



Development and Simulation of Recharge Scenarios to Enhance Springflow

Joshua “Bud” Davis, PhD¹

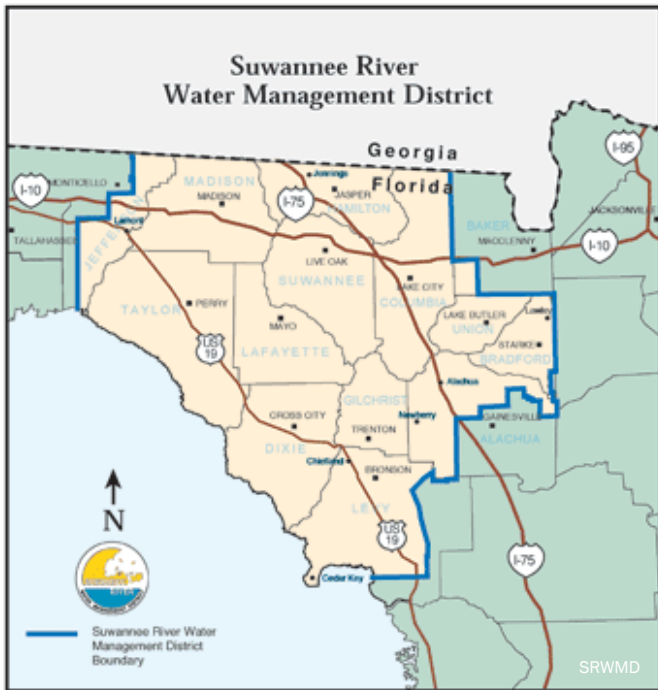
Lisa Baker, PE²

Rachel Pieschek, PE¹

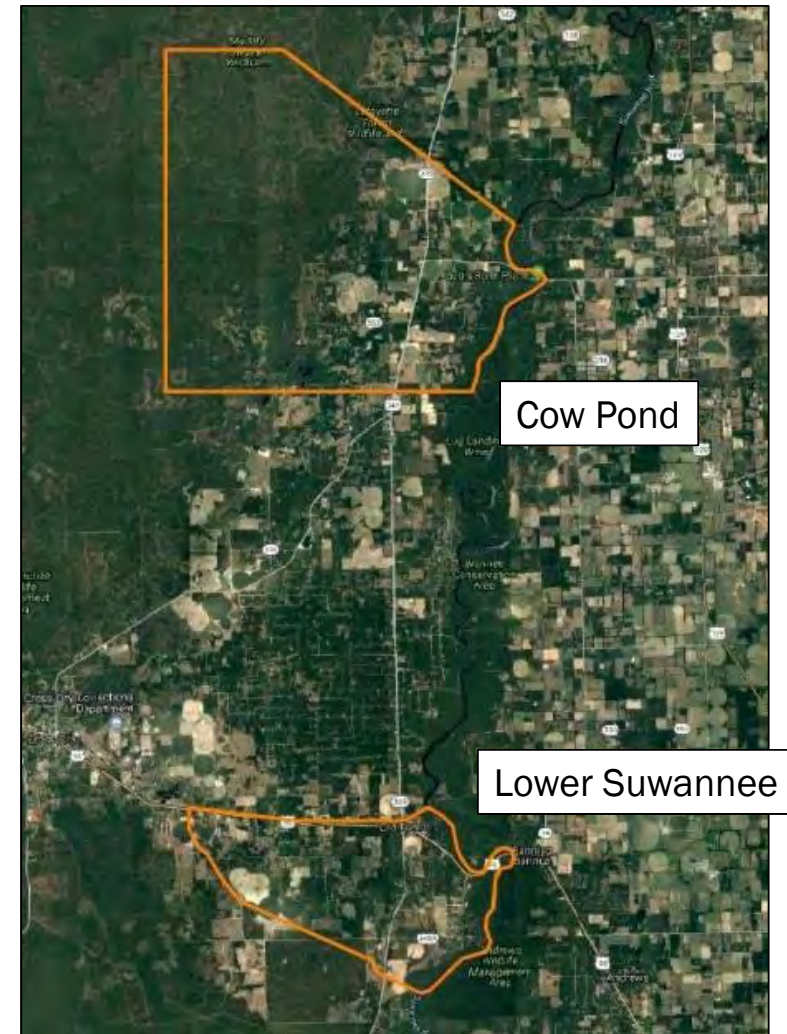
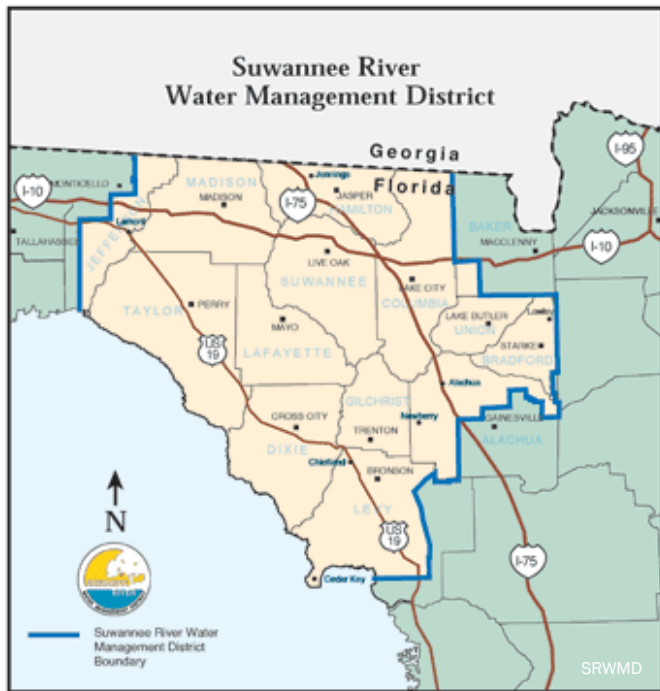
¹Drummond Carpenter, PLLC, Orlando, FL 32817

