Lower West Coast Surficial Aquifer System and Intermediate Aquifer System (LWC SAS/IAS) Modeling Project Meeting

Tuesday, December 10, 2013
10:00 a.m. to 12:00 noon

City Hall Council Chambers
City of Bonita Springs
9101 Bonita Beach Road
Bonita Springs, FL 34135
(239) 949-6262

1. **Welcome and Opening Remarks (5 min) –** Peter Kwiatkowski, Section Administrator, Resource Evaluation Section, SFWMD

2. **Modeling Project Update (15 min) –** Laura Kuebler, Senior Hydrologic Modeler, Resource Evaluation Section, SFWMD

3. **Hydrostratigraphy Presentation: Part 1 (20 min) –** Elizabeth Geddes, Hydrogeologist, Resource Evaluation Section, SFWMD

4. **Hydrostratigraphy Presentation and Open Discussion: Part 2* (45-60 min) -** Emily Richardson, Lead Hydrogeologist, Resource Evaluation Section, SFWMD

5. **Additional Comment Period (15 min)**

6. **Wrap Up and Next Steps (5 min) –** Peter Kwiatkowski and Laura Kuebler, SFWMD

7. **Adjourn**

** Open discussion among all attendees will occur during the hydrostratigraphy presentation.*

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Modeling Project Meeting
Tuesday, December 10, 2013

NAME (PRINT)	ORGANIZATION	TELEPHONE	EMAIL
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Laura Kuebler	SFWMD	561-682-2815	lkuebler@sfwmd.gov
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NAME (PRINT)	ORGANIZATION	TELEPHONE	EMAIL
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KIRK MARTIN	WATER SCIENCE ASSOC	239-218-1043	KIRK@WSACONSULT.COM
Lee Wurst	Lee County Division of Natural Resource	239 533-8136	Weistle@leegov.com
Terry Bengtsson	Johnson Engineering	239-461-2413	tbengtsson@johnsoneng.com
Rebecca Elliott	FDACS/OAWP	561-682-6040	relliotte standlgov

Methodology for Updating the Lower West Coast Hydrostratigraphy for the Surficial Aquifer System and Intermediate Aquifer System

December 10, 2013

Hydrogeology Unit
Resource Evaluation Section
Water Supply Bureau

Overview of Presentation

- Objective
- Conceptual Framework
- Data and Literature Review Process
- Mapping Software and Methods
- Hydrostratigraphic Surfaces
- Technical Uncertainties
- Next steps

Objective

- Update hydrogeologic maps for the units of regional significance in the LWC region
  - Hydrostratigraphic boundaries and isopach maps
  - Map unit spatial extents
  - Archive surfaces and source data for model development, regulatory use and the public

Conceptual Framework

System	Hydrogeologic Unit		Geologic Unit	
Surficial Aquifer System	WATER TABLE AQUIFER (WT)		Undifferentiated Holocene/ Pleistocene	
	TAMIAMI CONFINING ZONE (TC)		Tamiami Formation	
	LOWER TAMIAMI AQUIFER (LT)			
Intermediate Aquifer System / Confining Unit	UPPER HAWTHORN CONFINING ZONE (H1)		Hawthorn Group	Peace River Formation
	SANDSTONE AQUIFER (SA)	CLASTIC ZONE (S2)		
		CARBONATE ZONE (S1)		
	MID-HAWTHORN CONFINING ZONE (H2)			
	MID-HAWTHORN AQUIFER (HM)			Arcadia Formation
	LOWER HAWTHORN CONFINING ZONE (H3)			

Data and Literature Review

- SFWMD
  - DBhydro
  - Groundwater library
  - RegDB and E-Permitting
- BEM and WRS (2002-2004)
- Stakeholder data

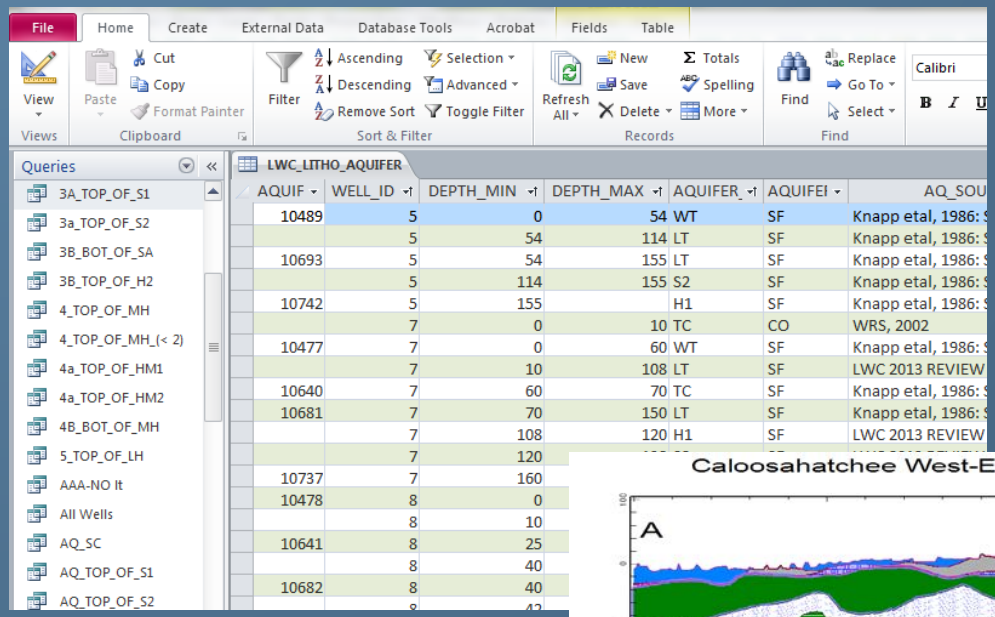
Data and Literature Review Process

- Preliminary literature and data review
- Solicit local knowledge base
- Formal literature and data review
- Generate initial maps from scrubbed data-set
- Evaluate anomalous data-points
- Re-generate surfaces and perform additional data review

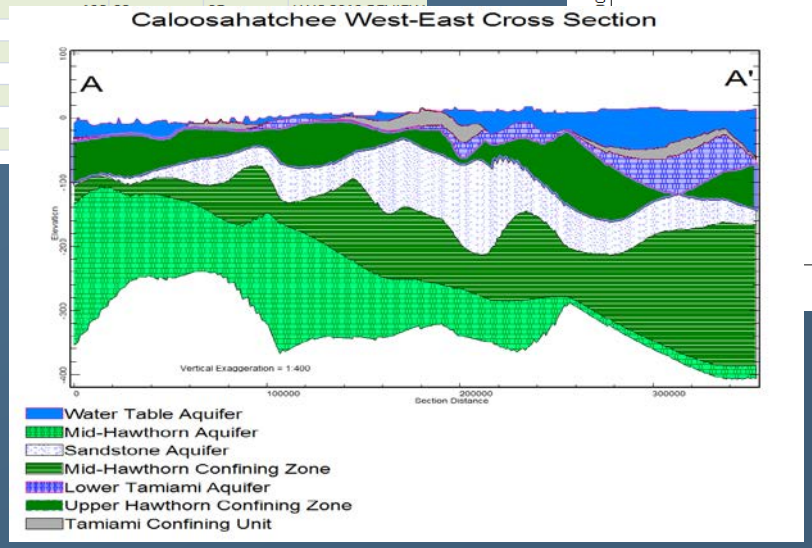
Mapping Software and Methods

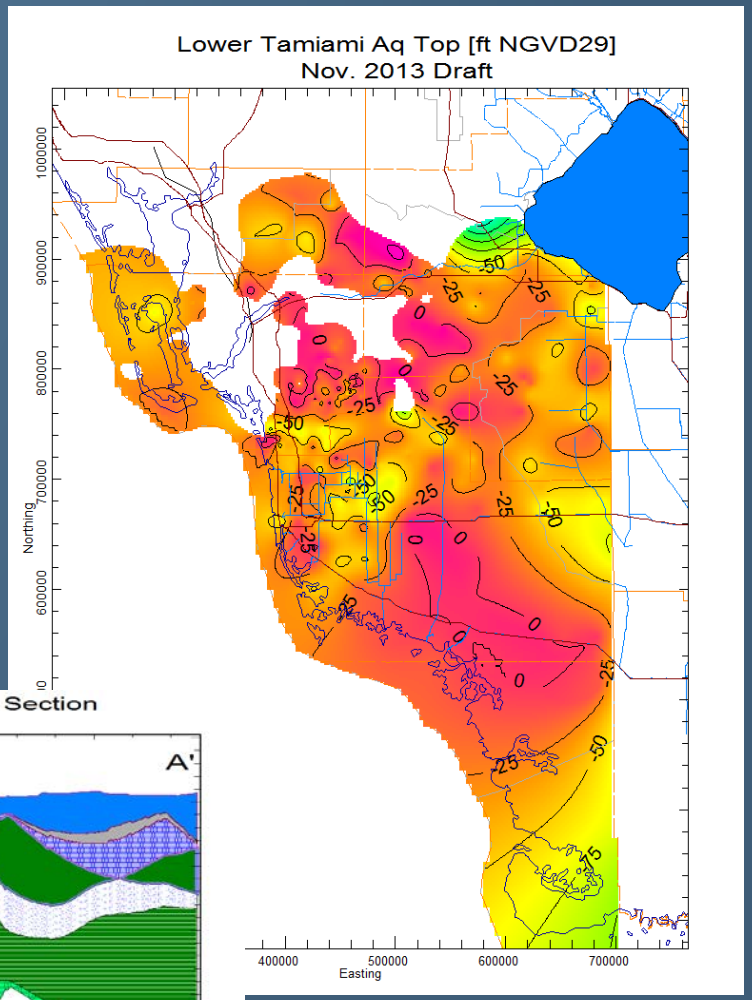
Viewlog Pro 3.0.93

Microsoft Access 2010



AQUIF	WELL_ID	DEPTH_MIN	DEPTH_MAX	AQUIFER	AQUIFEI	AQ_SOU
10489	5	0	54	WT	SF	Knapp etal, 1986: S
	5	54	114	LT	SF	Knapp etal, 1986: S
10693	5	54	155	LT	SF	Knapp etal, 1986: S
	5	114	155	S2	SF	Knapp etal, 1986: S
10742	5	155		H1	SF	Knapp etal, 1986: S
	7	0	10	TC	CO	WRS, 2002
10477	7	0	60	WT	SF	Knapp etal, 1986: S
	7	10	108	LT	SF	LWC 2013 REVIEW
10640	7	60	70	TC	SF	Knapp etal, 1986: S
10681	7	70	150	LT	SF	Knapp etal, 1986: S
	7	108	120	H1	SF	LWC 2013 REVIEW
	7	120				
10737	7	160				
10478	8	0				
	8	10				
10641	8	25				
	8	40				
10682	8	40				





