January 4, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Response to questions and comments submitted in November 2010 by Mr. Ron Miller, Vice President of the Save the Homosassa River Alliance, regarding recommended minimum flows for the Homosassa River system

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This memorandum addresses correspondences associated with a letter from Mr. Ron Miller, Vice President of the Save the Homosassa River Alliance that was submitted to the Southwest Florida Water Management District in November 2010. The letter concerns the Alliance's position regarding development of minimum flows for the Homosassa River system and was submitted twice as an e-mail attachment, with the second submission presented on the Save the Homosassa River Alliance letterhead. Two attachments to the letter, showing location information for the Homosassa Springs springshed or ground-water basin, and potential water-supply wellfields in the vicinity of the river system, were included with the second submission of the letter. Mr. Miller also provided a copy of the Alliance's letter, along with the two noted attachments, to the District Governing Board at the Board's November 16, 2010 meeting. Mr. Miller's submission to the Board coincided with staff's presentation of a report outlining peer-review findings concerning proposed minimum flows for the river system and staff response to the peer-review findings.

With regard to the currently recommended minimum flows, which allow for up to a five percent reduction in natural flows, Mr. Miller notes that the Alliance urges the District "*…to set the maximum flow reduction to near zero and to declare the Homosassa Springshed off limits to any new well field development*."

The letter submitted by Mr. Miller and associated electronic-mail and attachments are included in their entirety as Attachments A through G to this memorandum to provide context for the Save the Homosassa River Alliance's perspective on the currently recommended minimum flows for the Homosassa River system. Excerpted portions of Mr. Miller's letter are reproduced below in the body of this memorandum, along with staff responses to the comments included in the excerpts.

<u>Excerpt No. 1</u>
"The SWFWMD is in the process of defining state-wide "Minimum Flows and Levels" for the Homosassa River System. The Minimum Flow Level would then become a factor in the permitting process for future water withdrawals that are higher than current approved land use zoning in Citrus County. Minimum Flow Levels are defined as the most amount of water that can be withdrawn that would result in a

destruction of up to 15% of the local wildlife and ecology. That is to destroy 15% more than the baseline of today's status."

Staff Response to Excerpt No. 1

Minimum flows are to be established for the Homosassa River system to prevent significant harm that may result from water withdrawals. Once incorporated into District rules, the minimum flows will be considered during evaluations associated with the issuance of water-use permits to ensure that any requested water-use will not violate the adopted minimum flows. The minimum flows will also be incorporated into District planning activities, including regional water-supply planning.

The District establishes minimum flows using an approach that allows for reductions to natural flows, *i.e.*, flows expected in the absence of water withdrawals, which will result in no more than a fifteen percent change in habitat or resource value. Emphasis should be placed on the word "change", which is quite different from the supposition that the allowable flow reduction will result in the destruction of existing habitat or resource.

Excerpt No. 2

"The SWFWMD studies consistently show the ecology of the Homosassa River to be exceptionally sensitive to reductions of water flowing from the springs. This sensitivity is well known to the local residents who have observed significant changes to the Homosassa River in the brief span of 20 years. For example the so called "No Name Storm" resulted in major changes of aquatic and vegetative character. We believe the historical river flows have already been reduced to a critical point and any further reduction would contradict all the efforts and funds already spent to protect this coastal area. We urge you to set the maximum flow reduction to near zero and to declare the Homosassa Springshed off limits to any new well field development."

Staff Response to Excerpt No. 2

Staff acknowledges that components of the Homosassa River system appear to be relatively sensitive to changes in flows/spring discharge and has accordingly proposed relatively conservative minimum flows to protect the system from significant harm that may result from area water use. Staff acknowledges the Alliance's position that minimum flows should be established for the system that would allow no additional change in flows.

Excerpt No. 3

"All studies agreed that even a 5% water flow reduction would significantly harm the Homosassa River, primarily because this results in increased water salinity. The unique salinity range existing in the Homosassa Springs area, known as the Oligohaline zone, is a fundamental part of the estuary and oceanic habitat web and provides required breeding grounds and food sources for a large number of fish and wildlife. This zone of the Homosassa River supports manatees, snook, redfish, and herons, and is critical to many more fresh and saltwater species. Unfortunately, this environment is also especially

sensitive to spring water flow. The reduction of spring water flow annihilates the Oligohaline zone and with that destroys many species and the delicate ecology."

Staff Response to Excerpt No. 3

Oligohaline zones are areas of estuaries where salinities range from 0.5 to 5, and are considered to be important nursery areas for many fish and invertebrate species. For the analyses supporting the District's proposed minimum flows for the Homosassa River system, changes in river bottom area, water-column volume and shoreline length associated with salinities less than five were evaluated for various flow reduction scenarios. These low salinity habitats were predicted to be reduced by less than 15 percent for the flow reduction scenario associated with the currently recommended minimum flows, which would allow for up to a five percent reduction in flows. The recommended minimum flows are, therefore, expected to prevent significant harm to oligohaline habitats of the Homosassa River system.

Excerpt No. 4

"*Unfortunately, the recommended application of a five-percent reduction in the current Minimum Flow Level in Citrus County is a step in the opposite direction. A local water authority is already planning well-fields in the Homosassa Springshed for regional water transfer. Why would the Federal Government, the State of Florida and Citrus County establish a priority of protecting sensitive threatened wildlife in the unique environment of the Homosassa River, then apply a Minimum Flow Level that would allow water withdrawals that result in the destruction of 15% of the delicate ecology?"*

Staff Response to Excerpt No. 3

The purpose for establishing minimum flows for the Homosassa River system is to identify limits at which further withdrawals would be significantly harmful to the water resources and ecology of the area. Once established, the minimum flows will be used to support environmentally responsible planning and permitting activities that the District is mandated to perform. The District acknowledges that staff has applied an approach for establishing minimum flows for the Homosassa River system that allows up to a fifteen percent change in habitat or resource value, but does not agree that compliance with the proposed minimum flows will result in the *"…destruction of 15% of the delicate ecology*" of the river system.

With regard to planned withdrawals in the vicinity of the river system, staff encourages interested parties to review information on existing and potential water supplies that is included in the draft Southwest Florida Water Management District 2010 Regional Water Supply Plan - Northern Planning Region and the Withlacoochee Regional Water Supply Authority Phase II – Detailed Water Supply Feasibility Analyses, which was completed by Water Resource Associates in 2010 for the Withlacoochee Regional Water Supply Authority. An electronic version of the draft District water supply plan for the northern planning region is available from the Documents and Publications – Regional Water Supply Plan page of the District web site at the following URL: *http://www.swfwmd.state.fl.us/documents/plans/RWSP/drafts/NPR-Public-Draft-4_20_10.pdf*. An electronic version of the 2010 Withlacoochee Regional Water Supply Authority document may be obtained by contacting Mr. Doug Leeper at the

Southwest Florida Water Management District via e-mail at *doug.leeper@watermatters.org* or by telephone at 800-423-1476, extension 4272.

Staff notes that a regional wellfield in south-central Citrus County is identified in both the draft regional water supply plan for the Northern Planning Region of the District and the Withlacoochee Regional Water Supply Authority water-supply feasibility report. As noted on page 10-10 of the Authority's feasibility report, projected local water-demand suggests that development of the wellfield may not be justified in the short term (defined as the next twenty years), although development of the system may be appropriated in the mid-term (defined as the period between 15 and 35 years from the present), given that the project could support transmission of alternative water supplies throughout the region. The plan also provides information on potential impacts of the wellfield on spring discharge in the Homosassa River system. Development of the Citrus County Wellfield is predicted to result in a 1.3% reduction in discharge for the Homosassa River system.

Although development of the 2010 Withlacoochee Regional Water Supply Authority feasibility report was co-funded by the District, questions pertaining to the report may be best addressed by Mr. Jackson Sullivan, the Withlacoochee Regional Water Supply Director. Mr. Sullivan should be able to provide information on the likelihood of implementation of the water supply options identified in the report during the coming decades. He may be reached by e-mail at *jesull@comcast.net* or by telephone at 850-591-7422. Additional information on planned water-supply development projects in the vicinity of the Homosassa River system may be obtained by contacting the Citrus County Utilities Division at 352-527-7646 and the Hernando County Utilities Department at 352-754-4037.

DAL

Attachments:
A - One page e-mail from Mr. Ron Miller to Mr. Doug Leeper, dated November 14, 2010
B - Two page document submitted by Mr. Ron Miller with his November 14, 2010 e-mail
C - Two page e-mail from Mr. Doug Leeper to Mr. Ron Miller, dated November 15, 2010
D - One page e-mail from Mr. Ron Miller to Mr. Doug Leeper, dated November 17, 2010
E - Two page letter submitted by Mr. Ron Miller with his November 17, 2010 e-mail
F - One page document submitted by Mr. Ron Miller with his November 17, 2010 e-mail
G - Second one page document submitted by Mr. Ron Miller with his November 17, 2010 e-mail

Attachment A

One Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

E-Mail Submitted by Mr. Miller on November 14, 2010

From:	Ron Miller
To:	Doug Leeper
Cc:	Al Grubman; Ron Schultz; Priscilla Watkins
Subject:	Homosassa MFL letter for Governing Board
Date:	Sunday, November 14, 2010 7:34:06 PM
Attachments:	To Doug Leeper 11-14-10 (2).doc

Hi Doug,

The Homosassa River Alliance is alarmed that the MFL program provides a path toward the destruction of the Homosassa River. We think your studies support our concern that this River is currently in a very delicate state. We do not mean to speak negatively of your work. In fact we think you have done a good job with a very complex springs, river and estuary. However we do take exception to the fact that you are not using all the historical data that exists. We have never, ever met a citizen of this county that believes the Homosassa has not been degraded from its historic flows. In fact I doubt that any such river exists in the state of Florida or perhaps even the nation. We also believe that the MFL program does not account for the enormous investments (literally hundreds of millions of dollars) that have been made by the Federal Government, The State of Florida (including SWFWMD) and the citizens of Citrus County in order to protect these coastal springs, rivers and estuaries.

Accordingly I have written the attached letter to you. I want this to be part of your final study document but I know it is to late to include it in your data package for the Nov 16 Governing Board meeting. Therefore I plan to present it to the Governing Board during the Citizen Input time (Item 6 on the agenda) of that meeting.

Sincerely,

Ron

Attachment B

Two Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

Letter attached to E-Mail Submitted by Mr. Miller on November 14, 2010

Date: Nov 14, 2010

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899

Subject: MFLs and Protecting the Homosassa River System

Dear Mr. Leeper,

The SWFWMD is in the process of defining state-wide “Minimum Flows and Levels” for the Homosassa River System. The Minimum Flow Level would then become a factor in the permitting process for future water withdrawals that are higher than current approved land use zoning in Citrus County. Minimum Flow Levels are defined as the most amount of water that can be withdrawn that would result in a destruction of up to 15% of the local wildlife and ecology. That is to destroy 15% more than the baseline of today’s status.

The SWFWMD studies consistently show the ecology of the Homosassa River to be exceptionally sensitive to reductions of water flowing from the springs. This sensitivity is well known to the local residents who have observed significant changes to the Homosassa River in the brief span of 20 years. For example the so called “No Name Storm” resulted in major changes of aquatic and vegetative character. We believe the historical river flows have already been reduced to a critical point and any further reduction would contradict all the efforts and funds already spent to protect this coastal area. We urge you to set the maximum flow reduction to near zero and to declare the Homosassa Springshed off limits to any new well field development.

All studies agreed that even a 5% water flow reduction would significantly harm the Homosassa River, primarily because this results in increased water salinity. The unique salinity range existing in the Homosassa Springs area, known as the Oligohaline zone, is a fundamental part of the estuary and oceanic habitat web and provides required breeding grounds and food sources for a large number of fish and wildlife. This zone of the Homosassa River supports manatees, snook, redfish, and herons, and is critical to many more fresh and saltwater species. Unfortunately, this environment is also especially sensitive to spring water flow. The reduction of spring water flow annihilates the Oligohaline zone and with that destroys many species and the delicate ecology.

The State of Florida has long recognized the importance of these special springfed estuarine resources, and has established numerous programs to protect and preserve them. The Florida Forever program established the Florida Coastal Springs Greenway, which set aside and preserved 43,000 acres of critical coastal land in Citrus County. Combined with the St. Martin's Aquatic Preserve, the Rooks Tract of the Withlacoochee State Forest, the Chassahowitzka Swamp, the Homosassa Springs Wildlife State Park, the Crystal River Buffer Preserve State Park and the Chassahowitzka National Wildlife Refuge over 100,000 acres in Citrus County is dedicated to protecting our coastal river systems and estuaries. The protection of the coastal river systems is also built into the Citrus County Comprehensive Plan. All told hundreds of millions of dollars of federal, state and local funds have been invested toward this goal.

Importantly, our citizens and visitors enjoy immeasurable natural, recreational and economic benefits from these unique springs and rivers.

Unfortunately, the recommended application of a five-percent reduction in the current Minimum Flow Level in Citrus County is a step in the opposite direction. A local water authority is already planning well-fields in the Homosassa Springshed for regional water transfer. Why would the Federal Government, the State of Florida and Citrus County establish a priority of protecting sensitive threatened wildlife in the unique environment of the Homosassa River, then apply a Minimum Flow Level that would allow water withdrawals that result in the destruction of 15% of the delicate ecology?

Please protect the Homosassa River by setting the maximum flow reduction to near zero and by declaring the Homosassa Springshed as off limits to any new well head development.

Sincerely,

Ron Miller, Vice President
Save the Homosassa River Alliance

Attachment C

Two Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

E-Mail Sent to Mr. Miller on November 15, 2010

From: Doug Leeper
To: "Ron Miller"
Cc: Marty Kelly; Sid Flannery; Mark Barcelo; Ron Basso; Karen Lloyd; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Kevin P. Wills; Mark Hammond; Bruce Wirth
Subject: Homosassa Minimum Flows and Nov 17 Board Meeting
Date: Monday, November 15, 2010 11:21:29 AM

Mr. Miller:

Thank you for your recent e-mail and attached letter outlining the Save the Homosassa River Alliance's concerns and recommendations regarding minimum flows for the Homosassa River system. Staff appreciates the opportunity to consider comments such as those of the Alliance as we develop draft rule amendments associated with minimum flows for the river system. As noted in our previous communications, all comments submitted to the District will be incorporated as appendices into a revised report on proposed minimum flows for the river system, to document the critical review and public input associated with development of the minimum flows. Please note also that once completed, the revised report will be provided to the Governing Board to support their consideration of rule amendments associated with establishing the minimum flows.

Thanks also for letting me know that you plan to address the Resource Management Committee of the Governing Board tomorrow regarding Board Agenda Item 38, which concerns the scientific peer review of recommended flows for the Homosassa River system and staff response to the peer review. Please be aware that the information associated with this agenda item is being provided for the Committee's information only and that staff are not requesting that the Committee or Board take any action on this information. Staff will recommend that the Governing Board take action regarding approval of rule amendments associated with minimum flows for the river system at a later Board meeting.

To address the Board Committee tomorrow, please fill out a blue speaker's card that will be available at the reception desk in the lobby outside the Board room and submit the completed card to the meeting secretary. Your card will be provided to the Resource Management Committee Chair who will call on you at the appropriate time during the meeting. Although the Governing Board meeting begins at 9:00 AM, you may expect that the Resource Committee may likely not begin discussion of Agenda Item 38 until after lunch or mid-afternoon. When addressing the Committee, please step to the meeting-room podium, adjust the microphone for your comfort, and state your name for the record. Comments will be limited to three minutes per speaker. In appropriate circumstances, the Chair may grant exceptions to the three-minute limit.

Please let me know if you have any questions regarding the meeting tomorrow.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District

2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment D
One Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

E-Mail Submitted by Mr. Miller on November 17, 2010

From: Ron Miller
To: Doug Leeper
Subject: Letter to Governing Board
Date: Wednesday, November 17, 2010 10:40:59 AM
Attachments: To Doug on Letterhead.doc
Planned Wellheads.jpg
Homosassa Springshed.jpg

Hi Doug,

Attached is the letter that I gave to the Governing Board yesterday. It is the same as I had e-mailed to you except it is on Homosassa River Alliance letterhead and it has 2 attachments showing the springshed and the planned wellheads. Let me know if you can use this as sent. If not I'll snail mail a copy.

Ron

Attachment E

One Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

Two Page Attachment to E-Mail Submitted by Mr. Ron Miller on November 17, 2010.

Homosassa River Alliance

Save the Homosassa River Alliance

P.O. Box 124
Homosassa, Florida 34487-0124

Date: Nov 14, 2010

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899

Subject: MFLs and Protecting the Homosassa River System

Dear Mr. Leeper,

The SWFWMD is in the process of defining state-wide "Minimum Flows and Levels" for the Homosassa River System. The Minimum Flow Level would then become a factor in the permitting process for future water withdrawals that are higher than current approved land use zoning in Citrus County. Minimum Flow Levels are defined as the most amount of water that can be withdrawn that would result in a destruction of up to 15% of the local wildlife and ecology. That is to destroy 15% more than the baseline of today's status.

The SWFWMD studies consistently show the ecology of the Homosassa River to be exceptionally sensitive to reductions of water flowing from the springs. This sensitivity is well known to the local residents who have observed significant changes to the Homosassa River in the brief span of 20 years. For example the so called "No Name Storm" resulted in major changes of aquatic and vegetative character. We believe the historical river flows have already been reduced to a critical point and any further reduction would contradict all the efforts and funds already spent to protect this coastal area. We urge you to set the maximum flow reduction to near zero and to declare the Homosassa Springshed off limits to any new well field development.

All studies agreed that even a 5% water flow reduction would significantly harm the Homosassa River, primarily because this results in increased water salinity. The unique salinity range existing in the Homosassa Springs area, known as the Oligohaline zone, is a fundamental part of the estuary and oceanic habitat web and provides required breeding grounds and food sources for a large number of fish and wildlife. This zone of the Homosassa River supports manatees, snook, redfish, and herons, and is critical to many more fresh and saltwater species. Unfortunately, this environment is also especially sensitive to spring water flow. The reduction of spring water flow annihilates the Oligohaline zone and with that destroys many species and the delicate ecology.

The State of Florida has long recognized the importance of these special springfed estuarine resources, and has established numerous programs to protect and preserve them. The Florida Forever program established the Florida Coastal Springs Greenway, which set aside and preserved 43,000 acres of critical coastal land in Citrus County. Combined with the St. Martin's Aquatic Preserve, the Rooks Tract of the Withlacoochee State Forest, the Chassahowitzka Swamp, the

Homosassa River Alliance

Save the Homosassa River Alliance

P.O. Box 124
Homosassa, Florida 34487-0124

Homosassa Springs Wildlife State Park, the Crystal River Buffer Preserve State Park and the Chassahowitzka National Wildlife Refuge over 100,000 acres in Citrus County is dedicated to protecting our coastal river systems and estuaries. The protection of the coastal river systems is also built into the Citrus County Comprehensive Plan. All told hundreds of millions of dollars of federal, state and local funds have been invested toward this goal.

Importantly, our citizens and visitors enjoy immeasurable natural, recreational and economic benefits from these unique springs and rivers.

Unfortunately, the recommended application of a five-percent reduction in the current Minimum Flow Level in Citrus County is a step in the opposite direction. A local water authority is already planning well-fields in the Homosassa Springshed for regional water transfer. Why would the Federal Government, the State of Florida and Citrus County establish a priority of protecting sensitive threatened wildlife in the unique environment of the Homosassa River, then apply a Minimum Flow Level that would allow water withdrawals that result in the destruction of 15% of the delicate ecology?

Please protect the Homosassa River by setting the maximum flow reduction to near zero and by declaring the Homosassa Springshed as off limits to any new well head development.

Sincerely,

Ron Miller, Vice President
Save the Homosassa River Alliance

Attachment F
One Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

One Page Attachment to E-Mail Submitted by Mr. Ron Miller on November 17, 2010.

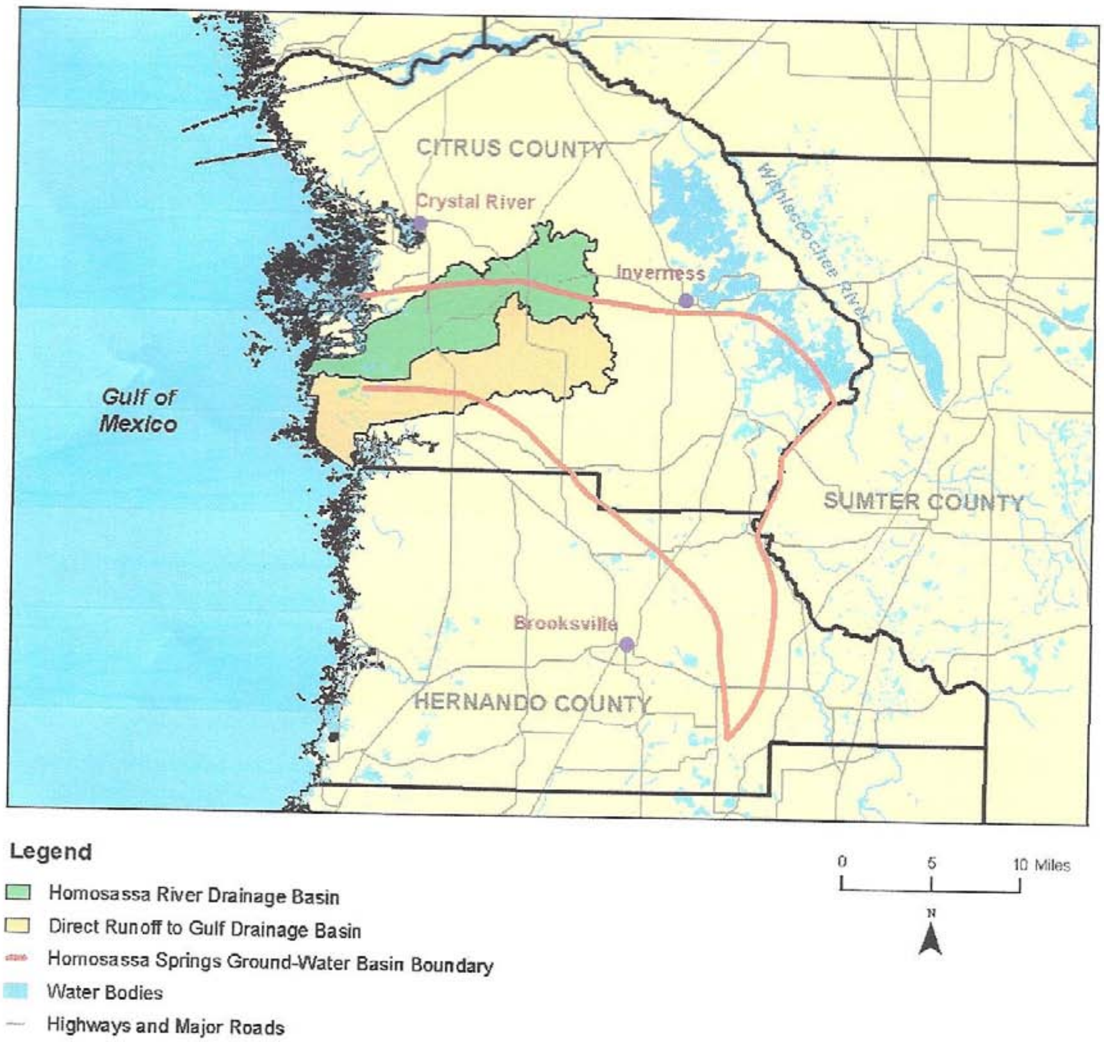
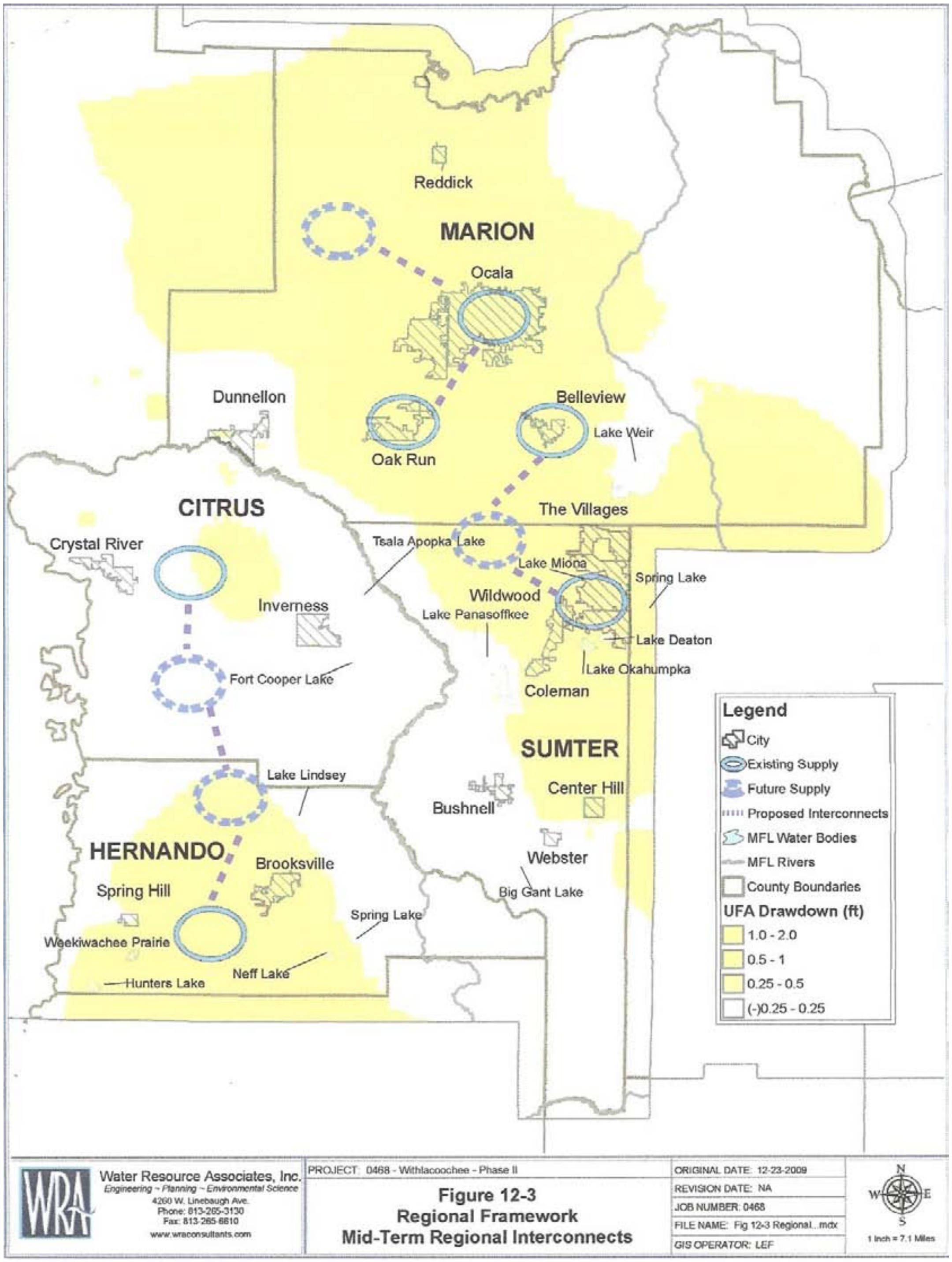


Figure 2-6. Homosassa River and Direct Runoff to Gulf drainage basins as delineated by the United States Geological Survey (Florida Department of Environmental Protection 2004a) and approximate location of the Homosassa Springs ground-water basin boundary as adapted from Knochenmus and Yobbi (2001). The Homosassa, Southeast Fork of the Homosassa and Halls rivers lie within the Homosassa River Drainage Basin. Hidden River is located in the Direct Runoff to Gulf drainage basin.

Attachment G
One Page Attachment to January 4, 2011 Memorandum Addressing Comments Submitted by Mr. Ron Miller, Save the Homosassa River Alliance

One Page Attachment to E-Mail Submitted by Mr. Ron Miller on November 17, 2010.



February 15, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: December 2010 correspondence between Cara Martin, Ron Miller and Jim Bitter concerning minimum flows for the Homosassa River system

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This memorandum documents a letter from Mr. Ron Miller that was published in the Citrus County Chronicle. The letter is documented here for its relevance to the development of minimum flows for the Homosassa River system.

DAL
Attachment: Letter from Ron Miller published in the Citrus County Chronicle

Attachment

Letter from Ron Miller Published in the Citrus County Chronicle

Citrus County Chronicle – Letter
Nov. 22, 2010

Detriment of low water levels

By Ron Miller

Editor's note: The following piece is a letter from Ron Miller, vice president of the Save the Homosassa River Alliance, to Douglas A. Leeper, chief environmental scientist in the Resource Projects Department of the Southwest Florida Water Management District.

The Southwest Florida Water Management District (SWFWMD) is in the process of defining statewide "minimum flows and levels" for the Homosassa River system. The minimum flow level would then become a factor in the permitting process for future water withdrawals that are higher than current approved land use zoning in Citrus County.

Minimum flow levels are defined as the most amount of water that can be withdrawn without resulting the destruction of up to 15 percent of the local wildlife and ecology.

The SWFWMD studies consistently show the ecology of the Homosassa River to be exceptionally sensitive to reductions of water flowing from the springs. This sensitivity is well known to the local residents who have observed significant changes to the Homosassa River in the brief span of 20 years. For example, the so-called "No-Name Storm" resulted in major changes of aquatic and vegetative character. We believe the historical river flows have already been reduced to a critical point and any further reduction would contradict all the efforts and funds already spent to protect this coastal area. We urge you to set the maximum flow reduction to near zero and to declare the Homosassa Springshed off limits to any new well field development.

All studies agreed that even a 5 percent water flow reduction would significantly harm the Homosassa River, primarily because this results in increased water salinity. The unique salinity range existing in the Homosassa Springs area, known as the oligohaline zone, is a fundamental part of the estuary and oceanic habitat web and provides required breeding grounds and food sources for a large number of fish and wildlife.

This zone of the Homosassa River supports manatees, snook, redfish, and herons, and is critical to many more fresh and saltwater species. Unfortunately, this environment is also especially sensitive to spring water flow. The reduction of spring water flow annihilates the oligohaline zone and with that destroys many species and the delicate ecology.

The state of Florida has long recognized the importance of these special spring-fed estuarine resources and has established numerous programs to protect and preserve them. The Florida Forever program established the Florida Coastal Springs Greenway, which set aside and preserved 43,000 acres of critical coastal land in Citrus County. Combined with the St. Martin's Aquatic Preserve, the Rooks Tract of the Withlacoochee State Forest, the Chassahowitzka Swamp, the Homosassa Springs Wildlife State Park, the Crystal River Buffer Preserve State Park and the Chassahowitzka National Wildlife Refuge, over 100,000 acres in Citrus County is dedicated to protecting our coastal river systems and estuaries.

The protection of the coastal river systems is also built into the Citrus County Comprehensive Plan. All told hundreds of millions of dollars of federal, state and local funds have been invested toward this goal.

Importantly, our citizens and visitors enjoy immeasurable natural, recreational and economic benefits from these unique springs and rivers.

Unfortunately, the recommended application of a 5 percent reduction in the current minimum flow level in Citrus County is a step in the opposite direction. A local water authority is already planning well fields in the Homosassa Springshed for regional water transfer. Why would the federal government, the state of Florida and Citrus County establish a priority of protecting sensitive threatened wildlife in the unique environment of the Homosassa River, then apply a minimum flow level that would allow water withdrawals that result in the destruction of 15 percent of the delicate ecology?

Please protect the Homosassa River by setting the maximum flow reduction to near zero and by declaring the Homosassa Springshed as off limits to any new well head development.

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Correspondence between Doug Leeper and Joyce Kleen regarding review of proposed minimum flows for the Homosassa River and Chassahowitzka River systems

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This memorandum documents correspondence between Doug Leeper (SWFWMD) and Joyce Kleen (USFWS) regarding minimum flows development for the Homosassa and Chassahowitzka River systems.

DAL
Attachments

From:	Joyce_Kleen@fws.gov
To:	Doug Leeper
Subject:	Minimum flow comment due dates
Date:	Friday, November 05, 2010 2:39:24 PM

Doug,

Are formal comments still being accepted for the Homosassa and Chassahowitzka River recommended minimum flows?

Joyce M. Kleen
Chassahowitzka National Wildlife Refuge Complex
1502 SE Kings Bay Drive
Crystal River, Florida 34429
Phone: 352/563-2088 x209
Fax: 352/795-7961
e-mail: joyce_kleen@fws.gov

From:	Doug Leeper
To:	"Joyce_Kleen@fws.gov"
Cc:	Marty Kelly; Mike Heyl
Subject:	RE: Minimum flow comment due dates
Date:	Friday, November 05, 2010 3:12:56 PM

Hey Joyce:

Yes we are still accepting comments on the proposed minimum flows for the Chassahowitzka and Homosassa River systems. We look forward to your comments.

Note that we plan to present rule amendments associated with the Chassahowitzka minimum flows and the peer-review report for the Homosassa minimum flows to the Governing Board at the November 16, 2010 Board meeting.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From: Joyce_Kleen@fws.gov [mailto:Joyce_Kleen@fws.gov]
Sent: Friday, November 05, 2010 2:30 PM
To: Doug Leeper
Subject: Minimum flow comment due dates

Doug,

Are formal comments still being accepted for the Homosassa and Chassahowitzka River recommended minimum flows?

Joyce M. Kleen
Chassahowitzka National Wildlife Refuge Complex
1502 SE Kings Bay Drive
Crystal River, Florida 34429
Phone: 352/563-2088 x209
Fax: 352/795-7961
e-mail: joyce_kleen@fws.gov

December 20, 2010

MEMORANDUM

TO:	File
FROM:	Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District
SUBJECT:	Comments submitted by Mr. William Garvin, regarding recommended minimum flows for the Homosassa River system

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This memorandum documents an e-mail submitted to the Southwest Florida Water Management District on December 2010 by Mr. William Garvin regarding development of minimum flows for the Homosassa River system. In his e-mail, Mr. Garvin asked that the District review a report by Frazer and others titled *Increased Nutrient Loading of Spring-Fed Coastal Rivers: Effects on Habitat and Faunal Communities*. Staff responded to Mr. Garvin, thanking him for bringing the report to the attention of the District, and noting that the report would be reviewed to support revision of the District report of minimum flows for the Homosassa River system.

DAL

Attachments: Two page e-mail (with e-mail string) from Mr. William Garvin, dated December 15, 2010
One page e-mail response to Mr. William Garvin, dated December 15, 2010

Attachment A

December 20, 2010 Memorandum Concerning Questions and Comments Submitted by Mr. Robert Knight, Regarding Recommended Minimum Flows for the Homosassa River System

E-Mail (with E-Mail String) from Mr. William Garvin, Dated December 15, 2010

From:	Bill Garvin
To:	Doug Leeper; Dave Dewitt; Cara S. Martin
Cc:	Alan Grubman; Alan Martyn Johnson; Priscilla Watkins; Jim Bitter; Ron Miller; Janet "Love Bug" Garvin
Subject:	Fw: Report
Date:	Wednesday, December 15, 2010 2:01:38 PM
Attachments:	Frazer et al_SWG Year 3 Annual Report.pdf

Good Afternoon,

The three year report from the University of Florida and FWC is finally complete. I had sent you the first two years of the report previously. I believe this report should be included in the MFL report for the Homosassa River. It is based on scientific data from very reputable people.
Sincerely,
William Garvin

----- Original Message -----
From: Matthew Lauretta
To: 'Bill Garvin'
Sent: Tuesday, December 14, 2010 12:05 PM
Subject: RE: Report

Hi Bill,
To follow up on your last request, here is the current annual report from the Homosassa and Chassahowitzka fish assessment. Please let me know if you have any questions. Thanks again for your interest in our research, and please feel free to distribute the document to other interested parties.
Thanks,
Matt

From: Bill Garvin [mailto:wgarvin@tampabay.rr.com]
Sent: Thursday, October 14, 2010 3:27 PM
To: Matthew Lauretta
Subject: Report
Hi Matt,
You had mentioned the final report on the Homosassa should be complete in June 2010. Is it finished? Could you send me a copy PDF please.
Thank You,
Bill Garvin

----- Original Message -----
From: Matthew Lauretta
To: 'Bill Garvin'
Sent: Wednesday, September 02, 2009 2:38 PM
Subject: RE: Saw some of your fish Sunday

Hi Bill,
Thanks for the update on the snappers. Here is a copy of our most recent report on the fish monitoring program. We are currently working on collecting our last year of data, and the project should be completed by June 2010. The attached report summarizes the data collection over the last two years for plants, invertebrates and fishes. Talk to you soon,
Matt

From: Bill Garvin [mailto:wgarvin@tampabay.rr.com]
Sent: Wednesday, September 02, 2009 2:26 PM
To: Matthew Lauretta
Subject: Saw some of your fish Sunday

Good Afternoon,
Sunday by the entrance of the canal by the Wildlife Park in Homosassa there were a school of about 25 to 30 snappers all about the 4 to 5 inch length and I counted 3 that had the small white ID tags you were putting on then to trace there movements.
Mat you were going to have your paper (thesis) out by about now and I was wondering how it is going and if there is a way I could get a copy. PDF in the mail etc. or what ever means possible.

Thank You,
Bill Garvin
4380 S. Blue Water Point
Homosassa, FL 34448
352-628-4685

Attachment B

December 20, 2010 Memorandum Concerning Questions and Comments Submitted by Mr. Robert Knight, Regarding Recommended Minimum Flows for the Homosassa River System

E-Mail Response to Mr. William Garvin, Dated December 15, 2010

From: Doug Leeper
To: "Bill Garvin"
Bcc: Mike Heyl; Marty Kelly; Cara S. Martin; Doug Leeper
Subject: Suggestion Regarding a Recent Chassahowitzka and Homosassa Report
Date: Wednesday, December 15, 2010 2:57:12 PM

Mr. Garvin:

Thanks for forwarding the 2010 report by Frazer and his colleagues concerning their recent study of the Chassahowitzka and Homosassa rivers. I'll plan on reviewing the document as I work on revising the District report on proposed minimum flows for the Homosassa River. Incidentally, I noticed that the report includes a "DRAFT" watermark, so I'm assuming there may yet be some changes made to the document.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

December 20, 2010

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Questions and Comments submitted by Mr. Robert Knight, regarding recommended minimum flows for the Homosassa River system

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This memorandum documents e-mail submitted to the Southwest Florida Water Management District in December 2010 by Mr. Robert Knight, Utilities Director for Citrus County, concerning development of minimum flows for the Homosassa River system. Mr. Knight's e-mail requests for information and staff responses provided by e-mail are attached to this memorandum.

\- -

DAL
Attachment: Three pages including e-mails from Mr. Robert Knight and e-mail responses from staff, dated December 9, 2010

Attachment
December 20, 2010 Memorandum Concerning Questions and Comments Submitted by Mr. Robert Knight, Regarding Recommended Minimum Flows for the Homosassa River System

E-Mail from Mr. Robert Knight, Dated December 9, 2010

From: Robert Knight [mailto:Robert.Knight@bocc.citrus.fl.us]
Sent: Thursday, December 09, 2010 9:44 AM
To: Marty Kelly
Cc: Eber Brown
Subject: MFL's for Chazz and Homosassa

I'm sure you know the person who can get this for me. I need to know the following for the proposed MFL's for Chassahowitzka and Homosassa: What were the parameters for each that were considered and what was the projected harm at the proposed levels of reduced flows? Also, with some specificity, which parameter(s) would have significant harm if flows were less than proposed? For these, how was that (or those) determined? Thanks.

E-Mail to Mr. Robert Knight, Dated December 9, 2010

From: Doug Leeper
To: "Robert.Knight@bocc.citrus.fl.us"
Cc: Marty Kelly; Mike Heyl; Cara S. Martin
Subject: RE: MFL"s for Chass and Homosassa
Date: Thursday, December 09, 2010 2:05:21 PM

Robert:

To develop recommended minimum flows for the Homosassa River system, District staff evaluated potential flow-related changes in the extent of salinity-based habitats, abundances of fish and invertebrates, and available thermal-refuge habitat for manatees. Flow-related reductions in these parameters of more than fifteen percent were considered representative of significant harm. The salinity-based habitats that were evaluated included bottom area, water-column volume and shoreline length of the river exposed to salinities of up to 2, 3, 5, and 12. These habitats were evaluated with the goal of preventing significant harm to the wide variety of organisms and the physical, chemical and biological processes associated with the range of salinities occurring within the tidally-influenced river system. The salinity-habitats were evaluated using predictions based on numerical and statistical models. Abundances of fish and invertebrate plankton and nekton, *i.e*., free-floating and actively swimming organisms, were evaluated using statistical models. Thermally favorable habitat for manatees was characterized as the volume of warm-water refuge available during chronic (three day) and acute (four hour) critically cold periods, and was evaluated using a numerical model.

The proposed minimum flows for the Homosassa River system are ninety-five percent of the system's natural flow. Natural flow is defined as flow that would exist in the absence of water withdrawals. Compliance with the proposed minimum flows may be assured if combined withdrawals that affect flows in the river system do not reduce natural flows by more than five percent.

A five percent reduction in natural flows may be expected to result in more than a fifteen percent reduction in the extent of selected salinity-based habitats, including the bottom area and water column volume associated with salinities of up to 2 or 3. Other salinity-based habitats evaluated would be expected to change by less than fifteen percent in response to a five percent reduction in natural flows. Statistical models for predicting fish and invertebrate plankton and nekton responses to flow reductions were not included in the final evaluation leading to development of the proposed minimum flows. With regard to thermally-favorable manatee habitat, a five percent reduction in natural flows would be predicted to result in one and eight percent reductions in habitat, respectively, as compared to the extent of available refuge habitat under baseline, natural flow conditions.

In summary, results from the District minimum flows and levels analyses suggest that significant harm to habitats in the river system where salinities are less than 2 or 3 may be expected if flows are reduced below the proposed minimum flows. Please contact me if you need additional information or would like to discuss the District's development of minimum flows for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Second E-Mail from Mr. Robert Knight, Dated December 9, 2010

From: Robert Knight
To: Doug Leeper
Subject: RE: MFL"s for Chass and Homosassa
Date: Thursday, December 09, 2010 2:51:09 PM

When you say salinities of up to "2, 3, 5, and 12", what is that? Is it PPB? (I'm used to seeing salinity as say 12,000 PPM.

Second E-Mail to Mr. Robert Knight, Dated December 9, 2010

From: Doug Leeper
To: "Robert Knight"
Subject: RE: MFL"s for Chass and Homosassa
Date: Thursday, December 09, 2010 3:38:31 PM

Robert:
This salinity reporting thing is something that oceanographers continue to argue about. Most don't use the old practice of report in parts per thousand (ppt), some use something called practical

salinity units (PSU) and others note that salinity should be report without units (hence my reporting of salinities of 2, 3, etc.).

For practical purposes you may consider a salinity of 2 to be equivalent to 2 ppt, 2 PSU, or based on the convention identified in your e-mail, 2,000 ppm.

Hope this helps.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

May 19, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Powerpoint slides by Marty Kelly concerning minimum flows and levels presented to the Citrus County Utility Infrastructure Advisory Group

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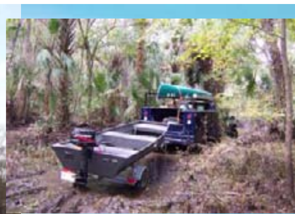
This memorandum documents a Powerpoint slide presentation that was developed by Marty Kelly, Minimum Flows and Levels Program Director for the District. The slides were used for a presentation to the Citrus County Utility Infrastructure Advisory Group in December 2010.

DAL
Attachment: Powerpoint slides by Marty Kelly concerning minimum flows and levels

Attachment

<u>Powerpoint Slides by Marty Kelly Concerning Minimum Flows and Levels</u>

MINIMUM FLOWS AND LEVELS



CITRUS COUNTY

UTILITY INFRASTRUCTURE ADVISORY GROUP

DECEMBER 8, 2010

Southwest Florida Water Management District

Minimum Flows and Levels

Florida Statutes, Section 373.042

The **minimum flow** for a given watercourse shall be the limit at which further <u>withdrawals</u> would be significantly harmful to the water resources or ecology of the area.

The **minimum water level** shall be the level of groundwater in an aquifer and the level of surface water at which further <u>withdrawals</u> would be significantly harmful to the water resources of the area.

2010

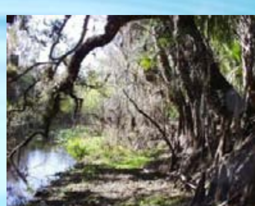
- **Chassahowitzka River System and Springs** (includes Chass. Main, Chass. #1, Crab Creek, Potter and Ruth and Blind Spring)
- **Homosassa River System and Springs** (includes Halls River Springs, Southeast Fork Homosassa River Springs, Homosassa Main Springs, Hidden River Springs)
- Lower Myakka River System
- Polk County Lakes – Crystal, North Lake Wales
- **Upper and Middle Withlacoochee River System (Green Swamp)**

2011

- Brooker Creek
- Hillsborough County Lakes – Carroll, Hooker, Raleigh, Rogers, Starvation, and Wimauma
- **Lower Withlacoochee River System**
- Marion County Lakes - Bonable, Little Bonable, Tiger
- Polk County Lake – Lowery, Hancock
- Upper Peace River "Middle" and "High" Minimum Flows
- **Crystal River System and Kings Bay Spring**
- Pithlachascotee River System
- **Gum Springs Group**
- Little Manatee River
- Manatee River System (Braden River Estuary)
- **Rainbow River and Springs**
- Shell Creek Estuary

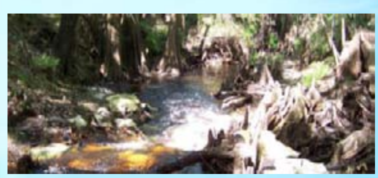
2012

- Charlie Creek
- Horse Creek
- North Prong Alafia River
- South Prong Alafia River
- Hillsborough County Lakes – Kell, Keene, Hanna
- Polk County Lakes – Amoret, Aurora, Bonnet, Easy, Effie, Little Aurora, Josephine



2013

- Prairie Creek
- Shell Creek (freshwater segment)
- Hernando County Lakes - Tooke, Whitehurst
- Highland County Lakes – Damon, Pioneer, Pythias, Viola
- Polk County Lake – Trout



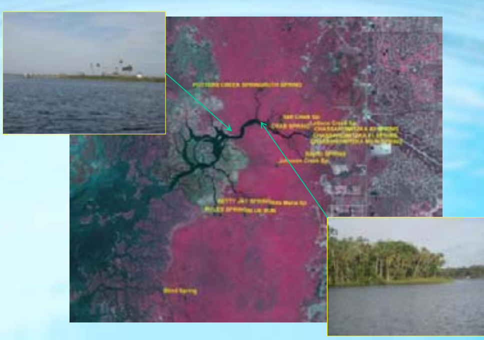
2014

- Cypress Creek
- Bullfrog Creek

2015

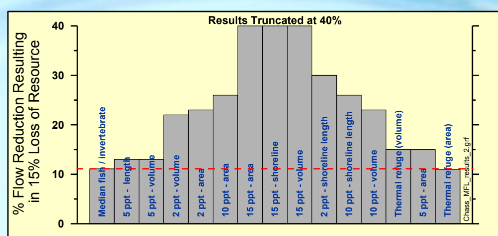
- Lower Peace River – re-evaluation
- Polk County Lake - Eva

Chassahowitzka River System



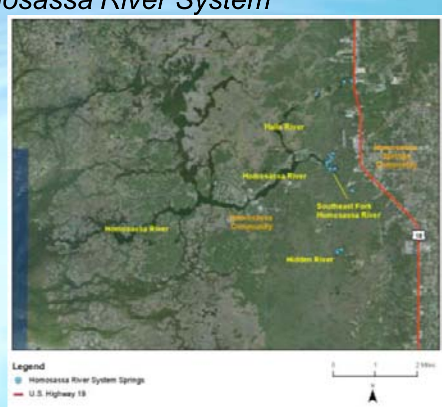
9

Chassahowitzka Recommended MFL – No More than 11% Reduction in Flow



10

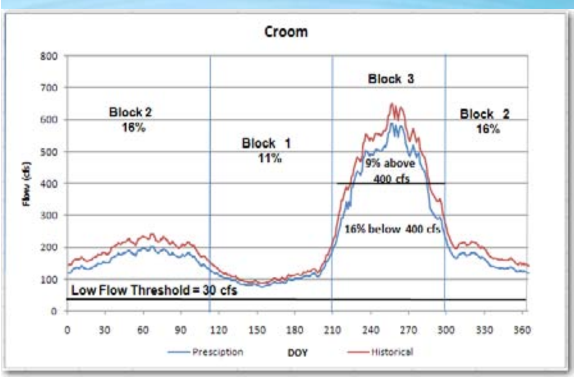
Homosassa River System



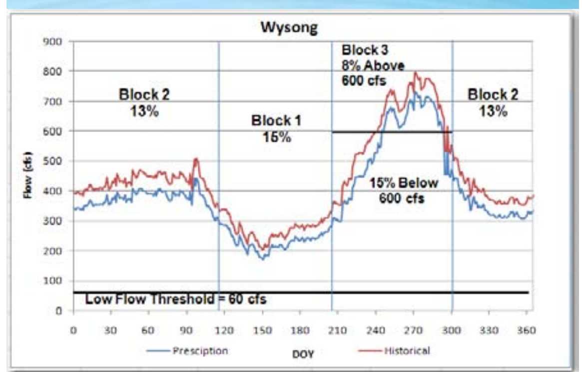
Homosassa River System Recommended Minimum Flows

A five percent reduction in baseline flows measured as combined daily mean flow past the USGS Homosassa Springs at Homosassa Springs, FL and Southeast Fork Homosassa Springs at Homosassa Springs, FL

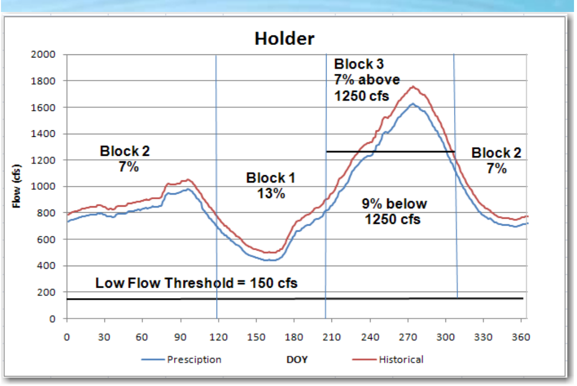
Flow Prescription – Croom and Upstream



Flow Prescription – Croom to Wysong



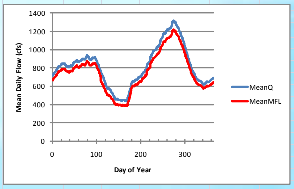
Flow Prescription – Wysong to Holder



WITHLACOOCHEE AT HOLDER

Period for Calculations		B2 Low Trigger %	0.07
8/10/1965 to 12/31/2009		B3 Low Trigger %	0.09
LFT	150		
Block 1	0.13	B2 Trigger Q	0
Block 2	0.07	B3 Trigger Q	1250
Block 3 HF %	0.07		
Max Diversion	10000		

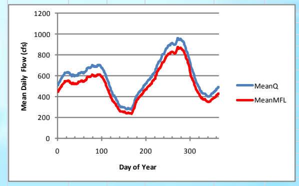
	CFS	MGD		% of Q
Mean Q	817	528.1	Block 1	10.88%
Mean MFL Q	753	486.3	Block 2	6.59%
Mean Available	65	41.7	Block 3	7.90%
% of Mean Q	7.90%	7.90%	%ofXAnnuals	7.80%



WITHLACOOCHEE AT WYSONG

Period for Calculations		B2 Low Trigger %	0.13
8/10/1965 to 12/31/2009		B3 Low Trigger %	0.15
LFT	60		
Block 1	0.15	B2 Trigger Q	0
Block 2 HF %	0.13	B3 Trigger Q	600
Block 3 HF %	0.08		
Max Diversion	100000		

	CFS	MGD		% of Q
Mean Q	592	382.6	Block 1	12.70%
Mean MFL Q	523	337.8	Block 2	12.26%
Mean Available	69	44.7	Block 3	11.14%
% of Mean Q	11.70%	11.70%	%ofXAnnuals	11.98%

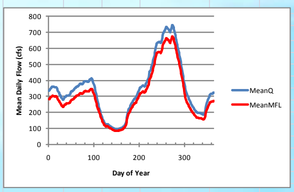


WITHLACOOCHEE AT CROOM

Period for Calculations		B2 Low Trigger %	0.16
8/10/1965 to 12/31/2009		B3 Low Trigger %	0.16
LFT	30		
Block 1	0.11	B2 Trigger Q	0
Block 2 HF%	0.16	B3 Trigger Q	400
Block 3 HF %	0.09		
Max Diversion	10000		

Note: substituted 0.01 cfs for flows on days when reported flow was 0 to avoid division by zero errors in the spreadsheet

	CFS	MGD		% of Q
Mean Q	347	224.1	Block 1	8.05%
Mean MFL Q	303	195.8	Block 2	13.74%
Mean Available	44	28.3	Block 3	11.23%
% of Mean Q	12.61%	12.61%	%ofXAnnuals	11.87%



Simple River Water Budget

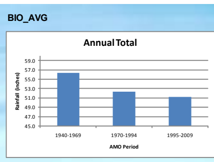
Discharge = Rainfall – ET

Rainfall = 50 inches
ET = 38 inches
Discharge = 12 inches

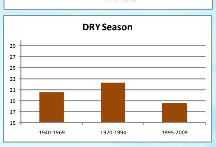
Rainfall = 45 inches
ET = 38 inches
Discharge = 7 inches

Net Result
10% decrease in rainfall
42% decrease in discharge

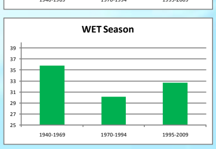
BIO_AVG



	Annual Total (inches)
1940-1969	56.3
1970-1994	52.4
1995-2009	51.3
POR	54.1



	Dry Season Total (inches)	X% of Annual Totals
1940-1969	20.6	36%
1970-1994	22.3	42%
1995-2009	18.6	36%
POR	20.6	38%

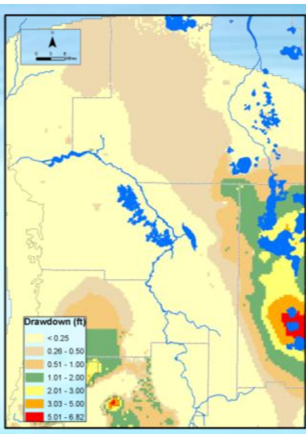


	Wet Season Total (inches)	X% of Annual Totals
1940-1969	35.8	64%
1970-1994	30.1	58%
1995-2009	32.7	64%
POR	33.5	62%

Withdrawal Impacts

- Northern District Model -

Source: Basso (2010)



USGS Gaging Station	No Pumping Baseflow (cfs)	2005 Baseflow (cfs)	Percent Change (%)
Compressco	8.92	8.80	-1.3
Dade City	12.61	12.31	-2.3
Trilby	56.62	56.15	-0.8
Croom	99.36	101.36	2.0
Floral City	95.16	97.43	2.4
Wysong Dam	152.54	155.58	2.0
Holder	235.58	231.13	-1.9

Criteria for Selection of MFL Waterbodies

- "Each water management district shall include all first magnitude springs, and all second magnitude springs within state or federally owned lands purchased for conservation purposes. . ." FS 373.042 (2)

Must Also Consider Structural Alterations

Florida Statutes, Section 373.0421

Culverts, Dams, Ditches, etc.

Roads, Buildings, etc.

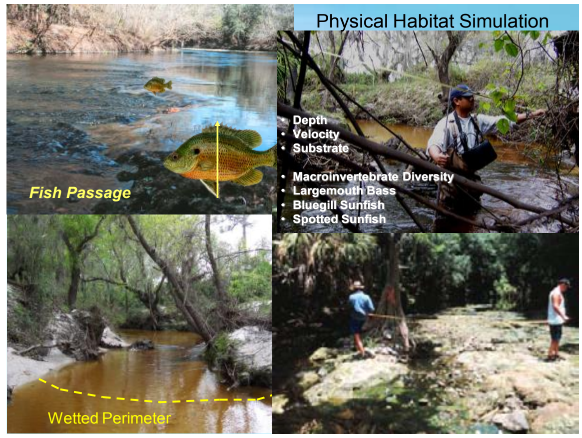
What is Significant Harm?

- Not defined by State Law
- Defined or implicit in District standards or thresholds used to establish minimum flows and levels
- Standards or thresholds are specific to water resource type and value

Examples

- Preventing cypress wetland degradation in lake basins
- Preventing more than a 15% decline in habitat availability in river segments
- Preventing or slowing rate of saltwater intrusion into aquifers

Physical Habitat Simulation

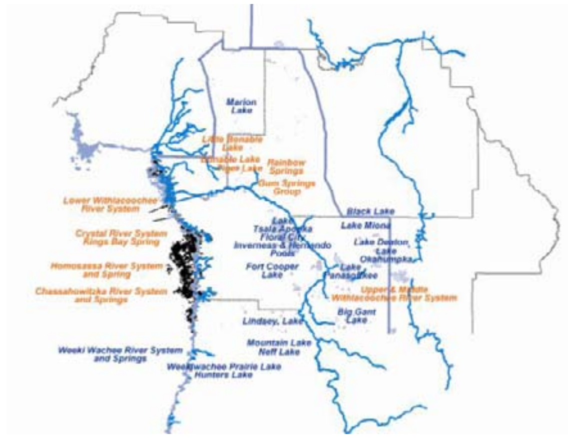


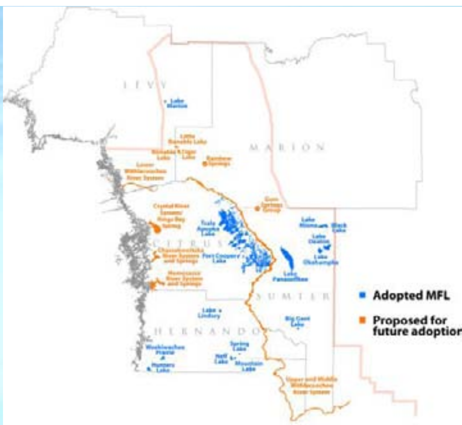
Weeki Wachee MFL Rule adopted 12/16/08

40D-8.041

- ***(a)** “. . . . For purposes of this rule, the Weeki Wachee System includes the watercourse from the Weeki Wachee Spring to the Gulf of Mexico including Twin Dees Spring, Mud River (including Salt Spring) from Mud Spring to the confluence with the Weeki Wachee River and Jenkins Springs and associated spring run.*
- ***(b)** The Minimum Flow for the Weeki Wachee River System is intended to preserve 90% of the natural flow of the Weeki Wachee River system. . . .”*

31





January 24, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section
Ron Basso, Senior Professional Geologist/Engineer, Hydrologic Evaluation Section
Southwest Florida Water Management District

SUBJECT: Questions and Comments submitted by Mr. Martyn Johnson on December 24, 2010 regarding recommended minimum flows for the Homosassa River system

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This memorandum documents an e-mail submitted to the Southwest Florida Water Management District by Mr. Martyn Johnson on December 24, 2010 concerning development of minimum flows for the Homosassa River system. With regard to potential flow reductions associated with establishment of minimum flows for the river system, Mr. Johnson notes that "[*a]nything that results in further reduction in the flows of freshwater into the river is very likely to have serious consequences to the river and its associated value both economically and ecologically*." Excerpted portions of Mr. Johnson's e-mail are reproduced below in italics, along with staff responses to his questions and comments. Mr. Johnson's entire e-mail is reproduced as a four-page attachment to this memorandum, to provide context for his perspective on the currently recommended minimum flows for the Homosassa River system.

- - - - - - - - - - - - - - - - - - - -

Excerpt 1 from Mr. Johnson's E-Mail

"Excerpt 1

Water Chemistry - Bulletin 69

Although Bulletin 69 does add some information regarding the trends and statistics of chemical analyses for the springs in the Homosassa system (Homosassa Springs 1, 2, 3, Pump House Spring and Trotter Spring and Hidden River) it covers 1991 – 2003.

The figures in Table 20, Sequence A: show positive trends in many key parameters from 1991 -2003, notable exceptions Pump House and Trotter (other than nitrate). Table 22 Sequence B: shows few positive trends for 1991-1997.
Given that the trends are more positive in the period Sequence A than in Sequence B it highlights the need to look at the trends for years since 2003.

Can the analyses results from all samplings summarized in Table 2-6 of the Peer Review Draft July 2010 be made available? *Bulletin 69 does show all results 1991-2003 in the Appendices.*

The point is we have been observing harmful changes to the Homosassa River in recent years e.g. barnacle growth in the upper reaches. There needs to be clear understanding if the trends mentioned in Bulletin 69 are continuing from 2003 to present and how much of a factor these trends may be.

Has the question been answered.

Regarding the comments from staff about sizable localized withdrawals; I hope this generalization is true as SWFWMD have the responsibility to prevent such withdrawals from occurring. The peer-review question was more specifically directed at the ratio of the water from the low salinity springs. I would speculate these waters originate from much further away and as the exact routing of these waters thru the aquifer are not known; ***Is it not possible that any well drilled could hit /draw from the 'vein' feeding these springs which are primarily in the SE Fork?"***

Staff Response to Excerpt 1
With regard to Mr. Johnson's comments concerning water quality data for the Homosassa River system, staff notes that the District data summarized in the draft minimum flows report will be included in the appendices of the revised version of the report. In addition, electronic files containing the data will be provided directly to Mr. Johnson.

With regard to Mr. Johnson's question concerning the impact of wells on spring flows, staff notes that it is possible that very large withdrawals close to the Homosassa Main Spring or springs of the Southeast Fork would have substantially more impact on flow then the current distribution of pumping. As noted in a previous response to Mr. Johnson, it would take a very large localized withdrawal to affect the relative contribution of fresh to saline water from a group of springs and cause salinity changes to the system overall, and expectations for this occurring are low.

Finally, staff notes that groundwater withdrawals associated with individual water use permit requests are evaluated for their potential impact on area water resources, including springs. Any well that is six inches in diameter or greater, can withdraw 100,000 gallons per day or greater, or has the capacity to withdraw 1,000,000 gallons per day requires a water use permit from the District. Groundwater flow modeling associated with any requested water use that could affect the flows in the river system and environmental monitoring that would be associated with the permits would ensure that the District fulfills its mission to allow responsible water-use while affording protection to natural resources and other existing legal users of the resources.

Excerpt 2 from Mr. Johnson's E-Mail
"Declines in aquifer levels (Excerpt 4/5)
Again I see the reliance on the model. The model if it is any value must consider the actual annual rainfall as a real input. IMHO it is pointless to talk about cumulative rainfall deficit. The rain that fell is the rain that fell, no one can change that. The reality is that the actual levels in the aquifer are dropping, as evident from recorded well levels. The water level in the aquifer is the driving force to actual spring flows. Therefore, actual changes in well levels should feature prominently in any discussion/decision regarding Minimum Flows. Regarding staff's comment re Lecanto 2, let us be clear this is the only comment in the report regarding the downward trend/s of well in the area; the statistical significance is not quantified and is dismissed as being consistent with regional rainfall patterns. In my opinion that is insufficient coverage of this important factor.

I note that the Statue addresses both flow and level of groundwater in the aquifer, but I am not aware of where these minimum levels of groundwater in the aquifer are addressed. Presumably these are subject of other studies/reports."

Staff Response to Excerpt 2

The Northern District Model was calibrated by matching water levels from 295 wells within the model domain. Baseflow from major rivers and spring flow from 93 springs was also matched during the calibration process. The recharge applied in the model was also derived based on radar estimated rainfall, land use, soils, and depth to water table information. Detailed information on the model calibration is included in a 2008 report by HydroGeoLogic, Inc., titled *Groundwater Flow and Saltwater Intrusion Model for the Northern District Water Resources Assessment Project Area*. This report was supplied to the scientific panel that recently completed an independent, peer-review of the technical work associated with development of the District's recommended minimum flows for the Homosassa River system.

Staff agrees that there has been a long term decline in rainfall and that spring flows have responded to this decline through lower than average flows under current conditions. Water levels within the Floridan aquifer also mimic this long-term decline in rainfall. The Lecanto 2 well was shown in the District's draft Homosassa River minimum flows report because it has the longest period of record (since the mid-1960s) of water levels in the immediate area. The District monitors many more wells and while they generally have shorter records, they show a long-term decline similar to Lecanto 2.

Staff acknowledges Mr. Johnson's comments regarding declines in potentiometric levels of the Floridan aquifer system in west-central Florida and his opinion regarding discussion of this information in the draft minimum flows report for the Homosassa River system. The District did address the statistical significance of the long-term decline at the Lecanto 2 well in the following excerpt from Mr. Basso's technical memorandum contained within the report…."*Simple linear regression of the monthly water levels since 1965 shows a statistically significant downward trend of -0.048 ft/year or about -2.1 ft. for the period 1965-2009."* While additional shorter-term water level hydrographs of wells in the Floridan aquifer could be shown in the report they would only serve to reiterate the point that there have been long-term declines in the Floridan aquifer water levels in this area. All of the District analyses, however, indicate that this is almost entirely due to long-term decline in rainfall. Staff will consider the inclusion of additional information on well levels in the revised version of the minimum flows report.

The District has established minimum aquifer levels for the Floridan aquifer system in regions of the District where significant impacts to water resource have been associated with groundwater withdrawals. Reports outlining this work are available on the Minimum Flows and Levels (Environmental Flows) Documents and Reports page of the District web site at: http://www.swfwmd.state.fl.us/projects/mfl/mfl_reports.php.

Excerpt 3 from Mr. Johnson's E-Mail

"Excerpt 5
I did not need the diagram highlighted in red to show the rainfalls, but thanks.

What I was hoping for was an explanation of who/where was water usage so much more in those years when rainfall was low, and possibly what was done to control usage in 1999, 2000, 2001 which were also low rainfall years. Such information could help understand how SWFWMD crosslink data that you have to make recommendations."

Staff Response to Excerpt 3

When rainfall is low, water use typically increases for public supply due to outdoor residential lawn irrigation and agricultural use. The District also applies water shortage rules during droughts that limit outdoor home irrigation to one or two days per week which helps to offset increased demand during dry times.

Information on historical water use in the vicinity of the Homosassa River system is available in the July 2005 District Water Management Plan, the December 2010 Draft Southwest Florida Water Management District Regional Water Supply Plan – Northern Planning Region, the 2012-2016 Southwest Florida Water Management District Strategic Plan, and estimated water use reports prepared for the period from 1998 through 2008. The District also maintains an electronic database of estimated and metered water use within our District from 1992 through 2006. This database includes both metered and estimated water use from both water use permits and estimates of domestic well water use.

Most of the reports identified in the previous paragraph include information on District water conservation activities associated with public outreach/education, incentive programs, and implementation of water-use regulation rules and programs. Links to the reports are provided below along with a link to the District's Water Conservation Page, which includes a wealth of information pertaining to water conservation efforts.

July 2005 District Water Management Plan and Appendices
http://www.swfwmd.state.fl.us/about/watermanagementplan/
http://www.swfwmd.state.fl.us/about/watermanagementplan/dwmp-appendix.pdf

December 2010 Draft Southwest Florida Water Management District Regional Water Supply Plan – Northern Planning Region
http://www.swfwmd.state.fl.us/documents/plans/RWSP/drafts/NPR-Public-Draft-4_20_10.pdf

2012-2016 Southwest Florida Water Management District Strategic Plan
http://www.swfwmd.state.fl.us/files/database/site_files/StrategicPlan.pdf

Estimated Water Use Reports for Various Years/Time Periods, filed under the General Reports heading
http://www.swfwmd.state.fl.us/documents/index.php#reports

Water Conservation Page of the District Web Site
http://www.swfwmd.state.fl.us/conservation/

Excerpt 4 from Mr. Johnson's E-Mail

"Excerpt 6

I do not understand how staff came to their answer talking about withdrawals.

I was trying to ascertain/understand the starting point/date for 15% further harm and starting date/flow used as a base for the 5% reduction (mentioned in the July report). Also, I was pointing out that no mention is made about how compliance will be monitored other than by the model. The condition of the Homosassa River was, by all reasonable accounts, better in 1970, when the legislation was first enacted than in recent years and with some 25 mg/d less withdrawals in Citrus County.

Additionally, the figure quoted in the reply
"Based on recent regional water-use information, staff has determined that the effect of withdrawals on flows in the Homosassa River system is on the order of one percent."appear to be at odds with:

The United States Geological Survey (USGS) developed a water budget for the basin for calendar years 1997 and 1998 (Knochenmus and Yobbi, 2001). According to Knochenmus and Yobbi's calculations, average annual values for the following water budget components were:

Rainfall = 52 inches (in)/yr,
Evapotranspiration = 32 in/yr,
Springflow = 12.5 in/yr,
Groundwater Withdrawals = 0.6 in/yr,
Groundwater Outflow = 6.7 in/yr and
Change in Storage = 0.2 in/yr

I read that to say that groundwater withdrawals are close to 5% of the spring flow. Of course I may be missing something as I am not sure what Groundwater Outflow is and possibly incorrectly assume it to be surface run off.

Note; The 12.5 inches per year over 292 square miles does, as I am sure you are aware, have close agreement with the annual mean tidally adjusted outflow of 272 cfs at Homosassa River Site (possibly that is where the 12.5 inches derived from).

I assume the concept used in the various reports and model is that water if not withdrawn from wells would have been spring flow. However, I question if that is totally true as flow to the springs is aquifer level driven which I assume to be less efficient than mechanical extraction by pumps in numerous wells. Many of these pumps are in small wells in locations such as Sugar Mill Woods and similar developments that are not metered. Presumably these withdrawals are factored by some assumed usage and the number of known wells.

It is recognized that some of the withdrawals do return into the ground, generally these carry higher TDS due to evaporation/transpiration in the case of irrigation use and additives from commercial and domestic use.

Staff Response to Excerpt 4

Staff acknowledges Mr. Johnson's comments and notes that the assertion that *"the effect of withdrawals on flows in the Homosassa River system is on the order of one percent"* is not inconsistent with the water budget information for the system presented by Knochenmus and Yobbi (2001). The estimated one percent effect of groundwater withdrawals on spring discharge in the Homosassa River system is based on comparison of discharge values associated with modeled scenarios under pumping and non-pumping conditions. Comparison of the values for springflow and groundwater withdrawals presented by the United States Geological Survey simply provides a means for evaluating the relative magnitude of components of the water budget; it does not provide a means for evaluating the effect of withdrawals on spring flow.

When evaluating a water budget for the Homosassa Springs basin, all of the groundwater withdrawn from the area cannot be assigned toward a reduction in spring flow. Groundwater withdrawals lower water levels in the aquifer which decreases storage, reduces lateral groundwater outflow to the coast, surface water runoff, spring discharge, and evapotranspiration. Water that is removed from an aquifer is essentially offset by changes in aquifer storage, lateral outflow, runoff, spring discharge, and evapotranspiration. The decline in storage, *i.e*., the lowering of the Upper Floridan aquifer water level, and changes in spring discharge are simulated by the Northern District model. Changes in water levels due to withdrawals are largely predicated on the aquifers transmissive (permeable) properties, the magnitude of the aquifer storage coefficient, and the amount of recharge that reaches the aquifer.

The water level elevation of the Floridan aquifer at the spring vents in the Homosassa River system is the driving head that controls spring discharge. For the 2005-withdrawal scenario that was evaluated for the river system with the Northern District Model, the predicted lowering in the Upper Floridan aquifer water level due to all withdrawals in the model domain at the locations that make up the numerous springs of the system was less than 0.1 feet. This resulted in a predicted reduction in modeled spring discharge of approximately one percent. The groundwater flow system in Citrus County is less vulnerable to the impacts of withdrawals because the Upper Floridan aquifer is mostly unconfined, has very high recharge rates, is very permeable, and groundwater withdrawals are relatively low in magnitude and dispersed.

Excerpt 5 from Mr. Johnson's E-mail

"Excerpt 7

We agree.

But, the observed evidence is that during the cold months the manatee are consuming more and more of the vegetation (SAV is possibly the more correct term) in the upper reaches as the years pass. Possibly *this is not the documented science that we would like to support decisions, but it is evidence that is extremely important to decision making.*

As touched on earlier in this e-mail. Possibly such input could be gained by interviewing long term residents using a standardized question and answer survey. As I have commented before the comments made by human observation are not included in the report. Noted comments to file from the various meetings are lost in the mass of scientific data, but those firsthand observations over many years get to the heart of the matter much more succinctly."

Staff Response to Excerpt 5

Staff acknowledges Mr. Johnson's comments regarding manatees, submersed aquatic vegetation and implementation of a survey for compiling information on observations made by local residents. The District does not currently anticipate conducting a survey of long-term residents regarding environmental change in the Homosassa River system. The District is, however, considering the creation of a stakeholders group to assist in the identification of monitoring and data collection efforts that will support compliance evaluations and potential re-evaluation of minimum flows that are adopted for the river system.

DAL
Attachment: Four page e-mail from Mr. Martyn Johnson dated December 24, 2010

Four Page Attachment to January 24, 2011 Memorandum on Questions and Comments Submitted by Mr. Martyn Johnson on December 24, 2010

From: Alan Martyn Johnson
To: Doug Leeper
Cc: Marty Kelly; Sid Flannery; Mike Heyl; Mark Barcelo; Ron Basso; Karen Lloyd; Jay Yingling; Yassert Gonzalez; Cara S. Martin; rkane@usgs.gov; kjgrims@usgs.gov
Subject: Homosassa MFLs
Date: Friday, December 24, 2010 9:13:11 AM

Doug,
Thanks for your e-mails of November 22 and December 17. Unless I hear to the contrary I hope to be at the January 6 workshop. I would like to express my appreciation that you and SWFWMD are taking the time to hear further public input. I would really like to see some form of survey of long term residents so that anecdotal observations, as staff has referred to them, can better be transformed to firsthand knowledge and used in the decision making process.

I have read and thought about the comments in your December 15, 2010 memo to file attached to the December 17 e-mail. I would like to comment as follows:

Excerpt 1
Water Chemistry - Bulletin 69
Although Bulletin 69 does add some information regarding the trends and statistics of chemical analyses for the springs in the Homosassa system (Homosassa Springs 1, 2, 3, Pump House Spring and Trotter Spring and Hidden River) it covers 1991 – 2003.

The figures in Table 20, Sequence A: show positive trends in many key parameters from 1991 -2003, notable exceptions Pump House and Trotter (other than nitrate). Table 22 Sequence B: shows few positive trends for 1991-1997.
Given that the trends are more positive in the period Sequence A than in Sequence B it highlights the need to look at the trends for years since 2003.

Can the analyses results from all samplings summarized in Table 2-6 of the Peer Review Draft July 2010 be made available? Bulletin 69 does show all results 1991-2003 in the Appendices.

The point is we have been observing harmful changes to the Homosassa River in recent years e.g. barnacle growth in the upper reaches. There needs to be clear understanding if the trends mentioned in Bulletin 69 are continuing from 2003 to present and how much of a factor these trends may be.

Has the question been answered.
Regarding the comments from staff about sizable localized withdrawals; I hope this generalization is true as SWFWMD have the responsibility to prevent such withdrawals from occurring. The peer-review question was more specifically directed at the ratio of the water from the low salinity springs. I would speculate these waters originate from much further away and as the exact routing of these waters thru the aquifer are not known; **Is it not possible that any well drilled could hit /draw from the 'vein' feeding these springs which are primarily in the SE Fork?**

Excerpt 2
As you are aware I have asked for input from the Park. I will certainly share if such should materialize.

Excerpt 3
Thank you for acknowledging my comments, presumably staff are thinking about these when looking at the NDM (the model).

Excerpt 4
Flow/Discharge Calculations
As you are aware I have asked the USGS if the rating curves/equations have changed over time.

Declines in aquifer levels (Excerpt 4/5)
Again I see the reliance on the model. The model if it is any value must consider the actual annual rainfall as a real input. IMHO it is pointless to talk about cumulative rainfall deficit. The rain that fell is the rain that fell, no one can change that. The reality is that the actual levels in the aquifer are dropping, as evident from recorded well levels. The water level in the aquifer is the driving force to actual spring flows. Therefore, actual changes in well levels should feature prominently in any discussion/decision regarding Minimum Flows. Regarding staff's comment re Lecanto 2, let us be clear this is the only comment in the report regarding the downward trend/s of well in the area; the statistical significance is not quantified and is dismissed as being consistent with regional rainfall patterns. In my opinion that is insufficient coverage of this important factor.

I note that the Statue addresses both flow and level of groundwater in the aquifer, but I am not aware of where these minimum levels of groundwater in the aquifer are addressed. Presumably these are subject of other studies/reports.

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What I was hoping for was an explanation of who/where was water usage so much more in those years when rainfall was low, and possibly what was done to control usage in 1999, 2000, 2001 which were also low rainfall years. Such information could help understand how SWFWMD crosslink data that you have to make recommendations.

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I do not understand how staff came to their answer talking about withdrawals.

I was trying to ascertain/understand the starting point/date for 15% further harm and starting date/flow used as a base for the 5% reduction (mentioned in the July report). Also, I was pointing out that no mention is made about how compliance will be monitored other than by the model. The condition of the Homosassa River was, by all reasonable accounts, better in 1970, when the legislation was first enacted than in recent years and with some 25 mg/d less withdrawals in Citrus County.

Additionally, the figure quoted in the reply
"*Based on recent regional water-use information, staff has determined that the effect of withdrawals on flows in the Homosassa River system is on the order of one percent.*"
appear to be at odds with:

The United States Geological Survey (USGS) developed a water budget for the basin for calendar years 1997 and 1998 (Knochenmus and Yobbi, 2001). According to Knochenmus and Yobbi's calculations, average annual values for the following water budget components were:
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I assume the concept used in the various reports and model is that water if not withdrawn from wells would have been spring flow. However, I question if that is totally true as flow to the springs is aquifer level driven which I assume to be less efficient than mechanical extraction by pumps in numerous wells. Many of these pumps are in small wells in locations such as Sugar Mill Woods and similar developments that are not metered. Presumably these withdrawals are factored by some assumed usage and the number of known wells.

It is recognized that some of the withdrawals do return into the ground, generally these carry higher TDS due to evaporation/transpiration in the case of irrigation use and additives from commercial and domestic use.

Excerpt 7
We agree.

But, the observed evidence is that during the cold months the manatee are consuming more and more of the vegetation (SAV is possibly the more correct term) in the upper reaches as the years pass. Possibly this is not the documented science that we would like to support decisions, but it is evidence that is extremely important to decision making.

As touched on earlier in this e-mail. Possibly such input could be gained by interviewing long term residents using a standardized question and answer survey. As I have commented before the comments made by human observation are not included in the report. Noted comments to file from the various meetings are lost in the mass of scientific data, but those firsthand observations over many years get to the heart of the matter much more succinctly.

In conclusion.
I hope that someone starts looking at reality and not relying so heavily on the model.

The Homosassa River is a valuable and rare resource for Florida, its future is no doubt very delicate as evidenced by changes over the years, scientifically documented and human observation. Everything possible should be done to protect the river. Anything that results in further reduction in the flows of freshwater into the river is very likely to have serious consequences to the river and its associated value both economically and ecologically.

Thanks for allowing me to again make comments.

Martyn Johnson

February 15, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: December 2010 correspondence between Martyn Johnson and Dana Bryan, FDEP concerning spring flow in the Homosassa River system

---

This memorandum documents an e-mail correspondence between Mr. Martyn Johnson and Mr. Dana Bryan (with the Florida Department of Environmental Protection) from December 2010. The correspondence concerns measurement discharge from a spring vent near or within the Homosassa Springs state park. The correspondence was copied to District staff and is documented here for its relevance to the development of minimum flows for the river system.

DAL
Attachment: E-mail from Martyn Johnson to Dana Bryan, dated December 15, 2010

Attachment

E-Mail from Martyn Johnson to Dana Bryan

From: Alan Martyn Johnson
To: Dana Bryan
Cc: Doug Leeper
Subject: Homosassa River Minimum Flow Rates
Date: Wednesday, December 15, 2010 10:59:51 AM

Dana,
Did you get any follow up comments from people at the Homosassa State Park regarding their observations of any changes at the various springs over time. You may recall that I was particularly interested in the spring at the overlook platform that I personally have seen change from a good clearly significant flow to the current no noticable flow.

A number of long time residents fully agree with my observation, but it would be useful to have input from the park on this and the other springs within the park.

SWFWMD dismiss my comments stating there was only negligable flow from this spring. They appear to miss the point about the flow having stopped.

Any comments that you have from the park management or long time volunteers would be appreciated.

Thanks,

Merry Christmas and Best Wishes for the New Year.
Martyn Johnson

February 15, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: December 2010 correspondence between Martyn Johnson, Kevin Grimsley and Richard Kane concerning flow measurement in the Homosassa River system

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This memorandum documents e-mail correspondence between Mr. Martyn Johnson, Mr. Kevin Grimsley and Mr. Richard Kane) from December 2010. The correspondence concerns measurement of flows by the United States Geological Survey at sites in the Homosassa River system. The correspondence was copied to District staff and is documented here for its relevance to the development of minimum flows for the river system.

DAL

Attachments: A – E-mail from Martyn Johnson to Kevin Grimsley, dated December 15, 2010
B – E-mail from Richard Kane to Martyn Johnson, dated December 15, 2010
C – E-mail from Kevin Grimsley to Martyn Johnson, dated December 17, 2010
D – E-mail from Martyn Johnson to Kevin Grimsley, dated December 20, 2010

Attachment A

E-Mail from Martyn Johnson to Kevin Grimsley

From: Alan Martyn Johnson
To: kjgrims@usgs.gov
Cc: Doug Leeper; rkane@usgs.gov
Subject: Homosassa River Flows
Date: Wednesday, December 15, 2010 6:37:45 PM

Kevin,

While I understand the direct scope of the USGS involvement in this project, the use of data originating from USGS by SWFWMD is of significant importance to the task that SWFWMD are legislated to perform by the State of Florida. That is why I am reviewing such data in an attempt to fully understand it to make meaningful commentary on the matter.

Couple of points I would like to share with you from previous e-mails.

Firstly, regarding your Nov 15 answer to my question 3 (copied below for ease of reference). A number of long term residents have been asked if they have ever noticed negative flow under the bridge at SE Fork (02310688)...they have never observed such a situation. They all agree that flow at this location is always down stream. The calculated data of flows at this site are always positive. May I ask that this explanation/formula be given some further consideration before such data is presented in early January.
QUOTE
Question 3: Why is the dS/dt (change in river stage during a 15-minute period, in ft.) in one equation to such a large multiplier and not in the other? There appears to be a significant difference in the methodology used, see comment below.
The gage height change comes into play at 0231688 (SE Fork) because the flow actually becomes significantly negative during high tides. The change of rate of stage can be thought of as a surrogate for velocity in that it gives an indication of the direction of flow (negative rate of change correlates to positive flow, positive rate of change correlates to negative flow).

There is no rate of change of stage component at 02310688 (Homosassa Springs) because there is no occurrence of negative net flow at the site. There has been some bidirectional flow noted along the edges of the channel at high tides, but overall net flow has always remained positive. It should not be concerning at all that the rate of change of stage component is significant at one station and not at another.
END QUOTE

Secondly on the thought that I had about times between the zero flow conditions at the Homosassa River site 02310700 I had the chance to discuss this with some students at Georgia Tech who took it to one of their professors. The thought along with a diagram that was returned to me is that there must be a clear relationship because there are two finite situations:

1. If there were no flow from the springs the inflow and out flow times at the above site 'MacReas' would be the same for any high/low tide combination. Assumptions are that

there is no other exit or entry to the upper reach of the Homosassa River from this site.
2. If the flow from the springs were increased there would be a spring flow that would only result in out flow at 02310700; this would range from zero flow at high tide to a maximum flow at low tide. Probably I should say Gage Height rather than tide.

While these situations are theoretical they do represent defined ends of a potential mathematical formula derived from a differential that a small decrease in the flow from situation 2 would result in a small time where inflow would result at 02310700. While the professor did not claim to be a hydrologist he did give some ideas about how to look at the data. And he offered to find the name of someone who he thinks is at University of Texas Austin who may specialize in this area.

Is there any way that I/we can access or be supplied with the data from this site since 2004? The on-line information is limited to the last 120 days and this will be looked at as a starting point.

Kevin, this request for data is not one I would expect you to spend time on, it is more a question of can it be accessed.

I thought the presentation of the two finite situation did make sense. Any professional commentary is welcome.

Thanks,
Merry Christmas and All the Best for the New Year.

Martyn Johnson

Attachment B

E-Mail from Richard Kane to Martyn Johnson

Note: e-mail string deleted by Doug Leeper, SWFWMD

From: Richard L Kane
To: Alan Martyn Johnson
Cc: Doug Leeper; kjgrims@usgs.gov
Subject: Re: Homosassa River Flows
Date: Wednesday, December 15, 2010 9:43:55 PM

Martyn in regards to your request for the data back to 2004, yes that can be made available. All of the daily values data is available on NWISWEB and you can download it directly. You can either go to the real time sites and then choose the daily values data from the drop down menu, Also you can retrieve the instantaneous data for discharge (for period of record) from the same site. If however you need instantaneous data from other parameters (gage height, water quality, velocity) you will need to request that data. We normally charge a small fee for retrievals that we have to do, to recover our cost. That can sometime be waived for small requests that only take a few minutes to process.

http://waterdata.usgs.gov/fl/nwis/si

http://ida.water.usgs.gov/ida/available_records.cfm?sn=02310688

Richard L. Kane
Chief Hydrologic Data Section, Tampa
U. S. Geological Survey
Florida Water Science Center
10500 University Center Dr., Suite 215
Tampa, Fl. 33612
rkane@usgs.gov
(813-975-8620, ext. 131)
FAX (813-975-0839)
Cell 813-918-1275

Attachment C

E-Mail from Kevin Grimsley to Martyn Johnson

Note: e-mail string deleted by Doug Leeper, SWFWMD

From: Kevin J Grimsley
To: Alan Martyn Johnson
Cc: Doug Leeper; rkane@usgs.gov
Subject: Re: Homosassa River Flows
Date: Friday, December 17, 2010 10:42:54 AM

Martyn,

First let me say that you're absolutely right, the total flow at SE fork does not completely reverse. That was a poor choice of wording on my part so let me clarify. While the total net flow at SE fork does not reverse, the negative flow components (bidirectional flow) are much more significant at the SE fork gage than they are at Homosassa Springs. I suspect this is mainly because there's simply more positive flow coming from the main spring, so the backpressure caused by a rising tide affects it less. When bidirectional flow occurs, the negative component is typically on the bottom (because water with a higher salinity is more dense) so this is not something that someone observing from above would probably notice.

In the end however, there are many different variables that can be significant at one station and not at another for a myriad of reasons. These equations were developed by starting with the simplest case, a single variable, and evaluating the discharge resulting from that equation against the known discharge measurements. From there, other variables were added to the equation and evaluated in an iterative process until the equation that best fit the discharge measurements was found. So the fact that the rate of change of stage variable does not appear in the final equation used at Homosassa Springs doesn't mean that there was a change in methodology, it just means that the addition of that variable didn't help the equation fit the measurements at that station.

The reality is that the regression equation at SE fork matches the discharge measurements better with the rate of change of stage variable than without it. We're always evaluating how well our equations match our new measurements as we make them throughout the year, but as part of preparing this email I made a quick evaluation of how the equation matched all the measurements over the past 5 years. The average difference between the SE fork regression equation and our measurements was less than 3 percent which shows an excellent correlation.
Regarding the second section of your email, while I certainly agree that there is some relationship between the duration of flows in each direction and the net flow, I stand by my previous concern that looking only at the duration of flow in each direction would not account for the magnitude of those flows. The station could easily flow for 6 hours in each direction but with an average positive velocity of 3 feet per second and average negative velocity of 2 feet per second. This would obviously result in 50% more positive flow than negative.

Lastly, as Richard said in his email most of our data is available for download through the website and data that you can't find there can be requested. We take great pride in our data and continue to welcome any questions and comments about how it has been collected and computed. I must reiterate, however, that questions regarding how USGS data has or has not been used and interpreted to look at longer term trends or other issues related to the proposed minimum flow recommendations are better directed to SWFWMD. The USGS has simply not been involved beyond providing the data itself so we cannot provide insight into how that data was used.

I hope I've helped answer your questions. Merry Christmas to you as well.

Kevin
****
Kevin Grimsley, P.E.

Supervisory Hydrologist
USGS, Florida Water Science Center
10500 University Center Drive, Suite 215
Tampa, FL 33612
kjgrims@usgs.gov
813-975-8620 x159

Attachment D

E-Mail with Attached JPEG File from Martyn Johnson to Kevin Grimsley

Note: e-mail string deleted by Doug Leeper, SWFWMD

From: Alan Martyn Johnson
To: kjgrims@usgs.gov
Cc: Doug Leeper; rkane@usgs.gov
Subject: RE: Homosassa River Flows
Date: Monday, December 20, 2010 9:46:45 AM
Attachments: 2010-12-19-1844-04.jpg

Kevin,
Thanks for the response.

Homosassa River Flows
On the subject of flows at the Homosassa River Site 02310700, we agree that the data on actual flow velocity and the computation of net flow since this was started is good and useful data.
The idea of trying to look at flow times in each direction was raised hoping that velocity data was available for a much more extended period than the calculated net flow. Although I understand your point about the difference regarding 3 ft/sec and 2 ft/sec the differences at this Site are not that pronounced. Anyway, let us leave that point to the students who have got a Christmas break interest over and above parties!!

SE Fork Flow
Regarding the SE Fork Site 02310688; I and another resident (he was born in Homosassa some 60 years ago) regularly kayak to and along the SE Fork. We are confident that there is no reverse (bidirectional) flow under the Fishbowl Drive bridge. Vegetation SAV and fallen leaves can clearly be seen „bouncing" along the bottom under the bridge, even at high tide. With a stream velocity of about one foot per second and a flow from the various springs that can generate a rise of about 0.4 feet in 15 minute (this is from flow of about 60cfs and an area of about 3 acres of water upstream of the bridge) which is over ten times the normal gage height change rate, I do not see the reverse flow being a reality.

The specific conductance data also does not support bidirectional flow.

We have looked carefully at the conductivity data increases from normal that occasionally are detected. From what we can see the times when conductivity increases above the norm (~900) are associated with gage height rises of over 0.04 ft per 15 minute monitoring interval, and usually with gage heights over 1 ft.. Why we asked ourselves.
Looking at the location of the monitoring site we speculate that the reason may be eddy currents set up along the concrete wall immediately downstream of the monitor. This could draw main springs water (conductivity ~4500) past the monitor in a „vortex" created by the main flow from the SE Fork trying to pass the rising water. The curve in the river, we think, adds to this speculation being valid.

I noted above increased conductivity is usually associated with gage heights over one foot. An example of an exception to this can be seen November 29 starting at 9:00am. Conductivity did rise slightly (~1200 from normal ~900) even at low gage height, but look at the rate of increase in gage height they are 0.07, 0.06, 0.05 ft per 15 min interval.

The attached diagram may help you understand our speculation. This diagram was traced from an aerial view. Just thought you may be interested in these thoughts from people who see the river regularly.

<u>Equations for discharge calculation</u>
Regarding the equations used to calculate the discharge, there is no question that this must be an iterative process to find the best match. I appreciate that you took the time to crosscheck the calculated discharge with the last 5 years empirical measurements. The agreement of less than 3 percent is excellent and significantly better that commented on by Dave Fulcher (USGS-Tampa) on May 1, 2009 and contained in the SWFWMD Report.
Re Homosassa Springs
Quote
According to Mr. Fulcher, the standard error of the rating is approximately 15 percent, and no shifts have been applied during the rating analysis.
End Quote
And Re SE Fork
Quote
The rating is maintained and average daily flow is calculated using the same methods as for the
Homosassa Springs station, although the standard error of the SE Fork station's rating is somewhat higher.
End Quote

If you still have the data yuou checked we would be interested in looking at it. If you do not still have it no problem.

One final point if I may.
Have the equations used to calculate the flow at the three sites changed over time?
Homosassa Springs at Homosassa (02310678):
Q = 90.8162 + 3.823(GW) – 20.3771(GH)
In which
Q = spring discharge measurement, in cfs.
GW = maximum daily groundwater level measured at the Floridan aquifer monitor well Weeki Wachee Well at Weeki Wachee (283201082315601) on the day of the discharge measurement used for the rating, in ft NGVD29.
GH = 15-minute gauge height of the river stage recorded at the time of the discharge measurement used for the rating, in feet relative to a gauge datum that is 2.99 feet below NAVD88.
SE Fork Homosassa Spring at Homosassa (02310688):
:
Q = 18.63 + 3.31(GW) – 10.31(GH) – 418.14(dS/dt)
In which
Q = spring discharge, in cfs.
GW = maximum daily groundwater level measured at the Floridan aquifer monitor well 283201082315601 (Weeki Wachee at Weeki Wachee) on the day of the discharge measurement used for the rating, in ft NGVD29.
GH = 15-minute gauge height of the river recorded at the time of the discharge measurement used for the rating, in ft NGVD29.

dS/dt = change in river stage during a 15-minute period, in ft.

Homosassa River at Homosassa (02310700):

:

$Q = V_m(A)$ (B-3)

$V_m = 0.00902154 + 0.9019V_i + 0.12138V_{i2} + 0.045375(GH)$

In which

Q = river discharge, in cfs.

A = area of channel cross section at the gauge, in ft2.

Vm = average velocity in the channel cross section at the gauge, in ft/s.

