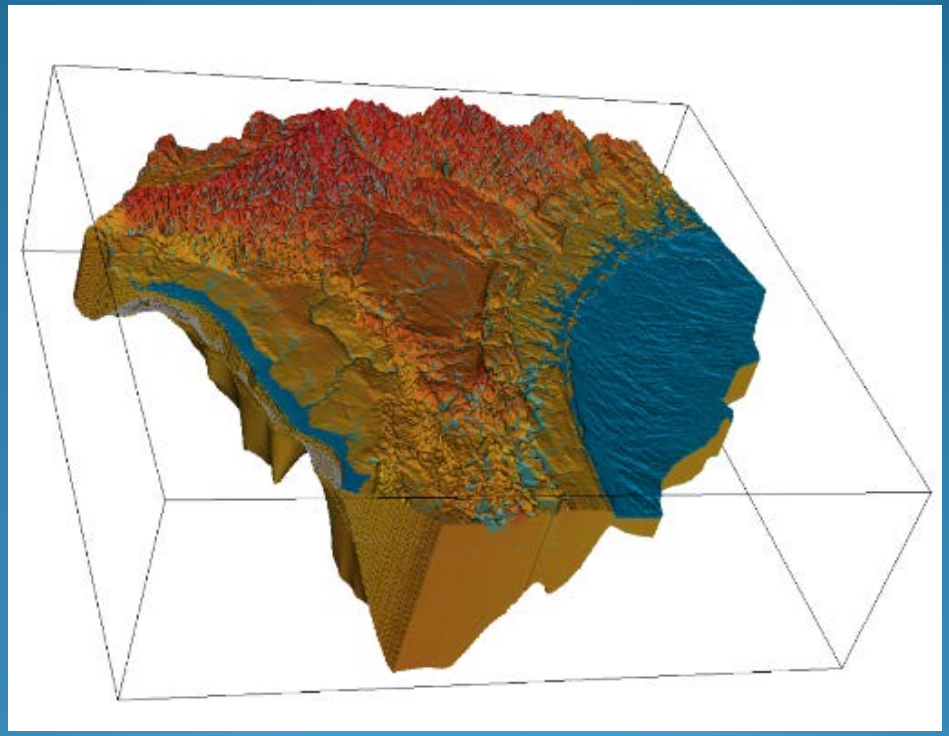
NFSEG v1.1 Phase 1 Preliminary Calibration Results



May 5, 2017

Outline

- Introduction / Meeting Objective
- Phase 1 Preliminary Results
  - HSPF
  - MODFLOW
- Peer Review Panel Discussions
- Technical Stakeholder Input
- Next Steps
- Schedule
- Public Comments

Introduction / Meeting Objective

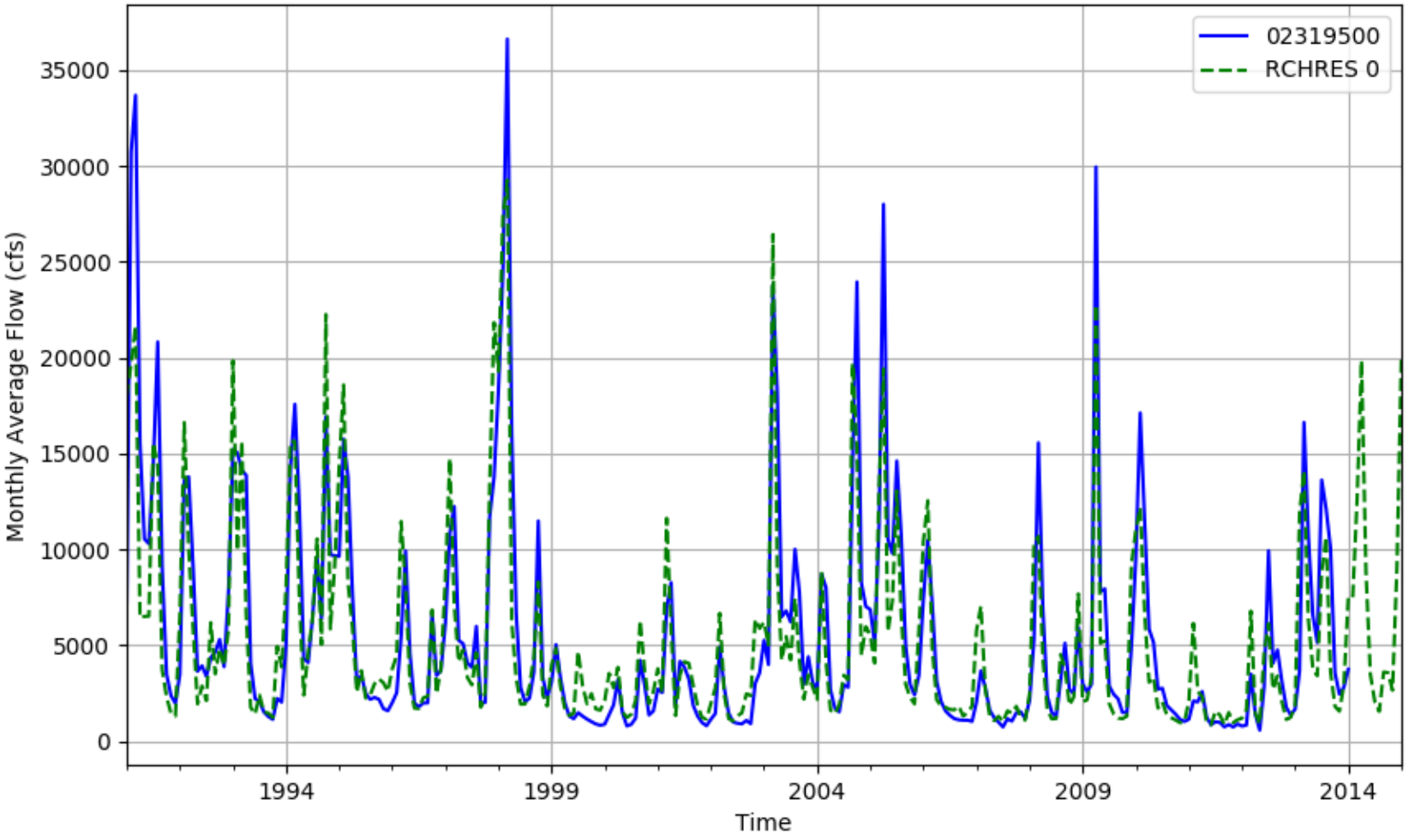
- Task B Phase 1 Draft NFSEG v1.1 Model
  - B.1. Preliminary Phase 1 Results – 5/5
  - B.2. Phase 1 Review Meeting – 6/6 1:00 – 4:00
  - B.3. Phase 1 Memorandum
    - Review model changes made to date
      - Emphasis on use of the model to predict changes in groundwater levels in the Keystone Heights area to set boundary conditions for local scale transient MODFLOW model
    - Summary of key findings as well as specific suggestions on outstanding tasks to be completed for final v1.1

HSPF Phase 1

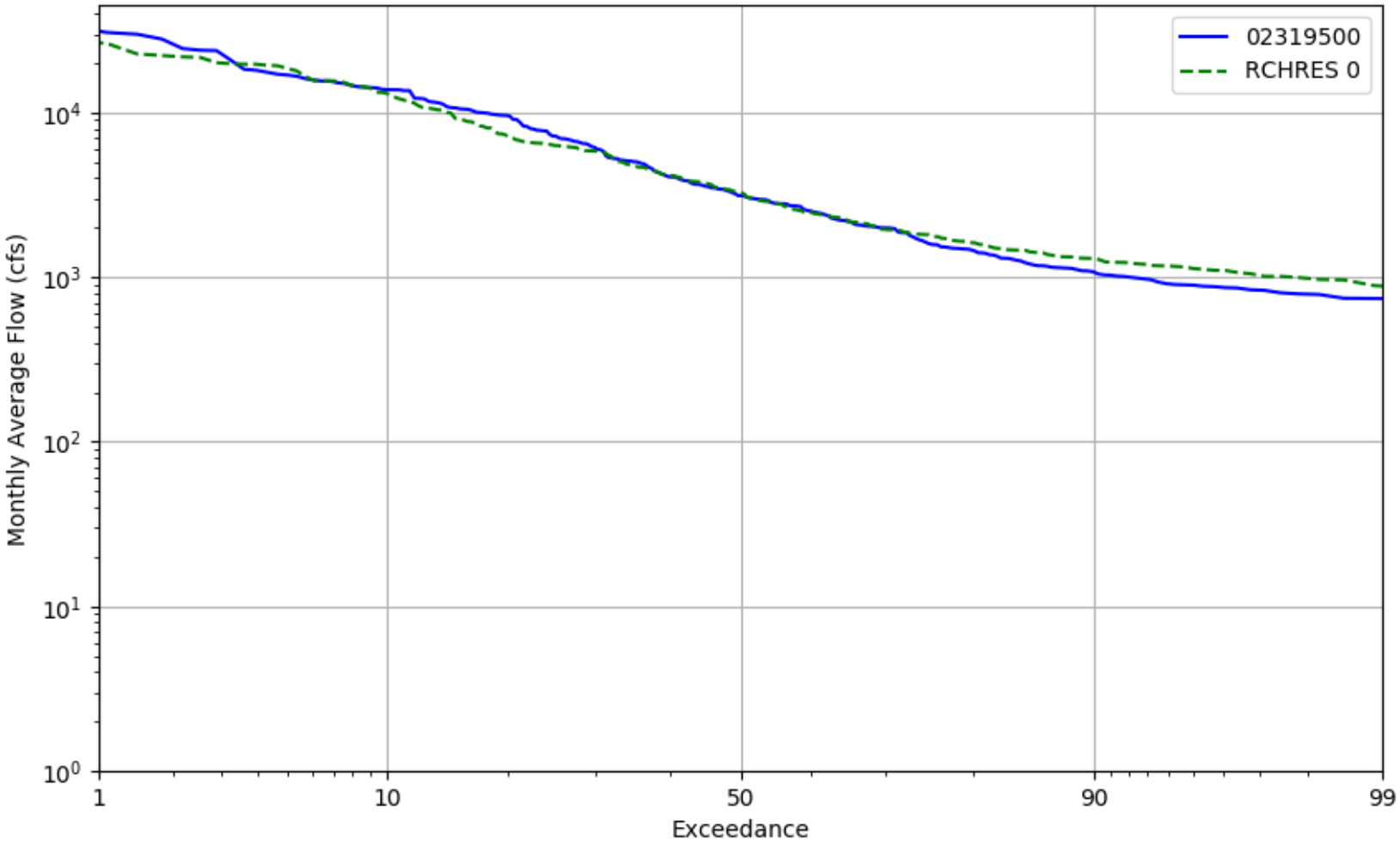
Peer Review Comment

- All gages should be calibrated if sufficient data are available
  - Added two gauges in 03110205 (Suwannee River)
  - Evaluated adding additional gauges in 03110201 and 03110202

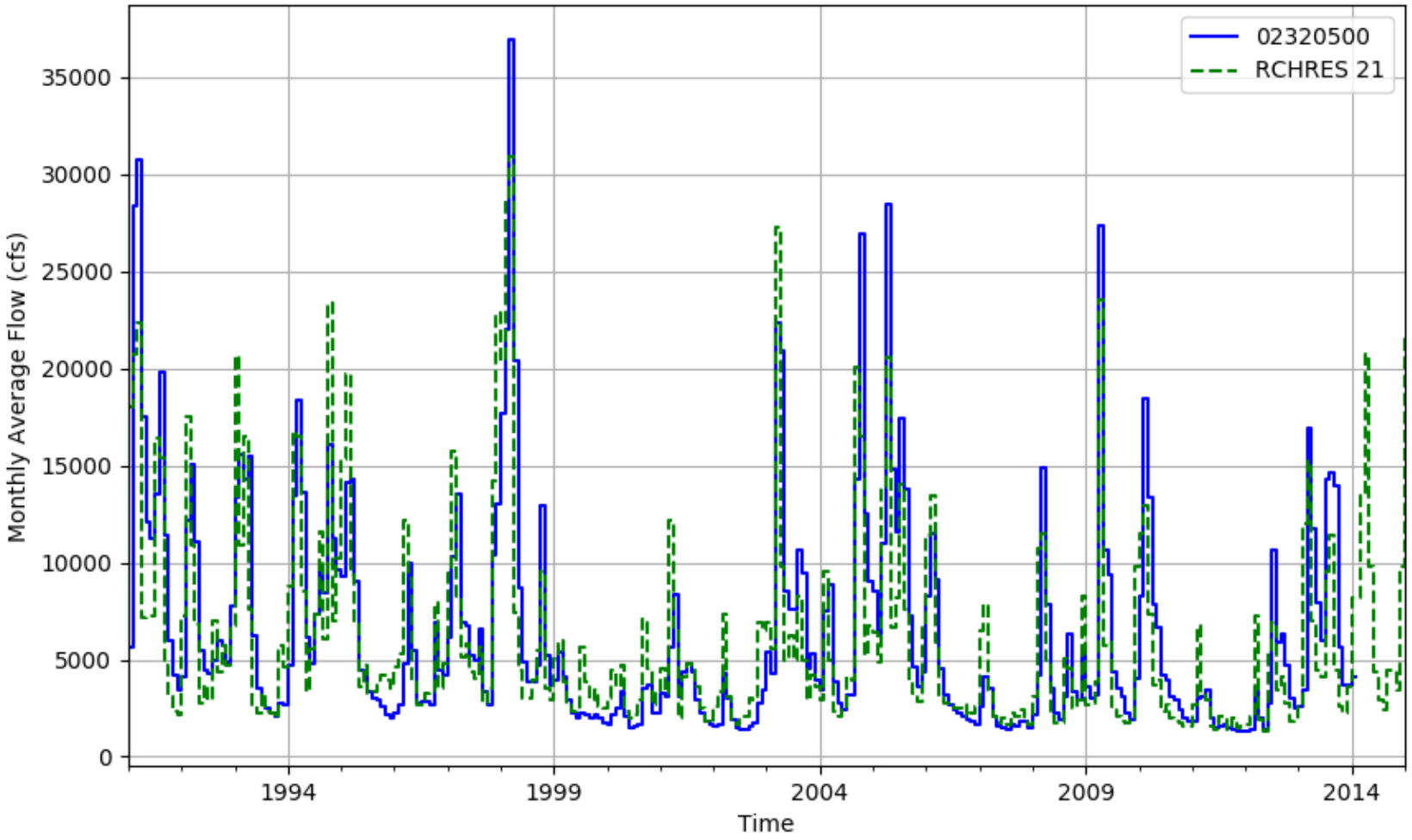
HSPF Phase 1


02319500
RCHRES 0
Monthly Average Flow (cfs)
35000
30000
25000
20000
15000
10000
5000
0
1994
1999
2004
2009
2014
Time

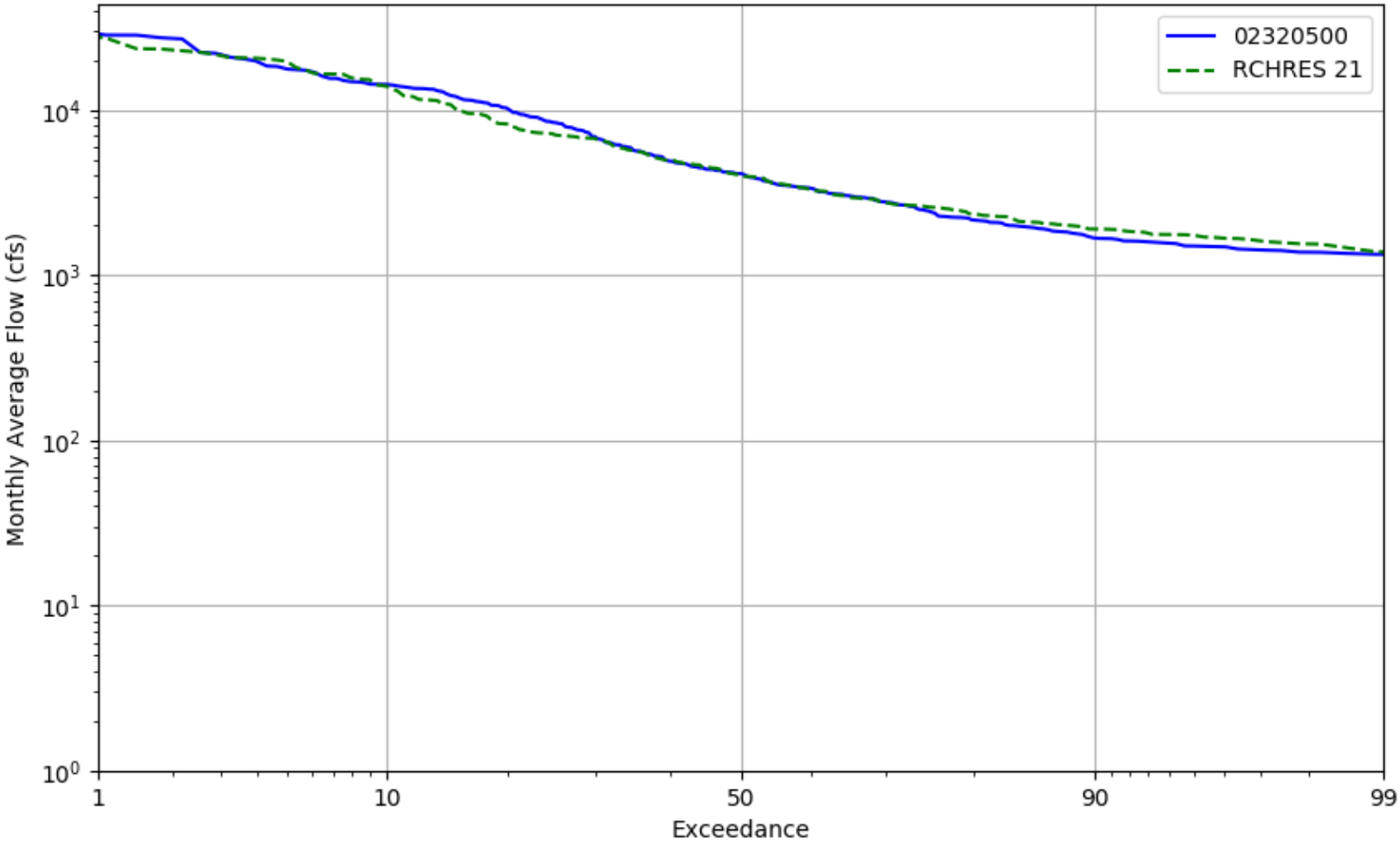
HSPF Phase 1


02319500
RCHRES 0
Monthly Average Flow (cfs)
10^4
10^3
10^2
10^1
10^0
1
10
50
90
99
Exceedance

HSPF Phase 1


02320500
RCHRES 21
Monthly Average Flow (cfs)
0
5000
10000
15000
20000
25000
30000
35000
1994
1999
2004
2009
2014
Time

HSPF Phase 1


02320500
RCHRES 21
Monthly Average Flow (cfs)
10^4
10^3
10^2
10^1
10^0
1
10
50
90
99
Exceedance

HSPF Phase 1

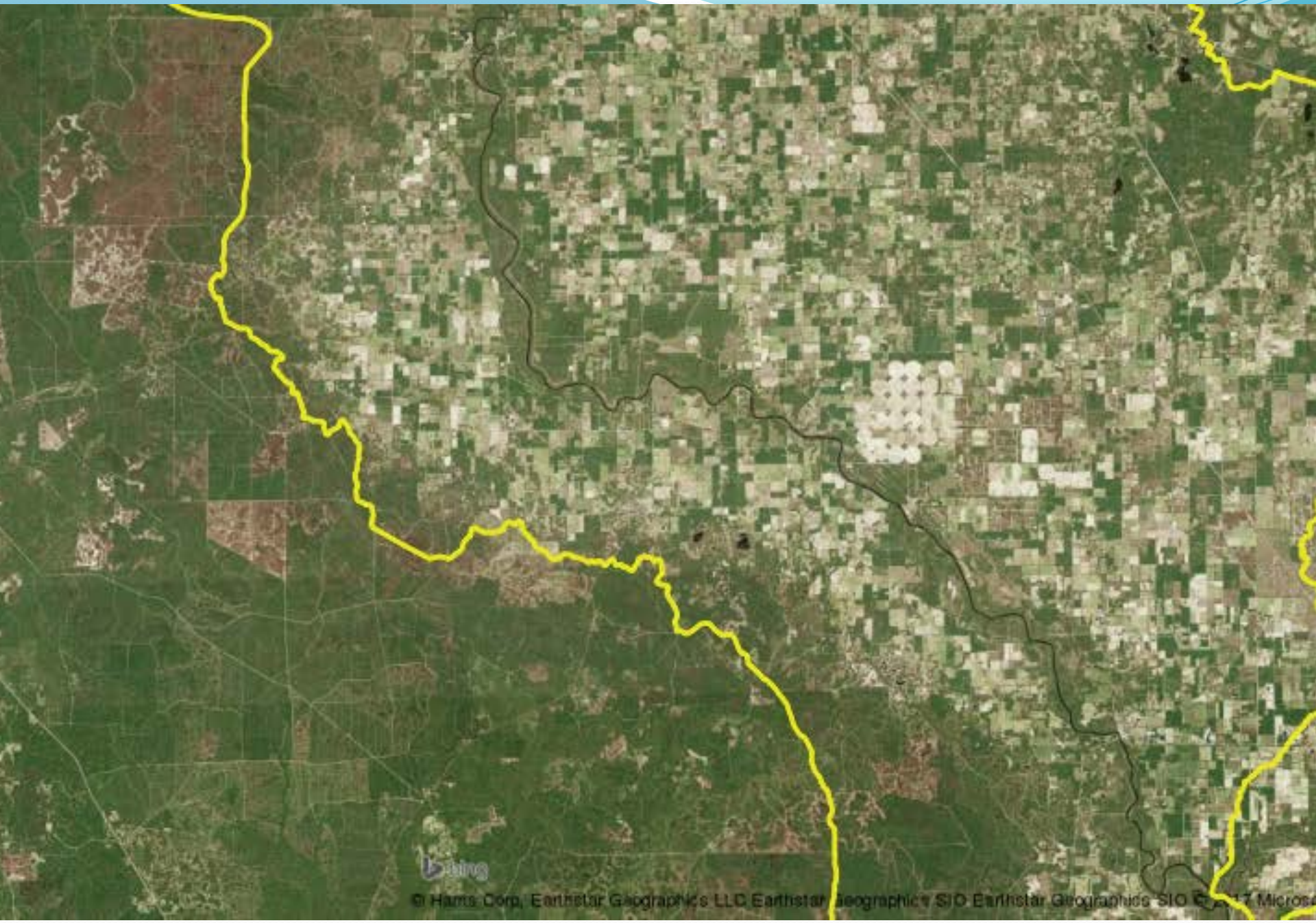
Peer Review Comment

- The objective function should increase the weighting of the total overall flow and the flow frequency relative to other measures
  - Increased weight to overall flow and flow frequency
  - After review increased the weight given to the literature estimates of Total Actual ET
  - Optimized parameters for all models using the new weights

HSPF Phase 1

Peer Review Comment

- Areal recharge should be less discontinuous at watershed boundaries; provide recharge areal displays (maps) for each land use category and the overall recharge to verify that it is relatively continuous
  - The obvious discontinuities along the western boundary of the Lower Suwannee River and along Trail Ridge are explainable because of differences in land cover and hydrology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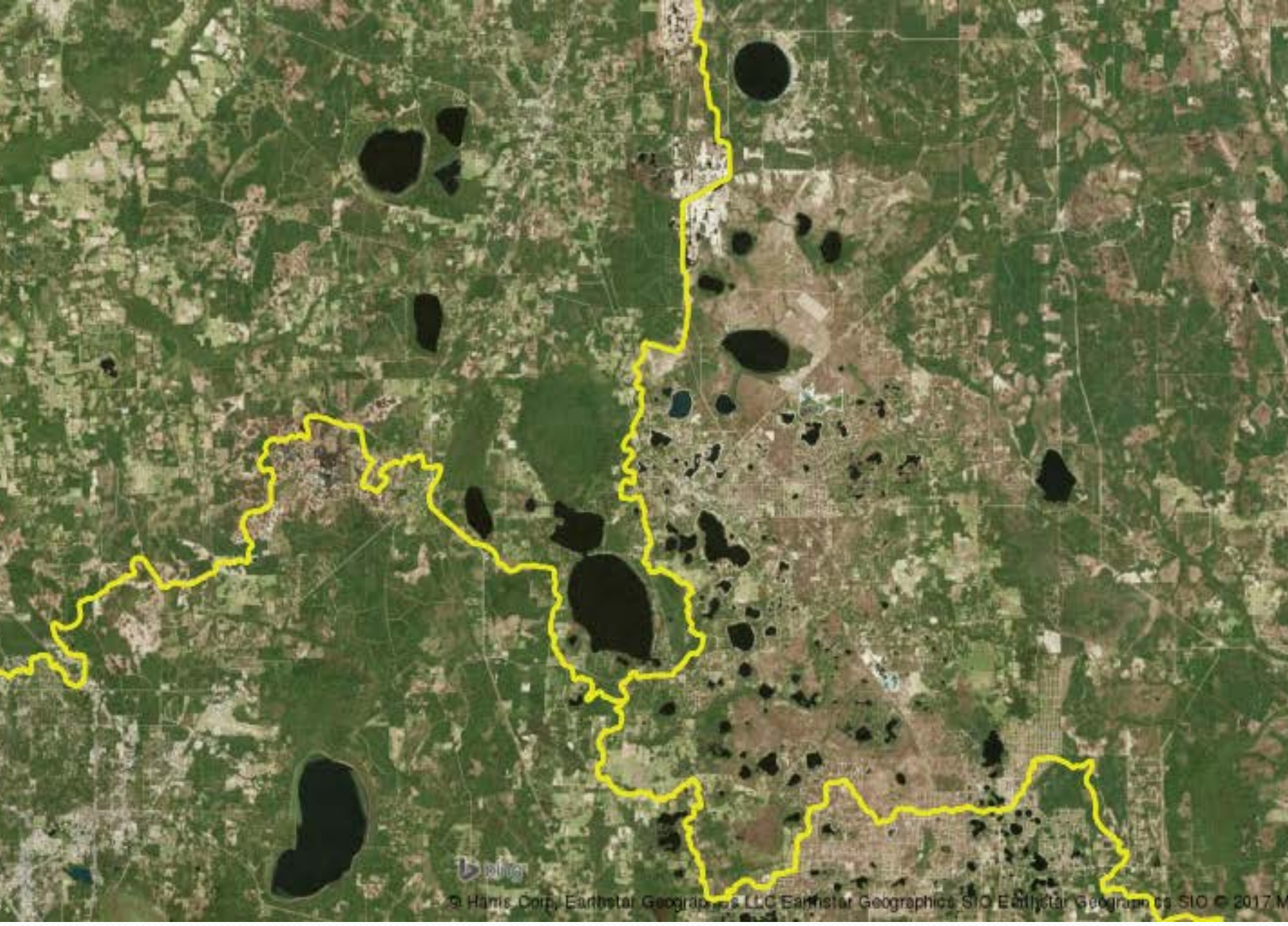
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HSPF Phase 1

