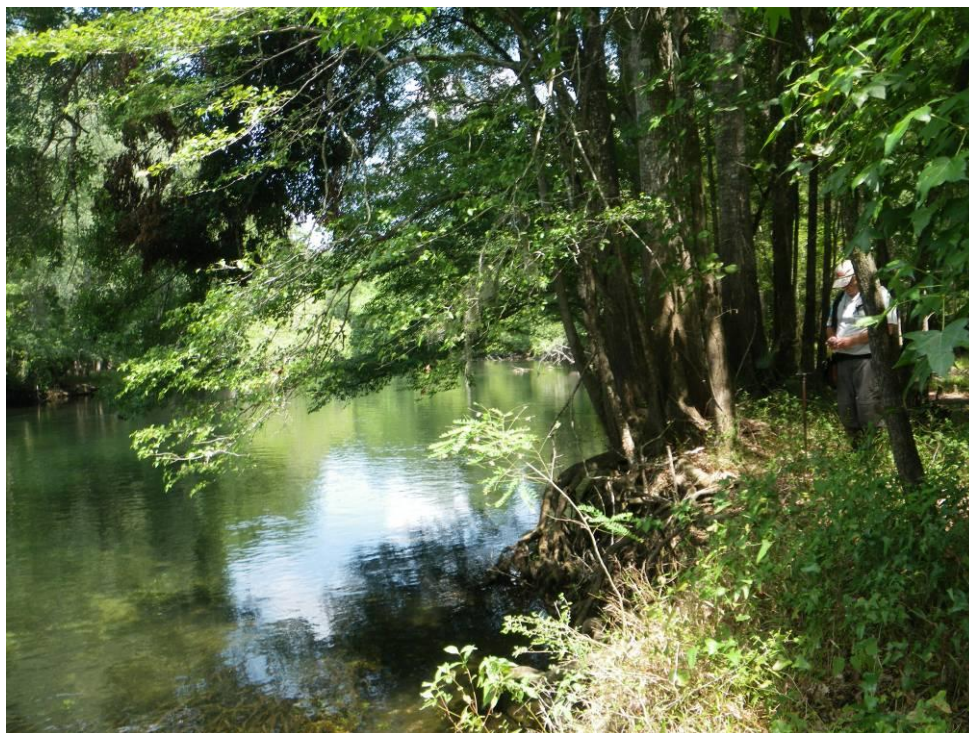
Photograph #46: Lower Santa Fe River – Ft. White XS-5 facing Downstream



Photograph #47: Lower Santa Fe River – Ft. White XS-5 facing Right Bank



Photograph #48: Lower Santa Fe River – Ft. White XS-5 facing Left Bank



Photograph #49: Lower Santa Fe River – Ft. White XS-4 facing Upstream



Photograph #50: Lower Santa Fe River – Ft. White XS-4 facing Downstream



Photograph #51: Lower Santa Fe River – Ft. White XS-4 facing Right Bank



Photograph #52: Lower Santa Fe River – Ft. White XS-4 facing Left Bank



Photograph #53: Lower Santa Fe River – Hildreth XS-3 facing Upstream



Photograph #54: Lower Santa Fe River – Hildreth XS-3 facing Downstream



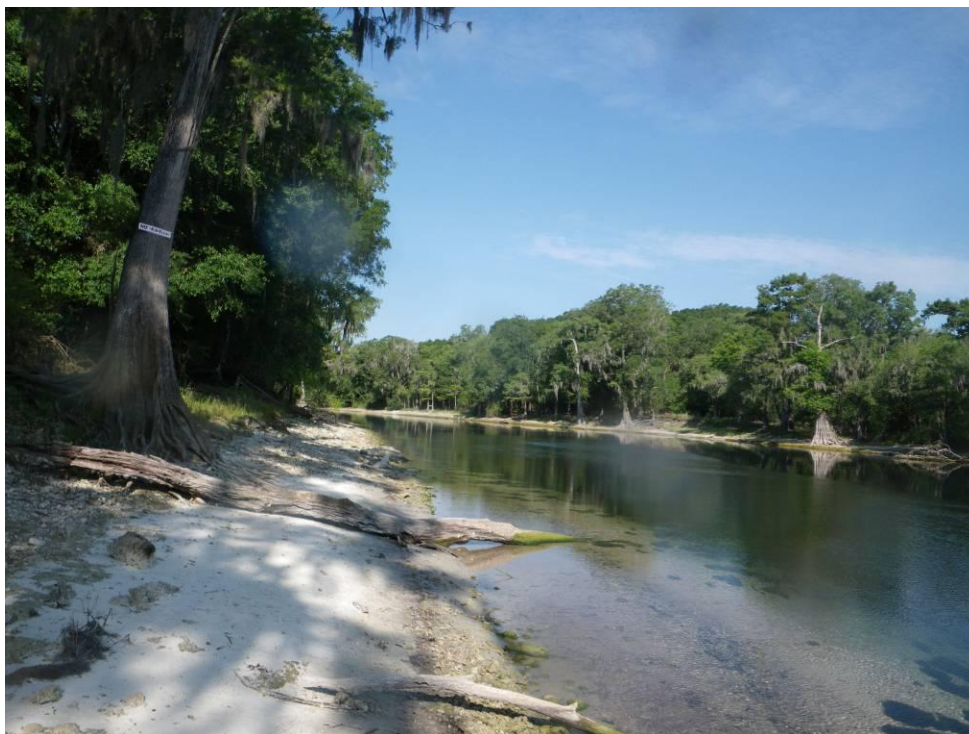
Photograph #55: Lower Santa Fe River – Hildreth XS-3 facing Right Bank



Photograph #56: Lower Santa Fe River – Hildreth XS-3 facing Left Bank



Photograph #57: Lower Santa Fe River – Hildreth XS-2 facing Upstream



Photograph #58: Lower Santa Fe River – Hildreth XS-2 facing Downstream



Photograph #59: Lower Santa Fe River – Hildreth XS-2 facing Right Bank



Photograph #60: Lower Santa Fe River – Hildreth XS-2 facing Left Bank



Photograph #61: Lower Santa Fe River – Hildreth XS-1 facing Upstream



Photograph #62: Lower Santa Fe River – Hildreth XS-1 Downstream



Photograph #63: Lower Santa Fe River – Hildreth XS-1 facing Right Bank



Photograph #64: Lower Santa Fe River – Hildreth XS-1 facing Left Bank



Photograph #65: Ichetucknee River – Dampier’s Landing XS-4 Facing Upstream



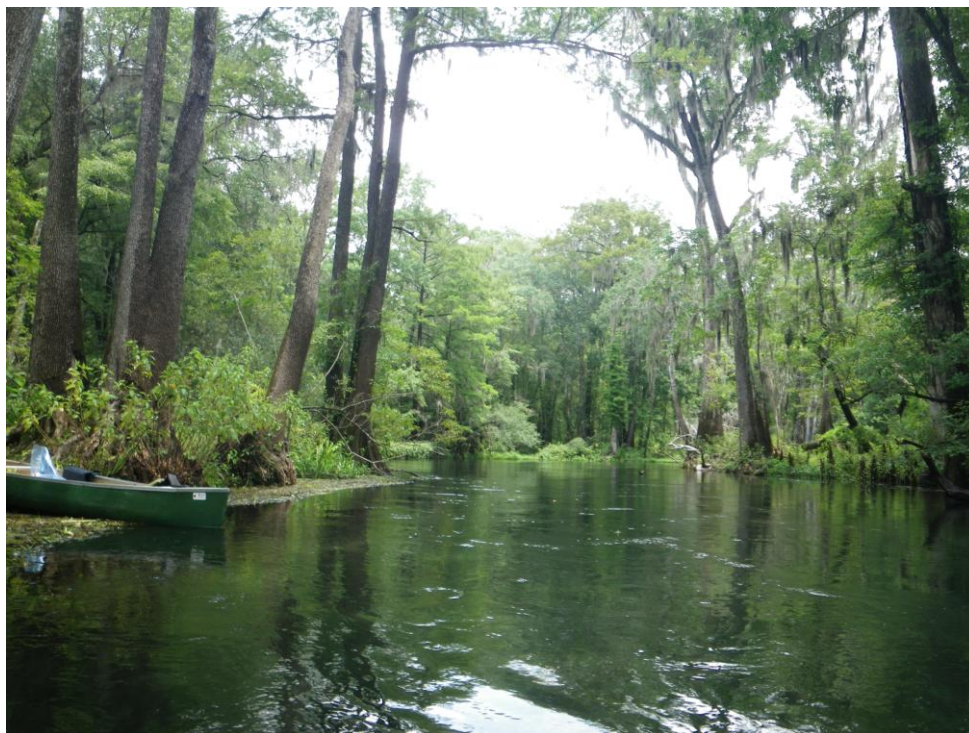
Photograph #66: Ichetucknee River – Dampier’s Landing XS-4 Facing Downstream



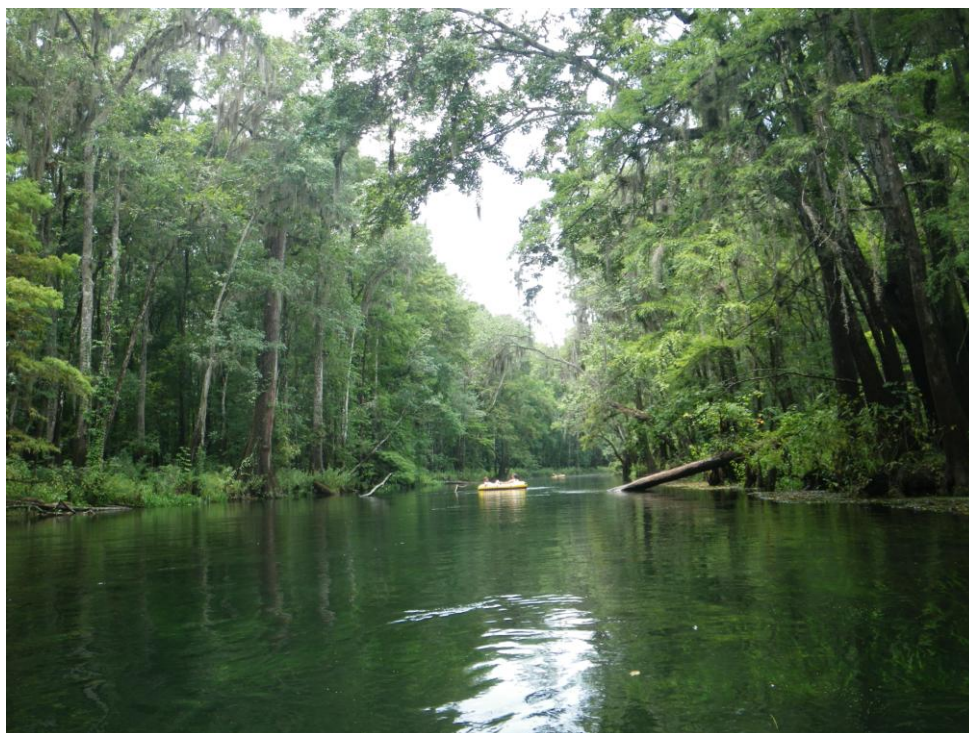
Photograph #67: Ichetucknee River – Dampier’s Landing XS-4 Facing Right Bank



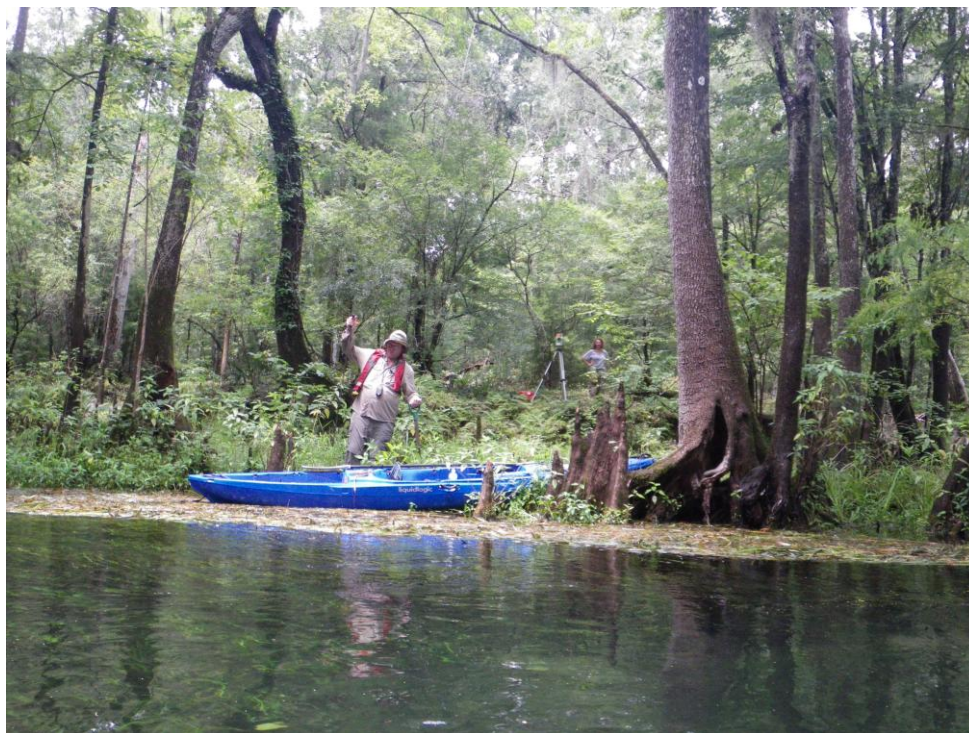
Photograph #68: Ichetucknee River – Dampier’s Landing XS-4 Facing Left Bank



Photograph #69: Ichetucknee River – Dampier’s Landing XS-3 Facing Upstream



Photograph #70: Ichetucknee River – Dampier’s Landing XS-3 Facing Downstream



Photograph #71: Ichetucknee River – Dampier’s Landing XS-3 Facing Right Bank



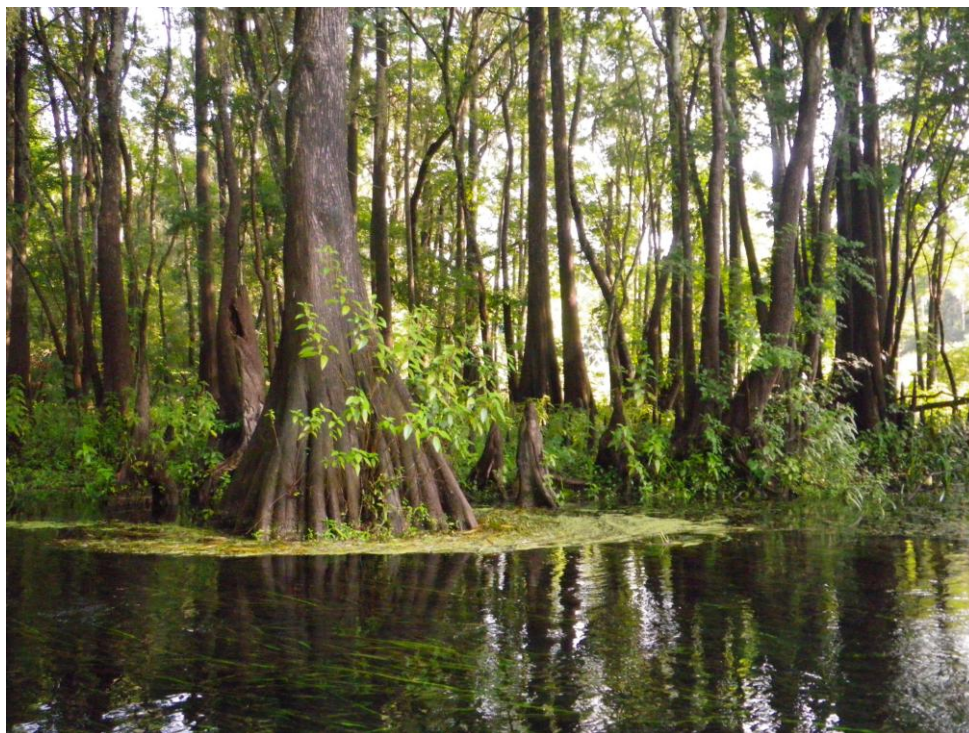
Photograph #72: Ichetucknee River – Dampier’s Landing XS-3 Facing Left Bank



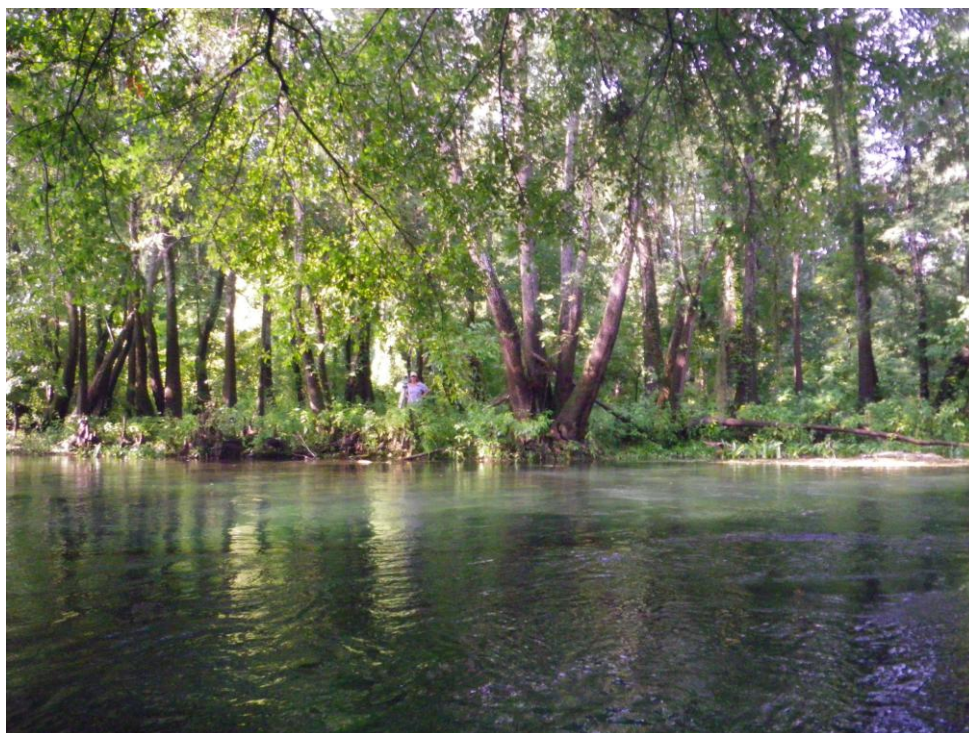
Photograph #73: Ichetucknee River – Hwy 27 XS-2 Facing Upstream



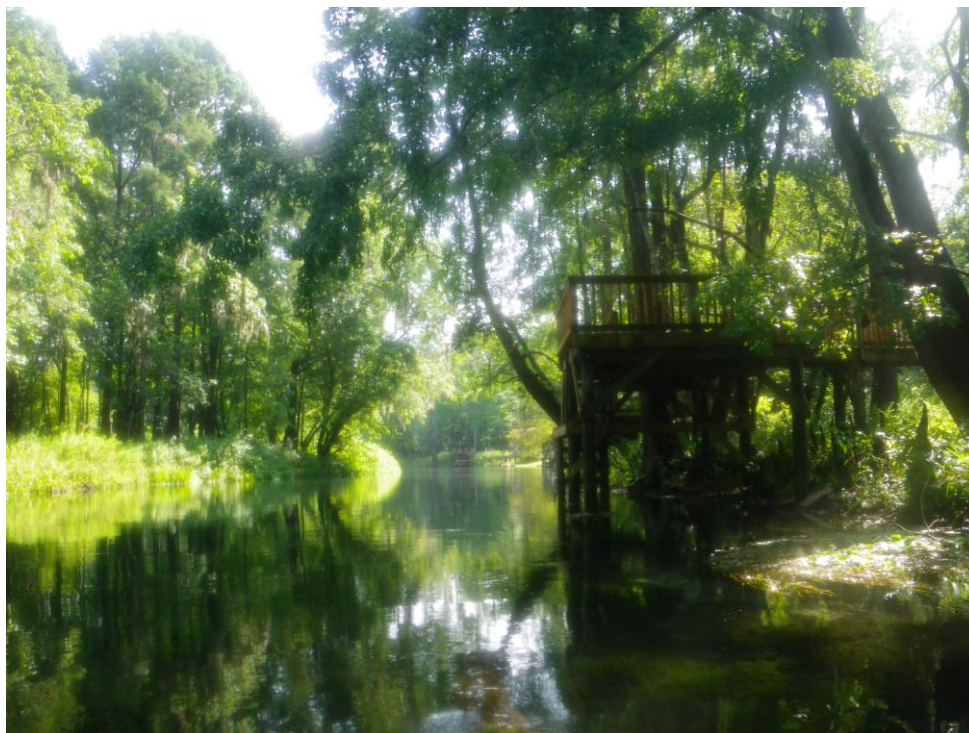
Photograph #74: Ichetucknee River – Hwy 27 XS-2 Facing Downstream



Photograph #75: Ichetucknee River – Hwy 27 XS-2 Facing Right Bank



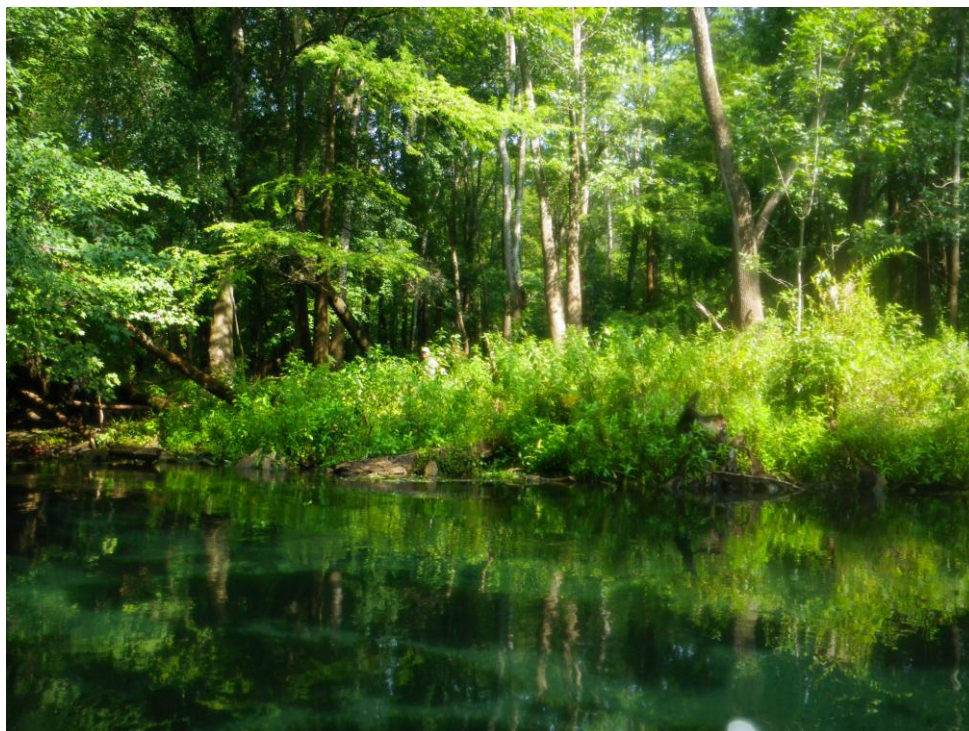
Photograph #76: Ichetucknee River – Hwy 27 XS-2 Facing Left Bank



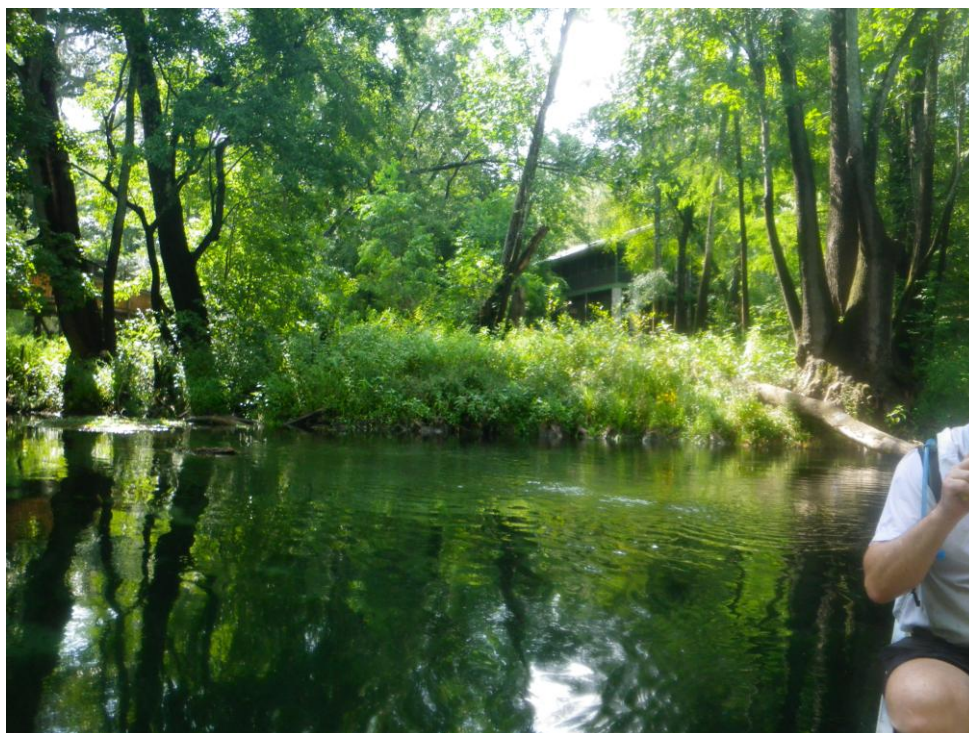
Photograph #77: Ichetucknee River – Hwy 27 XS-1 Facing Upstream



Photograph #78: Ichetucknee River – Hwy 27 XS-1 Facing Downstream



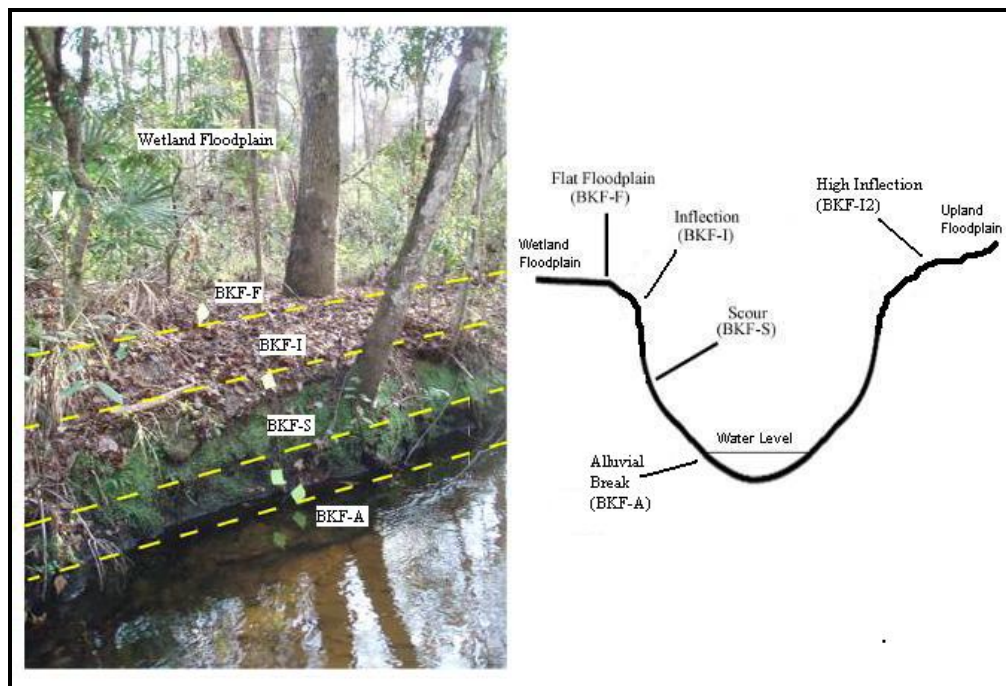
Photograph #79: Ichetucknee River – Hwy 27 XS-1 Facing Right Bank



Photograph #80: Ichetucknee River – Hwy 27 XS-1 Facing Left Bank

APPENDIX B

Field Indicators of Bankfull Stage and Their Typical Locations

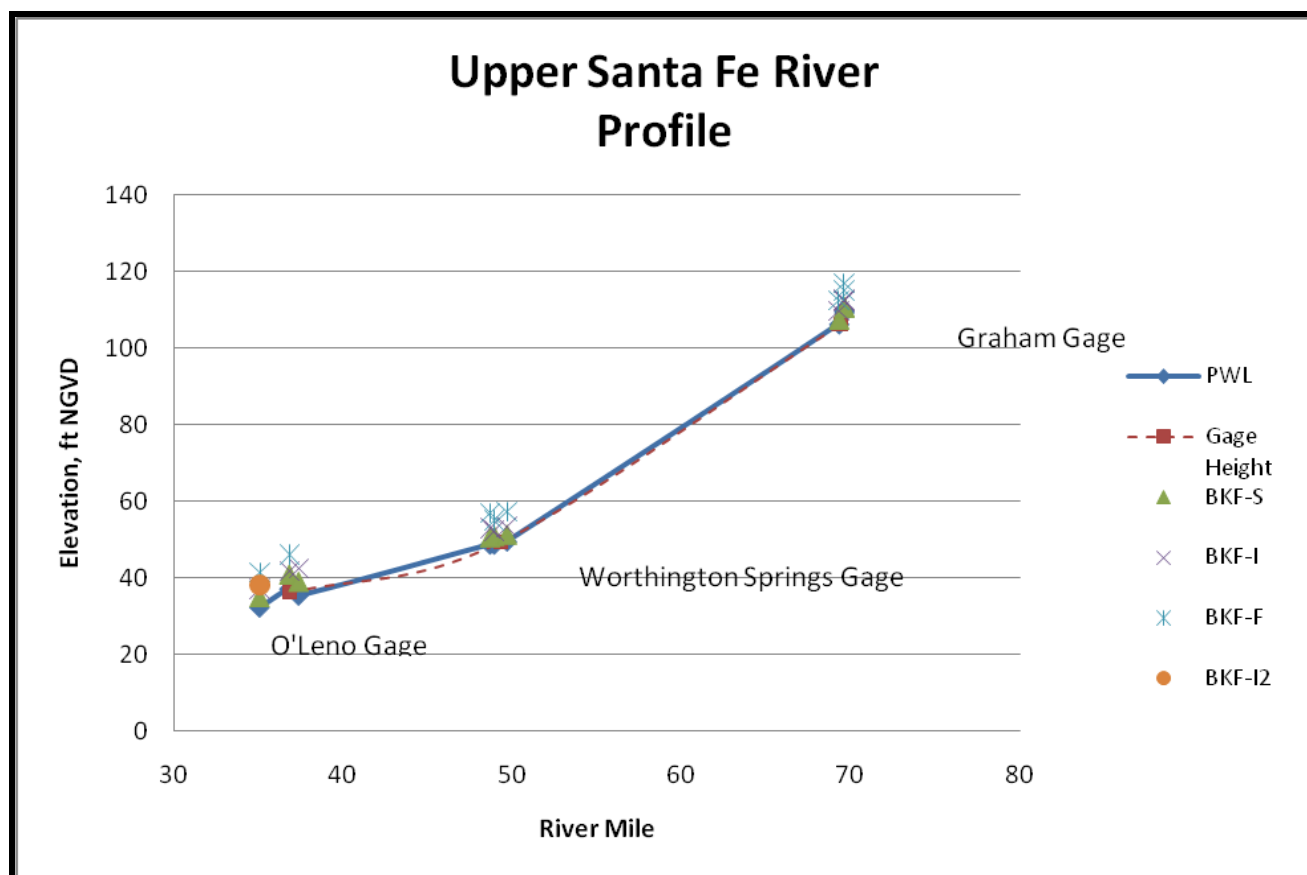


Notes regarding field indicators of bankfull stage and their typical locations:

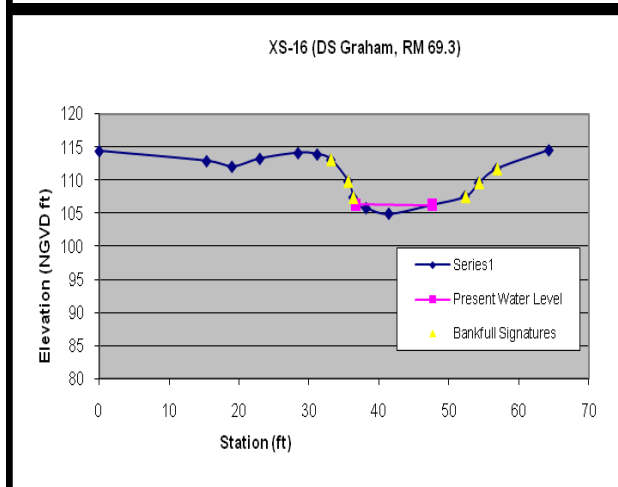
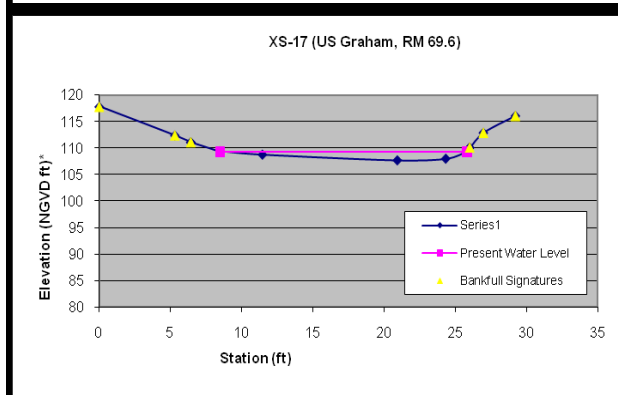
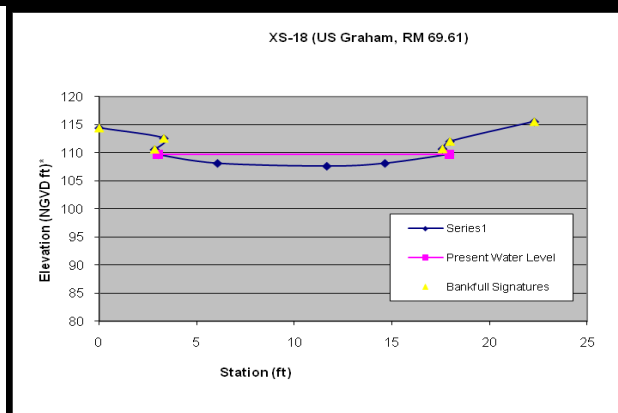
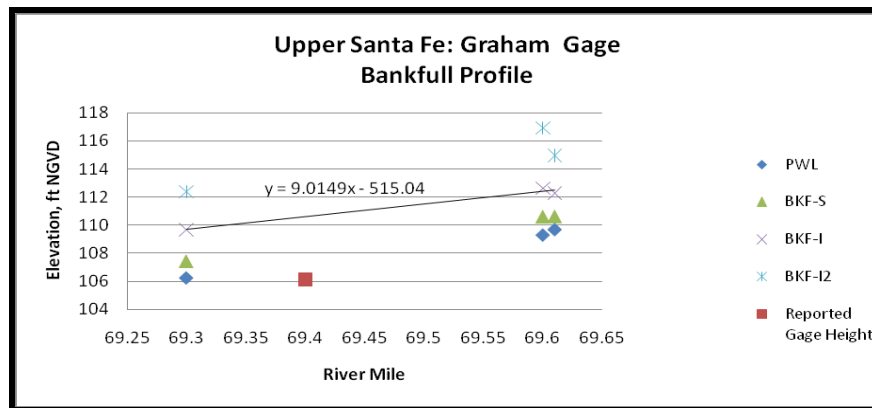
The following field indicators of bankfull stage are commonly found in peninsular Florida streams:

- **Elevation of flat floodplain (BKF-F):** This is the position on the bank where the slope first becomes level. This feature can be identified by facing the stream and dragging your foot along the bank until it flattens.
- **Inflection or break in slope of the bank (BKF-I):** This feature can be identified by finding the first break in the bank's slope as you look or feel from the streambed up the side of the bank.
- **Top of scour or undercuts in the bank (BKF-S):** This feature usually reaches an interior elevation slightly below bankfull stage and may be found around plant roots.
- **Alluvial break (BKF-A):** This feature can be identified by finding the break between more easily transported streambed material and less easily transported bank material. This break may be found where roots become denser and prevent movement of sediment from the banks, where sediment texture changes (i.e., bank material may consist of more organics), or where sediment color changes (i.e., bank material may be darker in color due to the presence of organics).

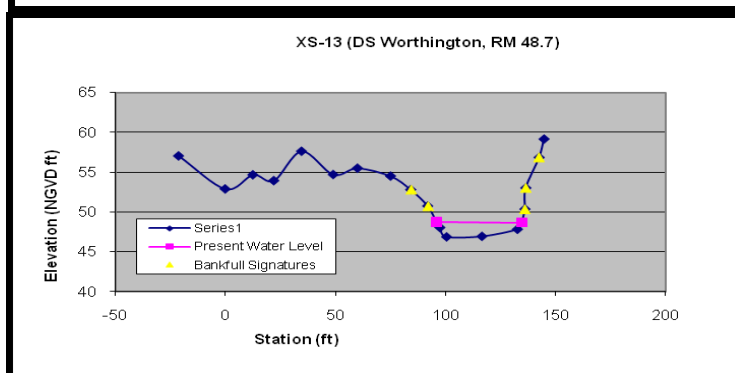
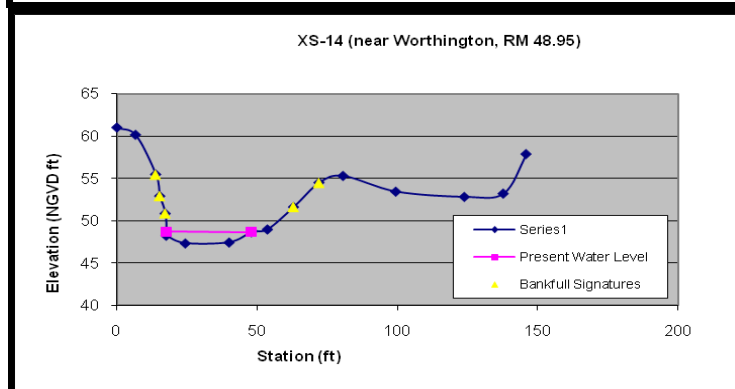
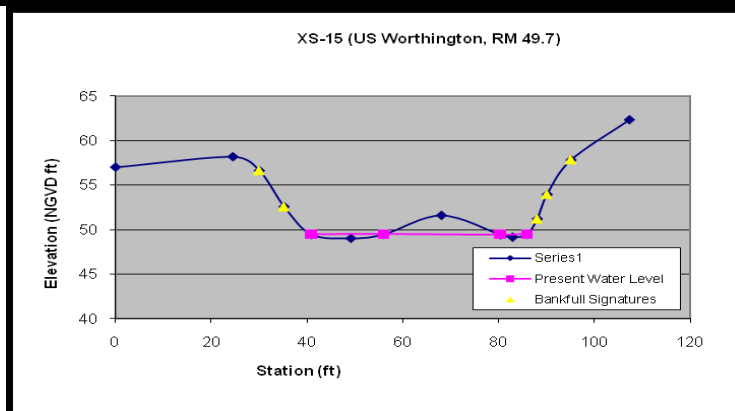
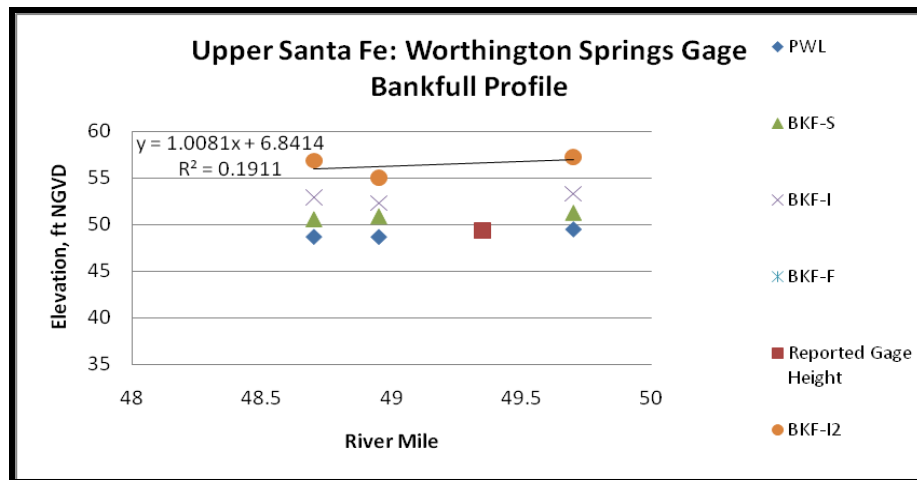
In general, bankfull indicators are located in the following order along the bank: BKF-F (highest in elevation), BKF-I, BKF-S, and BKF-A (lowest in elevation). In streams with a wetland floodplain, the BKF-F indicator appears to be correlated strongly with the top of bank, while in streams without a wetland floodplain (which were often incised), BKF-F is often absent (Blanton, 2008). BKF-S and BKF-A indicators are generally closely associated with water surface elevation, occurring at a flow duration considered too high to be the bankfull stage (Blanton, 2008). In streams with relatively high banks (such as the Upper Santa Fe River), two sets of inflection points, a high (BKF-I2) and a low (BKF-I), can often be found.

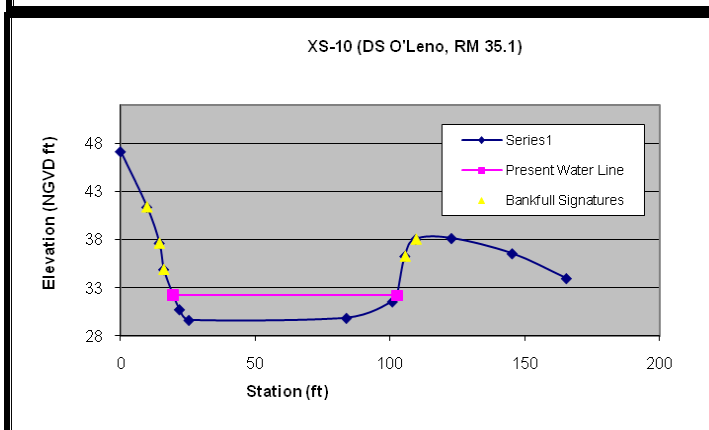
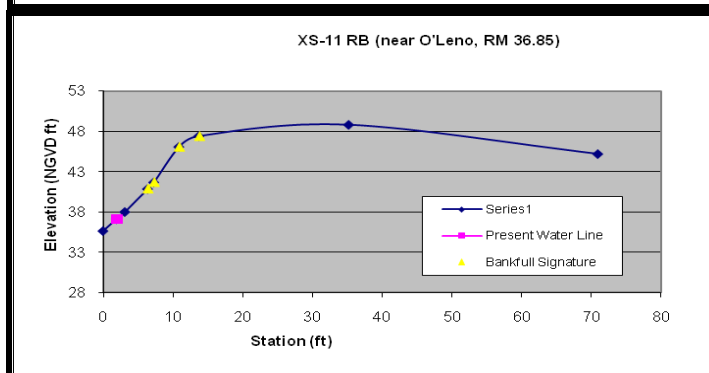
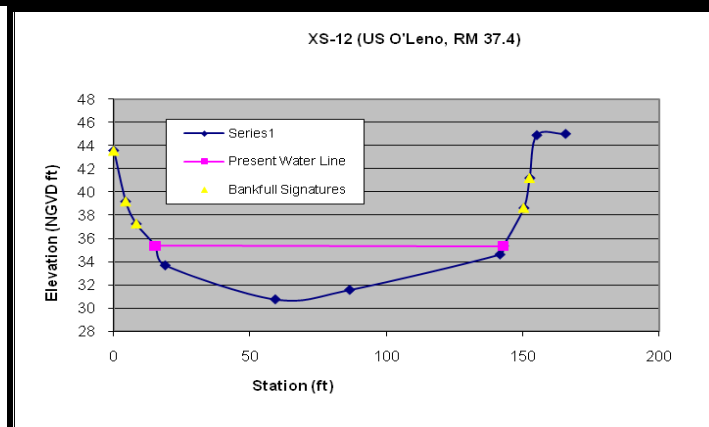
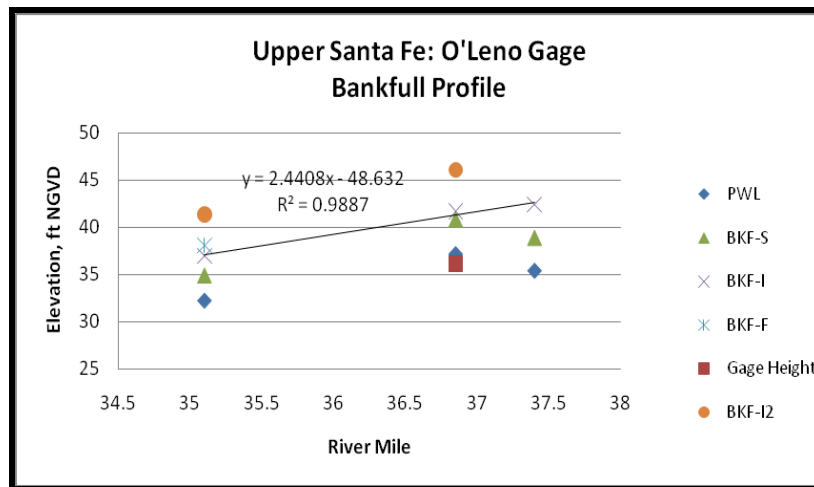


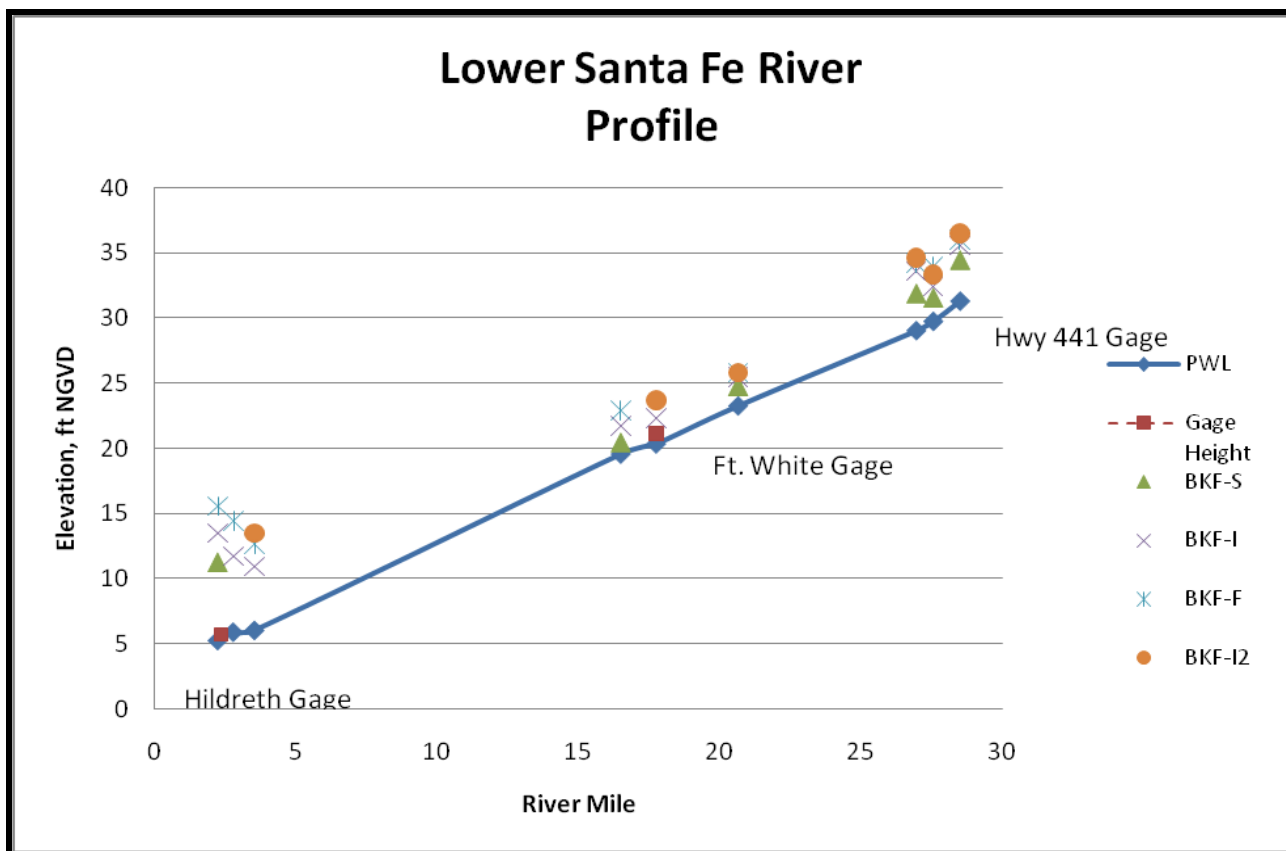
- PWL = present water level on day of survey (6/22/2011 – 6/23/2011)



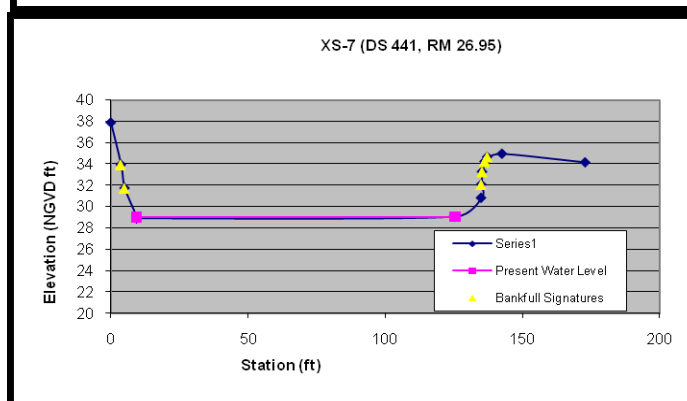
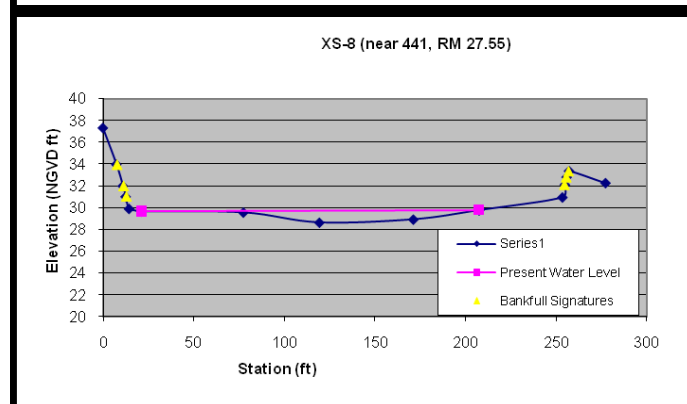
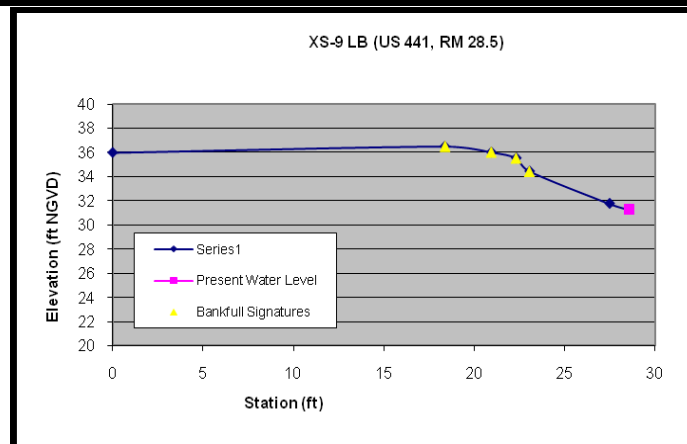
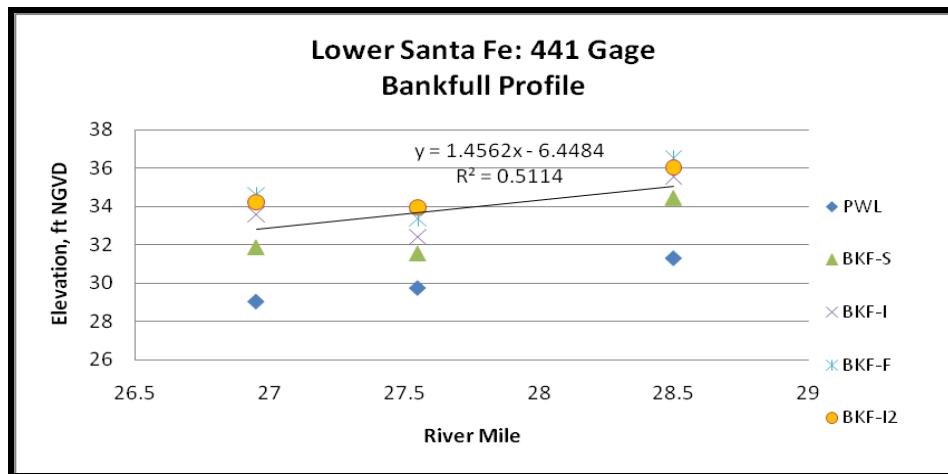
*XS-18 and XS-17 Elevations not surveyed, estimated from LiDAR-derived topography