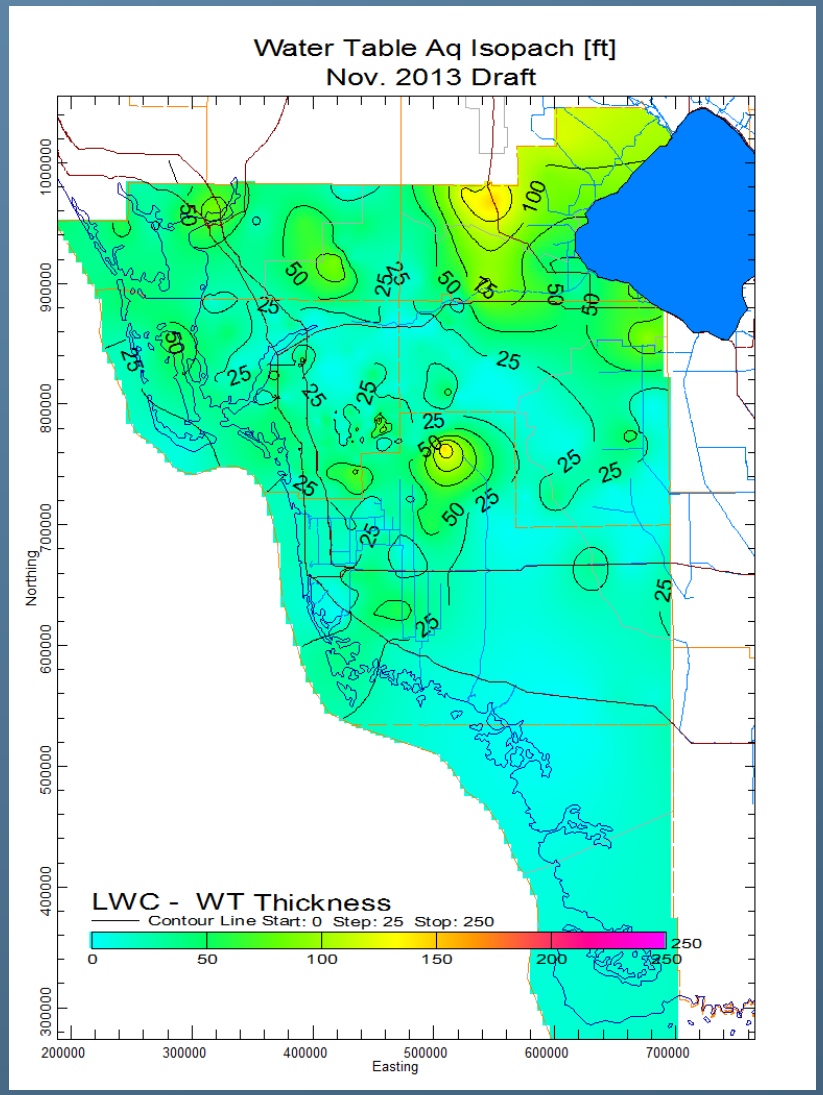
Review

- Geophysical logs
- Lithology
- Literature
- Comparison with neighboring wells
- Comparison with previous surfaces
- Spot checks with RegDB and e-Permitting well completion reports
- Evaluation of surfaces relative to USGS monitoring well construction

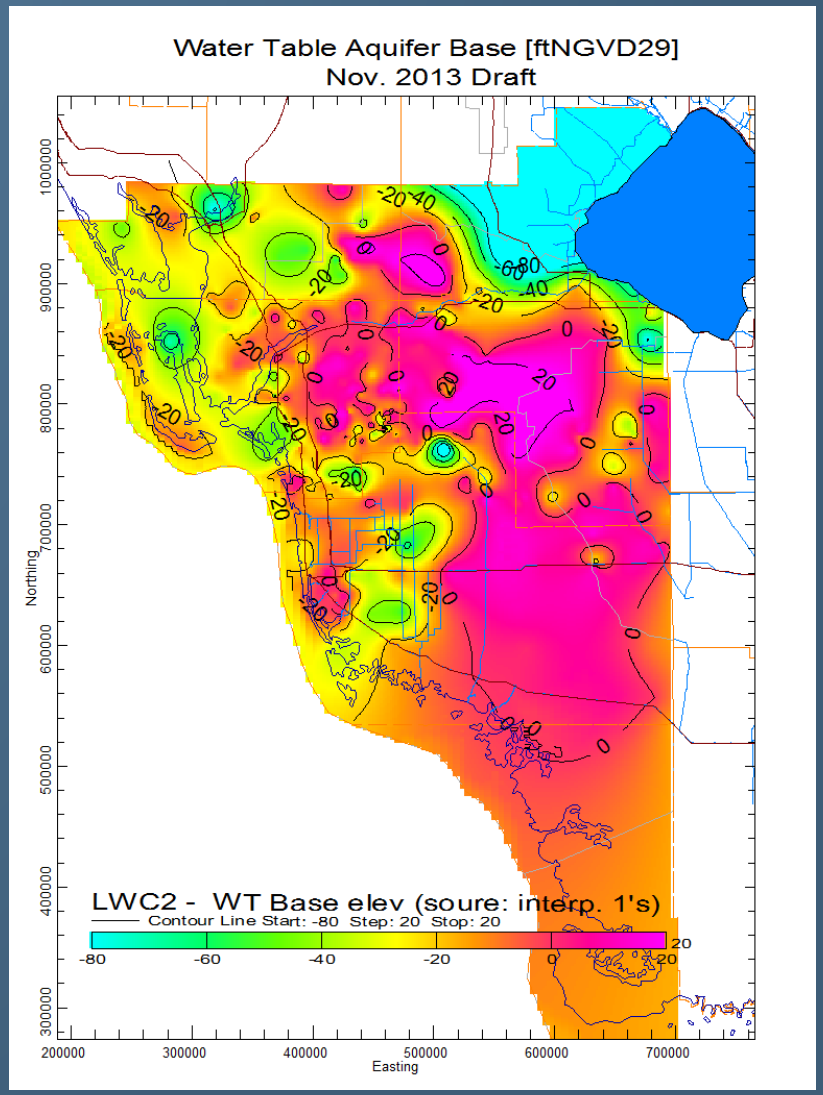
Draft Surfaces

- Water Table Aquifer
- Lower Tamiami Aquifer
- Sandstone Aquifer
- Mid Hawthorn Aquifer