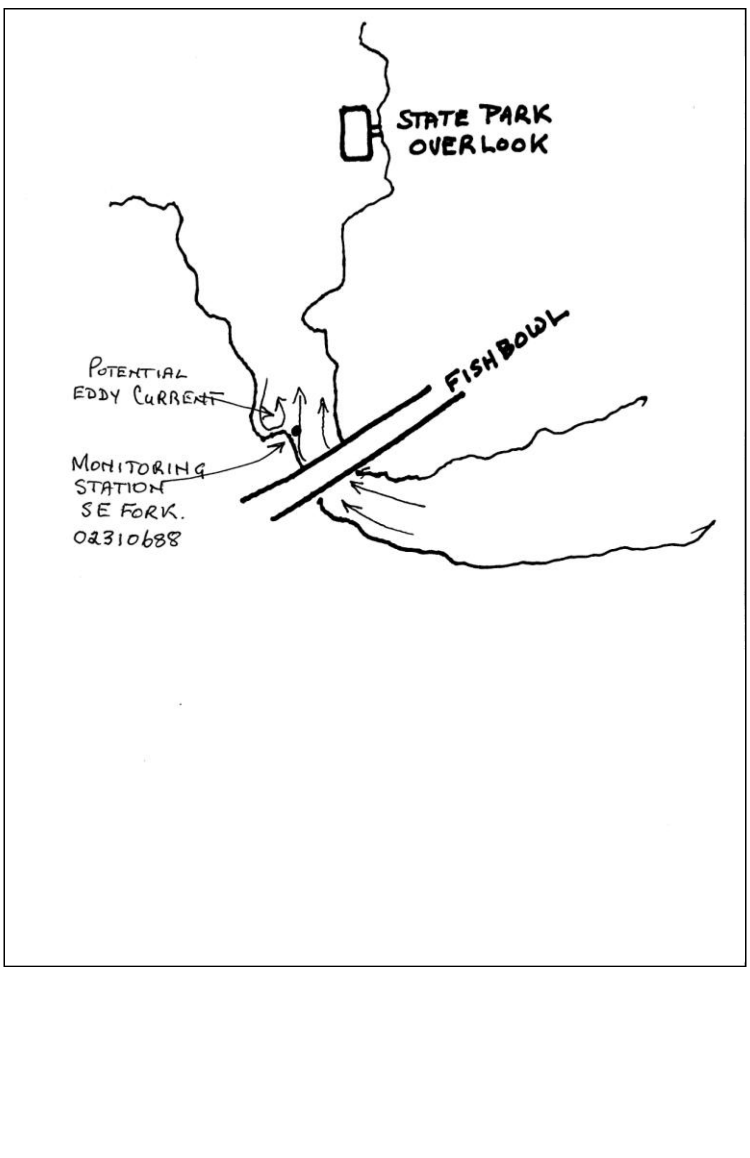
Vi = average velocity in channel measured during a 2-minute period by an "uplooking" acoustic velocity meter anchored on the channel bottom near the gauge, in ft/s.

GH = 15-minute gauge height of the river recorded at the time of the discharge measurement used for the rating, in ft NGVD29 (see follow section regarding gauge datum).

Kevin,

Really appreciate the time you have spent on my questions. The work and data available from USGS is amazing. I trust you appreciate the comments and interest in these e-mails; we are simply interested in protecting the Homosassa River from further deterioration.

Martyn



February 15, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: December 2010 correspondence between Cara Martin, Ron Miller and Jim Bitter concerning minimum flows for the Homosassa River system

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This memorandum documents e-mail correspondence between Mr. Ron Miller, Mr. Jim Bitter and Ms. Cara Martin (with the District) from December 2010. The correspondence is documented here for its relevance to the development of minimum flows for the Homosassa River system.

DAL

Attachments: A – E-mail from Ron Miller to Cara Martin, dated December 29, 2010
B – E-mail string of communications between Cara Martin, Ron Miller and Jim Bitter

Attachment A

E-Mail from Ron Miller to Cara Martin

From: Ron Miller [rmille76@tampabay.rr.com]
Sent: Wednesday, December 29, 2010 11:30 AM
To: Cara S. Martin
Subject: Fw: Workshop on Homosassa Minimum Flows

Hi Cara,

Here is more on the Homosassa Springs and River MFLs. The recommended maximum flow reduction for the Homosassa River system is five percent. A report on this work for the Homosassa River system is posted on the SWFWMD web site www.swfwmd.state.fl.us . Click on Projects & Programs; then MFLs; then Reports. Resources evaluated in this report included: 1) salinity-based habitats, 2) fish and Invertebrates, and 3) thermal-refuge for manatees.

We reviewed this report and submitted a series of questions to SWFWMD. The Questions and answers are presented in the attachments.

Ron

Attachment B

E-Mail String of Communications between Cara Martin, Ron Miller and Jim Bitter

From: Cara S. Martin
Sent: Wednesday, December 29, 2010 2:21 PM
To: Ron Miller
Cc: Mike Heyl; Marty Kelly
Subject: RE: Meeting

Ron-
Thank you for the e-mail and attached information. I will pass along to the appropriate staff.
Thank you,
Cara

From: Ron Miller [rmille76@tampabay.rr.com]
Sent: Wednesday, December 29, 2010 11:26 AM
To: Cara S. Martin
Subject: Fw: Meeting

Hi Cara,
Per Jim bitter's request I am going to forward some information on the Homosassa Springs and River Minimum Flows and Levels. Attached are some letters we wrote, some figures showing the planned wellheads and the Homosassa watershed and an article which also announces the Jan 6th public meeting with SWFWMD. More information will be sent on a separate email.
Ron

From: James Bitter
Sent: Monday, December 20, 2010 8:43 PM
To: ron miller
Subject: Fw: Meeting
I told the SWFMD people that we would like to have the USF&W Svc./ to have the info that we had accumulated. Can you forward to them?
----- Original Message -----

From: Cara S. Martin
To: jbitter@tampabay.rr.com
Sent: Monday, December 20, 2010 9:13 AM
Subject: Meeting

Mr. Bitter-
It was a pleasure speaking with you at the Chassahowitzka public meeting last Thursday (12/16/10) evening. Per your request, District staff will be meeting with the U.S. Fish and Wildlife Service on January 5, 2011.
The contact address is:

Boyd Blihovde
Deputy Refuge Manager
Chassahowitzka National Wildlife Refuge Complex
1502 SE Kings Bay Drive
Crystal River, FL 34429

Thank you,
Cara

Cara Martin
Community Affairs Manager
Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604
Office: (352) 796-7211 ext: 4636
Cell: (352) 410-0525
E-mail: cara.martin@watermatters.org
http://WaterMatters.org/twitter http://WaterMatters.org/facebook

February 9, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Communications with Ms. Hope Corona in late January and early February 2011 associated with minimum flows for the Homosassa and Chassahowitzka River sytems

---

This memorandum addresses communications between District staff and Ms. Hope Corona in late January and early February 2011. The communications addressed issues related to development of minimum flows for the Homosassa and Chassahowitzka River system and are summarized or included in attachments to this memorandum.

DAL

Attachments: A – Log for Telephone Call to the District by Ms. Corona on January 21, 2011
B through M – E-Mail correspondence with Ms. Corona

Attachment A

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

Log for Telephone Call to the District by Ms. Corona on January 21, 2011

Telephone Conversation Log

Date: 21jan2011

Name: Hope Corona

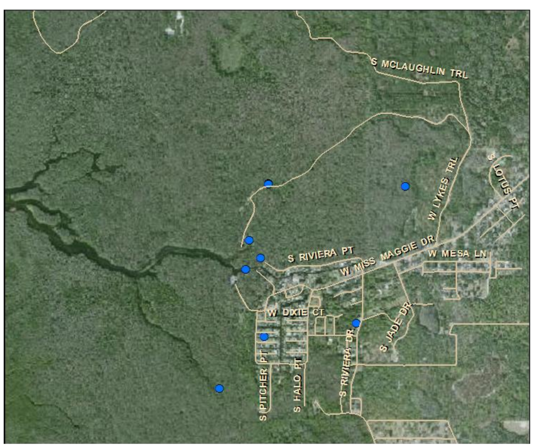
Phone: 352-382-2809 Home, 352-302-4466 Cell

E-mail: hopecorona@tampabay.rr.com

1. Wants well location, depth and salinity data for wells near Chassahowitzka River headwaters. In particular, wells located north of the river near Lykes Trail Road and also south of the river.

2. Wants to know whether the District of the USGS monitors the wells.

3. Issue is salinity in groundwater near springs and discharging from springs. Has questions about the thickness of the freshwater lens in this area



Attachment B

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Corona to Mr. Leeper, Dated January 21, 2011

From: Hope
To: Doug Leeper
Subject: Fw: Vallisneria and Salinity
Date: Friday, January 21, 2011 10:45:11 AM

----- Original Message -----
From: Hope
To: Mike Heyl ; Marty Kelly
Sent: Tuesday, December 21, 2010 8:37 AM
Subject: Vallisneria and Salinity

Hello Mr. Heyl and Mr. Kelly,

Regarding the Vallisneria data that we discussed briefly at the Second Public Workshop:

My anecdotal experience on the Chassahowitzka River system is that the healthy Vallisneria populations are observed in the clear, flowing areas of our spring runs and river, and diminishes substantially as the river becomes more brackish. I did not want to assume that my anecdotal observations were scientifically defensible, so I went to the internet when I got home from the meeting, and found several online articles and papers which discussed relationship between Vallisneria and salinity. Here's a link to one of the more recent papers (2009) that might be of interest: http://www.springerlink.com/content/700uj657143x6260/fulltext.pdf

There are other similar studies online, but this one also controlled for other growth factors (like light/shading), and was conducted in Florida in a fresh to brackish system.

Vallisneria, in my anecdotal experience, seems an important component of a healthy spring/river system, and essential habitat for numerous organisms (from the tiny ones that attach to its leaves, to the invertebrate larvae, fish, waterfowl, herptiles, manatees, herbivores and detrital feeders, that use it for everything from cover to food to egg/larval attachment). Vallisneria seems an important data set to keep in the MFL report of a fresh to brackish system like our Chassahowitzka.
Thank you for considering the recent scientific data on Vallisneria and salinity.

Your friend in science and ecology,
Hope Coron

Attachment C

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Mr. Leeper to Ms. Kraft, Dated January 21, 2011

From: Doug Leeper
To: Carol Kraft
Cc: "hopecorona@tampabay.rr.com"
Bcc: Marty Kelly; Mike Heyl; Ron Basso
Subject: Well Data Request from Hope Corona
Date: Friday, January 21, 2011 1:59:58 PM
Attachments: image003.png

Carol:
Per our phone discussion, I'm providing some information pertaining to Ms. Hope Corona's request from earlier today for data associated with wells in the Chassahowitzka River headwaters area. I've copied Ms. Corona on this e-mail, so she will know that you are working on her data request and will contact her.

Phone: 352-382-2809 Home, 352-302-4466 Cell
E-mail: hopecorona@tampabay.rr.com

1. Ms. Corona asked for well location, depth and salinity data for wells near Chassahowitzka River headwaters. In particular, she is interested in wells located north of the river near Lykes Trail Road and also south of the river (general area map below). You may want to contact her regarding the scope of the area she is interested in, as it is may be larger than the area depicted in the image below.
2. She also asked whether the District or the USGS monitors wells in the area. I'm guessing that we will be able to provide her with District well information, but may have to direct her to the USGS web site or staff for USGS well data.

Thanks,

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment D

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Mr. Leeper to Ms. Corona, Dated January 21, 2011

From: Doug Leeper
To: "Hope"
Bcc: Marty Kelly; Mike Heyl
Subject: RE: Vallisneria and Salinity
Date: Friday, January 21, 2011 4:13:58 PM

Ms. Corona:

It was good to speak with you today regarding minimum flows for the Chassahowitzka River system and other local, tidal rivers. As you know from the e-mail that I copied you on earlier today, Carol Kraft, a Staff Hydrologist with the District's Water Quality Monitoring Program Section has agreed to assist with your request for information on wells in the vicinity of the Chassahowitzka River. Thank you for forwarding the link to the 2010 paper by Boustany and others on the effects of salinity and light on *Vallisneria americana*. I have seen this paper previously, but it was good to take another look at it. As a follow-up to our discussion on *Vallisneria*, I have loaded a number of documents containing information on salinity tolerances for the species into a zipped file that you may retrieve from the District FTP site. Directions for retrieving files from our FTP site may be found on the "How to Access our Anonymous FTP Server" page of the District web site at the following link:

http://www.swfwmd.state.fl.us/data/ftp/

The file is named **Docs_forHCorona.zip** and is located in the Public – Outgoing folder.

Please let me know if you have any problems obtaining the zipped file from our FTP site or are unable to unzip the file.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment E

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Corona to Mr. Leeper, Dated January 27, 2011

From: Hope
To: Doug Leeper
Subject: Re: Vallisneria and Salinity
Date: Thursday, January 27, 2011 12:45:22 PM

Hi Doug,

Thank you so much for looking into the Vallisneria and other fresh water dependent species, which I fear may have been ignored in the Chassahowitzka MFL. I'm still trying to download data from the link you sent, but my computer must not have sufficient ram for the task. I'll try to get my neighbor to help when he gets back to his Chassahowitzka home (he has a much better pc), or will try to download again when I next go to the library in Homosassa.
Thanks also for putting me in touch with Carol, she's wonderful! I had so much trouble trying to query the USGS monitoring well data (I think both my computer and I need "updating").

Hope

Attachment F

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Mr. Leeper to Ms. Corona, Dated January 27, 2011

From: Doug Leeper
To: "Hope"
Subject: RE: Vallisneria and Salinity
Date: Thursday, January 27, 2011 1:37:53 PM

Hope:

I can load the files on a CD and mail them to you if that would be easier. If this is your preference, please provide a mailing address and I'll drop the disc in the U.S. Mail.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment G

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Corona to Mr. Leeper, Dated January 28, 2011

From: Hope
To: Doug Leeper
Subject: Data on CD: Re: Vallisneria and Salinity
Date: Friday, January 28, 2011 10:20:43 AM

Hi Doug,
Is the well data ready too? I've been reading the regional plan, and it looks like you guys are doing some of that anyway as part of a WRAP for this area.
I've been browsing USGS documents and see that the potentiometrics are terrible for this area (there are zeros and numbers less than 2 around our Nature Coast springs).

I haven't found any data suggesting there have been any dye tracer tests in our area to see how much the existing mines and proposed mines in our Nature Coast Springs Watershed(s) interact with the aquifer. Some of the USGS tracer tests in South Florida mines, as you know, were quite disturbing, showing, not only existing mining pollutants that had migrated to municipal wellfields, but also test wells in proposed mining sites that illustrated rapid (4 hours from test well to municipal wells and to Miami River; instead of the anticipated 4 days) movement of potential mining-related contaminants to the aquifer.

The proposed DRI (Quarry Preserve) on Hwy. 98, east of Chassahowitzka, very likely has existing mine "lakes" and other open water features that may directly relate to Chassahowtizka's watershed. The massive development planned there will certainly negatively impact our Chassahowitzka Springs watershed, not only due to aquifer withdrawals that will diminish our flow, but also all the urban development (road pollutants, herbicides, pesticides, etc.) that are likely to be transported (run-off, mining lakes, aquifer) via underground conduits to our springs and river. I spoke with Anthony at DCA who told me that their office found the development "not in compliance," but it looks like Hernando County and the developer think it's a "slam dunk."

If the disk doesn't cost the taxpayers too much to send me, that would be great, but you might as well wait until Carol has the well data to load onto the CD too. (I wish your office was within bike riding distance, and I'd pick it up myself). Secure mailing address is: 10024 S. Riviera Pt., Homosassa, FL 34448

If you're ever in our area of the Nature Coast, I think you'd really enjoy exploring the spring runs in our forested wetlands; there are wonderful fresh water mussels (at least two species of Elliptio - *Elliptio jayensis* and *Uniomerus caroliniana*, the

glochidia host for which a friend at USGS tells me has not yet been identified), redeyed chubs, giant cypress, diverse orchid species, etc.; a real treat for people like us who like to "key out" species in rare, (and now imperiled) diverse ecosystems. It's too bad the Springs Task Force recommendations didn't come to pass, or we'd all have a better idea of what imperiled species now living in Chassahowitzka's spring runs and forested wetlands are about to be destroyed (or as FWCC puts it, "extirpated") with what seems like inevitable overdrafting of our aquifer and salt water intrusion.
Thanks again for the data,

Hope

Attachment H

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Corona to Mr. Leeper, Dated January 31, 2011

From: Hope
To: Doug Leeper
Subject: FTP files
Date: Monday, January 31, 2011 4:42:53 PM

Hi Doug,

Our neighbor, Brad, is back in town, and said he would download the ftps for me if you haven't sent them yet. I went over to his house this morning, but couldn't find the files again on your FTP site. I bet you mailed them already (if not, I now have access to a "good pc" from which to download the ftps). Thanks again,

Hope

Attachment I

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Mr. Leeper to Ms. Corona, Dated February 1, 2011

From: Doug Leeper
To: "Hope"
Subject: RE: FTP files
Date: Tuesday, February 01, 2011 7:49:05 AM

Hope:
Spoke to Carol Kraft recently and she indicated that she would be able to send you the well information that you requested by e-mail, so I was planning to send you a CD with the vegetation documents today. I can still do this, or if you would prefer, you may go to our FTP site and download a zipped file that contains the documents. Let me know if you want me to send the CD via U.S. Mail today.

Note that if you browse to our FTP site, the file that you want is located in the public-outgoing folder and is named: Docs_for_HCorona2.zip

Sincerely,
Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment J

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Kraft to Ms. Corona, Dated February 4, 2011

From: Carol Kraft
Sent: Friday, February 04, 2011 9:37 AM
To: 'hopecorona@tampabay.rr.com'
Subject: RE: Well Data Request from Hope Corona

Good Morning Ms. Corona,

Please find attached the groundwater quality data and associated well specifications you requested for your area of interest. I have included a .pdf file of the entire period of record water quality data and all parameters analyzed for that we currently have available for these wells, along with the associated well specifications, well site location map, and a figure depicting the hydrogeology of western Citrus County.

My query returned 4 wells with water quality data. These wells are either monitor wells or private residential wells that were/are sampled as part of one of the SWFWMD's groundwater quality monitoring networks. The water quality data within the .pdf file are sorted according to Site ID (SID). This number is unique to each site and can be used as a cross-reference within the well specifications table and site location map enclosed. The SID can also be used to look up data within our online data retrieval tool known as the Water Management Information System (WMIS). The link to WMIS is included in my signature line. Please do not hesitate to contact me if you require any additional water quality data or assistance with WMIS.

Thank you,
Carol Kraft
Staff Hydrologist
Water Quality Monitoring Program
Resource Data and Restoration Department
Southwest Florida Water Management District
7601 Hwy 301 N.
Tampa, FL 33637
Toll Free: 1-800-836-0797
Office: (813) 985-7481 ext. 2119
Fax: (813) 987-6585
email: carol.kraft@swfwmd.state.fl.us
District Website: http://www.watermatters.org
WMIS Link: http://www8.swfwmd.state.fl.us/WMIS/ResourceData/ExtDefault.aspx
WMIS Help Document: http://www.swfwmd.state.fl.us/data/resource_data_help.pdf
<><><><><><><><>
From: Doug Leeper
Sent: Friday, January 21, 2011 2:00 PM
To: Carol Kraft
Cc: hopecorona@tampabay.rr.com

Subject: Well Data Request from Hope Corona

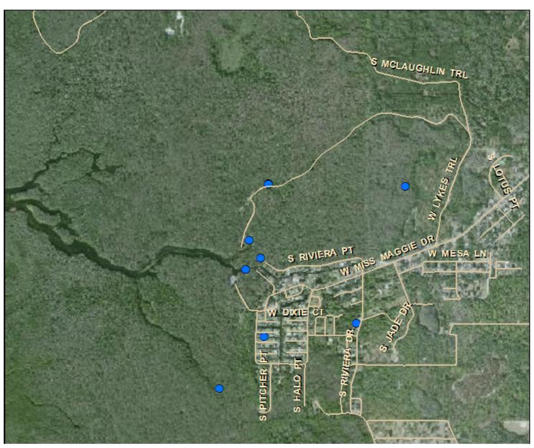
Carol:

Per our phone discussion, I'm providing some information pertaining to Ms. Hope Corona's request from earlier today for data associated with wells in the Chassahowitzka River headwaters area. I've copied Ms. Corona on this e-mail, so she will know that you are working on her data request and will contact her.

Phone: 352-382-2809 Home, 352-302-4466 Cell
E-mail: hopecorona@tampabay.rr.com

1. Ms. Corona asked for well location, depth and salinity data for wells near Chassahowitzka River headwaters. In particular, she is interested in wells located north of the river near Lykes Trail Road and also south of the river (general area map below). You may want to contact her regarding the scope of the area she is interested in, as it is may be larger than the area depicted in the image below.

2. She also asked whether the District or the USGS monitors wells in the area. I'm guessing that we will be able to provide her with District well information, but may have to direct her to the USGS web site or staff for USGS well data.



Thanks,
Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment K

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

Attachment to E-Mail from Ms. Kraft to Ms. Corona, Dated February 4, 2011

Southwest Florida Water Management District
Water Quality Monitoring Program
Water Quality Monitoring Network Results

Data Qualifier Codes

A Value reported is the mean of two or more determinations.

B Results based upon colony counts outside acceptable range.

D Test results are reported on samples without distillation.

F The value is questionable because of improper field sampling protocols.

I Reported value is between the laboratory method detection limit and the laboratory practical quantitation limit. The practical quantitation limit is 4 times the detection limit.

J Estimated value, value not accurate.

1. Surrogate recovery limits have been exceeded.
2. No known quality control criteria exists for the Component.
3. The reported value failed to meet the established quality control criteria for either precision or accuracy.
4. The sample matrix interfered with the ability to make any accurate determination.
5. The data is questionable because of improper lab or field protocols.
6. The Total measurement for a component is exceeded by a similar component. The error limits for each measurement overlap.

K The actual value is less than the value given.
L Secchi disc visible to bottom of waterbody.

N This test is not NELAC certified by this laboratory.

1. Certification not requested/required by client.
2. Certification not available through NELAC.
3. An E.P.A. Region IV variance is on file for the use of this method.

O Sampled, but analysis lost or not performed.

VALUE QUALIFIER DESCRIPTIONS

A The value reported is the average of two or more determinations.
D Test results are reported on samples without distillation.
F The value is questionable because of improper field sampling protocols.
I The reported value is between the MDL (Method Detection Limit) and PQL (Practical Quantitation Limit)
J The value is questionable because of improper laboratory protocols.
N **This test is not NELAC certified by this laboratory**
Q Sample held beyond the acceptable holding time. Result may be compromised.
U Compound analyzed for but not detected. Value is Lab Detection Limit.

Q Sample held beyond holding time.

T Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.

U Indicates that the compound was analyzed for but not detected. (Method Detection Limit)

V Indicates that the analyte was detected in both the sample and any of the associated blanks, at similar concentrations.

W Aspects of the well construction may significantly influence the representativeness of this value.

Y The laboratory analysis was from an unpreserved or improperly preserved sample.

Z Too many colonies were present (TNTC).

! Indicates that the reported value deviates from historic spatially established concentration ranges.

? Indicates that the reported value deviates from historic temporally established concentration ranges.

Southwest Florida Water Management District
Water Quality Monitoring Program
Water Quality Monitoring Network Results

Table 1. Well Specifications

SID	Primary Feature Type	Resource Type	Aquifer	Casing Depth (ft. bls)	Total Depth (ft. bls)	Casing Diameter (in.)	County	Latitude	Longitude
20018	Well	Ground Water/Geologic	FLORIDAN	64	78	Unknown	CITRUS	28 43 15.96	82 33 51.35
21026	Well	Ground Water/Geologic	SURFICIAL	2	12	4	CITRUS	28 43 16.12	82 34 28.48
20019	Well	Ground Water/Geologic	UPPER FLORIDAN	25	67	6	CITRUS	28 43 16.19	82 34 28.45
21031	Well	Ground Water/Geologic	FLORIDAN	72	78	4	CITRUS	28 42 39.49	82 34 29.13

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Water Quality Monitoring Program Disclaimer -The water quality data obtained from the Southwest Florida Water Management District (District) are retrieved from several sources, including but not limited to federal, state, county, and municipal agencies and other water management districts. These data may be provisional and thus subject to revision at any time. The District and/or the contributing agencies specifically disclaim any warranty, either expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular use. The entire risk as to quality and performance is with the user. In no event will the District and/or the contributing agencies be liable for any direct, indirect, incidental, special, consequential, or other damages, including loss of profit, arising out of the use of these data even if the District and/or contributing agencies have been advised of the possibility of such damages. If you have any questions concerning these data, you should contact the Water Quality Monitoring Program at (813) 985-7481 or1-800-836-0797 (Florida).

Wells sampled for water quality by the SWFWMD

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Hydrogeology of Western Citrus County

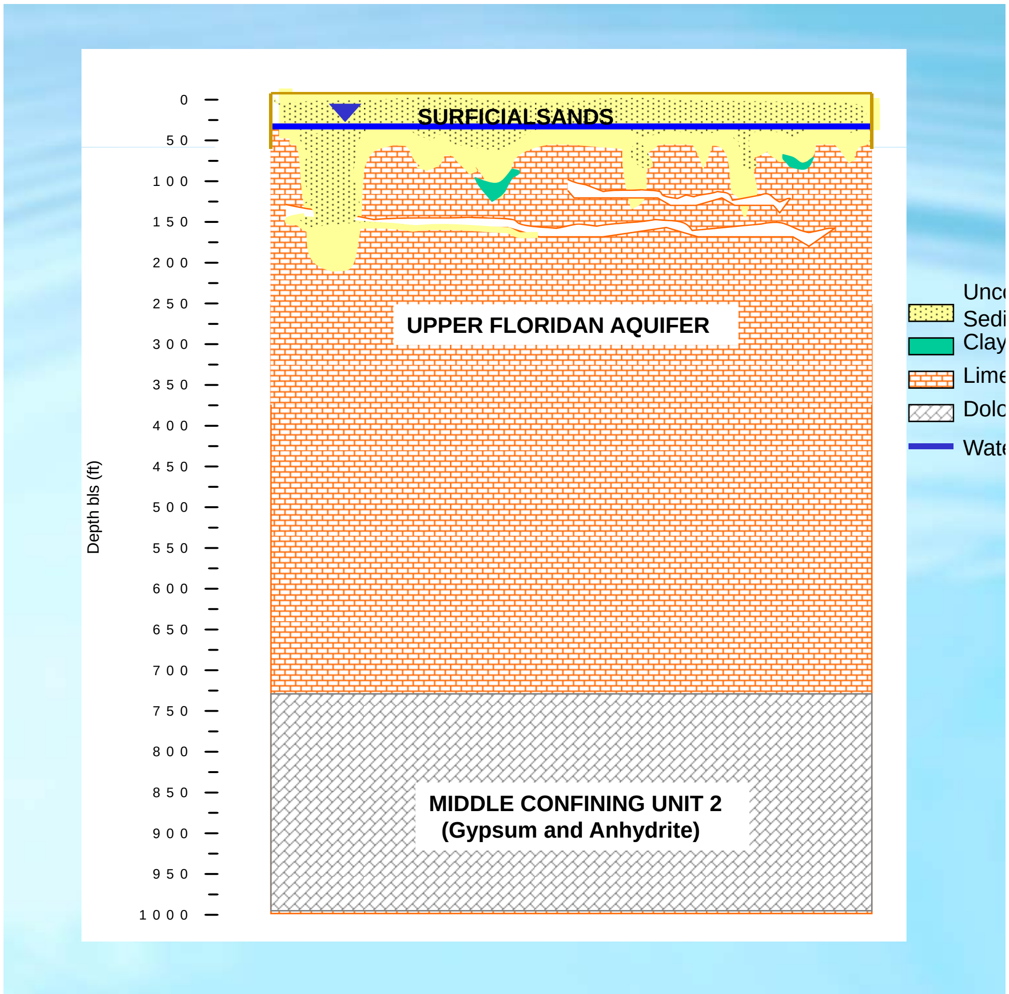

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Table 2. Water Quality Data

SID	Collected Date	Value	Units	Analyte	Qualifier
20018	11/9/1994	145	mg/L	Alkalinity (Total)	
20018	10/6/2003	154	mg/L	Alkalinity (Total)	
20018	12/30/2003	151	mg/L	Alkalinity (Total)	
20018	3/18/2004	150	mg/L	Alkalinity (Total)	
20018	6/17/2004	155.48	mg/L	Alkalinity (Total)	Q
20018	10/26/2004	157.24	mg/L	Alkalinity (Total)	Q
20018	1/11/2005	164.53	mg/L	Alkalinity (Total)	Q
20018	4/12/2005	149.65	mg/L	Alkalinity (Total)	
20018	7/7/2005	146.4	mg/L	Alkalinity (Total)	
20018	5/4/2010	160	mg/L	Alkalinity (Total)	A
20018	11/9/1994	0.01	mg/L	Ammonia (N) (Dissolved)	U
20018	3/22/1995	0.01	mg/L	Ammonia (N) (Dissolved)	U
20018	10/6/2003	0.005	mg/L	Ammonia (N) (Dissolved)	I
20018	12/30/2003	0.005	mg/L	Ammonia (N) (Dissolved)	U
20018	3/18/2004	0.005	mg/L	Ammonia (N) (Dissolved)	U
20018	6/17/2004	0.005	mg/L	Ammonia (N) (Dissolved)	U
20018	10/26/2004	0.005	mg/L	Ammonia (N) (Dissolved)	U
20018	1/11/2005	0.005	mg/L	Ammonia (N) (Dissolved)	U
20018	4/12/2005	0.005	mg/L	Ammonia (N) (Dissolved)	U
20018	5/4/2010	0.01	mg/L	Ammonia (N) (Dissolved)	U
20018	5/4/2010	0.25	ug/L	Arsenic (Total)	I
20018	11/9/1994	51	mg/L	Calcium (Dissolved)	
20018	10/6/2003	50.2	mg/L	Calcium (Dissolved)	
20018	12/30/2003	47.5	mg/L	Calcium (Dissolved)	
20018	3/18/2004	48.2	mg/L	Calcium (Dissolved)	
20018	6/17/2004	51.2	mg/L	Calcium (Dissolved)	
20018	10/26/2004	50.1	mg/L	Calcium (Dissolved)	
20018	1/11/2005	47	mg/L	Calcium (Dissolved)	
20018	4/12/2005	49.9	mg/L	Calcium (Dissolved)	
20018	7/7/2005	48.6	mg/L	Calcium (Dissolved)	
20018	7/7/2005	48.6	mg/L	Calcium (Dissolved)	
20018	5/4/2010	53.8	mg/L	Calcium (Total)	

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SID	Collected Date	Value	Units	Analyte	Qualifier
20018	5/4/2010	1	mg/L	Carbon- Organic (Total)	U
20018	11/9/1994	0.5	mg/L	Carbon- Total Organic (Total)	U
20018	3/22/1995	0.5	mg/L	Carbon- Total Organic (Total)	U
20018	10/6/2003	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	12/30/2003	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	3/18/2004	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	6/17/2004	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	10/26/2004	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	1/11/2005	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	4/12/2005	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	7/7/2005	0.3	mg/L	Carbon- Total Organic (Total)	U
20018	11/9/1994	16	mg/L	Chloride (Dissolved)	
20018	10/6/2003	54.1	mg/L	Chloride (Dissolved)	
20018	12/30/2003	48.9	mg/L	Chloride (Dissolved)	
20018	3/18/2004	43.7	mg/L	Chloride (Dissolved)	
20018	6/17/2004	40.19	mg/L	Chloride (Dissolved)	
20018	10/26/2004	32.37	mg/L	Chloride (Dissolved)	
20018	1/11/2005	30.82	mg/L	Chloride (Dissolved)	
20018	4/12/2005	27.17	mg/L	Chloride (Dissolved)	
20018	7/7/2005	25.2	mg/L	Chloride (Dissolved)	
20018	7/7/2005	25.2	mg/L	Chloride (Dissolved)	
20018	5/4/2010	75	mg/L	Chloride (Dissolved)	
20018	10/6/2003	4.54	mg/L	Dissolved Oxygen (Total)	
20018	12/30/2003	5.03	mg/L	Dissolved Oxygen (Total)	
20018	3/18/2004	5.7	mg/L	Dissolved Oxygen (Total)	
20018	6/17/2004	4.6	mg/L	Dissolved Oxygen (Total)	
20018	10/26/2004	5.51	mg/L	Dissolved Oxygen (Total)	
20018	1/11/2005	6.86	mg/L	Dissolved Oxygen (Total)	
20018	4/12/2005	4.62	mg/L	Dissolved Oxygen (Total)	
20018	11/9/1994	0.16	mg/L	Fluoride (Dissolved)	
20018	10/6/2003	0.13	mg/L	Fluoride (Dissolved)	
20018	12/30/2003	0.14	mg/L	Fluoride (Dissolved)	
20018	3/18/2004	0.15	mg/L	Fluoride (Dissolved)	
20018	6/17/2004	0.139	mg/L	Fluoride (Dissolved)	

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Southwest Florida Water Management District
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SID	Collected Date	Value	Units	Analyte	Qualifier
20018	10/26/2004	0.152	mg/L	Fluoride (Dissolved)	
20018	1/11/2005	0.148	mg/L	Fluoride (Dissolved)	
20018	4/12/2005	0.153	mg/L	Fluoride (Dissolved)	
20018	7/7/2005	0.13	mg/L	Fluoride (Dissolved)	
20018	7/7/2005	0.13	mg/L	Fluoride (Dissolved)	
20018	5/4/2010	0.13	mg/L	Fluoride (Dissolved)	
20018	11/9/1994	30	ug/L	Iron (Dissolved)	U
20018	10/6/2003	12.5	ug/L	Iron (Dissolved)	U
20018	12/30/2003	26	ug/L	Iron (Dissolved)	I
20018	3/18/2004	18.2	ug/L	Iron (Dissolved)	I
20018	6/17/2004	12.5	ug/L	Iron (Dissolved)	U
20018	10/26/2004	12.5	ug/L	Iron (Dissolved)	U
20018	1/11/2005	12.5	ug/L	Iron (Dissolved)	U
20018	4/12/2005	12.5	ug/L	Iron (Dissolved)	U
20018	7/7/2005	12.5	ug/L	Iron (Dissolved)	U
20018	7/7/2005	12.5	ug/L	Iron (Dissolved)	U
20018	5/4/2010	30	ug/L	Iron (Total)	U
20018	11/9/1994	11	mg/L	Magnesium (Dissolved)	
20018	10/6/2003	13.3	mg/L	Magnesium (Dissolved)	
20018	12/30/2003	12.2	mg/L	Magnesium (Dissolved)	
20018	3/18/2004	12.4	mg/L	Magnesium (Dissolved)	
20018	6/17/2004	12.7	mg/L	Magnesium (Dissolved)	
20018	10/26/2004	12.3	mg/L	Magnesium (Dissolved)	
20018	1/11/2005	11.3	mg/L	Magnesium (Dissolved)	
20018	4/12/2005	11.7	mg/L	Magnesium (Dissolved)	
20018	7/7/2005	11.6	mg/L	Magnesium (Dissolved)	
20018	5/4/2010	15.2	mg/L	Magnesium (Total)	
20018	11/9/1994	0.493	mg/L	Nitrate (N) (Dissolved)	
20018	3/22/1995	0.46	mg/L	Nitrate (N) (Dissolved)	
20018	10/6/2003	0.595	mg/L	Nitrate (N) (Dissolved)	
20018	12/30/2003	0.6235	mg/L	Nitrate (N) (Dissolved)	
20018	3/18/2004	0.5955	mg/L	Nitrate (N) (Dissolved)	
20018	6/17/2004	0.6525	mg/L	Nitrate (N) (Dissolved)	
20018	10/26/2004	0.6649	mg/L	Nitrate (N) (Dissolved)	

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20018	1/11/2005	0.7125	mg/L	Nitrate (N) (Dissolved)	
20018	4/12/2005	0.6474	mg/L	Nitrate (N) (Dissolved)	
20018	11/9/1994	0.495	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	3/22/1995	0.479	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	10/6/2003	0.595	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	12/30/2003	0.626	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	3/18/2004	0.598	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	6/17/2004	0.655	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	10/26/2004	0.6674	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	1/11/2005	0.715	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	4/12/2005	0.6524	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	7/7/2005	0.662	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	5/4/2010	0.78	mg/L	Nitrate-Nitrite (N) (Dissolved)	
20018	10/6/2003	0.0025	mg/L	Nitrite (N) (Dissolved)	U
20018	12/30/2003	0.0025	mg/L	Nitrite (N) (Dissolved)	U
20018	3/18/2004	0.0025	mg/L	Nitrite (N) (Dissolved)	U
20018	6/17/2004	0.0025	mg/L	Nitrite (N) (Dissolved)	U
20018	10/26/2004	0.0025	mg/L	Nitrite (N) (Dissolved)	U
20018	1/11/2005	0.005	mg/L	Nitrite (N) (Dissolved)	U
20018	4/12/2005	0.005	mg/L	Nitrite (N) (Dissolved)	I
20018	7/7/2005	0.005	mg/L	Nitrite (N) (Dissolved)	U
20018	5/4/2010	0.004	mg/L	Nitrite (N) (Dissolved)	U
20018	11/9/1994	0.387	mg/L	Nitrogen- Organic (Dissolved)	
20018	7/7/2005	0.69	mg/L	Nitrogen- Total (Dissolved)	
20018	10/6/2003	0.635	mg/L	Nitrogen- Total (Total)	
20018	12/30/2003	0.773	mg/L	Nitrogen- Total (Total)	
20018	3/18/2004	0.686	mg/L	Nitrogen- Total (Total)	N2
20018	6/17/2004	0.6238	mg/L	Nitrogen- Total (Total)	JN2
20018	10/26/2004	0.6972	mg/L	Nitrogen- Total (Total)	
20018	1/11/2005	0.7409	mg/L	Nitrogen- Total (Total)	N1
20018	4/12/2005	0.654	mg/L	Nitrogen- Total (Total)	JN1
20018	7/7/2005	0.69	mg/L	Nitrogen- Total (Total)	
20018	5/4/2010	0.095	mg/L	Nitrogen- Total Kjeldahl (Dissolved)	I
20018	5/4/2010	0.08	mg/L	Nitrogen- Total Kjeldahl (Total)	U

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20018	3/22/1995	3.5	Ratio	Nitrogen15/Nitrogen14 Isotope Ratio	
20018	10/6/2003	4.4	Ratio	Nitrogen15/Nitrogen14 Isotope Ratio	
20018	11/9/1994	0.03	mg/L	Orthophosphate (P) (Dissolved)	
20018	3/22/1995	0.02	mg/L	Orthophosphate (P) (Dissolved)	
20018	10/6/2003	0.02	mg/L	Orthophosphate (P) (Dissolved)	I
20018	12/30/2003	0.012	mg/L	Orthophosphate (P) (Dissolved)	I
20018	3/18/2004	0.017	mg/L	Orthophosphate (P) (Dissolved)	
20018	6/17/2004	0.0167	mg/L	Orthophosphate (P) (Dissolved)	I
20018	10/26/2004	0.0211	mg/L	Orthophosphate (P) (Dissolved)	I
20018	1/11/2005	0.02	mg/L	Orthophosphate (P) (Dissolved)	I
20018	4/12/2005	0.0183	mg/L	Orthophosphate (P) (Dissolved)	I
20018	7/7/2005	0.016	mg/L	Orthophosphate (P) (Dissolved)	I
20018	5/4/2010	0.023	mg/L	Orthophosphate (P) (Dissolved)	
20018	11/9/1994	7.72	SU	pH (Total)	
20018	3/22/1995	7.57	SU	pH (Total)	
20018	10/6/2003	7.52	SU	pH (Total)	
20018	12/30/2003	7.44	SU	pH (Total)	
20018	3/18/2004	7.46	SU	pH (Total)	
20018	6/17/2004	7.3	SU	pH (Total)	
20018	10/26/2004	7.38	SU	pH (Total)	
20018	1/11/2005	7.43	SU	pH (Total)	
20018	4/12/2005	7.19	SU	pH (Total)	
20018	7/7/2005	7.99	SU	pH (Total)	
20018	11/9/1994	0.02	mg/L	Phosphorus- Total (Total)	
20018	3/22/1995	0.01	mg/L	Phosphorus- Total (Total)	
20018	10/6/2003	0.018	mg/L	Phosphorus- Total (Total)	IJ
20018	12/30/2003	0.021	mg/L	Phosphorus- Total (Total)	I
20018	3/18/2004	0.021	mg/L	Phosphorus- Total (Total)	
20018	6/17/2004	0.0163	mg/L	Phosphorus- Total (Total)	I
20018	10/26/2004	0.0189	mg/L	Phosphorus- Total (Total)	I
20018	1/11/2005	0.0222	mg/L	Phosphorus- Total (Total)	I
20018	4/12/2005	0.0211	mg/L	Phosphorus- Total (Total)	I
20018	7/7/2005	0.015	mg/L	Phosphorus- Total (Total)	I
20018	7/7/2005	0.015	mg/L	Phosphorus- Total (Total)	I

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20018	5/4/2010	0.021	mg/L	Phosphorus- Total (Total)	
20018	11/9/1994	0.4	mg/L	Potassium (Dissolved)	
20018	10/6/2003	1.27	mg/L	Potassium (Dissolved)	
20018	12/30/2003	1.09	mg/L	Potassium (Dissolved)	
20018	3/18/2004	1.03	mg/L	Potassium (Dissolved)	
20018	6/17/2004	1.01	mg/L	Potassium (Dissolved)	
20018	10/26/2004	0.89	mg/L	Potassium (Dissolved)	
20018	1/11/2005	0.86	mg/L	Potassium (Dissolved)	
20018	4/12/2005	0.8	mg/L	Potassium (Dissolved)	
20018	7/7/2005	0.68	mg/L	Potassium (Dissolved)	I
20018	7/7/2005	0.68	mg/L	Potassium (Dissolved)	I
20018	5/4/2010	1.6	mg/L	Potassium (Total)	
20018	11/9/1994	187	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	10/6/2003	270	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	12/30/2003	264	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	3/18/2004	258	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	6/17/2004	257	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	10/26/2004	232	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	1/11/2005	230	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	4/12/2005	223	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	7/7/2005	222	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	7/7/2005	222	mg/L	Residues- Filterable (TDS) (Dissolved)	
20018	10/6/2003	9.2	mg/L	Silica- Dissolved (Dissolved)	
20018	12/30/2003	9.1	mg/L	Silica- Dissolved (Dissolved)	
20018	3/18/2004	9.4	mg/L	Silica- Dissolved (Dissolved)	
20018	6/17/2004	9.5134	mg/L	Silica- Dissolved (Dissolved)	
20018	10/26/2004	9.5433	mg/L	Silica- Dissolved (Dissolved)	
20018	1/11/2005	9.8384	mg/L	Silica- Dissolved (Dissolved)	

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20018	4/12/2005	9.5508	mg/L	Silica- Dissolved (Dissolved)	
20018	7/7/2005	9.5	mg/L	Silica- Dissolved (Dissolved)	
20018	11/9/1994	9.8	mg/L	Sodium (Dissolved)	
20018	10/6/2003	31	mg/L	Sodium (Dissolved)	
20018	12/30/2003	25.9	mg/L	Sodium (Dissolved)	J
20018	3/18/2004	24	mg/L	Sodium (Dissolved)	
20018	6/17/2004	23.2	mg/L	Sodium (Dissolved)	
20018	10/26/2004	19	mg/L	Sodium (Dissolved)	
20018	1/11/2005	16.9	mg/L	Sodium (Dissolved)	
20018	4/12/2005	15.9	mg/L	Sodium (Dissolved)	
20018	7/7/2005	14.3	mg/L	Sodium (Dissolved)	
20018	5/4/2010	42.7	mg/L	Sodium (Total)	
20018	11/9/1994	354	uS/cm	Specific Conductance (Total)	
20018	3/22/1995	355	uS/cm	Specific Conductance (Total)	
20018	10/6/2003	506	uS/cm	Specific Conductance (Total)	
20018	10/6/2003	496	uS/cm	Specific Conductance (Total)	
20018	12/30/2003	481	uS/cm	Specific Conductance (Total)	
20018	12/30/2003	477	uS/cm	Specific Conductance (Total)	
20018	3/18/2004	460	uS/cm	Specific Conductance (Total)	
20018	3/18/2004	453	uS/cm	Specific Conductance (Total)	
20018	6/17/2004	446	uS/cm	Specific Conductance (Total)	
20018	6/17/2004	446	uS/cm	Specific Conductance (Total)	
20018	10/26/2004	414	uS/cm	Specific Conductance (Total)	
20018	10/26/2004	423	uS/cm	Specific Conductance (Total)	
20018	1/11/2005	399	uS/cm	Specific Conductance (Total)	
20018	1/11/2005	416	uS/cm	Specific Conductance (Total)	
20018	4/12/2005	403	uS/cm	Specific Conductance (Total)	
20018	4/12/2005	400	uS/cm	Specific Conductance (Total)	
20018	7/7/2005	387	uS/cm	Specific Conductance (Total)	
20018	5/4/2010	571	uS/cm	Specific Conductance (Total)	A
20018	10/6/2003	250	ug/L	Strontium (Dissolved)	U
20018	12/30/2003	250	ug/L	Strontium (Dissolved)	U
20018	3/18/2004	250	ug/L	Strontium (Dissolved)	U
20018	6/17/2004	250	ug/L	Strontium (Dissolved)	U

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20018	10/26/2004	250	ug/L	Strontium (Dissolved)	U
20018	1/11/2005	250	ug/L	Strontium (Dissolved)	U
20018	4/12/2005	250	ug/L	Strontium (Dissolved)	U
20018	7/7/2005	0.25	mg/L	Strontium (Dissolved)	U
20018	7/7/2005	250	ug/L	Strontium (Dissolved)	U
20018	5/4/2010	177	ug/L	Strontium (Total)	
20018	11/9/1994	8.7	mg/L	Sulfate (Dissolved)	
20018	10/6/2003	15.2	mg/L	Sulfate (Dissolved)	
20018	12/30/2003	14.4	mg/L	Sulfate (Dissolved)	
20018	3/18/2004	14.1	mg/L	Sulfate (Dissolved)	
20018	6/17/2004	13.5	mg/L	Sulfate (Dissolved)	
20018	10/26/2004	12.26	mg/L	Sulfate (Dissolved)	
20018	1/11/2005	11.34	mg/L	Sulfate (Dissolved)	
20018	4/12/2005	10.99	mg/L	Sulfate (Dissolved)	
20018	7/7/2005	10.9	mg/L	Sulfate (Dissolved)	
20018	7/7/2005	10.9	mg/L	Sulfate (Dissolved)	
20018	5/4/2010	20	mg/L	Sulfate (Dissolved)	
20018	11/9/1994	25.2	Deg. C	Temperature (Total)	
20018	3/22/1995	24	Deg. C	Temperature (Total)	
20018	10/6/2003	23.65	Deg. C	Temperature (Total)	
20018	12/30/2003	23.34	Deg. C	Temperature (Total)	
20018	3/18/2004	25.2	Deg. C	Temperature (Total)	
20018	6/17/2004	23.46	Deg. C	Temperature (Total)	
20018	10/26/2004	23.43	Deg. C	Temperature (Total)	
20018	1/11/2005	23.52	Deg. C	Temperature (Total)	
20018	4/12/2005	23.58	Deg. C	Temperature (Total)	
20018	11/9/1994	0.05	NTU	Turbidity (Total)	U
20018	10/6/2003	1.13	NTU	Turbidity (Total)	
20018	12/30/2003	2	NTU	Turbidity (Total)	
20018	3/18/2004	6.14	NTU	Turbidity (Total)	
20018	6/17/2004	0.114	NTU	Turbidity (Total)	I
20018	10/26/2004	0.08	NTU	Turbidity (Total)	U
20018	1/11/2005	1.83	NTU	Turbidity (Total)	
20018	4/12/2005	0.08	NTU	Turbidity (Total)	U

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20018	7/7/2005	0.08	NTU	Turbidity (Total)	U
20018	5/4/2010	0.1	NTU	Turbidity (Total)	U
20019	10/6/1998	157	mg/L	Alkalinity (Dissolved)	
20019	10/6/1998	1	mg/L	Alkalinity (Dissolved)	U
20019	12/11/1998	155	mg/L	Alkalinity (Dissolved)	
20019	12/11/1998	1	mg/L	Alkalinity (Dissolved)	U
20019	4/26/1999	151	mg/L	Alkalinity (Dissolved)	
20019	4/26/1999	1	mg/L	Alkalinity (Dissolved)	U
20019	10/4/1999	158	mg/L	Alkalinity (Dissolved)	
20019	10/4/1999	1	mg/L	Alkalinity (Dissolved)	U
20019	1/25/2000	169	mg/L	Alkalinity (Dissolved)	
20019	1/25/2000	1	mg/L	Alkalinity (Dissolved)	U
20019	12/28/2000	166	mg/L	Alkalinity (Total)	
20019	12/28/2000	1	mg/L	Alkalinity (Total)	U
20019	12/18/2001	164	mg/L	Alkalinity (Total)	
20019	12/18/2001	0	mg/L	Alkalinity (Total)	U
20019	11/20/2002	189	mg/L	Alkalinity (Total)	Q
20019	3/8/2004	176	mg/L	Alkalinity (Total)	J
20019	12/22/2004	173.1	mg/L	Alkalinity (Total)	Q
20019	12/13/2005	171	mg/L	Alkalinity (Total)	
20019	12/12/2006	166.9	mg/L	Alkalinity (Total)	
20019	12/18/2007	184	mg/L	Alkalinity (Total)	
20019	12/16/2008	167.3	mg/L	Alkalinity (Total)	
20019	3/22/2010	174.9	mg/L	Alkalinity (Total)	
20019	10/6/1998	0.038	mg/L	Bromide (Total)	U
20019	12/11/1998	0.05	mg/L	Bromide (Total)	U
20019	10/6/1998	59.8	mg/L	Calcium (Dissolved)	
20019	12/11/1998	58.5	mg/L	Calcium (Dissolved)	
20019	4/26/1999	57.1	mg/L	Calcium (Dissolved)	
20019	10/4/1999	62.2	mg/L	Calcium (Dissolved)	
20019	1/25/2000	67	mg/L	Calcium (Dissolved)	
20019	12/28/2000	64.4	mg/L	Calcium (Dissolved)	
20019	12/18/2001	64.04	mg/L	Calcium (Dissolved)	
20019	11/20/2002	62	mg/L	Calcium (Dissolved)	

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20019	3/8/2004	64.5	mg/L	Calcium (Dissolved)	
20019	12/22/2004	58.9	mg/L	Calcium (Dissolved)	
20019	12/13/2005	62.7	mg/L	Calcium (Dissolved)	
20019	12/12/2006	61.3	mg/L	Calcium (Dissolved)	
20019	12/18/2007	67.8	mg/L	Calcium (Dissolved)	
20019	12/16/2008	64.6	mg/L	Calcium (Dissolved)	
20019	3/22/2010	67.2	mg/L	Calcium (Dissolved)	
20019	10/6/1998	8.06	mg/L	Chloride (Dissolved)	
20019	12/11/1998	11.2	mg/L	Chloride (Dissolved)	
20019	4/26/1999	10.6	mg/L	Chloride (Dissolved)	
20019	10/4/1999	8.67	mg/L	Chloride (Dissolved)	
20019	1/25/2000	7.93	mg/L	Chloride (Dissolved)	
20019	12/28/2000	7.6	mg/L	Chloride (Dissolved)	
20019	12/18/2001	11.46	mg/L	Chloride (Dissolved)	
20019	11/20/2002	10.7	mg/L	Chloride (Dissolved)	
20019	3/8/2004	9.3699	mg/L	Chloride (Dissolved)	
20019	12/22/2004	10.3699	mg/L	Chloride (Dissolved)	
20019	12/13/2005	9.3	mg/L	Chloride (Dissolved)	
20019	12/13/2005	9.3	mg/L	Chloride (Dissolved)	
20019	12/12/2006	9.2	mg/L	Chloride (Dissolved)	
20019	12/18/2007	9.2	mg/L	Chloride (Dissolved)	
20019	12/16/2008	10.9	mg/L	Chloride (Dissolved)	
20019	3/22/2010	9.5	mg/L	Chloride (Dissolved)	
20019	10/6/1998	163.3218	mg/L	Hardness (Total)	
20019	12/11/1998	171.5649	mg/L	Hardness (Total)	
20019	4/26/1999	174.5344	mg/L	Hardness (Total)	
20019	10/4/1999	177.9624	mg/L	Hardness (Total)	
20019	1/25/2000	189.8245	mg/L	Hardness (Total)	
20019	12/28/2000	176.3317	mg/L	Hardness (Total)	
20019	10/6/1998	2020	ug/L	Iron (Dissolved)	
20019	12/11/1998	670	ug/L	Iron (Dissolved)	
20019	4/26/1999	40	ug/L	Iron (Dissolved)	
20019	10/4/1999	1610	ug/L	Iron (Dissolved)	
20019	1/25/2000	1160	ug/L	Iron (Dissolved)	

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20019	12/28/2000	3090	ug/L	Iron (Dissolved)	
20019	12/18/2001	1360	ug/L	Iron (Dissolved)	
20019	11/20/2002	2490	ug/L	Iron (Dissolved)	
20019	3/8/2004	1980	ug/L	Iron (Dissolved)	
20019	12/22/2004	998	ug/L	Iron (Dissolved)	
20019	12/13/2005	2420	ug/L	Iron (Dissolved)	
20019	12/13/2005	2420	ug/L	Iron (Dissolved)	
20019	12/12/2006	1530	ug/L	Iron (Dissolved)	
20019	12/18/2007	3210	ug/L	Iron (Dissolved)	
20019	12/16/2008	1410	ug/L	Iron (Dissolved)	
20019	3/22/2010	3500	ug/L	Iron (Dissolved)	
20019	10/6/1998	3.4	mg/L	Magnesium (Dissolved)	
20019	12/11/1998	6.19	mg/L	Magnesium (Dissolved)	
20019	4/26/1999	7.76	mg/L	Magnesium (Dissolved)	
20019	10/4/1999	5.5	mg/L	Magnesium (Dissolved)	
20019	1/25/2000	5.47	mg/L	Magnesium (Dissolved)	
20019	12/28/2000	3.77	mg/L	Magnesium (Dissolved)	
20019	12/18/2001	5.73	mg/L	Magnesium (Dissolved)	
20019	11/20/2002	4.02	mg/L	Magnesium (Dissolved)	
20019	3/8/2004	4.3899	mg/L	Magnesium (Dissolved)	
20019	12/22/2004	5.9699	mg/L	Magnesium (Dissolved)	
20019	12/13/2005	4.5	mg/L	Magnesium (Dissolved)	
20019	12/12/2006	6.01	mg/L	Magnesium (Dissolved)	
20019	12/18/2007	4.25	mg/L	Magnesium (Dissolved)	
20019	12/16/2008	5.45	mg/L	Magnesium (Dissolved)	
20019	3/22/2010	3.97	mg/L	Magnesium (Dissolved)	
20019	12/13/2005	7.69	pH	pH (Dissolved)	
20019	10/6/1998	7.33	SU	pH (Total)	
20019	12/11/1998	7.06	SU	pH (Total)	
20019	4/26/1999	7.4	SU	pH (Total)	
20019	10/4/1999	7.35	SU	pH (Total)	
20019	1/25/2000	7.39	SU	pH (Total)	
20019	12/28/2000	7.32	SU	pH (Total)	
20019	12/18/2001	7.4	SU	pH (Total)	

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20019	11/20/2002	7.36	SU	pH (Total)	
20019	3/8/2004	7.0999	SU	pH (Total)	
20019	12/22/2004	7.34	SU	pH (Total)	
20019	12/13/2005	7.69	SU	pH (Total)	
20019	12/13/2005	7.31	SU	pH (Total)	
20019	12/12/2006	7.68	SU	pH (Total)	
20019	12/12/2006	7.2	SU	pH (Total)	
20019	12/18/2007	7.82	SU	pH (Total)	
20019	12/18/2007	7.23	SU	pH (Total)	
20019	12/16/2008	7.57	SU	pH (Total)	
20019	3/22/2010	7.95	SU	pH (Total)	
20019	10/6/1998	0.92	mg/L	Potassium (Dissolved)	
20019	12/11/1998	0.41	mg/L	Potassium (Dissolved)	
20019	4/26/1999	0.05	mg/L	Potassium (Dissolved)	U
20019	10/4/1999	0.51	mg/L	Potassium (Dissolved)	
20019	1/25/2000	0.54	mg/L	Potassium (Dissolved)	
20019	12/28/2000	0.69	mg/L	Potassium (Dissolved)	
20019	12/18/2001	0.78	mg/L	Potassium (Dissolved)	
20019	11/20/2002	0.53	mg/L	Potassium (Dissolved)	I
20019	3/8/2004	0.66	mg/L	Potassium (Dissolved)	I
20019	12/22/2004	0.5299	mg/L	Potassium (Dissolved)	I
20019	12/13/2005	0.63	mg/L	Potassium (Dissolved)	I
20019	12/12/2006	0.56	mg/L	Potassium (Dissolved)	I
20019	12/18/2007	0.69	mg/L	Potassium (Dissolved)	I
20019	12/16/2008	0.63	mg/L	Potassium (Dissolved)	I
20019	3/22/2010	0.68	mg/L	Potassium (Dissolved)	
20019	10/6/1998	202	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/11/1998	210	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	10/4/1999	196	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	1/25/2000	204	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/28/2000	243	mg/L	Residues- Filterable (TDS) (Dissolved)	Q

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20019	12/18/2001	216	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	11/20/2002	239	mg/L	Residues- Filterable (TDS) (Dissolved)	Q
20019	3/8/2004	241	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/22/2004	217	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/13/2005	211	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/12/2006	216	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/18/2007	214	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	12/16/2008	213	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	3/22/2010	219	mg/L	Residues- Filterable (TDS) (Dissolved)	
20019	10/6/1998	7.8891	mg/L	Silica- Dissolved (Dissolved)	
20019	12/11/1998	8.742	mg/L	Silica- Dissolved (Dissolved)	
20019	4/26/1999	8.1023	mg/L	Silica- Dissolved (Dissolved)	
20019	10/4/1999	3.838	mg/L	Silica- Dissolved (Dissolved)	
20019	1/25/2000	7.9531	mg/L	Silica- Dissolved (Dissolved)	
20019	12/28/2000	7.8	mg/L	Silica- Dissolved (Dissolved)	
20019	12/18/2001	7.9	mg/L	Silica- Dissolved (Dissolved)	
20019	11/20/2002	7.7	mg/L	Silica- Dissolved (Dissolved)	N1
20019	3/8/2004	7.6999	mg/L	Silica- Dissolved (Dissolved)	N1
20019	12/22/2004	8.1084	mg/L	Silica- Dissolved (Dissolved)	
20019	12/13/2005	7.7	mg/L	Silica- Dissolved (Total)	
20019	12/13/2005	7.7	mg/L	Silica- Dissolved (Total)	N1
20019	12/12/2006	7.9	mg/L	Silica- Dissolved (Total)	
20019	12/18/2007	7.8	mg/L	Silica- Dissolved (Total)	N1
20019	12/16/2008	7.8	mg/L	Silica- Dissolved (Total)	
20019	3/22/2010	7.5	mg/L	Silica- Dissolved (Total)	
20019	10/6/1998	4.77	mg/L	Sodium (Dissolved)	
20019	12/11/1998	6.14	mg/L	Sodium (Dissolved)	
20019	4/26/1999	6.41	mg/L	Sodium (Dissolved)	
20019	10/4/1999	5.29	mg/L	Sodium (Dissolved)	

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20019	1/25/2000	5.21	mg/L	Sodium (Dissolved)	
20019	12/28/2000	4.35	mg/L	Sodium (Dissolved)	
20019	12/18/2001	6.86	mg/L	Sodium (Dissolved)	
20019	11/20/2002	5.3	mg/L	Sodium (Dissolved)	
20019	3/8/2004	5.2399	mg/L	Sodium (Dissolved)	
20019	12/22/2004	5.8699	mg/L	Sodium (Dissolved)	
20019	12/13/2005	4.96	mg/L	Sodium (Dissolved)	
20019	12/13/2005	4.96	mg/L	Sodium (Dissolved)	
20019	12/12/2006	5.5	mg/L	Sodium (Dissolved)	
20019	12/18/2007	4.79	mg/L	Sodium (Dissolved)	
20019	12/16/2008	6.33	mg/L	Sodium (Dissolved)	
20019	3/22/2010	5.01	mg/L	Sodium (Dissolved)	
20019	10/6/1998	354	uS/cm	Specific Conductance (Total)	
20019	10/6/1998	333	uS/cm	Specific Conductance (Total)	
20019	12/11/1998	354	uS/cm	Specific Conductance (Total)	
20019	12/11/1998	336	uS/cm	Specific Conductance (Total)	
20019	4/26/1999	347	uS/cm	Specific Conductance (Total)	
20019	4/26/1999	327	uS/cm	Specific Conductance (Total)	
20019	10/4/1999	352	uS/cm	Specific Conductance (Total)	
20019	10/4/1999	341	uS/cm	Specific Conductance (Total)	
20019	1/25/2000	358	uS/cm	Specific Conductance (Total)	
20019	1/25/2000	340	uS/cm	Specific Conductance (Total)	
20019	12/28/2000	364	uS/cm	Specific Conductance (Total)	
20019	12/28/2000	355	uS/cm	Specific Conductance (Total)	
20019	12/18/2001	369	uS/cm	Specific Conductance (Total)	
20019	12/18/2001	374	uS/cm	Specific Conductance (Total)	
20019	11/20/2002	358	uS/cm	Specific Conductance (Total)	
20019	11/20/2002	360	uS/cm	Specific Conductance (Total)	
20019	3/8/2004	362	uS/cm	Specific Conductance (Total)	
20019	3/8/2004	357	uS/cm	Specific Conductance (Total)	
20019	12/22/2004	350	uS/cm	Specific Conductance (Total)	
20019	12/22/2004	357	uS/cm	Specific Conductance (Total)	
20019	12/13/2005	354	uS/cm	Specific Conductance (Total)	
20019	12/13/2005	368	uS/cm	Specific Conductance (Total)	

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20019	12/12/2006	358	uS/cm	Specific Conductance (Total)	
20019	12/12/2006	365	uS/cm	Specific Conductance (Total)	
20019	12/18/2007	361	uS/cm	Specific Conductance (Total)	
20019	12/18/2007	389	uS/cm	Specific Conductance (Total)	
20019	12/16/2008	377	uS/cm	Specific Conductance (Total)	
20019	3/22/2010	369	uS/cm	Specific Conductance (Total)	
20019	10/6/1998	50	ug/L	Strontium (Dissolved)	U
20019	12/11/1998	50	ug/L	Strontium (Dissolved)	U
20019	4/26/1999	50	ug/L	Strontium (Dissolved)	U
20019	10/4/1999	210	ug/L	Strontium (Dissolved)	U
20019	1/25/2000	210	ug/L	Strontium (Dissolved)	U
20019	12/28/2000	210	ug/L	Strontium (Dissolved)	U
20019	12/18/2001	360	ug/L	Strontium (Dissolved)	I
20019	11/20/2002	250	ug/L	Strontium (Dissolved)	U
20019	3/8/2004	250	ug/L	Strontium (Dissolved)	U
20019	12/22/2004	250	ug/L	Strontium (Dissolved)	U
20019	12/13/2005	0.25	mg/L	Strontium (Dissolved)	U
20019	12/13/2005	250	ug/L	Strontium (Dissolved)	U
20019	12/12/2006	0.25	mg/L	Strontium (Dissolved)	U
20019	12/18/2007	0.25	mg/L	Strontium (Dissolved)	U
20019	12/16/2008	0.25	mg/L	Strontium (Dissolved)	U
20019	3/22/2010	0.1	mg/L	Strontium (Dissolved)	I
20019	10/6/1998	1.69	mg/L	Sulfate (Dissolved)	
20019	12/11/1998	4.36	mg/L	Sulfate (Dissolved)	
20019	4/26/1999	6.03	mg/L	Sulfate (Dissolved)	
20019	10/4/1999	3.31	mg/L	Sulfate (Dissolved)	
20019	1/25/2000	2.43	mg/L	Sulfate (Dissolved)	
20019	12/28/2000	0.18	mg/L	Sulfate (Dissolved)	
20019	12/18/2001	2.87	mg/L	Sulfate (Dissolved)	
20019	11/20/2002	1.41	mg/L	Sulfate (Dissolved)	
20019	3/8/2004	1.6699	mg/L	Sulfate (Dissolved)	
20019	12/22/2004	3.98	mg/L	Sulfate (Dissolved)	
20019	12/13/2005	1.4	mg/L	Sulfate (Dissolved)	J
20019	12/12/2006	5.5	mg/L	Sulfate (Dissolved)	

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20019	12/18/2007	0.8	mg/L	Sulfate (Dissolved)	
20019	12/16/2008	2.2	mg/L	Sulfate (Dissolved)	
20019	3/22/2010	0.9	mg/L	Sulfate (Dissolved)	J
20019	10/6/1998	22.9	Deg. C	Temperature (Total)	
20019	12/11/1998	22.8	Deg. C	Temperature (Total)	
20019	4/26/1999	23	Deg. C	Temperature (Total)	
20019	10/4/1999	22.2	Deg. C	Temperature (Total)	
20019	1/25/2000	21.9	Deg. C	Temperature (Total)	
20019	12/28/2000	21.8	Deg. C	Temperature (Total)	
20019	12/18/2001	21.8	Deg. C	Temperature (Total)	
20019	11/20/2002	21.9	Deg. C	Temperature (Total)	
20019	3/8/2004	21.8199	Deg. C	Temperature (Total)	
20019	12/22/2004	21.8899	Deg. C	Temperature (Total)	
20019	12/13/2005	21.86	Deg. C	Temperature (Total)	
20019	12/12/2006	22.27	Deg. C	Temperature (Total)	
20019	12/18/2007	22	Deg. C	Temperature (Total)	
21026	4/15/1998	156	mg/L	Bicarbonate (Total)	
21026	4/15/1998	0.05	mg/L	Bromide (Dissolved)	U
21026	4/15/1998	55.4	mg/L	Calcium (Total)	
21026	4/15/1998	13.3	mg/L	Chloride (Dissolved)	
21026	4/15/1998	164.236	mg/L	Hardness (Total)	
21026	4/15/1998	1230	ug/L	Iron (Dissolved)	
21026	4/15/1998	7.8	pH	pH (Dissolved)	
21026	4/15/1998	0.43	mg/L	Potassium (Total)	
21026	4/15/1998	211	mg/L	Residues- Filterable (TDS) (Dissolved)	
21026	4/15/1998	3.6	mg/L	Silica- Dissolved (Total)	
21026	4/15/1998	6.77	mg/L	Sodium (Total)	
21026	4/15/1998	346	uS/cm	Specific Conductance (Total)	
21026	4/15/1998	50	ug/L	Strontium (Total)	U
21026	4/15/1998	4.58	mg/L	Sulfate (Dissolved)	
21031	5/22/1992	151	mg/L	Alkalinity (Dissolved)	
21031	5/10/1993	113	mg/L	Alkalinity (Dissolved)	
21031	2/2/1994	95	mg/L	Alkalinity (Dissolved)	

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21031	2/10/1995	62	mg/L	Alkalinity (Dissolved)	
21031	3/5/1996	151	mg/L	Alkalinity (Dissolved)	
21031	2/26/1997	147	mg/L	Alkalinity (Dissolved)	
21031	2/26/1997	1	mg/L	Alkalinity (Dissolved)	U
21031	12/24/1997	137	mg/L	Alkalinity (Dissolved)	
21031	12/24/1997	1	mg/L	Alkalinity (Dissolved)	U
21031	12/11/1998	149	mg/L	Alkalinity (Dissolved)	
21031	12/11/1998	1	mg/L	Alkalinity (Dissolved)	U
21031	12/16/1999	145	mg/L	Alkalinity (Dissolved)	
21031	12/16/1999	1	mg/L	Alkalinity (Dissolved)	U
21031	10/17/1994	150	mg/L	Alkalinity (Total)	
21031	12/28/2000	62.5	mg/L	Alkalinity (Total)	
21031	12/28/2000	1	mg/L	Alkalinity (Total)	U
21031	12/18/2001	152	mg/L	Alkalinity (Total)	
21031	12/18/2001	0	mg/L	Alkalinity (Total)	U
21031	11/18/2002	168	mg/L	Alkalinity (Total)	Q
21031	3/22/2004	152	mg/L	Alkalinity (Total)	
21031	12/22/2004	160.1399	mg/L	Alkalinity (Total)	Q
21031	12/13/2005	149.3	mg/L	Alkalinity (Total)	
21031	12/13/2006	135.6	mg/L	Alkalinity (Total)	
21031	10/17/1994	0.035	mg/L	Ammonia (N) (Dissolved)	
21031	5/22/1992	2.6	mg/L	Bromide (Total)	
21031	2/2/1994	4.5	mg/L	Bromide (Total)	
21031	2/10/1995	5.7	mg/L	Bromide (Total)	
21031	3/5/1996	3.4	mg/L	Bromide (Total)	
21031	2/26/1997	1.4	mg/L	Bromide (Total)	
21031	12/24/1997	2.15	mg/L	Bromide (Total)	
21031	12/11/1998	18.8	mg/L	Bromide (Total)	
21031	5/22/1992	70	mg/L	Calcium (Dissolved)	
21031	5/10/1993	59	mg/L	Calcium (Dissolved)	
21031	2/2/1994	44	mg/L	Calcium (Dissolved)	
21031	10/17/1994	93	mg/L	Calcium (Dissolved)	
21031	2/10/1995	36	mg/L	Calcium (Dissolved)	
21031	3/5/1996	72	mg/L	Calcium (Dissolved)	

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21031	2/26/1997	52	mg/L	Calcium (Dissolved)	
21031	12/24/1997	66.3	mg/L	Calcium (Dissolved)	
21031	12/11/1998	60.8	mg/L	Calcium (Dissolved)	
21031	12/16/1999	66	mg/L	Calcium (Dissolved)	
21031	12/28/2000	45	mg/L	Calcium (Dissolved)	
21031	12/18/2001	89.37	mg/L	Calcium (Dissolved)	
21031	11/18/2002	74.6	mg/L	Calcium (Dissolved)	
21031	3/22/2004	63.9	mg/L	Calcium (Dissolved)	
21031	12/22/2004	67.9	mg/L	Calcium (Dissolved)	
21031	12/13/2005	57.9	mg/L	Calcium (Dissolved)	
21031	12/13/2005	57.9	mg/L	Calcium (Dissolved)	
21031	12/13/2006	47.3	mg/L	Calcium (Dissolved)	
21031	10/17/1994	0.5	mg/L	Carbon- Total Organic (Total)	U
21031	12/27/1991	1170	mg/L	Chloride (Dissolved)	
21031	5/22/1992	870	mg/L	Chloride (Dissolved)	
21031	5/10/1993	1107	mg/L	Chloride (Dissolved)	
21031	2/2/1994	899	mg/L	Chloride (Dissolved)	
21031	10/17/1994	1540	mg/L	Chloride (Dissolved)	
21031	2/10/1995	1407	mg/L	Chloride (Dissolved)	
21031	3/5/1996	762	mg/L	Chloride (Dissolved)	
21031	2/26/1997	403	mg/L	Chloride (Dissolved)	
21031	12/24/1997	777	mg/L	Chloride (Dissolved)	
21031	12/11/1998	605	mg/L	Chloride (Dissolved)	
21031	12/16/1999	522	mg/L	Chloride (Dissolved)	
21031	12/28/2000	1193	mg/L	Chloride (Dissolved)	
21031	12/18/2001	1284.76	mg/L	Chloride (Dissolved)	
21031	11/18/2002	1260	mg/L	Chloride (Dissolved)	
21031	3/22/2004	583	mg/L	Chloride (Dissolved)	
21031	12/22/2004	647.21	mg/L	Chloride (Dissolved)	
21031	12/13/2005	502	mg/L	Chloride (Dissolved)	
21031	12/13/2006	431	mg/L	Chloride (Dissolved)	
21031	10/17/1994	0.12	mg/L	Fluoride (Dissolved)	
21031	5/22/1992	426	mg/L	Hardness (Total)	
21031	5/10/1993	446	mg/L	Hardness (Total)	

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21031	2/2/1994	369	mg/L	Hardness (Total)	
21031	2/10/1995	432	mg/L	Hardness (Total)	
21031	3/5/1996	410	mg/L	Hardness (Total)	
21031	2/26/1997	278	mg/L	Hardness (Total)	
21031	12/24/1997	371	mg/L	Hardness (Total)	
21031	12/11/1998	340.0102	mg/L	Hardness (Total)	
21031	12/16/1999	332.8164	mg/L	Hardness (Total)	
21031	12/28/2000	372.6226	mg/L	Hardness (Total)	
21031	2/2/1994	0.05	mg/L	Iodide (Total)	U
21031	5/22/1992	570	ug/L	Iron (Dissolved)	
21031	5/10/1993	63	ug/L	Iron (Dissolved)	
21031	2/2/1994	30	ug/L	Iron (Dissolved)	U
21031	10/17/1994	391	ug/L	Iron (Dissolved)	
21031	2/10/1995	30	ug/L	Iron (Dissolved)	U
21031	3/5/1996	121	ug/L	Iron (Dissolved)	
21031	2/26/1997	648	ug/L	Iron (Dissolved)	
21031	12/24/1997	912	ug/L	Iron (Dissolved)	
21031	12/11/1998	270	ug/L	Iron (Dissolved)	
21031	12/16/1999	170	ug/L	Iron (Dissolved)	
21031	12/28/2000	190	ug/L	Iron (Dissolved)	
21031	12/18/2001	300	ug/L	Iron (Dissolved)	
21031	11/18/2002	120	ug/L	Iron (Dissolved)	
21031	3/22/2004	25.8999	ug/L	Iron (Dissolved)	I
21031	12/22/2004	98.8	ug/L	Iron (Dissolved)	
21031	12/13/2005	27.7	ug/L	Iron (Dissolved)	I
21031	12/13/2005	27.7	ug/L	Iron (Dissolved)	I
21031	12/13/2006	395	ug/L	Iron (Dissolved)	
21031	5/22/1992	61	mg/L	Magnesium (Dissolved)	
21031	2/2/1994	63	mg/L	Magnesium (Dissolved)	
21031	10/17/1994	92	mg/L	Magnesium (Dissolved)	
21031	2/10/1995	83	mg/L	Magnesium (Dissolved)	
21031	3/5/1996	56	mg/L	Magnesium (Dissolved)	
21031	2/26/1997	36	mg/L	Magnesium (Dissolved)	
21031	12/24/1997	50	mg/L	Magnesium (Dissolved)	

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21031	12/11/1998	45.7	mg/L	Magnesium (Dissolved)	
21031	12/16/1999	40.8	mg/L	Magnesium (Dissolved)	
21031	12/28/2000	63.2	mg/L	Magnesium (Dissolved)	
21031	12/18/2001	85.14	mg/L	Magnesium (Dissolved)	
21031	11/18/2002	88	mg/L	Magnesium (Dissolved)	
21031	3/22/2004	46.7999	mg/L	Magnesium (Dissolved)	
21031	12/22/2004	48.2999	mg/L	Magnesium (Dissolved)	
21031	12/13/2005	42.4	mg/L	Magnesium (Dissolved)	
21031	12/13/2005	42.4	mg/L	Magnesium (Dissolved)	
21031	12/13/2006	35.6	mg/L	Magnesium (Dissolved)	
21031	10/17/1994	0.018	mg/L	Nitrate (N) (Dissolved)	
21031	10/17/1994	0.019	mg/L	Nitrate-Nitrite (N) (Dissolved)	
21031	10/17/1994	0.05	mg/L	Nitrogen- Organic (Dissolved)	U
21031	10/17/1994	0.05	mg/L	Orthophosphate (P) (Dissolved)	
21031	12/13/2005	7.94	pH	pH (Dissolved)	
21031	12/27/1991	7.71	SU	pH (Total)	
21031	5/22/1992	7.69	SU	pH (Total)	
21031	11/14/1992	8.5	SU	pH (Total)	
21031	5/10/1993	8.49	SU	pH (Total)	
21031	2/2/1994	8.76	SU	pH (Total)	
21031	10/17/1994	7.49	SU	pH (Total)	
21031	2/10/1995	8.93	SU	pH (Total)	
21031	3/5/1996	7.72	SU	pH (Total)	
21031	2/26/1997	7.59	SU	pH (Total)	
21031	12/24/1997	8.28	SU	pH (Total)	
21031	12/11/1998	8.06	SU	pH (Total)	
21031	12/16/1999	7.59	SU	pH (Total)	
21031	12/28/2000	8.72	SU	pH (Total)	
21031	12/18/2001	7.55	SU	pH (Total)	
21031	11/18/2002	7.49	SU	pH (Total)	
21031	3/22/2004	7.3899	SU	pH (Total)	
21031	12/22/2004	7.53	SU	pH (Total)	
21031	12/13/2005	7.94	SU	pH (Total)	
21031	12/13/2005	7.6	SU	pH (Total)	

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21031	12/13/2006	7.93	SU	pH (Total)	
21031	12/13/2006	8.01	SU	pH (Total)	
21031	10/17/1994	0.05	mg/L	Phosphorus- Total (Total)	
21031	5/22/1992	19	mg/L	Potassium (Dissolved)	
21031	5/10/1993	24	mg/L	Potassium (Dissolved)	
21031	2/2/1994	19	mg/L	Potassium (Dissolved)	
21031	10/17/1994	27	mg/L	Potassium (Dissolved)	
21031	2/10/1995	28	mg/L	Potassium (Dissolved)	
21031	3/5/1996	19	mg/L	Potassium (Dissolved)	
21031	2/26/1997	9.4	mg/L	Potassium (Dissolved)	
21031	12/24/1997	12.7	mg/L	Potassium (Dissolved)	
21031	12/11/1998	14	mg/L	Potassium (Dissolved)	
21031	12/16/1999	11.5	mg/L	Potassium (Dissolved)	
21031	12/28/2000	26.4	mg/L	Potassium (Dissolved)	
21031	12/18/2001	26.5	mg/L	Potassium (Dissolved)	
21031	11/18/2002	26.1	mg/L	Potassium (Dissolved)	
21031	3/22/2004	13.5	mg/L	Potassium (Dissolved)	
21031	12/22/2004	12.8	mg/L	Potassium (Dissolved)	
21031	12/13/2005	12	mg/L	Potassium (Dissolved)	
21031	12/13/2005	12	mg/L	Potassium (Dissolved)	
21031	12/13/2006	8.98	mg/L	Potassium (Dissolved)	
21031	12/27/1991	2421	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	5/22/1992	1800	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	11/14/1992	1523	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	5/10/1993	1780	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	2/2/1994	1690	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	10/17/1994	2836	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	2/10/1995	2489	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	3/5/1996	1546	mg/L	Residues- Filterable (TDS) (Dissolved)	

VALUE QUALIFIER DESCRIPTIONS

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- **F** The value is questionable because of improper field sampling protocols.
- **I** The reported value is between the MDL (Method Detection Limit) and PQL (Practical Quantitation Limit)
- **J** The value is questionable because of improper laboratory protocols.
- **N** **This test is not NELAC certified by this laboratory**
- **Q** Sample held beyond the acceptable holding time. Result may be compromised.
- **U** Compound analyzed for but not detected. Value is Lab Detection Limit.

Southwest Florida Water Management District
Water Quality Monitoring Program
Water Quality Monitoring Network Results

Water Quality Monitoring Program Disclaimer -The water quality data obtained from the Southwest Florida Water Management District (District) are retrieved from several sources, including but not limited to federal, state, county, and municipal agencies and other water management districts. These data may be provisional and thus subject to revision at any time. The District and/or the contributing agencies specifically disclaim any warranty, either expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular use. The entire risk as to quality and performance is with the user. In no event will the District and/or the contributing agencies be liable for any direct, indirect, incidental, special, consequential, or other damages, including loss of profit, arising out of the use of these data even if the District and/or contributing agencies have been advised of the possibility of such damages. If you have any questions concerning these data, you should contact the Water Quality Monitoring Program at (813) 985-7481 or1-800-836-0797 (Florida).

SID	Collected Date	Value	Units	Analyte	Qualifier
21031	2/26/1997	868	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/24/1997	1334	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/11/1998	1107	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/16/1999	1077	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/28/2000	2131	mg/L	Residues- Filterable (TDS) (Dissolved)	Q
21031	12/18/2001	2491	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	11/18/2002	2380	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	3/22/2004	1250	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/22/2004	1305	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/13/2005	1090	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	12/13/2006	926	mg/L	Residues- Filterable (TDS) (Dissolved)	
21031	5/22/1992	7.9957	mg/L	Silica- Dissolved (Dissolved)	
21031	5/10/1993	2.3454	mg/L	Silica- Dissolved (Dissolved)	
21031	2/2/1994	2.1322	mg/L	Silica- Dissolved (Dissolved)	
21031	2/10/1995	0.9168	mg/L	Silica- Dissolved (Dissolved)	
21031	3/5/1996	8.1023	mg/L	Silica- Dissolved (Dissolved)	
21031	2/26/1997	7.8891	mg/L	Silica- Dissolved (Dissolved)	
21031	12/24/1997	4.3284	mg/L	Silica- Dissolved (Dissolved)	
21031	12/11/1998	6.823	mg/L	Silica- Dissolved (Dissolved)	
21031	12/16/1999	7.8891	mg/L	Silica- Dissolved (Dissolved)	
21031	12/28/2000	1.2	mg/L	Silica- Dissolved (Dissolved)	
21031	12/18/2001	8.3	mg/L	Silica- Dissolved (Dissolved)	
21031	11/18/2002	8.3	mg/L	Silica- Dissolved (Dissolved)	N1
21031	3/22/2004	8.3	mg/L	Silica- Dissolved (Dissolved)	N1
21031	12/22/2004	7.9931	mg/L	Silica- Dissolved (Dissolved)	
21031	12/13/2005	7.9	mg/L	Silica- Dissolved (Total)	
21031	12/13/2005	7.9	mg/L	Silica- Dissolved (Total)	N1
21031	12/13/2006	6.3	mg/L	Silica- Dissolved (Total)	

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Southwest Florida Water Management District

Southwest Florida Water Management District
Water Quality Monitoring Program
Water Quality Monitoring Network Results

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21031	5/22/1992	400	mg/L	Sodium (Dissolved)	
21031	5/10/1993	573	mg/L	Sodium (Dissolved)	
21031	2/2/1994	490	mg/L	Sodium (Dissolved)	
21031	10/17/1994	770	mg/L	Sodium (Dissolved)	
21031	2/10/1995	826	mg/L	Sodium (Dissolved)	
21031	3/5/1996	421	mg/L	Sodium (Dissolved)	
21031	2/26/1997	222	mg/L	Sodium (Dissolved)	
21031	12/24/1997	409	mg/L	Sodium (Dissolved)	
21031	12/11/1998	331	mg/L	Sodium (Dissolved)	
21031	12/16/1999	281	mg/L	Sodium (Dissolved)	
21031	12/28/2000	648	mg/L	Sodium (Dissolved)	
21031	12/18/2001	689.04	mg/L	Sodium (Dissolved)	
21031	11/18/2002	685	mg/L	Sodium (Dissolved)	
21031	3/22/2004	327	mg/L	Sodium (Dissolved)	
21031	12/22/2004	333	mg/L	Sodium (Dissolved)	
21031	12/13/2005	268	mg/L	Sodium (Dissolved)	
21031	12/13/2005	268	mg/L	Sodium (Dissolved)	
21031	12/13/2006	236	mg/L	Sodium (Dissolved)	
21031	12/27/1991	3900	uS/cm	Specific Conductance (Total)	
21031	5/22/1992	3100	uS/cm	Specific Conductance (Total)	
21031	11/14/1992	2990	uS/cm	Specific Conductance (Total)	
21031	5/10/1993	3760	uS/cm	Specific Conductance (Total)	
21031	2/2/1994	3180	uS/cm	Specific Conductance (Total)	
21031	10/17/1994	5420	uS/cm	Specific Conductance (Total)	
21031	2/10/1995	4800	uS/cm	Specific Conductance (Total)	
21031	3/5/1996	2940	uS/cm	Specific Conductance (Total)	
21031	2/26/1997	1709	uS/cm	Specific Conductance (Total)	
21031	2/26/1997	1642	uS/cm	Specific Conductance (Total)	
21031	12/24/1997	2800	uS/cm	Specific Conductance (Total)	
21031	12/24/1997	2910	uS/cm	Specific Conductance (Total)	
21031	12/11/1998	2310	uS/cm	Specific Conductance (Total)	
21031	12/11/1998	2170	uS/cm	Specific Conductance (Total)	
21031	12/16/1999	2060	uS/cm	Specific Conductance (Total)	
21031	12/16/1999	1994	uS/cm	Specific Conductance (Total)	

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Southwest Florida Water Management District
Water Quality Monitoring Program
Water Quality Monitoring Network Results

SID	Collected Date	Value	Units	Analyte	Qualifier
21031	12/28/2000	3970	uS/cm	Specific Conductance (Total)	
21031	12/28/2000	3900	uS/cm	Specific Conductance (Total)	
21031	12/18/2001	4530	uS/cm	Specific Conductance (Total)	
21031	12/18/2001	4440	uS/cm	Specific Conductance (Total)	
21031	11/18/2002	4377	uS/cm	Specific Conductance (Total)	
21031	11/18/2002	4410	uS/cm	Specific Conductance (Total)	
21031	3/22/2004	2376	uS/cm	Specific Conductance (Total)	
21031	3/22/2004	2360	uS/cm	Specific Conductance (Total)	
21031	12/22/2004	2480	uS/cm	Specific Conductance (Total)	
21031	12/22/2004	2497	uS/cm	Specific Conductance (Total)	
21031	12/13/2005	2040	uS/cm	Specific Conductance (Total)	
21031	12/13/2005	2046	uS/cm	Specific Conductance (Total)	
21031	12/13/2006	1759	uS/cm	Specific Conductance (Total)	
21031	12/13/2006	1796	uS/cm	Specific Conductance (Total)	
21031	3/5/1996	100	ug/L	Strontium (Dissolved)	U
21031	2/26/1997	500	ug/L	Strontium (Dissolved)	
21031	12/24/1997	50	ug/L	Strontium (Dissolved)	U
21031	12/11/1998	50	ug/L	Strontium (Dissolved)	U
21031	12/16/1999	900	ug/L	Strontium (Dissolved)	
21031	12/28/2000	1690	ug/L	Strontium (Dissolved)	
21031	12/18/2001	1060	ug/L	Strontium (Dissolved)	
21031	11/18/2002	750	ug/L	Strontium (Dissolved)	I
21031	3/22/2004	450	ug/L	Strontium (Dissolved)	I
21031	12/22/2004	470	ug/L	Strontium (Dissolved)	I
21031	12/13/2005	0.42	mg/L	Strontium (Dissolved)	I
21031	12/13/2006	0.39	mg/L	Strontium (Dissolved)	I
21031	12/27/1991	145	mg/L	Sulfate (Dissolved)	
21031	5/22/1992	150	mg/L	Sulfate (Dissolved)	
21031	5/10/1993	112	mg/L	Sulfate (Dissolved)	
21031	2/2/1994	93	mg/L	Sulfate (Dissolved)	
21031	10/17/1994	211	mg/L	Sulfate (Dissolved)	
21031	2/10/1995	118	mg/L	Sulfate (Dissolved)	
21031	3/5/1996	116	mg/L	Sulfate (Dissolved)	
21031	2/26/1997	73	mg/L	Sulfate (Dissolved)	

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Southwest Florida Water Management District
Water Quality Monitoring Program
Water Quality Monitoring Network Results

SID	Collected Date	Value	Units	Analyte	Qualifier
21031	12/24/1997	70.7	mg/L	Sulfate (Dissolved)	
21031	12/11/1998	92.8	mg/L	Sulfate (Dissolved)	
21031	12/16/1999	75.5	mg/L	Sulfate (Dissolved)	
21031	12/28/2000	42.8	mg/L	Sulfate (Dissolved)	
21031	12/18/2001	172.07	mg/L	Sulfate (Dissolved)	
21031	11/18/2002	162	mg/L	Sulfate (Dissolved)	
21031	3/22/2004	98.3	mg/L	Sulfate (Dissolved)	
21031	12/22/2004	90.69	mg/L	Sulfate (Dissolved)	
21031	12/13/2005	87.8	mg/L	Sulfate (Dissolved)	
21031	12/13/2006	51.1	mg/L	Sulfate (Dissolved)	
21031	12/27/1991	24	Deg. C	Temperature (Total)	
21031	5/22/1992	23.5	Deg. C	Temperature (Total)	
21031	11/14/1992	18.6	Deg. C	Temperature (Total)	
21031	5/10/1993	23.7	Deg. C	Temperature (Total)	
21031	2/2/1994	13.8	Deg. C	Temperature (Total)	
21031	10/17/1994	23.6	Deg. C	Temperature (Total)	
21031	2/10/1995	18.2	Deg. C	Temperature (Total)	
21031	3/5/1996	23.4	Deg. C	Temperature (Total)	
21031	2/26/1997	24	Deg. C	Temperature (Total)	
21031	12/24/1997	23	Deg. C	Temperature (Total)	
21031	12/11/1998	23.4	Deg. C	Temperature (Total)	
21031	12/16/1999	23.4	Deg. C	Temperature (Total)	
21031	12/28/2000	22	Deg. C	Temperature (Total)	
21031	12/18/2001	23.5	Deg. C	Temperature (Total)	
21031	11/18/2002	23.2	Deg. C	Temperature (Total)	
21031	3/22/2004	23.3799	Deg. C	Temperature (Total)	
21031	12/22/2004	23.1	Deg. C	Temperature (Total)	
21031	12/13/2005	23.32	Deg. C	Temperature (Total)	
21031	12/13/2006	23.33	Deg. C	Temperature (Total)	
21031	10/17/1994	4.6	NTU	Turbidity (Total)	

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Attachment L

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Corona to Ms. Kraft, Dated February 4, 2011

From: Hope [mailto:hopecorona@tampabay.rr.com]
Sent: Friday, February 04, 2011 4:54 PM
To: Carol Kraft
Subject: Re: Well Data Request from Hope Corona

Thanks, Carol.

Wow, some of the wells are much deeper than those typical of our neighborhood's private wells.

I'm curious whether it's the Sodium or the Chloride that indicates salt water, (or should I be looking at "Specific Conductance"), and what the "standard" or acceptable ranges are for all of the sampled analytes.

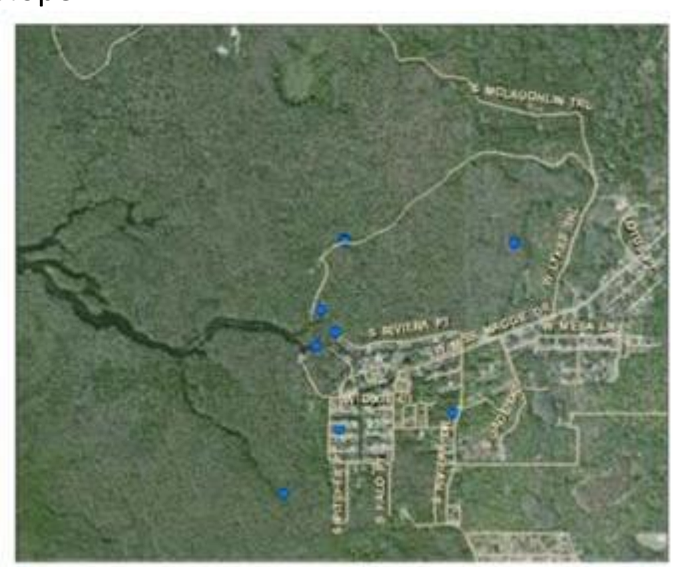
Is there some kind of standard chart that describes the "normal" range - expressed in mg/L, or uS/cm, respectively - of the sampled analytes for "fresh" or potable water? If so, could you send me a link?

The original map Doug sent me showed more wells, and I'm particularly interested in the one at the headwaters of Baird Creek, West of Pitcher Point. (See screen capture below of map I received in our original email correspondence; it's the west-most, south-most dot). Could you send me that data also?

If either Sodium or Chloride values are an indicator of salinity, then, per our telephone discussion, the well South of the River (with triple digit Sodium & Chloride values) seems to be in a much "saltier" area of the aquifer than those to the North (with mostly single and double digit values), and may suggest that the near-by south-of-river springs may also be "fed" by a different source, that is already approaching dangerously "impaired" conditions, that can certainly not withstand further reduction in fresh water flow.

The spring known as "Snapper Hole," where the Manatee "moms" customarily leave their juveniles in winter months, is on the South side of

the River, just east of Baird, and we are concerned that additional reductions in flow will threaten the thermal refuge currently provided in the Snapper Hole "nursery." Snapper Hole is East of Baird Creek, where Baird meets the main Chassahowitzka River. I don't think Snapper is monitored at all.
It will be interesting to see the data for Baird, and if it correlates with nearby well 21031.
The Chassahowitzka MFL does not adequately address fresh water flow to the springs and fresh water habitats in the eastern portion of our river, much less the southeastern springs, like Baird, and Snapper Hole.
We fear that the proposed 11% reduction in flow may cause fresh water to "cease flowing" to both Baird and Snapper, and this would be devastating to the Manatees who depend upon Snapper Hole as their main thermal refuge for juveniles and sub-adults.
Thanks again for your help,
Hope



The West-most, south-most dot.

Attachment M

Attachment to Memorandum Addressing Communications with Ms. Hope Corona Regarding Minimum Flows for the Homosassa and Chassahowitzka River Systems

E-Mail from Ms. Kraft to Ms. Corona, Dated February 9, 2011

From: Carol Kraft
Sent: Wednesday, February 09, 2011 7:35 AM
To: 'hopecorona@tampabay.rr.com'
Subject: RE: Well Data Request from Hope Corona

Good Morning Ms. Corona,

Sodium, chloride, and specific conductance can all be used to indicate how saline water is. The websites for the Florida Administrative Code, Environmental Protection Agency, and Florida Department of Environmental Protection, all contain the groundwater guidance concentrations for drinking water quality. By searching the aforementioned agency's websites you should also be able to locate further information on saline indicators, ranges, and additional information on various water quality parameters.

