Status of Salinity Network Workgroup

(June 15, 2016)

Chair: Rick Copeland (FDEP)

Agenda

- **Introduction**
- **(1) GWL, PR Index for the UFA** - Status
- **(2) Coastal Salinity Monitoring Network** - Status
- **(3) Protocols for Sampling Wells Cased Close to the Fresh-water/Salt-water interface** - Status
- **(4) GWQ Index** – Status
- **(5) Ideas for Future Direction of the SNW**

  - Discussion

(1) GWL Percentile Ranking Index (Status)

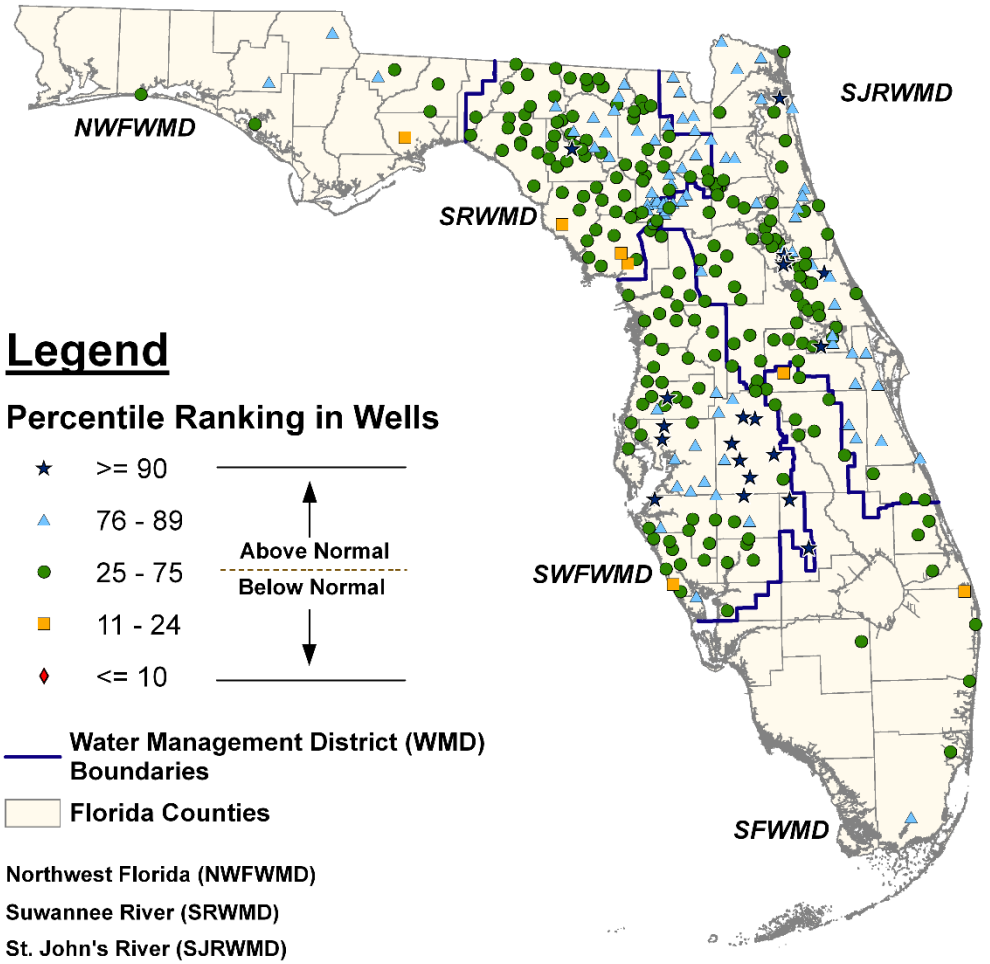
- Periodically create a **composite** statewide PR map, along with explanatory text

- Completed Pilot study (late 2014)
- Commence production twice/year; (2015)
  - May and September

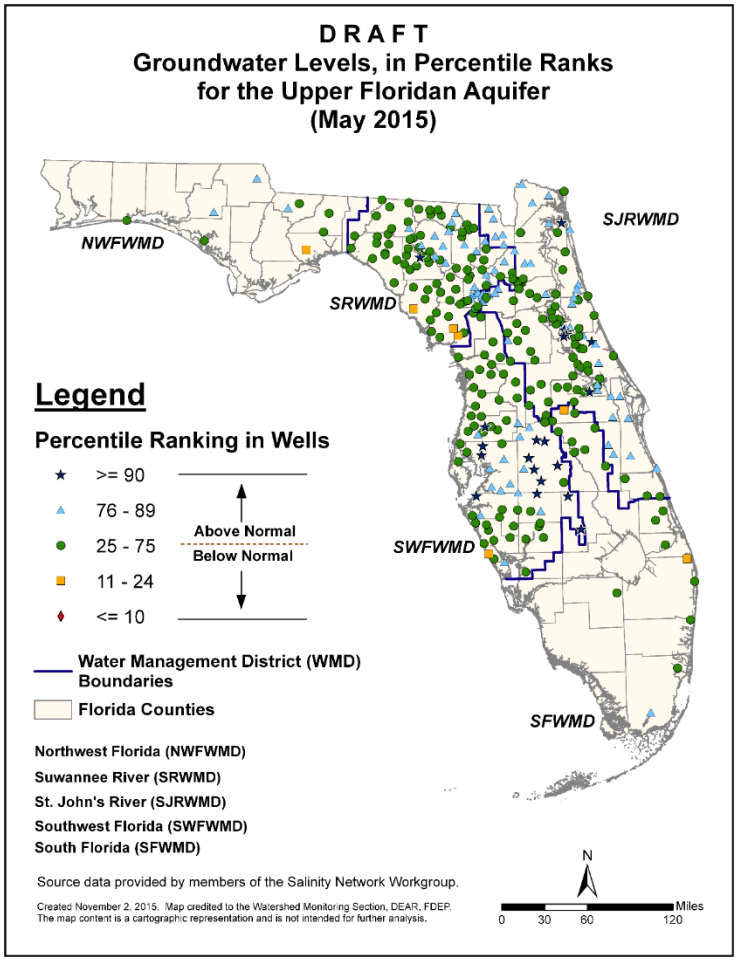
Map and Text

- Each map to be accompanied by an explanation page
- Lag time – Currently working on September, 2015 map
- When complete, each map/text is uploaded to a link

D R A F T
Groundwater Levels, in Percentile Ranks for the Upper Floridan Aquifer (May 2015)



Issues to be addressed in the future



- PRI map is composite
  - Inconsistent POR
  - and methodologies
- For PR map
  - Decrease density of wells in SR, SJ, & SW?
  - Over time PORs may become more consistent
  - Over time, change to one standard meth?

SR- SRWMD
SJ- SJRMD
SW- SWFWMD

May 2015 Map - Status

- STATUS
  - RC – Needs to complete text and then post final version on web site.

September 2015 Map - Status

- STATUS
  - NW - supplied PRs
  - SR - supplied PRs
  - Ala Co – supplied PRs
  - SJ – not supplied at this time
  - SW – Supplied PRs
  - SF – not supplied at this time
  - RC will send out reminders

(2) Development of the Coastal Salinity Monitoring Network

- Not only the Salinity Network, but also a Coastal Salinity Monitoring Network (CSMN)- "Rind around the state"
  - Networks-of-existing networks
    - **No new $**
  - Add wells and surface water sites in future

- **Governor's Office Supports CSN**

Why Have a Salinity Network?