Water Table Aquifer

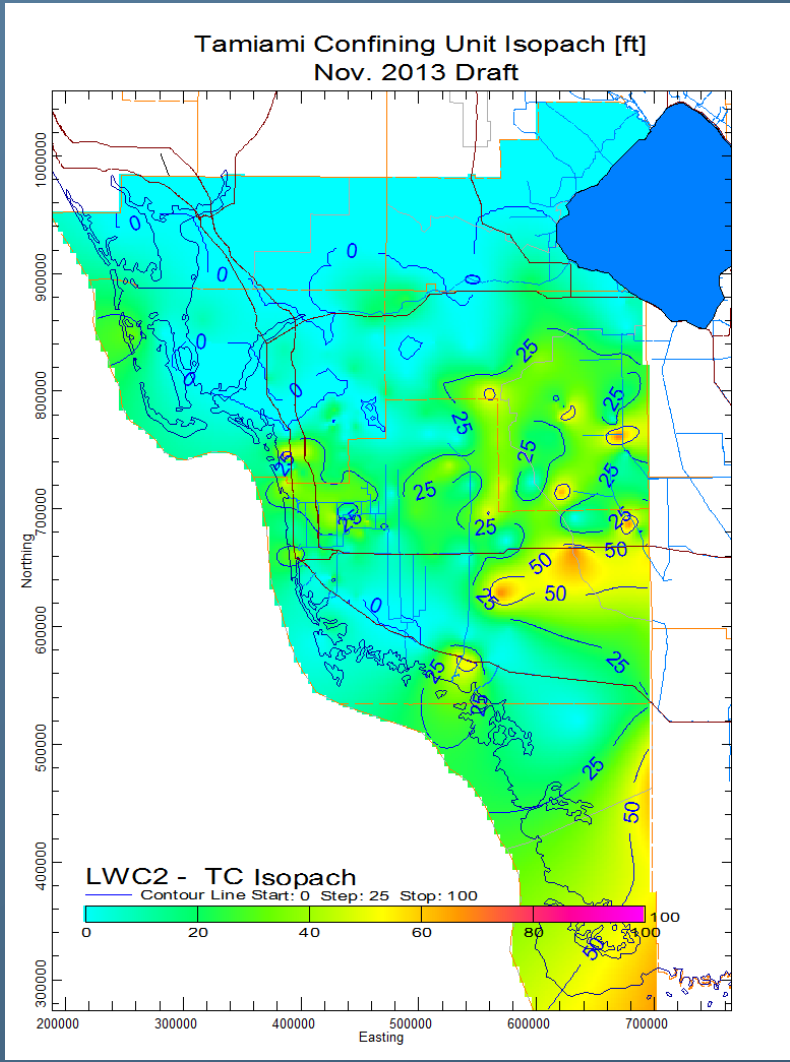


461 wells



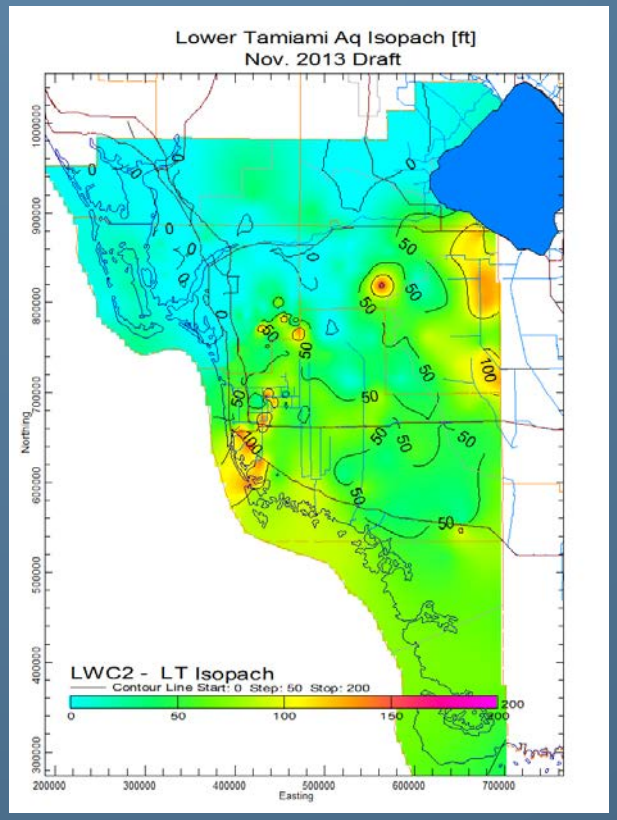
461 wells

Tamiami Confining Unit

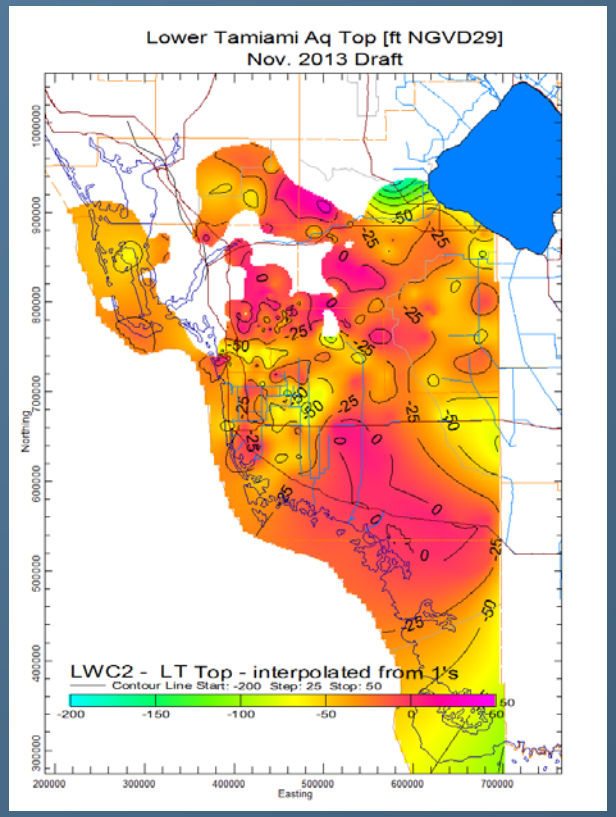


460 wells

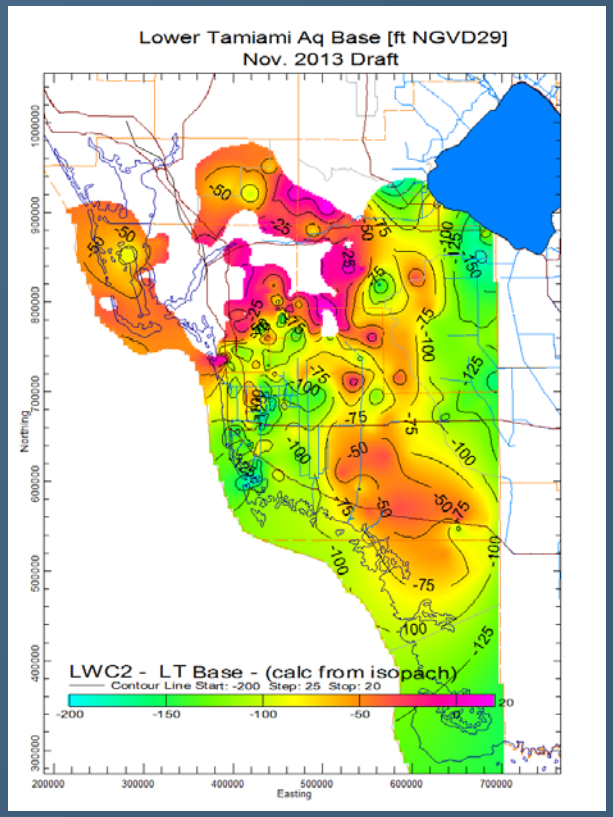
Lower Tamiami Aquifer



444 wells

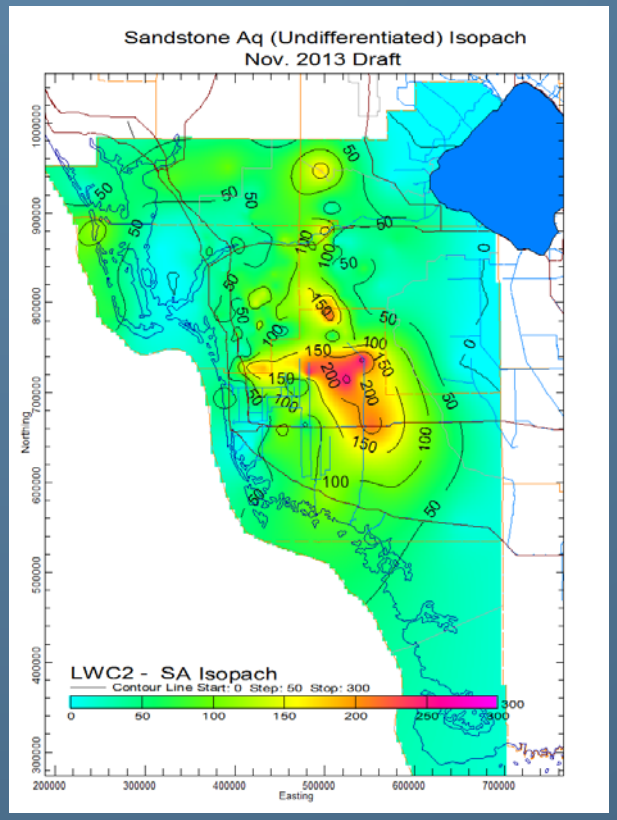


527 wells

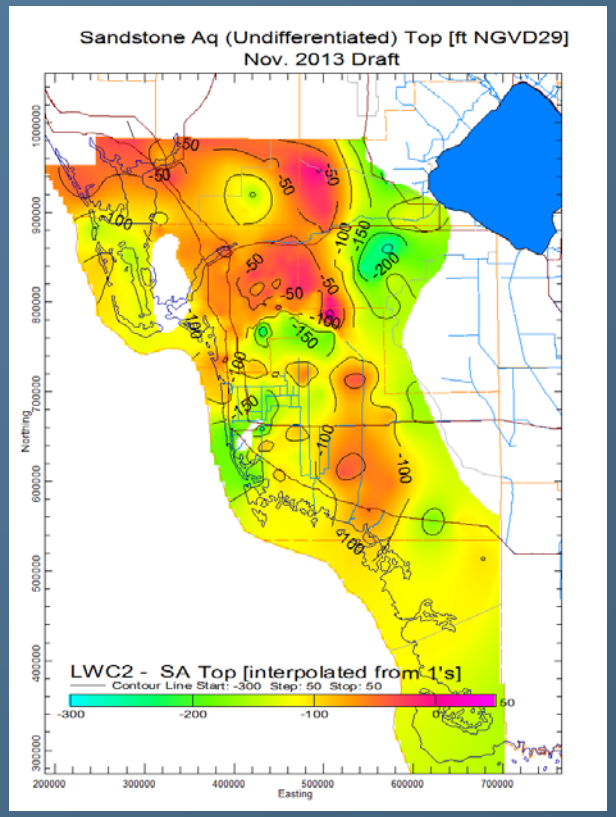


444 wells

Sandstone Aquifer - Undifferentiated



250 wells



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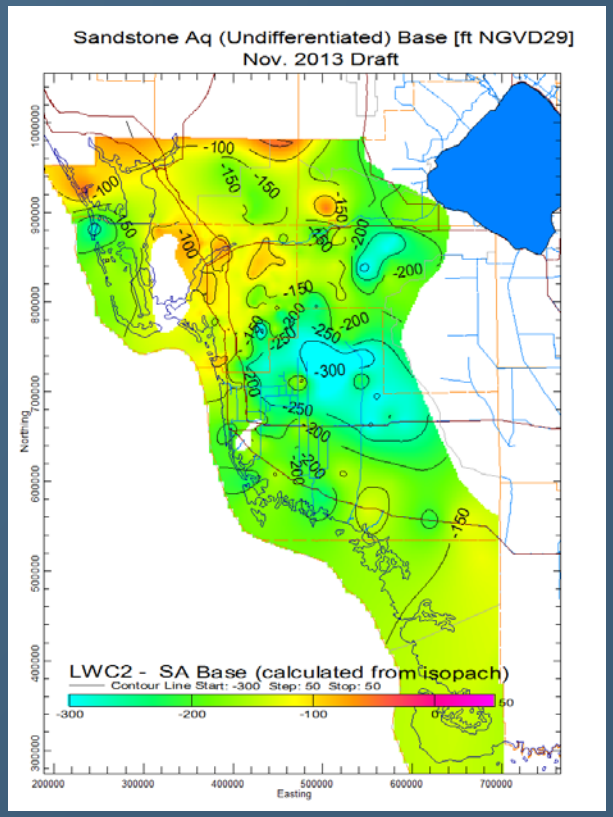
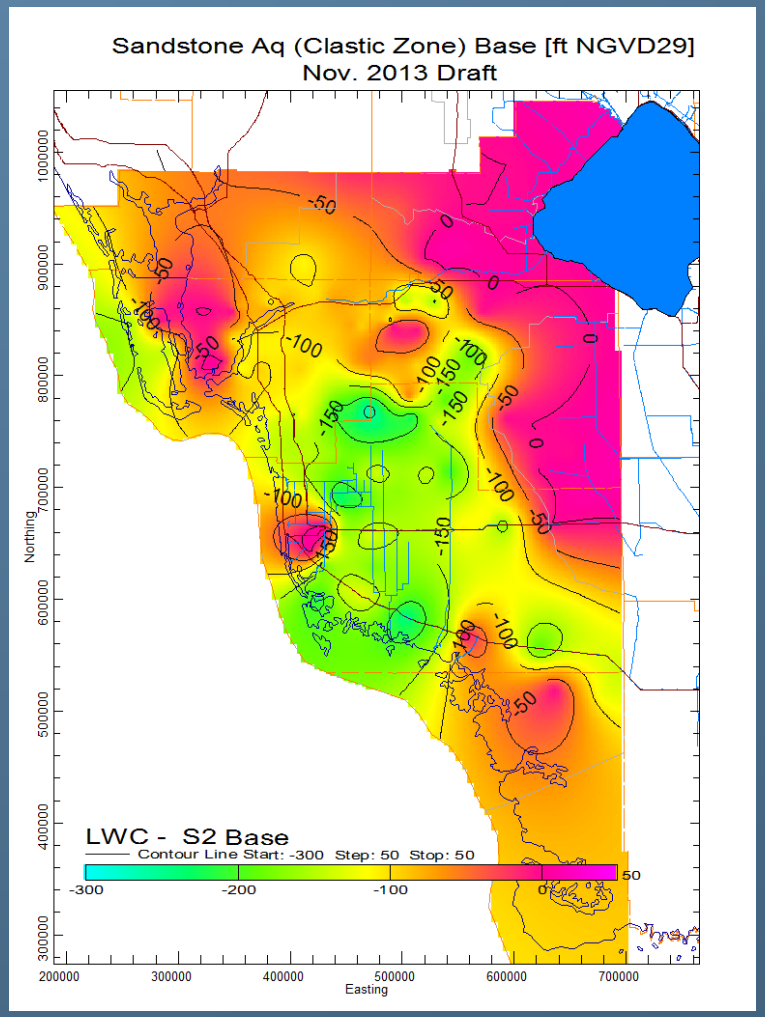
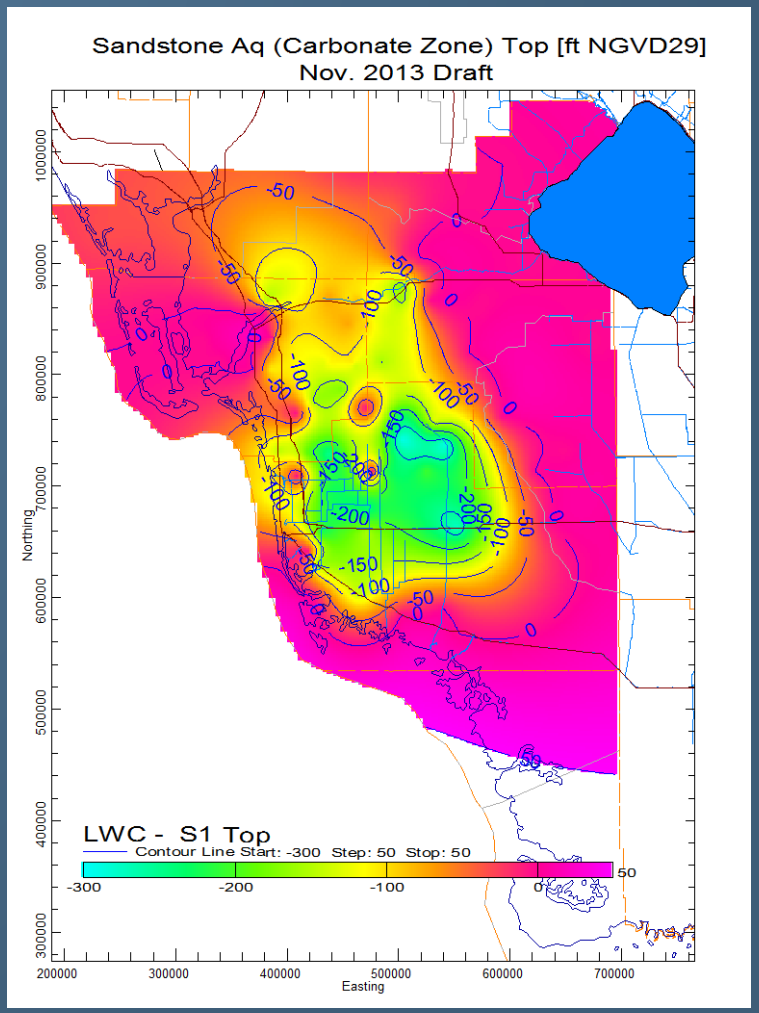