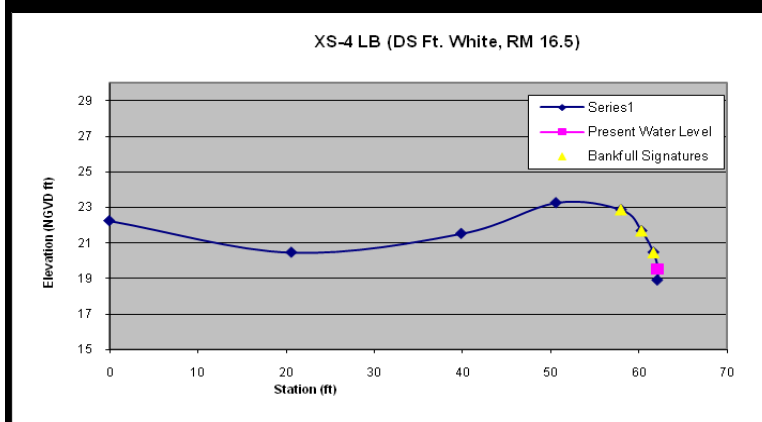
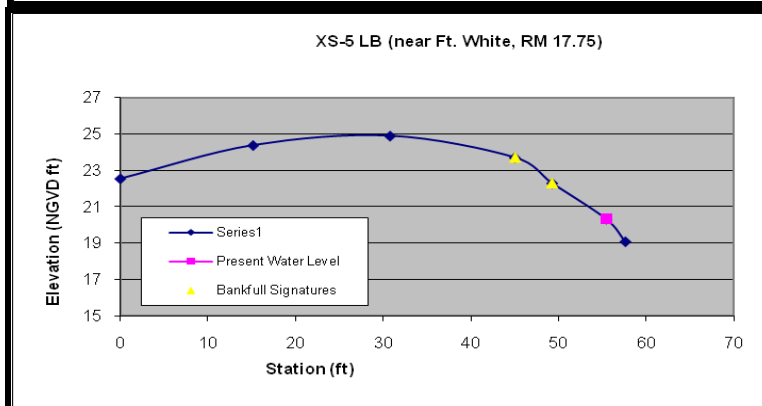
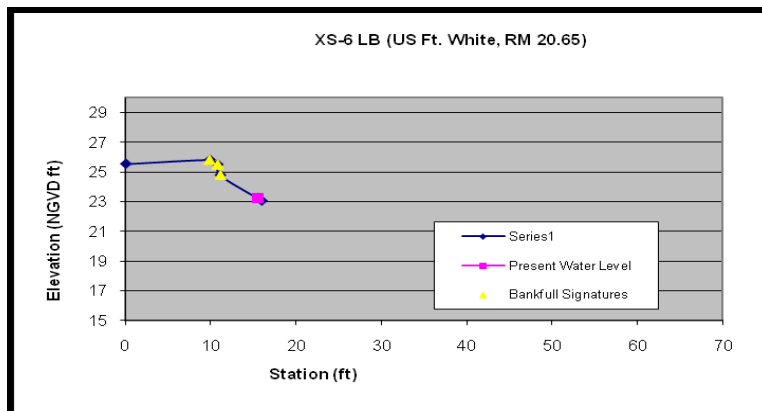
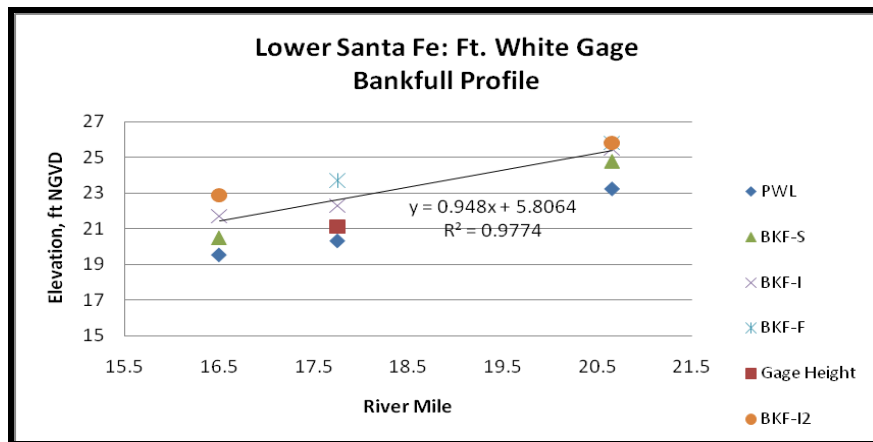


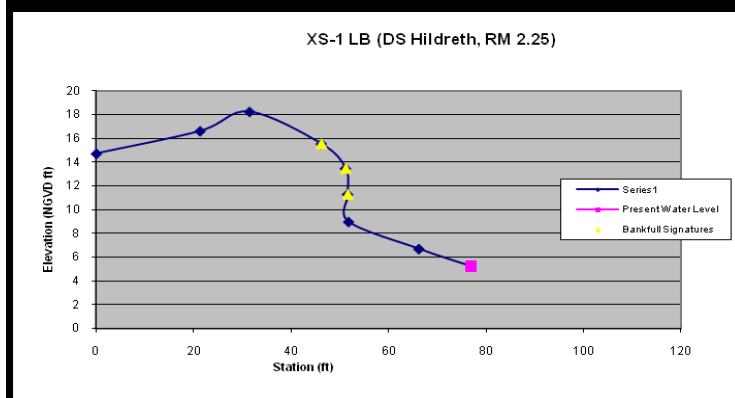
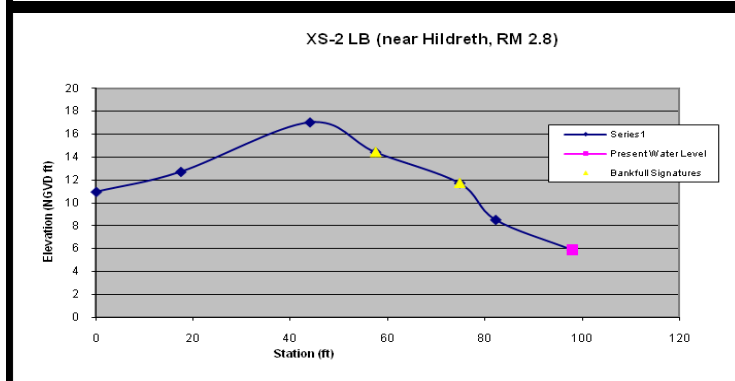
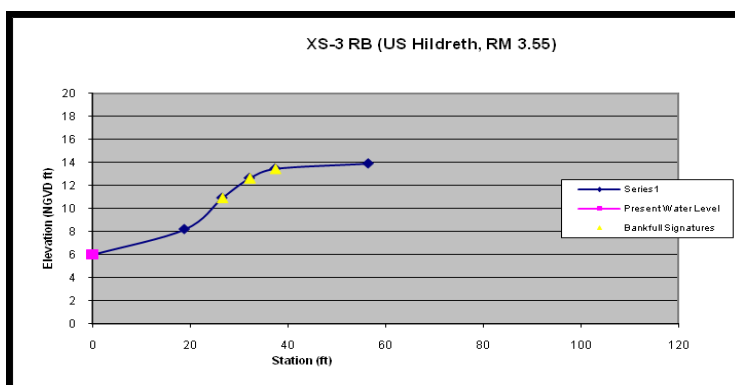
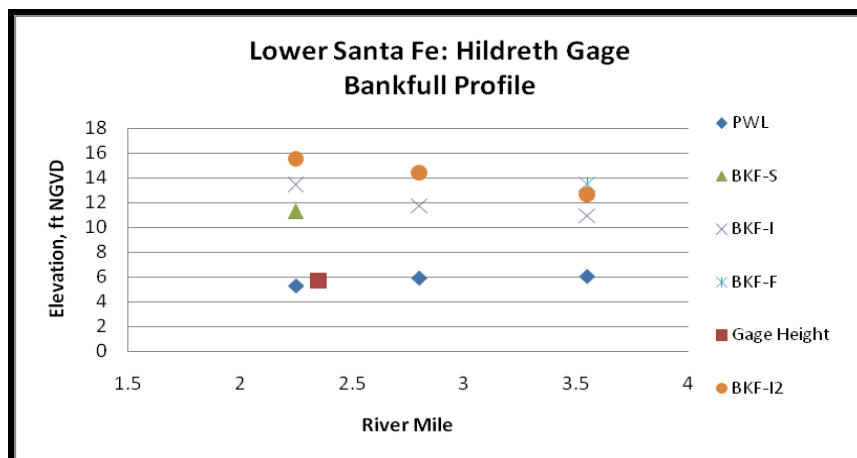


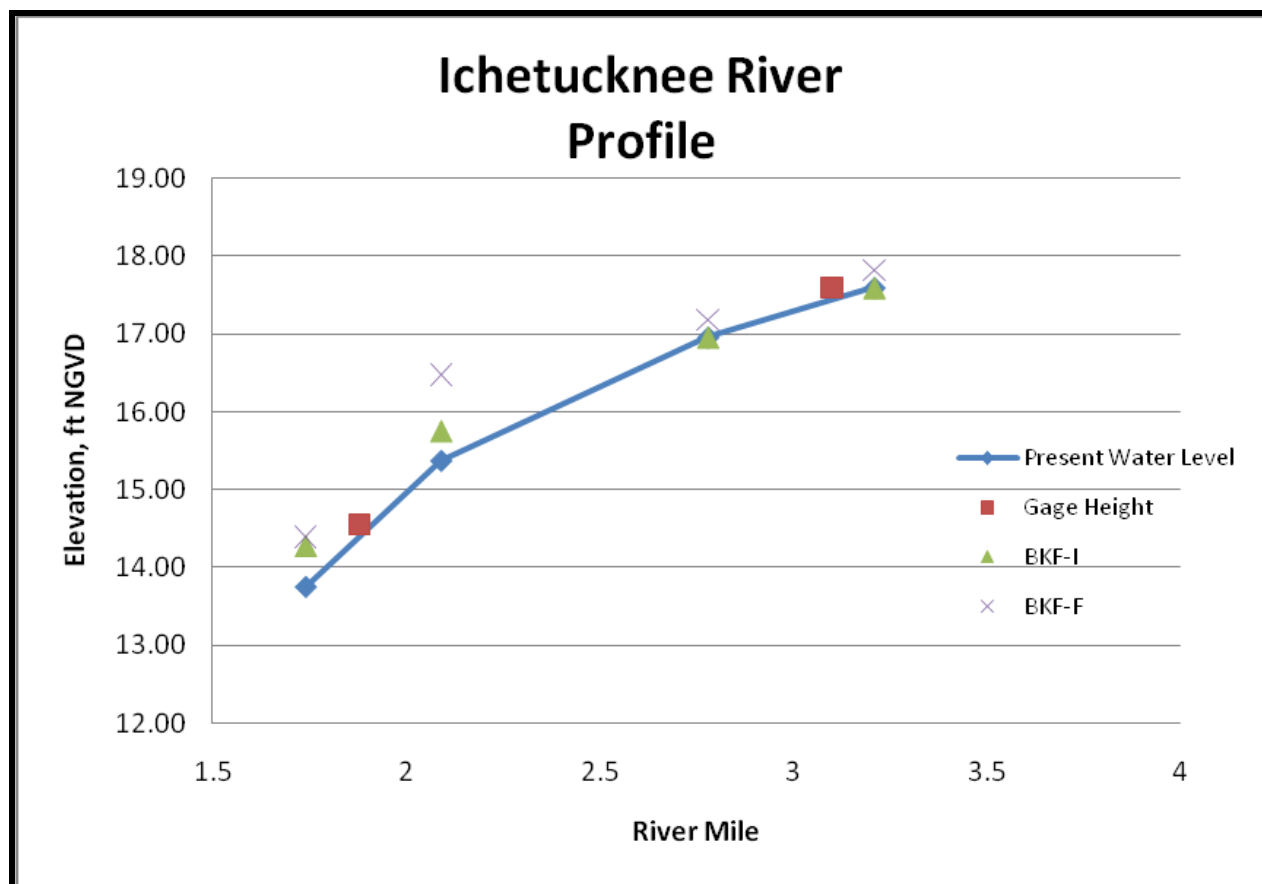


- PWL = present water level on day of survey (6/21/2011 – 6/22/2011)

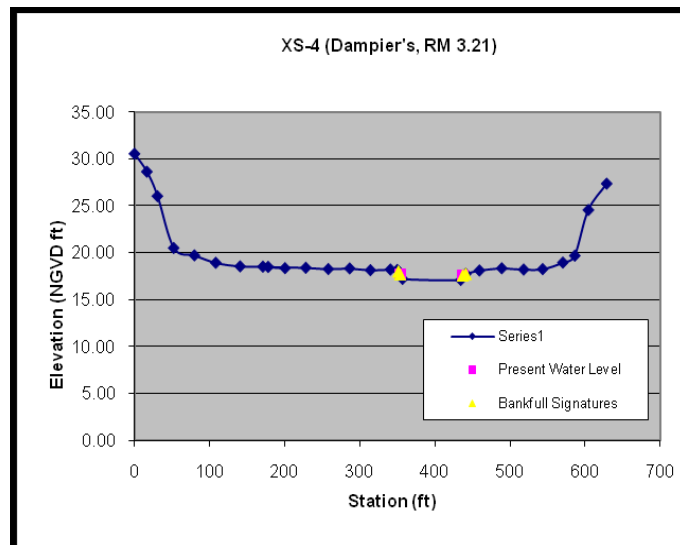
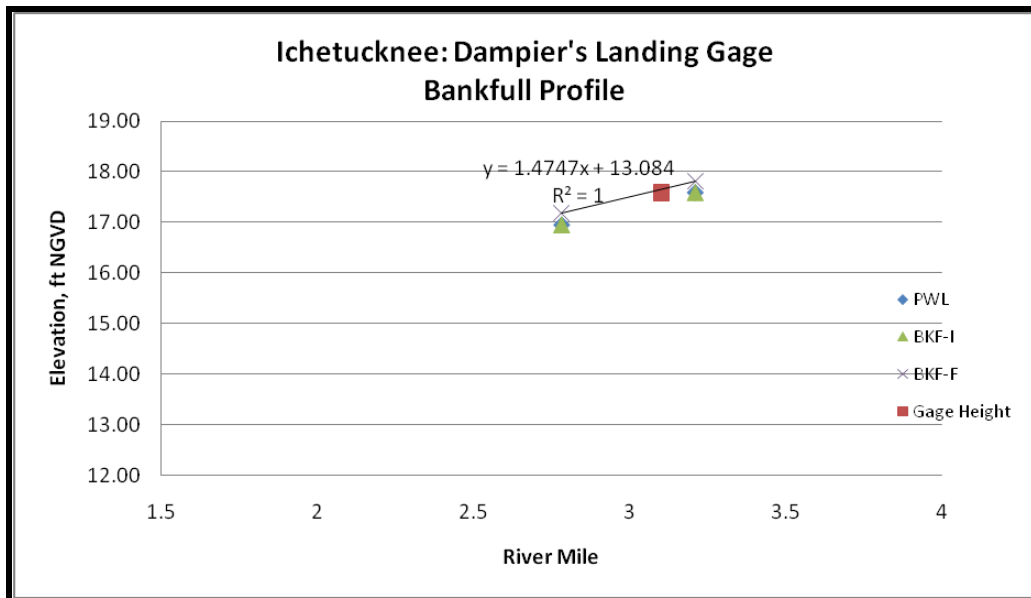


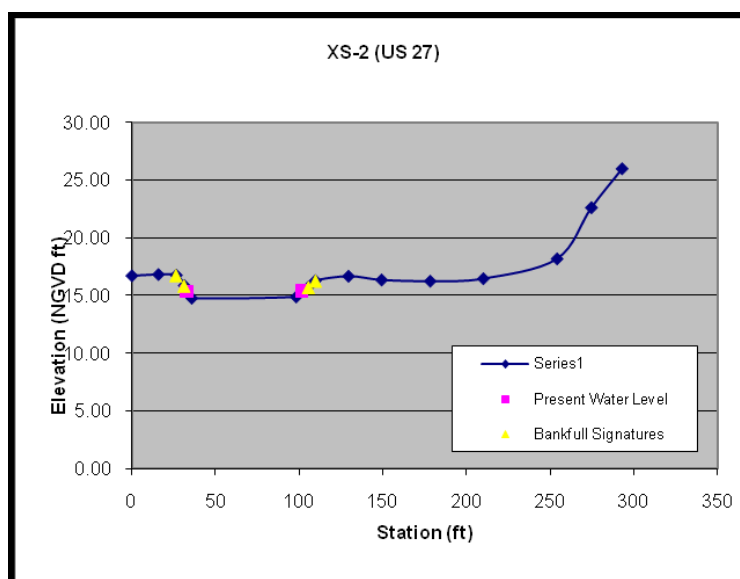
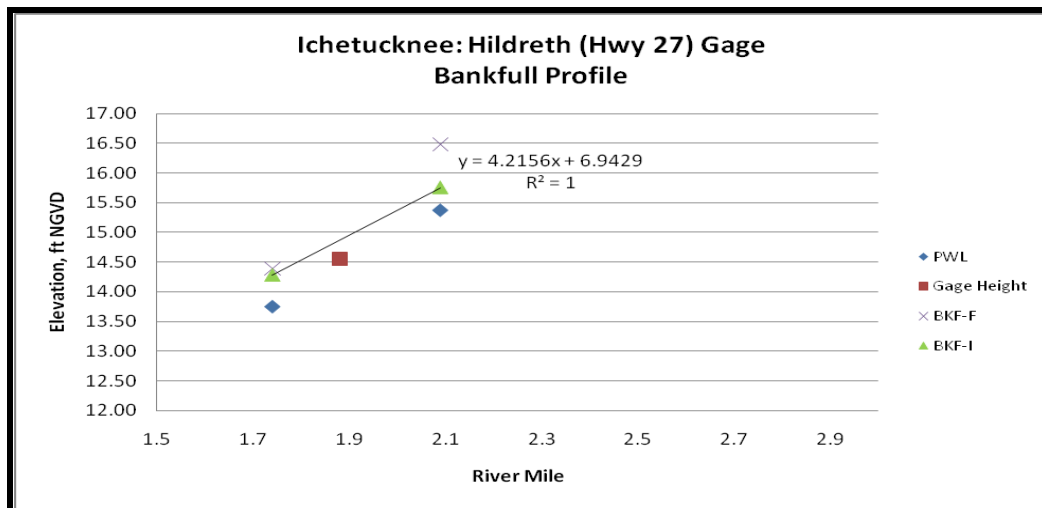
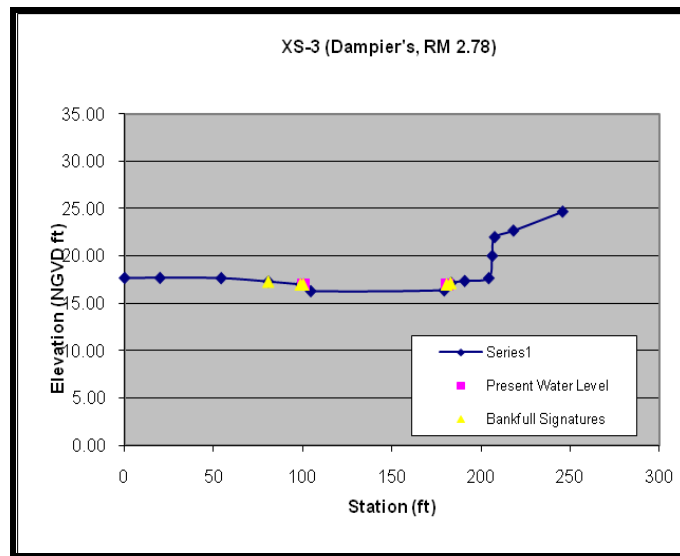


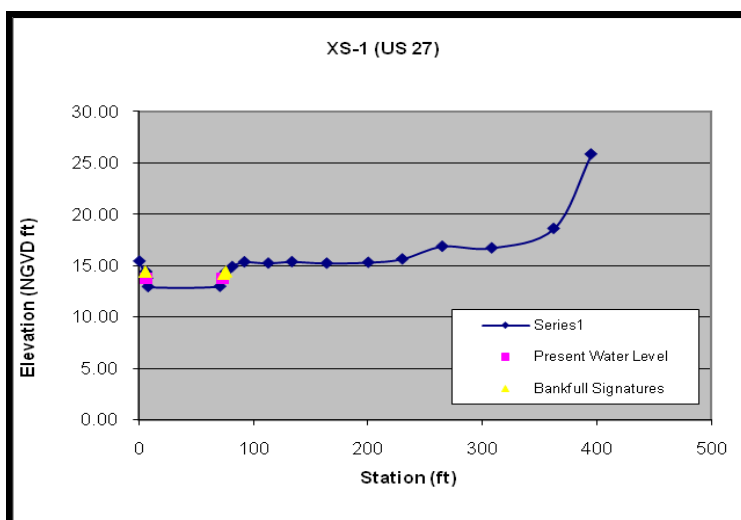




- PWL = present water level on day of survey (8/1/2011 – 8/2/2011)

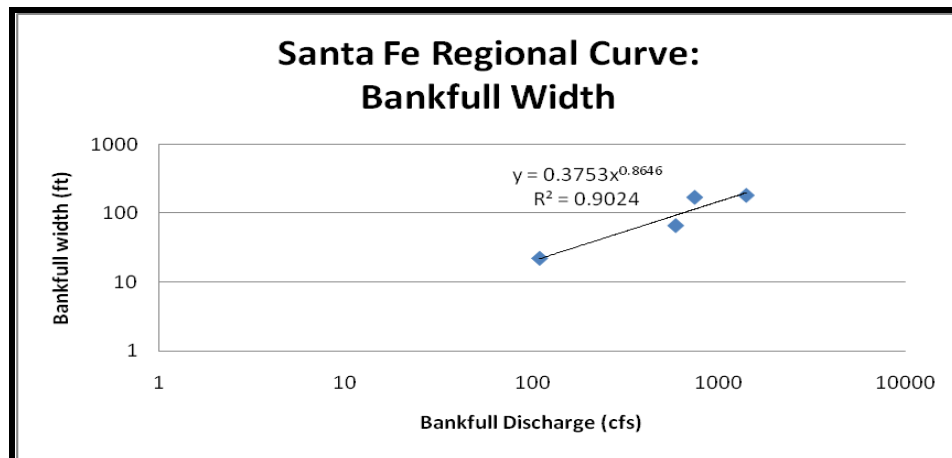




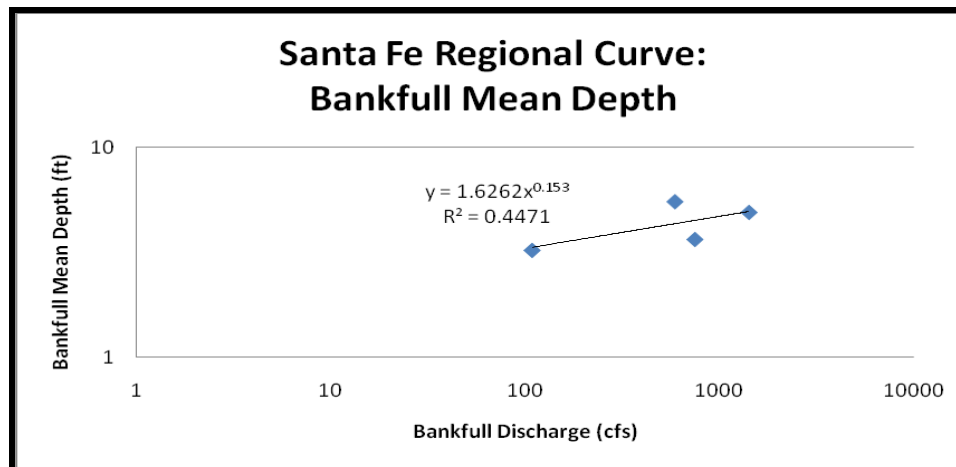


APPENDIX C

A)



B)



C)

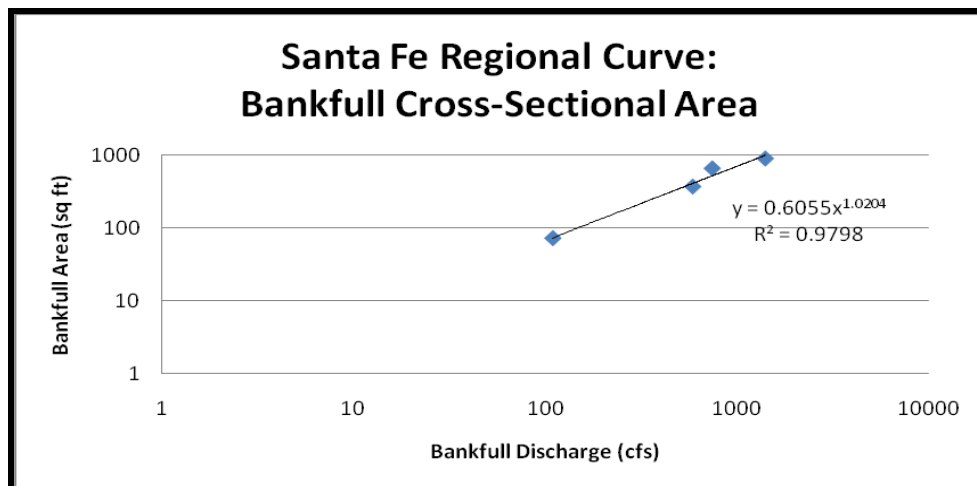
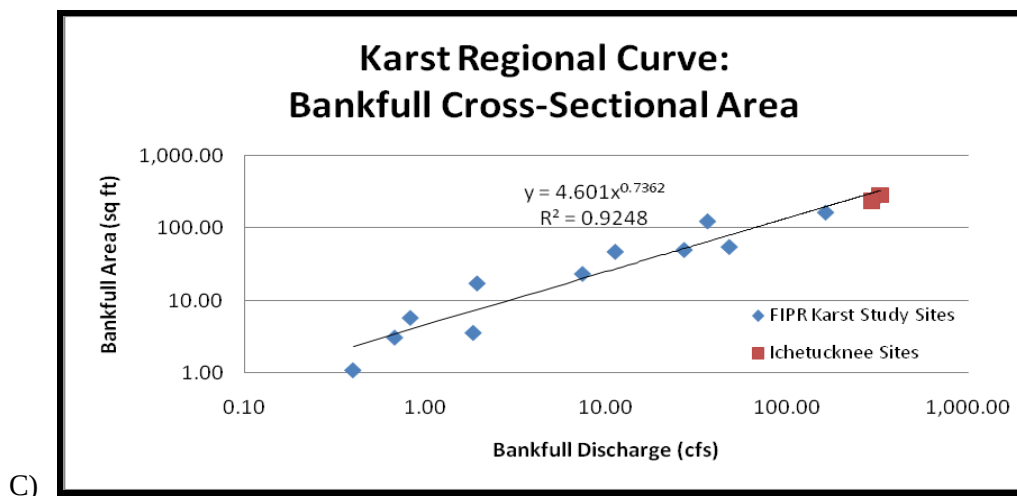
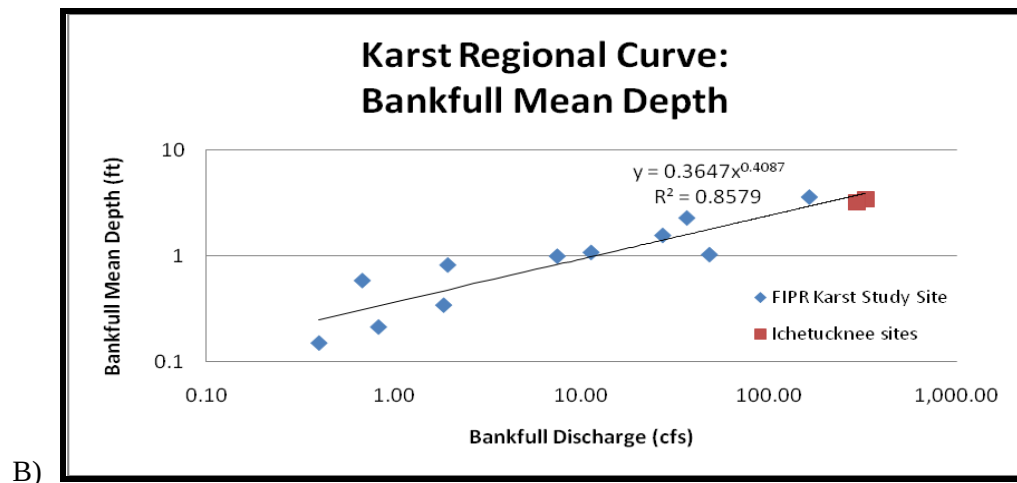
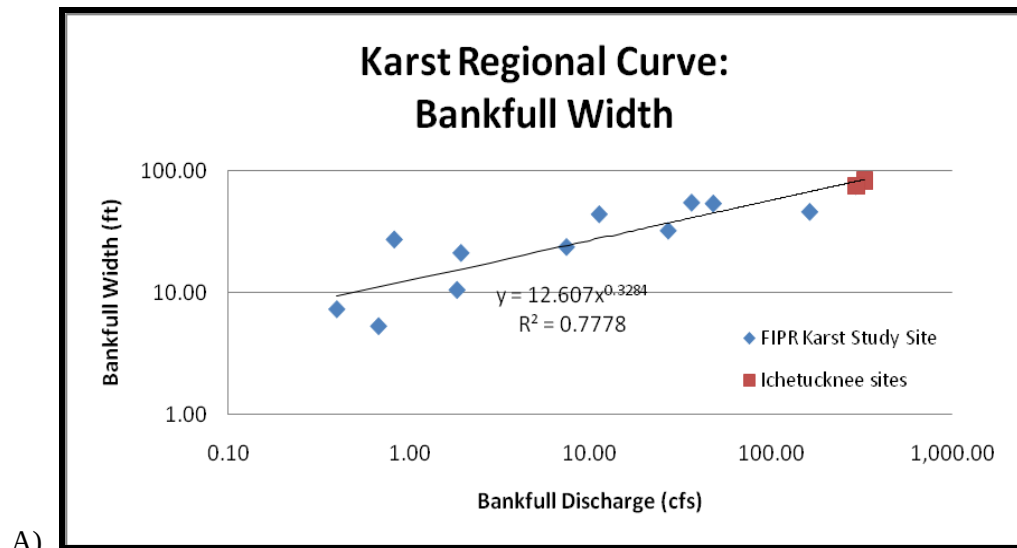


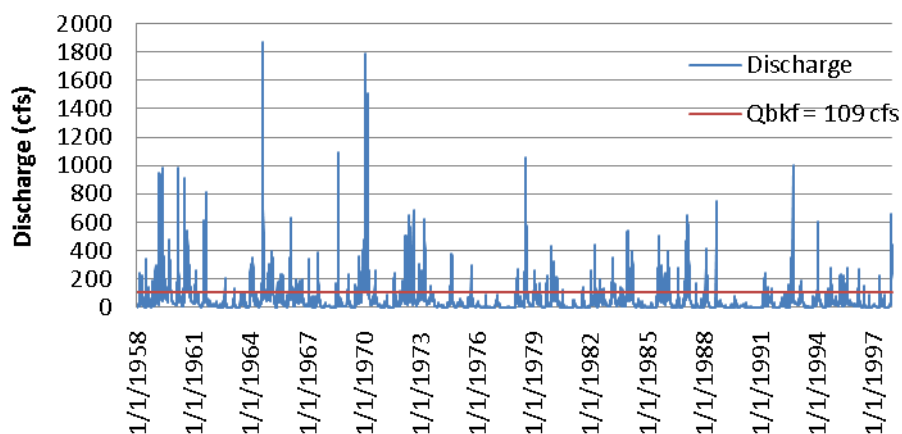
Exhibit C-1
Santa Fe River Site Specific Regional Curves



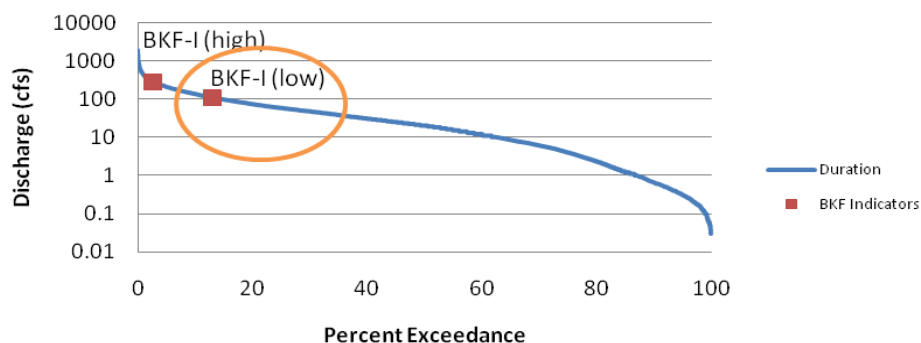
**Exhibit C-2
Ichetucknee River Regional Curves**

APPENDIX D

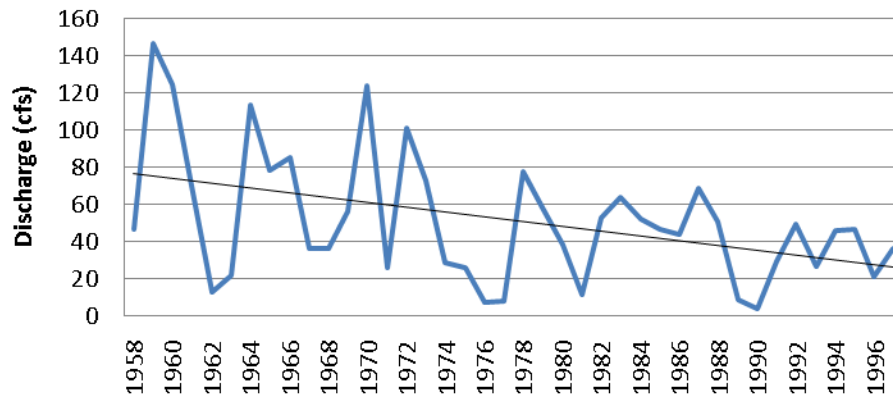
Upper Santa Fe River: Graham Gage Hydrograph (1958-1997)



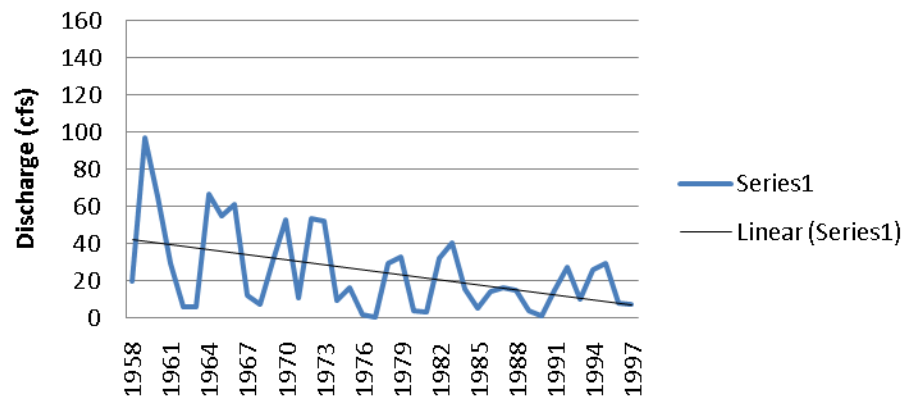
Upper Santa Fe: Graham Gage Flow Duration Curve (1958-1997)



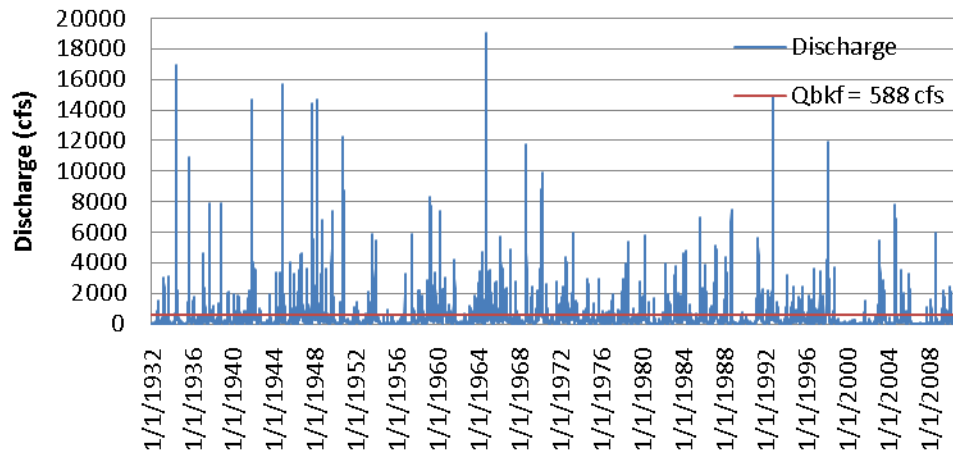
Upper Santa Fe: Graham Gage Mean Annual Flow (1958-1997)



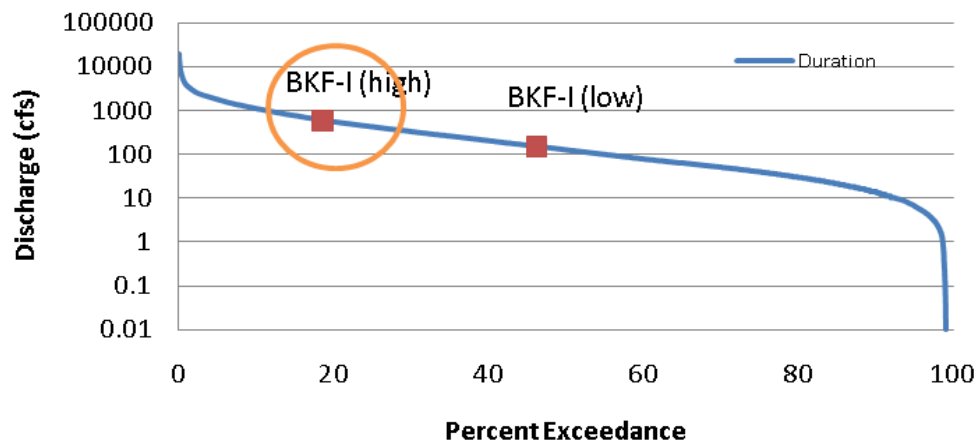
Upper Santa Fe: Graham Gage Median Annual Flow (1958-1997)



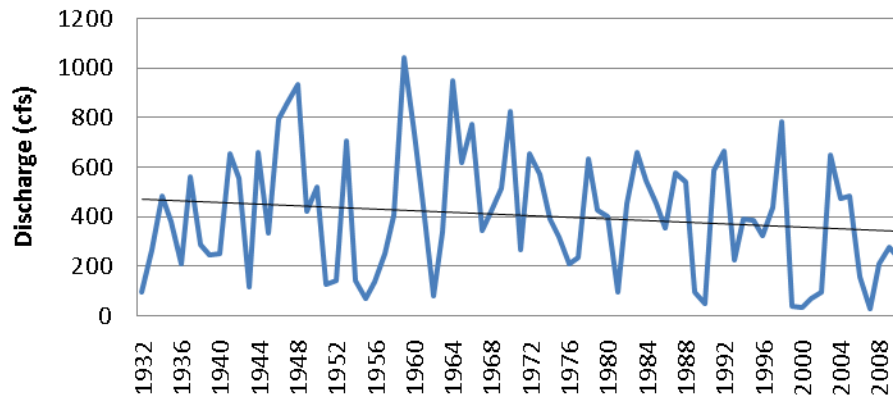
Upper Santa Fe: Worthington Gage Hydrograph (1932-2010)



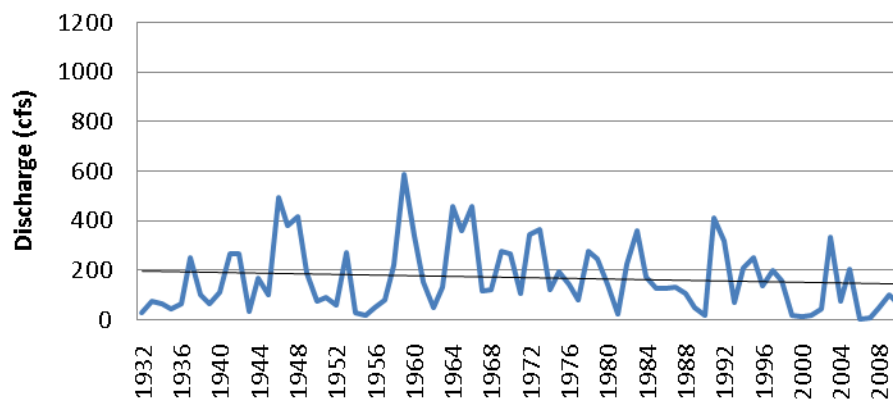
Upper Santa Fe: Worthington Gage Flow Duration Curve (1932-2010)

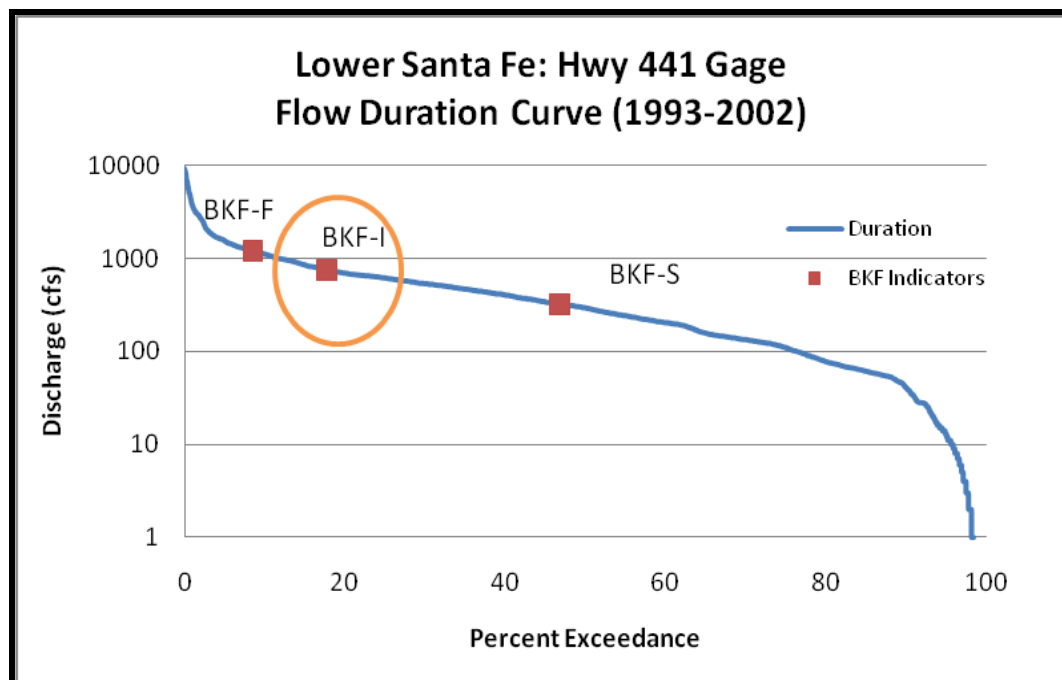
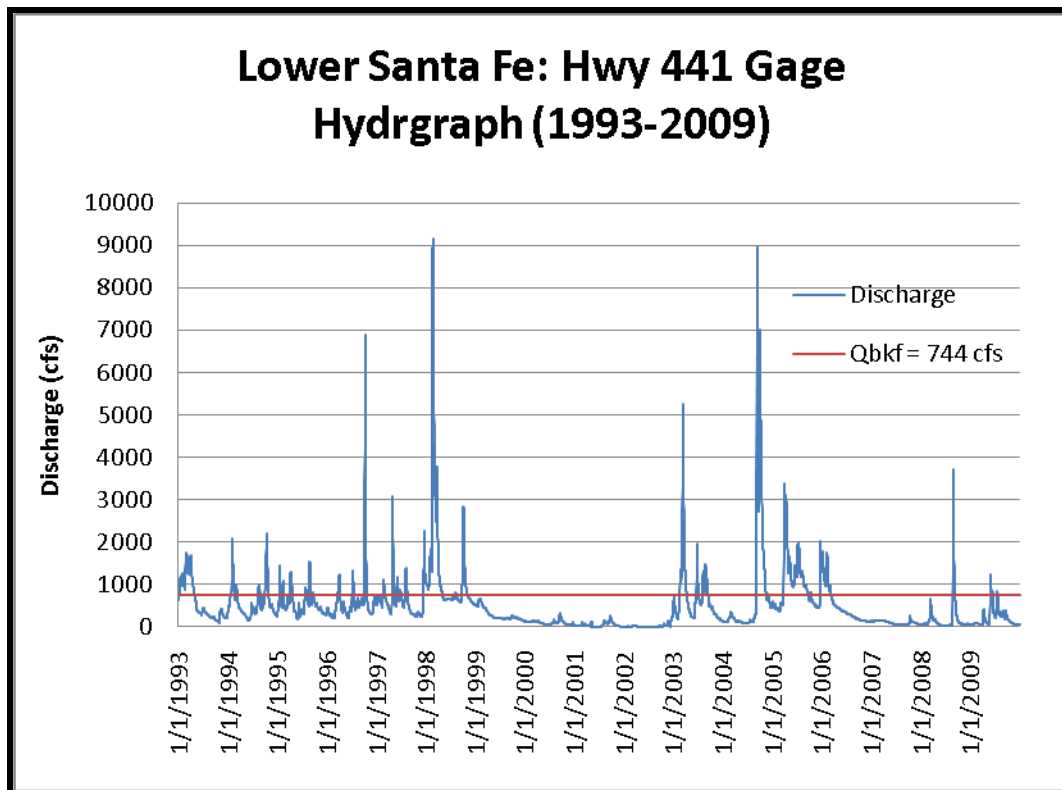


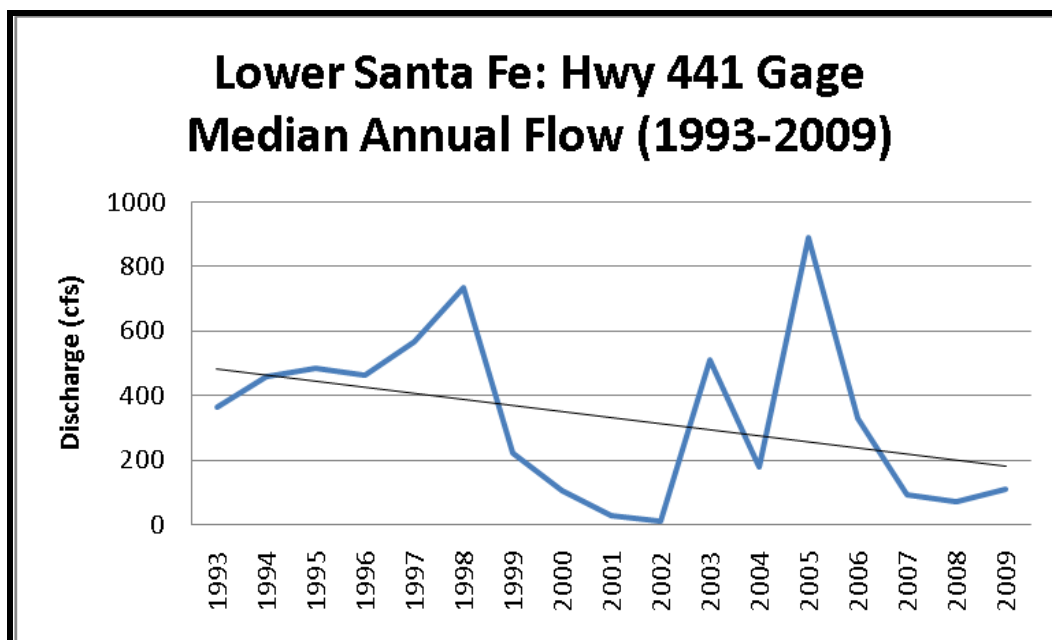
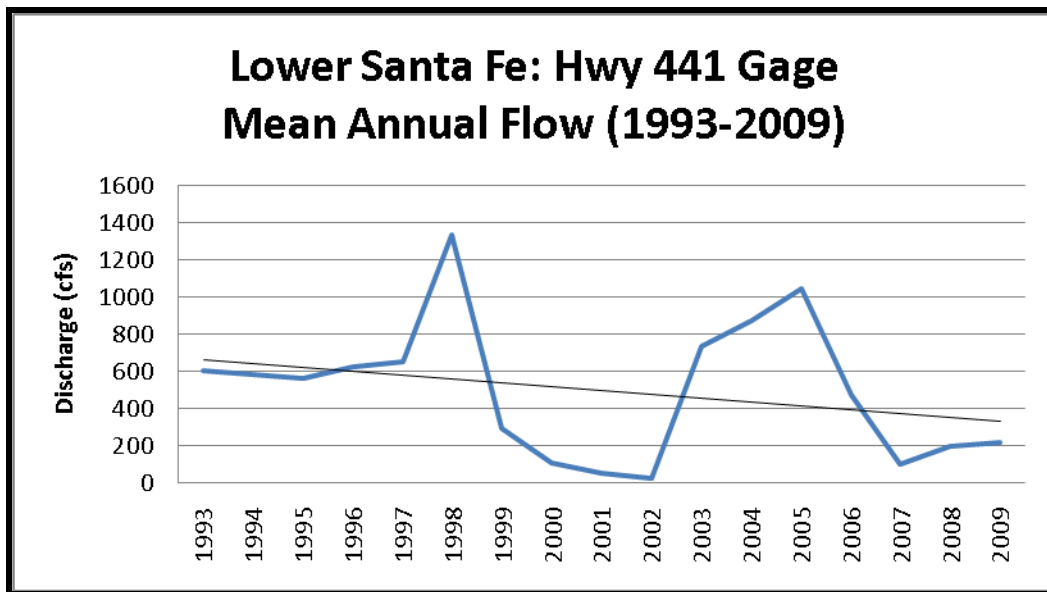
Upper Santa Fe: Worthington Gage Mean Annual Flow (1932-2010)



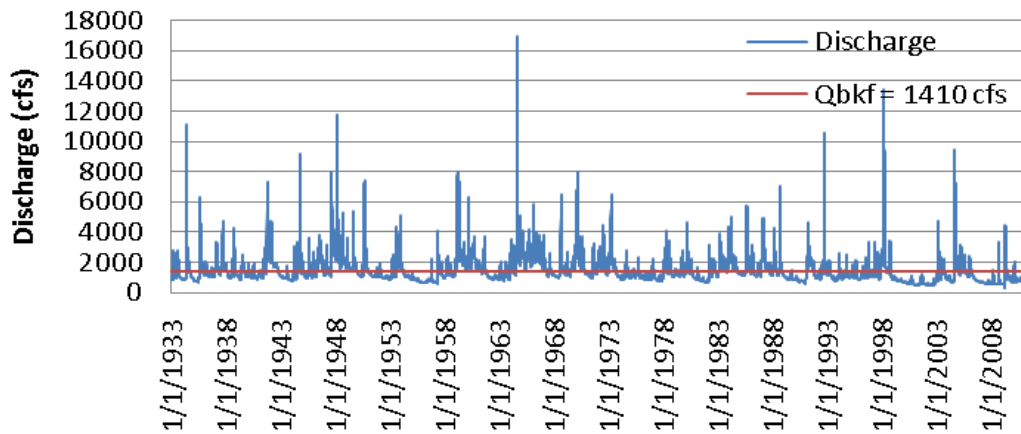
Upper Santa Fe: Worthington Gage Median Annual Flow (1932-2010)



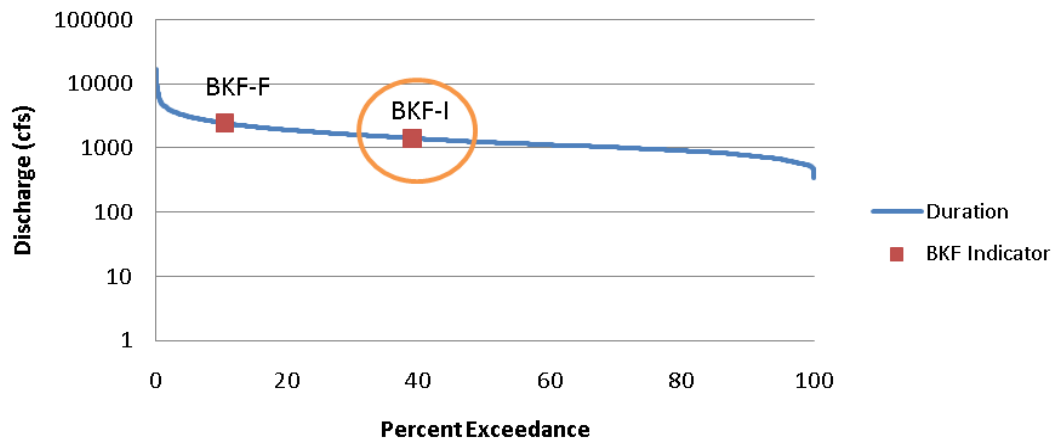




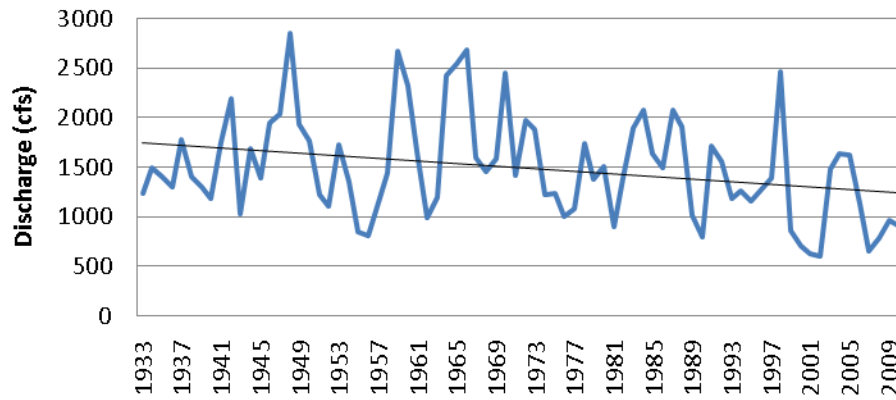
Lower Santa Fe: Ft. White Gage Hydrograph (1933-2010)



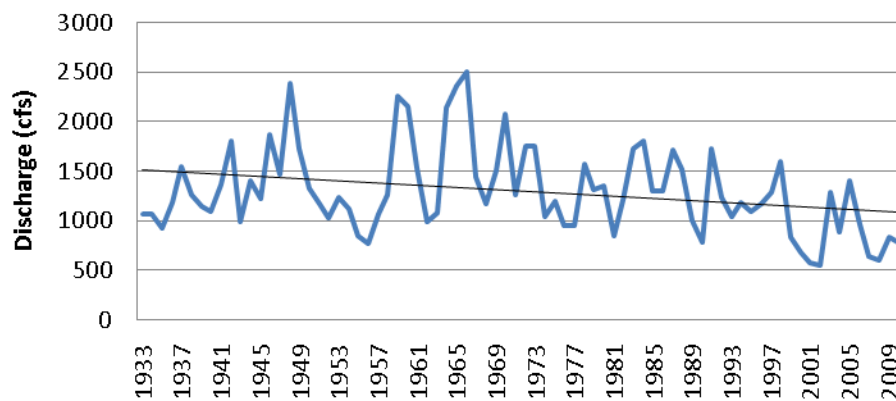
Lower Santa Fe: Ft. White Gage Flow Duration Curve (1933-2010)