· Chapter 62-550, Florida Administrative Code. Chapter Title: DRINKING WATER STANDARDS, MONITORING, AND REPORTING
https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-550
· Florida Department of Environmental Protection, Home Page: http://www.dep.state.fl.us/
o Florida Department of Environmental Protection, 2010. Maximum Contaminant Levels for Drinking water in Florida. Available at:
http://www.dep.state.fl.us/water/drinkingwater/standard.htm
· United States Environmental Protection Agency, Home Page: http://www.epa.gov/
o United States Environmental Protection Agency, 2010. Drinking Water Contaminants, Maximum Contaminant Level Goal. Available at:
(http://www.epa.gov/safewater/contaminants/index.html)
· An additional resource - United States Geological Survey, Home Page:
http://www.usgs.gov/

The map that was provided in the email dated Friday, January 21, 2011 2:00 PM includes site locations of all our groundwater resource data collection sites within the map's extent. This potentially includes locations of spring sites and/or well sites that at one point in time could have had atmospheric, geohydrologic, water level, and/or water quality data collected at them. The water quality data that I previously provided you were all the data that we have available from all wells located within the map's extent (map - from email dated Friday, January 21, 2011 2:00 PM). The west-most, south-most point on the map (from email dated Friday, January 21, 2011 2:00 PM) is a spring site not a well site. All of these data are available on our on-line data retrieval system known as the Water Management Information System (WMIS). Site types (atmospheric, groundwater/geologic (well, spring, etc.), surface water, etc) as well as the types of data collected (atmospheric, water level, geohydrologic, water quality, etc.) at each can also be determined from the WMIS. For your reference, the link to WMIS is included within my signature line below. Please let me know if you have any difficulty navigating or retrieving data from the WMIS.

Thank you,

Carol Kraft
Staff Hydrologist
Water Quality Monitoring Program
Resource Data and Restoration Department
Southwest Florida Water Management District
7601 Hwy 301 N.
Tampa, FL 33637
Toll Free: 1-800-836-0797
Office: (813) 985-7481 ext. 2119
Fax: (813) 987-6585
email: carol.kraft@swfwmd.state.fl.us
District Website: http://www.watermatters.org
WMIS Link: http://www8.swfwmd.state.fl.us/WMIS/ResourceData/ExtDefault.aspx
WMIS Help Document: http://www.swfwmd.state.fl.us/data/resource_data_help.pdf

March 15, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Letter to the editor by Mr. Harold Seckinger addressing proposed minimum flows for the Homosassa River system published in the Citrus County Chronicle in January 2011 and response letter by Doug Leeper published in the Chronicle in February 2011

This memorandum documents a letter by Mr. Harold Seckinger that was published in the Citrus County Chronicle on January 14, 2011. The letter addresses Mr. Seckinger's concerns regarding development of minimum flows for the Homosassa River system. This memorandum also addresses a response letter written by Mr. Doug Leeper (with the District) that was published in the Chronicle on February 24, 2011. Electronic mails and copies of the published letters are attached to this memorandum.

DAL

Attachments:
A - Letter from Harold Seckinger Published in the Citrus County Chronicle on January 14, 2011
B - E-Mail dated January 21, 2011 from Robyn Felix to the Editor of the Citrus County Chronicle
C - E-Mail dated January 24, 2011 from Robyn Felix to the Editor of the Citrus County Chronicle
D - Letter from Doug Leeper Published in the Citrus County Chronicle on February 24, 2011

Attachment A

Letter from Harold Seckinger Published in the Citrus County Chronicle on January 14, 2011

Citrus County Chronicle - Opinion - Letter
Jan. 14, 2011

Swiftmud's goals

My impression of SWFWMD at the Lecanto Government Center on Thursday, Jan. 7, from graphs, charts, calculations, maps, records, documentation prepared by SWFWMD, and response to attendees by two presenters: SWFWMD has concluded that regulating flows in the Homosassa River is justified and public input will not change it. Comment and questions were systematically deprecated, and one question bypassed in argument, all as being unimportant in view of extensive data being presented.

SWFWMD maintains:

The Citrus County aquifer recharge is sufficient to meet all requirements and maintain supply. Fluctuating rainfall has no adverse effect on the aquifer.

Aquifers to the south, Pasco-Hillsborough, Sarasota, do not recharge to the same degree because of coverage of development and decline.

Salt intrusion is minimal and can be dismissed; however, it is admitted that trace amounts of water from the spring have a saline content.

Projected water usage for 2050 shows only a small area in Citrus County with recharge decline.

Projection of climate change, physiological change in the aquifer, or any other insubstantial question of decrease in water availability was denied.

The entire presentation was based upon future requirements of surrounding population. This is the beginning of a concerted effort to transfer water from Citrus County. The area maps indicate that Citrus County in 2050 will be the only aquifer in this part of the state with a projected stable water source. Reducing water flow in the Homosassa River is the beginning to supply water for every county on our border. Once the transfer of water begins, it will accelerate and never end. The dialog indicated that development is a major factor in recharge; that is where the votes are, and that is where control of the state resides. SWFWMD thinks in water quantities of 100,000 gallons a day. Argument that current saline content of the Homosassa River now harbors barnacles in the river was dismissed as unimportant. Since control of development on the river was transferred to SWFWMD, construction of docks and pavilions are destroying the waterfront. Is our aquifer next?

Harold Seckinger
Homosassa

Attachment B

<u>E-Mail dated January 21, 2011 from Robyn Felix to the Editor of the Citrus County Chronicle</u>

From: Robyn O. Felix
To: letters@chronicleonline.com
Cc: Charlie Brennan (cbrennan@chronicleonline.com); Doug Leeper
Subject: Southwest Florida Water Management District Letter to the Editor Response
Date: Friday, January 21, 2011 4:09:33 PM
Attachments: Chronicle_lettertotheeditor_HomosassaMFL Response.doc

Please accept the following letter to the editor response regarding the proposed Homosassa River System MFL on behalf of Doug Leeper, Chief Environmental Scientist, with the Southwest Florida Water Management District. Please let me know if you have any questions. Thanks in advance for your consideration.

Re: Swiftmud's Goals, Jan. 14, 2011

I would like to clear up some misconceptions about the Southwest Florida Water Management District's ongoing development of minimum flows for the Homosassa River system in response to a recent letter to the editor.

The state Legislature requires the District to set minimum flows and levels for priority water bodies within the District. A minimum flow or level is the limit at which further water withdrawals will cause significant harm to the water resources and/or the environment. A great deal of scientific information has been compiled to support the development of minimum flows for the Homosassa system. This information shows that the major factor controlling flows in the river and the springs that discharge to the river is rainfall, with only minimal impacts associated with area water use. The influence of rainfall on flows is extremely significant in Citrus County and nearby areas as a result of the geology of the region, which allows for rapid recharge of the aquifer from rain falling on the land surface. We have looked at projected water demands over the next 20 years. Using that data, our computer modeling indicates that potential groundwater withdrawals are not expected to cause flows to go below the recommended minimum flows.

We have also learned that changes in river flows affect salinity in the river, and this relationship has been used to develop proposed minimum flows that protect the salinity-based habitats that are essential for the plants and animals that inhabit this tidally influenced river system.

As part of this process, the District has submitted the recommended minimum flows to an independent scientific review panel, conducted two public workshops to solicit input on the minimum flows, and continues to work with individuals and organizations interested in protecting the river and associated springs. As a result of the comments that have been provided, the District has initiated additional analysis that may result in the modification of the current minimum flow recommendations.

The District is committed to developing the best possible minimum flows that will protect the

Homosassa River system. A draft report summarizing information related to development of minimum flows for the Homosassa River system is available on the District's web site by visiting *WaterMatters.org/mfl* and clicking on the “MFL documents and reports” link. Our staff is also more than happy to address any questions or comments from the public on this important water management activity. Please feel free to contact us at 1-800-423-1476, ext. 4272.

Doug Leeper
Chief Environmental Scientist
Resource Projects Department
Southwest Florida Water Management District

Robyn Felix
Media Relations Manager
Southwest Florida Water Management District
Direct: 1-800-423-1476 ext. 4770
Cell: (813) 781-9817
www.WaterMatters.org

Attachment C

E-Mail dated January 24, 2011 from Robyn Felix to the Editor of the Citrus County Chronicle

From: Robyn O. Felix
To: letters
Cc: Doug Leeper
Subject: RE: Southwest Florida Water Management District Letter to the Editor Response
Date: Monday, January 24, 2011 10:59:26 AM
Attachments: Chronicle_lettertotheeditor_HomosassaMFL Response 350-word version.doc

J.K.,
Thanks for your e-mail. Attached is a revised version of the letter I submitted on Friday. I've made a note in my files about the 350-word limit for future reference. Thanks.

Re: Swiftmud's Goals, Jan. 14, 2011

I would like to clear up some misconceptions about the Southwest Florida Water Management District's ongoing development of minimum flows for the Homosassa River system in response to a recent letter to the editor.

The state Legislature requires the District to set minimum flows and levels for priority water bodies within the District. A minimum flow or level is the limit at which further water withdrawals will cause significant harm to the water resources and/or the environment.

The District has compiled scientific data to support development of minimum flows for the Homosassa River system and summarized this information in a draft report that is available on the District's web site at *WaterMatters.org.* The information shows that the major factor controlling flows in the river and associated springs is rainfall, with only minimal impacts associated with area water use. The influence of rainfall on flows is significant in Citrus County and nearby areas as a result of the geology of the region, which allows for rapid recharge of the aquifer. Using water demand estimates for the next 20 years, computer modeling indicates that potential groundwater withdrawals are not expected to cause flows to go below the recommended minimum flows. We have also learned that changes in river flows affect salinity in the river, and this relationship has been used to develop proposed minimum flows that protect the salinity-based habitats that are essential for the plants and animals populating the system.

The District is committed to developing the best possible minimum flows for protection of the Homosassa River. As part of this process, the District has submitted the recommended minimum flows to an independent scientific review panel, conducted two workshops to solicit public input, and continues to work with individuals and organizations interested in protecting the river system. As a result of the comments that have been provided, the District has initiated additional analysis that may result in the modification of the current minimum flow recommendations.
Please feel free to contact us at 1-800-423-1476, ext. 4272 to address any questions or comments you may have regarding minimum flows for the Homosassa River system.

Doug Leeper
Chief Environmental Scientist
Resource Projects Department
Southwest Florida Water Management District

Robyn Felix
Media Relations Manager
Southwest Florida Water Management District
Direct: 1-800-423-1476 ext. 4770
Cell: (813) 781-9817
www.WaterMatters.org

Attachment D

Letter from Doug Leeper Published in the Citrus County Chronicle on February 24, 2011

Citrus County Chronicle - Opinion - Letter
Feb. 24, 2011

Scientific Study

Re: Swiftmud's Goals, Jan. 14, 2011

I would like to clear up some misconceptions about the Southwest Florida Water Management District's ongoing development of minimum flows for the Homosassa River system in response to a recent letter to the editor.

The state Legislature requires the district to set minimum flows and levels for priority water bodies within the district. A minimum flow or level is the limit at which further water withdrawals will cause significant harm to the water resources and/or the environment.

The district has compiled scientific data to support development of minimum flows for the Homosassa River system and summarized this information in a draft report that is available on the district's website at WaterMatters.org. The information shows that the major factor controlling flows in the river and associated springs is rainfall, with only minimal impacts associated with area water use. The influence of rainfall on flows is significant in Citrus County and nearby areas as a result of the geology of the region, which allows for rapid recharge of the aquifer.

Using water-demand estimates for the next 20 years, computer modeling indicates that potential groundwater withdrawals are not expected to cause flows to go below the recommended minimum flows. We have also learned that changes in river flows affect salinity in the river, and this relationship has been used to develop proposed minimum flows that protect the salinity-based habitats that are essential for the plants and animals populating the system.

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Please feel free to contact us at (800) 423-1476, ext. 4272 to address any questions or comments you may have regarding minimum flows for the Homosassa River system.

Doug Leeper
Chief Environmental Scientist, Resource Projects Department, Southwest Florida Water Management District

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Citrus County Chronicle article published January 27, 2011

This memorandum documents an article on proposed minimum flows for the Homosassa River system that was published in the January 27, 2012 edition of the Citrus County Chronicle.

DAL
Attachment

Citrus County Chronicle
Jan. 27, 2011

Residents concerned about river flows

By Amanda Mims

It's a familiar scenario: Residents have seen changes in their river over the past five or six decades — changes they see as deterioration. The government agency responsible for issuing water use permits says the river hasn't reached the point of significant harm due to water withdrawals.

Just as it is with the Chassahowitzka River, the Southwest Florida Water Management District is in the process of setting minimum flows and levels for the Homosassa River. And, just like with the Chassahowitska, some residents say they don't like the numbers the district is proposing.

The district is required to evaluate certain water bodies periodically and establish minimum flows and levels for them. Established minimum flows and levels are meant to prevent significant harm associated with water withdrawals. The district generally defines significant harm as a 15 percent reduction in available habitat.

Jim Bitter, president of the Save the Homosassa River Alliance, said he has been familiar with the Homosassa since the 1950s and has watched water quality in the once pristine river.

"I saw a decline in water quality" over the years, he said. "This used to be a destination for bass fisherman and it used to be that I could walk out to the river and catch a couple of brim for my dinner. Now you can't find either one of those fish in this water. This is a nursery for the entire Nature Coast section of the Gulf of Mexico, as are all of these little rivers. As we degrade them, we directly affect the Gulf itself."

He said the change is evident and the Water Management District should not allow water levels to drop any more.

The district has proposed allowing no more than a 5 percent reduction in flow for the Homosassa River but is re-evaluating its data in light of concerns residents have expressed.

"We're trying to fine tune it a little better," said Marty Kelly, the district's minimum flows and levels program director. "It might not go lower. It was just a question that was raised. The question was: Was it really 4.5 or was it 5? What's the actual number? I honestly don't think it's going to change much."

Ron Miller, vice president of the Save the Homosassa River Alliance, wrote a letter to the district asking it to protect the Homosassa River by "setting the maximum flow reduction to near zero."

Kelly said he doesn't deny that residents have witnessed water levels on the river drop or that there has been more saltwater intrusion in recent decades. However, he said those things happen largely because of rainfall patterns and climate changes, not because of water withdrawals.

Florida Statutes require the district to set minimum flows and levels so that water withdrawals do not cause significant harm to water bodies. Factors such as climate change and rainfall aren't considered.

"Historically, you'll see similar periods of drought" like there is now, Kelly said. "A lot of people's frame of reference dates to the '50s and '60s when we had high levels of rainfall."

District staff is working on proposed minimum flows and levels to submit to its governing board. The proposal will include comments from the public and staff members' responses to those comments. Kelly said he doesn't expect the proposed minimum flows and levels for the Homosassa to go before the district's governing any earlier than April.

The district continues to accept written comments about the Homosassa River minimum flows and levels. Comments can be submitted via mail or e-mail to Doug Leeper, chief environmental scientist, at 2379 Broad Street, Brooksville, FL 34604-6899 or Doug.Leeper@watermatters.org.

A draft report containing information on the development of minimum flows and levels for the Homosassa River is available on the district's website. To locate the report, visit www.WaterMatters.org/mfl and click on the "MFL documents and reports" link. For more information, call Leeper at (800) 423-1476, ext. 4272.

Chronicle reporter Amanda Mims can be reached at amims@chronicleonline.com.

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Communications with Bernard Berauer regarding proposed minimum flows for the Homosassa River system

---

This memorandum addresses communications between District staff and Bernard Berauer regarding proposed minimum flows for the Homosassa River system.

DAL
Attachments

From:	Ben Berauer
To:	Doug Leeper
Cc:	Ron Basso
Subject:	Could you assist me in getting additional info re: Homosassa River MFL draft plan
Date:	Friday, January 07, 2011 10:03:30 AM

Doug,

I attended last night's public workshop and listened to your presentations and associated comments. You offered to provide additional information, and I would like to have the following, please:

Soft copies of the presentations.

The DEP comments sent to SWFWMD regarding the draft plan.

The 20 year water use projections for each county showing their projected use and water sources (believe you said this was available online)

The Withlacoochee Water Authority planned well field study.

Thank you,
Bernard Berauer
352-610-6704
10332 S McClung Loop
Homosassa, FL 34448

From: Doug Leeper
To: "Ben Berauer"
Subject: RE: Could you assist me in getting additional info re: Homosassa River MFL draft plan
Date: Friday, January 07, 2011 12:32:08 PM

Mr. Berauer:

Thank you for contributing to the public workshop on proposed minimum flows for the Homosassa River system last night.

Several of the electronic files that you requested are too large to send via e-mail, so I have bundled a selection of files into a zipped file named "For_BBerauer" and placed the file on the District FTP site for you to retrieve. Directions for retrieving files from the FTP site may be found on the "How to Access our Anonymous FTP Server" page of the District web site at the following link:

http://www.swfwmd.state.fl.us/data/ftp/

The zipped file includes Adobe PDF formatted versions of the documents listed below. I believe all the information you requested may be found in these documents. Note that the most recent estimates for projected water-use are contained in the draft 2010 Regional Water Supply Plan - Northern Planning Region.

Leeper 2010 - Memo-FDEP 15nov2010 Questions & Comments on Homosassa MFLs
Slides - DLeeper Second Homosassa MFLs Wkshp 07jan2011
Slides - RBasso Second Homosassa MFLs Wkshp 07jan2011
SWFWMD 2005 - District Water Management Plan
SWFWMD 2005 - District Water Management Plan Appendices
SWFWMD 2006 - Regional Water Supply Plan
SWFWMD 2010 - Draft 2010 Regional Water Supply Plan - Northern Planning Region
WRA 2010 - WRWSA Phase 2 Part A
WRA 2010 - WRWSA Phase 2 Part B

Please let me know if you are unable to obtain the zipped file from the District FTP site or have problems opening the file. If you run into any trouble, I could send you copies of the original files on a CD or DVD.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

-----Original Message-----
From: Ben Berauer [mailto:bfberauer@aol.com]

From:	Ben Berauer
To:	Doug Leeper
Subject:	Re: Could you assist me in getting additional info re: Homosassa River MFL draft plan
Date:	Friday, January 07, 2011 1:51:57 PM

Thank you, Doug. I have successfully retrieved the files.

Bernard Berauer

On Jan 7, 2011, at 12:32 PM, Doug Leeper wrote:

> Mr. Berauer:
>
> Thank you for contributing to the public workshop on proposed minimum flows for the Homosassa River system last night.
>
> Several of the electronic files that you requested are too large to send via e-mail, so I have bundled a selection of files into a zipped file named "For_BBerauer" and placed the file on the District FTP site for you to retrieve. Directions for retrieving files from the FTP site may be found on the "How to Access our Anonymous FTP Server" page of the District web site at the following link:
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>
> The zipped file includes Adobe PDF formatted versions of the documents listed below. I believe all the information you requested may be found in these documents. Note that the most recent estimates for projected water-use are contained in the draft 2010 Regional Water Supply Plan - Northern Planning Region.
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> SWFWMD 2005 - District Water Management Plan Appendices
> SWFWMD 2006 - Regional Water Supply Plan
> SWFWMD 2010 - Draft 2010 Regional Water Supply Plan - Northern Planning Region
> WRA 2010 - WRWSA Phase 2 Part A
> WRA 2010 - WRWSA Phase 2 Part B
>
> Please let me know if you are unable to obtain the zipped file from the District FTP site or have problems opening the file. If you run into any trouble, I could send you copies of the original files on a CD or DVD.
>
> Douglas A. Leeper, Chief Environmental Scientist
> Resource Projects Department, Southwest Florida Water Management District
> 2379 Broad Street, Brooksville, FL 34604-6899

January 7, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments submitted by Mr. Robert Knight, Director of Water Resources for Citrus County, regarding recommended minimum flows for the Homosassa River and Chassahowitzka River systems

---

This memorandum documents an e-mail submitted to the Southwest Florida Water Management District on January 7, 2011 by Mr. Robert Knight, Director for Water Resources for Citrus County, concerning development of minimum flows for the Homosassa River and Chassahowitzka River systems. Mr. Knight's e-mail is attached to this memorandum along with an e-mail response sent to Mr. Knight by Dr. Marty Kelly, the District's Minimum Flows and Levels Program Director.

DAL

Attachments: One page e-mail from Mr. Robert Knight, dated January 6, 2011
One page e-mail from Dr. Marty Kelly to Mr. Robert Knight, dated January 7, 2011

Attachment A to January 7, 2011 Memorandum Concerning Comments Submitted by Mr. Robert Knight, Director of Water Resources for Citrus County, Regarding Recommended Minimum Flows for the Homosassa River and Chassahowitzka River Systems

<u>E-Mail from Mr. Robert Knight, Dated January 6, 2011</u>

From: Robert Knight [mailto:Robert.Knight@bocc.citrus.fl.us]
Sent: Thursday, January 06, 2011 6:01 PM
To: Marty Kelly
Cc: Eber Brown; Mary Glancy
Subject: Proposed MFL's for Chassahowitzka and Homosassa Springs and Associated Rivers

I'm providing my comments as the Director of Water Resources for Citrus County and as a member of the Water Management District's Water Supply Users Advisory Committee.

I have reviewed the basis upon which proposed minimum flows and levels (MFL's) have been evaluated and proposed for both Chassahowitzka and Homosassa Springs and associated rivers. I have had communications with the two employees of the District who were in charge of these studies and have reviewed their findings and conclusions. Although by no means am I a hydrogeologist, I do have a working understanding of the guidelines by which the proposed levels are to be established.

Based on my working knowledge of this process and a review of the methodology applied specifically in the proposed MFL's for these two waters, I conclude that the proposed MFL's are appropriate and supportable as being consistent with established and required methodologies.

Robert Knight,
Director of Water Resources
Citrus County, Florida

Attachment B to January 7, 2011 Memorandum Concerning Comments Submitted by Mr. Robert Knight, Director of Water Resources for Citrus County, Regarding Recommended Minimum Flows for the Homosassa River and Chassahowitzka River Systems

E-Mail From Dr. Marty Kelly to Mr. Robert Knight, Dated January 7, 2011

From: Marty Kelly
To: Robert Knight
Cc: Mike Heyl; Doug Leeper
Subject: RE: Proposed MFL"s for Chassahowitzka and Homosassa Springs and Associated Rivers
Date: Friday, January 07, 2011 8:58:55 AM

Bob,

Thanks for the timely email; we will include it as part of the public record. I have copied the two lead scientists who directed the MFL development on these two waterbodies.

Thanks again and for attending our meeting last night.

Marty

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Communications with Brad Rimbey regarding proposed minimum flows for the Homosassa River system and the Withlacoochee Regional Water Supply Plan

---

This memorandum addresses communications between District staff and Brad Rimbey regarding proposed minimum flows for the Homosassa River system and the Withlacoochee Regional Water Supply Plan.

DAL
Attachments

From: Brad Rimbey@CRRC
To: Doug Leeper
Subject: Homosassa MFL
Date: Sunday, January 09, 2011 9:13:39 AM

Dear Mr. Leeper,

Thank you for your presentation at the Homosassa MFL workshop last Thursday night. During the workshop, I asked to receive the following documents;

a) Comments on the Homosassa MFL draft report from DEP,

b) Comments on the Homosassa MFL draft report from FWC,

c) The 2010 Withlacoochee Regional Water Supply Plan.

I would also like to receive all public comments on the Homosassa MFL draft report.

I would prefer to receive digital copies of these documents. If you post these documents on your ftp site I can simply download them. Let me know if that is not possible and I will provide you with my snail mail address.

Brad W. Rimbey
for the Chassahowitzka River Restoration Committee

From: Doug Leeper
To: "Brad Rimbey@CRRC"
Cc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Karen Lloyd
Subject: Request for Files Related to Homosassa MFLs
Date: Tuesday, January 11, 2011 1:33:23 PM

Mr. Rimbey:

Thanks for your contribution to the recent public workshop on proposed minimum flows for the Homosassa River. Per your request from January 9, 2011, I have bundled a number of files into a zipped file named "For_BRimbey" and placed the file on the District FTP site for you to retrieve. Directions for retrieving files from the FTP site may be found on the "How to Access our Anonymous FTP Server" page of the District web site at the following link:

http://www.swfwmd.state.fl.us/data/ftp/

The zipped file includes Adobe PDF formatted versions of the 35 files listed below. The files include the *Withlacoochee Regional Water Supply Authority Phase II – Detailed Water Supply Feasibility Analyses*, public and agency input that has been received on the proposed minimum flows for the Homosassa River system, staff responses to submitted comments, and the report of the peer-review panel convened to evaluate the proposed minimum flows.

E-Mail from BRimby - Homosassa MFL Info Request 09jan2011
E-Mail from MJohnson - Follow Up to e-mail sent a few minutes ago 10jan2011
E-Mail from MJohnson - Homosassa MFLs 24dec2010
E-Mail from MJohnson - Lecanto Workshop Homosassa MFLs 10jan2010
E-Mail to MCzerwinski - Adobe PDF of Homosassa MFLs Workshop Slides 15oct2010
E-Mail to MHammond - Summary of Homosassa MFLs Public Workshop 15oct2010
E-Mail to RBreraer - Re_Request for Docs 07jan2011
Gov Board 11-16-10 Minutes
Hackney et al. 2010 - Scientific Review...Minimum Flows...Homosassa...
Homosassa MFLs 06jan2011 Workshop Summary
Leeper 2010 - Memo-BGarvin Report Submission Homo MFLs 20dec2010
Leeper 2010 - Memo-BKnight Questions Homosassa MFLs
Leeper 2010 - Memo-FDEP 15nov2010 Questions & Comments on Homosassa MFLs
Leeper 2010 - Memo-FFWCC 11oct2010 Comments on Homosassa MFLs with Poole Letter Attchmnt
Leeper 2010 - Memo-KTripp 05nov2010 Comments on Homosassa MFLs
Leeper 2010 - Memo-MJohnson -02nov2010 Comments on Homosassa MFLs
Leeper 2010 - Memo-MJohnson -15nov2010 Comments Homosassa MFLs
Leeper 2010 - Memo-MJohnson 28oct2010 Comments on Homosassa MFLs
Leeper 2010 - Memo-RAuermann 17oct2010 Comments on Homosassa MFLs 18oct2010
Leeper 2010 - Memo-RMiller 25oct2010 Questions & Comments on Homosassa MFLs
Leeper 2010 - Memo-RMiller Questions on Homosassa MFLs 01oct2010
Leeper 2010 - Memo-WGarvin 23oct2010 Comments on Homosassa MFLs
Leeper 2010 - Response to BGarvin 27oct2010 Comment on Homosassa MFLs
Leeper 2011 - Memo - BKnight Comments on Homo & Chass MFLs 07jan2011
Leeper 2011 - Memo - JSchulz 03jan2011 Comments on Homo & Chass MFLs 10jan2011
Leeper 2011 - Memo - KSchulz 03jan2011 Comments on Homo & Chass MFLs 10jan2011
Leeper 2011 - Memo - KStonerock 09jan2011 Comments Homo MFLs 11jan2011
Leeper 2011 - Memo - Letter from RMiller 04jan2011
Leeper 2011 - Memo - MRhinesmith Comments on Homo MFLs 05jan2011
Leeper 2011 - Memo - RMiller 09jan2011 Info Request and Question 11jan2011
Leeper - Memo-RMiller 30sep2010 Questions on Homosassa MFLs 06oct2010

From: Brad Rimbey
To: Doug Leeper
Subject: Re: Request for Files Related to Homosassa MFLs
Date: Tuesday, January 11, 2011 5:13:23 PM

Thanks Doug. I won't be back to my broadband connection for a few days. I'll check the ftp site when I get home and let you know if I have any problems with the downloads. Brad Rimbey

----- Original Message -----
From: Doug Leeper
To: Brad Rimbey@CRRC
Cc: Marty Kelly ; Sid Flannery ; Mike Heyl ; Ron Basso ; Mark Barcelo ; Cara S. Martin ; Jay Yingling ; Yassert Gonzalez ; Karen Lloyd
Sent: Tuesday, January 11, 2011 1:33 PM
Subject: Request for Files Related to Homosassa MFLs

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Leeper 2010 - Memo-MJohnson-15nov2010 Comments Homosassa MFLs
Leeper 2010 - Memo-MJohnson 28oct2010 Comments on Homosassa MFLs
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Leeper 2010 - Memo-RMiller 25oct2010 Questions & Comments on Homosassa MFLs
Leeper 2010 - Memo-RMiller Questions on Homosassa MFLs 01oct2010

May 19, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Meeting and correspondence with Chassahowitzka National Wildlife Refuge staff regarding minimum flows development

---

This memorandum documents a January 2011 meeting and associated correspondence between staff from the District and the Chassahowitzka National Wildlife Refuge concerning minimum flows development for Springs Coast rivers.

DAL

Attachments: A - E-Mail from Boyd Blihovde, dated December 10, 2010
B - Slides by Doug Leeper used for the January 5, 2011 meeting
C - Slides by Mike Heyl used for the January 5, 2011 meeting
D - E-Mail from Doug Leeper to Joyce Kleen, dated January 14, 2011
E - E-Mail from Doug Leeper to Joyce Kleen, dated February 2, 2011

Attachment A

E-Mail from Boyd Blihovde, dated December 10, 2010

From: Boyd_Blihovde@fws.gov
To: Doug Leeper
Cc: Michael_Lusk@fws.gov
Subject: Fw: MFL contact for Kings Bay
Date: Friday, December 10, 2010 11:45:48 AM

Mr Leeper,

Hey, I am the Assistant Manager at Chassahowitzka NWR Complex (which includes the Crystal River NWR). We are very interested in talking to you about the upcoming establishment of MFLs for Crystal River. As you are aware, this is a critical area for the manatee (a focal species for the Refuge). We would appreciate it if we could schedule a meeting sometime after the Holidays to discuss the MFL process and discuss some of our concerns.

If that is possible, please let me know. Also don't hesitate to call if needed. My cell phone number is 352-302-2301...

Thanks,
boyd blihovde
Deputy Refuge Manager
Chassahowitzka National Wildlife Refuge Complex
1502 SE Kings Bay Drive
Crystal River, FL 34429
(P) 352-563-2088
(F) 352-795-7961

Attachment B

<u>Slides by Doug Leeper used for the January 5, 2011 meeting</u>

Development of Minimum Flows for the Homosassa River, Chassahowitzka River and Crystal River/Kings Bay Systems

Doug Leeper - Mike Heyl - Sid Flannery - Marty Kelly

Southwest Florida Water Management District

Brooksville, Florida

January 5, 2011

Minimum Flows and Levels

- Florida Statutes, Section 373.042 -

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.

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

What is Significant Harm?

- Not defined by state law
- Defined or implicit in District standards or thresholds used to establish minimum flows and levels
- Standards or thresholds are specific to water resource type and value

Examples

- Preventing cypress wetland degradation in lake basins
- Preventing or slowing rate of saltwater intrusion into aquifers
- Preventing more than a 15% decline in habitat availability in river segments

Minimum Flows and Levels Considerations

- Florida Administrative Code, Chapter 62-40.473 -

Shall consider natural seasonal fluctuations and environmental values, including:

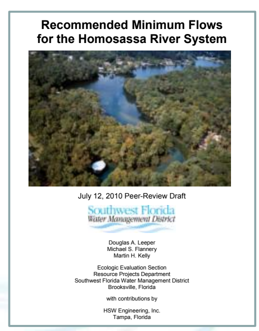
- Recreation in and on the water
- Fish and wildlife habitats and the passage of fish
- Estuarine resources
- Transfer of detrital material
- Maintenance of freshwater storage and supply
- Aesthetic and scenic attributes
- Filtration and absorption of nutrients and other pollutants
- Sediment loads
- Water quality
- Navigation

Regulatory Use of Minimum Flows and Levels

- Water-Use Permitting
- Environmental Resource Permitting
- Water Resource Planning

Minimum Flows Reports

Draft minimum flows reports and peer-review reports are posted on the District Web site at: *watermatters.org*



Recommended Minimum Flows
for the Homosassa River System

July 12, 2010 Peer-Review Draft

Southwest Florida Water Management District

Douglas A. Leeper
Michael S. Flannery
Martin H. Kelly

Ecologic Evaluation Section
Resource Projects Department
Southwest Florida Water Management District
Brooksville, Florida

with contributions by

HSW Engineering, Inc.
Tampa, Florida

Process for Establishing Minimum Flows and Levels

- Priority List and Schedule developed
- Methods, flows or levels developed and peer-reviewed
- Workshops held for public input
- Recovery or prevention strategies developed, as necessary
- Governing Board adopts minimum flows and levels into Chapter 40D-8, Florida Administrative Code
- Necessary recovery strategies included in Regional Water Supply Plan and in some cases adopted into Chapter 40D-80, Florida Administrative Code

Tidal River Minimum Flows

- Study Elements -

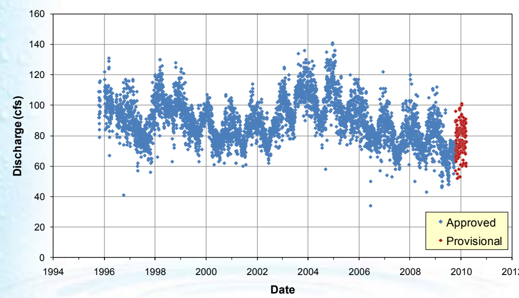
- Defining the system
- Baseline flows and salinity evaluations
- Evaluation of withdrawal impacts on flows
- Evaluation of structural alterations
- Bathymetric mapping
- Shoreline and vegetation mapping
- Benthic invertebrate evaluations
- Planktonic and nektonic fish and invertebrate evaluations
- Salinity-based habitat modeling
- Thermal habitat modeling for manatees

System Definition

- Homosassa River System -

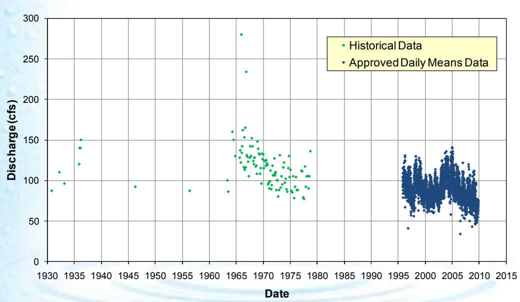
Baseline Flows and Salinity

- Daily Mean Discharge Record for Homosassa Springs -



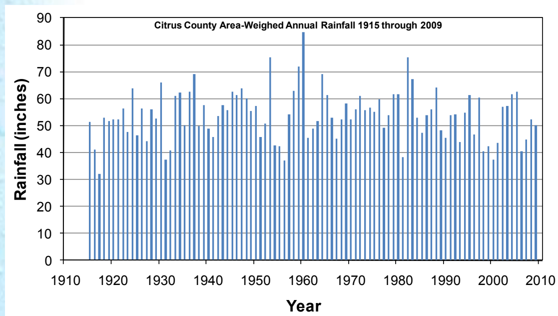
Baseline Flows and Salinity

-Approved Daily Mean Discharge Record and Historical Instantaneous Discharge Record for Homosassa Springs -



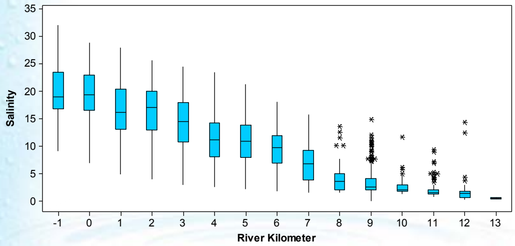
Baseline Flows and Salinity

-Flows are Consistent with Rainfall -



Baseline Flows and Salinity

-Tides, Spring Discharge and Winds Create a Longitudinal Salinity Gradient In the Homosassa River -



Withdrawal Impacts

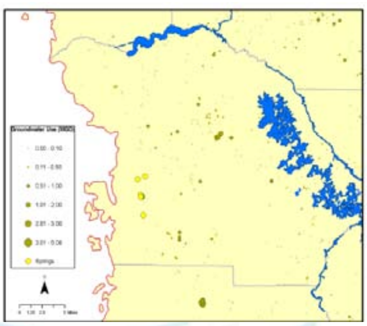
- Northern District Model -

Source: Basso (2010)

Withdrawal Impacts

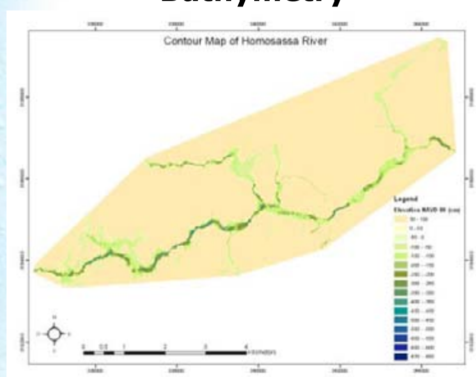
- Northern District Model -

Withdrawals of 438.1 MGD in 2005 were associated with an ~1% reduction in discharge from Homosassa River system springs



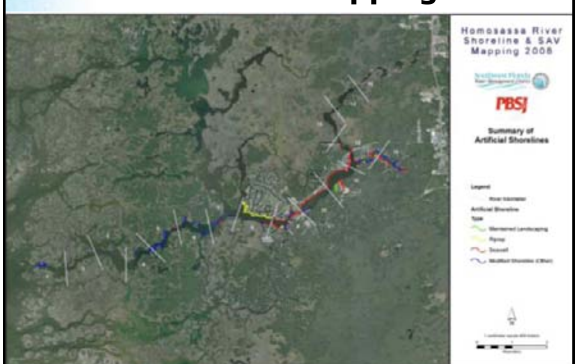
Source: Basso (2010)

Bathymetry



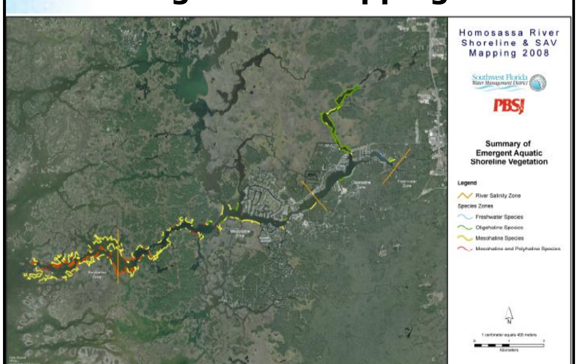
Source: Wang (2007)

Shoreline Mapping



Source: PBS&J (2009)

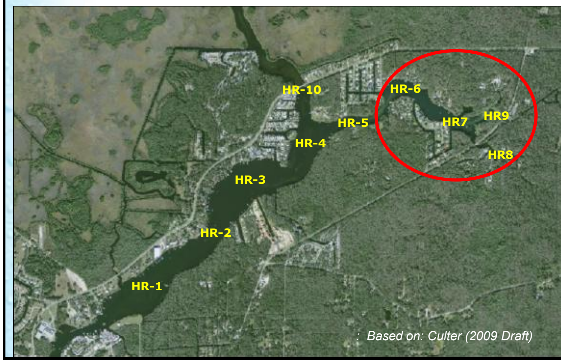
Vegetation Mapping



Source: PBS&J (2009)

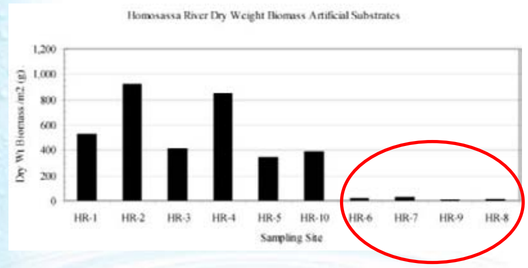
Benthic Invertebrates

- Barnacle Sampling Sites -



Benthic Invertebrates

- Barnacle Biomass by Site -



Source: Cutetr (2009)

Plankton and Nekton

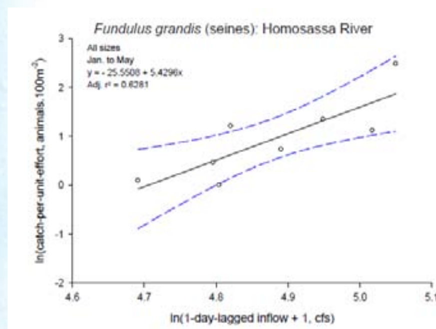
- Gulf Killifish Example -

Maximum Length = 145 mm

Image Source: Freshwater Fishes of Texas: A Field Guide by *C. Thomas, T.H. Bonner and B.G. Whiteside*

Plankton and Nekton

- Gulf Killifish Abundance and Flow -



Source: Peebles et al. (2009)

Plankton and Nekton

- Abundance and Flow Results -

- Flow reductions from <1 to 2.7% associated with 15% reductions in abundances of 20 pseudo-species
- However, model issues suggest caution when interpreting results

Image source: J. Ditty, S. Holt, J. Matthews and T. Minello; NOAA Fisheries Service, Galveston Lab

Salinity-Based Habitat Modeling

- Biologically Relevant Salinity Criteria -

Water volume, bottom area and shoreline length associated with salinities that characterize or affect:

- availability of fish habitat
- availability of invertebrate habitat
- the amount and/or type of shoreline vegetation
- other, undefined system components and processes

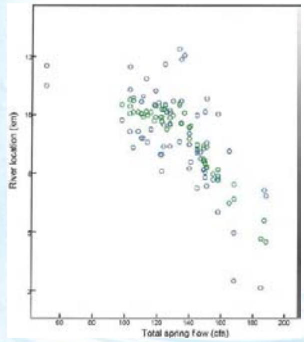
Salinity-Based Habitat Modeling

- Hydrodynamic Model -

Source: HSW Engineering, Inc. (2010)

Salinity-Based Habitat Modeling

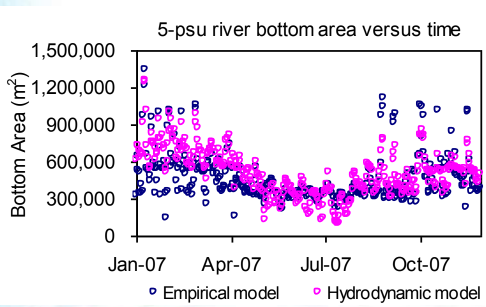
- Regression Models -



Source: HSW Engineering, Inc. (2010)

Salinity-Based Habitat Modeling

- Hydrodynamic and Regression Model Comparison-



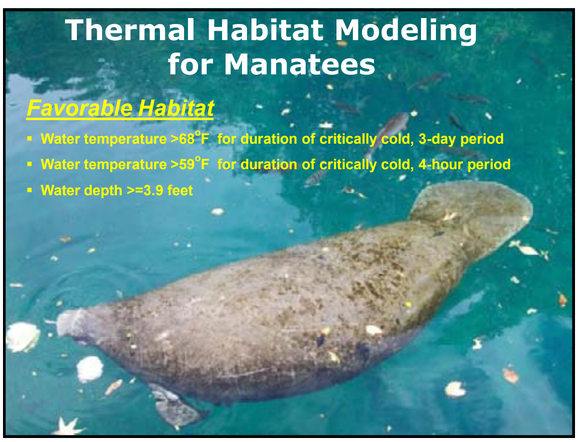
Source: HSW Engineering, Inc. (2010)

Salinity-Based Habitat Modeling

- All Results -

Salinity-Based Habitat	Percent-of-Flow Reduction Associated with 15% Reductions in Habitat from Median Baseline Conditions		
	Hydrodynamic Model 2007 Benchmark Period	***Regression Model 2007 Benchmark Period***	***Regression Model 1995-2009 Benchmark Period***
Bottom Area			
Salinity ≤ 2 Based on Bottom Isohaline Location	< 5	NM	NM
Salinity ≤ 2 Based on Water-Column Average Isohaline Location	< 5	NM	NM
Salinity ≤ 3 Based on Bottom Isohaline Location	5 – 10 (9.4)	< 5	< 5
Salinity ≤ 3 Based on Water-Column Average Isohaline Location	5 – 10 (9.1)	< 5	< 5
Salinity ≤ 5 Based on Bottom Isohaline Location	15	> 30	5 – 10 (6.3)
Salinity ≤ 5 Based on Water-Column Average Isohaline Location	10 – 15	20	5 – 10 (7.0)
Salinity ≤ 12 Based on Bottom Isohaline Location	25	20	10
Salinity ≤ 12 Based on Water-Column Average Isohaline Location	25 – 30	30	10 – 15
Water Volume			
Salinity ≤ 2	< 5	NM	NM
Salinity ≤ 3	10	5 – 10 (5.3)	< 5
Salinity ≤ 5	15	20 – 25	5 – 10 (6.9)
Salinity ≤ 12	20 – 25	25	10 – 15
Natural Shoreline Length			
Salinity ≤ 2	NA	NM	NM
Salinity ≤ 3	20 – 25	10 – 15	10 – 15
Salinity ≤ 5	15 – 20	> 30	> 30
Salinity ≤ 12	NA	5	5

Thermal Habitat Modeling for Manatees

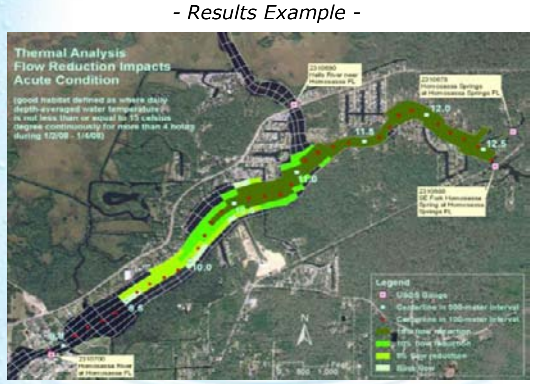


Favorable Habitat

- Water temperature >68°F for duration of critically cold, 3-day period
- Water temperature >59°F for duration of critically cold, 4-hour period
- Water depth >=3.9 feet

Thermal Habitat Modeling for Manatees

- Results Example -



Source: HSW Engineering, Inc. (2010)

Thermal Habitat Modeling for Manatees
- Results -

- Flow reduction between 5-10% associated with a 15% reduction in favorable refuge habitat during critically cold four-hour period
- Flow reduction between 25-30% associated with a15% reduction in favorable refuge habitat during critically cold three-day period

Recommended Minimum Flows for the Homosassa River System

Ninety-five percent of natural flows, which are defined as the combined daily mean flow past the USGS Homosassa Springs at Homosassa Springs, FL and Southeast Fork Homosassa Springs at Homosassa Springs, FL gages

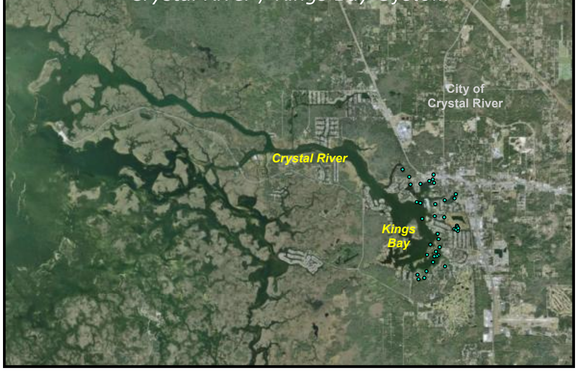
Crystal River / Kings Bay System
- Schedule -

- **Target date for initial draft report development – May 2011**
- **Target date for presentation of draft report to the District Governing Board – Jul 2011**
- **Target date for completion of peer-review – Oct 2011**
- **Target date for rule adoption – Nov 2011**

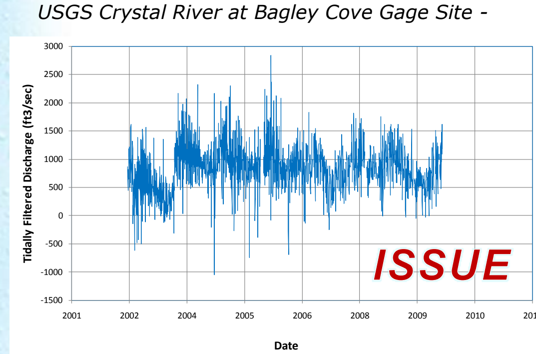
Crystal River / Kings Bay
- Study Elements -

- Defining the system ✓
- Baseline flows and salinity evaluations *Ongoing*
- Evaluation of withdrawal impacts on flows *Ongoing*
- Evaluation of structural alterations ✓
- Bathymetric mapping ✓
- Shoreline and vegetation mapping *Ongoing*
- Benthic invertebrate evaluations ✓
- Planktonic-nektonic fish & invertebrate evaluations *Ongoing*
- Salinity-based habitat modeling *Ongoing*
- Thermal habitat modeling for manatees *Ongoing*

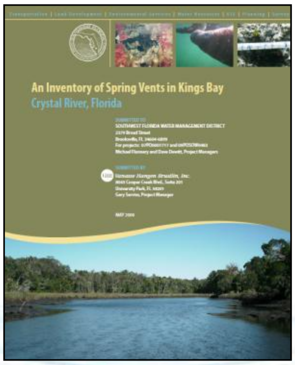
System Definition
- Crystal River / Kings Bay System -



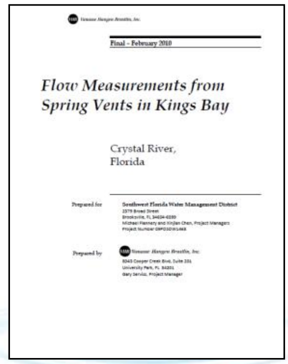
Baseline Flows and Salinity
-Approved Daily Mean Discharge Record, USGS Crystal River at Bagley Cove Gage Site -



Spring Vent Mapping



Spring Vent Discharge Evaluation


Final – February 2010

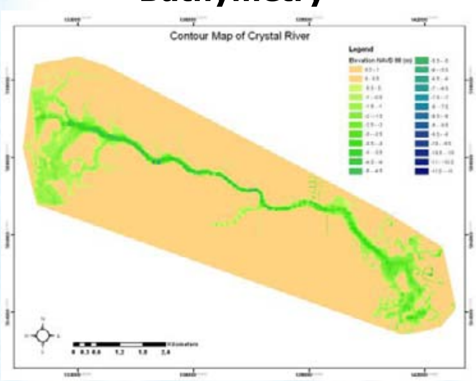
Flow Measurements from Spring Vents in Kings Bay

Crystal River, Florida

Prepared for: Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604-6899
Michael Flannery and Xinjian Chen, Project Managers

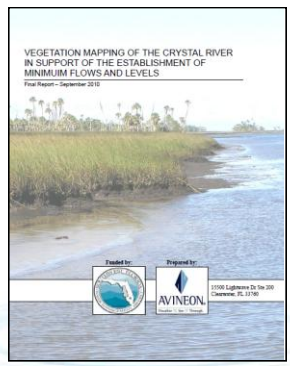
Prepared by: Janicki Environmental / Vanasse Hangen Brustlin, Inc.
8043 Cooper Creek Blvd, Suite 201
University Park, FL 34201
Gary Serviss, Project Manager

Bathymetry



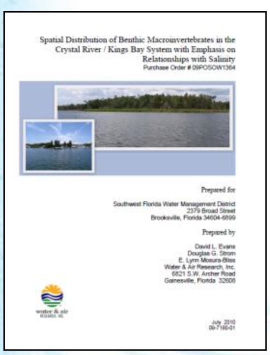
Source: Wang (2008)

Shoreline & Vegetation Mapping


VEGETATION MAPPING OF THE CRYSTAL RIVER
IN SUPPORT OF THE ESTABLISHMENT OF
MINIMUM FLOWS AND LEVELS
Final Report – September 2010

Funded by:
Prepared by:
AVINEON
15500 Lightwave Dr Ste 200
Clearwater, FL 33760

Benthic Invertebrates

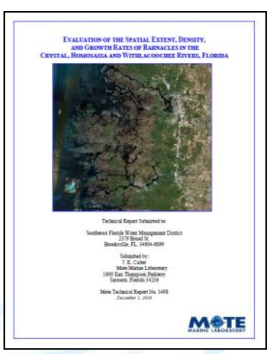

Spatial Distribution of Benthic Macroinvertebrates in the Crystal River / Kings Bay System with Emphasis on Relationships with Salinity
Purchase Order # 09POSOW1364

Prepared for
Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 34604-6899

Prepared by
David L. Evans
Douglas G. Strom
E. Lynn Mosura-Bliss
Water & Air Research, Inc.
6821 S.W. Archer Road
Gainesville, Florida 32608

water & air

July 2010
09-7190-01


EVALUATION OF THE SPATIAL EXTENT, DENSITY, AND GROWTH RATES OF BARNACLES IN THE CRYSTAL, HOMOSASSA AND WITHLACOOCHEE RIVERS, FLORIDA

Technical Report Submitted to:
Southwest Florida Water Management District
2379 Broad St.
Brooksville, FL 34604-6899

Submitted by:
J. K. Culter
Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, Florida 34236

Mote Technical Report No. 1498
December 1, 2010

MOTE MARINE LABORATORY

Data Summarization


Southwest Florida Water Management District Contract #00075499 Project # 00084045

Compilation and Synthesis of Existing Data in Support of the Determination of Minimum Flows for Crystal River

Task 1 - Summary of Previous Studies and Data Collection Efforts

Prepared by

Thomas K. Frazer, Charles A. Jacoby, and Sky K. Notestein

Program in Fisheries and Aquatic Sciences
School of Forest Resources and Conservation
University of Florida
7922 NW 71st Street
Gainesville, Florida 32653

Submitted to

Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 34604-6899

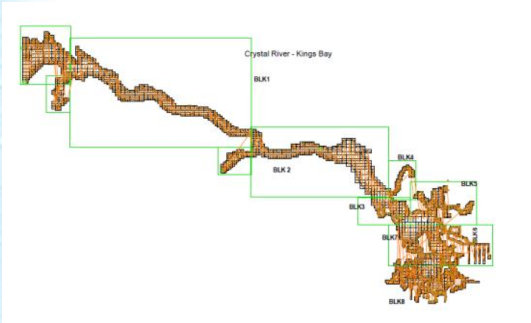
May 3, 2010

UF UNIVERSITY of FLORIDA IFAS

SFRC

Salinity-Based Habitat Modeling

- Hydrodynamic Model -



Source: X. Chen, SWFWMD

Contact Information

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Title: Chief Environmental Scientist

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2379 Broad St.
Brooksville, FL 34604-6899

Phone: 1-800-423-1476 or 352-796-7211
Extension 4272

E-Mail: doug.leeper@swfwmd.state.fl.us

Web Site: www.swfwmd.state.fl.us or
watermatters.org

Plankton and Nekton Results

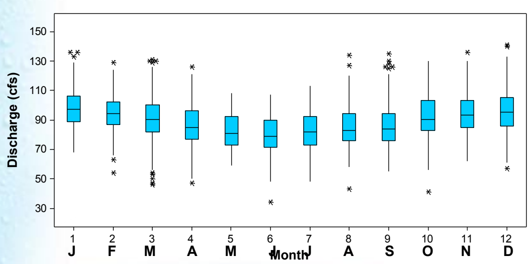
Taxon or Pseudo-Species	Benchmark Period	Baseline Flow[a] (cfs)	Baseline Abundance (number/ channel or number/ 100m²)	85% of Baseline Abundance (number/ channel or number/ 100m²)	Flow Associated with 85% of Baseline Abundance (cfs)	Percent of Flow Reduction Associated with 85% of Baseline Abundance (%)
Plankton-Net Captured			**(number/ channel)**	**(number/ channel)**		
Hargeria rapax[b]	2007	130	67,242	57,155	128.1	1.4
	1995-2009	150	333,722	283,663	147.8	1.4
Lucania parva postflexion larvae[b]	2007	130	1,407	1,196	128.2	1.4
	1995-2009	150	7,457	6,339	147.9	1.4
Ostracods, podocopid[b]	2007	130	31,031	26,376	128.2	1.3
	1995-2009	150	172,563	146,678	148.0	1.3
Acartia tonsa[b]	2007	130	1,294,494	1,100,319	128.6	1.1
	1995-2009	150	11,345,444	9,643,627	148.40	1.1
Eurytemora affinis[b]	2007	130	2,849	2,421	128.9	0.8
	1995-2009	150	49,686	42,233	148.8	0.8
Seine-Net Captured			**(number/ 100m²)**	**(number/ 100m²)**		
Palaemonetes intermedius[c]	2007	130	11.4	9.7	127.5	1.9
	1995-2009	150	35.8	30.4	146.9	2.1
Callinectus sapidus; <30 mm in length[c]	2007	130	1.4	1.2	129.1	0.7
	1995-2009	150	16.1	13.7	148.3	1.1

Plankton and Nekton Results (cont.)

Taxon or Pseudo-Species	Benchmark Period	Baseline Flow[a] (cfs)	Baseline Abundance	15% Decrease from Baseline Abundance	Flow Associated with 85% of Baseline Abundance (cfs)	Percent of Flow Reduction Associated with 85% of Baseline Abundance (%)
Callinectus sapidus; >30mm in length[c]	2007	130	0.5	0.5	128.0	1.6
	1995-2009	150	1.5	1.3	145.9	2.7
Fundulus grandis[c]	2007	130	1.5	1.3	127.7	1.7
	1995-2009	150	4.4	3.8	146.4	2.4
Lucania parva[c]	2007	130	43.6	37.0	128.3	1.3
	1995-2009	150	236.1	200.6	147.9	1.4
Gambusia holbrooki[c]	2007	130	4.9	4.2	128.9	0.8
	1995-2009	150	55.3	47.0	148.5	1.0
Poecilia latipinna[c]	2007	130	0.4	0.4	128.1	1.5
	1995-2009	150	1.2	1.0	145.9	2.7
Syngnathus scovelli[d]	2007	130	1.8	1.5	127.9	1.6
	1995-2009	150	5.7	4.9	146.7	2.2
Lepomis punctatusi[d]	2007	130	3.3	2.8	128.3	1.3
	1995-2009	150	15.9	13.5	147.6	1.6
Micropterus salmoides[c]	2007	130	8.5	7.2	128.8	1.0
	1995-2009	150	79.2	67.3	148.4	1.1
Micropterus salmoidesi[d]	2007	130	4.0	3.4	129.2	0.6
	1995-2009	150	92.9	79.0	148.8	0.8
Lagadon rhomboides[c]	2007	130	8.9	7.6	128.4	1.2
	1995-2009	150	53.1	45.1	148.0	1.3
Leiostomus xanthurus[c]	2007	130	<0	NA	NA	NA
	1995-2009	150	59.3	50.4	149.3	0.5
Trawl-Net Captured			**(number/ 100m²)**	**(number/ 100m²)**		
Callinectus sapidus[e]	2007	130	0.1	0.1	129.4	0.5
	1995-2009	150	0.9	0.7	147.0	2.0
Syngnathus scovelli[e]	2007	130	0.2	0.2	129.3	0.6
	1995-2009	150	1.2	1.0	147.0	2.0

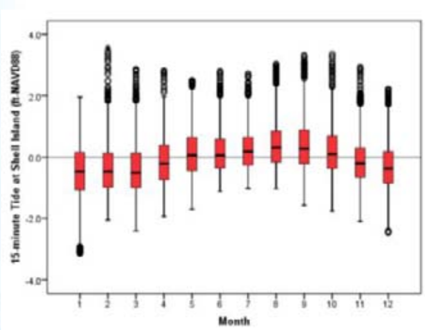
Baseline Flows and Salinity

- Monthly Mean Discharge for Homosassa Springs -



Baseline Flows and Salinity

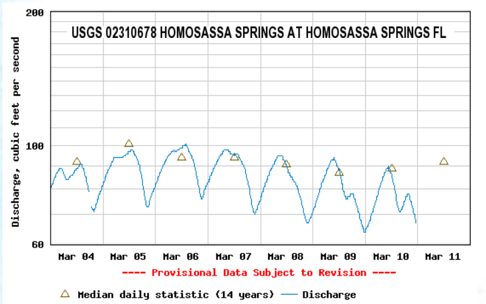
- Seasonal Tide Influences -



Source: HSW Engineering, Inc. (2010)

Baseline Flows and Salinity

- Daily Tidal Cycle Influences -



Source: USGS National Water Interface System Web Interface

Baseline Flows and Salinity

- Flows Summary Table -

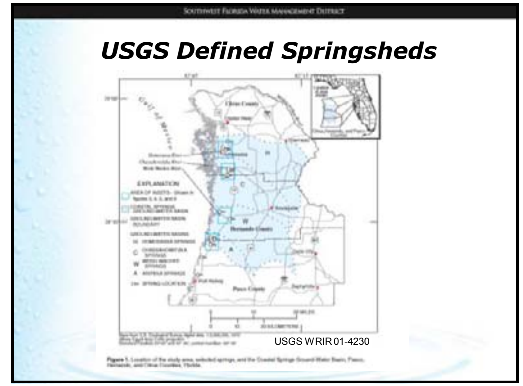
Statistic (cfs or N)	Homosassa Springs at Homosassa Springs FL	SE Fork Homosassa Spring at Homosassa Springs FL	Combined Homosassa and SE Fork Springs	Halls River	Homosassa River at Homosassa FL (tidally filtered)	Hidden River near Homosass a FL
Maximum	141	100	240	1,995	2,090	25.0
75th Percentile	98	68	165	200	350	11
Median	88	60	147	108	251	8.0
25th Percentile	79	53	131	28	167	4.6
Minimum	34	23	57	-765	-636	1.3
Mean	89	61	149	129	272	8.0
Standard Deviation	14	11	26	181	183	4.4
Number (N) of daily Records	4,975	3,123	3,102	1,662	1,774	2,063

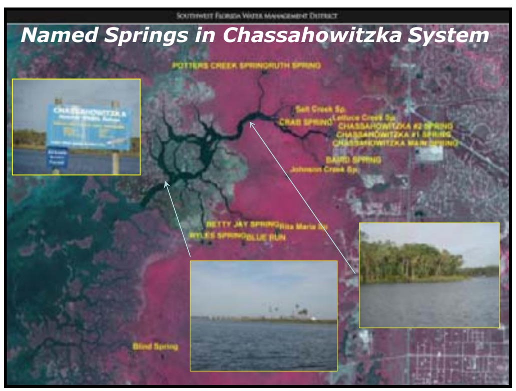
Attachment C

Slides by Mike Heyl used for the January 5, 2011 meeting

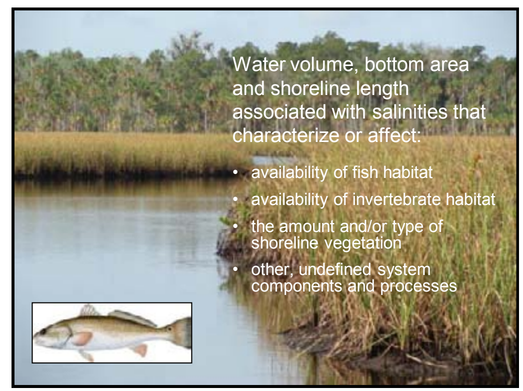

Proposed Minimum Flows and Levels for the Chassahowitzka River System
Mike Heyl
Chief Env. Scientist
Public Meeting
December 16, 2010
Southwest Florida Water Management District


Southwest Florida Water Management District
Chassahowitzka River System
Brooksville 17 Miles
Tampa Bay 75 Miles


Southwest Florida Water Management District
USGS Defined Springsheds
USGS WRIR 01-4230


Southwest Florida Water Management District
Named Springs in Chassahowitzka System
POTTERS CREEK SPRINGRUTH SPRING
Salt Creek Sp.
CRAB SPRING
Lettuce Creek Sp.
CHASSAHOWITZKA #2 SPRING
CHASSAHOWITZKA #1 SPRING
CHASSAHOWITZKA MAIN SPRING
BAIRD SPRING
Johnson Creek Sp.
BETTY JAY SPRING
Rita Maria Sp.
RYLES SPRING
BLUE RUN
Blind Spring


Southwest Florida Water Management District
Rkm and Salinity
Gulf Salinity = 35


Water volume, bottom area and shoreline length associated with salinities that characterize or affect:
• availability of fish habitat
• availability of invertebrate habitat
• the amount and/or type of shoreline vegetation
• other, undefined system components and processes

Minimum Flow and Levels (MFL) Rule

Section 373.042 F.S.

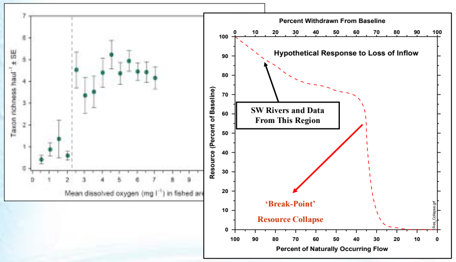
'the minimum flow shall be the limit at which further **withdrawals** would be **significantly harmful** to the water resources or ecology of the area.'

- Based on 'best information available'

(See also 62-40.473 FAC.)

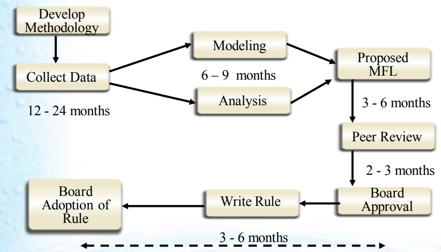
Not to be confused with a permit.

Significantly Harmful ?



Operationally Defined as 15% Loss of Resource or Habitat

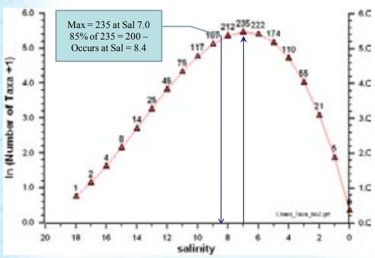
MFL Timeline - Process



Resources and Habitats Evaluated

Resources and Habitat Evaluated	
Salinity Habitat	**Fish / Invertebrate Abundance**
2 ppt - volume	Bay anchovy, juvenile *(Anchoa mitchilli)*
5 ppt - volume	Tanaid (*Hargeria rapax*)
10 ppt - volume	Midge larvae (dipterans, chironomid larvae)
15 ppt - volume	Pink shrimp *(Farfantepenaeus duorarum)*
2 ppt - area	Gulf killifish *(Fundulus grandis)*
5 ppt - area	Rainwater killifish *(Lucania parva)*
10 ppt - area	Bluefin killifish *(Lucania goodei)*
15 ppt - area	Sailfin Molly *(Poecilia latipinna)*
2 ppt - shoreline length	Spotted sunfish *(Lepomis punctatus)*
5 ppt - shoreline length	Pinfish (*Lagodon rhomboides)*
10 ppt - shoreline length	
15 ppt - shoreline length	
Benthos	**West Indian Manatee**
Diversity	Chronic / Acute thermal refuge (volume)
Abundance	Chronic / Acute thermal refuge (area)
Mollusc	**SAV Density**
Oyster (*Crassostrea virginica*)	American eelgrass (*Vallisneria americana*)
Marshclam *(Polymesoda caroliniana)*	Southern waternymph (*Najas guadulupensis)*
Hooked mussel *(Ischadium recurvum)*	Sago pondweed (*Potamogeten pectinatus*)

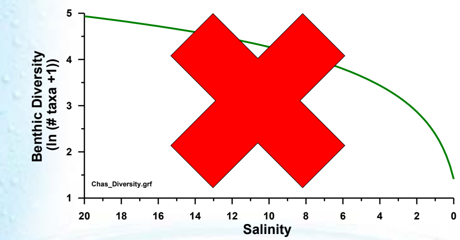
Benthos Diversity Example



At typical flow, salinity 7.0 occurs at Rkm 3.3

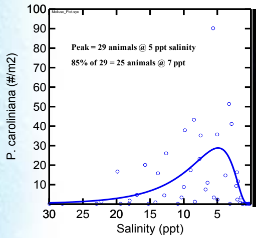
At this same location, salinity = 8.4 when flow is reduced 8%

Chassahowitzka Diversity



SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Polymesoda carolinia– #/m2 v.s. Salinity (Regional)



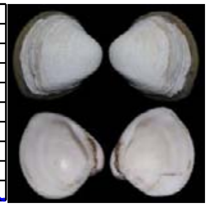
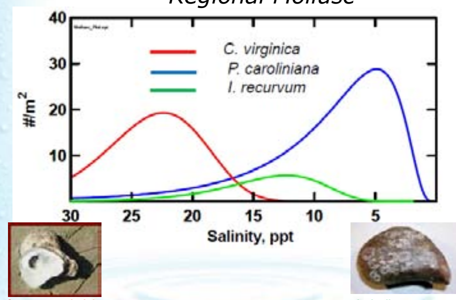


Photo Credit http://www.jaxshells.org/mesod.htm

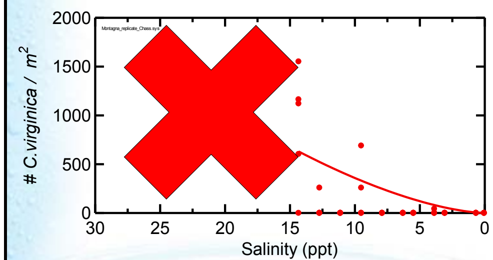
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Regional Mollusc



SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

C. Virginica (oysters)



SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

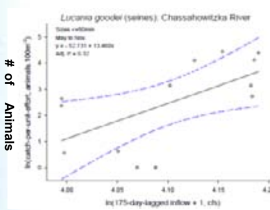
Criteria for evaluating fish/invertebrates

	Seine or trawl	Tow	Combined
Taxa Collected	46	66	112
Significant relationship to Flow	23	13	36
Number positive linear or mid-flow maximum	13	3	16
Greater than or equal to 10 observations	8	3	11
Variation explained by flow greater than or equal to 30%	8	3	11
Percent of taxa collected	17%	5%	10%

Bay anchovy *(Anchoa mitchilli)*	Fresh to Marine
Tanaid *(Hargeria rapax)*	Marine
Midges (dipterand, chironomid larvae)	Fresh
Pink shrimp *(Farfantepenaeus duorarum)*	Marine
Gulf killifish *(Fundulus grandis)*	Fresh - Brackish
Rainwater killifish *(Lucania parva)*	Fresh to Marine
Bluefin killifish *(Lucania goodei)*	Fresh - Brackish
Sailfin molly *(Poecilia latipinna)*	Fresh to Marine
Spotted sunfish *(Lepomis punctatus)*	Fresh
pinfish *(Lagadon rhomboides)*	Marine

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Chassahowitzka Fish



Bluefin Killifish (*Lucania goodei*)
© Noel Burkhead

http://www.flmnh.ufl.edu/fish/southflorida/everglades/marshes/glossary/bluefinkillifish.html

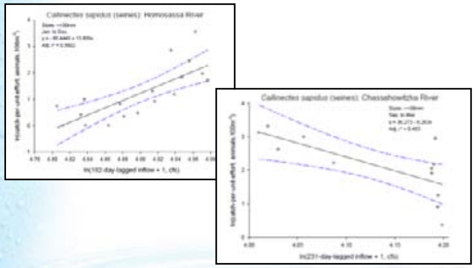
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Plankton and Nekton

- Blue Crab Example -

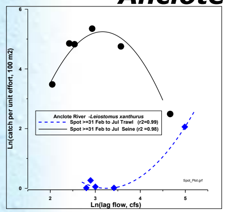
Source: J. Ditty, S. Holt, J. Matthews and T. Minello NOAA Fisheries Service, Galveston Lab

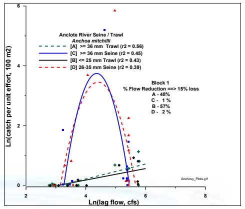
Blue Crab Nekton



Source: Peebles et al. (2009). Greenwood et al. (2008)

Fish / Invertebrate Responses Anclote Example





Fish / Invertebrate Responses

Taxa	Type	Season	Flow Reduction (%)		
			As Presented in Peer Draft	All Taxa	As Presented In Final Report
Plankton Net					
Anchoa mitchilli juveniles	Linear	Annual	1.0	1.0	1.0
Hargeria rapax	Linear	Annual	1.9	1.9	1.9
Dipterans, chironomid larvae	Linear	Annual	2.3	2.3	2.3
Seine and Trawl					
Farfantepenaeus duorarum (T)	Quadratic	Annual	15.2	15.2	15.2
Farfantepenaeus duorarum (S)	Quadratic	Annual	17.2	17.2	17.2
Fundulus grandis	Quadratic	Annual		11.9	11.9
Lucania parva	Quadratic	Annual	11.1	11.1	11.1
Lucania goodei	Linear	May-Nov		0.9	
Poecilia latipinna	Quadratic	Annual	13.3	13.3	13.3
Lepomis punctatus	Linear	May-Nov		1.6	
Lagodon rhomboides	Quadratic	Jan-Jun		17.9	
Median for resource			**11.1**	**11.1**	**11.5**

Thermal Refuge Requirements

No More than a 15% Loss over Baseline Area and Volume

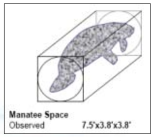
Chronic Requirements :

- Minimum 3.8 ft Access at High Tide
- Minimum 3.8 ft Depth at Low Tide
- Minimum of 20° C for 3-days

Acute Requirements :

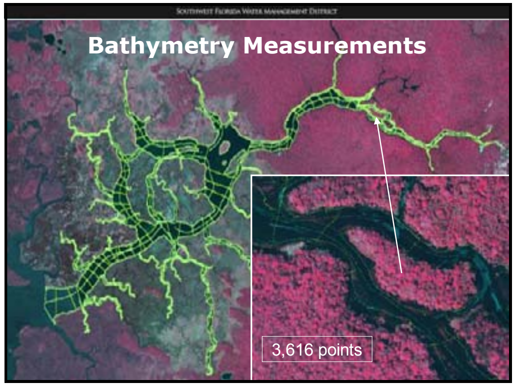
- No more than 4 hours ≤ 15° C

Rouhani et al. 2006



22

Bathymetry Measurements



Thermal Refuge - Chassahowitzka

Chronic Thermal Refuge – No overlapping red areas.

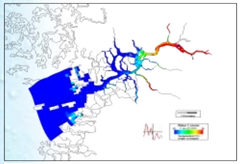


Figure -
Plan view of water temperatures during the critically cold period

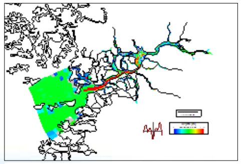
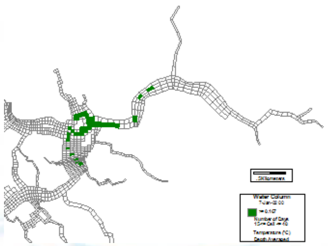


Figure -
Plan view of water depths at low tide during the critically cold period

Southwest Florida Water Management District

Thermal Refuge

Acute Thermal Refuge – 11 % Flow Reduction
Causes 15% reduction in volume.



Southwest Florida Water Management District

MFL Summary - 1

Resource	Criteria	Reduction in Baseline Flow
Salinity Habitat		(%)
2 ppt - volume	15% loss in volume	22
5 ppt - volume	15% loss in volume	13
10 ppt - volume	15% loss in volume	23
15 ppt - volume	15% loss in volume	>40
2 ppt - area	15% loss in area	23
5 ppt - area	15% loss in area	15
10 ppt - area	15% loss in area	26
15 ppt - area	15% loss in area	>40
2 ppt - shoreline length	15% loss in length	30
5 ppt - shoreline length	15% loss in length	13
10 ppt - shoreline length	15% loss in length	26
15 ppt - shoreline length	15% loss in length	>40

Southwest Florida Water Management District

MFL Summary - 2

Resource	Criteria	Reduction in Baseline Flow
Fish / Invertebrate Abundance		
Anchoa mitchilli juveniles (#/channel)	15% loss in abundance	1.0
Hargeria rapax (#/channel)	15% loss in abundance	1.9
Dipterans, chironomid larvae (#/channel)	15% loss in abundance	2.3
Farfantepenaeus duorarum (#/100m^2)	15% loss in abundance	17.2
Farfantepenaeus duorarum (#/100m^2)	15% loss in abundance	15.2
Fundulusgrandis(#/100m^2)	15% loss in abundance	11.9
Lucania parva (#/100m^2)	15% loss in abundance	11.1
Lucania goodei (#/100m^2) Seasonally derived	15% loss in abundance	0.9
Poecilia latipinna (#/100m^2)	15% loss in abundance	13.3
Lepomis punctatus (#/100m^2) Seasonally derived	15% loss in abundance	1.6
Lagodon rhomboids (#/100m^2) Seasonally derived	15% loss in abundance	17.9
	Fish / Invertebrate Median :	**11.5**

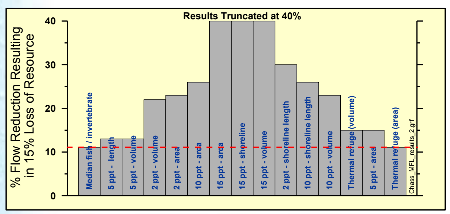
Southwest Florida Water Management District

MFL Summary - 3

Resource	Criteria	Reduction in Baseline Flow
Benthos		
Diversity - Positive response with salinity not included	15% loss of diversity	
SAV Density		
Vallisneria americana (Not used - see text)	15% loss of peak density	1
Najas guadalupensis (Not used - see text)	15% loss of peak density	2
Potamogeton pectinatus (Not used - see text)	15% loss of peak density	1
Mollusc		
Crassostrea virginica - Optimal salinity outside sample domain - not used.	15% loss of peak abundance	
West Indian Manatee		
Acute thermal refuge (volume)	15% loss in volume	15
Acute thermal refuge (area)	15% loss of area	11

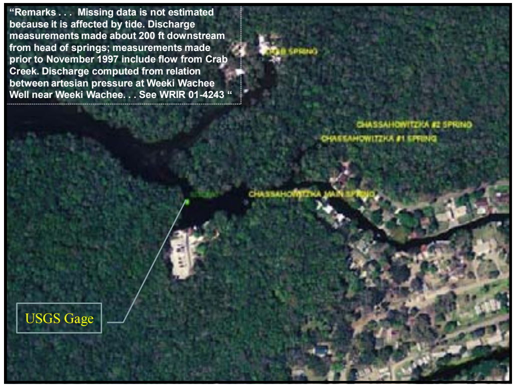
Southwest Florida Water Management District

Recommended MFL – No More than 11% Reduction in Flow

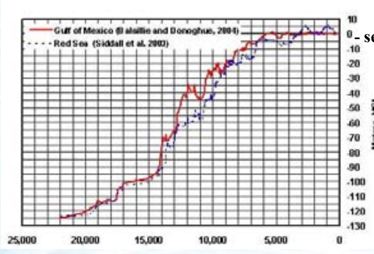


Questions ?

Photography by :
W. Sotera and K. Duffy

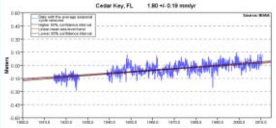


Sea Level Rise – Gulf of Mexico

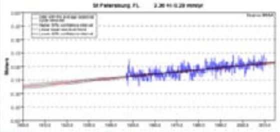


Calendar year, B.P.

Sea Level Rise – Gulf of Mexico



Cedar Key
5.7 “ since 1931



St. Petersburg
7.4 “ since 1931

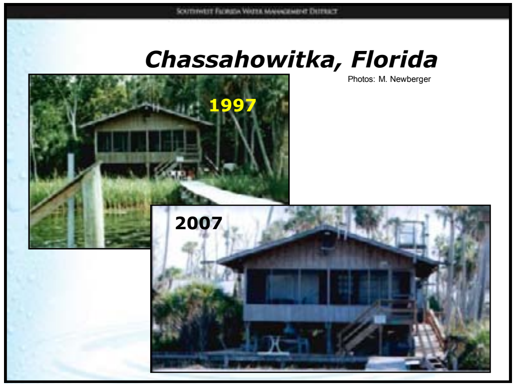
Sea Level Rise

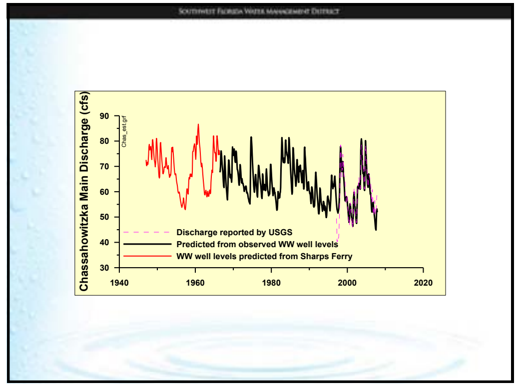
Sea-level rise influences coastal ecosystems through several mechanisms

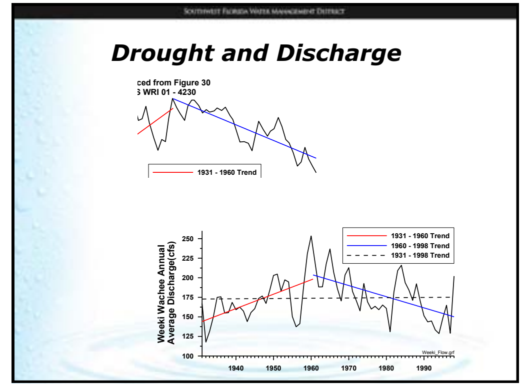
- Increases salinity
- Alters plant community structure & productivity

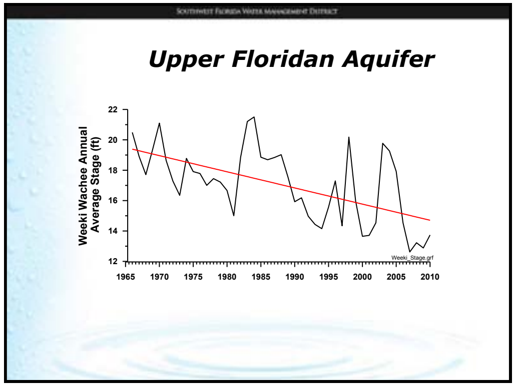
USGS

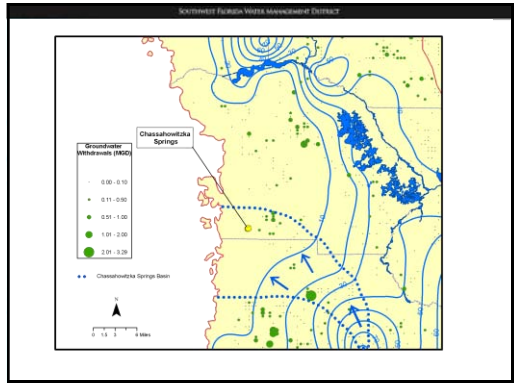
V.Burkett, Ph.D. 3/1/2010
Hart Research Institute.
Texas A&M

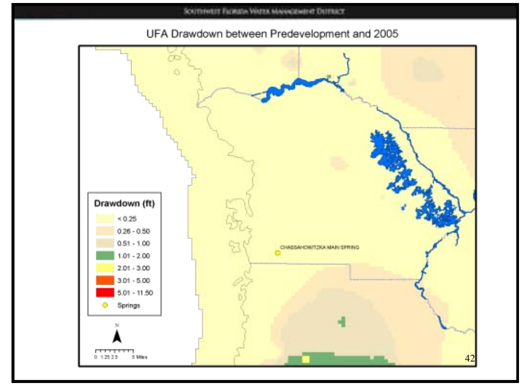

Chassahowitka, Florida
Photos: M. Newberger
1997
2007


Chassahowitzka Main Discharge (cfs)
Discharge reported by USGS
Predicted from observed WW well levels
WW well levels predicted from Sharps Ferry
1940
1960
1980
2000
2020

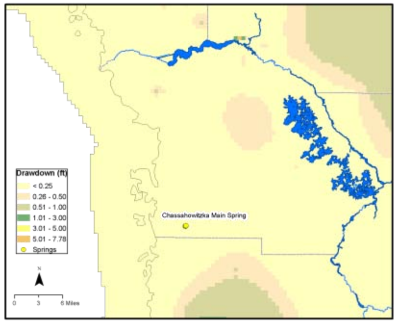

Drought and Discharge
1931 - 1960 Trend
Weeki Wachee Annual Average Discharge(cfs)
1931 - 1960 Trend
1960 - 1998 Trend
1931 - 1998 Trend
1940
1950
1960
1970
1980
1990


Upper Floridan Aquifer
Weeki Wachee Annual Average Stage (ft)
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010


Chassahowitzka Springs
Groundwater Withdrawals (MGD)


UFA Drawdown between Predevelopment and 2005
Drawdown (ft)
Springs

UFA Drawdown between Predevelopment and 2030



SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Northern District Model Results

Simulated Change in Nature Coast Springflow due to 2005 and Projected 2030 Groundwater Use

Spring Name	Predev Flow (cfs)	2005 Flow (cfs)	Percent Change (%)	2030 Flow (cfs)	Percent Change (%)
Weeki Wachee Spring	143.73	137.27	-4.5	132.31	-7.9
Crystal River Group	346.85	343.57	-0.9	339.55	-2.1
Homosassa Spring	71.65	70.98	-0.9	70.12	-2.1
Chassahowitzka Spring	64.14	63.47	-1.0	62.83	-2.0

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Peer Review Panel Summary

The District is to be commended for voluntarily committing to independent scientific peer review of its MFLs determinations. The Scientific Review Panel (the Panel) finds that the District's goals, data, methods and conclusions, as developed and explained in the MFL report, are reasonable and appropriate. The District's multi-species approach is to be applauded because it does not ignore species with variable life history requirements. The District approached this analysis in an appropriately holistic manner; that is, with attention paid to both the ecological requirements of the river system and to the various watershed and springshed segments of the contributing landscape already modified by humans.

Attachment D

E-Mail from Doug Leeper to Joyce Kleen, dated January 14, 2011

From: Doug Leeper
To: Joyce_Kleen@fws.gov
Subject: Updated Mote Barnacle Report
Date: Friday, January 14, 2011 9:04:46 AM
Attachments: Culter 2010 - Evaluation...barnacles in the Crystal, Homosassa and Withlacoochee....pdf

Joyce – after I provided the set of recent reports on the Homosassa and other spring systems, Sid Flannery provided me with an updated copy of the barnacle report by Mote Marine Lab. Please replace any file I've already provided with the attached version of the report. Thanks.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment E

E-Mail from Doug Leeper to Joyce Kleen, dated February 2, 2011

From: Doug Leeper
To: Joyce_Kleen@fws.gov
Cc: Mike Heyl; Marty Kelly
Subject: Follow-Up on Data Discussion from our Jan 5 Meeting
Date: Thursday, February 03, 2011 9:59:50 AM

Hi Joyce:

Mike Heyl checked with me today to see whether we have provided the information that you requested during our Jan 5 meeting in Brooksville. Some scribbles I made on my calendar indicate that I sent you the following reports on the afternoon of the 5th, right after our meeting ended.

- Homosassa, Kings Bay, Withlacoochee barnacle report by Culter (Mote Marine Laboratory)
(I also sent a revised version of the report on Jan 14)
- Kings Bay vent location report by VHB, Inc.
- Kings Bay vent discharge report by VHB, Inc.
Crystal River/Kings Bay benthos report by Water and Air Research, Inc.
- Crystal River/Kings Bay bathymetry report by Wang
- Crystal River/Kings Bay literature review by Frazer and others

Mike recalls that you requested a copy of the slides he and I showed during the meeting and also were interested in discharge data obtained by VHB, Inc. and any vegetation data that we may have for Kings Bay, Crystal River and the Chassahowitzka River System. I think we're covered with regard to the discharge data, as that information is included in the Kings Bay vent discharge report by VHB, but I will send some additional data files anyway. You can look forward to soon receiving a CD (or two – not sure the file will fit on one disc) with the following information.

- Slides that I showed at our meeting on January fifth
- Slides that Mike showed at the meeting
- A 2010 report and associated data on vegetation in Crystal River/Kings Bay that was prepared by Avineon, Inc.
(I think I already sent you the Avineon report and data, but I'm not sure)
- A 2002 report by Clewell and others concerning vegetation in the Crystal River system and several other west-central FL tidal rivers
- A 1997 report and associated data on vegetation in Crystal River/Kings Bay and four other tidal river system that was prepared by the Florida Marine Research Institute
- Reports dated 2005, 2006, 2007 and 2010 and associated data on submersed aquatic vegetation in Kings Bay that were prepared by Frazer, Jacoby and others with the University of Florida
- A 2006 report and associated data on the bathymetry of the Chassahowitzka River system that was prepared by Ping Wang with the University of South Florida
- A 2008 report and associated data on the bathymetry of the Crystal River/Kings Bay system

that was prepared by Ping Wang with the University of South Florida
- A 2009 report and associated data (pictures) on the location of spring vents in Kings Bay that was prepared by Vanesse Hangen Brustlin, Inc.
- A 2010 report and associated data on flows from spring vents in Kings Bay that was prepared by Vanesse Hangen Brustlin, Inc.

Let me know if you have any questions about the files/data once you get the CD(s).
See you sometime soon, I'm sure.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Presentation to Citrus County Task Force by Ron Miller regarding minimum flows and levels

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This memorandum addresses a presentation to the Citrus County Task Force made by Ron Miller. The presentation concerned development of minimum flows and levels on the Springs Coast.

DAL
Attachments

Citrus County Task Force
Meeting Agenda

January 10, 2011
2:00 p.m.

Lecanto Government Building
3600 West Sovereign Path, Room 166
Lecanto, Florida 34461

*******All meetings are open to the public*******

SWFWMD – Southwest Florida Water Management District	FFWCC – Florida Fish and Wildlife Conservation Commission
FDEP – Florida Department of Environmental Protection	FDOT – Florida Department of Transportation
TAG – Technical Advisory Group	USACOE – United States Army Corp. of Engineers

1. Call to Order and Roll Call
2. Pledge of Allegiance
3. **Review** the October 11, 2010 Minutes
4. Fish Populations for Tsala Apopka and Lake Rousseau
   (Electroshocking Results) – Allen Martin, FFWCC
5. Tussock Management – POWAR
6. Flying Eagle/Potts Preserve Prescribed Fire Update – Kevin Love, SWFWMD
7. Water Quality Recap – Philip Rhinesmith, SWFWMD
8. Minimum Flows and Levels - Ron Miller, Homosassa River Alliance
9. Agenda Items for Next Meeting – March 14, 2011
10. Public Input
11. Adjournment

If you have any questions concerning this meeting, please call 1-352-796-7211 or 1-800-423-1476 (Florida only), extension 4227. If a party decides to appeal any decision made with respect to any matter considered at a meeting, that party will need a record of the proceedings, and for such purpose that party may need to ensure that a verbatim record of the proceedings is made, which record includes the testimony and evidence upon which they appear is to be based.

www.watermatters.org/waterways

MINUTES OF THE MEETING

Citrus County Task Force
of the
Citrus/Hernando Waterways Restoration Council

January 10, 2011

The Citrus County Task Force met at 2:05 p.m., January 10, 2011 at the Lecanto Government Building, Lecanto, Florida.

Task Force Members Present	**Technical Advisory Group Members Present**	**Recording Secretary**
Robert Christensen, Member	Mark Edwards, Citrus Co.	Josie Guillen, SWFWMD
Sandra Clodwick, Secretary	Allen Martin, FFWCC	
Michael Czerwinski, Member	Philip Rhinesmith, SWFWMD	
Eric Latimer, Member	Judy Ashton, FDEP	
Michael Moberley, Chair	Al Grubman, WRBB	
Wayne Sawyer, Member	Katasha Cornwell, FDOT	

Task Force Members Absent	**Technical Advisory Group Members Absent**
Vacant, Member	Bill Bachschmidt, WRBB
	Colonel Alfred Pantano, USACOE

SWFWMD – Southwest Florida Water Management District	FFWCC – Florida Fish and Wildlife Conservation Commission
FDEP – Florida Department of Environmental Protection	FDOT – Florida Department of Transportation
CRBB – Coastal Rivers Basin Board Member	USACOE – United States Army Corp of Engineers
WRBB – Withlacoochee River Basin Board Member	TAG – Technical Advisory Group

A list of others present who signed the attendance roster is filed in the permanent files of the Task Force. The numbers preceding the items listed below correspond with the published agenda.

Audio recording of the meeting is available upon request.

1. **Call to Order and Roll Call**
   Chair Moberley convened the meeting. Ms. Josie Guillen called the roll and noted a quorum was present; however, the Task Force was not fully constituted due to the resignation of a member.

2. **Pledge of Allegiance**
   Chair Moberley led the Pledge of Allegiance.

3. **Review the October 11, 2010 Minutes**
   No changes to the October 11, 2010 minutes; however, the minutes could not be approved since the Task Force was not fully constituted.

4. **<u>Fish Populations for Tsala Apopka and Lake Rousseau</u>**
<u>approx. 3 minutes into the meeting</u>

Mr. Allen Martin, FFWCC, gave an update on the Tsala Apopka fish populations in the Floral City Pool, Inverness Pool, and the Hernando Pool areas. Mr. Martin showed on several graphs the number of largemouth bass and bluegill data collected per minute when staff performs electro-fishing. Mr. Allen provided the same information for the fish population in Lake Rousseau. In addition, Mr. Martin included the data for hydrilla coverage. Mr. Martin gave a brief update on the Spivey Lake Project. Mr. Martin stated that FFWCC and Citrus County Aquatics are working on this project. There are 14 acres of material to be removed from the site. Mr. Martin stated there will be some maintenance, some through herbicide and some through harvesting for the next 3 years. The initial harvesting was about $100,000 and budgeted $40,000 for the next 3 years for maintenance.

<u>Public Input</u>

- Ms. Hayes, citizen, would like to see the data collected when the individuals spray; how much, when and what kind. Ms. Hayes also asked, “do you collect the data?”
- Ms. Ellen Tate, citizen, stated she is an avid bass fisherman and keeps a diary of what time of day, what was caught on that day, how many, and other information.
- Mr. Steve LaFlair, citizen, stated that there is a correlation between the plant growth and the fish. The lower Withlacoochee River, there is no plant growth, completely stripped out and is devastated. Mr. LaFlair tried to introduce native plants and after the herbicides, the plants are gone, which is destroying the waterway. Mr. LaFlair stated this is being ignored and needs to be further looked into.
- Mr. Al Grubman, WRBB and TOOFAR, commented on the Lake Spivey project recently completed by FFWCC and Citrus County. Mr. Grubman stated he used to fish the areas since before it was finished. Prior to dredging, the area that was inaccessible for fishing and is now accessible. Mr. Grubman thanked FFWCC and Citrus County for making this happen.
- Mr. Harold Beasley, citizen, asked why are they killing the hydrillas? There used to be lots of freshwater shrimp. It was a substance of food for a lot of the fisherman. Mr. Beasley stated they are no longer fishing there because there are no more shrimp. Mr. Beasley stated his friend was fishing in an area at Lake Rousseau called Smith Pasture. In the past, he said another fisherman caught approximately 600 bass out from Peaceful Acres and recorded the data. Mr. Beasley stated his friend caught approximately 200 bass last year. Mr. Beasley stated he goes fishing everyday and the fishery is going down.
- Mr. Jack Scofield, citizen, stated in May 2009 there was sizable gar kill on the lower Withlacoochee River. Mr. Scofield reported the issue. Afterward staff from FFWCC met with Mr. Scofield. Mr. Scofield stated 2 weeks prior to the fish kill, Mr. Scofield noticed there was spraying being done in Lake Rousseau.

5. **<u>Tussock Management</u>**

Due to technical difficulties, the presentation had to be rescheduled.