250 wells

Sandstone Clastic and Carbonate

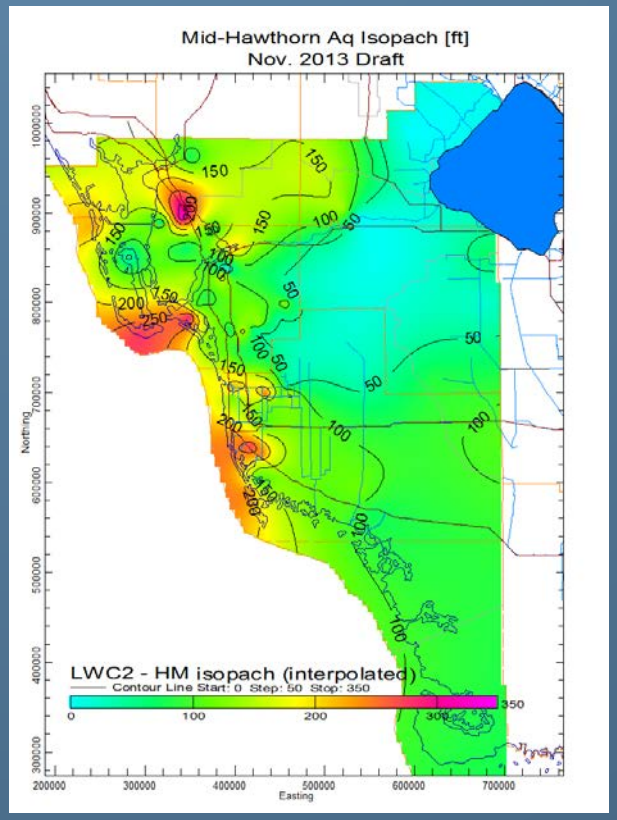


124 wells

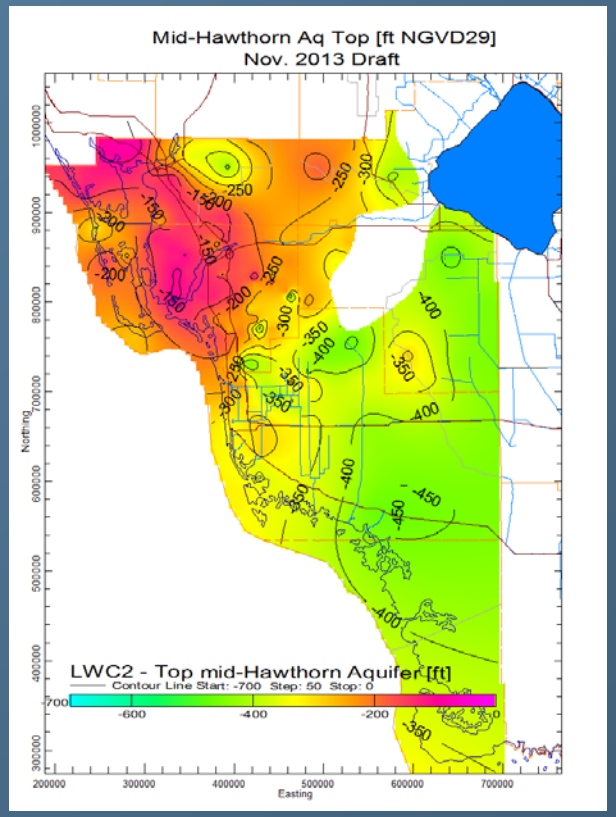


82 wells

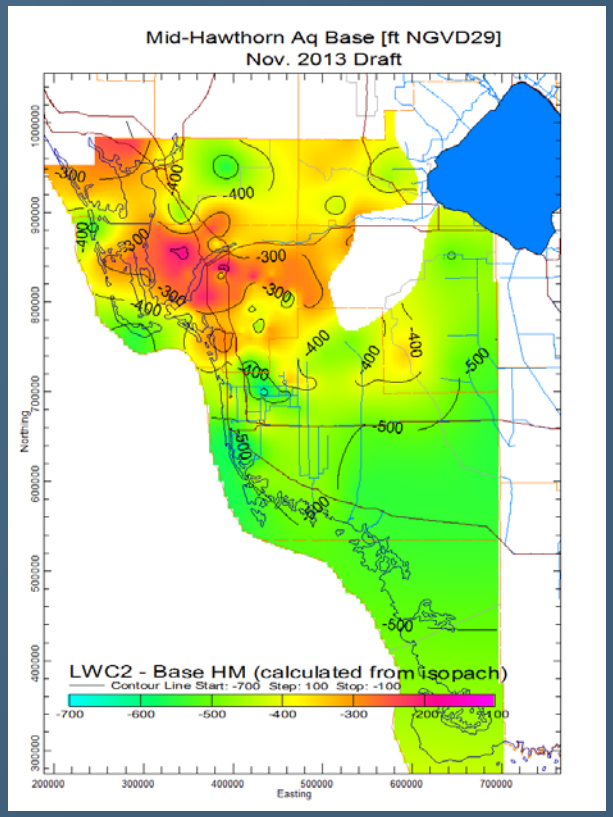
Mid Hawthorn Aquifer



110 wells



186 wells



110 wells

Technical Uncertainties

- Hydrogeologic unit definitions
- Level of detail – local versus regional
- Correlation north of the border
- Spatial variation in hydrogeologic units

Hydrogeologic Unit Definitions: Water Table

Composition: *Generally* quartz sand, shell & minor amounts of organic material. May have dense limestone cap-rock in some areas.

Position: Encompasses all water-bearing materials from the water-table to ?

- 1st persistent confinement

or

- Top of the Ochopee ls.

Yes!

Upper Confinement: Un-confined

Lower Confinement: Geographically variable, it is separated from the lower Tamiami aquifer by the Bonita Springs marl and/or low permeability portions of the Pinecrest Sand.

Hydrogeologic Unit Definitions: Sandstone Aquifer

... and 'un-named' Miocene-age Formation, where Peace River not clearly identifiable.

Composition: Sands alcareous sands.

Position: Lies entirely within the Peace River formation of the Hawthorn Group. Occurs as 2 distinct permeable zones (upper clastic & lower carbonate), which may be contiguous or separated by varying amounts of low permeability silt or clay.

Upper Confinement: Geographically variable, it is separated from the lower Tamiami aquifer by the lower permeability clays and dolosilts of the upper Peace River formation (e.g. Cape Coral clay). Confinement is absent in some areas, and the unit out-crops in north Charlotte county.

Lower Confinement: separated from the under-lying mid-Hawthorn aq, by low permeability clays and marls of the basal Peace River.

Hydrogeologic Unit Definitions: Be Aware!

Unit definitions may be precise, but their application is not

- Definitions rely on stratigraphic unit boundaries that may not be easily identified
  - Contact boundaries may be gradational (leading to wide variation in interpretation within very short distances)
  - Units may not exist at all (e.g. un-named formation)
- No fixed standard for defining whether a unit is or isn't productive
- In most of the wells from the eastern portion of the study area, 'productivity' in the deeper units must be extrapolated from very limited data
- Precise application not always helpful

Conceptual Framework

Correlating North of the Border

Series	Stratigraphic unit		Hydrogeologic unit	
Holocene and Pleistocene	Undifferentiated surficial deposits (including the Caloosahatchee Formation and the Tamiami Formation)		Surficial aquifer system	
Pliocene			Confining unit	Intermediate aquifer system
			Tamiami/Peace River zone (PZ1)	
Miocene	Hawthorn Group	Peace River Formation	Confining unit	
		Undifferentiated Arcadia Formation	Upper Arcadia zone (PZ2)	
			Confining unit	
Oligocene		Tampa Member / Nocatee Member	Lower Arcadia zone (PZ3)	
			Confining unit	

System	Hydrogeologic Unit
Surficial Aquifer System	WATER TABLE AQUIFER
	TAMIAMI CONFINING ZONE
	LOWER TAMIAMI AQUIFER
Intermediate Aquifer System / Confining Unit	UPPER HAWTHORN CONFINING ZONE
	SANDSTONE AQUIFER
	MID-HAWTHORN CONFINING ZONE
	MID-HAWTHORN AQUIFER
	LOWER HAWTHORN CONFINING ZONE