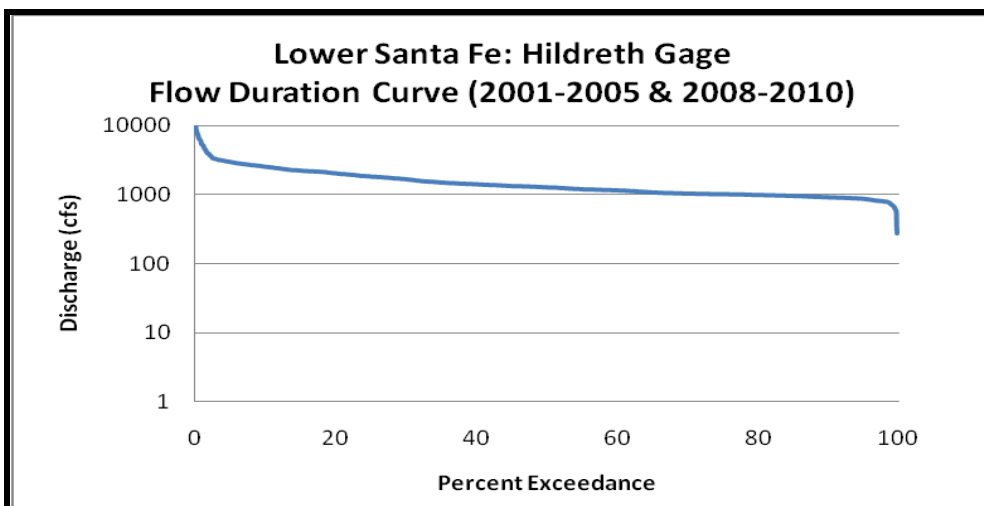
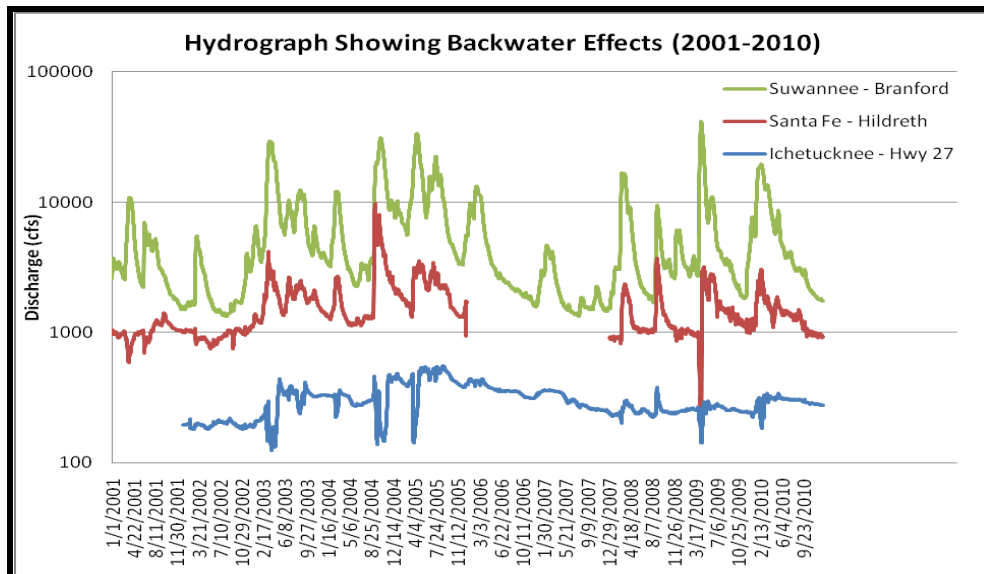
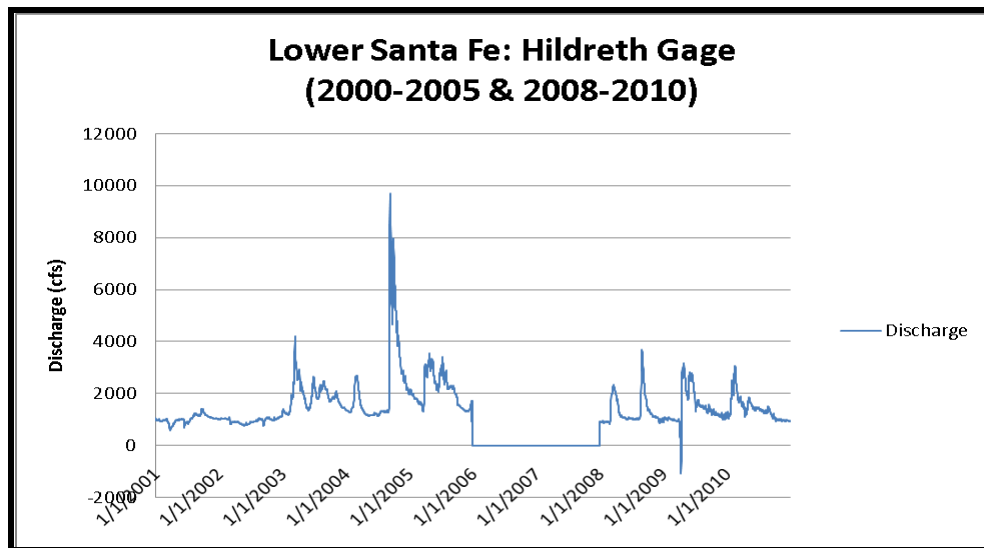


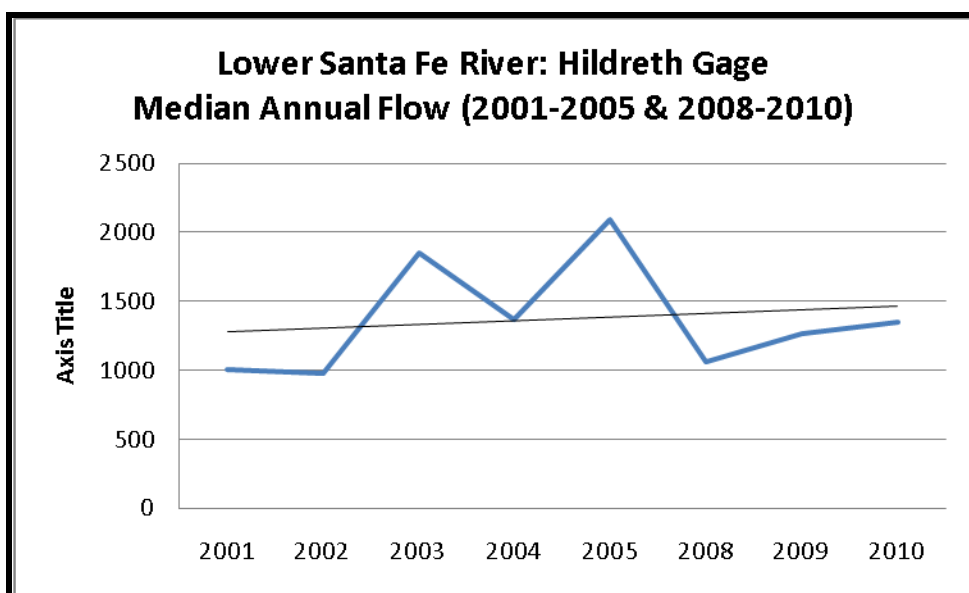
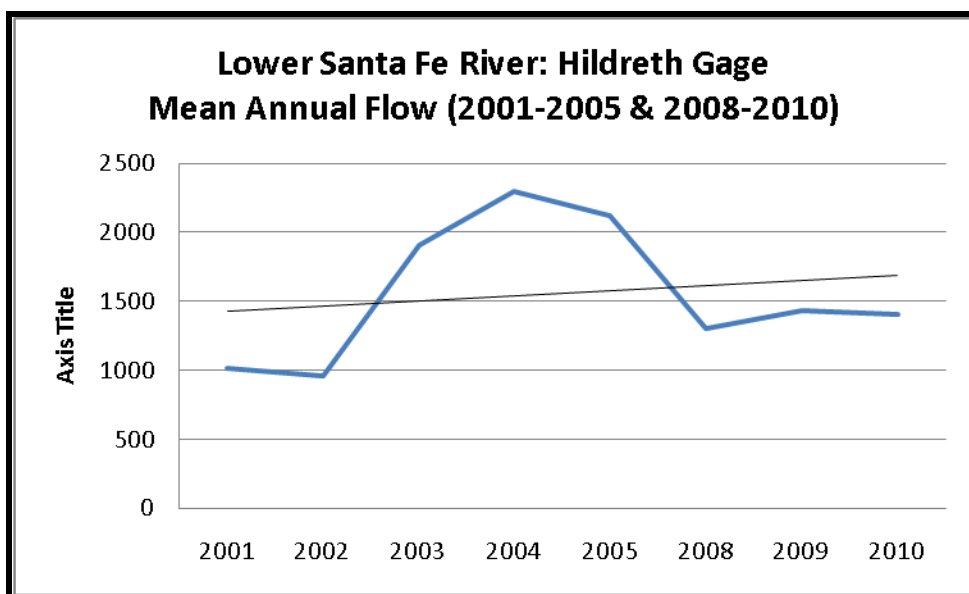
Lower Santa Fe: Ft. White Gage Mean Annual Flow (1933-2010)



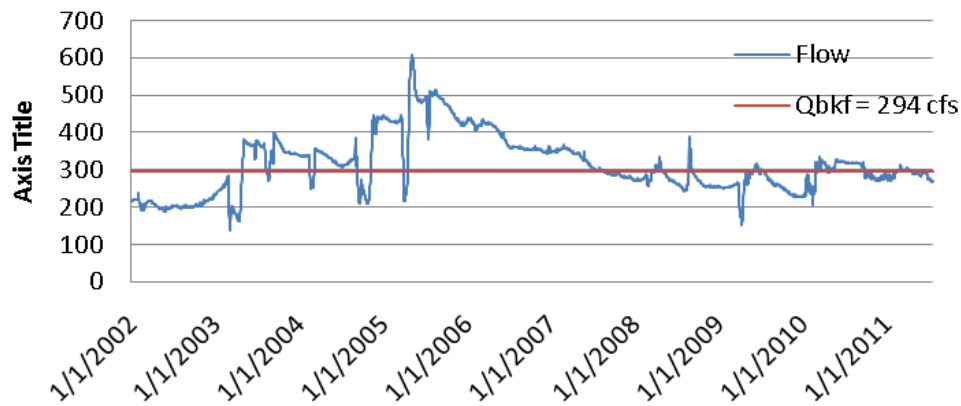
Lower Santa Fe: Ft. White Gage Median Annual Flow (1933-2010)



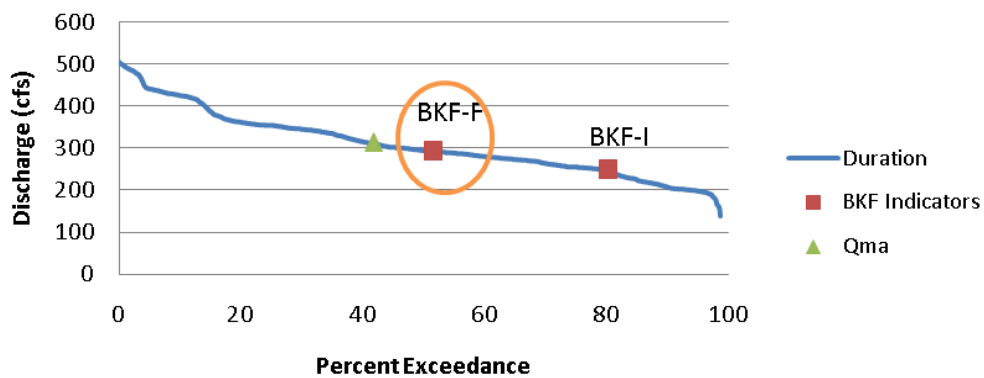




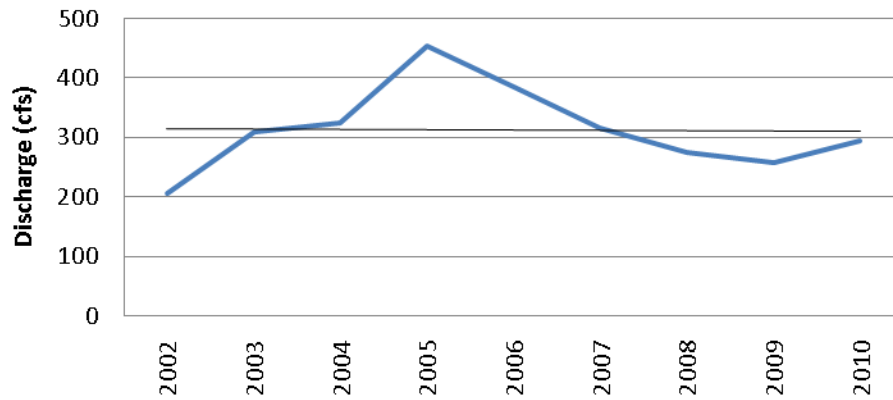
Ichetucknee: Dampier's Landing Gage Hydrograph (2002-2010)



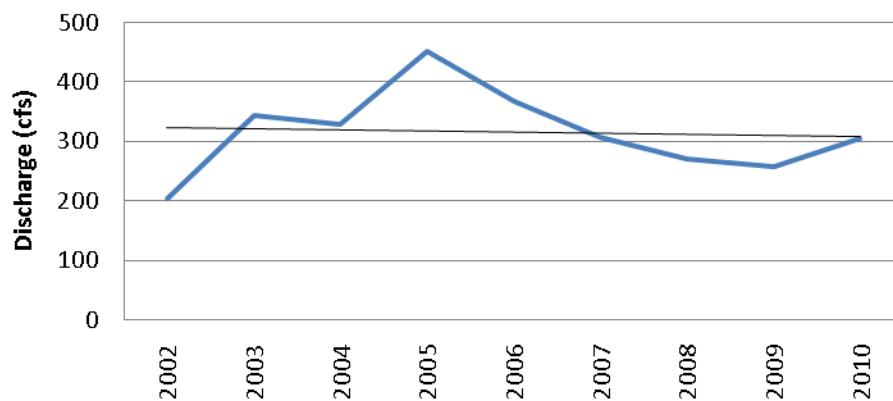
Ichetucknee: Dampier's Landing Gage Flow Duration Curve (2002-2010)



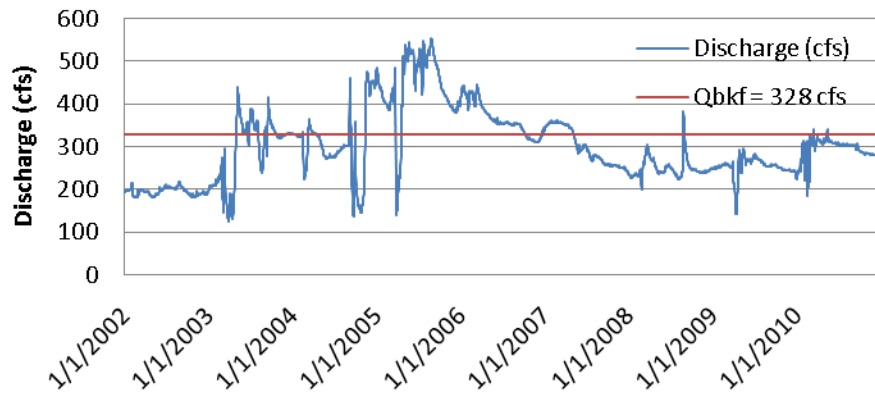
Ichetucknee: Dampier's Landing Gage Mean Annual Flow (2002-2010)



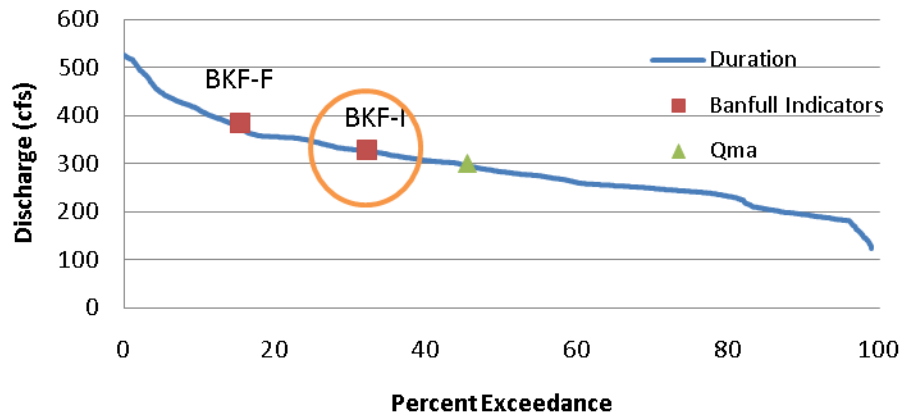
Ichetucknee: Dampier's Landing Gage Median Annual Flow (2002-2010)

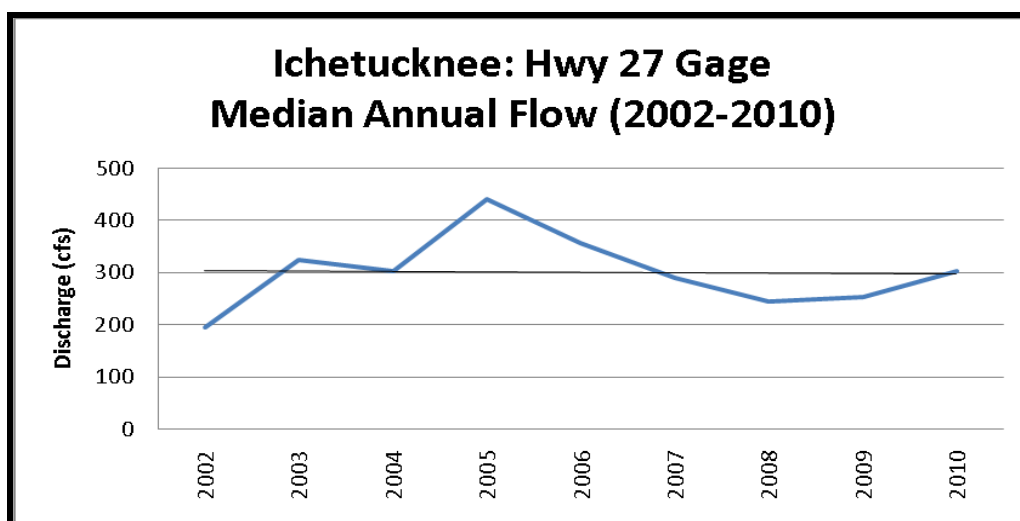
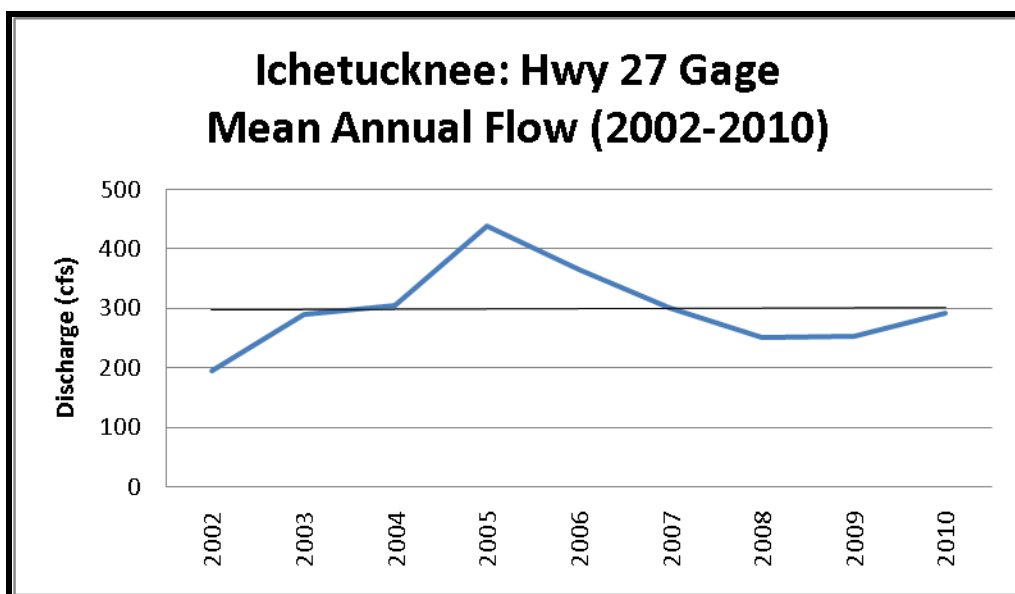


Ichetucknee: Hwy 27 Gage Hydrograph (2002-2010)



Ichetucknee: Hwy 27 Gage Flow Duration Curve (2002-2010)





APPENDIX E

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Reporting Period Summary		
Start based on User	1/1/1958	1/1/1958
End Date	12/31/1997	12/31/1997
General Statistics		
Whole Period		
Minimum	0.03	0.03
Maximum	1870	1589.5
Percentile 10	0.66	0.66
Percentile 90	135	114.75
Mean	51.292	43.623
Median	20	17
Zeros	0	0
Total	749374.51	637335.325
Less or equal 109	12724	13062
Greater or equal 109	1902	1548
Summary for each year		
Minimum for 1958	1.9	1.9
Minimum for 1959	20	17
Minimum for 1960	4	3.4
Minimum for 1961	0.5	0.5
Minimum for 1962	0.3	0.3
Minimum for 1963	0.1	0.1
Minimum for 1964	2.9	2.465
Minimum for 1965	1.1	1.1
Minimum for 1966	6.5	5.525
Minimum for 1967	0.58	0.58
Minimum for 1968	0.06	0.06
Minimum for 1969	0.09	0.09
Minimum for 1970	1.5	1.5
Minimum for 1971	0.22	0.22
Minimum for 1972	11	9.35
Minimum for 1973	1.7	1.7
Minimum for 1974	0.31	0.31
Minimum for 1975	0.55	0.55
Minimum for 1976	0.16	0.16
Minimum for 1977	0.07	0.07
Minimum for 1978	0.98	0.98
Minimum for 1979	0.06	0.06
Minimum for 1980	0.18	0.18
Minimum for 1981	0.03	0.03
Minimum for 1982	2.2	2.2
Minimum for 1983	3.4	2.89
Minimum for 1984	1.3	1.3
Minimum for 1985	0.11	0.11
Minimum for 1986	0.52	0.52
Minimum for 1987	0.37	0.37
Minimum for 1988	0.25	0.25
Minimum for 1989	0.07	0.07
Minimum for 1990	0.1	0.1
Minimum for 1991	0.12	0.12
Minimum for 1992	0.24	0.24
Minimum for 1993	0.22	0.22
Minimum for 1994	0.17	0.17

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Minimum for 1995	10	8.5
Minimum for 1996	0.47	0.47
Minimum for 1997	0.06	0.06
Maximum for 1958	343	291.55
Maximum for 1959	984	836.4
Maximum for 1960	979	832.15
Maximum for 1961	811	689.35
Maximum for 1962	206	175.1
Maximum for 1963	132	112.2
Maximum for 1964	1870	1589.5
Maximum for 1965	393	334.05
Maximum for 1966	630	535.5
Maximum for 1967	383	325.55
Maximum for 1968	1090	926.5
Maximum for 1969	407	345.95
Maximum for 1970	1790	1521.5
Maximum for 1971	242	205.7
Maximum for 1972	689	585.65
Maximum for 1973	618	525.3
Maximum for 1974	381	323.85
Maximum for 1975	300	255
Maximum for 1976	91	77.35
Maximum for 1977	85	72.25
Maximum for 1978	1060	901
Maximum for 1979	431	366.35
Maximum for 1980	323	274.55
Maximum for 1981	145	123.25
Maximum for 1982	443	376.55
Maximum for 1983	545	463.25
Maximum for 1984	477	405.45
Maximum for 1985	506	430.1
Maximum for 1986	400	340
Maximum for 1987	650	552.5
Maximum for 1988	751	638.35
Maximum for 1989	79	67.15
Maximum for 1990	31	26.35
Maximum for 1991	240	204
Maximum for 1992	1000	850
Maximum for 1993	186	158.1
Maximum for 1994	601	510.85
Maximum for 1995	278	236.3
Maximum for 1996	268	227.8
Maximum for 1997	660	561
Percentile 10 for 1958	5.2	4.42
Percentile 10 for 1959	30	25.5
Percentile 10 for 1960	17	14.45
Percentile 10 for 1961	7.08	6.018
Percentile 10 for 1962	1	1
Percentile 10 for 1963	0.4	0.4
Percentile 10 for 1964	11	9.35
Percentile 10 for 1965	5.88	4.998
Percentile 10 for 1966	10.4	8.84
Percentile 10 for 1967	1.9	1.9

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Percentile 10 for 1968	0.34	0.34
Percentile 10 for 1969	2.1	2.064
Percentile 10 for 1970	3.8	3.23
Percentile 10 for 1971	0.36	0.36
Percentile 10 for 1972	25	21.25
Percentile 10 for 1973	6.7	5.695
Percentile 10 for 1974	1.1	1.1
Percentile 10 for 1975	1.8	1.8
Percentile 10 for 1976	0.27	0.27
Percentile 10 for 1977	0.13	0.13
Percentile 10 for 1978	7.08	6.018
Percentile 10 for 1979	1.2	1.2
Percentile 10 for 1980	0.44	0.44
Percentile 10 for 1981	0.06	0.06
Percentile 10 for 1982	9.1	7.735
Percentile 10 for 1983	9.44	8.024
Percentile 10 for 1984	3.1	2.635
Percentile 10 for 1985	0.16	0.16
Percentile 10 for 1986	0.828	0.828
Percentile 10 for 1987	0.846	0.846
Percentile 10 for 1988	0.405	0.405
Percentile 10 for 1989	0.264	0.264
Percentile 10 for 1990	0.17	0.17
Percentile 10 for 1991	0.61	0.61
Percentile 10 for 1992	1.85	1.85
Percentile 10 for 1993	0.4	0.4
Percentile 10 for 1994	3.24	2.754
Percentile 10 for 1995	15	12.75
Percentile 10 for 1996	1.1	1.1
Percentile 10 for 1997	0.378	0.378
Percentile 90 for 1958	133.2	113.22
Percentile 90 for 1959	291.2	247.52
Percentile 90 for 1960	305	259.25
Percentile 90 for 1961	198.8	168.98
Percentile 90 for 1962	28	23.8
Percentile 90 for 1963	64	54.4
Percentile 90 for 1964	237	201.45
Percentile 90 for 1965	188	159.8
Percentile 90 for 1966	162.6	138.21
Percentile 90 for 1967	93.2	79.22
Percentile 90 for 1968	68.5	58.225
Percentile 90 for 1969	157.6	133.96
Percentile 90 for 1970	258	219.3
Percentile 90 for 1971	69.2	58.82
Percentile 90 for 1972	245.5	208.675
Percentile 90 for 1973	157	133.45
Percentile 90 for 1974	80.6	68.51
Percentile 90 for 1975	55.2	46.92
Percentile 90 for 1976	19.5	16.575
Percentile 90 for 1977	28.6	24.31
Percentile 90 for 1978	193.2	164.22
Percentile 90 for 1979	152.4	129.54
Percentile 90 for 1980	114.5	97.325

Name	Santa Fe - Graham 1958- 1997	Santa Fe - Graham 1958- 1997 REDUCED
Percentile 90 for 1981	30	25.5
Percentile 90 for 1982	111.6	94.86
Percentile 90 for 1983	145.4	123.59
Percentile 90 for 1984	154	130.9
Percentile 90 for 1985	139.6	118.66
Percentile 90 for 1986	131.2	111.52
Percentile 90 for 1987	216.8	184.28
Percentile 90 for 1988	140	119
Percentile 90 for 1989	24.6	20.91
Percentile 90 for 1990	9.96	8.466
Percentile 90 for 1991	73.6	62.56
Percentile 90 for 1992	95	80.75
Percentile 90 for 1993	84.2	71.57
Percentile 90 for 1994	98	83.3
Percentile 90 for 1995	103.6	88.06
Percentile 90 for 1996	58.5	49.725
Percentile 90 for 1997	70.6	60.01
Mean for 1958	46.6	39.616
Mean for 1959	146.707	124.701
Mean for 1960	124.134	105.514
Mean for 1961	69.744	59.288
Mean for 1962	13.053	11.162
Mean for 1963	21.675	18.463
Mean for 1964	113.634	96.589
Mean for 1965	78.067	66.365
Mean for 1966	85.017	72.265
Mean for 1967	35.935	30.573
Mean for 1968	36.374	30.938
Mean for 1969	56.286	47.854
Mean for 1970	123.996	105.414
Mean for 1971	25.786	21.941
Mean for 1972	101.208	86.027
Mean for 1973	72.957	62.019
Mean for 1974	28.399	24.171
Mean for 1975	26.077	22.196
Mean for 1976	7.324	6.285
Mean for 1977	8.042	6.876
Mean for 1978	77.595	65.961
Mean for 1979	58.112	49.41
Mean for 1980	38.267	32.587
Mean for 1981	11.068	9.448
Mean for 1982	52.739	44.83
Mean for 1983	63.774	54.208
Mean for 1984	52.186	44.373
Mean for 1985	46.465	39.55
Mean for 1986	43.608	37.129
Mean for 1987	68.349	58.137
Mean for 1988	50.475	42.93
Mean for 1989	8.637	7.402
Mean for 1990	3.608	3.119
Mean for 1991	29.508	25.127
Mean for 1992	49.399	42.012
Mean for 1993	26.861	22.862

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Mean for 1994	45.669	38.827
Mean for 1995	46.652	39.654
Mean for 1996	21.112	17.983
Mean for 1997	36.355	30.933
Median for 1958	20	17
Median for 1959	97	82.45
Median for 1960	65.5	55.675
Median for 1961	29	24.65
Median for 1962	5.9	5.015
Median for 1963	5.7	4.845
Median for 1964	66.5	56.525
Median for 1965	55	46.75
Median for 1966	61	51.85
Median for 1967	12	10.2
Median for 1968	7.4	6.29
Median for 1969	31	26.35
Median for 1970	53	45.05
Median for 1971	11	9.35
Median for 1972	53.5	45.475
Median for 1973	52	44.2
Median for 1974	9.4	7.99
Median for 1975	16	13.6
Median for 1976	1.45	1.45
Median for 1977	0.45	0.45
Median for 1978	29	24.65
Median for 1979	33	28.05
Median for 1980	3.7	3.145
Median for 1981	2.9	2.465
Median for 1982	32	27.2
Median for 1983	40	34
Median for 1984	15.5	13.175
Median for 1985	5	4.25
Median for 1986	14	11.9
Median for 1987	16	13.6
Median for 1988	15	12.75
Median for 1989	3.6	3.06
Median for 1990	0.71	0.71
Median for 1991	15	12.75
Median for 1992	27	22.95
Median for 1993	9.8	8.33
Median for 1994	26	22.1
Median for 1995	29	24.65
Median for 1996	7.85	6.672
Median for 1997	7.3	6.205
Zeros for 1958	0	0
Zeros for 1959	0	0
Zeros for 1960	0	0
Zeros for 1961	0	0
Zeros for 1962	0	0
Zeros for 1963	0	0
Zeros for 1964	0	0
Zeros for 1965	0	0
Zeros for 1966	0	0

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Zeros for 1967	0	0
Zeros for 1968	0	0
Zeros for 1969	0	0
Zeros for 1970	0	0
Zeros for 1971	0	0
Zeros for 1972	0	0
Zeros for 1973	0	0
Zeros for 1974	0	0
Zeros for 1975	0	0
Zeros for 1976	0	0
Zeros for 1977	0	0
Zeros for 1978	0	0
Zeros for 1979	0	0
Zeros for 1980	0	0
Zeros for 1981	0	0
Zeros for 1982	0	0
Zeros for 1983	0	0
Zeros for 1984	0	0
Zeros for 1985	0	0
Zeros for 1986	0	0
Zeros for 1987	0	0
Zeros for 1988	0	0
Zeros for 1989	0	0
Zeros for 1990	0	0
Zeros for 1991	0	0
Zeros for 1992	0	0
Zeros for 1993	0	0
Zeros for 1994	0	0
Zeros for 1995	0	0
Zeros for 1996	0	0
Zeros for 1997	0	0
Less or equal 109 for 1958	315	326
Less or equal 109 for 1959	201	223
Less or equal 109 for 1960	221	249
Less or equal 109 for 1961	302	310
Less or equal 109 for 1962	359	360
Less or equal 109 for 1963	362	364
Less or equal 109 for 1964	254	278
Less or equal 109 for 1965	271	288
Less or equal 109 for 1966	271	296
Less or equal 109 for 1967	337	346
Less or equal 109 for 1968	343	344
Less or equal 109 for 1969	302	313
Less or equal 109 for 1970	238	250
Less or equal 109 for 1971	345	351
Less or equal 109 for 1972	276	289
Less or equal 109 for 1973	305	316
Less or equal 109 for 1974	345	349
Less or equal 109 for 1975	353	354
Less or equal 109 for 1976	366	366
Less or equal 109 for 1977	365	365
Less or equal 109 for 1978	293	305
Less or equal 109 for 1979	308	318

Name	Santa Fe - Graham 1958- 1997	Santa Fe - Graham 1958- 1997 REDUCED
Less or equal 109 for 1980	326	335
Less or equal 109 for 1981	359	362
Less or equal 109 for 1982	326	344
Less or equal 109 for 1983	305	317
Less or equal 109 for 1984	314	320
Less or equal 109 for 1985	310	322
Less or equal 109 for 1986	319	327
Less or equal 109 for 1987	291	299
Less or equal 109 for 1988	320	326
Less or equal 109 for 1989	365	365
Less or equal 109 for 1990	365	365
Less or equal 109 for 1991	345	350
Less or equal 109 for 1992	336	340
Less or equal 109 for 1993	350	353
Less or equal 109 for 1994	336	343
Less or equal 109 for 1995	332	337
Less or equal 109 for 1996	355	357
Less or equal 109 for 1997	338	340
Greater or equal 109 for 1958	50	39
Greater or equal 109 for 1959	164	142
Greater or equal 109 for 1960	145	117
Greater or equal 109 for 1961	64	55
Greater or equal 109 for 1962	6	5
Greater or equal 109 for 1963	3	1
Greater or equal 109 for 1964	113	88
Greater or equal 109 for 1965	94	77
Greater or equal 109 for 1966	95	69
Greater or equal 109 for 1967	29	19
Greater or equal 109 for 1968	23	22
Greater or equal 109 for 1969	63	52
Greater or equal 109 for 1970	129	115
Greater or equal 109 for 1971	20	14
Greater or equal 109 for 1972	92	77
Greater or equal 109 for 1973	62	49
Greater or equal 109 for 1974	20	16
Greater or equal 109 for 1975	12	11
Greater or equal 109 for 1976	0	0
Greater or equal 109 for 1977	0	0
Greater or equal 109 for 1978	72	60
Greater or equal 109 for 1979	57	47
Greater or equal 109 for 1980	40	31
Greater or equal 109 for 1981	6	3
Greater or equal 109 for 1982	40	21
Greater or equal 109 for 1983	62	48
Greater or equal 109 for 1984	52	46
Greater or equal 109 for 1985	55	43
Greater or equal 109 for 1986	47	38
Greater or equal 109 for 1987	74	66
Greater or equal 109 for 1988	46	40
Greater or equal 109 for 1989	0	0
Greater or equal 109 for 1990	0	0
Greater or equal 109 for 1991	20	15
Greater or equal 109 for 1992	30	26

Name	Santa Fe - Graham 1958-	Santa Fe - Graham 1958-
	1997	1997 REDUCED
Greater or equal 109 for 1993	15	12
Greater or equal 109 for 1994	30	22
Greater or equal 109 for 1995	34	28
Greater or equal 109 for 1996	11	9
Greater or equal 109 for 1997	27	25
Summary of interannual measures		
Mean of all years Minimum	1.86	1.643
Mean of all years Maximum	537.45	456.832
Mean of all years Percentile 10	4.678	4.044
Mean of all years Percentile 90	124.686	105.984
Mean of all years Mean	51.286	43.618
Mean of all years Median	24.629	20.944
Mean of all years CV	1.56	1.556
Mean of all years Standard Deviation	74.949	63.692
Mean of all years Skewness	3.356	3.26
Mean of all years Variability	-9.07	-8.722
Mean of all years Zeros	0	0
Mean of all years Total	18734.363	15933.383
Mean of all years S_Log	0.533	0.518
Mean of all years Lanes	0.57	0.553
Mean of all years Less or equal 109	318.1	326.55
Mean of all years Greater or equal 109	47.55	38.7
Median of all years Minimum	0.34	0.34
Median of all years Maximum	419	356.15
Median of all years Percentile 10	1.5	1.5
Median of all years Percentile 90	113.05	96.092
Median of all years Mean	46.532	39.583
Median of all years Median	15.75	13.388
Median of all years CV	1.534	1.53
Median of all years Standard Deviation	69.353	58.928
Median of all years Skewness	2.372	2.376
Median of all years Variability	-6.409	-6.409
Median of all years Zeros	0	0
Median of all years Total	16984.435	14447.943
Median of all years S_Log	0.54	0.526
Median of all years Lanes	0.561	0.54
Median of all years Less or equal 109	326	336
Median of all years Greater or equal 109	40	29.5
High Flow Spell result		
Whole Period		
High Spell Threshold	109	109
Number of High Spell	193	180
Longest High Spell	57	45
Mean of High Spell Peaks	289.819	264.034
Mean Duration of High Spell	9.756	8.572
Total Duration of High Spell	1883	1543
Total of periods Between High Spells	12670	13010
Mean period Between High Spells	65.99	72.682
Longest period Between High Spells	910	911
Total (Sum) Raw Values	433336	335172
Mean Raw Values	2245.264	1862.067
Summary for each year		
High Spell Threshold for 1958	109	109

Name	Santa Fe - Graham 1958- 1997	Santa Fe - Graham 1958- 1997 REDUCED
High Spell Threshold for 1959	109	109
High Spell Threshold for 1960	109	109
High Spell Threshold for 1961	109	109
High Spell Threshold for 1962	109	109
High Spell Threshold for 1963	109	109
High Spell Threshold for 1964	109	109
High Spell Threshold for 1965	109	109
High Spell Threshold for 1966	109	109
High Spell Threshold for 1967	109	109
High Spell Threshold for 1968	109	109
High Spell Threshold for 1969	109	109
High Spell Threshold for 1970	109	109
High Spell Threshold for 1971	109	109
High Spell Threshold for 1972	109	109
High Spell Threshold for 1973	109	109
High Spell Threshold for 1974	109	109
High Spell Threshold for 1975	109	109
High Spell Threshold for 1976	109	109
High Spell Threshold for 1977	109	109
High Spell Threshold for 1978	109	109
High Spell Threshold for 1979	109	109
High Spell Threshold for 1980	109	109
High Spell Threshold for 1981	109	109
High Spell Threshold for 1982	109	109
High Spell Threshold for 1983	109	109
High Spell Threshold for 1984	109	109
High Spell Threshold for 1985	109	109
High Spell Threshold for 1986	109	109
High Spell Threshold for 1987	109	109
High Spell Threshold for 1988	109	109
High Spell Threshold for 1989	109	109
High Spell Threshold for 1990	109	109
High Spell Threshold for 1991	109	109
High Spell Threshold for 1992	109	109
High Spell Threshold for 1993	109	109
High Spell Threshold for 1994	109	109
High Spell Threshold for 1995	109	109
High Spell Threshold for 1996	109	109
High Spell Threshold for 1997	109	109
Number of High Spell for 1958	10	7
Number of High Spell for 1959	12	13
Number of High Spell for 1960	7	10
Number of High Spell for 1961	5	5
Number of High Spell for 1962	1	1
Number of High Spell for 1963	1	1
Number of High Spell for 1964	6	9
Number of High Spell for 1965	6	9
Number of High Spell for 1966	12	10
Number of High Spell for 1967	6	3
Number of High Spell for 1968	4	4
Number of High Spell for 1969	9	7
Number of High Spell for 1970	5	6
Number of High Spell for 1971	4	3

Name	Santa Fe - Graham 1958- 1997	Santa Fe - Graham 1958- 1997 REDUCED
Number of High Spell for 1972	10	9
Number of High Spell for 1973	6	4
Number of High Spell for 1974	4	3
Number of High Spell for 1975	1	1
Number of High Spell for 1976	0	0
Number of High Spell for 1977	0	0
Number of High Spell for 1978	5	5
Number of High Spell for 1979	7	6
Number of High Spell for 1980	5	4
Number of High Spell for 1981	2	1
Number of High Spell for 1982	10	4
Number of High Spell for 1983	9	9
Number of High Spell for 1984	3	3
Number of High Spell for 1985	5	7
Number of High Spell for 1986	4	4
Number of High Spell for 1987	5	6
Number of High Spell for 1988	4	3
Number of High Spell for 1989	0	0
Number of High Spell for 1990	0	0
Number of High Spell for 1991	4	4
Number of High Spell for 1992	4	5
Number of High Spell for 1993	2	2
Number of High Spell for 1994	6	4
Number of High Spell for 1995	7	6
Number of High Spell for 1996	3	3
Number of High Spell for 1997	2	2
Longest High Spell for 1958	19	18
Longest High Spell for 1959	45	43
Longest High Spell for 1960	57	40
Longest High Spell for 1961	26	21
Longest High Spell for 1962	6	5
Longest High Spell for 1963	3	1
Longest High Spell for 1964	42	31
Longest High Spell for 1965	52	31
Longest High Spell for 1966	31	28
Longest High Spell for 1967	11	9
Longest High Spell for 1968	20	19
Longest High Spell for 1969	13	11
Longest High Spell for 1970	48	45
Longest High Spell for 1971	7	6
Longest High Spell for 1972	21	16
Longest High Spell for 1973	26	24
Longest High Spell for 1974	13	12
Longest High Spell for 1975	12	11
Longest High Spell for 1976	NaN	NaN
Longest High Spell for 1977	NaN	NaN
Longest High Spell for 1978	38	32
Longest High Spell for 1979	23	15
Longest High Spell for 1980	12	10
Longest High Spell for 1981	4	3
Longest High Spell for 1982	12	11
Longest High Spell for 1983	18	16
Longest High Spell for 1984	22	19

Name	Santa Fe - Graham 1958- 1997	Santa Fe - Graham 1958- 1997 REDUCED
Longest High Spell for 1985	25	11
Longest High Spell for 1986	16	14
Longest High Spell for 1987	37	34
Longest High Spell for 1988	23	21
Longest High Spell for 1989	NaN	NaN
Longest High Spell for 1990	NaN	NaN
Longest High Spell for 1991	8	7
Longest High Spell for 1992	14	12
Longest High Spell for 1993	8	6
Longest High Spell for 1994	12	11
Longest High Spell for 1995	10	9
Longest High Spell for 1996	7	6
Longest High Spell for 1997	20	19
Mean of High Spell Peaks for 1958	191.6	188.943
Mean of High Spell Peaks for 1959	339.583	276.969
Mean of High Spell Peaks for 1960	433.143	326.06
Mean of High Spell Peaks for 1961	390.6	338.3
Mean of High Spell Peaks for 1962	206	175.1
Mean of High Spell Peaks for 1963	132	112.2
Mean of High Spell Peaks for 1964	548.667	374
Mean of High Spell Peaks for 1965	232.667	191.628
Mean of High Spell Peaks for 1966	200.333	184.195
Mean of High Spell Peaks for 1967	197.5	246.783
Mean of High Spell Peaks for 1968	384.25	326.612
Mean of High Spell Peaks for 1969	222.111	213.714
Mean of High Spell Peaks for 1970	851.8	622.483
Mean of High Spell Peaks for 1971	189	180.767
Mean of High Spell Peaks for 1972	345.7	321.3
Mean of High Spell Peaks for 1973	230.167	247.775
Mean of High Spell Peaks for 1974	208.5	201.733
Mean of High Spell Peaks for 1975	300	255
Mean of High Spell Peaks for 1976	NaN	NaN
Mean of High Spell Peaks for 1977	NaN	NaN
Mean of High Spell Peaks for 1978	388.2	329.97
Mean of High Spell Peaks for 1979	213.143	202.442
Mean of High Spell Peaks for 1980	212.2	198.262
Mean of High Spell Peaks for 1981	132.5	123.25
Mean of High Spell Peaks for 1982	175.5	221.85
Mean of High Spell Peaks for 1983	224.111	190.494
Mean of High Spell Peaks for 1984	385	327.25
Mean of High Spell Peaks for 1985	282.4	211.771
Mean of High Spell Peaks for 1986	299.25	254.362
Mean of High Spell Peaks for 1987	365.2	278.092
Mean of High Spell Peaks for 1988	392.75	413.667
Mean of High Spell Peaks for 1989	NaN	NaN
Mean of High Spell Peaks for 1990	NaN	NaN
Mean of High Spell Peaks for 1991	182.25	154.912
Mean of High Spell Peaks for 1992	446.5	326.74
Mean of High Spell Peaks for 1993	171	145.35
Mean of High Spell Peaks for 1994	227.833	242.675
Mean of High Spell Peaks for 1995	189	171.133
Mean of High Spell Peaks for 1996	185.667	157.817
Mean of High Spell Peaks for 1997	444.5	377.825

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Mean Duration of High Spell for 1958	4.7	5.571
Mean Duration of High Spell for 1959	13.5	10.846
Mean Duration of High Spell for 1960	20.429	11.7
Mean Duration of High Spell for 1961	12.6	11
Mean Duration of High Spell for 1962	6	5
Mean Duration of High Spell for 1963	3	1
Mean Duration of High Spell for 1964	18.833	9.778
Mean Duration of High Spell for 1965	15.667	8.556
Mean Duration of High Spell for 1966	7.917	6.9
Mean Duration of High Spell for 1967	4.5	6.333
Mean Duration of High Spell for 1968	5.75	5.5
Mean Duration of High Spell for 1969	6.778	7.429
Mean Duration of High Spell for 1970	25.4	19
Mean Duration of High Spell for 1971	5	4.667
Mean Duration of High Spell for 1972	9.1	8.556
Mean Duration of High Spell for 1973	10.167	12.25
Mean Duration of High Spell for 1974	5	5.333
Mean Duration of High Spell for 1975	12	11
Mean Duration of High Spell for 1976	NaN	NaN
Mean Duration of High Spell for 1977	NaN	NaN
Mean Duration of High Spell for 1978	14.2	12
Mean Duration of High Spell for 1979	8.143	7.833
Mean Duration of High Spell for 1980	8	7.75
Mean Duration of High Spell for 1981	3	3
Mean Duration of High Spell for 1982	4	5.25
Mean Duration of High Spell for 1983	6.889	5.333
Mean Duration of High Spell for 1984	17.333	15.333
Mean Duration of High Spell for 1985	10.8	6
Mean Duration of High Spell for 1986	11.75	9.5
Mean Duration of High Spell for 1987	14.8	10.833
Mean Duration of High Spell for 1988	11.5	13.333
Mean Duration of High Spell for 1989	NaN	NaN
Mean Duration of High Spell for 1990	NaN	NaN
Mean Duration of High Spell for 1991	5	3.75
Mean Duration of High Spell for 1992	7.5	5
Mean Duration of High Spell for 1993	7.5	6
Mean Duration of High Spell for 1994	5	5.5
Mean Duration of High Spell for 1995	4.714	4.667
Mean Duration of High Spell for 1996	3.667	3
Mean Duration of High Spell for 1997	13.5	12.5
Total Duration of High Spell for 1958	47	39
Total Duration of High Spell for 1959	162	141
Total Duration of High Spell for 1960	143	117
Total Duration of High Spell for 1961	63	55
Total Duration of High Spell for 1962	6	5
Total Duration of High Spell for 1963	3	1
Total Duration of High Spell for 1964	113	88
Total Duration of High Spell for 1965	94	77
Total Duration of High Spell for 1966	95	69
Total Duration of High Spell for 1967	27	19
Total Duration of High Spell for 1968	23	22
Total Duration of High Spell for 1969	61	52
Total Duration of High Spell for 1970	127	114

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Total Duration of High Spell for 1971	20	14
Total Duration of High Spell for 1972	91	77
Total Duration of High Spell for 1973	61	49
Total Duration of High Spell for 1974	20	16
Total Duration of High Spell for 1975	12	11
Total Duration of High Spell for 1976	NaN	NaN
Total Duration of High Spell for 1977	NaN	NaN
Total Duration of High Spell for 1978	71	60
Total Duration of High Spell for 1979	57	47
Total Duration of High Spell for 1980	40	31
Total Duration of High Spell for 1981	6	3
Total Duration of High Spell for 1982	40	21
Total Duration of High Spell for 1983	62	48
Total Duration of High Spell for 1984	52	46
Total Duration of High Spell for 1985	54	42
Total Duration of High Spell for 1986	47	38
Total Duration of High Spell for 1987	74	65
Total Duration of High Spell for 1988	46	40
Total Duration of High Spell for 1989	NaN	NaN
Total Duration of High Spell for 1990	NaN	NaN
Total Duration of High Spell for 1991	20	15
Total Duration of High Spell for 1992	30	25
Total Duration of High Spell for 1993	15	12
Total Duration of High Spell for 1994	30	22
Total Duration of High Spell for 1995	33	28
Total Duration of High Spell for 1996	11	9
Total Duration of High Spell for 1997	27	25
Total of periods Between High Spells for 1958	242	215
Total of periods Between High Spells for 1959	138	157
Total of periods Between High Spells for 1960	113	137
Total of periods Between High Spells for 1961	156	159
Total of periods Between High Spells for 1962	NaN	NaN
Total of periods Between High Spells for 1963	NaN	NaN
Total of periods Between High Spells for 1964	242	267
Total of periods Between High Spells for 1965	185	201
Total of periods Between High Spells for 1966	166	184
Total of periods Between High Spells for 1967	164	170
Total of periods Between High Spells for 1968	34	34
Total of periods Between High Spells for 1969	258	237
Total of periods Between High Spells for 1970	118	130
Total of periods Between High Spells for 1971	95	14
Total of periods Between High Spells for 1972	247	252
Total of periods Between High Spells for 1973	149	141
Total of periods Between High Spells for 1974	31	34
Total of periods Between High Spells for 1975	NaN	NaN
Total of periods Between High Spells for 1976	NaN	NaN
Total of periods Between High Spells for 1977	NaN	NaN
Total of periods Between High Spells for 1978	134	143
Total of periods Between High Spells for 1979	282	284
Total of periods Between High Spells for 1980	160	56
Total of periods Between High Spells for 1981	27	NaN
Total of periods Between High Spells for 1982	217	235
Total of periods Between High Spells for 1983	259	273

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Total of periods Between High Spells for 1984	54	59
Total of periods Between High Spells for 1985	42	52
Total of periods Between High Spells for 1986	204	211
Total of periods Between High Spells for 1987	153	162
Total of periods Between High Spells for 1988	191	170
Total of periods Between High Spells for 1989	NaN	NaN
Total of periods Between High Spells for 1990	NaN	NaN
Total of periods Between High Spells for 1991	129	133
Total of periods Between High Spells for 1992	78	81
Total of periods Between High Spells for 1993	16	17
Total of periods Between High Spells for 1994	258	252
Total of periods Between High Spells for 1995	132	136
Total of periods Between High Spells for 1996	105	106
Total of periods Between High Spells for 1997	221	223
Mean period Between High Spells for 1958	26.889	35.833
Mean period Between High Spells for 1959	12.545	13.083
Mean period Between High Spells for 1960	18.833	15.222
Mean period Between High Spells for 1961	39	39.75
Mean period Between High Spells for 1962	NaN	NaN
Mean period Between High Spells for 1963	NaN	NaN
Mean period Between High Spells for 1964	48.4	33.375
Mean period Between High Spells for 1965	37	25.125
Mean period Between High Spells for 1966	15.091	20.444
Mean period Between High Spells for 1967	32.8	85
Mean period Between High Spells for 1968	11.333	11.333
Mean period Between High Spells for 1969	32.25	39.5
Mean period Between High Spells for 1970	29.5	26
Mean period Between High Spells for 1971	31.667	7
Mean period Between High Spells for 1972	27.444	31.5
Mean period Between High Spells for 1973	29.8	47
Mean period Between High Spells for 1974	10.333	17
Mean period Between High Spells for 1975	NaN	NaN
Mean period Between High Spells for 1976	NaN	NaN
Mean period Between High Spells for 1977	NaN	NaN
Mean period Between High Spells for 1978	33.5	35.75
Mean period Between High Spells for 1979	47	56.8
Mean period Between High Spells for 1980	40	18.667
Mean period Between High Spells for 1981	27	NaN
Mean period Between High Spells for 1982	24.111	78.333
Mean period Between High Spells for 1983	32.375	34.125
Mean period Between High Spells for 1984	27	29.5
Mean period Between High Spells for 1985	10.5	8.667
Mean period Between High Spells for 1986	68	70.333
Mean period Between High Spells for 1987	38.25	32.4
Mean period Between High Spells for 1988	63.667	85
Mean period Between High Spells for 1989	NaN	NaN
Mean period Between High Spells for 1990	NaN	NaN
Mean period Between High Spells for 1991	43	44.333
Mean period Between High Spells for 1992	26	20.25
Mean period Between High Spells for 1993	16	17
Mean period Between High Spells for 1994	51.6	84
Mean period Between High Spells for 1995	22	27.2
Mean period Between High Spells for 1996	52.5	53