6. **<u>Flying Eagle/Potts Preserve Prescribed Fire Update</u>**
<u>approx. 1:02 hours into the meeting</u>

Mr. Joel DeAngelis, SWFWMD, stated there is no change in the acreage treated status since the Task Force heard the item at their last meeting. Mr. DeAngelis stated as far as the marsh is concerned at Potts Preserve, between prescribed fire and wild fires, it is in good shape. Mr. DeAngelis stated the last burn he did at Flying Eagle was about 600 acres in 2005. For this year, the last burn at Flying Eagle was attempted in June and July. The water level was above normal in June and because of that the marshes were green. Mr. DeAngelis stated there is a lot of frost-kill, but the water level is too low to safely conduct the burns. Mr. DeAngelis stated provided that we do get some rains, enough water in the marsh to stop fire, the prescribed burns will begin in late February or early March. Mr. DeAngelis stated that he is coordinating with the Division of Forestry and FFWCC to organize a team response. Mr. DeAngelis stated aerial burning is probably going to be the only viable means of getting the acres burnt. Currently, SWFWMD staff does not have that option. Mr. DeAngelis stated what SWFWMD staff wants to see are agencies getting together to do large scale aerial burning. Mr. DeAngelis stated in terms of effectiveness of fire in the areas of Flying Eagle, the concern is if staff will be able to get into those areas. From observing burns in the area, if conditions are severe in terms of drought/dryness and the fuel moisture is low, the fire is going to lay down before it does any good.

<u>Public Input</u>

- Mr. Al Grubman, stated that he and other people have offered to help out with the burning at Flying Eagle. Mr. Grubman stated that Mr. Will Miller, SWFWMD pointed out that they could not use the help of volunteers. Mr. Grubman stated that he understands the limitations of burning.
- Mr. Chester Bradshaw, citizen, stated that prescribed fires are an old way of burning. Mr. Bradshaw stated that commercial industries are now using a rotary mower. Mr. Bradshaw stated that under electrical lines, FDOT roadways are no longer being burned, they are being mowed. Mr. Bradshaw suggested trying another option, looking into innovative ways to what other states are doing.

7. **<u>Water Quality Recap</u>**
<u>approx. 1:30 hours into the meeting</u>

Mr. Philip Rhinesmith, SWFWMD, explained how the data is arranged into divisions. 1.) Tsala Apopka - the separate lakes within each of the three named pools were compared (2006-2009); 2.) Withlacoochee River - 9 Stations compared Total Nitrogen and Dissolved Oxygen (DO); 3.) Rainbow River DO and Total Nitrogen; and 4.) Lake Rousseau (Upstream/Downstream) Total Nitrogen, Trophic State Index (TSI), and DO. Mr. Rhinesmith showed a list of the lakes that are sampled with the most dependable and the least dependable conditions. Mr. Rhinesmith showed a graph with the trends of Total Nitrogen, Phosphorus, Chlorophyll, DO, and the TSI in the lakes.

<u>Public Input</u>

- Mr. Steve LaFlair, stated some of the information was peculiar as far as the DO and the organic levels being lower. Mr. LaFlair asked, "Could there be a correlation with the herbicide and the killing of the all the organic material?"
- Mr. Dan Hilliard, citizen, asked what Trophic State Index meant.
- Captain Ray Wright, Nature Coast Bass Anglers, stated if the Task Force members need further information, the club members would be happy to give you

information on creels, etc. Mr. Wright thanked the county for keeping the lakes and trails open. Mr. Wright stated he would like to see FFWCC continue their good work, such as the Spivey Project. Mr. Wright stated opening more lakes and trails needs to be done. There are other locations that could be opened as well, such as Lake Henderson, and Hernando Lake, and Parson's Point area of Croft. Mr. Wright stated that we've need to keep up with making better fisheries. In the March 2009 edition of a Florida wildlife magazine, there was an article that an FFWCC biologist stocked approximately 22,000 largemouth bass in Lake Okeechobee. In April, approximately 55,000 bass were stocked. Mr. Wright asked if that is what they are doing in Lake Okeechobee and wouldn't it be beneficial to do that here? Mr. Wright also asked if there was any further information on the fish stocking on Lake Okeechobee? Mr. Wright suggested that instead of treating all the areas of hydrilla, some should be left to provide habitat. Mr. Wright stated we need to get our fishery back.

- Mr. Al Grubman, stated he read in the newspaper about the county budget, that it could be facing a diet. Mr. Grubman read a portion of the article, "The county administrator said, an obvious source to ease the pain is delaying or eliminating projects. The public wouldn't notice if the county used money from lake restoration funds". Mr. Grubman stated he will be attending the next county commissioners meeting and will congratulate each of the Task Force members that attend the meeting and make their point heard regarding the article.
- Mr. Lawrence McConnell, citizen, asked, "What is the purpose of the spraying program (spraying of the hydrilla)? What are we trying to achieve? As a tax payer, how much is this going to cost?"
- Ms. Marsha Drew, Levy County Commissioner, stated what the Task Force is doing is great. Ms. Drew asked if Levy County and the Task Force can work together and be informed of further meetings so there can be a representative attending the Task Force meetings?

8. **<u>Minimum Flows and Levels</u>**

<u>approx. 2:15 hours into the meeting</u>

Mr. Ron Miller, Homosassa River Alliance, stated minimum flows and levels (MFLs) are being evaluated on the rivers and the coastal springs. The springs are pushing out fresh water and the tide is bringing in the salt water which are causing the salinity levels to shift. Mr. Miller's concern is as the springs are being reduced, the salinity zone is pushed back into the spring and is lost. For example, in the Homosassa studies, it shows if the flow is cut back by 1 percent, 15 percent of the bass is lost. What are the impacts of the total flows that have come out of the rivers? Mr. Miller stated in regard to the Homosassa River, not to put wells in the spring heads and watersheds, not to put in wells to ship the water somewhere else. Mr. Miller asked to please help him do that. What needs to be done is to implement a policy that prevents locating well heads in areas that will impact the coastal springs and rivers.

<u>Public Input</u>

- Mr. Duane Brooks, citizen, stated the people of the Citrus County and the state of Florida need to wake up. Mr. Brooks asked, "You heard of the 100 that was coming after our water and we went to Chiefland to stop it?" Mr. Brooks stated they are coming again. If we can stop all these minimum flows where they are at right now and not allow them to be lowered, keep the water and don't let anyone have it. There are over 13,000 people that live along the water in Citrus County and probably over 13,000 that use it for boating, fishing and swimming. Mr. Brooks stated we need to keep the water we have.

- Mr. Dan Hilliard, citizen, requested to the Task Force members to be on the next agenda to discuss the restoration of the lower Withlacoochee River and Lake Rousseau.
- Ms. Hayes, citizen, stated when you design a study and measure the data, there are quantitative and qualitative data. Even though the opinions of the fisherman cannot be included in the study, it does not mean there are not ways to present qualitative data. This is why the public and the anglers need their own studies too, because they have merit. Ms. Hayes stated the reason she is able to get in and out of Lake Rousseau is because she hires someone with a cookie cutter about 2 times a year to clean out the area.

9. **Agenda Items for Next Meeting**
   - Tussock Management – POWAR
   - Restoration of the Lower Withlacoochee River – Dan Hilliard

10. **Public Input**
    Public input was taken after each item on the agenda.

11. **Adjournment**
    There being no further business or announcements presented before the Task Force, the meeting was adjourned at 4:47 p.m.

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Communications with Dan Hilliard regarding an information request concerning development of minimum flows along the Springs Coast

---

This memorandum addresses communications between District staff and Dan Hilliard an information request concerning development of minimum flows along the Springs Coast.

DAL
Attachments

From:	2buntings
To:	Doug Leeper
Subject:	Document request
Date:	Thursday, January 13, 2011 10:10:25 PM

Hello Doug,

After some consideration of the presentation on the Homosassa MFL in Lecanto on 6 Jan 2011, I have two requests for information copy or reference.

1) a copy, preferably electronic, of the spring basins indicated on the power point presentation. If there is a graphic of all spring basins/sheds within the Withlacoochee River Basin I would appreciate that as well.
2) copy or source reference for sea level rise referred to in the presentation. Mike Heyl has referred to this in discussion about the Withlacoochee River MFL as well. We do not doubt this is occurring but would like to review comprehensive discussion on the point.

Thanks for your time....and patience.

Regards,

Dan Hilliard

President
Withlacoochee Area Residents, Inc.(501.C3)
352/447-5434
WWW.WARINCONLINE.COM

From:	Doug Leeper
To:	"2buntings"
Cc:	Marty Kelly; Ron Basso; Mike Heyl; Jason Hood; Gary E. Williams; Dave Dewitt
Subject:	RE: Document request
Date:	Friday, January 14, 2011 8:58:14 AM
Attachments:	Slide - DLeeper Basin and Watershed - Homosassa MFLs Wkshp 06Jan2011.pdf Slides - RBasso Basins MFLs Wkshp 06Jan2011.pdf Knochnemus and Yobbi 2001 - Hydrology of the coastal springs groundwater basin....pdf

Dan:

Thanks again for contributing to the public workshop on proposed minimum flows for the Homosassa River last week.

Per the first request in your e-mail below, I am providing a few files as attachments to this e-mail. The first file includes slides from Ron Basso's Powerpoint presentation that show approximate groundwater basin boundaries for the west-central Florida area and the Homosassa River system. The second file contains a slide from my presentation, which shows the approximate springshed boundary for the Homosassa River system, along with surface watersheds that contribute flows to the system. I've also attached a copy of a 2001 USGS report by Knochenmus and Yobbi that was used as the source for approximating the springshed boundary shown in Ron's and my slides. Finally, I regret to inform you that I am unaware of any published figures showing all springsheds in the Withlacoochee River basin. I know the Florida Geological Survey/Florida Department of Environmental Protection has previously maintained a geographic information system database showing springshed boundaries, but I'm not sure whether this information is currently supported or maintained by the Survey/Department. I've contacted someone at the Survey to learn more about the database. I've also copied a number of colleagues on this e-mail -- perhaps one of them will have some knowledge of an appropriate figure that can be provided in response to your request.

With regard to the second request in your e-mail, please consult the following web page:

http://tidesandcurrents.noaa.gov/sltrends/sltrends_states.shtml?region=fl

This "Mean Sea Level Trends for Florida Stations" page on the NOAA Tides and Currents web site was the source for the sea-level time series plots I showed at the public workshop.

Hope this information helps. Please feel free to contact me if you have additional questions or comments regarding development of minimum flows for the Homosassa River system or other water management issues.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

-----Original Message-----
From: 2buntings [mailto:2buntings@comcast.net]
Sent: Thursday, January 13, 2011 10:10 PM
To: Doug Leeper
Subject: Document request

Hello Doug,

After some consideration of the presentation on the Homosassa MFL in Lecanto on 6 Jan 2011, I have two requests for information copy or reference.

From: 2buntings
To: Doug Leeper
Subject: Re: Document request
Date: Friday, January 14, 2011 9:05:29 AM

Appreciate the quick response and information very much, have a good
weekend!

Dan

On 1/14/2011 8:58 AM, Doug Leeper wrote:
> Dan:
>
> Thanks again for contributing to the public workshop on proposed minimum flows for the Homosassa River last week.
>
> Per the first request in your e-mail below, I am providing a few files as attachments to this e-mail. The first file includes slides from Ron Basso's Powerpoint presentation that show approximate groundwater basin boundaries for the west-central Florida area and the Homosassa River system. The second file contains a slide from my presentation, which shows the approximate springshed boundary for the Homosassa River system, along with surface watersheds that contribute flows to the system. I've also attached a copy of a 2001 USGS report by Knochenmus and Yobbi that was used as the source for approximating the springshed boundary shown in Ron's and my slides. Finally, I regret to inform you that I am unaware of any published figures showing all springsheds in the Withlacoochee River basin. I know the Florida Geological Survey/Florida Department of Environmental Protection has previously maintained a geographic information system database showing springshed boundaries, but I'm not sure whether this information is currently supported or maintained by the Survey/Department. I've contacted someone at the Survey to learn more about the database. I've also copied a number of colleagues on this e-mail -- perhaps one of them will have some knowledge of an appropriate figure that can be provided in response to your request.
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>
> Hope this information helps. Please feel free to contact me if you have additional questions or comments regarding development of minimum flows for the Homosassa River system or other water management issues.
>
> Douglas A. Leeper, Chief Environmental Scientist
> Resource Projects Department, Southwest Florida Water Management District
> 2379 Broad Street, Brooksville, FL 34604-6899
> Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
> Fax: 352-754-6885
> E-Mail: doug.leeper@watermatters.org
> Web Site: watermatters.org
>
> -----Original Message-----
> From: 2buntings [mailto:2buntings@comcast.net]
> Sent: Thursday, January 13, 2011 10:10 PM
> To: Doug Leeper
> Subject: Document request
>
> Hello Doug,
>

From:	Jason Hood
To:	Doug Leeper; 2buntings
Cc:	Marty Kelly; Ron Basso; Mike Heyl; Gary E. Williams; Dave Dewitt
Subject:	RE: Document request
Date:	Friday, January 14, 2011 9:32:50 AM
Attachments:	Withlacoochee_SubBasins.png

Dan,

Attached is a map I had prepared for the Upper and Middle Withlacoochee MFL report that shows the sub-basins for the Withlacoochee watershed.

Jason

Jason Hood
Environmental Scientist
Ecologic Evaluation Section
Southwest FL Water Mgt. District
(352) 796-7211 (EXT. 4192) (Office)
(352) 279-0324 (Cell)

-----Original Message-----
From: Doug Leeper
Sent: Friday, January 14, 2011 8:58 AM
To: 2buntings
Cc: Marty Kelly; Ron Basso; Mike Heyl; Jason Hood; Gary E. Williams; Dave Dewitt
Subject: RE: Document request

Dan:

Thanks again for contributing to the public workshop on proposed minimum flows for the Homosassa River last week.

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Hope this information helps. Please feel free to contact me if you have additional questions or comments regarding development of minimum flows for the Homosassa River system or other water management issues.

January 21, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Response to comments on minimum flows for the Homosassa River System submitted by Mr. George Harbin on January 17, 2011

This memorandum addresses correspondence concerning comments on proposed minimum flows for the Homosassa River system submitted to the District by Mr. George Harbin on January 17, 2011. Mr. Harbin's original e-mail submission and a January 21, 2011 e-mail response to his submission are provided as attachments to this memorandum.

DAL

Attachments: A) E-mail submitted to the District by Mr. George Harbin, dated January 17, 2011
B) E-mail sent to Mr. George Harbin, dated January 21, 2011

Attachment A to January 21, 2011 Memorandum Concerning Comments on Minimum Flows for the Homosassa River Submitted by Mr. George Harbin

E-Mail from Mr. George Harbin, Dated January 17, 2011

From: George Harbin
To: Doug Leeper
Subject: RE: Submission Info for Comments on Proposed Minimum Flows - Homosassa River System
Date: Monday, January 17, 2011 11:37:13 AM

Thanks Mr. Leeper for the opportunity to state my thoughts on prospective changes in the Homosassa River flow by as much as 15 percent.

My wife and I have lived in Homosassa since early 1980 and have had the opportunity to be on all the rivers along the west coast of Florida from Key West to Cedar Key. I have fished on many of them but in particular, have for years fished the Chassahowitzka and Homosassa and to a lesser extent, the Crystal River, both in the upper reaches and salt water. During that time, the waters have become less pristine due to increased population using the rivers, pollution caused by leaching of chemicals into the aquifer, and atmospheric pollution. It has also caused fish populations to decline and plant life changes.

Not being a hydrologist I can only report my concerns and my opinions of how a reduction in flows of the Homosassa River will affect the wildlife and plant life in the river, to the citizens who live along the river, and those local, national and even international who use the Homosassa for recreation.

Unless there have been extensive tests proving that flow reduction in any of our rivers to the extent proposed has no effect on wildlife and plant life, it should not be done. It seems to me that until Progress Energy eliminates or reduces their toxic flow of particulates into the atmosphere, which I believe must have an affect on the Citrus County aquifer, consideration of flow reduction should be delayed.

I am also very concerned with the affect of the proposed withdrawal of billions of gallons of fresh water from the aquifer for the proposed nuclear plant at Ingles which I assume will involve Citrus County aquifer feeding Crystal River and perhaps Homosassa River as well. It seems to me that such a plant being contiguous to salt water would be approved by the state and federal government using only sea water.

Finally, there has been no indication by SWFWMD of the reason behind the flow reduction proposal. My first thought was that it was related to population. I hope not! Why? Because, Florida will continue to grow and reducing all the aquifer fed streams in the state will be only a temporary solution. At some point in time our state government will have to fund salt water conversion plants or discontinue issuing building permits for homes and businesses.

Attachment B to January 11, 2011 Memorandum Concerning Comments on Minimum Flows for the Homosassa River Submitted by Mr. George Harbin

E-Mail to Mr. George Harbin, Dated January 21, 2011

From: Doug Leeper
To: "George Harbin"
Bcc: Marty Kelly; Sid Flannery; Ron Basso; Mark Barcelo; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Karen Lloyd
Subject: RE: Comments on Proposed Minimum Flows - Homosassa River System
Date: Friday, January 21, 2011 11:42:19 AM

Mr. Harbin:

Thank you for your recently submitted comments regarding development of minimum flows for the Homosassa River system. Public input such as yours is an important component of the minimum flows development process. Staff has and will continue to consider your comments and plans to include them along with other submitted input and peer-review findings in a revised version of the District report on proposed minimum flows for the river system. The revised report will be made available for public review and will be presented to the District Governing Board to support the Board's consideration of rule amendments associated with the proposed minimum flows.

In response to your comments regarding support for seawater desalination as a means to address future demand for water in the northern counties of the District, I'd like to suggest that you consider reviewing Chapter 5 of the *December 2010 Draft Southwest Florida Water Management District Regional Water Supply Plan – Northern Planning Region*. This section of the draft report includes information on water supply options that may be implemented by local water suppliers in the future. For your information, the draft report is available from the Documents and Publications– Regional Water Supply Plan of the District web site at:
http://www.swfwmd.state.fl.us/documents/plans/RWSP/drafts/NPR-Public-Draft-4_20_10.pdf

Please feel free to contact me if you have additional comments concerning development of minimum flows for the Homosassa River system or other water management issues.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Communications with George Harbin regarding contact information to be used for submitting comments on proposed minimum flows along the Springs Coast

---

This memorandum addresses communications between District staff and George Harbin regarding contact information to be used for submitting comments on proposed minimum flows along the Springs Coast

---

DAL
Attachments

From: Doug Leeper
To: "gharbin@tampabay.rr.com"
Subject: Submission Info for Comments on Proposed Minimum Flows - Homosassa River System
Date: Monday, January 10, 2011 8:07:06 AM

Mr. Harbin:

In response to the voice-mail you left for me last Friday, I'm sending this e-mail with contact information you may use to submit comments concerning development of minimum flows for the Homosassa River system.

Please send any comments you may have to me via e-mail, U.S. Mail or FAX, and also please feel to call me if you would like to discuss the proposed minimum flows for the river system or other water management issues.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
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Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From: George Harbin
To: Doug Leeper
Subject: RE: Submission Info for Comments on Proposed Minimum Flows - Homosassa River System
Date: Monday, January 10, 2011 12:02:29 PM

Thank you Mr. Leeper. I sincerely appreciate your early response to my voice-mail and your invitation. I hope to reply by this Wednesday, January 12.
George

From: Doug Leeper [mailto:Doug.Leeper@swfwmd.state.fl.us]
Sent: Monday, January 10, 2011 8:07 AM
To: gharbin@tampabay.rr.com
Subject: Submission Info for Comments on Proposed Minimum Flows - Homosassa River System

Mr. Harbin:

In response to the voice-mail you left for me last Friday, I'm sending this e-mail with contact information you may use to submit comments concerning development of minimum flows for the Homosassa River system.

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E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

April 20, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Information request form George Harbin

This memorandum addresses correspondence concerning a request for information submitted by George Harbin in January 2011.

DAL
Attachments

From:	George Harbin
To:	Doug Leeper
Subject:	RE: Comments on Proposed Minimum Flows - Homosassa River System
Date:	Wednesday, January 26, 2011 12:52:07 PM

Mr. Leeper

Sorry for the delay in responding but first wanted to look at the link you provided. I just now attempted to open it and found "the page could not be found". I hope another link is available.

Thanks, George

From: Doug Leeper [mailto:Doug.Leeper@swfwmd.state.fl.us]
Sent: Friday, January 21, 2011 11:42 AM
To: George Harbin
Subject: RE: Comments on Proposed Minimum Flows - Homosassa River System

Mr. Harbin:

Thank you for your recently submitted comments regarding development of minimum flows for the Homosassa River system. Public input such as yours is an important component of the minimum flows development process. Staff has and will continue to consider your comments and plans to include them along with other submitted input and peer-review findings in a revised version of the District report on proposed minimum flows for the river system. The revised report will be made available for public review and will be presented to the District Governing Board to support the Board's consideration of rule amendments associated with the proposed minimum flows.

In response to your comments regarding support for seawater desalination as a means to address future demand for water in the northern counties of the District, I'd like to suggest that you consider reviewing Chapter 5 of the *December 2010 Draft Southwest Florida Water Management District Regional Water Supply Plan – Northern Planning Region*. This section of the draft report includes information on water supply options that may be implemented by local water suppliers in the future. For your information, the draft report is available from the Documents and Publications – Regional Water Supply Plan of the District web site at:

http://www.swfwmd.state.fl.us/documents/plans/RWSP/drafts/NPR-Public-Draft-4_20_10.pdf

Please feel free to contact me if you have additional comments concerning development of minimum flows for the Homosassa River system or other water management issues.

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Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272

From: Doug Leeper
To: "George Harbin"
Subject: Updated Link for Northern Planning Region Regional Water Supply Plan
Date: Wednesday, January 26, 2011 1:06:49 PM

Mr. Harbin:

The draft report associated with the link in my previous e-mail has just been finalized. The January 2001 version of the report is posted on the District web site at:

http://www.swfwmd.state.fl.us/documents/plans/RWSP/northern_planning_region.pdf

Please let me know if you have any trouble locating or downloading this file.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
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Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From: George Harbin [mailto:gharbin@tampabay.rr.com]
Sent: Wednesday, January 26, 2011 12:52 PM
To: Doug Leeper
Subject: RE: Comments on Proposed Minimum Flows - Homosassa River System

Mr. Leeper

Sorry for the delay in responding but first wanted to look at the link you provided. I just now attempted to open it and found "the page could not be found". I hope another link is available.

Thanks, George

From: Doug Leeper [mailto:Doug.Leeper@swfwmd.state.fl.us]
Sent: Friday, January 21, 2011 11:42 AM
To: George Harbin
Subject: RE: Comments on Proposed Minimum Flows - Homosassa River System

Mr. Harbin:

Thank you for your recently submitted comments regarding development of minimum flows for the Homosassa River system. Public input such as yours is an important component of the minimum flows development process. Staff has and will continue to consider your comments and plans to include them along with other submitted input and peer-review findings in a revised version of the District report on proposed minimum flows for the river system. The revised report

From:	George Harbin
To:	Doug Leeper
Subject:	RE: Updated Link for Northern Planning Region Regional Water Supply Plan
Date:	Wednesday, January 26, 2011 7:19:55 PM

Thanks Mr. Leeper. No problem this time. I'll review it soonest. George

---

From: Doug Leeper [mailto:Doug.Leeper@swfwmd.state.fl.us]
Sent: Wednesday, January 26, 2011 1:07 PM
To: George Harbin
Subject: Updated Link for Northern Planning Region Regional Water Supply Plan

Mr. Harbin:

The draft report associated with the link in my previous e-mail has just been finalized. The January 2001 version of the report is posted on the District web site at:

http://www.swfwmd.state.fl.us/documents/plans/RWSP/northern_planning_region.pdf

Please let me know if you have any trouble locating or downloading this file.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From: George Harbin [mailto:gharbin@tampabay.rr.com]
Sent: Wednesday, January 26, 2011 12:52 PM
To: Doug Leeper
Subject: RE: Comments on Proposed Minimum Flows - Homosassa River System

Mr. Leeper

Sorry for the delay in responding but first wanted to look at the link you provided. I just now attempted to open it and found "the page could not be found". I hope another link is available.

Thanks, George

From: Doug Leeper [mailto:Doug.Leeper@swfwmd.state.fl.us]
Sent: Friday, January 21, 2011 11:42 AM
To: George Harbin
Subject: RE: Comments on Proposed Minimum Flows - Homosassa River System

January 10, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments submitted by Ms. Jo An A. Schulz regarding recommended minimum flows for the Homosassa River system

---

This memorandum documents comments concerning the development of minimum flows for the Homosassa River system that were sent to the Southwest Florida Water Management District on January 3, 2011 by Ms. Jo An A. Schulz. In her postcard submission, Ms. Schulz requests that the District "…*not allow more fresh spring water to be drawn from the Homosassa River."*

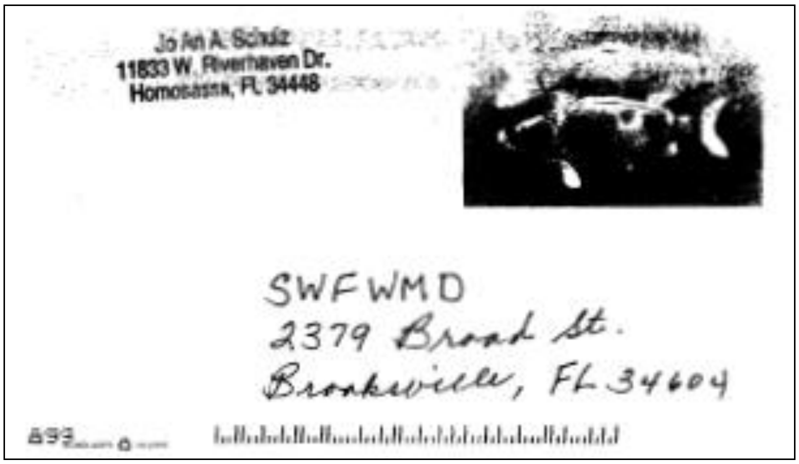
A scanned version of Ms. Schulz' postcard is attached to this memorandum along with a letter response to Ms. Schulz from Mr. Doug Leeper, Chief Environmental Scientist with the Ecologic Evaluation Section.

DAL

Attachments: Scanned postcard from Ms. Schulz, dated January 3, 2011
Letter from Mr. Leeper to Ms. Schulz, dated January 10, 2011

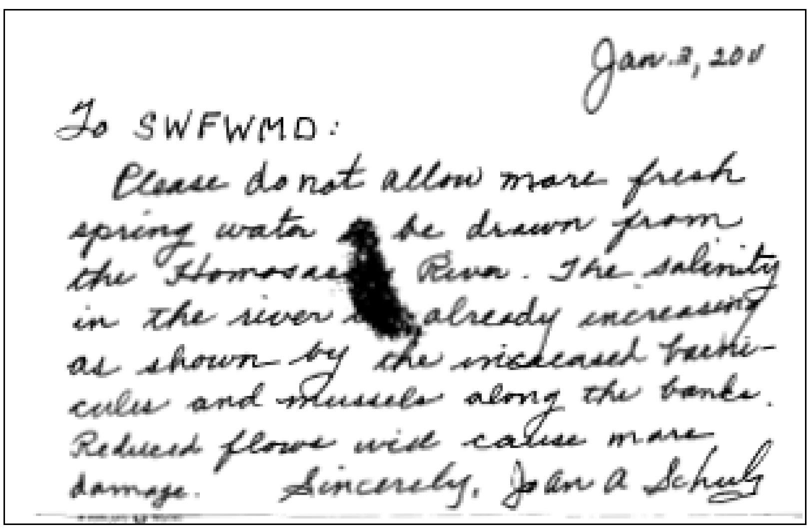
Attachment A to January 10, 2011 Memorandum Concerning Comments Submitted by Ms. Jo An A. Schulz Regarding Recommended Minimum Flows for the Homosassa River System

<u>Postcard from Ms. Schulz, Dated January 3, 2011</u>



Jo An A. Schulz
11833 W. Riverhaven Dr.
Homosassa, FL 34448

SWFWMD
2379 Broad St.
Brooksville, FL 34604



Jan. 3, 2011

To SWFWMD:

Please do not allow more fresh spring water to be drawn from the Homosassa River. The salinity in the river is already increasing as shown by the increased barnacles and mussels along the banks. Reduced flows will cause more damage.

Sincerely, Jo An A Schulz

Attachment B to January 10, 2011 Memorandum Concerning Comments Submitted by Ms. Jo An A. Schulz Regarding Recommended Minimum Flows for the Homosassa River System

<u>Letter Sent to Ms. Schulz, Dated January 10, 2011</u>

Southwest Florida
Water Management District

2379 Broad Street, Brooksville, Florida 34604-6899
(352) 796-7211 or 1-800-423-1476 (FL only)
TDD only: 1-800-231-6103 (FL only)
On the Internet at WaterMatters.org

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Bartow, Florida 33830-7700
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1-800-492-7862 (FL only)

Sarasota Service Office
6750 Fruitville Road
Sarasota, Florida 34240-9711
(941) 377-3722 or
1-800-320-3503 (FL only)

Tampa Service Office
7601 Highway 301 North
Tampa, Florida 33637-6759
(813) 985-7481 or
1-800-836-0797 (FL only)

January 10, 2011

Ms. Jo An A. Schulz
11833 West Riverhaven Drive
Homosassa, Florida 34448

Subject: Comments on Proposed Minimum Flows for the Homosassa River System

Dear Ms. Schulz:

Thank you for your January 3, 2011 submittal of written comments regarding establishment of minimum flows for the Homosassa River system. Public input such as yours is an important component of the minimum flows development process. Staff will consider your comments and plan on including them along with other public input in a revised version of the District report on proposed minimum flows for the river system. The revised report will be made available for public review and will be presented to the District Governing Board to support the Board's consideration of rule amendments associated with the minimum flows.

Please feel free to contact me by mail, e-mail, telephone or in person at the District if you have additional comments concerning development of minimum flows or other water management issues.

Sincerely,

Douglas A. Leeper
Chief Environmental Scientist
Ecologic Evaluation Section/Resource Projects Department

DAL/brm
cc: Ecologic Evaluation File

January 10, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments submitted by Mr. Karl C. Schulz regarding recommended minimum flows for the Homosassa River system

---

This memorandum documents comments concerning the development of minimum flows for the Homosassa River system that were sent to the Southwest Florida Water Management District on January 3, 2011 by Mr. Karl C. Schulz. In his postcard submission, Ms. Schulz requests that the District "…*not allow more fresh spring water to be drawn from the Homosassa River area."*

A scanned version of Mr. Schulz' postcard is attached to this memorandum along with a letter response to Mr. Schulz from Mr. Doug Leeper, Chief Environmental Scientist with the Ecologic Evaluation Section.

DAL
Attachments: Scanned postcard from Mr. Schulz, dated January 3, 2011
Letter from Mr. Leeper to Mr. Schulz, dated January 10, 2011

Attachment A to January 10, 2011 Memorandum Concerning Comments Submitted by Mr. Karl C. Schulz Regarding Recommended Minimum Flows for the Homosassa River System

__Postcard from Mr. Schulz, Dated January 3, 2011__

Karl C. Schulz
11833 W. Riverhaven Dr
Homosassa, FL 34448

SOUTHWEST WATER MGMT DISTRICT
2379 BROAD ST.
BROOKSVILLE, FLA 34601-6899

Jan 3, 2011

To SWFWMD:

The salinity in the water of the canal here in Homosassa is increasing. Mussels and barnacles are increasing due to increased salinity.

Please do not allow more fresh spring water to be drawn from the Homosassa River water area.

Reducing flows to the river will cause additional damage. Thank you Karl Schulz

Attachment B to January 10, 2011 Memorandum Concerning Comments Submitted by Mr. Karl C. Schulz Regarding Recommended Minimum Flows for the Homosassa River System

Letter Sent to Mr. Schulz, Dated January 10, 2011

Southwest Florida
Water Management District

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(941) 377-3722 or
1-800-320-3503 (FL only)

Tampa Service Office
7601 Highway 301 North
Tampa, Florida 33637-6759
(813) 985-7481 or
1-800-836-0797 (FL only)

January 10, 2011

Mr. Karl C. Schulz
11833 West Riverhaven Drive
Homosassa, Florida 34448

Subject: Comments on Proposed Minimum Flows for the Homosassa River System

Dear Mr. Schulz:

Thank you for your January 3, 2011 submittal of written comments regarding establishment of minimum flows for the Homosassa River system. Public input such as yours is an important component of the minimum flows development process. Staff will consider your comments and plan on including them along with other public input in a revised version of the District report on proposed minimum flows for the river system. The revised report will be made available for public review and will be presented to the District Governing Board to support the Board's consideration of rule amendments associated with the minimum flows.

Please feel free to contact me by mail, e-mail, telephone or in person at the District if you have additional comments concerning development of minimum flows or other water management issues.

Sincerely,

Douglas A. Leeper
Chief Environmental Scientist
Ecologic Evaluation Section/Resource Projects Department

DAL/bm
cc: File

January 11, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Response to comments on minimum flows for the Homosassa River System submitted by Mr. Charles Stonerock on January 9, 2011

This memorandum addresses correspondence concerning comments on proposed minimum flows for the Homosassa River system submitted to the District by Mr. Charles Stonerock on January 9, 2011. Mr. Stonerock's original e-mail submission and a January 11, 2011 e-mail response to his submission are provided as attachments to this memorandum.

DAL

Attachments: A) E-mail submitted to the District Mr. Charles Stonerock, dated January 9, 2011
B) E-mail sent to Mr. Charles Stonerock, dated January 11, 2011

Attachment A to January 11, 2011 Memorandum Concerning Comments on Minimum Flows for the Homosassa River Submitted by Mr. Charles Stonerock

E-Mail from Mr. Charles Stonerock, Dated January 9, 2011

From: kathy stonerock
To: Doug Leeper
Subject: Homosassa Minimum Flow Levels
Date: Sunday, January 09, 2011 11:49:56 AM

Dear Mr. Leeper, Thank you for your presentation on minimum flow levels for the Homosassa River on 1-6-11. You did an excellent job. And the working models developed are most impressive.
If I understand correctly, you are saying that at any time in the flow vs. time relationship, a 5% reduction in the flow can be tolerated with no more than a 15% loss in quality of the river habitat. I probably misunderstood as using this standard of withdrawing 5% in an up year would result in a much larger percentage for a down year. You would be better off working from a "worst case scenario".
Secondly, it appears that the 5% withdrawal was the point at which many measurable quality considerations were degraded by 15%.
It would seem that a lower level would be appropriate to allow for unseen factors and provide for some margin of error.
Thank you for sharing your time and information, Charles Stonerock.

Attachment B to January 11, 2011 Memorandum Concerning Comments on Minimum Flows for the Homosassa River Submitted by Mr. Charles Stonerock

E-Mail to Mr. Charles Stonerock, Dated January 11, 2011

From: Doug Leeper
To: "kathy stonerock"
Cc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Cara S. Martin; Karen Lloyd; Jay Yingling; Yassert Gonzalez
Subject: RE: Homosassa Minimum Flow Levels
Date: Tuesday, January 11, 2011 11:49:00 AM

Mr. Stonerock:

Thank you for contributing to the January 6, 2011 Southwest Florida Water Management District rule development public workshop on proposed minimum flows for the Homosassa River system, and thanks also for your recently submitted comments regarding the proposed minimum flows. Public input such as yours is an important component of the minimum flows development process. Staff has and will continue to consider your comments and plans to include them along with other submitted input and peer-review findings in a revised version of the District report on proposed minimum flows for the river system. The revised report will be made available for public review and will be presented to the District Governing Board to support the Board's consideration of rule amendments associated with the proposed minimum flows.

With regard to your comments concerning the recommended maximum five percent reduction in natural flows in the Homosassa River system that are associated with the currently proposed minimum flows, staff notes that the minimum flows that will eventually be established for the system are expected to be applicable during periods of average, above average and below average flows. Implementation of a percentage-of-flows approach with a constant maximum flow reduction percentage means that during periods of below average flows the absolute magnitude of the allowable flow reduction will be relatively small, as compared to periods when flows are higher. This proportional scaling of allowable flow reductions based on absolute flows minimizes potential adverse impacts that could result from withdrawal of large amounts of water during periods of low flows. The analyses used to establish the proposed percentage-of-flow reduction for the Homosassa River system were based on two baseline flow periods; calendar year 2007, when rainfall was below average and from 1995 through 2009, a period that included numerous years of below average rainfall. Results from the analyses may, therefore, be considered appropriate for evaluating environmental responses expected during low flow conditions, and should be considered conservative of river system resources.

With regard to your comment concerning flow-related changes in salinity-based habitats, you are correct in noting that changes of more fifteen percent were predicted to occur for some salinity-based habits with a five percent flow reduction, the lowest flow-reduction scenario that was evaluated and addressed in the draft minimum flows report for the river system. Staff is currently evaluating predicted changes to salinity-based habitats for flow reductions of less than five percent, to determine whether the current minimum flows recommendation for the system should be modified. Results from these analyses will be included in the revised version of the report outlining the recommended minimum flows for the river system.

Please feel free to contact me by mail, e-mail, telephone or in person at the District if you have additional comments concerning development of minimum flows for the Homosassa River system or other water management issues.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

____

From: kathy stonerock
To: Doug Leeper
Subject: Homosassa Minimum Flow Levels
Date: Sunday, January 09, 2011 11:49:56 AM

Dear Mr. Leeper, Thank you for your presentation on minimum flow levels for the Homosassa River on 1-6-11. You did an excellent job. And the working models developed are most impressive.
If I understand correctly, you are saying that at any time in the flow vs. time relationship, a 5% reduction in the flow can be tolerated with no more than a 15% loss in quality of the river habitat. I probably misunderstood as using this standard of withdrawing 5% in an up year would result in a much larger percentage for a down year. You would be better off working from a "worst case scenario".
Secondly, it appears that the 5% withdrawal was the point at which many measurable quality considerations were degraded by 15%.
It would seem that a lower level would be appropriate to allow for unseen factors and provide for some margin of error.
Thank you for sharing your time and information, Charles Stonerock.

January 28, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Response to comments on minimum flows for the Homosassa River System submitted by Dr. Katie Tripp on January 25, 2011

This memorandum addresses correspondences associated with an electronic mail submitted to the District by Dr. Katie Tripp on January 25, 2011. The e-mail includes Dr. Tripp's comments regarding development of minimum flows for the Homosassa River system and is attached to this memorandum. An e-mail response from the District is also attached.

DAL

Attachments: A - Two page e-mail submitted to the District Dr. Katie Tripp, dated January 25, 2011
B - One page e-mail sent to Dr. Katie Tripp, dated January 28, 2011

Attachment A

Two Page Attachment to January 28, 2011 Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Dr. Katie Tripp

E-Mail Submitted to the District by Dr. Tripp on January 25, 2011

From: ktripp@savethemanatee.org
To: Doug Leeper
Cc: ktripp@savethemanatee.org
Subject: Re: Response to K. Tripp 05nov2010 E-Mail on Homosassa MFLs
Date: Tuesday, January 25, 2011 6:45:17 PM

Hi Doug,
I've read through staff's responses to my comments and wanted to clarify a couple of points.

My comment that became "Excerpt No. 7" was not at all related to the manatee thermal refuge. My point was that there is a goal of maintaining a healthy Homosassa River, and the MFL is only one piece of the equation, and cannot be considered alone. There are other factors affecting the river and quality and quantity of habitat that are available for a variety of species. There have already been changes to SAV noted in the Homosassa River, which the report states could be attributable to eutrophication caused by nutrient loading. There is no consideration for the cumulative impacts of decreased flow, continued nutrient loading, or other environmental factors that affect the overall health of the river. There is no discussion of whether nutrient impacts could be heightened if there is less flow in the river- that was my point.

Excerpt No. 10 deals with the relationship between salinity and water temperature. Saline water is more dense. In other areas of the state, it has been found that the stratification of the water column (with denser, saltier water at the bottom) serves as a type of secondary thermal refuge for manatees. In a system where there is both fresh and saline water, this potential for stratification occurs. The amount of freshwater and salt water being contributed to the system affect whether pockets of denser, more saline water will exist. There is a salinity component in the Homosassa River, near the spring, therefore the interplay between fresh and saltier water could affect the size of the available thermal refuge- it may not just be related to what is flowing out of the spring. Here's a link to an article that describes the USGS findings at Port of the Islands- perhaps this will help demonstrate my point:
http://www.usgs.gov/newsroom/article.asp?ID=2474

Please feel free to contact me if you have questions.
Thanks very much,

Katie

Katie Tripp, Ph.D.
Director of Science and Conservation
Save the Manatee Club
500 N. Maitland Ave.
Maitland, FL 32751
Phone: 407-539-0990

Fax: 407-539-0871
E-mail: ktripp@savethemanatee.org

On Thu 23/12/10 9:32 AM , Doug Leeper Doug.Leeper@swfwmd.state.fl.us sent:

Dr. Tripp:

Thank you for your November 5, 2010 e-mail outlining comments from the Save the Manatee Club regarding the Southwest Florida Water Management District report titled *Recommended Minimum Flows for the Homosassa River System, July 12, 2010 Peer-Review Draft*. Staff appreciates the opportunity to consider comments such as those included in your e-mail as we develop draft rule amendments associated with minimum flows for the river system.

The attached memorandum, which includes a reproduction of your original e-mail, serves as a formal acknowledgement of your comments. We plan to include this memorandum as an appendix to the final, revised version of the report on minimum flows for the Homosassa River system, to document the critical review and public input associated with development of the minimum flows.

Please contact me if you have additional questions or comments.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment B

One Page Attachment to January 28, 2011 Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Dr. Katie Tripp

E-Mail Sent to Mr. Tripp on January 28, 2011

From: Doug Leeper
To: "ktripp@savethemanatee.org"
Bcc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Yassert Gonzalez; Jay Yingling; Cara S. Martin; Karen Lloyd
Subject: Thanks for the Follow-Up E-mail on Homosassa Minimum Flow Comments
Date: Friday, January 28, 2011 8:34:00 AM

Katie:
Thanks for the follow-up e-mail regarding your comments on the District's development of minimum flows for the Homosassa River system. Staff continues to discuss your input and that of others as we review and consider modification of our minimum flow recommendations for the system.

Please feel free to call or otherwise contact me to discuss the proposed minimum flows or other water management issues.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

January 28, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: E-Mail submitted by Mr. Martyn Johnson regarding discharge measurements in the Homosassa River system

---

This memorandum documents correspondence between Mr. Martyn Johnson and Mr. Doug Leeper regarding discharge measurements for sited in the Homosassa River system.

Mr. Johson's e-mail, which was submitted on January 23, 2011, and an e-mail response sent to Mr. Johnson on January 28, 2011 are attached.

DAL

Attachments: Attachment A - E-Mail from Mr. Martyn Johnson, dated January 23, 2011
Attachment B - E-Mail to Mr. Martyn Johnson, dated January 28, 2011

Attachment A

E-Mail from Mr. Johnson, Dated January 23, 2011

From: Alan Martyn Johnson
To: Doug Leeper; Ron Basso; Kevin J Grimsley; rkane@usgs.gov
Cc: rmill76@tampabay.rr.com; Dana Bryan
Subject: Homosassa Flow Concerns
Date: Sunday, January 23, 2011 6:39:31 PM
Attachments: Low Water Flow Data Jan13 and 14.xls
Homosassa River Data.xls

DISCHARGE FROM SE FORK USGS 02310688
Following observations made during kayak trips into the SE Fork on January 13 and 14, 2011, when the water levels were very low, I have looked at some of the data on flows and have very big concerns about the accuracy of the flow data.

Water levels on January 13 and 14 were low to the extent that discharge from Pumphouse Spring and Trotter Spring were clearly above the water level in the main stream to the extent that water was flowing down 'waterfalls'. Flow from these two springs was much much stronger than from the other springs in the fork. Abdoney Spring was also discharging from above the level of water in the main stream and was the third strongest flow but no where near Pumphouse and Trotter.

Given these observations it was clear that the only driving force for flow was the head in the aquifer. This led me to see what the calculated flows were. In studying the data extracted from the USGS real time records and presented in the attached spreadsheet (Low Water Flow…) it is clear that the equation used must be questioned. As you will see in the data there are times when calculated discharge changes very significantly. Such changes can not be true in a situation where the discharge is not affected by conditions in the river.
It could be argued that this was an unusual situation with water levels so low. I agree that it was an unusual situation with water levels so low the conductivity sensor was at times above water with no conductivity recorded. I suggest that it is not unusual when we look at discharge data, the ds/dt multiplier appears to be far too large. Allow me to explain further.

You will recall in earlier correspondence I asked why the multiplier for the ds/dt (change in river stage) was so high. On the spreadsheet (Sheet 2 SE Fork Equation) I have shown the influence the ds/dt factor has on the water held in the pool upstream of the SE Fork gage site 02310688 as a result in stage increase/decrease. These show minimal changes in flow, compared to the figures resulting from the large multiplier used in the equation.

I would strongly suggest this clearly gives concern to erroneous calculation/equation of discharge from the SE Fork.

Also, given the observed uninhibited flows from these spring vents Jan 13 & 14, it only adds to the comments I have made about assumptions used in the modeling of flows as presented in Table 2-4 of the July 2010 report.

Notes:
1. Data from the Homosassa Springs site for the same time period was included on the spreadsheet simply for comparison.
2. The reference made in WRIR 01-4230 by Yobbi and Knochemus on page 16 "Additionally, a single explanatory variable (spring flow from a nearby spring in the complex) was used in the regression models to estimate flow at two tidal springs (Unnamed Tributary to Chassahowitzka River and Southeast Fork of the Homosassa River)." Is noted as possible origin of the equation; ***however, the SE Fork is not truly tidal as there is no reverse flow as mentioned and supported in previous e-mails.***

Eddy Current at Gage Site 02310688

In an earlier e-mail I speculated that there was a possibility of eddy currents causing the occasional increase in conductivity readings at this site. Since that speculation I have carefully observed the flow at the gage site. Regularly, in fact most of the time, a thin layer of flow can be observed going upstream along the concrete seawall towards the instruments location. This observation is made by watching small clumps of weed that can easily be tracked in the water. Most of the time the flow is captured *(typically the flow can be seen going about 4 feet upstream along the seawall and is less than 6 inches wide)* by the main outflow before it reaches the instrument location. I have not yet seen weed reach the plastic tubes. Why is this happening? Previously I had suggested that it was the flow changing direction as it goes under the bridge…close observation shows that a stack of riprap concrete immediately upstream of the instrument location causes a major shift in the flow. I wish I had

Componets in the equation used to calculate discharge from SE Fork

Fixed Multiplier Date GW Multiplier Time GH Multiplier ds/dt
Q in cfs 18.63 3.31 1/13/2011 12.51 10.31 6:15 -0.78 418.14
6:30 -0.81 -0.03
6:45 -0.81 0
7:00 -0.83 -0.02
1/14/2011 12.5 14:00 -0.98 0.01
14:15 -0.96 0.02
14:30 -0.91 0.05
14:45 -0.88 0.03
15:00 -0.88 0

photographs to show this. But, there is nothing like looking at this firsthand.

DISCHARGE DATA HOMOSASSA RIVER USGS 02310700

On the subject of discharge calculation I find some of the data reported from the Homosassa River site perplexing. I have attached a spreadsheet (Homosassa River) in which I have shown the implied cross section of the river from the discharge volume and stream velocity. While I understand that the cross section area will change with stage height this does not appear to explain the wide variation of the *implied cross sectional area* in the spreadsheet.
I do not know the exact location of the Acoustic Doppler Current Profiler (ADCP) but would estimate the river width at that point to be about 200 feet, and would assume that the stream velocity reported is the average stream velocity.

There are even occasions where an inflow is shown when the stream velocity is outward, agreed these few situations are at times when flow direction is changing. However, these provide further indication that discharge results are subject to some mathematical treatment other than simple logic.

I would appreciate if someone can explain what other factors are use to make this calculation. I was under the impression that data from this site was:

Stream Velocity x Cross Section Area (for stage height) = Discharge

Summary

Given the funds that are spent on developing models, often using regression analysis which use flow data, to predict the ecological future of this river I think it critical that the very basis of the flow measurements are fully understood. May be the gaps are only in my understanding, but somewhere I am not getting the logic. I hope those spending the monies and making the decisions are.

Observations, comments and questions with the best of intent.
Martyn Johnson

Reference:
SE Fork Homosassa Spring at Homosassa (02310688):
The current rating curve for the spring discharge reported at this station is represented by the equation:
$Q = 18.63 + 3.31(GW) – 10.31(GH) – 418.14(dS/dt)$
In which
Q = spring discharge, in cfs.
GW = maximum daily groundwater level measured at the Floridan aquifer monitor well 283201082315601 (Weeki Wachee at Weeki Wachee) on the day of the dischargemeasurement used for the rating, in ft NGVD29.
GH = 15-minute gauge height of the river recorded at the time of the discharge measurement used for the rating, in ft NGVD29.
dS/dt = change in river stage during a 15-minute period, in ft.

For anyone not able to open the first spreadsheet.

Componets in the equation used to calculate discharge from SE Fork

	Fixed	Multiplier	Date	GW	Multiplier	Time	GH	Multiplier	ds/dt
Q in cfs	18.63	3.31	1/13/2011	12.51	10.31	6:15	-0.78	418.14	
						6:30	-0.81		-0.03
						6:45	-0.81		0
						7:00	-0.83		-0.02
			1/14/2011	12.5		14:00	-0.98		0.01
						14:15	-0.96		0.02
						14:30	-0.91		0.05
						14:45	-0.88		0.03
						15:00	-0.88		0

Date	Time	Q Calc cfs					cfs Change in 15 minutes
1/13/2011	6:30	**80.9334**	18.63	41.4081	-8.3511	-12.544	
1/13/2011	6:45	**68.3892**	18.63	41.4081	-8.3511	0	**-15%**
1/13/2011	7:00	**76.9582**	18.63	41.4081	-8.5573	-8.3628	**13%**
1/14/2011	14:00	**65.9274**	18.63	41.375	-10.1038	4.1814	
1/14/2011	14:15	**61.5398**	18.63	41.375	-9.8976	8.3628	**-7%**
1/14/2011	14:30	**48.4801**	18.63	41.375	-9.3821	20.907	**-21%**
1/14/2011	14:45	**56.5336**	18.63	41.375	-9.0728	12.5442	**17%**
1/14/2011	15:00	**69.0778**	18.63	41.375	-9.0728	0	**22%**

Water storage/discharge due to stage change SE Fork

Estimated area of SE Fork pool 3 acres Average flow 60 cfs

	ds/dt	cf in 15 mins	cf flow/15 min	Time to discharge storage	cfs at gage site Decrease	Increase	Frequency* ds/dt
Volume for	0.01	1306.8	54000	0.4	58.5	61.5	15%
	0.02	2613.6		0.7	57.1	62.9	30%
	0.03	3920.4		1.1	55.6	64.4	25%
	0.04	5227.2		1.5	54.2	65.8	10%
	0.05	6534		1.8	52.7	67.3	10%
	0.06	7840.8		2.2	51.3	68.7	2%
	0.07	9147.6		2.5	49.8	70.2	1%

Frequency ds/dt is percent of times this change is seen both negative and positive.
Positive changes are seen approx 45% of the time versus negative 55%,
Zero chang is seen about 5% of time reported.

Attachment B

E-Mail to Mr. Johnson, Dated January 28, 2011

From: Doug Leeper
To: "Alan Martyn Johnson"
Bcc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Yassert Gonzalez; Jay Yingling; Cara S. Martin; Karen Lloyd; Richard Kane(rkane@usgs.gov); Kevin Grimsely (kjgrims@usgs.gov)
Subject: RE: Homosassa Flow Concerns
Date: Friday, January 28, 2011 4:10:00 PM

Martyn:
Thanks for your recent e-mail regarding reported discharge at the USGS Southeast Fork Homosassa Spring at HomosassaSprings, FL and Homosassa River at Homosassa, FL gage sites. In response to your e-mail, I spoke with Richard Kane and Kevin Grimsley and can offer the following comments regarding the points raised in your e-mail.

First, it should be noted that the published method for used for evaluating flows at the Southeast Fork gage is considered adequate for estimating daily mean discharge at the site. The method is used to develop 96 daily estimates of discharge, which are then averaged to derive mean daily values. Individual discrete discharge estimates may exhibit moderate variation from actual physical conditions at the site, but the average of the composited discrete measurements made over a 24-hour period has been shown to correspond well with actual daily mean discharge.

With regard to the Homosassa River gage issues, it should be noted that the method used by the USGS for estimating discharge at the site involves measurement of index velocity values, conversion of index velocity values to cross-sectional mean velocity values, and multiplication of the cross-sectional mean velocities by cross-section area values. Your derivation of “implied” cross-section area values from data obtained from the USGS site suggests that the cross-section area at the Homosassa River gage site is quite variable, even with consideration given to area changes associated with tidal fluctuations. As it turns out, the velocity data you obtained from the USGS web site are the index velocity values rather than the cross-sectional mean values that would be expected to yield more stable “implied” cross section areas based on division into the reported discharge values.

I hope this information is of some help.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
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E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

January 25, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Questions and Comments submitted by Mr. Martyn Johnson on January 10, 2011 regarding recommended minimum flows for the Homosassa River system

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This memorandum was produced to document two e-mails submitted to the Southwest Florida Water Management District by Mr. Martyn Johnson on January 10, 2011. The e-mails generally concern development of minimum flows for the Homosassa River system, and specifically address the discussion that ensued during the rule development public workshop on the proposed minimum flows that was held in Lecanto on January 6, 2011. With regard to potential flow reductions associated with establishment of minimum flows for the river system, Mr. Johnson asks in his correspondence that the District "*[p]lease consider recommending and approving the setting of minimum flows at NO FURTHER REDUCTION at this point in time.*"

Excerpts from Mr. Johnson's first e-mail that include specific questions addressed to staff are reproduced below in italics, and followed by staff responses. Development of staff responses to Mr. Johnson's second e-mail was considered unnecessary, as the correspondence did not include any direct questions and was apparently provided for information purposes only. Mr. Johnson's two e-mails are reproduced in their entirety as attachments to this memorandum, to provide context for his perspective on the currently recommended minimum flows for the Homosassa River system.

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<u>Excerpt No. 1 from Mr. Johnson's E-Mail (Attachment A)</u>

"*While the presentation regarding low rainfalls over the last 20 years or more was certainly highly important to changes, it should not be used as a defense for withdrawals having little or no influence. At one point, later in the meeting, Doug commenting that flows would increase* ***when*** *rainfall increases. The analytical mind in me says this should have been* ***if*** *rainfall increases. Moreover, if rainfall levels should return to those of the 50s, 60s, and 70s, how long will it take for the river to recover? Recovery is by nature a much longer time frame than destruction."*

<u>Staff Response to Excerpt No. 1</u>

Staff agrees that Mr. Leeper should have noted that flows in the Homosassa River system may be expected to increase if rainfall increases. Staff expects that the response time for changes in flows in the river system as a function of changes in rainfall may be observed on a seasonal or shorter-term basis.

Excerpt No. 2 from Mr. Johnson's First E-Mail (Attachment A)
"An issue that was touched on in questions a number of times was about granting well permits. Questions about the new well field, Chassahowitzka, were frequent. One member of the audience asked if SWFWMD ever refused permits. This question became lost among all the others, and unfortunately, it was never answered. (This is not a criticism, as Doug fielded a lot of questions very well). So, let me ask the question in writing: how many well permit applications has SWFWMD received and how many have actually been denied? A timeframe of your choosing needs to be attached to that question.
From people who have some knowledge of the Citrus County permits for small domestic wells, all appear to be granted providing appropriate paperwork and fees are filed. I plan on following up with the County regarding this matter."

Staff Response to Excerpt No. 2
The District issues both well construction permits and water-use permits for groundwater withdrawals. Issuance of well construction permits ensures that wells are properly constructed to protect water resources. Water use permits are issued to allow for legal withdrawal of specific quantities of ground or surface water for limited periods of time in accordance with permit conditions. Water use permits are required for groundwater withdrawals if the planned withdrawal involves more than 100,000 gallons per day, or the outside diameter of the planned well is six inches in diameter or larger, or the total withdrawal capacity associated a planned system of withdrawal points is one or more million gallons per day. Similar requirements apply to the need for a permit associated with a surface withdrawal, although the size threshold for the outside diameter of the withdrawal pipe is four inches, rather than six inches. Withdrawals associated with personal domestic use for an individual residence are typically below the threshold that requires issuance of a water use permit, but if an individual withdrawal involves a well, a well construction permit is required prior to installation of the well.

With regard to well construction permitting, staff reviews permit requests to ensure that the proposed construction activity is in compliance with District and Florida Department of Environmental Protection rules addressing well construction and water use permitting. Permits are issued if the proposed construction activity meets rule requirements and any necessary water use permitting conditions are also met. In the instances when well construction meets rule criteria and a water use permit is required, but is to be denied, the request for a well construction permit is also denied. Review of the District's Well Construction Database indicates that 213 and 941 permits were issued for withdrawals in Citrus County during the past year and past three years, respectively. A total of seven well construction permits evaluated last year were determined to not meet conditions for issuance and were, therefore, not issued. These seven permits were not formally denied, but could be if the permit requestors cannot meet the conditions for issuance and do not withdraw their permit requests.

With regard to water-use permitting, staff reviews permit requests to ensure that any requested withdrawal is reasonable and beneficial, does not impact an existing legal user and is in the public interest and meets other requirements in District rules. This review process may involve or result in reductions in the quantity of water that may be withdrawn, restrictions on the period during which withdrawals may occur, relocation of the proposed withdrawal site, requirements for environmental monitoring, and identification and use of alternative water sources (*e.g.*, surface water vs. groundwater). Fewer than ten of the hundreds of surface- and groundwater use permit requests received by the Brooksville Regulation Department during the past three years were not issued. Note that this department of the District handles water use permitting for withdrawals in the northern portion of the District, which includes Citrus County, Hernando County, Pasco County, Sumter County, and portions of Lake, Levy and Marion counties. In the instances when a permit was not issued, the parties requesting the permits withdrew their request in response to District initiation of the denial process, or failed to respond to a District request for additional information that was needed for review of the requested permits. In addition to these cases, a number of parties in the Department service area were dissuaded from applying for a water use permit during the past three years, based on initial communications with staff regarding the possibility or feasibility of issuance of a permit associated with the requested withdrawal.

DAL

Attachments: Attachment A - Four page e-mail from Mr. Martyn Johnson dated January 10, 2011
Attachment B - One page e-mail from Mr. Martyn Johnson dated January 10, 2011

Attachment A
Four Page Attachment to January 25, 2011 Memorandum on Questions and Comments Submitted by Mr. Martyn Johnson on January 10, 2011

From: Alan Martyn Johnson
To: Doug Leeper; Ron Basso
Subject: Lecanto Workshop Homosassa Minumum Flows
Date: Monday, January 10, 2011 11:24:24 AM

Doug and Ron,
I would like to follow up on a few points from last Thursday evenings workshop in Lecanto. But, first a Thank You to both of you for a good professional job in front of an audience who are deeply concerned by the deterioration they have witnessed in the Homosassa River over the years.

Skeptical audience
Notable were comments from long time residents who have seen the river on a daily basis for over 50 years and those from former government employees who patrolled the waterways for over 20 years. They stated that the river has changed/deteriorated; flows have reduced, vegetation has changed, fish and wildlife have changed. They and others frequently mentioned recent and major barnacle growths where they were never seen before. There is clear observed evidence of salt water intrusion/salinity increases and the associated negative impact on this unique river.
The scientific studies and data analyses can be interpreted in many ways, as can the intent of statute No 373.042., passed in 1972. Underlying these is the fact that almost four percent of the rainfall on Citrus County (770 sq mls.), after subtracting evapotranspiration, (52 inches minus 32 inches evapotranspiration and without considering surface run-off) over is now pumped out of the ground. In the 70's the withdrawals were just over one percent on the same basis. While four percent may not appear that high, people are skeptical about this having no impact. A skepticism that is further enhanced by suggesting that there is limited or no lateral flow in the aquifer to areas where large drops in the aquifer levels have been recorded (brown shaded areas on the presented slide). Skepticism that is fueled by comments that this area is like the Saudi Arabia for Florida water; a very worrying concept that we have heard at both workshops .
You heard a number of questions about why has almost 40 years delay in setting minimum flows and levels occurred since the legislation passed. And why levels for the baseline for significant harm should not be from the time legislation was passed. There was due reason to pass the legislation in 1972. Regarding the delay, 'We did not have the data' is an argument, but not one that appeared to convince many who attended the workshop.
While the presentation regarding low rainfalls over the last 20 years or more was certainly highly important to changes, it should not be used as a defense for withdrawals having little or no influence. At one point, later in the meeting, Doug commenting that flows would increase **when** rainfall increases. The analytical mind in me says this should have been **if** rainfall increases. Moreover, if rainfall levels should return to those of the 50s, 60s, and 70s, how long will it take for the river to recover? Recovery is by nature a much longer time frame than destruction.

Modeling

Ron did a good job at explaining the Northern District Model, despite the many questions and interruptions during his presentation. Nevertheless, the quote he mentioned near the end of his presentation, 'paraphrasing', that models are never right, but are often useful, is apropos. There was an emphasis on the vertical sections of the model but little explanation of transition from one column to adjacent ones, a critical factor in how water moves in the aquifer to the springs.

Well Permits

An issue that was touched on in questions a number of times was about granting well permits. Questions about the new well field, Chassahowitzka, were frequent. One member of the audience asked if SWFWMD ever refused permits. This question became lost among all the others, and unfortunately, it was never answered. (This is not a criticism, as Doug fielded a lot of questions very well). So, let me ask the question in writing: how many well permit applications has SWFWMD received and how many have actually been denied? A timeframe of your choosing needs to be attached to that question.

From people who have some knowledge of the Citrus County permits for small domestic wells, all appear to be granted providing appropriate paperwork and fees are filed. I plan on following up with the County regarding this matter.

Spring Water Quality

Later in the meeting a few questions were asked about spring water quality and how it is changing. One comment was regarding the deterioration of the spring that was historically used as the Homosassa drinking water source, and how it has 'gone bad' in recent years. I was unaware of that fact until the workshop. It is strong evidence of how the spring water quality is changing for the worse. Concerning that this was not mentioned in the report.

You may recall my mention about how critical the quality of water from the SE Fork is, with its significantly lower salinity; and how devastating some catastrophic collapse in the caverns feeding these springs could be to the river. **I appreciated Doug's quick thinking that maybe a minimum flow for each of the critical spring groups may be worth considering in the proposal, rather than simply a minimum flow for the combined springs.** That thought from Doug spoke volumes of the professionalism and genuine concerns regarding the task you are undertaking.

Spring Flow Measurements

Finally, I would like you to pass on my apology to your colleague at the back of the room for disagreeing with him about flow variations from the springs with tidal level. It was late in the meeting, and there was little point in detailed discussion at that time. But let me expand here. The USGS discharge figure from the three main springs is a calculated figure from the equation:

$Q = 90.8162 + 3.823(GW) - 20(GH)$

GH at the site is recorded every 15 minutes, GW at Weeki Wachee is one figure for the day. This equation is a mathematical best fit, not an empirical measurement of stream flow or measurements in the three vents. It is a leap of faith to say 96 gage height measurements and one aquifer level are 96 measurements of discharge each day…there are **96 calculated discharge** which as commented by Fulcher and quoted in the draft report are subject to a 15% standard error.

I have to point out to your colleague that measuring flow in the channel exiting the springs (about 100 feet from the spring vents) is not easy in the channel that is roughly 50 feet wide, 4 feet deep subject to a regular level change of about 1-1.5 ft. Just assuming a steady 80 cfs this equates to a velocity of between 0.3 and 0.4 ft/sec on high versus low tide even assuming laminar flow which is certainly not true. In connection with this a brief review of the accuracy and use of Acoustic Doppler Current Profilers was undertaken.

FYI for your colleague the two most recent field measurements at the Homosassa Springs Site are:

2010-12-08 @ 16:11:30 94.2 cfs

Calculated results in the record are:	@16:00	92 cfs
	@16:15	92 cfs

2010-10-13 @ 14:54:30 83.1 cfs

Calculated results in the record are:	@14:45	71cfs
	@15:00	72 cfs
	@15:15	73 cfs

Did I select these figures to make a point? No they are simply the two that are easily referenced in the USGS real time data records that are on line. Please feel free to double check these in case I have made a typographical error.

Looking at the SE Fork field measurements in the same way:

2010-12-09 @16:21 55.1 cfs

Calculated results in the record are:	@16:15	66 cfs
	@16:30	66 cfs

2010-10-06	@14:14	51.3 cfs
	@14:21	44.8 cfs
	@14:29	49.2 cfs
	@14:34	44.8 cfs

Calculated results in the record are:	@14:15	61 cfs
	@14:30	52 cfs
	@14:45	52 cfs

Note; the equation used by USGS for SE Fork is different.

I have no doubt that USGS try to do the best they can, but knowing how the data is derived avoids leaps of faith to present/believe the data as absolute measurements.

Looking carefully at all this I ask myself why is the aquifer level at Weeki Wachee used as the head for spring flow in the equations; it is not even in the Homosassa Groundwater Basin. Yes I know more questions than answers, but blind acceptance of data is dangerous.

In Summary

Doug, Ron, your Staff and SWFWMD Board,

You have a difficult task to perform in setting minimum flows. The data, while the best available, has:

- intrinsic errors which cannot be ignored,
- assumptions in both data analyses and modeling,
- limited results showing the situation when the legislation was passed,
- limited results confirming the observed deterioration e.g. barnacles

· no way of predicting the future critical areas such as rainfall
· averages…….as opposed to tends in chemical analyses (being addressed)

It is clear that the Homosassa River has deteriorated possibly to the point that irreparable harm has already occurred. Recovery is certainly dependent on IF rainfall returns to the levels seen 20+ years ago. Further increasing withdrawals of groundwater without increased rainfall and better/more accurate science is taking unnecessary risks.
Please consider recommending and approving the setting of minimum flows at NO FURTHER REDUCTION at this point in time. As pointed out in the letter from the Homosassa River Alliance hundreds of millions of dollars have been invested to protect the river system. To not recognize the delicate balance of the unique river system in the decision making process to allow more groundwater withdrawals may prove to be irresponsible. This area is not Saudi Arabia…there is unique ecology to protect, not a barren terrain with a resource below. But, that is the task you have, responsible management. By comments and questions I trust we help make the management decisions more informed and more responsibly balanced.

Thank you for allowing us the opportunity to be involved.

Martyn Johnson

Attachment B
One Page Attachment to January 25, 2011 Memorandum on Questions and Comments Submitted by Mr. Martyn Johnson on January 10, 2011

From: Alan Martyn Johnson
To: Doug Leeper; Ron Basso
Subject: Follow Up to e-mail sent a few minutes ago
Date: Monday, January 10, 2011 12:16:15 PM

I have just followed up on the well used by the Homosassa Special Water District that was commented on at Thursdays workshop as having 'gone bad'.

THIS WELL WAS 'CAPPED' ABOUT 20 YEARS AGO, THEREFORE IT IS VERY UNDERSTANDABLE WHY IT WAS NOT MENTIONED IN THE REPORT. MY APOLOGY FOR NOT CHECKING THIS BEFORE SENDING THE E-MAIL.

I did however learn that the wells in use are considered to have a 5 year travel time at depths of 330-340 feet. Initial though is that it takes the aquifer a long time to react with travel at inches per day!!!

Martyn Johnson

February 3, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Communications associated with comments on minimum flows for the Homosassa River System submitted by Mr. Martyn Johnson on January 26, 2011

This memorandum addresses correspondences associated with two e-mails submitted to the District by Mr. Martyn Johnson on January 26, 2011. Mr. Johnson's original e-mails, responses from the District and a follow-up e-mail from Mr. Johnson submitted on February 3, 2011 are attached to this memorandum.

DAL

Attachments: A - One page e-mail submitted to the District by Mr. Martyn Johnson, dated January 26, 2011
B - One page e-mail submitted to the District by Mr. Martyn Johnson, dated January 26, 2011
C - Two page e-mail sent to Mr. Martyn Johnson, dated January 28, 2011
D - One page e-mail sent to Mr. Martyn Johnson, dated January 28, 2011
E - One page e-mail submitted to the District by Mr. Martyn Johnson, dated February 3, 2011

Attachment A

One Page Attachment to Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Martyn Johnson

E-Mail Submitted to the District by Mr. Johnson on January 26, 2011

From: Alan Martyn Johnson
To: Doug Leeper
Cc: Ron Basso; Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Karen Lloyd
Subject: RE: Response to Comments on Homosassa Minimum Flows
Date: Wednesday, January 26, 2011 8:40:35 AM

Doug,
Thanks for your e-mails of Jan 24 and 25. I have reviewed these briefly.

In my initial reading I do not find the information on water chemistry that would allow trends to be reviewed.

The Excel file with the statistical analyses of the water chemistry parameters from the various springs does not provide the dates of the samplings and individual results necessary to look at trends.

While the ranges and standard deviation provide some added insight they do not show trends as did the data presented in Bulletin 69 upto 2003. Preliminary review of the standard deviations and ranges in parameters such as calcium, magnesium, sodium, chloride and TDS from the various springs (particulary those with more samplings) only heightens my concern that the positive trends noted in Bulletin 69 may be continuing.

At this stage I have only compared a few parameters at four springs with more numerous samplings (Homosassa Spring 1 & 3, Hidden River Head Spring and Pumphouse) to those in Bulletin 69; *not easy and not scientific*, but some of the ranges appears to indicate continued positive trends (*maximums clearly higher than visually scanning the results in Bulletin 69, agreed maximums can be dangerous eg the TDS of 23300 for Halls River...clearly an error in sampling or analysis or reporting*).

Positive trends i.e. deteriorating quality of water entering the river from the springs is important to consider along with flow.

I would appreciate if the raw data with sampling dates can be made available. Even more useful would be line graphs to show the trends for some of the major parameters.

I appreciate the time and efforts you and the staff take to address the concerns presented in my e-mails.

Thanks,
Martyn Johnson

Attachment B

One Page Attachment to Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Martyn Johnson

<u>E-Mail Submitted to the District by Mr. Johnson on January 26, 2011</u>

From: Alan Martyn Johnson
To: Doug Leeper
Cc: Ron Basso; Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Karen Lloyd
Subject: RE: Response to Comments on Homosassa Minimum Flows
Date: Wednesday, January 26, 2011 9:16:05 AM

Doug,
As follow up to my message a few minutes ago. I forgot to mention that it appeared that the data in your excel file (number of samples) included the samples from Bulletin 69; which is why I looked at maximums.

Please confirm if data from 1993 - 2003 is included.

Thanks,

Martyn Johnson

Attachment C

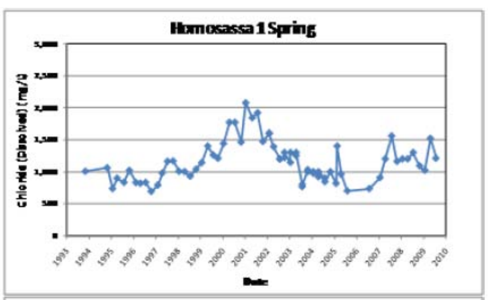
Two Page Attachment to Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Martyn Johnson

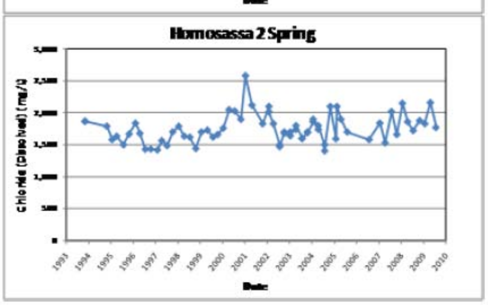
<u>E-Mail Sent to Mr. Johnson on January 28, 2011</u>

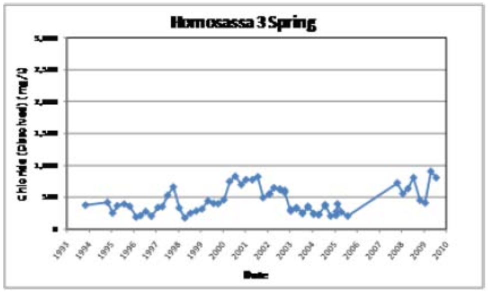
From: Doug Leeper
To: "Alan Martyn Johnson"
Bcc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Cara S. Martin; Yassert Gonzalez; Jay Yingling; Karen Lloyd
Subject: RE: Response to Comments on Homosassa Minimum Flows
Date: Friday, January 28, 2011 9:00:00 AM
Attachments: SWFWMD Homo Springs WQ Data from MINITAB File 26jan2011.xlsx

Martyn:

I reviewed the Excel file I sent to you recently and note that the sample collection dates are included on the "WMIS and EDMS – USE THIS" sheet, but not on the "Spring Summary Stats from Minitab" sheet. Data on this sheet could be sorted by site and date to examine temporal trends for specific analytes. However, to make these types of analyses easier, I created the attached Excel file that includes sheets showing the "raw" data and summary stats for the spring data. The data on the "raw" data sheet can be easily filtered/sorted by date, site and analyte for plotting purposes. Here are examples of time-series plot of dissolved chloride concentrations for the Homosassa 1, 2 and 3 Spring sites.







Let me know if you have any questions pertaining to the attached data file.

Sincerely,

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Attachment D

One Page Attachment to Memorandum Addressing Comments
Regarding Minimum Flows for the Homosassa River System Submitted by Dr. Martyn Johnson

E-Mail Sent to Mr. Johnson on January 28, 2011

From: Doug Leeper
To: "Alan Martyn Johnson"
Bcc: Marty Kelly; Mike Heyl; Sid Flannery; Ron Basso; Mark Barcelo; Yassert Gonzalez; Jay Yingling; Cara S. Martin; Karen Lloyd
Subject: RE: Response to Comments on Homosassa Minimum Flows
Date: Friday, January 28, 2011 9:00:00 AM

Martyn:

In response to the question in your e-mail below, I note that the District water chemistry data for the Homosassa system that I have provided includes records from 1993 through 2009.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

<><><><><><><><><><><><><><><><><><><><><><><><><>

From: Alan Martyn Johnson [mailto:martynellijay@hotmail.com]
Sent: Wednesday, January 26, 2011 9:16 AM
To: Doug Leeper
Cc: Ron Basso; Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Karen Lloyd
Subject: RE: Response to Comments on Homosassa Minimum Flows

Doug,

As follow up to my message a few minutes ago. I forgot to mention that it appeared that the data in your excel file (number of samples) included the samples from Bulletin 69; which is why I looked at maximums.

Please confirm if data from 1993 - 2003 is included.

Thanks,
Martyn Johnson

Attachment E

One Page Attachment to Memorandum Addressing Comments

Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Martyn Johnson

E-Mail Submitted to the District by Mr. Johnson on February 3, 2011

Note: string of previous e-mails not reproduced here

From: Alan Martyn Johnson
To: Doug Leeper
Subject: RE: Response to Comments on Homosassa Minimum Flows
Date: Thursday, February 03, 2011 11:07:46 AM

Doug,

Thanks for sharing the raw data. Much appreciated. I have limited computer access for the next 10 days, but will look at the data when I have full computer access. I also saw your reply on the flow measurements and will try to respond tomorrow with my comments.

Thanks,
Martyn

February 15, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: E-mail from Martyn Johnson to Kevin Grimsley, concerning flow measurement in the Homosassa River system

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This memorandum documents e-mail correspondence between Mr. Martyn Johnson and Mr. Kevin Grimsley from December 2010 and early January 2011. The correspondence concerns measurement of flows by the United States Geological Survey at sites in the Homosassa River system. The correspondence was copied to District staff and is documented here for its relevance to the development of minimum flows for the river system.

DAL

Attachment: E-Mail correspondence between Mr. Martyn Johnson and Mr. Kevin Grimsley, December 2010 and early January 2011

Attachment

<u>E-Mail from Kevin Grimsley to Martyn Johnson, with E-mail String</u>

From: Kevin J Grimsley
To: Alan Martyn Johnson
Cc: Doug Leeper; rkane@usgs.gov
Subject: RE: Homosassa River Flows
Date: Tuesday, January 04, 2011 4:35:34 PM

Martyn,
I apologize for taking so long to get back to you. The equations used to calculate flow at the three stations in question have not changed. The equations continue to be evaluated using new measurements as they're made. Those evaluations have shown that the equations continue to be accurate so there's been no reason to change them.
****
Kevin Grimsley, P.E.
Supervisory Hydrologist
USGS, Florida Water Science Center
10500 University Center Drive, Suite 215
Tampa, FL 33612
kjgrims@usgs.gov
813-975-8620 x159
****
From: Alan Martyn Johnson <martynellijay@hotmail.com>
To: <kjgrims@usgs.gov>
Cc: Doug Leeper <doug.leeper@swfwmd.state.fl.us>, <rkane@usgs.gov>
Date: 12/20/2010 09:45 AM
Subject: RE: Homosassa River Flows

Kevin,
Thanks for the response.
Homosassa River Flows
On the subject of flows at the Homosassa River Site 02310700, we agree that the data on actual flow velocity and the computation of net flow since this was started is good and useful data.
The idea of trying to look at flow times in each direction was raised hoping that velocity data was available for a much more extended period than the calculated net flow. Although I understand your point about the difference regarding 3 ft/sec and 2 ft/sec the differences at this Site are not that pronounced. Anyway, let us leave that point to the students who have got a Christmas break interest over and above parties!!
SE Fork Flow
Regarding the SE Fork Site 02310688; I and another resident (he was born in Homosassa some 60 years ago) regularly kayak to and along the SE Fork. We are confident that there is no reverse (bidirectional) flow under the Fishbowl Drive bridge. Vegetation SAV and fallen leaves can clearly be seen ‘bouncing’ along the bottom under the bridge, even at high tide. With a stream velocity of about one foot per second and a flow from the various springs that can generate a rise of about 0.4 feet in 15 minute (this is from flow of about 60cfs and an area of about 3 acres of water upstream of the bridge) which is over ten times the normal gage height change rate, I do not see the reverse flow being a reality.
The specific conductance data also does not support bidirectional flow.

We have looked carefully at the conductivity data increases from normal that occasionally are detected. From what we can see the times when conductivity increases above the norm (~900) are associated with gage height rises of over 0.04 ft per 15 minute monitoring interval, and usually with gage heights over 1 ft.. Why we asked ourselves.

Looking at the location of the monitoring site we speculate that the reason may be eddy currents set up along the concrete wall immediately downstream of the monitor. This could draw main springs water (conductivity ~4500) past the monitor in a 'vortex' created by the main flow from the SE Fork trying to pass the rising water. The curve in the river, we think, adds to this speculation being valid.

I noted above increased conductivity is usually associated with gage heights over one foot. An example of an exception to this can be seen November 29 starting at 9:00am.

Conductivity did rise slightly (~1200 from normal ~900) even at low gage height, but look at the rate of increase in gage height they are 0.07, 0.06, 0.05 ft per 15 min interval.

The attached diagram may help you understand our speculation. This diagram was traced from an aerial view. Just thought you may be interested in these thoughts from people who see the river regularly.

Equations for discharge calculation

Regarding the equations used to calculate the discharge, there is no question that this must be an iterative process to find the best match. I appreciate that you took the time to crosscheck the calculated discharge with the last 5 years empirical measurements. The agreement of less than 3 percent is excellent and significantly better that commented on by Dave Fulcher (USGS-Tampa) on May 1, 2009 and contained in the SWFWMD Report.

Re Homosassa Springs

Quote

According to Mr. Fulcher, the standard error of the rating is approximately 15 percent, and no shifts have been applied during the rating analysis.

End Quote

And Re SE Fork

Quote

The rating is maintained and average daily flow is calculated using the same methods as for the

Homosassa Springs station, although the standard error of the SE Fork station's rating is somewhat higher.

End Quote

If you still have the data yuou checked we would be interested in looking at it. If you do not still have it no problem.

One final point if I may.

Have the equations used to calculate the flow at the three sites changed over time?

Homosassa Springs at Homosassa (02310678):

$$Q = 90.8162 + 3.823(GW) – 20.3771(GH)$$

In which

Q = spring discharge measurement, in cfs.

GW = maximum daily groundwater level measured at the Floridan aquifer monitor well Weeki Wachee Well at Weeki Wachee (283201082315601) on the day of the discharge measurement used for the rating, in ft NGVD29.

GH = 15-minute gauge height of the river stage recorded at the time of the discharge

measurement used for the rating, in feet relative to a gauge datum that is 2.99 feet
below NAVD88.

SE Fork Homosassa Spring at Homosassa (02310688):

:

$$Q = 18.63 + 3.31(GW) – 10.31(GH) – 418.14(dS/dt)$$

In which
Q = spring discharge, in cfs.
GW = maximum daily groundwater level measured at the Floridan aquifer monitor well
283201082315601 (Weeki Wachee at Weeki Wachee) on the day of the discharge measurement used for the rating, in ft NGVD29.
GH = 15-minute gauge height of the river recorded at the time of the discharge
measurement used for the rating, in ft NGVD29.
dS/dt = change in river stage during a 15-minute period, in ft.

Homosassa River at Homosassa (02310700):

:

$$Q = V_m(A) \text{ (B-3)}$$

$$V_m = 0.00902154 + 0.9019V_i + 0.12138V_{i2} + 0.045375(GH)$$

In which
Q = river discharge, in cfs.
A = area of channel cross section at the gauge, in ft2.
Vm = average velocity in the channel cross section at the gauge, in ft/s.
Vi = average velocity in channel measured during a 2-minute period by an
"uplooking" acoustic velocity meter anchored on the channel bottom near
the gauge, in ft/s.
GH = 15-minute gauge height of the river recorded at the time of the discharge
measurement used for the rating, in ft NGVD29 (see follow section regarding
gauge datum).

Kevin,

Really appreciate the time you have spent on my questions. The work and data available from USGS is amazing. I trust you appreciate the comments and interest in these e-mails; we are simply interested in protecting the Homosassa River from further deterioration.
Martyn

To: martynellijay@hotmail.com
CC: doug.leeper@swfwmd.state.fl.us; rkane@usgs.gov
Subject: Re: Homosassa River Flows
From: kjgrims@usgs.gov
Date: Fri, 17 Dec 2010 10:42:34 -0500

Martyn,

First let me say that you're absolutely right, the total flow at SE fork does not completely reverse. That was a poor choice of wording on my part so let me clarify. While the total net flow at SE fork does not reverse, the negative flow components (bidirectional flow) are much more significant at the SE fork gage than they are at Homosassa Springs. I suspect this is mainly because there's simply more positive flow coming from the main spring, so the backpressure caused by a rising tide affects it less. When bidirectional flow occurs, the negative component is typically on the bottom (because water with a higher salinity is more dense) so this is not something that someone observing from above would probably notice.

In the end however, there are many different variables that can be significant at one station and not at another for a myriad of reasons. These equations were developed by starting with the simplest case, a single variable, and evaluating the discharge resulting from that equation against the known discharge measurements. From there, other variables were added to the equation and evaluated in an iterative process until the equation that best fit the discharge measurements was found. So the fact that the rate of change of stage variable does not appear in the final equation used at Homosassa Springs doesn't mean that there was a change in methodology, it just means that the addition of that variable didn't help the equation fit the measurements at that station.

The reality is that the regression equation at SE fork matches the discharge measurements better with the rate of change of stage variable than without it. We're always evaluating how well our equations match our new measurements as we make them throughout the year, but as part of preparing this email I made a quick evaluation of how the equation matched all the measurements over the past 5 years. The average difference between the SE fork regression equation and our measurements was less than 3 percent which shows an excellent correlation.

Regarding the second section of your email, while I certainly agree that there is some relationship between the duration of flows in each direction and the net flow, I stand by my previous concern that looking only at the duration of flow in each direction would not account for the magnitude of those flows. The station could easily flow for 6 hours in each direction but with an average positive velocity of 3 feet per second and average negative velocity of 2 feet per second. This would obviously result in 50% more positive flow than negative.

Lastly, as Richard said in his email most of our data is available for download through the website and data that you can't find there can be requested. We take great pride in our data and continue to welcome any questions and comments about how it has been collected and computed. I must reiterate, however, that questions regarding how USGS data has or has not been used and interpreted to look at longer term trends or other issues related to the proposed minimum flow recommendations are better directed to SWFWMD. The USGS has simply not been involved beyond providing the data itself so we cannot provide insight into how that data was used.

I hope I've helped answer your questions. Merry Christmas to you as well.

Kevin

****

Kevin Grimsley, P.E.
Supervisory Hydrologist
USGS, Florida Water Science Center
10500 University Center Drive, Suite 215
Tampa, FL 33612
kjgrims@usgs.gov
813-975-8620 x159[attachment "2010-12-19-1844-04.jpg" deleted by Kevin J Grimsley/WRD/USGS/DOI]

January 5, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Response to comments on minimum flows for the Homosassa River System submitted by Mr. Max Rhinesmith on January 3, 2011

This memorandum addresses correspondences associated with an electronic mail submitted to the District by Mr. Max Rhinesmith on January 3, 2011. The e-mail includes Mr. Rhinesmith's comments regarding development of minimum flows for the Homosassa River system and is attached to this memorandum. An electronic mail response from the District is also attached.

DAL

Attachments: Attachment A - One page e-mail submitted to the District Mr. Max Rhinesmith, dated January 3, 2011

Attachment B - Two page e-mail sent to Mr. Max Rhinesmith, dated January 5, 2011

Attachment A

One Page Attachment to January 5, 2011 Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Max Rhinesmith

E-Mail Submitted to the District by Mr. Rhinesmith on January 3, 2011

From: MAD MAX [mailto:rhinesmith@webtv.net]
Sent: Monday, January 03, 2011 2:24 AM
To: info
Subject: Homosassa River minimum flow

SIRS, I read Ron Miller's letter in the Chronicle. I swam in the river once this year, and went to wildlife park once. And of course watched fireworks,raft race, boat parade, and hit the bars on the river. Therefore i like to visit the river. And i would become upset if it was damaged, wildlife harmed, turned to salt water, had real low levels etc.
Sooo please BE REAL CAREFUL WITH the Homosassa river. i do NOT think selling off its water is a good idea. MAX Rhinesmith Inverness, FL age 61

PS Remember that millions of $$$dollars have been invested by businesses along the river to attract tourists. And that the Wildlife park , along with those tourists, spend $$$ millions to help Citrus county thrive.

Attachment B

Two Page Attachment to January 5, 2011 Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Max Rhinesmith

E-Mail Sent to Mr. Rhinesmith on January 5, 2011

From: Doug Leeper
To: "rhinesmith@webtv.net"
Cc: Josie Guillen; Gwen Brown; Marty Kelly; Sid Flannery; Ron Basso; Karen Lloyd; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Tahla Paige; Lou Kavouras
Subject: Homosassa River Minimum Flows - Susp. Item PRJ-009
Date: Wednesday, January 05, 2011 7:47:00 AM

Mr. Rhinesmith:

Thank you for your recent e-mail concerning the establishment of minimum flows for the Homosassa River system. As you are aware, the Southwest Florida Water Management District is in the process of setting minimum flows for the river system to prevent significant harm that may occur as a result of water withdrawals. Once established the minimum flows will be one criterion that our Regulatory Staff review when considering issuance of water use permits that may influence discharge from the springs that supply flow to the river system.

Details on the currently proposed minimum flows for the Homosassa River system are available in a draft report titled *Recommended Minimum Flows for the Homosassa River System, July 12, 2010 Peer- Review Draft.* An electronic version of the report may be viewed and downloaded from the District web site at the following Uniform Resource Locator (URL) on the World Wide Web.

http://www.swfwmd.state.fl.us/projects/mfl/reports/PeerReviewDraftHomosassaRiverMFLsReport2010-07-12.pdf

Appendices for the draft report are posted at:
http://www.swfwmd.state.fl.us/projects/mfl/reports/Appendices-PeerReviewDraftHomosassaRiverMFLsReport2010-07-12.pdf

Public review and input is an important component of the minimum flows development process. Please note that staff will carefully consider your comments and will plan on including your e-mail along with other public comments in a revised version of the District report on minimum flows for the Homosassa River system.

To learn more about minimum flows for the river, you may want to attend the rule development public workshop that is scheduled for later this week in Lecanto. The workshop will include an overview of the process used to develop the proposed minimum flows and serve as an additional opportunity for interested parties to provide input on the District's minimum flow recommendations. The workshop will begin at 6:00 PM on January 6, 2011 in Room 280 of the Lecanto Government Building. The Lecanto Government Building is located at 3600 West Sovereign Path, Lecanto, Florida 34461.

Please feel free to contact me directly if you have any questions concerning the upcoming workshop or additional comments on the development of minimum flows for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From: MAD MAX [mailto:rhinesmith@webtv.net]
Sent: Monday, January 03, 2011 2:24 AM
To: info
Subject: Homosassa River minimum flow

SIRS, I read Ron Miller's letter in the Chronicle. I swam in the river once this year, and went to wildlife park once. And of course watched fireworks,raft race, boat parade, and hit the bars on the river.

Therefore i like to visit the river. And i would become upset if it was damaged, wildlife harmed, turned to salt water, had real low levels etc.
Sooo please BE REAL CAREFUL WITH the Homosassa river. i do NOT think selling off its water is a good idea. MAX Rhinesmith Inverness, FL age 61

PS Remember that millions of $$$dollars have been invested by businesses along the river to attract tourists. And that the Wildlife park , along with those tourists, spend $$$ millions to help Citrus county thrive.

January 28, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Response to comments on minimum flows for the Homosassa River System submitted by Mr. Paul Carpenter on January 27, 2011

This memorandum addresses correspondences associated with an electronic mail submitted to the District by Mr. Paul Carpenter on January 27, 2011. The e-mail includes Mr. Carpenter's comments regarding development of minimum flows for the Homosassa River system and is attached to this memorandum. An e-mail response from the District is also attached.

DAL

Attachments: Attachment A - One page e-mail submitted to the District Mr. Paul Carpenter, dated January 27, 2011

Attachment B - One page e-mail sent to Mr. Paul Carpenter, dated January 28, 2011

Attachment A

One Page Attachment to January 28, 2011 Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Paul Carpenter

E-Mail Submitted to the District by Mr. Carpenter on January 27, 2011

From: Paul Carpenter
To: Doug Leeper
Subject: Homosassa River
Date: Thursday, January 27, 2011 7:55:42 PM

http://www.chronicleonline.com/content/residents-concerned-about-river-flows

I read this article about the Homosassa River. I have been coming up here since the 1950's also, and have seen this river destroyed by pumping to much water and cutting and poisoning all the grass in it. There is no grass on the bottom or shorelines. They don't want any grass in this river for some reason. The river needs the grass for oxygen and filtration and the fish need it for cover for there young. No wonder you can't see the bottom anymore.

Paul Carpenter
10294 W Halls River Rd
Homosassa,Fl.34448

Attachment B

One Page Attachment to January 28, 2011 Memorandum Addressing Comments Regarding Minimum Flows for the Homosassa River System Submitted by Mr. Paul Carpenter

E-Mail Sent to Mr. Carpenter on January 28, 2011

From: Doug Leeper
To: "Paul Carpenter"
Bcc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Cara S. Martin; Yassert Gonzalez; Jay Yingling; Karen
Lloyd
Subject: RE: Homosassa River
Date: Friday, January 28, 2011 8:08:09 AM

Mr. Carpenter:
Thank you for your recently submitted e-mail concerning development of minimum flows for the Homosassa River system. As you are aware, the Southwest Florida Water Management District is in the process of setting minimum flows for the river system to prevent significant harm that could occur as a result of water withdrawals. Once established, the minimum flows will be one criterion that our Regulatory Staff review when considering issuance of permits for water withdrawals that could affect flows from the springs that discharge to the river system.

Details on the currently proposed minimum flows for the Homosassa River system are available in a draft report titled *Recommended Minimum Flows for the Homosassa River System, July 12, 2010 Peer-Review Draft.* An electronic version of the report may be viewed and downloaded from the District web site at the following Uniform Resource Locator (URL) on the World Wide Web

http://www.swfwmd.state.fl.us/projects/mfl/reports/PeerReviewDraftHomosassaRiverMFLsReport2010-07-12.pdf

Public input such as yours is an important component of the minimum flows development process. Staff will consider your comments and include them along with other submitted input and peer-review findings in a revised version of the District report on proposed minimum flows for the river system. The revised report will be made available for public review and will be presented to the District Governing Board to support the Board's consideration of rule amendments associated with the proposed minimum flows.

Please feel free to contact me if you have any additional comments or questions regarding minimum flows for the Homosassa River or other water management issues.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Information pertaining to Springs Coast minimum flows provided to Mr. Matassa

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This memorandum addresses correspondence and other documents concerning information concerning minimum flows development for the Springs Coast that was provided to Mr. R. Matassa. Mr. Matassa is a member of the Coastal Rivers Basin Board of the Southwest Florida Water Management District.

DAL
Attachments

From:	Marty Kelly
To:	Doug Leeper; Mike Heyl
Subject:	Info Regarding Chass and Homosassa for Richard Matassa
Date:	Friday, January 28, 2011 8:31:33 AM

Guys,
We're meeting separately with Fritz Musselman and Judy Whitehead on Tuesday afternoon, but Mr. Matassa of the Coastal Basin Board said he would not need a meeting, and we could just forward him some relevant material as pdf's. Would like to get something to him today. Think we could introduce ourselves as points of contact with a link to the relevant MFL document and peer review reports, and email him a pdf of most recent MFL presentation on Chass and Homosassa, and perhaps one of our more inclusive responses to a citizen or group, if we have a good example. What do you think?

Haven't heard from Mr. Bunch.

Judy will not need anything in advance of our Tuesday meeting, and Barb has sent Fritz a copy of the Chass MFL report with peer review.

Mr. Richard Matassa's email address is richm@acivildesign.com.

Thanks,
Marty

Mike, I'll be in Tampa office this afternoon.

Martin H. Kelly, Ph.D.
Minimum Flows and Levels Program Director
Resource Projects Department
Phone: (352) 796-7211 Ext. 4235

From:	Mike Heyl
To:	Matassa (richm@acivildesign.com)
Cc:	Marty Kelly; Doug Leeper
Subject:	FW: MFL"s for Chass and Homosassa
Date:	Friday, January 28, 2011 9:02:17 AM
Attachments:	Chass_MFL_Summary.pdf

Mr. Matassa - I am following up on the discussion you had with Dr. Marty Kelly yesterday. I am the District's project manager for the Chassahowitzka Minimum Flow and Level (MFL) project. I have attached a brief synopsis that I prepared for the Citrus County Utility Director regarding the MFL project. If this is insufficient background, please let me know and I can provide additional information or meet with you at your convenience.