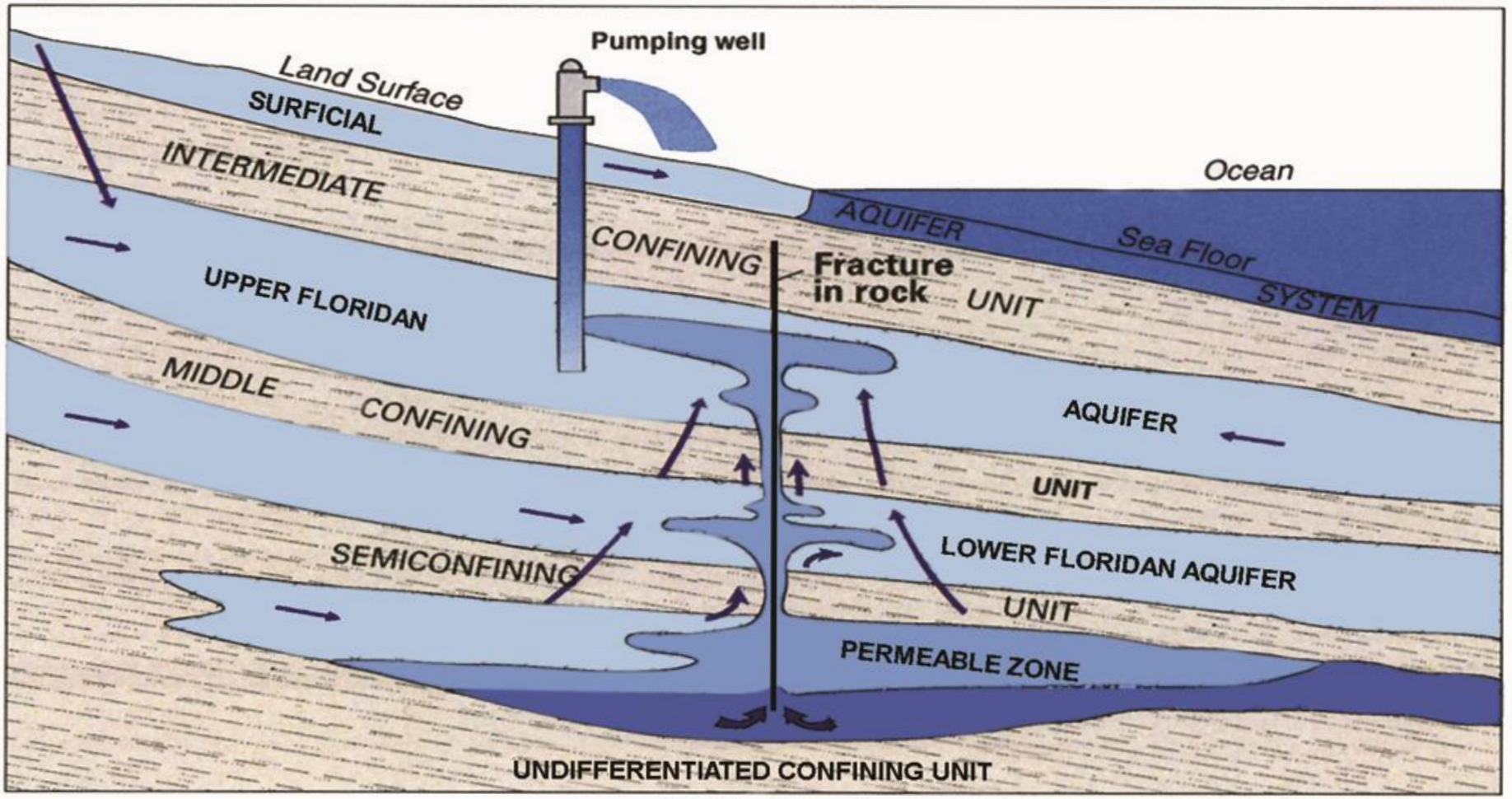
Several Causes of intrusion

Two of particular interest are:

1. Potential Upwelling of saline GW from base of Floridan aquifer system (FAS)?

2. More typical - intrusion issues along coast

Potential Upwelling

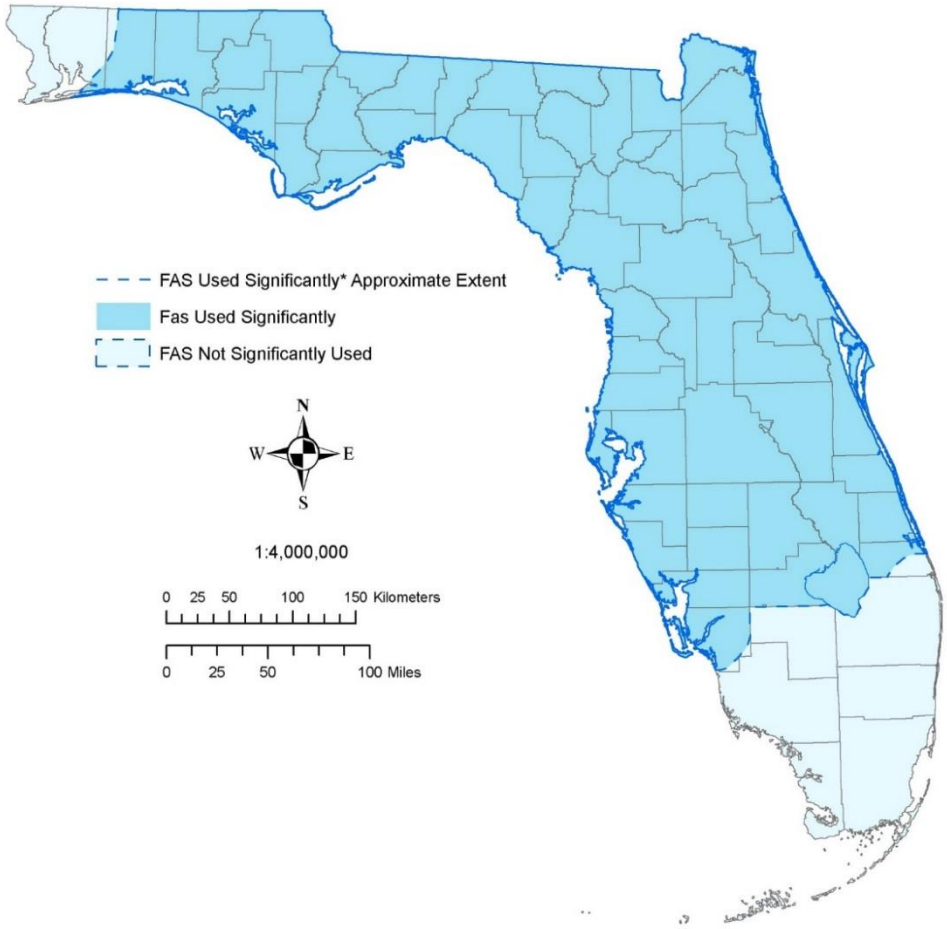


Modified from Krause and Randolph (1989) and Spechler (1994)