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Mean period Between High Spells for 1997	221	223
Longest period Between High Spells for 1958	86	87
Longest period Between High Spells for 1959	42	51
Longest period Between High Spells for 1960	78	80
Longest period Between High Spells for 1961	130	131
Longest period Between High Spells for 1962	NaN	NaN
Longest period Between High Spells for 1963	NaN	NaN
Longest period Between High Spells for 1964	152	153
Longest period Between High Spells for 1965	76	78
Longest period Between High Spells for 1966	33	51
Longest period Between High Spells for 1967	154	157
Longest period Between High Spells for 1968	22	22
Longest period Between High Spells for 1969	128	129
Longest period Between High Spells for 1970	110	113
Longest period Between High Spells for 1971	83	10
Longest period Between High Spells for 1972	93	95
Longest period Between High Spells for 1973	101	106
Longest period Between High Spells for 1974	14	19
Longest period Between High Spells for 1975	NaN	NaN
Longest period Between High Spells for 1976	NaN	NaN
Longest period Between High Spells for 1977	NaN	NaN
Longest period Between High Spells for 1978	120	121
Longest period Between High Spells for 1979	121	122
Longest period Between High Spells for 1980	109	33
Longest period Between High Spells for 1981	27	NaN
Longest period Between High Spells for 1982	78	82
Longest period Between High Spells for 1983	103	104
Longest period Between High Spells for 1984	41	44
Longest period Between High Spells for 1985	30	32
Longest period Between High Spells for 1986	167	169
Longest period Between High Spells for 1987	124	126
Longest period Between High Spells for 1988	162	164
Longest period Between High Spells for 1989	NaN	NaN
Longest period Between High Spells for 1990	NaN	NaN
Longest period Between High Spells for 1991	60	62
Longest period Between High Spells for 1992	48	49
Longest period Between High Spells for 1993	16	17
Longest period Between High Spells for 1994	133	180
Longest period Between High Spells for 1995	50	54
Longest period Between High Spells for 1996	94	95
Longest period Between High Spells for 1997	221	223
Total (Sum) Raw Values for 1958	8358	6384.35
Total (Sum) Raw Values for 1959	41455	33159.35
Total (Sum) Raw Values for 1960	36079	28067.85
Total (Sum) Raw Values for 1961	16367	13101.9
Total (Sum) Raw Values for 1962	907	668.95
Total (Sum) Raw Values for 1963	356	112.2
Total (Sum) Raw Values for 1964	29838	22856.5
Total (Sum) Raw Values for 1965	17602	13246.4
Total (Sum) Raw Values for 1966	17972	12661.6
Total (Sum) Raw Values for 1967	5742	4123.35
Total (Sum) Raw Values for 1968	8450	7079.65
Total (Sum) Raw Values for 1969	11965	9271.8

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Total (Sum) Raw Values for 1970	35960	30091.7
Total (Sum) Raw Values for 1971	3150	2096.1
Total (Sum) Raw Values for 1972	23636	18733.15
Total (Sum) Raw Values for 1973	13251	10071.65
Total (Sum) Raw Values for 1974	4242	3206.2
Total (Sum) Raw Values for 1975	2362	1909.95
Total (Sum) Raw Values for 1976	0	0
Total (Sum) Raw Values for 1977	0	0
Total (Sum) Raw Values for 1978	19322	15349.3
Total (Sum) Raw Values for 1979	10537	7943.25
Total (Sum) Raw Values for 1980	7038	5077.05
Total (Sum) Raw Values for 1981	783	359.55
Total (Sum) Raw Values for 1982	7260	4261.9
Total (Sum) Raw Values for 1983	11648	8488.1
Total (Sum) Raw Values for 1984	10989	8722.7
Total (Sum) Raw Values for 1985	10736	7929.65
Total (Sum) Raw Values for 1986	9207	6927.5
Total (Sum) Raw Values for 1987	18705	14952.35
Total (Sum) Raw Values for 1988	12207	9782.65
Total (Sum) Raw Values for 1989	0	0
Total (Sum) Raw Values for 1990	0	0
Total (Sum) Raw Values for 1991	3179	2190.45
Total (Sum) Raw Values for 1992	8966	7062.65
Total (Sum) Raw Values for 1993	2269	1620.95
Total (Sum) Raw Values for 1994	6642	4851.8
Total (Sum) Raw Values for 1995	5721	4352
Total (Sum) Raw Values for 1996	1897	1406.75
Total (Sum) Raw Values for 1997	8538	7050.75
Mean Raw Values for 1958	835.8	912.05
Mean Raw Values for 1959	3454.583	2550.719
Mean Raw Values for 1960	5154.143	2806.785
Mean Raw Values for 1961	3273.4	2620.38
Mean Raw Values for 1962	907	668.95
Mean Raw Values for 1963	356	112.2
Mean Raw Values for 1964	4973	2539.611
Mean Raw Values for 1965	2933.667	1471.822
Mean Raw Values for 1966	1497.667	1266.16
Mean Raw Values for 1967	957	1374.45
Mean Raw Values for 1968	2112.5	1769.913
Mean Raw Values for 1969	1329.444	1324.543
Mean Raw Values for 1970	7192	5015.283
Mean Raw Values for 1971	787.5	698.7
Mean Raw Values for 1972	2363.6	2081.461
Mean Raw Values for 1973	2208.5	2517.913
Mean Raw Values for 1974	1060.5	1068.733
Mean Raw Values for 1975	2362	1909.95
Mean Raw Values for 1976	NaN	NaN
Mean Raw Values for 1977	NaN	NaN
Mean Raw Values for 1978	3864.4	3069.86
Mean Raw Values for 1979	1505.286	1323.875
Mean Raw Values for 1980	1407.6	1269.262
Mean Raw Values for 1981	391.5	359.55
Mean Raw Values for 1982	726	1065.475

Name	Santa Fe - Graham 1958-1997	Santa Fe - Graham 1958-1997 REDUCED
Mean Raw Values for 1983	1294.222	943.122
Mean Raw Values for 1984	3663	2907.567
Mean Raw Values for 1985	2147.2	1132.807
Mean Raw Values for 1986	2301.75	1731.875
Mean Raw Values for 1987	3741	2492.058
Mean Raw Values for 1988	3051.75	3260.883
Mean Raw Values for 1989	NaN	NaN
Mean Raw Values for 1990	NaN	NaN
Mean Raw Values for 1991	794.75	547.612
Mean Raw Values for 1992	2241.5	1412.53
Mean Raw Values for 1993	1134.5	810.475
Mean Raw Values for 1994	1107	1212.95
Mean Raw Values for 1995	817.286	725.333
Mean Raw Values for 1996	632.333	468.917
Mean Raw Values for 1997	4269	3525.375
Summary of interannual measures		
Mean of all years High Spell Threshold	109	109
Mean of all years Number of High Spell	4.9	4.575
Mean of all years Longest High Spell	NaN	NaN
Mean of all years Mean of High Spell Peaks	NaN	NaN
Mean of all years Mean Duration of High Spell	NaN	NaN
Mean of all years Total Duration of High Spell	NaN	NaN
Mean of all years Total of periods Between High Spells	NaN	NaN
Mean of all years Mean period Between High Spells	NaN	NaN
Mean of all years Longest period Between High Spells	NaN	NaN
Mean of all years Total (Sum) Raw Values	10833.4	8379.3
Mean of all years Mean Raw Values	NaN	NaN
Median of all years High Spell Threshold	109	109
Median of all years Number of High Spell	5	4
Median of all years Longest High Spell	20.5	16.5
Median of all years Mean of High Spell Peaks	NaN	NaN
Median of all years Mean Duration of High Spell	10.166	7.166
Median of all years Total Duration of High Spell	NaN	NaN
Median of all years Total of periods Between High Spells	NaN	NaN
Median of all years Mean period Between High Spells	39.166	NaN
Median of all years Longest period Between High Spells	90.5	NaN
Median of all years Total (Sum) Raw Values	8494	6989.125
Median of all years Mean Raw Values	NaN	NaN

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Reporting Period Summary		
Start based on User	1/1/1932	1/1/1932
End Date	12/31/2010	12/31/2010
General Statistics		
Whole Period		
Minimum	0	0
Maximum	19000	16150
Percentile 10	14	14
Percentile 90	1080	918
Mean	407.723	347.332
Median	124	105.4
Zeros	266	266
Total	11764850.54	10022268.89
Less or equal 588	23507	24207
Greater or equal 588	5358	4648
Summary for each year		
Minimum for 1932	1.3	1.3
Minimum for 1933	9	9
Minimum for 1934	5.5	5.5
Minimum for 1935	1.9	1.9
Minimum for 1936	5.1	5.1
Minimum for 1937	10	10
Minimum for 1938	3.3	3.3
Minimum for 1939	10	10
Minimum for 1940	8.1	8.1
Minimum for 1941	1.9	1.9
Minimum for 1942	21	21
Minimum for 1943	5.6	5.6
Minimum for 1944	18	18
Minimum for 1945	2.8	2.8
Minimum for 1946	34	34
Minimum for 1947	27	27
Minimum for 1948	17	17
Minimum for 1949	13	13
Minimum for 1950	2.6	2.6
Minimum for 1951	3.1	3.1
Minimum for 1952	7.3	7.3
Minimum for 1953	21	21
Minimum for 1954	5.7	5.7
Minimum for 1955	0.6	0.6
Minimum for 1956	1	1
Minimum for 1957	16	16
Minimum for 1958	16	16
Minimum for 1959	119	101.15
Minimum for 1960	30	30
Minimum for 1961	13	13
Minimum for 1962	3.9	3.9
Minimum for 1963	8.8	8.8
Minimum for 1964	18	18
Minimum for 1965	11	11
Minimum for 1966	50	42.5

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Minimum for 1967	9.7	9.7
Minimum for 1968	6.2	6.2
Minimum for 1969	19	19
Minimum for 1970	31	31
Minimum for 1971	8.3	8.3
Minimum for 1972	33	33
Minimum for 1973	19	19
Minimum for 1974	17	17
Minimum for 1975	27	27
Minimum for 1976	15	15
Minimum for 1977	5.3	5.3
Minimum for 1978	19	19
Minimum for 1979	19	19
Minimum for 1980	10	10
Minimum for 1981	4.1	4.1
Minimum for 1982	35	35
Minimum for 1983	43	36.55
Minimum for 1984	20	20
Minimum for 1985	5.9	5.9
Minimum for 1986	15	15
Minimum for 1987	18	18
Minimum for 1988	5	5
Minimum for 1989	1.2	1.2
Minimum for 1990	1.5	1.5
Minimum for 1991	9.6	9.6
Minimum for 1992	22	22
Minimum for 1993	7.7	7.7
Minimum for 1994	4.4	4.4
Minimum for 1995	38	38
Minimum for 1996	18	18
Minimum for 1997	12	12
Minimum for 1998	2.9	2.9
Minimum for 1999	1.5	1.5
Minimum for 2000	0	0
Minimum for 2001	0	0
Minimum for 2002	0	0
Minimum for 2003	13	13
Minimum for 2004	0	0
Minimum for 2005	19	19
Minimum for 2006	0	0
Minimum for 2007	0	0
Minimum for 2008	0	0
Minimum for 2009	20	20
Minimum for 2010	1.9	1.9
Maximum for 1932	1540	1309
Maximum for 1933	3120	2652
Maximum for 1934	16900	14365
Maximum for 1935	10900	9265
Maximum for 1936	1780	1513
Maximum for 1937	7900	6715
Maximum for 1938	7900	6715

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Maximum for 1939	2140	1819
Maximum for 1940	1950	1657.5
Maximum for 1941	14700	12495
Maximum for 1942	4000	3400
Maximum for 1943	1970	1674.5
Maximum for 1944	15700	13345
Maximum for 1945	4000	3400
Maximum for 1946	4640	3944
Maximum for 1947	14400	12240
Maximum for 1948	14700	12495
Maximum for 1949	7410	6298.5
Maximum for 1950	12200	10370
Maximum for 1951	1110	943.5
Maximum for 1952	1440	1224
Maximum for 1953	5860	4981
Maximum for 1954	2200	1870
Maximum for 1955	892	758.2
Maximum for 1956	3250	2762.5
Maximum for 1957	5860	4981
Maximum for 1958	2190	1861.5
Maximum for 1959	8310	7063.5
Maximum for 1960	7390	6281.5
Maximum for 1961	4160	3536
Maximum for 1962	706	600.1
Maximum for 1963	1880	1598
Maximum for 1964	19000	16150
Maximum for 1965	3510	2983.5
Maximum for 1966	5700	4845
Maximum for 1967	4880	4148
Maximum for 1968	11700	9945
Maximum for 1969	3620	3077
Maximum for 1970	9930	8440.5
Maximum for 1971	2780	2363
Maximum for 1972	4340	3689
Maximum for 1973	5980	5083
Maximum for 1974	2930	2490.5
Maximum for 1975	2910	2473.5
Maximum for 1976	864	734.4
Maximum for 1977	1920	1632
Maximum for 1978	5340	4539
Maximum for 1979	2780	2363
Maximum for 1980	5800	4930
Maximum for 1981	1660	1411
Maximum for 1982	3970	3374.5
Maximum for 1983	4260	3621
Maximum for 1984	4770	4054.5
Maximum for 1985	6980	5933
Maximum for 1986	3830	3255.5
Maximum for 1987	5080	4318
Maximum for 1988	7430	6315.5
Maximum for 1989	729	619.65

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Maximum for 1990	495	420.75
Maximum for 1991	5590	4751.5
Maximum for 1992	14800	12580
Maximum for 1993	1400	1190
Maximum for 1994	3230	2745.5
Maximum for 1995	2420	2057
Maximum for 1996	3610	3068.5
Maximum for 1997	4160	3536
Maximum for 1998	11900	10115
Maximum for 1999	338	287.3
Maximum for 2000	280	238
Maximum for 2001	1510	1283.5
Maximum for 2002	1220	1037
Maximum for 2003	5440	4624
Maximum for 2004	7810	6638.5
Maximum for 2005	3550	3017.5
Maximum for 2006	2240	1904
Maximum for 2007	1100	935
Maximum for 2008	5950	5057.5
Maximum for 2009	2160	1836
Maximum for 2010	2430	2065.5
Percentile 10 for 1932	3.4	3.4
Percentile 10 for 1933	19	19
Percentile 10 for 1934	16	16
Percentile 10 for 1935	3.1	3.1
Percentile 10 for 1936	16	16
Percentile 10 for 1937	43	36.73
Percentile 10 for 1938	10.4	10.4
Percentile 10 for 1939	20.4	20.4
Percentile 10 for 1940	12	12
Percentile 10 for 1941	20	20
Percentile 10 for 1942	30.8	30.8
Percentile 10 for 1943	11	11
Percentile 10 for 1944	35.5	35.5
Percentile 10 for 1945	13	13
Percentile 10 for 1946	79	67.15
Percentile 10 for 1947	51	43.35
Percentile 10 for 1948	61	51.85
Percentile 10 for 1949	74	62.9
Percentile 10 for 1950	16	16
Percentile 10 for 1951	8.52	8.52
Percentile 10 for 1952	18	18
Percentile 10 for 1953	55.4	47.09
Percentile 10 for 1954	8.52	8.52
Percentile 10 for 1955	6.4	6.4
Percentile 10 for 1956	8.3	8.3
Percentile 10 for 1957	23	23
Percentile 10 for 1958	37	37
Percentile 10 for 1959	178.2	151.47
Percentile 10 for 1960	89	75.65
Percentile 10 for 1961	36	36

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Percentile 10 for 1962	13	13
Percentile 10 for 1963	19.4	19.4
Percentile 10 for 1964	47.5	41.65
Percentile 10 for 1965	54.4	46.24
Percentile 10 for 1966	76	64.6
Percentile 10 for 1967	20	20
Percentile 10 for 1968	14.5	14.5
Percentile 10 for 1969	52	44.2
Percentile 10 for 1970	40	38.55
Percentile 10 for 1971	28	28
Percentile 10 for 1972	76	64.6
Percentile 10 for 1973	33.8	33.8
Percentile 10 for 1974	31	31
Percentile 10 for 1975	44	40
Percentile 10 for 1976	38	36.775
Percentile 10 for 1977	10	10
Percentile 10 for 1978	37	36.73
Percentile 10 for 1979	37.4	37
Percentile 10 for 1980	15	15
Percentile 10 for 1981	6.4	6.4
Percentile 10 for 1982	52	44.2
Percentile 10 for 1983	80.4	68.34
Percentile 10 for 1984	55.5	47.175
Percentile 10 for 1985	20	20
Percentile 10 for 1986	31.4	31.4
Percentile 10 for 1987	43.4	39.95
Percentile 10 for 1988	12.5	12.5
Percentile 10 for 1989	8.5	8.5
Percentile 10 for 1990	3.14	3.14
Percentile 10 for 1991	33	33
Percentile 10 for 1992	66	56.1
Percentile 10 for 1993	18	18
Percentile 10 for 1994	21	21
Percentile 10 for 1995	81	68.85
Percentile 10 for 1996	41	37.7
Percentile 10 for 1997	24	24
Percentile 10 for 1998	15.4	15.4
Percentile 10 for 1999	4.44	4.44
Percentile 10 for 2000	0.33	0.33
Percentile 10 for 2001	0.29	0.29
Percentile 10 for 2002	2.8	2.8
Percentile 10 for 2003	34.4	34.4
Percentile 10 for 2004	5.25	5.25
Percentile 10 for 2005	42	39.04
Percentile 10 for 2006	0	0
Percentile 10 for 2007	0	0
Percentile 10 for 2008	2.25	2.25
Percentile 10 for 2009	30	30
Percentile 10 for 2010	3.4	3.4
Percentile 90 for 1932	242	205.7
Percentile 90 for 1933	630.2	535.67

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Percentile 90 for 1934	915	777.75
Percentile 90 for 1935	1050	892.5
Percentile 90 for 1936	652	554.2
Percentile 90 for 1937	1310	1113.5
Percentile 90 for 1938	555.4	472.09
Percentile 90 for 1939	674.2	573.07
Percentile 90 for 1940	680.5	578.425
Percentile 90 for 1941	1570	1334.5
Percentile 90 for 1942	1790	1521.5
Percentile 90 for 1943	272	231.2
Percentile 90 for 1944	1500	1275
Percentile 90 for 1945	919.8	781.83
Percentile 90 for 1946	1860	1581
Percentile 90 for 1947	2042	1735.7
Percentile 90 for 1948	2140	1819
Percentile 90 for 1949	698.2	593.47
Percentile 90 for 1950	1016	863.6
Percentile 90 for 1951	256.4	217.94
Percentile 90 for 1952	274	232.9
Percentile 90 for 1953	1960	1666
Percentile 90 for 1954	356.6	303.11
Percentile 90 for 1955	168	142.8
Percentile 90 for 1956	272.5	231.625
Percentile 90 for 1957	539	458.15
Percentile 90 for 1958	1116	948.6
Percentile 90 for 1959	2266	1926.1
Percentile 90 for 1960	1875	1593.75
Percentile 90 for 1961	1082	919.7
Percentile 90 for 1962	179.6	152.66
Percentile 90 for 1963	926.4	787.44
Percentile 90 for 1964	2170	1844.5
Percentile 90 for 1965	1508	1281.8
Percentile 90 for 1966	1888	1604.8
Percentile 90 for 1967	831.8	707.03
Percentile 90 for 1968	718	610.3
Percentile 90 for 1969	1438	1222.3
Percentile 90 for 1970	2028	1723.8
Percentile 90 for 1971	720.6	612.51
Percentile 90 for 1972	1590	1351.5
Percentile 90 for 1973	1300	1105
Percentile 90 for 1974	1310	1113.5
Percentile 90 for 1975	616.8	524.28
Percentile 90 for 1976	518	440.3
Percentile 90 for 1977	667.2	567.12
Percentile 90 for 1978	1942	1650.7
Percentile 90 for 1979	943.8	802.23
Percentile 90 for 1980	1070	909.5
Percentile 90 for 1981	267.6	227.46
Percentile 90 for 1982	1100	935
Percentile 90 for 1983	1626	1382.1
Percentile 90 for 1984	1435	1219.75

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Percentile 90 for 1985	1330	1130.5
Percentile 90 for 1986	915	777.75
Percentile 90 for 1987	1842	1565.7
Percentile 90 for 1988	1540	1309
Percentile 90 for 1989	264.6	224.91
Percentile 90 for 1990	126	107.1
Percentile 90 for 1991	1348	1145.8
Percentile 90 for 1992	1315	1117.75
Percentile 90 for 1993	741.2	630.02
Percentile 90 for 1994	924.8	786.08
Percentile 90 for 1995	864.8	735.08
Percentile 90 for 1996	794	674.9
Percentile 90 for 1997	1394	1184.9
Percentile 90 for 1998	2136	1815.6
Percentile 90 for 1999	82.2	69.87
Percentile 90 for 2000	96.5	82.025
Percentile 90 for 2001	125	106.25
Percentile 90 for 2002	276.2	234.77
Percentile 90 for 2003	1820	1547
Percentile 90 for 2004	1035	879.75
Percentile 90 for 2005	1500	1275
Percentile 90 for 2006	519	441.15
Percentile 90 for 2007	37.6	37.24
Percentile 90 for 2008	323	274.55
Percentile 90 for 2009	822.4	699.04
Percentile 90 for 2010	579.8	492.83
Mean for 1932	93.607	80.677
Mean for 1933	268.131	229.254
Mean for 1934	481.117	410.324
Mean for 1935	382.586	326.137
Mean for 1936	210.38	179.909
Mean for 1937	563.238	479.042
Mean for 1938	286.084	243.918
Mean for 1939	247.104	211.366
Mean for 1940	248.547	212.05
Mean for 1941	656.264	558.252
Mean for 1942	558.096	475.215
Mean for 1943	115.445	100.067
Mean for 1944	659.374	561.058
Mean for 1945	335.65	286.368
Mean for 1946	794.307	675.253
Mean for 1947	861.542	732.379
Mean for 1948	931.667	792.24
Mean for 1949	419.203	356.526
Mean for 1950	519.993	442.966
Mean for 1951	126.549	108.288
Mean for 1952	144.236	123.981
Mean for 1953	707.096	601.282
Mean for 1954	139.961	120.457
Mean for 1955	68.263	59.548
Mean for 1956	136.056	116.858

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Mean for 1957	252.896	216.076
Mean for 1958	407.238	346.748
Mean for 1959	1044.184	887.556
Mean for 1960	734.74	624.6
Mean for 1961	441.403	375.774
Mean for 1962	82.199	71.309
Mean for 1963	337.588	287.522
Mean for 1964	951.393	809.039
Mean for 1965	618.762	526.192
Mean for 1966	775.562	659.227
Mean for 1967	346.476	295.583
Mean for 1968	420.57	358.03
Mean for 1969	516.745	439.558
Mean for 1970	822.463	699.656
Mean for 1971	265.147	226.224
Mean for 1972	655.899	557.715
Mean for 1973	573.378	487.926
Mean for 1974	389.197	331.751
Mean for 1975	318.214	270.94
Mean for 1976	211.361	180.191
Mean for 1977	237.589	202.883
Mean for 1978	635.501	540.77
Mean for 1979	427.233	363.686
Mean for 1980	401.653	342.353
Mean for 1981	97.82	84.738
Mean for 1982	450.589	383.242
Mean for 1983	657.94	559.249
Mean for 1984	547.391	465.46
Mean for 1985	450.997	384.022
Mean for 1986	354.493	302.022
Mean for 1987	577.888	491.638
Mean for 1988	542.945	462.032
Mean for 1989	96.961	83.741
Mean for 1990	51.131	44.741
Mean for 1991	586.769	499.478
Mean for 1992	665.328	565.783
Mean for 1993	223.059	190.964
Mean for 1994	391.46	333.188
Mean for 1995	383.674	326.172
Mean for 1996	325.579	277.223
Mean for 1997	437.49	372.518
Mean for 1998	785.676	668.637
Mean for 1999	37.78	33.859
Mean for 2000	34.337	30.636
Mean for 2001	71.482	62.325
Mean for 2002	94.784	81.801
Mean for 2003	648.181	551.644
Mean for 2004	473.927	403.752
Mean for 2005	486.079	413.64
Mean for 2006	156.765	133.819
Mean for 2007	30.798	27.198

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean for 2008	210.056	179.829
Mean for 2009	278.608	237.956
Mean for 2010	237.032	202.174
Median for 1932	26	26
Median for 1933	75	63.75
Median for 1934	66	56.1
Median for 1935	46	40
Median for 1936	66	56.1
Median for 1937	253	215.05
Median for 1938	99	84.15
Median for 1939	65	55.25
Median for 1940	113	96.05
Median for 1941	266	226.1
Median for 1942	266	226.1
Median for 1943	35	35
Median for 1944	167	141.95
Median for 1945	102	86.7
Median for 1946	495	420.75
Median for 1947	381	323.85
Median for 1948	416	353.6
Median for 1949	191	162.35
Median for 1950	74	62.9
Median for 1951	89	75.65
Median for 1952	59.5	50.575
Median for 1953	274	232.9
Median for 1954	29	29
Median for 1955	20	20
Median for 1956	50	42.5
Median for 1957	78	66.3
Median for 1958	220	187
Median for 1959	588	499.8
Median for 1960	340	289
Median for 1961	151	128.35
Median for 1962	50	42.5
Median for 1963	133	113.05
Median for 1964	456	387.6
Median for 1965	358	304.3
Median for 1966	460	391
Median for 1967	115	97.75
Median for 1968	121.5	103.275
Median for 1969	277	235.45
Median for 1970	268	227.8
Median for 1971	107	90.95
Median for 1972	344	292.4
Median for 1973	364	309.4
Median for 1974	122	103.7
Median for 1975	194	164.9
Median for 1976	143	121.55
Median for 1977	82	69.7
Median for 1978	275	233.75
Median for 1979	245	208.25

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Median for 1980	143	121.55
Median for 1981	25	25
Median for 1982	224	190.4
Median for 1983	357	303.45
Median for 1984	173.5	147.475
Median for 1985	126	107.1
Median for 1986	125	106.25
Median for 1987	130	110.5
Median for 1988	107	90.95
Median for 1989	49	42
Median for 1990	18	18
Median for 1991	409	347.65
Median for 1992	317	269.45
Median for 1993	72	61.2
Median for 1994	210	178.5
Median for 1995	249	211.65
Median for 1996	137	116.45
Median for 1997	198	168.3
Median for 1998	157	133.45
Median for 1999	17	17
Median for 2000	14	14
Median for 2001	16	16
Median for 2002	43	40
Median for 2003	335	284.75
Median for 2004	75	63.75
Median for 2005	203	172.55
Median for 2006	3.6	3.6
Median for 2007	6.3	6.3
Median for 2008	50.5	42.925
Median for 2009	100	85
Median for 2010	63	53.55
Zeros for 1932	0	0
Zeros for 1933	0	0
Zeros for 1934	0	0
Zeros for 1935	0	0
Zeros for 1936	0	0
Zeros for 1937	0	0
Zeros for 1938	0	0
Zeros for 1939	0	0
Zeros for 1940	0	0
Zeros for 1941	0	0
Zeros for 1942	0	0
Zeros for 1943	0	0
Zeros for 1944	0	0
Zeros for 1945	0	0
Zeros for 1946	0	0
Zeros for 1947	0	0
Zeros for 1948	0	0
Zeros for 1949	0	0
Zeros for 1950	0	0
Zeros for 1951	0	0

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Zeros for 1952	0	0
Zeros for 1953	0	0
Zeros for 1954	0	0
Zeros for 1955	0	0
Zeros for 1956	0	0
Zeros for 1957	0	0
Zeros for 1958	0	0
Zeros for 1959	0	0
Zeros for 1960	0	0
Zeros for 1961	0	0
Zeros for 1962	0	0
Zeros for 1963	0	0
Zeros for 1964	0	0
Zeros for 1965	0	0
Zeros for 1966	0	0
Zeros for 1967	0	0
Zeros for 1968	0	0
Zeros for 1969	0	0
Zeros for 1970	0	0
Zeros for 1971	0	0
Zeros for 1972	0	0
Zeros for 1973	0	0
Zeros for 1974	0	0
Zeros for 1975	0	0
Zeros for 1976	0	0
Zeros for 1977	0	0
Zeros for 1978	0	0
Zeros for 1979	0	0
Zeros for 1980	0	0
Zeros for 1981	0	0
Zeros for 1982	0	0
Zeros for 1983	0	0
Zeros for 1984	0	0
Zeros for 1985	0	0
Zeros for 1986	0	0
Zeros for 1987	0	0
Zeros for 1988	0	0
Zeros for 1989	0	0
Zeros for 1990	0	0
Zeros for 1991	0	0
Zeros for 1992	0	0
Zeros for 1993	0	0
Zeros for 1994	0	0
Zeros for 1995	0	0
Zeros for 1996	0	0
Zeros for 1997	0	0
Zeros for 1998	0	0
Zeros for 1999	0	0
Zeros for 2000	26	26
Zeros for 2001	30	30
Zeros for 2002	3	3

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Zeros for 2003	0	0
Zeros for 2004	3	3
Zeros for 2005	0	0
Zeros for 2006	100	100
Zeros for 2007	99	99
Zeros for 2008	5	5
Zeros for 2009	0	0
Zeros for 2010	0	0
Total for 1932	34260.3	29527.8
Total for 1933	97867.8	83677.65
Total for 1934	175607.7	149768.25
Total for 1935	139643.9	119039.9
Total for 1936	76998.9	65846.85
Total for 1937	205582	174850.45
Total for 1938	104420.6	89030
Total for 1939	90193	77148.55
Total for 1940	90968.1	77610.45
Total for 1941	239536.4	203762
Total for 1942	203705	173453.6
Total for 1943	42137.6	36524.45
Total for 1944	241331	205347.2
Total for 1945	122512.3	104524.45
Total for 1946	289922	246467.45
Total for 1947	314463	267318.45
Total for 1948	340990	289959.85
Total for 1949	153009	130131.9
Total for 1950	189797.6	161682.5
Total for 1951	46190.5	39525.1
Total for 1952	52790.5	45377.2
Total for 1953	258090	219468
Total for 1954	51085.9	43966.75
Total for 1955	24916.1	21734.9
Total for 1956	49796.6	42770
Total for 1957	92307	78867.6
Total for 1958	148642	126563.05
Total for 1959	381127	323957.95
Total for 1960	268915	228603.7
Total for 1961	161112	137157.6
Total for 1962	30002.7	26027.7
Total for 1963	123219.6	104945.55
Total for 1964	348210	296108.4
Total for 1965	225848	192059.9
Total for 1966	283080	240618
Total for 1967	126463.7	107887.7
Total for 1968	153928.8	131038.95
Total for 1969	188612	160438.55
Total for 1970	300199	255374.35
Total for 1971	96778.6	82571.65
Total for 1972	240059	204123.8
Total for 1973	209283	178092.9
Total for 1974	142057	121089.1

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Total for 1975	116148	98893.05
Total for 1976	77358	65950.05
Total for 1977	86720.1	74052.45
Total for 1978	231958	197380.9
Total for 1979	155940	132745.5
Total for 1980	147005	125301.05
Total for 1981	35704.3	30929.35
Total for 1982	164465	139883.15
Total for 1983	240148	204125.8
Total for 1984	200345	170358.5
Total for 1985	164614	140168.05
Total for 1986	129390	110238.15
Total for 1987	210929	179447.9
Total for 1988	198717.7	169103.8
Total for 1989	35390.8	30565.6
Total for 1990	18662.9	16330.4
Total for 1991	214170.6	182309.4
Total for 1992	243510	207076.65
Total for 1993	81416.5	69701.8
Total for 1994	142883	121613.45
Total for 1995	140041	119052.85
Total for 1996	119162	101463.65
Total for 1997	159684	135969
Total for 1998	286771.7	244052.6
Total for 1999	13789.7	12358.55
Total for 2000	12567.25	11212.6
Total for 2001	26090.85	22748.7
Total for 2002	34596.17	29857.37
Total for 2003	236586	201349.95
Total for 2004	173457.46	147773.26
Total for 2005	177419	150978.65
Total for 2006	57219.05	48844.1
Total for 2007	11241.12	9927.42
Total for 2008	76880.64	65817.54
Total for 2009	101692	86854
Total for 2010	86516.5	73793.5
Less or equal 588 for 1932	353	355
Less or equal 588 for 1933	327	331
Less or equal 588 for 1934	309	317
Less or equal 588 for 1935	321	323
Less or equal 588 for 1936	325	333
Less or equal 588 for 1937	278	294
Less or equal 588 for 1938	330	335
Less or equal 588 for 1939	317	329
Less or equal 588 for 1940	322	329
Less or equal 588 for 1941	256	266
Less or equal 588 for 1942	272	285
Less or equal 588 for 1943	351	352
Less or equal 588 for 1944	265	274
Less or equal 588 for 1945	306	315
Less or equal 588 for 1946	199	214

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Less or equal 588 for 1947	221	242
Less or equal 588 for 1948	229	241
Less or equal 588 for 1949	321	328
Less or equal 588 for 1950	301	307
Less or equal 588 for 1951	357	359
Less or equal 588 for 1952	347	349
Less or equal 588 for 1953	245	261
Less or equal 588 for 1954	349	352
Less or equal 588 for 1955	358	361
Less or equal 588 for 1956	352	354
Less or equal 588 for 1957	334	343
Less or equal 588 for 1958	284	293
Less or equal 588 for 1959	183	202
Less or equal 588 for 1960	222	233
Less or equal 588 for 1961	284	301
Less or equal 588 for 1962	363	364
Less or equal 588 for 1963	274	291
Less or equal 588 for 1964	221	236
Less or equal 588 for 1965	227	241
Less or equal 588 for 1966	205	218
Less or equal 588 for 1967	306	313
Less or equal 588 for 1968	321	327
Less or equal 588 for 1969	263	281
Less or equal 588 for 1970	224	236
Less or equal 588 for 1971	321	326
Less or equal 588 for 1972	243	259
Less or equal 588 for 1973	263	275
Less or equal 588 for 1974	301	308
Less or equal 588 for 1975	325	332
Less or equal 588 for 1976	340	351
Less or equal 588 for 1977	321	330
Less or equal 588 for 1978	256	264
Less or equal 588 for 1979	290	305
Less or equal 588 for 1980	291	302
Less or equal 588 for 1981	356	357
Less or equal 588 for 1982	268	287
Less or equal 588 for 1983	236	252
Less or equal 588 for 1984	276	287
Less or equal 588 for 1985	294	299
Less or equal 588 for 1986	299	313
Less or equal 588 for 1987	263	270
Less or equal 588 for 1988	286	292
Less or equal 588 for 1989	355	363
Less or equal 588 for 1990	365	365
Less or equal 588 for 1991	233	267
Less or equal 588 for 1992	270	286
Less or equal 588 for 1993	315	325
Less or equal 588 for 1994	296	304
Less or equal 588 for 1995	299	309
Less or equal 588 for 1996	312	323
Less or equal 588 for 1997	303	309

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Less or equal 588 for 1998	247	253
Less or equal 588 for 1999	365	365
Less or equal 588 for 2000	366	366
Less or equal 588 for 2001	356	357
Less or equal 588 for 2002	360	360
Less or equal 588 for 2003	239	256
Less or equal 588 for 2004	318	321
Less or equal 588 for 2005	282	291
Less or equal 588 for 2006	334	339
Less or equal 588 for 2007	359	360
Less or equal 588 for 2008	341	344
Less or equal 588 for 2009	312	319
Less or equal 588 for 2010	329	331
Greater or equal 588 for 1932	13	11
Greater or equal 588 for 1933	38	34
Greater or equal 588 for 1934	56	48
Greater or equal 588 for 1935	44	42
Greater or equal 588 for 1936	41	33
Greater or equal 588 for 1937	87	71
Greater or equal 588 for 1938	35	30
Greater or equal 588 for 1939	48	36
Greater or equal 588 for 1940	44	37
Greater or equal 588 for 1941	109	99
Greater or equal 588 for 1942	93	80
Greater or equal 588 for 1943	14	13
Greater or equal 588 for 1944	101	92
Greater or equal 588 for 1945	61	50
Greater or equal 588 for 1946	167	151
Greater or equal 588 for 1947	145	123
Greater or equal 588 for 1948	137	125
Greater or equal 588 for 1949	44	37
Greater or equal 588 for 1950	64	58
Greater or equal 588 for 1951	8	6
Greater or equal 588 for 1952	19	17
Greater or equal 588 for 1953	120	104
Greater or equal 588 for 1954	16	13
Greater or equal 588 for 1955	7	4
Greater or equal 588 for 1956	14	12
Greater or equal 588 for 1957	31	22
Greater or equal 588 for 1958	81	72
Greater or equal 588 for 1959	183	163
Greater or equal 588 for 1960	144	133
Greater or equal 588 for 1961	81	64
Greater or equal 588 for 1962	2	1
Greater or equal 588 for 1963	91	74
Greater or equal 588 for 1964	145	130
Greater or equal 588 for 1965	138	124
Greater or equal 588 for 1966	160	147
Greater or equal 588 for 1967	59	52
Greater or equal 588 for 1968	45	39
Greater or equal 588 for 1969	102	84

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Greater or equal 588 for 1970	142	129
Greater or equal 588 for 1971	44	39
Greater or equal 588 for 1972	123	107
Greater or equal 588 for 1973	102	90
Greater or equal 588 for 1974	64	57
Greater or equal 588 for 1975	40	33
Greater or equal 588 for 1976	26	15
Greater or equal 588 for 1977	44	35
Greater or equal 588 for 1978	110	101
Greater or equal 588 for 1979	76	60
Greater or equal 588 for 1980	75	64
Greater or equal 588 for 1981	9	8
Greater or equal 588 for 1982	97	78
Greater or equal 588 for 1983	129	113
Greater or equal 588 for 1984	90	79
Greater or equal 588 for 1985	71	66
Greater or equal 588 for 1986	66	52
Greater or equal 588 for 1987	102	95
Greater or equal 588 for 1988	80	74
Greater or equal 588 for 1989	10	2
Greater or equal 588 for 1990	0	0
Greater or equal 588 for 1991	132	98
Greater or equal 588 for 1992	97	80
Greater or equal 588 for 1993	50	40
Greater or equal 588 for 1994	69	61
Greater or equal 588 for 1995	66	56
Greater or equal 588 for 1996	54	43
Greater or equal 588 for 1997	63	56
Greater or equal 588 for 1998	118	112
Greater or equal 588 for 1999	0	0
Greater or equal 588 for 2000	0	0
Greater or equal 588 for 2001	9	8
Greater or equal 588 for 2002	5	5
Greater or equal 588 for 2003	126	109
Greater or equal 588 for 2004	48	45
Greater or equal 588 for 2005	83	74
Greater or equal 588 for 2006	31	26
Greater or equal 588 for 2007	6	5
Greater or equal 588 for 2008	25	22
Greater or equal 588 for 2009	53	46
Greater or equal 588 for 2010	36	34
Summary of interannual measures		
Mean of all years Minimum	13.654	13.252
Mean of all years Maximum	5157.266	4383.676
Mean of all years Percentile 10	30.731	28.119
Mean of all years Percentile 90	1015.566	863.298
Mean of all years Mean	407.708	347.319
Mean of all years Median	169.214	144.29
Mean of all years Zeros	3.367	3.367
Mean of all years Total	148922.159	126864.163
Mean of all years Less or equal 588	297.557	306.418

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Mean of all years Greater or equal 588	67.823	58.835
Median of all years Minimum	9.7	9.7
Median of all years Maximum	3970	3374.5
Median of all years Percentile 10	21	21
Median of all years Percentile 90	924.8	786.08
Median of all years Mean	391.46	333.188
Median of all years Median	126	107.1
Median of all years Zeros	0	0
Median of all years Total	142883	121613.45
Median of all years Less or equal 588	303	313
Median of all years Greater or equal 588	63	52
High Flow Spell result		
Whole Period		
High Spell Threshold	588	588
Number of High Spell	382	364
Longest High Spell	112	83
Mean of High Spell Peaks	2315.995	2075.357
Mean Duration of High Spell	13.976	12.747
Total Duration of High Spell	5339	4640
Total of periods Between High Spells	23039	23667
Mean period Between High Spells	60.47	65.198
Longest period Between High Spells	1020	1021
Total (Sum) Raw Values	8447696	6804571.3
Mean Raw Values	22114.387	18693.877
Summary for each year		
High Spell Threshold for 1932	588	588
High Spell Threshold for 1933	588	588
High Spell Threshold for 1934	588	588
High Spell Threshold for 1935	588	588
High Spell Threshold for 1936	588	588
High Spell Threshold for 1937	588	588
High Spell Threshold for 1938	588	588
High Spell Threshold for 1939	588	588
High Spell Threshold for 1940	588	588
High Spell Threshold for 1941	588	588
High Spell Threshold for 1942	588	588
High Spell Threshold for 1943	588	588
High Spell Threshold for 1944	588	588
High Spell Threshold for 1945	588	588
High Spell Threshold for 1946	588	588
High Spell Threshold for 1947	588	588
High Spell Threshold for 1948	588	588
High Spell Threshold for 1949	588	588
High Spell Threshold for 1950	588	588
High Spell Threshold for 1951	588	588
High Spell Threshold for 1952	588	588
High Spell Threshold for 1953	588	588
High Spell Threshold for 1954	588	588
High Spell Threshold for 1955	588	588
High Spell Threshold for 1956	588	588
High Spell Threshold for 1957	588	588

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
High Spell Threshold for 1958	588	588
High Spell Threshold for 1959	588	588
High Spell Threshold for 1960	588	588
High Spell Threshold for 1961	588	588
High Spell Threshold for 1962	588	588
High Spell Threshold for 1963	588	588
High Spell Threshold for 1964	588	588
High Spell Threshold for 1965	588	588
High Spell Threshold for 1966	588	588
High Spell Threshold for 1967	588	588
High Spell Threshold for 1968	588	588
High Spell Threshold for 1969	588	588
High Spell Threshold for 1970	588	588
High Spell Threshold for 1971	588	588
High Spell Threshold for 1972	588	588
High Spell Threshold for 1973	588	588
High Spell Threshold for 1974	588	588
High Spell Threshold for 1975	588	588
High Spell Threshold for 1976	588	588
High Spell Threshold for 1977	588	588
High Spell Threshold for 1978	588	588
High Spell Threshold for 1979	588	588
High Spell Threshold for 1980	588	588
High Spell Threshold for 1981	588	588
High Spell Threshold for 1982	588	588
High Spell Threshold for 1983	588	588
High Spell Threshold for 1984	588	588
High Spell Threshold for 1985	588	588
High Spell Threshold for 1986	588	588
High Spell Threshold for 1987	588	588
High Spell Threshold for 1988	588	588
High Spell Threshold for 1989	588	588
High Spell Threshold for 1990	588	588
High Spell Threshold for 1991	588	588
High Spell Threshold for 1992	588	588
High Spell Threshold for 1993	588	588
High Spell Threshold for 1994	588	588
High Spell Threshold for 1995	588	588
High Spell Threshold for 1996	588	588
High Spell Threshold for 1997	588	588
High Spell Threshold for 1998	588	588
High Spell Threshold for 1999	588	588
High Spell Threshold for 2000	588	588
High Spell Threshold for 2001	588	588
High Spell Threshold for 2002	588	588
High Spell Threshold for 2003	588	588
High Spell Threshold for 2004	588	588
High Spell Threshold for 2005	588	588
High Spell Threshold for 2006	588	588
High Spell Threshold for 2007	588	588
High Spell Threshold for 2008	588	588

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
High Spell Threshold for 2009	588	588
High Spell Threshold for 2010	588	588
Number of High Spell for 1932	3	4
Number of High Spell for 1933	3	3
Number of High Spell for 1934	4	3
Number of High Spell for 1935	1	1
Number of High Spell for 1936	3	4
Number of High Spell for 1937	7	6
Number of High Spell for 1938	4	4
Number of High Spell for 1939	5	4
Number of High Spell for 1940	5	5
Number of High Spell for 1941	8	8
Number of High Spell for 1942	7	6
Number of High Spell for 1943	2	2
Number of High Spell for 1944	5	5
Number of High Spell for 1945	6	6
Number of High Spell for 1946	8	8
Number of High Spell for 1947	8	8
Number of High Spell for 1948	7	6
Number of High Spell for 1949	4	4
Number of High Spell for 1950	4	4
Number of High Spell for 1951	1	1
Number of High Spell for 1952	1	1
Number of High Spell for 1953	7	6
Number of High Spell for 1954	1	1
Number of High Spell for 1955	1	1
Number of High Spell for 1956	1	1
Number of High Spell for 1957	5	3
Number of High Spell for 1958	6	6
Number of High Spell for 1959	10	10
Number of High Spell for 1960	6	6
Number of High Spell for 1961	8	7
Number of High Spell for 1962	1	1
Number of High Spell for 1963	7	6
Number of High Spell for 1964	7	7
Number of High Spell for 1965	8	9
Number of High Spell for 1966	8	8
Number of High Spell for 1967	4	5
Number of High Spell for 1968	3	3
Number of High Spell for 1969	10	8
Number of High Spell for 1970	4	5
Number of High Spell for 1971	4	4
Number of High Spell for 1972	7	6
Number of High Spell for 1973	7	6
Number of High Spell for 1974	5	5
Number of High Spell for 1975	5	4
Number of High Spell for 1976	7	6
Number of High Spell for 1977	5	5
Number of High Spell for 1978	7	6
Number of High Spell for 1979	6	5
Number of High Spell for 1980	7	6

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Number of High Spell for 1981	1	1
Number of High Spell for 1982	9	10
Number of High Spell for 1983	11	11
Number of High Spell for 1984	7	7
Number of High Spell for 1985	4	4
Number of High Spell for 1986	7	6
Number of High Spell for 1987	3	3
Number of High Spell for 1988	3	3
Number of High Spell for 1989	2	1
Number of High Spell for 1990	0	0
Number of High Spell for 1991	13	16
Number of High Spell for 1992	9	7
Number of High Spell for 1993	4	4
Number of High Spell for 1994	8	7
Number of High Spell for 1995	7	6
Number of High Spell for 1996	7	7
Number of High Spell for 1997	8	6
Number of High Spell for 1998	4	4
Number of High Spell for 1999	0	0
Number of High Spell for 2000	0	0
Number of High Spell for 2001	2	2
Number of High Spell for 2002	1	1
Number of High Spell for 2003	7	8
Number of High Spell for 2004	1	1
Number of High Spell for 2005	7	7
Number of High Spell for 2006	3	2
Number of High Spell for 2007	1	1
Number of High Spell for 2008	2	2
Number of High Spell for 2009	7	7
Number of High Spell for 2010	2	1
Longest High Spell for 1932	6	5
Longest High Spell for 1933	19	18
Longest High Spell for 1934	26	25
Longest High Spell for 1935	44	42
Longest High Spell for 1936	25	12
Longest High Spell for 1937	27	18
Longest High Spell for 1938	13	12
Longest High Spell for 1939	22	19
Longest High Spell for 1940	12	11
Longest High Spell for 1941	38	36
Longest High Spell for 1942	49	48
Longest High Spell for 1943	9	9
Longest High Spell for 1944	47	44
Longest High Spell for 1945	21	20
Longest High Spell for 1946	69	67
Longest High Spell for 1947	69	67
Longest High Spell for 1948	51	50
Longest High Spell for 1949	17	16
Longest High Spell for 1950	20	18
Longest High Spell for 1951	8	6
Longest High Spell for 1952	19	17

Name	Santa Fe -	Santa Fe -
	Worthington 1932-2010	Worthington 1932-2010 REDUCED
Longest High Spell for 1953	36	29
Longest High Spell for 1954	16	13
Longest High Spell for 1955	7	4
Longest High Spell for 1956	14	12
Longest High Spell for 1957	12	11
Longest High Spell for 1958	35	33
Longest High Spell for 1959	46	44
Longest High Spell for 1960	40	39
Longest High Spell for 1961	27	23
Longest High Spell for 1962	2	1
Longest High Spell for 1963	38	35
Longest High Spell for 1964	63	61
Longest High Spell for 1965	52	38
Longest High Spell for 1966	34	33
Longest High Spell for 1967	23	21
Longest High Spell for 1968	30	28
Longest High Spell for 1969	22	22
Longest High Spell for 1970	63	61
Longest High Spell for 1971	19	19
Longest High Spell for 1972	45	42
Longest High Spell for 1973	30	28
Longest High Spell for 1974	34	33
Longest High Spell for 1975	21	20
Longest High Spell for 1976	5	4
Longest High Spell for 1977	21	17
Longest High Spell for 1978	42	40
Longest High Spell for 1979	29	27
Longest High Spell for 1980	19	17
Longest High Spell for 1981	9	8
Longest High Spell for 1982	22	13
Longest High Spell for 1983	56	46
Longest High Spell for 1984	26	24
Longest High Spell for 1985	52	50
Longest High Spell for 1986	20	17
Longest High Spell for 1987	82	64
Longest High Spell for 1988	40	37
Longest High Spell for 1989	6	2
Longest High Spell for 1990	NaN	NaN
Longest High Spell for 1991	30	23
Longest High Spell for 1992	28	25
Longest High Spell for 1993	27	22
Longest High Spell for 1994	17	16
Longest High Spell for 1995	25	24
Longest High Spell for 1996	11	11
Longest High Spell for 1997	19	19
Longest High Spell for 1998	93	69
Longest High Spell for 1999	NaN	NaN
Longest High Spell for 2000	NaN	NaN
Longest High Spell for 2001	7	7
Longest High Spell for 2002	5	5
Longest High Spell for 2003	53	46

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Longest High Spell for 2004	48	45
Longest High Spell for 2005	28	27
Longest High Spell for 2006	15	14
Longest High Spell for 2007	6	5
Longest High Spell for 2008	15	14
Longest High Spell for 2009	16	14
Longest High Spell for 2010	35	34
Mean of High Spell Peaks for 1932	1082	857.862
Mean of High Spell Peaks for 1933	2410	2048.5
Mean of High Spell Peaks for 1934	5243.75	5774.333
Mean of High Spell Peaks for 1935	10900	9265
Mean of High Spell Peaks for 1936	1351	1078.012
Mean of High Spell Peaks for 1937	3525.429	3541.667
Mean of High Spell Peaks for 1938	2821.5	2398.275
Mean of High Spell Peaks for 1939	1226.8	1203.175
Mean of High Spell Peaks for 1940	1536.8	1306.28
Mean of High Spell Peaks for 1941	3048.125	2590.906
Mean of High Spell Peaks for 1942	1665.571	1567.258
Mean of High Spell Peaks for 1943	1630	1385.5
Mean of High Spell Peaks for 1944	4840.6	4114.51
Mean of High Spell Peaks for 1945	2009.833	1708.358
Mean of High Spell Peaks for 1946	2774.625	2439.5
Mean of High Spell Peaks for 1947	3068.625	2677.075
Mean of High Spell Peaks for 1948	4237.714	4114
Mean of High Spell Peaks for 1949	3385.75	2877.888
Mean of High Spell Peaks for 1950	5942.5	5051.125
Mean of High Spell Peaks for 1951	1110	943.5
Mean of High Spell Peaks for 1952	1440	1224
Mean of High Spell Peaks for 1953	2579.143	2510.475
Mean of High Spell Peaks for 1954	2200	1870
Mean of High Spell Peaks for 1955	892	758.2
Mean of High Spell Peaks for 1956	3250	2762.5
Mean of High Spell Peaks for 1957	1802	2190.45
Mean of High Spell Peaks for 1958	1348	1145.8
Mean of High Spell Peaks for 1959	3001.2	2551.02
Mean of High Spell Peaks for 1960	2948.333	2506.083
Mean of High Spell Peaks for 1961	1571	1450.95
Mean of High Spell Peaks for 1962	706	600.1
Mean of High Spell Peaks for 1963	1083.571	1057.258
Mean of High Spell Peaks for 1964	5064.429	4304.764
Mean of High Spell Peaks for 1965	2001.125	1665.906
Mean of High Spell Peaks for 1966	2434.75	2069.538
Mean of High Spell Peaks for 1967	2450	1805.4
Mean of High Spell Peaks for 1968	4616.667	3924.167
Mean of High Spell Peaks for 1969	1587.4	1556.138
Mean of High Spell Peaks for 1970	5647.5	3995
Mean of High Spell Peaks for 1971	1433.25	1218.262
Mean of High Spell Peaks for 1972	2303.857	2188.75
Mean of High Spell Peaks for 1973	1925.714	1820.417
Mean of High Spell Peaks for 1974	1619.2	1376.32
Mean of High Spell Peaks for 1975	1279.6	1231.65

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean of High Spell Peaks for 1976	761.143	666.4
Mean of High Spell Peaks for 1977	1160.8	995.35
Mean of High Spell Peaks for 1978	2492.571	2385.667
Mean of High Spell Peaks for 1979	1277.5	1252.05
Mean of High Spell Peaks for 1980	2012.571	1901.308
Mean of High Spell Peaks for 1981	1660	1411
Mean of High Spell Peaks for 1982	1514.444	1293.785
Mean of High Spell Peaks for 1983	1860.636	1644.905
Mean of High Spell Peaks for 1984	2363.143	2008.671
Mean of High Spell Peaks for 1985	2800.75	2380.638
Mean of High Spell Peaks for 1986	1595.714	1497.417
Mean of High Spell Peaks for 1987	3520.667	3300.833
Mean of High Spell Peaks for 1988	4463.333	3793.833
Mean of High Spell Peaks for 1989	675	619.65
Mean of High Spell Peaks for 1990	NaN	NaN
Mean of High Spell Peaks for 1991	1650	1315.481
Mean of High Spell Peaks for 1992	3021.778	3145.607
Mean of High Spell Peaks for 1993	998.75	848.938
Mean of High Spell Peaks for 1994	1483.625	1363.521
Mean of High Spell Peaks for 1995	1272.714	1176.117
Mean of High Spell Peaks for 1996	1579.714	1342.757
Mean of High Spell Peaks for 1997	1793	1853
Mean of High Spell Peaks for 1998	4260	3827.125
Mean of High Spell Peaks for 1999	NaN	NaN
Mean of High Spell Peaks for 2000	NaN	NaN
Mean of High Spell Peaks for 2001	1144.5	972.825
Mean of High Spell Peaks for 2002	1220	1037
Mean of High Spell Peaks for 2003	2064.143	1780.75
Mean of High Spell Peaks for 2004	7810	6638.5
Mean of High Spell Peaks for 2005	1803.714	1533.157
Mean of High Spell Peaks for 2006	1583.667	1759.5
Mean of High Spell Peaks for 2007	1100	935
Mean of High Spell Peaks for 2008	3785	3217.25
Mean of High Spell Peaks for 2009	1273.714	1082.657
Mean of High Spell Peaks for 2010	1524.5	2065.5
Mean Duration of High Spell for 1932	4	2.75
Mean Duration of High Spell for 1933	12.667	11.333
Mean Duration of High Spell for 1934	14	16
Mean Duration of High Spell for 1935	44	42
Mean Duration of High Spell for 1936	13.667	8.25
Mean Duration of High Spell for 1937	12.286	11.833
Mean Duration of High Spell for 1938	8.75	7.5
Mean Duration of High Spell for 1939	9.6	9
Mean Duration of High Spell for 1940	8.8	7.4
Mean Duration of High Spell for 1941	13.625	12.375
Mean Duration of High Spell for 1942	13.143	13.167
Mean Duration of High Spell for 1943	7	6.5
Mean Duration of High Spell for 1944	20	18.4
Mean Duration of High Spell for 1945	10.167	8.333
Mean Duration of High Spell for 1946	20.875	18.875
Mean Duration of High Spell for 1947	18	15.5