²Locklear and Associates, Inc., Gainesville, FL 32606

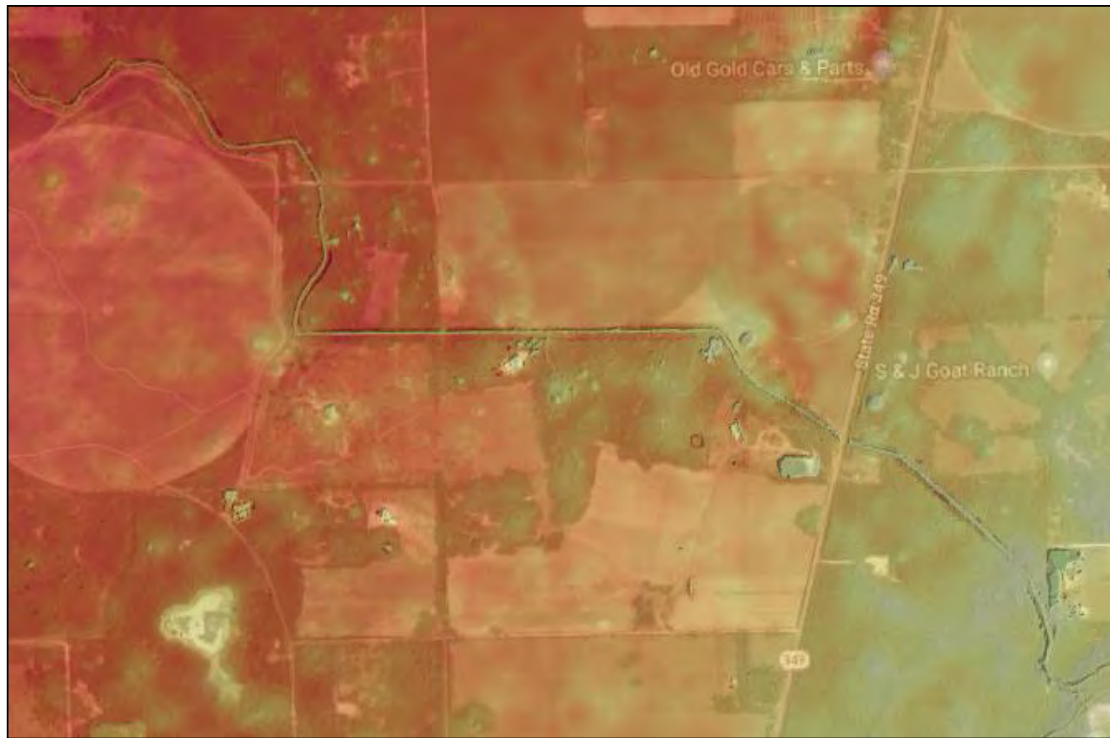
Introduction



Focus Sites



Ditching and Draining



Motivation

restore ponds and wetlands
wildlife habitat
aquifer recharge
enhance springflow
reduce direct runoff