EXPLANATION

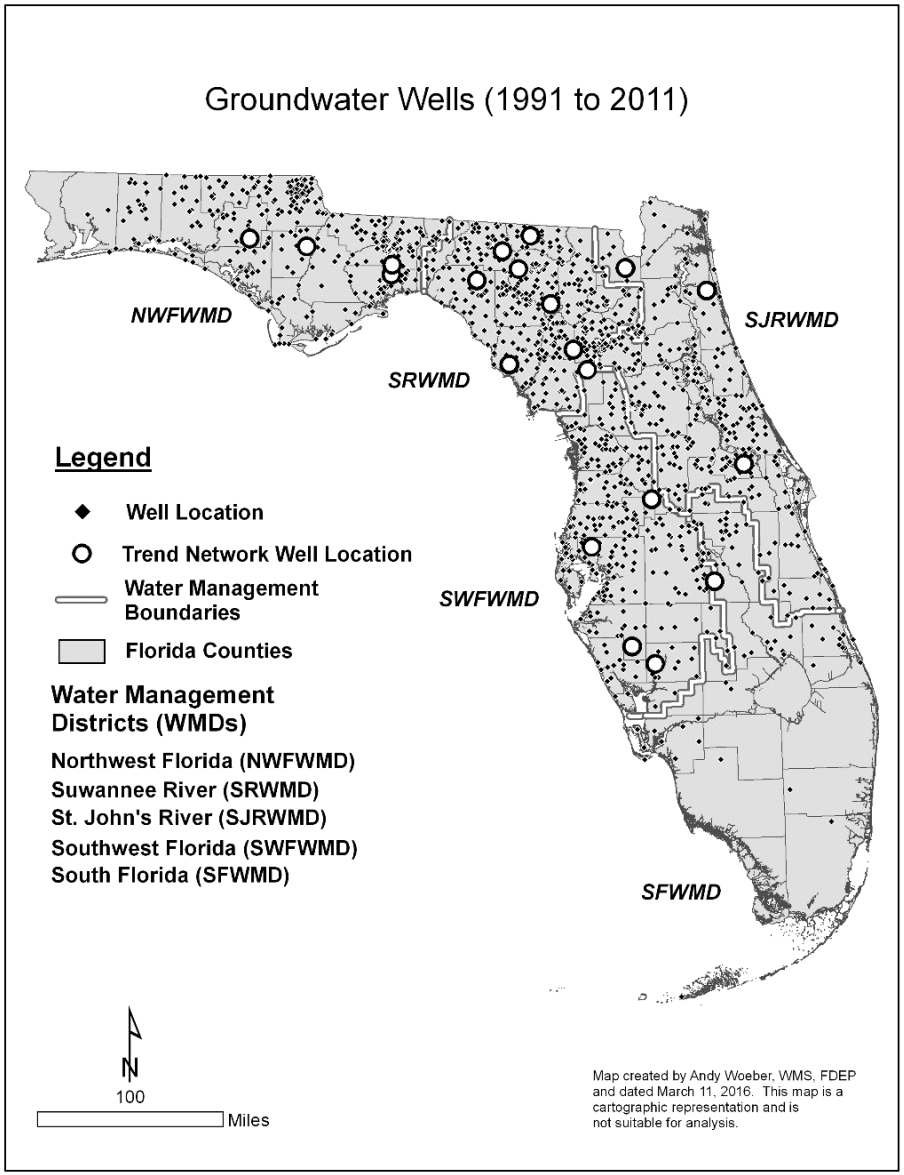
- Brackish water
- Saltwater
- Freshwater
- Direction of ground-water flow

Floridan Aquifer System (FAS)



* Significant is greater than 5% of county groundwater use based on 2000 data from Marella and Bendt (2005).

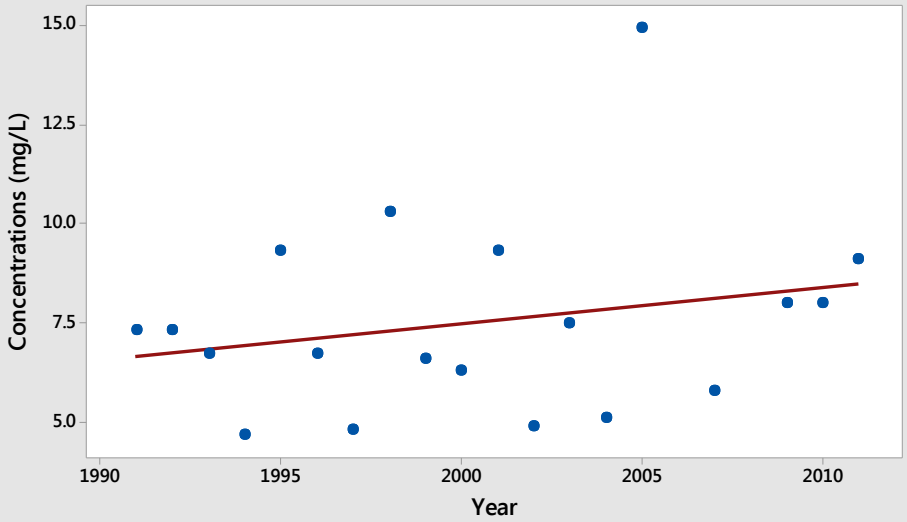
FAS – DEP Wells with Na and Cl data



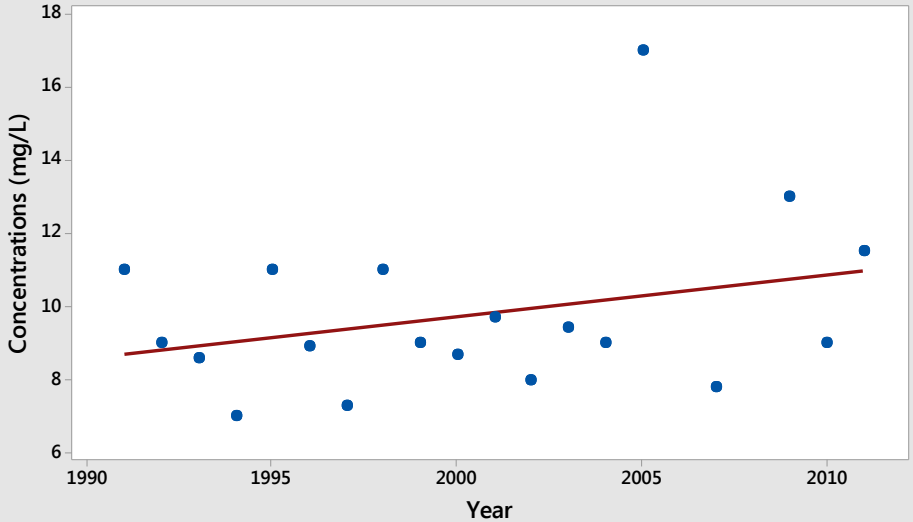
>1400 FAS Monitoring Wells

- Part of DEP's Status Network (SN)
- SN: 60-366 samples/year, across FL
- E.G. -Obtained annual medians
  - Na and Cl
- Plotted medians per year