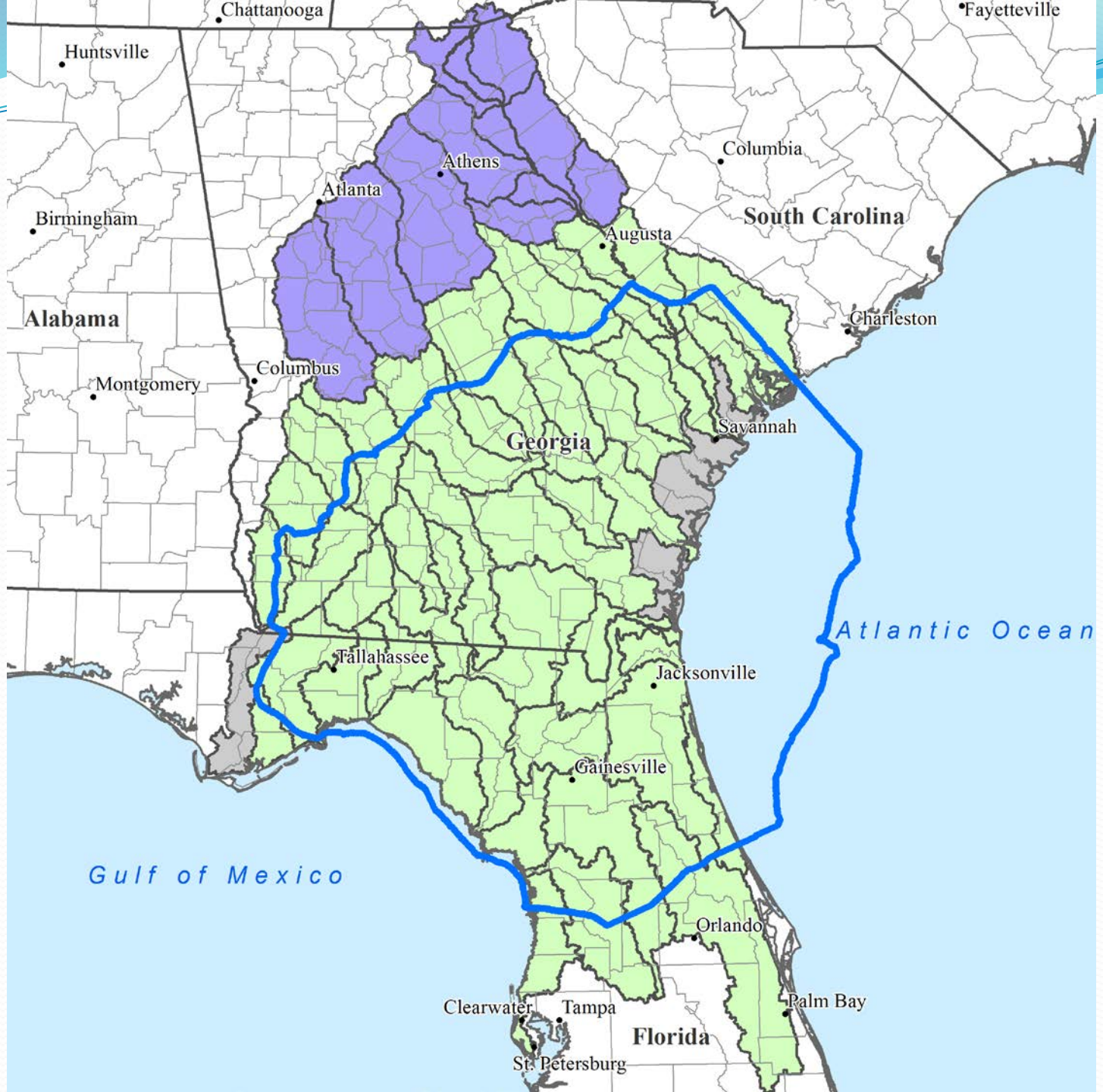
Peer Review Comment

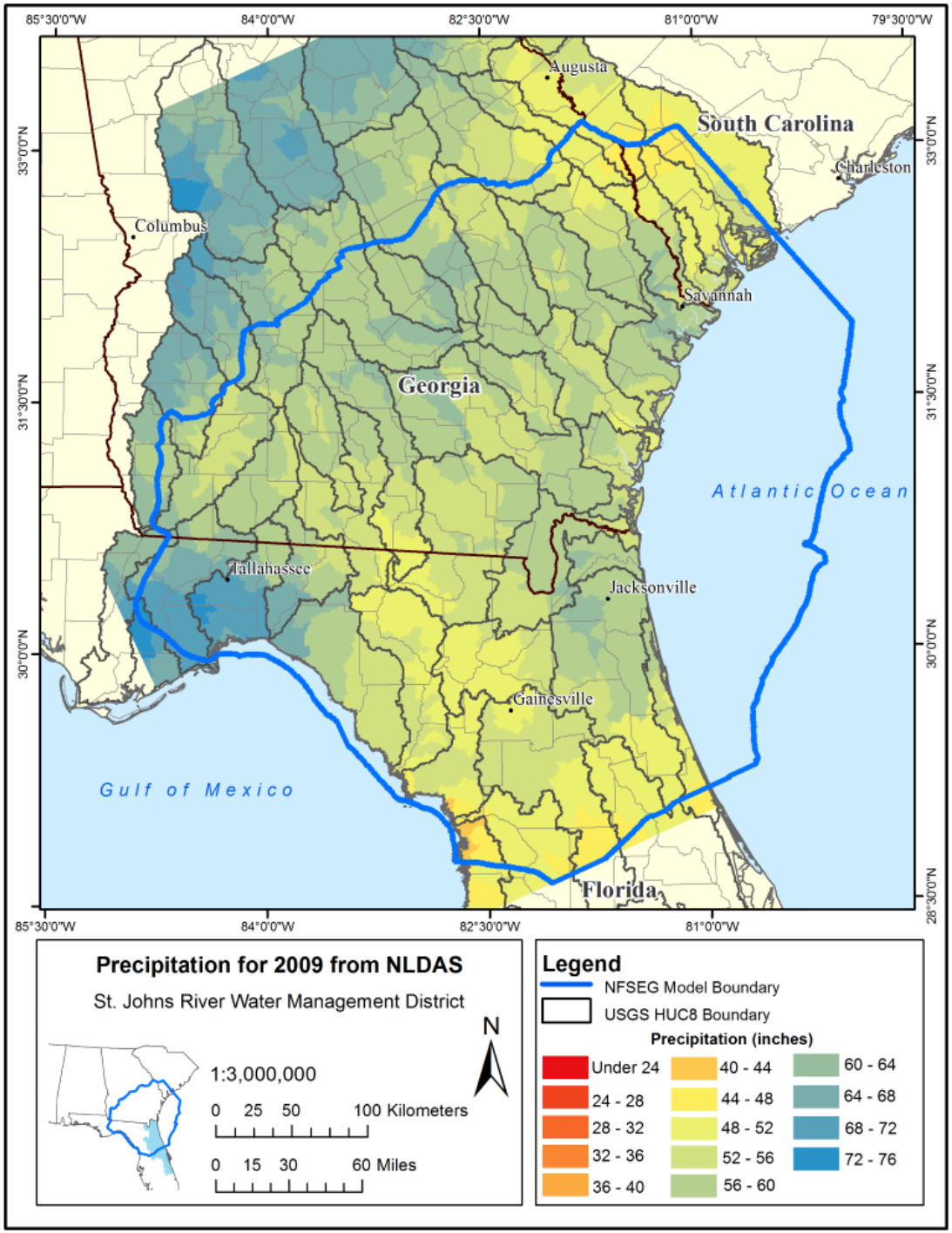
- Provide details of the overall recharge computation from the land use category recharge
  - Took advantage of VRTs (ViRTual GIS datasets) which are short XML files that allowed a simple lookup table between the PERLND label raster and HSPF results from the binary file
  - Will include documentation of post-processing

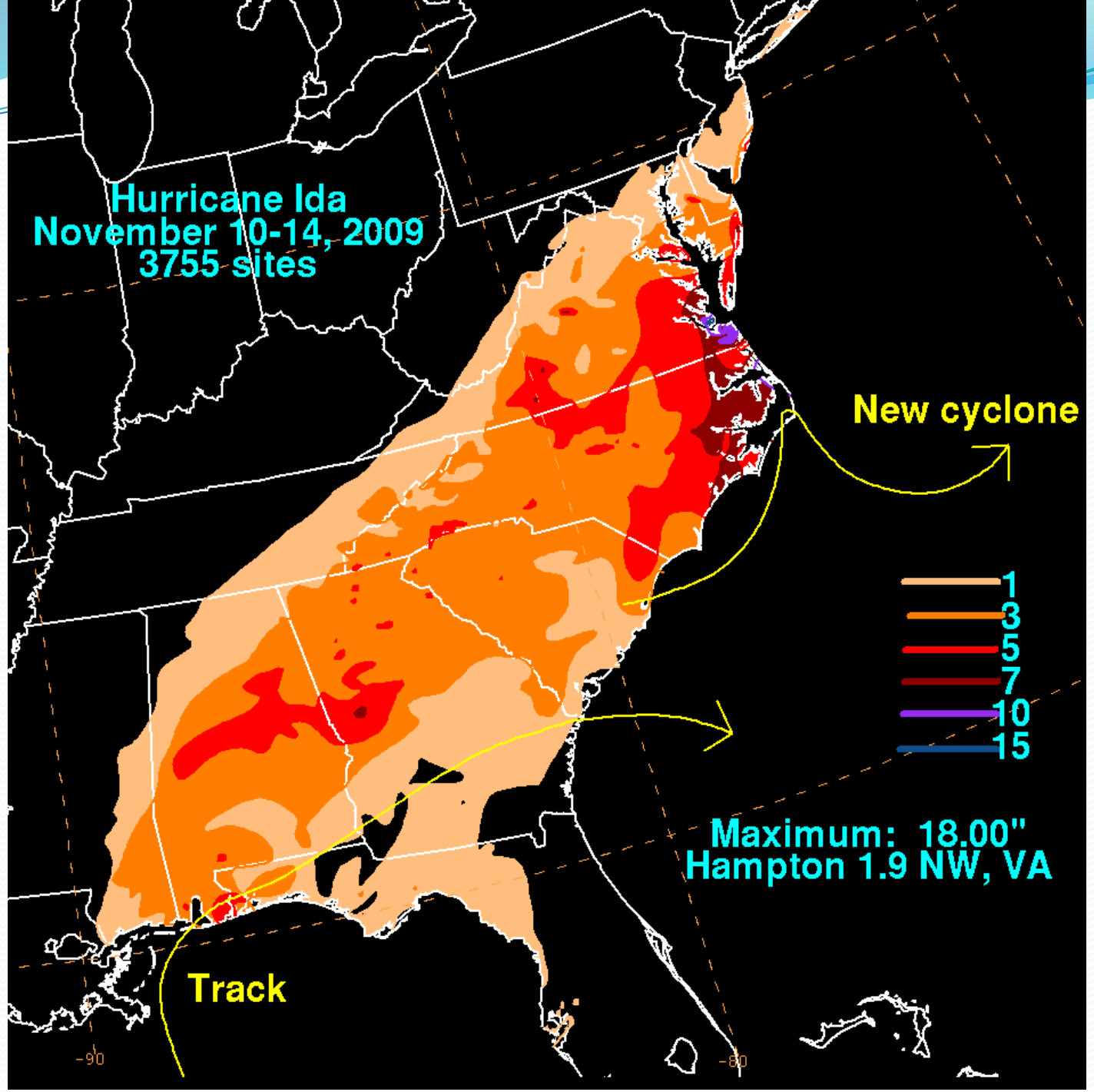
HSPF Phase 1

Peer Review Comment

- In the documentation, include more detail of the PEST calibration and objective function, including components and their initial and revised weights
  - Will add more detail


Chattanooga
Fayetteville
Huntsville
Athens
Columbia
Atlanta
Birmingham
South Carolina
Augusta
Alabama
Charleston
Columbus
Montgomery
Savannah
Georgia
Atlantic Ocean
Tallahassee
Jacksonville
Gainesville
Gulf of Mexico
Orlando
Clearwater
Tampa
Palm Bay
Florida
St. Petersburg

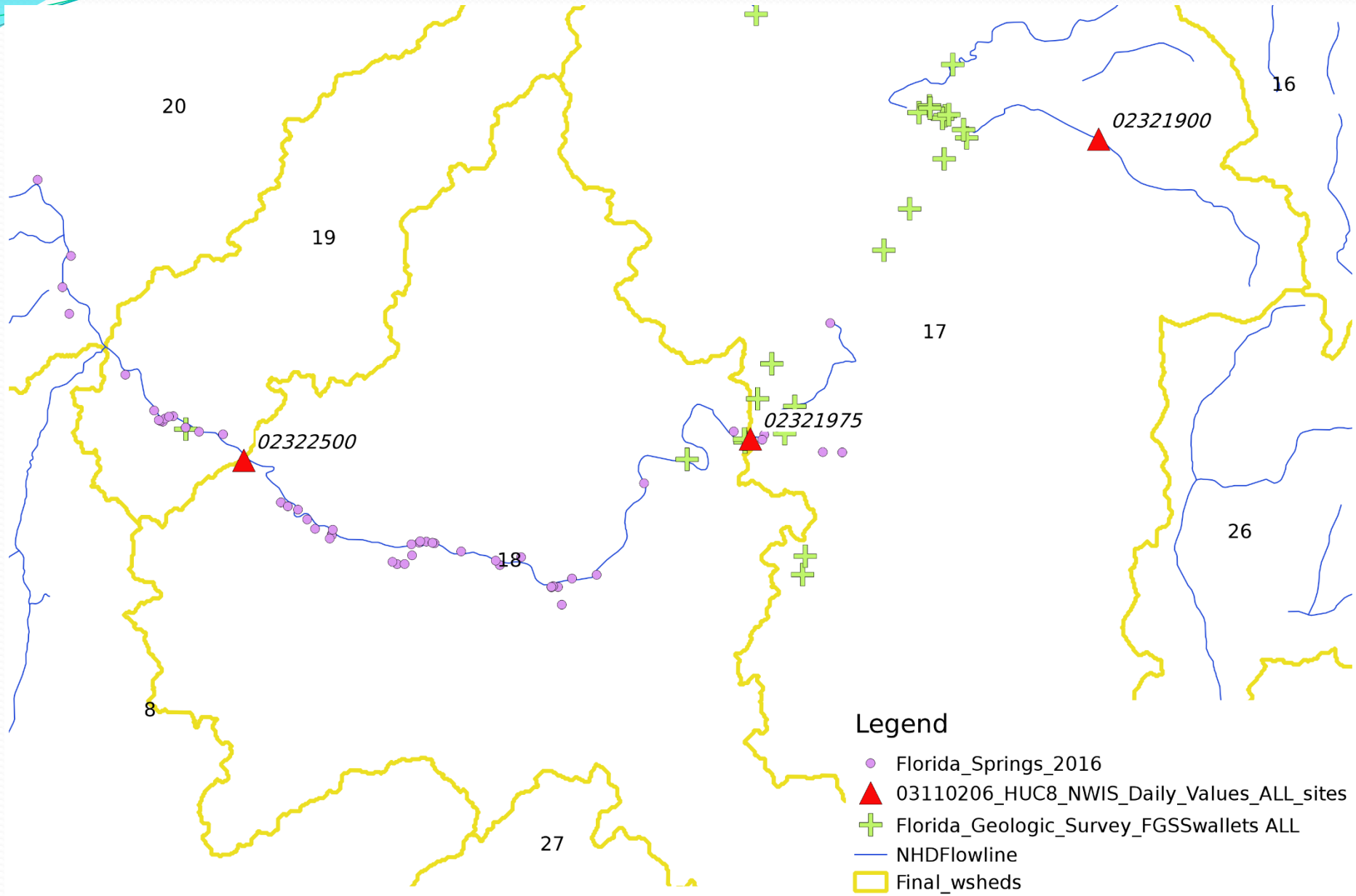

85°30'0"W
84°0'0"W
82°30'0"W
81°0'0"W
79°30'0"W
33°0'0"N
31°30'0"N
30°0'0"N
28°30'0"N
Augusta
South Carolina
Charleston
Columbus
Savannah
Georgia
Atlantic Ocean
Tallahassee
Jacksonville
Gainesville
Gulf of Mexico
Florida
Precipitation for 2009 from NLDAS
St. Johns River Water Management District
1:3,000,000
0 25 50 100 Kilometers
0 15 30 60 Miles
N
Legend
NFSEG Model Boundary
USGS HUC8 Boundary
Precipitation (inches)
Under 24
24 - 28
28 - 32
32 - 36
36 - 40
40 - 44
44 - 48
48 - 52
52 - 56
56 - 60
60 - 64
64 - 68
68 - 72
72 - 76


Hurricane Ida
November 10-14, 2009
3755 sites
New cyclone
1
3
5
7
10
15
Maximum: 18.00"
Hampton 1.9 NW, VA
Track
-90
-80

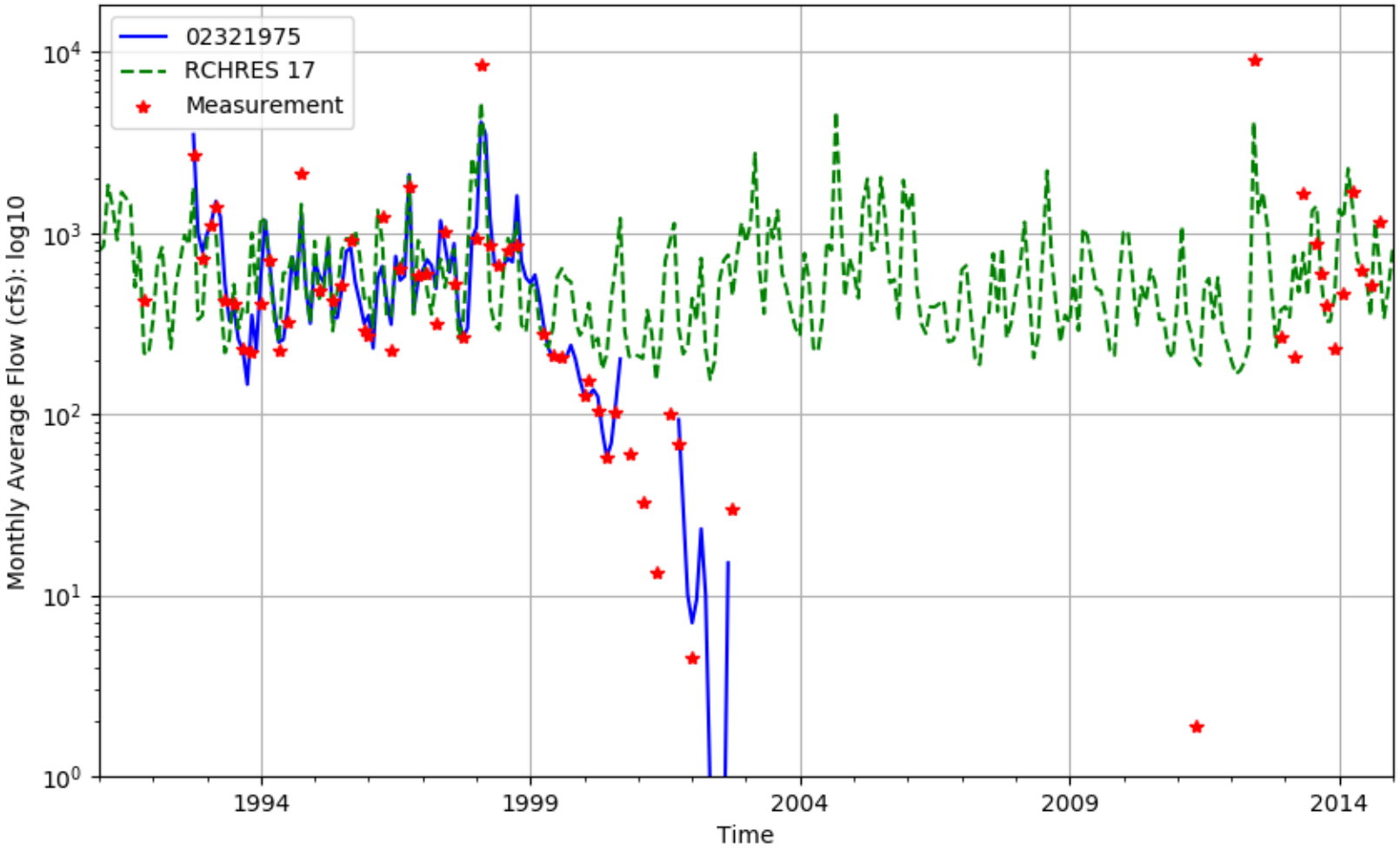
HSPF Phase 1

- USGS Gauges
  - 02321975: SANTA FE RIVER AT US HWY 441 NEAR HIGH SPRINGS
  - 02322500: SANTA FE RIVER NEAR FORT WHITE

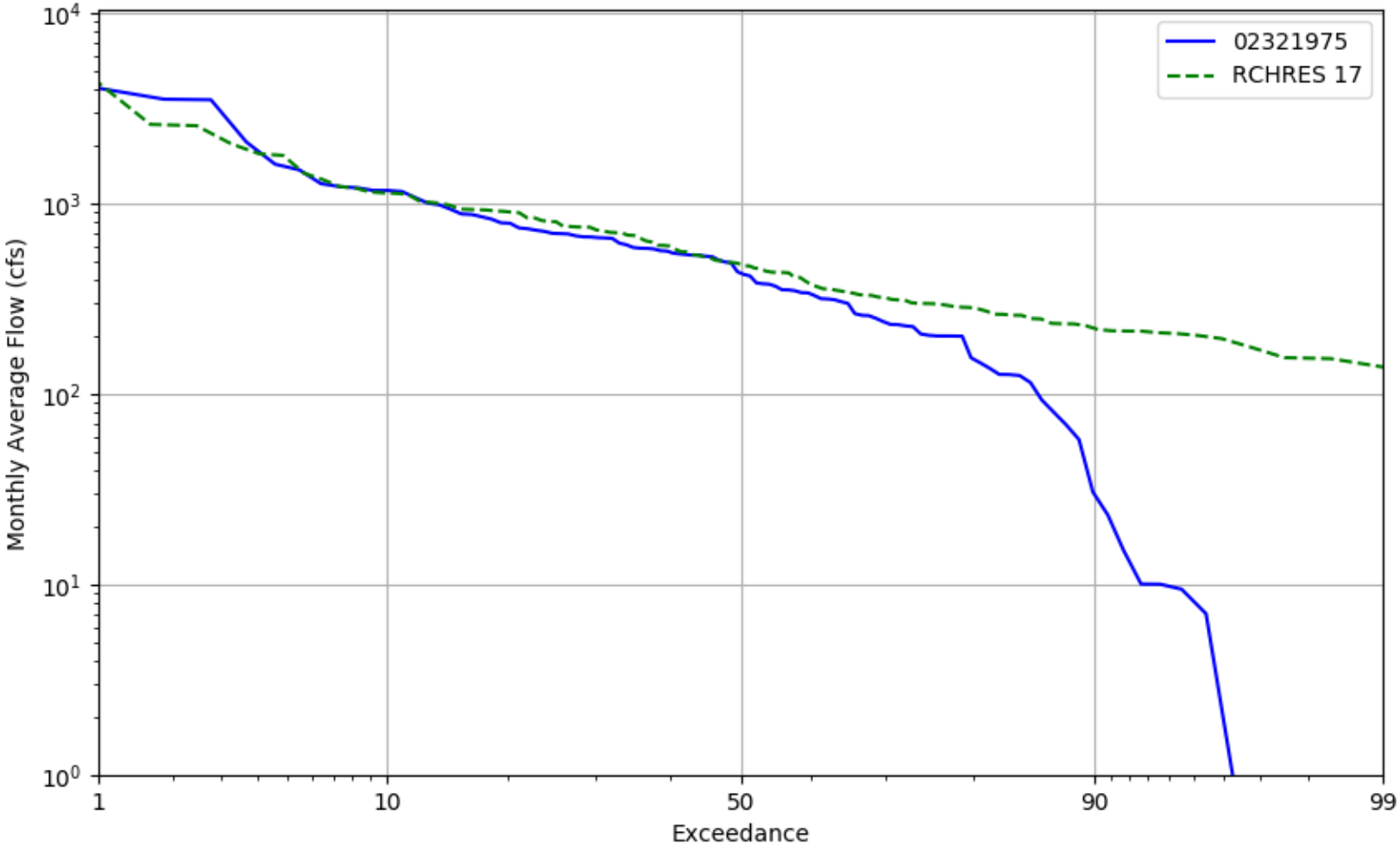
HSPF Phase 1


20
19
18
8
27
17
16
26
02322500
02321975
02321900
Legend
Florida_Springs_2016
03110206_HUC8_NWIS_Daily_Values_ALL_sites
Florida_Geologic_Survey_FGSSwallets ALL
NHDFlowline
Final_wsheds