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean Duration of High Spell for 1948	19.571	20.833
Mean Duration of High Spell for 1949	11	9.25
Mean Duration of High Spell for 1950	16	14.5
Mean Duration of High Spell for 1951	8	6
Mean Duration of High Spell for 1952	19	17
Mean Duration of High Spell for 1953	17	17.333
Mean Duration of High Spell for 1954	16	13
Mean Duration of High Spell for 1955	7	4
Mean Duration of High Spell for 1956	14	12
Mean Duration of High Spell for 1957	6.2	7.333
Mean Duration of High Spell for 1958	13.5	12
Mean Duration of High Spell for 1959	18.3	16.3
Mean Duration of High Spell for 1960	24	22.167
Mean Duration of High Spell for 1961	9.875	9.143
Mean Duration of High Spell for 1962	2	1
Mean Duration of High Spell for 1963	13	12.333
Mean Duration of High Spell for 1964	20.714	18.571
Mean Duration of High Spell for 1965	17.25	13.667
Mean Duration of High Spell for 1966	20	18.375
Mean Duration of High Spell for 1967	14.5	10.4
Mean Duration of High Spell for 1968	15	13
Mean Duration of High Spell for 1969	10.2	10.5
Mean Duration of High Spell for 1970	35.25	25.8
Mean Duration of High Spell for 1971	11	9.75
Mean Duration of High Spell for 1972	17.571	17.833
Mean Duration of High Spell for 1973	14.571	15
Mean Duration of High Spell for 1974	12.8	11.4
Mean Duration of High Spell for 1975	8	8.25
Mean Duration of High Spell for 1976	3.714	2.5
Mean Duration of High Spell for 1977	8.8	6.8
Mean Duration of High Spell for 1978	15.571	16.833
Mean Duration of High Spell for 1979	12.667	11.8
Mean Duration of High Spell for 1980	10.571	10.667
Mean Duration of High Spell for 1981	9	8
Mean Duration of High Spell for 1982	10.667	7.7
Mean Duration of High Spell for 1983	11.636	10.182
Mean Duration of High Spell for 1984	12.857	11.286
Mean Duration of High Spell for 1985	17.75	16.5
Mean Duration of High Spell for 1986	9.429	8.667
Mean Duration of High Spell for 1987	34	31.667
Mean Duration of High Spell for 1988	26.667	24.667
Mean Duration of High Spell for 1989	5	2
Mean Duration of High Spell for 1990	NaN	NaN
Mean Duration of High Spell for 1991	10.077	6.062
Mean Duration of High Spell for 1992	10.778	11.429
Mean Duration of High Spell for 1993	12.5	10
Mean Duration of High Spell for 1994	8.625	8.714
Mean Duration of High Spell for 1995	9.429	9.333
Mean Duration of High Spell for 1996	7.714	6.143
Mean Duration of High Spell for 1997	7.75	9.333
Mean Duration of High Spell for 1998	29.5	28

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean Duration of High Spell for 1999	NaN	NaN
Mean Duration of High Spell for 2000	NaN	NaN
Mean Duration of High Spell for 2001	4.5	4
Mean Duration of High Spell for 2002	5	5
Mean Duration of High Spell for 2003	17.714	13.5
Mean Duration of High Spell for 2004	48	45
Mean Duration of High Spell for 2005	11.857	10.571
Mean Duration of High Spell for 2006	10.333	13
Mean Duration of High Spell for 2007	6	5
Mean Duration of High Spell for 2008	12.5	11
Mean Duration of High Spell for 2009	7.429	6.571
Mean Duration of High Spell for 2010	18	17
Total Duration of High Spell for 1932	12	11
Total Duration of High Spell for 1933	38	34
Total Duration of High Spell for 1934	56	48
Total Duration of High Spell for 1935	44	42
Total Duration of High Spell for 1936	41	33
Total Duration of High Spell for 1937	86	71
Total Duration of High Spell for 1938	35	30
Total Duration of High Spell for 1939	48	36
Total Duration of High Spell for 1940	44	37
Total Duration of High Spell for 1941	109	99
Total Duration of High Spell for 1942	92	79
Total Duration of High Spell for 1943	14	13
Total Duration of High Spell for 1944	100	92
Total Duration of High Spell for 1945	61	50
Total Duration of High Spell for 1946	167	151
Total Duration of High Spell for 1947	144	124
Total Duration of High Spell for 1948	137	125
Total Duration of High Spell for 1949	44	37
Total Duration of High Spell for 1950	64	58
Total Duration of High Spell for 1951	8	6
Total Duration of High Spell for 1952	19	17
Total Duration of High Spell for 1953	119	104
Total Duration of High Spell for 1954	16	13
Total Duration of High Spell for 1955	7	4
Total Duration of High Spell for 1956	14	12
Total Duration of High Spell for 1957	31	22
Total Duration of High Spell for 1958	81	72
Total Duration of High Spell for 1959	183	163
Total Duration of High Spell for 1960	144	133
Total Duration of High Spell for 1961	79	64
Total Duration of High Spell for 1962	2	1
Total Duration of High Spell for 1963	91	74
Total Duration of High Spell for 1964	145	130
Total Duration of High Spell for 1965	138	123
Total Duration of High Spell for 1966	160	147
Total Duration of High Spell for 1967	58	52
Total Duration of High Spell for 1968	45	39
Total Duration of High Spell for 1969	102	84
Total Duration of High Spell for 1970	141	129

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Total Duration of High Spell for 1971	44	39
Total Duration of High Spell for 1972	123	107
Total Duration of High Spell for 1973	102	90
Total Duration of High Spell for 1974	64	57
Total Duration of High Spell for 1975	40	33
Total Duration of High Spell for 1976	26	15
Total Duration of High Spell for 1977	44	34
Total Duration of High Spell for 1978	109	101
Total Duration of High Spell for 1979	76	59
Total Duration of High Spell for 1980	74	64
Total Duration of High Spell for 1981	9	8
Total Duration of High Spell for 1982	96	77
Total Duration of High Spell for 1983	128	112
Total Duration of High Spell for 1984	90	79
Total Duration of High Spell for 1985	71	66
Total Duration of High Spell for 1986	66	52
Total Duration of High Spell for 1987	102	95
Total Duration of High Spell for 1988	80	74
Total Duration of High Spell for 1989	10	2
Total Duration of High Spell for 1990	NaN	NaN
Total Duration of High Spell for 1991	131	97
Total Duration of High Spell for 1992	97	80
Total Duration of High Spell for 1993	50	40
Total Duration of High Spell for 1994	69	61
Total Duration of High Spell for 1995	66	56
Total Duration of High Spell for 1996	54	43
Total Duration of High Spell for 1997	62	56
Total Duration of High Spell for 1998	118	112
Total Duration of High Spell for 1999	NaN	NaN
Total Duration of High Spell for 2000	NaN	NaN
Total Duration of High Spell for 2001	9	8
Total Duration of High Spell for 2002	5	5
Total Duration of High Spell for 2003	124	108
Total Duration of High Spell for 2004	48	45
Total duration of Falls for 1984	83	74
Total Duration of High Spell for 2006	31	26
Total Duration of High Spell for 2007	6	5
Total Duration of High Spell for 2008	25	22
Total Duration of High Spell for 2009	52	46
Total Duration of High Spell for 2010	36	34
Total of periods Between High Spells for 1932	20	21
Total of periods Between High Spells for 1933	142	144
Total of periods Between High Spells for 1934	32	37
Total of periods Between High Spells for 1935	NaN	NaN
Total of periods Between High Spells for 1936	23	30
Total of periods Between High Spells for 1937	180	190
Total of periods Between High Spells for 1938	271	275
Total of periods Between High Spells for 1939	23	27
Total of periods Between High Spells for 1940	152	157
Total of periods Between High Spells for 1941	218	227
Total of periods Between High Spells for 1942	182	181

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Total of periods Between High Spells for 1943	9	10
Total of periods Between High Spells for 1944	124	131
Total of periods Between High Spells for 1945	297	308
Total of periods Between High Spells for 1946	128	142
Total of periods Between High Spells for 1947	189	204
Total of periods Between High Spells for 1948	213	166
Total of periods Between High Spells for 1949	247	253
Total of periods Between High Spells for 1950	54	58
Total of periods Between High Spells for 1951	NaN	NaN
Total of periods Between High Spells for 1952	NaN	NaN
Total of periods Between High Spells for 1953	234	165
Total of periods Between High Spells for 1954	NaN	NaN
Total of periods Between High Spells for 1955	NaN	NaN
Total of periods Between High Spells for 1956	NaN	NaN
Total of periods Between High Spells for 1957	94	102
Total of periods Between High Spells for 1958	96	104
Total of periods Between High Spells for 1959	117	135
Total of periods Between High Spells for 1960	96	105
Total of periods Between High Spells for 1961	142	152
Total of periods Between High Spells for 1962	NaN	NaN
Total of periods Between High Spells for 1963	156	171
Total of periods Between High Spells for 1964	210	225
Total of periods Between High Spells for 1965	223	236
Total of periods Between High Spells for 1966	106	118
Total of periods Between High Spells for 1967	150	156
Total of periods Between High Spells for 1968	10	14
Total of periods Between High Spells for 1969	217	235
Total of periods Between High Spells for 1970	118	129
Total of periods Between High Spells for 1971	91	95
Total of periods Between High Spells for 1972	227	240
Total of periods Between High Spells for 1973	112	107
Total of periods Between High Spells for 1974	118	124
Total of periods Between High Spells for 1975	204	210
Total of periods Between High Spells for 1976	307	307
Total of periods Between High Spells for 1977	228	235
Total of periods Between High Spells for 1978	119	121
Total of periods Between High Spells for 1979	255	269
Total of periods Between High Spells for 1980	148	136
Total of periods Between High Spells for 1981	NaN	NaN
Total of periods Between High Spells for 1982	163	179
Total of periods Between High Spells for 1983	194	209
Total of periods Between High Spells for 1984	189	199
Total of periods Between High Spells for 1985	140	143
Total of periods Between High Spells for 1986	286	289
Total of periods Between High Spells for 1987	157	8
Total of periods Between High Spells for 1988	169	173
Total of periods Between High Spells for 1989	21	NaN
Total of periods Between High Spells for 1990	NaN	NaN
Total of periods Between High Spells for 1991	124	157
Total of periods Between High Spells for 1992	147	162
Total of periods Between High Spells for 1993	33	41

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Total of periods Between High Spells for 1994	211	218
Total of periods Between High Spells for 1995	184	193
Total of periods Between High Spells for 1996	238	244
Total of periods Between High Spells for 1997	253	259
Total of periods Between High Spells for 1998	171	176
Total of periods Between High Spells for 1999	NaN	NaN
Total of periods Between High Spells for 2000	NaN	NaN
Total of periods Between High Spells for 2001	45	46
Total of periods Between High Spells for 2002	NaN	NaN
Total of periods Between High Spells for 2003	150	144
Total of periods Between High Spells for 2004	NaN	NaN
Total of periods Between High Spells for 2005	198	207
Total of periods Between High Spells for 2006	30	20
Total of periods Between High Spells for 2007	NaN	NaN
Total of periods Between High Spells for 2008	158	159
Total of periods Between High Spells for 2009	118	123
Total of periods Between High Spells for 2010	69	NaN
Mean period Between High Spells for 1932	10	7
Mean period Between High Spells for 1933	71	72
Mean period Between High Spells for 1934	10.667	18.5
Mean period Between High Spells for 1935	NaN	NaN
Mean period Between High Spells for 1936	11.5	10
Mean period Between High Spells for 1937	30	38
Mean period Between High Spells for 1938	90.333	91.667
Mean period Between High Spells for 1939	5.75	9
Mean period Between High Spells for 1940	38	39.25
Mean period Between High Spells for 1941	31.143	32.429
Mean period Between High Spells for 1942	30.333	36.2
Mean period Between High Spells for 1943	9	10
Mean period Between High Spells for 1944	31	32.75
Mean period Between High Spells for 1945	59.4	61.6
Mean period Between High Spells for 1946	18.286	20.286
Mean period Between High Spells for 1947	27	29.143
Mean period Between High Spells for 1948	35.5	33.2
Mean period Between High Spells for 1949	82.333	84.333
Mean period Between High Spells for 1950	18	19.333
Mean period Between High Spells for 1951	NaN	NaN
Mean period Between High Spells for 1952	NaN	NaN
Mean period Between High Spells for 1953	39	33
Mean period Between High Spells for 1954	NaN	NaN
Mean period Between High Spells for 1955	NaN	NaN
Mean period Between High Spells for 1956	NaN	NaN
Mean period Between High Spells for 1957	23.5	51
Mean period Between High Spells for 1958	19.2	20.8
Mean period Between High Spells for 1959	13	15
Mean period Between High Spells for 1960	19.2	21
Mean period Between High Spells for 1961	20.286	25.333
Mean period Between High Spells for 1962	NaN	NaN
Mean period Between High Spells for 1963	26	34.2
Mean period Between High Spells for 1964	35	37.5
Mean period Between High Spells for 1965	31.857	29.5

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean period Between High Spells for 1966	15.143	16.857
Mean period Between High Spells for 1967	50	39
Mean period Between High Spells for 1968	5	7
Mean period Between High Spells for 1969	24.111	33.571
Mean period Between High Spells for 1970	39.333	32.25
Mean period Between High Spells for 1971	30.333	31.667
Mean period Between High Spells for 1972	37.833	48
Mean period Between High Spells for 1973	18.667	21.4
Mean period Between High Spells for 1974	29.5	31
Mean period Between High Spells for 1975	51	70
Mean period Between High Spells for 1976	51.167	61.4
Mean period Between High Spells for 1977	57	58.75
Mean period Between High Spells for 1978	19.833	24.2
Mean period Between High Spells for 1979	51	67.25
Mean period Between High Spells for 1980	24.667	27.2
Mean period Between High Spells for 1981	NaN	NaN
Mean period Between High Spells for 1982	20.375	19.889
Mean period Between High Spells for 1983	19.4	20.9
Mean period Between High Spells for 1984	31.5	33.167
Mean period Between High Spells for 1985	46.667	47.667
Mean period Between High Spells for 1986	47.667	57.8
Mean period Between High Spells for 1987	78.5	4
Mean period Between High Spells for 1988	84.5	86.5
Mean period Between High Spells for 1989	21	NaN
Mean period Between High Spells for 1990	NaN	NaN
Mean period Between High Spells for 1991	10.333	10.467
Mean period Between High Spells for 1992	18.375	27
Mean period Between High Spells for 1993	11	13.667
Mean period Between High Spells for 1994	30.143	36.333
Mean period Between High Spells for 1995	30.667	38.6
Mean period Between High Spells for 1996	39.667	40.667
Mean period Between High Spells for 1997	36.143	51.8
Mean period Between High Spells for 1998	57	58.667
Mean period Between High Spells for 1999	NaN	NaN
Mean period Between High Spells for 2000	NaN	NaN
Mean period Between High Spells for 2001	45	46
Mean period Between High Spells for 2002	NaN	NaN
Mean period Between High Spells for 2003	25	20.571
Mean period Between High Spells for 2004	NaN	NaN
Mean period Between High Spells for 2005	33	34.5
Mean period Between High Spells for 2006	15	20
Mean period Between High Spells for 2007	NaN	NaN
Mean period Between High Spells for 2008	158	159
Mean period Between High Spells for 2009	19.667	20.5
Mean period Between High Spells for 2010	69	NaN
Longest period Between High Spells for 1932	16	17
Longest period Between High Spells for 1933	134	135
Longest period Between High Spells for 1934	18	31
Longest period Between High Spells for 1935	NaN	NaN
Longest period Between High Spells for 1936	16	19
Longest period Between High Spells for 1937	135	135

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Longest period Between High Spells for 1938	177	179
Longest period Between High Spells for 1939	9	17
Longest period Between High Spells for 1940	84	84
Longest period Between High Spells for 1941	102	103
Longest period Between High Spells for 1942	110	112
Longest period Between High Spells for 1943	9	10
Longest period Between High Spells for 1944	86	89
Longest period Between High Spells for 1945	182	183
Longest period Between High Spells for 1946	92	94
Longest period Between High Spells for 1947	110	111
Longest period Between High Spells for 1948	95	97
Longest period Between High Spells for 1949	136	140
Longest period Between High Spells for 1950	37	38
Longest period Between High Spells for 1951	NaN	NaN
Longest period Between High Spells for 1952	NaN	NaN
Longest period Between High Spells for 1953	106	107
Longest period Between High Spells for 1954	NaN	NaN
Longest period Between High Spells for 1955	NaN	NaN
Longest period Between High Spells for 1956	NaN	NaN
Longest period Between High Spells for 1957	43	51
Longest period Between High Spells for 1958	61	63
Longest period Between High Spells for 1959	51	53
Longest period Between High Spells for 1960	70	71
Longest period Between High Spells for 1961	90	91
Longest period Between High Spells for 1962	NaN	NaN
Longest period Between High Spells for 1963	111	119
Longest period Between High Spells for 1964	83	85
Longest period Between High Spells for 1965	77	78
Longest period Between High Spells for 1966	45	46
Longest period Between High Spells for 1967	145	147
Longest period Between High Spells for 1968	7	9
Longest period Between High Spells for 1969	127	144
Longest period Between High Spells for 1970	111	113
Longest period Between High Spells for 1971	78	80
Longest period Between High Spells for 1972	102	104
Longest period Between High Spells for 1973	61	63
Longest period Between High Spells for 1974	48	50
Longest period Between High Spells for 1975	148	148
Longest period Between High Spells for 1976	112	113
Longest period Between High Spells for 1977	163	195
Longest period Between High Spells for 1978	60	61
Longest period Between High Spells for 1979	170	193
Longest period Between High Spells for 1980	99	101
Longest period Between High Spells for 1981	NaN	NaN
Longest period Between High Spells for 1982	58	77
Longest period Between High Spells for 1983	55	57
Longest period Between High Spells for 1984	92	94
Longest period Between High Spells for 1985	112	113
Longest period Between High Spells for 1986	159	161
Longest period Between High Spells for 1987	153	6
Longest period Between High Spells for 1988	152	155

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Longest period Between High Spells for 1989	21	NaN
Longest period Between High Spells for 1990	NaN	NaN
Longest period Between High Spells for 1991	33	34
Longest period Between High Spells for 1992	48	51
Longest period Between High Spells for 1993	22	24
Longest period Between High Spells for 1994	106	107
Longest period Between High Spells for 1995	56	94
Longest period Between High Spells for 1996	88	89
Longest period Between High Spells for 1997	122	123
Longest period Between High Spells for 1998	123	124
Longest period Between High Spells for 1999	NaN	NaN
Longest period Between High Spells for 2000	NaN	NaN
Longest period Between High Spells for 2001	45	46
Longest period Between High Spells for 2002	NaN	NaN
Longest period Between High Spells for 2003	67	68
Longest period Between High Spells for 2004	NaN	NaN
Longest period Between High Spells for 2005	67	68
Longest period Between High Spells for 2006	19	20
Longest period Between High Spells for 2007	NaN	NaN
Longest period Between High Spells for 2008	158	159
Longest period Between High Spells for 2009	44	45
Longest period Between High Spells for 2010	69	NaN
Total (Sum) Raw Values for 1932	10595	8653
Total (Sum) Raw Values for 1933	58924	47895.8
Total (Sum) Raw Values for 1934	139064	113881.3
Total (Sum) Raw Values for 1935	116935	98284.65
Total (Sum) Raw Values for 1936	39248	28937.4
Total (Sum) Raw Values for 1937	148256	118094.75
Total (Sum) Raw Values for 1938	61004	49065.4
Total (Sum) Raw Values for 1939	56011	41157.85
Total (Sum) Raw Values for 1940	46176	35533.4
Total (Sum) Raw Values for 1941	189609	155660.5
Total (Sum) Raw Values for 1942	151374	121482.85
Total (Sum) Raw Values for 1943	17454	14315.7
Total (Sum) Raw Values for 1944	199077	164922.1
Total (Sum) Raw Values for 1945	82788	64498
Total (Sum) Raw Values for 1946	244599	199250.2
Total (Sum) Raw Values for 1947	272257	220550.35
Total (Sum) Raw Values for 1948	283872	234919.6
Total (Sum) Raw Values for 1949	86188	69484.95
Total (Sum) Raw Values for 1950	157018	130259.1
Total (Sum) Raw Values for 1951	6731	4652.9
Total (Sum) Raw Values for 1952	19746	15664.65
Total (Sum) Raw Values for 1953	209724	170142.8
Total (Sum) Raw Values for 1954	17777	13463.15
Total (Sum) Raw Values for 1955	5277	2818.6
Total (Sum) Raw Values for 1956	21660	17352.75
Total (Sum) Raw Values for 1957	46937	34957.1
Total (Sum) Raw Values for 1958	93650	74667.4
Total (Sum) Raw Values for 1959	322969	263621.55
Total (Sum) Raw Values for 1960	222435	183134.2

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Total (Sum) Raw Values for 1961	112500	88963.55
Total (Sum) Raw Values for 1962	1314	600.1
Total (Sum) Raw Values for 1963	83571	61935.25
Total (Sum) Raw Values for 1964	295530	243110.2
Total (Sum) Raw Values for 1965	177687	142732.85
Total (Sum) Raw Values for 1966	234047	191998.85
Total (Sum) Raw Values for 1967	83303	67507.85
Total (Sum) Raw Values for 1968	107506	88145
Total (Sum) Raw Values for 1969	135160	105119.5
Total (Sum) Raw Values for 1970	264592	218354.8
Total (Sum) Raw Values for 1971	51620	41150.2
Total (Sum) Raw Values for 1972	183126	146902.1
Total (Sum) Raw Values for 1973	145783	117496.35
Total (Sum) Raw Values for 1974	96141	77870.2
Total (Sum) Raw Values for 1975	48062	37109.3
Total (Sum) Raw Values for 1976	18369	9749.5
Total (Sum) Raw Values for 1977	41763	29819.7
Total (Sum) Raw Values for 1978	183188	151477.65
Total (Sum) Raw Values for 1979	93875	70528.75
Total (Sum) Raw Values for 1980	105809	84522.3
Total (Sum) Raw Values for 1981	10195	8131.95
Total (Sum) Raw Values for 1982	111136	84195.05
Total (Sum) Raw Values for 1983	185681	149302.5
Total (Sum) Raw Values for 1984	151611	122979.7
Total (Sum) Raw Values for 1985	124168	102844.9
Total (Sum) Raw Values for 1986	83023	63068.3
Total (Sum) Raw Values for 1987	175247	145179.15
Total (Sum) Raw Values for 1988	160441	133097.25
Total (Sum) Raw Values for 1989	6420	1228.25
Total (Sum) Raw Values for 1990	0	0
Total (Sum) Raw Values for 1991	165935	122643.95
Total (Sum) Raw Values for 1992	177390	141666.95
Total (Sum) Raw Values for 1993	44156	32080.7
Total (Sum) Raw Values for 1994	83838	67043.75
Total (Sum) Raw Values for 1995	71416	55317.15
Total (Sum) Raw Values for 1996	67196	51113.05
Total (Sum) Raw Values for 1997	104054	85411.4
Total (Sum) Raw Values for 1998	258090	216183.05
Total (Sum) Raw Values for 1999	0	0
Total (Sum) Raw Values for 2000	0	0
Total (Sum) Raw Values for 2001	9453	7485.1
Total (Sum) Raw Values for 2002	5241	4454.85
Total (Sum) Raw Values for 2003	189954	152965.15
Total (Sum) Raw Values for 2004	141026	118287.7
Total (Sum) Raw Values for 2005	125726	102009.35
Total (Sum) Raw Values for 2006	39008	30543.9
Total (Sum) Raw Values for 2007	5319	3994.15
Total (Sum) Raw Values for 2008	50559	41299.8
Total (Sum) Raw Values for 2009	60271	48022.45
Total (Sum) Raw Values for 2010	50841	42136.2
Mean Raw Values for 1932	3531.667	2163.25

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean Raw Values for 1933	19641.333	15965.267
Mean Raw Values for 1934	34766	37960.433
Mean Raw Values for 1935	116935	98284.65
Mean Raw Values for 1936	13082.667	7234.35
Mean Raw Values for 1937	21179.429	19682.458
Mean Raw Values for 1938	15251	12266.35
Mean Raw Values for 1939	11202.2	10289.462
Mean Raw Values for 1940	9235.2	7106.68
Mean Raw Values for 1941	23701.125	19457.562
Mean Raw Values for 1942	21624.857	20247.142
Mean Raw Values for 1943	8727	7157.85
Mean Raw Values for 1944	39815.4	32984.42
Mean Raw Values for 1945	13798	10749.667
Mean Raw Values for 1946	30574.875	24906.275
Mean Raw Values for 1947	34032.125	27568.794
Mean Raw Values for 1948	40553.143	39153.267
Mean Raw Values for 1949	21547	17371.238
Mean Raw Values for 1950	39254.5	32564.775
Mean Raw Values for 1951	6731	4652.9
Mean Raw Values for 1952	19746	15664.65
Mean Raw Values for 1953	29960.571	28357.133
Mean Raw Values for 1954	17777	13463.15
Mean Raw Values for 1955	5277	2818.6
Mean Raw Values for 1956	21660	17352.75
Mean Raw Values for 1957	9387.4	11652.367
Mean Raw Values for 1958	15608.333	12444.567
Mean Raw Values for 1959	32296.9	26362.155
Mean Raw Values for 1960	37072.5	30522.367
Mean Raw Values for 1961	14062.5	12709.079
Mean Raw Values for 1962	1314	600.1
Mean Raw Values for 1963	11938.714	10322.542
Mean Raw Values for 1964	42218.571	34730.029
Mean Raw Values for 1965	22210.875	15859.206
Mean Raw Values for 1966	29255.875	23999.856
Mean Raw Values for 1967	20825.75	13501.57
Mean Raw Values for 1968	35835.333	29381.667
Mean Raw Values for 1969	13516	13139.938
Mean Raw Values for 1970	66148	43670.96
Mean Raw Values for 1971	12905	10287.55
Mean Raw Values for 1972	26160.857	24483.683
Mean Raw Values for 1973	20826.143	19582.725
Mean Raw Values for 1974	19228.2	15574.04
Mean Raw Values for 1975	9612.4	9277.325
Mean Raw Values for 1976	2624.143	1624.917
Mean Raw Values for 1977	8352.6	5963.94
Mean Raw Values for 1978	26169.714	25246.275
Mean Raw Values for 1979	15645.833	14105.75
Mean Raw Values for 1980	15115.571	14087.05
Mean Raw Values for 1981	10195	8131.95
Mean Raw Values for 1982	12348.444	8419.505
Mean Raw Values for 1983	16880.091	13572.955

Name	Santa Fe - Worthington 1932- 2010	Santa Fe - Worthington 1932- 2010 REDUCED
Mean Raw Values for 1984	21658.714	17568.529
Mean Raw Values for 1985	31042	25711.225
Mean Raw Values for 1986	11860.429	10511.383
Mean Raw Values for 1987	58415.667	48393.05
Mean Raw Values for 1988	53480.333	44365.75
Mean Raw Values for 1989	3210	1228.25
Mean Raw Values for 1990	NaN	NaN
Mean Raw Values for 1991	12764.231	7665.247
Mean Raw Values for 1992	19710	20238.136
Mean Raw Values for 1993	11039	8020.175
Mean Raw Values for 1994	10479.75	9577.679
Mean Raw Values for 1995	10202.286	9219.525
Mean Raw Values for 1996	9599.429	7301.864
Mean Raw Values for 1997	13006.75	14235.233
Mean Raw Values for 1998	64522.5	54045.762
Mean Raw Values for 1999	NaN	NaN
Mean Raw Values for 2000	NaN	NaN
Mean Raw Values for 2001	4726.5	3742.55
Mean Raw Values for 2002	5241	4454.85
Mean Raw Values for 2003	27136.286	19120.644
Mean Raw Values for 2004	141026	118287.7
Mean Raw Values for 2005	17960.857	14572.764
Mean Raw Values for 2006	13002.667	15271.95
Mean Raw Values for 2007	5319	3994.15
Mean Raw Values for 2008	25279.5	20649.9
Mean Raw Values for 2009	8610.143	6860.35
Mean Raw Values for 2010	25420.5	42136.2
Summary of interannual measures		
Mean of all years High Spell Threshold	588	588
Mean of all years Number of High Spell	4.975	4.734
Mean of all years Longest High Spell	NaN	NaN
Mean of all years Mean of High Spell Peaks	NaN	NaN
Mean of all years Mean Duration of High Spell	NaN	NaN
Mean of all years Total Duration of High Spell	NaN	NaN
Mean of all years Total of periods Between High Spells	NaN	NaN
Mean of all years Mean period Between High Spells	NaN	NaN
Mean of all years Longest period Between High Spells	NaN	NaN
Mean of all years Total (Sum) Raw Values	106932.861	86140.528
Mean of all years Mean Raw Values	NaN	NaN
Median of all years High Spell Threshold	588	588
Median of all years Number of High Spell	5	5
Median of all years Longest High Spell	25	21
Median of all years Mean of High Spell Peaks	1802	1708.358
Median of all years Mean Duration of High Spell	12.5	11
Median of all years Total Duration of High Spell	62	52
Median of all years Total of periods Between High Spells	142	144
Median of all years Mean period Between High Spells	30.333	32.75
Median of all years Longest period Between High Spells	NaN	89
Median of all years Total (Sum) Raw Values	93650	70528.75
Median of all years Mean Raw Values	16880.091	14105.75

Name	Santa Fe - 441 1993-2009	Santa Fe - 441 1993-2009 REDUCED
Reporting Period Summary		
Start based on User	1/1/1993	1/1/1993
End Date	12/31/2009	12/31/2009
General Statistics		
Whole Period		
Minimum	0	0
Maximum	9150	7594.5
Percentile 10	40	38.12
Percentile 90	1100	983.82
Mean	498.223	444.959
Median	292	272.558
Zeros	103	103
Total	3093465.61	2762751.212
Less or equal 744	5110	5200
Greater or equal 744	1099	1011
Summary for each year		
Minimum for 1993	99	94.347
Minimum for 1994	146	139.138
Minimum for 1995	176	167.728
Minimum for 1996	195	185.835
Minimum for 1997	231	220.143
Minimum for 1998	518	479.15
Minimum for 1999	132	125.796
Minimum for 2000	42	40.026
Minimum for 2001	1	0.953
Minimum for 2002	0	0
Minimum for 2003	139	132.467
Minimum for 2004	84	80.052
Minimum for 2005	350	323.75
Minimum for 2006	122.09	116.352
Minimum for 2007	50.43	48.06
Minimum for 2008	27.39	26.103
Minimum for 2009	45.49	43.352
Maximum for 1993	1760	1460.8
Maximum for 1994	2210	1834.3
Maximum for 1995	1540	1294.5
Maximum for 1996	6890	5718.7
Maximum for 1997	3080	2556.4
Maximum for 1998	9150	7594.5
Maximum for 1999	660	613.8
Maximum for 2000	320	296
Maximum for 2001	266	253.498
Maximum for 2002	504	466.2
Maximum for 2003	5260	4365.8
Maximum for 2004	8960	7436.8
Maximum for 2005	3390	2813.7
Maximum for 2006	1770	1469.1
Maximum for 2007	256.66	244.597
Maximum for 2008	3709.2	3078.636
Maximum for 2009	1236.1	1066.754
Percentile 10 for 1993	196	186.788
Percentile 10 for 1994	254	242.062

Name	Santa Fe - 441 1993- 2009	Santa Fe - 441 1993- 2009 REDUCED
Percentile 10 for 1995	308	284.9
Percentile 10 for 1996	254	242.062
Percentile 10 for 1997	285	270.1
Percentile 10 for 1998	614	571.02
Percentile 10 for 1999	183	174.399
Percentile 10 for 2000	51.5	49.079
Percentile 10 for 2001	4	3.812
Percentile 10 for 2002	0	0
Percentile 10 for 2003	209	199.177
Percentile 10 for 2004	94	89.582
Percentile 10 for 2005	455	420.875
Percentile 10 for 2006	134.722	128.39
Percentile 10 for 2007	57.474	54.773
Percentile 10 for 2008	28.09	26.77
Percentile 10 for 2009	56.754	54.087
Percentile 90 for 1993	1346	1161.598
Percentile 90 for 1994	1000	930
Percentile 90 for 1995	929.8	864.714
Percentile 90 for 1996	929.5	864.435
Percentile 90 for 1997	1160	1004.4
Percentile 90 for 1998	2738	2272.54
Percentile 90 for 1999	517.8	478.965
Percentile 90 for 2000	148.5	141.521
Percentile 90 for 2001	125.6	119.697
Percentile 90 for 2002	74.6	71.094
Percentile 90 for 2003	1326	1144.338
Percentile 90 for 2004	2930	2431.9
Percentile 90 for 2005	1880	1560.4
Percentile 90 for 2006	1092	982.08
Percentile 90 for 2007	149.488	142.462
Percentile 90 for 2008	367.76	340.178
Percentile 90 for 2009	527.908	488.315
Mean for 1993	606.019	540.681
Mean for 1994	585.786	532.224
Mean for 1995	562.227	514.949
Mean for 1996	622.929	562.285
Mean for 1997	654.989	592.886
Mean for 1998	1335.003	1162.252
Mean for 1999	290.353	272.831
Mean for 2000	105.096	100.014
Mean for 2001	48.636	46.35
Mean for 2002	26.518	25.149
Mean for 2003	733.709	652.503
Mean for 2004	871.913	746.465
Mean for 2005	1042.962	914.154
Mean for 2006	472.851	429.126
Mean for 2007	102.171	97.369
Mean for 2008	193.522	174.152
Mean for 2009	215.652	201.456
Median for 1993	363	335.775
Median for 1994	457	422.725
Median for 1995	486	449.55

Name	Santa Fe - 441 1993- 2009	Santa Fe - 441 1993- 2009 REDUCED
Median for 1996	464	429.2
Median for 1997	568	525.4
Median for 1998	734	682.62
Median for 1999	220	209.66
Median for 2000	103.5	98.636
Median for 2001	30	28.59
Median for 2002	9	8.577
Median for 2003	510	471.75
Median for 2004	180	171.54
Median for 2005	888	825.84
Median for 2006	330	305.25
Median for 2007	92.06	87.733
Median for 2008	71.505	68.144
Median for 2009	108.52	103.42
Zeros for 1993	0	0
Zeros for 1994	0	0
Zeros for 1995	0	0
Zeros for 1996	0	0
Zeros for 1997	0	0
Zeros for 1998	0	0
Zeros for 1999	0	0
Zeros for 2000	0	0
Zeros for 2001	0	0
Zeros for 2002	103	103
Zeros for 2003	0	0
Zeros for 2004	0	0
Zeros for 2005	0	0
Zeros for 2006	0	0
Zeros for 2007	0	0
Zeros for 2008	0	0
Zeros for 2009	0	0
Total for 1993	221197	197348.69
Total for 1994	213812	194261.659
Total for 1995	205213	187956.473
Total for 1996	227992	205796.458
Total for 1997	239071	216403.313
Total for 1998	487276	424221.82
Total for 1999	105979	99583.335
Total for 2000	38465	36605.065
Total for 2001	17752	16917.656
Total for 2002	9679	9179.287
Total for 2003	267803.7	238163.563
Total for 2004	319120	273206.018
Total for 2005	380681	333666.385
Total for 2006	172590.45	156630.831
Total for 2007	37292.4	35539.657
Total for 2008	70829.05	63739.632
Total for 2009	78713.01	73531.37
Less or equal 744 for 1993	251	254
Less or equal 744 for 1994	278	290
Less or equal 744 for 1995	303	312
Less or equal 744 for 1996	309	319

Name	Santa Fe - 441 1993-2009	Santa Fe - 441 1993-2009 REDUCED
Less or equal 744 for 1997	271	282
Less or equal 744 for 1998	186	200
Less or equal 744 for 1999	365	365
Less or equal 744 for 2000	366	366
Less or equal 744 for 2001	365	365
Less or equal 744 for 2002	365	365
Less or equal 744 for 2003	253	259
Less or equal 744 for 2004	287	295
Less or equal 744 for 2005	157	170
Less or equal 744 for 2006	295	297
Less or equal 744 for 2007	365	365
Less or equal 744 for 2008	350	351
Less or equal 744 for 2009	344	345
Greater or equal 744 for 1993	114	111
Greater or equal 744 for 1994	87	75
Greater or equal 744 for 1995	62	53
Greater or equal 744 for 1996	57	47
Greater or equal 744 for 1997	94	83
Greater or equal 744 for 1998	179	167
Greater or equal 744 for 1999	0	0
Greater or equal 744 for 2000	0	0
Greater or equal 744 for 2001	0	0
Greater or equal 744 for 2002	0	0
Greater or equal 744 for 2003	112	106
Greater or equal 744 for 2004	79	71
Greater or equal 744 for 2005	208	195
Greater or equal 744 for 2006	70	68
Greater or equal 744 for 2007	0	0
Greater or equal 744 for 2008	16	15
Greater or equal 744 for 2009	21	20
High Flow Spell result		
Whole Period		
High Spell Threshold	744	744
Number of High Spell	38	37
Longest High Spell	189	180
Mean of High Spell Peaks	2095.781	1814.929
Mean Duration of High Spell	28.921	27.297
Total Duration of High Spell	1099	1010
Total of periods Between High Spells	4946	5027
Mean period Between High Spells	133.676	139.639
Longest period Between High Spells	1566	1570
Total (Sum) Raw Values	1746863.42	1441421.27
Mean Raw Values	45970.09	38957.332
Summary for each year		
High Spell Threshold for 1993	744	744
High Spell Threshold for 1994	744	744
High Spell Threshold for 1995	744	744
High Spell Threshold for 1996	744	744
High Spell Threshold for 1997	744	744
High Spell Threshold for 1998	744	744
High Spell Threshold for 1999	744	744
High Spell Threshold for 2000	744	744

Name	Santa Fe - 441 1993-2009	Santa Fe - 441 1993-2009 REDUCED
High Spell Threshold for 2001	744	744
High Spell Threshold for 2002	744	744
High Spell Threshold for 2003	744	744
High Spell Threshold for 2004	744	744
High Spell Threshold for 2005	744	744
High Spell Threshold for 2006	744	744
High Spell Threshold for 2007	744	744
High Spell Threshold for 2008	744	744
High Spell Threshold for 2009	744	744
Number of High Spell for 1993	2	1
Number of High Spell for 1994	4	5
Number of High Spell for 1995	7	7
Number of High Spell for 1996	5	4
Number of High Spell for 1997	6	6
Number of High Spell for 1998	3	4
Number of High Spell for 1999	0	0
Number of High Spell for 2000	0	0
Number of High Spell for 2001	0	0
Number of High Spell for 2002	0	0
Number of High Spell for 2003	3	3
Number of High Spell for 2004	2	1
Number of High Spell for 2005	3	3
Number of High Spell for 2006	1	1
Number of High Spell for 2007	0	0
Number of High Spell for 2008	1	1
Number of High Spell for 2009	3	3
Longest High Spell for 1993	113	111
Longest High Spell for 1994	30	25
Longest High Spell for 1995	16	15
Longest High Spell for 1996	23	21
Longest High Spell for 1997	18	17
Longest High Spell for 1998	125	122
Longest High Spell for 1999	NaN	NaN
Longest High Spell for 2000	NaN	NaN
Longest High Spell for 2001	NaN	NaN
Longest High Spell for 2002	NaN	NaN
Longest High Spell for 2003	53	51
Longest High Spell for 2004	73	71
Longest High Spell for 2005	189	180
Longest High Spell for 2006	70	68
Longest High Spell for 2007	NaN	NaN
Longest High Spell for 2008	16	15
Longest High Spell for 2009	10	10
Mean of High Spell Peaks for 1993	1254.5	1460.8
Mean of High Spell Peaks for 1994	1575	1236.646
Mean of High Spell Peaks for 1995	1147.286	1010.263
Mean of High Spell Peaks for 1996	2210.8	2178.885
Mean of High Spell Peaks for 1997	1651.333	1410.182
Mean of High Spell Peaks for 1998	4266	2865.058
Mean of High Spell Peaks for 1999	NaN	NaN
Mean of High Spell Peaks for 2000	NaN	NaN
Mean of High Spell Peaks for 2001	NaN	NaN

Name	Santa Fe - 441 1993-2009	Santa Fe - 441 1993-2009 REDUCED
Mean of High Spell Peaks for 2002	NaN	NaN
Mean of High Spell Peaks for 2003	2903.333	2426.157
Mean of High Spell Peaks for 2004	4868	7436.8
Mean of High Spell Peaks for 2005	2079.333	1753.113
Mean of High Spell Peaks for 2006	1770	1469.1
Mean of High Spell Peaks for 2007	NaN	NaN
Mean of High Spell Peaks for 2008	3709.2	3078.636
Mean of High Spell Peaks for 2009	975.493	879.603
Mean Duration of High Spell for 1993	57	55.5
Mean Duration of High Spell for 1994	21.75	15
Mean Duration of High Spell for 1995	8.857	7.571
Mean Duration of High Spell for 1996	11.4	11.75
Mean Duration of High Spell for 1997	15.667	13.833
Mean Duration of High Spell for 1998	59.667	41.5
Mean Duration of High Spell for 1999	NaN	NaN
Mean Duration of High Spell for 2000	NaN	NaN
Mean Duration of High Spell for 2001	NaN	NaN
Mean Duration of High Spell for 2002	NaN	NaN
Mean Duration of High Spell for 2003	37.333	35.333
Mean Duration of High Spell for 2004	39.5	35.5
Mean Duration of High Spell for 2005	69.333	65
Mean Duration of High Spell for 2006	70	68
Mean Duration of High Spell for 2007	NaN	NaN
Mean Duration of High Spell for 2008	16	15
Mean Duration of High Spell for 2009	7	6.667
Total Duration of High Spell for 1993	114	111
Total Duration of High Spell for 1994	87	75
Total Duration of High Spell for 1995	62	53
Total Duration of High Spell for 1996	57	47
Total Duration of High Spell for 1997	94	83
Total Duration of High Spell for 1998	179	166
Total Duration of High Spell for 1999	NaN	NaN
Total Duration of High Spell for 2000	NaN	NaN
Total Duration of High Spell for 2001	NaN	NaN
Total Duration of High Spell for 2002	NaN	NaN
Total Duration of High Spell for 2003	112	106
Total Duration of High Spell for 2004	79	71
Total Duration of High Spell for 2005	208	195
Total Duration of High Spell for 2006	70	68
Total Duration of High Spell for 2007	NaN	NaN
Total Duration of High Spell for 2008	16	15
Total Duration of High Spell for 2009	21	20
Total of periods Between High Spells for 1993	5	NaN
Total of periods Between High Spells for 1994	195	203
Total of periods Between High Spells for 1995	188	196
Total of periods Between High Spells for 1996	224	169
Total of periods Between High Spells for 1997	220	231
Total of periods Between High Spells for 1998	131	140
Total of periods Between High Spells for 1999	NaN	NaN
Total of periods Between High Spells for 2000	NaN	NaN
Total of periods Between High Spells for 2001	NaN	NaN
Total of periods Between High Spells for 2002	NaN	NaN

Name	Santa Fe - 441 1993-2009	Santa Fe - 441 1993-2009 REDUCED
Total of periods Between High Spells for 2003	97	102
Total of periods Between High Spells for 2004	9	NaN
Total of periods Between High Spells for 2005	72	85
Total of periods Between High Spells for 2006	NaN	NaN
Total of periods Between High Spells for 2007	NaN	NaN
Total of periods Between High Spells for 2008	NaN	NaN
Total of periods Between High Spells for 2009	36	36
Mean period Between High Spells for 1993	5	NaN
Mean period Between High Spells for 1994	65	50.75
Mean period Between High Spells for 1995	31.333	32.667
Mean period Between High Spells for 1996	56	56.333
Mean period Between High Spells for 1997	44	46.2
Mean period Between High Spells for 1998	65.5	46.667
Mean period Between High Spells for 1999	NaN	NaN
Mean period Between High Spells for 2000	NaN	NaN
Mean period Between High Spells for 2001	NaN	NaN
Mean period Between High Spells for 2002	NaN	NaN
Mean period Between High Spells for 2003	48.5	51
Mean period Between High Spells for 2004	9	NaN
Mean period Between High Spells for 2005	36	42.5
Mean period Between High Spells for 2006	NaN	NaN
Mean period Between High Spells for 2007	NaN	NaN
Mean period Between High Spells for 2008	NaN	NaN
Mean period Between High Spells for 2009	18	18
Longest period Between High Spells for 1993	5	NaN
Longest period Between High Spells for 1994	149	152
Longest period Between High Spells for 1995	96	97
Longest period Between High Spells for 1996	87	88
Longest period Between High Spells for 1997	116	117
Longest period Between High Spells for 1998	92	95
Longest period Between High Spells for 1999	NaN	NaN
Longest period Between High Spells for 2000	NaN	NaN
Longest period Between High Spells for 2001	NaN	NaN
Longest period Between High Spells for 2002	NaN	NaN
Longest period Between High Spells for 2003	70	72
Longest period Between High Spells for 2004	9	NaN
Longest period Between High Spells for 2005	64	67
Longest period Between High Spells for 2006	NaN	NaN
Longest period Between High Spells for 2007	NaN	NaN
Longest period Between High Spells for 2008	NaN	NaN
Longest period Between High Spells for 2009	30	30
Total (Sum) Raw Values for 1993	142152	121268.28
Total (Sum) Raw Values for 1994	99511	79385.35
Total (Sum) Raw Values for 1995	66067	52454.18
Total (Sum) Raw Values for 1996	93703	73949.04
Total (Sum) Raw Values for 1997	113881	92203.9
Total (Sum) Raw Values for 1998	367120	303189.12
Total (Sum) Raw Values for 1999	0	0
Total (Sum) Raw Values for 2000	0	0
Total (Sum) Raw Values for 2001	0	0
Total (Sum) Raw Values for 2002	0	0
Total (Sum) Raw Values for 2003	169563	142337.73

Name	Santa Fe - 441 1993-2009	Santa Fe - 441 1993-2009 REDUCED
Total (Sum) Raw Values for 2004	258948	210903.51
Total (Sum) Raw Values for 2005	299947	249472.26
Total (Sum) Raw Values for 2006	84532	72869.48
Total (Sum) Raw Values for 2007	0	0
Total (Sum) Raw Values for 2008	31746.4	26102.485
Total (Sum) Raw Values for 2009	19693.02	17285.935
Mean Raw Values for 1993	71076	121268.28
Mean Raw Values for 1994	24877.75	15877.07
Mean Raw Values for 1995	9438.143	7493.454
Mean Raw Values for 1996	18740.6	18487.26
Mean Raw Values for 1997	18980.167	15367.317
Mean Raw Values for 1998	122373.333	75797.28
Mean Raw Values for 1999	NaN	NaN
Mean Raw Values for 2000	NaN	NaN
Mean Raw Values for 2001	NaN	NaN
Mean Raw Values for 2002	NaN	NaN
Mean Raw Values for 2003	56521	47445.91
Mean Raw Values for 2004	129474	210903.51
Mean Raw Values for 2005	99982.333	83157.42
Mean Raw Values for 2006	84532	72869.48
Mean Raw Values for 2007	NaN	NaN
Mean Raw Values for 2008	31746.4	26102.485
Mean Raw Values for 2009	6564.34	5761.978

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Reporting Period Summary		
Start based on User	1/1/1933	1/1/1933
End Date	12/31/2010	12/31/2010
General Statistics		
Whole Period		
Minimum	342	325.926
Maximum	16900	14027
Percentile 10	764	728.856
Percentile 90	2460	2262
Mean	1491.883	1367.293
Median	1240	1153.2
Zeros	0	0
Total	42502242.5	38952820.08
Less or equal 1410	17446	18699
Greater or equal 1410	11168	9790
Summary for each year		
Minimum for 1933	816	778.464
Minimum for 1934	838	799.452
Minimum for 1935	690	658.26
Minimum for 1936	1020	973.08
Minimum for 1937	1020	973.08
Minimum for 1938	954	910.116
Minimum for 1939	862	822.348
Minimum for 1940	864	824.256
Minimum for 1941	912	870.048
Minimum for 1942	1180	1097.4
Minimum for 1943	817	779.418
Minimum for 1944	810	772.74
Minimum for 1945	930	887.22
Minimum for 1946	1050	1001.7
Minimum for 1947	1050	1001.7
Minimum for 1948	1640	1525.2
Minimum for 1949	1440	1339.2
Minimum for 1950	1020	973.08
Minimum for 1951	1020	973.08
Minimum for 1952	903	861.462
Minimum for 1953	896	854.784
Minimum for 1954	876	835.704
Minimum for 1955	675	643.95
Minimum for 1956	633	603.882
Minimum for 1957	617	588.618
Minimum for 1958	988	942.552
Minimum for 1959	1250	1162.5
Minimum for 1960	1430	1329.9
Minimum for 1961	1110	1032.3
Minimum for 1962	872	831.888
Minimum for 1963	768	732.672
Minimum for 1964	870	829.98
Minimum for 1965	1520	1413.6
Minimum for 1966	1650	1534.5
Minimum for 1967	1090	1013.7
Minimum for 1968	980	934.92

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Minimum for 1969	1090	1013.7
Minimum for 1970	1230	1143.9
Minimum for 1971	950	906.3
Minimum for 1972	1150	1069.5
Minimum for 1973	1060	1004.4
Minimum for 1974	819	781.326
Minimum for 1975	911	869.094
Minimum for 1976	835	796.59
Minimum for 1977	768	732.672
Minimum for 1978	972	927.288
Minimum for 1979	1020	973.08
Minimum for 1980	895	853.83
Minimum for 1981	674	642.996
Minimum for 1982	682	650.628
Minimum for 1983	1050	1001.7
Minimum for 1984	1250	1162.5
Minimum for 1985	1100	1023
Minimum for 1986	1070	1004.4
Minimum for 1987	1130	1050.9
Minimum for 1988	1110	1032.3
Minimum for 1989	821	783.234
Minimum for 1990	616	587.664
Minimum for 1991	608	580.032
Minimum for 1992	888	847.152
Minimum for 1993	790	753.66
Minimum for 1994	874	833.796
Minimum for 1995	852	812.808
Minimum for 1996	844	805.176
Minimum for 1997	855	815.67
Minimum for 1998	910	868.14
Minimum for 1999	707	674.478
Minimum for 2000	517	493.218
Minimum for 2001	468	446.472
Minimum for 2002	446	425.484
Minimum for 2003	759	724.086
Minimum for 2004	708	675.432
Minimum for 2005	1090	1013.7
Minimum for 2006	700	667.8
Minimum for 2007	560	534.24
Minimum for 2008	542	517.068
Minimum for 2009	342	325.926
Minimum for 2010	685	653.49
Maximum for 1933	2810	2444.7
Maximum for 1934	11100	9213
Maximum for 1935	6280	5212.4
Maximum for 1936	2070	1925.1
Maximum for 1937	4730	3925.9
Maximum for 1938	4250	3527.5
Maximum for 1939	2480	2306.4
Maximum for 1940	1930	1794.9
Maximum for 1941	7280	6042.4
Maximum for 1942	4750	3942.5

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Maximum for 1943	1760	1636.8
Maximum for 1944	9160	7602.8
Maximum for 1945	3650	3029.5
Maximum for 1946	3820	3170.6
Maximum for 1947	7980	6623.4
Maximum for 1948	11800	9794
Maximum for 1949	5420	4498.6
Maximum for 1950	7440	6175.2
Maximum for 1951	1670	1553.1
Maximum for 1952	2010	1869.3
Maximum for 1953	5080	4216.4
Maximum for 1954	5000	4150
Maximum for 1955	1300	1209
Maximum for 1956	2200	2046
Maximum for 1957	4090	3394.7
Maximum for 1958	2450	2278.5
Maximum for 1959	7970	6615.1
Maximum for 1960	6290	5220.7
Maximum for 1961	3750	3112.5
Maximum for 1962	1240	1153.2
Maximum for 1963	2060	1915.8
Maximum for 1964	16900	14027
Maximum for 1965	5100	4233
Maximum for 1966	5850	4855.5
Maximum for 1967	3790	3145.7
Maximum for 1968	6500	5395
Maximum for 1969	3130	2723.1
Maximum for 1970	7980	6623.4
Maximum for 1971	3240	2714.4
Maximum for 1972	4440	3685.2
Maximum for 1973	6530	5419.9
Maximum for 1974	2830	2462.1
Maximum for 1975	2330	2166.9
Maximum for 1976	1310	1218.3
Maximum for 1977	2240	2083.2
Maximum for 1978	4110	3411.3
Maximum for 1979	2790	2427.3
Maximum for 1980	4690	3892.7
Maximum for 1981	1720	1599.6
Maximum for 1982	3150	2740.5
Maximum for 1983	3900	3237
Maximum for 1984	5030	4174.9
Maximum for 1985	5750	4772.5
Maximum for 1986	3190	2775.3
Maximum for 1987	4940	4100.2
Maximum for 1988	7030	5834.9
Maximum for 1989	1460	1357.8
Maximum for 1990	1100	1023
Maximum for 1991	4660	3867.8
Maximum for 1992	10600	8798
Maximum for 1993	2130	1980.9
Maximum for 1994	2580	2362.2