Annual Medians



Outliers (2006 and 2008). There were removed for visual reasonsi



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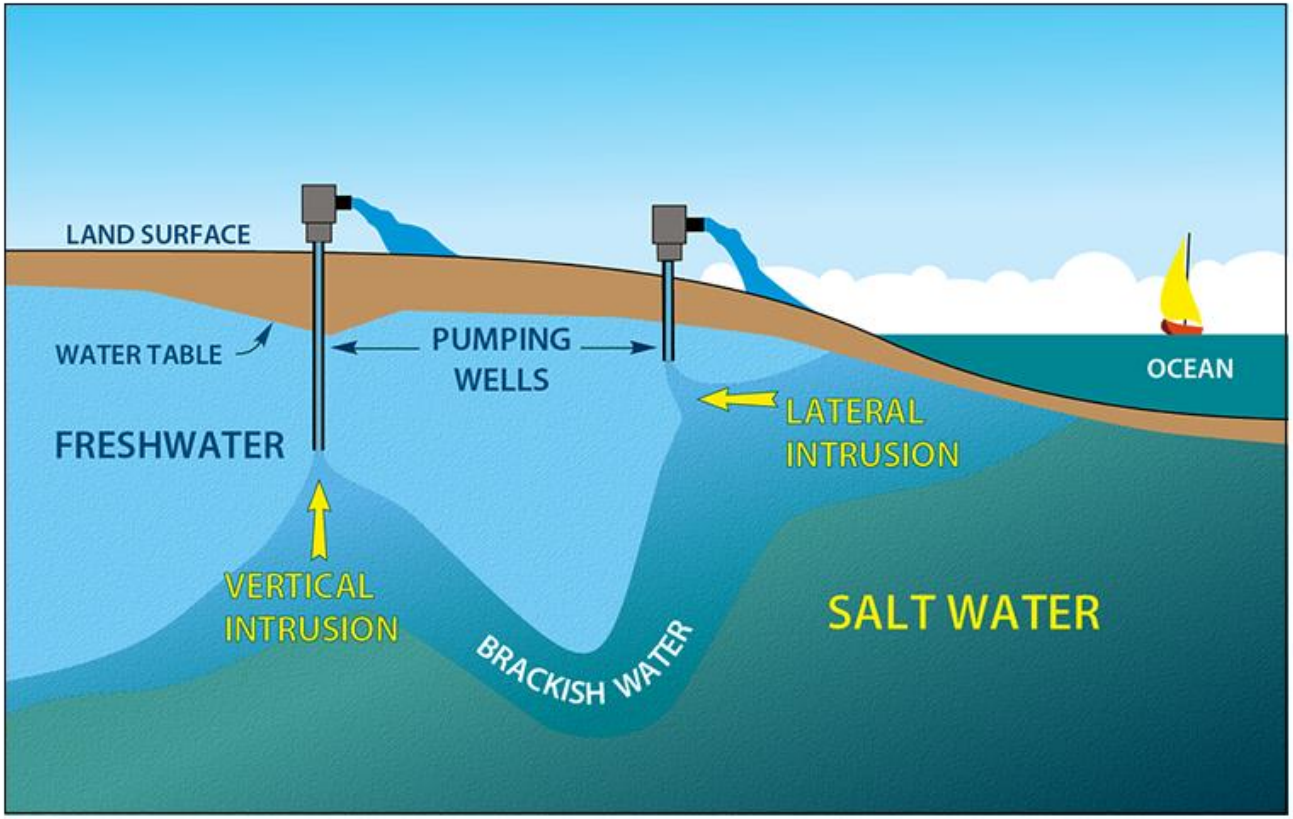
Intrusion along Coast



Saint Johns River Water Management District (Date Unknown)

Establishment of CSMN

- “Let data suggest were to build Coastal SalNet”

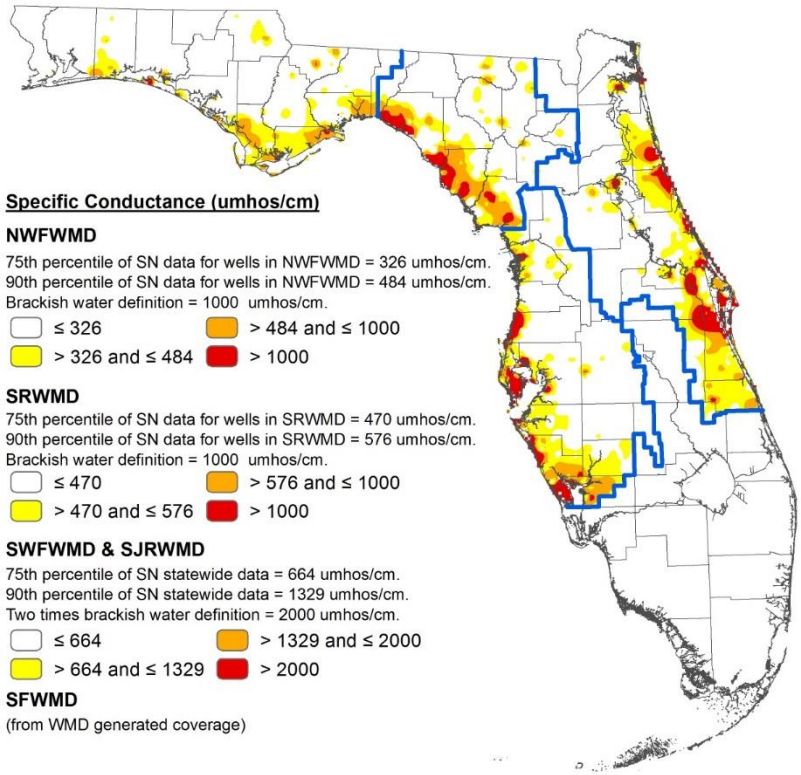
Establishment of CSMN

- Data are from DEP Status Monitoring Network
- Sampled between 2000-2014
- If multiple samples at a site, used most recent
- > 2000 Wells
- Four analytes: TDS, SC, Cl, and SO4

Identify Potential CSMN Wells

- Generated greatest concentration maps (“Rind”)
- Then used WMD wells as candidate wells
- WMDs to determine:
  - Which wells (and aquifers)
  - Additional areas (if needed)

Specific Conductance in Status Network (SN) Wells (All Aquifers) Modeled Using Inverse Distance Weighting



Specific Conductance (umhos/cm)

NWFWMD

75th percentile of SN data for wells in NWFWMD = 326 umhos/cm.
90th percentile of SN data for wells in NWFWMD = 484 umhos/cm.
Brackish water definition = 1000 umhos/cm.

- ≤ 326
- > 326 and ≤ 484
- > 484 and ≤ 1000
- > 1000

SRWMD

75th percentile of SN data for wells in SRWMD = 470 umhos/cm.
90th percentile of SN data for wells in SRWMD = 576 umhos/cm.
Brackish water definition = 1000 umhos/cm.

- ≤ 470
- > 470 and ≤ 576
- > 576 and ≤ 1000
- > 1000

SWFWMD & SJRWMD

75th percentile of SN statewide data = 664 umhos/cm.
90th percentile of SN statewide data = 1329 umhos/cm.
Two times brackish water definition = 2000 umhos/cm.

- ≤ 664
- > 664 and ≤ 1329
- > 1329 and ≤ 2000
- > 2000

SFWMD

(from WMD generated coverage)