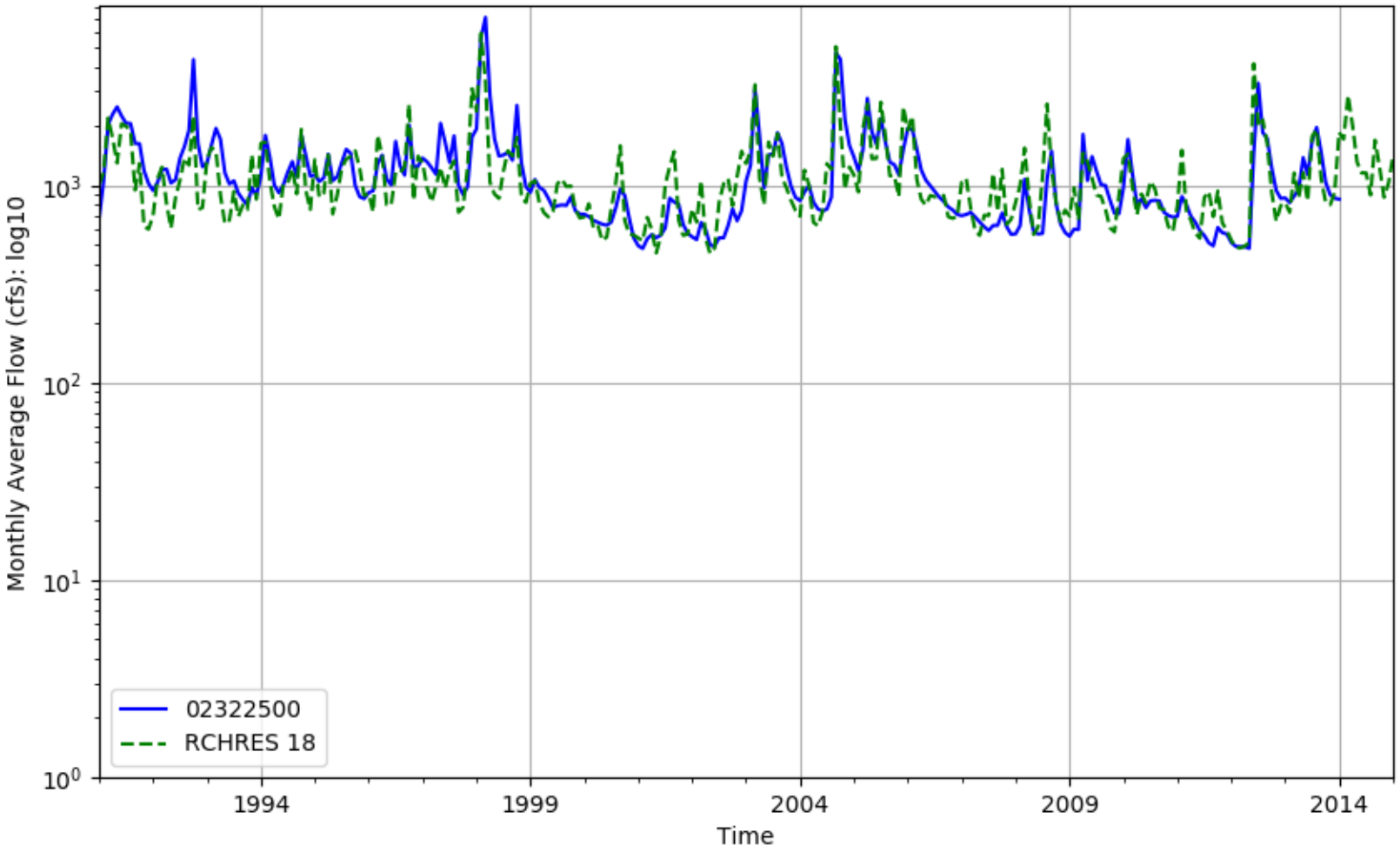
HSPF Phase 1


02321975
RCHRES 17
Measurement
Monthly Average Flow (cfs): log10
10^4
10^3
10^2
10^1
10^0
1994
1999
2004
2009
2014
Time

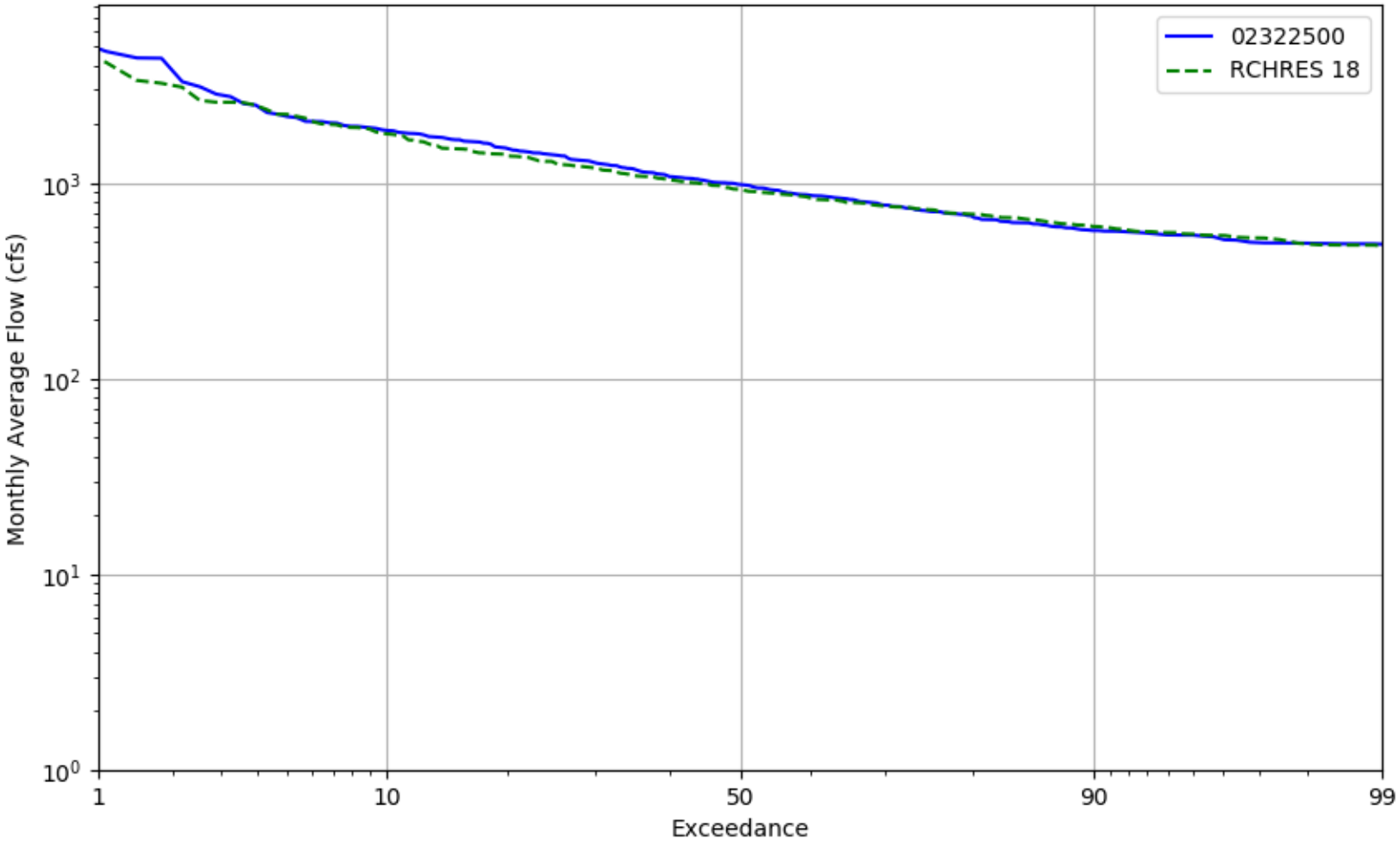
HSPF Phase 1


02321975
RCHRES 17
Monthly Average Flow (cfs)
10^4
10^3
10^2
10^1
10^0
1
10
50
90
99
Exceedance

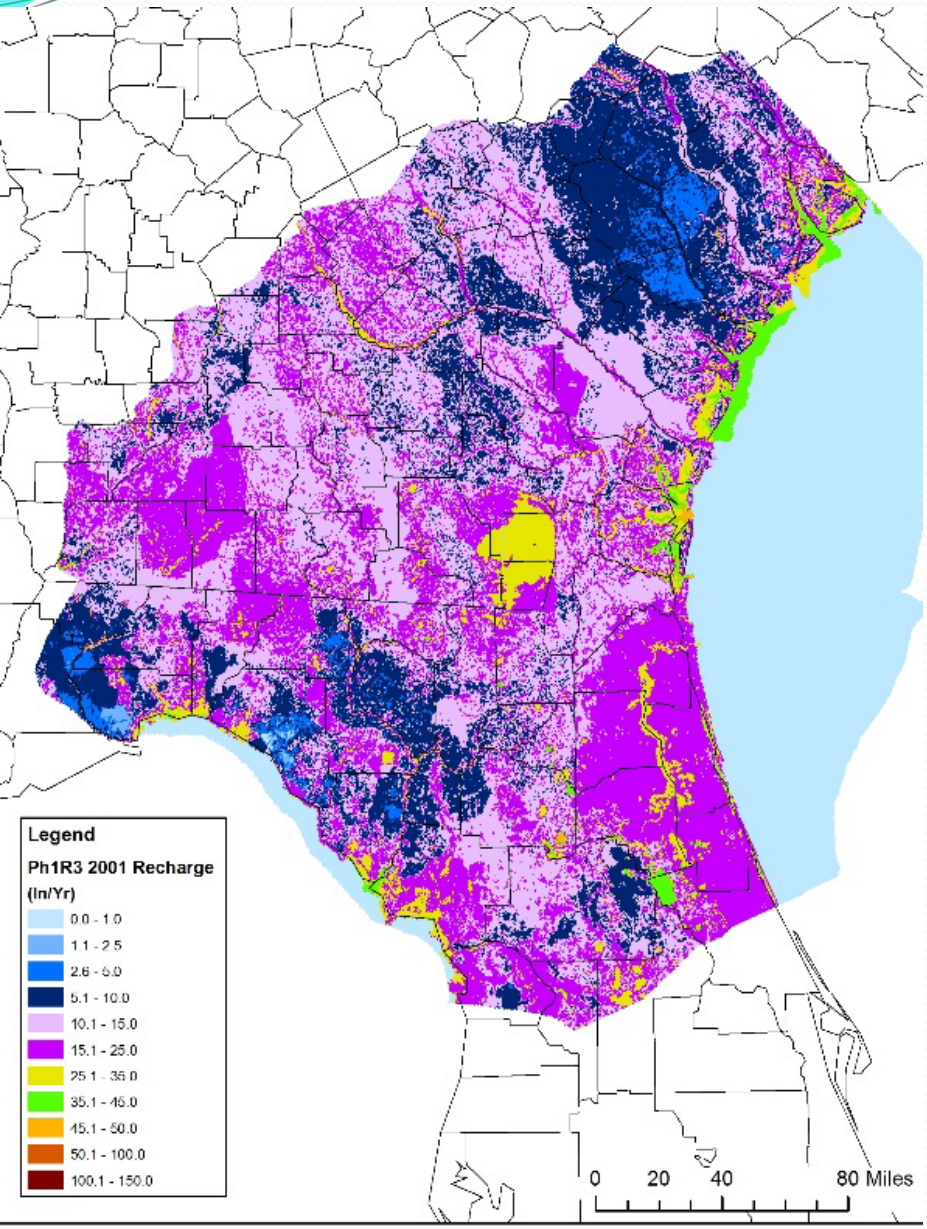
HSPF Phase 1

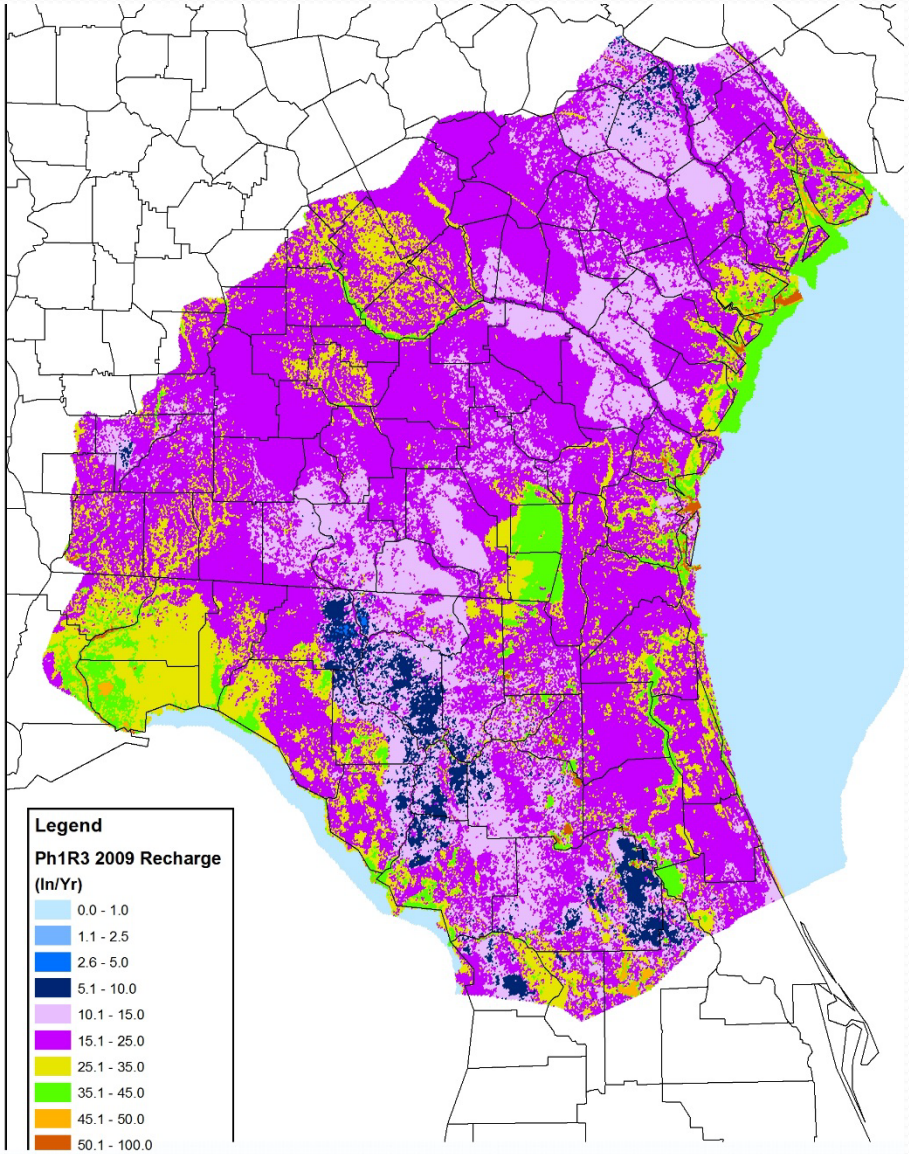

Monthly Average Flow (cfs): log10
10^3
10^2
10^1
10^0
1994
1999
2004
2009
2014
Time
02322500
RCHRES 18

HSPF Phase 1

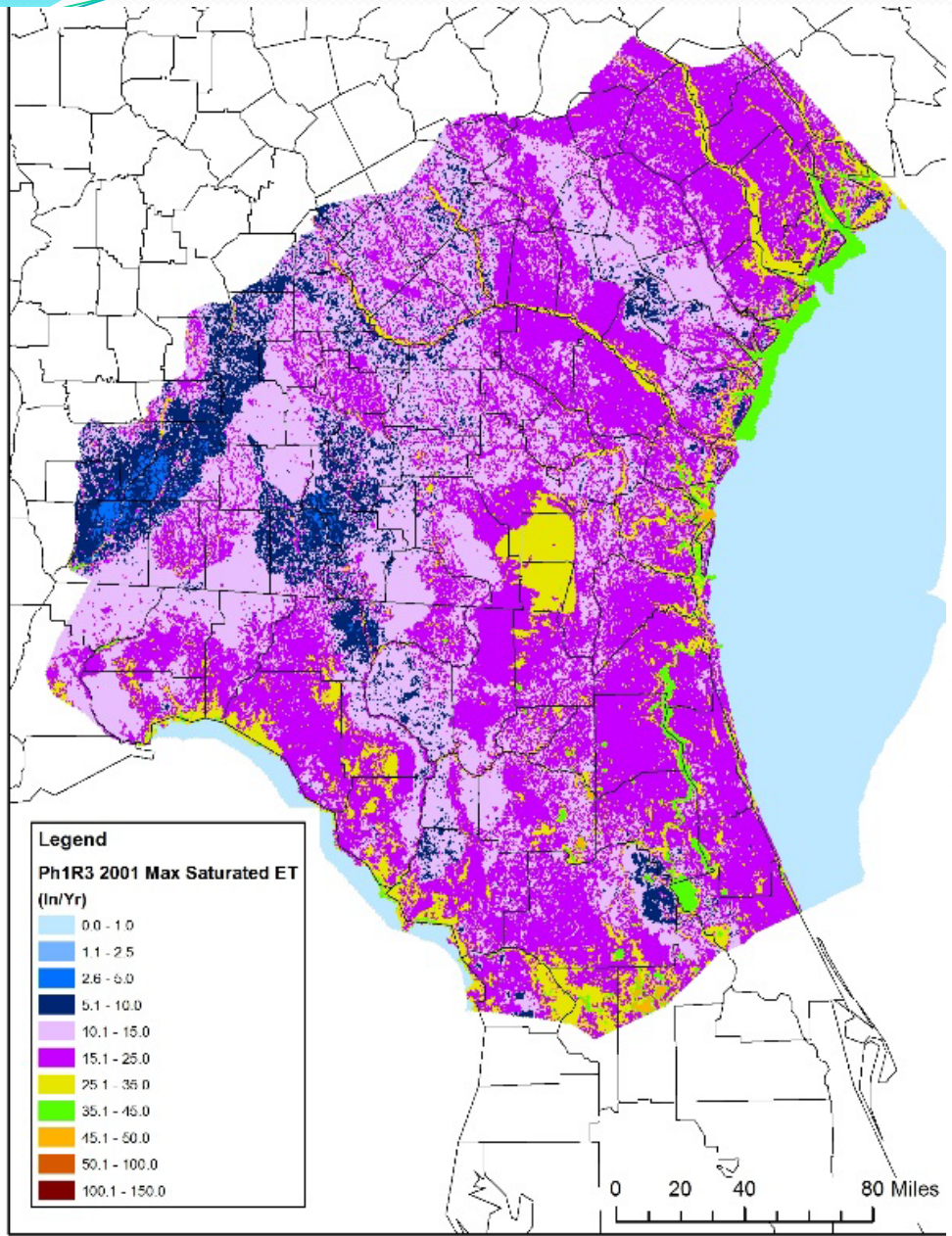

02322500
RCHRES 18
Monthly Average Flow (cfs)
10^3
10^2
10^1
10^0
1
10
50
90
99
Exceedance

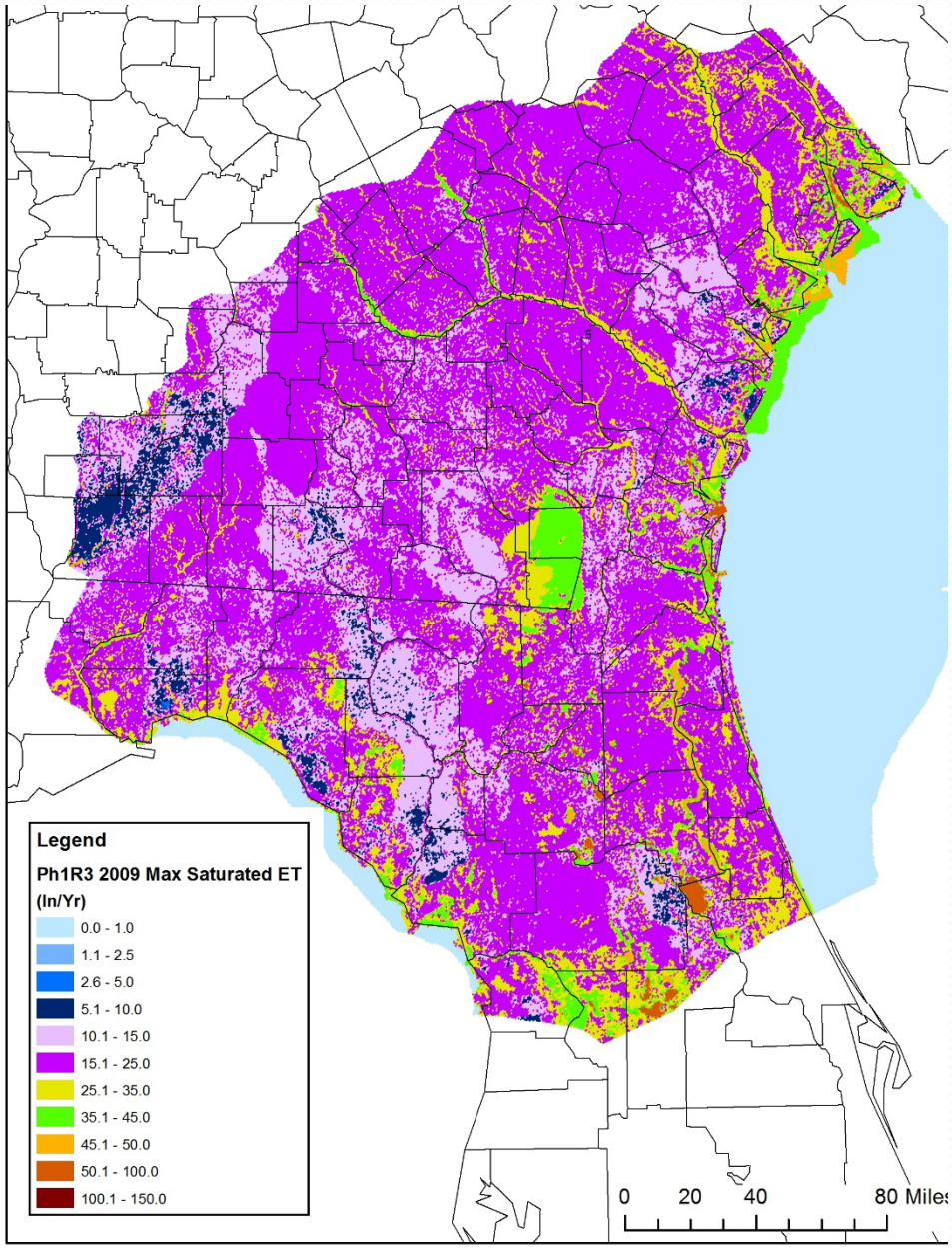
HSPF Phase 1 New Recharge





HSPF Phase 1 New Max Sat ET





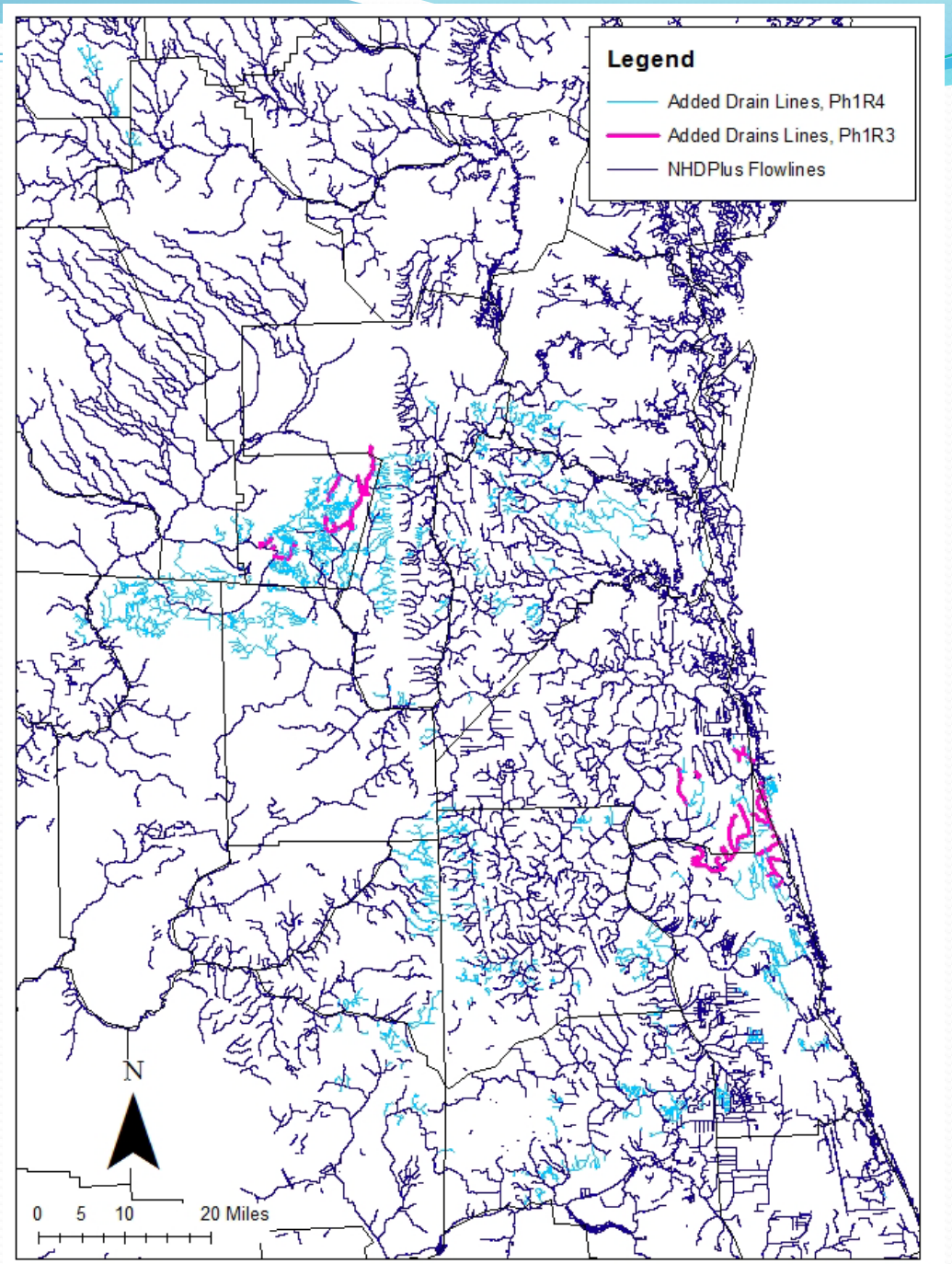
MODFLOW

MODFLOW Phase 1

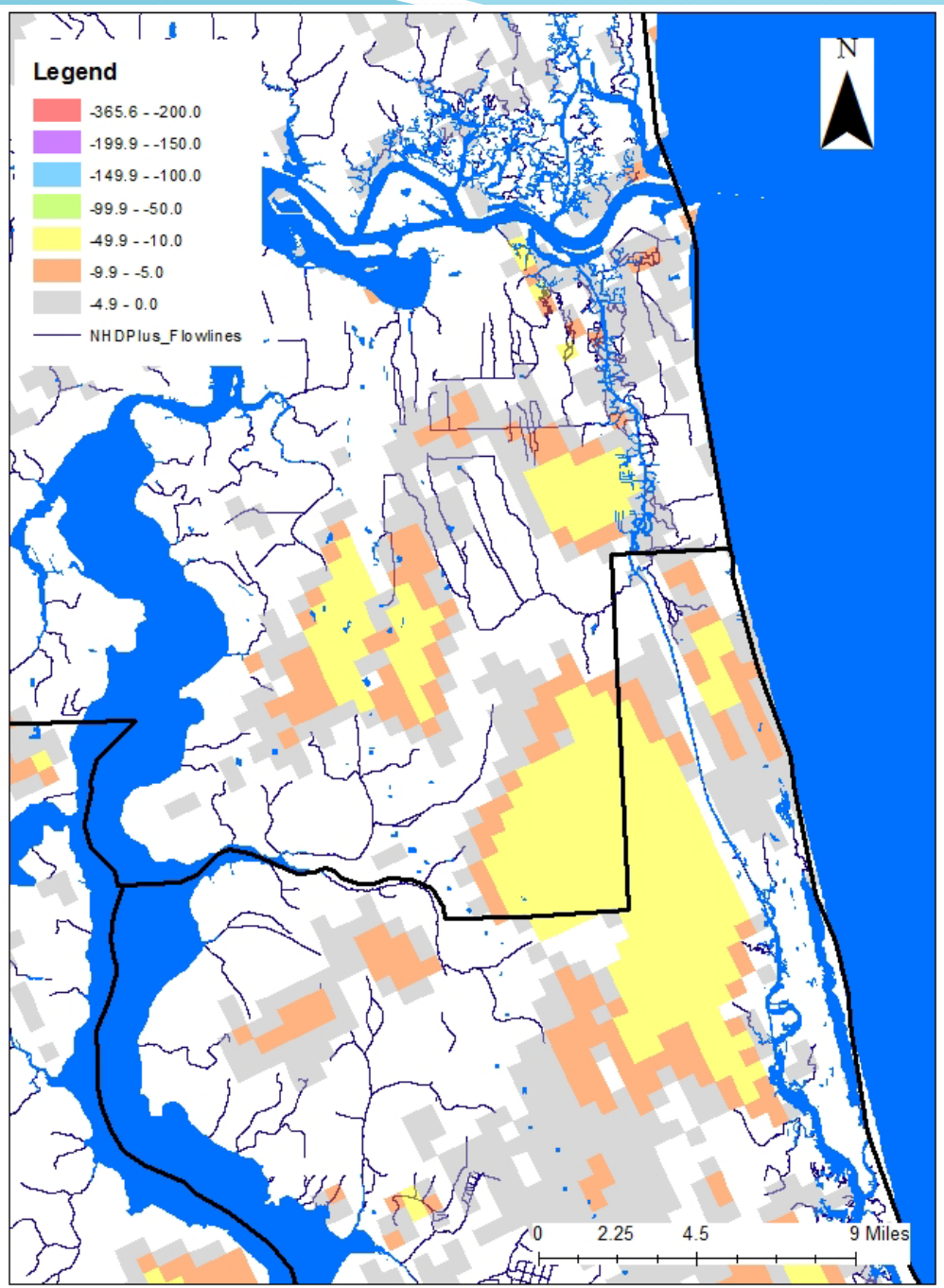
Improvements to Groundwater Flow Model

- Recharge and Max ETsat updates (in process)
- Additional drain features (in process)