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Maximum for 1995	2180	2027.4
Maximum for 1996	3330	2763.9
Maximum for 1997	3360	2788.8
Maximum for 1998	13400	11122
Maximum for 1999	1140	1060.2
Maximum for 2000	1110	1032.3
Maximum for 2001	1230	1143.9
Maximum for 2002	1080	1004.4
Maximum for 2003	4780	3967.4
Maximum for 2004	9410	7810.3
Maximum for 2005	3210	2740.5
Maximum for 2006	2370	2204.1
Maximum for 2007	842	803.268
Maximum for 2008	3340	2775.3
Maximum for 2009	4470	3710.1
Maximum for 2010	2080	1934.4
Percentile 10 for 1933	859	819.486
Percentile 10 for 1934	860	820.44
Percentile 10 for 1935	749	714.546
Percentile 10 for 1936	1070	1020.78
Percentile 10 for 1937	1180	1097.4
Percentile 10 for 1938	1000	954
Percentile 10 for 1939	922	879.588
Percentile 10 for 1940	912	870.048
Percentile 10 for 1941	1020	973.08
Percentile 10 for 1942	1280	1190.4
Percentile 10 for 1943	853	813.762
Percentile 10 for 1944	831	792.774
Percentile 10 for 1945	960	915.84
Percentile 10 for 1946	1140	1060.2
Percentile 10 for 1947	1160	1078.8
Percentile 10 for 1948	1835	1706.55
Percentile 10 for 1949	1520	1413.6
Percentile 10 for 1950	1090	1020.78
Percentile 10 for 1951	1060	1004.4
Percentile 10 for 1952	917	874.818
Percentile 10 for 1953	975	930.15
Percentile 10 for 1954	910	868.14
Percentile 10 for 1955	700	667.8
Percentile 10 for 1956	666	635.364
Percentile 10 for 1957	658	627.732
Percentile 10 for 1958	1074	1011.24
Percentile 10 for 1959	1674	1556.82
Percentile 10 for 1960	1575	1464.75
Percentile 10 for 1961	1260	1171.8
Percentile 10 for 1962	888	847.152
Percentile 10 for 1963	856	816.624
Percentile 10 for 1964	1210	1125.3
Percentile 10 for 1965	1724	1603.32
Percentile 10 for 1966	1850	1720.5
Percentile 10 for 1967	1170	1088.1
Percentile 10 for 1968	1020	973.08

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Percentile 10 for 1969	1134	1054.62
Percentile 10 for 1970	1354	1259.22
Percentile 10 for 1971	982	936.828
Percentile 10 for 1972	1250	1162.5
Percentile 10 for 1973	1120	1041.6
Percentile 10 for 1974	896.4	855.166
Percentile 10 for 1975	940	896.76
Percentile 10 for 1976	870	829.98
Percentile 10 for 1977	793	756.522
Percentile 10 for 1978	1070	1011.24
Percentile 10 for 1979	1094	1021.668
Percentile 10 for 1980	954	910.116
Percentile 10 for 1981	720.2	687.071
Percentile 10 for 1982	852	812.808
Percentile 10 for 1983	1270	1181.1
Percentile 10 for 1984	1340	1246.2
Percentile 10 for 1985	1144	1063.92
Percentile 10 for 1986	1100	1023
Percentile 10 for 1987	1210	1125.3
Percentile 10 for 1988	1200	1116
Percentile 10 for 1989	849	809.946
Percentile 10 for 1990	674.8	643.759
Percentile 10 for 1991	971.4	926.716
Percentile 10 for 1992	947.5	903.915
Percentile 10 for 1993	829	790.866
Percentile 10 for 1994	929	886.266
Percentile 10 for 1995	869	829.026
Percentile 10 for 1996	937	893.898
Percentile 10 for 1997	955	911.07
Percentile 10 for 1998	1134	1054.62
Percentile 10 for 1999	725	691.65
Percentile 10 for 2000	600	572.4
Percentile 10 for 2001	488	465.552
Percentile 10 for 2002	503	479.862
Percentile 10 for 2003	873	832.842
Percentile 10 for 2004	735	701.19
Percentile 10 for 2005	1140	1060.2
Percentile 10 for 2006	740.2	706.151
Percentile 10 for 2007	584	557.136
Percentile 10 for 2008	560.5	534.717
Percentile 10 for 2009	585	558.09
Percentile 10 for 2010	696.8	664.747
Percentile 90 for 1933	1880	1748.4
Percentile 90 for 1934	2360	2194.8
Percentile 90 for 1935	2628	2326.26
Percentile 90 for 1936	1825	1697.25
Percentile 90 for 1937	2730	2375.1
Percentile 90 for 1938	1856	1726.08
Percentile 90 for 1939	1920	1785.6
Percentile 90 for 1940	1580	1469.4
Percentile 90 for 1941	3082	2681.34
Percentile 90 for 1942	3938	3268.54

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Percentile 90 for 1943	1190	1106.7
Percentile 90 for 1944	2865	2492.55
Percentile 90 for 1945	2088	1941.84
Percentile 90 for 1946	2852	2481.24
Percentile 90 for 1947	3702	3072.66
Percentile 90 for 1948	4285	3556.55
Percentile 90 for 1949	2456	2267.34
Percentile 90 for 1950	2748	2403.48
Percentile 90 for 1951	1416	1316.88
Percentile 90 for 1952	1385	1288.05
Percentile 90 for 1953	3124	2685.88
Percentile 90 for 1954	1916	1781.88
Percentile 90 for 1955	972	927.288
Percentile 90 for 1956	918	875.772
Percentile 90 for 1957	1806	1679.58
Percentile 90 for 1958	2146	1995.78
Percentile 90 for 1959	4234	3514.22
Percentile 90 for 1960	3265	2714.4
Percentile 90 for 1961	2212	2057.16
Percentile 90 for 1962	1100	1023
Percentile 90 for 1963	1750	1627.5
Percentile 90 for 1964	3290	2766.6
Percentile 90 for 1965	3650	3029.5
Percentile 90 for 1966	3648	3027.84
Percentile 90 for 1967	2210	2055.3
Percentile 90 for 1968	1935	1799.55
Percentile 90 for 1969	2300	2139
Percentile 90 for 1970	3632	3014.56
Percentile 90 for 1971	2012	1871.16
Percentile 90 for 1972	2880	2505.6
Percentile 90 for 1973	2692	2352.9
Percentile 90 for 1974	2022	1880.46
Percentile 90 for 1975	1556	1447.08
Percentile 90 for 1976	1200	1116
Percentile 90 for 1977	1540	1432.2
Percentile 90 for 1978	2746	2389.02
Percentile 90 for 1979	1630	1515.9
Percentile 90 for 1980	2220	2064.6
Percentile 90 for 1981	1136	1056.48
Percentile 90 for 1982	2032	1889.76
Percentile 90 for 1983	2792	2429.04
Percentile 90 for 1984	3295	2757.9
Percentile 90 for 1985	2326	2163.18
Percentile 90 for 1986	2220	2064.6
Percentile 90 for 1987	3406	2826.98
Percentile 90 for 1988	3275	2749.2
Percentile 90 for 1989	1266	1177.38
Percentile 90 for 1990	904.2	862.607
Percentile 90 for 1991	2426	2241.12
Percentile 90 for 1992	2155	2004.15
Percentile 90 for 1993	1866	1735.38
Percentile 90 for 1994	1620	1506.6

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Percentile 90 for 1995	1562	1452.66
Percentile 90 for 1996	1730	1608.9
Percentile 90 for 1997	2128	1979.04
Percentile 90 for 1998	4096	3399.68
Percentile 90 for 1999	992.6	946.94
Percentile 90 for 2000	867.5	827.595
Percentile 90 for 2001	828.4	790.294
Percentile 90 for 2002	766.4	731.146
Percentile 90 for 2003	2256	2098.08
Percentile 90 for 2004	3725	3091.75
Percentile 90 for 2005	2436	2257.26
Percentile 90 for 2006	1826	1698.18
Percentile 90 for 2007	725.6	692.222
Percentile 90 for 2008	1210	1125.3
Percentile 90 for 2009	1420	1320.6
Percentile 90 for 2010	1412	1313.16
Mean for 1933	1236.682	1154.232
Mean for 1934	1497.458	1369.558
Mean for 1935	1399.148	1271.565
Mean for 1936	1303.005	1216.455
Mean for 1937	1776.493	1622.878
Mean for 1938	1398.326	1297.341
Mean for 1939	1293.022	1209.353
Mean for 1940	1187.893	1114.789
Mean for 1941	1747.874	1579.408
Mean for 1942	2191.37	1958.464
Mean for 1943	1024.803	969.306
Mean for 1944	1682	1528.391
Mean for 1945	1389.238	1288.988
Mean for 1946	1950.685	1770.357
Mean for 1947	2034.137	1809.466
Mean for 1948	2846.831	2506.717
Mean for 1949	1936.904	1772.327
Mean for 1950	1758.795	1592.801
Mean for 1951	1217.068	1136.03
Mean for 1952	1104.172	1040.025
Mean for 1953	1729.721	1567.884
Mean for 1954	1353.975	1251.482
Mean for 1955	843.789	803.869
Mean for 1956	808.025	768.326
Mean for 1957	1140.625	1062.074
Mean for 1958	1438.148	1340.003
Mean for 1959	2669.836	2358.395
Mean for 1960	2314.891	2069.84
Mean for 1961	1664.63	1534.732
Mean for 1962	987.797	937.081
Mean for 1963	1194.688	1121.992
Mean for 1964	2422.331	2165.371
Mean for 1965	2544.356	2258.278
Mean for 1966	2684.274	2365.124
Mean for 1967	1594.904	1468.8
Mean for 1968	1454.295	1334.16

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Mean for 1969	1582.027	1464.848
Mean for 1970	2445.507	2155.05
Mean for 1971	1409.775	1302.532
Mean for 1972	1970.601	1788.733
Mean for 1973	1880.027	1715.944
Mean for 1974	1216.329	1140.292
Mean for 1975	1230.521	1150.975
Mean for 1976	997.664	944.396
Mean for 1977	1075.627	1014.481
Mean for 1978	1732.83	1583.537
Mean for 1979	1374.959	1276.692
Mean for 1980	1508.833	1392.956
Mean for 1981	897.562	851.672
Mean for 1982	1392.584	1298.451
Mean for 1983	1891.836	1728.891
Mean for 1984	2070.246	1867.934
Mean for 1985	1628.986	1488.259
Mean for 1986	1487.89	1379.31
Mean for 1987	2081.178	1857.932
Mean for 1988	1901.913	1711.466
Mean for 1989	1018.893	962.354
Mean for 1990	793.455	756.67
Mean for 1991	1709.142	1571.585
Mean for 1992	1555.538	1423.518
Mean for 1993	1184.693	1114.547
Mean for 1994	1263.573	1183.381
Mean for 1995	1161.192	1090.503
Mean for 1996	1274.79	1188.36
Mean for 1997	1383.819	1286.639
Mean for 1998	2464.652	2176.167
Mean for 1999	855.466	815.019
Mean for 2000	708.514	675.35
Mean for 2001	625.762	595.993
Mean for 2002	601.811	574.057
Mean for 2003	1474.197	1361.366
Mean for 2004	1632.019	1458.723
Mean for 2005	1626.904	1500.249
Mean for 2006	1126.63	1060.842
Mean for 2007	656.293	626.104
Mean for 2008	780.639	736.033
Mean for 2009	961.307	900.93
Mean for 2010	905.24	857.67
Median for 1933	1070	1020.78
Median for 1934	1070	1020.78
Median for 1935	926	883.404
Median for 1936	1180	1097.4
Median for 1937	1550	1441.5
Median for 1938	1260	1171.8
Median for 1939	1150	1069.5
Median for 1940	1090	1013.7
Median for 1941	1360	1264.8
Median for 1942	1800	1674

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Median for 1943	990	944.46
Median for 1944	1400	1302
Median for 1945	1220	1134.6
Median for 1946	1870	1739.1
Median for 1947	1470	1367.1
Median for 1948	2380	2213.4
Median for 1949	1720	1599.6
Median for 1950	1320	1227.6
Median for 1951	1170	1088.1
Median for 1952	1030	982.62
Median for 1953	1230	1143.9
Median for 1954	1120	1041.6
Median for 1955	851	811.854
Median for 1956	766	730.764
Median for 1957	1070	1004.4
Median for 1958	1260	1171.8
Median for 1959	2250	2092.5
Median for 1960	2150	1999.5
Median for 1961	1530	1422.9
Median for 1962	992	946.368
Median for 1963	1080	1020.78
Median for 1964	2140	1990.2
Median for 1965	2360	2194.8
Median for 1966	2500	2279.4
Median for 1967	1440	1339.2
Median for 1968	1170	1088.1
Median for 1969	1510	1404.3
Median for 1970	2080	1934.4
Median for 1971	1260	1171.8
Median for 1972	1750	1627.5
Median for 1973	1750	1627.5
Median for 1974	1040	992.16
Median for 1975	1190	1106.7
Median for 1976	956.5	912.501
Median for 1977	947	903.438
Median for 1978	1570	1460.1
Median for 1979	1310	1218.3
Median for 1980	1350	1255.5
Median for 1981	844	805.176
Median for 1982	1210	1125.3
Median for 1983	1730	1608.9
Median for 1984	1805	1678.65
Median for 1985	1300	1209
Median for 1986	1300	1209
Median for 1987	1710	1590.3
Median for 1988	1520	1413.6
Median for 1989	997	951.138
Median for 1990	783	746.982
Median for 1991	1730	1608.9
Median for 1992	1240	1153.2
Median for 1993	1040	992.16
Median for 1994	1180	1097.4

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Median for 1995	1090	1020.78
Median for 1996	1170	1088.1
Median for 1997	1290	1199.7
Median for 1998	1600	1488
Median for 1999	834	795.636
Median for 2000	682	650.628
Median for 2001	574	547.596
Median for 2002	555	529.47
Median for 2003	1290	1199.7
Median for 2004	883	842.382
Median for 2005	1400	1302
Median for 2006	964	919.656
Median for 2007	645	615.33
Median for 2008	607	579.078
Median for 2009	840	801.36
Median for 2010	778	742.212
Zeros for 1933	0	0
Zeros for 1934	0	0
Zeros for 1935	0	0
Zeros for 1936	0	0
Zeros for 1937	0	0
Zeros for 1938	0	0
Zeros for 1939	0	0
Zeros for 1940	0	0
Zeros for 1941	0	0
Zeros for 1942	0	0
Zeros for 1943	0	0
Zeros for 1944	0	0
Zeros for 1945	0	0
Zeros for 1946	0	0
Zeros for 1947	0	0
Zeros for 1948	0	0
Zeros for 1949	0	0
Zeros for 1950	0	0
Zeros for 1951	0	0
Zeros for 1952	0	0
Zeros for 1953	0	0
Zeros for 1954	0	0
Zeros for 1955	0	0
Zeros for 1956	0	0
Zeros for 1957	0	0
Zeros for 1958	0	0
Zeros for 1959	0	0
Zeros for 1960	0	0
Zeros for 1961	0	0
Zeros for 1962	0	0
Zeros for 1963	0	0
Zeros for 1964	0	0
Zeros for 1965	0	0
Zeros for 1966	0	0
Zeros for 1967	0	0
Zeros for 1968	0	0

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Zeros for 1969	0	0
Zeros for 1970	0	0
Zeros for 1971	0	0
Zeros for 1972	0	0
Zeros for 1973	0	0
Zeros for 1974	0	0
Zeros for 1975	0	0
Zeros for 1976	0	0
Zeros for 1977	0	0
Zeros for 1978	0	0
Zeros for 1979	0	0
Zeros for 1980	0	0
Zeros for 1981	0	0
Zeros for 1982	0	0
Zeros for 1983	0	0
Zeros for 1984	0	0
Zeros for 1985	0	0
Zeros for 1986	0	0
Zeros for 1987	0	0
Zeros for 1988	0	0
Zeros for 1989	0	0
Zeros for 1990	0	0
Zeros for 1991	0	0
Zeros for 1992	0	0
Zeros for 1993	0	0
Zeros for 1994	0	0
Zeros for 1995	0	0
Zeros for 1996	0	0
Zeros for 1997	0	0
Zeros for 1998	0	0
Zeros for 1999	0	0
Zeros for 2000	0	0
Zeros for 2001	0	0
Zeros for 2002	0	0
Zeros for 2003	0	0
Zeros for 2004	0	0
Zeros for 2005	0	0
Zeros for 2006	0	0
Zeros for 2007	0	0
Zeros for 2008	0	0
Zeros for 2009	0	0
Zeros for 2010	0	0
Total for 1933	451389	421294.746
Total for 1934	546572	499888.568
Total for 1935	510689	464121.306
Total for 1936	476900	445222.44
Total for 1937	648420	592350.56
Total for 1938	510389	473529.306
Total for 1939	471953	441413.802
Total for 1940	434769	408012.906
Total for 1941	637974	576484.036
Total for 1942	799850	714839.5

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Total for 1943	374053	353796.642
Total for 1944	615612	559391.168
Total for 1945	507072	470480.528
Total for 1946	712000	646180.2
Total for 1947	742460	660455.16
Total for 1948	1041940	917458.4
Total for 1949	706970	646899.3
Total for 1950	641960	581372.2
Total for 1951	444230	414650.94
Total for 1952	404127	380649.078
Total for 1953	631348	572277.712
Total for 1954	494201	456790.834
Total for 1955	307983	293412.102
Total for 1956	295737	281207.178
Total for 1957	416328	387656.992
Total for 1958	524924	489101.256
Total for 1959	974490	860814.3
Total for 1960	847250	757561.3
Total for 1961	607590	560177.3
Total for 1962	360546	342034.644
Total for 1963	436061	409527.234
Total for 1964	886573	792525.642
Total for 1965	928690	824271.5
Total for 1966	979760	863270.4
Total for 1967	582140	536112
Total for 1968	532272	488302.608
Total for 1969	577440	534669.6
Total for 1970	892610	786593.3
Total for 1971	514568	475424.112
Total for 1972	721240	654676.2
Total for 1973	686210	626319.74
Total for 1974	443960	416206.56
Total for 1975	449140	420105.96
Total for 1976	365145	345649.05
Total for 1977	392604	370285.656
Total for 1978	632483	577990.902
Total for 1979	501860	465992.4
Total for 1980	552233	509821.882
Total for 1981	327610	310860.18
Total for 1982	508293	473934.522
Total for 1983	690520	631045.08
Total for 1984	757710	683663.9
Total for 1985	594580	543214.6
Total for 1986	543080	503448.12
Total for 1987	759630	678145.1
Total for 1988	696100	626396.4
Total for 1989	371896	351259.104
Total for 1990	289611	276184.494
Total for 1991	623837	573628.698
Total for 1992	569327	521007.678
Total for 1993	432413	406809.522
Total for 1994	461204	431933.976

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Total for 1995	423835	398033.55
Total for 1996	466573	434939.762
Total for 1997	505094	469623.076
Total for 1998	899598	794301.092
Total for 1999	312245	297481.89
Total for 2000	259316	247177.944
Total for 2001	228403	217537.422
Total for 2002	219661	209530.674
Total for 2003	538082	496898.428
Total for 2004	597319	533892.526
Total for 2005	593820	547591
Total for 2006	411220	387207.24
Total for 2007	239547	228527.838
Total for 2008	285714	269388.116
Total for 2009	350877	328839.556
Total for 2010	330412.5	313049.445
Less or equal 1410 for 1933	297	307
Less or equal 1410 for 1934	250	261
Less or equal 1410 for 1935	262	275
Less or equal 1410 for 1936	275	294
Less or equal 1410 for 1937	120	176
Less or equal 1410 for 1938	229	266
Less or equal 1410 for 1939	259	279
Less or equal 1410 for 1940	290	318
Less or equal 1410 for 1941	206	223
Less or equal 1410 for 1942	63	75
Less or equal 1410 for 1943	354	357
Less or equal 1410 for 1944	186	203
Less or equal 1410 for 1945	254	270
Less or equal 1410 for 1946	103	118
Less or equal 1410 for 1947	170	191
Less or equal 1410 for 1948	0	0
Less or equal 1410 for 1949	0	33
Less or equal 1410 for 1950	204	223
Less or equal 1410 for 1951	328	342
Less or equal 1410 for 1952	335	340
Less or equal 1410 for 1953	198	204
Less or equal 1410 for 1954	273	288
Less or equal 1410 for 1955	365	365
Less or equal 1410 for 1956	351	352
Less or equal 1410 for 1957	277	299
Less or equal 1410 for 1958	225	247
Less or equal 1410 for 1959	3	4
Less or equal 1410 for 1960	0	19
Less or equal 1410 for 1961	134	171
Less or equal 1410 for 1962	365	365
Less or equal 1410 for 1963	278	290
Less or equal 1410 for 1964	74	88
Less or equal 1410 for 1965	0	0
Less or equal 1410 for 1966	0	0
Less or equal 1410 for 1967	173	201
Less or equal 1410 for 1968	256	291

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Less or equal 1410 for 1969	146	184
Less or equal 1410 for 1970	47	61
Less or equal 1410 for 1971	256	271
Less or equal 1410 for 1972	71	93
Less or equal 1410 for 1973	114	127
Less or equal 1410 for 1974	298	303
Less or equal 1410 for 1975	313	323
Less or equal 1410 for 1976	366	366
Less or equal 1410 for 1977	291	324
Less or equal 1410 for 1978	148	171
Less or equal 1410 for 1979	250	299
Less or equal 1410 for 1980	200	236
Less or equal 1410 for 1981	352	356
Less or equal 1410 for 1982	217	227
Less or equal 1410 for 1983	59	77
Less or equal 1410 for 1984	69	95
Less or equal 1410 for 1985	241	250
Less or equal 1410 for 1986	220	247
Less or equal 1410 for 1987	83	108
Less or equal 1410 for 1988	153	182
Less or equal 1410 for 1989	360	365
Less or equal 1410 for 1990	365	365
Less or equal 1410 for 1991	133	151
Less or equal 1410 for 1992	241	261
Less or equal 1410 for 1993	271	286
Less or equal 1410 for 1994	282	313
Less or equal 1410 for 1995	314	324
Less or equal 1410 for 1996	284	304
Less or equal 1410 for 1997	240	276
Less or equal 1410 for 1998	127	159
Less or equal 1410 for 1999	365	365
Less or equal 1410 for 2000	366	366
Less or equal 1410 for 2001	365	365
Less or equal 1410 for 2002	365	365
Less or equal 1410 for 2003	226	242
Less or equal 1410 for 2004	250	260
Less or equal 1410 for 2005	193	219
Less or equal 1410 for 2006	285	295
Less or equal 1410 for 2007	365	365
Less or equal 1410 for 2008	343	349
Less or equal 1410 for 2009	327	337
Less or equal 1410 for 2010	328	332
Greater or equal 1410 for 1933	68	58
Greater or equal 1410 for 1934	115	104
Greater or equal 1410 for 1935	103	90
Greater or equal 1410 for 1936	91	72
Greater or equal 1410 for 1937	245	189
Greater or equal 1410 for 1938	136	99
Greater or equal 1410 for 1939	106	86
Greater or equal 1410 for 1940	76	48
Greater or equal 1410 for 1941	168	142
Greater or equal 1410 for 1942	308	290

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Greater or equal 1410 for 1943	11	8
Greater or equal 1410 for 1944	182	163
Greater or equal 1410 for 1945	112	95
Greater or equal 1410 for 1946	262	247
Greater or equal 1410 for 1947	197	174
Greater or equal 1410 for 1948	366	366
Greater or equal 1410 for 1949	365	332
Greater or equal 1410 for 1950	161	142
Greater or equal 1410 for 1951	38	23
Greater or equal 1410 for 1952	31	26
Greater or equal 1410 for 1953	168	161
Greater or equal 1410 for 1954	94	77
Greater or equal 1410 for 1955	0	0
Greater or equal 1410 for 1956	15	14
Greater or equal 1410 for 1957	89	66
Greater or equal 1410 for 1958	140	118
Greater or equal 1410 for 1959	362	361
Greater or equal 1410 for 1960	366	347
Greater or equal 1410 for 1961	237	194
Greater or equal 1410 for 1962	0	0
Greater or equal 1410 for 1963	87	75
Greater or equal 1410 for 1964	294	278
Greater or equal 1410 for 1965	365	365
Greater or equal 1410 for 1966	365	365
Greater or equal 1410 for 1967	196	164
Greater or equal 1410 for 1968	114	75
Greater or equal 1410 for 1969	221	181
Greater or equal 1410 for 1970	319	304
Greater or equal 1410 for 1971	114	94
Greater or equal 1410 for 1972	296	273
Greater or equal 1410 for 1973	253	238
Greater or equal 1410 for 1974	67	62
Greater or equal 1410 for 1975	52	42
Greater or equal 1410 for 1976	0	0
Greater or equal 1410 for 1977	74	41
Greater or equal 1410 for 1978	219	194
Greater or equal 1410 for 1979	125	66
Greater or equal 1410 for 1980	168	130
Greater or equal 1410 for 1981	13	9
Greater or equal 1410 for 1982	149	138
Greater or equal 1410 for 1983	311	288
Greater or equal 1410 for 1984	300	271
Greater or equal 1410 for 1985	124	115
Greater or equal 1410 for 1986	149	118
Greater or equal 1410 for 1987	284	257
Greater or equal 1410 for 1988	219	184
Greater or equal 1410 for 1989	6	0
Greater or equal 1410 for 1990	0	0
Greater or equal 1410 for 1991	234	214
Greater or equal 1410 for 1992	131	105
Greater or equal 1410 for 1993	95	79
Greater or equal 1410 for 1994	86	52

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Greater or equal 1410 for 1995	53	41
Greater or equal 1410 for 1996	82	62
Greater or equal 1410 for 1997	128	89
Greater or equal 1410 for 1998	249	206
Greater or equal 1410 for 1999	0	0
Greater or equal 1410 for 2000	0	0
Greater or equal 1410 for 2001	0	0
Greater or equal 1410 for 2002	0	0
Greater or equal 1410 for 2003	139	123
Greater or equal 1410 for 2004	116	106
Greater or equal 1410 for 2005	180	146
Greater or equal 1410 for 2006	80	70
Greater or equal 1410 for 2007	0	0
Greater or equal 1410 for 2008	23	17
Greater or equal 1410 for 2009	39	28
Greater or equal 1410 for 2010	37	33
High Flow Spell result		
Whole Period		
High Spell Threshold	1410	1410
Number of High Spell	152	163
Longest High Spell	1006	922
Mean of High Spell Peaks	3078.487	2728.02
Mean Duration of High Spell	73.421	60.018
Total Duration of High Spell	11160	9783
Total of periods Between High Spells	16942	18316
Mean period Between High Spells	112.199	113.062
Longest period Between High Spells	1562	1567
Total (Sum) Raw Values	25053600	20650559.7
Mean Raw Values	164826.316	126690.55
Summary for each year		
High Spell Threshold for 1933	1410	1410
High Spell Threshold for 1934	1410	1410
High Spell Threshold for 1935	1410	1410
High Spell Threshold for 1936	1410	1410
High Spell Threshold for 1937	1410	1410
High Spell Threshold for 1938	1410	1410
High Spell Threshold for 1939	1410	1410
High Spell Threshold for 1940	1410	1410
High Spell Threshold for 1941	1410	1410
High Spell Threshold for 1942	1410	1410
High Spell Threshold for 1943	1410	1410
High Spell Threshold for 1944	1410	1410
High Spell Threshold for 1945	1410	1410
High Spell Threshold for 1946	1410	1410
High Spell Threshold for 1947	1410	1410
High Spell Threshold for 1948	1410	1410
High Spell Threshold for 1949	1410	1410
High Spell Threshold for 1950	1410	1410
High Spell Threshold for 1951	1410	1410
High Spell Threshold for 1952	1410	1410
High Spell Threshold for 1953	1410	1410
High Spell Threshold for 1954	1410	1410

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
High Spell Threshold for 1955	1410	1410
High Spell Threshold for 1956	1410	1410
High Spell Threshold for 1957	1410	1410
High Spell Threshold for 1958	1410	1410
High Spell Threshold for 1959	1410	1410
High Spell Threshold for 1960	1410	1410
High Spell Threshold for 1961	1410	1410
High Spell Threshold for 1962	1410	1410
High Spell Threshold for 1963	1410	1410
High Spell Threshold for 1964	1410	1410
High Spell Threshold for 1965	1410	1410
High Spell Threshold for 1966	1410	1410
High Spell Threshold for 1967	1410	1410
High Spell Threshold for 1968	1410	1410
High Spell Threshold for 1969	1410	1410
High Spell Threshold for 1970	1410	1410
High Spell Threshold for 1971	1410	1410
High Spell Threshold for 1972	1410	1410
High Spell Threshold for 1973	1410	1410
High Spell Threshold for 1974	1410	1410
High Spell Threshold for 1975	1410	1410
High Spell Threshold for 1976	1410	1410
High Spell Threshold for 1977	1410	1410
High Spell Threshold for 1978	1410	1410
High Spell Threshold for 1979	1410	1410
High Spell Threshold for 1980	1410	1410
High Spell Threshold for 1981	1410	1410
High Spell Threshold for 1982	1410	1410
High Spell Threshold for 1983	1410	1410
High Spell Threshold for 1984	1410	1410
High Spell Threshold for 1985	1410	1410
High Spell Threshold for 1986	1410	1410
High Spell Threshold for 1987	1410	1410
High Spell Threshold for 1988	1410	1410
High Spell Threshold for 1989	1410	1410
High Spell Threshold for 1990	1410	1410
High Spell Threshold for 1991	1410	1410
High Spell Threshold for 1992	1410	1410
High Spell Threshold for 1993	1410	1410
High Spell Threshold for 1994	1410	1410
High Spell Threshold for 1995	1410	1410
High Spell Threshold for 1996	1410	1410
High Spell Threshold for 1997	1410	1410
High Spell Threshold for 1998	1410	1410
High Spell Threshold for 1999	1410	1410
High Spell Threshold for 2000	1410	1410
High Spell Threshold for 2001	1410	1410
High Spell Threshold for 2002	1410	1410
High Spell Threshold for 2003	1410	1410
High Spell Threshold for 2004	1410	1410
High Spell Threshold for 2005	1410	1410
High Spell Threshold for 2006	1410	1410

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
High Spell Threshold for 2007	1410	1410
High Spell Threshold for 2008	1410	1410
High Spell Threshold for 2009	1410	1410
High Spell Threshold for 2010	1410	1410
Number of High Spell for 1933	3	3
Number of High Spell for 1934	2	1
Number of High Spell for 1935	1	1
Number of High Spell for 1936	2	3
Number of High Spell for 1937	4	5
Number of High Spell for 1938	5	3
Number of High Spell for 1939	1	1
Number of High Spell for 1940	4	4
Number of High Spell for 1941	5	2
Number of High Spell for 1942	1	1
Number of High Spell for 1943	1	1
Number of High Spell for 1944	3	3
Number of High Spell for 1945	3	3
Number of High Spell for 1946	2	2
Number of High Spell for 1947	3	4
Number of High Spell for 1948	1	1
Number of High Spell for 1949	1	4
Number of High Spell for 1950	3	3
Number of High Spell for 1951	2	2
Number of High Spell for 1952	1	1
Number of High Spell for 1953	2	2
Number of High Spell for 1954	1	2
Number of High Spell for 1955	0	0
Number of High Spell for 1956	1	1
Number of High Spell for 1957	3	3
Number of High Spell for 1958	3	3
Number of High Spell for 1959	1	1
Number of High Spell for 1960	1	2
Number of High Spell for 1961	3	3
Number of High Spell for 1962	0	0
Number of High Spell for 1963	3	3
Number of High Spell for 1964	3	3
Number of High Spell for 1965	1	1
Number of High Spell for 1966	1	1
Number of High Spell for 1967	2	3
Number of High Spell for 1968	2	2
Number of High Spell for 1969	2	7
Number of High Spell for 1970	1	1
Number of High Spell for 1971	2	3
Number of High Spell for 1972	3	5
Number of High Spell for 1973	2	1
Number of High Spell for 1974	1	1
Number of High Spell for 1975	2	2
Number of High Spell for 1976	0	0
Number of High Spell for 1977	2	3
Number of High Spell for 1978	5	4
Number of High Spell for 1979	8	4
Number of High Spell for 1980	3	5

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Number of High Spell for 1981	1	1
Number of High Spell for 1982	2	2
Number of High Spell for 1983	2	3
Number of High Spell for 1984	2	2
Number of High Spell for 1985	1	1
Number of High Spell for 1986	3	2
Number of High Spell for 1987	1	2
Number of High Spell for 1988	7	6
Number of High Spell for 1989	1	0
Number of High Spell for 1990	0	0
Number of High Spell for 1991	3	3
Number of High Spell for 1992	4	5
Number of High Spell for 1993	1	2
Number of High Spell for 1994	4	3
Number of High Spell for 1995	3	3
Number of High Spell for 1996	4	5
Number of High Spell for 1997	6	5
Number of High Spell for 1998	4	4
Number of High Spell for 1999	0	0
Number of High Spell for 2000	0	0
Number of High Spell for 2001	0	0
Number of High Spell for 2002	0	0
Number of High Spell for 2003	3	3
Number of High Spell for 2004	1	2
Number of High Spell for 2005	5	4
Number of High Spell for 2006	1	2
Number of High Spell for 2007	0	0
Number of High Spell for 2008	2	1
Number of High Spell for 2009	5	4
Number of High Spell for 2010	1	2
Longest High Spell for 1933	35	31
Longest High Spell for 1934	112	104
Longest High Spell for 1935	103	90
Longest High Spell for 1936	74	47
Longest High Spell for 1937	115	79
Longest High Spell for 1938	57	46
Longest High Spell for 1939	106	86
Longest High Spell for 1940	43	17
Longest High Spell for 1941	78	72
Longest High Spell for 1942	308	290
Longest High Spell for 1943	11	8
Longest High Spell for 1944	77	69
Longest High Spell for 1945	55	47
Longest High Spell for 1946	217	208
Longest High Spell for 1947	99	99
Longest High Spell for 1948	366	366
Longest High Spell for 1949	365	166
Longest High Spell for 1950	117	117
Longest High Spell for 1951	26	13
Longest High Spell for 1952	31	26
Longest High Spell for 1953	138	134
Longest High Spell for 1954	94	70

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Longest High Spell for 1955	NaN	NaN
Longest High Spell for 1956	15	14
Longest High Spell for 1957	36	26
Longest High Spell for 1958	86	76
Longest High Spell for 1959	362	361
Longest High Spell for 1960	366	331
Longest High Spell for 1961	128	88
Longest High Spell for 1962	NaN	NaN
Longest High Spell for 1963	47	42
Longest High Spell for 1964	155	154
Longest High Spell for 1965	365	365
Longest High Spell for 1966	365	365
Longest High Spell for 1967	121	63
Longest High Spell for 1968	92	74
Longest High Spell for 1969	147	66
Longest High Spell for 1970	319	304
Longest High Spell for 1971	87	54
Longest High Spell for 1972	149	147
Longest High Spell for 1973	251	238
Longest High Spell for 1974	67	62
Longest High Spell for 1975	43	36
Longest High Spell for 1976	NaN	NaN
Longest High Spell for 1977	48	21
Longest High Spell for 1978	81	78
Longest High Spell for 1979	43	38
Longest High Spell for 1980	99	84
Longest High Spell for 1981	13	9
Longest High Spell for 1982	122	114
Longest High Spell for 1983	271	206
Longest High Spell for 1984	295	259
Longest High Spell for 1985	124	115
Longest High Spell for 1986	106	98
Longest High Spell for 1987	284	201
Longest High Spell for 1988	118	81
Longest High Spell for 1989	6	NaN
Longest High Spell for 1990	NaN	NaN
Longest High Spell for 1991	195	186
Longest High Spell for 1992	108	70
Longest High Spell for 1993	95	59
Longest High Spell for 1994	34	27
Longest High Spell for 1995	22	16
Longest High Spell for 1996	27	24
Longest High Spell for 1997	74	24
Longest High Spell for 1998	165	152
Longest High Spell for 1999	NaN	NaN
Longest High Spell for 2000	NaN	NaN
Longest High Spell for 2001	NaN	NaN
Longest High Spell for 2002	NaN	NaN
Longest High Spell for 2003	67	62
Longest High Spell for 2004	116	104
Longest High Spell for 2005	87	69
Longest High Spell for 2006	80	40

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Longest High Spell for 2007	NaN	NaN
Longest High Spell for 2008	21	17
Longest High Spell for 2009	23	11
Longest High Spell for 2010	37	17
Mean of High Spell Peaks for 1933	2406.667	2126.6
Mean of High Spell Peaks for 1934	6270	9213
Mean of High Spell Peaks for 1935	6280	5212.4
Mean of High Spell Peaks for 1936	1900	1819.7
Mean of High Spell Peaks for 1937	2755	2468.42
Mean of High Spell Peaks for 1938	2260	2480.933
Mean of High Spell Peaks for 1939	2480	2306.4
Mean of High Spell Peaks for 1940	1732.5	1720.5
Mean of High Spell Peaks for 1941	2918	4300.1
Mean of High Spell Peaks for 1942	4750	3942.5
Mean of High Spell Peaks for 1943	1760	1636.8
Mean of High Spell Peaks for 1944	5203.333	4364.167
Mean of High Spell Peaks for 1945	2860	2516.433
Mean of High Spell Peaks for 1946	3260	2761.75
Mean of High Spell Peaks for 1947	4270	3108.375
Mean of High Spell Peaks for 1948	11800	9794
Mean of High Spell Peaks for 1949	5420	2621.625
Mean of High Spell Peaks for 1950	3606.667	3106.2
Mean of High Spell Peaks for 1951	1630	1515.9
Mean of High Spell Peaks for 1952	2010	1869.3
Mean of High Spell Peaks for 1953	3780	3261.4
Mean of High Spell Peaks for 1954	5000	2809.7
Mean of High Spell Peaks for 1955	NaN	NaN
Mean of High Spell Peaks for 1956	2200	2046
Mean of High Spell Peaks for 1957	2680	2356.067
Mean of High Spell Peaks for 1958	2053.333	1909.6
Mean of High Spell Peaks for 1959	7970	6615.1
Mean of High Spell Peaks for 1960	6290	3345.05
Mean of High Spell Peaks for 1961	2433.333	2190.7
Mean of High Spell Peaks for 1962	NaN	NaN
Mean of High Spell Peaks for 1963	2003.333	1863.1
Mean of High Spell Peaks for 1964	7863.333	6568.567
Mean of High Spell Peaks for 1965	5100	4233
Mean of High Spell Peaks for 1966	5850	4855.5
Mean of High Spell Peaks for 1967	3205	2409.467
Mean of High Spell Peaks for 1968	4010	3404.3
Mean of High Spell Peaks for 1969	2920	1999.243
Mean of High Spell Peaks for 1970	7980	6623.4
Mean of High Spell Peaks for 1971	2540	1980.5
Mean of High Spell Peaks for 1972	2996.667	2586.74
Mean of High Spell Peaks for 1973	3985	5419.9
Mean of High Spell Peaks for 1974	2830	2462.1
Mean of High Spell Peaks for 1975	1960	1822.8
Mean of High Spell Peaks for 1976	NaN	NaN
Mean of High Spell Peaks for 1977	2025	1732.9
Mean of High Spell Peaks for 1978	2746	2608.475
Mean of High Spell Peaks for 1979	1680	1732.125
Mean of High Spell Peaks for 1980	2946.667	2128.9

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Mean of High Spell Peaks for 1981	1720	1599.6
Mean of High Spell Peaks for 1982	2700	2416.5
Mean of High Spell Peaks for 1983	3145	2505
Mean of High Spell Peaks for 1984	3235	2864
Mean of High Spell Peaks for 1985	5750	4772.5
Mean of High Spell Peaks for 1986	2196.667	2289.75
Mean of High Spell Peaks for 1987	4940	2984.75
Mean of High Spell Peaks for 1988	2690	2598.233
Mean of High Spell Peaks for 1989	1460	NaN
Mean of High Spell Peaks for 1990	NaN	NaN
Mean of High Spell Peaks for 1991	2886.667	2529.267
Mean of High Spell Peaks for 1992	3932.5	3119.26
Mean of High Spell Peaks for 1993	2130	1748.4
Mean of High Spell Peaks for 1994	2057.5	2070.8
Mean of High Spell Peaks for 1995	1900	1767
Mean of High Spell Peaks for 1996	2242.5	1897.56
Mean of High Spell Peaks for 1997	2210	2191.86
Mean of High Spell Peaks for 1998	4982.5	4240.125
Mean of High Spell Peaks for 1999	NaN	NaN
Mean of High Spell Peaks for 2000	NaN	NaN
Mean of High Spell Peaks for 2001	NaN	NaN
Mean of High Spell Peaks for 2002	NaN	NaN
Mean of High Spell Peaks for 2003	3126.667	2748.467
Mean of High Spell Peaks for 2004	9410	4616.6
Mean of High Spell Peaks for 2005	2232	2194.05
Mean of High Spell Peaks for 2006	2370	2166.9
Mean of High Spell Peaks for 2007	NaN	NaN
Mean of High Spell Peaks for 2008	2405	2775.3
Mean of High Spell Peaks for 2009	2240	2194.65
Mean of High Spell Peaks for 2010	2080	1813.5
Mean Duration of High Spell for 1933	22.667	19.333
Mean Duration of High Spell for 1934	57.5	104
Mean Duration of High Spell for 1935	103	90
Mean Duration of High Spell for 1936	45.5	24
Mean Duration of High Spell for 1937	61.25	37.8
Mean Duration of High Spell for 1938	27	33
Mean Duration of High Spell for 1939	106	86
Mean Duration of High Spell for 1940	19	12
Mean Duration of High Spell for 1941	33.6	71
Mean Duration of High Spell for 1942	308	290
Mean Duration of High Spell for 1943	11	8
Mean Duration of High Spell for 1944	60.667	54.333
Mean Duration of High Spell for 1945	37	31.333
Mean Duration of High Spell for 1946	131	123.5
Mean Duration of High Spell for 1947	65.333	43.5
Mean Duration of High Spell for 1948	366	366
Mean Duration of High Spell for 1949	365	83
Mean Duration of High Spell for 1950	53.667	47.333
Mean Duration of High Spell for 1951	19	11
Mean Duration of High Spell for 1952	31	26
Mean Duration of High Spell for 1953	84	80.5
Mean Duration of High Spell for 1954	94	38.5

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Mean Duration of High Spell for 1955	NaN	NaN
Mean Duration of High Spell for 1956	15	14
Mean Duration of High Spell for 1957	29.667	22
Mean Duration of High Spell for 1958	46.667	39.333
Mean Duration of High Spell for 1959	362	361
Mean Duration of High Spell for 1960	366	173.5
Mean Duration of High Spell for 1961	78.667	64.667
Mean Duration of High Spell for 1962	NaN	NaN
Mean Duration of High Spell for 1963	29	25
Mean Duration of High Spell for 1964	98	92.667
Mean Duration of High Spell for 1965	365	365
Mean Duration of High Spell for 1966	365	365
Mean Duration of High Spell for 1967	98	54.333
Mean Duration of High Spell for 1968	56.5	37.5
Mean Duration of High Spell for 1969	110.5	25.857
Mean Duration of High Spell for 1970	319	304
Mean Duration of High Spell for 1971	57	31
Mean Duration of High Spell for 1972	98.333	54.4
Mean Duration of High Spell for 1973	126.5	238
Mean Duration of High Spell for 1974	67	62
Mean Duration of High Spell for 1975	26	21
Mean Duration of High Spell for 1976	NaN	NaN
Mean Duration of High Spell for 1977	37	13.667
Mean Duration of High Spell for 1978	43.6	48.5
Mean Duration of High Spell for 1979	15.625	16.5
Mean Duration of High Spell for 1980	56	25.8
Mean Duration of High Spell for 1981	13	9
Mean Duration of High Spell for 1982	74.5	69
Mean Duration of High Spell for 1983	155.5	96
Mean Duration of High Spell for 1984	150	135.5
Mean Duration of High Spell for 1985	124	115
Mean Duration of High Spell for 1986	49.667	59
Mean Duration of High Spell for 1987	284	128.5
Mean Duration of High Spell for 1988	31.143	30.667
Mean Duration of High Spell for 1989	6	NaN
Mean Duration of High Spell for 1990	NaN	NaN
Mean Duration of High Spell for 1991	78	71.333
Mean Duration of High Spell for 1992	32.75	21
Mean Duration of High Spell for 1993	95	39.5
Mean Duration of High Spell for 1994	21.5	17.333
Mean Duration of High Spell for 1995	17.667	13.667
Mean Duration of High Spell for 1996	20.5	12.4
Mean Duration of High Spell for 1997	21.333	17.8
Mean Duration of High Spell for 1998	62.25	51.5
Mean Duration of High Spell for 1999	NaN	NaN
Mean Duration of High Spell for 2000	NaN	NaN
Mean Duration of High Spell for 2001	NaN	NaN
Mean Duration of High Spell for 2002	NaN	NaN
Mean Duration of High Spell for 2003	46.333	41
Mean Duration of High Spell for 2004	116	53
Mean Duration of High Spell for 2005	36	36.5
Mean Duration of High Spell for 2006	80	35

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Mean Duration of High Spell for 2007	NaN	NaN
Mean Duration of High Spell for 2008	11.5	17
Mean Duration of High Spell for 2009	7.8	7
Mean Duration of High Spell for 2010	37	16
Total Duration of High Spell for 1933	68	58
Total Duration of High Spell for 1934	115	104
Total Duration of High Spell for 1935	103	90
Total Duration of High Spell for 1936	91	72
Total Duration of High Spell for 1937	245	189
Total Duration of High Spell for 1938	135	99
Total Duration of High Spell for 1939	106	86
Total Duration of High Spell for 1940	76	48
Total Duration of High Spell for 1941	168	142
Total Duration of High Spell for 1942	308	290
Total Duration of High Spell for 1943	11	8
Total Duration of High Spell for 1944	182	163
Total Duration of High Spell for 1945	111	94
Total Duration of High Spell for 1946	262	247
Total Duration of High Spell for 1947	196	174
Total Duration of High Spell for 1948	366	366
Total Duration of High Spell for 1949	365	332
Total Duration of High Spell for 1950	161	142
Total Duration of High Spell for 1951	38	22
Total Duration of High Spell for 1952	31	26
Total Duration of High Spell for 1953	168	161
Total Duration of High Spell for 1954	94	77
Total Duration of High Spell for 1955	NaN	NaN
Total Duration of High Spell for 1956	15	14
Total Duration of High Spell for 1957	89	66
Total Duration of High Spell for 1958	140	118
Total Duration of High Spell for 1959	362	361
Total Duration of High Spell for 1960	366	347
Total Duration of High Spell for 1961	236	194
Total Duration of High Spell for 1962	NaN	NaN
Total Duration of High Spell for 1963	87	75
Total Duration of High Spell for 1964	294	278
Total Duration of High Spell for 1965	365	365
Total Duration of High Spell for 1966	365	365
Total Duration of High Spell for 1967	196	163
Total Duration of High Spell for 1968	113	75
Total Duration of High Spell for 1969	221	181
Total Duration of High Spell for 1970	319	304
Total Duration of High Spell for 1971	114	93
Total Duration of High Spell for 1972	295	272
Total Duration of High Spell for 1973	253	238
Total Duration of High Spell for 1974	67	62
Total Duration of High Spell for 1975	52	42
Total Duration of High Spell for 1976	NaN	NaN
Total Duration of High Spell for 1977	74	41
Total Duration of High Spell for 1978	218	194
Total Duration of High Spell for 1979	125	66
Total Duration of High Spell for 1980	168	129

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Total Duration of High Spell for 1981	13	9
Total Duration of High Spell for 1982	149	138
Total Duration of High Spell for 1983	311	288
Total Duration of High Spell for 1984	300	271
Total Duration of High Spell for 1985	124	115
Total Duration of High Spell for 1986	149	118
Total Duration of High Spell for 1987	284	257
Total Duration of High Spell for 1988	218	184
Total Duration of High Spell for 1989	6	NaN
Total Duration of High Spell for 1990	NaN	NaN
Total Duration of High Spell for 1991	234	214
Total Duration of High Spell for 1992	131	105
Total Duration of High Spell for 1993	95	79
Total Duration of High Spell for 1994	86	52
Total Duration of High Spell for 1995	53	41
Total Duration of High Spell for 1996	82	62
Total Duration of High Spell for 1997	128	89
Total Duration of High Spell for 1998	249	206
Total Duration of High Spell for 1999	NaN	NaN
Total Duration of High Spell for 2000	NaN	NaN
Total Duration of High Spell for 2001	NaN	NaN
Total Duration of High Spell for 2002	NaN	NaN
Total Duration of High Spell for 2003	139	123
Total Duration of High Spell for 2004	116	106
Total Duration of High Spell for 2005	180	146
Total Duration of High Spell for 2006	80	70
Total Duration of High Spell for 2007	NaN	NaN
Total Duration of High Spell for 2008	23	17
Total Duration of High Spell for 2009	39	28
Total Duration of High Spell for 2010	37	32
Total of periods Between High Spells for 1933	123	129
Total of periods Between High Spells for 1934	7	NaN
Total of periods Between High Spells for 1935	NaN	NaN
Total of periods Between High Spells for 1936	175	191
Total of periods Between High Spells for 1937	87	101
Total of periods Between High Spells for 1938	205	227
Total of periods Between High Spells for 1939	NaN	NaN
Total of periods Between High Spells for 1940	129	150
Total of periods Between High Spells for 1941	153	44
Total of periods Between High Spells for 1942	NaN	NaN
Total of periods Between High Spells for 1943	NaN	NaN
Total of periods Between High Spells for 1944	82	92
Total of periods Between High Spells for 1945	248	264
Total of periods Between High Spells for 1946	81	88
Total of periods Between High Spells for 1947	132	144
Total of periods Between High Spells for 1948	NaN	NaN
Total of periods Between High Spells for 1949	NaN	33
Total of periods Between High Spells for 1950	204	223
Total of periods Between High Spells for 1951	296	310
Total of periods Between High Spells for 1952	NaN	NaN
Total of periods Between High Spells for 1953	98	105
Total of periods Between High Spells for 1954	NaN	10

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Total of periods Between High Spells for 1955	NaN	NaN
Total of periods Between High Spells for 1956	NaN	NaN
Total of periods Between High Spells for 1957	48	66
Total of periods Between High Spells for 1958	47	64
Total of periods Between High Spells for 1959	NaN	NaN
Total of periods Between High Spells for 1960	NaN	19
Total of periods Between High Spells for 1961	61	93
Total of periods Between High Spells for 1962	NaN	NaN
Total of periods Between High Spells for 1963	161	170
Total duration of Falls for 1984	58	74
Total of periods Between High Spells for 1965	NaN	NaN
Total of periods Between High Spells for 1966	NaN	NaN
Total of periods Between High Spells for 1967	86	108
Total of periods Between High Spells for 1968	2	19
Total of periods Between High Spells for 1969	96	136
Total of periods Between High Spells for 1970	NaN	NaN
Total of periods Between High Spells for 1971	24	45
Total of periods Between High Spells for 1972	71	12
Total of periods Between High Spells for 1973	27	NaN
Total of periods Between High Spells for 1974	NaN	NaN
Total of periods Between High Spells for 1975	143	149
Total of periods Between High Spells for 1976	NaN	NaN
Total of periods Between High Spells for 1977	4	33
Total of periods Between High Spells for 1978	36	52
Total of periods Between High Spells for 1979	202	248
Total of periods Between High Spells for 1980	58	84
Total of periods Between High Spells for 1981	NaN	NaN
Total of periods Between High Spells for 1982	48	52
Total of periods Between High Spells for 1983	11	32
Total of periods Between High Spells for 1984	17	17
Total of periods Between High Spells for 1985	NaN	NaN
Total of periods Between High Spells for 1986	209	141
Total of periods Between High Spells for 1987	NaN	17
Total of periods Between High Spells for 1988	90	106
Total of periods Between High Spells for 1989	NaN	NaN
Total of periods Between High Spells for 1990	NaN	NaN
Total of periods Between High Spells for 1991	5	19
Total of periods Between High Spells for 1992	91	103
Total of periods Between High Spells for 1993	NaN	5
Total of periods Between High Spells for 1994	197	227
Total of periods Between High Spells for 1995	103	112
Total of periods Between High Spells for 1996	204	218
Total of periods Between High Spells for 1997	237	158
Total of periods Between High Spells for 1998	64	103
Total of periods Between High Spells for 1999	NaN	NaN
Total of periods Between High Spells for 2000	NaN	NaN
Total of periods Between High Spells for 2001	NaN	NaN
Total of periods Between High Spells for 2002	NaN	NaN
Total of periods Between High Spells for 2003	75	87
Total of periods Between High Spells for 2004	NaN	10
Total of periods Between High Spells for 2005	185	219
Total of periods Between High Spells for 2006	NaN	3

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Total of periods Between High Spells for 2007	NaN	NaN
Total of periods Between High Spells for 2008	161	NaN
Total of periods Between High Spells for 2009	62	38
Total of periods Between High Spells for 2010	NaN	2
Mean period Between High Spells for 1933	61.5	64.5
Mean period Between High Spells for 1934	7	NaN
Mean period Between High Spells for 1935	NaN	NaN
Mean period Between High Spells for 1936	175	95.5
Mean period Between High Spells for 1937	29	25.25
Mean period Between High Spells for 1938	51.25	113.5
Mean period Between High Spells for 1939	NaN	NaN
Mean period Between High Spells for 1940	43	50
Mean period Between High Spells for 1941	38.25	44
Mean period Between High Spells for 1942	NaN	NaN
Mean period Between High Spells for 1943	NaN	NaN
Mean period Between High Spells for 1944	41	46
Mean period Between High Spells for 1945	124	132
Mean period Between High Spells for 1946	81	88
Mean period Between High Spells for 1947	66	48
Mean period Between High Spells for 1948	NaN	NaN
Mean period Between High Spells for 1949	NaN	11
Mean period Between High Spells for 1950	102	111.5
Mean period Between High Spells for 1951	296	310
Mean period Between High Spells for 1952	NaN	NaN
Mean period Between High Spells for 1953	98	105
Mean period Between High Spells for 1954	NaN	10
Mean period Between High Spells for 1955	NaN	NaN
Mean period Between High Spells for 1956	NaN	NaN
Mean period Between High Spells for 1957	24	33
Mean period Between High Spells for 1958	23.5	32
Mean period Between High Spells for 1959	NaN	NaN
Mean period Between High Spells for 1960	NaN	19
Mean period Between High Spells for 1961	30.5	46.5
Mean period Between High Spells for 1962	NaN	NaN
Mean period Between High Spells for 1963	80.5	85
Mean period Between High Spells for 1964	29	37
Mean period Between High Spells for 1965	NaN	NaN
Mean period Between High Spells for 1966	NaN	NaN
Mean period Between High Spells for 1967	86	54
Mean period Between High Spells for 1968	2	19
Mean period Between High Spells for 1969	96	22.667
Mean period Between High Spells for 1970	NaN	NaN
Mean period Between High Spells for 1971	24	22.5
Mean period Between High Spells for 1972	35.5	3
Mean period Between High Spells for 1973	27	NaN
Mean period Between High Spells for 1974	NaN	NaN
Mean period Between High Spells for 1975	143	149
Mean period Between High Spells for 1976	NaN	NaN
Mean period Between High Spells for 1977	4	16.5
Mean period Between High Spells for 1978	9	17.333
Mean period Between High Spells for 1979	28.857	82.667
Mean period Between High Spells for 1980	29	21