Water Management Districts

Florida Counties

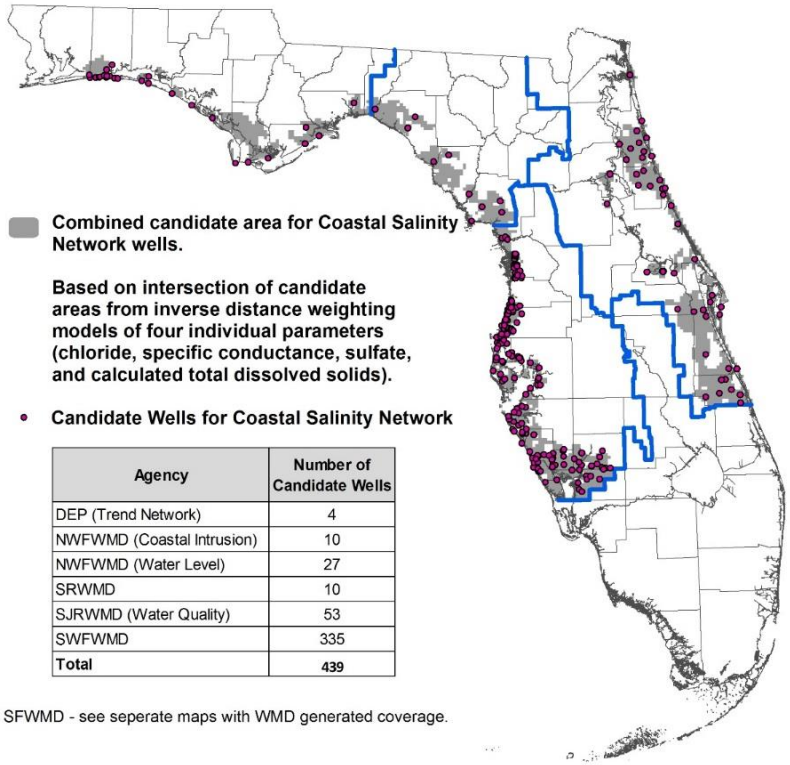
N

0 50 100 200 Kilometers

0 50 100 200 Miles

Created November 3, 2015 by Florida Department of Enviornmental Protection staff in the Division of Environmental Assessment and Restoration. This map is a cartographic representation and is not intended for further analysis.

Candidate Coastal Salinity Network Wells
Based on Combined Modeled Data
(Chloride, Specific Conductance, Sulfate, Calculated TDS)



Combined candidate area for Coastal Salinity Network wells.

Based on intersection of candidate areas from inverse distance weighting models of four individual parameters (chloride, specific conductance, sulfate, and calculated total dissolved solids).

Candidate Wells for Coastal Salinity Network

Agency	Number of Candidate Wells
DEP (Trend Network)	4
NWFWMD (Coastal Intrusion)	10
NWFWMD (Water Level)	27
SRWMD	10
SJRWMD (Water Quality)	53
SWFWMD	335
Total	**439**

SFWMD - see seperate maps with WMD generated coverage.

Water Management Districts

Florida Counties

N

0 50 100 200 Kilometers

0 50 100 200 Miles

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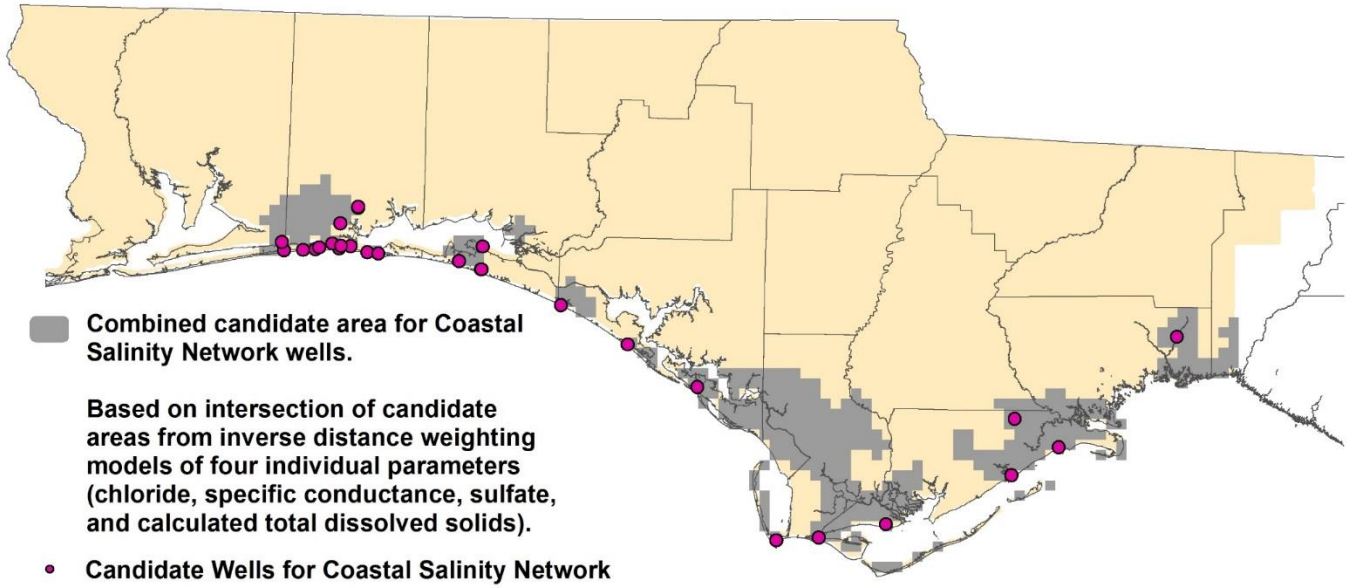
Candidate Coastal Salinity Network Wells in NWFWMD
Based on Combined Modeled Data
(Chloride, Specific Conductance, Sulfate, Calculated TDS)



Combined candidate area for Coastal Salinity Network wells.

Based on intersection of candidate areas from inverse distance weighting models of four individual parameters (chloride, specific conductance, sulfate, and calculated total dissolved solids).

Candidate Wells for Coastal Salinity Network

Agency	Number of Candidate Wells
NWFWMD (Coastal Intrusion)	10
NWFWMD (Water Level)	27
Total	**37**