Lower Hawthorn producing zone

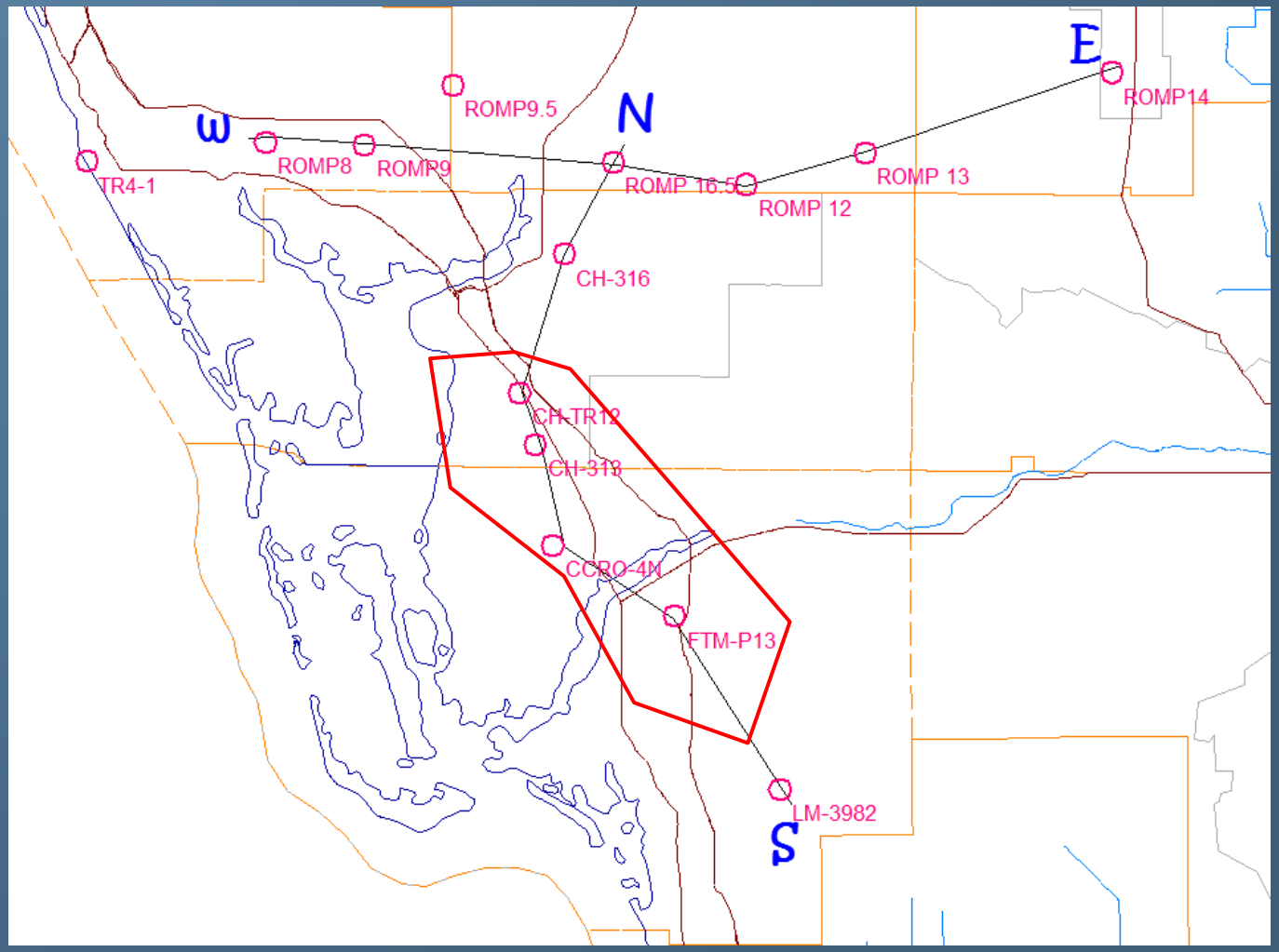
Conceptual Framework

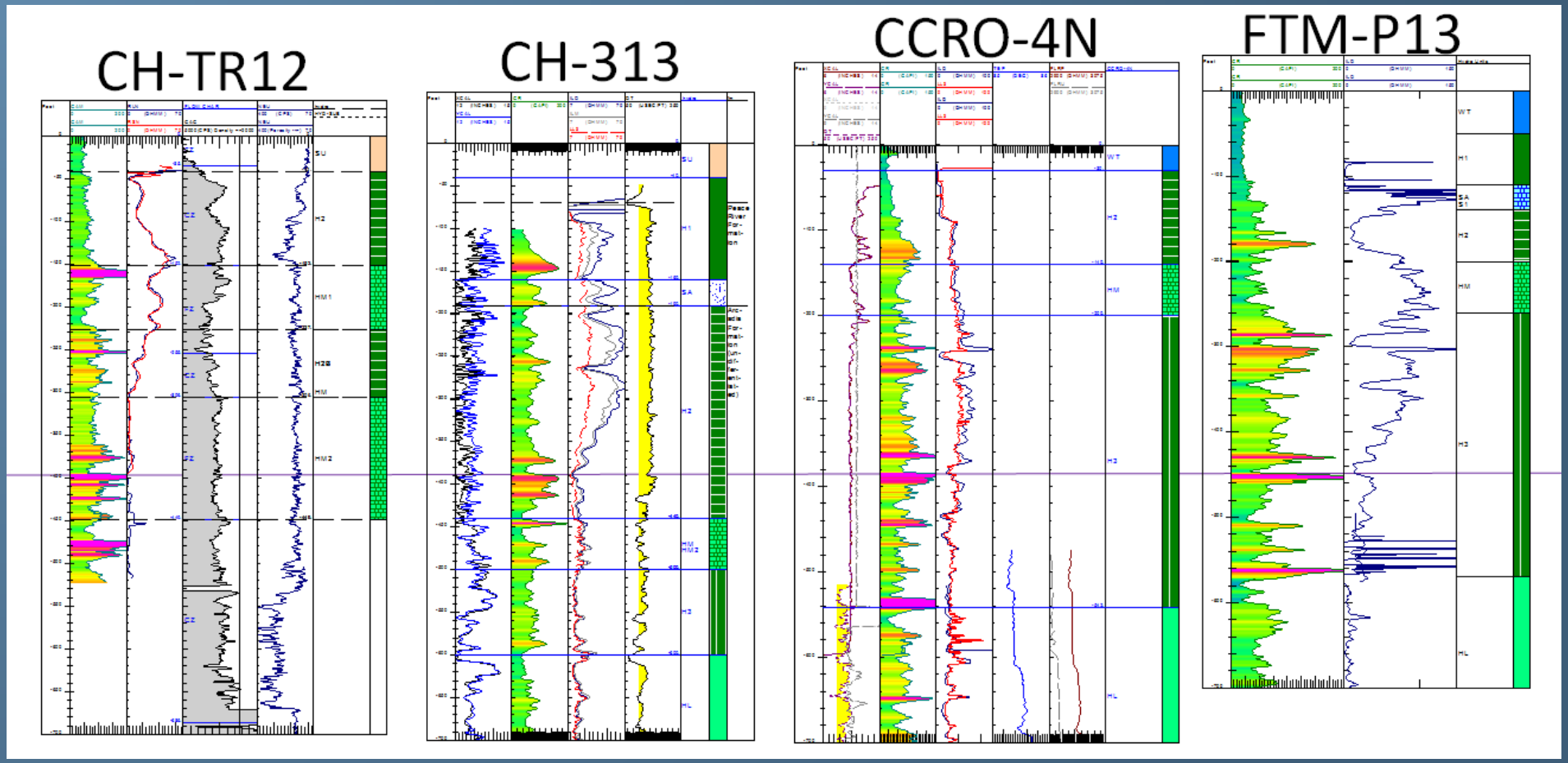
Correlating North of the Border

WEDDERBURN 1982		TORRES 2001		KNOCHENMUS 2006		SWFWMD NOMENCLATURE	
Hawthorn aquifer system	confining unit	intermediate aquifer system	confining unit	intermediate aquifer system	confining unit		confining unit
	Sandstone aquifer		Tamiami/ Peace River zone (PZ1)		Zone 1	Hawthorn aquifer system	Peace River aquifer
	confining unit		confining unit		confining unit		confining unit
	mid-Hawthorn aquifer		Upper Arcadia zone (PZ2)		Zone 2		upper Arcadia aquifer
	confining unit		confining unit		confining unit		confining unit
FAS	lower Hawthorn / Tampa producing zone		Lower Arcadia zone (PZ3)		Zone 3		lower Arcadia aquifer
	confining unit		confining unit		confining unit		confining unit

Knochenmus, L.A., 2006, *Regional Evaluation of the Hydrogeologic Framework, Hydraulic Properties, and Chemical Characteristics of the Intermediate Aquifer System Underlying Southern West-Central Florida*: U.S. Geological Survey Scientific Investigations Report. 2006-5013, 40 p.

Correlating North of the Border & Dealing with Criteria Application Issues

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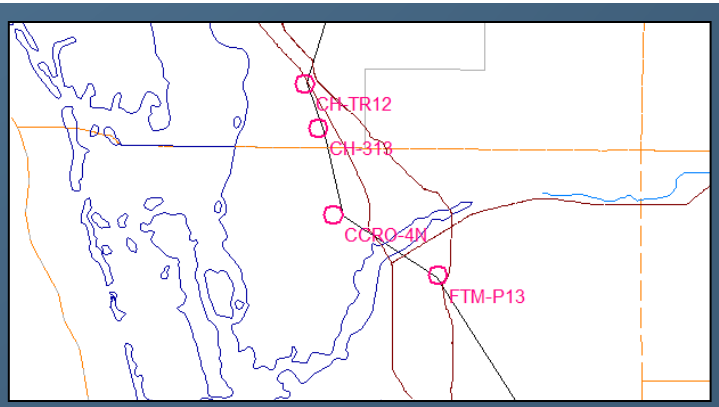
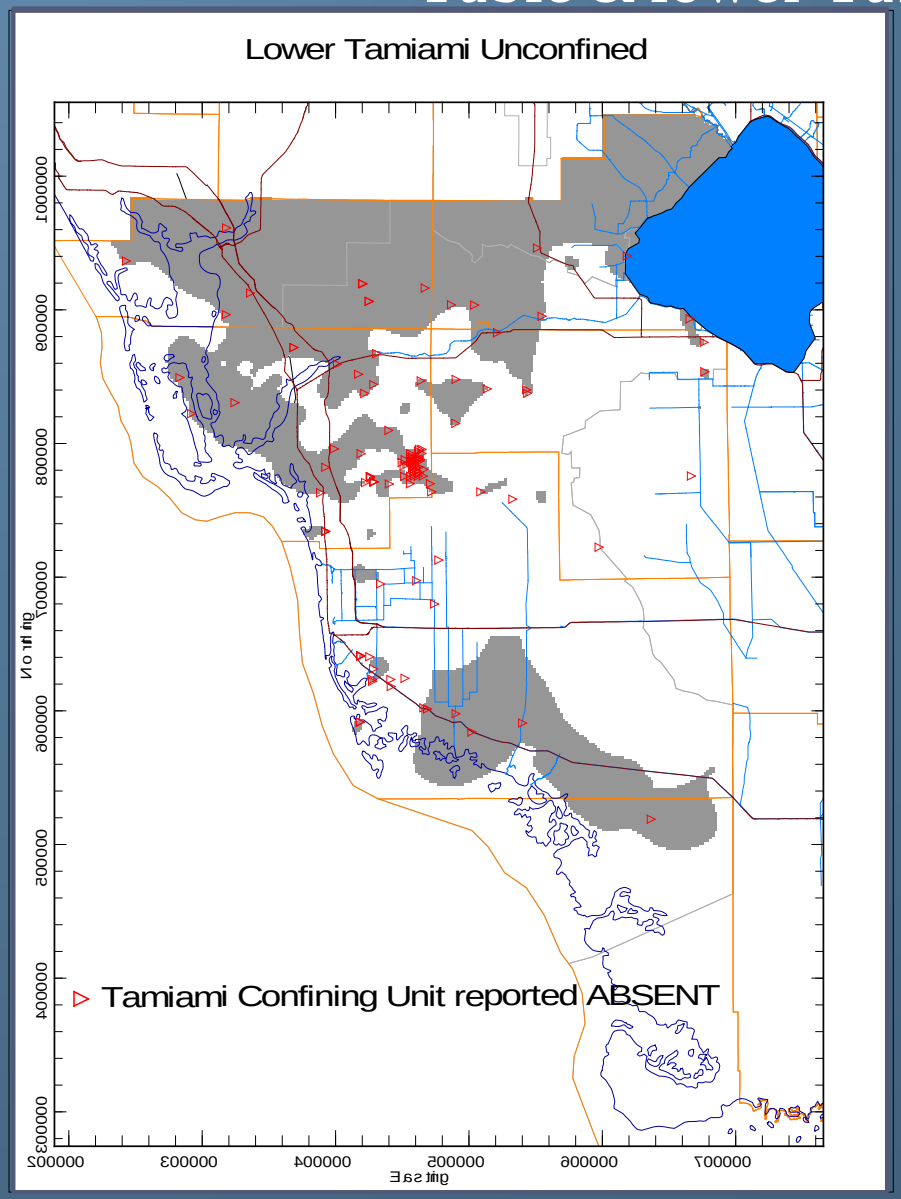
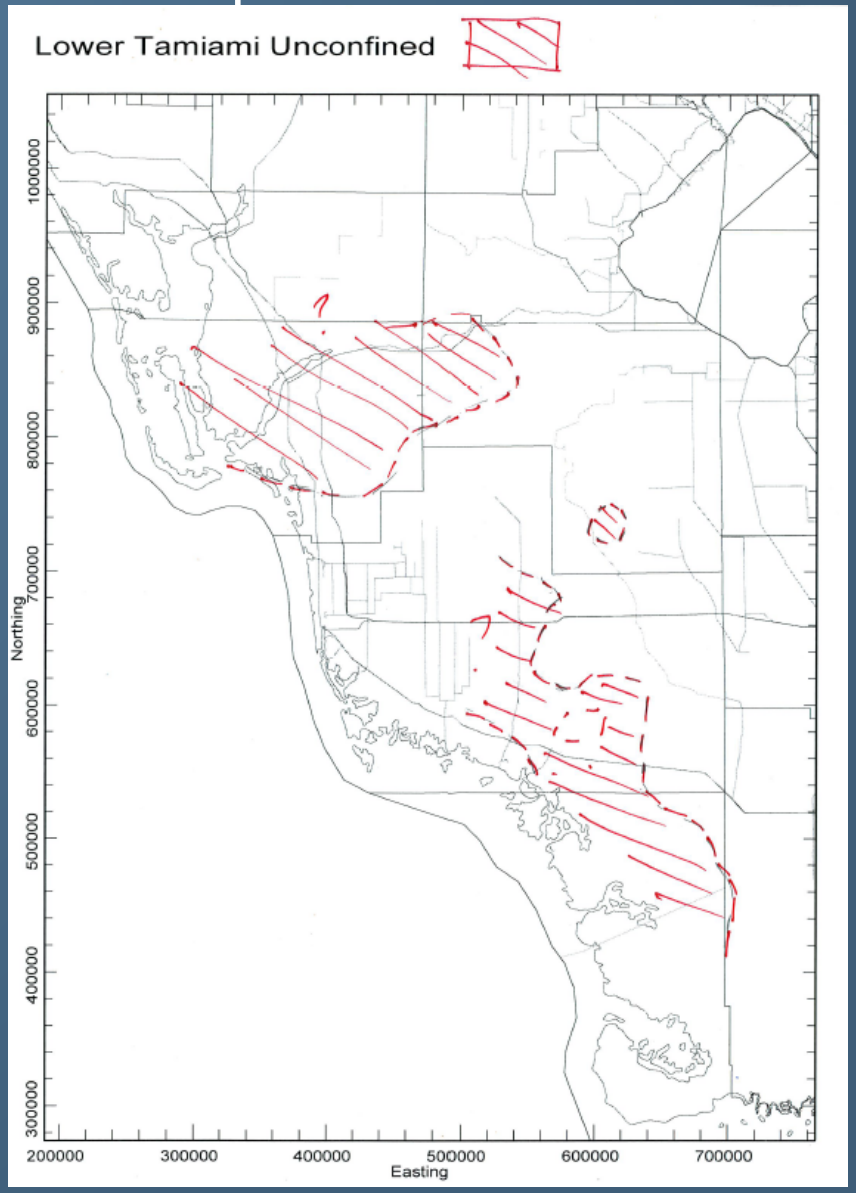
CH-313
CCRO-4N
FTM-P13


CH-TR12
CH-313
CCRO-4N
FTM-P13

Question: Where is there no confinement between the Water-Table & lower Tamiami Aquifers ?