Current Status

developed ICPR v4 model

two dimensional

coupled groundwater/surface
water

calibrated

applied restoration testing

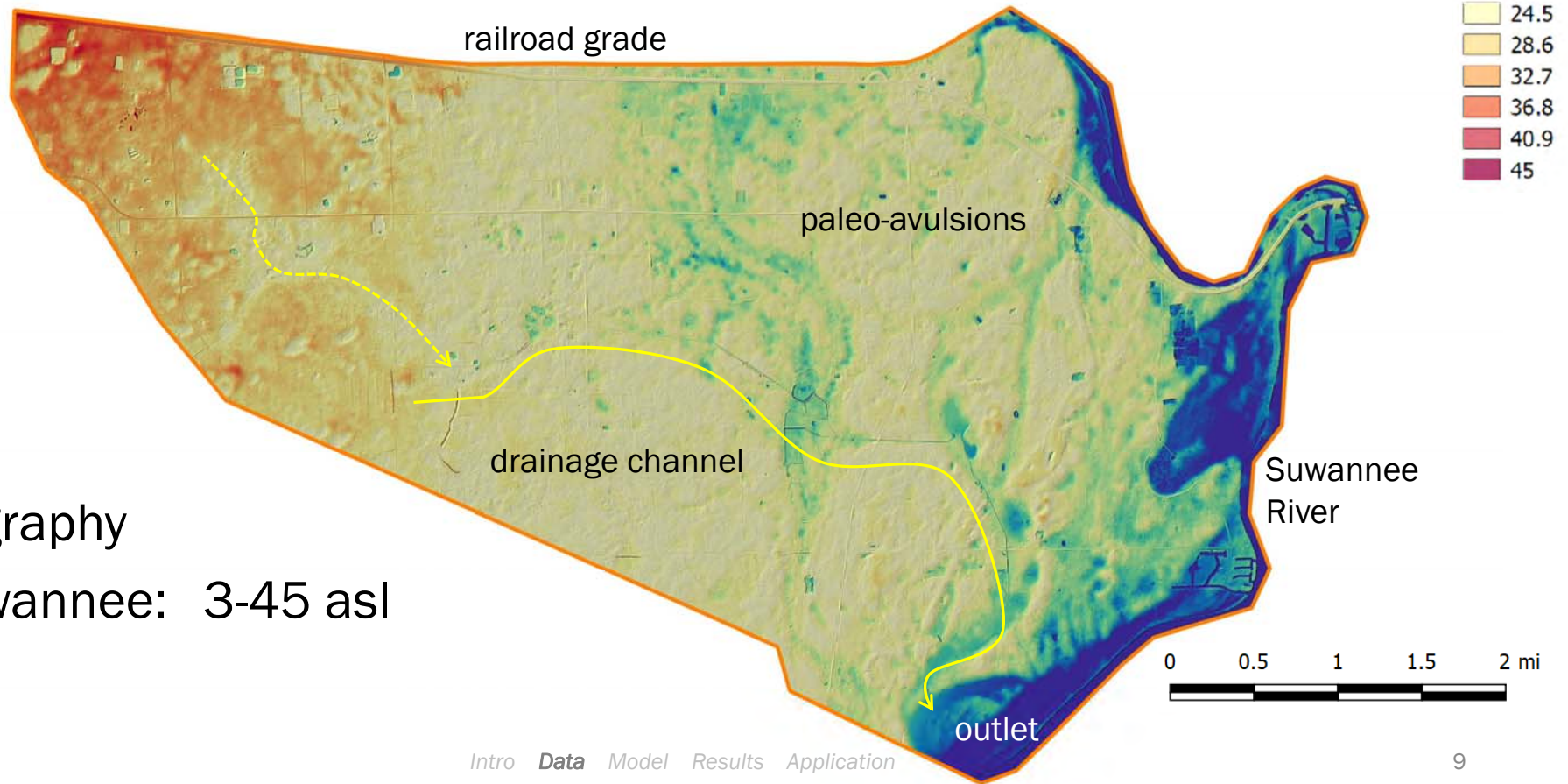