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Mean period Between High Spells for 1981	NaN	NaN
Mean period Between High Spells for 1982	48	52
Mean period Between High Spells for 1983	11	16
Mean period Between High Spells for 1984	17	17
Mean period Between High Spells for 1985	NaN	NaN
Mean period Between High Spells for 1986	104.5	141
Mean period Between High Spells for 1987	NaN	17
Mean period Between High Spells for 1988	15	21.2
Mean period Between High Spells for 1989	NaN	NaN
Mean period Between High Spells for 1990	NaN	NaN
Mean period Between High Spells for 1991	2.5	9.5
Mean period Between High Spells for 1992	30.333	25.75
Mean period Between High Spells for 1993	NaN	5
Mean period Between High Spells for 1994	65.667	113.5
Mean period Between High Spells for 1995	51.5	56
Mean period Between High Spells for 1996	68	54.5
Mean period Between High Spells for 1997	47.4	39.5
Mean period Between High Spells for 1998	21.333	34.333
Mean period Between High Spells for 1999	NaN	NaN
Mean period Between High Spells for 2000	NaN	NaN
Mean period Between High Spells for 2001	NaN	NaN
Mean period Between High Spells for 2002	NaN	NaN
Mean period Between High Spells for 2003	37.5	43.5
Mean period Between High Spells for 2004	NaN	10
Mean period Between High Spells for 2005	46.25	73
Mean period Between High Spells for 2006	NaN	3
Mean period Between High Spells for 2007	NaN	NaN
Mean period Between High Spells for 2008	161	NaN
Mean period Between High Spells for 2009	15.5	12.667
Mean period Between High Spells for 2010	NaN	2
Longest period Between High Spells for 1933	118	121
Longest period Between High Spells for 1934	7	NaN
Longest period Between High Spells for 1935	NaN	NaN
Longest period Between High Spells for 1936	175	183
Longest period Between High Spells for 1937	69	78
Longest period Between High Spells for 1938	155	168
Longest period Between High Spells for 1939	NaN	NaN
Longest period Between High Spells for 1940	83	129
Longest period Between High Spells for 1941	100	44
Longest period Between High Spells for 1942	NaN	NaN
Longest period Between High Spells for 1943	NaN	NaN
Longest period Between High Spells for 1944	74	76
Longest period Between High Spells for 1945	168	177
Longest period Between High Spells for 1946	81	88
Longest period Between High Spells for 1947	105	108
Longest period Between High Spells for 1948	NaN	NaN
Longest period Between High Spells for 1949	NaN	26
Longest period Between High Spells for 1950	175	192
Longest period Between High Spells for 1951	296	310
Longest period Between High Spells for 1952	NaN	NaN
Longest period Between High Spells for 1953	98	105
Longest period Between High Spells for 1954	NaN	10

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Longest period Between High Spells for 1955	NaN	NaN
Longest period Between High Spells for 1956	NaN	NaN
Longest period Between High Spells for 1957	32	36
Longest period Between High Spells for 1958	41	51
Longest period Between High Spells for 1959	NaN	NaN
Longest period Between High Spells for 1960	NaN	19
Longest period Between High Spells for 1961	56	82
Longest period Between High Spells for 1962	NaN	NaN
Longest period Between High Spells for 1963	145	151
Longest period Between High Spells for 1964	53	59
Longest period Between High Spells for 1965	NaN	NaN
Longest period Between High Spells for 1966	NaN	NaN
Longest period Between High Spells for 1967	86	106
Longest period Between High Spells for 1968	2	19
Longest period Between High Spells for 1969	96	107
Longest period Between High Spells for 1970	NaN	NaN
Longest period Between High Spells for 1971	24	40
Longest period Between High Spells for 1972	69	5
Longest period Between High Spells for 1973	27	NaN
Longest period Between High Spells for 1974	NaN	NaN
Longest period Between High Spells for 1975	143	149
Longest period Between High Spells for 1976	NaN	NaN
Longest period Between High Spells for 1977	4	23
Longest period Between High Spells for 1978	23	33
Longest period Between High Spells for 1979	99	184
Longest period Between High Spells for 1980	51	58
Longest period Between High Spells for 1981	NaN	NaN
Longest period Between High Spells for 1982	48	52
Longest period Between High Spells for 1983	11	26
Longest period Between High Spells for 1984	17	17
Longest period Between High Spells for 1985	NaN	NaN
Longest period Between High Spells for 1986	131	141
Longest period Between High Spells for 1987	NaN	17
Longest period Between High Spells for 1988	46	74
Longest period Between High Spells for 1989	NaN	NaN
Longest period Between High Spells for 1990	NaN	NaN
Longest period Between High Spells for 1991	3	16
Longest period Between High Spells for 1992	64	67
Longest period Between High Spells for 1993	NaN	5
Longest period Between High Spells for 1994	150	212
Longest period Between High Spells for 1995	93	98
Longest period Between High Spells for 1996	83	86
Longest period Between High Spells for 1997	115	117
Longest period Between High Spells for 1998	32	50
Longest period Between High Spells for 1999	NaN	NaN
Longest period Between High Spells for 2000	NaN	NaN
Longest period Between High Spells for 2001	NaN	NaN
Longest period Between High Spells for 2002	NaN	NaN
Longest period Between High Spells for 2003	53	60
Longest period Between High Spells for 2004	NaN	10
Longest period Between High Spells for 2005	73	120
Longest period Between High Spells for 2006	NaN	3

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Longest period Between High Spells for 2007	NaN	NaN
Longest period Between High Spells for 2008	161	NaN
Longest period Between High Spells for 2009	28	29
Longest period Between High Spells for 2010	NaN	2
Total (Sum) Raw Values for 1933	139040	112989.3
Total (Sum) Raw Values for 1934	299420	250992.2
Total (Sum) Raw Values for 1935	277330	224934.9
Total (Sum) Raw Values for 1936	159360	122118.3
Total (Sum) Raw Values for 1937	500440	377448.5
Total (Sum) Raw Values for 1938	245990	177243.3
Total (Sum) Raw Values for 1939	191110	150501.9
Total (Sum) Raw Values for 1940	122980	76427.4
Total (Sum) Raw Values for 1941	411460	329500.9
Total (Sum) Raw Values for 1942	726970	622825.3
Total (Sum) Raw Values for 1943	17900	12536.4
Total (Sum) Raw Values for 1944	434870	362534.6
Total (Sum) Raw Values for 1945	223810	181098.2
Total (Sum) Raw Values for 1946	586850	509274
Total (Sum) Raw Values for 1947	537250	439482.9
Total (Sum) Raw Values for 1948	1041940	917458.4
Total (Sum) Raw Values for 1949	706970	601515.3
Total (Sum) Raw Values for 1950	402320	332110
Total (Sum) Raw Values for 1951	58150	32345.4
Total (Sum) Raw Values for 1952	54260	43672.8
Total (Sum) Raw Values for 1953	419980	363579.4
Total (Sum) Raw Values for 1954	198780	155896.3
Total (Sum) Raw Values for 1955	0	0
Total (Sum) Raw Values for 1956	27560	24291.6
Total (Sum) Raw Values for 1957	168950	123365.5
Total (Sum) Raw Values for 1958	262390	214290.6
Total (Sum) Raw Values for 1959	970590	855838.8
Total (Sum) Raw Values for 1960	847250	731614.3
Total (Sum) Raw Values for 1961	440970	348155.9
Total (Sum) Raw Values for 1962	0	0
Total (Sum) Raw Values for 1963	151640	124787.4
Total (Sum) Raw Values for 1964	800690	690803.1
Total (Sum) Raw Values for 1965	928690	824271.5
Total (Sum) Raw Values for 1966	979760	863270.4
Total (Sum) Raw Values for 1967	373570	297501.9
Total (Sum) Raw Values for 1968	245190	167328.6
Total (Sum) Raw Values for 1969	404050	318695.7
Total (Sum) Raw Values for 1970	832500	710231
Total (Sum) Raw Values for 1971	224910	175461
Total (Sum) Raw Values for 1972	632050	540053.7
Total (Sum) Raw Values for 1973	551320	480317
Total (Sum) Raw Values for 1974	140990	122696.1
Total (Sum) Raw Values for 1975	89940	70056.9
Total (Sum) Raw Values for 1976	0	0
Total (Sum) Raw Values for 1977	120520	67006.5
Total (Sum) Raw Values for 1978	457900	382335.6
Total (Sum) Raw Values for 1979	210920	115510.5
Total (Sum) Raw Values for 1980	327810	246002.8

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Total (Sum) Raw Values for 1981	20670	13810.5
Total (Sum) Raw Values for 1982	283880	247827
Total (Sum) Raw Values for 1983	626470	539946.9
Total (Sum) Raw Values for 1984	669920	562810.4
Total (Sum) Raw Values for 1985	296860	254133.4
Total (Sum) Raw Values for 1986	286470	222829.5
Total (Sum) Raw Values for 1987	659730	547917.2
Total (Sum) Raw Values for 1988	508550	405893.4
Total (Sum) Raw Values for 1989	8630	0
Total (Sum) Raw Values for 1990	0	0
Total (Sum) Raw Values for 1991	490880	421454.4
Total (Sum) Raw Values for 1992	309040	241127.7
Total (Sum) Raw Values for 1993	166640	133157.4
Total (Sum) Raw Values for 1994	151280	94240.2
Total (Sum) Raw Values for 1995	88220	65825.4
Total (Sum) Raw Values for 1996	152480	112569.8
Total (Sum) Raw Values for 1997	241090	168495.4
Total (Sum) Raw Values for 1998	758100	603903.2
Total (Sum) Raw Values for 1999	0	0
Total (Sum) Raw Values for 2000	0	0
Total (Sum) Raw Values for 2001	0	0
Total (Sum) Raw Values for 2002	0	0
Total (Sum) Raw Values for 2003	296650	247669.3
Total (Sum) Raw Values for 2004	385600	318660.4
Total (Sum) Raw Values for 2005	365430	289599.7
Total (Sum) Raw Values for 2006	148700	124573.5
Total (Sum) Raw Values for 2007	0	0
Total (Sum) Raw Values for 2008	48140	35257.1
Total (Sum) Raw Values for 2009	79920	56898.7
Total (Sum) Raw Values for 2010	62910	51587.1
Mean Raw Values for 1933	46346.667	37663.1
Mean Raw Values for 1934	149710	250992.2
Mean Raw Values for 1935	277330	224934.9
Mean Raw Values for 1936	79680	40706.1
Mean Raw Values for 1937	125110	75489.7
Mean Raw Values for 1938	49198	59081.1
Mean Raw Values for 1939	191110	150501.9
Mean Raw Values for 1940	30745	19106.85
Mean Raw Values for 1941	82292	164750.45
Mean Raw Values for 1942	726970	622825.3
Mean Raw Values for 1943	17900	12536.4
Mean Raw Values for 1944	144956.667	120844.867
Mean Raw Values for 1945	74603.333	60366.067
Mean Raw Values for 1946	293425	254637
Mean Raw Values for 1947	179083.333	109870.725
Mean Raw Values for 1948	1041940	917458.4
Mean Raw Values for 1949	706970	150378.825
Mean Raw Values for 1950	134106.667	110703.333
Mean Raw Values for 1951	29075	16172.7
Mean Raw Values for 1952	54260	43672.8
Mean Raw Values for 1953	209990	181789.7
Mean Raw Values for 1954	198780	77948.15

Name	Santa Fe - Ft. White 1933-2010	Santa Fe - Ft. White 1933-2010 REDUCED
Mean Raw Values for 1955	NaN	NaN
Mean Raw Values for 1956	27560	24291.6
Mean Raw Values for 1957	56316.667	41121.833
Mean Raw Values for 1958	87463.333	71430.2
Mean Raw Values for 1959	970590	855838.8
Mean Raw Values for 1960	847250	365807.15
Mean Raw Values for 1961	146990	116051.967
Mean Raw Values for 1962	NaN	NaN
Mean Raw Values for 1963	50546.667	41595.8
Mean Raw Values for 1964	266896.667	230267.7
Mean Raw Values for 1965	928690	824271.5
Mean Raw Values for 1966	979760	863270.4
Mean Raw Values for 1967	186785	99167.3
Mean Raw Values for 1968	122595	83664.3
Mean Raw Values for 1969	202025	45527.957
Mean Raw Values for 1970	832500	710231
Mean Raw Values for 1971	112455	58487
Mean Raw Values for 1972	210683.333	108010.74
Mean Raw Values for 1973	275660	480317
Mean Raw Values for 1974	140990	122696.1
Mean Raw Values for 1975	44970	35028.45
Mean Raw Values for 1976	NaN	NaN
Mean Raw Values for 1977	60260	22335.5
Mean Raw Values for 1978	91580	95583.9
Mean Raw Values for 1979	26365	28877.625
Mean Raw Values for 1980	109270	49200.56
Mean Raw Values for 1981	20670	13810.5
Mean Raw Values for 1982	141940	123913.5
Mean Raw Values for 1983	313235	179982.3
Mean Raw Values for 1984	334960	281405.2
Mean Raw Values for 1985	296860	254133.4
Mean Raw Values for 1986	95490	111414.75
Mean Raw Values for 1987	659730	273958.6
Mean Raw Values for 1988	72650	67648.9
Mean Raw Values for 1989	8630	NaN
Mean Raw Values for 1990	NaN	NaN
Mean Raw Values for 1991	163626.667	140484.8
Mean Raw Values for 1992	77260	48225.54
Mean Raw Values for 1993	166640	66578.7
Mean Raw Values for 1994	37820	31413.4
Mean Raw Values for 1995	29406.667	21941.8
Mean Raw Values for 1996	38120	22513.96
Mean Raw Values for 1997	40181.667	33699.08
Mean Raw Values for 1998	189525	150975.8
Mean Raw Values for 1999	NaN	NaN
Mean Raw Values for 2000	NaN	NaN
Mean Raw Values for 2001	NaN	NaN
Mean Raw Values for 2002	NaN	NaN
Mean Raw Values for 2003	98883.333	82556.433
Mean Raw Values for 2004	385600	159330.2
Mean Raw Values for 2005	73086	72399.925
Mean Raw Values for 2006	148700	62286.75

Name	Santa Fe - Ft. White 1933- 2010	Santa Fe - Ft. White 1933- 2010 REDUCED
Mean Raw Values for 2007	NaN	NaN
Mean Raw Values for 2008	24070	35257.1
Mean Raw Values for 2009	15984	14224.675
Mean Raw Values for 2010	62910	25793.55

Name	Ichetucknee - Dampiers 2002-2010	Ichetucknee - Dampiers 2002- 2010 REDUCED
Reporting Period Summary		
Start based on User	1/1/2002	1/1/2002
End Date	12/31/2010	12/31/2010
General Statistics		
Whole Period		
Minimum	138	132.48
Maximum	609	584.64
Percentile 10	211	202.56
Percentile 90	430	412.8
Mean	313.379	300.844
Median	304	291.84
CV	0.256	0.256
Standard Deviation	80.103	76.899
Skewness	1.031	1.031
Variability	-0.72	-0.72
Zeros	0	0
Total	1030076.281	988873.23
S_Log	0.112	0.112
Lanes	0.113	0.113
Less or equal 294	1513	1667
Greater or equal 294	1794	1620
Summary for each year		
Minimum for 2002	189	181.44
Minimum for 2003	138	132.48
Minimum for 2004	209	200.64
Minimum for 2005	215	206.4
Minimum for 2006	344	330.24
Minimum for 2007	275	264
Minimum for 2008	243	233.28
Minimum for 2009	152	145.92
Minimum for 2010	205	196.8
Maximum for 2002	236.997	227.517
Maximum for 2003	399	383.04
Maximum for 2004	448	430.08
Maximum for 2005	609	584.64
Maximum for 2006	439	421.44
Maximum for 2007	366	351.36
Maximum for 2008	389	373.44
Maximum for 2009	318	305.28
Maximum for 2010	335	321.6
Percentile 10 for 2002	195	187.2
Percentile 10 for 2003	190.6	182.976
Percentile 10 for 2004	241.5	231.84
Percentile 10 for 2005	418	401.28
Percentile 10 for 2006	353	338.88
Percentile 10 for 2007	281	269.76
Percentile 10 for 2008	254	243.84
Percentile 10 for 2009	228	218.88
Percentile 10 for 2010	249	239.04
Percentile 90 for 2002	220	211.2
Percentile 90 for 2003	375	360
Percentile 90 for 2004	404.5	388.32
Percentile 90 for 2005	509	488.64
Percentile 90 for 2006	427.6	410.496
Percentile 90 for 2007	355	340.8
Percentile 90 for 2008	300	288

Name	Ichetucknee - Dampiers 2002-2010	Ichetucknee - Dampiers 2002- 2010 REDUCED
Percentile 90 for 2009	294	282.24
Percentile 90 for 2010	321	308.16
Mean for 2002	206.207	197.959
Mean for 2003	308.742	296.393
Mean for 2004	323.664	310.717
Mean for 2005	453.247	435.117
Mean for 2006	384.704	369.316
Mean for 2007	316.392	303.736
Mean for 2008	274.779	263.788
Mean for 2009	258.416	248.08
Mean for 2010	294.336	282.563
Median for 2002	203	194.88
Median for 2003	343	329.28
Median for 2004	329	315.84
Median for 2005	452	433.92
Median for 2006	367	352.32
Median for 2007	308	295.68
Median for 2008	271	260.16
Median for 2009	257	246.72
Median for 2010	304	291.84
Zeros for 2002	0	0
Zeros for 2003	0	0
Zeros for 2004	0	0
Zeros for 2005	0	0
Zeros for 2006	0	0
Zeros for 2007	0	0
Zeros for 2008	0	0
Zeros for 2009	0	0
Zeros for 2010	0	0
Total for 2002	75265.54	72254.918
Total for 2003	112691	108183.36
Total for 2004	118461	113722.56
Total for 2005	165435	158817.6
Total for 2006	140417	134800.32
Total for 2007	115483	110863.68
Total for 2008	100569	96546.24
Total for 2009	94322	90549.12
Total for 2010	107432.742	103135.432
S_Log for 2002	0.018	0.018
S_Log for 2003	0.1	0.1
S_Log for 2004	0.091	0.091
S_Log for 2005	0.084	0.084
S_Log for 2006	0.029	0.029
S_Log for 2007	0.032	0.032
S_Log for 2008	0.03	0.03
S_Log for 2009	0.038	0.038
S_Log for 2010	0.044	0.044
Lanes for 2002	0.02	0.02
Lanes for 2003	0.11	0.11
Lanes for 2004	0.081	0.081
Lanes for 2005	0.074	0.074
Lanes for 2006	0.038	0.038
Lanes for 2007	0.042	0.042
Lanes for 2008	0.031	0.031
Lanes for 2009	0.039	0.039
Lanes for 2010	0.046	0.046

Name	Ichetucknee - Dampiers 2002-2010	Ichetucknee - Dampiers 2002- 2010 REDUCED
Less or equal 294 for 2002	365	365
Less or equal 294 for 2003	135	139
Less or equal 294 for 2004	77	80
Less or equal 294 for 2005	19	19
Less or equal 294 for 2006	0	0
Less or equal 294 for 2007	127	181
Less or equal 294 for 2008	309	342
Less or equal 294 for 2009	329	351
Less or equal 294 for 2010	152	190
Greater or equal 294 for 2002	0	0
Greater or equal 294 for 2003	232	226
Greater or equal 294 for 2004	289	286
Greater or equal 294 for 2005	346	346
Greater or equal 294 for 2006	365	365
Greater or equal 294 for 2007	242	184
Greater or equal 294 for 2008	61	24
Greater or equal 294 for 2009	46	14
Greater or equal 294 for 2010	213	175
Summary of interannual measures		
Mean of all years Minimum	218.889	210.133
Mean of all years Maximum	393.333	377.6
Mean of all years Percentile 10	267.789	257.077
Mean of all years Percentile 90	356.233	341.984
Mean of all years Mean	313.387	300.852
Mean of all years Median	314.889	302.293
Mean of all years Zeros	0	0
Mean of all years Total	114452.92	109874.803
Mean of all years Less or equal 294	168.111	185.222
Mean of all years Greater or equal 294	199.333	180
Median of all years Minimum	209	200.64
Median of all years Maximum	389	373.44
Median of all years Percentile 10	249	239.04
Median of all years Percentile 90	355	340.8
Median of all years Mean	308.742	296.393
Median of all years Median	308	295.68
Median of all years Zeros	0	0
Median of all years Total	112691	108183.36
Median of all years Less or equal 294	135	181
Median of all years Greater or equal 294	232	184
High Flow Spell result		
Whole Period		
High Spell Threshold	294	294
Number of High Spell	16	17
Longest High Spell	860	802
Mean of High Spell Peaks	358.505	346.678
Mean Duration of High Spell	112.062	95.176
Total Duration of High Spell	1793	1618
Total of periods Between High Spells	920	1092
Mean period Between High Spells	61.333	68.25
Longest period Between High Spells	234	278
Total (Sum) Raw Values	664090.742	587203.674
Mean Raw Values	41505.671	34541.393
Summary for each year		
High Spell Threshold for 2002	294	294
High Spell Threshold for 2003	294	294
High Spell Threshold for 2004	294	294

Name	Ichetucknee - Dampiers 2002-2010	Ichetucknee - Dampiers 2002- 2010 REDUCED
High Spell Threshold for 2005	294	294
High Spell Threshold for 2006	294	294
High Spell Threshold for 2007	294	294
High Spell Threshold for 2008	294	294
High Spell Threshold for 2009	294	294
High Spell Threshold for 2010	294	294
Number of High Spell for 2002	0	0
Number of High Spell for 2003	3	2
Number of High Spell for 2004	3	3
Number of High Spell for 2005	2	2
Number of High Spell for 2006	1	1
Number of High Spell for 2007	1	1
Number of High Spell for 2008	3	3
Number of High Spell for 2009	4	1
Number of High Spell for 2010	3	8
Longest High Spell for 2002	NaN	NaN
Longest High Spell for 2003	124	122
Longest High Spell for 2004	188	186
Longest High Spell for 2005	253	253
Longest High Spell for 2006	365	365
Longest High Spell for 2007	242	184
Longest High Spell for 2008	39	13
Longest High Spell for 2009	27	14
Longest High Spell for 2010	159	129
Mean of High Spell Peaks for 2002	NaN	NaN
Mean of High Spell Peaks for 2003	358.667	375.36
Mean of High Spell Peaks for 2004	391.333	375.68
Mean of High Spell Peaks for 2005	528	506.88
Mean of High Spell Peaks for 2006	439	421.44
Mean of High Spell Peaks for 2007	366	351.36
Mean of High Spell Peaks for 2008	341.667	332.48
Mean of High Spell Peaks for 2009	302	305.28
Mean of High Spell Peaks for 2010	328.029	306.85
Mean Duration of High Spell for 2002	NaN	NaN
Mean Duration of High Spell for 2003	77.333	113
Mean Duration of High Spell for 2004	96.333	95.333
Mean Duration of High Spell for 2005	173	173
Mean Duration of High Spell for 2006	365	365
Mean Duration of High Spell for 2007	242	184
Mean Duration of High Spell for 2008	20.333	8
Mean Duration of High Spell for 2009	11.5	14
Mean Duration of High Spell for 2010	70.667	21.625
Total Duration of High Spell for 2002	NaN	NaN
Total Duration of High Spell for 2003	232	226
Total Duration of High Spell for 2004	289	286
Total Duration of High Spell for 2005	346	346
Total Duration of High Spell for 2006	365	365
Total Duration of High Spell for 2007	242	184
Total Duration of High Spell for 2008	61	24
Total Duration of High Spell for 2009	46	14
Total Duration of High Spell for 2010	212	173
Total of periods Between High Spells for 2002	NaN	NaN
Total of periods Between High Spells for 2003	11	16
Total of periods Between High Spells for 2004	77	80
Total of periods Between High Spells for 2005	19	19
Total of periods Between High Spells for 2006	NaN	NaN

Name	Ichetucknee - Dampiers 2002-2010	Ichetucknee - Dampiers 2002- 2010 REDUCED
Total of periods Between High Spells for 2007	NaN	NaN
Total of periods Between High Spells for 2008	114	130
Total of periods Between High Spells for 2009	34	NaN
Total of periods Between High Spells for 2010	4	41
Mean period Between High Spells for 2002	NaN	NaN
Mean period Between High Spells for 2003	5.5	16
Mean period Between High Spells for 2004	38.5	40
Mean period Between High Spells for 2005	19	19
Mean period Between High Spells for 2006	NaN	NaN
Mean period Between High Spells for 2007	NaN	NaN
Mean period Between High Spells for 2008	57	65
Mean period Between High Spells for 2009	11.333	NaN
Mean period Between High Spells for 2010	2	5.857
Longest period Between High Spells for 2002	NaN	NaN
Longest period Between High Spells for 2003	8	16
Longest period Between High Spells for 2004	58	60
Longest period Between High Spells for 2005	19	19
Longest period Between High Spells for 2006	NaN	NaN
Longest period Between High Spells for 2007	NaN	NaN
Longest period Between High Spells for 2008	112	122
Longest period Between High Spells for 2009	24	NaN
Longest period Between High Spells for 2010	2	15
Total (Sum) Raw Values for 2002	0	0
Total (Sum) Raw Values for 2003	82645	77624.64
Total (Sum) Raw Values for 2004	99899	95036.16
Total (Sum) Raw Values for 2005	160910	154473.6
Total (Sum) Raw Values for 2006	140417	134800.32
Total (Sum) Raw Values for 2007	80477	60578.88
Total (Sum) Raw Values for 2008	19092	7695.36
Total (Sum) Raw Values for 2009	13862	4188.48
Total (Sum) Raw Values for 2010	66788.742	52806.234
Mean Raw Values for 2002	NaN	NaN
Mean Raw Values for 2003	27548.333	38812.32
Mean Raw Values for 2004	33299.667	31678.72
Mean Raw Values for 2005	80455	77236.8
Mean Raw Values for 2006	140417	134800.32
Mean Raw Values for 2007	80477	60578.88
Mean Raw Values for 2008	6364	2565.12
Mean Raw Values for 2009	3465.5	4188.48
Mean Raw Values for 2010	22262.914	6600.779
Summary of interannual measures		
Mean of all years High Spell Threshold	294	294
Mean of all years Number of High Spell	2.222	2.333
Mean of all years Longest High Spell	NaN	NaN
Mean of all years Mean of High Spell Peaks	NaN	NaN
Mean of all years Mean Duration of High Spell	NaN	NaN
Mean of all years Total Duration of High Spell	NaN	NaN
Mean of all years Total of periods Between High Spells	NaN	NaN
Mean of all years Mean period Between High Spells	NaN	NaN
Mean of all years Longest period Between High Spells	NaN	NaN
Mean of all years Total (Sum) Raw Values	73787.86	65244.853
Mean of all years Mean Raw Values	NaN	NaN
Median of all years High Spell Threshold	294	294
Median of all years Number of High Spell	3	2
Median of all years Longest High Spell	NaN	NaN
Median of all years Mean of High Spell Peaks	341.667	332.48

Name	Ichetucknee - Dampiers 2002-2010	Ichetucknee - Dampiers 2002- 2010 REDUCED
Median of all years Mean Duration of High Spell	77.333	95.333
Median of all years Total Duration of High Spell	232	184
Median of all years Total of periods Between High Spells	NaN	NaN
Median of all years Mean period Between High Spells	NaN	NaN
Median of all years Longest period Between High Spells	NaN	NaN
Median of all years Total (Sum) Raw Values	80477	60578.88
Median of all years Mean Raw Values	27548.333	31678.72

Name	Ichetucknee - Hwy27 2002- 2010	Ichetucknee - Hwy27 2002- 2010 REDUCED
Reporting Period Summary		
Start based on User	1/1/2002	1/1/2002
End Date	12/31/2010	12/31/2010
General Statistics		
Whole Period		
Minimum	124	119.04
Maximum	554	531.84
Percentile 10	197	189.12
Percentile 90	420	403.2
Mean	299.288	287.317
Median	286	274.56
Zeros	0	0
Total	983761.111	944410.667
Less or equal 328	2235	2390
Greater or equal 328	1063	897
Summary for each year		
Minimum for 2002	181	173.76
Minimum for 2003	124	119.04
Minimum for 2004	137	131.52
Minimum for 2005	141	135.36
Minimum for 2006	310	297.6
Minimum for 2007	241	231.36
Minimum for 2008	200	192
Minimum for 2009	142	136.32
Minimum for 2010	185	177.6
Maximum for 2002	219	210.24
Maximum for 2003	439	421.44
Maximum for 2004	475	456
Maximum for 2005	554	531.84
Maximum for 2006	444	426.24
Maximum for 2007	363	348.48
Maximum for 2008	381	365.76
Maximum for 2009	297	285.12
Maximum for 2010	341	327.36
Percentile 10 for 2002	184	176.64
Percentile 10 for 2003	177.2	170.112
Percentile 10 for 2004	183.5	176.16
Percentile 10 for 2005	383.4	368.064
Percentile 10 for 2006	316	303.36
Percentile 10 for 2007	252.4	242.304
Percentile 10 for 2008	232	222.72
Percentile 10 for 2009	243	233.28
Percentile 10 for 2010	250	240
Percentile 90 for 2002	206	197.76
Percentile 90 for 2003	370.6	355.776
Percentile 90 for 2004	438	420.48
Percentile 90 for 2005	525	504
Percentile 90 for 2006	425	408
Percentile 90 for 2007	357	342.72
Percentile 90 for 2008	279	267.84
Percentile 90 for 2009	272.6	261.696
Percentile 90 for 2010	314	301.44
Mean for 2002	195.055	187.253
Mean for 2003	290.518	278.897

Name	Ichetucknee - Hwy27 2002- Ichetucknee - Hwy27 2002-	
	2010	2010 REDUCED
Mean for 2004	305.115	292.91
Mean for 2005	439.427	421.85
Mean for 2006	365.997	351.357
Mean for 2007	300.77	288.739
Mean for 2008	250.74	240.711
Mean for 2009	253.603	243.459
Mean for 2010	292.488	280.788
Median for 2002	195	187.2
Median for 2003	324	311.04
Median for 2004	302	289.92
Median for 2005	440	422.4
Median for 2006	356	341.76
Median for 2007	290	278.4
Median for 2008	244	234.24
Median for 2009	254	243.84
Median for 2010	303	290.88
Zeros for 2002	0	0
Zeros for 2003	0	0
Zeros for 2004	0	0
Zeros for 2005	0	0
Zeros for 2006	0	0
Zeros for 2007	0	0
Zeros for 2008	0	0
Zeros for 2009	0	0
Zeros for 2010	0	0
Total for 2002	71195.111	68347.307
Total for 2003	106039	101797.44
Total for 2004	111672	107205.12
Total for 2005	160391	153975.36
Total for 2006	133589	128245.44
Total for 2007	109781	105389.76
Total for 2008	91771	88100.16
Total for 2009	92565	88862.4
Total for 2010	106758	102487.68
Less or equal 328 for 2002	365	365
Less or equal 328 for 2003	204	272
Less or equal 328 for 2004	256	300
Less or equal 328 for 2005	25	26
Less or equal 328 for 2006	72	92
Less or equal 328 for 2007	234	245
Less or equal 328 for 2008	358	360
Less or equal 328 for 2009	365	365
Less or equal 328 for 2010	356	365
Greater or equal 328 for 2002	0	0
Greater or equal 328 for 2003	163	93
Greater or equal 328 for 2004	117	66
Greater or equal 328 for 2005	340	339
Greater or equal 328 for 2006	294	273
Greater or equal 328 for 2007	131	120
Greater or equal 328 for 2008	8	6
Greater or equal 328 for 2009	0	0
Greater or equal 328 for 2010	10	0
Summary of interannual measures		
Mean of all years Minimum	184.556	177.173

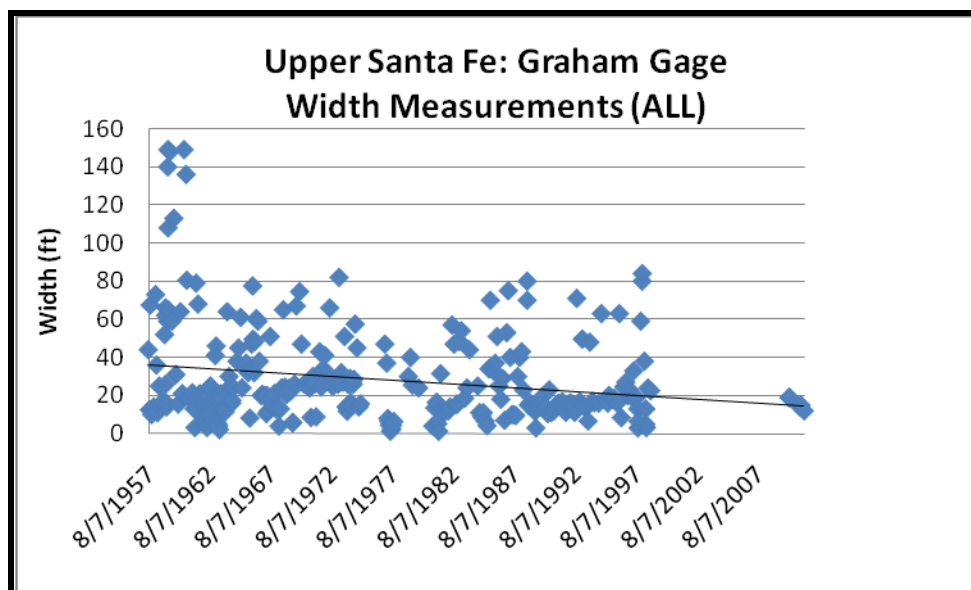
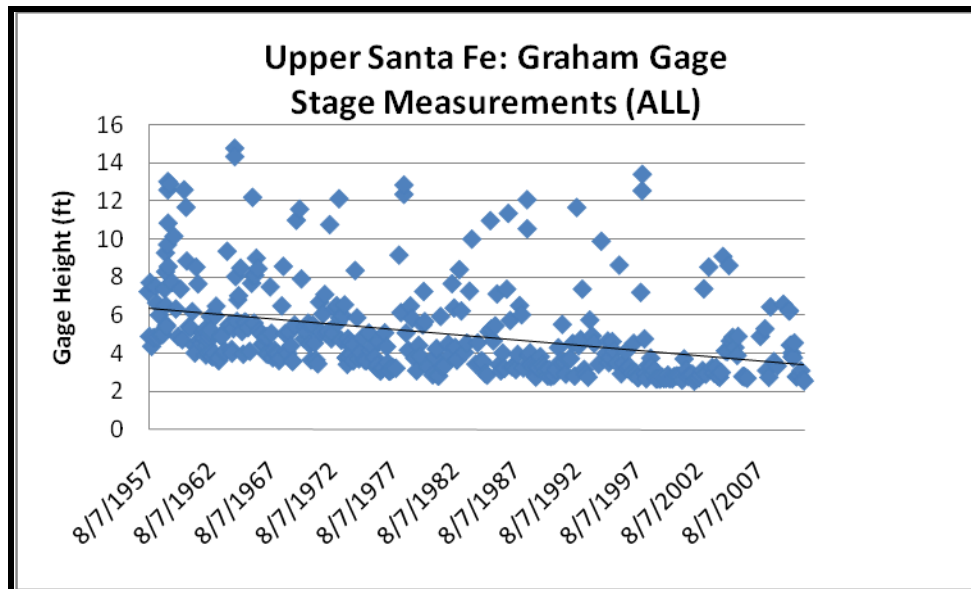
Name	Ichetucknee - Hwy27 2002- Ichetucknee - Hwy27 2002-	
	2010	2010 REDUCED
Mean of all years Maximum	390.333	374.72
Mean of all years Percentile 10	246.833	236.96
Mean of all years Percentile 90	354.133	339.968
Mean of all years Mean	299.301	287.329
Mean of all years Median	300.889	288.853
Mean of all years Zeros	0	0
Mean of all years Total	109306.79	104934.519
Mean of all years Less or equal 328	248.333	265.556
Mean of all years Greater or equal 328	118.111	99.667
Median of all years Minimum	181	173.76
Median of all years Maximum	381	365.76
Median of all years Percentile 10	243	233.28
Median of all years Percentile 90	357	342.72
Median of all years Mean	292.488	280.788
Median of all years Median	302	289.92
Median of all years Zeros	0	0
Median of all years Total	106758	102487.68
Median of all years Less or equal 328	256	300
Median of all years Greater or equal 328	117	66
High Flow Spell result		
Whole Period		
High Spell Threshold	328	328
Number of High Spell	17	15
Longest High Spell	540	526
Mean of High Spell Peaks	386.118	381.824
Mean Duration of High Spell	62.529	59.8
Total Duration of High Spell	1063	897
Total of periods Between High Spells	1511	1052
Mean period Between High Spells	94.438	75.143
Longest period Between High Spells	545	484
Total (Sum) Raw Values	421141	351158.4
Mean Raw Values	24773	23410.56
Summary for each year		
High Spell Threshold for 2002	328	328
High Spell Threshold for 2003	328	328
High Spell Threshold for 2004	328	328
High Spell Threshold for 2005	328	328
High Spell Threshold for 2006	328	328
High Spell Threshold for 2007	328	328
High Spell Threshold for 2008	328	328
High Spell Threshold for 2009	328	328
High Spell Threshold for 2010	328	328
Number of High Spell for 2002	0	0
Number of High Spell for 2003	5	7
Number of High Spell for 2004	6	4
Number of High Spell for 2005	2	2
Number of High Spell for 2006	3	1
Number of High Spell for 2007	1	2
Number of High Spell for 2008	1	1
Number of High Spell for 2009	0	0
Number of High Spell for 2010	3	0
Longest High Spell for 2002	NaN	NaN
Longest High Spell for 2003	51	27
Longest High Spell for 2004	46	45

Name	Ichetucknee - Hwy27 2002- Ichetucknee - Hwy27 2002-	
	2010	2010 REDUCED
Longest High Spell for 2005	254	253
Longest High Spell for 2006	286	273
Longest High Spell for 2007	131	119
Longest High Spell for 2008	8	6
Longest High Spell for 2009	NaN	NaN
Longest High Spell for 2010	7	NaN
Mean of High Spell Peaks for 2002	NaN	NaN
Mean of High Spell Peaks for 2003	384.8	364.251
Mean of High Spell Peaks for 2004	387	397.68
Mean of High Spell Peaks for 2005	519.5	498.72
Mean of High Spell Peaks for 2006	371	426.24
Mean of High Spell Peaks for 2007	363	339.84
Mean of High Spell Peaks for 2008	381	365.76
Mean of High Spell Peaks for 2009	NaN	NaN
Mean of High Spell Peaks for 2010	337	NaN
Mean Duration of High Spell for 2002	NaN	NaN
Mean Duration of High Spell for 2003	32.6	13.286
Mean Duration of High Spell for 2004	19.5	16.5
Mean Duration of High Spell for 2005	170	169.5
Mean Duration of High Spell for 2006	98	273
Mean Duration of High Spell for 2007	131	60
Mean Duration of High Spell for 2008	8	6
Mean Duration of High Spell for 2009	NaN	NaN
Mean Duration of High Spell for 2010	3.333	NaN
Total Duration of High Spell for 2002	NaN	NaN
Total Duration of High Spell for 2003	163	93
Total Duration of High Spell for 2004	117	66
Total Duration of High Spell for 2005	340	339
Total Duration of High Spell for 2006	294	273
Total Duration of High Spell for 2007	131	120
Total Duration of High Spell for 2008	8	6
Total Duration of High Spell for 2009	NaN	NaN
Total Duration of High Spell for 2010	10	NaN
Total of periods Between High Spells for 2002	NaN	NaN
Total of periods Between High Spells for 2003	78	69
Total of periods Between High Spells for 2004	249	228
Total of periods Between High Spells for 2005	25	26
Total of periods Between High Spells for 2006	71	NaN
Total of periods Between High Spells for 2007	NaN	3
Total of periods Between High Spells for 2008	NaN	NaN
Total of periods Between High Spells for 2009	NaN	NaN
Total of periods Between High Spells for 2010	68	NaN
Mean period Between High Spells for 2002	NaN	NaN
Mean period Between High Spells for 2003	19.5	11.5
Mean period Between High Spells for 2004	49.8	76
Mean period Between High Spells for 2005	25	26
Mean period Between High Spells for 2006	35.5	NaN
Mean period Between High Spells for 2007	NaN	3
Mean period Between High Spells for 2008	NaN	NaN
Mean period Between High Spells for 2009	NaN	NaN
Mean period Between High Spells for 2010	34	NaN
Longest period Between High Spells for 2002	NaN	NaN
Longest period Between High Spells for 2003	37	32
Longest period Between High Spells for 2004	141	168

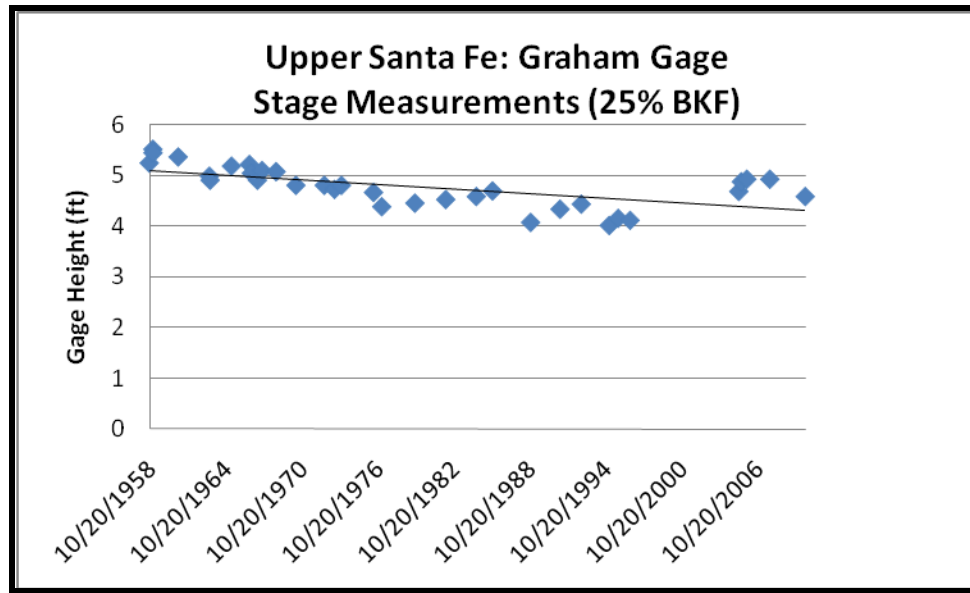
Name	Ichetucknee - Hwy27 2002- Ichetucknee - Hwy27 2002-	
	2010	2010 REDUCED
Longest period Between High Spells for 2005	25	26
Longest period Between High Spells for 2006	69	NaN
Longest period Between High Spells for 2007	NaN	3
Longest period Between High Spells for 2008	NaN	NaN
Longest period Between High Spells for 2009	NaN	NaN
Longest period Between High Spells for 2010	54	NaN
Total (Sum) Raw Values for 2002	0	0
Total (Sum) Raw Values for 2003	57609	32884.8
Total (Sum) Raw Values for 2004	44761	26697.6
Total (Sum) Raw Values for 2005	155353	148818.24
Total (Sum) Raw Values for 2006	111094	99923.52
Total (Sum) Raw Values for 2007	46128	40735.68
Total (Sum) Raw Values for 2008	2860	2098.56
Total (Sum) Raw Values for 2009	0	0
Total (Sum) Raw Values for 2010	3336	0
Mean Raw Values for 2002	NaN	NaN
Mean Raw Values for 2003	11521.8	4697.829
Mean Raw Values for 2004	7460.167	6674.4
Mean Raw Values for 2005	77676.5	74409.12
Mean Raw Values for 2006	37031.333	99923.52
Mean Raw Values for 2007	46128	20367.84
Mean Raw Values for 2008	2860	2098.56
Mean Raw Values for 2009	NaN	NaN
Mean Raw Values for 2010	1112	NaN
Summary of interannual measures		
Mean of all years High Spell Threshold	328	328
Mean of all years Number of High Spell	2.333	1.889
Mean of all years Longest High Spell	NaN	NaN
Mean of all years Mean of High Spell Peaks	NaN	NaN
Mean of all years Mean Duration of High Spell	NaN	NaN
Mean of all years Total Duration of High Spell	NaN	NaN
Mean of all years Total of periods Between High Spells	NaN	NaN
Mean of all years Mean period Between High Spells	NaN	NaN
Mean of all years Longest period Between High Spells	NaN	NaN
Mean of all years Total (Sum) Raw Values	46793.444	39017.6
Mean of all years Mean Raw Values	NaN	NaN
Median of all years High Spell Threshold	328	328
Median of all years Number of High Spell	2	1
Median of all years Longest High Spell	8	NaN
Median of all years Mean of High Spell Peaks	363	364.251
Median of all years Mean Duration of High Spell	8	NaN
Median of all years Total Duration of High Spell	117	NaN
Median of all years Total of periods Between High Spells	68	NaN
Median of all years Mean period Between High Spells	19.5	NaN
Median of all years Longest period Between High Spells	37	NaN
Median of all years Total (Sum) Raw Values	44761	26697.6
Median of all years Mean Raw Values	2860	NaN

APPENDIX F

UPPER SANTA FE: GRAHAM GAGE



Stage (25% BANKFULL +/- 20%)



Linear Regression

Data source: Graham - 25% BANKFULL in Analysis

Date = 2488916.202 - (9364.761 * Stage)

N = 33

R = 0.624 Rsqr = 0.389 Adj Rsqr = 0.369

Standard Error of Estimate = 4686.135

	Coefficient	Std. Error	t	P
Constant	2488916.202	10085.552	246.780	<0.001
Stage	-9364.761	2107.712	-4.443	<0.001

Analysis of Variance:

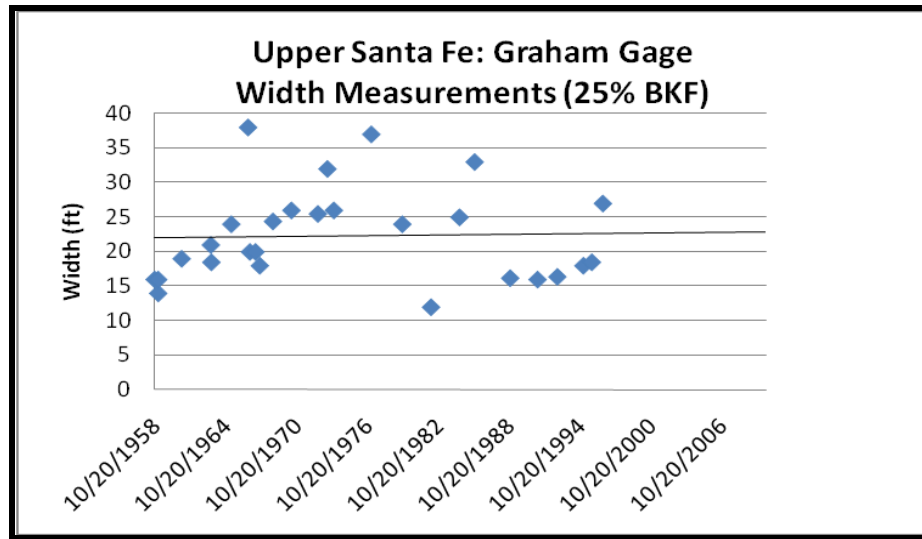
	DF	SS	MS	F	P
Regression	1	433511344.984	433511344.984	19.741	<0.001
Residual	31	680755675.985	21959860.516		
Total	32	1114267020.970		34820844.405	

Normality Test (Shapiro-Wilk) Failed (P = <0.001)

Constant Variance Test: Passed (P = 0.875)

Power of performed test with alpha = 0.050: 0.980

Width (25% BANKFULL +/- 20%)



Linear Regression

Data source: Graham - 25% BANKFULL in Analysis

Date = 2442098.753 + (16.653 * Width)

N = 27 Missing Observations = 6

R = 0.0250 Rsqr = 0.000623 Adj Rsqr = 0.000

Standard Error of Estimate = 4629.347

	Coefficient	Std. Error	t	P
Constant	2442098.753	3103.535	786.876	<0.001
Width	16.653	133.4470.125	0.902	

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	333729.860	333729.860	0.0156	0.902
Residual	25	535771453.325	21430858.133		
Total	26	536105183.185	20619430.123		

Normality Test (Shapiro-Wilk) Failed (P = 0.024)

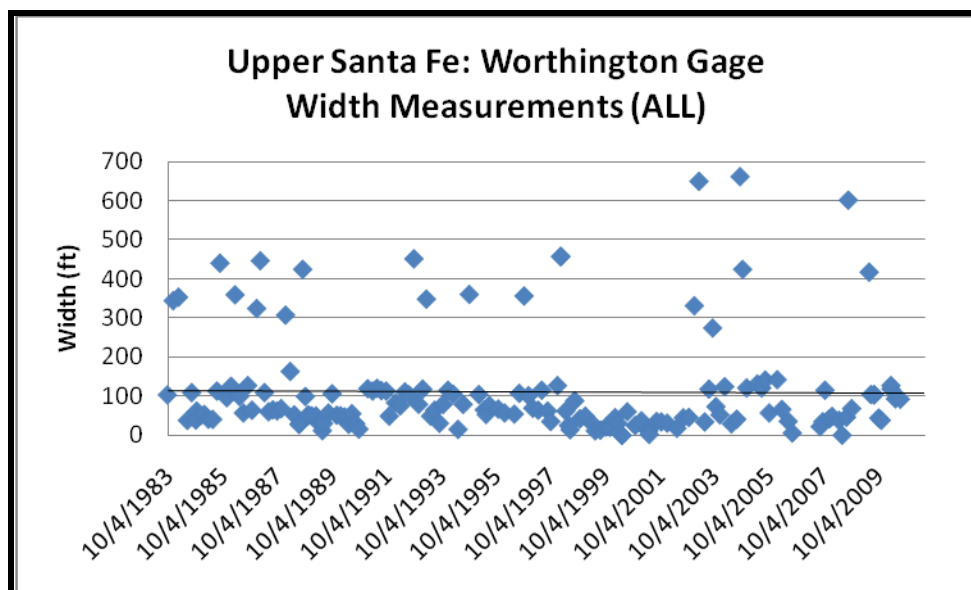
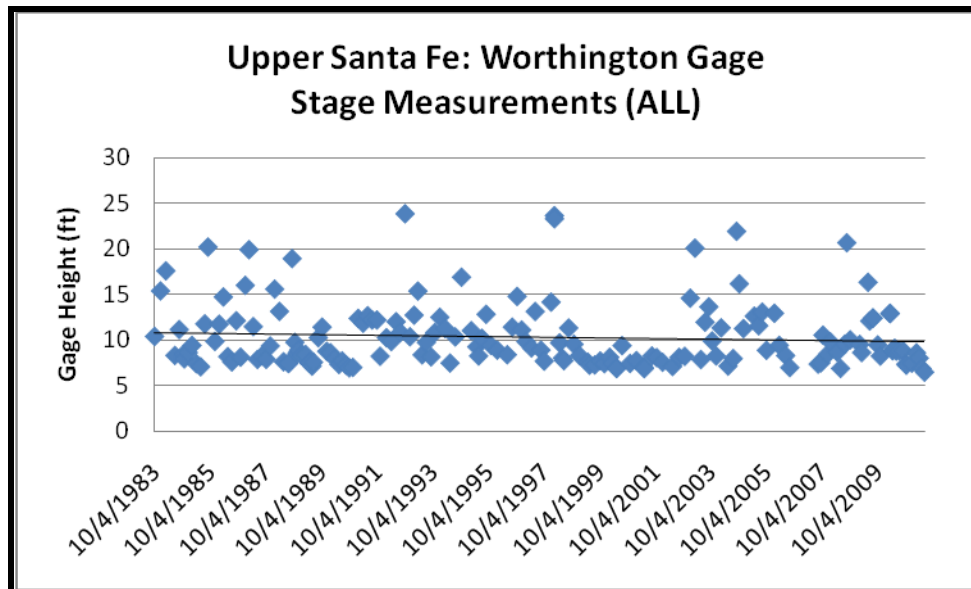
Constant Variance Test: Failed (P = 0.005)

Power of performed test with alpha = 0.050: 0.033

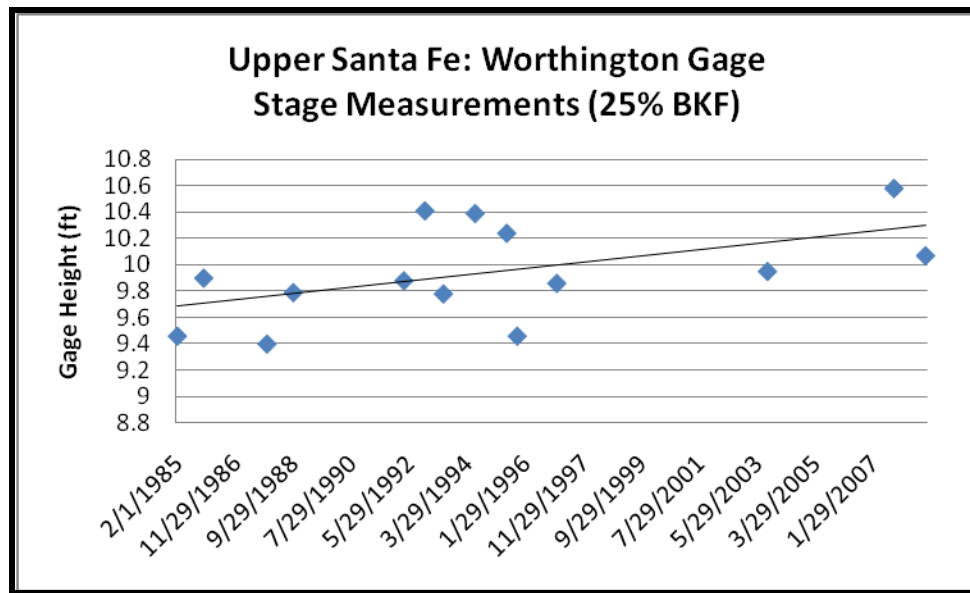
The power of the performed test (0.033) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