The full text of the report, appendices and peer review can be inspected or downloaded from the District's website at ***http://www.swfwmd.state.fl.us/projects/mfl/mfl_reports.php***

MGH

==
Michael G. Heyl - Chief Environmental Scientist
Mike.Heyl@SWFWMD.state.fl.us or Mike.Heyl@WaterMatters.org
==
SWFWMD/Ecologic Evaluation (7:00 am - 3:30 pm)
7601 U.S. Highway 301 1-813-985-7481 Ext 2211
Tampa, Fl. 33637-6759 1-813-987-6747 (Fax)

--------- Note ; District Limit for Incoming Email is 5 Megabytes -------
An ftp site is available for larger attachments ; http://ftp.swfwmd.state.fl.us/
This email consists of 100% recycled electrons. Consider the environment before printing
==

From: Mike Heyl
Sent: Thursday, December 09, 2010 1:10 PM
To: Robert.Knight@bocc.citrus.fl.us
Cc: Cara S. Martin; Marty Kelly; Doug Leeper
Subject: RE: MFL's for Chass and Homosassa

Mr. Knight - Attached please find a very brief summary of the components and results of the Chassahowitzka MFL. The first page lists the habitats (salinity and manatee thermal refuge) that were numerically evaluated. However, for a variety of reasons not all of these results were carried forward. For example, the 'chronic' thermal refuge for manatee must have water at least 3.8 feet deep and over 68 degrees temperature for three continuous days during a critically cold event. As it turns out, the location of the warm water was in an area too shallow to support manatees. Consequently, the chronic refuge evaluation was not carried forward. In contrast, the acute thermal refuge only requires that an area of sufficient depth maintain a temperature over 59 degrees for four hours. We did find an area of co-located depth and temperature meeting the acute thermal requirements and this metric was promoted to further evaluation.

From:	Doug Leeper
To:	"richm@acivildesign.com"
Cc:	Marty Kelly; Mike Heyl; Lou Kavouras
Subject:	Minimum Flows for the Homosassa River System
Date:	Friday, January 28, 2011 10:17:00 AM
Attachments:	Second Homosassa MFLs Wkshp 07jan2011 - Part A.pdf

Mr. Matassa:

Marty Kelly asked me to send you some information pertaining to the District's ongoing development of minimum flows for the Homosassa River system. A draft District report, associated appendices, and a peer-review of the draft report are available on the Minimum Flows and Levels (Environmental Flows) Documents and Reports page of the District web site at:

http://www.swfwmd.state.fl.us/projects/mfl/mfl_reports.php

To aid in your understanding of the proposed minimum flows for the river system, I am forwarding an Adobe PDF version of the slides used by District staff at a recent rule development public workshop that was held in Lecanto. I've split the slides into two parts, with Part A attached to this e-mail and Part B to be forwarded with a separate e-mail. I will also be providing a memorandum that address comments we have received on the proposed minimum flows from Mr. Ron Miller, a member of the Save the Homosassa River Alliance. Mr. Miller's comments are representative of the quite substantial number of comments and inquiries staff has received on the proposed minimum flows. Finally, I will forward a copy of a recent article on the proposed flows that appeared in the Citrus County Chronicle.

Please feel free to contact me if you have any questions regarding the proposed minimum flows or the documents I have provided.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From: Doug Leeper
To: "richm@acivildesign.com"
Cc: Marty Kelly; Mike Heyl; Lou Kavouras
Subject: Part B of Homosassa Minimum Flow Slides
Date: Friday, January 28, 2011 10:21:46 AM
Attachments: Second Homosassa MFLs Wkshp 07jan2011 - Part B.pdf

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Mr. Matassa:

Attached please find Part B of the slides staff used at the recent rule development public workshop held in Lecanto. Note that the file is dated January 7, 2011, but the workshop was actually held on January 6, 2011.

Douglas A. Leeper, Chief Environmental Scientist
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E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From:	Doug Leeper
To:	"richm@acivildesign.com"
Cc:	Marty Kelly; Mike Heyl; Lou Kavouras
Date:	Friday, January 28, 2011 10:24:13 AM
Attachments:	Leeper 2011 - Memo - Letter from RMiller 04jan2011.pdf Mims 2011 - Citrus County Chronicle - Residents concerned about river flows 27jan2011.pdf

---

Mr. Matassa:

Attached please find a memorandum and a recent newspaper article addressing comments on proposed minimum flows for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
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Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

March 17, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Information request and question submitted by Mr. Ron Miller regarding minimum Flows for the Homosassa River system

---

This memorandum documents an information request and question concerning the development of minimum flows for the Homosassa River system that was submitted to the Southwest Florida Water Management District on January 9, 2011 by Mr. Ron Miller. Mr. Miller's original e-mail submission and a January 11, 2011 e-mail response to his submission are provided as attachments to this memorandum. An e-mail to Mr. Miller, dated March 17, 2011 is also attached. This latter e-mail addresses revisions to some documents that were provided to Mr. Miller in January 2011.

DAL

Attachments: A- E-Mail from Ron Miller to Doug Leeper , dated January 9, 2011
B - E-Mail from Doug Leeper to Ron Miller, dated January 11, 2011
C - E-Mail from Doug Leeper to Ron Miller, dated March 17, 2011

Attachment A

<u>E-Mail from Ron Miller to Doug Leeper, Dated January 9, 2011</u>

From: Ron Miller
To: Doug Leeper
Cc: Al Grubman; Mike Cerwinski
Subject: MLF references
Date: Sunday, January 09, 2011 12:11:37 PM

Hi Doug,

As mentioned at the Public Workshop on Thursday, please make the following MFL references available on the internet:

1. Government Agency comments on the MFL draft report.
2. The SWFWMD slide presentation used at the workshop.
3. The Withlacoochee Regional Water Supply Authority report that includes the plan for regional distribution well fields in Citrus county.

In addition Ron Basso said that the aquifer in Citrus County was over 700 feet thick. However in 1998 John Parker, SWFWMD, said: "Earlier reports of 750 to 1250 feet of potable water in Citrus and Marion County are over estimated by a factor of three to six. The potable lens is generally 200 to 250 feet thick in a region that encompasses most of Citrus County and extends northeast to Ocala." Who is right. Basso or Parker?

Thank you,
Ron

Attachment B

<u>E-Mail from Doug Leeper to Ron Miller, Dated January 11, 2011</u>

From: Doug Leeper
To: "Ron Miller"
Cc: Ron Basso; Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Karen Lloyd; Jay Yingling;
Yassert Gonzalez
Subject: Request for Documents and Question - Homosassa MFLs
Date: Tuesday, January 11, 2011 8:43:00 AM

Ron:

Thanks for contributing to the public workshop last Thursday and thanks for your inquiry on the ninth (e-mail below). We have not yet established whether or how we will make public comment on proposed minimum flows available on the District web site other than the current approach we use, which involves inclusion of public/agency input and peer-review findings in "final" versions of the respective minimum flows or levels reports. Given this uncertainty regarding the posting of public input on the District web site, I thought it was prudent to provide you with the information identified in your e-mail as soon as possible. That's why I loaded the files you requested on a CD and gave you the disc at the Citrus Task Force meeting yesterday. I believe the following files were included on the disc, although I did not prepare a file-log in my haste to load the files onto the CD prior to driving to Lecanto.

Leeper 2010 - Memo-RMiller Questions on Homosassa MFLs 01oct2010
(Note: although the file above addresses an e-mail you submitted on October 23, 2010 and may be considered public input rather than
government agency input, I included the file because your e-mail included comments from Dana Bryan, who is with the Florida
Department of Environmental Protection)
Leeper 2010 - Memo-FFWCC 11oct2010 Comments on Homosassa MFLs with Poole Letter Attchmnt
Hackney et al. 2010 - Scientific Review...Minimum Flows...Homosassa...
Leeper 2010 - Memo-FDEP 15nov2010 Questions & Comments on Homosassa MFLs
Leeper 2010 - Memo-BKnight Questions Homosassa MFL
Leeper 2011 - Memo - BKnight Comments on Homo & Chass MFLs 07jan2011
Slides - DLeeper Second Homosassa MFLs Wkshp 07jan2011
Slides - RBasso Second Homosassa MFLs Wkshp 07jan2011
WRA 2010 - WRWSA Phase 2 Part A
WRA 2010 - WRWSA Phase 2 Part B

With regard to your question concerning the upper Floridan aquifer system in Citrus County, Ron Basso indicated that the limestone units that make up the flow system of the Upper Floridan aquifer occur from near surface to about 700 feet deep in Citrus County. Ron also indicated that the depth to the saline water interface (or thickness of potable water) is variable depending on the proximity to the Gulf Coast with a thin lens of freshwater found west of US 19 and greater thickness of fresh groundwater further east of US 19.

I hope this e-mail and the files provided to you yesterday address your concerns. As always, please feel free to contact me with any additional questions or comments regarding development of minimum flows for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org'

From: Ron Miller
To: Doug Leeper
Cc: Al Grubman; Mike Cerwinski
Subject: MLF references
Date: Sunday, January 09, 2011 12:11:37 PM

Hi Doug,

As mentioned at the Public Workshop on Thursday, please make the following MFL references available on the internet:

1. Government Agency comments on the MFL draft report.
2. The SWFWMD slide presentation used at the workshop.
3. The Withlacoochee Regional Water Supply Authority report that includes the plan for regional distribution well fields in Citrus county.

In addition Ron Basso said that the aquifer in Citrus County was over 700 feet thick. However in 1998 John Parker, SWFWMD, said: "Earlier reports of 750 to 1250 feet of potable water in Citrus and Marion County are over estimated by a factor of three to six. The potable lens is generally 200 to 250 feet thick in a region that encompasses most of Citrus County and extends northeast to Ocala." Who is right. Basso or Parker?

Thank you,
Ron

Attachment C

E-Mail from Doug Leeper to Ron Miller, Dated March 17, 2011

From: Doug Leeper
To: "bfberauer@aol.com"; "rmille76@tampabay.rr.com"; "BWR.CRRC@tampabay.rr.com"
Bcc: Marty Kelly; Cara S. Martin
Subject: Missing Figures for WRWSA Phase II Report
Date: Thursday, March 17, 2011 8:53:28 AM
Attachments: Figures 6-10 Through 6-13.msg

Greetings:

I'm sending this e-mail to address some necessary additions to the *Withlacoochee Regional WaterSupply Authority Phase II – Detailed Water Supply Feasibility Analyses* report that I recentlyprovided to you in response to your request. In reviewing the report, I noticed that four figures (6-10 through 6-13) were missing. This information was conveyed to the consultant that prepared thedocument for the Water Supply Authority, and they have provided four figures that should beincluded in the report (see the e-mail below and associated attachment from Pete Hubbell thatwas forwarded to me by John Ferguson).

I'd also like to provide a link to the 2010 Southwest Florida Water Management District Regional Water Supply Plan for the Northern Planning Region. I believe that I previously provided some of you with a copy of the draft version of the report, which has now been finalized and may be reviewed and downloaded from the following URL:

http://www.swfwmd.state.fl.us/documents/plans/RWSP/northern_planning_region.pdf

Please let me know if you have any trouble locating or downloading the District report or have questions regarding the figure additions for the Withlacoochee Regional Water Supply plan.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

<><><><><><>
From: John F. Ferguson
Sent: Wednesday, March 16, 2011 9:11 AM
To: Doug Leeper
Subject: FW: Phase II Reports
FYI.

<><><><><><>
From: Peter Hubbell [mailto:phubbell@wraconsultants.com]
Sent: Tuesday, March 15, 2011 3:04 PM
To: Jackson Sullivan

Cc: Joe Stapf; Brad Cornelius; Jeff Holcomb, Director; Josh Schmitz; Dale Ravencraft; Richard W. Radacky; Bruce Day, Planning Director; Ron Pianta; Katie Cottrell; Alys Brockway; Keith Mullins; Ron Allen, Water Director; William Smith; Bruce Hickle; Brian Armstrong; Sue Farnsworth; Timothy Pitts; Larry Haag, Attorney; Michael Shrader; Miki Renner; Trey Arnett; Robert Knight; John F. Ferguson; Ron Basso; Kenneth R. Herd
Subject: RE: Phase II Reports

All:

It has been brought to my attention that four (4) figures cited in the text of the Phase II Report – Detailed Water Supply Feasibility Analyses, where inadvertently left out of the document. Please print out the attached figures and put them into your copy of the report. Sorry for the oversight.

Pete
Peter G. Hubbell
Principal/Senior Hydrologist
Water Resource Associates, Inc.
4260 W. Linebaugh Avenue
Tampa, FL 33624
Office: 813-265-3130
Fax: 813-265-6610
Cell: 813-610-2828

NOTE: remainder of e-mail string deleted by Doug Leeper

January 12, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Information and request for comment submitted on January 11, 2011 by Mr. Ron Miller regarding minimum Flows for the Homosassa River system

---

This memorandum documents an information request associated with development of minimum flows for the Homosassa River system that was submitted to the Southwest Florida Water Management District on January 11, 2011 by Mr. Ron Miller. Mr. Miller's original e-mail submission and a January 12, 2011 e-mail response by Ron Basso, a Professional Geologist/Engineer with the District, are provided as attachments to this memorandum.

DAL

Attachments: E-Mail from Mr. Ron Miller, dated January 11, 2011 with three scanned pages from a newspaper
E-Mail to Mr. Ron Miller, dated January 12, 2011

Attachment A to January 12, 2011 Memorandum Concerning Information and a Request for Comment Submitted by Mr. Ron Miller Regarding Minimum Flows for the Homosassa River System

E-Mail from Mr. Miller, Dated January 11, 2011

From: Ron Miller
To: Doug Leeper
Cc: Ron Basso; Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Karen Lloyd; Jay Yingling; Yassert Gonzalez; Al Grubman; Jim Bitter; Ron Schultz; Priscilla Watkins; Bill Garvin; Mike Cerwinski; Mike
Moberley; Veronica Craw; Gerry Mulligan; Curt Ebitz; Norm Hopkins
Subject: Re: Request for Documents and Question - Homosassa MFLs
Date: Tuesday, January 11, 2011 1:01:13 PM
Attachments: Page01.pdf, Page02.pdf, Page03.pdf

Hi Doug,
Good to see you at the Task Force meeting yesterday. Thank you for the reference information.

Basso may be right that the limestone goes to 700 feet but John Parker has it that the potable lens is only 200 to 250 feet thick. Parker says potability is judged by the sulfates and minerals as well as salinity. If the model is adjusted to account for the potable lens then we should be three times more sensitive to withdrawals than Basso's model has shown. I have attached copies of the **Feb 21, 1998 Citrus County Chronicle** where Parker explains the situation. Please review and comment.

Thanks,
Ron

From: Doug Leeper
Sent: Tuesday, January 11, 2011 8:43 AM
To: Ron Miller
Cc: Ron Basso ; Mark Barcelo ; Marty Kelly ; Sid Flannery ; Mike Heyl ; Cara S. Martin ; Karen Lloyd ; Jay Yingling ; Yassert Gonzalez
Subject: Request for Documents and Question - Homosassa MFLs

Ron:

Thanks for contributing to the public workshop last Thursday and thanks for your inquiry on the ninth (e-mail below). We have not yet established whether or how we will make public comment on proposed minimum flows available on the District web site other than the current approach we use, which involves inclusion of public/agency input and peer-review findings in "final" versions of the respective minimum flows or levels reports. Given this uncertainty regarding the posting of public input on the District web site, I thought it was prudent to provide you with the information identified in your e-mail as soon as possible. That's why I loaded the files you requested on a CD and gave you the disc at the

Citrus Task Force meeting yesterday. I believe the following files wereincluded on the disc, although I did not prepare a file-log in my haste to load the files onto the CDprior to driving to Lecanto.

Leeper 2010 - Memo-RMiller Questions on Homosassa MFLs 01oct2010
(Note: although the file above addresses an e-mail you submitted on October 23, 2010 and may be considered public input rather than government agency input, I included the file because your e-mail included comments from Dana Bryan, who is with the Florida Department of Environmental Protection)
Leeper 2010 - Memo-FFWCC 11oct2010 Comments on Homosassa MFLs with Poole Letter Attchmnt
Hackney et al. 2010 - Scientific Review...Minimum Flows...Homosassa...
Leeper 2010 - Memo-FDEP 15nov2010 Questions & Comments on Homosassa MFLs
Leeper 2010 - Memo-BKnight Questions Homosassa MFL
Leeper 2011 - Memo - BKnight Comments on Homo & Chass MFLs 07jan2011
Slides - DLeeper Second Homosassa MFLs Wkshp 07jan2011
Slides - RBasso Second Homosassa MFLs Wkshp 07jan2011
WRA 2010 - WRWSA Phase 2 Part A
WRA 2010 - WRWSA Phase 2 Part B

With regard to your question concerning the upper Floridan aquifer system in Citrus County, Ron Basso indicated that the limestone units that make up the flow system of the Upper Floridan aquifer occur from near surface to about 700 feet deep in Citrus County. Ron also indicated that the depth to the saline water interface (or thickness of potable water) is variable depending on the proximity to the Gulf Coast with a thin lens of freshwater found west of US 19 and greater thickness of fresh groundwater further east of US 19.

I hope this e-mail and the files provided to you yesterday address your concerns. As always, please feel free to contact me with any additional questions or comments regarding development of minimum flows for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
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From: Ron Miller [mailto:rmille76@tampabay.rr.com]
Sent: Sunday, January 09, 2011 12:11 PM
To: Doug Leeper
Cc: Al Grubman; Mike Cerwinski
Subject: MLF references
Hi Doug,
As mentioned at the Public Workshop on Thursday, please make the following MFL references available on the internet:

1. Government Agency comments on the MFL draft report.
2. The SWFWMD slide presentation used at the workshop.
3. The Withlacoochee Regional Water Supply Authority report that includes the plan for regional distribution well fields in Citrus county.

In addition Ron Basso said that the aquifer in Citrus County was over 700 feet thick.

However in 1998 John Parker, SWFWMD, said: “Earlier reports of 750 to 1250 feet ofpotable water in Citrus and Marion County are over estimated by a factor of three to six.
The potable lens is generally 200 to 250 feet thick in a region that encompasses most of Citrus County and extends northeast to Ocala.” Who is right. Basso or Parker?
Thank you,
Ron

CITRUS CHRONICLE -

CRYSTAL RIVER, FLORIDA 34429

COUNTY

INVERNESS, FLORIDA 34452

Lecanto and Dunnellon started sub-regional boys basketball playoff action Friday night. Dunnellon hosted Pasco, Lecanto traveled to Zephyrhills. 1B

Feb 21,st 1998

Aquifer smaller than thought

New calculations reveal less potable water than previous measurements

By Jim Hunter
Staff writer

As it turns out, Citrus County is not as "water rich" as once believed.

While it has good underground water resources for current needs, the vertical thickness of the "lens" of drinkable, or potable, water under the county has been significantly overestimated, water managers are finding.

In notes for a discussion on large water use permits, John Parker at the Southwest Florida Water Management District, noted recently that the northern portions of the water district, including Citrus and Marion County, are usually conceived as "water rich."

"While this may be true in terms of vast quantities of water moving though the hydrologic systems to springs and rivers," he wrote, "the amount of potable water in aquifer storage has been greatly overestimated.

"Earlier reports of 750 to 1,250 feet of potable water in Citrus and Marion counties are overestimated by a factor of three to six.

"The potable lens is generally 200 to 250 feet thick (or less) in a region which encompasses most of Citrus County and extends northeast to Ocala.

"The active circulation zone of groundwater is much thinner than previously expected, and the residence time for water is correspondingly less than previously expected."

Such overestimation could have substantial, long range-effects on this region as it plays into decisions made about planning and future development, county officials say. It will also affect how the water district permits large water supply uses.

Please see **WATER**, *Page* **2A**

Officials halt river traffic

By Jim Hunter
Staff writer

The Withlacoochee River was closed to

School board officials about using [illegible] Primary School as a temporary [illegible] for the center and the response has been favorable.

"If we just had one place in the county where these parents could meet to drop

having to supervise that visitation," Gurrola said. "We would have a trained staff to do that."

That staff will consist of the volunteers who came forward to help.

Gurrola said she's hoping that a civic

"I'm always int[illegible] helping children an[illegible] this is something [illegible] need in this county

"She started talking [illegible] it sounded like a gre[illegible]

WATER

continued from Page 1A

The evidence of the overestimation has been gradually emerging in the past few years as more and more data has been collected and analyzed by the water district.

The "water rich" moniker was put on Citrus and the surrounding areas when U.S. Geologic Survey and Florida Bureau of Geology survey information showed that the potable lens of water under the county appeared to vary from about 300 feet to 1,200 feet thick.

The water is indeed there in the karst, or the limestone strata underlying this area, and actually the water goes much deeper than the drinkable water.

The problem is that the potability of the water in the Floridan Aquifer was judged in those first studies on just chlorides — for saltwater — not the other chemical components, Parker said in a recent interview.

Parker is the water Use Regulation Section manager with the water district for this region.

So the water's potability was being judged on its salinity, which will be encountered beginning at certain levels in the ground water depending on the location and increasing with depth.

"The hydrologists were looking at chloride, not sulfate," Parker said.

He said the original information wasn't bad, it just wasn't complete. Newer exploratory wells and analysis have provided the new picture, and more wells are going to provide further data as the district continues its water assessment program in this end of the district, he said.

That older information has led to situations where someone drills a 500-foot well and, though the salinity may not exceed the threshold for drinking water, the water is too heavy in sulfates or minerals for drinking water, though they thought they had plenty of good water under them.

Parker said when a well hits the sulfate threshold, it may not have encountered an appreciable increase in chlorides, which accounts for the sizable difference in the old statistics and the new.

That kind of "overdrilling" based on the old information has already occurred in a number of locations in the county, he said, and well drillers and permitting personnel have had to adjust for it. It has happened, for example, in wells in Dunnellon and the county's Citrus Hills water facility, he said.

So, judged on the potable standards for sulfate, the lens of water is only a fraction of what was once believed, and water managers who permit wells and are responsible for the resource have revised their way of looking at the aquifer in this region.

From the top of the potable water lens to the bottom of it is generally less than 300 feet in Citrus County, Parker said, making the county technically less underground water rich, at least in terms of potable water than was once thought.

That has various ramifications aside from the change in the quantity of available drinking water, he said.

For one thing, it means that the potable water moves through underground faster than was thought before.

That's because the closer one measures to the top of the aquifer, the faster the water moves underground, he said. The consequences of that need to be explored, he said.

Then there is the matter of the whole system and how much withdrawal it can take. "What it means in terms of sustainability, we don't know yet. We need to have more information about that."

After the negative environmental e[illegible] of what turned out to be overpumping for Tampa Bay in Pasco County wellfields water scientists are being very cautious about how systems work and are affected by large, long-term withdrawals.

In recent discussions about long term consumptive use permits for large wells, Parker posed the question of how a more shallow, faster moving aquifer is affected by drawdowns from large wells, like a public supply wellfield, that may only draw the aquifer down a foot, but overlaps with other similar drawdowns in that region.

What cumulative effect that overlap will have needs to be studied, he said. What effect that has on coastal springs and rivers fed by the aquifer needs to be studied too he said, adding that the coastal springs need to be protected.

"This new view of the northern part of the district mean that the district's predictive capability is uncertain as to how the aquifers in the aforementioned region will respond to increasing use in the long term," Parker wrote.

He continued: "The aquifer systems may be much less robust than we think, more sensitive to drawdown and the possibility of upconing." Upconing is when the highly mineralized water below the drinkable water rises as the pressure of the water above is removed as it is pumped out.

"Upconing effects are observed in Marion County, at several locations along the State Road 200 corridor between Dunnellon and Ocala," he wrote, "evidenced by sulfate and total dissolved solid concentrations at surprisingly shallow depths."

Parker said in the interview that the Citrus geology consists at the top of "pretty droughty soils" and a rather leaky system, meaning that there is not an impervious confining layer over the aquifer to protect it from infiltration from above. That recharges a underground system, but it also makes it vulnerable to pollution from above.

Page 2

…e really County.
…" he said.
…about it and I thought
…at idea. So, I asked if

…saying that I know we can do this for the children."

Gurrola said the center has the potential to have long-reaching effects on the

…meeting at 7 p.m. Mon… courtroom B at the Courthouse.

Currently the effects of the drawdown in this northern region of the district are causing a pretty low level of stress on the aquifer, Parker said, but he added that with development and public supply needs, "It will increase."

From the water district's point of view, all this means more data and more studies and modeling are needed. "We need to understand it better and proceed with caution so we don't overproduce," Parker said.

"It's important to get answers ahead of the curve."

One thing it does mean, however, is that "We need more careful planning."

Parker said, "We can provide the information to the county as we develop it to use in land use decisions. The water district, he said, will use the information in how it applies its water use criteria in permitting and protecting the water resources. It's less robust."

He said the new way of looking at the potable water in the aquifer is like finding out you had a smaller battery in your car than you once thought, and you have to act accordingly.

Citrus County Commission Chairman Gary Bartell said he would definitely press for that information from the district for use by the county. He said it was possible that "It won't be too long until this area is looking for alternative water supplies just like other areas are."

One of those supplies, Parker pointed out is a good surface water supply the county has, Lake Rousseau at the end of the Withlacoochee River. That has been noted in a district water resources inventory and was a source which some, like state Rep. Nancy Argenziano warned the Tampa Bay area at one time was coveting for a new source of drinking water.

Bartell said the revised figures on the potable water in the aquifer under Citrus has a message. "We need to start planning for 10 years down the road. We need to plan for that and not wait until it's a crisis situation."

In his notes on long term permitting, Parker had written: "We learned a lot about how the aquifer system in Pasco County responds to withdrawals, largely by over-permitting mistakes.

"The mistakes were facilitated by incorrect assumptions as to the time factor in predictive modeling, and by ignorance of the simplest water budget assessments."

Parker reiterated in the interview: "Let's not think we understand the limitations of the system and make mistakes like the one made in Pasco."

County Administrator Gary Kuhl said the revised view of the drinkable aquifer under the county means that "We need to know we have a limited supply and we have to be careful how we use it."

The county needs to be looking at water conservation on both an individual, personal basis and on the larger scale, he said.

""We have to be a lot more conscious of our water use than we were when we were under the impression we were water rich."

He said one of the things the county is already doing is investigating reuse of wastewater treatment effluent in irrigation for large users like golf courses.

That is also part of the plan for the Homosassa sewer district planned to serve the southwest quadrant of the county, he said.

Aquifer has different traits in parts of state

By Jim Hunter
Staff writer

Potable water has traditionally come from underground in this region of Florida. The source of that water is the Floridan Aquifer that resides in the porous limestone that makes up much of the underground geology of this part of Florida.

The aquifer changes further south in the state, becoming less and less of a good underground source for drinking water. Going south on the map, near Manatee County, there is a dependence on surface water rather than groundwater for drinking water supplies.

The northern half of the Southwest Florida Water Management District is made up of 16 counties from Levy/Marion to Highlands/DeSoto and Charlotte counties.

The aquifer in the northern region of the water district is replenished by inland rainfall. It percolates into the ground and then moves slowly underground, down the gradient toward sea level and out to the Gulf of Mexico. Coastal springs are fed by the aquifer.

The aquifer has a "len" of fresh, good quality drinking water floating at the top. The thickness of that lens varies, being the thickest in Pasco County.

The whole aquifer goes very deep. At certain depths sulfates and chlorides begin to be evident, eventually exceeding the 250-milligram-per-liter threshold for drinking water standards.

Further down, the aquifer becomes more like saltwater and then even further the becomes extremely mineralized.

The further down, the more stagnant and slower moving the water is.

Page 3

…ER REPORT

Attachment B to January 12, 2011 Memorandum Concerning Information and a Request for Comment Submitted by Mr. Ron Miller Regarding Minimum Flows for the Homosassa River System

E-Mail sent to Mr. Miller, Dated January 12, 2011
Note: e-mail string deleted

From: Ron Basso
To: Ron Miller; Doug Leeper
Cc: Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Karen Lloyd; Jay Yingling; Yassert Gonzalez; Al Grubman; Jim Bitter; Ron Schultz; Priscilla Watkins; Bill Garvin; Mike Cerwinski; Mike Moberley; Veronica Craw; Gerry Mulligan; Curt Ebitz; Norm Hopkins
Subject: RE: Request for Documents and Question - Homosassa MFLs
Date: Wednesday, January 12, 2011 9:13:06 AM

Mr. Miller:

The potable thickness of the aquifer is governed by the elevation above sea level of the Floridan aquifer water level. There is a general relationship that for each foot of freshwater head above sea level, the location of the saltwater interface is 40 feet below that. So if the elevation of the Floridan aquifer water level is 10 ft above sea level, then the saltwater interface would be 400 ft below. Thus, the depth of the saltwater interface varies according to water level elevation of the Floridan aquifer – as one moves closer to the coast, the Upper Floridan Aquifer (UFA) water level elevation decreases and the saline water zone is shallower – as one moves further inland, the UFA water level elevation increases, and the saline zone is deeper. This relationship can vary due to other factors but it's a good rule of thumb. The presence of higher sulfate water within the UFA appears to be a localized situation that cannot be generalized across the entire County. It typically occurs within deeper portions of the aquifer near its base where gypsum and anhydrite are present and groundwater flow is sluggish.

In response to assumptions regarding the flow model, it contains parameters for how groundwater moves through the limestone and is independent of water quality. The presence of mineralized or higher sulfate water would not affect the ability of the model to predict UFA water level response due to pumping or other factors. However, as a side note – in Citrus County most of the Upper Floridan aquifer permeability (or its ability to yield water) lies within the uppermost unit – the Ocala Limestone. This is a karst-dominated formation that is about 200 feet thick which contains numerous large conduits, voids, and openings. In the Northern District model, over 90% of the Upper Floridan aquifer permeability is simulated within this unit in Citrus County. The ND model contains individual layers for the sand, clay, and each rock formation within the Upper Floridan aquifer (i.e. the Suwannee Limestone, the Ocala Limestone, and the Avon Park Formation). In Citrus County, only the Ocala and Avon Park Formations are present.

I hope this detailed explanation addresses your concerns regarding the groundwater flow system in Citrus County. Please contact me if you have any further questions or concerns regarding this issue.

Ron Basso, P.G.
Senior Professional Geologist
Hydrologic Evaluation Section
Southwest Florida Water Management District
ph 1-800-423-1476 (in state)
ph 352-796-7211, ext. 4291 (outside state)
FAX 352-797-5799

January 26, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Question submitted by Mr. Ron Miller regarding sinkholes and minimum flows for the Homosassa River system

---

This memorandum documents correspondence between Mr. Ron, Miller, with the Save the Homosassa River Alliance and Mr. Doug Leeper, with the Southwest Florida Water Management District regarding sinkholes and development of minimum flow recommendations for the Homosassa River system.

Mr. Miller's e-mail, which was submitted on January 23, 2011, and an e-mail response sent to Mr. Miller on January 26, 2011 are attached.

DAL

Attachments: Attachment A - E-Mail from Mr. Ron Miller, dated January 23, 2011
Attachment B - E-Mail to Mr. Ron Miller, dated January 26, 2011

Attachment A to January 26, 2011 Memorandum Concerning a Question Submitted by Mr. Ron Miller Regarding Sinkholes and Minimum Flows for the Homosassa River System

E-Mail from Mr. Miller, Dated January 23, 2011

From: Ron Miller
To: Doug Leeper
Subject: Sinkholes
Date: Sunday, January 23, 2011 3:31:31 PM

Hi Doug,
It has been brought to our attention that water withdrawal and the related sinkholes have an impact on our homeowner costs. Insurance companies are raising the rates in Citrus County due to sinkholes in the Plant City area. And those sinkholes are related to water withdrawals.

Have your Homosassa River MFL studies considered the impact the water withdrawal will have on the occurrence of local sinkholes?

Thank you,
Ron

Attachment B to January 26, 2011 Memorandum Concerning a Question Submitted by Mr. Ron Miller Regarding Sinkholes and Minimum Flows for the Homosassa River System

E-Mail to Mr. Miller, Dated January 26, 2011

From:	Doug Leeper
To:	"Ron Miller"
Cc:	Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Cara S. Martin; Jay Yingling; Yassert Gonzalez; Karen Lloyd
Subject:	RE: Sinkholes
Date:	Wednesday, January 26, 2011 12:05:00 PM

Ron:

The potential for development of sinkholes, whether caused by natural or anthropogenic forces, was not evaluated as part of the analyses undertaken to develop minimum flow recommendations for the Homosassa River system. The random nature of sinkhole development precludes our ability to predict sinkhole occurrence. That said, it may be reasonable to assume that modest flow reductions on the order of five percent or less would not likely be expected to substantially increase the risk of sinkhole occurrence in the vicinity of the river system. This assumption is based on the potential relationship between lowered aquifer levels and the relatively minor influence of current and projected water use on area aquifer levels. Modeled effects of water use through the year 2030 indicate that the drawdown of the Upper Floridan aquifer in the vicinity of the Homosassa River system is 0.25 feet or less. For perspective, the occurrence of sinkholes and the drying of wells resulting from the groundwater withdrawals for crop protection in the Dover/Plant City area in January 2010 were associated with up to a sixty foot drop in the aquifer water level.

I hope this information addresses the comments and question raised in your recent e-mail. As always, please feel free to contact me if you have additional questions. If I can’t answer them, I can put you in touch with someone at the District who should be able to address your concerns.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

January 27, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments pertinaing to hydrogeology of the Homosassa River System submitted by Mr. Ron Miller on January 27, 2011

This memorandum documents an e-mail and associated attachments submitted to the District by Mr. Ron Miller on January 27, 2011. The e-mail concerns hydrogeology in the Homosassa River system and is attached to this memorandum.

DAL
Attachments: e-mail and attachments submitted to the District Mr. Ron Miller on January 27, 2011

Attachment

E-Mail with Four Attachments Submitted to the District by Mr. Miller on January 27, 2011

Note: E -mail string deleted by Doug Leeper

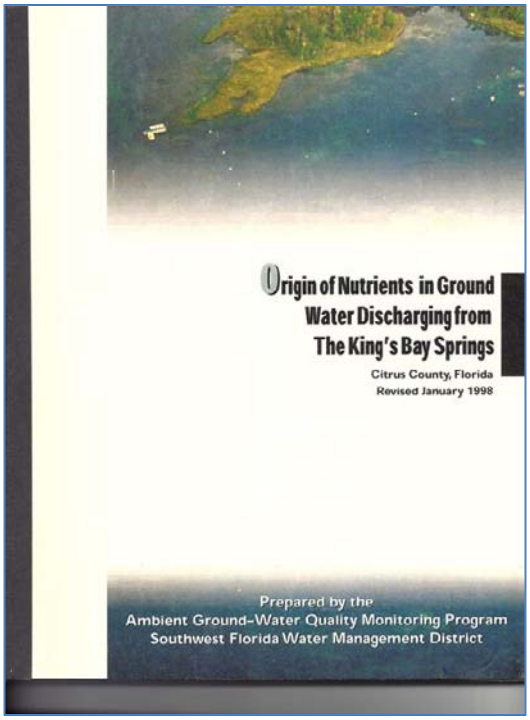
From: Ron Miller
To: Ron Basso; Doug Leeper
Cc: Mark Barcelo; Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Karen Lloyd; Jay Yingling; Yassert Gonzalez; Al Grubman; Jim Bitter; Ron Schultz; Priscilla Watkins; Bill Garvin; Mike Cerwinski; Mike Moberley; Veronica Craw; Gerry Mulligan; Curt Ebitz; Norm Hopkins; Alan Martyn Johnson
Subject: Re: Request for Documents and Question - Homosassa MFLs
Date: Thursday, January 27, 2011 9:21:30 PM
Attachments: Jones0001b.jpg
Jones0002b.jpg
Jones0003b.jpg
Jones0004b.jpg

Hi Doug & Ron,

Thank you for the aquifer/salinity model information. The rule of thumb is very interesting. In SWFWMD report on "Origins of Nutrients in Ground Water Discharging from the King's Bay Springs", Gregg Jones confirms the lens of the potable water in Citrus County to average about 200 to 300 feet thick, thinner along the coastline. Attached are the related pages. Jones reports the shallow nature of the potable zone to be generalized across Citrus County. If this is due to sulfur near the bottom of the aquifer then the aquifer is not much deeper in Citrus County.

Ron

NOTE: Remainder of e-mail string deleted by Doug Leeper



Yobbi (1992) showed the approximate position of the 250 mg/l line of equal chloride concentration at a depth of 100 feet below sea level in the Upper Floridan aquifer based on samples collected from wells and springs (1964 through 1980) (Figure 8). Chloride concentrations in ground water exceeding 250 mg/l generally occur at a depth of less than 100 feet seaward of this line and greater than 100 feet inland of this line.

Data presented in Yobbi (1992), water quality data collected by the AGWQMP (DeHaven, 1995) from its coastal monitor well network, and surface geophysical surveys (Bisdorf and Zohdy, 1979; Stewart and Gay, 1983;) indicate very prominent landward reentrants of the transition zone in the vicinity of the major coastal springs. The reentrants result from the concentration of discharge at the major springs, which has the effect of reducing fresh-water head. This allows salt water to migrate inland in the vicinity of the springs.

Thickness of the Potable Water Zone

Figure 9 depicts a generalized thickness of potable ground-water in the Floridan aquifer across Citrus County. The potable thickness interpretation is based on historical hydrogeologic data spanning several years and includes water-quality data from monitor wells, test drilling data, and from geophysical logs (Appendix IV). Water quality criteria for determining the thickness of the potable-water zone are defined by ground-water conditions where chloride or sulfate concentrations exceed the 250 mg/l drinking water standards established by the FDEP (1993).

The depth to nonpotable ground water was determined from the casing depths of wells when sample data indicated that nonpotable conditions exist in the open wellbore intersecting the aquifer. Water-quality profiles obtained during test drilling at monitor sites or associated geophysical data were also used to verify water-quality changes with depth.

Thickness of the potable-water zone in the Floridan aquifer in Citrus County and the study area ranges from 300 feet in the southern and central regions, to less than 200 feet along the coastal margin and in the Tsala Apopka/Withlacoochee River area. The average thickness of potable ground water in Citrus County is 200 to 300 feet, although nonpotable conditions occur less than 100 feet deep near the coast where landward reentrants of the transition zone exist near the spring complexes.

Potable thickness in the central and eastern regions of the county is limited by the occurrence of sulfate-rich waters emanating from the dissolution of gypsum or anhydrite near the base of the Floridan aquifer (Sacks 1996, Hickey 1990). Depth to sulfate-rich ground water is controlled by the depth of sulfate minerals and the recharge potential, where a high degree of ground-water recharge in an active flow system tends

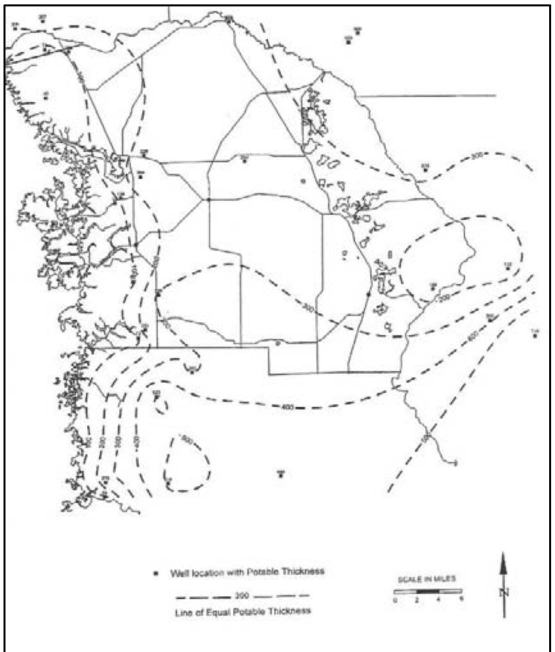


Figure 9. Generalized Thickness of the Potable Water Zone in the Floridan Aquifer across Citrus County.

to increase potable thickness. A thinner freshwater lens is found in regions where ground-water recharge rates are lower and where ground-water discharge is occurring, such as along the Withlacoochee River and the Gulf coast.

Although Causey and Leve (1976) determined the thickness of the potable-water zone in the northern portion of the SWFWMD to be considerably greater, the information presented above is based on recent data that provide a more accurate assessment of the potable-water thickness. The conclusion that the potable-water zone is considerably thinner than what was described by Causey and Leve is supported by Ryder (1985).

Description of the King's Bay Springs

Thirty springs in and around King's Bay constitute the headwaters of Crystal River, which discharges to the Gulf of Mexico approximately six miles west of the bay. Figure 1 depicts the locations of eleven of the springs that were considered important enough to periodically sample. The bay is approximately 600 acres in surface area and ranges from 3 to 10 feet in depth throughout most of its area. Ground-water discharge from the springs accounts for the majority of the 975 cfs (630 mgd) (Yobbi and Knochenmus, 1989) of water flowing from King's Bay to the Gulf of Mexico. The springs discharge through subaqueous vents or flow into the bay over short spring runs. Because the spring discharge comprises a large percentage of the water flowing from King's Bay, it plays an important role in determining the overall water quality of the bay (Romie, 1990). The largest and best known of the King's Bay Springs is Tarpon Hole (Figure 1). Also known as Crystal Spring and Big Hole, it has become a very popular dive location and Manatee viewing area. The spring is a large subaqueous vent approximately 200 feet in diameter and 50 feet deep.

The discharge of the springs in King's Bay is affected by tidal fluctuations (Rosenau et al. 1977). Conductivity readings taken before and after dead-low tide by AGWQMP staff indicate that the water quality of many coastal springs changes with tidal fluctuations. In addition, Yobbi (1992), has documented changes in specific conductance that range from 5,000 to 20,000 microsiemens per centimeter between low and high tide in nearby coastal springs.

April 30, 2012

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: January 2012 Rule Development Public Workshop on Proposed Minimum Flows for the Homosassa River System

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This memorandum documents communications and other public correspondence associated with a rule development public workshop on proposed minimum flows for the Homosassa River system that was hosted the Southwest Florida Water Management District on January 6, 2012.

DAL

Attachments

From:	Doug Leeper
To:	(priswat@tampabay.rr.com); Ron Miller (rmille76@tampabay.rr.com); "maryann.poole@myfwc.com"; "Dale.Jones@MyFWC.com"; "eric.nagid@MyFWC.com"; "traci.wallace@MyFWC.com"; Hoehn, Ted; Voyles, Carolyn (Carolyn.Voyles@dep.state.fl.us); Greenwood, Kathleen (Kathleen.Greenwood@dep.state.fl.us); Llewellyn, Janet (Janet.Llewellyn@dep.state.fl.us); "rauerman@tampabay.rr.com"; "mczerwin@tampabay.rr.com"; "wgarvin@tampabay.rr.com"; "martynellijay@hotmail.com"; "ktripp@savethemanatee.org"; Michael Lusk (Michael_Lusk@fws.gov); "Joyce_Kleen@fws.gov"; "jmgarvin@tampabay.rr.com"; "jbitter@tampabay.rr.com"; "jimmiekey22@yahoo.com"; "2cetechnology21@gmail.com"; "dhiers3@gmail.com"; "Art.Yerian@dep.state.fl.us"; "grubman1@gmail.com"
Cc:	Marty Kelly; Sid Flannery; Mark Barcelo; Ron Basso; Cara S. Martin; Karen Lloyd; Jay Yingling; Yassert Gonzalez
Subject:	Update on Minimum Flows Development for the Homosassa River System
Date:	Monday, November 22, 2010 4:11:00 PM

Greetings:

I'm writing to let you know that District staff will not be presenting proposed rule amendments associated with minimum flows for the Homosassa River system to the Southwest Florida Water Management District Governing Board in December. Staff has delayed presentation of the rule amendments to the Board to allow for additional time to review and consider public input concerning minimum flows for the river system, and to provide for the scheduling of a second public workshop on the proposed minimum flows.

The second public workshop will begin at 6:00 PM on January 6, 2011 in Room 280 of the Lecanto Government Building. The Lecanto Government Building is located at 3600 West Sovereign Path, Lecanto, Florida 34461.

Please feel free to contact me with questions or comments regarding the planned workshop or the development of minimum flows for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

From:	Ron Miller
To:	Doug Leeper
Subject:	Re: Update on Minimum Flows Development for the Homosassa River System
Date:	Monday, November 22, 2010 5:25:55 PM

Hi Doug,

Good idea. Thanks for the heads up.
Happy Thanksgiving!

Ron

From: Doug Leeper
Sent: Monday, November 22, 2010 4:11 PM
To: (priswat@tampabay.rr.com) ; Ron Miller (rmille76@tampabay.rr.com) ; maryann.poole@myfwc.com ; Dale.Jones@MyFWC.com ; eric.nagid@MyFWC.com ; traci.wallace@MyFWC.com ; Hoehn, Ted ; Voyles, Carolyn (Carolyn.Voyles@dep.state.fl.us) ; Greenwood, Kathleen (Kathleen.Greenwood@dep.state.fl.us) ; Llewellyn, Janet (Janet.Llewellyn@dep.state.fl.us) ; rauerman@tampabay.rr.com ; mczerwin@tampabay.rr.com ; wgarvin@tampabay.rr.com ; martynellijay@hotmail.com ; ktripp@savethemanatee.org ; Michael Lusk (Michael_Lusk@fws.gov) ; Joyce_Kleen@fws.gov ; jmgarvin@tampabay.rr.com ; jbitter@tampabay.rr.com ; jimmiekey22@yahoo.com ; 2cetechnology21@gmail.com ; dhiers3@gmail.com ; Art.Yerian@dep.state.fl.us ; grubman1@gmail.com
Cc: Marty Kelly ; Sid Flannery ; Mark Barcelo ; Ron Basso ; Cara S. Martin ; Karen Lloyd ; Jay Yingling ; Yassert Gonzalez
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Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org

Web Site: watermatters.org

From:	Doug Leeper
To:	Josie Guillen
Cc:	Marty Kelly; Mike Heyl; Mark Hammond
Subject:	Draft Meetings Announcement for Citrus Task Force
Date:	Wednesday, December 01, 2010 10:48:41 AM

Josie – Here's a draft meeting announcement that you may want to use for an e-mail to the Citrus County Task Force of the Citrus-Hernando Waterways Restoration Council. – Doug Leeper

Good Morning.
Below are two meeting announcements from Mr. Doug Leeper of our staff. Mr. Leeper addressed the Task Force at the August meeting and you asked him to keep you apprised of developments related to establishing minimum flows for the Homosassa River system and other area water bodies. If you have any questions regarding the workshops or any other minimum flows and levels issues, please contact Mr. Leeper. Thank you.

PUBLIC WORKSHOP ANNOUNCEMENTS
The Southwest Florida Water Management District will be hosting public workshops in December 2010 and January 2011 for discussion, respectively, of proposed minimum flows for the Chassahowitzka River system and the Homosassa River system. Minimum flows are defined as "… the the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area" (Section 373.042, Florida Statutes). Minimum flows are adopted by the District Governing Board into Chapter 40D-8, Florida Administrative Code, and are used for regulatory purposes, including review of water-use permits.

The planned workshops will be the second public meetings convened to discuss the proposed minimum flows for each river system, and have been scheduled to afford additional opportunities for public input on the proposed minimum flows. Public comment received during and following the workshops will be used to modify the minimum flows, as appropriate, and made available to the District Governing Board when staff present recommended levels to the Board for adoption into the Florida Administrative Code.

Here's the pertinent information for the workshops.

What: Second public workshop on proposed minimum flows for the Chassahowitzka River system in Citrus and Hernando Counties, Florida
When: December 16, 2010; 6:00 to 8:30 P.M.
Where: Lecanto Government Building – Room 280, 3600 West Sovereign Path, Lecanto, FL 34461

What: Rule development public workshop on proposed minimum flows for the Homosassa River system in Citrus County, Florida
When: January 6, 2011; 6:00 P.M.
Where: Lecanto Government Building – Room 280, 3600 West Sovereign Path, Lecanto, FL 34461

Please contact Doug Leeper if you have any questions or comments concerning the upcoming workshops or the proposed minimum flows. Contact information for Doug is provided below.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

Recommended Minimum Flows for the Homosassa River System

Southwest Florida Water Management District

Second Rule Development Public Workshop
Lecanto, Florida
January 6, 2011

Doug Leeper, Ron Basso, Sid Flannery, Marty Kelly and Cara Martin

Minimum Flows and Levels

- Florida Statutes, Section 373.042 -

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.

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

What is Significant Harm?

- Not defined by state law
- Defined or implicit in District standards or thresholds used to establish minimum flows and levels
- Standards or thresholds are specific to water resource type and value

Examples

- Preventing cypress wetland degradation in lake basins
- Preventing or slowing rate of saltwater intrusion into aquifers
- Preventing more than a 15% decline in habitat availability in river segments

Minimum Flows and Levels Considerations

- Florida Administrative Code, Chapter 62-40.473 -

Shall consider natural seasonal fluctuations and environmental values, including:

- Recreation in and on the water
- Fish and wildlife habitats and the passage of fish
- Estuarine resources
- Transfer of detrital material
- Maintenance of freshwater storage and supply
- Aesthetic and scenic attributes
- Filtration and absorption of nutrients and other pollutants
- Sediment loads
- Water quality
- Navigation

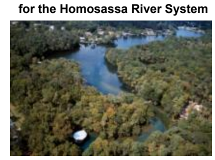
Regulatory Use of Minimum Flows and Levels

- Water-Use Permitting
- Environmental Resource Permitting
- Water Resource Planning

Draft Reports

Draft minimum flows report and peer-review report are posted on the District Web site at: *watermatters.org*

Move cursor over Documents & Publications button and click on the Minimum Flows and Levels Documents and Reports link to access documents



Recommended Minimum Flows for the Homosassa River System

July 12, 2010 Peer-Review Draft

Southwest Florida Water Management District

Douglas A. Leeper
Michael S. Flannery
Martin H. Kelly

Ecologic Evaluation Section
Resource Projects Department
Southwest Florida Water Management District
Brooksville, Florida

with contributions by

HSW Engineering, Inc.
Tampa, Florida

Process for Establishing Minimum Flows and Levels

- Priority List and Schedule developed
- Methods, flows or levels developed and peer-reviewed
- Workshops held for public input
- Recovery or prevention strategies developed, as necessary
- Governing Board adopts minimum flows and levels into Chapter 40D-8, Florida Administrative Code
- Necessary recovery strategies included in Regional Water Supply Plan and in some cases adopted into Chapter 40D-80, Florida Administrative Code

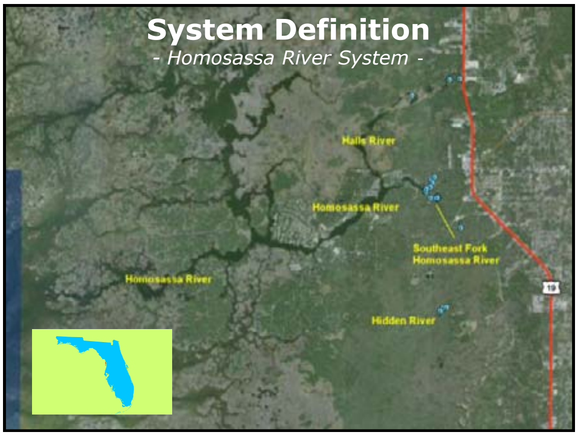
Tidal River Minimum Flows

- Study Elements -

- System definition
- Evaluation of withdrawal impacts on flows
- Baseline flows and salinity evaluations
- Evaluation of structural alterations
- Bathymetric mapping
- Shoreline and vegetation mapping
- Benthic invertebrate evaluations
- Planktonic and nektonic fish and invertebrate evaluations
- Salinity-based habitat modeling
- Thermal habitat modeling for manatees

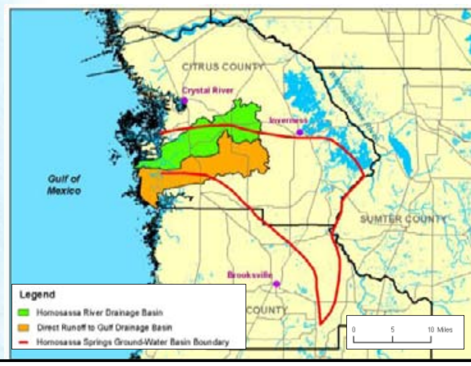
System Definition

- Homosassa River System -



System Definition

- Surface and Groundwater Basins -



Evaluation of Withdrawal Impacts

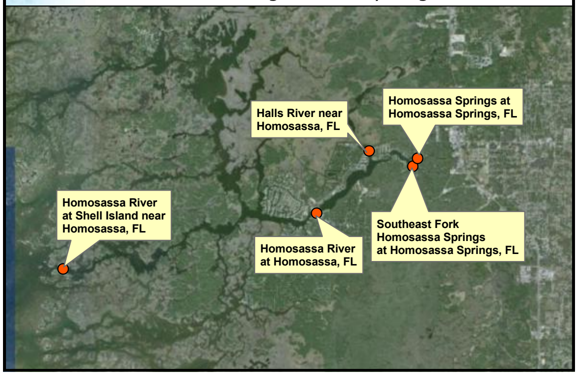
Tidal River Minimum Flows

- Study Elements -

- Defining the system
- Evaluation of withdrawal impacts on flows
- Baseline flows and salinity evaluations
- Evaluation of structural alterations
- Bathymetric mapping
- Shoreline and vegetation mapping
- Benthic invertebrate evaluations
- Planktonic and nektonic fish and invertebrate evaluations
- Salinity-based habitat modeling
- Thermal habitat modeling for manatees

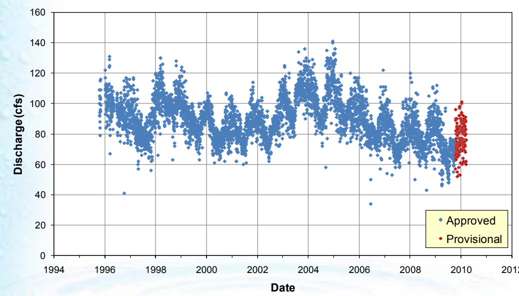
Baseline Flows and Salinity

- United States Geological Survey Gage Sites -



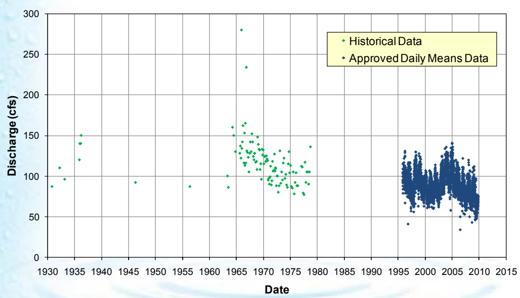
Baseline Flows

- Daily Mean Discharge Record for Homosassa Springs -



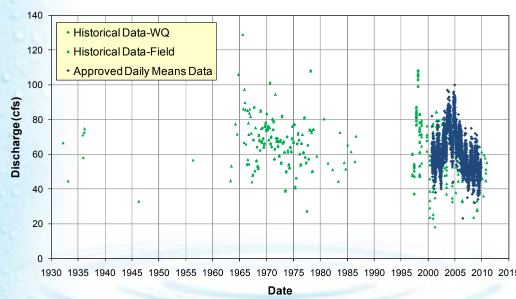
Baseline Flows

-Approved Daily Mean Discharge Record and Historical Instantaneous Discharge Record for Homosassa Springs -



Baseline Flows

- Approved Daily Mean Discharge Record and Historical Instantaneous Discharge Record for Southeast Fork Homosassa Springs -



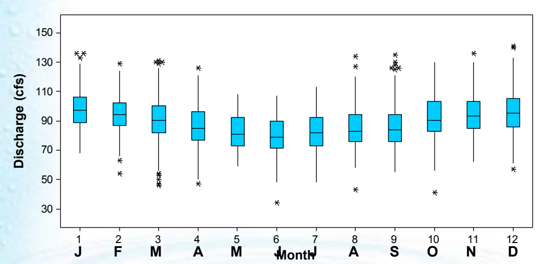
Baseline Flows

- Flows Summary Table -

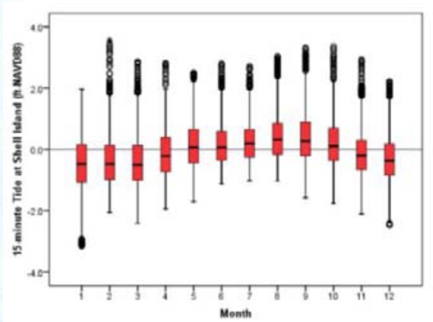
Statistic (cfs or N)	Homosassa Springs at Homosassa Springs FL	SE Fork Homosassa Spring at Homosassa Springs FL	Combined Homosassa and SE Fork Springs	Halls River	Homosassa River at Homosassa FL (tidally filtered)	Hidden River near Homossass a FL
Maximum	141	100	240	1,995	2,090	25.0
75th Percentile	98	68	165	200	350	11
Median	88	60	147	108	251	8.0
25th Percentile	79	53	131	28	167	4.6
Minimum	34	23	57	-765	-636	1.3
Mean	89	61	149	129	272	8.0
Standard Deviation	14	11	26	181	183	4.4
Number (N) of daily Records	4,975	3,123	3,102	1,662	1,774	2,063

Seasonal Variability in Flows

- Monthly Mean Discharge for Homosassa Springs -

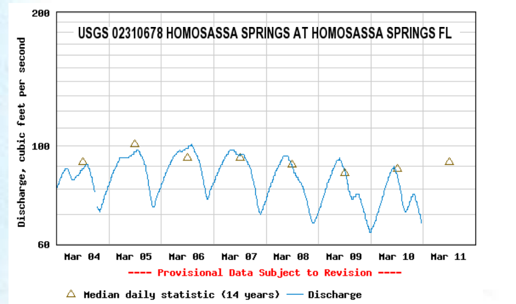


Seasonal Tides Influence Flows



Source: HSW Engineering, Inc. (2010)

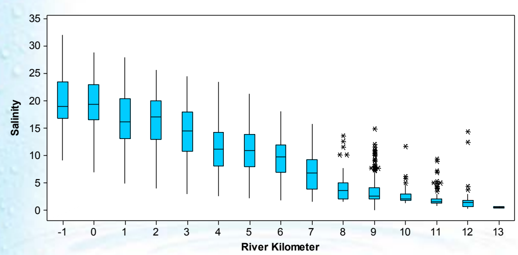
Daily Tidal Cycle Influences Flows



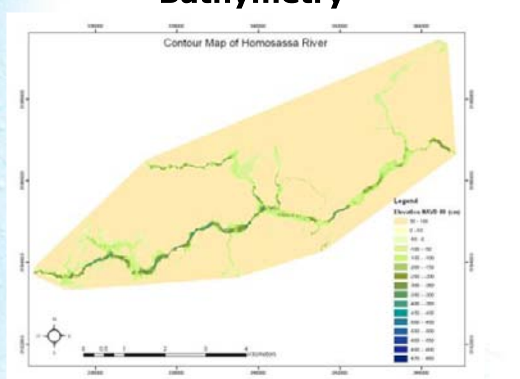
Source: USGS National Water Interface System Web Interface

Baseline Flows and Salinity

-Tides, Spring Discharge and Winds Create a Longitudinal Salinity Gradient In the Homosassa River -

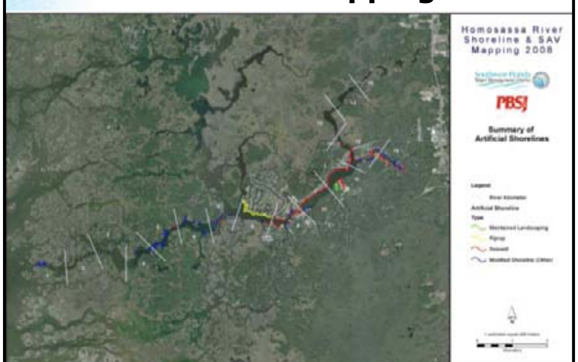


Bathymetry



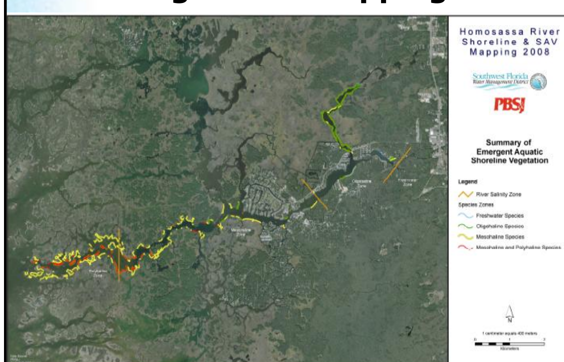
Source: Wang (2007)

Shoreline Mapping



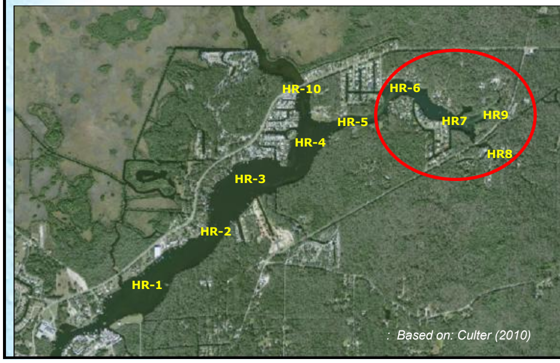
Source: PBS&J (2009)

Vegetation Mapping

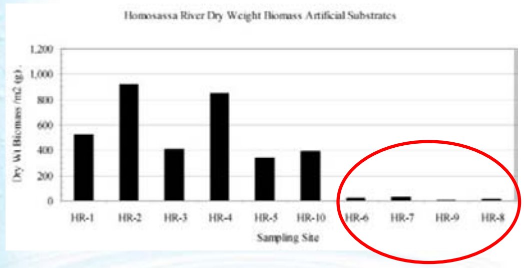


Source: PBS&J (2009)

Benthic Invertebrates
- Barnacle Sampling Sites -



Benthic Invertebrates
- Barnacle Biomass by Site -



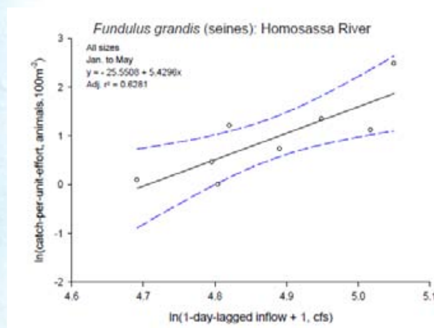
Source: Culter (2010)

Plankton and Nekton
- Gulf Killifish Example -

Maximum Length = 145 mm

Image Source: Freshwater Fishes of Texas: A Field Guide by *C. Thomas, T.H. Bonner and B.G. Whiteside*

Plankton and Nekton
- Gulf Killifish Abundance and Flow -



Source: Peebles et al. (2009)

Plankton and Nekton
- Abundance and Flow Results -

- Flow reductions from <1 to 3% associated with 15% reductions in abundances of 20 pseudo-species
- However, model issues suggest caution when interpreting results

Image source: J. Ditty, S. Holt, J. Matthews and T. Minello; NOAA Fisheries Service, Galveston Lab

Salinity-Based Habitat Modeling
- Biologically Relevant Salinity Criteria -

Water volume, bottom area and shoreline length associated with salinities that characterize or affect:

- availability of fish habitat
- availability of invertebrate habitat
- the amount and/or type of shoreline vegetation
- other, undefined system components and processes

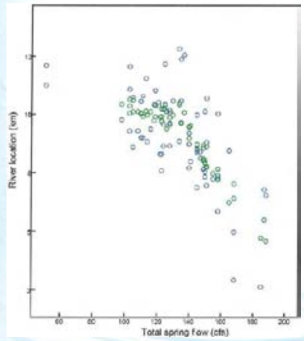
Salinity-Based Habitat Modeling

- Hydrodynamic Model -

Source: HSW Engineering, Inc. (2010)

Salinity-Based Habitat Modeling

- Regression Models -



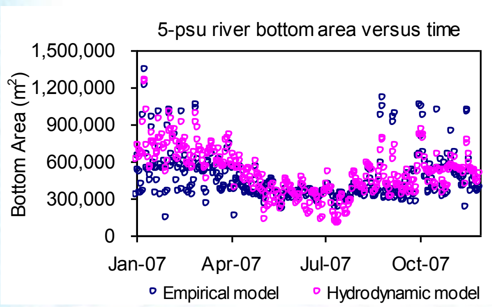
Surface Salinity = 5

- Measured
- Predicted

Source: HSW Engineering, Inc. (2010)

Salinity-Based Habitat Modeling

- Hydrodynamic and Regression Model Comparison-



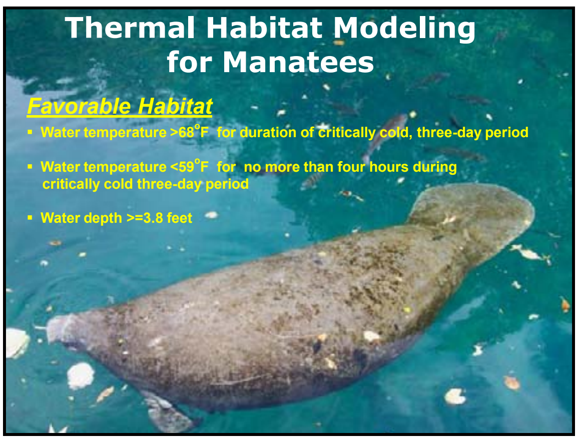
Source: HSW Engineering, Inc. (2010)

Salinity-Based Habitat Modeling

- All Results -

Salinity-Based Habitat	Percent-of-Flow Reduction Associated with 15% Reductions in Habitat from Median Baseline Conditions		
	Hydrodynamic Model 2007 Benchmark Period	*Regression Model 2007 Benchmark Period*	*Regression Model 1995-2009 Benchmark Period*
Bottom Area			
Salinity ≤ 2 Based on Bottom Isohaline Location	< 5	NM	NM
Salinity ≤ 2 Based on Water-Column Average Isohaline Location	< 5	NM	NM
Salinity ≤ 3 Based on Bottom Isohaline Location	5 – 10 (9.4)	< 5	< 5
Salinity ≤ 3 Based on Water-Column Average Isohaline Location	5 – 10 (9.1)	< 5	< 5
Salinity ≤ 5 Based on Bottom Isohaline Location	15	> 30	5 – 10 (6.3)
Salinity ≤ 5 Based on Water-Column Average Isohaline Location	10 – 15	20	5 – 10 (7.0)
Salinity ≤ 12 Based on Bottom Isohaline Location	25	20	10
Salinity ≤ 12 Based on Water-Column Average Isohaline Location	25 – 30	30	10 – 15
Water Volume			
Salinity ≤ 2	< 5	NM	NM
Salinity ≤ 3	10	5 – 10 (5.3)	< 5
Salinity ≤ 5	15	20 – 25	5 – 10 (6.9)
Salinity ≤ 12	20 – 25	25	10 – 15
Natural Shoreline Length			
Salinity ≤ 2	NA	NM	NM
Salinity ≤ 3	20 – 25	10 – 15	10 – 15
Salinity ≤ 5	15 – 20	> 30	> 30
Salinity ≤ 12	NA	5	5

Thermal Habitat Modeling for Manatees

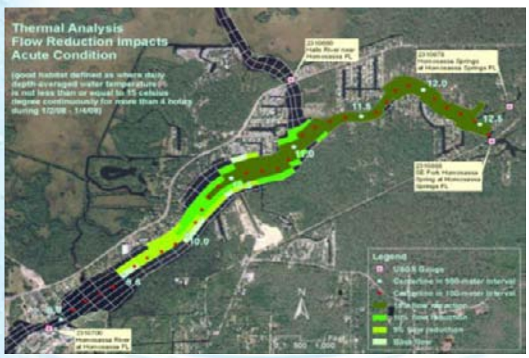


Favorable Habitat

- Water temperature >68°F for duration of critically cold, three-day period
- Water temperature <59°F for no more than four hours during critically cold three-day period
- Water depth >=3.8 feet

Thermal Habitat Modeling for Manatees

- Results Example -

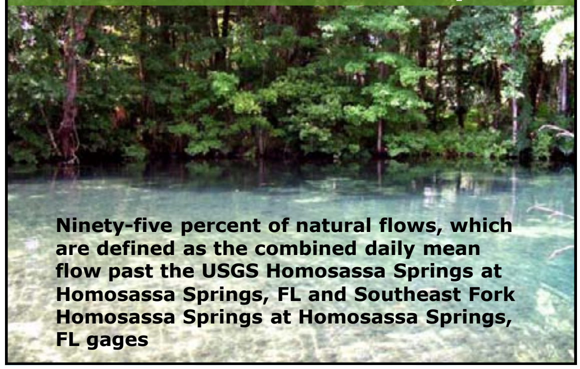


Source: HSW Engineering, Inc. (2010)

Thermal Habitat Modeling for Manatees
- Results -

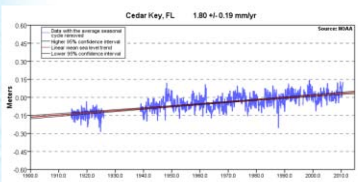
- Flow reductions between 5-10% associated with a 15% reduction in favorable refuge habitat during critically cold four-hour period
- Flow reductions between 25-30% associated with a 15% reduction in favorable refuge habitat during critically cold three-day period

Recommended Minimum Flows for the Homosassa River System

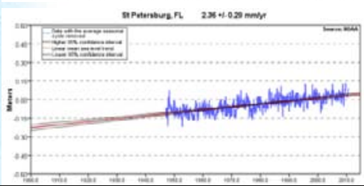


Ninety-five percent of natural flows, which are defined as the combined daily mean flow past the USGS Homosassa Springs at Homosassa Springs, FL and Southeast Fork Homosassa Springs at Homosassa Springs, FL gages

Sea Level Rise–Eastern Gulf of Mexico



Cedar Key
5.7 inches since 1931



St. Petersburg
7.4 inches since 1931

Source: NOAA Tides & Currents Web Page

Questions and Comments

Contact Information

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Title: Chief Environmental Scientist

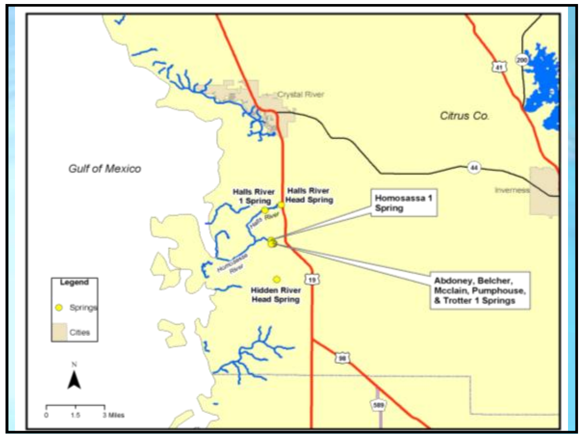
Mail: Southwest Florida Water Mgmt. District
2379 Broad St.
Brooksville, FL 34604-6899

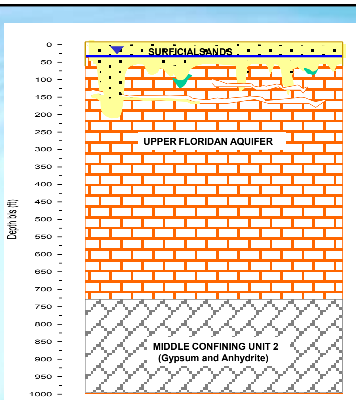
Phone: 1-800-423-1476 or 352-796-7211, Extension 4272

E-Mail: doug.leeper@swfwmd.state.fl.us

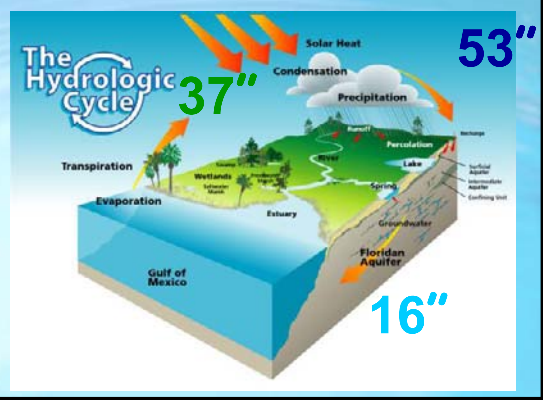
Web Site: www.swfwmd.state.fl.us or watermatters.org

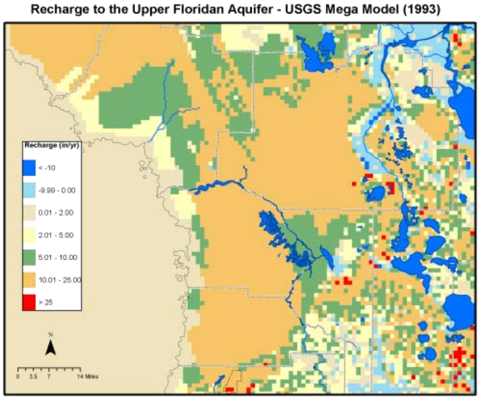
Hydrology of Western Citrus County and Potential Groundwater Withdrawal Impacts to Homosassa Springs





Southwest Florida Water Management District





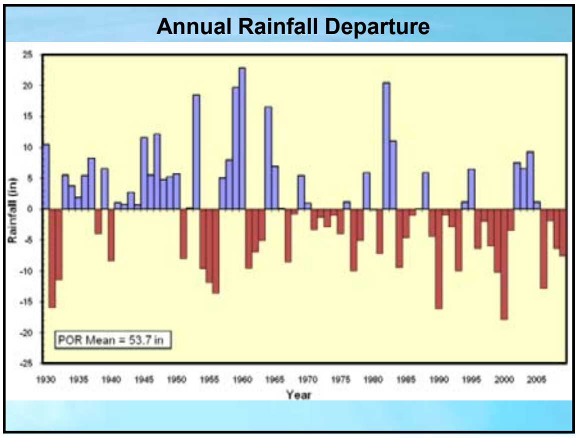
Simple Water Budget

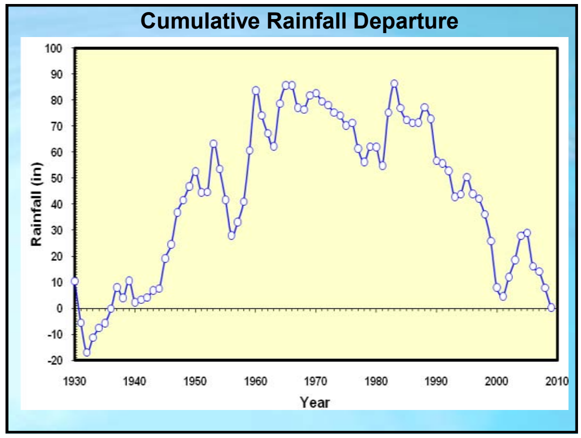
Recharge = Rainfall – ET - Runoff

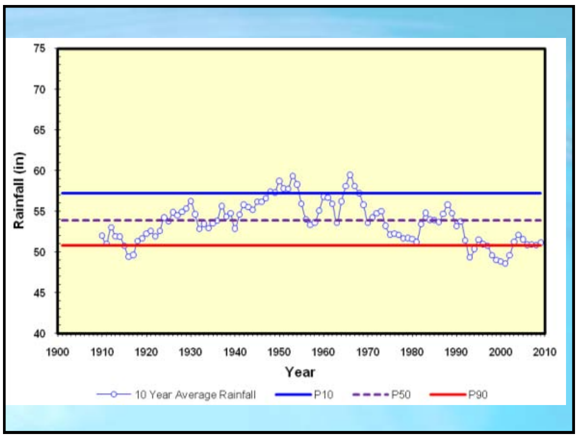
Recharge = Rainfall – ET

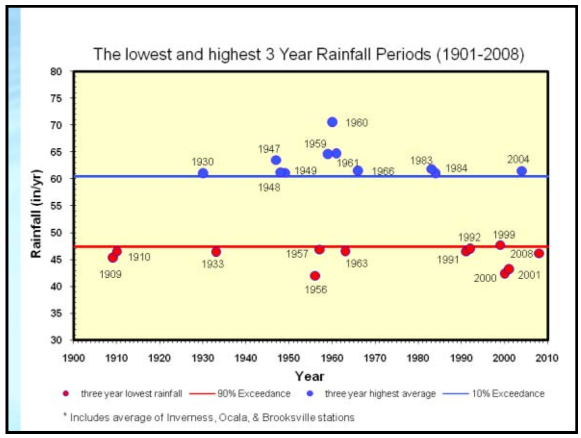
Rainfall = 53 inches	Rainfall = 45 inches
ET = 37 inches	ET = 37 inches
Recharge = 16 inches	Recharge = 8 inches

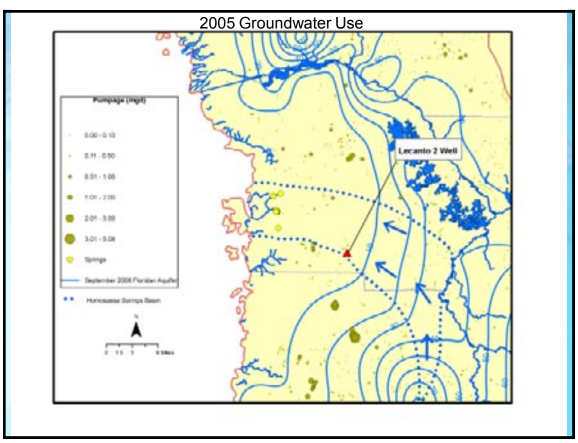
Net Result
15% decrease in rainfall
50% decrease in recharge

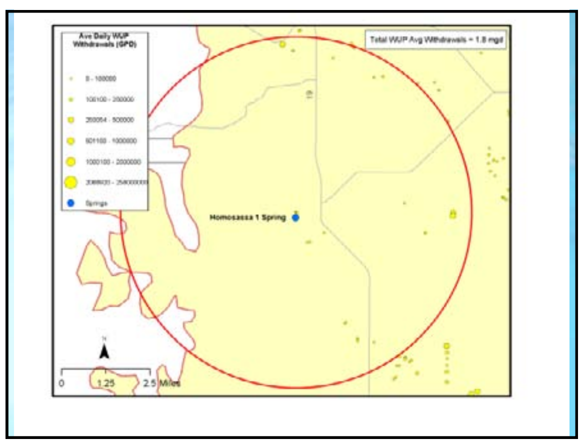

Annual Rainfall Departure
Rainfall (in)
POR Mean = 53.7 in
Year

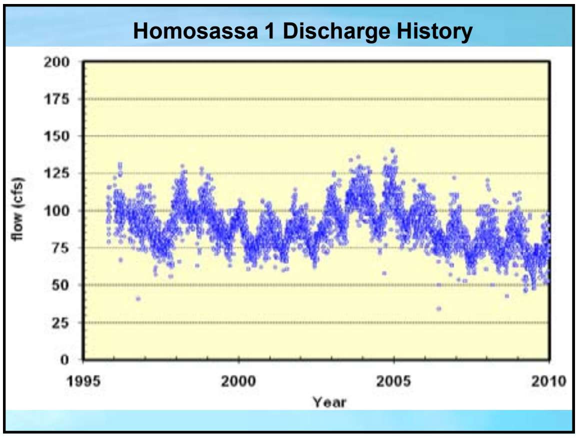

Cumulative Rainfall Departure
Rainfall (in)
Year

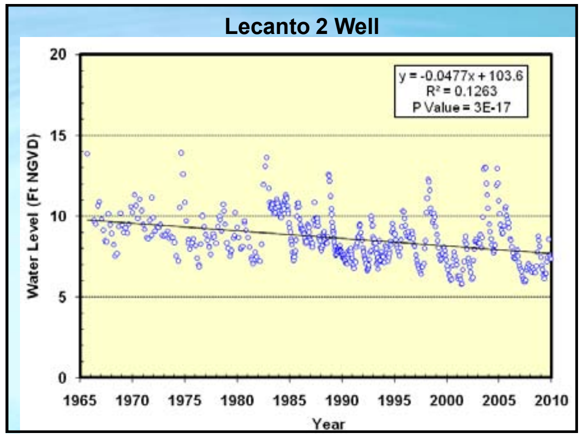

Rainfall (in)
Year
10 Year Average Rainfall
P10
P50
P90

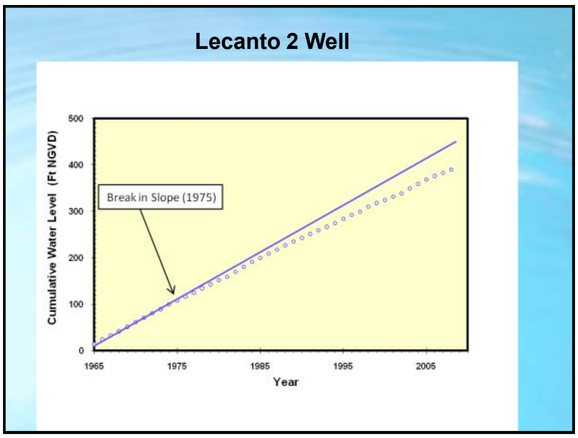

The lowest and highest 3 Year Rainfall Periods (1901-2008)
Rainfall (in/yr)
Year
three year lowest rainfall
90% Exceedance
three year highest average
10% Exceedance
* Includes average of Inverness, Ocala, & Brooksville stations

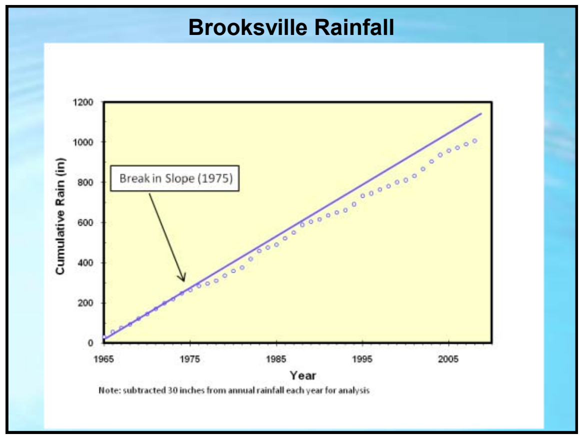

2005 Groundwater Use
Lecanto 2 Well

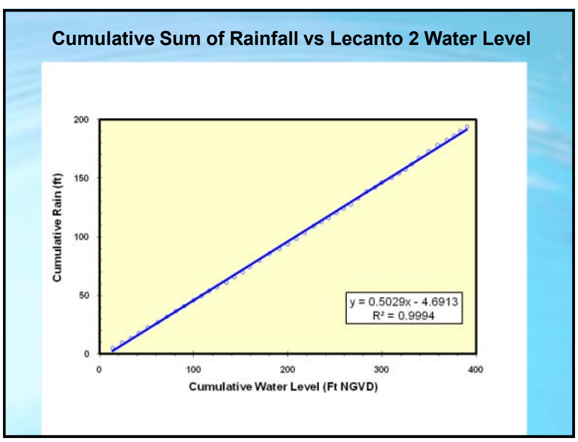

Total WUP Avg Withdrawals = 1.8 mgd
Homosassa 1 Spring
0
1.25
2.5 Miles

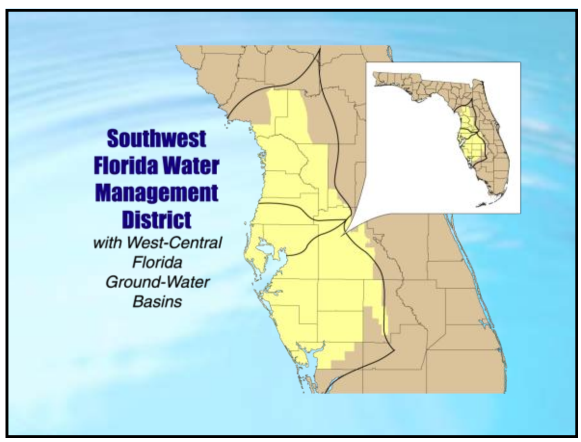

Homosassa 1 Discharge History
flow (cfs)
Year
0
25
50
75
100
125
150
175
200
1995
2000
2005
2010


Lecanto 2 Well
y = -0.0477x + 103.6
R² = 0.1263
P Value = 3E-17
Water Level (Ft NGVD)
Year
0
5
10
15
20
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010


Lecanto 2 Well
Break in Slope (1975)
Cumulative Water Level (Ft NGVD)
Year
0
100
200
300
400
500
1965
1975
1985
1995
2005


Brooksville Rainfall
Break in Slope (1975)
Cumulative Rain (in)
Year
0
200
400
600
800
1000
1200
1965
1975
1985
1995
2005
Note: subtracted 30 inches from annual rainfall each year for analysis

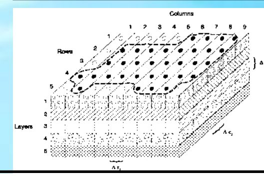

Cumulative Sum of Rainfall vs Lecanto 2 Water Level
y = 0.5029x - 4.6913
R² = 0.9994
Cumulative Rain (ft)
Cumulative Water Level (Ft NGVD)
0
50
100
150
200
0
100
200
300
400

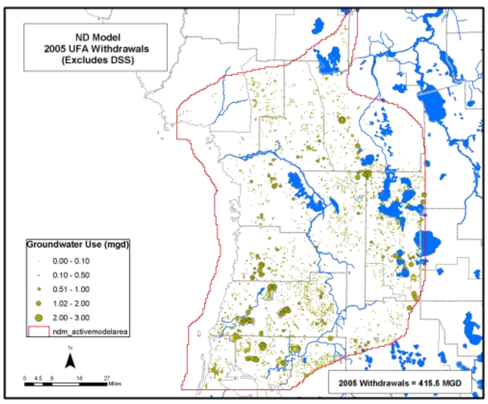

Southwest Florida Water Management District
with West-Central Florida Ground-Water Basins

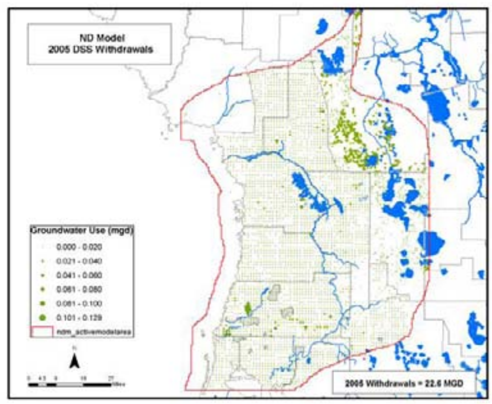
NWCFGWB	Flux (in/yr)
Recharge to UFA	12.6
Groundwater Extraction	1.0
Withdrawals (% of Recharge)	**8%**
CWCFGWB	**Flux (in/yr)**
Recharge to UFA	6.1
Groundwater Extraction	3.4
Withdrawals (% of Recharge)	**56%**
SWCFGWB	**Flux (in/yr)**
Recharge to UFA	2.5
Groundwater Extraction	2.7
Withdrawals (% of Recharge)	**108%**

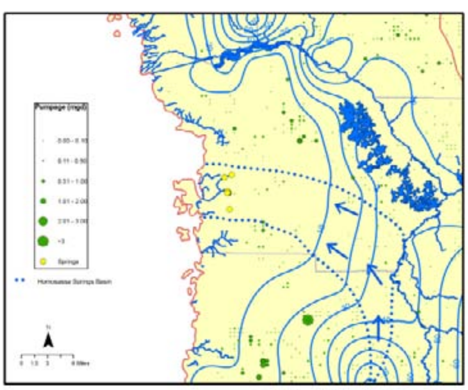
ND Model

- Layer 1 – Surficial Aquifer
- Layer 2 – Intermediate Confining Unit (Hawthorn)
- Layer 3 – Upper Floridan Aquifer (Suwanee)
- Layer 4 – Upper Floridan Aquifer (Ocala)
- Layer 5 – Upper Floridan Aquifer (Upper Avon Park)
- Layer 6 – Middle Confining Unit
- Layer 7 – Lower Floridan Aquifer (Lower Avon Park/Oldsmar)

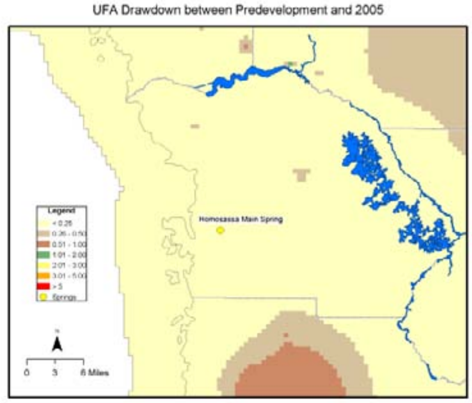


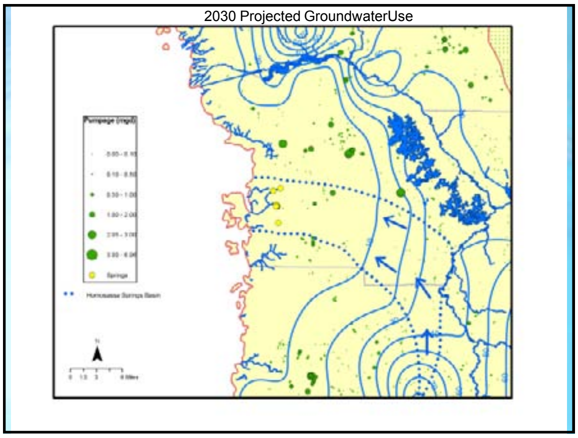


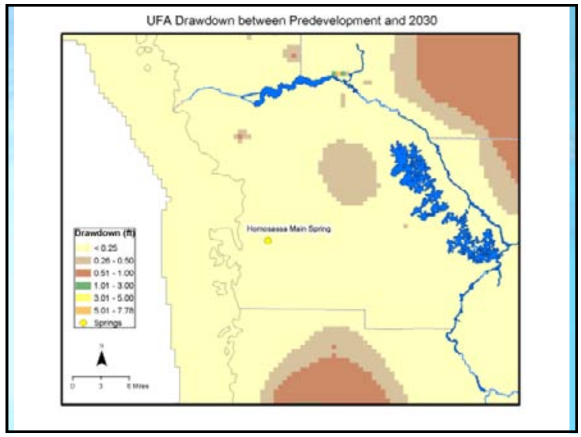




UFA Drawdown between Predevelopment and 2005







ND Model – Predicted changes in Discharge (Current)

Spring Name	Discharge for Non-Pumping Scenario (cfs)	Discharge for 2005 Pumping Scenario (cfs)	Difference (cfs)	Percent Difference
Abdoney Spring	4.98	4.93	-0.05	-0.9
Belcher Spring	4.98	4.89	-0.10	-2.0
Halls River 1 Spring	5.00	4.95	-0.05	-0.9
Halls River Head Main Spg	102.11	101.06	-1.05	-1.0
Hidden River Head Spring	6.61	6.35	-0.26	-4.0
Homosassa 1 Spring	71.65	70.98	-0.67	-0.9
Mcclain Spring	4.98	4.93	-0.05	-0.9
Pumphouse Spring	4.97	4.92	-0.05	-0.9
Trotter 1	4.97	4.93	-0.05	-0.9
Total	210.2	207.9	-2.31	-1.1

ND Model – Predicted changes in Discharge (2030)

Spring Name	Discharge for Non-Pumping Scenario (cfs)	Discharge for 2030 Pumping Scenario (cfs)	Difference (cfs)	Percent Difference
Abdoney Spring	4.98	4.87	-0.11	-2.13
Belcher Spring	4.98	4.77	-0.21	-4.29
Halls River 1 Spring	5.00	4.90	-0.10	-2.07
Halls River Head Main Spg	102.11	99.76	-2.35	-2.31
Hidden River Head Spring	6.61	6.05	-0.56	-8.47
Homosassa 1 Spring	71.65	70.16	-1.49	-2.07
Mcclain Spring	4.98	4.87	-0.11	-2.13
Pumphouse Spring	4.97	4.87	-0.10	-2.10
Trotter 1	4.97	4.87	-0.10	-2.02
Total	210.2	205.12	-5.13	-2.44

From:	Doug Leeper
To:	Mark Hammond; Marty Kelly; Ron Basso; Sid Flannery; Chris Zajac; Cara S. Martin
Cc:	Mark Barcelo; Karen Lloyd; Jay Yingling; Yassert Gonzalez; Mike Heyl
Subject:	Second Homosassa MFLs Workshop Summary
Date:	Monday, January 10, 2011 9:05:43 AM
Attachments:	Homosassa MFLs 06jan2011 Workshop Summary.pdf

Greetings – Attached is a summary of the recent rule development public workshop on proposed minimum flows for the Homosassa River system. Thanks to all who contributed to the meeting, and thanks to Sid, Ron, Chris, Cara and Marty for reviewing a draft version of the summary and contributing public questions/comments that I failed to include in a draft version of the document.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

MEETING SUMMARY

Southwest Florida Water Management District
Second Rule Development Public Workshop on Proposed Minimum Flows
for the Homosassa River System

Lecanto, Florida
January 6, 2011

A rule development public workshop on proposed minimum flows for the Homosassa River system was held on January 6, 2011 from 6:00 P.M. to approximately 9:45 P.M. in Room 280 at the Lecanto Government Building in Lecanto, Florida. The workshop was advertised in the Florida Administrative Weekly, local newspapers, and on the District's web site. In addition, several interested parties and local government staff and officials were notified of the meeting and a press release was made available to the regional media. Ron Basso, Sid Flannery, Mark Hammond, Marty Kelly, Doug Leeper, Cara Martin and Chris Zajac represented the District at the workshop and were joined by 38 other individuals, including Withlacoochee River Basin Board member Al Grubman.

Staff provided a presentation on currently proposed minimum flows for the river system and addressed questions that were raised by meeting participants regarding the proposed minimum flows and other water management issues. A few attendees suggested that the District should not establish minimum flows for the system. A number of meeting attendees indicated that they would prefer that the District establish minimum flows that would not allow for any reductions in river system flows. A few individuals suggested that minimum flows that would allow for less than the currently recommended allowable five percent reduction to natural flows should be developed.

With regard to specific comment on the recommended minimum flows, staff indicated that the District welcomes comment from all interested parties and that comments may be submitted by contacting the District via e-mail, fax, mail, telephone, or in person. Comments and questions raised by meeting participants and addressed by staff during the workshop are summarized below.

Comments and Questions

1. When was the statute concerning minimum flows and levels passed by the State Legislature?

2. What is significant harm?

3. Do established minimum flows apply to activities of the Withlacoochee Regional Water Supply Authority?

4. Has the District ever denied a request for a water use permit?

5. Which governmental agencies have commented on the proposed minimum flows for the Homosassa River system?

6. Can all comments on the proposed minimum flows be made available on request and/or can they be posted on the District web site?

7. Have the rates of evapotranspiration discussed at the meeting exhibited temporal change associated with or correlated with area development?