future works

informed stakeholder engagement

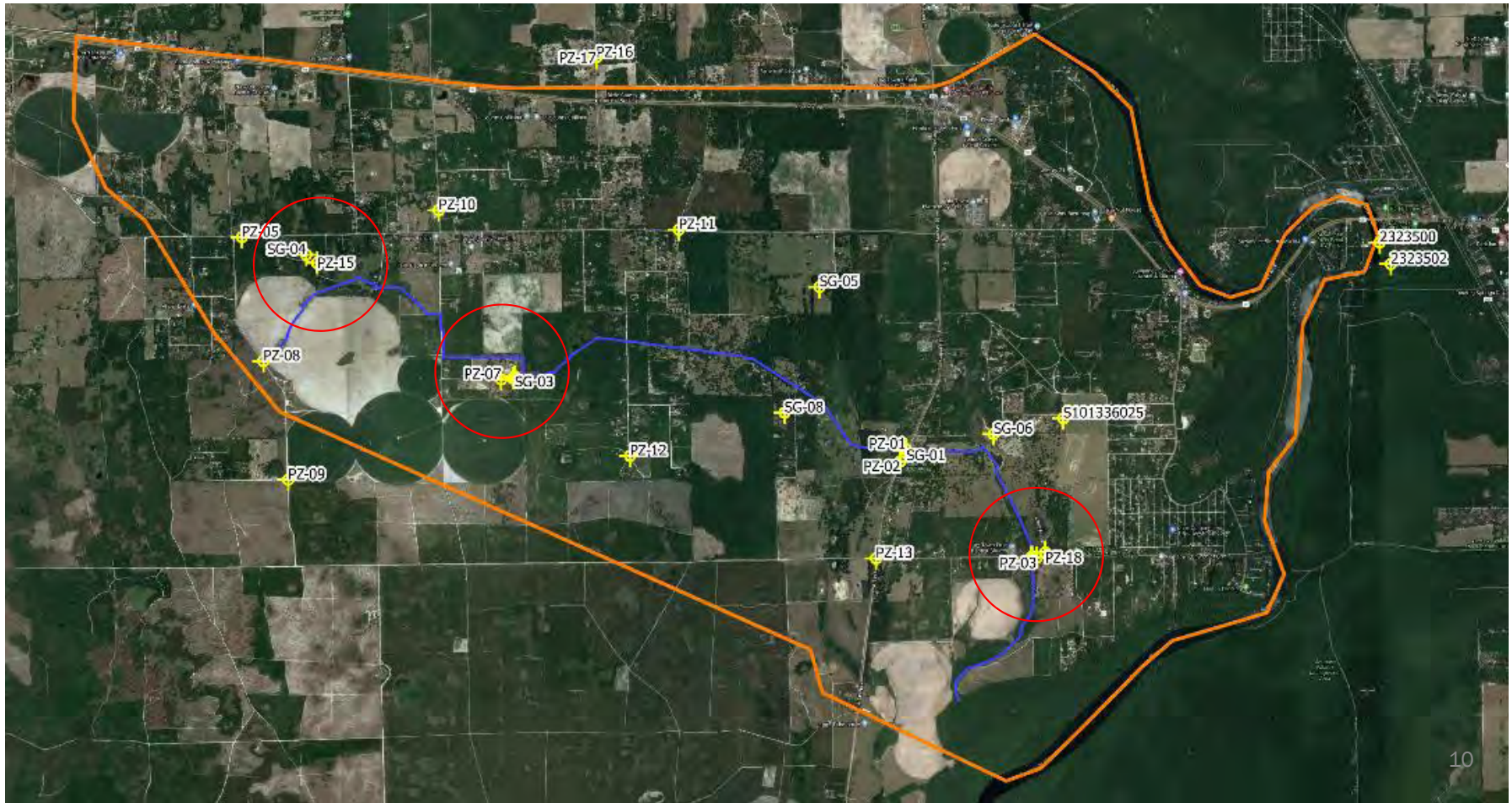
model extension



Area of Interest: Lower Suwannee