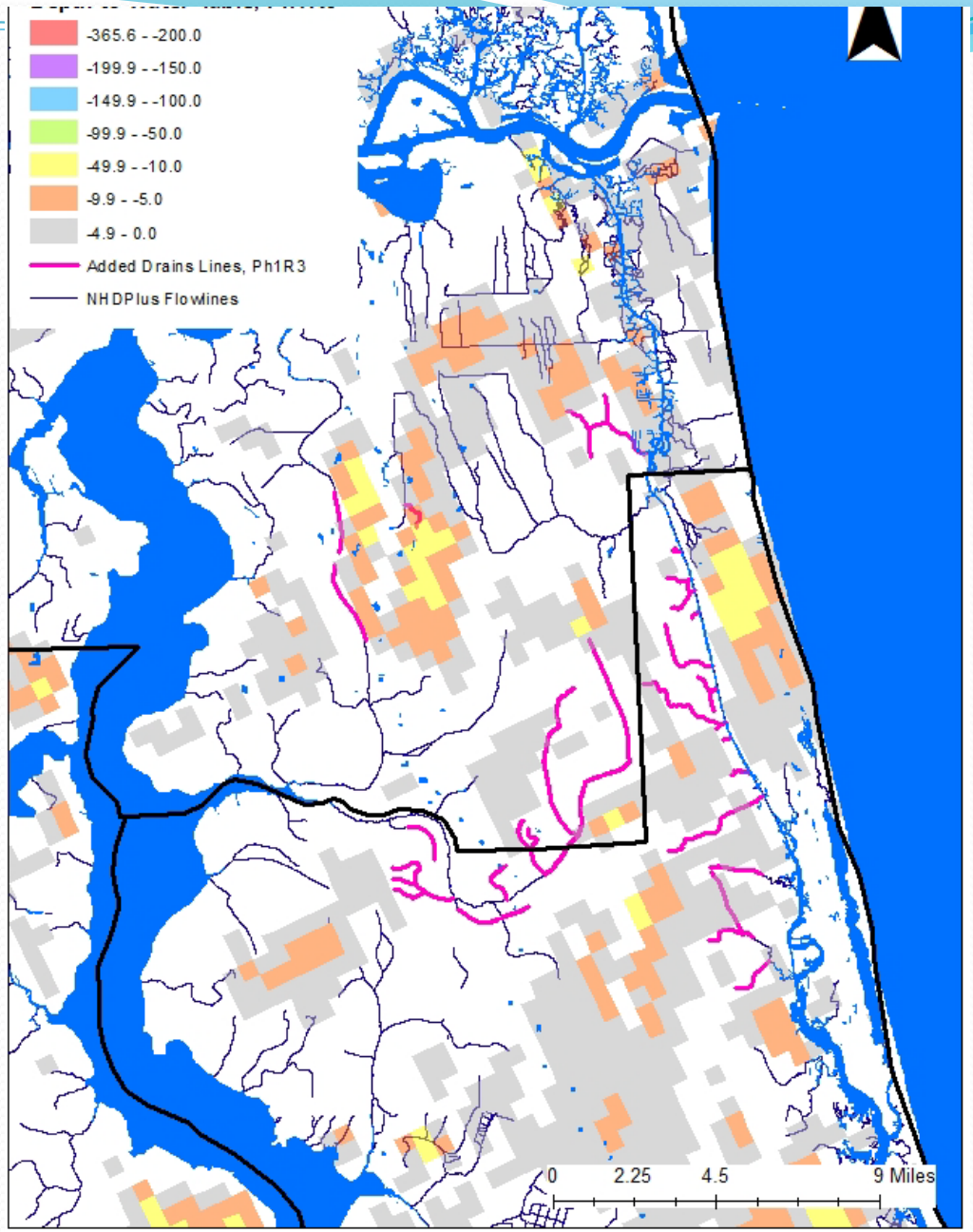
Additional Drain Features



Additional Drain Features



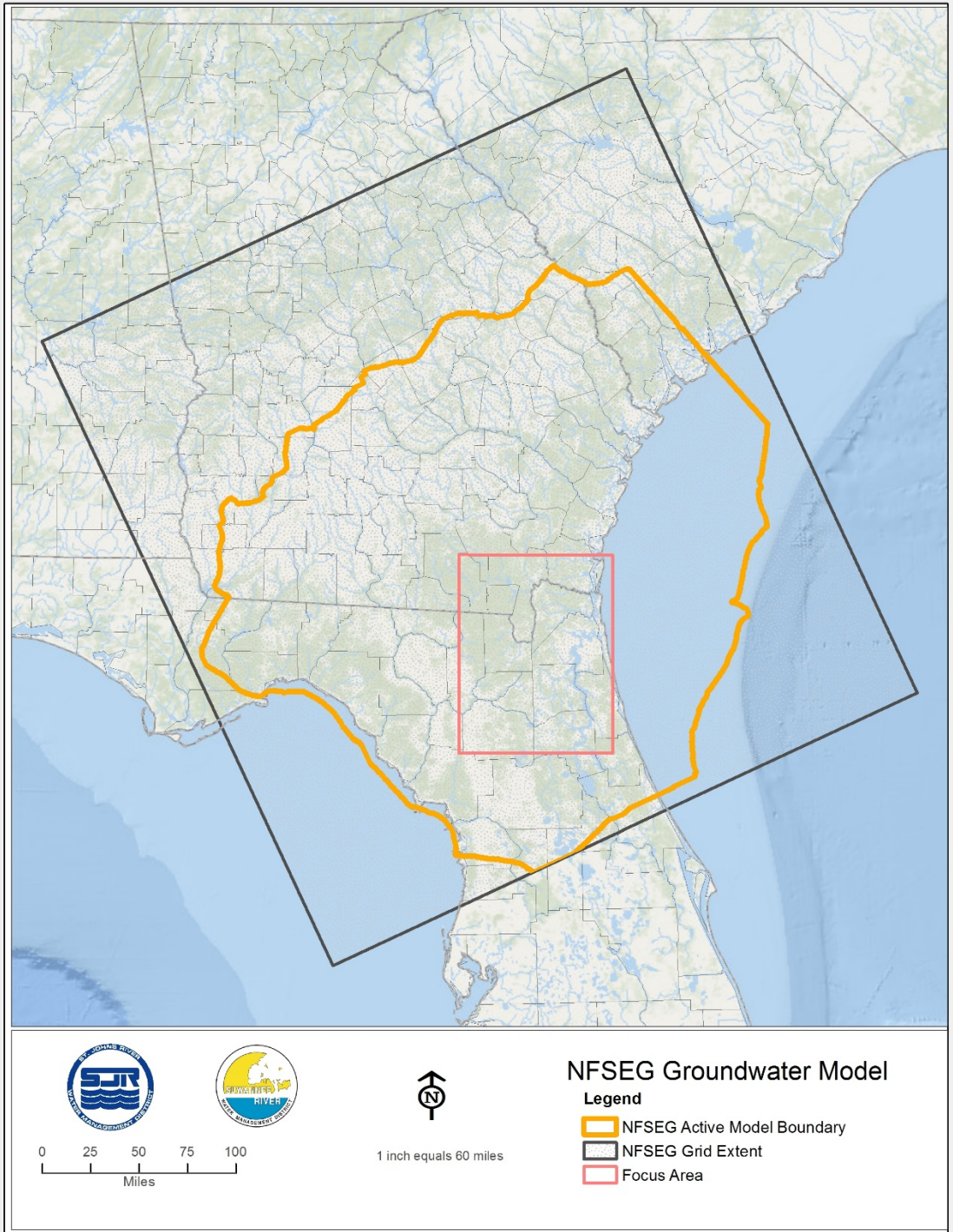
Additional Drain Features



Preliminary Simulation Results
Run 3 of PEST History Match

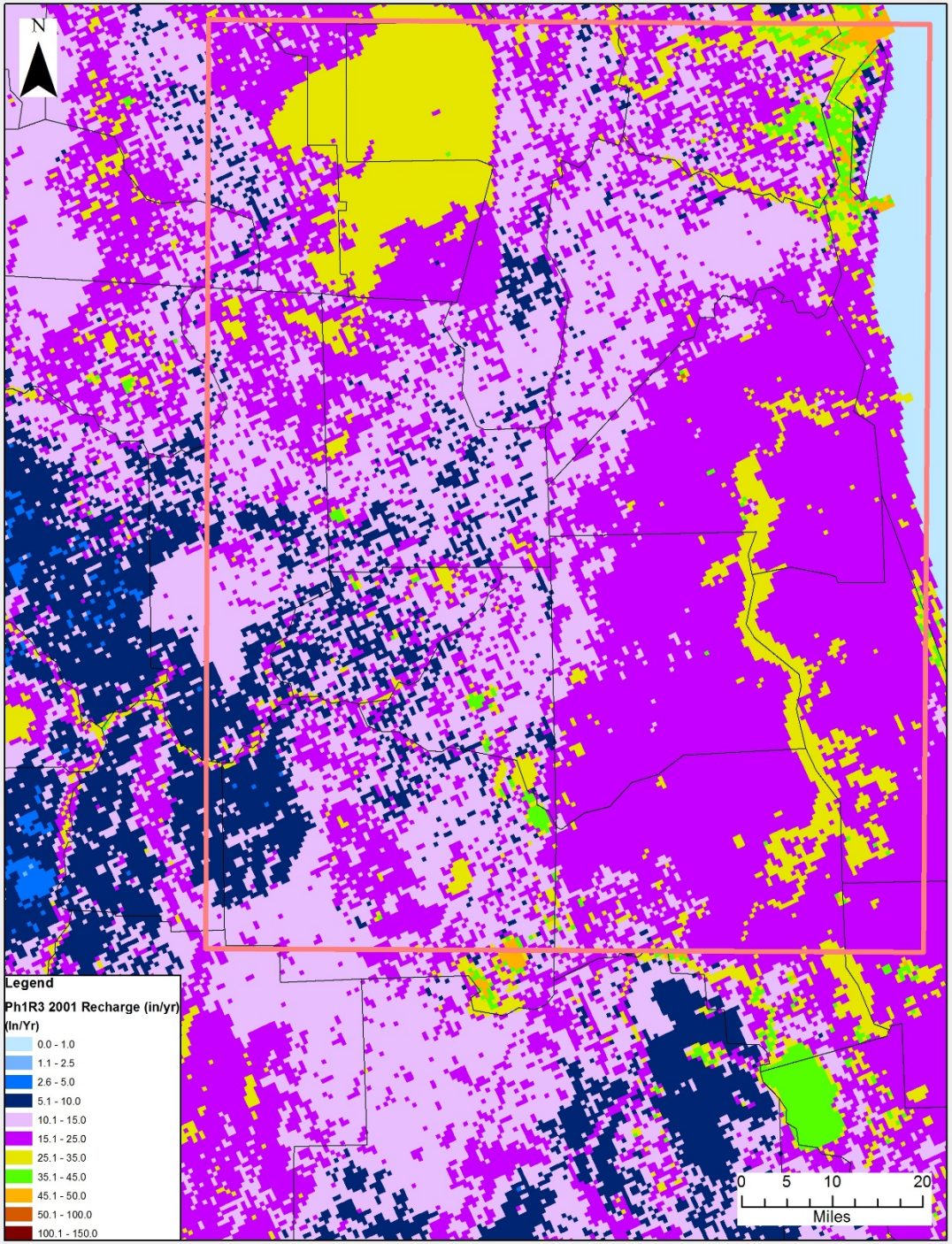
Phase 1 Focus Area

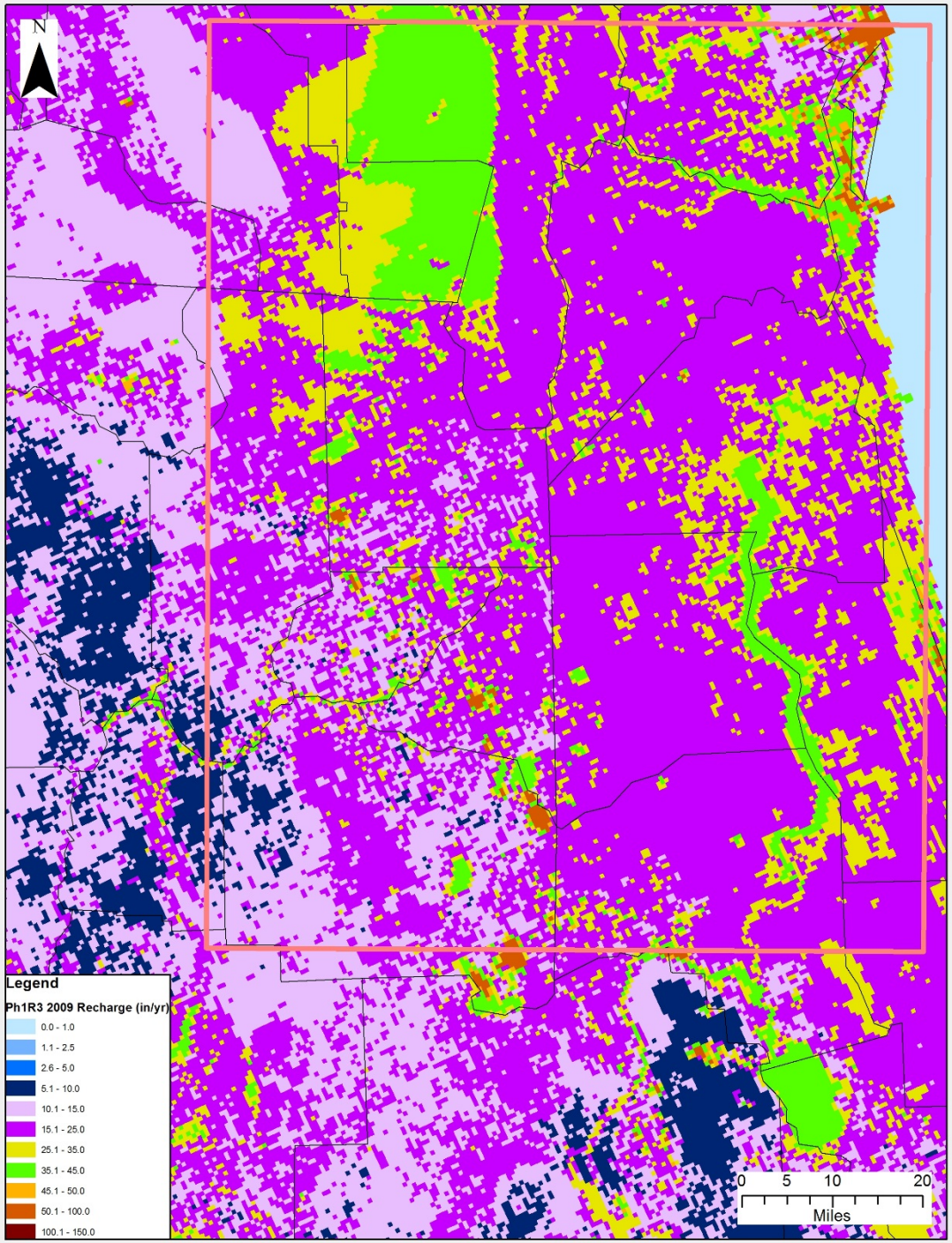
Phase 1 Focus Area



Phase 1 Focus Area

Recharge 2001



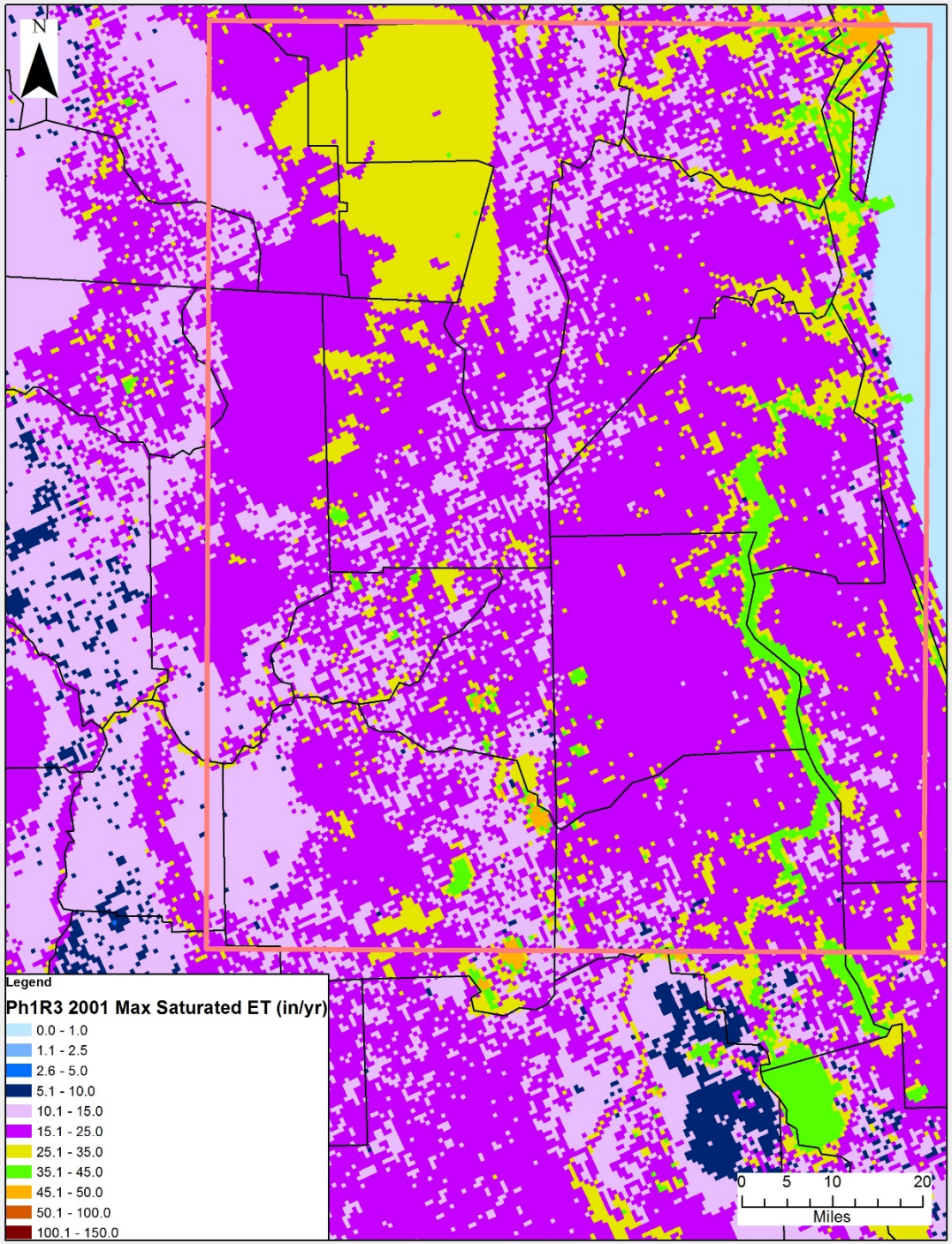


Phase 1 Focus Area

Recharge 2009

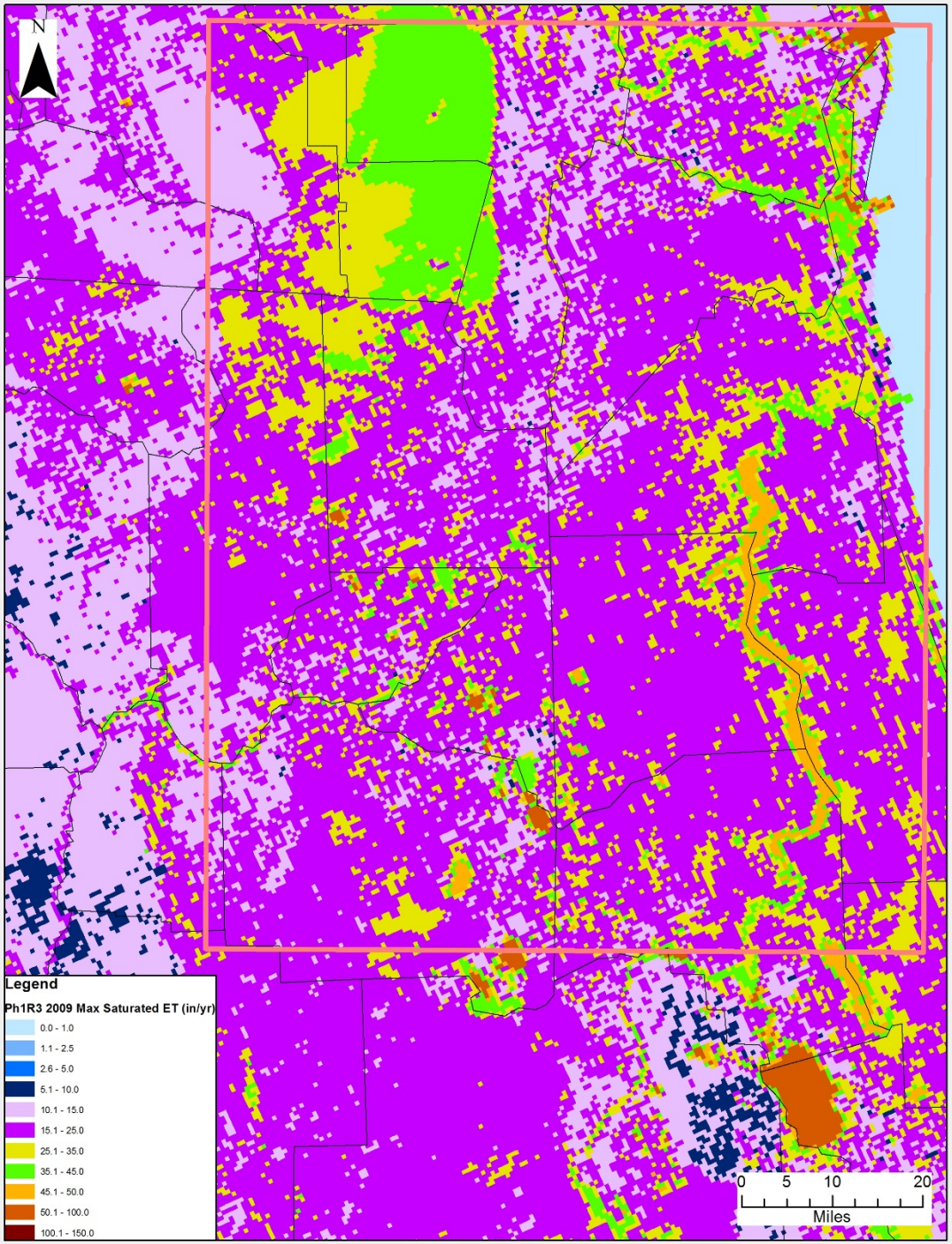
Phase 1 Focus Area

Max ETsat 2001

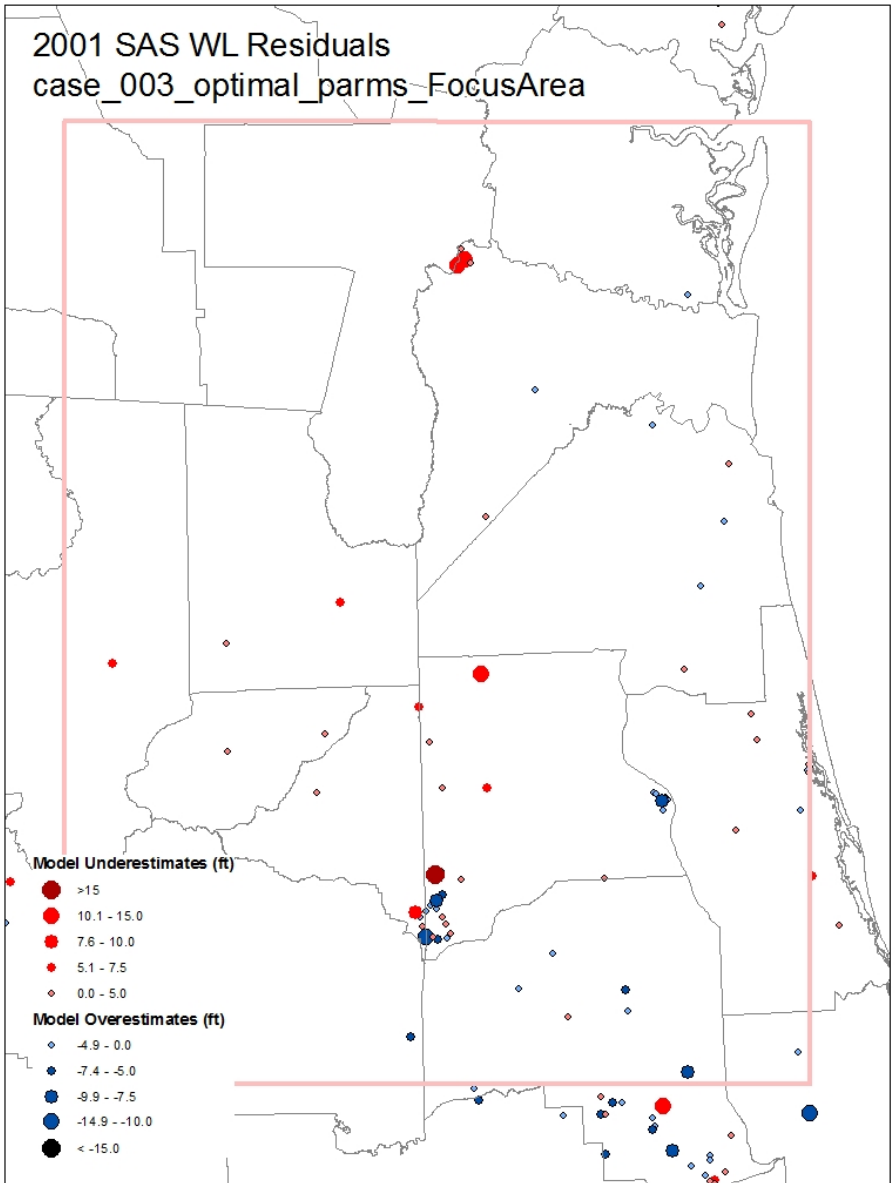