NWFWMD

Florida Counties

N

0 25 50 100 Kilometers

0 25 50 100 Miles

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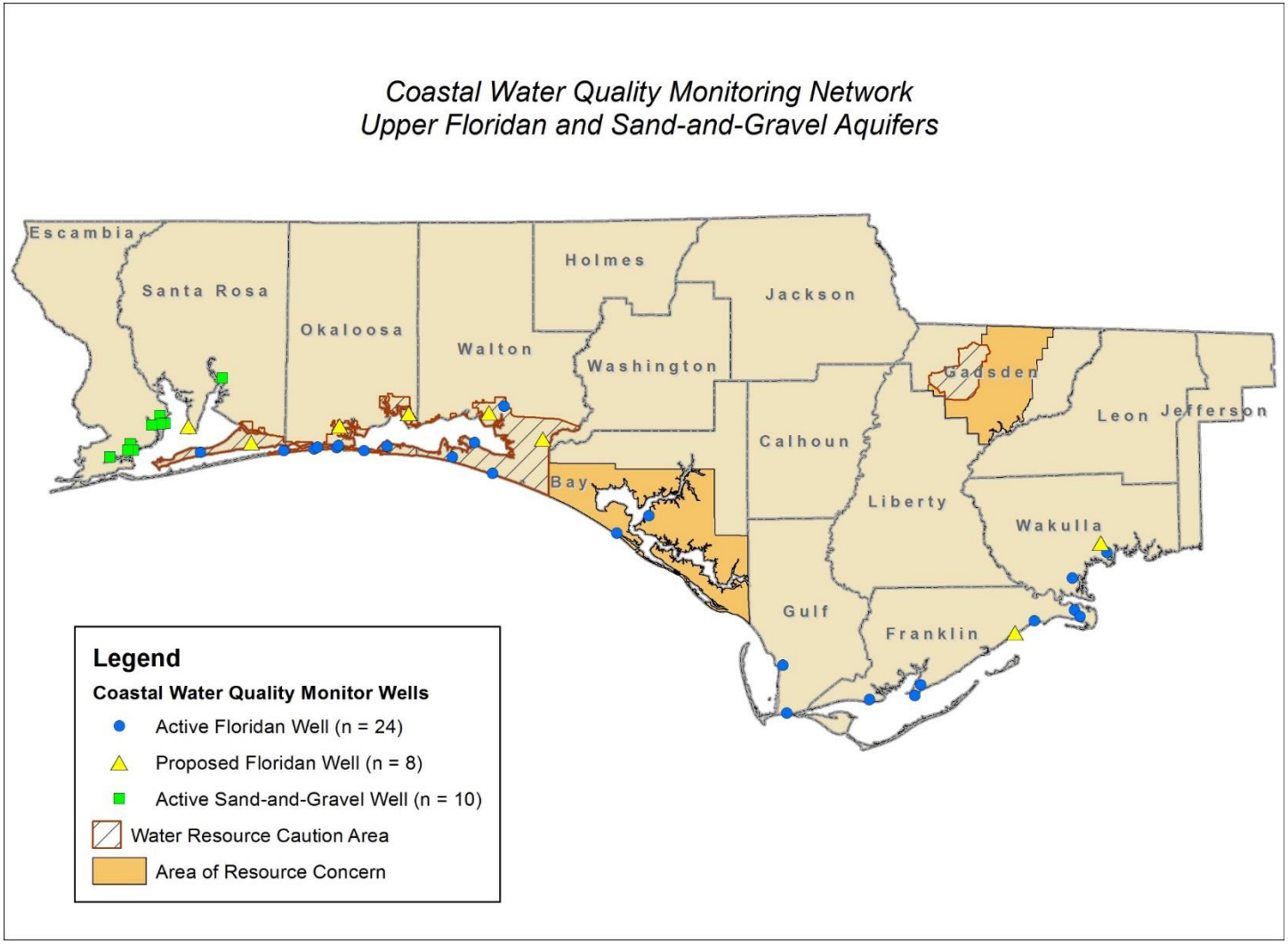
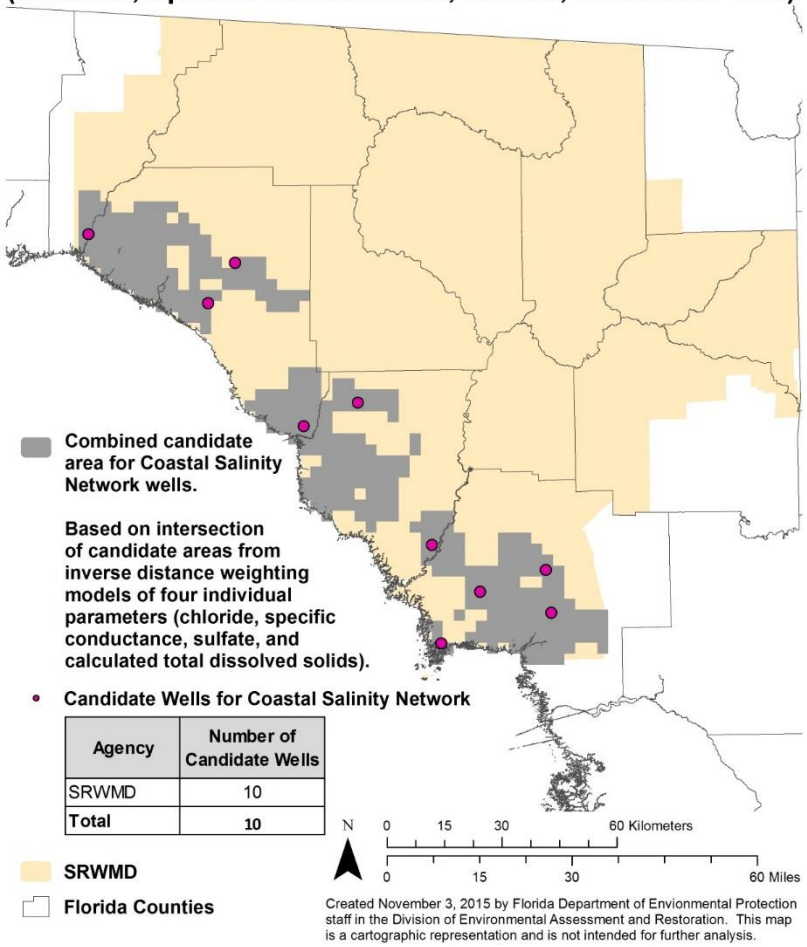

Coastal Water Quality Monitoring Network
Upper Floridan and Sand-and-Gravel Aquifers
Escambia
Santa Rosa
Okaloosa
Walton
Holmes
Washington
Jackson
Calhoun
Gadsden
Leon
Jefferson
Liberty
Wakulla
Bay
Gulf
Franklin
Legend
Coastal Water Quality Monitor Wells
Active Floridan Well (n = 24)
Proposed Floridan Well (n = 8)
Active Sand-and-Gravel Well (n = 10)
Water Resource Caution Area
Area of Resource Concern

Candidate Coastal Salinity Network Wells in SRWMD Based on Combined Modeled Data (Chloride, Specific Conductance, Sulfate, Calculated TDS)



Agency	Number of Candidate Wells
SRWMD	10
Total	**10**

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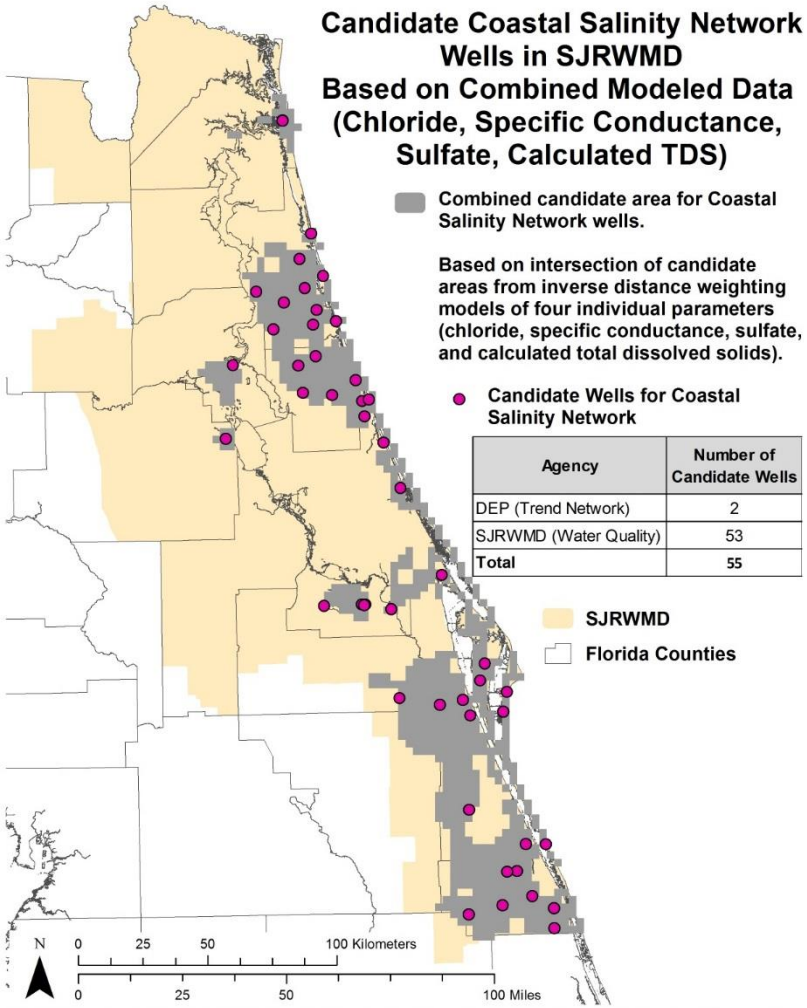