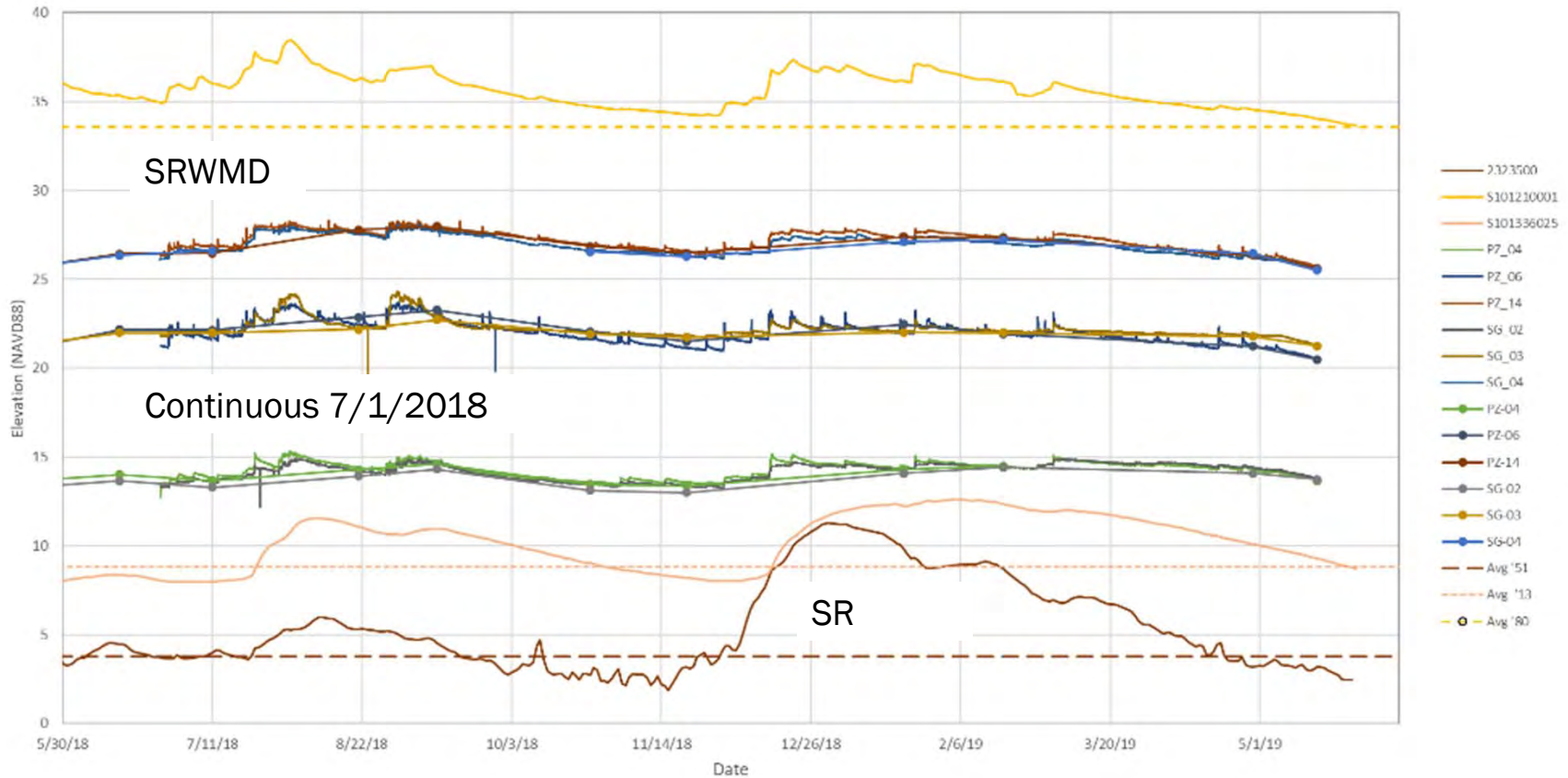
Water Level Monitoring



Water Level Monitoring

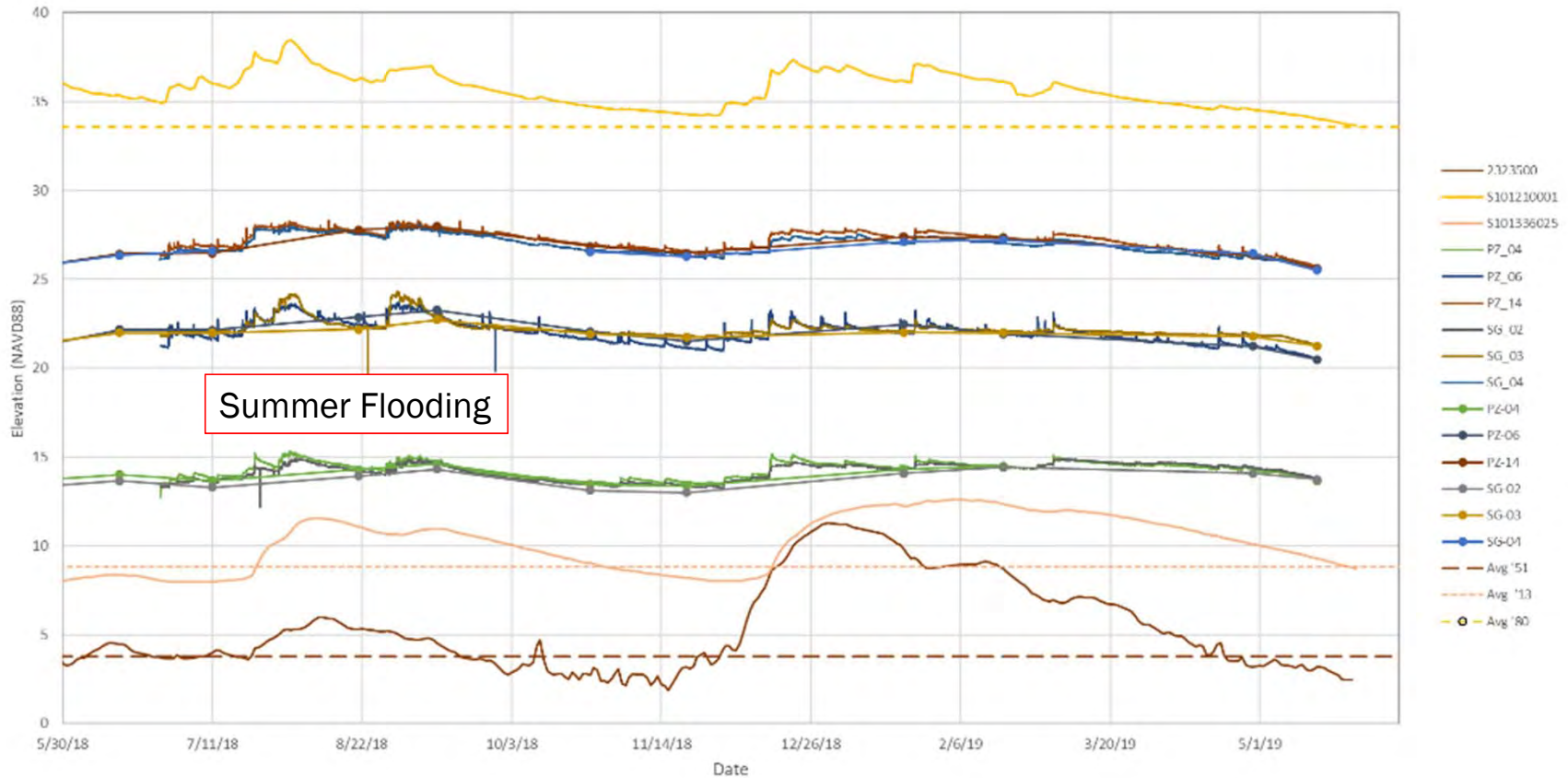


Water Level Monitoring



Non-continuous
10/2017