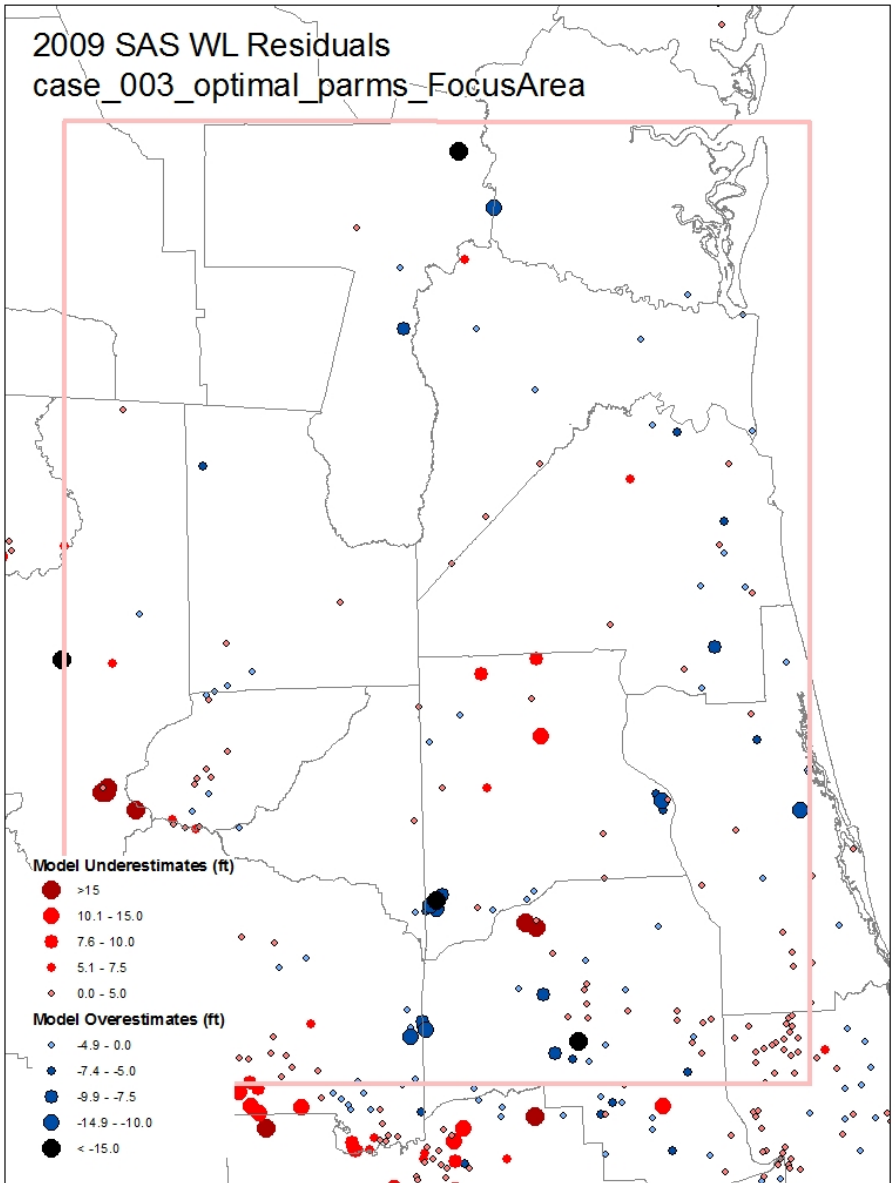
Phase 1 Focus Area

Max ETsat 2009

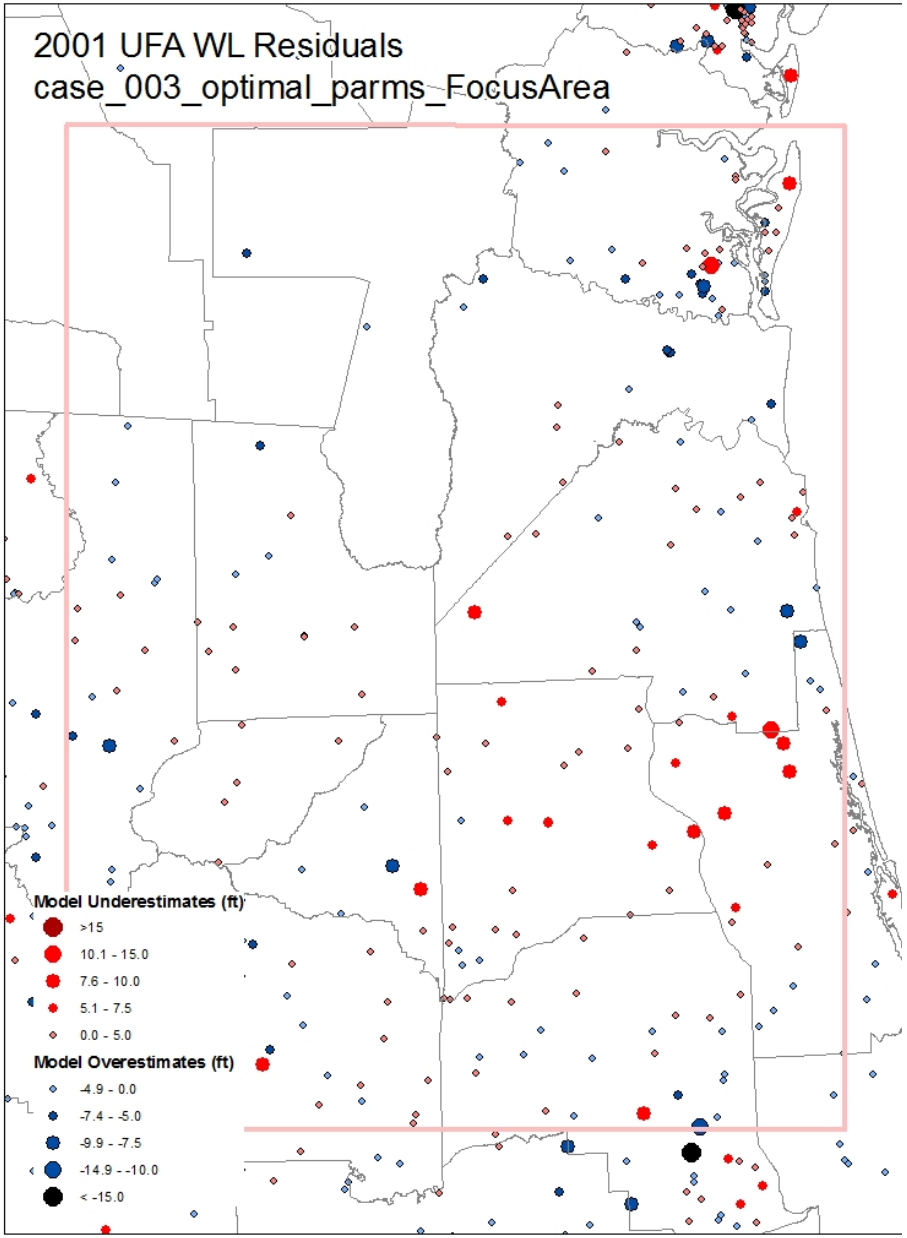


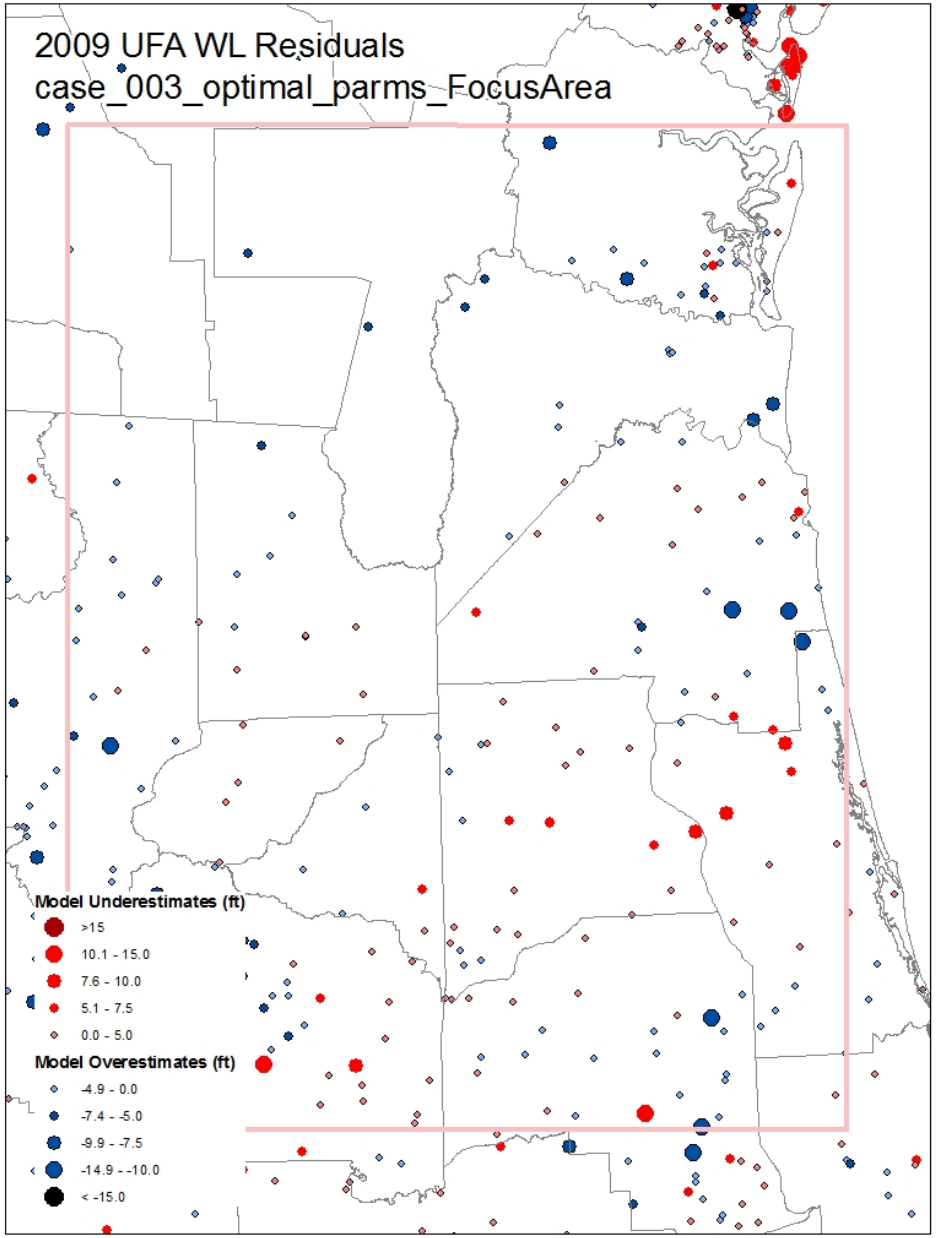
GW Level Residuals Layer 1

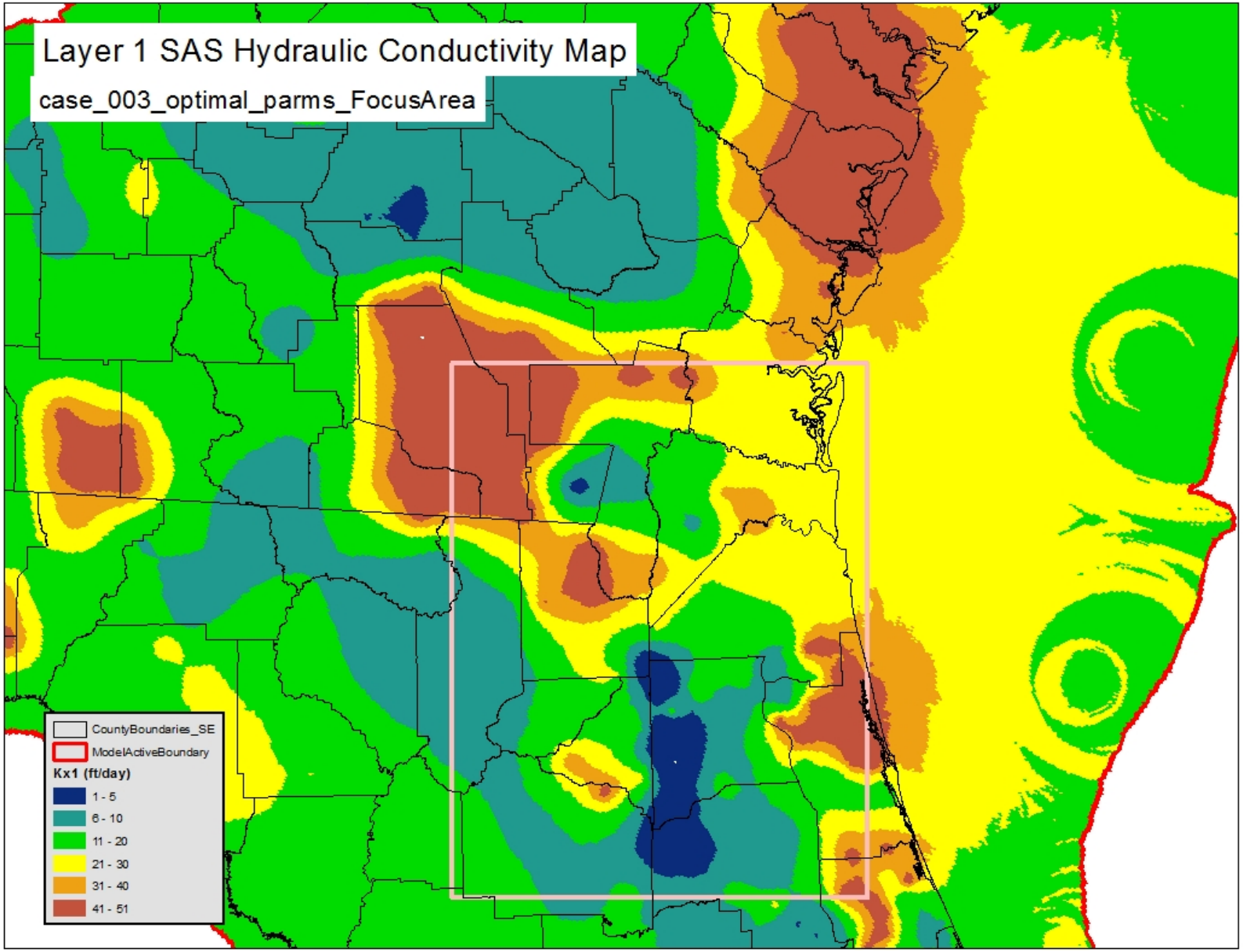




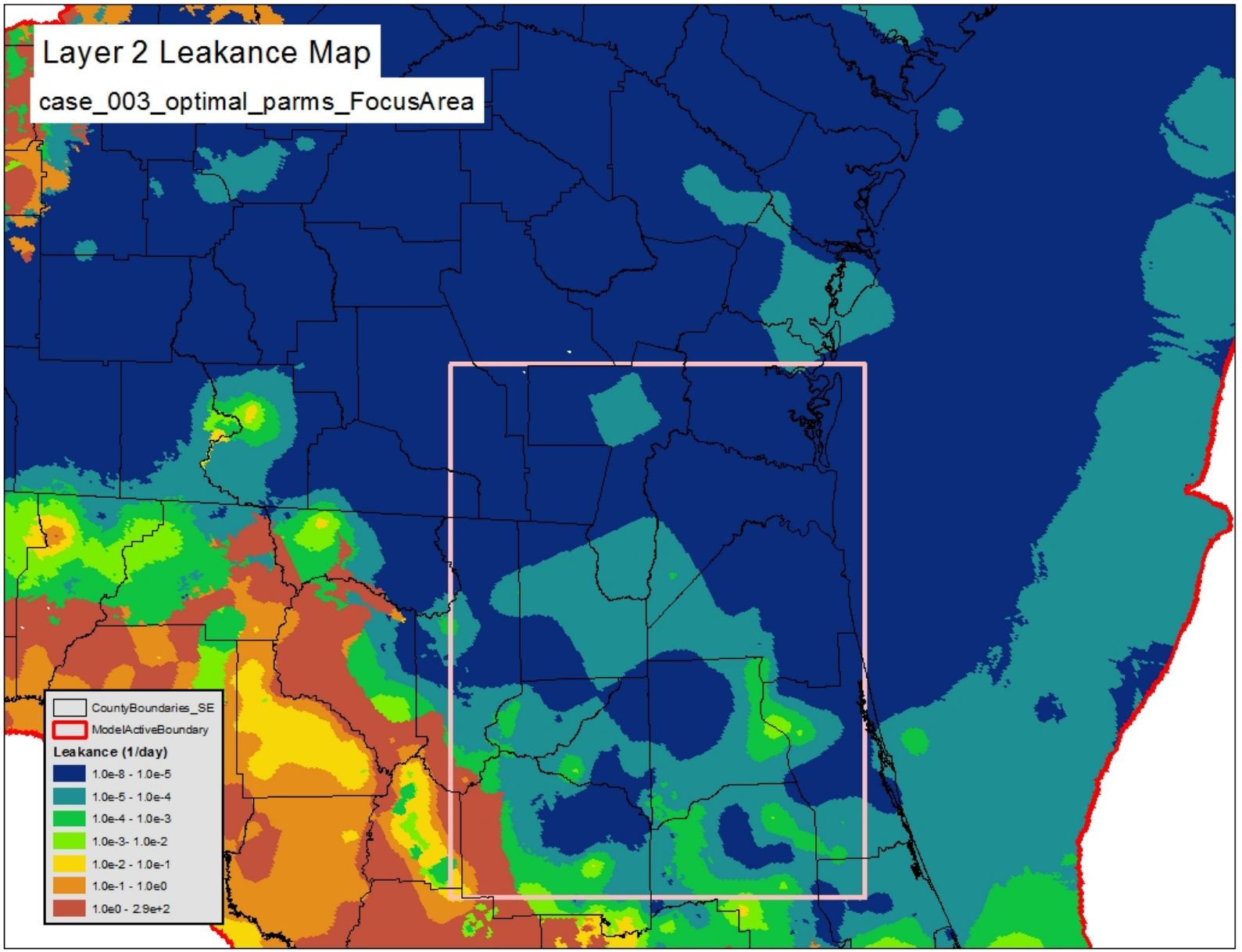
GW Level Residuals Laver 3



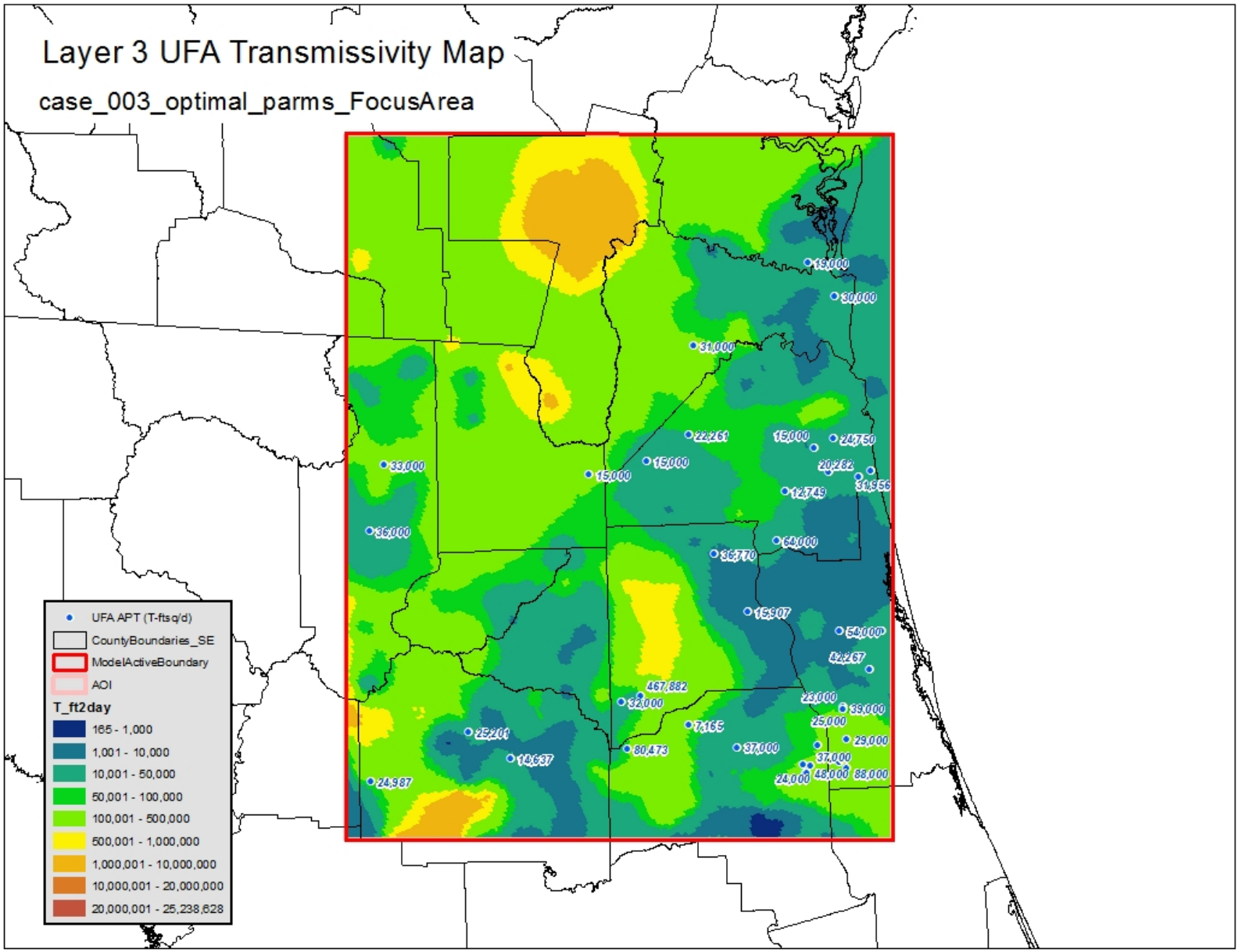




Estimated Horizontal Hydraulic Conductivity

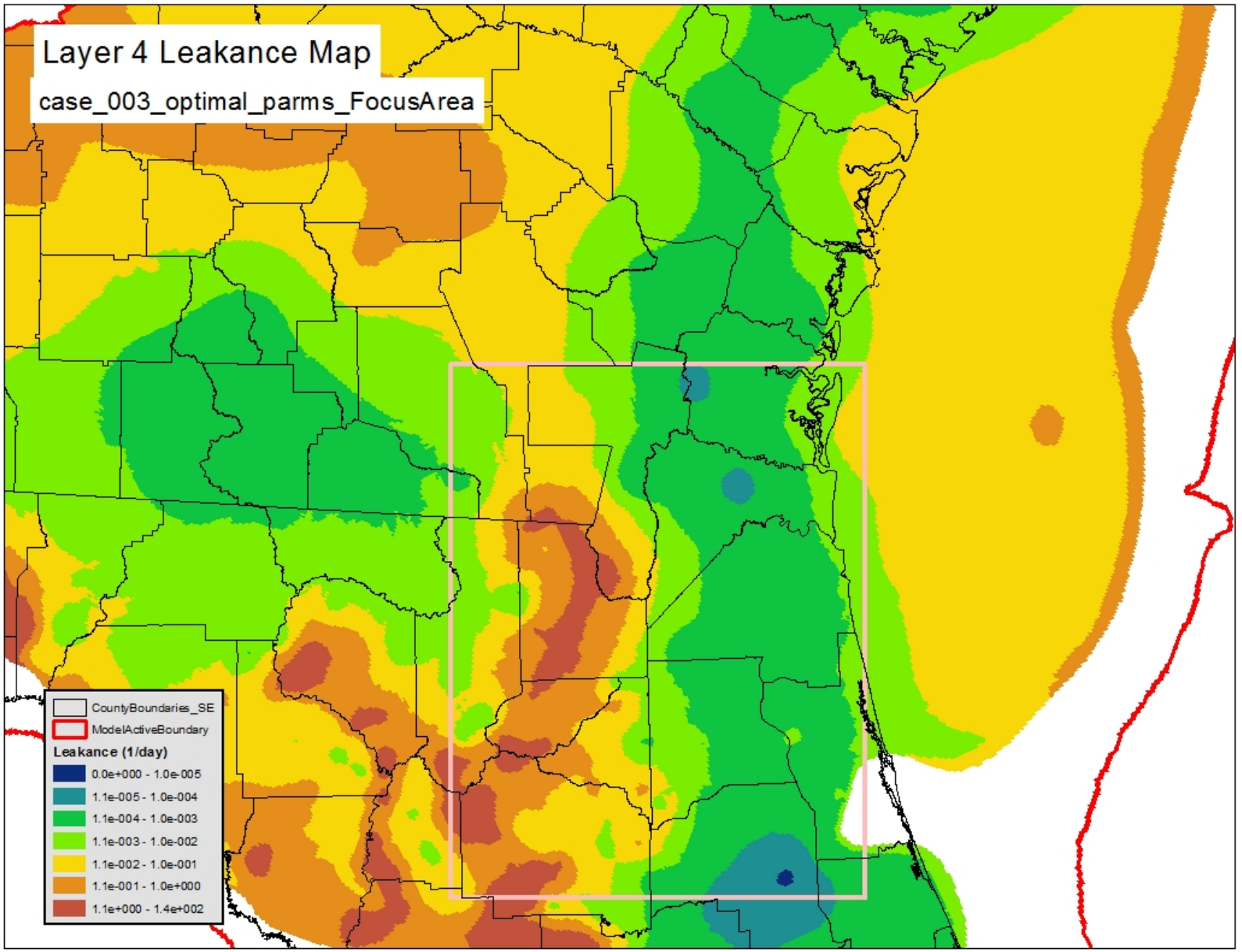


Estimated Horizontal Leakance

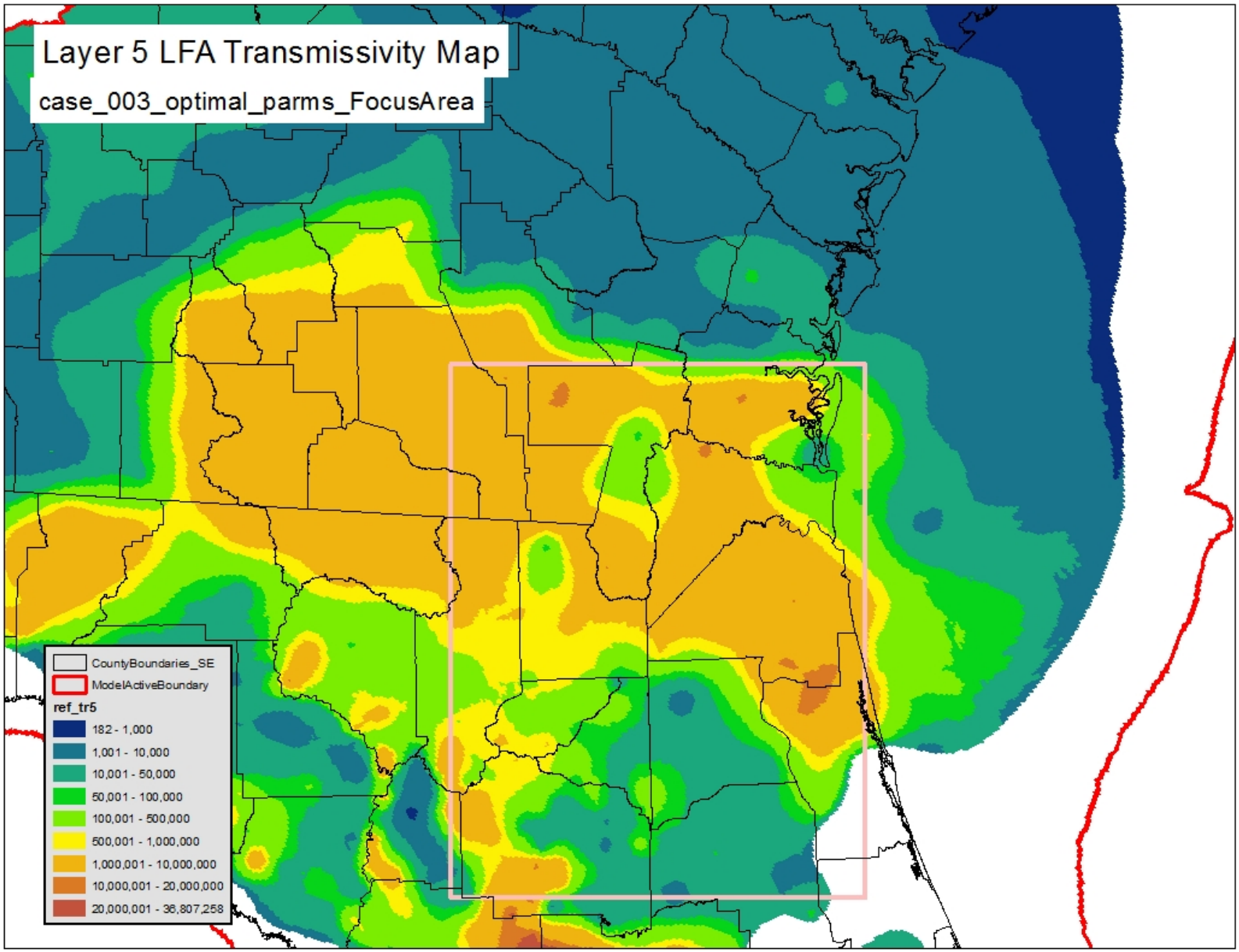


Estimated Transmissivity

(with superimposed point estimates from APT results)