8. How can the District issue permits during periods of low rainfall?

9. Minimum flows appear to be established for lawyers or for the District to allow for more water use.

10. Why is the District currently trying to establish minimum flows for the Homosassa River system and other spring-dominated systems?

11. Some scientists, other than those at the District, dispute the District assertion that the recent low flows in the Homosassa River system may be primarily attributed to natural factors.

12. How or why has the District issued water-use permits for areas or water bodies without adopted minimum flows?

13. Does the District keep track of water-use associated with small wells and water withdrawals that fall below the District's regulatory permitting authority?

14. What is the National Weather Service's long-term prediction for rainfall in the vicinity of the Homosassa River system?

15. How does the District account for existing water-use by permit holders that are not utilizing their full permitted quantities, and how does the District determine whether these quantities will be used in the future?

16. In its analysis of the effects of existing and future groundwater use, how does the District account for private wells that do not require water use permits?

17. Are there historical data for spring discharge in the Homosassa River system that the District has not utilized to support development of recommended minimum flows?

18. Why are water-use restrictions in place in the northern part of the District if existing water-use has only a minimal impact on spring discharge in the Homosassa River system and other coastal rivers in the area?

19. When was the Northern District Model developed and when was it first used by the District?

20. Has the Northern District Model been used to evaluate saltwater intrusion?

21. Rapid changes in salinity/specific conductivity have been documented in spring vents in Kings Bay, suggesting that the chemical composition of water discharged from area springs may respond rapidly to environmental factors.

22. Was the peer-review panel that reviewed the District's recommended minimum flows for the Homosassa River system mistaken when they suggested that a well-calibrated saltwater intrusion model is needed for the area?

23. The Northern District Model does not include regional fracture patterns and does not, therefore, account for the influence of these geological features on groundwater flow in the area.

24. Why are spring flows in the Homosassa River system decreasing?

25. How much fresh groundwater flows out of the Cross Florida Barge Canal?

26. Why do the results for the 2030 water-use scenario modeled with the Northern District Model predict two areas of drawdown in the Upper Floridan aquifer to the north of the Withlacoochee River, when these are known areas of potentiometric highs?

27. Estimated discharge values for Halls River presented at the workshop appear to be overestimates.

28. Are the 2030 water-use scenario results derived with the Northern District Model based on average rainfall conditions?

29. What is the predicted effect of the wellfield identified for development in south-central Citrus County on spring discharge in the Homosassa River system? Is the potential water-use associated with this wellfield included in the 2030 water-use scenario modeled with the Northern District Model? If so, how is this potential water-use incorporated into the modeled scenario?

30. How will the District monitor compliance with minimum flows established for the Homosassa River system?

31. A spring in the Homosassa River system that was historically used by local citizens as a drinking water supply has recently become unsuitable for drinking, based on changes in water chemistry.

32. Will compliance with the proposed minimum flows lead to increased development of sinkholes, and is sinkhole formation considered when reviewing requests for the issuance of water use permits?

33. The District should note that many workshop participants are skeptical of the District's findings and recommendations regarding proposed minimum flows for the river system. Further, the District's recommendations are illogical, as the Homosassa River system is already an impaired system.

34. Does wind influence tide stage in the Homosassa River area?

35. How are discharge estimates for the United States Geological Survey Homosassa Springs and Southeast Fork Homosassa Springs gage sites derived?

36. Is the reported discharge for the Homosassa Springs site an indirect measure of discharge from the spring vents in the main pool, or is the discharge based on measured discharge from the vents?

37. When was the sampling conducted by Mote Marine Laboratory for the District-funded study of barnacles in the Homosassa River?

38. Barnacles are currently distributed upstream in the Homosassa River to a point very near the main spring pool run.

39. Is the District planning to fund additional studies of barnacle distribution in the Homosassa River system?

40. Staff should be sure to include information on barnacle distributions in the Homosassa River in materials that are presented to the District Governing Board.

41. Is District staff aware of known relationships between salinity, blue crab abundances and whooping crane survivorship? Can the District somehow incorporate this information into the analyses supporting development of minimum flows for the Homosassa River system and the Chassahowitzka River system?

42. The District should consider not establishing minimum flows for the river system.

43. Have District staff members observed environmental degradation in the Homosassa River system over the past several decades?

44. The District should consider that effects of water withdrawals may differentially affect flows from individual springs or vents in the Homosassa River system, and this could lead to environmental problems. For example, if flows in the springs that discharge to the Southeast Fork of the Homosassa River were more strongly affected by withdrawals than the Homosassa Main Springs, river salinities could be strongly impacted as the springs in the Southeast Fork discharge relatively fresh water as compared to the main pool springs.

45. Why are there differences between reported sea level rise at Cedar Key and St. Petersburg over the past century?

46. Can the District please consider establishing minimum flows that allow for slightly less than a five percent reduction in baseline flows?

47. Can the District provide copies of the draft *Southwest Florida Water Management District 2010 Regional Water Supply Plan - Northern Planning Region* and the recent *Withlacoochee Regional Water Supply Authority Phase II – Detailed Water Supply Feasibility Analyses*?

48. Can the District post the slides shown at the workshop on the District web site?

49. Has the contribution of salts from water softeners been evaluated for its effect on the Homosassa River system?

50. The District should consider conducting a public survey to solicit input on observed environmental changes in the Homosassa River system.

51. The District may want to consider soliciting photographic records of barnacle abundances and from citizens living adjacent to the Homosassa River.

52. Is the District's use of fifteen percent change in habitat or resource value for determining significant harm thresholds appropriate? For example, one should consider the validity of fifteen percent change values associated with the societal and environmental destruction resulting from Hurricane Katrina in 2005 and the 2010 oil spill in the Gulf of Mexico.

53. Given the District's reliance on a fifteen percent change in environmental resources for establishment of minimum flows, perhaps staff should consider accepting a fifteen percent reduction in their salaries.

Residents invited to Swiftmud workshop

By Special to the Chronicle

Sunday, December 26, 2010 at 1:01 am (Updated: December 26, 1:01 am)

The Southwest Florida Water Management District is inviting the public to comment on proposed minimum flows and levels (MFLs) for the Homosassa River and associated springs at a public workshop on Thursday, Jan. 6. The workshop will be held from 6 to approximately 8:45 p.m. at Citrus County's Lecanto Government Building, 3600 W. Sovereign Path in Lecanto.

The District has already held one public workshop on the Homosassa River MFLs. This second meeting was scheduled to give the public additional time to review the proposed MFLs.

The state Legislature requires the District to set MFLs for priority water bodies within the District. A minimum flow or level is the limit at which further water withdrawals will cause significant harm to the water resources and/or environment.

During the workshop, District staff will review the regulatory framework and the technical basis for the proposed MFLs. The workshop will also provide an opportunity for local governments, citizens and others to be part of the development of minimum flows and levels for the river system.

Public comment gathered at the workshop will be summarized and presented to the Governing Board when staff submits a final report and proposed rule amendments associated with the MFLs in the coming months. Following consideration of the report, public comments and results from an independent peer review, the Governing Board may choose to adopt the MFLs into District rules. Governing

Board meetings are open to the public where brief oral comments are permitted on meeting agenda items.

Written comments are also welcome and can be submitted via mail or email to Doug Leeper, chief environmental scientist, no later than Jan. 20. The addresses are 2379 Broad Street, Brooksville, FL 34604-6899 or Doug.Leeper@watermatters.org.

A draft report containing information on the development of MFLs for the Homosassa River is available on the District's web site. To locate the report, visit www.WaterMatters.org/mfl and click on the "MFL documents and reports" link. For more information, please contact Doug Leeper at (800) 423-1476, ext. 4272.

June 24, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments submitted by Whitey Markle, Suwanee-St. Johns Group of the Sierra Club regarding minimum flow recommendations for the Homosassa and Chassahowitzka River systems

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This memorandum documents e-mail correspondence between Whitey Markle, Conservation Committee Chair of the Suwanee-St. Johns Group of the Sierra Club, and Marty Kelly, with the Southwest Florida Water Management District, regarding development of minimum flows for the Homosassa and Chassahowitzka River systems.

DAL

Attachments: A – Letter from Whitey Markle to Dave Moore, dated January 20, 2011

B – Letter from Marty Kelly to Whitey Markle, dated February 8, 2011

Attachment A

<u>Letter from Whitey Markle to Dave Moore, Dated January 20, 2011</u>

SIERRA CLUB
FOUNDED 1892

Suwannee-St. Johns Group
Sierra Club
PO Box 13951
Gainesville, FL 32604

1/20/2011

Dave Moore
Executive Director,
Southwest Florida Water Management District,
2379 Broad Street
Brooksville, FL 34604-6899

Director:
We, the Suwannee/St. Johns Sierra Club Executive Committee would like to ask for a moratorium on the reduction of Minimum Flows and Levels for the Lower Homosassa River and the lower Chassahowitzka River.

We feel the methodology used in determining the MFL's of these basins is invalid in that it is based on only the last 11 years of hydrologic data. Flow levels from 1950 to present indicate a 30% reduction. It should then be apparent that any reduction in MFL's will indeed be of significant harm to the ecosystem.

We oppose the imposition of the proposed 15% of the minimum flows and levels until a full public input process has been implemented. It appears to us that a plan for such a reduction in MFL's should be placed in public scrutiny for a reasonable time. I

We question the SWFWMD's definition of "significant harm ". We feel such a reduction in flow level will indeed cause "significant harm" to these ecosystems and that these levels are being implemented to *justify* the use of "alternative" water sources when existing water supplies become "fully developed" (used up). It appears to us that the definition of "fully developed" means that all available ground water is being used or is projected and/or permitted to be used.

We also feel that "alternative "water sources should not include surface water. Recycled and desalinated water should be considered the "alternative "sources, whereas water from the springs, creeks, and rivers (surface water) should not. We say surface water is the same as ground water, so withdrawing surface water is withdrawing ground water. If the ground water is depleted, then so is the surface water.

Whitey Markle, W Markle
Conservation Committee Chair,
Suwannee/St. Johns Sierra Club

Attachment B

Letter from Marty Kelly to Whitey Markle, Dated February 8, 2011

Southwest Florida
Water Management District

2379 Broad Street, Brooksville, Florida 34604-6899
(352) 796-7211 or 1-800-423-1476 (FL only)
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(813) 985-7481 or
1-800-836-0797 (FL only)

February 8, 2011

Mr. Whitey Markle
Conservation Committee Chair
Suwannee-St. Johns Group
Sierra Club
P.O. Box 13951
Gainesville, Florida 32604

Subject: Minimum Flows and Levels for the Lower Homosassa and Chassahowitzka Rivers

Dear Mr. Markle:

The District would like to acknowledge receipt of your letter to Dave Moore, Executive Director of the Southwest Florida Water Management District, dated January 20, 2011, regarding concerns expressed for the proposed Minimum Flows and Levels (MFLs) for the Homosassa and Chassahowitzka River systems. We appreciate your interest in these spring dominated systems, and would like to address a few of the comments contained in your letter.

With respect to your request *"for a moratorium on the reduction of Minimum Flows and Levels for the Lower Homosassa River the lower Chassahowtizka River",* action has been delayed to allow additional time for public review and comment.
The District has pursued a priority list and schedule for the adoption of MFLs on waterbodies as required by state law (F.S. 373.042), and included all first magnitude springs on this priority list as required (F.S. 372.042(2)). Both these systems have been on the Governing Board's approved list for several years with the intended date of rule development established for 2010. To that end, staff prepared reports detailing the science done in support of the recommended MFLs, and has submitted each of these to independent scientific peer review. Both the technical reports and the resultant peer review reports have been posted on the District's website (http://www.swfwmd.state.fl.us/projects/mfl/mfl_reports.php). In addition, the District has held two public meetings on each waterbody, presenting the results of the MFL determinations and inviting public comment. Comments on the proposed MFLs for these waterbodies are still being received, and staff will include all public input received (including your letter) and staff's response in the final MFL document that will be presented to the Governing Board at the time of proposed rule adoption. Following additional time for public review and comment, this item will be scheduled for Board action, and you will be notified.

In your correspondence, you stated that, *"[f]low levels from 1950 to present indicate a 30 reduction. It should be apparent that any reduction in MFL's will indeed be of significant harm to the ecosystem."* The legislation addressing MFLs explicitly states that, "[t]he 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." When developing MFLs on flowing water systems, staff makes every attempt to consider impacts due to withdrawals in their analyses. On both systems under discussion, staff determined that withdrawal impacts are minimal and have led to flow reductions of approximately one percent as compared to non-withdrawal conditions. Further, based on 2030 demand projections, staff expects that impacts due to ground water withdrawals will lead to no more than a three percent reduction in flows from either system. It should be appreciated that natural variation in rainfall can have large effects on recharge and spring flows. As an example, analysis of the average of three long term National Oceanic and Atmospheric Administration rainfall gages in the area shows that total annual rainfall averages 54.1 inches over the period of record (1900 to 2009); however, the annual average over the wettest 10-year period (1957-1966) was 59.74, while the annual average over the driest 10-year period (1992-2001) was 48.68 inches. This large difference in decadal rainfall, exceeding more than 10 inches, would be sufficient to cause a rather large decline in natural flows for the Chassahowitzka, Homosassa and other area systems.

Regarding your concern that "alternative" water sources should not include surface water, please note that Florida Statute 373.019 defines alternative sources.

> **373.019 Definitions.** — When appearing in this chapter or in any rule, regulation, or order adopted pursuant thereto, the term:
>
> (1) "Alternative water supplies" means salt water; brackish surface and groundwater; <u>surface water captured predominately during wet-weather flows</u>; sources made available through the addition of new storage capacity for surface or groundwater, water that has been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses; the downstream augmentation of water bodies with reclaimed water; stormwater; and any other water supply source that is designated as nontraditional for a water supply planning region in the applicable regional water supply plan. [please note: underlining added for reference]

Should you have any further questions or comments, I would be happy to try and address these, and again, thank you for your interest in these important water resources. Please feel free to contact me at any time with respect to MFL development within the Southwest Florida Water Management District.

Sincerely,

Martin H. Kelly

Martin H. Kelly, Ph.D.
Program Director, Minimum Flows and Levels
Ecologic Evaluation Section

MHK/brm
cc: Dave Moore, Bruce Wirth, Mark Hammond, Lou Kavouras, Richard Owen, Bill Bilenky, Kurt Fritsch, Log #24983-11

February 14, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Question submitted by Mr. Gary Maidhof regarding manatee data collection by the United States Geological Survey and development of minimum flows for the Chassahowitzka, Homosassa and Crystal River/Kings Bay systems

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This memorandum documents correspondence between Mr. Gary Maidhof, with the Citrus County, and Dr. Marty Kelly, with the Southwest Florida Water Management District regarding data collection by the United States Geological Survey for manatees in the Chassahowitzka, Homosassa and Crystal River/Kings Bay systems.

An e-mail from Mr. Maidhof, which was submitted on February 11, 2011, and an e-mail response sent to Mr. Maidhof on February 11, 2011 are included in an attachment to this memorandum.

DAL

Attachment: E-Mail from Mr. Maidhof, and response, both dated February 11, 2011

Attachment to Memorandum on a question submitted by Mr. Gary Maidhof regarding manatee data collection by the United States Geological Survey and development of minimum flows for the Chassahowitzka, Homosassa and Crystal River/Kings Bay systems

E-Mail from Mr. Maidhof, Dated February 11, 2011

From: Gary Maidhof [Gary.Maidhof@bocc.citrus.fl.us]
Sent: Friday, February 11, 2011 4:08 PM
To: Marty Kelly
Subject: MFL Analysis Question

I have a general question regarding the MFL analysis for the Chassahowitzka, Homosassa and /or the pending CR / King's Bay MFL studies ?

Are you using USGS for any of the analysis regarding manatees ?

Apparently somebody heard they were in-town studying manatees and wanted to know why. I figured it was probably MFL related but wanted to check with you first before I responded.
If you could drop me an e-mail response or feel free to call me at 352-527-5202.

Thanks

E-Mail to Mr. Maidhof, Dated February 11, 2011

From: Marty Kelly
To: Gary Maidhof
Cc: Doug Leeper; Mike Heyl
Subject: RE: MFL Analysis Question
Date: Friday, February 11, 2011 4:15:52 PM

Gary,

I'll ask my guys to correct me if I'm wrong, but we are not using the USGS for any manatee work. We are, of course, dependent on their flow monitoring which is partially supported by the District. Our primary work related to manatees involves the development of thermal models in order to predict the impact of potential withdrawals on volume/area of thermal refuge habitat.

Marty

February 11, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments submitted by Mr. Martyn Johnson regarding discharge measurements for the Homosassa River system

---

This memorandum documents correspondence between Mr. Martyn Johnson and Mr. Doug Leeper, with the Southwest Florida Water Management District regarding discharge measurements and development of minimum flows for the Homosassa River system.

Mr. Johsons's e-mail, which was submitted on February 5, 2011, and an e-mail response sent to Mr. Miller on February 11, 2011 are attached.

DAL

Attachments: Attachment A - E-Mail from Mr. Martyn Johnson, dated February 5, 2011
Attachment B - E-Mail to Mr. Martyn Johnson, dated February 11, 2011

Attachment A
to Memorandum on Comments submitted by Mr. Martyn Johnson regarding discharge measurements for the Homosassa River system

E-Mail from Mr. Johnson, Dated February 5, 2011

From: Alan Martyn Johnson
To: Doug Leeper; Kevin J Grimsley; rkane
Subject: RE: Homosassa Flow Concerns
Date: Saturday, February 05, 2011 10:46:24 AM

Doug,

I appreciate your following up on my concerns about reported cfs discharges.
SE Fork
The explanation for the SE Fork that averaging the 96 calculated discharges over a 24 hour period makes the data good as a *mean daily value* appears to be playing with numbers and words. The ***actual*** *daily mean discharge* you refer to is obtained from the same data set. Therefore, it is not surprising average and mean correspond well as the data set is basically cyclic..
Sorry, but that explanation does not give me confidence.
Lets face it the equation used for the calculation exagerating the impact of dS/dT.
The SE Fork DOES NOT experience reverse flow, and you must agree that changes in discharge rate over a 15 minute interval of -15% then +13% and -7%, -21%, +17%, +22% (as shown in cells M17 thru M25 on the spreadsheet I previously shared) are hard to believe.
Kevin commented on the reverse flow in his November 15 e-mail
The gage height change comes into play at 0231688 (SE Fork) because the flow actually becomes significantly negative during high tides.
I am sure that Kevin's comment was made from behind a desk looking at the equation being used. I am sure at the time he did not consider it necessary to make a field trip to verify the actual situation...he knew that such a factor is frequently used when reverse flow is the case. But, now given the input I have provided someone should have the intellectual ability to ask if erroneous data has been generated since Yobbi and Knochenmus (or whoever) came up with the equation. Errors when recognized are much better corrected internally than through some outside investigation.
Homosassa River
Regarding the Homosassa River 02130700 I was uncertain about the stream velocity reported being Vm or Vi. You will note that I commented about *There are even occasions where an inflow is shown when the stream velocity is outward.* I did run a spreadsheet using the equation B-4 and will share that when I am next home. For right now please consider these calculated Vm for a series of Vi velocities and different gage heights.
Velocity
GH -1.5 -1.0 -0.5 0 0.5 1.0 1.5
0.7 -1.03896 -0.73974 -0.37982 0.040784 0.522079 1.064064 1.666739
0 -1.07072 -0.7715 -0.41158 0.009022 0.490317 1.032302 1.634977
-0.7 -1.10249 -0.80326 -0.44335 -.002274 0.458554 1.000539 1.603214
-1.0 -1.1161 -0.81687 -0.45696 -0.03635 0.444942 0.986927 1.589602
-1.5 -1.13879 -0.83956 -0.47965 -0.05904 0.422254 0.964239 1.566914
The equation B-4 attempts to correct the velocity and the gage height in go. The results as you see provide some major differences in the Vm for in-flow versus out-flow for the same velocity Vi from the acoustic velocity meter eg compare -1.5 ft/sec with 1.5 gt/sec for gage height -0.7 ft. Surely there has to be a question about this.
The Vm changes as the GH changes are in the right direction but appear to be small. I did consider the situation lookoing at the change of 2.2 ft GH if the river is 200 feet wide this would result in a cross section area difference of 440 sq. ft which compared to the roughly 1600 sq ft is much more change than the columns above suggest.
I would have thought the cross section area could fairly accurately be corrected for gage height.
For example;

If the cross sectional area as measured at GH 0 were 1600 sq.ft.
If the channel width were 200 ft.
And we assume the seawall is vertical thru the normal GH change (which is true at Mac Rae's)
Then the equation would be:
Area = 1600 + 200* GH
This would allow Q to be directly calculated from the however corrected reading from the velocity meter.
Sure makes a lot more sense to me than some calculation that biases the reported flow depended on direction.
In conclusion.
Sorry to have to ask about these long established discharge calculations, but the use of this flow data to the extent it is used in predicting the future of a unique ecology demands attention to the accuracy of such data. Mistakes or incorrect assumptions in the past can not excuse the need for intellectual honesty and logical explanations today.
I think there is just a little more than *may be* that there are errors. There is a lot at stake.
I trust that someone has the guts to take a serious look at this.
Thanks for your time and efforts.
Martyn Johnson

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From: Doug.Leeper@swfwmd.state.fl.us
To: martynellijay@hotmail.com
Date: Fri, 28 Jan 2011 16:10:30 -0500
Subject: RE: Homosassa Flow Concerns
Martyn:
Thanks for your recent e-mail regarding reported discharge at the USGS Southeast Fork Homosassa Spring at Homosassa Springs, FL and Homosassa River at Homosassa, FL gage sites. In response to your e-mail, I spoke with Richard Kane and Kevin Grimsley and can offer the following comments regarding the points raised in your e-mail.
First, it should be noted that the published method for used for evaluating flows at the Southeast Fork gage is considered adequate for estimating daily mean discharge at the site. The method is used to develop 96 daily estimates of discharge, which are then averaged to derive mean daily values. Individual discrete discharge estimates may exhibit moderate variation from actual physical conditions at the site, but the average of the composited discrete measurements made over a 24-hour period has been shown to correspond well with actual daily mean discharge.
With regard to the Homosassa River gage issues, it should be noted that the method used by the USGS for estimating discharge at the site involves measurement of index velocity values, conversion of index velocity values to cross-sectional mean velocity values, and multiplication of the cross-sectional mean velocities by cross-section area values. Your derivation of “implied” cross-section area values from data obtained from the USGS site suggests that the cross-section area at the Homosassa River gage site is quite variable, even with consideration given to area changes associated with tidal fluctuations. As it turns out, the velocity data you obtained from the USGS web site are the index velocity values rather than the cross-sectional mean values that would be expected to yield more stable “implied” cross section areas based on division into the reported discharge values.
I hope this information is of some help.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

<><><><><><><><><><><><><><><><><>
From: Alan Martyn Johnson [mailto:martynellijay@hotmail.com]
Sent: Sunday, January 23, 2011 6:39 PM
To: Doug Leeper; Ron Basso; Kevin J Grimsley; rkane@usgs.gov
Cc: rmill76@tampabay.rr.com; Dana Bryan
Subject: Homosassa Flow Concerns
DISCHARGE FROM SE FORK USGS 02310688
Following observations made during kayak trips into the SE Fork on January 13 and 14, 2011, when the water levels were very low, I have looked at some of the data on flows and have very big concerns about the accuracy of the flow data.
Water levels on January 13 and 14 were low to the extent that discharge from Pumphouse Spring and Trotter Spring were clearly above the water level in the main stream to the extent that water was flowing down ‘waterfalls’. Flow from these two springs was much much stronger than from the other springs in the fork. Abdoney Spring was also discharging from above the

level of water in the main stream and was the third strongest flow but no where near Pumphouse and Trotter.
Given these observations it was clear that the only driving force for flow was the head in the aquifer. This led me to see what the calculated flows were. In studying the data extracted from the USGS real time records and presented in the attached spreadsheet (Low Water Flow...) it is clear that the equation used must be questioned. As you will see in the data there are times when calculated discharge changes very significantly. Such changes can not be true in a situation where the discharge is not affected by conditions in the river.
It could be argued that this was an unusual situation with water levels so low. I agree that it was an unusual situation with water levels so low the conductivity sensor was at times above water with no conductivity recorded. I suggest that it is not unusual when we look at discharge data, the ds/dt multiplier appears to be far too large. Allow me to explain further.
You will recall in earlier correspondence I asked why the multiplier for the ds/dt (change in river stage) was so high. On the spreadsheet (Sheet 2 SE Fork Equation) I have shown the influence the ds/dt factor has on the water held in the pool upstream of the SE Fork gage site 02310688 as a result in stage increase/decrease. These show minimal changes in flow, compared to the figures resulting from the large multiplier used in the equation.
I would strongly suggest this clearly gives concern to erroneous calculation/equation of discharge from the SE Fork.
Also, given the observed uninhibited flows from these spring vents Jan 13 & 14, it only adds to the comments I have made about assumptions used in the modeling of flows as presented in Table 2-4 of the July 2010 report.
Notes:
1. Data from the Homosassa Springs site for the same time period was included on the spreadsheet simply for comparison.
2. The reference made in WRIR 01-4230 by Yobbi and Knochemus on page 16 "Additionally, a single explanatory variable (spring flow from a nearby spring in the complex) was used in the regression models to estimate flow at two tidal springs (Unnamed Tributary to Chassahowitzka River and Southeast Fork of the Homosassa River)." Is noted as possible origin of the equation; however, the SE Fork is not truly tidal as there is no reverse flow as mentioned and supported in previous e-mails.

Eddy Current at Gage Site 02310688

In an earlier e-mail I speculated that there was a possibility of eddy currents causing the occasional increase in conductivity readings at this site. Since that speculation I have carefully observed the flow at the gage site. Regularly, in fact most of the time, a thin layer of flow can be observed going upstream along the concrete seawall towards the instruments location. This observation is made by watching small clumps of weed that can easily be tracked in the water. Most of the time the flow is captured (typically the flow can be seen going about 4 feet upstream along the seawall and is less than 6 inches wide) by the main outflow before it reaches the instrument location. I have not yet seen weed reach the plastic tubes. Why is this happening? Previously I had suggested that it was the flow changing direction as it goes under the bridge...close observation shows that a stack of riprap concrete immediately upstream of the instrument location causes a major shift in the flow. I wish I had photographs to show this. But, there is nothing like looking at this firsthand.

DISCHARGE DATA HOMOSASSA RIVER USGS 02310700

On the subject of discharge calculation I find some of the data reported from the Homosassa River site perplexing. I have attached a spreadsheet (Homosassa River) in which I have shown the implied cross section of the river from the discharge volume and stream velocity. While I understand that the cross section area will change with stage height this does not appear to explain the wide variation of the implied cross sectional area in the spreadsheet.
I do not know the exact location of the Acoustic Doppler Current Profiler (ADCP) but would estimate the river width at that point to be about 200 feet, and would assume that the stream velocity reported is the average stream velocity.
There are even occasions where an inflow is shown when the stream velocity is outward, agreed these few situations are at times when flow direction is changing. However, these provide further indication that discharge results are subject to some mathematical treatment other than simple logic.
I would appreciate if someone can explain what other factors are use to make this calculation. I was under the impression that data from this site was:
Stream Velocity x Cross Section Area (for stage height) = Discharge

Summary

Given the funds that are spent on developing models, often using regression analysis which use flow data, to predict the ecological future of this river I think it critical that the very basis of the flow measurements are fully understood. May be the gaps are only in my understanding, but somewhere I am not getting the logic. I hope those spending the monies and making the decisions are.

Componets in the equation used to calculate discharge from SE Fork

Fixed Multiplier Date GW Multiplier Time GH Multiplier ds/dt
Q in cfs 18.63 3.31 1/13/2011 12.51 10.31 6:15 -0.78 418.14
6:30 -0.81 -0.03
6:45 -0.81 0
7:00 -0.83 -0.02
1/14/2011 12.5 14:00 -0.98 0.01
14:15 -0.96 0.02
14:30 -0.91 0.05
14:45 -0.88 0.03
15:00 -0.88 0
cfs Change
Date Time
Q Calc
cfs
in 15
minutes
1/13/2011 6:30 **80.9334** 18.63 41.4081 -8.3511 -12.544
1/13/2011 6:45 **68.3892** 18.63 41.4081 -8.3511 0 **-15%**

1/13/2011 7:00 **76.9582** 18.63 41.4081 -8.5573 -8.3628 **13%**
1/14/2011 14:00 **65.9274** 18.63 41.375 -10.1038 4.1814
1/14/2011 14:15 **61.5398** 18.63 41.375 -9.8976 8.3628 **-7%**
1/14/2011 14:30 **48.4801** 18.63 41.375 -9.3821 20.907 **-21%**
1/14/2011 14:45 **56.5336** 18.63 41.375 -9.0728 12.5442 **17%**
1/14/2011 15:00 **69.0778** 18.63 41.375 -9.0728 0 **22%**

Water storage/discharge due to stage change SE Fork

Estimated area of SE Fork pool 3 acres Average flow 60 cfs
cfs at gage site Frequency*
ds/dt
cf in 15
mins
cf flow/15
min Time to discharge storage Decrease Increase ds/dt
Volume
for 0.01 1306.8 54000 0.4 58.5 61.5 15%
0.02 2613.6 0.7 57.1 62.9 30%
0.03 3920.4 1.1 55.6 64.4 25%
0.04 5227.2 1.5 54.2 65.8 10%
0.05 6534 1.8 52.7 67.3 10%
0.06 7840.8 2.2 51.3 68.7 2%
0.07 9147.6 2.5 49.8 70.2 1%
Frequency ds/dt is percent of times this change is seen both negative and positive.
Positive changes are seen approx 45% of the time versus negative 55%,

Observations, comments and questions with the best of intent.
Martyn Johnson
Reference:
SE Fork Homosassa Spring at Homosassa (02310688):
The current rating curve for the spring discharge reported at this station is represented by the
equation:
Q = 18.63 + 3.31(GW) – 10.31(GH) – 418.14(dS/dt)
In which
Q = spring discharge, in cfs.
GW = maximum daily groundwater level measured at the Floridan aquifer monitor well
283201082315601 (Weeki Wachee at Weeki Wachee) on the day of the dischargemeasurement used for the rating, in ft NGVD29.
GH = 15-minute gauge height of the river recorded at the time of the discharge
measurement used for the rating, in ft NGVD29.
dS/dt = change in river stage during a 15-minute period, in ft.
For anyone not able to open the first spreadsheet.
Zero chang is seen about 5% of time reported.

Attachment B
to Memorandum on Comments submitted by Mr. Martyn Johnson regarding discharge measurements for the Homosassa River system

E-Mail to Mr. Johnson, Dated February 11, 2011
Note: e-mail string deleted by Doug Leeper

From: Doug Leeper
To: "Alan Martyn Johnson"
Bcc: Marty Kelly; Sid Flannery; Mike Heyl; Ron Basso; Mark Barcelo; Cara S. Martin; Karen Lloyd; Yassert Gonzalez; Jay Yingling; Kevin Grimsely
(kjgrims@usgs.gov); Richard Kane (rkane@usgs.gov); Granville Kinsman
Subject: RE: Homosassa Flow Concerns
Date: Friday, February 11, 2011 3:55:13 PM

Martyn:

Thanks for your additional comments regarding discharge measurements at the Homosassa River and Southeast Fork Homosassa Springs gage sites. I have discussed the issues you've raised with staff from the United States Geological Survey, and have been assured that data for the sites has and continues to be collected and reported in accordance with accepted Survey standards. Staff therefore continues to support use of these data as "best available information" for development of minimum flow recommendations for the Homosassa River system.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
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February 14, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: E-mail from Martyn Johnson to Kevin Grimsley, concerning flow measurement in the Homosassa River system

---

This memorandum documents an e-mail concerning measurement of flows by the United States Geological Survey at sites in the Homosassa River system. The e-mail was sent by Mr. Martyn Johnson to Mr. Kevin Grimsley and is documented here for its relevance to the development of minimum flows for the river system.

Mr. Johnson's e-mail is attached to this memorandum.

DAL
Attachments: E-Mail from Mr. Martyn Johnson to Mr. Kevin Grimsley, dated February 14, 2011

Attachment

February 14, 2011 E-Mail from Mr. Johnson to Mr. Grimsley

From: Alan Martyn Johnson
To: Kevin J Grimsley
Cc: Doug Leeper; rkane
Date: Monday, February 14, 2011 12:49:54 PM

Kevin,

Just a quick note to say I appreciated the time we got to discuss the flows issues on Friday at the park.

A few minutes after I left (and the sun finally showed) I went back to where you were parked to show you what I was talking about with the stack of concrete at the gage site for the SE Fork. Unfortunately you had already left, but may be you took the opportunity to look...hope your thought process was quicker than mine.

I do have some additional thoughts about how to look at the 'averaging' of SE Fork data (re my e-mail comment about making good data from questionable data) and will share those when I have put them into a more presentable format.

Regarding the measurements Ray and yourself made at the Homosassa Springs site I looked at the calculated discharge figures around that time Friday they show 93 cfs compared to the 102-104 cfs you measured.

As mentioned I had made previous comparisons that I had shared with Doug after a workshop meeting in Lecanto

Quote
FYI for your colleague the two most recent field measurements at the Homosassa Springs Site are:
2010-12-08 @ 16:11:30 94.2 cfs
Calculated results in the record are:@16:00 92 cfs
@16:15 92 cfs
2010-10-13 @ 14:54:30 83.1 cfs
Calculated results in the record are:@14:45 71cfs
@15:00 72 cfs
@15:15 73 cfs
Did I select these figures to make a point? No they are simply the two that are easily referenced in the USGS real time data records that are on line. Please feel free to double check these in case I have made a typographical error.
End Quote

All these figures do fall within the 15% standard error as made in the commentary by Mr. Fulcher contained in SWFWMD's report on Minimum Flows, but it is noteworthy that all these field measurements are higher than the calculated flow (agree 2010-10-13 for all purposes is the same). As I mentioned I can only see the real-time data going back 120 days.

Kevin, again thanks for explaining the efforts that have been put into reviewing my comments and answering my questions. As you may have recognized I do feel my concerns are genuine with regard to the ways in which data is used to predict the future of a unique river.

And as you may expect I have reviewed your explanation about the relationship Vm versus Vi at the Homosassa River Site and have some additional thoughts, which I will share when I have a chance.

Martyn

February 16, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Correspondence between Martyn Johnson, Kevin Grimsley and Doug Leeper, concerning flow measurement in the Homosassa River system

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This memorandum documents e-mail correspondence between Mr. Martyn Johnson, Doug Leeper (with the Southwest Florida Water Management District) and Kevin Grimsley (with the United States Geological Survey) concerning measurement of flows in the Homosassa River by the United States Geological Survey. The e-mails and data attached to the e-mails are documented here for their relevance to the development of minimum flows for the Homosassa River system.

DAL

Attachments: A – February 15, 2011 e-mail from Martyn Johnson to Doug Leeper, with e-mail string
B – Data associated with February 15, 2011 e-mail from Martyn Johnson to Doug Leeper
C – February 15, 2011 e-mail from Kevin Grimsley to Martyn Johnson
D – Data associated with February 15, 2011 e-mail from Kevin Grimsley to Martyn Johnson
E – February 15, 2011 e-mail from Doug Leeper to Martyn Johnson and Kevin Grimsley

Attachment A

<u>February 15, 2011 E-Mail from Martyn Johnson to Doug Leeper, with E-mail String</u>

From:	Alan Martyn Johnson
To:	Doug Leeper
Cc:	Kevin J Grimsley; rkane
Subject:	RE: Homosassa Flow Concerns
Date:	Tuesday, February 15, 2011 3:13:03 PM
Attachments:	Homosassa River 02130700 Vm versus Vi.xls

Doug,
Attached as promised is the spreadsheet mentioned in an earlier e-mail where I used the Stream Velocity Vi reported in the Real-Time Data and the equation B-4 from the report to obtain Vm, Vm is shown in column F of the spreadsheet. This Vm value should give a constant Area value if the equation B-3 (Q=Vm x A) is being used. The values in column G are not constant implying that there is some other factor being used. As you will see the lowest value is about 78% of the highest.

Any explanation would be welcome.

As mentioned in my e-mail yesterday to Kevin I do have some additional thoughts to share on both the SE Fork and the Homosassa River site that I will tidy up for ease of review as I get time.

Martyn

From: Doug.Leeper@swfwmd.state.fl.us
To: martynellijay@hotmail.com
Date: Fri, 28 Jan 2011 16:10:30 -0500
Subject: RE: Homosassa Flow Concerns

Martyn:

Thanks for your recent e-mail regarding reported discharge at the USGS Southeast Fork Homosassa Spring at Homosassa Springs, FL and Homosassa River at Homosassa, FL gage sites. In response to your e-mail, I spoke with Richard Kane and Kevin Grimsley and can offer the following comments regarding the points raised in your e-mail.

First, it should be noted that the published method for used for evaluating flows at the Southeast Fork gage is considered adequate for estimating daily mean discharge at the site. The method is used to develop 96 daily estimates of discharge, which are then averaged to derive mean daily values. Individual discrete discharge estimates may exhibit moderate variation from actual physical conditions at the site, but the average of the composited discrete measurements made over a 24-hour period has been shown to correspond well with actual daily mean discharge.

With regard to the Homosassa River gage issues, it should be noted that the method used by the USGS for estimating discharge at the site involves measurement of index velocity values, conversion of index velocity values to cross-sectional mean velocity values, and multiplication of the cross-sectional mean velocities by cross-section area values. Your derivation of "implied" cross-section area values from data obtained from the USGS site suggests that the cross-section area at the Homosassa River gage site is quite variable, even with consideration given to area changes associated with tidal fluctuations. As it turns out, the velocity data you obtained from the USGS web site are the index velocity values rather than the cross-sectional mean values that would be expected to yield more stable "implied" cross section areas based on division into the reported discharge values.

I hope this information is of some help.

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From: Alan Martyn Johnson [mailto:martynellijay@hotmail.com]
Sent: Sunday, January 23, 2011 6:39 PM
To: Doug Leeper; Ron Basso; Kevin J Grimsley; rkane@usgs.gov
Cc: rmill76@tampabay.rr.com; Dana Bryan
Subject: Homosassa Flow Concerns

DISCHARGE FROM SE FORK USGS 02310688

Following observations made during kayak trips into the SE Fork on January 13 and 14, 2011, when the water levels were very low, I have looked at some of the data on flows and have very big concerns about the accuracy of the flow data.

Water levels on January 13 and 14 were low to the extent that discharge from Pumphouse Spring and Trotter Spring were clearly above the water level in the main stream to the extent that water was flowing down 'waterfalls'. Flow from these two springs was much much stronger than from the other springs in the fork. Abdoney Spring was also discharging from above the level of water in the main stream and was the third strongest flow but no where near Pumphouse and Trotter.

Given these observations it was clear that the only driving force for flow was the head in the aquifer. This led me to see what the calculated flows were. In studying the data extracted from the USGS real time records and presented in the attached spreadsheet (Low Water Flow…) it is clear that the equation used must be questioned. As you will see in the data there are times when calculated discharge changes very significantly. Such changes can not be true in a situation where the discharge is not affected by conditions in the river.

It could be argued that this was an unusual situation with water levels so low. I agree that it was an unusual situation with water levels so low the conductivity sensor was at times above water with no conductivity recorded. I suggest that it is not unusual when we look at discharge data, the ds/dt multiplier appears to be far too large. Allow me to explain further.
You will recall in earlier correspondence I asked why the multiplier for the ds/dt (change in river stage) was so high. On the spreadsheet (Sheet 2 SE Fork Equation) I have shown the influence the ds/dt factor has on the water held in the pool upstream of the SE Fork gage site 02310688 as a result in stage increase/decrease. These show minimal changes in flow, compared to the figures resulting from the large multiplier used in the equation.

I would strongly suggest this clearly gives concern to erroneous calculation/equation of discharge from the SE Fork.

Also, given the observed uninhibited flows from these spring vents Jan 13 & 14, it only adds to the comments I have made about assumptions used in the modeling of flows as presented in Table 2-4 of the July 2010 report.

Notes:
1. Data from the Homosassa Springs site for the same time period was included on the spreadsheet simply for comparison.
2. The reference made in WRIR 01-4230 by Yobbi and Knochemus on page 16 "Additionally, a single explanatory variable (spring flow from a nearby spring in the complex) was used in the regression models to estimate flow at two tidal springs (Unnamed Tributary to Chassahowitzka River and Southeast Fork of the Homosassa River)." Is noted as possible origin of the equation; however, the SE Fork is not truly tidal as there is no reverse flow as mentioned and supported in previous e-mails.

Eddy Current at Gage Site 02310688
In an earlier e-mail I speculated that there was a possibility of eddy currents causing the occasional increase in conductivity readings at this site. Since that speculation I have carefully observed the flow at the gage site. Regularly, in fact most of the time, a thin layer of flow can be observed going upstream along the concrete seawall towards the instruments location. This observation is made by watching small clumps of weed that can easily be tracked in the water. Most of the time the flow is captured *(typically the flow can be seen going about 4 feet upstream along the seawall and is less than 6 inches wide)* by the main outflow before it reaches the instrument location. I have not yet seen weed reach the plastic tubes. Why is this happening? Previously I had suggested that it was the flow changing direction as it goes under the bridge…close observation shows that a stack of riprap concrete immediately upstream of the instrument location causes a major shift in the flow. I wish I had photographs to show this. But, there is nothing like looking at this firsthand.

DISCHARGE DATA HOMOSASSA RIVER USGS 02310700

On the subject of discharge calculation I find some of the data reported from the Homosassa River site perplexing. I have attached a spreadsheet (Homosassa River) in which I have shown the implied cross section of the river from the discharge volume and stream velocity. While I understand that the cross section area will change with stage height this does not appear to explain the wide variation of the *implied cross sectional area* in the spreadsheet.
I do not know the exact location of the Acoustic Doppler Current Profiler (ADCP) but would estimate the river width at that point to be about 200 feet, and would assume that the stream velocity reported is the average stream velocity.

There are even occasions where an inflow is shown when the stream velocity is outward, agreed these few situations are at times when flow direction is changing. However, these provide further indication that discharge results are subject to some mathematical treatment other than simple logic.

I would appreciate if someone can explain what other factors are use to make this calculation. I was under the impression that data from this site was:

Stream Velocity x Cross Section Area (for stage height) = Discharge

Summary
Given the funds that are spent on developing models, often using regression analysis which use flow data, to predict the ecological future of this river I think it critical that the very basis of the flow measurements are fully understood. May be the gaps are only in my understanding, but somewhere I am not getting the logic. I hope those spending the monies and making the decisions are.

Observations, comments and questions with the best of intent.
Martyn Johnson

Reference:
SE Fork Homosassa Spring at Homosassa (02310688):
The current rating curve for the spring discharge reported at this station is represented by the equation:
$Q = 18.63 + 3.31(GW) – 10.31(GH) – 418.14(dS/dt)$
In which
Q = spring discharge, in cfs.
GW = maximum daily groundwater level measured at the Floridan aquifer monitor well 283201082315601 (Weeki Wachee at Weeki Wachee) on the day of the dischargemeasurement used for the rating, in ft NGVD29.
GH = 15-minute gauge height of the river recorded at the time of the discharge measurement used for the rating, in ft NGVD29.
dS/dt = change in river stage during a 15-minute period, in ft.

For anyone not able to open the first spreadsheet.

Componets in the equation used to calculate discharge from SE Fork

	Fixed	Multiplier	Date	GW	Multiplier	Time	GH	Multiplier	ds/dt
Q in cfs	18.63	3.31	1/13/2011	12.51	10.31	6:15	-0.78	418.14	
						6:30	-0.81		-0.03
						6:45	-0.81		0
						7:00	-0.83		-0.02
			1/14/2011	12.5		14:00	-0.98		0.01
						14:15	-0.96		0.02
						14:30	-0.91		0.05
						14:45	-0.88		0.03
						15:00	-0.88		0

Date	Time	Q Calc cfs					cfs Change in 15 minutes
1/13/2011	6:30	80.9334	18.63	41.4081	-8.3511	-12.544	
1/13/2011	6:45	68.3892	18.63	41.4081	-8.3511	0	-15%
1/13/2011	7:00	76.9582	18.63	41.4081	-8.5573	-8.3628	13%
1/14/2011	14:00	65.9274	18.63	41.375	-10.1038	4.1814	
1/14/2011	14:15	61.5398	18.63	41.375	-9.8976	8.3628	-7%
1/14/2011	14:30	48.4801	18.63	41.375	-9.3821	20.907	-21%
1/14/2011	14:45	56.5336	18.63	41.375	-9.0728	12.5442	17%
1/14/2011	15:00	69.0778	18.63	41.375	-9.0728	0	22%

Water storage/discharge due to stage change SE Fork

Estimated area of SE Fork pool 3 acres   Average flow 60 cfs

					cfs at gage site		Frequency*
	ds/dt	cf in 15 mins	cf flow/15 min	Time to discharge storage	Decrease	Increase	ds/dt
Volume for	0.01	1306.8	54000	0.4	58.5	61.5	15%
	0.02	2613.6		0.7	57.1	62.9	30%
	0.03	3920.4		1.1	55.6	64.4	25%
	0.04	5227.2		1.5	54.2	65.8	10%
	0.05	6534		1.8	52.7	67.3	10%
	0.06	7840.8		2.2	51.3	68.7	2%
	0.07	9147.6		2.5	49.8	70.2	1%

Frequency ds/dt is percent of times this change is seen both negative and positive.
Positive changes are seen approx 45% of the time versus negative 55%,

Zero chang is seen about 5% of time reported.

Attachment B

Data Associated with February 15, 2011 E-Mail from Martyn Johnson to Doug Leeper

Homosassa River USGS 02130700

Date / Time	Gage height, feet	Strea veloc-ity, ft/s	Dis-charge, ft3/s (not filtrd. for tide)	Vm	Area A from Discharge divided by Vm
01/13/2011 00:00 EST	-1.9	0.2	151	0.10804424	1397.57566
01/13/2011 00:15 EST	-1.91	0.21	164	0.117107148	1400.426898
01/13/2011 00:30 EST	-1.92	0.25	217	0.15496279	1400.336171
01/13/2011 00:45 EST	-1.93	0.28	256	0.183495982	1395.125916
01/13/2011 01:00 EST	-1.95	0.24	200	0.143987778	1389.006781
01/13/2011 01:15 EST	-1.95	0.24	200	0.143987778	1389.006781
01/13/2011 01:30 EST	-1.97	0.23	185	0.133490792	1385.863379
01/13/2011 01:45 EST	-1.99	0.21	157	0.113477148	1383.538472
01/13/2011 02:00 EST	-2	0.18	117	0.084546252	1383.857915
01/13/2011 02:15 EST	-2.01	0.2	142	0.10305299	1377.931878
01/13/2011 02:30 EST	-2.02	0.2	141	0.10259924	1374.279186
01/13/2011 02:45 EST	-2.04	0.23	179	0.130314542	1373.599579
01/13/2011 03:00 EST	-2.06	0.25	203	0.14861029	1365.988856
01/13/2011 03:15 EST	-2.07	0.3	268	0.19658949	1363.246835
01/13/2011 03:30 EST	-2.08	0.35	334	0.24517559	1362.288962
01/13/2011 03:45 EST	-2.1	0.28	239	0.175782232	1359.636849
01/13/2011 04:00 EST	-2.12	0.3	263	0.19432074	1353.432475
01/13/2011 04:15 EST	-2.13	0.33	302	0.223218072	1352.937051
01/13/2011 04:30 EST	-2.15	0.31	273	0.202718908	1346.692337
01/13/2011 04:45 EST	-2.16	0.32	286	0.212048852	1348.745807
01/13/2011 05:00 EST	-2.19	0.31	269	0.200903908	1338.948568
01/13/2011 05:15 EST	-2.2	0.3	255	0.19069074	1337.243749
01/13/2011 05:30 EST	-2.22	0.31	266	0.199542658	1333.048295
01/13/2011 05:45 EST	-2.23	0.33	291	0.218680572	1330.708061
01/13/2011 06:00 EST	-2.25	0.29	237	0.178686848	1326.34272
01/13/2011 06:15 EST	-2.26	0.33	288	0.217319322	1325.238811
01/13/2011 06:30 EST	-2.28	0.32	273	0.206603852	1321.369361
01/13/2011 06:45 EST	-2.3	0.3	245	0.18615324	1316.119988
01/13/2011 07:00 EST	-2.31	0.33	283	0.215050572	1315.969529
01/13/2011 07:15 EST	-2.33	0.32	268	0.204335102	1311.571029

Note:

1. If Column D is Vi.
2. Formula Q = Vm x Area where Vm = 0.00902154 + 0.9019*Vi + 0.12138*Vi*Vi + 0.045375 (GH)

01/13/2011 07:30 EST	-2.35	0.3	240	0.18388449	1305.167173
01/13/2011 07:45 EST	-2.36	0.29	227	0.173695598	1306.884012
01/13/2011 08:00 EST	-2.38	0.31	250	0.192282658	1300.169254
01/13/2011 08:15 EST	-2.39	0.28	211	0.162623482	1297.475601
01/13/2011 08:30 EST	-2.42	0.33	271	0.210059322	1290.111752
01/13/2011 08:45 EST	-2.43	0.39	347	0.268963188	1290.139378
01/13/2011 09:00 EST	-2.44	0.37	320	0.248626462	1287.071366
01/13/2011 09:15 EST	-2.46	0.34	280	0.218076568	1283.952708
01/13/2011 09:30 EST	-2.48	0.36	303	0.236906388	1278.986196
01/13/2011 09:45 EST	-2.49	0.36	302	0.236452638	1277.21138
01/13/2011 10:00 EST	-2.51	0.41	363	0.285313268	1272.285732
01/13/2011 10:15 EST	-2.53	0.42	374	0.294432222	1270.241407
01/13/2011 10:30 EST	-2.55	0.45	409	0.32374974	1263.321478
01/13/2011 10:45 EST	-2.56	0.4	345	0.27304234	1263.540299
01/13/2011 11:00 EST	-2.58	0.42	368	0.292163472	1259.568821
01/13/2011 11:15 EST	-2.59	0.43	379	0.301760452	1255.963124
01/13/2011 11:30 EST	-2.61	0.28	191	0.152640982	1251.302222
01/13/2011 11:45 EST	-2.63	0.37	300	0.240005212	1249.972855
01/13/2011 12:00 EST	-2.64	0.33	249	0.200076822	1244.521967
01/13/2011 12:15 EST	-2.65	0.32	236	0.189815102	1243.315192
01/13/2011 12:30 EST	-2.67	0.33	246	0.198715572	1237.95029
01/13/2011 12:45 EST	-2.68	0.3	209	0.16891074	1237.339911
01/13/2011 13:00 EST	-2.69	0.32	232	0.188000102	1234.041884
01/13/2011 13:15 EST	-2.7	0.44	378	0.306844208	1231.895503
01/13/2011 13:30 EST	-2.71	0.34	255	0.206732818	1233.476148
01/13/2011 13:45 EST	-2.73	0.29	193	0.156906848	1230.02917
01/13/2011 14:00 EST	-2.73	0.36	277	0.225562638	1228.040257
01/13/2011 14:15 EST	-2.75	0.37	287	0.234560212	1223.566425
01/13/2011 14:30 EST	-2.75	0.39	311	0.254443188	1222.276778
01/13/2011 14:45 EST	-2.76	0.39	310	0.253989438	1220.523194
01/13/2011 15:00 EST	-2.77	0.32	225	0.184370102	1220.371403
01/13/2011 15:15 EST	-2.77	0.32	225	0.184370102	1220.371403
01/13/2011 15:30 EST	-2.77	0.27	165	0.135694392	1215.967717
01/13/2011 15:45 EST	-2.78	0.31	212	0.174132658	1217.462608
01/13/2011 16:00 EST	-2.78	0.23	118	0.096737042	1219.801614
01/13/2011 16:15 EST	-2.78	0.24	129	0.106326528	1213.243792
01/13/2011 16:30 EST	-2.77	0.19	72	0.059075608	1218.77713
01/13/2011 16:45 EST	-2.76	0.15	27	0.02180259	1238.384981
01/13/2011 17:00 EST	-2.75	0.13	4.3	0.003538612	1215.16572
01/13/2011 17:15 EST	-2.74	0.09	-41	-0.033151782	1236.735932
01/13/2011 17:30 EST	-2.72	0.08	-51	-0.041469628	1229.81571
01/13/2011 17:45 EST	-2.7	0.01	-129	-0.104459822	1234.924563
01/13/2011 18:00 EST	-2.68	-0.05	-195	-0.15737501	1239.078555
01/13/2011 18:15 EST	-2.66	-0.02	-161	-0.129665408	1241.657297

01/13/2011 18:30 EST	-2.63	-0.01	-149	-0.119321572	1248.726425
01/13/2011 18:45 EST	-2.61	-0.05	-193	-0.15419876	1251.631336
01/13/2011 19:00 EST	-2.59	-0.01	-148	-0.117506572	1259.504022
01/13/2011 19:15 EST	-2.56	-0.08	-225	-0.178513628	1260.407973
01/13/2011 19:30 EST	-2.53	-0.05	-191	-0.15056876	1268.523431
01/13/2011 19:45 EST	-2.5	-0.07	-213	-0.166954198	1275.799007
01/13/2011 20:00 EST	-2.47	-0.06	-201	-0.156731742	1282.446028
01/13/2011 20:15 EST	-2.44	-0.09	-234	-0.181881282	1286.5535
01/13/2011 20:30 EST	-2.41	-0.1	-245	-0.18930841	1294.184447
01/13/2011 20:45 EST	-2.37	-0.11	-256	-0.196257512	1304.408669
01/13/2011 21:00 EST	-2.33	-0.13	-278	-0.211897888	1311.95267
01/13/2011 21:15 EST	-2.3	-0.13	-277	-0.210536638	1315.685491
01/13/2011 21:30 EST	-2.26	-0.15	-300	-0.22607991	1326.964435
01/13/2011 21:45 EST	-2.22	-0.2	-357	-0.26723576	1335.899058
01/13/2011 22:00 EST	-2.19	-0.19	-345	-0.257328892	1340.696714
01/13/2011 22:15 EST	-2.15	-0.19	-345	-0.255513892	1350.220128
01/13/2011 22:30 EST	-2.11	-0.19	-344	-0.253698892	1355.938125
01/13/2011 22:45 EST	-2.08	-0.22	-379	-0.277901668	1363.791742
01/13/2011 23:00 EST	-2.05	-0.22	-379	-0.276540418	1370.504908
01/13/2011 23:15 EST	-2.02	-0.17	-320	-0.232451078	1376.633753
01/13/2011 23:30 EST	-1.99	-0.15	-296	-0.21382866	1384.285904
01/13/2011 23:45 EST	-1.97	-0.16	-307	-0.221563882	1385.604897
01/14/2011 00:00 EST	-1.96	-0.1	-235	-0.16888966	1391.441015
01/14/2011 00:15 EST	-1.94	-0.06	-185	-0.132682992	1394.300786
01/14/2011 00:30 EST	-1.94	-0.03	-148	-0.105953718	1396.836305
01/14/2011 00:45 EST	-1.94	0.02	-85	-0.060919408	1395.286047
01/14/2011 01:00 EST	-1.94	0.05	-47	-0.03360751	1398.496943
01/14/2011 01:15 EST	-1.95	0.12	42	0.030516162	1376.319866
01/14/2011 01:30 EST	-1.96	0.2	146	0.10532174	1386.228522
01/14/2011 01:45 EST	-1.97	0.25	212	0.15269404	1388.397347
01/14/2011 02:00 EST	-1.99	0.24	197	0.142172778	1385.637974
01/14/2011 02:15 EST	-2.01	0.24	195	0.141265278	1380.381667
01/14/2011 02:30 EST	-2.02	0.26	220	0.160063328	1374.45599
01/14/2011 02:45 EST	-2.04	0.24	192	0.139904028	1372.36935
01/14/2011 03:00 EST	-2.05	0.28	244	0.178050982	1370.394014
01/14/2011 03:15 EST	-2.06	0.27	230	0.167910642	1369.776193
01/14/2011 03:30 EST	-2.08	0.28	241	0.176689732	1363.972865
01/14/2011 03:45 EST	-2.1	0.28	239	0.175782232	1359.636849
01/14/2011 04:00 EST	-2.11	0.31	278	0.204533908	1359.187837
01/14/2011 04:15 EST	-2.12	0.32	290	0.213863852	1356.002884
01/14/2011 04:30 EST	-2.14	0.33	301	0.222764322	1351.203807
01/14/2011 04:45 EST	-2.16	0.31	272	0.202265158	1344.769424
01/14/2011 05:00 EST	-2.17	0.31	271	0.201811408	1342.837864
01/14/2011 05:15 EST	-2.19	0.35	322	0.24018434	1340.636946

01/14/2011 05:30 EST	-2.2	0.35	321	0.23973059	1339.003087
01/14/2011 05:45 EST	-2.22	0.32	279	0.209326352	1332.846999
01/14/2011 06:00 EST	-2.23	0.3	252	0.18932949	1331.012934
01/14/2011 06:15 EST	-2.25	0.32	276	0.207965102	1327.145744
01/14/2011 06:30 EST	-2.27	0.32	274	0.207057602	1323.303261
01/14/2011 06:45 EST	-2.28	0.29	234	0.177325598	1319.606434
01/14/2011 07:00 EST	-2.3	0.36	323	0.245073888	1317.969869
01/14/2011 07:15 EST	-2.31	0.36	322	0.244620138	1316.326622
01/14/2011 07:30 EST	-2.33	0.43	411	0.313557952	1310.762484
01/14/2011 07:45 EST	-2.34	0.4	370	0.28302484	1307.305747
01/14/2011 08:00 EST	-2.36	0.39	355	0.272139438	1304.478331
01/14/2011 08:15 EST	-2.37	0.4	367	0.28166359	1302.972812
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01/14/2011 08:45 EST	-2.4	0.39	350	0.270324438	1294.740507
01/14/2011 09:00 EST	-2.42	0.37	322	0.249533962	1290.405512
01/14/2011 09:15 EST	-2.44	0.35	295	0.22884059	1289.106972
01/14/2011 09:30 EST	-2.45	0.4	357	0.27803359	1284.017517
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01/14/2011 10:00 EST	-2.47	0.35	292	0.22747934	1283.633054
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01/14/2011 10:45 EST	-2.51	0.36	300	0.235545138	1273.641233
01/14/2011 11:00 EST	-2.51	0.32	250	0.196167602	1274.420432
01/14/2011 11:15 EST	-2.52	0.29	212	0.166435598	1273.765964
01/14/2011 11:30 EST	-2.52	0.26	175	0.137375828	1273.877672
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01/16/2011 14:30 EST	-1.54	-0.18	-324	-0.219265248	1477.662343
01/16/2011 14:45 EST	-1.5	-0.3	-474	-0.31868676	1487.353915
01/16/2011 15:00 EST	-1.46	-0.27	-436	-0.291890358	1493.711553
01/16/2011 15:15 EST	-1.41	-0.26	-423	-0.281245922	1504.021808
01/16/2011 15:30 EST	-1.38	-0.31	-486	-0.321520342	1511.568434
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01/16/2011 16:00 EST	-1.3	-0.32	-499	-0.326144648	1529.995979
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01/16/2011 16:30 EST	-1.22	-0.3	-473	-0.30598176	1545.843778
01/16/2011 16:45 EST	-1.2	-0.3	-473	-0.30507426	1550.442178
01/16/2011 17:00 EST	-1.17	-0.23	-381	-0.245083208	1554.574069
01/16/2011 17:15 EST	-1.17	-0.13	-248	-0.159262888	1557.173822
01/16/2011 17:30 EST	-1.16	-0.08	-179	-0.114988628	1556.675674
01/16/2011 17:45 EST	-1.17	0	-69	-0.04406721	1565.790074
01/16/2011 18:00 EST	-1.18	0.05	1.4	0.00087749	1595.459777
01/16/2011 18:15 EST	-1.19	0.17	174	0.111856172	1555.569057
01/16/2011 18:30 EST	-1.21	0.21	230	0.148869648	1544.975776
01/16/2011 18:45 EST	-1.23	0.3	362	0.23470449	1542.36504
01/16/2011 19:00 EST	-1.25	0.31	375	0.243556408	1539.684392
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01/16/2011 19:30 EST	-1.26	0.14	124	0.080494088	1540.485806
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01/17/2011 05:15 EST	-0.54	0.5	788	0.46581404	1691.662192
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01/17/2011 05:45 EST	-0.61	0.6	949	0.56617959	1676.146609
01/17/2011 06:00 EST	-0.65	0.59	923	0.553901168	1666.362256
01/17/2011 06:15 EST	-0.68	0.55	849	0.51092899	1661.679053
01/17/2011 06:30 EST	-0.72	0.59	910	0.550724918	1652.36758
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01/17/2011 07:00 EST	-0.78	0.52	779	0.475438192	1638.488479
01/17/2011 07:15 EST	-0.82	0.54	806	0.494234448	1630.804982
01/17/2011 07:30 EST	-0.86	0.62	934	0.575835512	1621.990969
01/17/2011 07:45 EST	-0.89	0.57	844	0.522157152	1616.371617
01/17/2011 08:00 EST	-0.93	0.56	820	0.509951558	1607.995872
01/17/2011 08:15 EST	-0.96	0.56	814	0.508590308	1600.502383
01/17/2011 08:30 EST	-0.99	0.61	892	0.559424788	1594.494951
01/17/2011 08:45 EST	-1.02	0.59	853	0.537112418	1588.121912
01/17/2011 09:00 EST	-1.05	0.55	782	0.49414024	1582.546688
01/17/2011 09:15 EST	-1.08	0.61	875	0.555341038	1575.608392
01/17/2011 09:30 EST	-1.12	0.59	835	0.532574918	1567.854534
01/17/2011 09:45 EST	-1.15	0.61	862	0.552164788	1561.128161
01/17/2011 10:00 EST	-1.17	0.64	907	0.582866038	1556.103703
01/17/2011 10:15 EST	-1.2	0.55	755	0.48733399	1549.245518

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01/17/2011 11:00 EST	-1.3	0.62	850	0.555870512	1529.133101
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01/17/2011 17:00 EST	-0.74	-0.35	-536	-0.32535191	1647.446914
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01/17/2011 20:45 EST	-0.59	-0.2	-325	-0.19327451	1681.546108
01/17/2011 21:00 EST	-0.56	-0.22	-352	-0.208931668	1684.761355
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01/18/2011 05:45 EST	0.14	0.29	527	0.287133098	1835.385762
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01/18/2011 20:15 EST	-0.77	0.51	764	0.465622728	1640.813375
01/18/2011 20:30 EST	-0.8	0.54	810	0.495141948	1635.894521
01/18/2011 20:45 EST	-0.83	0.54	804	0.493780698	1628.253197
01/18/2011 21:00 EST	-0.86	0.51	749	0.461538978	1622.831517
01/18/2011 21:15 EST	-0.88	0.5	729	0.45038654	1618.60965
01/18/2011 21:30 EST	-0.91	0.52	757	0.469539442	1612.218128
01/18/2011 21:45 EST	-0.94	0.5	719	0.44766404	1606.115157
01/18/2011 22:00 EST	-0.95	0.46	652	0.406473298	1604.041405
01/18/2011 22:15 EST	-0.96	0.41	569	0.355644518	1599.912191
01/18/2011 22:30 EST	-0.96	0.35	474	0.29599559	1601.37521
01/18/2011 22:45 EST	-0.95	0.09	77	0.048069468	1601.848392
01/18/2011 23:00 EST	-0.93	-0.05	-125	-0.07796876	1603.206207
01/18/2011 23:15 EST	-0.89	-0.19	-321	-0.198341392	1618.421635
01/18/2011 23:30 EST	-0.86	-0.27	-429	-0.264665358	1620.914816
01/18/2011 23:45 EST	-0.82	-0.39	-589	-0.361465062	1629.479753
01/19/2011 00:00 EST	-0.77	-0.44	-655	-0.399254042	1640.559471
01/19/2011 00:15 EST	-0.72	-0.44	-656	-0.396985292	1652.454167
01/19/2011 00:30 EST	-0.66	-0.47	-696	-0.418006118	1665.0474
01/19/2011 00:45 EST	-0.6	-0.52	-762	-0.454370308	1677.046203
01/19/2011 01:00 EST	-0.53	-0.57	-829	-0.489673848	1692.963599
01/19/2011 01:15 EST	-0.46	-0.58	-844	-0.494120728	1708.084588
01/19/2011 01:30 EST	-0.38	-0.52	-767	-0.444387808	1725.969944
01/19/2011 01:45 EST	-0.3	-0.49	-727	-0.417378622	1741.823758
01/19/2011 02:00 EST	-0.23	-0.48	-714	-0.406360758	1757.059426
01/19/2011 02:15 EST	-0.16	-0.51	-756	-0.426636522	1772.000195
01/19/2011 02:30 EST	-0.09	-0.54	-798	-0.446693802	1786.458635
01/19/2011 02:45 EST	-0.03	-0.54	-799	-0.443971302	1799.665871
01/19/2011 03:00 EST	0.03	-0.53	-786	-0.433528568	1813.029309
01/19/2011 03:15 EST	0.08	-0.58	-856	-0.469618228	1822.757187
01/19/2011 03:30 EST	0.13	-0.5	-744	-0.40568471	1833.936507
01/19/2011 03:45 EST	0.16	-0.54	-801	-0.435350052	1839.898712
01/19/2011 04:00 EST	0.19	-0.43	-642	-0.347731048	1846.254465
01/19/2011 04:15 EST	0.2	-0.39	-583	-0.315182562	1849.721623
01/19/2011 04:30 EST	0.21	-0.29	-431	-0.232792652	1851.433008
01/19/2011 04:45 EST	0.2	-0.19	-275	-0.148882642	1847.092423
01/19/2011 05:00 EST	0.19	-0.1	-132	-0.07133341	1850.465301
01/19/2011 05:15 EST	0.17	0.02	64	0.034821842	1837.926897
01/19/2011 05:30 EST	0.15	0.09	180	0.097981968	1837.072715
01/19/2011 05:45 EST	0.12	0.17	314	0.171297422	1833.069035
01/19/2011 06:00 EST	0.09	0.2	362	0.19834049	1825.144225
01/19/2011 06:15 EST	0.07	0.26	464	0.254897078	1820.342562

01/19/2011 06:30 EST	0.05	0.29	514	0.283049348	1815.937764
01/19/2011 06:45 EST	0.03	0.41	726	0.400565768	1812.436454
01/19/2011 07:00 EST	0	0.43	757	0.419281702	1805.468725
01/19/2011 07:15 EST	-0.03	0.48	843	0.468538242	1799.212795

Max	1799.212795
Min	1397.57566
	0.776770632

Attachment C

<u>February 15, 2011 E-Mail from Kevin Grimsley to Martyn Johnson</u>

Note: E-mail string deleted by Doug Leeper

From: Kevin J Grimsley
To: Alan Martyn Johnson
Cc: Doug Leeper; rkane
Subject: RE: Homosassa Flow Concerns
Date: Tuesday, February 15, 2011 4:45:03 PM

Martyn,
It seems that you're unaware that there is a separate equation that computes an area value. That computed area is then multiplied by the computed Vm to obtain Q. I assume you're getting all your equations from the SWFWMD minimum flow report so perhaps it was accidentally omitted there.

The stage-area rating (as we call it) for station 02310700 is:

Channel Cross-sectional Area (ft2) = $0.9749 * GH^2 + 214.94 * GH + 1806.4$
Where:
GH = Gage Height (feet)

I hope this clarifies this issue. Everything in your spreadsheet looks to be correct. I added a column to calculate the area using the rating equation provided. The small differences seen between those areas and the ones you've already calculated are simply due to the rounding that's been applied to the data before display on our website. The original calculations use unrounded numbers from within our internal database.

****

Kevin Grimsley, P.E.
Supervisory Hydrologist
USGS, Florida Water Science Center
10500 University Center Drive, Suite 215
Tampa, FL 33612
kjgrims@usgs.gov
813-975-8620 x159

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Attachment D

<u>Data Associated with February 15, 2011 E-Mail from Kevin Grimsley to Martyn Johnson</u>

Note: The data file was not attached to original e-mail (see Attachment C), so Kevin Grimsley sent a second e-mail with the file attached

Homosassa River USGS 02130700

Note:

1. If Column D is Vi.

2. Formula Q = Vm x Area where Vm = 0.00902154 + 0.9019*Vi + 0.12138*Vi*Vi + 0.045375 (GH)

Date / Time	Gage height, feet	Stream veloc-ity, ft/s	Dis-charge, ft3/s (not filtrd. for tide)	Vm	Area A from Discharge divided by Vm	Area from Rating
01/13/2011 00:00 EST	-1.9	0.2	151	0.10804424	1397.57566	1401.53339
01/13/2011 00:15 EST	-1.91	0.21	164	0.117107148	1400.426898	1399.42113
01/13/2011 00:30 EST	-1.92	0.25	217	0.15496279	1400.336171	1397.30907
01/13/2011 00:45 EST	-1.93	0.28	256	0.183495982	1395.125916	1395.19721
01/13/2011 01:00 EST	-1.95	0.24	200	0.143987778	1389.006781	1390.97406
01/13/2011 01:15 EST	-1.95	0.24	200	0.143987778	1389.006781	1390.97406
01/13/2011 01:30 EST	-1.97	0.23	185	0.133490792	1385.863379	1386.75169
01/13/2011 01:45 EST	-1.99	0.21	157	0.113477148	1383.538472	1382.5301
01/13/2011 02:00 EST	-2	0.18	117	0.084546252	1383.857915	1380.4196
01/13/2011 02:15 EST	-2.01	0.2	142	0.10305299	1377.931878	1378.30929
01/13/2011 02:30 EST	-2.02	0.2	141	0.10259924	1374.279186	1376.19918
01/13/2011 02:45 EST	-2.04	0.23	179	0.130314542	1373.599579	1371.97954
01/13/2011 03:00 EST	-2.06	0.25	203	0.14861029	1365.988856	1367.76069
01/13/2011 03:15 EST	-2.07	0.3	268	0.19658949	1363.246835	1365.65155
01/13/2011 03:30 EST	-2.08	0.35	334	0.24517559	1362.288962	1363.54261
01/13/2011 03:45 EST	-2.1	0.28	239	0.175782232	1359.636849	1359.32531
01/13/2011 04:00 EST	-2.12	0.3	263	0.19432074	1353.432475	1355.10879
01/13/2011 04:15 EST	-2.13	0.33	302	0.223218072	1352.937051	1353.00082
01/13/2011 04:30 EST	-2.15	0.31	273	0.202718908	1346.692337	1348.78548
01/13/2011 04:45 EST	-2.16	0.32	286	0.212048852	1348.745807	1346.67809
01/13/2011 05:00 EST	-2.19	0.31	269	0.200903908	1338.948568	1340.35712
01/13/2011 05:15 EST	-2.2	0.3	255	0.19069074	1337.243749	1338.25052
01/13/2011 05:30 EST	-2.22	0.31	266	0.199542658	1333.048295	1334.0379
01/13/2011 05:45 EST	-2.23	0.33	291	0.218680572	1330.708061	1331.93188
01/13/2011 06:00 EST	-2.25	0.29	237	0.178686848	1326.34272	1327.72043
01/13/2011 06:15 EST	-2.26	0.33	288	0.217319322	1325.238811	1325.615
01/13/2011 06:30 EST	-2.28	0.32	273	0.206603852	1321.369361	1321.40472
01/13/2011 06:45 EST	-2.3	0.3	245	0.18615324	1316.119988	1317.19522
01/13/2011 07:00 EST	-2.31	0.33	283	0.215050572	1315.969529	1315.09076
01/13/2011 07:15 EST	-2.33	0.32	268	0.204335102	1311.571029	1310.88243
01/13/2011 07:30 EST	-2.35	0.3	240	0.18388449	1305.167173	1306.67489
01/13/2011 07:45 EST	-2.36	0.29	227	0.173695598	1306.884012	1304.5714
01/13/2011 08:00 EST	-2.38	0.31	250	0.192282658	1300.169254	1300.36502
01/13/2011 08:15 EST	-2.39	0.28	211	0.162623482	1297.475601	1298.26213
01/13/2011 08:30 EST	-2.42	0.33	271	0.210059322	1290.111752	1291.9546

01/13/2011 08:45 EST	-2.43	0.39	347	0.268963188	1290.139378	1289.85249
01/13/2011 09:00 EST	-2.44	0.37	320	0.248626462	1287.071366	1287.75056
01/13/2011 09:15 EST	-2.46	0.34	280	0.218076568	1283.952708	1283.5473
01/13/2011 09:30 EST	-2.48	0.36	303	0.236906388	1278.986196	1279.34482
01/13/2011 09:45 EST	-2.49	0.36	302	0.236452638	1277.21138	1277.24388
01/13/2011 10:00 EST	-2.51	0.41	363	0.285313268	1272.285732	1273.04257
01/13/2011 10:15 EST	-2.53	0.42	374	0.294432222	1270.241407	1268.84204
01/13/2011 10:30 EST	-2.55	0.45	409	0.32374974	1263.321478	1264.64229
01/13/2011 10:45 EST	-2.56	0.4	345	0.27304234	1263.540299	1262.5427
01/13/2011 11:00 EST	-2.58	0.42	368	0.292163472	1259.568821	1258.34412
01/13/2011 11:15 EST	-2.59	0.43	379	0.301760452	1255.963124	1256.24513
01/13/2011 11:30 EST	-2.61	0.28	191	0.152640982	1251.302222	1252.04772
01/13/2011 11:45 EST	-2.63	0.37	300	0.240005212	1249.972855	1247.85109
01/13/2011 12:00 EST	-2.64	0.33	249	0.200076822	1244.521967	1245.75306
01/13/2011 12:15 EST	-2.65	0.32	236	0.189815102	1243.315192	1243.65524
01/13/2011 12:30 EST	-2.67	0.33	246	0.198715572	1237.95029	1239.46016
01/13/2011 12:45 EST	-2.68	0.3	209	0.16891074	1237.339911	1237.36292
01/13/2011 13:00 EST	-2.69	0.32	232	0.188000102	1234.041884	1235.26587
01/13/2011 13:15 EST	-2.7	0.44	378	0.306844208	1231.895503	1233.16902
01/13/2011 13:30 EST	-2.71	0.34	255	0.206732818	1233.476148	1231.07236
01/13/2011 13:45 EST	-2.73	0.29	193	0.156906848	1230.02917	1226.87963
01/13/2011 14:00 EST	-2.73	0.36	277	0.225562638	1228.040257	1226.87963
01/13/2011 14:15 EST	-2.75	0.37	287	0.234560212	1223.566425	1222.68768
01/13/2011 14:30 EST	-2.75	0.39	311	0.254443188	1222.276778	1222.68768
01/13/2011 14:45 EST	-2.76	0.39	310	0.253989438	1220.523194	1220.592
01/13/2011 15:00 EST	-2.77	0.32	225	0.184370102	1220.371403	1218.49651
01/13/2011 15:15 EST	-2.77	0.32	225	0.184370102	1220.371403	1218.49651
01/13/2011 15:30 EST	-2.77	0.27	165	0.135694392	1215.967717	1218.49651
01/13/2011 15:45 EST	-2.78	0.31	212	0.174132658	1217.462608	1216.40122
01/13/2011 16:00 EST	-2.78	0.23	118	0.096737042	1219.801614	1216.40122
01/13/2011 16:15 EST	-2.78	0.24	129	0.106326528	1213.243792	1216.40122
01/13/2011 16:30 EST	-2.77	0.19	72	0.059075608	1218.77713	1218.49651
01/13/2011 16:45 EST	-2.76	0.15	27	0.02180259	1238.384981	1220.592
01/13/2011 17:00 EST	-2.75	0.13	4.3	0.003538612	1215.16572	1222.68768
01/13/2011 17:15 EST	-2.74	0.09	-41	-0.033151782	1236.735932	1224.78356
01/13/2011 17:30 EST	-2.72	0.08	-51	-0.041469628	1229.81571	1228.9759
01/13/2011 17:45 EST	-2.7	0.01	-129	-0.104459822	1234.924563	1233.16902
01/13/2011 18:00 EST	-2.68	-0.05	-195	-0.15737501	1239.078555	1237.36292
01/13/2011 18:15 EST	-2.66	-0.02	-161	-0.129665408	1241.657297	1241.5576
01/13/2011 18:30 EST	-2.63	-0.01	-149	-0.119321572	1248.726425	1247.85109
01/13/2011 18:45 EST	-2.61	-0.05	-193	-0.15419876	1251.631336	1252.04772
01/13/2011 19:00 EST	-2.59	-0.01	-148	-0.117506572	1259.504022	1256.24513
01/13/2011 19:15 EST	-2.56	-0.08	-225	-0.178513628	1260.407973	1262.5427
01/13/2011 19:30 EST	-2.53	-0.05	-191	-0.15056876	1268.523431	1268.84204
01/13/2011 19:45 EST	-2.5	-0.07	-213	-0.166954198	1275.799007	1275.14313
01/13/2011 20:00 EST	-2.47	-0.06	-201	-0.156731742	1282.446028	1281.44597
01/13/2011 20:15 EST	-2.44	-0.09	-234	-0.181881282	1286.5535	1287.75056
01/13/2011 20:30 EST	-2.41	-0.1	-245	-0.18930841	1294.184447	1294.05692
01/13/2011 20:45 EST	-2.37	-0.11	-256	-0.196257512	1304.408669	1302.46812

01/13/2011 21:00 EST	-2.33	-0.13	-278	-0.211897888	1311.95267	1310.88243
01/13/2011 21:15 EST	-2.3	-0.13	-277	-0.210536638	1315.685491	1317.19522
01/13/2011 21:30 EST	-2.26	-0.15	-300	-0.22607991	1326.964435	1325.615
01/13/2011 21:45 EST	-2.22	-0.2	-357	-0.26723576	1335.899058	1334.0379
01/13/2011 22:00 EST	-2.19	-0.19	-345	-0.257328892	1340.696714	1340.35712
01/13/2011 22:15 EST	-2.15	-0.19	-345	-0.255513892	1350.220128	1348.78548
01/13/2011 22:30 EST	-2.11	-0.19	-344	-0.253698892	1355.938125	1357.21695
01/13/2011 22:45 EST	-2.08	-0.22	-379	-0.277901668	1363.791742	1363.54261
01/13/2011 23:00 EST	-2.05	-0.22	-379	-0.276540418	1370.504908	1369.87002
01/13/2011 23:15 EST	-2.02	-0.17	-320	-0.232451078	1376.633753	1376.19918
01/13/2011 23:30 EST	-1.99	-0.15	-296	-0.21382866	1384.285904	1382.5301
01/13/2011 23:45 EST	-1.97	-0.16	-307	-0.221563882	1385.604897	1386.75169
01/14/2011 00:00 EST	-1.96	-0.1	-235	-0.16888966	1391.441015	1388.86278
01/14/2011 00:15 EST	-1.94	-0.06	-185	-0.132682992	1394.300786	1393.08553
01/14/2011 00:30 EST	-1.94	-0.03	-148	-0.105953718	1396.836305	1393.08553
01/14/2011 00:45 EST	-1.94	0.02	-85	-0.060919408	1395.286047	1393.08553
01/14/2011 01:00 EST	-1.94	0.05	-47	-0.03360751	1398.496943	1393.08553
01/14/2011 01:15 EST	-1.95	0.12	42	0.030516162	1376.319866	1390.97406
01/14/2011 01:30 EST	-1.96	0.2	146	0.10532174	1386.228522	1388.86278
01/14/2011 01:45 EST	-1.97	0.25	212	0.15269404	1388.397347	1386.75169
01/14/2011 02:00 EST	-1.99	0.24	197	0.142172778	1385.637974	1382.5301
01/14/2011 02:15 EST	-2.01	0.24	195	0.141265278	1380.381667	1378.30929
01/14/2011 02:30 EST	-2.02	0.26	220	0.160063328	1374.45599	1376.19918
01/14/2011 02:45 EST	-2.04	0.24	192	0.139904028	1372.36935	1371.97954
01/14/2011 03:00 EST	-2.05	0.28	244	0.178050982	1370.394014	1369.87002
01/14/2011 03:15 EST	-2.06	0.27	230	0.167910642	1369.776193	1367.76069
01/14/2011 03:30 EST	-2.08	0.28	241	0.176689732	1363.972865	1363.54261
01/14/2011 03:45 EST	-2.1	0.28	239	0.175782232	1359.636849	1359.32531
01/14/2011 04:00 EST	-2.11	0.31	278	0.204533908	1359.187837	1357.21695
01/14/2011 04:15 EST	-2.12	0.32	290	0.213863852	1356.002884	1355.10879
01/14/2011 04:30 EST	-2.14	0.33	301	0.222764322	1351.203807	1350.89305
01/14/2011 04:45 EST	-2.16	0.31	272	0.202265158	1344.769424	1346.67809
01/14/2011 05:00 EST	-2.17	0.31	271	0.201811408	1342.837864	1344.57091
01/14/2011 05:15 EST	-2.19	0.35	322	0.24018434	1340.636946	1340.35712
01/14/2011 05:30 EST	-2.2	0.35	321	0.23973059	1339.003087	1338.25052
01/14/2011 05:45 EST	-2.22	0.32	279	0.209326352	1332.846999	1334.0379
01/14/2011 06:00 EST	-2.23	0.3	252	0.18932949	1331.012934	1331.93188
01/14/2011 06:15 EST	-2.25	0.32	276	0.207965102	1327.145744	1327.72043
01/14/2011 06:30 EST	-2.27	0.32	274	0.207057602	1323.303261	1323.50976
01/14/2011 06:45 EST	-2.28	0.29	234	0.177325598	1319.606434	1321.40472
01/14/2011 07:00 EST	-2.3	0.36	323	0.245073888	1317.969869	1317.19522
01/14/2011 07:15 EST	-2.31	0.36	322	0.244620138	1316.326622	1315.09076
01/14/2011 07:30 EST	-2.33	0.43	411	0.313557952	1310.762484	1310.88243
01/14/2011 07:45 EST	-2.34	0.4	370	0.28302484	1307.305747	1308.77856
01/14/2011 08:00 EST	-2.36	0.39	355	0.272139438	1304.478331	1304.5714
01/14/2011 08:15 EST	-2.37	0.4	367	0.28166359	1302.972812	1302.46812
01/14/2011 08:30 EST	-2.39	0.35	300	0.23110934	1298.086871	1298.26213
01/14/2011 08:45 EST	-2.4	0.39	350	0.270324438	1294.740507	1296.15942
01/14/2011 09:00 EST	-2.42	0.37	322	0.249533962	1290.405512	1291.9546

01/14/2011 09:15 EST	-2.44	0.35	295	0.22884059		1289.106972	1287.75056
01/14/2011 09:30 EST	-2.45	0.4	357	0.27803359		1284.017517	1285.64884
01/14/2011 09:45 EST	-2.46	0.41	369	0.287582018		1283.112215	1283.5473
01/14/2011 10:00 EST	-2.47	0.35	292	0.22747934		1283.633054	1281.44597
01/14/2011 10:15 EST	-2.49	0.33	264	0.206883072		1276.083139	1277.24388
01/14/2011 10:30 EST	-2.49	0.39	340	0.266240688		1277.039969	1277.24388
01/14/2011 10:45 EST	-2.51	0.36	300	0.235545138		1273.641233	1273.04257
01/14/2011 11:00 EST	-2.51	0.32	250	0.196167602		1274.420432	1273.04257
01/14/2011 11:15 EST	-2.52	0.29	212	0.166435598		1273.765964	1270.9422
01/14/2011 11:30 EST	-2.52	0.26	175	0.137375828		1273.877672	1270.9422
01/14/2011 11:45 EST	-2.53	0.19	89	0.069965608		1272.05355	1268.84204
01/14/2011 12:00 EST	-2.52	0.21	114	0.089428398		1274.762856	1270.9422
01/14/2011 12:15 EST	-2.52	0.15	42	0.03269259		1284.694789	1270.9422
01/14/2011 12:30 EST	-2.5	0.1	-17	-0.01301216		1306.470256	1275.14313
01/14/2011 12:45 EST	-2.49	0.16	56	0.043449118		1288.863907	1277.24388
01/14/2011 13:00 EST	-2.47	0.03	-97	-0.075888468		1278.191569	1281.44597
01/14/2011 13:15 EST	-2.46	0.02	-108	-0.084514408		1277.888618	1283.5473
01/14/2011 13:30 EST	-2.44	-0.02	-154	-0.119682908		1286.733441	1287.75056
01/14/2011 13:45 EST	-2.42	-0.07	-211	-0.163324198		1291.908992	1291.9546
01/14/2011 14:00 EST	-2.4	-0.09	-233	-0.180066282		1293.967962	1296.15942
01/14/2011 14:15 EST	-2.38	-0.08	-222	-0.170346128		1303.228918	1300.36502
01/14/2011 14:30 EST	-2.36	-0.07	-210	-0.160601698		1307.582688	1304.5714
01/14/2011 14:45 EST	-2.34	0	-127	-0.09715596		1307.176626	1308.77856
01/14/2011 15:00 EST	-2.33	-0.03	-162	-0.123649968		1310.149955	1310.88243
01/14/2011 15:15 EST	-2.33	0.05	-67	-0.05130376		1305.947166	1310.88243
01/14/2011 15:30 EST	-2.32	0.1	-6.4	-0.00484466		1321.042137	1312.9865
01/14/2011 15:45 EST	-2.31	0.07	-42	-0.032066948		1309.759819	1315.09076
01/14/2011 16:00 EST	-2.3	0.05	-66	-0.04994251		1321.519483	1317.19522
01/14/2011 16:15 EST	-2.28	0.08	-28	-0.021504628		1302.045309	1321.40472
01/14/2011 16:30 EST	-2.28	0.06	-53	-0.039882492		1328.903921	1321.40472
01/14/2011 16:45 EST	-2.26	-0.01	-136	-0.102532822		1326.404534	1325.615
01/14/2011 17:00 EST	-2.25	-0.08	-218	-0.164447378		1325.652027	1327.72043
01/14/2011 17:15 EST	-2.24	-0.03	-159	-0.119566218		1329.807053	1329.82606
01/14/2011 17:30 EST	-2.22	-0.04	-170	-0.127592752		1332.364083	1334.0379
01/14/2011 17:45 EST	-2.21	-0.05	-182	-0.13604876		1337.755669	1336.14411
01/14/2011 18:00 EST	-2.19	0	-121	-0.09034971		1339.240602	1340.35712
01/14/2011 18:15 EST	-2.17	-0.04	-169	-0.125324002		1348.504654	1344.57091
01/14/2011 18:30 EST	-2.16	-0.04	-168	-0.124870252		1345.3965	1346.67809
01/14/2011 18:45 EST	-2.14	-0.07	-203	-0.150619198		1347.769758	1350.89305
01/14/2011 19:00 EST	-2.12	-0.09	-227	-0.167361282		1356.347163	1355.10879
01/14/2011 19:15 EST	-2.1	-0.11	-250	-0.184006262		1358.649414	1359.32531
01/14/2011 19:30 EST	-2.07	-0.09	-225	-0.165092532		1362.872065	1365.65155
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01/14/2011 20:00 EST	-2.03	-0.13	-272	-0.198285388		1371.760182	1374.08927
01/14/2011 20:15 EST	-2	-0.17	-320	-0.231543578		1382.029261	1380.4196
01/14/2011 20:30 EST	-1.97	-0.15	-295	-0.21292116		1385.489352	1386.75169
01/14/2011 20:45 EST	-1.94	-0.13	-271	-0.194201638		1395.456819	1393.08553
01/14/2011 21:00 EST	-1.91	-0.16	-306	-0.218841382		1398.273019	1399.42113
01/14/2011 21:15 EST	-1.88	-0.18	-330	-0.234692748		1406.093724	1405.75849

01/14/2011 21:30 EST	-1.84	-0.26	-425	-0.300757172	1413.100134	1414.21102
01/14/2011 21:45 EST	-1.81	-0.25	-413	-0.29099596	1419.26369	1420.55247
01/14/2011 22:00 EST	-1.77	-0.28	-449	-0.314308018	1428.534986	1429.01046
01/14/2011 22:15 EST	-1.73	-0.28	-449	-0.312493018	1436.832102	1437.47158
01/14/2011 22:30 EST	-1.69	-0.26	-425	-0.293950922	1445.819585	1445.93581
01/14/2011 22:45 EST	-1.64	-0.28	-449	-0.308409268	1455.857675	1456.52049
01/14/2011 23:00 EST	-1.61	-0.31	-486	-0.331956592	1464.046841	1462.87364
01/14/2011 23:15 EST	-1.57	-0.3	-474	-0.32186301	1472.676217	1471.34723
01/14/2011 23:30 EST	-1.54	-0.29	-461	-0.312198902	1476.622746	1477.70447
01/14/2011 23:45 EST	-1.5	-0.24	-399	-0.268505472	1486.003235	1486.18353
01/15/2011 00:00 EST	-1.48	-0.22	-374	-0.250676668	1491.961749	1490.42422
01/15/2011 00:15 EST	-1.46	-0.2	-348	-0.23275076	1495.161605	1494.6657
01/15/2011 00:30 EST	-1.44	-0.1	-218	-0.14529466	1500.399258	1498.90795
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01/15/2011 01:15 EST	-1.45	0.07	10	0.006955552	1437.700415	1496.78673
01/15/2011 01:30 EST	-1.46	0.11	65	0.043451738	1495.912546	1494.6657
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01/15/2011 02:00 EST	-1.5	0.23	230	0.154817042	1485.624561	1486.18353
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01/15/2011 02:45 EST	-1.55	0.24	239	0.162137778	1474.054986	1475.5852
01/15/2011 03:00 EST	-1.57	0.24	237	0.161230278	1469.947227	1471.34723
01/15/2011 03:15 EST	-1.59	0.28	292	0.198923482	1467.90111	1467.11004
01/15/2011 03:30 EST	-1.61	0.28	290	0.198015982	1464.528252	1462.87364
01/15/2011 03:45 EST	-1.62	0.32	346	0.236551352	1462.684517	1460.75573
01/15/2011 04:00 EST	-1.64	0.29	301	0.206365598	1458.576444	1456.52049
01/15/2011 04:15 EST	-1.66	0.34	369	0.254376568	1450.605309	1452.28603
01/15/2011 04:30 EST	-1.68	0.31	324	0.224045158	1446.137033	1448.05236
01/15/2011 04:45 EST	-1.7	0.32	336	0.232921352	1442.54701	1443.81946
01/15/2011 05:00 EST	-1.71	0.37	406	0.281750212	1440.992705	1441.70331
01/15/2011 05:15 EST	-1.74	0.34	360	0.250746568	1435.712572	1435.35601
01/15/2011 05:30 EST	-1.76	0.38	414	0.289410812	1430.492514	1431.12545
01/15/2011 05:45 EST	-1.78	0.34	355	0.248931568	1426.094741	1426.89567
01/15/2011 06:00 EST	-1.79	0.39	425	0.298003188	1426.15924	1424.78108
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01/15/2011 06:30 EST	-1.83	0.36	377	0.266400138	1415.164432	1416.32464
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01/15/2011 07:00 EST	-1.87	0.35	359	0.25470434	1409.477357	1407.87133
01/15/2011 07:15 EST	-1.9	0.39	411	0.293011938	1402.673225	1401.53339
01/15/2011 07:30 EST	-1.91	0.33	326	0.233200572	1397.938252	1399.42113
01/15/2011 07:45 EST	-1.93	0.37	379	0.271767712	1394.573319	1395.19721
01/15/2011 08:00 EST	-1.95	0.42	446	0.320749722	1390.492242	1390.97406
01/15/2011 08:15 EST	-1.97	0.4	416	0.29981359	1387.528831	1386.75169
01/15/2011 08:30 EST	-1.99	0.39	399	0.288928188	1380.965986	1382.5301
01/15/2011 08:45 EST	-2.01	0.4	411	0.29799859	1379.201157	1378.30929
01/15/2011 09:00 EST	-2.03	0.37	367	0.267230212	1373.347711	1374.08927
01/15/2011 09:15 EST	-2.05	0.33	311	0.226848072	1370.961619	1369.87002
01/15/2011 09:30 EST	-2.06	0.41	418	0.305732018	1367.210418	1367.76069

01/15/2011 09:45 EST	-2.08	0.4	402	0.29482234	1363.533035	1363.54261
01/15/2011 10:00 EST	-2.1	0.36	345	0.254148888	1357.472003	1359.32531
01/15/2011 10:15 EST	-2.11	0.35	331	0.24381434	1357.59037	1357.21695
01/15/2011 10:30 EST	-2.13	0.32	289	0.213410102	1354.200187	1353.00082
01/15/2011 10:45 EST	-2.13	0.36	342	0.252787638	1352.914259	1353.00082
01/15/2011 11:00 EST	-2.14	0.29	248	0.183678098	1350.188197	1350.89305
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01/15/2011 11:30 EST	-2.15	0.18	105	0.077740002	1350.655998	1348.78548
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01/15/2011 12:00 EST	-2.13	0.01	-106	-0.078596072	1348.667908	1353.00082
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01/15/2011 12:30 EST	-2.08	-0.09	-226	-0.165546282	1365.177141	1363.54261
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01/15/2011 14:00 EST	-1.94	-0.13	-271	-0.194201638	1395.456819	1393.08553
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01/15/2011 14:45 EST	-1.82	-0.33	-508	-0.357969678	1419.11461	1418.43846
01/15/2011 15:00 EST	-1.8	-0.22	-377	-0.265196668	1421.586488	1422.66668
01/15/2011 15:15 EST	-1.77	-0.19	-340	-0.238271392	1426.94428	1429.01046
01/15/2011 15:30 EST	-1.74	-0.16	-303	-0.211127632	1435.150848	1435.35601
01/15/2011 15:45 EST	-1.72	-0.19	-340	-0.236002642	1440.661838	1439.58734
01/15/2011 16:00 EST	-1.69	-0.22	-376	-0.260205418	1445.012186	1445.93581
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01/15/2011 16:30 EST	-1.65	-0.17	-314	-0.215662328	1455.979832	1454.40317
01/15/2011 16:45 EST	-1.62	-0.15	-288	-0.19703991	1461.632824	1460.75573
01/15/2011 17:00 EST	-1.61	-0.22	-375	-0.256575418	1461.558566	1462.87364
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01/15/2011 17:30 EST	-1.57	-0.14	-274	-0.186104162	1472.293779	1471.34723
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01/15/2011 18:00 EST	-1.54	-0.1	-221	-0.14983216	1474.983742	1477.70447
01/15/2011 18:15 EST	-1.53	-0.11	-234	-0.158142512	1479.678026	1479.82394
01/15/2011 18:30 EST	-1.51	-0.14	-272	-0.183381662	1483.245364	1484.06347
01/15/2011 18:45 EST	-1.49	-0.15	-284	-0.19114116	1485.812893	1488.30378
01/15/2011 19:00 EST	-1.47	-0.21	-361	-0.241725852	1493.427356	1492.54486
01/15/2011 19:15 EST	-1.45	-0.18	-322	-0.215181498	1496.411183	1496.78673
01/15/2011 19:30 EST	-1.42	-0.18	-321	-0.213820248	1501.261003	1503.15099
01/15/2011 19:45 EST	-1.4	-0.18	-321	-0.212912748	1507.659842	1507.3948
01/15/2011 20:00 EST	-1.37	-0.19	-333	-0.220121392	1512.801627	1513.76199
01/15/2011 20:15 EST	-1.34	-0.22	-371	-0.244324168	1518.474423	1520.13093
01/15/2011 20:30 EST	-1.31	-0.26	-422	-0.276708422	1525.071037	1526.50163
01/15/2011 20:45 EST	-1.27	-0.25	-409	-0.26649346	1534.746856	1534.99862
01/15/2011 21:00 EST	-1.24	-0.27	-435	-0.281907858	1543.057377	1541.37341
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01/15/2011 21:30 EST	-1.15	-0.35	-537	-0.34395566	1561.247749	1560.50831
01/15/2011 21:45 EST	-1.11	-0.35	-537	-0.34214066	1569.529912	1569.01777