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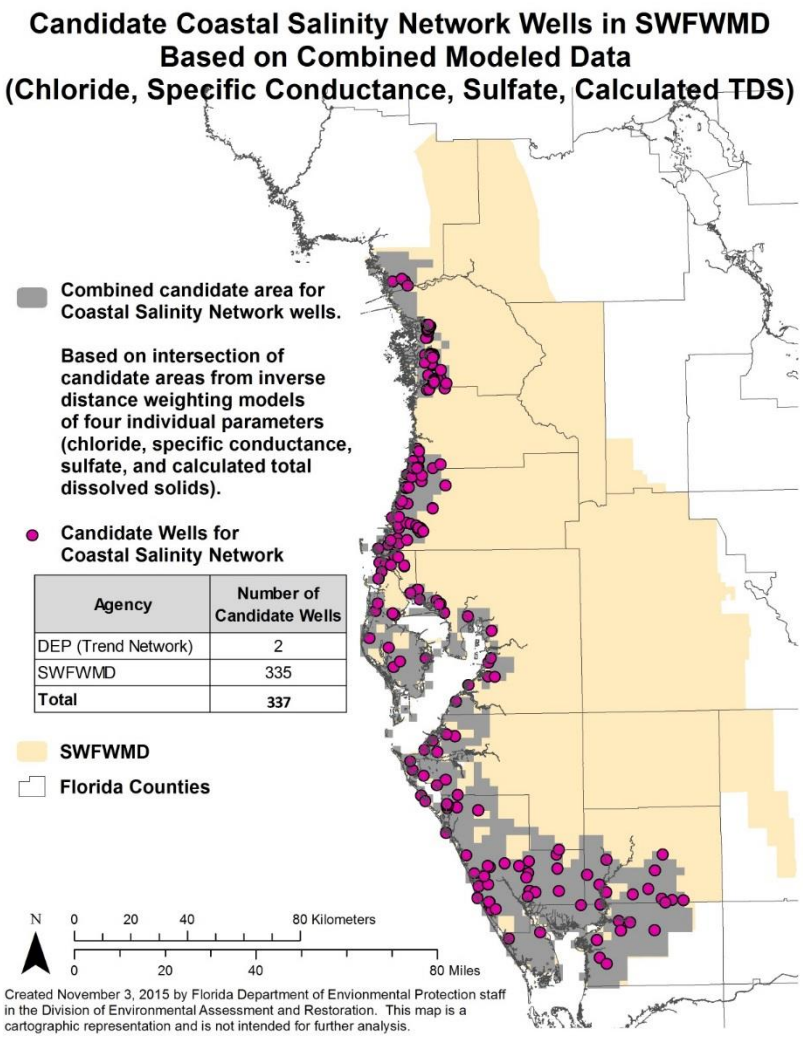

Candidate Coastal Salinity Network Wells in SWFWMD
Based on Combined Modeled Data
(Chloride, Specific Conductance, Sulfate, Calculated TDS)
Combined candidate area for Coastal Salinity Network wells.
Based on intersection of candidate areas from inverse distance weighting models of four individual parameters (chloride, specific conductance, sulfate, and calculated total dissolved solids).
Candidate Wells for Coastal Salinity Network
Agency
Number of Candidate Wells
DEP (Trend Network) 2
SWFWMD 335
Total 337
SWFWMD
Florida Counties
N
0 20 40 80 Kilometers
0 20 40 80 Miles
Created November 3, 2015 by Florida Department of Envionmental Protection staff in the Division of Environmental Assessment and Restoration. This map is a cartographic representation and is not intended for further analysis.

To Do

- Stephanie Sunderman has produced shapefiles for WMDs (but not SFWMD)
- Will be sent to each WMD

  Files contain:
  - Areas (Rind)for CSMN development
  - Candidate wells
    - NW – Already established and being monitored?
    - SR – need to establish a network?
    - SJ – need to finalize well selection?
    - SW – need to finalize well selection?

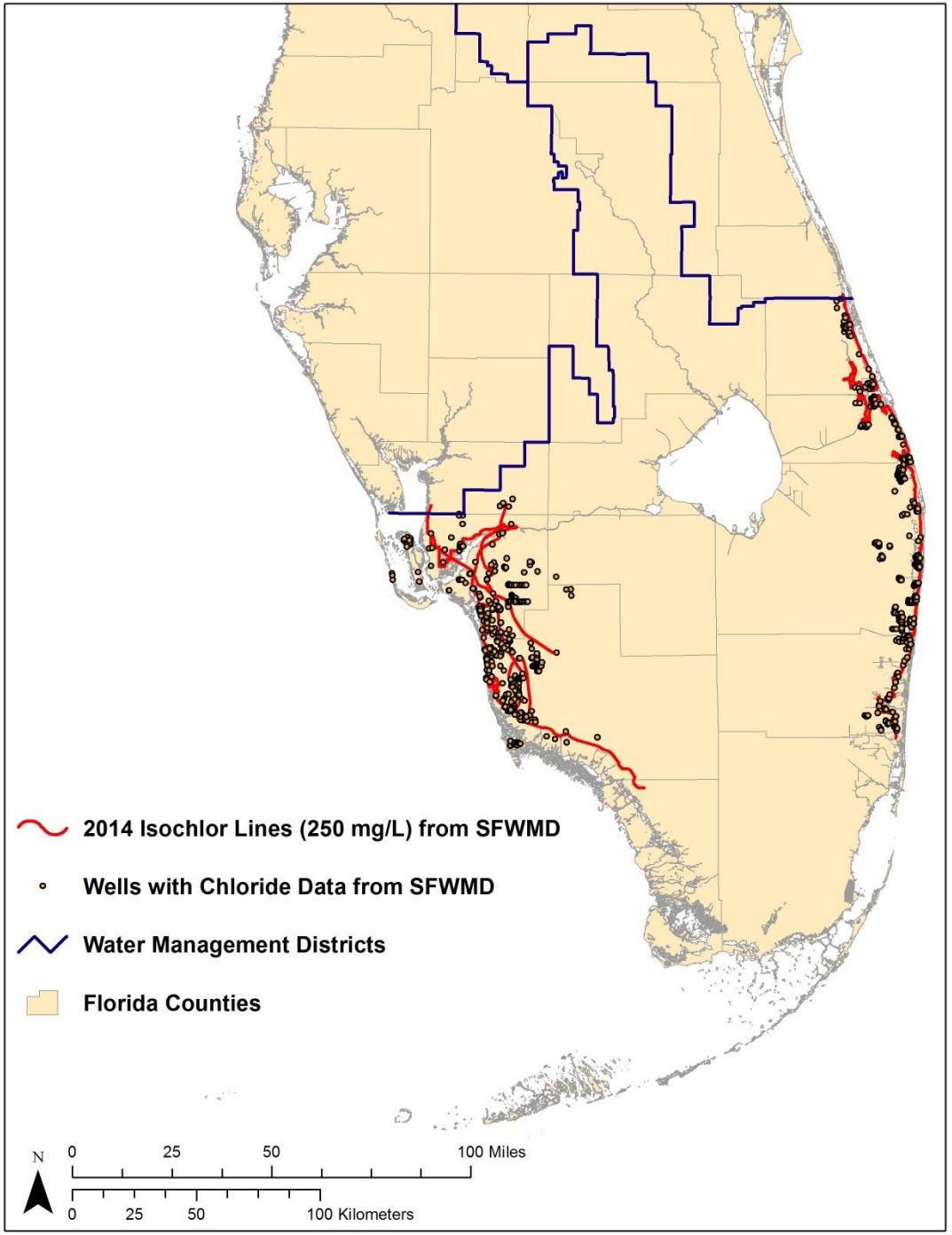
CSMN

- WMDs finalize:
  - Areas, aquifers, and wells for CSMN
  - Forward pertinent information to DEP