Estimated Leakance



Estimated Transmissivity

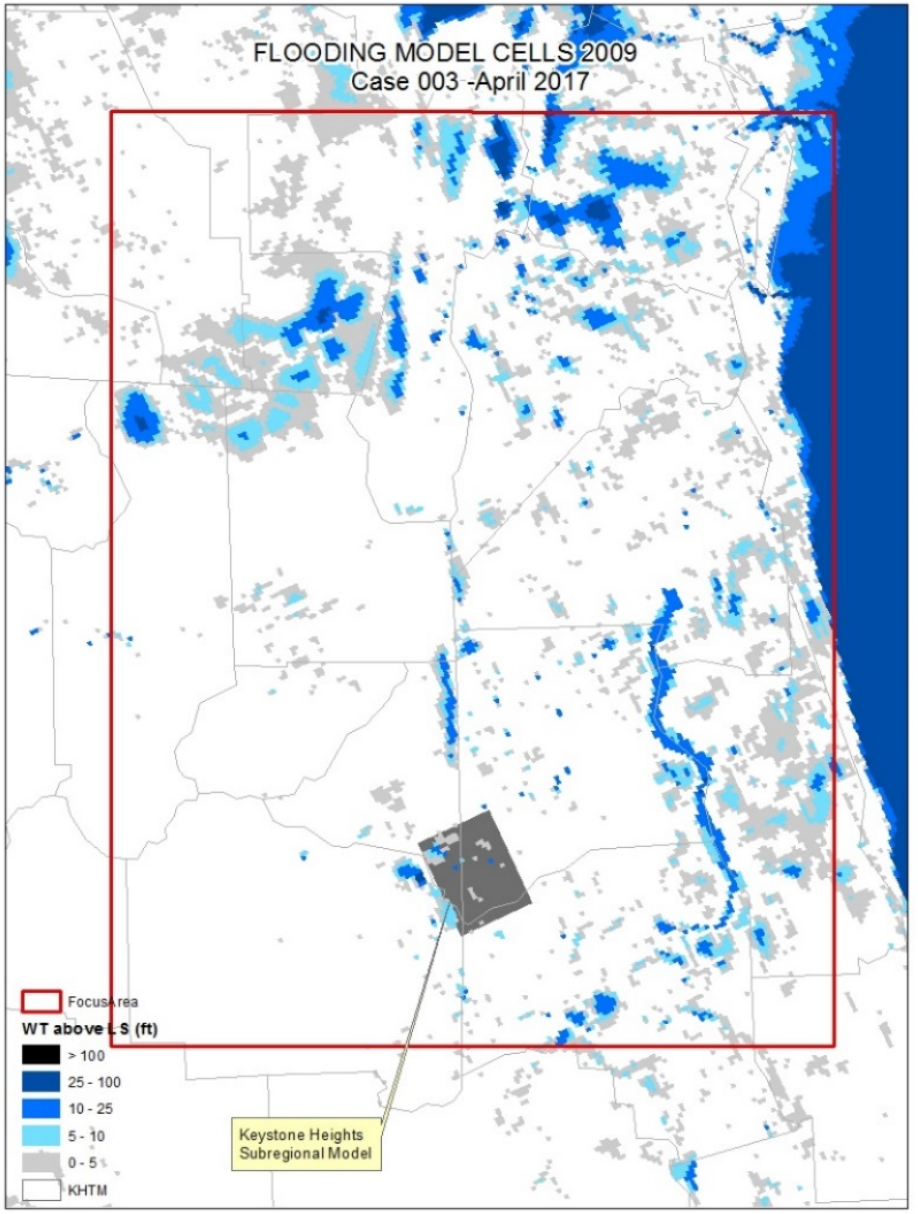
Phase 1 Focus Area
Lake Leakage

Lake	Vertical Leakage	
	Simulated	**Literature**
Magnolia	35- 38 in/yr	16 - 113 in/yr
Lowry	32 - 37 in/yr	14 - 50 in/yr
Geneva	5 - 15 in/yr	7 - 29 in/yr
Brooklyn	62 - 90 in/yr	27 - 168 in/yr

Phase 1 Focus Area

Simulated Inundated Areas

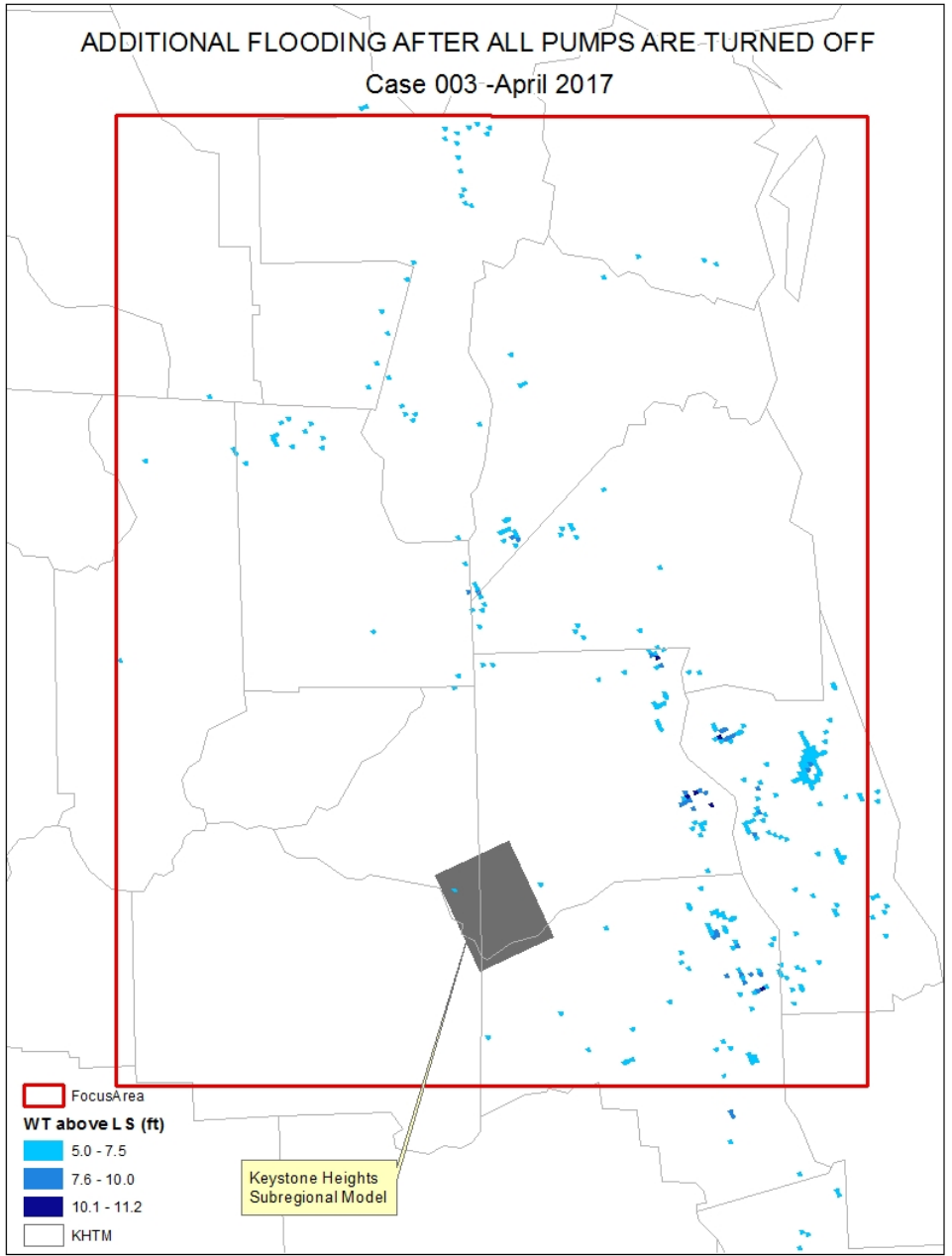
2009



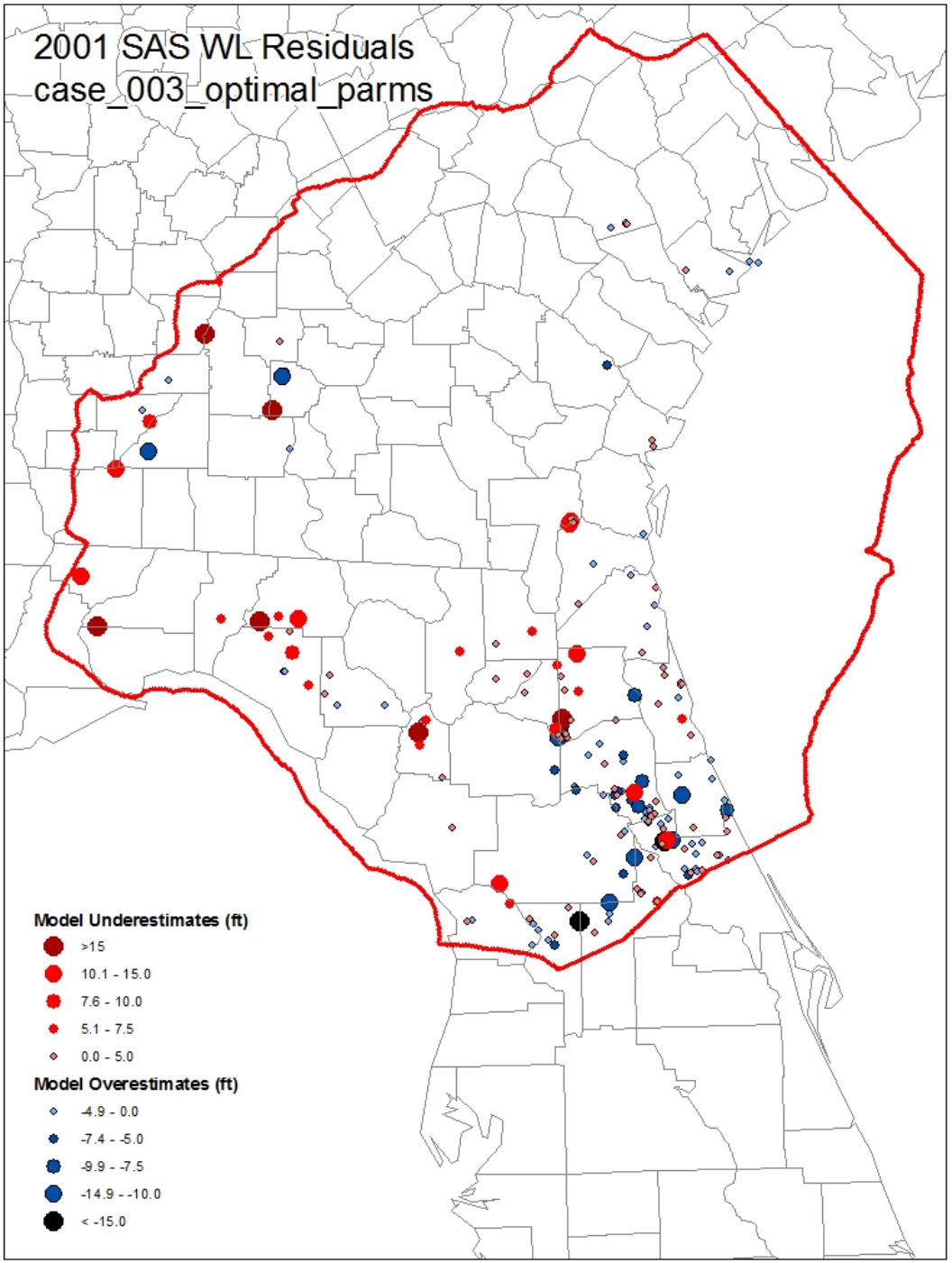
Phase 1 Focus Area

Change in Simulated Inundated Areas

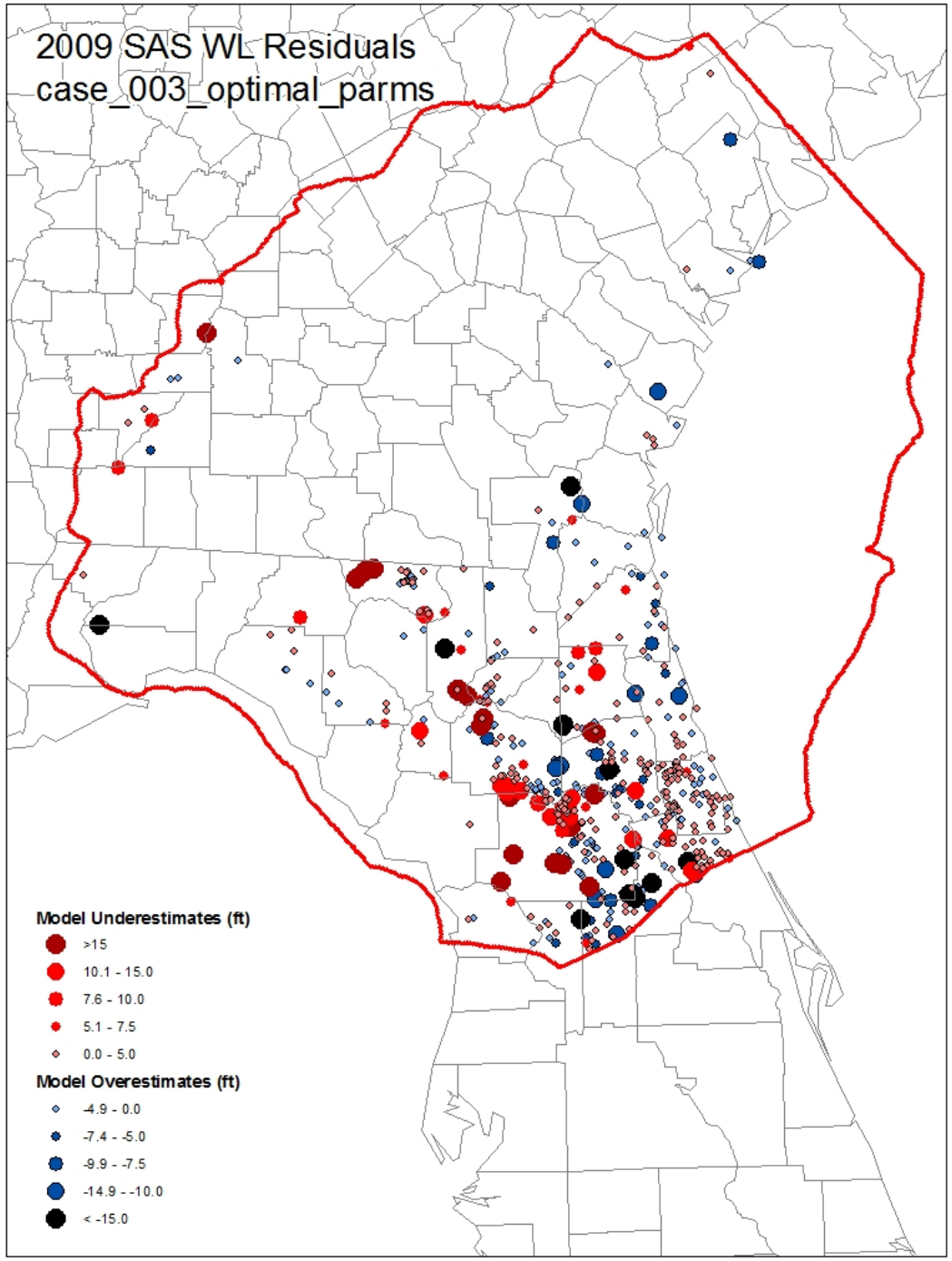
Pumps Off - 2009



Preliminary Simulation Results Run 3 of PEST History Match Domain Wide



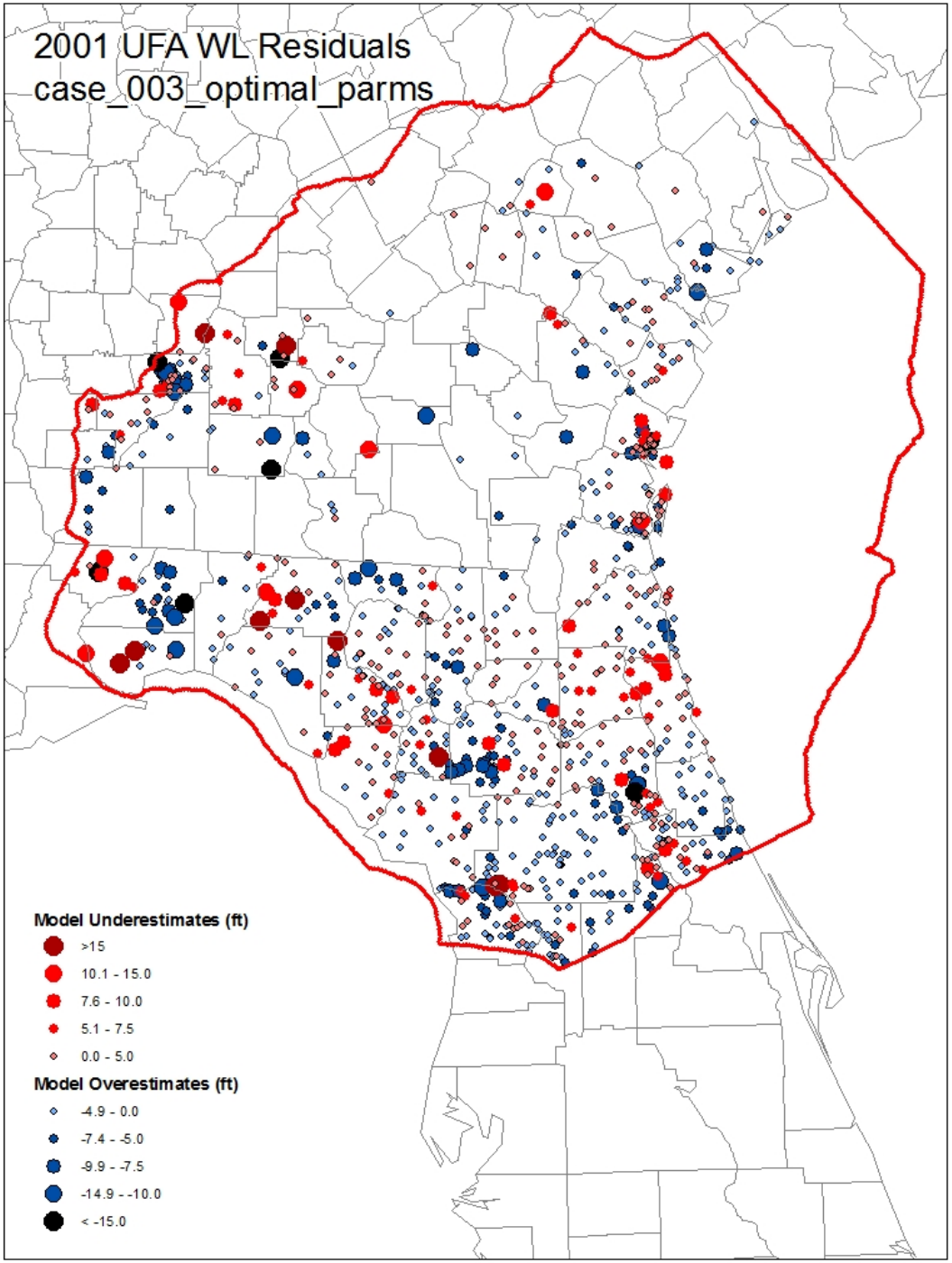
GW Level Residuals: Model Layer 1, Calendar Year 2001