01/15/2011 22:00 EST	-1.06	-0.39	-588	-0.372355062	1579.137925	1579.659
01/15/2011 22:15 EST	-1.02	-0.39	-588	-0.370540062	1586.872947	1588.17549
01/15/2011 22:30 EST	-0.97	-0.32	-498	-0.311170898	1600.406732	1598.82548
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01/15/2011 23:15 EST	-0.82	-0.31	-483	-0.296110342	1631.148702	1630.80472
01/15/2011 23:30 EST	-0.77	-0.35	-536	-0.32671316	1640.582828	1641.47422
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01/16/2011 00:00 EST	-0.69	-0.39	-590	-0.355566312	1659.324801	1658.55555
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01/16/2011 00:30 EST	-0.64	-0.2	-326	-0.19554326	1667.150277	1669.23772
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01/16/2011 02:45 EST	-0.77	0.29	404	0.245841848	1643.332912	1641.47422
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01/16/2011 03:45 EST	-0.87	0.29	391	0.241304348	1620.360359	1620.1401
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01/16/2011 05:00 EST	-1.02	0.39	529	0.332941938	1588.865624	1588.17549
01/16/2011 05:15 EST	-1.05	0.43	588	0.371637952	1582.185019	1581.78783
01/16/2011 05:30 EST	-1.08	0.41	552	0.350199518	1576.244317	1575.40192
01/16/2011 05:45 EST	-1.11	0.4	532	0.33883609	1570.080684	1569.01777
01/16/2011 06:00 EST	-1.13	0.49	671	0.428822128	1564.751341	1564.76265
01/16/2011 06:15 EST	-1.16	0.5	682	0.43768154	1558.210566	1558.38143
01/16/2011 06:30 EST	-1.19	0.44	583	0.375360458	1553.173723	1552.00196
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01/16/2011 07:00 EST	-1.25	0.46	605	0.392860798	1539.985672	1539.24828
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01/16/2011 07:30 EST	-1.31	0.5	658	0.43087529	1527.124008	1526.50163
01/16/2011 07:45 EST	-1.34	0.53	700	0.460321682	1520.675709	1520.13093
01/16/2011 08:00 EST	-1.36	0.49	634	0.418385878	1515.347514	1515.88478
01/16/2011 08:15 EST	-1.39	0.55	723	0.47871274	1510.300311	1509.517
01/16/2011 08:30 EST	-1.42	0.49	625	0.415663378	1503.620557	1503.15099
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01/16/2011 09:30 EST	-1.53	0.53	668	0.451700432	1478.856235	1479.82394
01/16/2011 09:45 EST	-1.56	0.51	633	0.429776478	1472.858643	1473.46612
01/16/2011 10:00 EST	-1.58	0.53	660	0.449431682	1468.521305	1469.22854

01/16/2011 10:15 EST	-1.61	0.49	595	0.407042128	1461.765157	1462.87364
01/16/2011 10:30 EST	-1.64	0.56	696	0.477735308	1456.873688	1456.52049
01/16/2011 10:45 EST	-1.65	0.53	649	0.446255432	1454.324034	1454.40317
01/16/2011 11:00 EST	-1.68	0.5	600	0.41408654	1448.972478	1448.05236
01/16/2011 11:15 EST	-1.7	0.5	597	0.41317904	1444.894204	1443.81946
01/16/2011 11:30 EST	-1.72	0.44	506	0.351311708	1440.316359	1439.58734
01/16/2011 11:45 EST	-1.73	0.4	447	0.31070359	1438.670213	1437.47158
01/16/2011 12:00 EST	-1.74	0.39	431	0.300271938	1435.365565	1435.35601
01/16/2011 12:15 EST	-1.74	0.28	276	0.192117232	1436.622822	1435.35601
01/16/2011 12:30 EST	-1.74	0.23	207	0.143927042	1438.228683	1435.35601
01/16/2011 12:45 EST	-1.72	0.13	72	0.050274862	1432.127253	1439.58734
01/16/2011 13:00 EST	-1.71	0.01	-86	-0.059538572	1444.441765	1441.70331
01/16/2011 13:15 EST	-1.68	-0.07	-188	-0.129746698	1448.977145	1448.05236
01/16/2011 13:30 EST	-1.66	-0.17	-314	-0.216116078	1452.922906	1452.28603
01/16/2011 13:45 EST	-1.63	-0.19	-338	-0.231918892	1457.406066	1458.63801
01/16/2011 14:00 EST	-1.6	-0.18	-325	-0.221987748	1464.044763	1464.99174
01/16/2011 14:15 EST	-1.57	-0.16	-299	-0.203413882	1469.909512	1471.34723
01/16/2011 14:30 EST	-1.54	-0.18	-324	-0.219265248	1477.662343	1477.70447
01/16/2011 14:45 EST	-1.5	-0.3	-474	-0.31868676	1487.353915	1486.18353
01/16/2011 15:00 EST	-1.46	-0.27	-436	-0.291890358	1493.711553	1494.6657
01/16/2011 15:15 EST	-1.41	-0.26	-423	-0.281245922	1504.021808	1505.2728
01/16/2011 15:30 EST	-1.38	-0.31	-486	-0.321520342	1511.568434	1511.6394
01/16/2011 15:45 EST	-1.34	-0.38	-573	-0.376975688	1519.991921	1520.13093
01/16/2011 16:00 EST	-1.3	-0.32	-499	-0.326144648	1529.995979	1528.62558
01/16/2011 16:15 EST	-1.25	-0.28	-447	-0.290713018	1537.598843	1539.24828
01/16/2011 16:30 EST	-1.22	-0.3	-473	-0.30598176	1545.843778	1545.62424
01/16/2011 16:45 EST	-1.2	-0.3	-473	-0.30507426	1550.442178	1549.87586
01/16/2011 17:00 EST	-1.17	-0.23	-381	-0.245083208	1554.574069	1556.25474
01/16/2011 17:15 EST	-1.17	-0.13	-248	-0.159262888	1557.173822	1556.25474
01/16/2011 17:30 EST	-1.16	-0.08	-179	-0.114988628	1556.675674	1558.38143
01/16/2011 17:45 EST	-1.17	0	-69	-0.04406721	1565.790074	1556.25474
01/16/2011 18:00 EST	-1.18	0.05	1.4	0.00087749	1595.459777	1554.12825
01/16/2011 18:15 EST	-1.19	0.17	174	0.111856172	1555.569057	1552.00196
01/16/2011 18:30 EST	-1.21	0.21	230	0.148869648	1544.975776	1547.74995
01/16/2011 18:45 EST	-1.23	0.3	362	0.23470449	1542.36504	1543.49873
01/16/2011 19:00 EST	-1.25	0.31	375	0.243556408	1539.684392	1539.24828
01/16/2011 19:15 EST	-1.25	0.21	226	0.147054648	1536.843637	1539.24828
01/16/2011 19:30 EST	-1.26	0.14	124	0.080494088	1540.485806	1537.12335
01/16/2011 19:45 EST	-1.26	0.04	-18	-0.011880752	1515.055613	1537.12335
01/16/2011 20:00 EST	-1.25	-0.07	-170	-0.110235448	1542.153664	1539.24828
01/16/2011 20:15 EST	-1.23	-0.07	-169	-0.109327948	1545.807848	1543.49873
01/16/2011 20:30 EST	-1.21	-0.14	-263	-0.169769162	1549.162386	1547.74995
01/16/2011 20:45 EST	-1.19	-0.15	-276	-0.17752866	1554.678552	1552.00196
01/16/2011 21:00 EST	-1.16	-0.22	-368	-0.236156668	1558.287569	1558.38143
01/16/2011 21:15 EST	-1.13	-0.2	-341	-0.21777701	1565.821847	1564.76265
01/16/2011 21:30 EST	-1.1	-0.3	-472	-0.30053676	1570.523353	1571.14563
01/16/2011 21:45 EST	-1.06	-0.3	-472	-0.29872176	1580.065677	1579.659
01/16/2011 22:00 EST	-1.02	-0.29	-458	-0.288603902	1586.950131	1588.17549
01/16/2011 22:15 EST	-0.97	-0.3	-471	-0.29463801	1598.571753	1598.82548

01/16/2011 22:30 EST	-0.93	-0.34	-524	-0.325791682	1608.389744	1607.34899
01/16/2011 22:45 EST	-0.88	-0.34	-523	-0.323522932	1616.577832	1618.00776
01/16/2011 23:00 EST	-0.82	-0.42	-629	-0.385572528	1631.340291	1630.80472
01/16/2011 23:15 EST	-0.76	-0.42	-629	-0.382850028	1642.940979	1643.6087
01/16/2011 23:30 EST	-0.7	-0.3	-468	-0.28238676	1657.301497	1656.4197
01/16/2011 23:45 EST	-0.64	-0.36	-549	-0.328971612	1668.837006	1669.23772
01/17/2011 00:00 EST	-0.58	-0.41	-617	-0.366670982	1682.707469	1682.06276
01/17/2011 00:15 EST	-0.52	-0.5	-738	-0.43517846	1695.855994	1694.89481
01/17/2011 00:30 EST	-0.46	-0.56	-818	-0.478850192	1708.258686	1707.73389
01/17/2011 00:45 EST	-0.4	-0.56	-819	-0.476127692	1720.126793	1720.57998
01/17/2011 01:00 EST	-0.35	-0.49	-727	-0.419647372	1732.406893	1731.29043
01/17/2011 01:15 EST	-0.31	-0.48	-713	-0.409990758	1739.063591	1739.86229
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01/17/2011 01:45 EST	-0.25	-0.37	-560	-0.319408288	1753.24192	1752.72593
01/17/2011 02:00 EST	-0.23	-0.3	-459	-0.26106051	1758.213067	1757.01537
01/17/2011 02:15 EST	-0.22	-0.24	-370	-0.210425472	1758.34226	1759.16039
01/17/2011 02:30 EST	-0.23	-0.15	-235	-0.13396866	1754.141603	1757.01537
01/17/2011 02:45 EST	-0.25	-0.01	-20	-0.011329072	1765.369661	1752.72593
01/17/2011 03:00 EST	-0.27	0.1	154	0.08817409	1746.544818	1748.43727
01/17/2011 03:15 EST	-0.3	0.18	282	0.161683752	1744.145571	1742.00574
01/17/2011 03:30 EST	-0.32	0.16	247	0.141912868	1740.504603	1737.71903
01/17/2011 03:45 EST	-0.35	0.18	276	0.159415002	1731.330154	1731.29043
01/17/2011 04:00 EST	-0.37	0.27	422	0.244594392	1725.305296	1727.00566
01/17/2011 04:15 EST	-0.41	0.32	501	0.291455102	1718.961159	1718.43848
01/17/2011 04:30 EST	-0.44	0.39	615	0.359259438	1711.854818	1712.01514
01/17/2011 04:45 EST	-0.47	0.39	610	0.357898188	1704.395329	1705.59356
01/17/2011 05:00 EST	-0.51	0.47	741	0.436586132	1697.259591	1697.03417
01/17/2011 05:15 EST	-0.54	0.5	788	0.46581404	1691.662192	1690.61668
01/17/2011 05:30 EST	-0.58	0.48	746	0.443581992	1681.763492	1682.06276
01/17/2011 05:45 EST	-0.61	0.6	949	0.56617959	1676.146609	1675.64936
01/17/2011 06:00 EST	-0.65	0.59	923	0.553901168	1666.362256	1667.1009
01/17/2011 06:15 EST	-0.68	0.55	849	0.51092899	1661.679053	1660.69159
01/17/2011 06:30 EST	-0.72	0.59	910	0.550724918	1652.36758	1652.14859
01/17/2011 06:45 EST	-0.75	0.55	836	0.50775274	1646.470682	1645.74338
01/17/2011 07:00 EST	-0.78	0.52	779	0.475438192	1638.488479	1639.33993
01/17/2011 07:15 EST	-0.82	0.54	806	0.494234448	1630.804982	1630.80472
01/17/2011 07:30 EST	-0.86	0.62	934	0.575835512	1621.990969	1622.27264
01/17/2011 07:45 EST	-0.89	0.57	844	0.522157152	1616.371617	1615.87562
01/17/2011 08:00 EST	-0.93	0.56	820	0.509951558	1607.995872	1607.34899
01/17/2011 08:15 EST	-0.96	0.56	814	0.508590308	1600.502383	1600.95607
01/17/2011 08:30 EST	-0.99	0.61	892	0.559424788	1594.494951	1594.5649
01/17/2011 08:45 EST	-1.02	0.59	853	0.537112418	1588.121912	1588.17549
01/17/2011 09:00 EST	-1.05	0.55	782	0.49414024	1582.546688	1581.78783
01/17/2011 09:15 EST	-1.08	0.61	875	0.555341038	1575.608392	1575.40192
01/17/2011 09:30 EST	-1.12	0.59	835	0.532574918	1567.854534	1566.89011
01/17/2011 09:45 EST	-1.15	0.61	862	0.552164788	1561.128161	1560.50831
01/17/2011 10:00 EST	-1.17	0.64	907	0.582866038	1556.103703	1556.25474
01/17/2011 10:15 EST	-1.2	0.55	755	0.48733399	1549.245518	1549.87586
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01/17/2011 11:00 EST	-1.3	0.62	850	0.555870512	1529.133101	1528.62558
01/17/2011 11:15 EST	-1.34	0.55	731	0.48098149	1519.809006	1520.13093
01/17/2011 11:30 EST	-1.35	0.6	809	0.53260209	1518.957614	1518.00776
01/17/2011 11:45 EST	-1.39	0.54	707	0.468370698	1509.488111	1509.517
01/17/2011 12:00 EST	-1.41	0.54	704	0.467463198	1506.000907	1505.2728
01/17/2011 12:15 EST	-1.43	0.46	577	0.384693298	1499.896159	1501.02937
01/17/2011 12:30 EST	-1.45	0.39	469	0.313430688	1496.343587	1496.78673
01/17/2011 12:45 EST	-1.46	0.35	409	0.27330809	1496.479669	1494.6657
01/17/2011 13:00 EST	-1.46	0.28	306	0.204822232	1493.978447	1494.6657
01/17/2011 13:15 EST	-1.44	0.1	53	0.03508534	1510.602434	1498.90795
01/17/2011 13:30 EST	-1.42	-0.04	-137	-0.091292752	1500.666778	1503.15099
01/17/2011 13:45 EST	-1.39	-0.15	-282	-0.18660366	1511.224378	1509.517
01/17/2011 14:00 EST	-1.36	-0.16	-294	-0.193885132	1516.36176	1515.88478
01/17/2011 14:15 EST	-1.33	-0.23	-384	-0.252343208	1521.737015	1522.2543
01/17/2011 14:30 EST	-1.28	-0.27	-435	-0.283722858	1533.186304	1532.87408
01/17/2011 14:45 EST	-1.25	-0.27	-435	-0.282361608	1540.577712	1539.24828
01/17/2011 15:00 EST	-1.2	-0.34	-524	-0.338042932	1550.098968	1549.87586
01/17/2011 15:15 EST	-1.15	-0.32	-498	-0.319338398	1559.474223	1560.50831
01/17/2011 15:30 EST	-1.09	-0.44	-651	-0.413774042	1573.322475	1573.27368
01/17/2011 15:45 EST	-1.04	-0.49	-714	-0.450956122	1583.302599	1583.91685
01/17/2011 16:00 EST	-0.98	-0.5	-728	-0.45605096	1596.312833	1596.69509
01/17/2011 16:15 EST	-0.91	-0.46	-679	-0.421459702	1611.067432	1611.61191
01/17/2011 16:30 EST	-0.84	-0.37	-563	-0.346179538	1626.323737	1626.53829
01/17/2011 16:45 EST	-0.79	-0.36	-550	-0.335777862	1637.987677	1637.20584
01/17/2011 17:00 EST	-0.74	-0.35	-536	-0.32535191	1647.446914	1647.87826
01/17/2011 17:15 EST	-0.7	-0.43	-643	-0.388114798	1656.726317	1656.4197
01/17/2011 17:30 EST	-0.67	-0.27	-426	-0.256044108	1663.775837	1662.82783
01/17/2011 17:45 EST	-0.65	-0.21	-341	-0.204518352	1667.332035	1667.1009
01/17/2011 18:00 EST	-0.64	-0.13	-226	-0.135214138	1671.422851	1669.23772
01/17/2011 18:15 EST	-0.63	-0.11	-196	-0.117305012	1670.857849	1671.37474
01/17/2011 18:30 EST	-0.63	0.05	43	0.02583374	1664.489927	1671.37474
01/17/2011 18:45 EST	-0.64	0.13	166	0.099279862	1672.041003	1669.23772
01/17/2011 19:00 EST	-0.65	0.21	291	0.174279648	1669.730249	1667.1009
01/17/2011 19:15 EST	-0.66	0.15	195	0.11709009	1665.384321	1664.96427
01/17/2011 19:30 EST	-0.67	0.23	320	0.192478292	1662.525143	1662.82783
01/17/2011 19:45 EST	-0.68	0.14	177	0.106811588	1657.12357	1660.69159
01/17/2011 20:00 EST	-0.66	0	-35	-0.02092596	1672.563648	1664.96427
01/17/2011 20:15 EST	-0.65	-0.11	-197	-0.118212512	1666.490261	1667.1009
01/17/2011 20:30 EST	-0.62	-0.2	-326	-0.19463576	1674.923457	1673.51195
01/17/2011 20:45 EST	-0.59	-0.2	-325	-0.19327451	1681.546108	1679.92476
01/17/2011 21:00 EST	-0.56	-0.22	-352	-0.208931668	1684.761355	1686.33933
01/17/2011 21:15 EST	-0.52	-0.23	-365	-0.215589458	1693.03269	1694.89481
01/17/2011 21:30 EST	-0.49	-0.23	-364	-0.214228208	1699.122648	1701.31347
01/17/2011 21:45 EST	-0.45	-0.25	-392	-0.22928596	1709.655489	1709.87442
01/17/2011 22:00 EST	-0.41	-0.22	-347	-0.202125418	1716.755881	1718.43848
01/17/2011 22:15 EST	-0.37	-0.3	-462	-0.26741301	1727.664634	1727.00566
01/17/2011 22:30 EST	-0.33	-0.24	-374	-0.215416722	1736.169767	1735.57597
01/17/2011 22:45 EST	-0.28	-0.27	-416	-0.238347858	1745.348179	1746.29323

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01/17/2011 23:15 EST	-0.19	-0.33	-501	-0.284008428	1764.032158	1765.59659
01/17/2011 23:30 EST	-0.14	-0.35	-530	-0.29812691	1777.766388	1776.32751
01/17/2011 23:45 EST	-0.1	-0.43	-644	-0.360889798	1784.478263	1784.91575
01/18/2011 00:00 EST	-0.05	-0.37	-557	-0.310333288	1794.844516	1795.65544
01/18/2011 00:15 EST	0	-0.46	-687	-0.380168452	1807.093662	1806.4
01/18/2011 00:30 EST	0.05	-0.7	-1,020	-0.56056351	1819.597569	1817.14944
01/18/2011 00:45 EST	0.1	-0.76	-1,100	-0.601775872	1827.923071	1827.90375
01/18/2011 01:00 EST	0.15	-0.78	-1,130	-0.613806618	1840.970701	1838.66294
01/18/2011 01:15 EST	0.2	-0.77	-1,120	-0.604400258	1853.076641	1849.427
01/18/2011 01:30 EST	0.25	-0.85	-1,230	-0.65855266	1867.732187	1860.19593
01/18/2011 01:45 EST	0.29	-0.87	-1,250	-0.670600188	1864.001863	1868.81459
01/18/2011 02:00 EST	0.33	-0.94	-1,350	-0.716539342	1884.055656	1877.43637
01/18/2011 02:15 EST	0.36	-0.75	-1,100	-0.58279221	1887.465174	1883.90475
01/18/2011 02:30 EST	0.39	-0.59	-876	-0.463150832	1891.392478	1890.37488
01/18/2011 02:45 EST	0.4	-0.5	-745	-0.39343346	1893.585767	1892.53198
01/18/2011 03:00 EST	0.41	-0.43	-640	-0.337748548	1894.900818	1894.68928
01/18/2011 03:15 EST	0.4	-0.19	-265	-0.139807642	1895.46148	1892.53198
01/18/2011 03:30 EST	0.38	-0.14	-184	-0.097622912	1884.803436	1888.21798
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01/18/2011 04:00 EST	0.33	-0.08	-89	-0.047379878	1878.434554	1877.43637
01/18/2011 04:15 EST	0.3	-0.07	-75	-0.039904198	1879.5015	1870.96974
01/18/2011 04:30 EST	0.28	-0.02	7	0.003737092	1873.114175	1866.65963
01/18/2011 04:45 EST	0.25	0.02	72	0.038451842	1872.472065	1860.19593
01/18/2011 05:00 EST	0.22	0.07	153	0.082731802	1849.349299	1853.73399
01/18/2011 05:15 EST	0.19	0.18	340	0.183917502	1848.654947	1847.27379
01/18/2011 05:30 EST	0.17	0.19	355	0.192478108	1844.365594	1842.96797
01/18/2011 05:45 EST	0.14	0.29	527	0.287133098	1835.385762	1836.51071
01/18/2011 06:00 EST	0.11	0.39	703	0.384215688	1829.701446	1830.0552
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01/18/2011 06:30 EST	0.05	0.48	858	0.472168242	1817.148897	1817.14944
01/18/2011 06:45 EST	0.02	0.52	927	0.511738192	1811.47316	1810.69919
01/18/2011 07:00 EST	-0.01	0.57	1,010	0.562087152	1796.874375	1804.2507
01/18/2011 07:15 EST	-0.04	0.67	1,200	0.665967022	1801.891025	1797.80396
01/18/2011 07:30 EST	-0.07	0.6	1,060	0.59068209	1794.535534	1791.35898
01/18/2011 07:45 EST	-0.11	0.63	1,110	0.620403012	1789.159592	1782.7684
01/18/2011 08:00 EST	-0.14	0.67	1,170	0.661429522	1768.895946	1776.32751
01/18/2011 08:15 EST	-0.18	0.7	1,220	0.69166024	1763.871811	1767.74239
01/18/2011 08:30 EST	-0.21	0.69	1,200	0.679592808	1765.763242	1761.30559
01/18/2011 08:45 EST	-0.25	0.71	1,230	0.699214448	1759.116968	1752.72593
01/18/2011 09:00 EST	-0.28	0.7	1,200	0.68712274	1746.412875	1746.29323
01/18/2011 09:15 EST	-0.32	0.71	1,210	0.696038198	1738.410339	1737.71903
01/18/2011 09:30 EST	-0.36	0.74	1,260	0.726560228	1734.198971	1729.14795
01/18/2011 09:45 EST	-0.39	0.76	1,290	0.746878378	1727.188841	1722.72168
01/18/2011 10:00 EST	-0.43	0.78	1,310	0.766839882	1708.309689	1714.15606
01/18/2011 10:15 EST	-0.47	0.78	1,300	0.765024882	1699.291135	1705.59356
01/18/2011 10:30 EST	-0.51	0.8	1,330	0.78508349	1694.087338	1697.03417
01/18/2011 10:45 EST	-0.55	0.8	1,320	0.78326849	1685.245885	1688.47791
01/18/2011 11:00 EST	-0.59	0.78	1,280	0.759579882	1685.142051	1679.92476

01/18/2011 11:15 EST	-0.63	0.77	1,250	0.746864492	1673.663715	1671.37474
01/18/2011 11:30 EST	-0.67	0.72	1,150	0.690911682	1664.467442	1662.82783
01/18/2011 11:45 EST	-0.71	0.79	1,270	0.765059548	1660.001504	1654.28405
01/18/2011 12:00 EST	-0.75	0.83	1,330	0.807185972	1647.699596	1645.74338
01/18/2011 12:15 EST	-0.79	0.8	1,260	0.77237849	1631.32456	1637.20584
01/18/2011 12:30 EST	-0.82	0.85	1,350	0.82612609	1634.133114	1630.80472
01/18/2011 12:45 EST	-0.85	0.82	1,290	0.791626702	1629.555947	1624.40537
01/18/2011 13:00 EST	-0.88	0.83	1,300	0.801287222	1622.389531	1618.00776
01/18/2011 13:15 EST	-0.91	0.76	1,170	0.723283378	1617.623238	1611.61191
01/18/2011 13:30 EST	-0.93	0.71	1,070	0.668359448	1600.934951	1607.34899
01/18/2011 13:45 EST	-0.95	0.67	1,000	0.624675772	1600.830454	1603.08685
01/18/2011 14:00 EST	-0.95	0.56	816	0.509044058	1603.004666	1603.08685
01/18/2011 14:15 EST	-0.93	0.37	510	0.317142712	1608.108844	1607.34899
01/18/2011 14:30 EST	-0.91	0.03	-8.2	-0.005103468	1606.750547	1611.61191
01/18/2011 14:45 EST	-0.87	-0.23	-375	-0.231470708	1620.075401	1620.1401
01/18/2011 15:00 EST	-0.83	-0.15	-263	-0.16119366	1631.577818	1628.67141
01/18/2011 15:15 EST	-0.79	-0.2	-331	-0.20234951	1635.783551	1637.20584
01/18/2011 15:30 EST	-0.75	-0.22	-358	-0.217552918	1645.576641	1645.74338
01/18/2011 15:45 EST	-0.71	-0.18	-300	-0.181603998	1651.946011	1654.28405
01/18/2011 16:00 EST	-0.66	-0.37	-563	-0.338012038	1665.621152	1664.96427
01/18/2011 16:15 EST	-0.61	-0.26	-410	-0.244945922	1673.838848	1675.64936
01/18/2011 16:30 EST	-0.56	-0.21	-338	-0.200434602	1686.335576	1686.33933
01/18/2011 16:45 EST	-0.53	-0.16	-264	-0.156223882	1689.882473	1692.75565
01/18/2011 17:00 EST	-0.5	-0.13	-219	-0.128861638	1699.497255	1699.17373
01/18/2011 17:15 EST	-0.49	-0.03	-68	-0.040159968	1693.228441	1701.31347
01/18/2011 17:30 EST	-0.49	0.06	70	0.041338758	1693.326152	1701.31347
01/18/2011 17:45 EST	-0.51	0.27	404	0.238241892	1695.755506	1697.03417
01/18/2011 18:00 EST	-0.53	0.41	635	0.375155768	1692.630246	1692.75565
01/18/2011 18:15 EST	-0.55	0.42	649	0.384274722	1688.895894	1688.47791
01/18/2011 18:30 EST	-0.58	0.48	746	0.443581992	1681.763492	1682.06276
01/18/2011 18:45 EST	-0.6	0.54	846	0.504216948	1677.849194	1677.78696
01/18/2011 19:00 EST	-0.63	0.49	755	0.451509628	1672.168107	1671.37474
01/18/2011 19:15 EST	-0.65	0.49	751	0.450602128	1666.658796	1667.1009
01/18/2011 19:30 EST	-0.68	0.44	662	0.398501708	1661.222491	1660.69159
01/18/2011 19:45 EST	-0.71	0.54	826	0.499225698	1654.562262	1654.28405
01/18/2011 20:00 EST	-0.74	0.49	736	0.446518378	1648.308415	1647.87826
01/18/2011 20:15 EST	-0.77	0.51	764	0.465622728	1640.813375	1641.47422
01/18/2011 20:30 EST	-0.8	0.54	810	0.495141948	1635.894521	1635.07194
01/18/2011 20:45 EST	-0.83	0.54	804	0.493780698	1628.253197	1628.67141
01/18/2011 21:00 EST	-0.86	0.51	749	0.461538978	1622.831517	1622.27264
01/18/2011 21:15 EST	-0.88	0.5	729	0.45038654	1618.60965	1618.00776
01/18/2011 21:30 EST	-0.91	0.52	757	0.469539442	1612.218128	1611.61191
01/18/2011 21:45 EST	-0.94	0.5	719	0.44766404	1606.115157	1605.21782
01/18/2011 22:00 EST	-0.95	0.46	652	0.406473298	1604.041405	1603.08685
01/18/2011 22:15 EST	-0.96	0.41	569	0.355644518	1599.912191	1600.95607
01/18/2011 22:30 EST	-0.96	0.35	474	0.29599559	1601.37521	1600.95607
01/18/2011 22:45 EST	-0.95	0.09	77	0.048069468	1601.848392	1603.08685
01/18/2011 23:00 EST	-0.93	-0.05	-125	-0.07796876	1603.206207	1607.34899
01/18/2011 23:15 EST	-0.89	-0.19	-321	-0.198341392	1618.421635	1615.87562

01/18/2011 23:30 EST	-0.86	-0.27	-429	-0.264665358	1620.914816	1622.27264
01/18/2011 23:45 EST	-0.82	-0.39	-589	-0.361465062	1629.479753	1630.80472
01/19/2011 00:00 EST	-0.77	-0.44	-655	-0.399254042	1640.559471	1641.47422
01/19/2011 00:15 EST	-0.72	-0.44	-656	-0.396985292	1652.454167	1652.14859
01/19/2011 00:30 EST	-0.66	-0.47	-696	-0.418006118	1665.0474	1664.96427
01/19/2011 00:45 EST	-0.6	-0.52	-762	-0.454370308	1677.046203	1677.78696
01/19/2011 01:00 EST	-0.53	-0.57	-829	-0.489673848	1692.963599	1692.75565
01/19/2011 01:15 EST	-0.46	-0.58	-844	-0.494120728	1708.084588	1707.73389
01/19/2011 01:30 EST	-0.38	-0.52	-767	-0.444387808	1725.969944	1724.86358
01/19/2011 01:45 EST	-0.3	-0.49	-727	-0.417378622	1741.823758	1742.00574
01/19/2011 02:00 EST	-0.23	-0.48	-714	-0.406360758	1757.059426	1757.01537
01/19/2011 02:15 EST	-0.16	-0.51	-756	-0.426636522	1772.000195	1772.03456
01/19/2011 02:30 EST	-0.09	-0.54	-798	-0.446693802	1786.458635	1787.0633
01/19/2011 02:45 EST	-0.03	-0.54	-799	-0.443971302	1799.665871	1799.95268
01/19/2011 03:00 EST	0.03	-0.53	-786	-0.433528568	1813.029309	1812.84908
01/19/2011 03:15 EST	0.08	-0.58	-856	-0.469618228	1822.757187	1823.60144
01/19/2011 03:30 EST	0.13	-0.5	-744	-0.40568471	1833.936507	1834.35868
01/19/2011 03:45 EST	0.16	-0.54	-801	-0.435350052	1839.898712	1840.81536
01/19/2011 04:00 EST	0.19	-0.43	-642	-0.347731048	1846.254465	1847.27379
01/19/2011 04:15 EST	0.2	-0.39	-583	-0.315182562	1849.721623	1849.427
01/19/2011 04:30 EST	0.21	-0.29	-431	-0.232792652	1851.433008	1851.58039
01/19/2011 04:45 EST	0.2	-0.19	-275	-0.148882642	1847.092423	1849.427
01/19/2011 05:00 EST	0.19	-0.1	-132	-0.07133341	1850.465301	1847.27379
01/19/2011 05:15 EST	0.17	0.02	64	0.034821842	1837.926897	1842.96797
01/19/2011 05:30 EST	0.15	0.09	180	0.097981968	1837.072715	1838.66294
01/19/2011 05:45 EST	0.12	0.17	314	0.171297422	1833.069035	1832.20684
01/19/2011 06:00 EST	0.09	0.2	362	0.19834049	1825.144225	1825.7525
01/19/2011 06:15 EST	0.07	0.26	464	0.254897078	1820.342562	1821.45058
01/19/2011 06:30 EST	0.05	0.29	514	0.283049348	1815.937764	1817.14944
01/19/2011 06:45 EST	0.03	0.41	726	0.400565768	1812.436454	1812.84908
01/19/2011 07:00 EST	0	0.43	757	0.419281702	1805.468725	1806.4
01/19/2011 07:15 EST	-0.03	0.48	843	0.468538242	1799.212795	1799.95268

Max	1799.212795
Min	1397.57566
	0.776770632

Attachment E

E-Mail from Doug Leeper to Martyn Johnson and Kevin Grimsley

From: Doug Leeper
To: "Alan Martyn Johnson"; Kevin Grimsely (kjgrims@usgs.gov)
Subject: RE: Homosassa Flow Concerns
Date: Wednesday, February 16, 2011 9:19:10 AM

Martyn and Kevin:

Thanks, Martyn, for you recent e-mail regarding discharge measurement and reporting for the USGS Homosassa River at Homosassa, FL gage site. And thanks Kevin, for responding to Martyn with information concerning calculation of channel cross-section area for the Homosassa River site as a function of gage height.

Incidentally, I'm currently working with HSW Engineering, Inc. on the revision of their 2010 report that was included in the draft Homosassa minimum flows report as Appendix A. This is fortuitous, as we should be able to incorporate the equation used for deriving channel cross-section area at the Homosassa River gage site into the revised report.

Thanks again to both of you.

Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

March 1, 2011

MEMORANDUM

TO: File

FROM: Douglas A. Leeper, Chief Environmental Scientist, Ecologic Evaluation Section, Southwest Florida Water Management District

SUBJECT: Comments submitted by Mr. Martyn Johnson regarding discharge measurements for the Homosassa River system

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This memorandum documents correspondence between Martyn Johnson, Doug Leeper, with the Southwest Florida Water Management District, and Kevin Grimsley and Richard Kane with the United States Geological Survey, regarding discharge measurements and development of minimum flows for the Homosassa River system.

Three e-mails from Martyn Johnson, including one sent to Kevin Grimsley on February 16, 2011, and two sent to Doug Leeper on February 19 and February 26, 2011, respectively, are included as attachments to this memorandum. A response to Martyn Johnson from Doug Leeper is also included along with other relevant communications.

DAL

Attachments:

- Attachment A – E-Mail from Martyn Johnson to Kevin Grimsley, dated February 16, 2011
- Attachment B – Attachment (*Vm from Vi Bias Question.xls*) to E-Mail from Martyn Johnson to Kevin Grimsley, Dated February 16, 2011
- Attachment C – E-Mail from Martyn Johnson to Doug Leeper, dated February 19, 2011
- Attachment D – Attachment (*SEFork Detail Comments-Analysis.doc*) to e-mail from Martyn Johnson to Doug Leeper, dated February 19, 2011
- Attachment E – Second attachment (*SEFork Flow Analysis.xls*) to e-mail from Martyn Johnson to Doug Leeper, dated February 19, 2011
- Attachment F – E-mail from Doug Leeper to Kevin Grimsley and Richard Kane, dated February 21, 2011
- Attachment G – E-mail from Richard Kane to Doug Leeper, dated February 21, 2011
- Attachment H – E-mail from Kevin Grimsley to Doug Leeper, dated February 24, 2011
- Attachment I – Attachments (10) to e-mail from Kevin Grimsley to Doug Leeper, dated February 24, 2011
- Attachment J – E-mail from Martyn Johnson to Doug Leeper and others, dated February 26, 2011
- Attachment K – E-mail from Doug Leeper to Martyn Johnson, dated March 1, 2011

Attachment A

E-Mail from Martyn Johnson to Kevin Grimsley (United States Geological Survey), Dated February 16, 2011

From: Alan Martyn Johnson
To: Kevin J Grimsley
Cc: Doug Leeper; rkane
Subject: RE: Homosassa River Flow Concerns
Date: Wednesday, February 16, 2011 12:50:15 PM
Attachments: Vm from Vi Bias Question.xls

Kevin,
Thank you very much for this information about the Stage Area Rating.

As you suggested this is missing from the Appendix B of the peer review where equations B-3 and B-4 (Vm from Vi and Q=Vm x A) are shown for this site. I just saw Doug's e-mail indicating they will include this in the revised report.

Knowing this equation is used certainly helps me understand part of the situation. I was close in my Feb 2 e-mail in suggesting the channel was 200 feet wide and 1600 square feet at GH 0. Not bad for an amateur...looks like the channel is 214 feet across and 1806 square feet...I was close to understanding but just missed making the last connection. I did note in my Feb 2 e-mail the formula did not take and I missed a g from exaggerate!!

For right now let me expand on the Homosassa River Site and the table I included in the Feb 2 e-mail. You may recall in our conversation Friday I commented on the squaring of the velocity in the calculation of Vm from Vi and how it appears to bias the result. In the attached spreadsheet I have highlighted in red the squared component of the equation and the influence highlighted orange. This results in a bias to **decrease the inflow figures or increase the out flow figures** (which ever way you look at it). I find it hard to understand how the differences highlighted in green (for example how is it possible that the velocity Vm can be 60% higher for the positive versus negative 1.5 ft/sec detected Vi velocity), can be explained.

As you will see further adding to the difficulty of finding an explanation the influence of the squared component has is the influence it has dependent on it being above or below 1.0 (I hope I made that clear but just in case 1.5 squared is 2.25 times the 0.12138 factor whereas 0.5 squared is 0.25 times the 0.12138 factor).

I trust this makes it a little easier to understand the question raised by my sharing the table in my Feb 2 e-mail.

But for completeness let me add:
for 1.0 ft/sec out flow at gage height 0 this gives 1.03230154x1806.4=1865cfs
for -1.0 ft/sec inflow at gage height 0 this gives -0.7714985x1806.4=1394cfs
for 0.5 ft/sec outflow at gage height 0 this gives 0.49031654x1806.4=885cfs
for -0.5 ft/sec inflow at gage height 0 this gives -0.41158346x 1806.4=743cfs

Kevin,
I recall your explanation about zero Vi not being zero Vm and the sketch you drew for me. As you will see from the spreadsheet the influence from the GH factored component that is offset from zero, is almost negligibly small. It is the slope of the curve that is influenced by the squaring of the velocity Vi, which reduces the inflow.

Again I appreciate all the efforts to help me understand the situation. I am trying to figure out why the 'locals' who have seen the river deteriorate over time are observing the changes when the modelling thinks all is OK. Flows are critical in this modelling and the reason I started looking at the Homosassa River site data was a comment from a gentleman who has known and patrolled the river for many years (who's name I unfortunately do not know). He said at the Lecanto workshop in January that 'he thought the flow from Halls River was much less than shown in the presentation'. The discharge presented from Halls River are derived, as I understand it, by subtracting the Homosassa Springs and SE Fork discharges from the Homosassa River.

Would really appreciate if you can clarify this for me.

Thanks,
Martyn

Table 2-3. Summary statistics for mean daily discharge records approved by the United States Geological Survey for Homosassa River system gage sites. Values are expressed as cubic feet per second (cfs) unless specified. Periods of record for approved data are listed by gage site in Table 2-2.

Statistic (cfs or N)	Homosassa Springs at Homosassa Springs FL	SE Fork Homosassa Spring at Homosassa Springs FL	Combined Springs[a]	Halls River[b]	Homosassa River at Homosassa FL (tidally filtered)	Hidden River near Homosassa FL
Maximum	141	100	240	1,995	2,090	25.0
75th Percentile	98	68	165	200	350	11
Median	88	60	147	108	251	8.0
25th Percentile	79	53	131	28	167	4.6
Minimum	34	23	57	-765	-636	1.3
Mean	89	61	149	129	272	8.0
Standard Deviation	14	11	26	181	183	4.4
Number (N) of daily Records	4,975	3,123	3,102	1,662	1,774	2,063

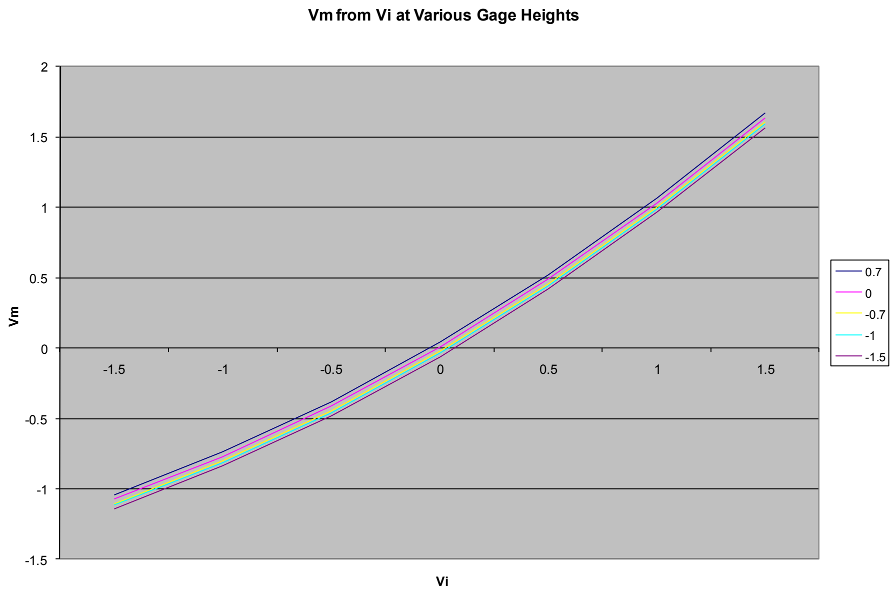
a Combined Springs discharge determined as the sum of the Homosassa Springs at Homosassa FL and SE Fork Homosassa Spring at Homosassa Springs FL discharge for days when records were available for both sites.
b Halls River discharge estimated by subtracting combined springs discharge from tidally filtered Homosassa River at Homosassa FL discharge for days when records were available for the two spring sites and the Homosassa River site

<u>NOTE: e-mail string deleted by Doug Leeper, Southwest Florida Water Management District</u>

Attachment B

Attachment (Vm from Vi Bias Question.xls) to E-Mail from Martyn Johnson to Kevin Grimsley, Dated February 16, 2011

Sheet: Chart1



Sheet: Vm from Vi Bias Question

	CALCULATED Vm FROM Vi AT VARIOUS GAGE HEIGHTS FROM PUBLISHE EQUATION								**% difference**	**% difference**
		Velocity Vi							**Inflow -0.5 ft/sec v**	**Inflow -1.5 ft/sec v**
	GH	-1.5	-1	-0.5	0	0.5	1	1.5	**Outflow 0.5 ft/sec**	**Outflow 1.5 ft/sec**
	0.7	-1.03896096	-0.739736	-0.37982096	0.04078404	0.522079	1.06406404	1.66673904	**137%**	**160%**
	0	-1.07072346	- 0.7714985	-0.41158346	0.00902154	0.4903165	1.03230154	1.63497654	**119%**	**153%**
	-0.7	-1.10248596	-0.803261	-0.44334596	-0.02274096	0.458554	1.00053904	1.60321404	**103%**	**145%**
	-1	-1.11609846	- 0.8168735	-0.45695846	-0.03635346	0.4449415	0.98692654	1.58960154	**97%**	**142%**
	-1.5	-1.13878596	-0.839561	-0.47964596	-0.05904096	0.422254	0.96423904	1.56691404	**88%**	**138%**
FOR Vi -1.5 feet/sec		-1.5								
		Equation Components					FIXED	FIXED+VARIABLE	Variable	Squared Influence in
		0.00902154	0.9019Vi	0.12138ViVi	.045375GH		Component	Component	Influence	Fixed Component
	0.7	0.00902154	-1.35285	**0.273105**	0.0317625		-1.07072346	-1.03896096	-3.06%	-25.5%
	0	0.00902154	-1.35285	**0.273105**	0		-1.07072346	-1.07072346	0.00%	-25.5%
	-0.7	0.00902154	-1.35285	**0.273105**	-0.0317625		-1.07072346	-1.10248596	2.88%	-25.5%
	-1	0.00902154	-1.35285	**0.273105**	-0.045375		-1.07072346	-1.11609846	4.07%	-25.5%
	-1.5	0.00902154	-1.35285	**0.273105**	-0.0680625		-1.07072346	-1.13878596	5.98%	-25.5%
FOR Vi 1.5 feet/sec		1.5								
		Equation Components								
		0.00902154	0.9019Vi	0.12138ViVi	.045375GH					
	0.7	0.00902154	1.35285	**0.273105**	0.0317625		1.63497654	1.66673904	1.91%	16.7%
	0	0.00902154	1.35285	**0.273105**	0		1.63497654	1.63497654	0.00%	16.7%
	-0.7	0.00902154	1.35285	**0.273105**	-0.0317625		1.63497654	1.60321404	-1.98%	16.7%
	-1	0.00902154	1.35285	**0.273105**	-0.045375		1.63497654	1.58960154	-2.85%	16.7%
	-1.5	0.00902154	1.35285	**0.273105**	-0.0680625		1.63497654	1.56691404	-4.34%	16.7%
FOR Vi -0.5 feet/sec		-0.5								
		Equation Components								
		0.00902154	0.9019Vi	0.12138ViVi	.045375GH					
	0.7	0.00902154	-0.45095	**0.030345**	0.0317625		-0.41158346	-0.37982096	-8.36%	-7.4%
	0	0.00902154	-0.45095	**0.030345**	0		-0.41158346	-0.41158346	0.00%	-7.4%

	-0.7	0.00902154	-0.45095	**0.030345**	-0.0317625		-0.41158346	-0.44334596	7.16%	-7.4%
	-1	0.00902154	-0.45095	**0.030345**	-0.045375		-0.41158346	-0.45695846	9.93%	-7.4%
	-1.5	0.00902154	-0.45095	**0.030345**	-0.0680625		-0.41158346	-0.47964596	14.19%	-7.4%
FOR Vi 0.5 feet/sec		0.5								
		Equation Components								
		0.00902154	0.9019Vi	0.12138ViVi	.045375GH					
	0.7	0.00902154	0.45095	**0.030345**	0.0317625		0.49031654	0.52207904	6.08%	6.2%
	0	0.00902154	0.45095	**0.030345**	0		0.49031654	0.49031654	0.00%	6.2%
	-0.7	0.00902154	0.45095	**0.030345**	-0.0317625		0.49031654	0.45855404	-6.93%	6.2%
	-1	0.00902154	0.45095	**0.030345**	-0.045375		0.49031654	0.44494154	-10.20%	6.2%
	-1.5	0.00902154	0.45095	**0.030345**	-0.0680625		0.49031654	0.42225404	-16.12%	6.2%
FOR Vi 0.0 feet/sec		0								
		Equation Components								
		0.00902154	0.9019Vi	0.12138ViVi	.045375GH					
	0.7	0.00902154	0	**0**	0.0317625		0.00902154	0.04078404		
	0	0.00902154	0	**0**	0		0.00902154	0.00902154		
	-0.7	0.00902154	0	**0**	-0.0317625		0.00902154	-0.02274096		
	-1	0.00902154	0	**0**	-0.045375		0.00902154	-0.03635346		
	-1.5	0.00902154	0	**0**	-0.0680625		0.00902154	-0.05904096		

Attachment C

<u>E-Mail from Martyn Johnson to Doug Leeper, Dated February 19, 2011</u>

From: Alan Martyn Johnson
To: Doug Leeper
Cc: Kevin J Grimsley; rkane; Ron Basso
Subject: SE Fork Homosassa River Flow Calculation Concerns
Date: Saturday, February 19, 2011 3:30:16 PM
Attachments: SEFork Detail Comments-Analysis.doc
SEFork Flow Analysis.xls

Doug,
Attached are two files that address the concerns I have mentioned before about the equation used to calculate the flow from the SEFork. In a recent e-mail I commented about your explanation, indicating that the average of the measurements and the actual daily mean discharge are one and the same thing. There is no separate measurement of the actual mean discharge.
Quote
Individual discrete discharge estimates may exhibit moderate variation from actual physical conditions at the site, but the average of the composited discrete measurements made over a 24-hour period has been shown to correspond well with actual daily mean discharge.
End Quote.

In the Word file I have provided a detailed explanation of the numbers as I see them and detail that these are not moderate variations from actual. I see them as frankly inexplicable variations from actual and logical explanation. The Excel file has the supporting data/calculation/analysis from the base data copied from the USGS web site and the calculation equation as published.

I decided to leave my discussion in the word file as the included charts did not want to copy into an e-mail and I hope it easier for you and others to review.
Please take the time to look over my comments, if I am wrong I will happily admit it providing there is valid explanation.

I know that the reaction may be that if I am right it will require a good explanation of why this was not recognized earlier and maybe why so much money has been spent on studies that appear to come to conclusions vastly different to what people are observing. My aim is to understand how the observations of good honest people do not match the 'scientific' data.

A lot more effort is needed to understand why the Homosassa River is deteriorating and not into finding ways to justify more water extraction from the aquifer. This is like Congress years ago ignoring the foolishness of the mortgage market that resulted in the crash, or the damage that has been even more dramatic in other rivers where recovery is now necessary. Transferring the problem is not the solution.

I have started to look at the water chemistry data you shared earlier and while comment soon.

Do not dismiss my analysis without a good reasoned argument, as you may have gathered I do not disappear easily.

Thanks for your continued attention to this matter of preventing further destruction of the Homosassa River. Simple solution is moratorium on drilling anymore wells or increasing extractions for 5 years for assessment to be validated.

Martyn

Attachment D

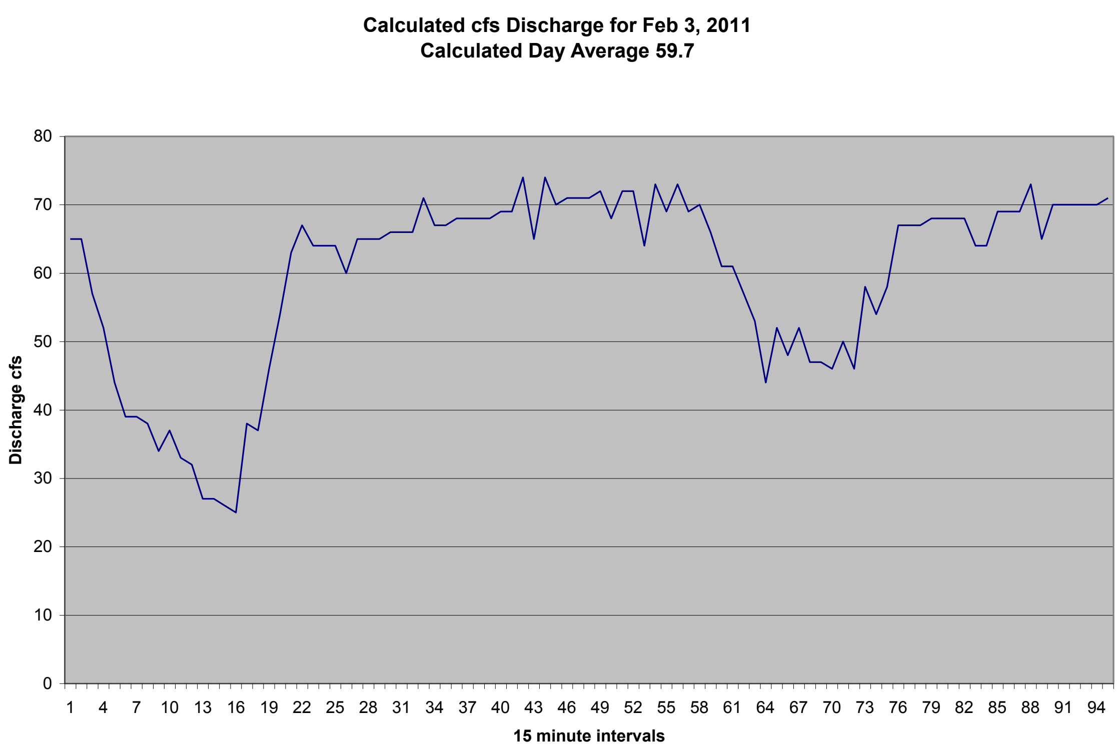
Attachment (SEFork Detail Comments-Analysis.doc) to E-Mail from Martyn Johnson to Doug Leeper, Dated February 19, 2011

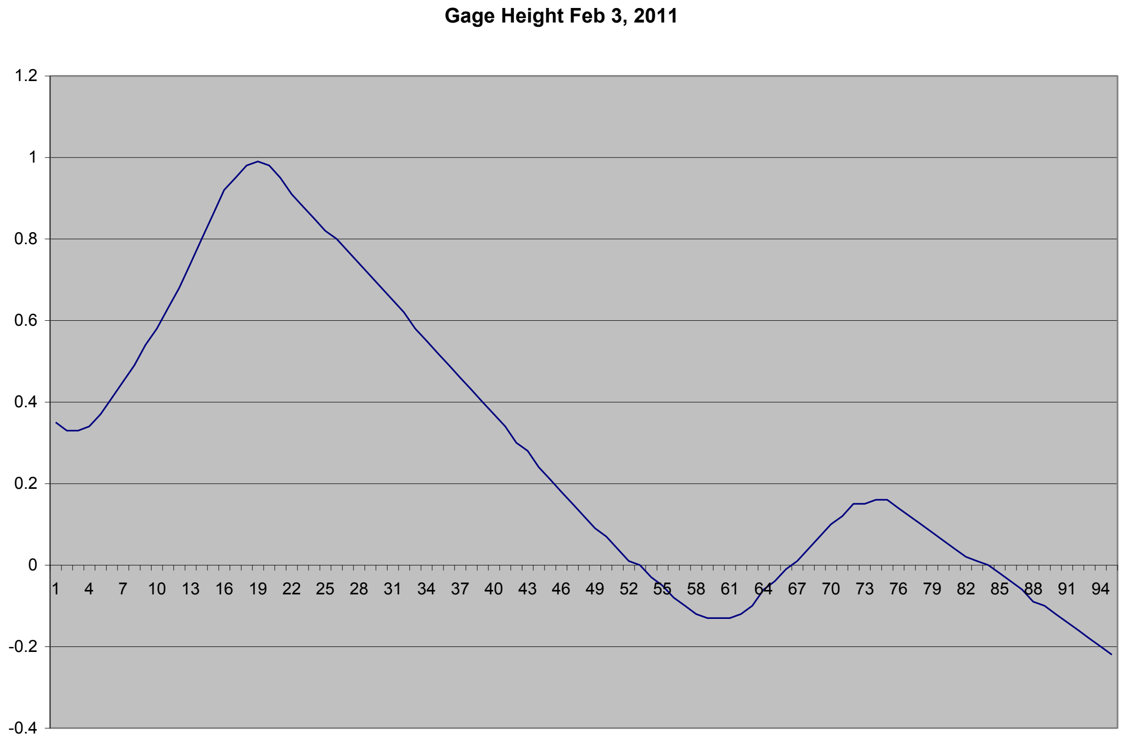
In previous e-mails I have questioned the accuracy of the discharge from the SE Fork of the Homosassa River as calculated from the equation referred to as B-2:

Q = 18.63 + 3.31(GW) – 10.31(GH) – 418.14(dS/dt)

As promised I will try to further explain my point as follows.

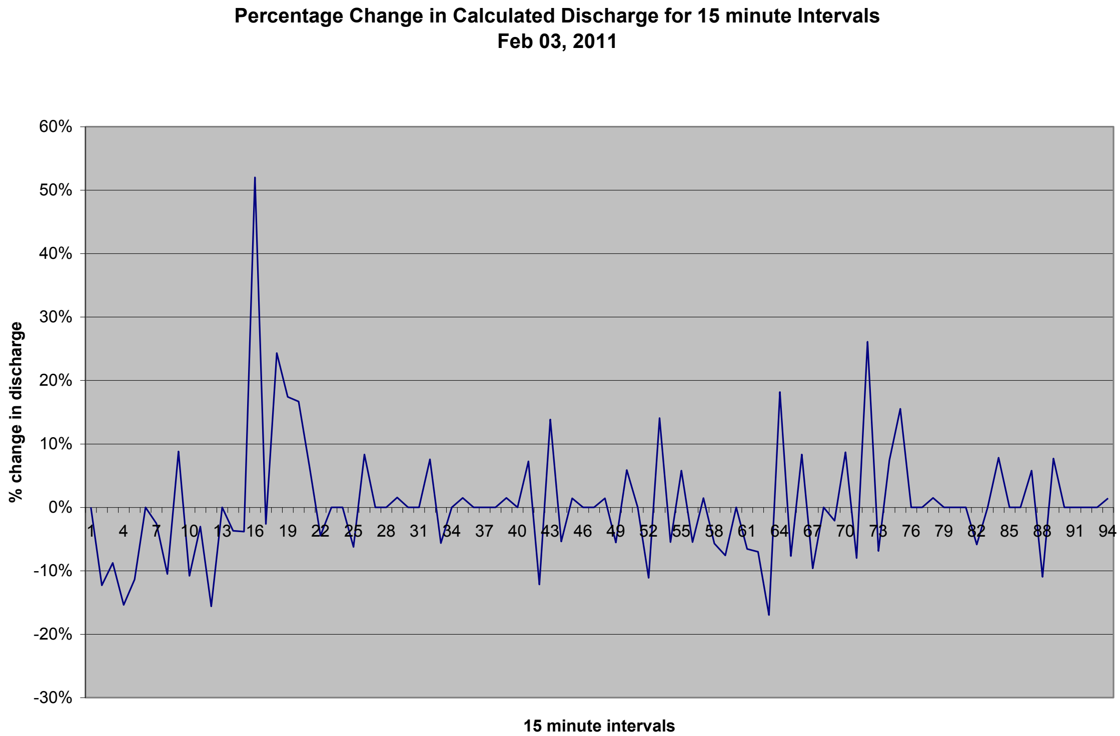
First look at the chart titled cfs Discharge Feb 3, 2011 you will see that the calculated discharges cycle and range from a low of 25cfs to high of 74cfs (data from sheet Feb 3, 2011 cells D98 and D99, real-time data from USGS is in cells B3 thruD97). This says that there is 3 times more water flowing under the bridge at 10:30 and 11:00 than at 4:00. Even if these calculated values are 'moderate variations from actual physical conditions'
They are very difficult to imagine e.g. kayaking under the bridge with 3 times the volume of water flowing thru the channel which is 0.6 feet shallower, that is making the velocity over 3 times greater. That is not reality. The Gage Heights are shown on worksheet Gage Height Feb 3, 2011.





But, wait the Gage Height continues to drop from 0.3 feet at 11:00 to -0.13 feet at 15:00 and the discharge rate cfs decreases from 74cfs to 61cfs. No such a dramatic change. But, look what the calculated discharge is at 16:00 it has dropped to 44cfs in one hour with a Gage Height change to -0.06 feet. Almost 30% drop in one hour. These can not be 'moderate variations from the actual physical conditions'.

As I am at the point of percentage changes in discharge, the percentage changes in each 15 minute interval are calculated from the real-time data in the Feb 3, 2011 worksheet cells E4 thru E97 and on the chart Percent Change in 15 minutes.



Hunting is the only comment/conclusion I can draw.

Now going back to those calculated discharges. What do these say if we assume they are somewhere close to actual.

We can be reasonably sure that the flow from the various springs in the SE Fork does not change with anything like a 3 fold change during the day given by the calculation e.g. 25cfs to 74cfs. There will be a small change due to the change in water level (head) over the spring (see ** below). So for now assume that it is constant as expressed by the calculated average daily flow. For Feb 3, 2011 that is 59.7cfs as shown in cell D100 of the Feb 3, 2011 worksheet (on USGS web site the Mean for Feb 3 is provisionally shown as 60cfs).

The explanation for changes of discharge under the bridge result from spring discharge accumulating in, or draining from the pool upstream of the bridge/gage site.

That is during times when gage height is increasing water accumulates in the pool and during times when gage height is decreasing water drains from the pool.

On the worksheet Feb 3 in column F the flow during the 15 minute interval is shown as total cubic feet of discharge under the bridge/gage site.

Note: this is not the rate of discharge for the entire 15 minutes…average it if you want outcome is the same.

In column H the cubic feet of discharge above or below average is shown in red or green.

During times that water is below average it is accumulating in the pool so if the cubic feet are accumulated this is shown in cells such as I22 in this case 350000 cubic feet would have accumulated. It has gone somewhere, because according to the calculation it did not pass under the bridge/past the gage site. If it is in the pool which I have previously suggested is about 3 acres it would result in an increase level of 2.68 feet as shown in J23. The gage height shows an increase over this time of 0.33 to

0.98 feet or 0.65 feet. Similarly, drop in level of 2.27 feet shown in J64 where the actual drop is 1.08 feet.

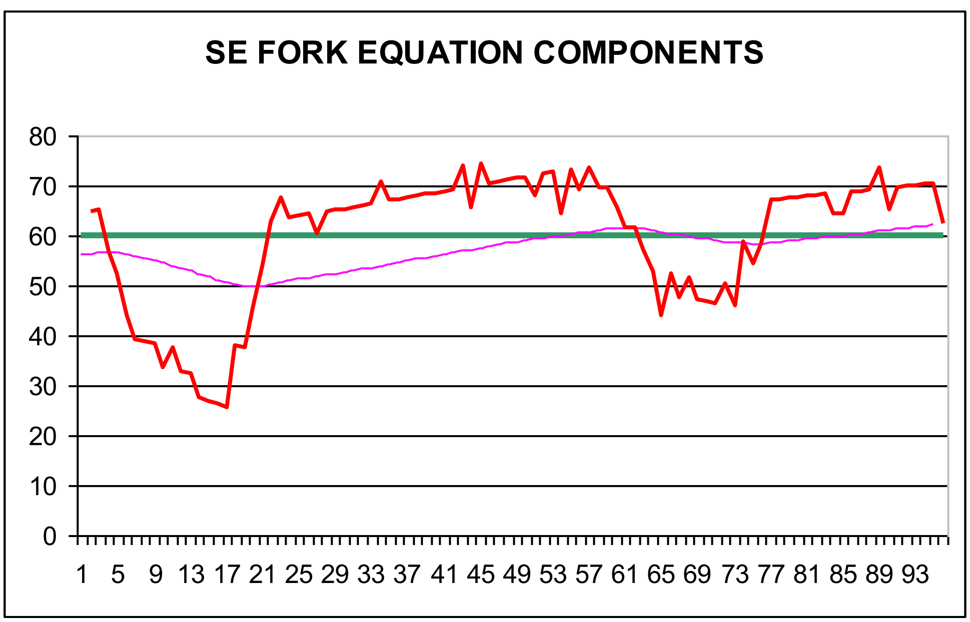
Hard to understand the calculated discharges…or am I again missing something? But, is that not what the calculation is saying.

These are not moderate variations from actual physical conditions; the regression analysis rendered and equation that generate a gross exaggeration of the actual. You can't have good data coming from bad however much you say about averaging.   Agreed over the day it appears to all balance out as would be expected with averaging a cyclic situation. The actual change in gage height over the day of -0.57 feet this would represent an average discharge past the gage site of 0.86cfs additional (assuming again the 3 acre pool).

Now, take a look at the calculation and the various components as is shown on worksheet Equation Components Analysis.

The first and second components are fixed for the day. The 18.63 constant and the 3.31 times the Weeki Wachee level which for Feb 3 was 12.52 feet equaling 41.44 which is total fixed 60.07. The first variable is 10.31 times the gage height shown in column H. During the day this subtraction, from the fixed 60.07, varies from a maximum of 10.21 to a minimum of -2.27. Resulting in max to min spread when this component is included of 62.34 to 49.86. It could be speculated that this component is intended to address the change of discharge from the various springs mentioned at ** above, for those interested to consider this further the change in head is expressed as a % in column I.

The fourth component -418.14 time ds/dt (the change in stage height or gage height in each 15 minute interval) results in a subtraction of 25.08 to -16.72 (note subtraction of a minus results in an increase so) these are shown in column M and in the graph included in the worksheet.



Green line is the Fixed, Purple Line is the 10.31*GH subtracted

Red line is the 418.14*ds/dt subtracted.

Breakdown of the equation components is included in the worksheet for Jan 13, 2011 and Nov 3, 2010. Jan 13, 2011 incidentally is the day mentioned in a previous e-mail when the water level was very low and flows from Trotter and Pumphouse Springs were not influenced by any change of head (** reference) yet the calculated discharge shows the flow coming to an abrupt decline after 20:45.

My conclusions:

1. The equation is wrong. It bares no resemblance to the actual physical conditions.
2. The huge multiplier on the ds/dt causes exaggeration of actual accumulation or discharge from the pool upstream of the gage site. The failure to recognize the reality of the ds/dt component in the regression analysis has most likely decreased the multiplier used on the GW component thus underestimating the flow from the springs.
3. The multiplier used, in what I speculated is the attempt to adjust for change in head over the springs, appears to be larger than normal for a change in head over a fixed orifice. (the spring vents are a fixed orifice over time periods such as weeks/months but may change over years) and the influence of the change in gage height is much more likely to be a direct relationship to the change in actual head…I know Weeki Wachee may not be the actual head, but it is used as record go back forever!

Commentary
Just possibly the flow from the SE Fork has dropped a lot more than this calculated data shows and could be a factor in the increased salinity which is resulting in barnacle growth.

Speculation may be. But, adding to the above comments the only field measurements for the SEF where I have been able to compare actual versus calculated are;

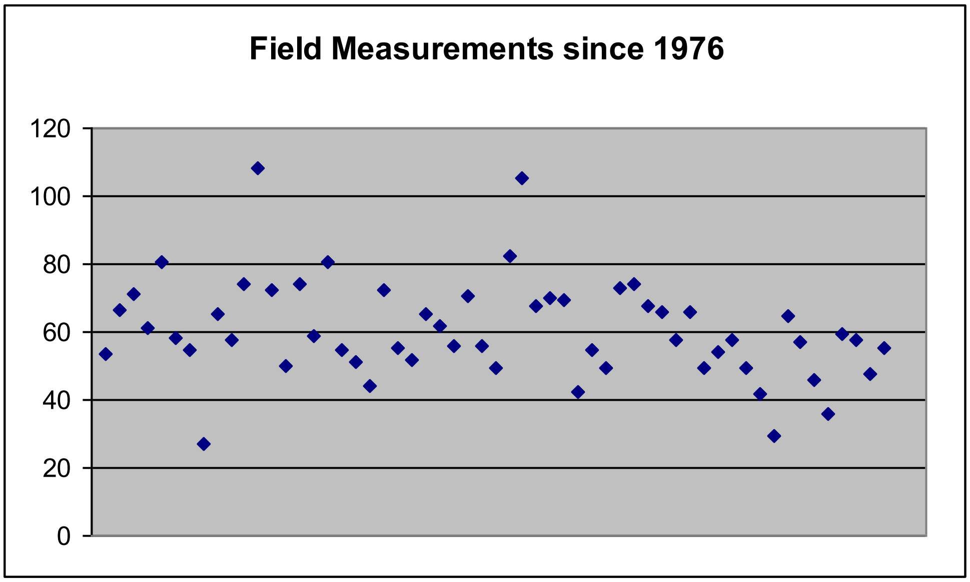
Meas. Number	Date	Time	Stream flow (ft^3/s)	Real Time Data 'Calculated' Date	Time	cfs
162	2010-12-09	16:21	55.1	2010-12-09	16:30	66
161	2010-10-06	14:34:30	44.8	2010-10-06	14:30	52
160	2010-10-06	14:29	49.2			
159	2010-10-06	14:21:30	44.8			
158	2010-10-06	14:14:30	51.3		14:15	61

In both these situations the actual field measured discharge is lower than the calculated value. Agreed two situation do not make a trend, but hopefully someone has access to the calculated data to compare to other field measurements.

Additionally, if the field measurements since 1976 are plotted there appears to be a declining trend. This declining trend is also in the calculated discharge data, but as can be seen in the equation component analysis this is primarily 3.31*GW. If that factor is in error even by a small amount the flow is considerably higher. Long term residents have commented at the workshop meetings the flow was much stronger.

Please note this next chart is nothing more than illustration.

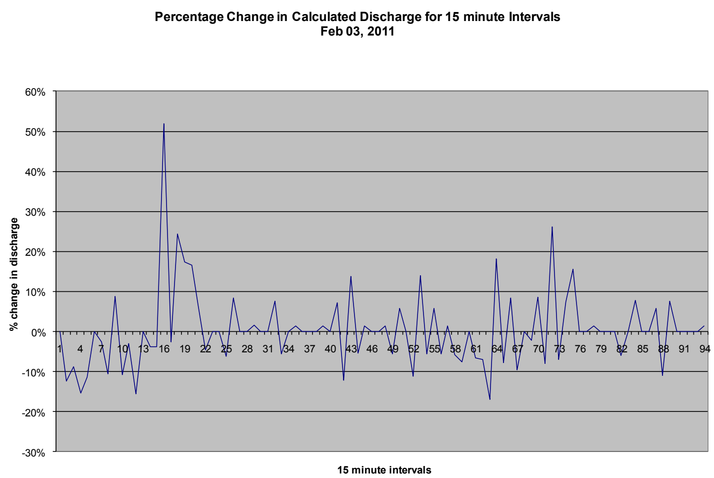
- The data includes measurements made for 0.08 to 0.12 hrs in October 2010, and others range from 0.15 to 1.27 hrs…and all intervals in between. Maybe a look at the SOP (Standard Operating Procedure is in order).
- The condition at the time of the measurement as reflected in notations such as POOR for July 2008 and Feb 2009 and the influence of "Field Measurement Adjustment" also noted on the web site data is not clear.
- Field measurements 1932 to 1976 are not included.



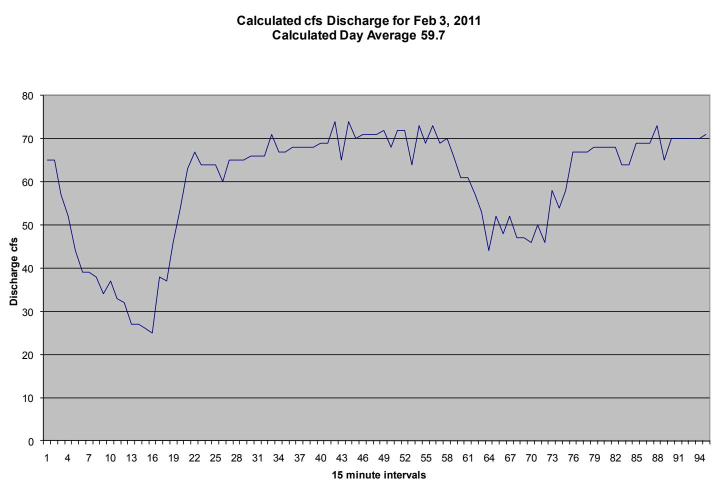
Attachment E

Second Attachment (SEFork Flow Analysis.xls) to E-Mail from Martyn Johnson to Doug Leeper, Dated February 19, 2011

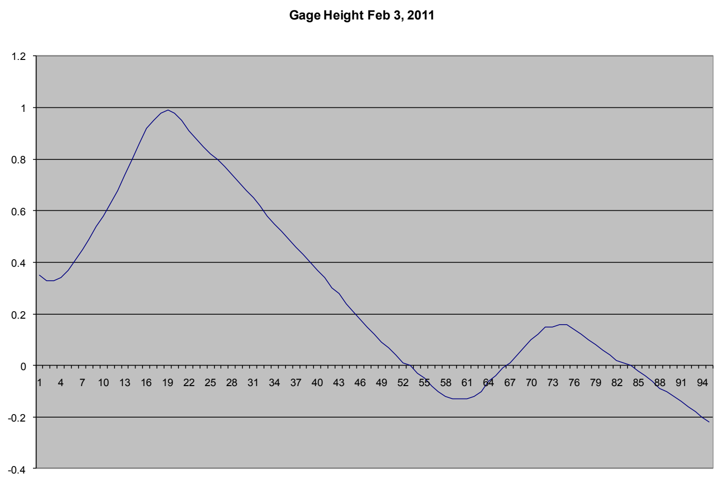
Sheet: Percentage Change in 15 minute



Sheet: cfs Discharge Feb 3, 2011



Sheet: Gage Height Feb 3, 2011



Sheet: Feb 3, 2011

GH	Discharge		Discharge cf in 15 minutes	Change	Above/Below Average			
0.35	65		58500		4784			
0.33	65	0%	58500	0	4784	9568		
0.33	57	-12%	51300	-7200	-2416			
0.34	52	-9%	46800	-4500	-6916			
0.37	44	-15%	39600	-7200	-14116			
0.41	39	-11%	35100	-4500	-18616			
0.45	39	0%	35100	0	-18616			
0.49	38	-3%	34200	-900	-19516			
0.54	34	-11%	30600	-3600	-23116			
0.58	37	9%	33300	2700	-20416			
0.63	33	-11%	29700	-3600	-24016			
0.68	32	-3%	28800	-900	-24916			
0.74	27	-16%	24300	-4500	-29416			
0.8	27	0%	24300	0	-29416			
0.86	26	-4%	23400	-900	-30316			
0.92	25	-4%	22500	-900	-31216			
0.95	38	52%	34200	11700	-19516			
0.98	37	-3%	33300	-900	-20416			
0.99	46	24%	41400	8100	-12316			
0.98	54	17%	48600	7200	-5116	-350384	Cumulative cf below average	
0.95	63	17%	56700	8100	2984		2.68	Increase level in 3 acre pool
0.91	67	6%	60300	3600	6584			

0.88	64	-4%	57600	-2700	3884
0.85	64	0%	57600	0	3884
0.82	64	0%	57600	0	3884
0.8	60	-6%	54000	-3600	284
0.77	65	8%	58500	4500	4784
0.74	65	0%	58500	0	4784
0.71	65	0%	58500	0	4784
0.68	66	2%	59400	900	5684
0.65	66	0%	59400	0	5684
0.62	66	0%	59400	0	5684
0.58	71	8%	63900	4500	10184
0.55	67	-6%	60300	-3600	6584
0.52	67	0%	60300	0	6584
0.49	68	1%	61200	900	7484
0.46	68	0%	61200	0	7484
0.43	68	0%	61200	0	7484
0.4	68	0%	61200	0	7484
0.37	69	1%	62100	900	8384
0.34	69	0%	62100	0	8384
0.3	74	7%	66600	4500	12884
0.28	65	-12%	58500	-8100	4784
0.24	74	14%	66600	8100	12884
0.21	70	-5%	63000	-3600	9284
0.18	71	1%	63900	900	10184
0.15	71	0%	63900	0	10184

0.12	71	0%	63900	0	10184			
0.09	72	1%	64800	900	11084			
0.07	68	-6%	61200	-3600	7484			
0.04	72	6%	64800	3600	11084			
0.01	72	0%	64800	0	11084			
0	64	-11%	57600	-7200	3884			
-0.03	73	14%	65700	8100	11984			
-0.05	69	-5%	62100	-3600	8384			
-0.08	73	6%	65700	3600	11984			
-0.1	69	-5%	62100	-3600	8384			
-0.12	70	1%	63000	900	9284			
-0.13	66	-6%	59400	-3600	5684			
-0.13	61	-8%	54900	-4500	1184			
-0.13	61	0%	54900	0	1184	296053		Cumulative cf above average
-0.12	57	-7%	51300	-3600	-2416		2.27	Decrease level in 3 acre pool
-0.1	53	-7%	47700	-3600	-6016			
-0.06	44	-17%	39600	-8100	-14116			
-0.04	52	18%	46800	7200	-6916			
-0.01	48	-8%	43200	-3600	-10516			
0.01	52	8%	46800	3600	-6916			
0.04	47	-10%	42300	-4500	-11416			
0.07	47	0%	42300	0	-11416			
0.1	46	-2%	41400	-900	-12316			
0.12	50	9%	45000	3600	-8716			
0.15	46	-8%	41400	-3600	-12316			

0.15	58	26%	52200	10800	-1516			
0.16	54	-7%	48600	-3600	-5116			
0.16	58	7%	52200	3600	-1516	-111221		
0.14	67	16%	60300	8100	6584		0.85	Increase level in 3 acre pool
0.12	67	0%	60300	0	6584			
0.1	67	0%	60300	0	6584			
0.08	68	1%	61200	900	7484			
0.06	68	0%	61200	0	7484			
0.04	68	0%	61200	0	7484			
0.02	68	0%	61200	0	7484			
0.01	64	-6%	57600	-3600	3884			
0	64	0%	57600	0	3884			
-0.02	69	8%	62100	4500	8384			
-0.04	69	0%	62100	0	8384			
-0.06	69	0%	62100	0	8384			
-0.09	73	6%	65700	3600	11984			
-0.1	65	-11%	58500	-7200	4784			
-0.12	70	8%	63000	4500	9284			
-0.14	70	0%	63000	0	9284			
-0.16	70	0%	63000	0	9284			
-0.18	70	0%	63000	0	9284			
-0.2	70	0%	63000	0	9284			
-0.22	71	1%	63900	900	10184	155984		
MIN	25						1.19	Decrease level in 3 acre pool
MAX	74							
AVG	59.6842				0	0		

Total Gage Height Change

-0.57

Flow under Bridge due to Gage Drop

74487.
6

Sheet: Jan 13, 2011

				Discharge in 15 minutes	Above/Below Average
01/13/ 2011 00:00 EST	-0.43	73		65700	3375
01/13/ 2011 00:15 EST	-0.44	69	-6%	62100	-225
01/13/ 2011 00:30 EST	-0.46	73	5%	65700	3375
01/13/ 2011 00:45 EST	-0.47	69	-6%	62100	-225
01/13/ 2011 01:00 EST	-0.48	69	0%	62100	-225
01/13/ 2011 01:15 EST	-0.49	69	0%	62100	-225
01/13/ 2011 01:30 EST	-0.5	69	0%	62100	-225
01/13/ 2011 01:45 EST	-0.51	70	1%	63000	675
01/13/ 2011 02:00 EST	-0.52	70	0%	63000	675
01/13/ 2011 02:15 EST	-0.53	70	0%	63000	675
01/13/ 2011 02:30 EST	-0.55	74	5%	66600	4275
01/13/ 2011 02:45 EST	-0.56	70	-6%	63000	675
01/13/ 2011 03:00 EST	-0.57	70	0%	63000	675
01/13/ 2011 03:15 EST	-0.59	74	5%	66600	4275
01/13/ 2011 03:30	-0.61	75	1%	67500	5175

EST					
01/13/ 2011 03:45 EST	-0.62	71	-6%	63900	1575
01/13/ 2011 04:00 EST	-0.64	75	5%	67500	5175
01/13/ 2011 04:15 EST	-0.66	75	0%	67500	5175
01/13/ 2011 04:30 EST	-0.67	71	-6%	63900	1575
01/13/ 2011 04:45 EST	-0.69	76	7%	68400	6075
01/13/ 2011 05:00 EST	-0.7	71	-7%	63900	1575
01/13/ 2011 05:15 EST	-0.72	76	7%	68400	6075
01/13/ 2011 05:30 EST	-0.74	76	0%	68400	6075
01/13/ 2011 05:45 EST	-0.75	72	-6%	64800	2475
01/13/ 2011 06:00 EST	-0.77	76	5%	68400	6075
01/13/ 2011 06:15 EST	-0.78	72	-6%	64800	2475
01/13/ 2011 06:30 EST	-0.81	81	11%	72900	10575
01/13/ 2011 06:45 EST	-0.81	68	-19%	61200	-1125
01/13/ 2011 07:00 EST	-0.83	77	12%	69300	6975
01/13/ 2011 07:15 EST	-0.85	77	0%	69300	6975
01/13/ 2011 07:30	-0.86	73	-5%	65700	3375

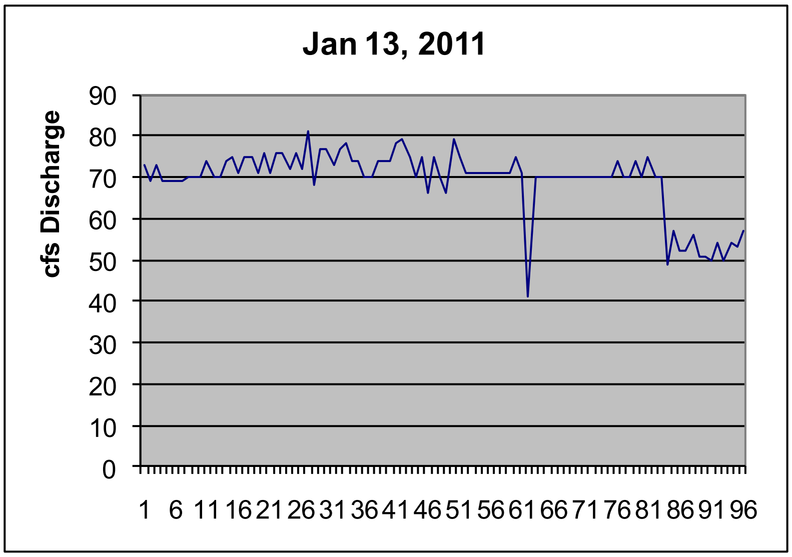
EST					
01/13/ 2011 07:45 EST	-0.88	77	5%	69300	6975
01/13/ 2011 08:00 EST	-0.9	78	1%	70200	7875
01/13/ 2011 08:15 EST	-0.91	74	-5%	66600	4275
01/13/ 2011 08:30 EST	-0.92	74	0%	66600	4275
01/13/ 2011 08:45 EST	-0.92	70	-6%	63000	675
01/13/ 2011 09:00 EST	-0.92	70	0%	63000	675
01/13/ 2011 09:15 EST	-0.93	74	5%	66600	4275
01/13/ 2011 09:30 EST	-0.94	74	0%	66600	4275
01/13/ 2011 09:45 EST	-0.95	74	0%	66600	4275
01/13/ 2011 10:00 EST	-0.97	78	5%	70200	7875
01/13/ 2011 10:15 EST	-0.99	79	1%	71100	8775
01/13/ 2011 10:30 EST	-1	75	-5%	67500	5175
01/13/ 2011 10:45 EST	-1	70	-7%	63000	675
01/13/ 2011 11:00 EST	-1.01	75	7%	67500	5175
01/13/ 2011 11:15 EST	-1	66	-14%	59400	-2925
01/13/ 2011 11:30	-1.01	75	12%	67500	5175

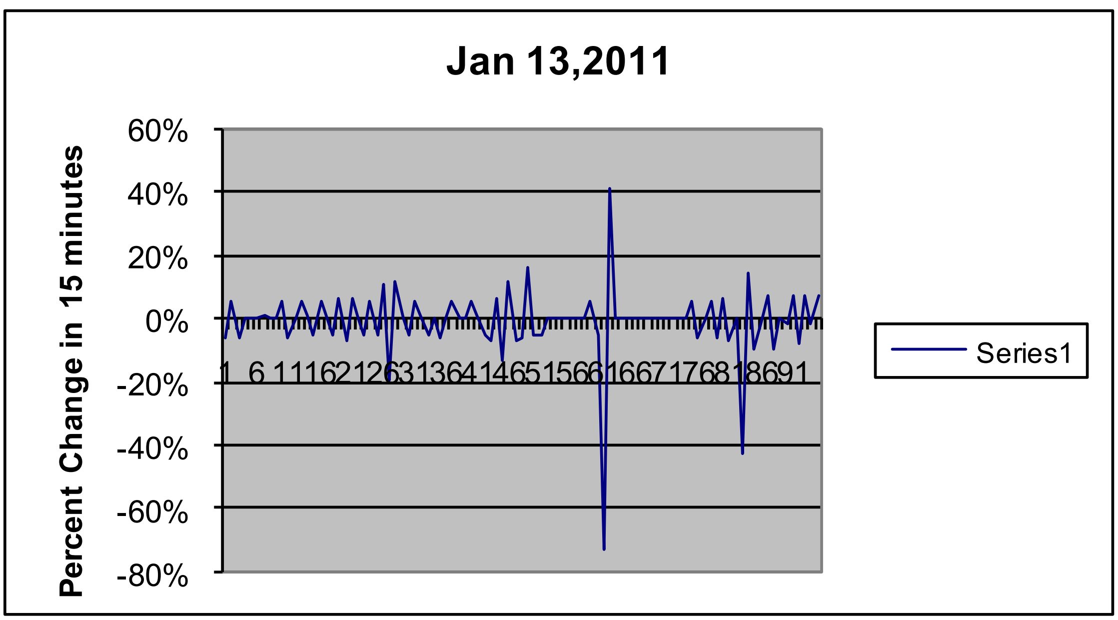
EST					
01/13/ 2011 11:45 EST	-1.01	70	-7%	63000	675
01/13/ 2011 12:00 EST	-1	66	-6%	59400	-2925
01/13/ 2011 12:15 EST	-1.02	79	16%	71100	8775
01/13/ 2011 12:30 EST	-1.03	75	-5%	67500	5175
01/13/ 2011 12:45 EST	-1.03	71	-6%	63900	1575
01/13/ 2011 13:00 EST	-1.03	71	0%	63900	1575
01/13/ 2011 13:15 EST	-1.03	71	0%	63900	1575
01/13/ 2011 13:30 EST	-1.03	71	0%	63900	1575
01/13/ 2011 13:45 EST	-1.03	71	0%	63900	1575
01/13/ 2011 14:00 EST	-1.03	71	0%	63900	1575
01/13/ 2011 14:15 EST	-1.03	71	0%	63900	1575
01/13/ 2011 14:30 EST	-1.03	71	0%	63900	1575
01/13/ 2011 14:45 EST	-1.04	75	5%	67500	5175
01/13/ 2011 15:00 EST	-1.04	71	-6%	63900	1575
01/13/ 2011 15:15 EST	-0.97	41	-73%	36900	-25425
01/13/ 2011 15:30	-0.97	70	41%	63000	675

EST					
01/13/ 2011 15:45 EST	-0.97	70	0%	63000	675
01/13/ 2011 16:00 EST	-0.97	70	0%	63000	675
01/13/ 2011 16:15 EST	-0.97	70	0%	63000	675
01/13/ 2011 16:30 EST	-0.97	70	0%	63000	675
01/13/ 2011 16:45 EST	-0.97	70	0%	63000	675
01/13/ 2011 17:00 EST	-0.97	70	0%	63000	675
01/13/ 2011 17:15 EST	-0.97	70	0%	63000	675
01/13/ 2011 17:30 EST	-0.97	70	0%	63000	675
01/13/ 2011 17:45 EST	-0.97	70	0%	63000	675
01/13/ 2011 18:00 EST	-0.97	70	0%	63000	675
01/13/ 2011 18:15 EST	-0.97	70	0%	63000	675
01/13/ 2011 18:30 EST	-0.97	70	0%	63000	675
01/13/ 2011 18:45 EST	-0.98	74	5%	66600	4275
01/13/ 2011 19:00 EST	-0.98	70	-6%	63000	675
01/13/ 2011 19:15 EST	-0.98	70	0%	63000	675
01/13/ 2011 19:30	-0.99	74	5%	66600	4275

EST					
01/13/ 2011 19:45 EST	-0.99	70	-6%	63000	675
01/13/ 2011 20:00 EST	-1	75	7%	67500	5175
01/13/ 2011 20:15 EST	-1	70	-7%	63000	675
01/13/ 2011 20:30 EST	-1	70	0%	63000	675
01/13/ 2011 20:45 EST	-0.95	49	-43%	44100	-18225
01/13/ 2011 21:00 EST	-0.92	57	14%	51300	-11025
01/13/ 2011 21:15 EST	-0.88	52	-10%	46800	-15525
01/13/ 2011 21:30 EST	-0.84	52	0%	46800	-15525
01/13/ 2011 21:45 EST	-0.81	56	7%	50400	-11925
01/13/ 2011 22:00 EST	-0.77	51	-10%	45900	-16425
01/13/ 2011 22:15 EST	-0.73	51	0%	45900	-16425
01/13/ 2011 22:30 EST	-0.69	50	-2%	45000	-17325
01/13/ 2011 22:45 EST	-0.66	54	7%	48600	-13725
01/13/ 2011 23:00 EST	-0.62	50	-8%	45000	-17325
01/13/ 2011 23:15 EST	-0.59	54	7%	48600	-13725
01/13/ 2011 23:30	-0.56	53	-2%	47700	-14625

EST					
01/13/2011 23:45 EST	-0.54	57	7%	51300	-11025
	AVG	69.25		5983200	0
MAX	-0.43	81			
MIN	-1.04	41			
				5983200	





Sheet: Nov 02, 2010

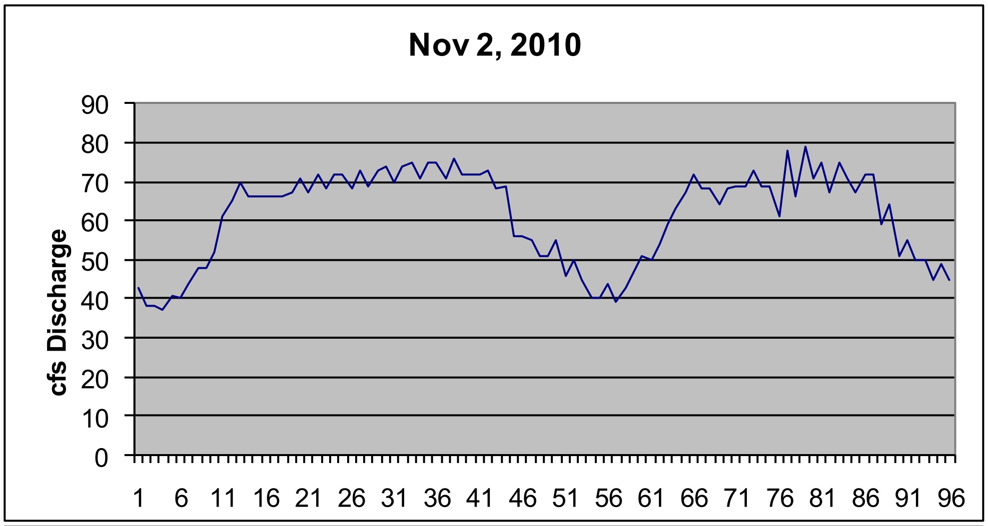
				Discharge in 15 minutes	Above/Below Average
11/02/2010 00:00 EST	0.55	43		38700	-16491
11/02/2010 00:15 EST	0.6	38	-13%	34200	-20991
11/02/2010 00:30 EST	0.65	38	0%	34200	-20991
11/02/2010 00:45 EST	0.7	37	-3%	33300	-21891
11/02/2010 01:00 EST	0.74	41	10%	36900	-18291
11/02/2010 01:15 EST	0.78	40	-3%	36000	-19191
11/02/2010 01:30 EST	0.81	44	9%	39600	-15591
11/02/2010 01:45 EST	0.83	48	8%	43200	-11991
11/02/2010 02:00 EST	0.85	48	0%	43200	-11991
11/02/2010 02:15 EST	0.86	52	8%	46800	-8391
11/02/2010 02:30 EST	0.85	61	15%	54900	-291
11/02/2010 02:45 EST	0.83	65	6%	58500	3309
11/02/2010 03:00 EST	0.8	70	7%	63000	7809
11/02/2010 03:15 EST	0.78	66	-6%	59400	4209
11/02/2010 03:30 EST	0.76	66	0%	59400	4209
11/02/2010 03:45 EST	0.74	66	0%	59400	4209
11/02/2010 04:00 EST	0.72	66	0%	59400	4209

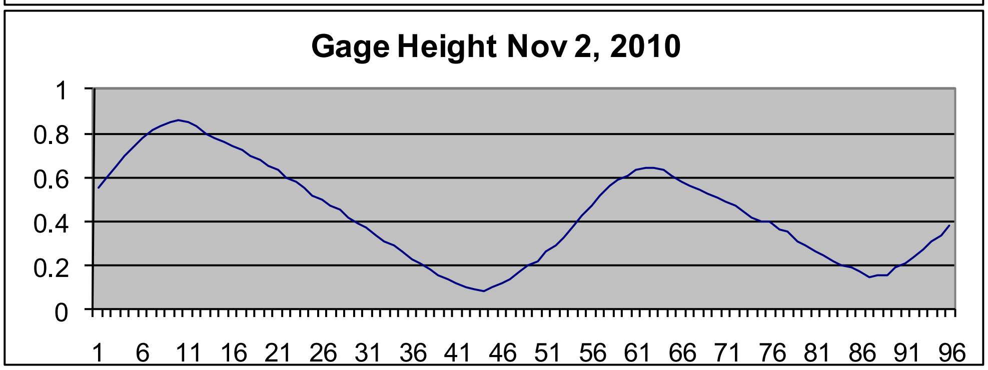
11/02/2010 04:15 EST	0.7	66	0%	59400	**4209**
11/02/2010 04:30 EST	0.68	67	1%	60300	**5109**
11/02/2010 04:45 EST	0.65	71	6%	63900	**8709**
11/02/2010 05:00 EST	0.63	67	-6%	60300	**5109**
11/02/2010 05:15 EST	0.6	72	7%	64800	**9609**
11/02/2010 05:30 EST	0.58	68	-6%	61200	**6009**
11/02/2010 05:45 EST	0.55	72	6%	64800	**9609**
11/02/2010 06:00 EST	0.52	72	0%	64800	**9609**
11/02/2010 06:15 EST	0.5	68	-6%	61200	**6009**
11/02/2010 06:30 EST	0.47	73	7%	65700	**10509**
11/02/2010 06:45 EST	0.45	69	-6%	62100	**6909**
11/02/2010 07:00 EST	0.42	73	5%	65700	**10509**
11/02/2010 07:15 EST	0.39	74	1%	66600	**11409**
11/02/2010 07:30 EST	0.37	70	-6%	63000	**7809**
11/02/2010 07:45 EST	0.34	74	5%	66600	**11409**
11/02/2010 08:00 EST	0.31	75	1%	67500	**12309**
11/02/2010 08:15 EST	0.29	71	-6%	63900	**8709**
11/02/2010 08:30 EST	0.26	75	5%	67500	**12309**
11/02/2010 08:45 EST	0.23	75	0%	67500	**12309**
11/02/2010 09:00 EST	0.21	71	-6%	63900	**8709**