UPPER SANTA FE: WORTHINGTON SPRINGS GAGE



Stage (25% BANKFULL +/- 20%)



Linear Regression

Data source: Worthington - 25% BANKFULL in Analysis

Stage = -164.860 + (0.0000714 * Date)

N = 14

R = 0.528 Rsqr = 0.279 Adj Rsqr = 0.219

Standard Error of Estimate = 0.324

	Coefficient	Std. Error	t	P
Constant	-164.860	81.118	-2.032	0.065
Date	0.0000714	0.0000331	2.155	0.052

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.489	0.489	4.644	0.052
Residual	12	1.263	0.105		
Total	13	1.752	0.135		

Normality Test (Shapiro-Wilk) Passed (P = 0.643)

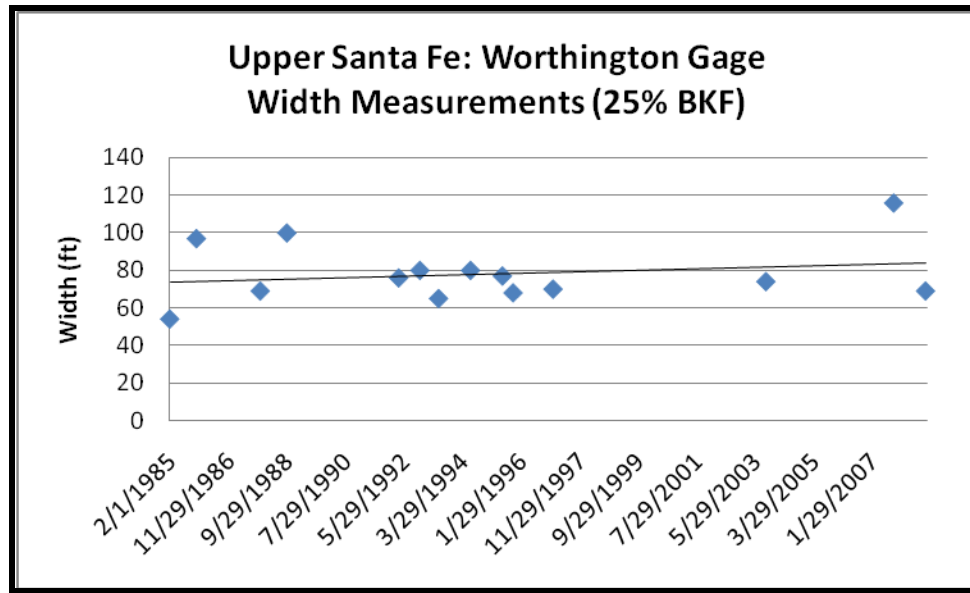
Constant Variance Test: Passed (P = 0.482)

Power of performed test with alpha = 0.050: 0.496

The power of the performed test (0.496) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Width (25% BANKFULL +/- 20%)



Linear Regression

Data source: Worthington - 25% BANKFULL in Analysis

$$\text{Width} = -2841.442 + (0.00119 * \text{Date})$$

N = 14

R = 0.201 Rsqr = 0.0402 Adj Rsqr = 0.000

Standard Error of Estimate = 16.462

	Coefficient	Std. Error	t	P
Constant	-2841.442	4115.722	-0.690	0.503
Date	0.001190	0.001680	0.709	0.492

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	136.376	136.376	0.503	0.492
Residual	12	3251.981	270.998		
Total	13	3388.357	260.643		

Normality Test (Shapiro-Wilk) Passed (P = 0.066)

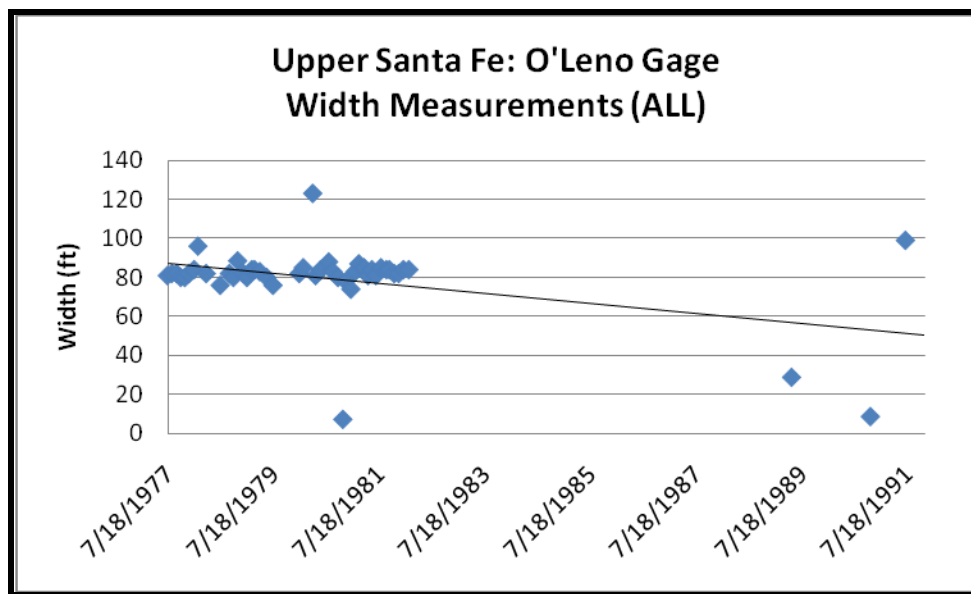
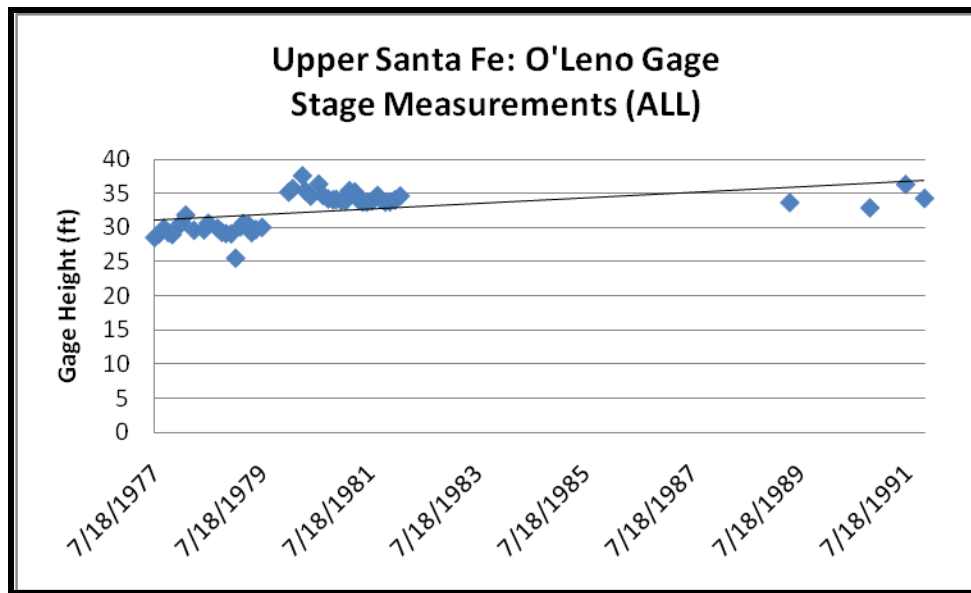
Constant Variance Test: Passed (P = 0.988)

Power of performed test with alpha = 0.050: 0.099

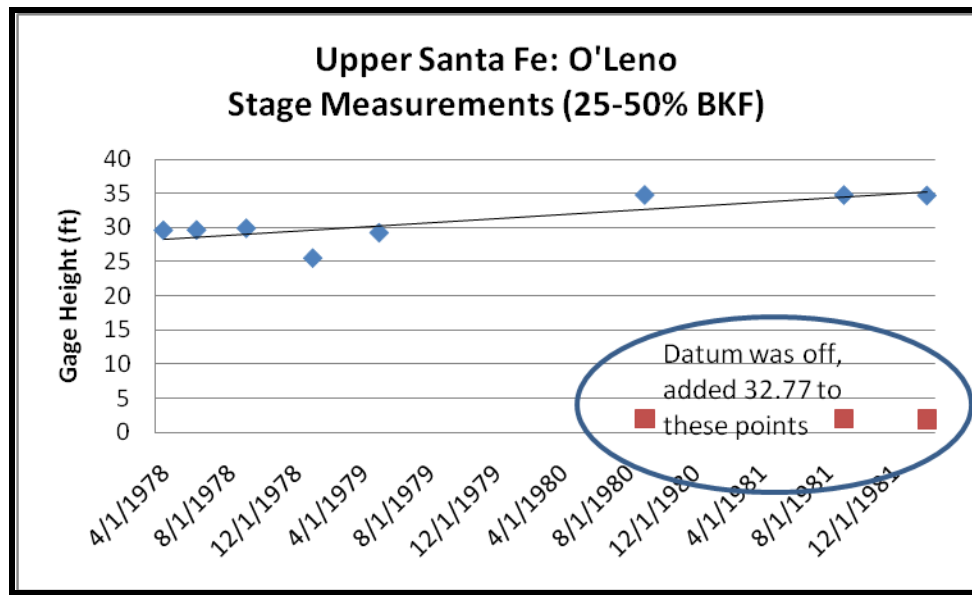
The power of the performed test (0.099) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

UPPER SANTA FE: O'LENO GAGE



Stage (25-50% BANKFULL)



Linear Regression

Data source: O'Leno 25-50% BANKFULL in Analysis

$$\text{Stage} = -12192.925 + (0.00500 * \text{Date})$$

N = 8 Missing Observations = 1

R = 0.817 Rsqr = 0.667 Adj Rsqr = 0.611

Standard Error of Estimate = 2.091

	Coefficient	Std. Error	t	P
Constant	-12192.925	3527.052	-3.457	0.014
Date	0.005000	0.001443	4.666	0.013

Analysis of Variance:

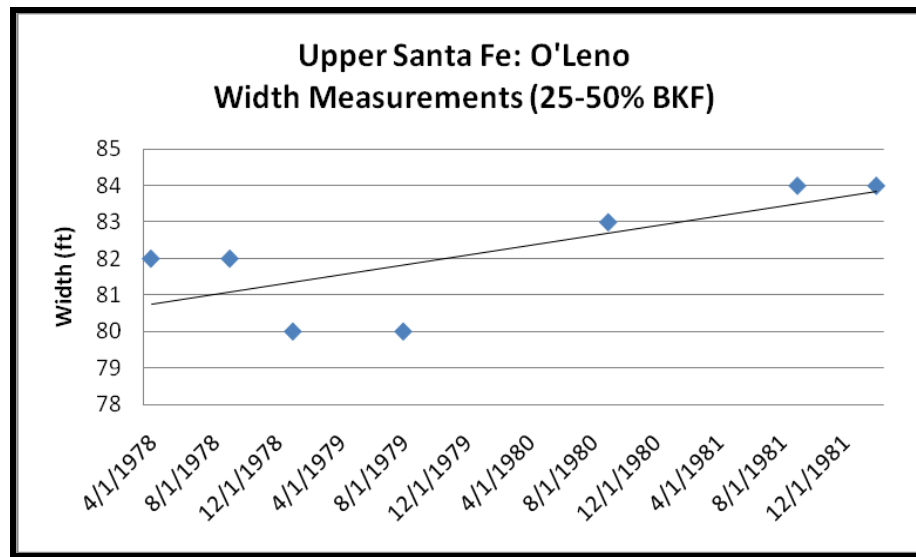
	DF	SS	MS	F	P
Regression	1	52.498	52.498	12.012	0.013
Residual	6	26.224	4.371		
Total	7	78.722	11.246		

Normality Test (Shapiro-Wilk) Passed (P = 0.192)

Constant Variance Test: Passed (P = 0.207)

Power of performed test with alpha = 0.050: 0.727

Width (25-50% BANKFULL)



Linear Regression

Data source: O'Leno 25-50% BANKFULL in Analysis

$$\text{Width} = -5343.264 + (0.00222 * \text{Date})$$

N = 7 Missing Observations = 2

R = 0.723 Rsqr = 0.523 Adj Rsqr = 0.428

Standard Error of Estimate = 1.268

	Coefficient	Std. Error	t	P
Constant	-5343.264	2315.527	-2.308	0.069
Date	0.00222000947	2.343	0.066	

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	8.822	8.822	5.490	0.066
Residual	5	8.035	1.607		
Total	6	16.857	2.810		

Normality Test (Shapiro-Wilk) Passed (P = 0.261)

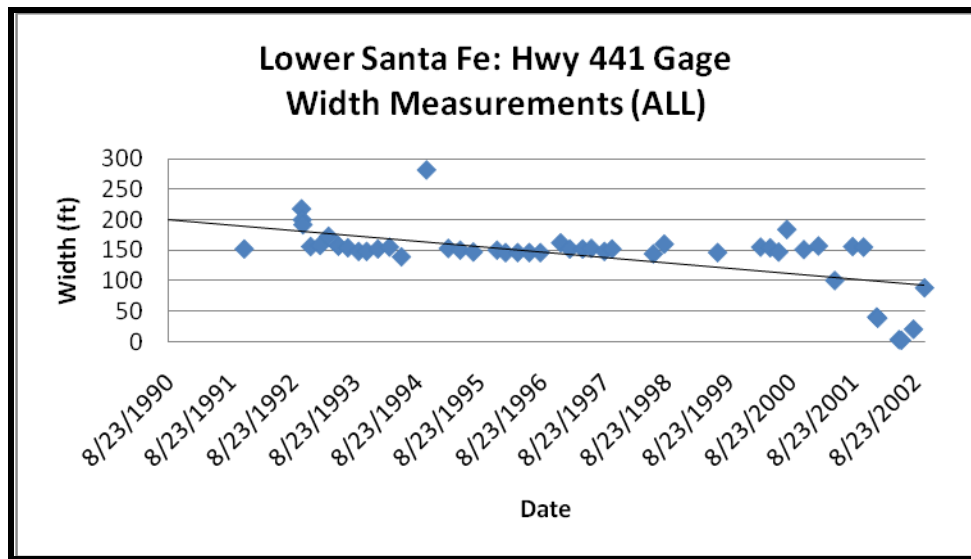
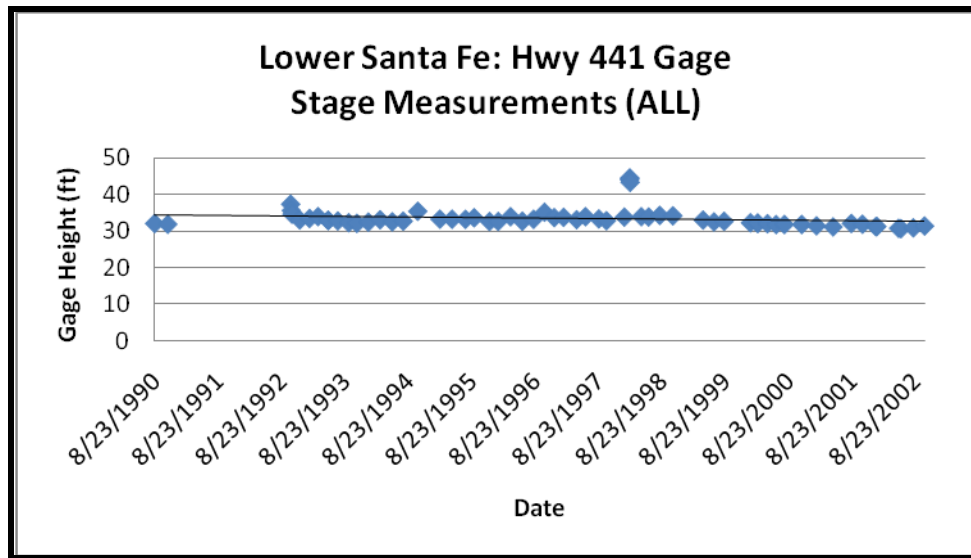
Constant Variance Test: Passed (P = 0.096)

Power of performed test with alpha = 0.050: 0.448

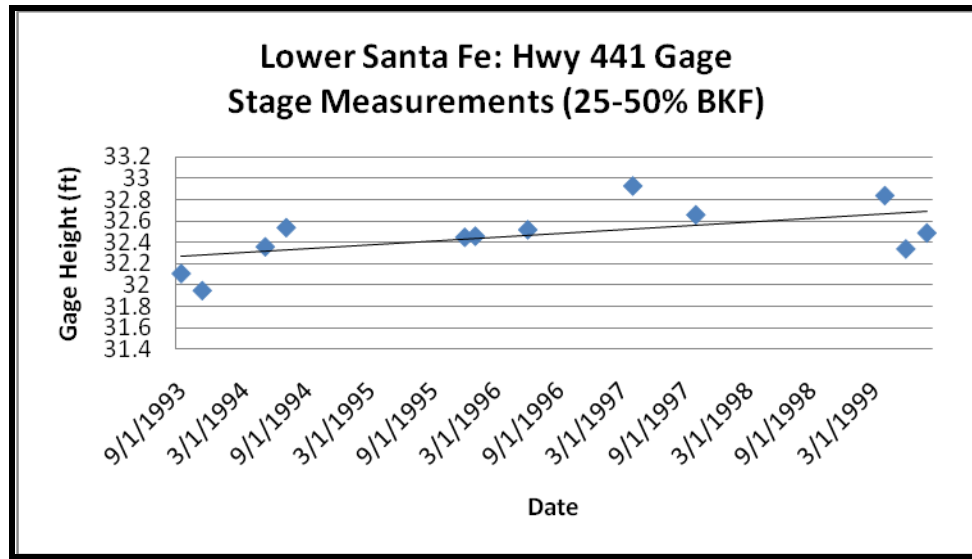
The power of the performed test (0.448) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

LOWER SANTA FE: HWY 441 GAGE



Stage (25-50% BANKFULL)



Linear Regression

Data source: 441 in Analysis

$$\text{Stage} = -457.813 + (0.000200 * \text{Date})$$

N = 12

R = 0.583 Rsqr = 0.340 Adj Rsqr = 0.274

Standard Error of Estimate = 0.233

	Coefficient	Std. Error	t	P
Constant	-457.813	215.965	-2.120	0.060
Date	0.000200	0.0000881	2.270	0.047

Analysis of Variance:

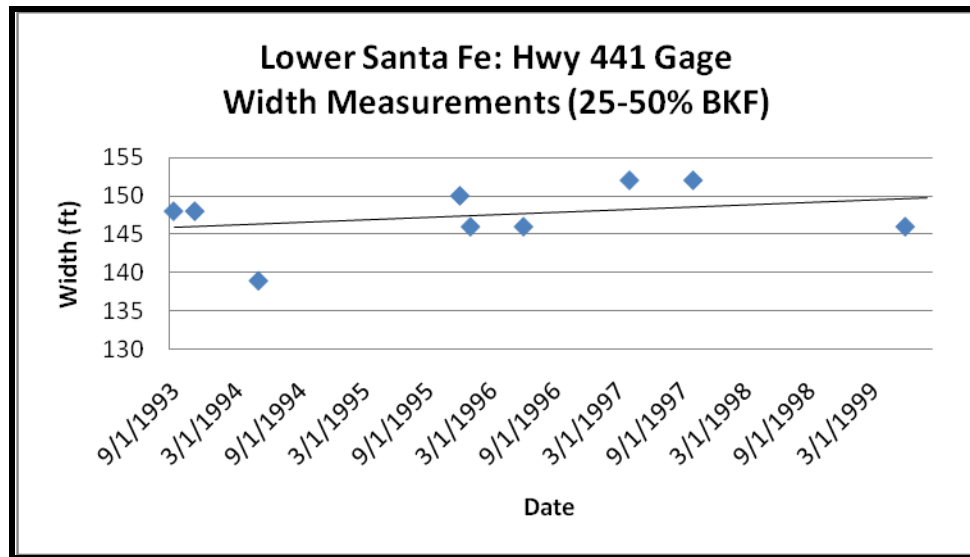
	DF	SS	MS	F	P
Regression	1	0.280	0.280	5.154	0.047
Residual	10	0.542	0.0542		
Total	11	0.822	0.0747		

Normality Test (Shapiro-Wilk) Passed (P = 0.713)

Constant Variance Test: Passed (P = 0.415)

Power of performed test with alpha = 0.050: 0.517

Width (25-50% BANKFULL)



Linear Regression

Data source: 441 in Analysis

$$\text{Width} = -4205.979 + (0.00178 * \text{Date})$$

N = 9 Missing Observations = 3

R = 0.314 Rsqr = 0.0986 Adj Rsqr = 0.000

Standard Error of Estimate = 4.032

	Coefficient	Std. Error	t	P
Constant	-4205.979	4975.165	-0.845	0.426
Date	0.001780	0.002030	0.875	0.411

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	12.445	12.445	0.766	0.411
Residual	7	113.777	16.254		
Total	8	126.222	15.778		

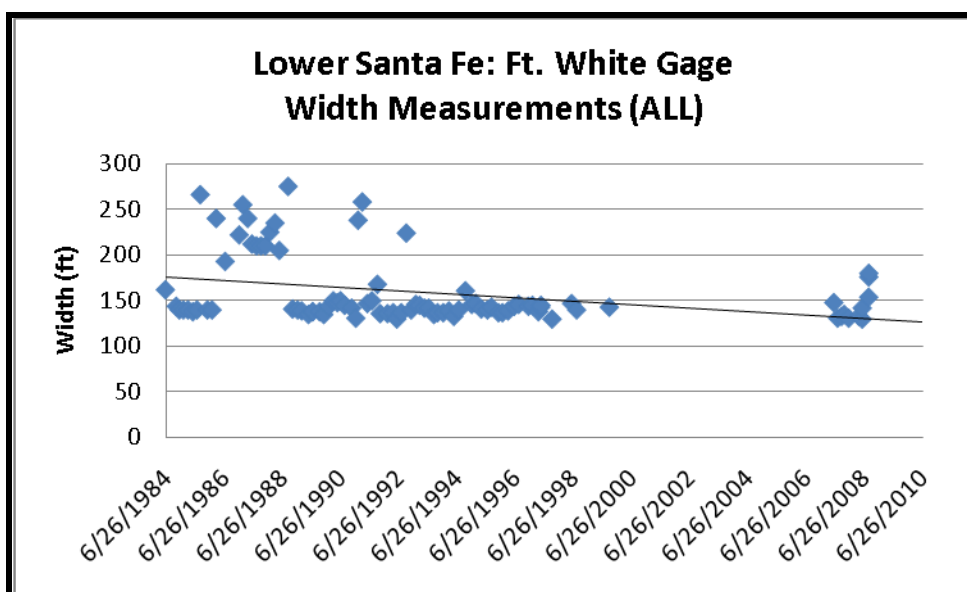
Normality Test (Shapiro-Wilk) Passed (P = 0.180)

Constant Variance Test: Passed (P = 0.462)

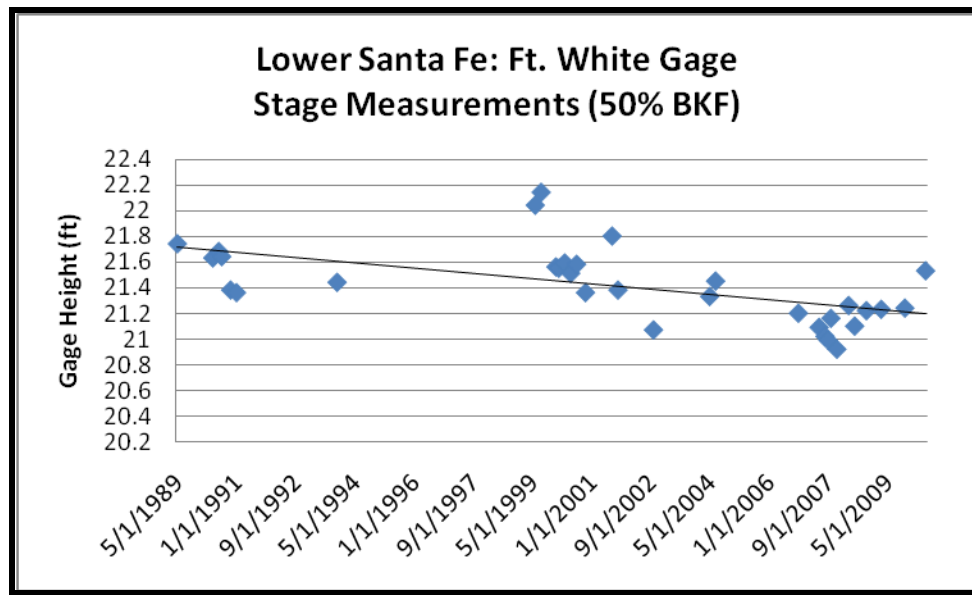
Power of performed test with alpha = 0.050: 0.122

The power of the performed test (0.122) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.



Stage (50% BANKFULL +/- 20%)



Linear Regression

Data source: Ft. White - 50% BANKFULL in Analysis

Stage = 185.808 - (0.0000670 * Date)

N = 32

R = 0.567 Rsqr = 0.321 Adj Rsqr = 0.299

Standard Error of Estimate = 0.243

	Coefficient	Std. Error	t	P
Constant	185.80843.616	4.260	<0.001	
Date	-0.0000670	0.0000178	-3.769	<0.001

Analysis of Variance:

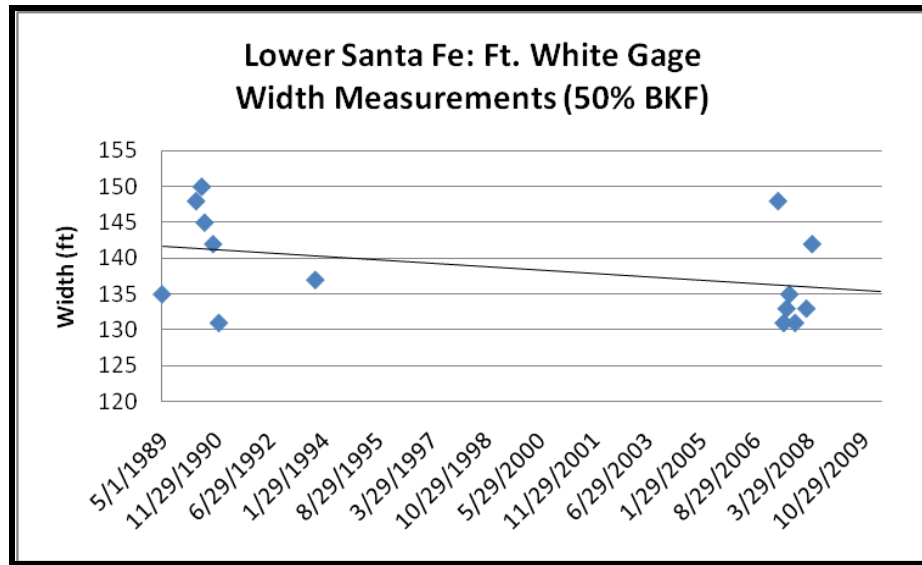
	DF	SS	MS	F	P
Regression	1	0.841	0.841	14.206	<0.001
Residual	30	1.776	0.0592		
Total	31	2.618	0.0844		

Normality Test (Shapiro-Wilk) Failed (P = 0.013)

Constant Variance Test: Passed (P = 0.801)

Power of performed test with alpha = 0.050: 0.933

Width (50% BANKFULL +/- 20%)



Linear Regression

Data source: Ft. White - 50% BANKFULL in Analysis

Width = 2186.405 - (0.000835 * Date)

N = 14 Missing Observations = 18

R = 0.386 Rsqr = 0.149 Adj Rsqr = 0.0781

Standard Error of Estimate = 6.712

	Coefficient	Std. Error	t	P
Constant	2186.405	1412.861	1.548	0.148
Date	-0.000835	0.000576	-1.449	0.173

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	94.633	94.633	2.101	0.173
Residual	12	540.582	45.048		
Total	13	635.214	48.863		

Normality Test (Shapiro-Wilk) Passed (P = 0.671)

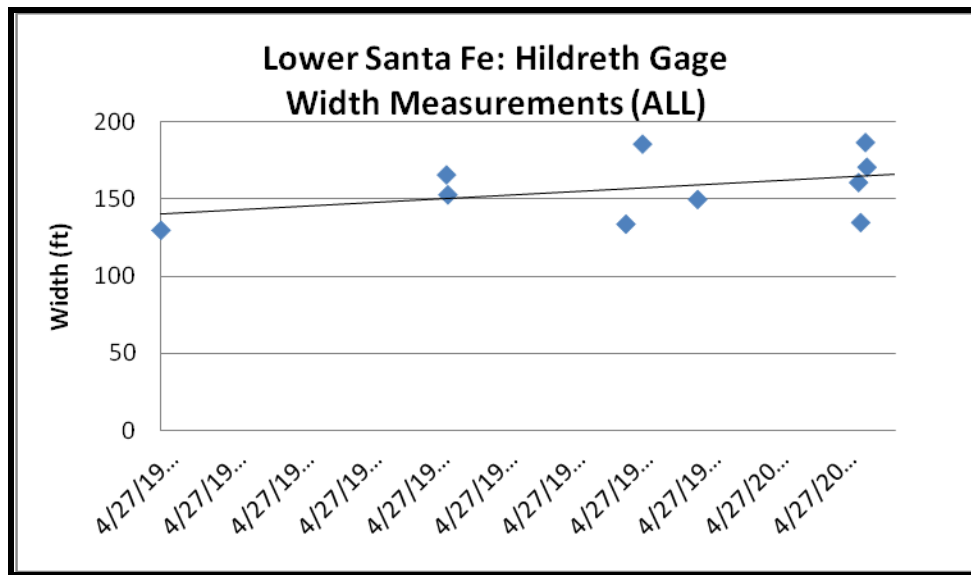
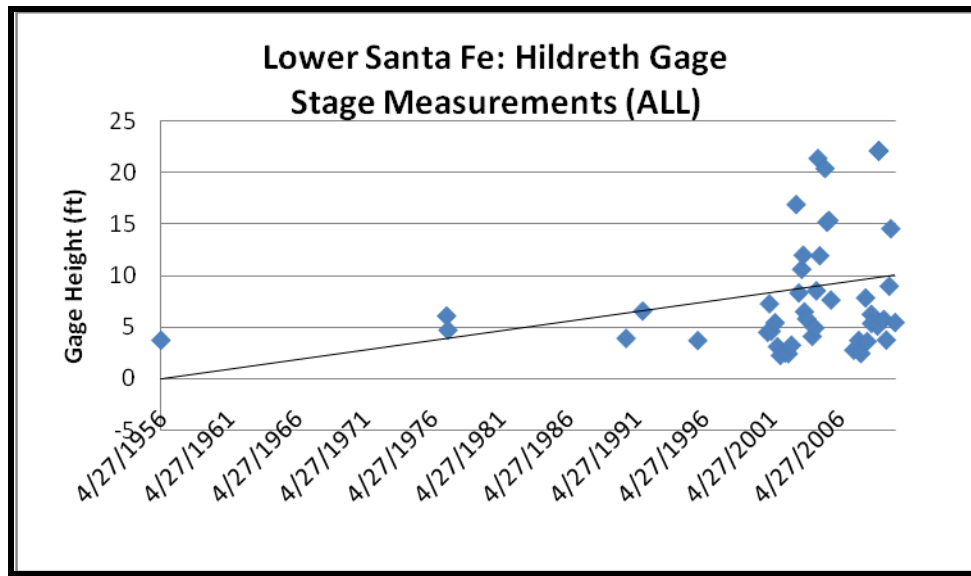
Constant Variance Test: Passed (P = 0.189)

Power of performed test with alpha = 0.050: 0.271

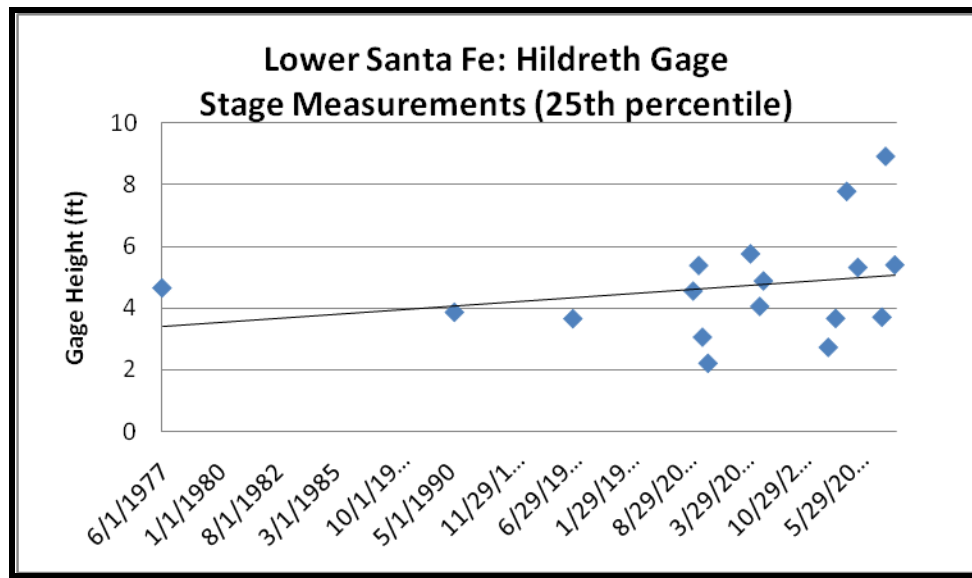
The power of the performed test (0.271) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

LOWER SANTA FE: HILDRETH GAGE



Stage (25th Percentile +/- 20%)



Linear Regression

Data source: Hildreth - 25th percentile in Analysis

Stage = -339.992 + (0.000141 * Date)

N = 17

R = 0.250 Rsqr = 0.0627 Adj Rsqr = 0.000174

Standard Error of Estimate = 1.717

	Coefficient	Std. Error	t	P
Constant	-339.992	344.191	-0.988	0.339
Date	0.000141	0.000140	1.001	0.333

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.955	2.955	1.003	0.333
Residual	15	44.202	2.947		
Total	16	47.157	2.947		

Normality Test (Shapiro-Wilk) Passed (P = 0.488)

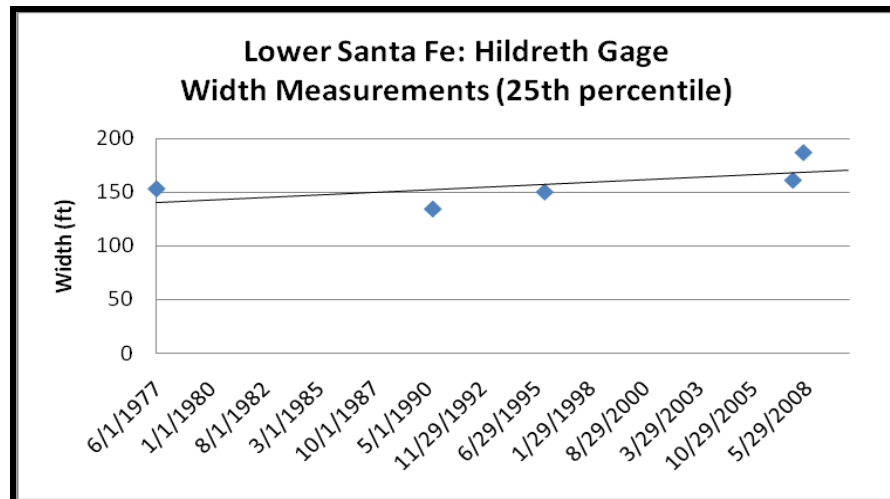
Constant Variance Test: Passed (P = 0.234)

Power of performed test with alpha = 0.050: 0.158

The power of the performed test (0.158) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Width (25th Percentile +/- 20%)



Linear Regression

Data source: Hildreth - 25th percentile in Analysis

$$\text{Width} = -6066.527 + (0.00254 * \text{Date})$$

N = 5 Missing Observations = 12

R = 0.614 Rsqr = 0.378 Adj Rsqr = 0.170

Standard Error of Estimate = 17.700

	Coefficient	Std. Error	t	P
Constant	-6066.527	4613.618	-1.315	0.280
Date	0.002540001881349	0.270		

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	570.100570	570.100	1.820	0.270
Residual	3	939.900313	313.300		
Total	4	1510.000	377.500		

Normality Test (Shapiro-Wilk) Passed (P = 0.445)

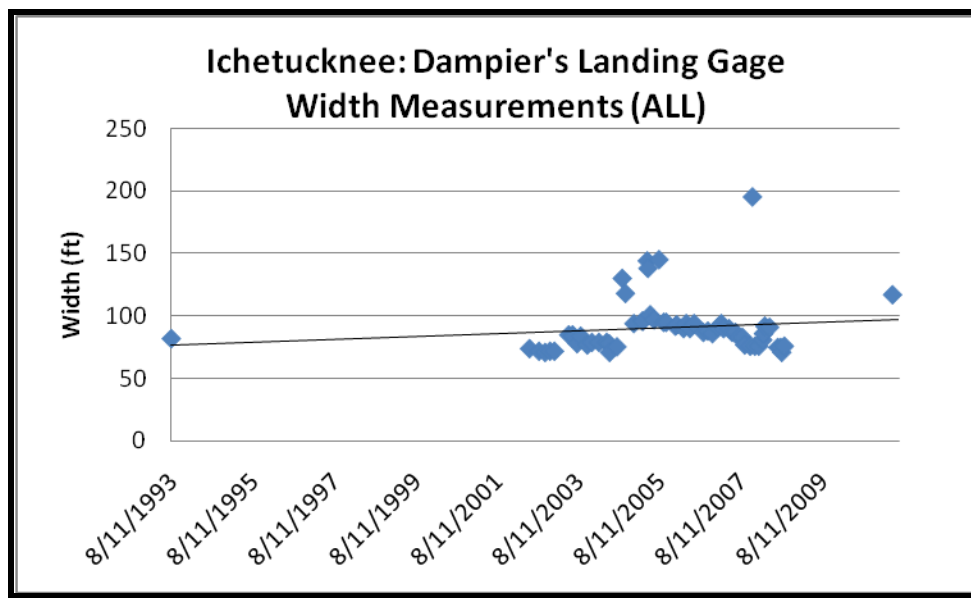
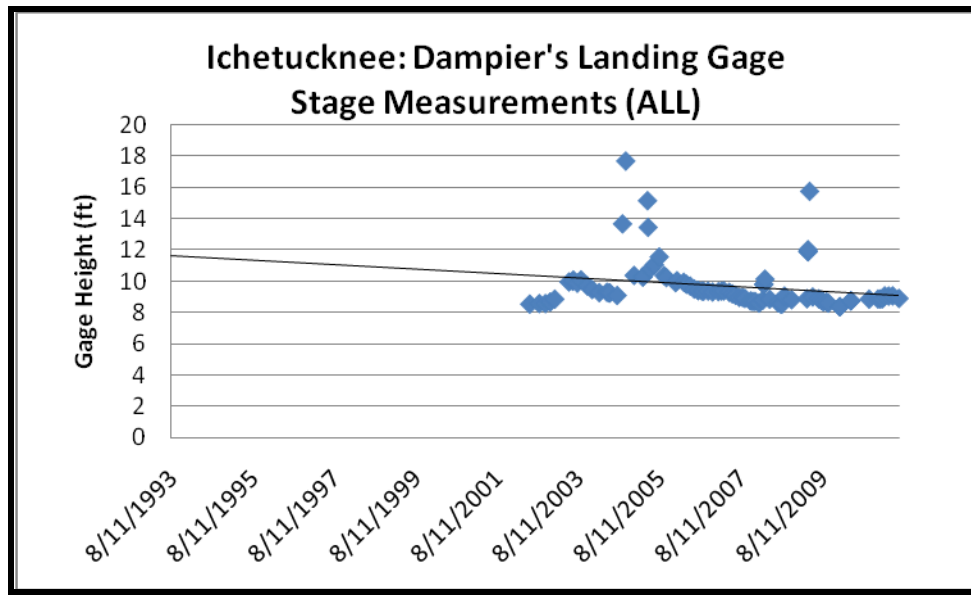
Constant Variance Test: Passed (P = 0.050)

Power of performed test with alpha = 0.050: 0.172

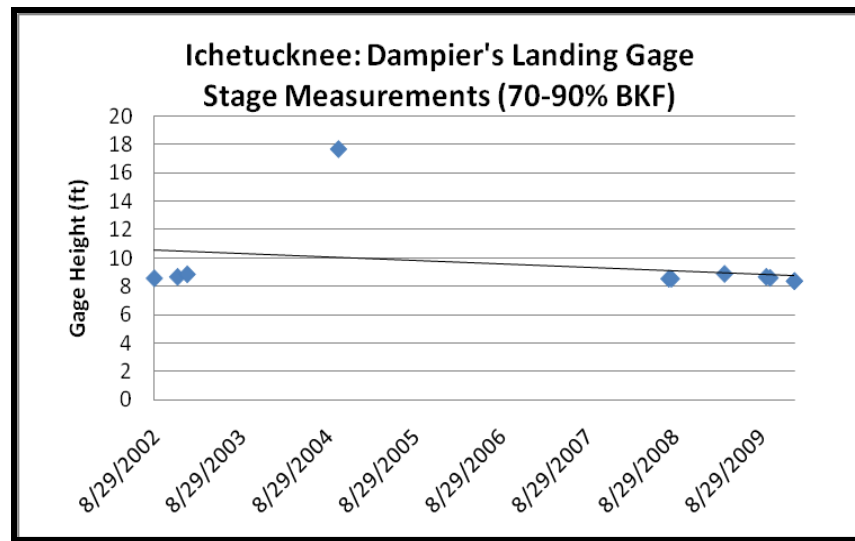
The power of the performed test (0.172) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

ICHETUCKNEE: DAMPIER'S LANDING GAGE



Stage (70-90% BANKFULL)



Linear Regression

Data source: Ichetucknee - Dampiers (70-90% BANKFULL in Analysis)

$$\text{Stage} = 149.747 - (0.0000575 * \text{Date})$$

N = 10 Missing Observations = 3

R = 0.394 Rsqr = 0.155 Adj Rsqr = 0.0496

Standard Error of Estimate = 0.167

	Coefficient	Std. Error	t	P
Constant	149.747	116.416	1.286	0.234
Date	-0.0000575	0.0000474	-1.212	0.260

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	0.0410	0.0410	1.470	0.260
Residual	8	0.223	0.0279		
Total	9	0.264	0.0294		

Normality Test (Shapiro-Wilk) Passed (P = 0.477)

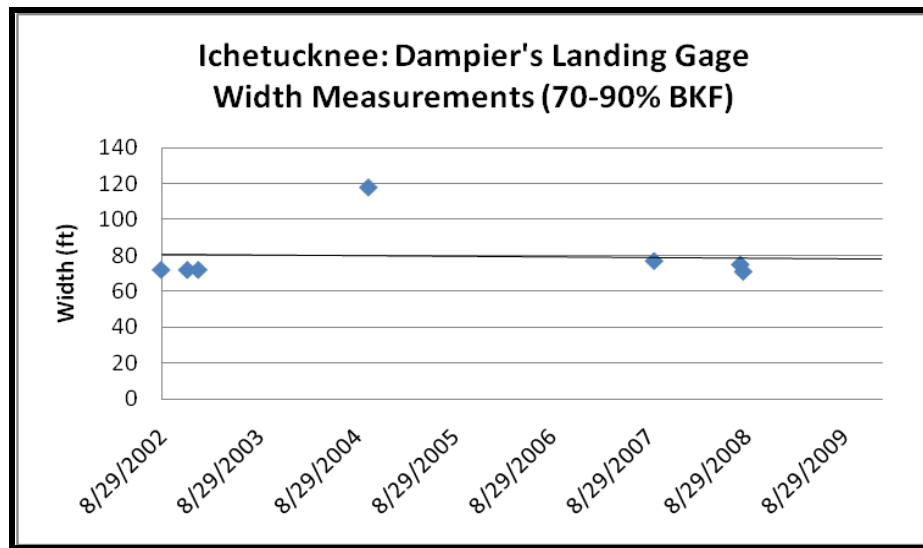
Constant Variance Test: Passed (P = 0.185)

Power of performed test with alpha = 0.050: 0.195

The power of the performed test (0.195) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Width (70-90% BANKFULL)



Linear Regression

Data source: Ichetucknee - Dampiers (70-90% BANKFULL in Analysis)

$$\text{Width} = -2400.574 + (0.00101 \times \text{Date})$$

N = 6 Missing Observations = 7

R = 0.477 Rsqr = 0.228 Adj Rsqr = 0.0346

Standard Error of Estimate = 2.276

	Coefficient	Std. Error	t	P
Constant	-2400.574	2277.991	-1.054	0.351
Date	0.001010.000928	1.086	0.339	

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	6.110	6.110	1.179	0.339
Residual	4	20.724	5.181		
Total	5	26.833	5.367		

Normality Test (Shapiro-Wilk) Passed (P = 0.457)

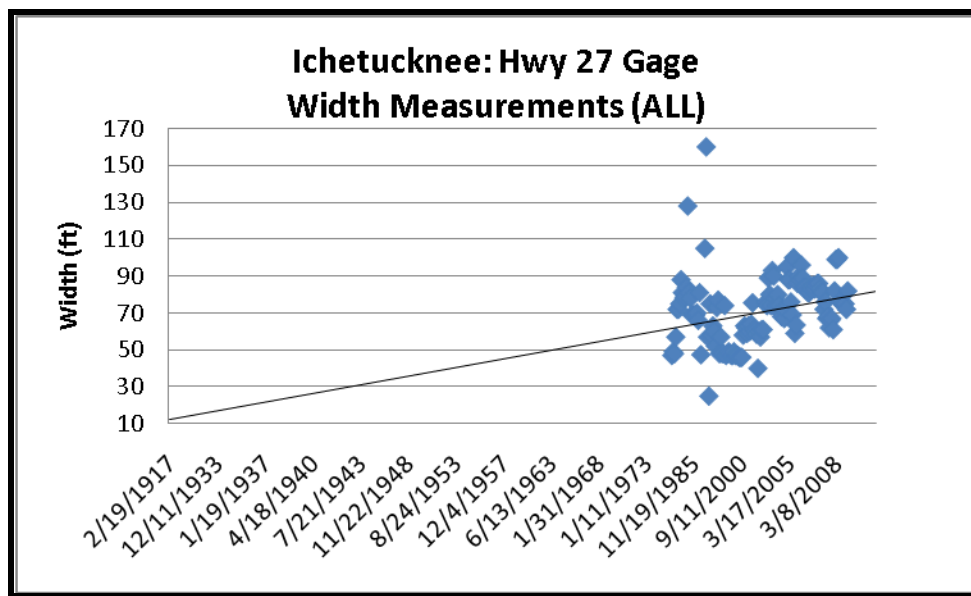
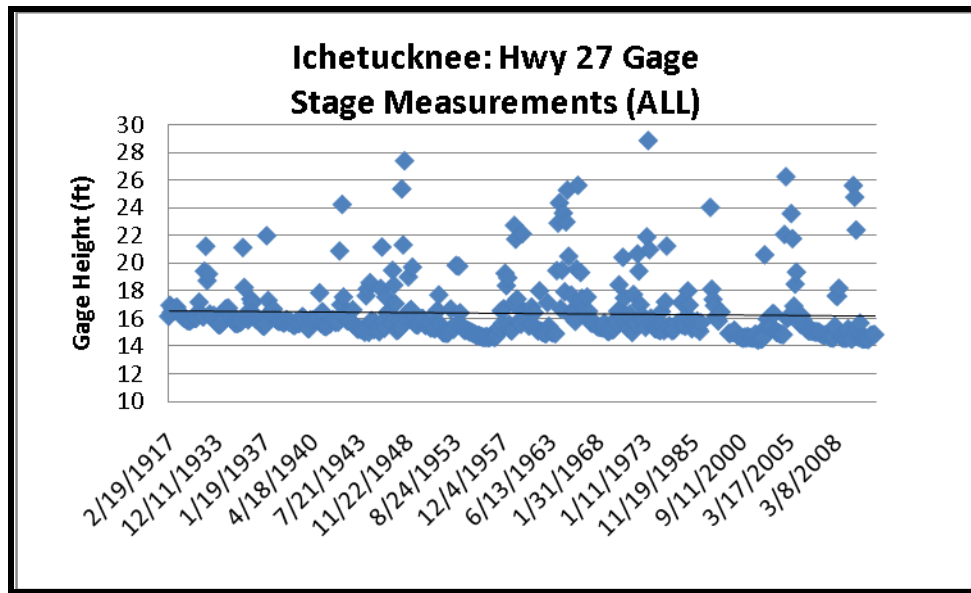
Constant Variance Test: Failed (P = 0.040)

Power of performed test with alpha = 0.050: 0.144

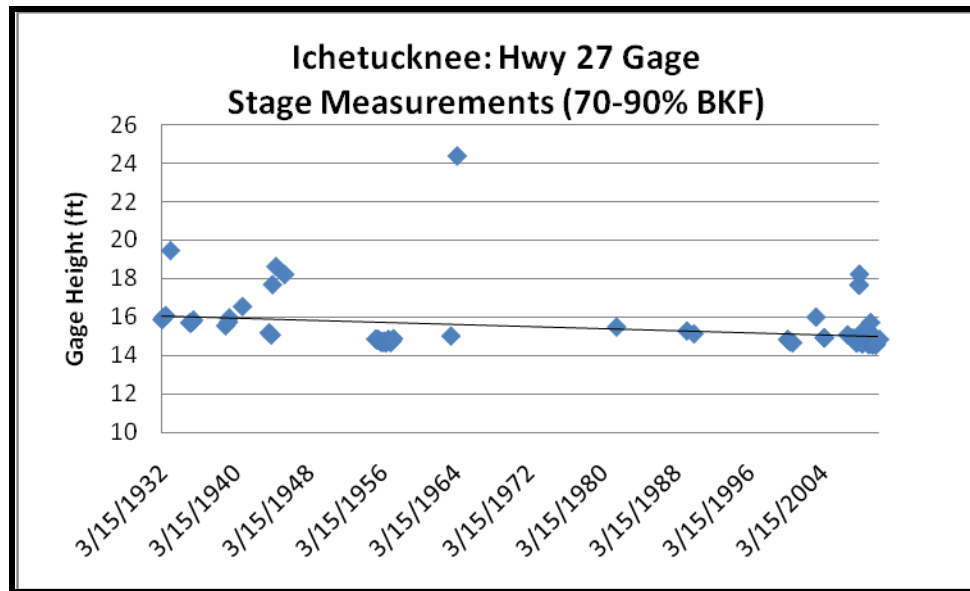
The power of the performed test (0.144) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

ICHETUCKNEE: HWY 27 (HILDRETH) GAGE



Stage (70-90% BANKFULL)



Linear Regression

Data source: Ich - Hwy27 in Analysis

$$\text{Col 2} = 106.939 - (0.0000375 * \text{Col 1})$$

N = 78 Missing Observations = 3

R = 0.281 Rsqr = 0.0789 Adj Rsqr = 0.0667

Standard Error of Estimate = 1.416

	Coefficient	Std. Error	t	P
Constant	106.939	35.885	2.980	0.004
Col 1	-0.0000375	0.0000147	-2.551	0.013

Analysis of Variance:

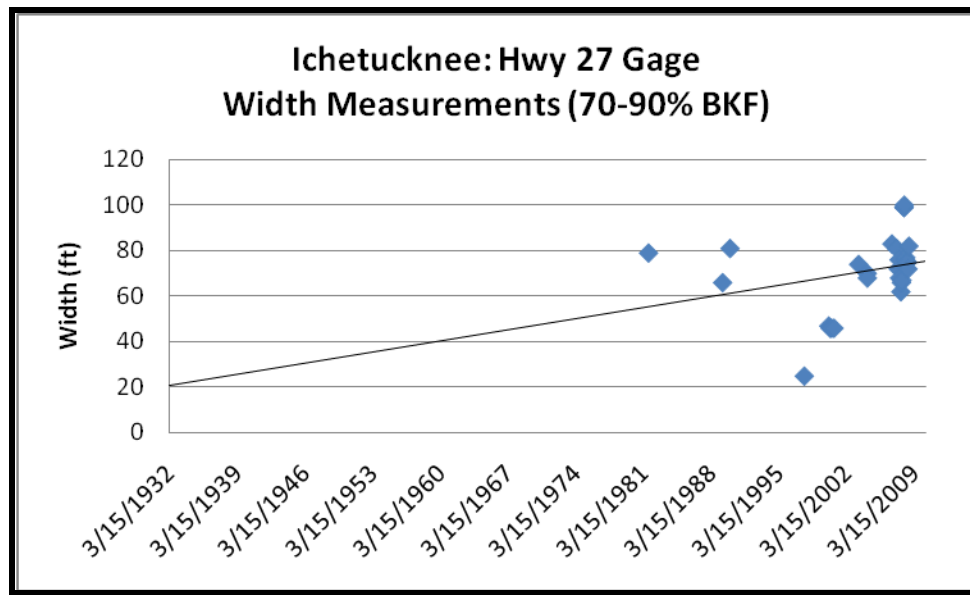
	DF	SS	MS	F	P
Regression	1	13.053	13.053	6.507	0.013
Residual	76	152.464	2.006		
Total	77	165.518	2.150		

Normality Test (Shapiro-Wilk) Failed (P = <0.001)

Constant Variance Test: Passed (P = 0.202)

Power of performed test with $\alpha = 0.050$: 0.705

Width (70-90% BANKFULL)



Linear Regression

Data source: Ich - Hwy27 in Analysis

Date = 2450091.507 + (41.734 * Width)

N = 29 Missing Observations = 52

R = 0.282 Rsqr = 0.0795 Adj Rsqr = 0.0455

Standard Error of Estimate = 2415.251

	Coefficient	Std. Error	t	P	
Constant	2450091.507	1985.492	1233.997	<0.001	
Width	41.734	27.321	1.528	0.138	

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	13611467.628	13611467.628	2.333	0.138
Residual	27	157502790.514	5833436.686		
Total	28	171114258.142	6111223.505		

Normality Test (Shapiro-Wilk) Failed (P = <0.001)

Constant Variance Test: Passed (P = 0.644)

Power of performed test with alpha = 0.050: 0.315

The power of the performed test (0.315) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.