Question: Where is there no confinement between lower Tamiami and Sandstone aquifers?

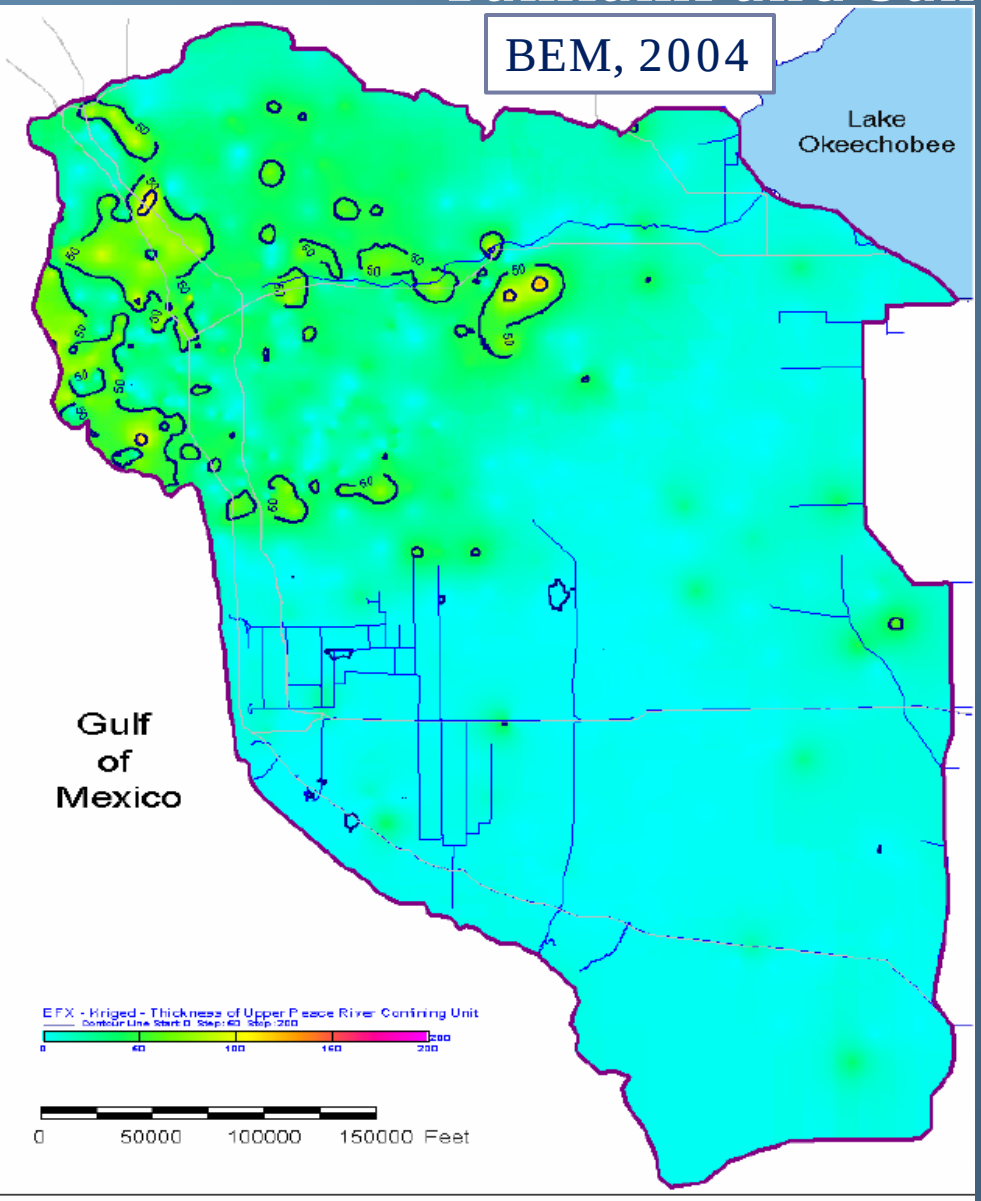
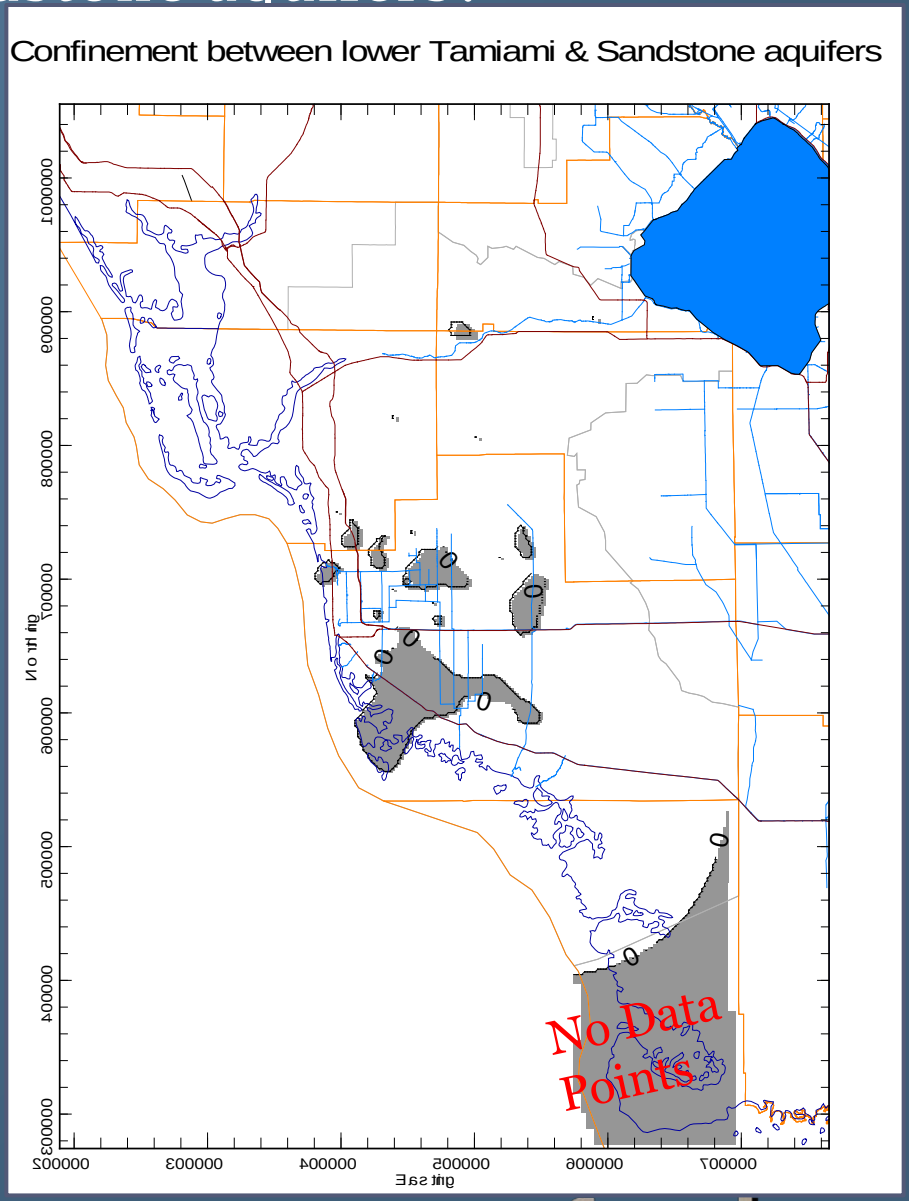
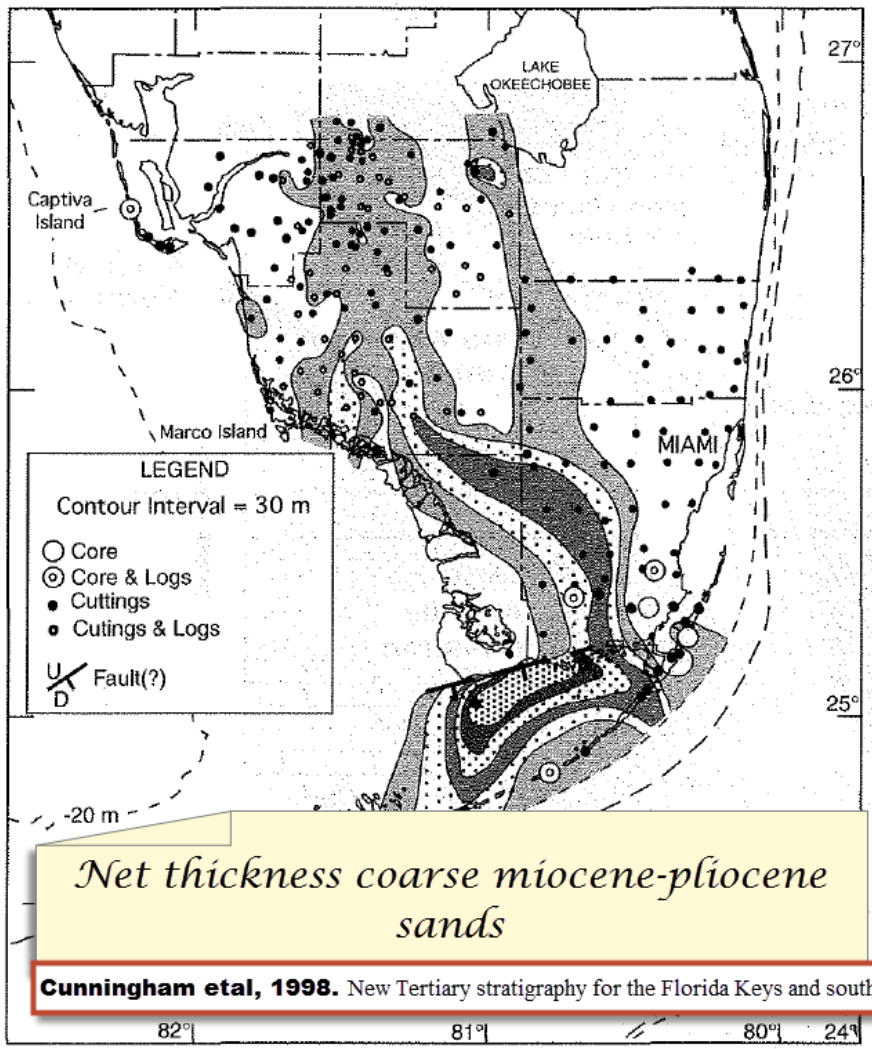