11/02/2010 09:15 EST	0.18	76	7%	68400	13209
11/02/2010 09:30 EST	0.16	72	-6%	64800	9609
11/02/2010 09:45 EST	0.14	72	0%	64800	9609
11/02/2010 10:00 EST	0.12	72	0%	64800	9609
11/02/2010 10:15 EST	0.1	73	1%	65700	10509
11/02/2010 10:30 EST	0.09	68	-7%	61200	6009
11/02/2010 10:45 EST	0.08	69	1%	62100	6909
11/02/2010 11:00 EST	0.1	56	-23%	50400	-4791
11/02/2010 11:15 EST	0.12	56	0%	50400	-4791
11/02/2010 11:30 EST	0.14	55	-2%	49500	-5691
11/02/2010 11:45 EST	0.17	51	-8%	45900	-9291
11/02/2010 12:00 EST	0.2	51	0%	45900	-9291
11/02/2010 12:15 EST	0.22	55	7%	49500	-5691
11/02/2010 12:30 EST	0.26	46	-20%	41400	-13791
11/02/2010 12:45 EST	0.29	50	8%	45000	-10191
11/02/2010 13:00 EST	0.33	45	-11%	40500	-14691
11/02/2010 13:15 EST	0.38	40	-13%	36000	-19191
11/02/2010 13:30 EST	0.43	40	0%	36000	-19191
11/02/2010 13:45 EST	0.47	44	9%	39600	-15591
11/02/2010 14:00 EST	0.52	39	-13%	35100	-20091

11/02/2010 14:15 EST	0.56	43	9%	38700	-16491
11/02/2010 14:30 EST	0.59	47	9%	42300	-12891
11/02/2010 14:45 EST	0.61	51	8%	45900	-9291
11/02/2010 15:00 EST	0.63	50	-2%	45000	-10191
11/02/2010 15:15 EST	0.64	54	7%	48600	-6591
11/02/2010 15:30 EST	0.64	59	8%	53100	-2091
11/02/2010 15:45 EST	0.63	63	6%	56700	1509
11/02/2010 16:00 EST	0.61	67	6%	60300	5109
11/02/2010 16:15 EST	0.58	72	7%	64800	9609
11/02/2010 16:30 EST	0.56	68	-6%	61200	6009
11/02/2010 16:45 EST	0.54	68	0%	61200	6009
11/02/2010 17:00 EST	0.53	64	-6%	57600	2409
11/02/2010 17:15 EST	0.51	68	6%	61200	6009
11/02/2010 17:30 EST	0.49	69	1%	62100	6909
11/02/2010 17:45 EST	0.47	69	0%	62100	6909
11/02/2010 18:00 EST	0.44	73	5%	65700	10509
11/02/2010 18:15 EST	0.42	69	-6%	62100	6909
11/02/2010 18:30 EST	0.4	69	0%	62100	6909
11/02/2010 18:45 EST	0.4	61	-13%	54900	-291
11/02/2010 19:00 EST	0.36	78	22%	70200	15009

11/02/2010 19:15 EST	0.35	66	-18%	59400	4209
11/02/2010 19:30 EST	0.31	79	16%	71100	15909
11/02/2010 19:45 EST	0.29	71	-11%	63900	8709
11/02/2010 20:00 EST	0.26	75	5%	67500	12309
11/02/2010 20:15 EST	0.25	67	-12%	60300	5109
11/02/2010 20:30 EST	0.22	75	11%	67500	12309
11/02/2010 20:45 EST	0.2	71	-6%	63900	8709
11/02/2010 21:00 EST	0.19	67	-6%	60300	5109
11/02/2010 21:15 EST	0.17	72	7%	64800	9609
11/02/2010 21:30 EST	0.15	72	0%	64800	9609
11/02/2010 21:45 EST	0.16	59	-22%	53100	-2091
11/02/2010 22:00 EST	0.16	64	8%	57600	2409
11/02/2010 22:15 EST	0.19	51	-25%	45900	-9291
11/02/2010 22:30 EST	0.21	55	7%	49500	-5691
11/02/2010 22:45 EST	0.24	50	-10%	45000	-10191
11/02/2010 23:00 EST	0.27	50	0%	45000	-10191
11/02/2010 23:15 EST	0.31	45	-11%	40500	-14691
11/02/2010 23:30 EST	0.34	49	8%	44100	-11091
11/02/2010 23:45 EST	0.38	45	-9%	40500	-14691
		61.32291667			0


Nov 2, 2010
cfs Discharge
90
80
70
60
50
40
30
20
10
0
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96


Gage Height Nov 2, 2010
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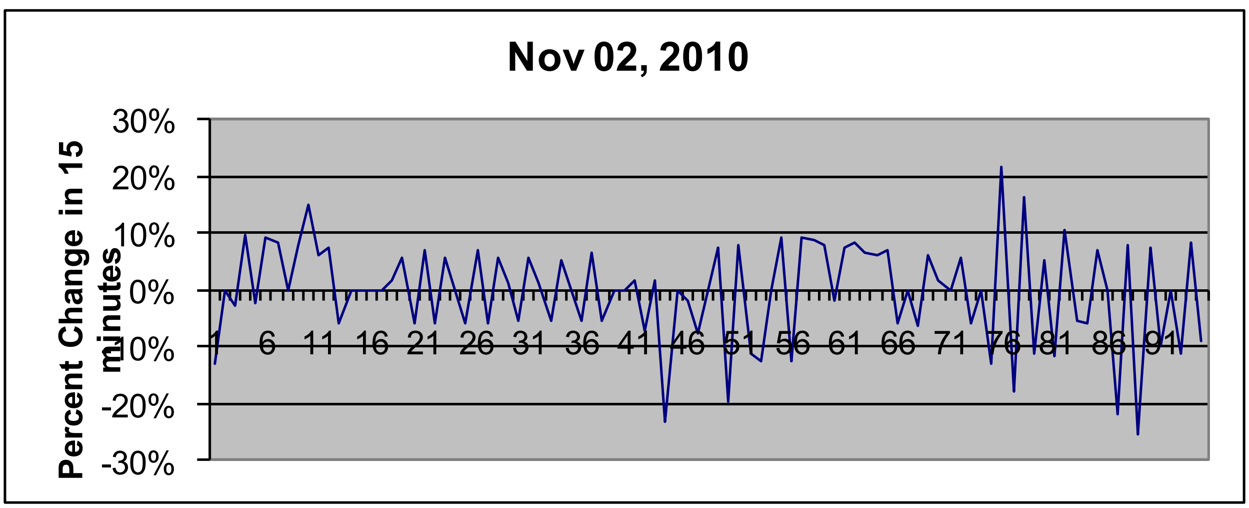
0.8
0.6
0.4
0.2
0
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96


Nov 02, 2010
Percent Change in 15 minutes
30%
20%
10%
0%
-10%
-20%
-30%
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91

Sheet: Equation Component Analysis

								FYI						
Weeki Wachee GW		12.5		Equation Components		**FIXED**		Change	FIRST	% Change			SECOND	**% Change**
				18.63	3.31*GW		10.31*GH	Head	VARIABLE	FIRST	ds/dt	418.14*ds/dt	VARIABLE	**SECOND**
					plus		minus		INCLUDED	VARIABLE		minus	INCLUDED	**VARIABLE**
03/2011 00:00 EST	0.37	65		18.63	41.44	**60.07**	3.815	97.04%	56.257	6.4%				
02/03/2011 00:15 EST	0.35	65	0.0%	18.63	41.44	**60.07**	3.609	97.20%	56.463	6.0%	-0.02	-8.36	64.83	**12.9%**
02/03/2011 00:30 EST	0.33	65	0.0%	18.63	41.44	**60.07**	3.402	97.36%	56.669	5.7%	-0.02	-8.36	65.03	**12.9%**
02/03/2011 00:45 EST	0.33	57	-14.0%	18.63	41.44	**60.07**	3.402	97.36%	56.669	5.7%	0	0	56.67	**0.0%**
02/03/2011 01:00 EST	0.34	52	-9.6%	18.63	41.44	**60.07**	3.505	97.28%	56.566	5.8%	0.01	4.181	52.38	**-8.0%**
02/03/2011 01:15 EST	0.37	44	-18.2%	18.63	41.44	**60.07**	3.815	97.04%	56.257	6.4%	0.03	12.54	43.71	**-28.7%**
02/03/2011 01:30 EST	0.41	39	-12.8%	18.63	41.44	**60.07**	4.227	96.73%	55.844	7.0%	0.04	16.73	39.12	**-42.8%**
02/03/2011 01:45 EST	0.45	39	0.0%	18.63	41.44	**60.07**	4.64	96.41%	55.432	7.7%	0.04	16.73	38.71	**-43.2%**
02/03/2011 02:00 EST	0.49	38	-2.6%	18.63	41.44	**60.07**	5.052	96.09%	55.019	8.4%	0.04	16.73	38.29	**-43.7%**
02/03/2011 02:15 EST	0.54	34	-11.8%	18.63	41.44	**60.07**	5.567	95.69%	54.504	9.3%	0.05	20.91	33.6	**-62.2%**
02/03/2011 02:30 EST	0.58	37	8.1%	18.63	41.44	**60.07**	5.98	95.37%	54.091	10.0%	0.04	16.73	37.37	**-44.8%**
02/03/2011 02:45 EST	0.63	33	-12.1%	18.63	41.44	**60.07**	6.495	94.97%	53.576	10.8%	0.05	20.91	32.67	**-64.0%**

02/03/2011 03:00 EST	0.68	32	-3.1%	18.63	41.44	**60.07**	7.011	94.57%	53.06	11.7%	0.05	20.91	32.15	**-65.0%**
02/03/2011 03:15 EST	0.74	27	-18.5%	18.63	41.44	**60.07**	7.629	94.09%	52.442	12.7%	0.06	25.09	27.35	**-91.7%**
02/03/2011 03:30 EST	0.8	27	0.0%	18.63	41.44	**60.07**	8.248	93.61%	51.823	13.7%	0.06	25.09	26.73	**-93.8%**
02/03/2011 03:45 EST	0.86	26	-3.8%	18.63	41.44	**60.07**	8.867	93.13%	51.205	14.8%	0.06	25.09	26.12	**-96.1%**
02/03/2011 04:00 EST	0.92	25	-4.0%	18.63	41.44	**60.07**	9.485	92.65%	50.586	15.8%	0.06	25.09	25.5	**-98.4%**
02/03/2011 04:15 EST	0.95	38	34.2%	18.63	41.44	**60.07**	9.795	92.41%	50.277	16.3%	0.03	12.54	37.73	**-33.2%**
02/03/2011 04:30 EST	0.98	37	-2.7%	18.63	41.44	**60.07**	10.1	92.17%	49.967	16.8%	0.03	12.54	37.42	**-33.5%**
02/03/2011 04:45 EST	0.99	46	19.6%	18.63	41.44	**60.07**	10.21	92.09%	49.864	17.0%	0.01	4.181	45.68	**-9.2%**
02/03/2011 05:00 EST	0.98	54	14.8%	18.63	41.44	**60.07**	10.1	92.17%	49.967	16.8%	-0.01	-4.18	54.15	**7.7%**
02/03/2011 05:15 EST	0.95	63	14.3%	18.63	41.44	**60.07**	9.795	92.41%	50.277	16.3%	-0.03	-12.5	62.82	**20.0%**
02/03/2011 05:30 EST	0.91	67	6.0%	18.63	41.44	**60.07**	9.382	92.73%	50.689	15.6%	-0.04	-16.7	67.41	**24.8%**
02/03/2011 05:45 EST	0.88	64	-4.7%	18.63	41.44	**60.07**	9.073	92.97%	50.998	15.1%	-0.03	-12.5	63.54	**19.7%**
02/03/2011 06:00 EST	0.85	64	0.0%	18.63	41.44	**60.07**	8.764	93.21%	51.308	14.6%	-0.03	-12.5	63.85	**19.6%**
02/03/2011 06:15 EST	0.82	64	0.0%	18.63	41.44	**60.07**	8.454	93.45%	51.617	14.1%	-0.03	-12.5	64.16	**19.6%**
02/03/2011 06:30 EST	0.8	60	-6.7%	18.63	41.44	**60.07**	8.248	93.61%	51.823	13.7%	-0.02	-8.36	60.19	**13.9%**

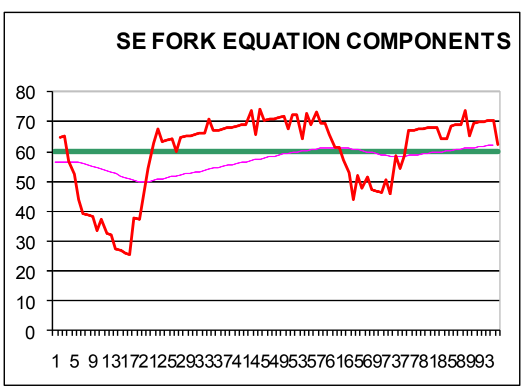
02/03 /2011 06:45 EST	0.77	65	7.7%	18.63	41.44	60.07	7.939	93.85%	52.133	13.2%	-0.03	-12.5	64.68	**19.4%**
02/03 /2011 07:00 EST	0.74	65	0.0%	18.63	41.44	60.07	7.629	94.09%	52.442	12.7%	-0.03	-12.5	64.99	**19.3%**
02/03 /2011 07:15 EST	0.71	65	0.0%	18.63	41.44	60.07	7.32	94.33%	52.751	12.2%	-0.03	-12.5	65.3	**19.2%**
02/03 /2011 07:30 EST	0.68	66	1.5%	18.63	41.44	60.07	7.011	94.57%	53.06	11.7%	-0.03	-12.5	65.6	**19.1%**
02/03 /2011 07:45 EST	0.65	66	0.0%	18.63	41.44	60.07	6.702	94.81%	53.37	11.2%	-0.03	-12.5	65.91	**19.0%**
02/03 /2011 08:00 EST	0.62	66	0.0%	18.63	41.44	60.07	6.392	95.05%	53.679	10.6%	-0.03	-12.5	66.22	**18.9%**
02/03 /2011 08:15 EST	0.58	71	7.0%	18.63	41.44	60.07	5.98	95.37%	54.091	10.0%	-0.04	-16.7	70.82	**23.6%**
02/03 /2011 08:30 EST	0.55	67	-6.0%	18.63	41.44	60.07	5.671	95.61%	54.401	9.4%	-0.03	-12.5	66.94	**18.7%**
02/03 /2011 08:45 EST	0.52	67	0.0%	18.63	41.44	60.07	5.361	95.85%	54.71	8.9%	-0.03	-12.5	67.25	**18.7%**
02/03 /2011 09:00 EST	0.49	68	1.5%	18.63	41.44	60.07	5.052	96.09%	55.019	8.4%	-0.03	-12.5	67.56	**18.6%**
02/03 /2011 09:15 EST	0.46	68	0.0%	18.63	41.44	60.07	4.743	96.33%	55.329	7.9%	-0.03	-12.5	67.87	**18.5%**
02/03 /2011 09:30 EST	0.43	68	0.0%	18.63	41.44	60.07	4.433	96.57%	55.638	7.4%	-0.03	-12.5	68.18	**18.4%**
02/03 /2011 09:45 EST	0.4	68	0.0%	18.63	41.44	60.07	4.124	96.81%	55.947	6.9%	-0.03	-12.5	68.49	**18.3%**
02/03 /2011 10:00 EST	0.37	69	1.4%	18.63	41.44	60.07	3.815	97.04%	56.257	6.4%	-0.03	-12.5	68.8	**18.2%**
02/03 /2011 10:15 EST	0.34	69	0.0%	18.63	41.44	60.07	3.505	97.28%	56.566	5.8%	-0.03	-12.5	69.11	**18.2%**

02/03/2011 10:30 EST	0.3	74	6.8%	18.63	41.44	**60.07**	3.093	97.60%	56.978	5.1%	-0.04	-16.7	73.7	**22.7%**
02/03/2011 10:45 EST	0.28	65	-13.8%	18.63	41.44	**60.07**	2.887	97.76%	57.184	4.8%	-0.02	-8.36	65.55	**12.8%**
02/03/2011 11:00 EST	0.24	74	12.2%	18.63	41.44	**60.07**	2.474	98.08%	57.597	4.1%	-0.04	-16.7	74.32	**22.5%**
02/03/2011 11:15 EST	0.21	70	-5.7%	18.63	41.44	**60.07**	2.165	98.32%	57.906	3.6%	-0.03	-12.5	70.45	**17.8%**
02/03/2011 11:30 EST	0.18	71	1.4%	18.63	41.44	**60.07**	1.856	98.56%	58.215	3.1%	-0.03	-12.5	70.76	**17.7%**
02/03/2011 11:45 EST	0.15	71	0.0%	18.63	41.44	**60.07**	1.547	98.80%	58.525	2.6%	-0.03	-12.5	71.07	**17.7%**
02/03/2011 12:00 EST	0.12	71	0.0%	18.63	41.44	**60.07**	1.237	99.04%	58.834	2.1%	-0.03	-12.5	71.38	**17.6%**
02/03/2011 12:15 EST	0.09	72	1.4%	18.63	41.44	**60.07**	0.928	99.28%	59.143	1.5%	-0.03	-12.5	71.69	**17.5%**
02/03/2011 12:30 EST	0.07	68	-5.9%	18.63	41.44	**60.07**	0.722	99.44%	59.35	1.2%	-0.02	-8.36	67.71	**12.4%**
02/03/2011 12:45 EST	0.04	72	5.6%	18.63	41.44	**60.07**	0.412	99.68%	59.659	0.7%	-0.03	-12.5	72.2	**17.4%**
02/03/2011 13:00 EST	0.01	72	0.0%	18.63	41.44	**60.07**	0.103	99.92%	59.968	0.2%	-0.03	-12.5	72.51	**17.3%**
02/03/2011 13:15 EST	0	64	-12.5%	18.63	41.44	**60.07**	0	100.00%	60.071	0.0%	-0.01	-4.18	64.25	**6.5%**
02/03/2011 13:30 EST	-0.03	73	12.3%	18.63	41.44	**60.07**	-0.31	100.24%	60.381	-0.5%	-0.03	-12.5	72.92	**17.2%**
02/03/2011 13:45 EST	-0.05	69	-5.8%	18.63	41.44	**60.07**	-0.52	100.40%	60.587	-0.9%	-0.02	-8.36	68.95	**12.1%**
02/03/2011 14:00 EST	-0.08	73	5.5%	18.63	41.44	**60.07**	-0.82	100.64%	60.896	-1.4%	-0.03	-12.5	73.44	**17.1%**

02/03/2011 14:15 EST	-0.1	69	-5.8%	18.63	41.44	60.07	-1.03	100.80%	61.102	-1.7%	-0.02	-8.36	69.47	**12.0%**
02/03/2011 14:30 EST	-0.12	70	1.4%	18.63	41.44	60.07	-1.24	100.96%	61.308	-2.1%	-0.02	-8.36	69.67	**12.0%**
02/03/2011 14:45 EST	-0.13	66	-6.1%	18.63	41.44	60.07	-1.34	101.04%	61.412	-2.2%	-0.01	-4.18	65.59	**6.4%**
02/03/2011 15:00 EST	-0.13	61	-8.2%	18.63	41.44	60.07	-1.34	101.04%	61.412	-2.2%	0	0	61.41	**0.0%**
02/03/2011 15:15 EST	-0.13	61	0.0%	18.63	41.44	60.07	-1.34	101.04%	61.412	-2.2%	0	0	61.41	**0.0%**
02/03/2011 15:30 EST	-0.12	57	-7.0%	18.63	41.44	60.07	-1.24	100.96%	61.308	-2.1%	0.01	4.181	57.13	**-7.3%**
02/03/2011 15:45 EST	-0.1	53	-7.5%	18.63	41.44	60.07	-1.03	100.80%	61.102	-1.7%	0.02	8.363	52.74	**-15.9%**
02/03/2011 16:00 EST	-0.06	44	-20.5%	18.63	41.44	60.07	-0.62	100.48%	60.69	-1.0%	0.04	16.73	43.96	**-38.0%**
02/03/2011 16:15 EST	-0.04	52	15.4%	18.63	41.44	60.07	-0.41	100.32%	60.484	-0.7%	0.02	8.363	52.12	**-16.0%**
02/03/2011 16:30 EST	-0.01	48	-8.3%	18.63	41.44	60.07	-0.1	100.08%	60.174	-0.2%	0.03	12.54	47.63	**-26.3%**
02/03/2011 16:45 EST	0.01	52	7.7%	18.63	41.44	60.07	0.103	99.92%	59.968	0.2%	0.02	8.363	51.61	**-16.2%**
02/03/2011 17:00 EST	0.04	47	-10.6%	18.63	41.44	60.07	0.412	99.68%	59.659	0.7%	0.03	12.54	47.11	**-26.6%**
02/03/2011 17:15 EST	0.07	47	0.0%	18.63	41.44	60.07	0.722	99.44%	59.35	1.2%	0.03	12.54	46.81	**-26.8%**
02/03/2011 17:30 EST	0.1	46	-2.2%	18.63	41.44	60.07	1.031	99.20%	59.04	1.7%	0.03	12.54	46.5	**-27.0%**
02/03/2011 17:45 EST	0.12	50	8.0%	18.63	41.44	60.07	1.237	99.04%	58.834	2.1%	0.02	8.363	50.47	**-16.6%**

02/03/2011 18:00 EST	0.15	46	-8.7%	18.63	41.44	**60.07**	1.547	98.80%	58.525	2.6%	0.03	12.54	45.98	**-27.3%**
02/03/2011 18:15 EST	0.15	58	20.7%	18.63	41.44	**60.07**	1.547	98.80%	58.525	2.6%	0	0	58.52	**0.0%**
02/03/2011 18:30 EST	0.16	54	-7.4%	18.63	41.44	**60.07**	1.65	98.72%	58.422	2.7%	0.01	4.181	54.24	**-7.7%**
02/03/2011 18:45 EST	0.16	58	6.9%	18.63	41.44	**60.07**	1.65	98.72%	58.422	2.7%	0	0	58.42	**0.0%**
02/03/2011 19:00 EST	0.14	67	13.4%	18.63	41.44	**60.07**	1.443	98.88%	58.628	2.4%	-0.02	-8.36	66.99	**12.5%**
02/03/2011 19:15 EST	0.12	67	0.0%	18.63	41.44	**60.07**	1.237	99.04%	58.834	2.1%	-0.02	-8.36	67.2	**12.4%**
02/03/2011 19:30 EST	0.1	67	0.0%	18.63	41.44	**60.07**	1.031	99.20%	59.04	1.7%	-0.02	-8.36	67.4	**12.4%**
02/03/2011 19:45 EST	0.08	68	1.5%	18.63	41.44	**60.07**	0.825	99.36%	59.246	1.4%	-0.02	-8.36	67.61	**12.4%**
02/03/2011 20:00 EST	0.06	68	0.0%	18.63	41.44	**60.07**	0.619	99.52%	59.453	1.0%	-0.02	-8.36	67.82	**12.3%**
02/03/2011 20:15 EST	0.04	68	0.0%	18.63	41.44	**60.07**	0.412	99.68%	59.659	0.7%	-0.02	-8.36	68.02	**12.3%**
02/03/2011 20:30 EST	0.02	68	0.0%	18.63	41.44	**60.07**	0.206	99.84%	59.865	0.3%	-0.02	-8.36	68.23	**12.3%**
02/03/2011 20:45 EST	0.01	64	-6.3%	18.63	41.44	**60.07**	0.103	99.92%	59.968	0.2%	-0.01	-4.18	64.15	**6.5%**
02/03/2011 21:00 EST	0	64	0.0%	18.63	41.44	**60.07**	0	100.00%	60.071	0.0%	-0.01	-4.18	64.25	**6.5%**
02/03/2011 21:15 EST	-0.02	69	7.2%	18.63	41.44	**60.07**	-0.21	100.16%	60.277	-0.3%	-0.02	-8.36	68.64	**12.2%**
02/03/2011 21:30 EST	-0.04	69	0.0%	18.63	41.44	**60.07**	-0.41	100.32%	60.484	-0.7%	-0.02	-8.36	68.85	**12.1%**

02/03/2011 21:45 EST	-0.06	69	0.0%	18.63	41.44	**60.07**	-0.62	100.48%	60.69	-1.0%	-0.02	-8.36	69.05	**12.1%**
02/03/2011 22:00 EST	-0.09	73	5.5%	18.63	41.44	**60.07**	-0.93	100.72%	60.999	-1.5%	-0.03	-12.5	73.54	**17.1%**
02/03/2011 22:15 EST	-0.1	65	-12.3%	18.63	41.44	**60.07**	-1.03	100.80%	61.102	-1.7%	-0.01	-4.18	65.28	**6.4%**
02/03/2011 22:30 EST	-0.12	70	7.1%	18.63	41.44	**60.07**	-1.24	100.96%	61.308	-2.1%	-0.02	-8.36	69.67	**12.0%**
02/03/2011 22:45 EST	-0.14	70	0.0%	18.63	41.44	**60.07**	-1.44	101.12%	61.515	-2.4%	-0.02	-8.36	69.88	**12.0%**
02/03/2011 23:00 EST	-0.16	70	0.0%	18.63	41.44	**60.07**	-1.65	101.28%	61.721	-2.7%	-0.02	-8.36	70.08	**11.9%**
02/03/2011 23:15 EST	-0.18	70	0.0%	18.63	41.44	**60.07**	-1.86	101.44%	61.927	-3.1%	-0.02	-8.36	70.29	**11.9%**
02/03/2011 23:30 EST	-0.2	70	0.0%	18.63	41.44	**60.07**	-2.06	101.60%	62.133	-3.4%	-0.02	-8.36	70.5	**11.9%**
02/03/2011 23:45 EST	-0.22	71	1.4%	18.63	41.44	**60.07**	-2.27	101.76%	62.339	-3.8%	-0.02		62.34	**0.0%**
		59.7				**60.07**			**57.129**			**-2.54**	**59.65**	
MAX	0.99					MAX	10.21	101.76%	62.34		MAX	25.09	74.32	
MIN	-0.22					MIN	-2.27	92.09%	49.86		MIN	-16.7	25.5	
Day Change GH														
	-0.59													



Weeki	12.52			Equation Components		**FIXED**		FIRST	% Change			SECOND	**% Change**
				18.63	3.31*GW		10.31*GH	VARIABLE	FIRST	ds/dt	418.14*ds/dt	VARIABLE	**SECOND**
					plus		minus	INCLUDED	VARIABLE		minus	INCLUDED	**VARIABLE**
01/13/2011 00:00 EST	-0.43	73		18.63	41.44	**60.07**	-4.43	64.5	6.9%				
01/13/2011 00:15 EST	-0.44	69	-5.8%	18.63	41.44	**60.07**	-4.54	64.61	7.0%	-0.01	-4.18	68.79	**6.1%**
01/13/2011 00:30 EST	-0.46	73	5.5%	18.63	41.44	**60.07**	-4.74	64.81	7.3%	-0.02	-8.36	73.18	**11.4%**
01/13/2011 00:45 EST	-0.47	69	-5.8%	18.63	41.44	**60.07**	-4.85	64.92	7.5%	-0.01	-4.18	69.1	**6.1%**
01/13/2011 01:00 EST	-0.48	69	0.0%	18.63	41.44	**60.07**	-4.95	65.02	7.6%	-0.01	-4.18	69.2	**6.0%**
01/13/2011 01:15 EST	-0.49	69	0.0%	18.63	41.44	**60.07**	-5.05	65.12	7.8%	-0.01	-4.18	69.3	**6.0%**
01/13/2011 01:30 EST	-0.5	69	0.0%	18.63	41.44	**60.07**	-5.16	65.23	7.9%	-0.01	-4.18	69.41	**6.0%**
01/13/2011 01:45 EST	-0.51	70	1.4%	18.63	41.44	**60.07**	-5.26	65.33	8.0%	-0.01	-4.18	69.51	**6.0%**
01/13/2011 02:00 EST	-0.52	70	0.0%	18.63	41.44	**60.07**	-5.36	65.43	8.2%	-0.01	-4.18	69.61	**6.0%**

01/13/2011 02:15 EST	-0.53	70	0.0%	18.63	41.44	**60.07**	-5.46	65.54	8.3%	-0.01	-4.18	69.72	**6.0%**
01/13/2011 02:30 EST	-0.55	74	5.4%	18.63	41.44	**60.07**	-5.67	65.74	8.6%	-0.02	-8.36	74.1	**11.3%**
01/13/2011 02:45 EST	-0.56	70	-5.7%	18.63	41.44	**60.07**	-5.77	65.84	8.8%	-0.01	-4.18	70.03	**6.0%**
01/13/2011 03:00 EST	-0.57	70	0.0%	18.63	41.44	**60.07**	-5.88	65.95	8.9%	-0.01	-4.18	70.13	**6.0%**
01/13/2011 03:15 EST	-0.59	74	5.4%	18.63	41.44	**60.07**	-6.08	66.15	9.2%	-0.02	-8.36	74.52	**11.2%**
01/13/2011 03:30 EST	-0.61	75	1.3%	18.63	41.44	**60.07**	-6.29	66.36	9.5%	-0.02	-8.36	74.72	**11.2%**
01/13/2011 03:45 EST	-0.62	71	-5.6%	18.63	41.44	**60.07**	-6.39	66.46	9.6%	-0.01	-4.18	70.64	**5.9%**
01/13/2011 04:00 EST	-0.64	75	5.3%	18.63	41.44	**60.07**	-6.6	66.67	9.9%	-0.02	-8.36	75.03	**11.1%**
01/13/2011 04:15 EST	-0.66	75	0.0%	18.63	41.44	**60.07**	-6.8	66.88	10.2%	-0.02	-8.36	75.24	**11.1%**
01/13/2011 04:30 EST	-0.67	71	-5.6%	18.63	41.44	**60.07**	-6.91	66.98	10.3%	-0.01	-4.18	71.16	**5.9%**
01/13/2011 04:45	-0.69	76	6.6%	18.63	41.44	**60.07**	-7.11	67.19	10.6%	-0.02	-8.36	75.55	**11.1%**

EST													
01/13/2011 05:00 EST	-0.7	71	-7.0%	18.63	41.44	**60.07**	-7.22	67.29	10.7%	-0.01	-4.18	71.47	**5.9%**
01/13/2011 05:15 EST	-0.72	76	6.6%	18.63	41.44	**60.07**	-7.42	67.49	11.0%	-0.02	-8.36	75.86	**11.0%**
01/13/2011 05:30 EST	-0.74	76	0.0%	18.63	41.44	**60.07**	-7.63	67.7	11.3%	-0.02	-8.36	76.06	**11.0%**
01/13/2011 05:45 EST	-0.75	72	-5.6%	18.63	41.44	**60.07**	-7.73	67.8	11.4%	-0.01	-4.18	71.99	**5.8%**
01/13/2011 06:00 EST	-0.77	76	5.3%	18.63	41.44	**60.07**	-7.94	68.01	11.7%	-0.02	-8.36	76.37	**10.9%**
01/13/2011 06:15 EST	-0.78	72	-5.6%	18.63	41.44	**60.07**	-8.04	68.11	11.8%	-0.01	-4.18	72.29	**5.8%**
01/13/2011 06:30 EST	-0.81	81	11.1%	18.63	41.44	**60.07**	-8.35	68.42	12.2%	-0.03	-12.5	80.97	**15.5%**
01/13/2011 06:45 EST	-0.81	68	-19.1%	18.63	41.44	**60.07**	-8.35	68.42	12.2%	0	0	68.42	**0.0%**
01/13/2011 07:00 EST	-0.83	77	11.7%	18.63	41.44	**60.07**	-8.56	68.63	12.5%	-0.02	-8.36	76.99	**10.9%**
01/13/2011 07:15 EST	-0.85	77	0.0%	18.63	41.44	**60.07**	-8.76	68.83	12.7%	-0.02	-8.36	77.2	**10.8%**

01/13/2011 07:30 EST	-0.86	73	-5.5%	18.63	41.44	**60.07**	-8.87	68.94	12.9%	-0.01	-4.18	73.12	**5.7%**
01/13/2011 07:45 EST	-0.88	77	5.2%	18.63	41.44	**60.07**	-9.07	69.14	13.1%	-0.02	-8.36	77.51	**10.8%**
01/13/2011 08:00 EST	-0.9	78	1.3%	18.63	41.44	**60.07**	-9.28	69.35	13.4%	-0.02	-8.36	77.71	**10.8%**
01/13/2011 08:15 EST	-0.91	74	-5.4%	18.63	41.44	**60.07**	-9.38	69.45	13.5%	-0.01	-4.18	73.63	**5.7%**
01/13/2011 08:30 EST	-0.92	74	0.0%	18.63	41.44	**60.07**	-9.49	69.56	13.6%	-0.01	-4.18	73.74	**5.7%**
01/13/2011 08:45 EST	-0.92	70	-5.7%	18.63	41.44	**60.07**	-9.49	69.56	13.6%	0	0	69.56	**0.0%**
01/13/2011 09:00 EST	-0.92	70	0.0%	18.63	41.44	**60.07**	-9.49	69.56	13.6%	0	0	69.56	**0.0%**
01/13/2011 09:15 EST	-0.93	74	5.4%	18.63	41.44	**60.07**	-9.59	69.66	13.8%	-0.01	-4.18	73.84	**5.7%**
01/13/2011 09:30 EST	-0.94	74	0.0%	18.63	41.44	**60.07**	-9.69	69.76	13.9%	-0.01	-4.18	73.94	**5.7%**
01/13/2011 09:45 EST	-0.95	74	0.0%	18.63	41.44	**60.07**	-9.79	69.87	14.0%	-0.01	-4.18	74.05	**5.6%**
01/13/2011 10:00	-0.97	78	5.1%	18.63	41.44	**60.07**	-10	70.07	14.3%	-0.02	-8.36	78.43	**10.7%**

EST													
01/13/2011 10:15 EST	-0.99	79	1.3%	18.63	41.44	**60.07**	-10.2	70.28	14.5%	-0.02	-8.36	78.64	**10.6%**
01/13/2011 10:30 EST	-1	75	-5.3%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	-0.01	-4.18	74.56	**5.6%**
01/13/2011 10:45 EST	-1	70	-7.1%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	0	0	70.38	**0.0%**
01/13/2011 11:00 EST	-1.01	75	6.7%	18.63	41.44	**60.07**	-10.4	70.48	14.8%	-0.01	-4.18	74.67	**5.6%**
01/13/2011 11:15 EST	-1	66	-13.6%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	0.01	4.181	66.2	**-6.3%**
01/13/2011 11:30 EST	-1.01	75	12.0%	18.63	41.44	**60.07**	-10.4	70.48	14.8%	-0.01	-4.18	74.67	**5.6%**
01/13/2011 11:45 EST	-1.01	70	-7.1%	18.63	41.44	**60.07**	-10.4	70.48	14.8%	0	0	70.48	**0.0%**
01/13/2011 12:00 EST	-1	66	-6.1%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	0.01	4.181	66.2	**-6.3%**
01/13/2011 12:15 EST	-1.02	79	16.5%	18.63	41.44	**60.07**	-10.5	70.59	14.9%	-0.02	-8.36	78.95	**10.6%**
01/13/2011 12:30 EST	-1.03	75	-5.3%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	-0.01	-4.18	74.87	**5.6%**

01/13/2011 12:45 EST	-1.03	71	-5.6%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 13:00 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 13:15 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 13:30 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 13:45 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 14:00 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 14:15 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 14:30 EST	-1.03	71	0.0%	18.63	41.44	**60.07**	-10.6	70.69	15.0%	0	0	70.69	**0.0%**
01/13/2011 14:45 EST	-1.04	75	5.3%	18.63	41.44	**60.07**	-10.7	70.79	15.1%	-0.01	-4.18	74.98	**5.6%**
01/13/2011 15:00 EST	-1.04	71	-5.6%	18.63	41.44	**60.07**	-10.7	70.79	15.1%	0	0	70.79	**0.0%**
01/13/2011 15:15	-0.97	41	-73.2%	18.63	41.44	**60.07**	-10	70.07	14.3%	0.07	29.27	40.8	**-71.7%**

EST													
01/13/2011 15:30 EST	-0.97	70	41.4%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 15:45 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 16:00 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 16:15 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 16:30 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 16:45 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 17:00 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 17:15 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 17:30 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 17:45 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**

01/13/2011 18:00 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 18:15 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 18:30 EST	-0.97	70	0.0%	18.63	41.44	**60.07**	-10	70.07	14.3%	0	0	70.07	**0.0%**
01/13/2011 18:45 EST	-0.98	74	5.4%	18.63	41.44	**60.07**	-10.1	70.18	14.4%	-0.01	-4.18	74.36	**5.6%**
01/13/2011 19:00 EST	-0.98	70	-5.7%	18.63	41.44	**60.07**	-10.1	70.18	14.4%	0	0	70.18	**0.0%**
01/13/2011 19:15 EST	-0.98	70	0.0%	18.63	41.44	**60.07**	-10.1	70.18	14.4%	0	0	70.18	**0.0%**
01/13/2011 19:30 EST	-0.99	74	5.4%	18.63	41.44	**60.07**	-10.2	70.28	14.5%	-0.01	-4.18	74.46	**5.6%**
01/13/2011 19:45 EST	-0.99	70	-5.7%	18.63	41.44	**60.07**	-10.2	70.28	14.5%	0	0	70.28	**0.0%**
01/13/2011 20:00 EST	-1	75	6.7%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	-0.01	-4.18	74.56	**5.6%**
01/13/2011 20:15 EST	-1	70	-7.1%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	0	0	70.38	**0.0%**
01/13/2011 20:30	-1	70	0.0%	18.63	41.44	**60.07**	-10.3	70.38	14.6%	0	0	70.38	**0.0%**

EST													
01/13/2011 20:45 EST	-0.95	49	-42.9%	18.63	41.44	**60.07**	-9.79	69.87	14.0%	0.05	20.91	48.96	**-42.7%**
01/13/2011 21:00 EST	-0.92	57	14.0%	18.63	41.44	**60.07**	-9.49	69.56	13.6%	0.03	12.54	57.01	**-22.0%**
01/13/2011 21:15 EST	-0.88	52	-9.6%	18.63	41.44	**60.07**	-9.07	69.14	13.1%	0.04	16.73	52.42	**-31.9%**
01/13/2011 21:30 EST	-0.84	52	0.0%	18.63	41.44	**60.07**	-8.66	68.73	12.6%	0.04	16.73	52.01	**-32.2%**
01/13/2011 21:45 EST	-0.81	56	7.1%	18.63	41.44	**60.07**	-8.35	68.42	12.2%	0.03	12.54	55.88	**-22.4%**
01/13/2011 22:00 EST	-0.77	51	-9.8%	18.63	41.44	**60.07**	-7.94	68.01	11.7%	0.04	16.73	51.28	**-32.6%**
01/13/2011 22:15 EST	-0.73	51	0.0%	18.63	41.44	**60.07**	-7.53	67.6	11.1%	0.04	16.73	50.87	**-32.9%**
01/13/2011 22:30 EST	-0.69	50	-2.0%	18.63	41.44	**60.07**	-7.11	67.19	10.6%	0.04	16.73	50.46	**-33.1%**
01/13/2011 22:45 EST	-0.66	54	7.4%	18.63	41.44	**60.07**	-6.8	66.88	10.2%	0.03	12.54	54.33	**-23.1%**
01/13/2011 23:00 EST	-0.62	50	-8.0%	18.63	41.44	**60.07**	-6.39	66.46	9.6%	0.04	16.73	49.74	**-33.6%**

01/13/2011 23:15 EST	-0.59	54	7.4%	18.63	41.44	**60.07**	-6.08	66.15	9.2%	0.03	12.54	53.61	**-23.4%**
01/13/2011 23:30 EST	-0.56	53	-1.9%	18.63	41.44	**60.07**	-5.77	65.84	8.8%	0.03	12.54	53.3	**-23.5%**
01/13/2011 23:45 EST	-0.54	57	7.0%	18.63	41.44	**60.07**	-5.57	65.64	8.5%	0.02		65.64	**0.0%**
						60.07		**68.7**			**-0.58**	**69.31**	
MAX	-0.44	81				MAX	-4.54			MAX	29.27	80.97	
MIN	-1.04	41				MIN	-10.7			MIN	-12.5	40.8	
Day Change GH													
	-0.11												

Weeki GW	14.09			Equation Components		**FIXED**		FIRST	% Change			SECOND	**% Change**
				18.63	3.31*GW		10.31*GH	VARIABLE	FIRST	ds/dt	418.14 *ds/dt	VARIABLE	**SECOND**
					plus		minus	INCLUDED	VARIABLE		minus	INCLUDED	**VARIABLE**
11/02/2010 00:00 EST	0.55	43		18.63	46.638	**65.268**	5.6705	59.5974	-9.5%			43	
11/02/2010 00:15 EST	0.6	38	-13.2%	18.63	46.638	**65.268**	6.186	59.0819	-10.5%	0.05	20.907	38.1749	**-54.8%**
11/02/2010 00:30 EST	0.65	38	0.0%	18.63	46.638	**65.268**	6.7015	58.5664	-11.4%	0.05	20.907	37.6594	**-55.5%**
11/02/2010 00:45 EST	0.7	37	-2.7%	18.63	46.638	**65.268**	7.217	58.0509	-12.4%	0.05	20.907	37.1439	**-56.3%**
11/02/2010 01:00 EST	0.74	41	9.8%	18.63	46.638	**65.268**	7.6294	57.6385	-13.2%	0.04	16.726	40.9129	**-40.9%**
11/02/2010 01:15 EST	0.78	40	-2.5%	18.63	46.638	**65.268**	8.0418	57.2261	-14.1%	0.04	16.726	40.5005	**-41.3%**
11/02/2010 01:30 EST	0.81	44	9.1%	18.63	46.638	**65.268**	8.3511	56.9168	-14.7%	0.03	12.544	44.3726	**-28.3%**
11/02/2010 01:45 EST	0.83	48	8.3%	18.63	46.638	**65.268**	8.5573	56.7106	-15.1%	0.02	8.3628	48.3478	**-17.3%**
11/02/2010 02:00 EST	0.85	48	0.0%	18.63	46.638	**65.268**	8.7635	56.5044	-15.5%	0.02	8.3628	48.1416	**-17.4%**
11/02/2010 02:15 EST	0.86	52	7.7%	18.63	46.638	**65.268**	8.8666	56.4013	-15.7%	0.01	4.1814	52.2199	**-8.0%**
11/02/2010 02:30 EST	0.85	61	14.8%	18.63	46.638	**65.268**	8.7635	56.5044	-15.5%	-0.01	-4.1814	60.6858	**6.9%**
11/02/2010 02:45 EST	0.83	65	6.2%	18.63	46.638	**65.268**	8.5573	56.7106	-15.1%	-0.02	-8.3628	65.0734	**12.9%**
11/02/2010 03:00 EST	0.8	70	7.1%	18.63	46.638	**65.268**	8.248	57.0199	-14.5%	-0.03	-12.544	69.5641	**18.0%**

11/02/2010 03:15 EST	0.78	66	-6.1%	18.63	46.638	**65.268**	8.0418	57.2261	-14.1%	-0.02	-8.3628	65.5889	**12.8%**
11/02/2010 03:30 EST	0.76	66	0.0%	18.63	46.638	**65.268**	7.8356	57.4323	-13.6%	-0.02	-8.3628	65.7951	**12.7%**
11/02/2010 03:45 EST	0.74	66	0.0%	18.63	46.638	**65.268**	7.6294	57.6385	-13.2%	-0.02	-8.3628	66.0013	**12.7%**
11/02/2010 04:00 EST	0.72	66	0.0%	18.63	46.638	**65.268**	7.4232	57.8447	-12.8%	-0.02	-8.3628	66.2075	**12.6%**
11/02/2010 04:15 EST	0.7	66	0.0%	18.63	46.638	**65.268**	7.217	58.0509	-12.4%	-0.02	-8.3628	66.4137	**12.6%**
11/02/2010 04:30 EST	0.68	67	1.5%	18.63	46.638	**65.268**	7.0108	58.2571	-12.0%	-0.02	-8.3628	66.6199	**12.6%**
11/02/2010 04:45 EST	0.65	71	5.6%	18.63	46.638	**65.268**	6.7015	58.5664	-11.4%	-0.03	-12.544	71.1106	**17.6%**
11/02/2010 05:00 EST	0.63	67	-6.0%	18.63	46.638	**65.268**	6.4953	58.7726	-11.1%	-0.02	-8.3628	67.1354	**12.5%**
11/02/2010 05:15 EST	0.6	72	6.9%	18.63	46.638	**65.268**	6.186	59.0819	-10.5%	-0.03	-12.544	71.6261	**17.5%**
11/02/2010 05:30 EST	0.58	68	-5.9%	18.63	46.638	**65.268**	5.9798	59.2881	-10.1%	-0.02	-8.3628	67.6509	**12.4%**
11/02/2010 05:45 EST	0.55	72	5.6%	18.63	46.638	**65.268**	5.6705	59.5974	-9.5%	-0.03	-12.544	72.1416	**17.4%**
11/02/2010 06:00 EST	0.52	72	0.0%	18.63	46.638	**65.268**	5.3612	59.9067	-8.9%	-0.03	-12.544	72.4509	**17.3%**
11/02/2010 06:15 EST	0.5	68	-5.9%	18.63	46.638	**65.268**	5.155	60.1129	-8.6%	-0.02	-8.3628	68.4757	**12.2%**
11/02/2010 06:30 EST	0.47	73	6.8%	18.63	46.638	**65.268**	4.8457	60.4222	-8.0%	-0.03	-12.544	72.9664	**17.2%**
11/02/2010 06:45 EST	0.45	69	-5.8%	18.63	46.638	**65.268**	4.6395	60.6284	-7.7%	-0.02	-8.3628	68.9912	**12.1%**

11/02/2010 07:00 EST	0.42	73	5.5%	18.63	46.638	**65.268**	4.3302	60.9377	-7.1%	-0.03	-12.544	73.4819	**17.1%**
11/02/2010 07:15 EST	0.39	74	1.4%	18.63	46.638	**65.268**	4.0209	61.247	-6.6%	-0.03	-12.544	73.7912	**17.0%**
11/02/2010 07:30 EST	0.37	70	-5.7%	18.63	46.638	**65.268**	3.8147	61.4532	-6.2%	-0.02	-8.3628	69.816	**12.0%**
11/02/2010 07:45 EST	0.34	74	5.4%	18.63	46.638	**65.268**	3.5054	61.7625	-5.7%	-0.03	-12.544	74.3067	**16.9%**
11/02/2010 08:00 EST	0.31	75	1.3%	18.63	46.638	**65.268**	3.1961	62.0718	-5.1%	-0.03	-12.544	74.616	**16.8%**
11/02/2010 08:15 EST	0.29	71	-5.6%	18.63	46.638	**65.268**	2.9899	62.278	-4.8%	-0.02	-8.3628	70.6408	**11.8%**
11/02/2010 08:30 EST	0.26	75	5.3%	18.63	46.638	**65.268**	2.6806	62.5873	-4.3%	-0.03	-12.544	75.1315	**16.7%**
11/02/2010 08:45 EST	0.23	75	0.0%	18.63	46.638	**65.268**	2.3713	62.8966	-3.8%	-0.03	-12.544	75.4408	**16.6%**
11/02/2010 09:00 EST	0.21	71	-5.6%	18.63	46.638	**65.268**	2.1651	63.1028	-3.4%	-0.02	-8.3628	71.4656	**11.7%**
11/02/2010 09:15 EST	0.18	76	6.6%	18.63	46.638	**65.268**	1.8558	63.4121	-2.9%	-0.03	-12.544	75.9563	**16.5%**
11/02/2010 09:30 EST	0.16	72	-5.6%	18.63	46.638	**65.268**	1.6496	63.6183	-2.6%	-0.02	-8.3628	71.9811	**11.6%**
11/02/2010 09:45 EST	0.14	72	0.0%	18.63	46.638	**65.268**	1.4434	63.8245	-2.3%	-0.02	-8.3628	72.1873	**11.6%**
11/02/2010 10:00 EST	0.12	72	0.0%	18.63	46.638	**65.268**	1.2372	64.0307	-1.9%	-0.02	-8.3628	72.3935	**11.6%**
11/02/2010 10:15 EST	0.1	73	1.4%	18.63	46.638	**65.268**	1.031	64.2369	-1.6%	-0.02	-8.3628	72.5997	**11.5%**
11/02/2010 10:30 EST	0.09	68	-7.4%	18.63	46.638	**65.268**	0.9279	64.34	-1.4%	-0.01	-4.1814	68.5214	**6.1%**

11/02/2010 10:45 EST	0.08	69	1.4%	18.63	46.638	**65.268**	0.8248	64.4431	-1.3%	-0.01	-4.1814	68.6245	**6.1%**
11/02/2010 11:00 EST	0.1	56	-23.2%	18.63	46.638	**65.268**	1.031	64.2369	-1.6%	0.02	8.3628	55.8741	**-15.0%**
11/02/2010 11:15 EST	0.12	56	0.0%	18.63	46.638	**65.268**	1.2372	64.0307	-1.9%	0.02	8.3628	55.6679	**-15.0%**
11/02/2010 11:30 EST	0.14	55	-1.8%	18.63	46.638	**65.268**	1.4434	63.8245	-2.3%	0.02	8.3628	55.4617	**-15.1%**
11/02/2010 11:45 EST	0.17	51	-7.8%	18.63	46.638	**65.268**	1.7527	63.5152	-2.8%	0.03	12.544	50.971	**-24.6%**
11/02/2010 12:00 EST	0.2	51	0.0%	18.63	46.638	**65.268**	2.062	63.2059	-3.3%	0.03	12.544	50.6617	**-24.8%**
11/02/2010 12:15 EST	0.22	55	7.3%	18.63	46.638	**65.268**	2.2682	62.9997	-3.6%	0.02	8.3628	54.6369	**-15.3%**
11/02/2010 12:30 EST	0.26	46	-19.6%	18.63	46.638	**65.268**	2.6806	62.5873	-4.3%	0.04	16.726	45.8617	**-36.5%**
11/02/2010 12:45 EST	0.29	50	8.0%	18.63	46.638	**65.268**	2.9899	62.278	-4.8%	0.03	12.544	49.7338	**-25.2%**
11/02/2010 13:00 EST	0.33	45	-11.1%	18.63	46.638	**65.268**	3.4023	61.8656	-5.5%	0.04	16.726	45.14	**-37.1%**
11/02/2010 13:15 EST	0.38	40	-12.5%	18.63	46.638	**65.268**	3.9178	61.3501	-6.4%	0.05	20.907	40.4431	**-51.7%**
11/02/2010 13:30 EST	0.43	40	0.0%	18.63	46.638	**65.268**	4.4333	60.8346	-7.3%	0.05	20.907	39.9276	**-52.4%**
11/02/2010 13:45 EST	0.47	44	9.1%	18.63	46.638	**65.268**	4.8457	60.4222	-8.0%	0.04	16.726	43.6966	**-38.3%**
11/02/2010 14:00 EST	0.52	39	-12.8%	18.63	46.638	**65.268**	5.3612	59.9067	-8.9%	0.05	20.907	38.9997	**-53.6%**
11/02/2010 14:15 EST	0.56	43	9.3%	18.63	46.638	**65.268**	5.7736	59.4943	-9.7%	0.04	16.726	42.7687	**-39.1%**

11/02/2010 14:30 EST	0.59	47	8.5%	18.63	46.638	**65.268**	6.0829	59.185	-10.3%	0.03	12.544	46.6408	**-26.9%**
11/02/2010 14:45 EST	0.61	51	7.8%	18.63	46.638	**65.268**	6.2891	58.9788	-10.7%	0.02	8.3628	50.616	**-16.5%**
11/02/2010 15:00 EST	0.63	50	-2.0%	18.63	46.638	**65.268**	6.4953	58.7726	-11.1%	0.02	8.3628	50.4098	**-16.6%**
11/02/2010 15:15 EST	0.64	54	7.4%	18.63	46.638	**65.268**	6.5984	58.6695	-11.2%	0.01	4.1814	54.4881	**-7.7%**
11/02/2010 15:30 EST	0.64	59	8.5%	18.63	46.638	**65.268**	6.5984	58.6695	-11.2%	0	0	58.6695	**0.0%**
11/02/2010 15:45 EST	0.63	63	6.3%	18.63	46.638	**65.268**	6.4953	58.7726	-11.1%	-0.01	-4.1814	62.954	**6.6%**
11/02/2010 16:00 EST	0.61	67	6.0%	18.63	46.638	**65.268**	6.2891	58.9788	-10.7%	-0.02	-8.3628	67.3416	**12.4%**
11/02/2010 16:15 EST	0.58	72	6.9%	18.63	46.638	**65.268**	5.9798	59.2881	-10.1%	-0.03	-12.544	71.8323	**17.5%**
11/02/2010 16:30 EST	0.56	68	-5.9%	18.63	46.638	**65.268**	5.7736	59.4943	-9.7%	-0.02	-8.3628	67.8571	**12.3%**
11/02/2010 16:45 EST	0.54	68	0.0%	18.63	46.638	**65.268**	5.5674	59.7005	-9.3%	-0.02	-8.3628	68.0633	**12.3%**
11/02/2010 17:00 EST	0.53	64	-6.3%	18.63	46.638	**65.268**	5.4643	59.8036	-9.1%	-0.01	-4.1814	63.985	**6.5%**
11/02/2010 17:15 EST	0.51	68	5.9%	18.63	46.638	**65.268**	5.2581	60.0098	-8.8%	-0.02	-8.3628	68.3726	**12.2%**
11/02/2010 17:30 EST	0.49	69	1.4%	18.63	46.638	**65.268**	5.0519	60.216	-8.4%	-0.02	-8.3628	68.5788	**12.2%**
11/02/2010 17:45 EST	0.47	69	0.0%	18.63	46.638	**65.268**	4.8457	60.4222	-8.0%	-0.02	-8.3628	68.785	**12.2%**
11/02/2010 18:00 EST	0.44	73	5.5%	18.63	46.638	**65.268**	4.5364	60.7315	-7.5%	-0.03	-12.544	73.2757	**17.1%**

11/02/2010 18:15 EST	0.42	69	-5.8%	18.63	46.638	**65.268**	4.3302	60.9377	-7.1%	-0.02	-8.3628	69.3005	**12.1%**
11/02/2010 18:30 EST	0.4	69	0.0%	18.63	46.638	**65.268**	4.124	61.1439	-6.7%	-0.02	-8.3628	69.5067	**12.0%**
11/02/2010 18:45 EST	0.4	61	-13.1%	18.63	46.638	**65.268**	4.124	61.1439	-6.7%	0	0	61.1439	**0.0%**
11/02/2010 19:00 EST	0.36	78	21.8%	18.63	46.638	**65.268**	3.7116	61.5563	-6.0%	-0.04	-16.726	78.2819	**21.4%**
11/02/2010 19:15 EST	0.35	66	-18.2%	18.63	46.638	**65.268**	3.6085	61.6594	-5.9%	-0.01	-4.1814	65.8408	**6.4%**
11/02/2010 19:30 EST	0.31	79	16.5%	18.63	46.638	**65.268**	3.1961	62.0718	-5.1%	-0.04	-16.726	78.7974	**21.2%**
11/02/2010 19:45 EST	0.29	71	-11.3%	18.63	46.638	**65.268**	2.9899	62.278	-4.8%	-0.02	-8.3628	70.6408	**11.8%**
11/02/2010 20:00 EST	0.26	75	5.3%	18.63	46.638	**65.268**	2.6806	62.5873	-4.3%	-0.03	-12.544	75.1315	**16.7%**
11/02/2010 20:15 EST	0.25	67	-11.9%	18.63	46.638	**65.268**	2.5775	62.6904	-4.1%	-0.01	-4.1814	66.8718	**6.3%**
11/02/2010 20:30 EST	0.22	75	10.7%	18.63	46.638	**65.268**	2.2682	62.9997	-3.6%	-0.03	-12.544	75.5439	**16.6%**
11/02/2010 20:45 EST	0.2	71	-5.6%	18.63	46.638	**65.268**	2.062	63.2059	-3.3%	-0.02	-8.3628	71.5687	**11.7%**
11/02/2010 21:00 EST	0.19	67	-6.0%	18.63	46.638	**65.268**	1.9589	63.309	-3.1%	-0.01	-4.1814	67.4904	**6.2%**
11/02/2010 21:15 EST	0.17	72	6.9%	18.63	46.638	**65.268**	1.7527	63.5152	-2.8%	-0.02	-8.3628	71.878	**11.6%**
11/02/2010 21:30 EST	0.15	72	0.0%	18.63	46.638	**65.268**	1.5465	63.7214	-2.4%	-0.02	-8.3628	72.0842	**11.6%**
11/02/2010 21:45 EST	0.16	59	-22.0%	18.63	46.638	**65.268**	1.6496	63.6183	-2.6%	0.01	4.1814	59.4369	**-7.0%**

11/02/2010 22:00 EST	0.16	64	7.8%	18.63	46.638	**65.268**	1.6496	63.6183	-2.6%	0	0	63.6183	**0.0%**
11/02/2010 22:15 EST	0.19	51	-25.5%	18.63	46.638	**65.268**	1.9589	63.309	-3.1%	0.03	12.544	50.7648	**-24.7%**
11/02/2010 22:30 EST	0.21	55	7.3%	18.63	46.638	**65.268**	2.1651	63.1028	-3.4%	0.02	8.3628	54.74	**-15.3%**
11/02/2010 22:45 EST	0.24	50	-10.0%	18.63	46.638	**65.268**	2.4744	62.7935	-3.9%	0.03	12.544	50.2493	**-25.0%**
11/02/2010 23:00 EST	0.27	50	0.0%	18.63	46.638	**65.268**	2.7837	62.4842	-4.5%	0.03	12.544	49.94	**-25.1%**
11/02/2010 23:15 EST	0.31	45	-11.1%	18.63	46.638	**65.268**	3.1961	62.0718	-5.1%	0.04	16.726	45.3462	**-36.9%**
11/02/2010 23:30 EST	0.34	49	8.2%	18.63	46.638	**65.268**	3.5054	61.7625	-5.7%	0.03	12.544	49.2183	**-25.5%**
11/02/2010 23:45 EST	0.38	45	-8.9%	18.63	46.638	**65.268**	3.9178	61.3501	-6.4%	0.04	16.726	44.6245	**-37.5%**
		61.3				**65.268**		**60.78305**			**-0.7483**	**61.35062**	
MAX	0.86	79									MAX	78.7974	
MIN	0.08	37									MIN	37.1439	
Day Change GH													
	-0.17												

Attachment F

E-Mail from Doug Leeper to Kevin Grimsley and Richard Kane (United States Geological Survey), Dated February 21, 2011

From: Doug Leeper
To: Kevin Grimsely (kjgrims@usgs.gov); Richard Kane (rkane@usgs.gov)
Cc: Marty Kelly; Ron Basso
Subject: FW: SE Fork Homosassa River Flow Calculation Concerns
Date: Monday, February 21, 2011 11:40:02 AM

Kevin and Richard:

Before I respond to Mr. Johnson regarding his latest e-mail, I'd like to hear from you guys regarding the merit of his arguments concerning discharge reported for the SE Fork gage site, and if any data collection issues for the site exist, how they may be best addressed. For example, we've spoken previously about outfitting the site as an index-velocity-type site, and the District is considering requesting funding for this effort in our FY2010 budget – I'm assuming you guys think this may be a good idea???

Thanks,
Douglas A. Leeper, Chief Environmental Scientist
Resource Projects Department, Southwest Florida Water Management District
2379 Broad Street, Brooksville, FL 34604-6899
Telephone: 1-800-423-1476, ext. 4272 (FL only) or 352-796-7211, ext. 4272
Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

NOTE: e-mail string deleted by Doug Leeper, Southwest Florida Water Management District

Attachment G

E-Mail Richard Kane (United States Geological Survey) to Doug Leeper,
Dated February 21, 2011

From: Richard L Kane
To: Doug Leeper
Cc: Kevin Grimsely (kjgrims@usgs.gov); Marty Kelly; Ron Basso; Richard L Kane
Subject: Re: FW: SE Fork Homosassa River Flow Calculation Concerns
Date: Monday, February 21, 2011 6:48:48 PM

Doug, Kevin and I did briefly discuss Mr. Johnson's latest email. Although he did a very a laborious exercise and brought up so many different issues it will take a considerable amount of time to respond to each one in writing. We'd prefer to discuss the emails with SWFWMD over the phone or in person, whichever you prefer. We do feel that you will get more accuracy with an index-velocity meter but not sure that will satisfy Mr. Johnson as he didn't understand the complexity of the IV rating at Homosassa River and ultimately in his letter he does let on to his agenda (moratorium on drilling and water withdrawals for 5 years), Also Dan Yobbi has expressed willingness to further explain the regression equations methods he developed for use with use large springs in a tidal regime.

Richard L. Kane
Acting Associate Center Director for Data
U. S. Geological Survey
Florida Water Science Center
10500 University Center Dr., Suite 215
Tampa, Fl. 33612
rkane@usgs.gov
(813-975-8620, ext. 131)
FAX (813-975-0839)
Cell 813-918-1275

NOTE: e-mail string deleted by Doug Leeper, Southwest Florida Water Management District

Attachment H

E-Mail from Kevin Grimsley (United States Geological Survey to Doug Leeper, Dated February 24, 2011

From: Kevin J Grimsley
To: Doug Leeper
Cc: Richard L Kane
Subject: SE Fork discharge plots
Date: Thursday, February 24, 2011 11:19:43 AM
Attachments: SE Fork Computed vs Measured.pdf
02310688.02182009.pdf
02310688.03082005.pdf
02310688.05232006.pdf
02310688.07012008.pdf
02310688.07132004.pdf
02310688.08112009.pdf
02310688.08162005.pdf
02310688.10062010.pdf
02310688.12092010.pdf

42 measurements from 2004 to current. Average difference between measured Q and computed Q was -2.4%. (I've already communicated that to Mr Johnson in a previous email) The negative sign indicates that on average the computed Q was slightly higher than the measured.
The first plot below shows the computed vs measured discharges. If everything were perfect, they would all fall on the "1 to 1 line". The regression aims to at least balance the measurements evenly on each side. Looking at the graph you can see that there are slightly more measurements plotting above the line than below. This represents the -2.4% from above and is certainly an acceptable error. Nothing's perfect.
The plots below show details of how groups of measurements compare with the computed values. Again, some plot above and some below, but in general they are pretty accurate.
****

Kevin Grimsley, P.E.
Supervisory Hydrologist
USGS, Florida Water Science Center
10500 University Center Drive, Suite 215
Tampa, FL 33612
kjgrims@usgs.gov
813-975-8620 x159

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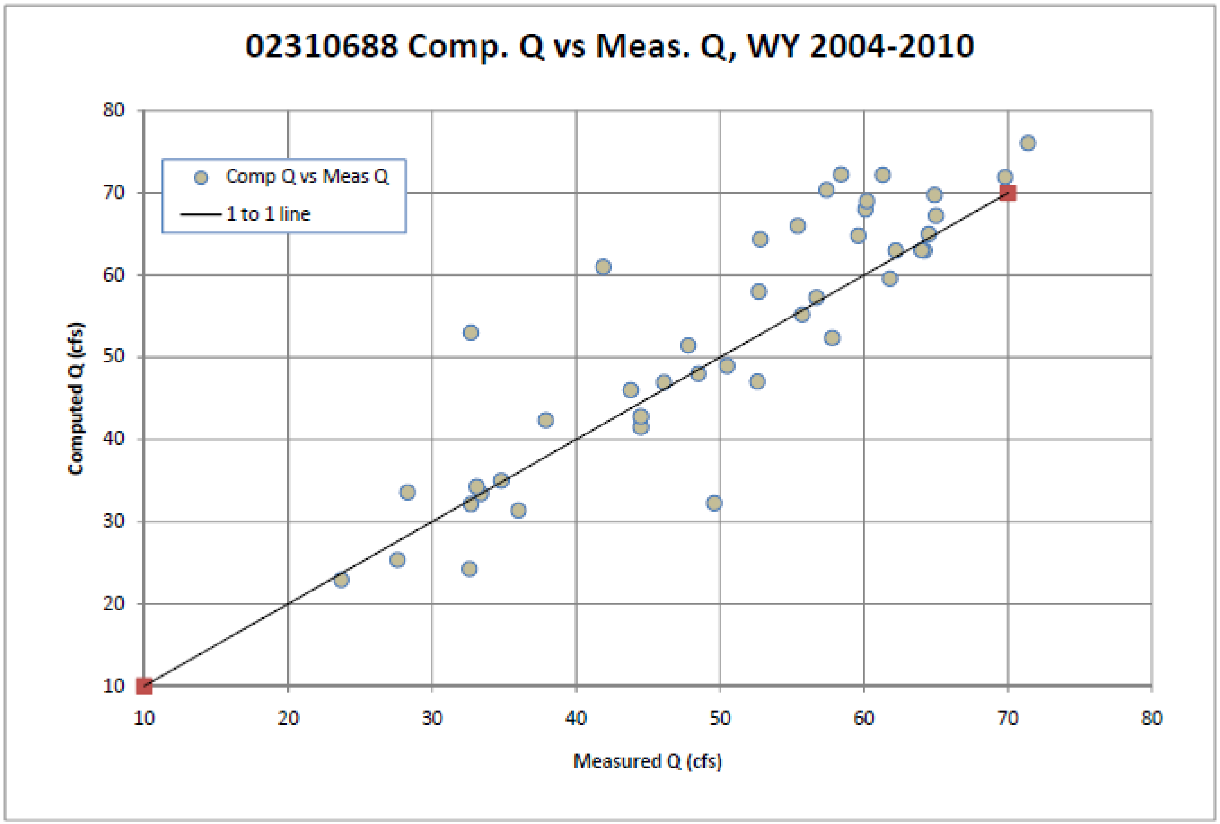
Attachment I

Attachments (10) to E-Mail from Kevin Grimsley to Doug Leeper, Dated February 24, 2011

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February, 2009
150A
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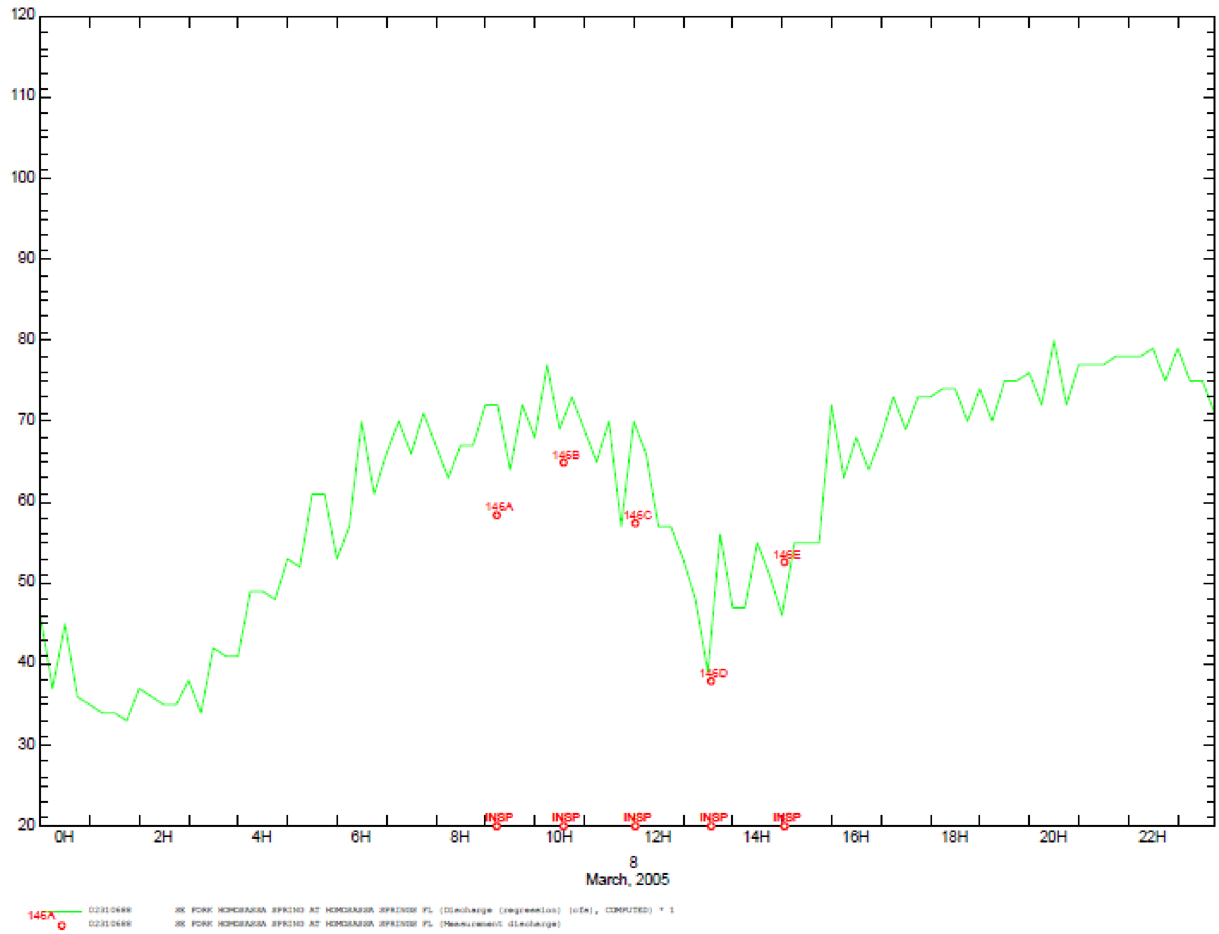
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March, 2005
146A
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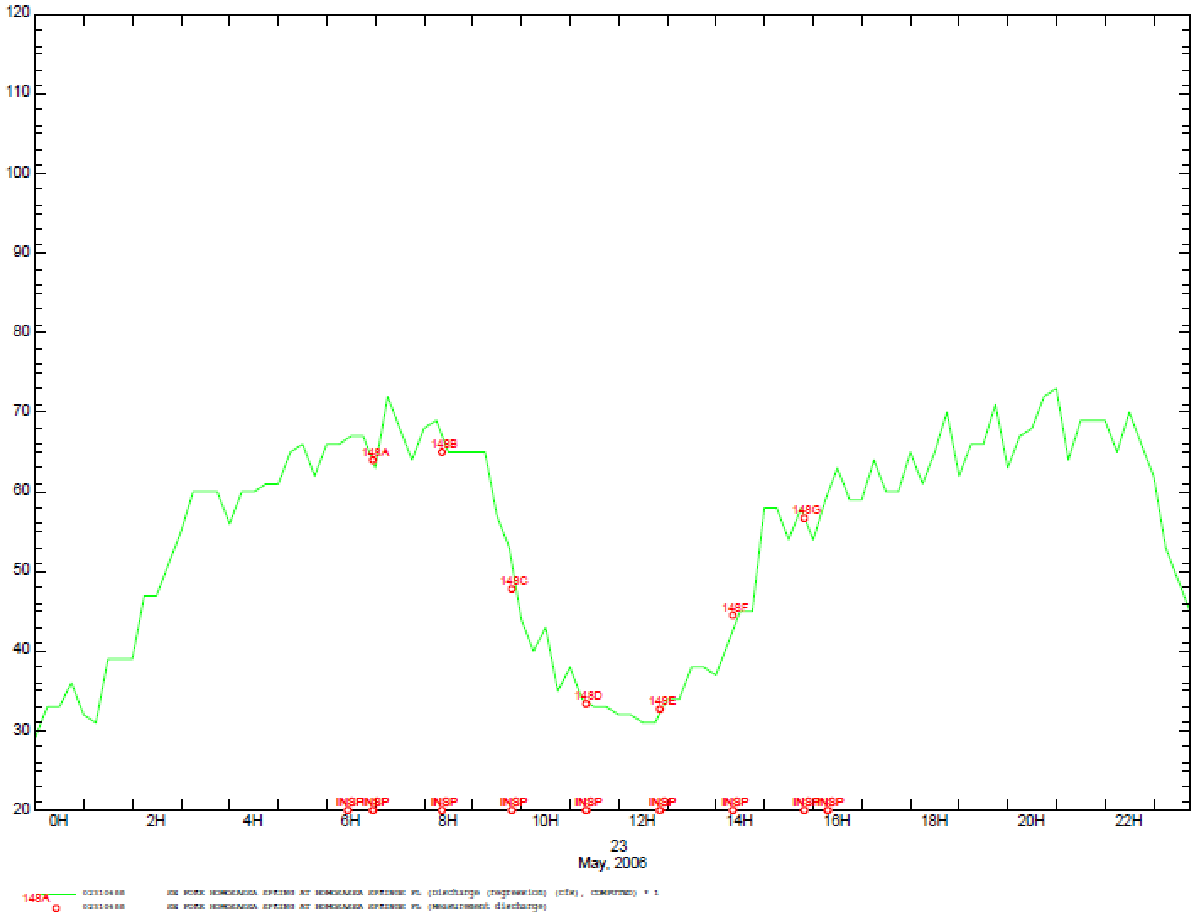
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May, 2006
148A
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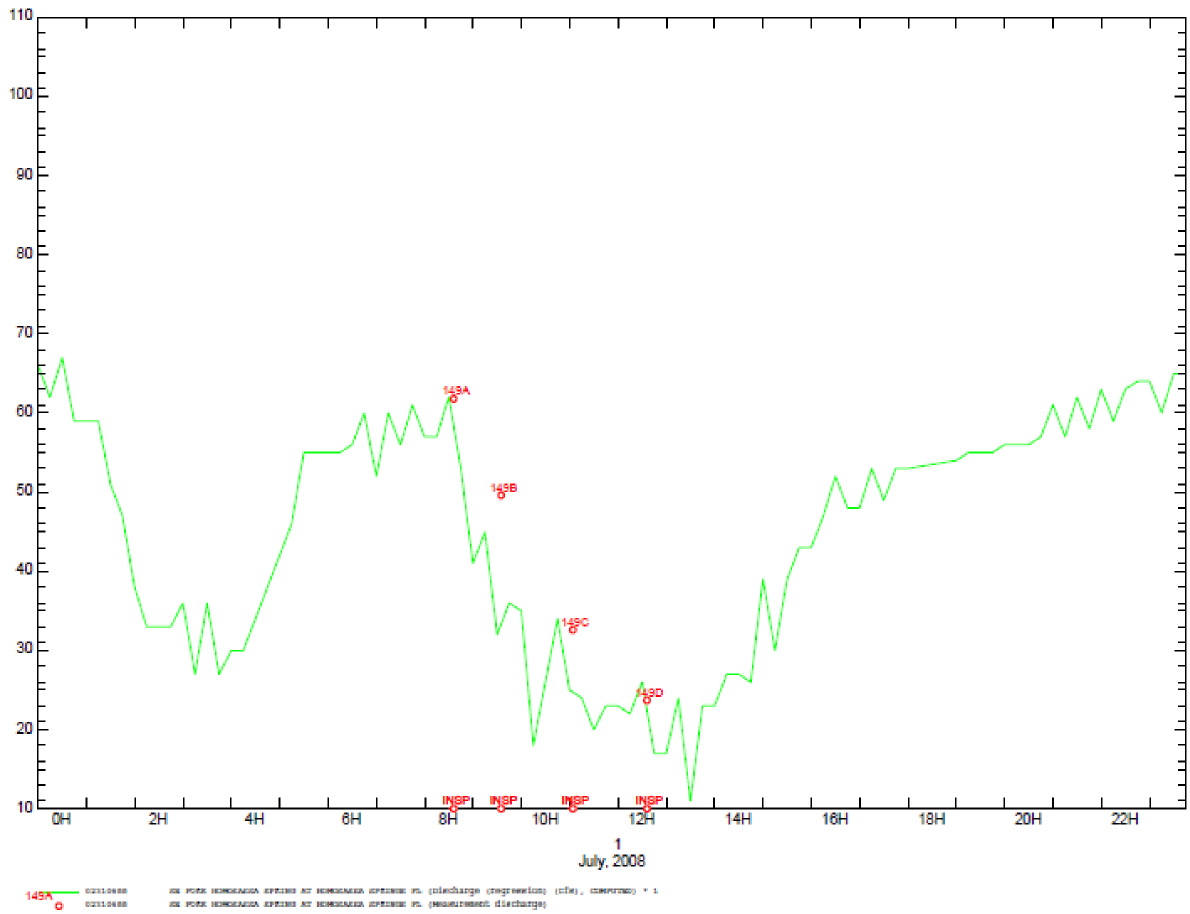
148F
148G
INSP



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149A
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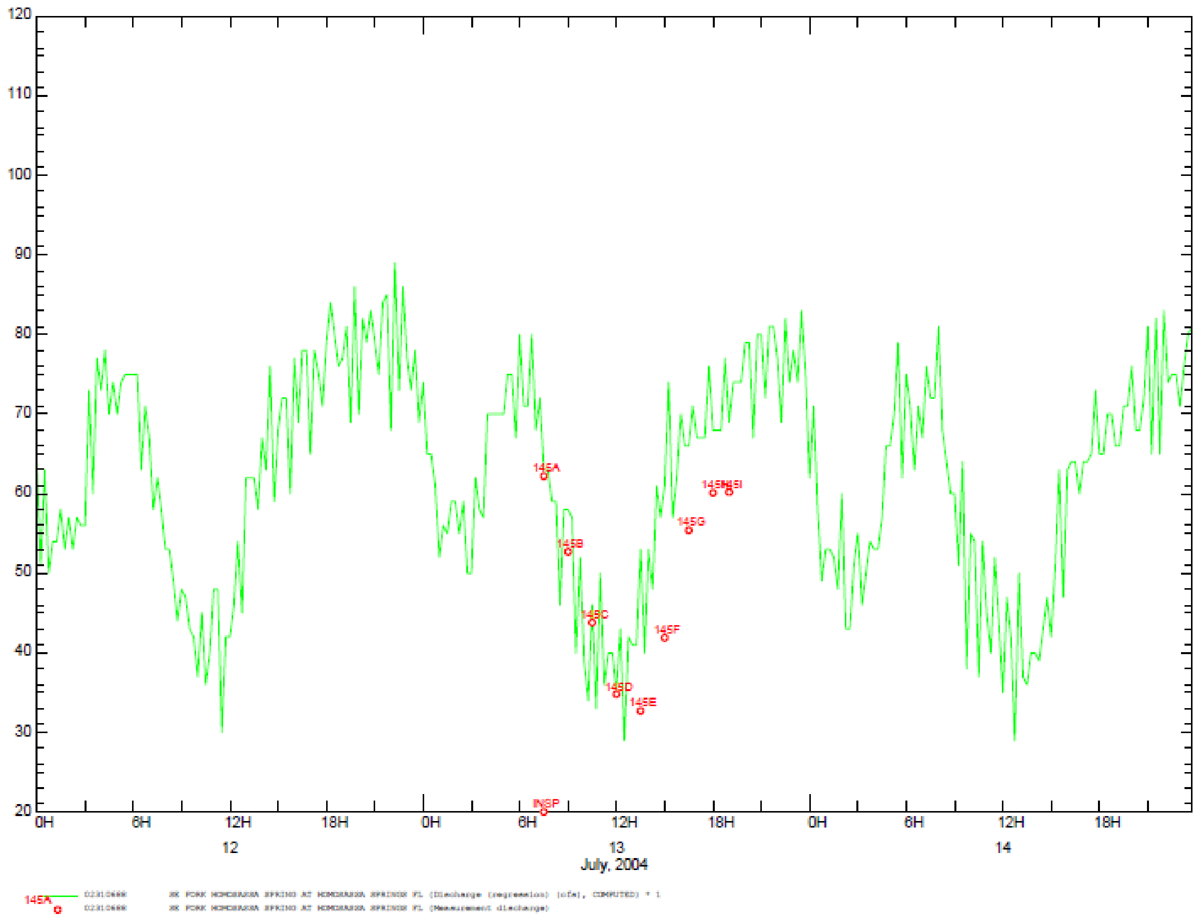

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145B
145C
145D
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145H
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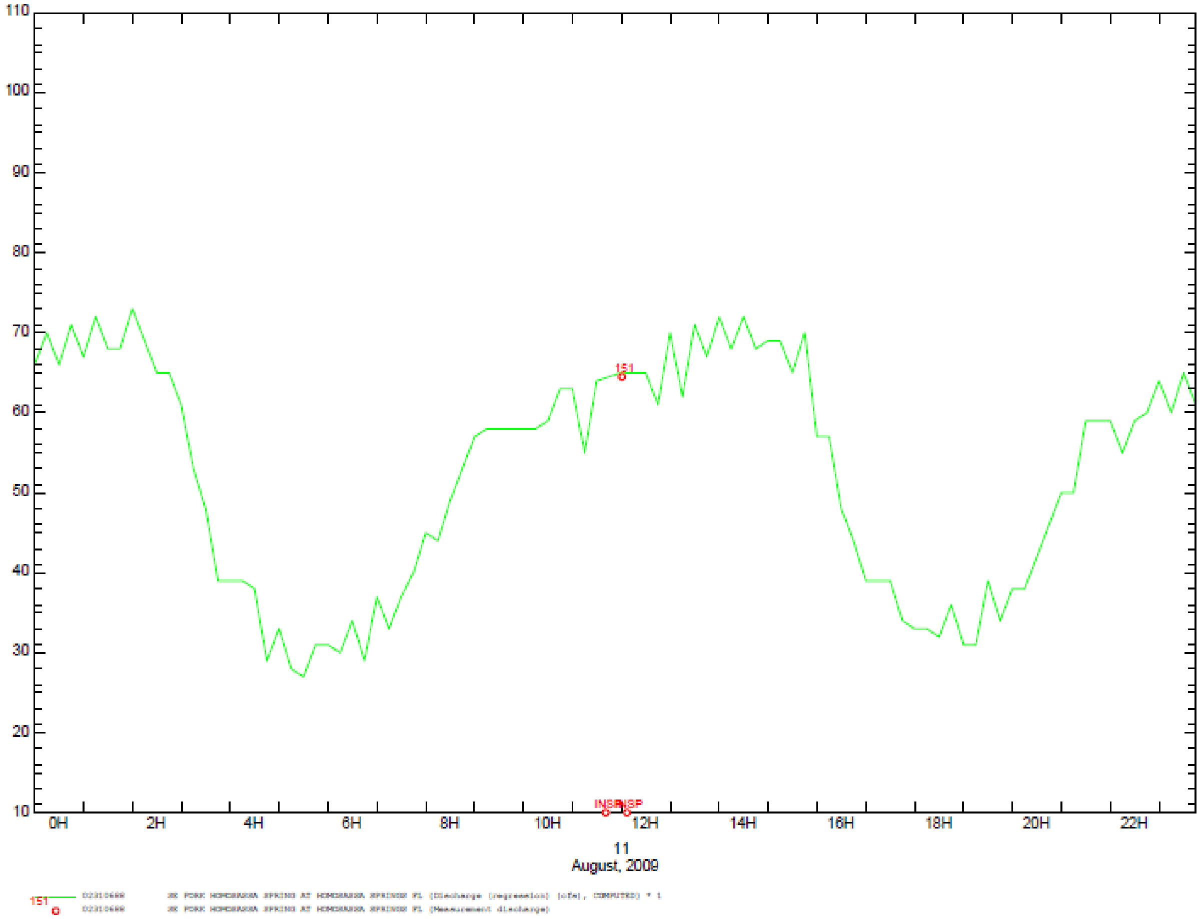
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151
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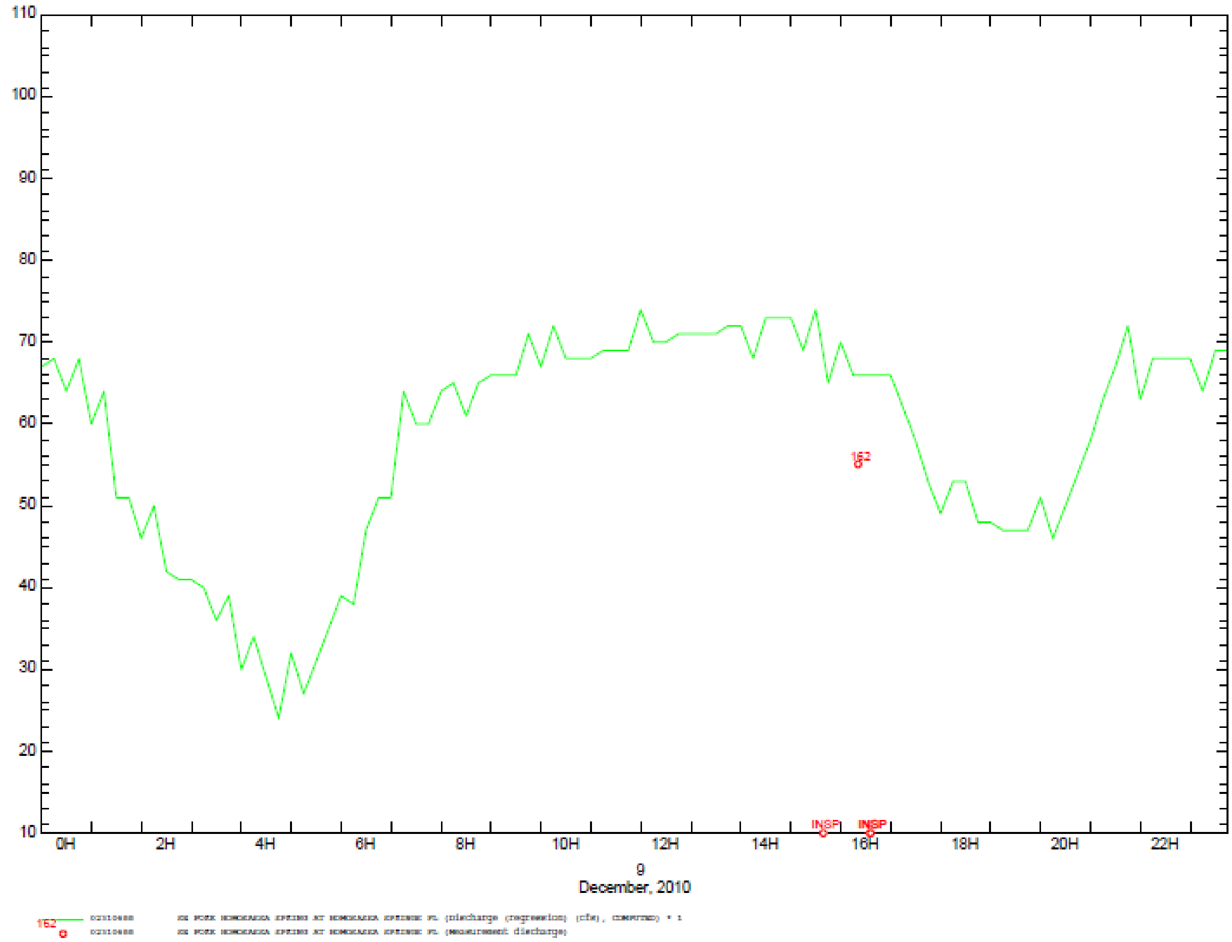
11
August, 2009
151
02310688 SE FORK HOMOSASSA SPRING AT HOMOSASSA SPRINGS FL (Discharge (regression) (cfs), COMPUTED) * 1
02310688 SE FORK HOMOSASSA SPRING AT HOMOSASSA SPRINGS FL (Measurement discharge)



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December, 2010
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INSP
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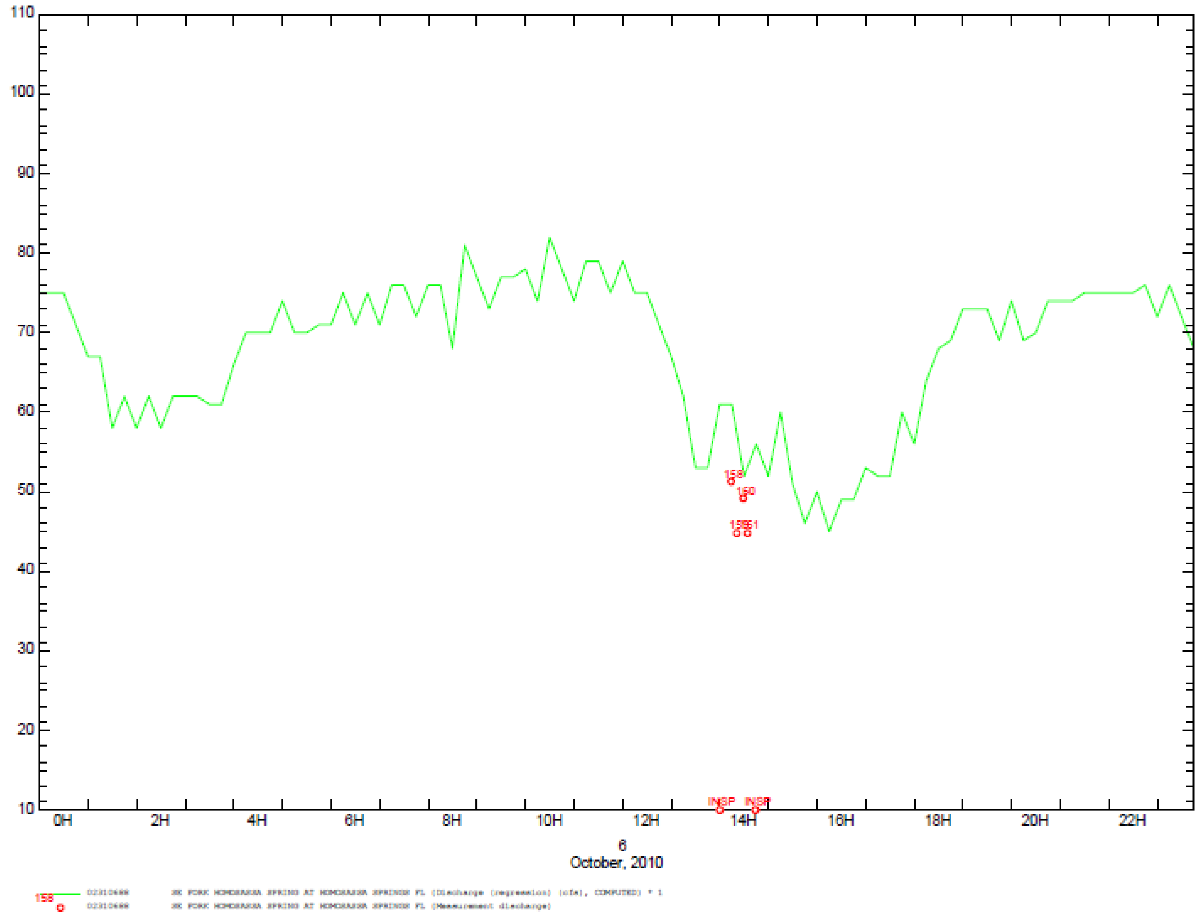
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158
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October, 2010
158


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August, 2005
147A
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147C
147D
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147G
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Attachment J

E-Mail from Martyn Johnson to Doug Leeper and others
Dated February 26, 2011

From: Alan Martyn Johnson
To: Doug Leeper; Kevin J Grimsley; Ron Koerber; rkane
Subject: Homosassa Flows
Date: Saturday, February 26, 2011 6:53:52 AM

FYI
For the next 3 weeks I will have very limited e-mail/computing access.
I trust that the silence regarding my e-mails of 2/16 and 2/19 regarding the flow calculations indicates that someone is taking a close look at these.

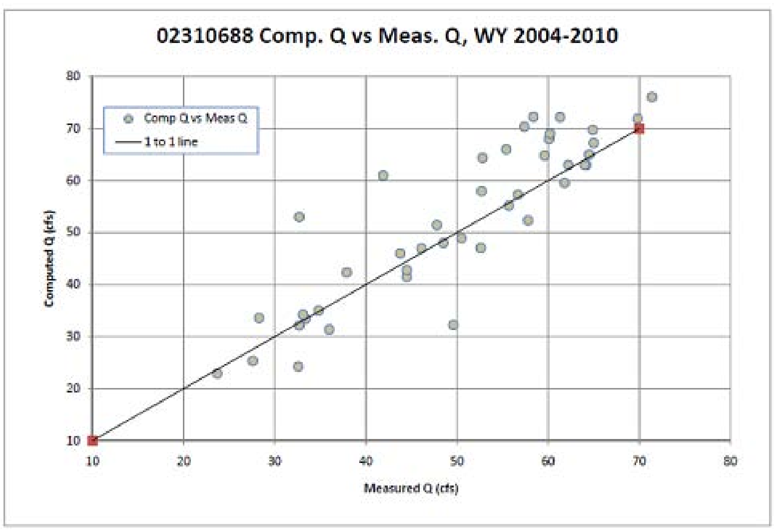
Martyn

Attachment K

E-Mail from Doug Leeper to Martyn Johnson, Dated March 1, 2011

From: Doug Leeper
To: "Alan Martyn Johnson"
Cc: Kevin Grimsely (kjgrims@usgs.gov); Richard Kane (rkane@usgs.gov); Ron Basso
Bcc: Marty Kelly; Sid Flannery; Mike Heyl; Cara S. Martin; Mark Barcelo; Karen Lloyd; Jay Yingling; Yassert Gonzalez
Subject: RE: SE Fork Homosassa River Flow Calculation Concerns
Date: Tuesday, March 01, 2011 11:31:12 AM
Attachments: image003.png

Martyn:
Thanks for the e-mail you sent to me on February 19, 2011, concerning measurement and reporting of discharge at the SE Fork Homosassa Springs gage site. I spoke with staff from the United States Geological Survey about your e-mail and was provided with information which indicates that discharge estimates based on the regression equation approach correspond well with discharge measurements made at the site. The figure below, provided by Kevin Grimsley, shows the relationship between 42 discharge measurements (Measured Q) made between 2004 and the present time, and corresponding discharge estimates based on the regression approach (Computed Q). Kevin informed me that the average difference between the computed and measured values is -2.4%; a difference that seems to be quite acceptable, given the complexities of flows in the SE Fork.



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Fax: 352-754-6885
E-Mail: doug.leeper@watermatters.org
Web Site: watermatters.org

NOTE: e-mail string deleted by Doug Leeper, Southwest Florida Water Management District