- No WQ data to be sent to DEP at this time
- Once WIN Database system is operational, data can be obtained by all entities

SFWMD area

Example of 250 mg/L isochlor maps for various aquifers in south Florida



Example of 250 mg/L isochlor map, and more, of Biscayne aquifer in Miami-Dade County, FL

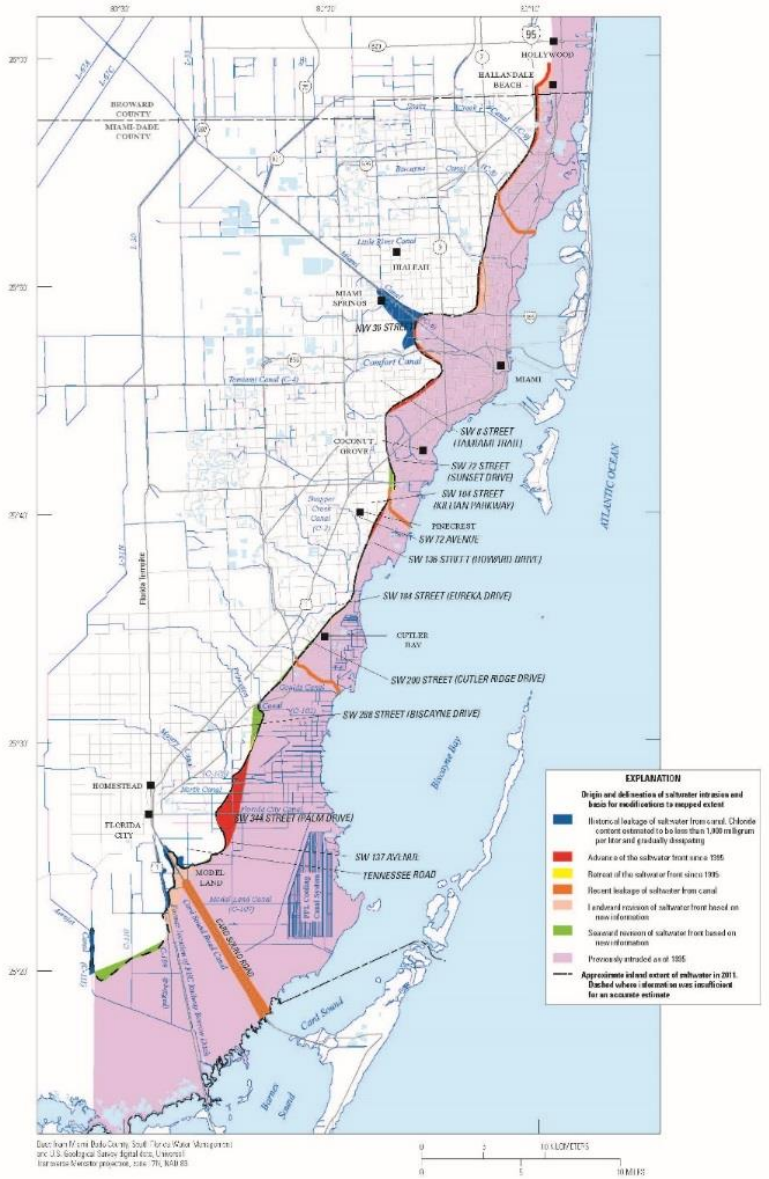


Figure 17. Map showing the origin and delineation of saltwater intrusion in the Biscayne aquifer and the basis for modifications to its mapped extent.

3. Wells cased close to saltwater /freshwater interface

- Are new/specialize protocols needed?
  - Scott Prinos - USGS

Ideas

- A. Stress that if new wells are specific used for salinity monitoring, short screened intervals are preferred over long open holes; which have greater potential for vertical flow
- Currently, long open interval wells are being installed for saltwater intrusion monitoring, despite warnings to not use them
- Possibly use sample tubes to extend down to various depths in the open hole

- B. If long open hole wells are to continue, ensure sample represents max salinity of aquifer

Next Step and Possible Solutions

- **Next Step = Information Gathering**

  The following information is requested from all stakeholders:

  - Define the problem - include details about monitoring objectives, well construction, and aquifer geology.
  - Propose solutions – (e.g. specific SOP changes needed) include details about procedures and well conditions / aquifer geology, references to other existing SOPs, and/or data from relevant studies
  - Send responses to Rick Copeland by 7/30/2016.

- **Possible Solutions**
  - DEP approval for alternative method through process described in 62-160 F.A.C. (statewide or project specific)
  - Revise DEP SOP FS2200 during upcoming rulemaking (e.g. add a section for salinity monitoring)

(4) Saline GWQ Index

- **Index needs to vary over time**
- **Need index for use at:**
  - Individual site, and
  - Over an Area (or space)

- **Analyte**
  - **One analyte, or multiple ones?**

- **Concentrations relative to thresholds**
  - Arbitrary thresholds
  - Contaminant thresholds
    - Depends on Health/Aesthetic Considerations
      - Health (Primary) and/or Aesthetics (Secondary)

One Potential Indicator

- **Total Dissolved Solids (TDS)**

- Note – TDS can have a very high correlation with Specific Conductance (SC)
  - Note TDS ≈ (α * SC)
    - $0.55 \leq \alpha \leq 0.75$, and often ≈ 0.65 (Freeze and Cherry, 1989)
  - Note also, TDS can be product of regression equation using SC to predict TDS

- For this reason, if done properly, many wells could be used

TDS/SC Example

Ca	Mg	Alk	SO4	Na	K	Cl	TDS	SC	Ratio TDS/SC
48.5	5.00	146	5.8	2.20	0.41	5.2	213	288	**0.74**
50.2	2.50	131	1.8	2.69	0.40	3.6	192	265	**0.73**
56.8	2.50	149	3.6	3.40	0.32	4.1	220	303	**0.73**
55.8	2.90	140	2.8	2.70	0.49	4.4	209	281	**0.74**
40.6	4.00	117	2.4	3.50	0.68	6.3	175	236	**0.74**

Ratio Mean = **0.74**

Relationship to a Threshold

- Thresholds (in mg/L) TDS:
  - 500 (Secondary)
  - 1,000 (Brackish)*
  - 10,000 (Saline)*

*(Fetter, 2001)

- Categories (in mg/L)
  - 0-500
  - > 500 to 1,000
  - >1,000 to 10,000
  - >10,000

Issue

- Potential Problem of using TDS
  - Cl has been used in past

    For this reason, it may be preferred

  - Using Estimates of TDS, based on SC,

    may cause angst

This priority is on hold for now

Next Steps

- 1. GWL PR Index
  - RC: complete May, 2015 Write up/upload
  - complete collection of Sept, 2015 PRIs
- 2. CSMN
  - complete well selection process
- 3. Sampling wells SW/FW interface
  - problem/solution ideas to RC by 7/30
- 4. Sal GWQ Index
  - currently on hold

Questions?

(5) Future Direction Ideas

Next SNW Meeting

Wednesday, November 9, 1:00 3:00

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