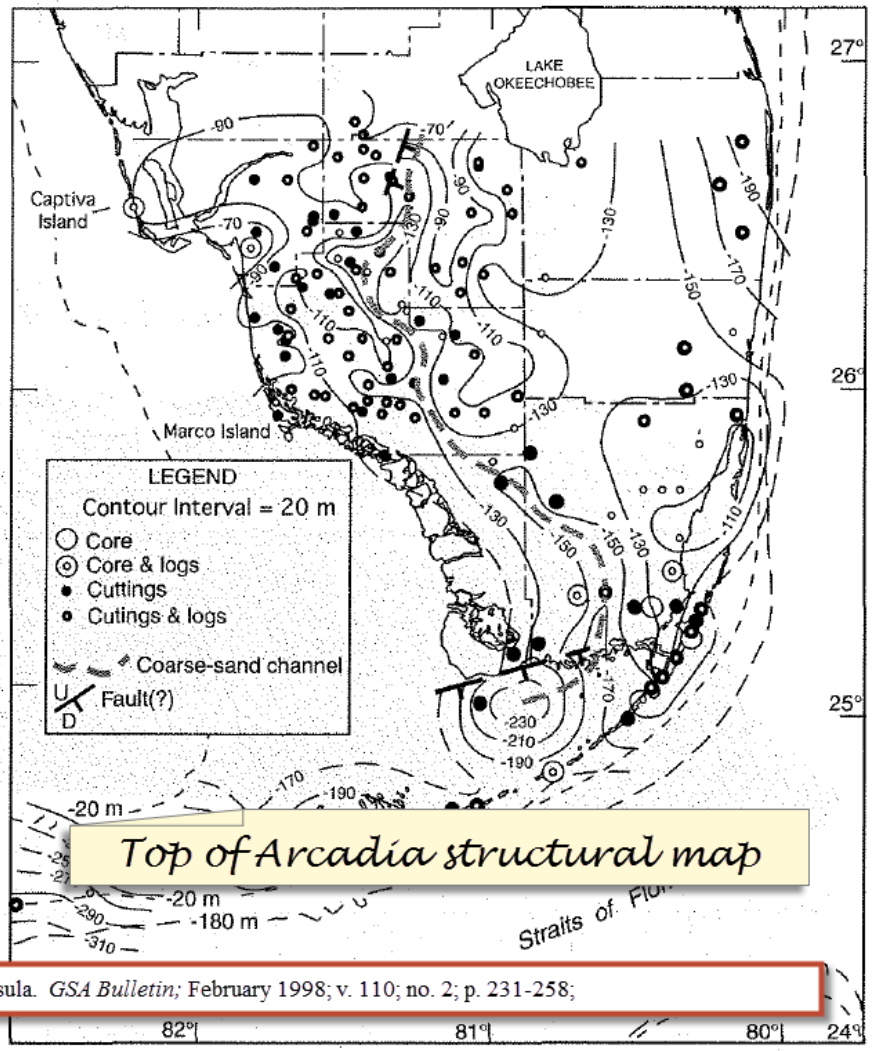
Figure 14. Thickness of Upper Peace River Clay (Aquitard 2)



Question: Where is the Sandstone aquifer Not Present?



Net thickness coarse miocene-pliocene sands

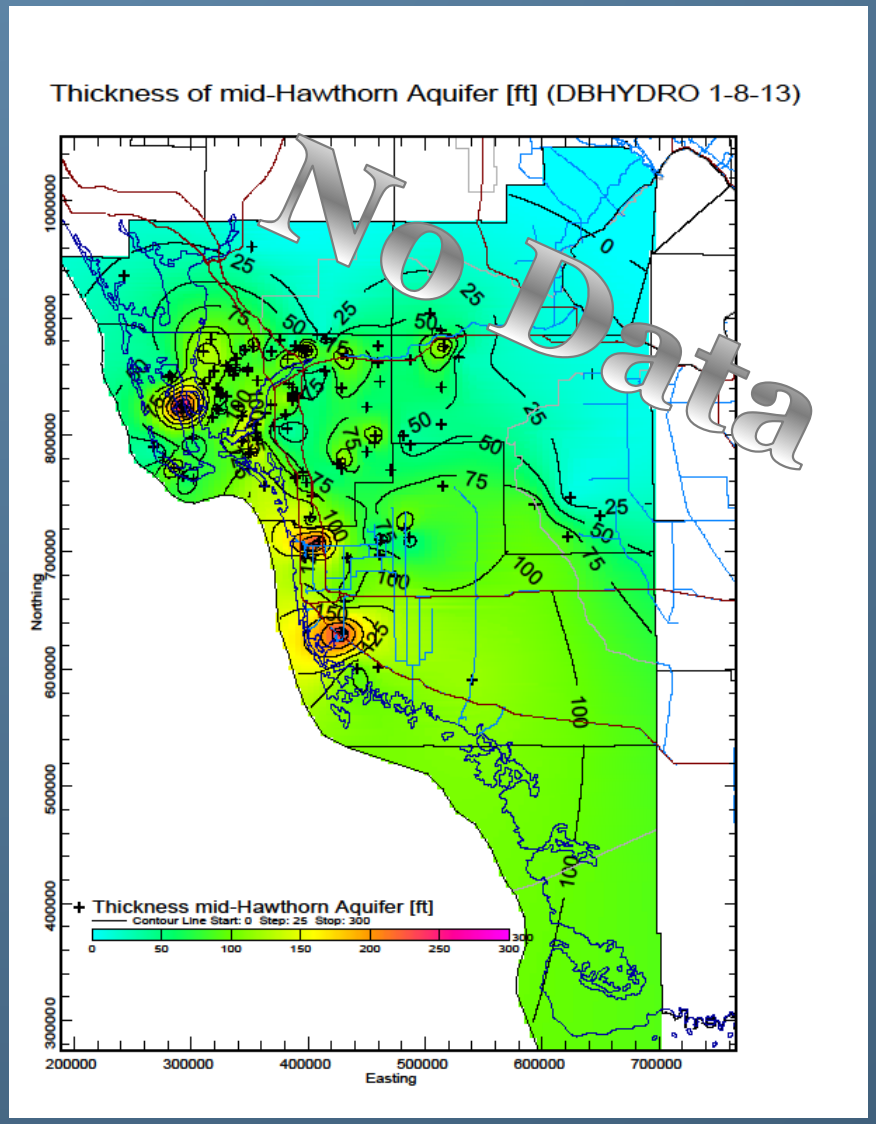


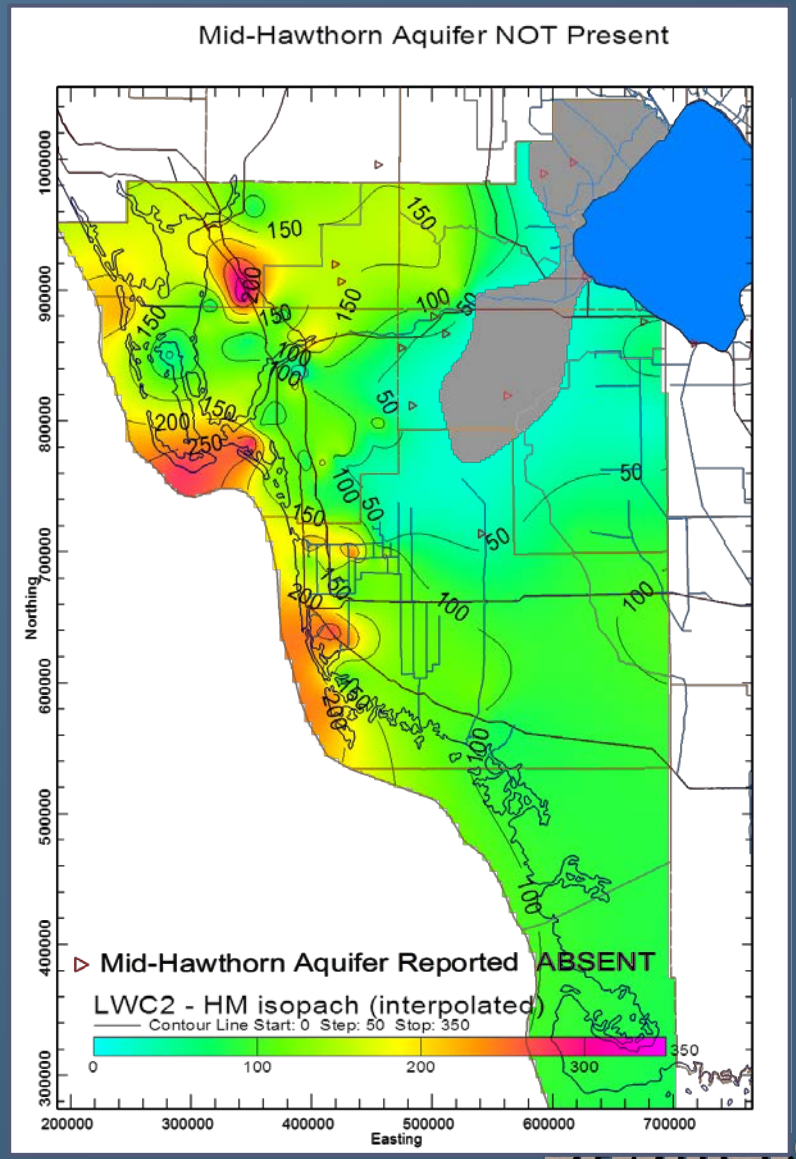
Top of Arcadia structural map

Cunningham etal, 1998. New Tertiary stratigraphy for the Florida Keys and southern peninsula. *GSA Bulletin;* February 1998; v. 110; no. 2; p. 231-258;

0 to 30 m | 30 to 60 m | 60 to 90 m | 90 to 120 m | 120 to 150 m | 150 to 180 m

Question: What are the spatial extents of the Mid-Hawthorn Aquifer?





Where do we go from here?

- Deliver electronic versions of surfaces to stakeholders via email by December 13, 2013
- **Solicit feedback from stakeholders by January 17, 2014**
- Currently preparing documentation for hydrostratigraphy update (Draft, January 31, 2014)

Tentative Modeling Process

Kick-off Meeting 1 (January 24, 2013)
Modeling & Hydrostratigraphy
Bonita Springs

Email to Stakeholders (May 30, 2013)
Draft Hydrostratigraphy Update

Email to Stakeholders (August 23, 2013)
Draft Hydrostratigraphy Update

Meeting 2 (December 10, 2013)
Final Hydrostratigraphy Surfaces
Bonita Springs

Staff Model Implementation & Documentation
(Aug. 2013- Nov. 2014)

Peer Review Process (Dec-Feb 2015)

Meeting 3 (March 2015)
Implementation, Documentation and Updated Model
Bonita Springs

Staff Final Model (March-May 2015)

Staff Model Documentation (June-July 2015)

Staff Model Applications
(August 2015 – March 2016)

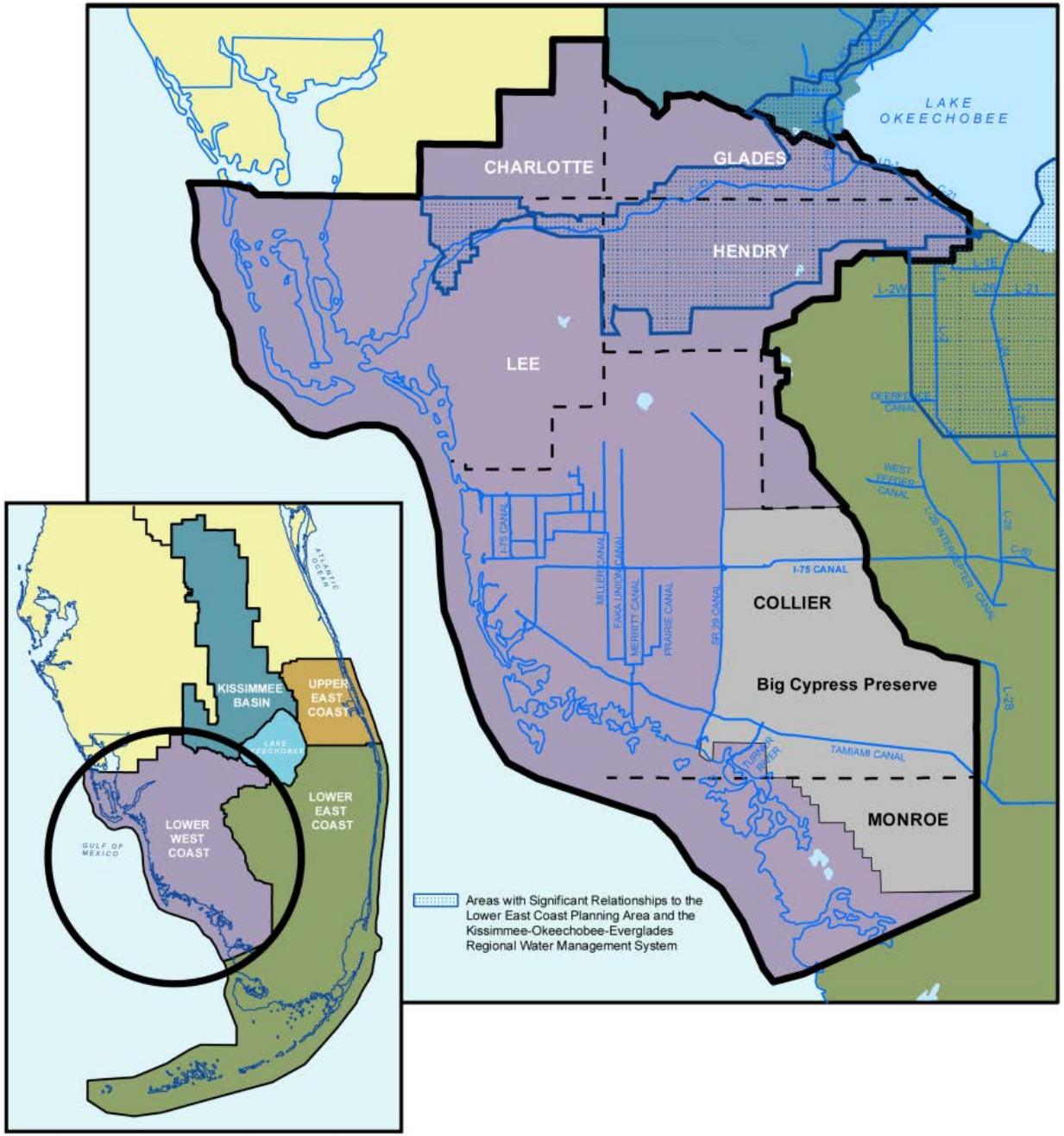
Meeting 4 (Dec 2015)
Model Applications/Runs
2010, 2015, 2030 Runs
Bonita Springs