GW Level Residuals

Model Layer 1

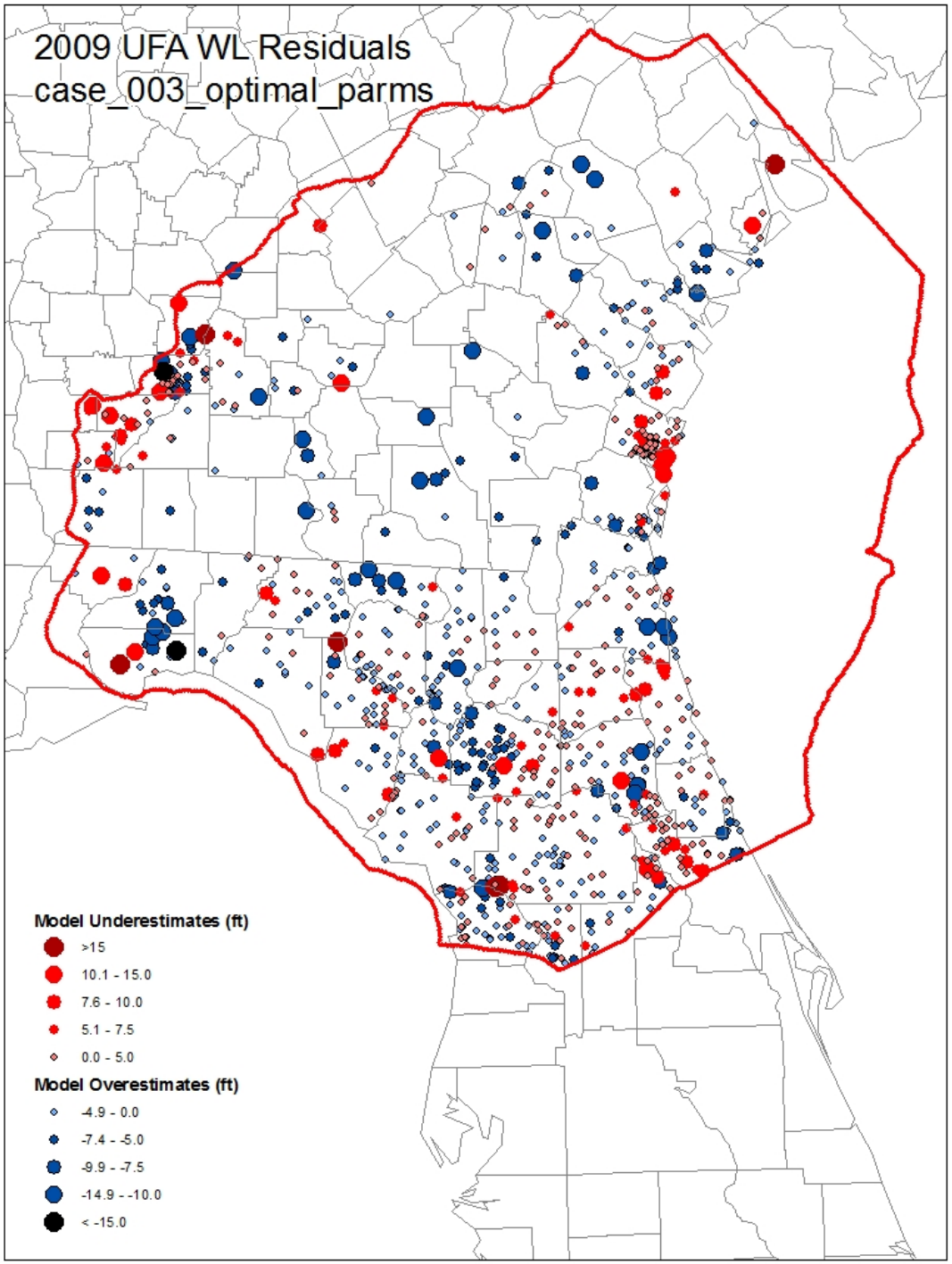
2009



GW Level Residuals

Model Layer 3

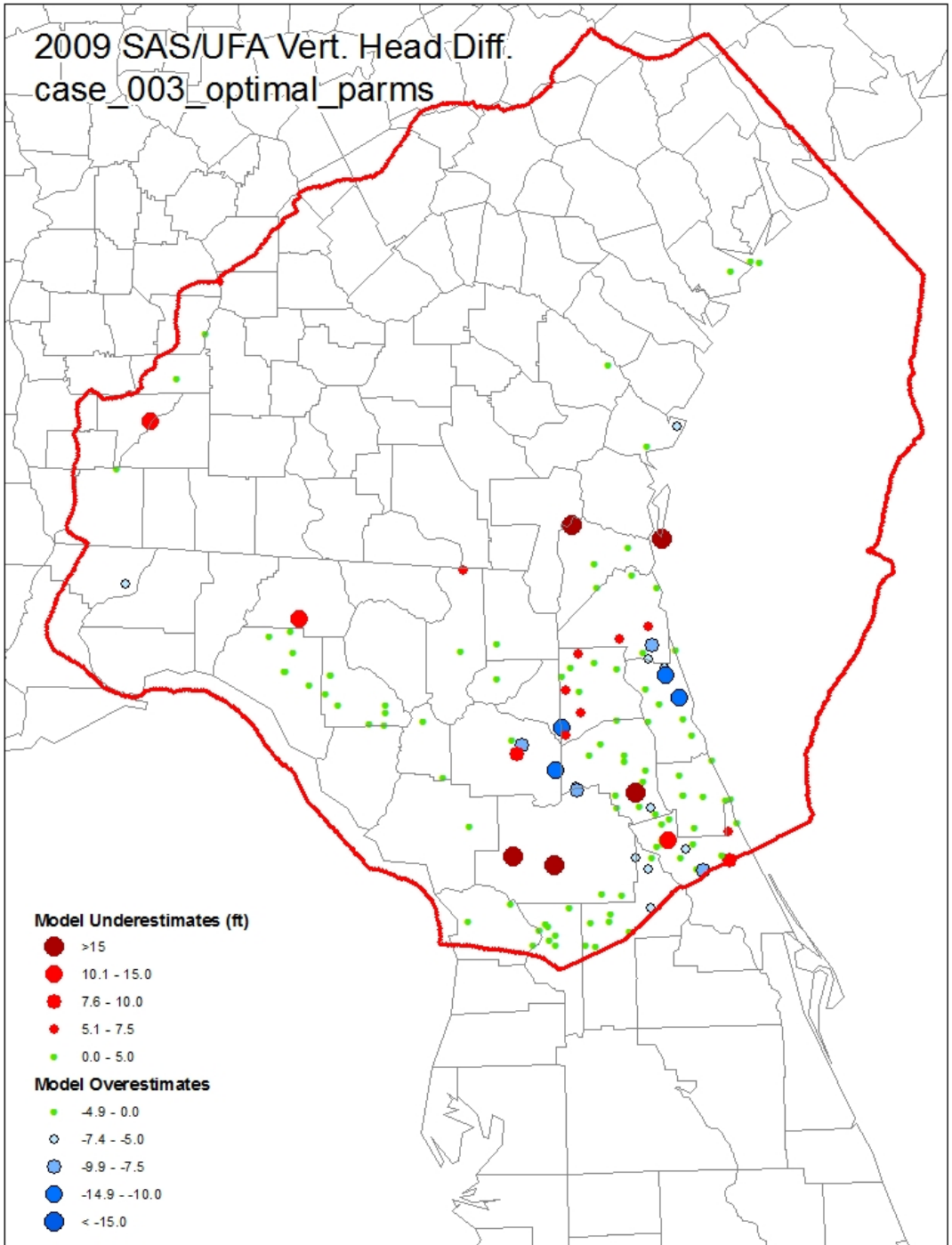
2001



GW Level Residuals

Model Layer 3

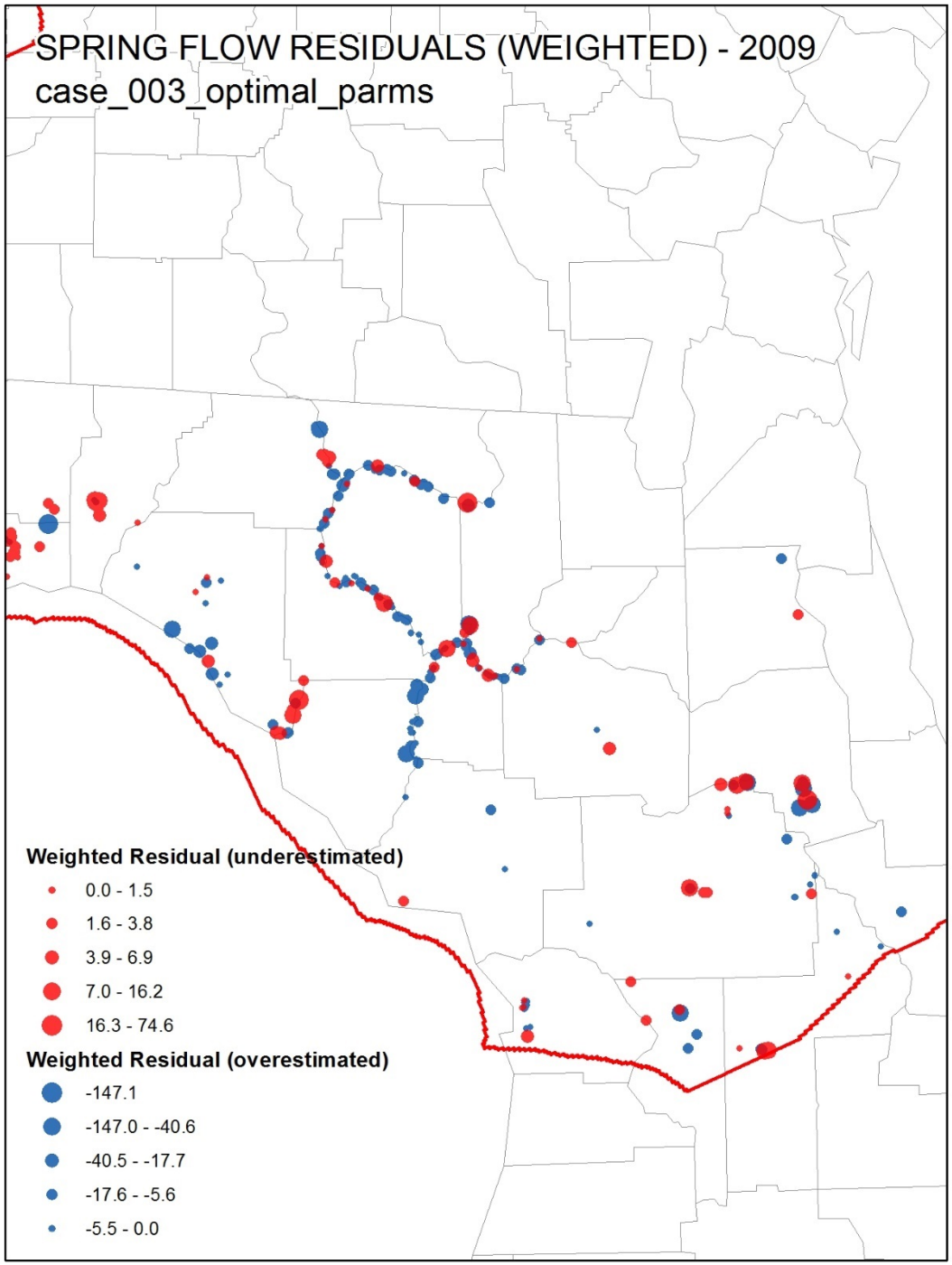
2009



Vertical Head Difference Residuals

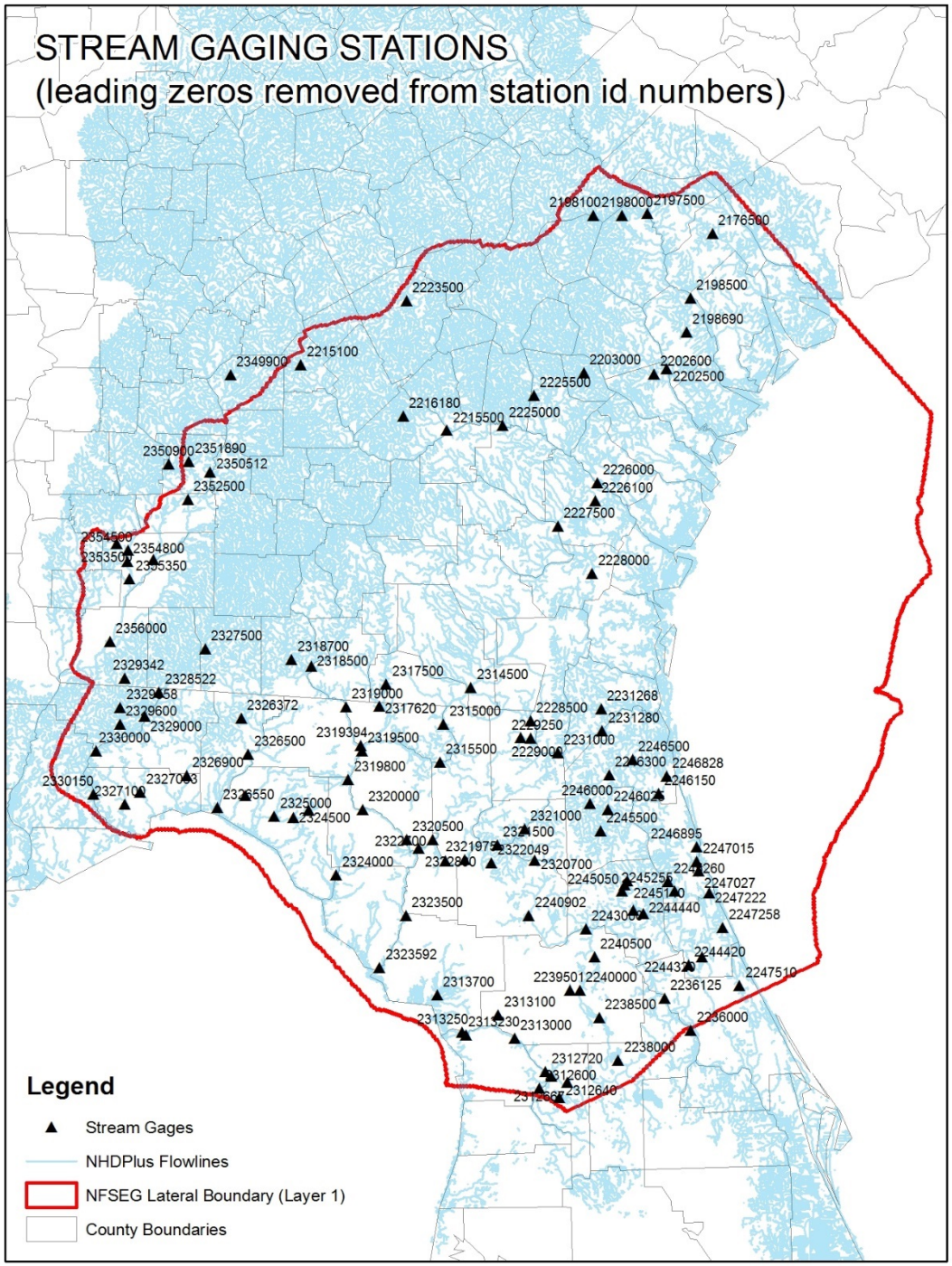
Differences between model layers 1 and 3

2009

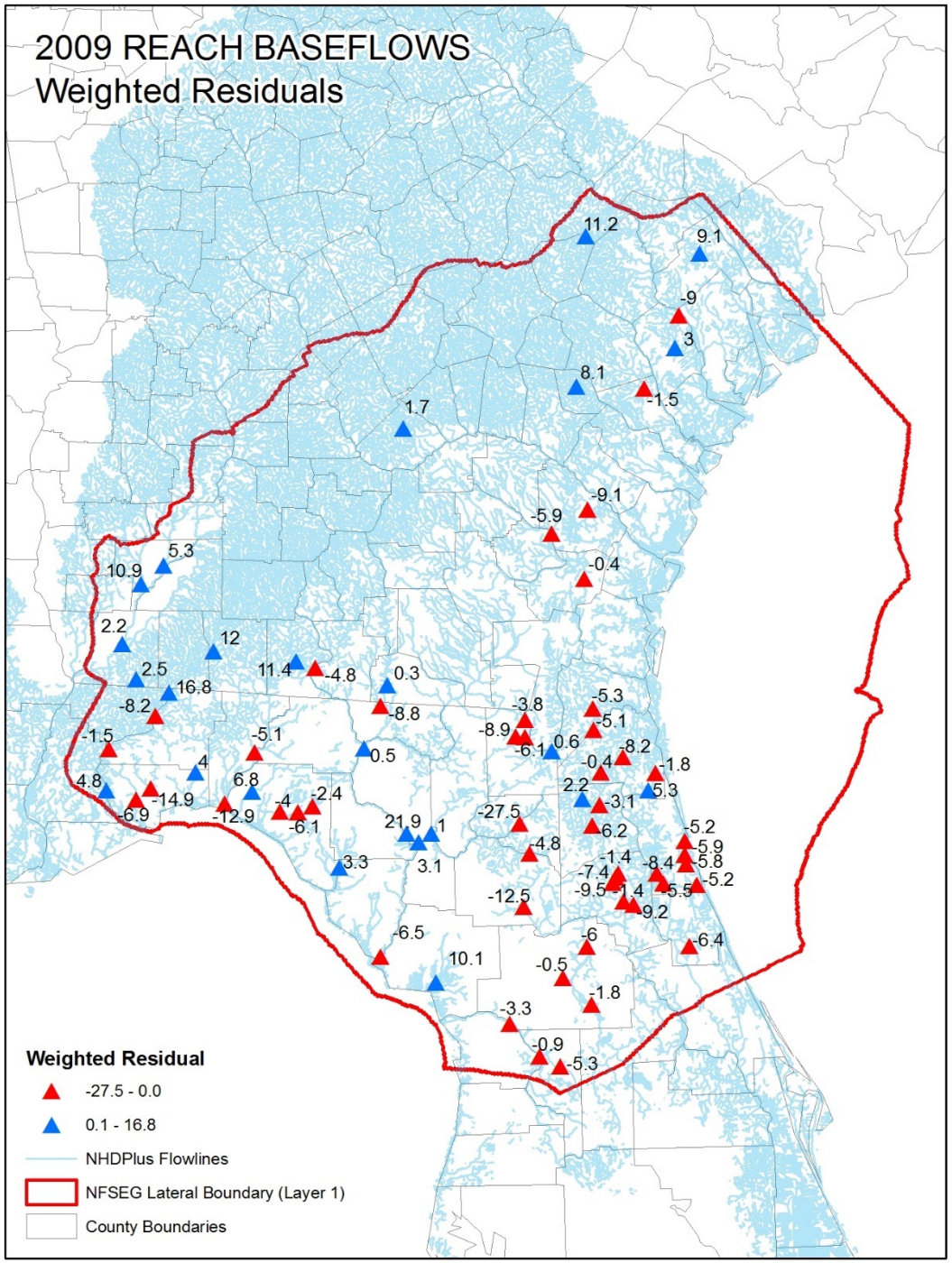


Spring Flow Residuals

2009



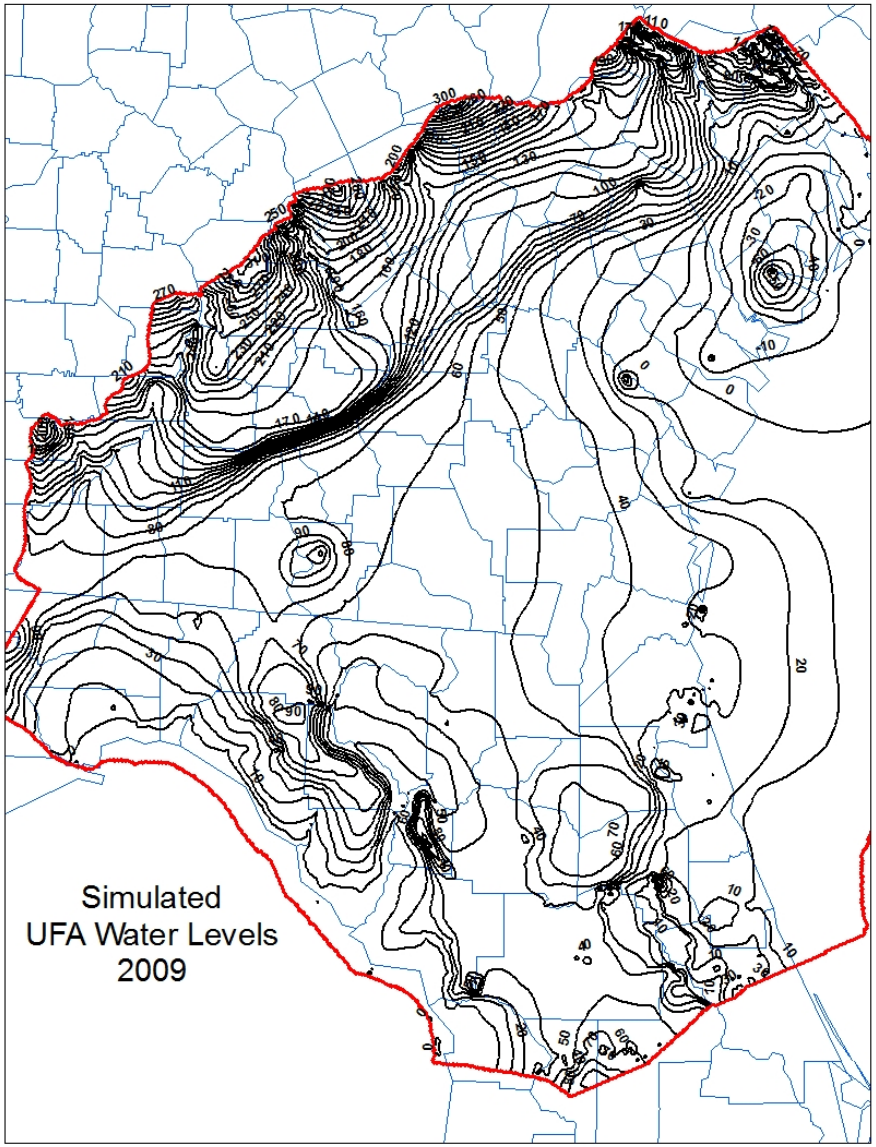
Stream Gages

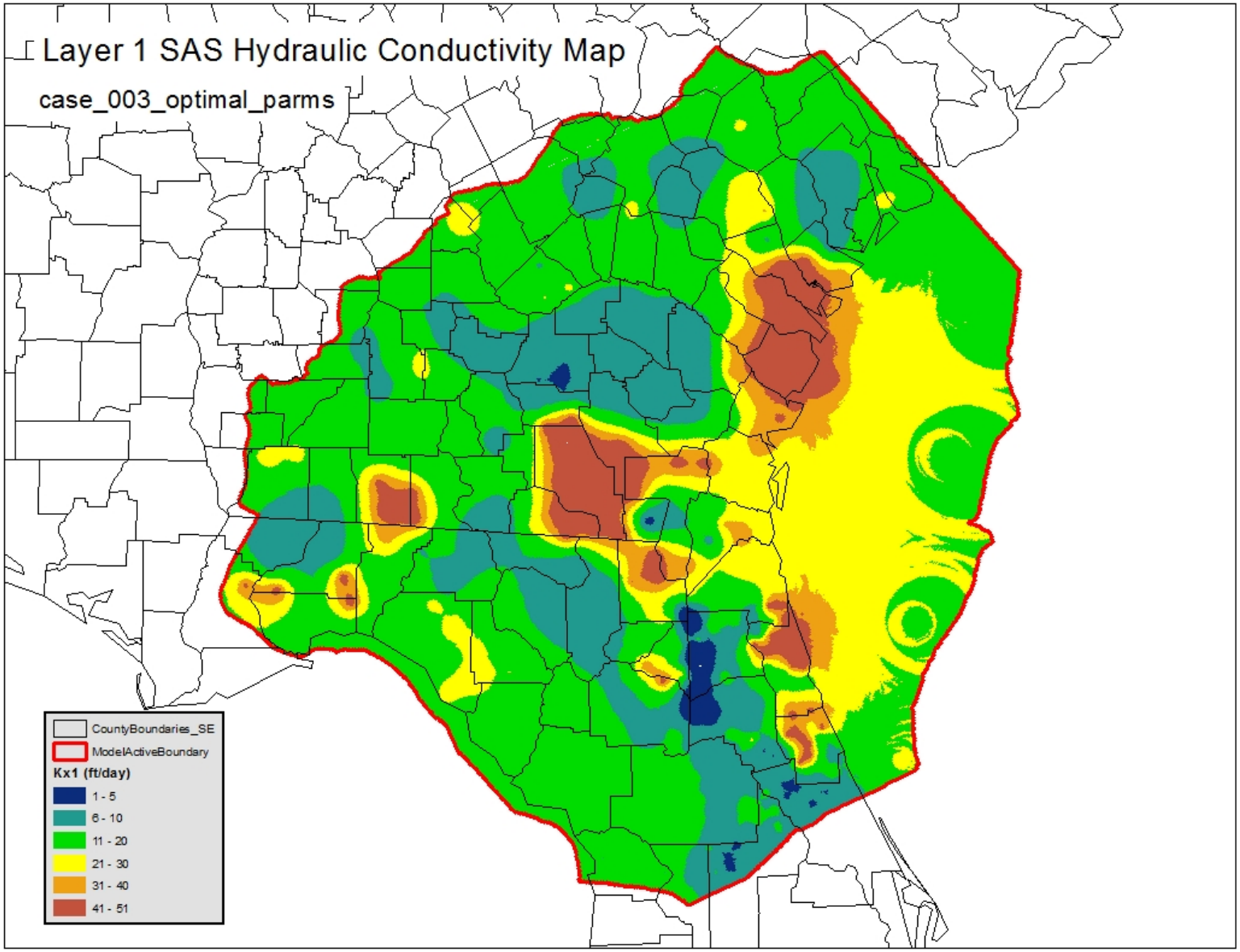


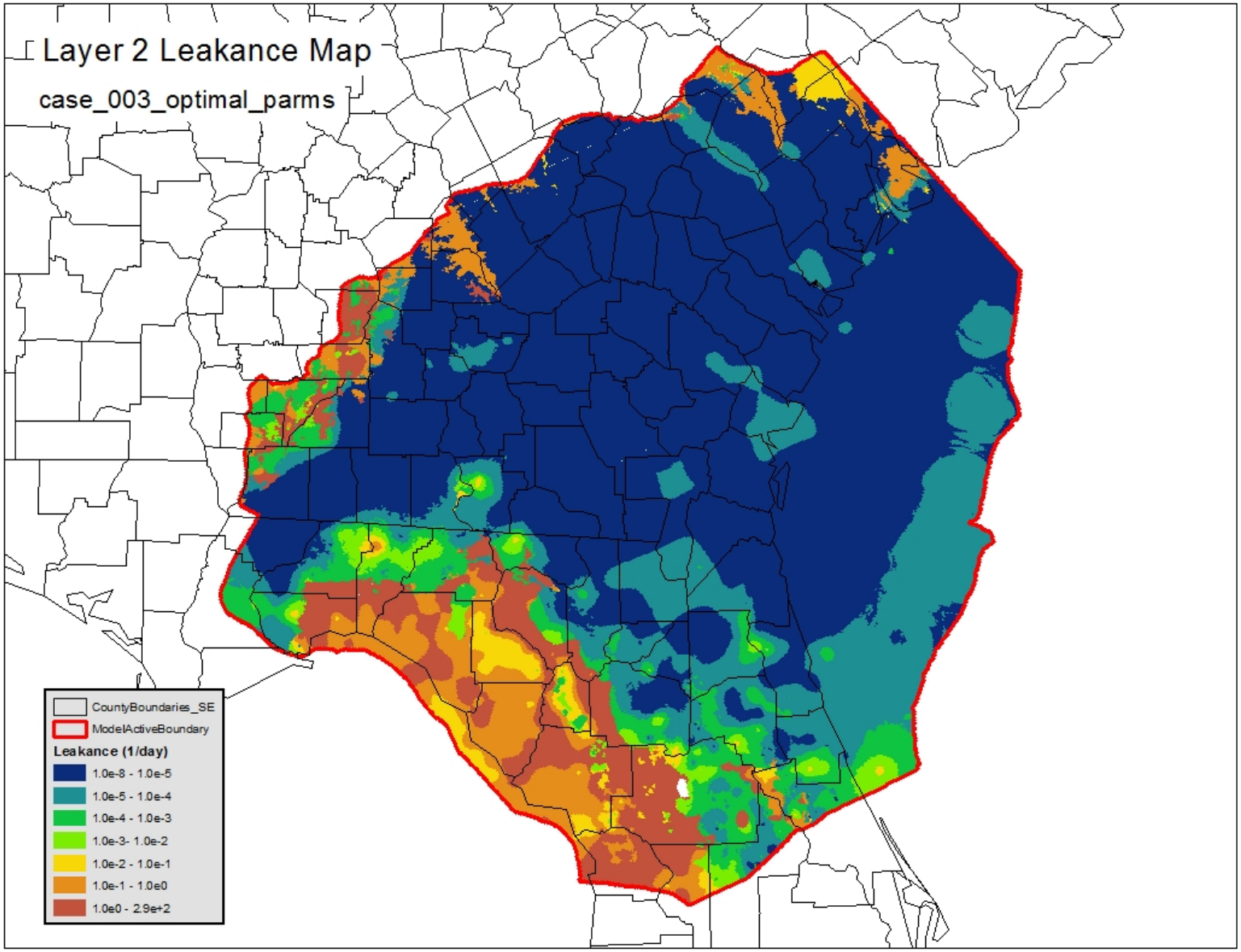
Weighted Baseflow Residuals

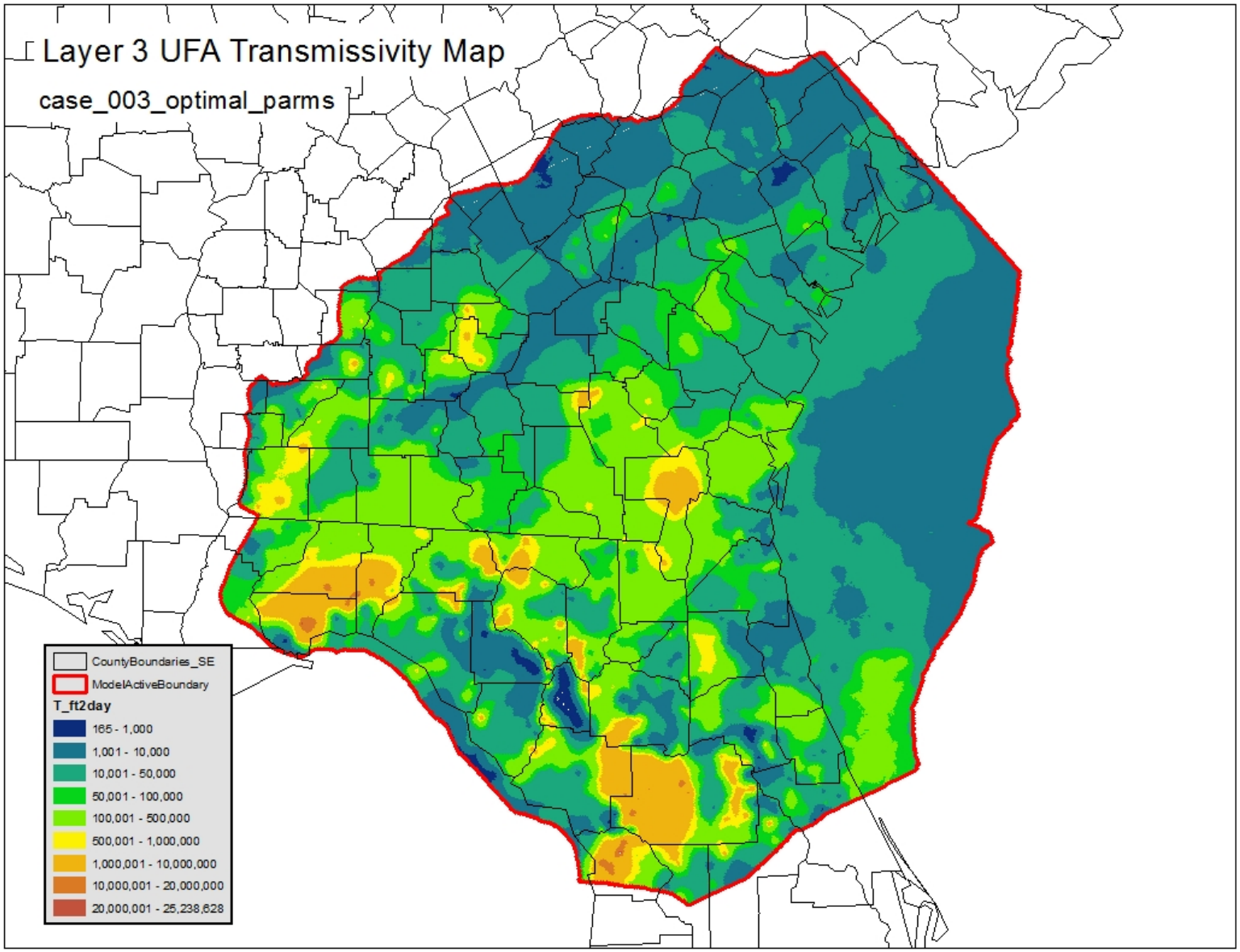
2009

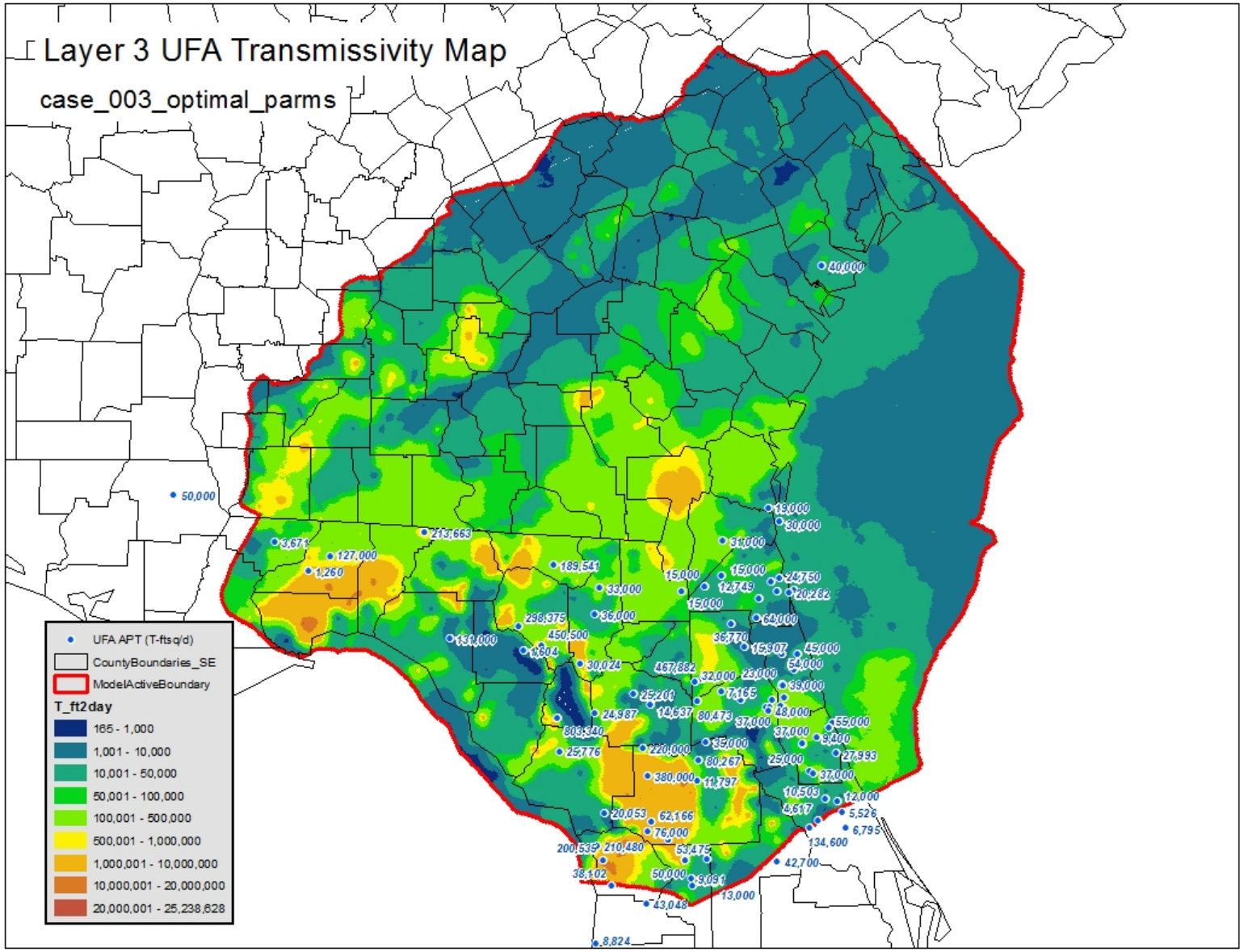
Simulated UFA Pot Map 2009



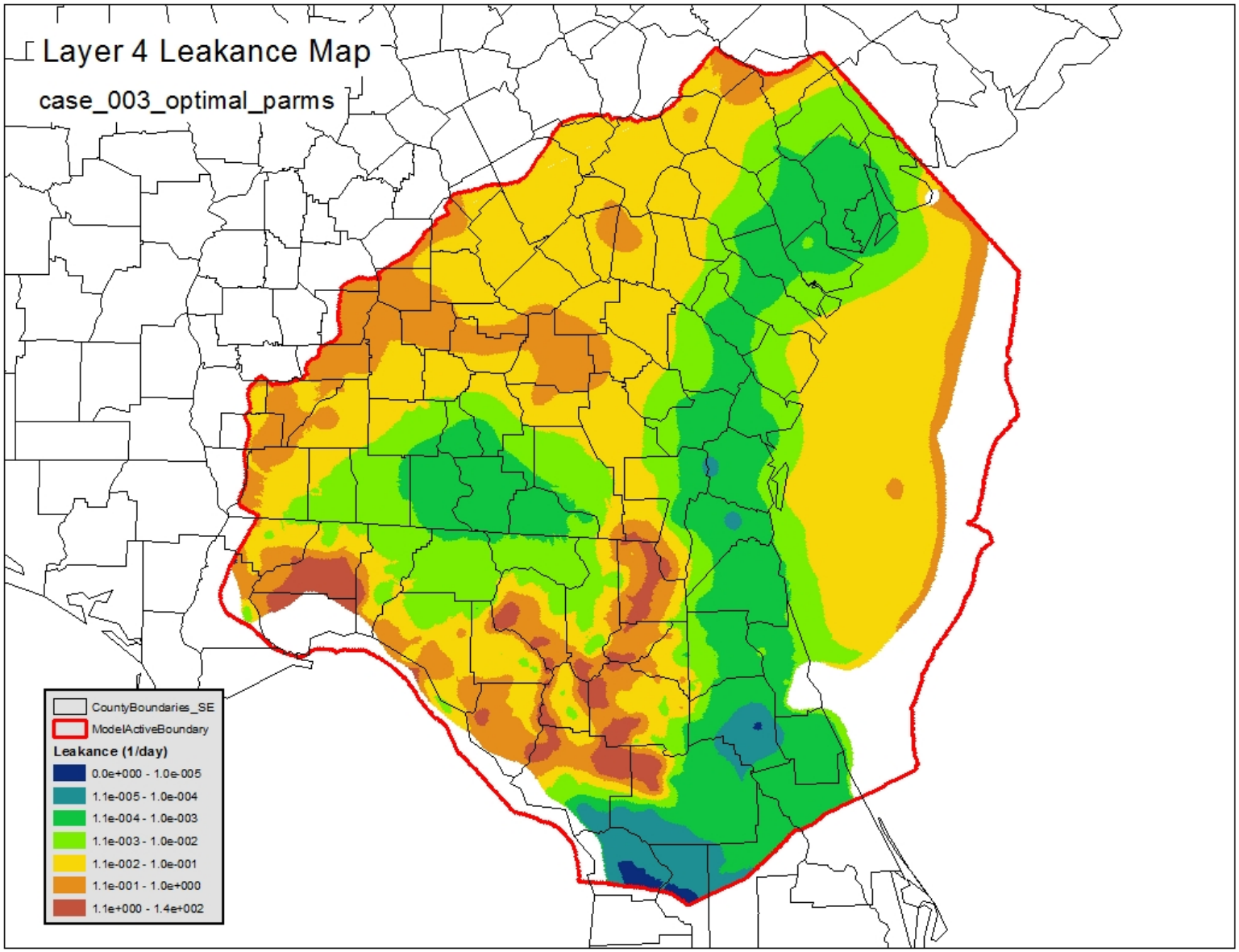

Layer 1 SAS Hydraulic Conductivity Map
case_003_optimal_parms
CountyBoundaries_SE
ModelActiveBoundary
Kx1 (ft/day)
1 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 51

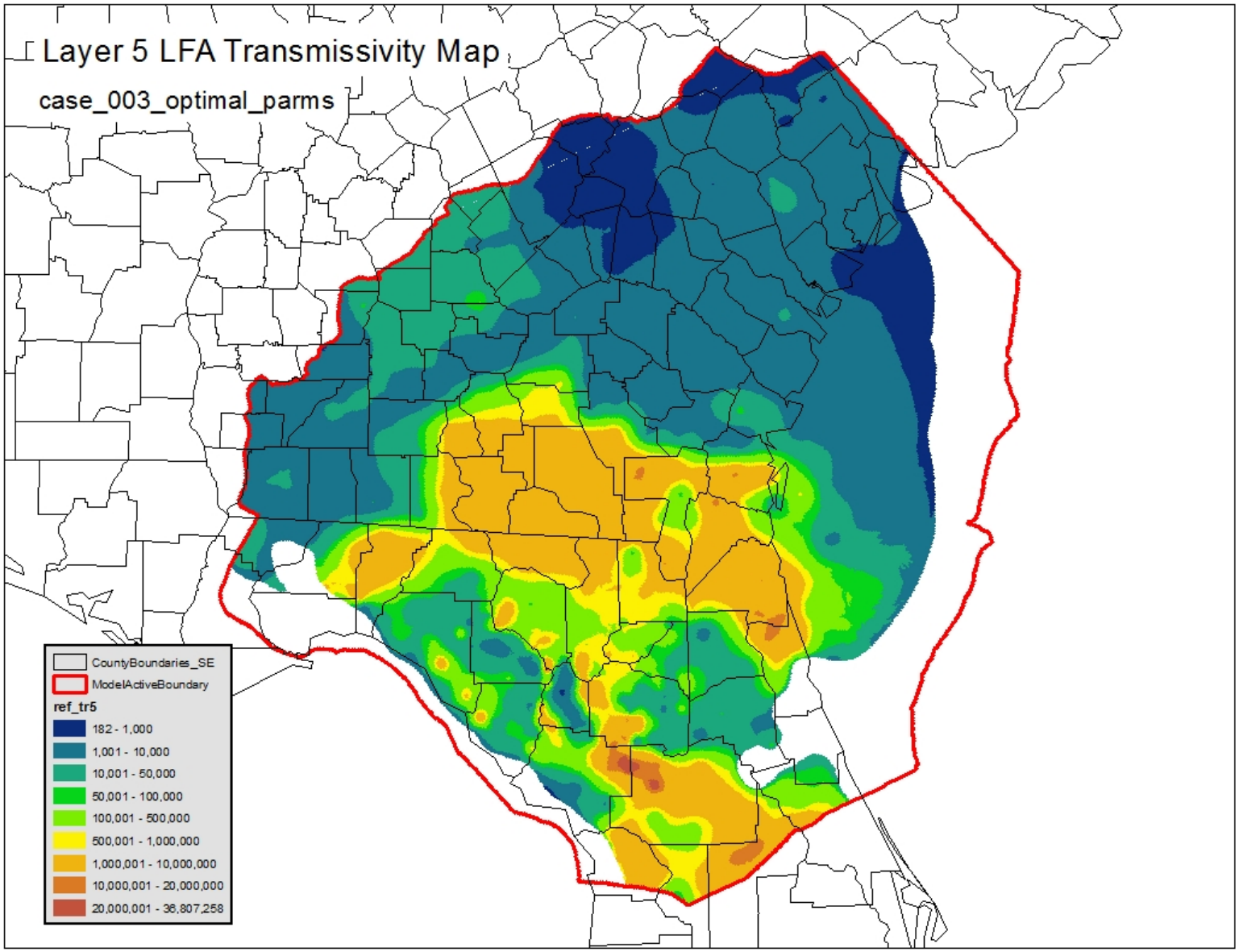

Layer 2 Leakance Map
case_003_optimal_parms
CountyBoundaries_SE
ModelActiveBoundary
Leakance (1/day)
1.0e-8 - 1.0e-5
1.0e-5 - 1.0e-4
1.0e-4 - 1.0e-3
1.0e-3- 1.0e-2
1.0e-2 - 1.0e-1
1.0e-1 - 1.0e0
1.0e0 - 2.9e+2


Layer 3 UFA Transmissivity Map
case_003_optimal_parms
CountyBoundaries_SE
ModelActiveBoundary
T_ft2day
165 - 1,000
1,001 - 10,000
10,001 - 50,000
50,001 - 100,000
100,001 - 500,000
500,001 - 1,000,000
1,000,001 - 10,000,000
10,000,001 - 20,000,000
20,000,001 - 25,238,628

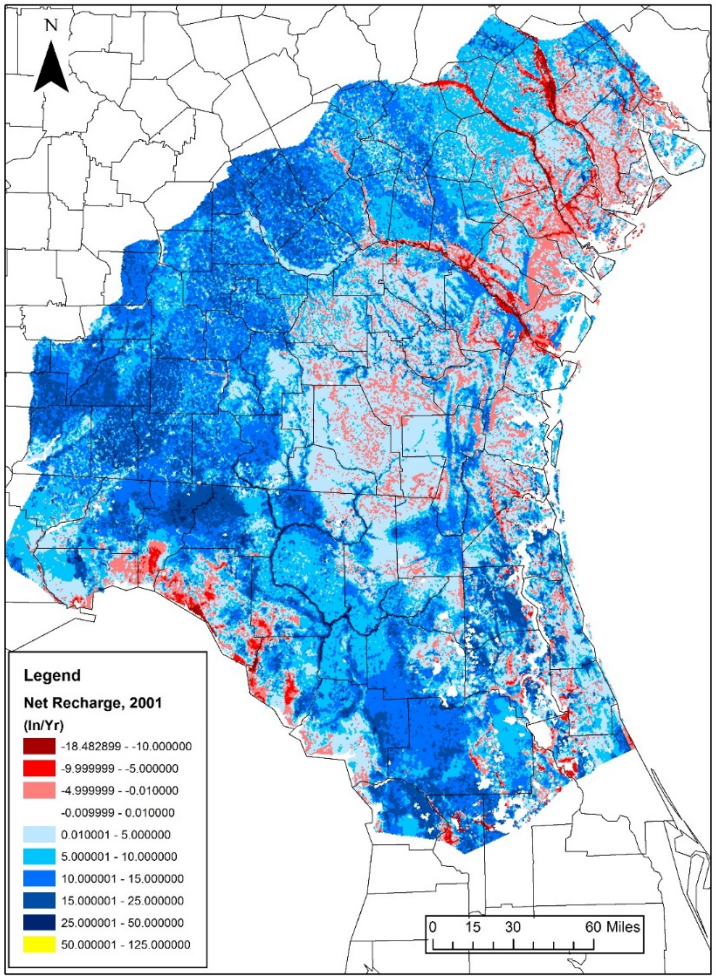


Estimated Transmissivity of Layer 3 (with superimposed point estimates from APT results)

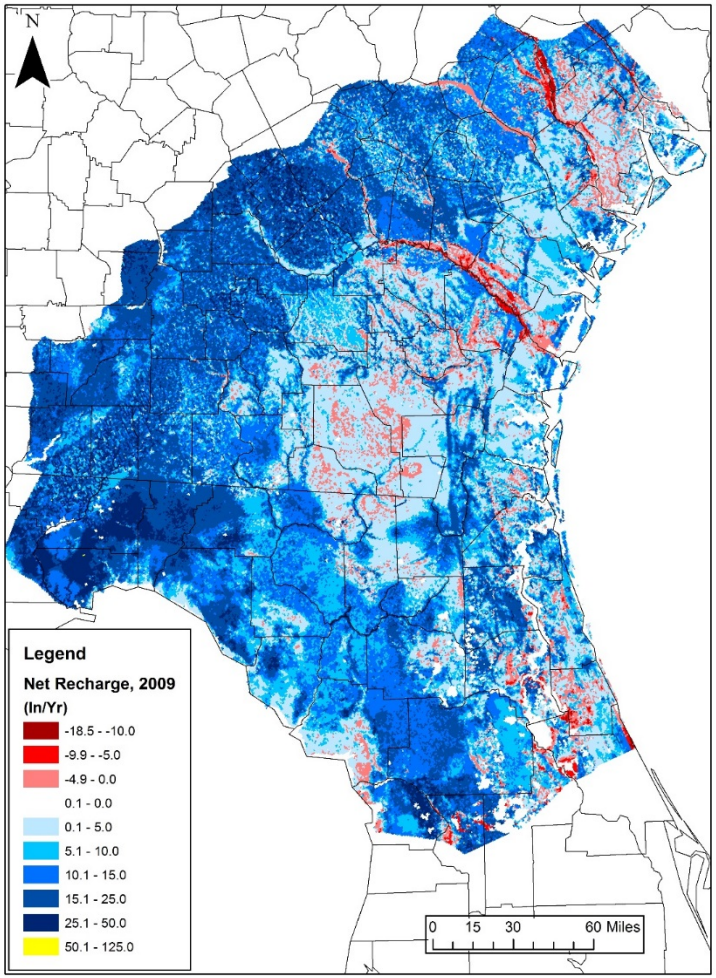

Layer 4 Leakance Map
case_003_optimal_parms
CountyBoundaries_SE
ModelActiveBoundary
Leakance (1/day)
0.0e+000 - 1.0e-005
1.1e-005 - 1.0e-004
1.1e-004 - 1.0e-003
1.1e-003 - 1.0e-002
1.1e-002 - 1.0e-001
1.1e-001 - 1.0e+000
1.1e+000 - 1.4e+002

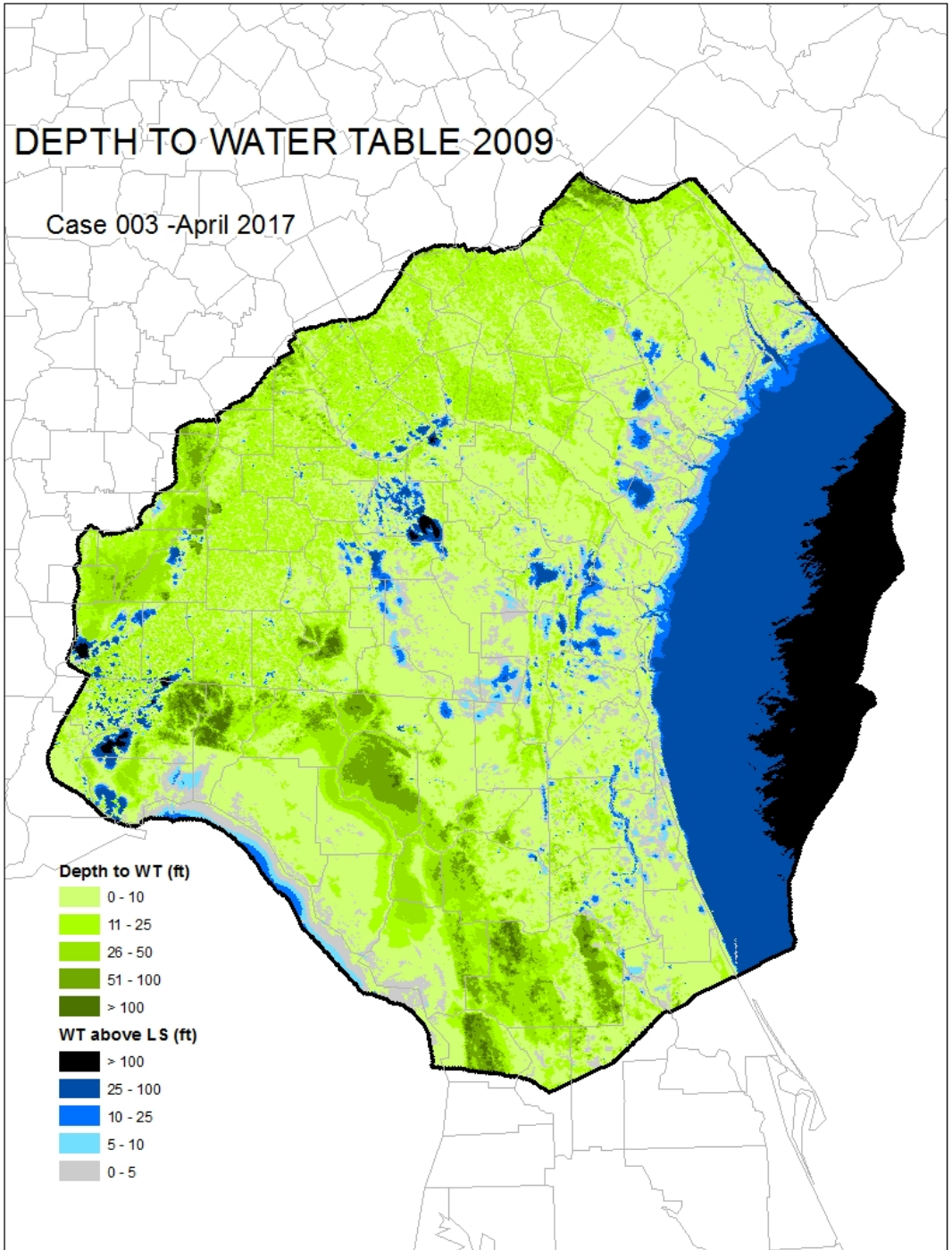

Layer 5 LFA Transmissivity Map
case_003_optimal_parms
CountyBoundaries_SE
ModelActiveBoundary
ref_tr5
182 - 1,000
1,001 - 10,000
10,001 - 50,000
50,001 - 100,000
100,001 - 500,000
500,001 - 1,000,000
1,000,001 - 10,000,000
10,000,001 - 20,000,000
20,000,001 - 36,807,258

Simulated Net Recharge - 2001



Simulated Net Recharge - 2009

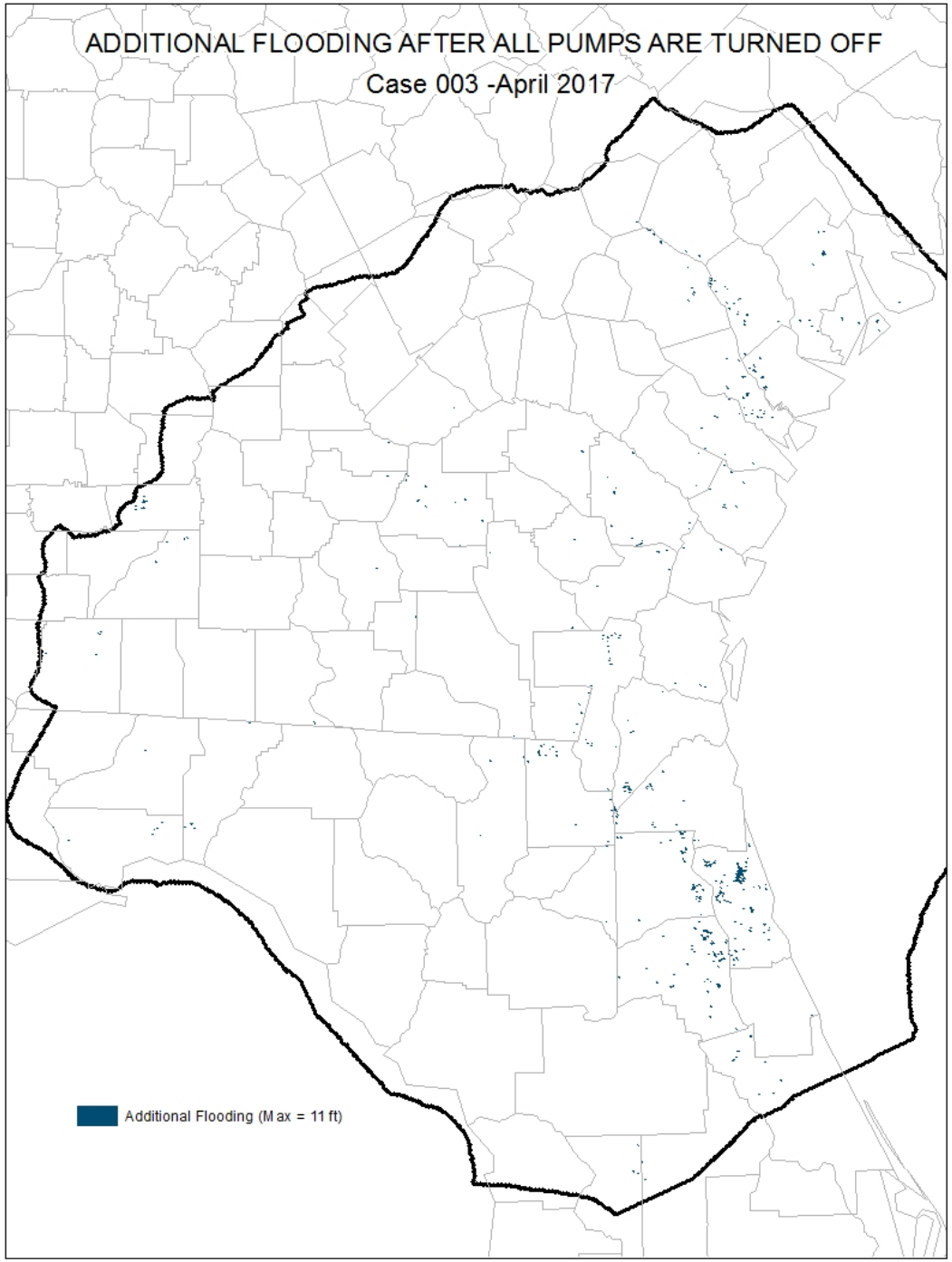




Simulated Depth to Water Table Map

2009

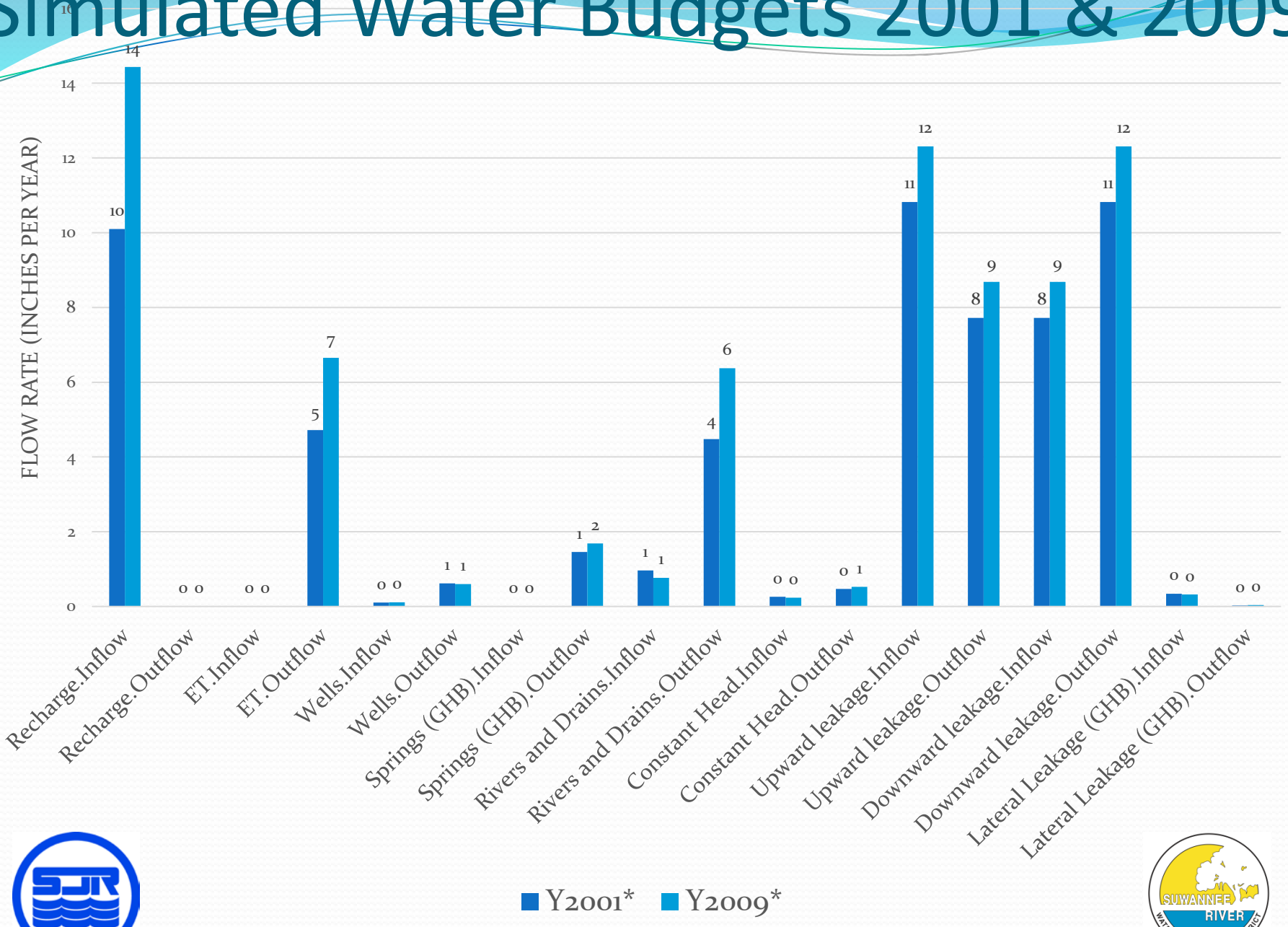
Model Domain



Change in Simulated Inundated Areas Layer 1

Pumps Off - 2009

Simulated Water Budgets 2001 & 2009



Peer Review Panel Discussion

Technical Stakeholder Input

Next Steps

- Phase I updates:
  - Update lake leakage targets and lake stages as needed
  - Add new Drain Package Features
  - Update recharge and maximum saturated ET fields
- Phase 2 updates:
  - Review spring observations (e.g. updates using new data)
  - Observation group reweighting
  - Regularization updates

Schedule

June 6	Phase 1 Results Meeting
June 30:	Review Memorandum
July 20:	Phase 2 Preliminary Results Meeting
August 24:	Phase 2 Results Meeting
October 19:	Review Draft NFSEG v1.1
November 9:	Draft Peer Review Report
December 21:	Final Peer Review Report

Dates subject to change based on peer reviewers' schedules

Public Comments