Meeting 5 (Jan/Feb 2016)
Model Applications/Runs Wrap-up
Bonita Springs

Potential Meeting 6 (March/April 2016)
(if more model runs needed)
Bonita Springs

Model Products Available to Public
Model & Documentation
(July 2016)

LWC Water Supply Plan Workshops
to begin: Spring/Summer 2016



Lower West Coast SAS/IAS* Modeling Project

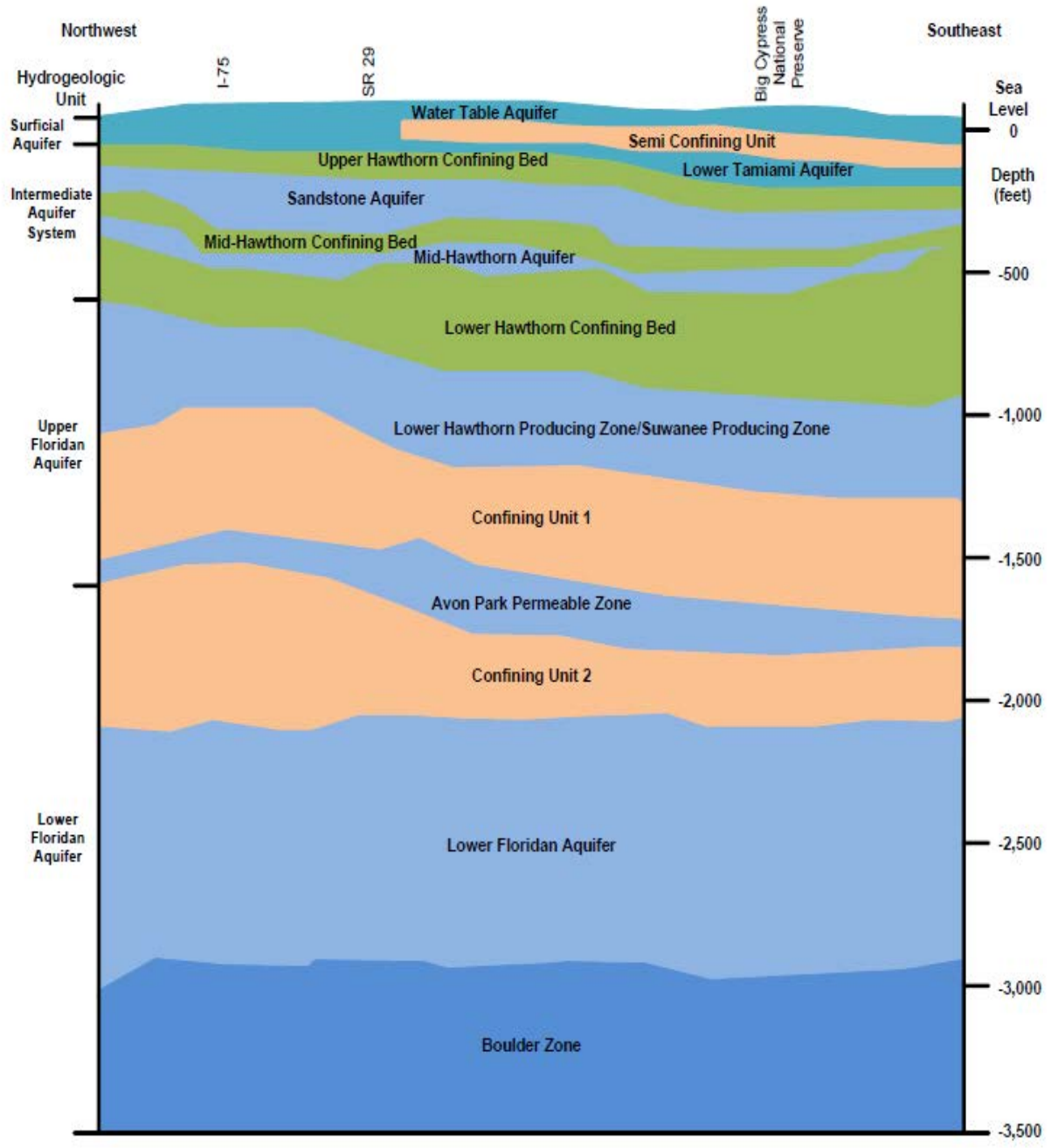
**surficial aquifer system (SAS), intermediate aquifer system (IAS)*

sfwmd.gov

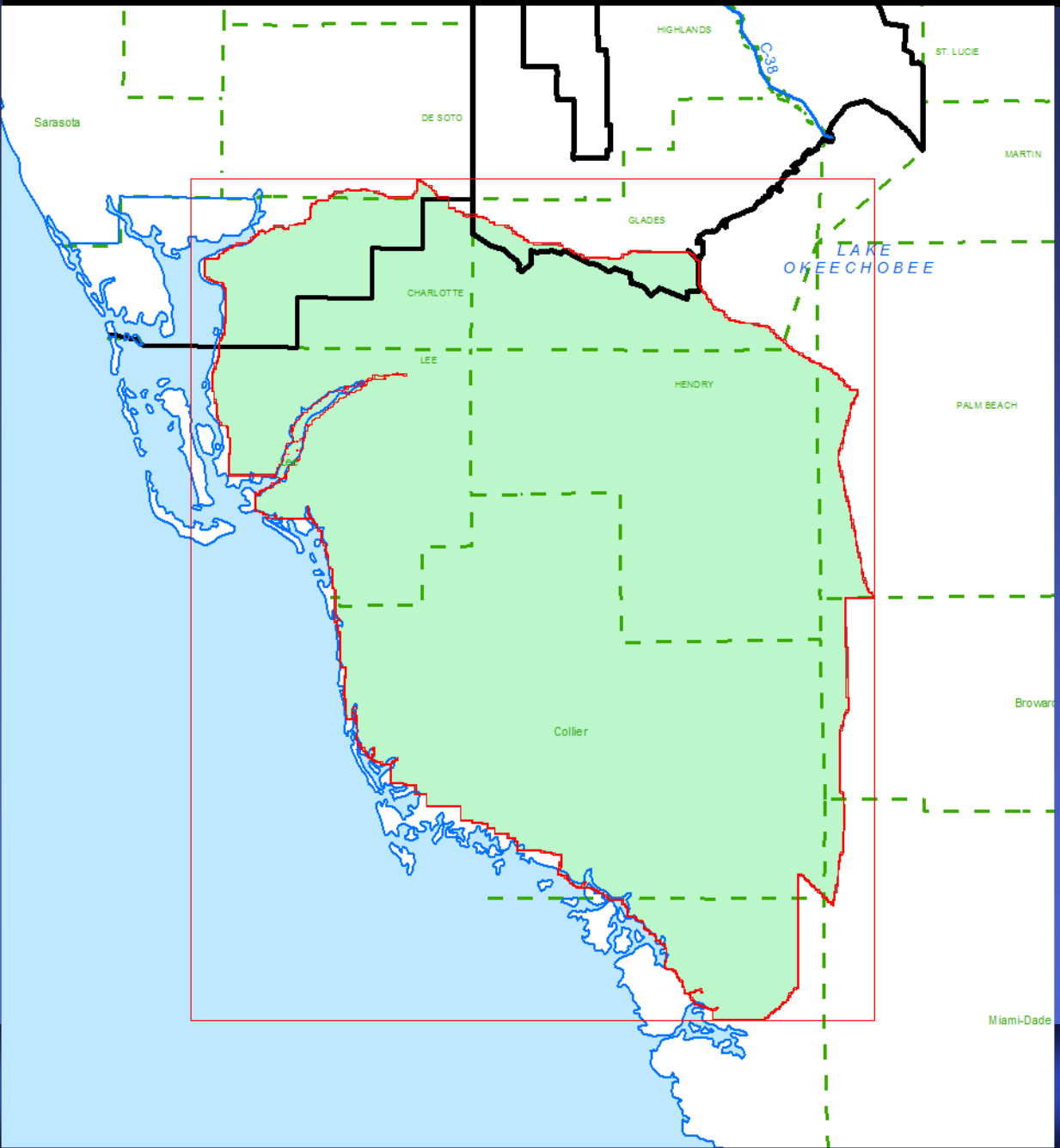
Lower West Coast SAS/IAS:
Modeling Project Update

Laura Kuebler, Senior Hydrologic Modeler
Groundwater Modeling, Resource Evaluation
December 10, 2013

sfwmd.gov



Generalized hydrogeologic cross-section of the LWC Planning Area (section extends from northwest Lee County through southeast Collier County)



Lower West Coast Surficial Aquifer System Model

sfwmd.gov

LWC SAS/IAS Model

- Regional Planning Tool
  - Evaluate effects of existing and future groundwater withdrawals
  - Evaluate regional changes in groundwater conditions over 20-yr planning period
  - Could be adapted for permitting purposes
- Updated hydrostratigraphy
  - <u>Focus of today's discussion</u>

General TimeLine

- Model Implementation: 2013-2014
  - Objectives, conceptualization, design, calibration, validation
- Model Peer Review: 2014-2015
- Model Applications: 2015-2016

Tentative Modeling Process

Kick-off Meeting 1 (January 24, 2013)
Modeling & Hydrostratigraphy
Bonita Springs

Email to Stakeholders (May 30, 2013)
Draft Hydrostratigraphy Update

Email to Stakeholders (August 23, 2013)
Draft Hydrostratigraphy Update

Meeting 2 (December 10, 2013)
Final Hydrostratigraphy Surfaces
Bonita Springs

Staff Model Implementation & Documentation
(Aug. 2013- Nov. 2014)

Peer Review Process (Dec-Feb 2015)

Meeting 3 (March 2015)
Implementation, Documentation and Updated Model
Bonita Springs

Staff Final Model (March-May 2015)

Staff Model Final Documentation (June-July 2015)

Staff Model Applications
(August 2015 – March 2016)

Meeting 4 (Dec 2015)
Model Applications/Runs
2010, 2015, 2030 Runs
Bonita Springs

Meeting 5 (Jan/Feb 2016)
Model Applications/Runs Wrap-up
Bonita Springs

Potential Meeting 6 (March/April 2016)
(if more model runs needed)
Bonita Springs

Model Products Available to Public
Model & Documentation
(July 2016)

LWC Water Supply Plan Workshops
to begin: Spring/Summer 2016

Project Contact

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