Water Level Monitoring



Summer Flooding



Summer Flooding



Locklear



Summer Flooding



Summer Flooding



Summer Flooding



Locklear



Summer Flooding

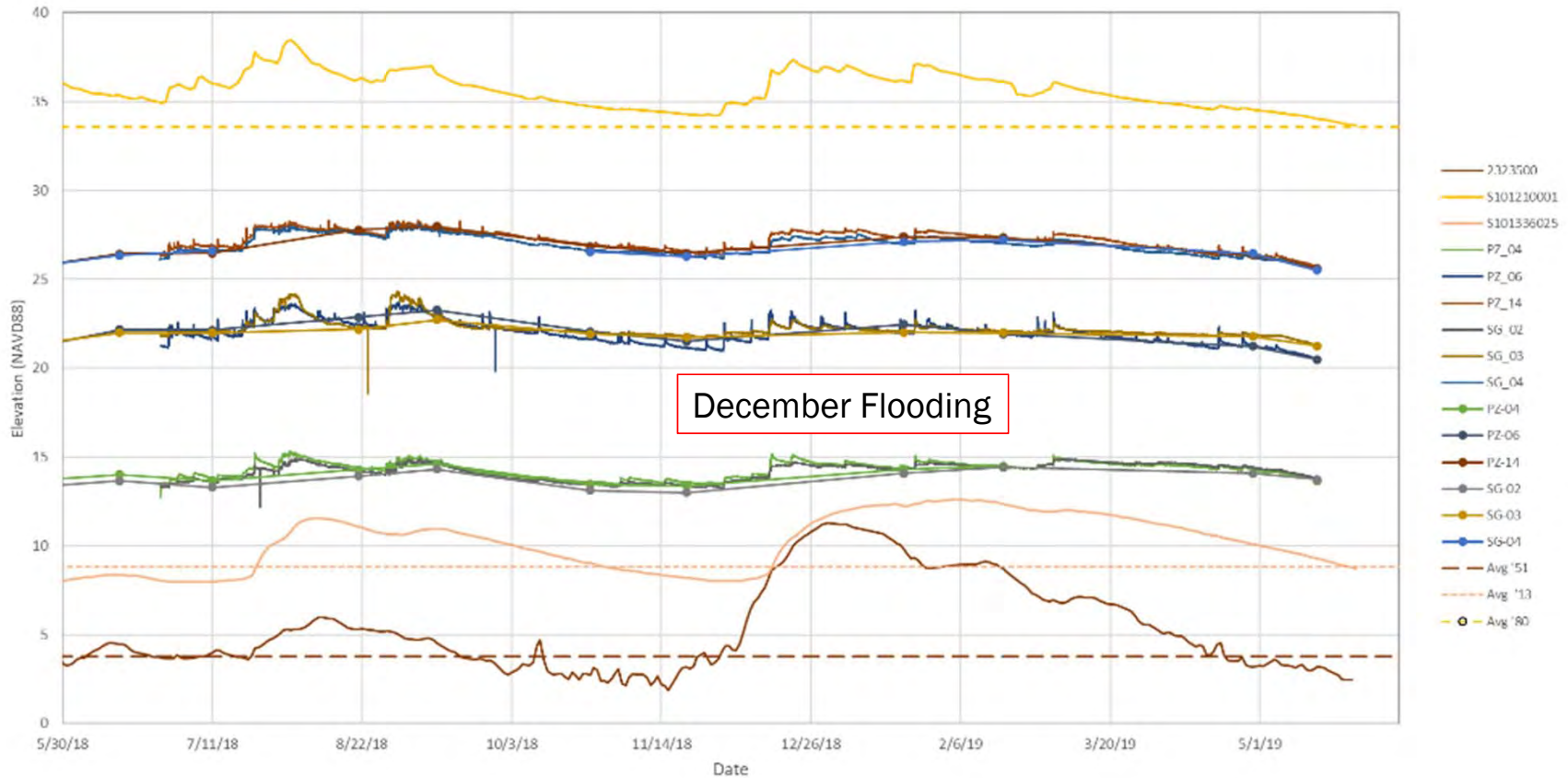


Summer Flooding



Locklear

Water Level Monitoring



December Flooding



December Flooding



Drummond Carpenter

December Flooding



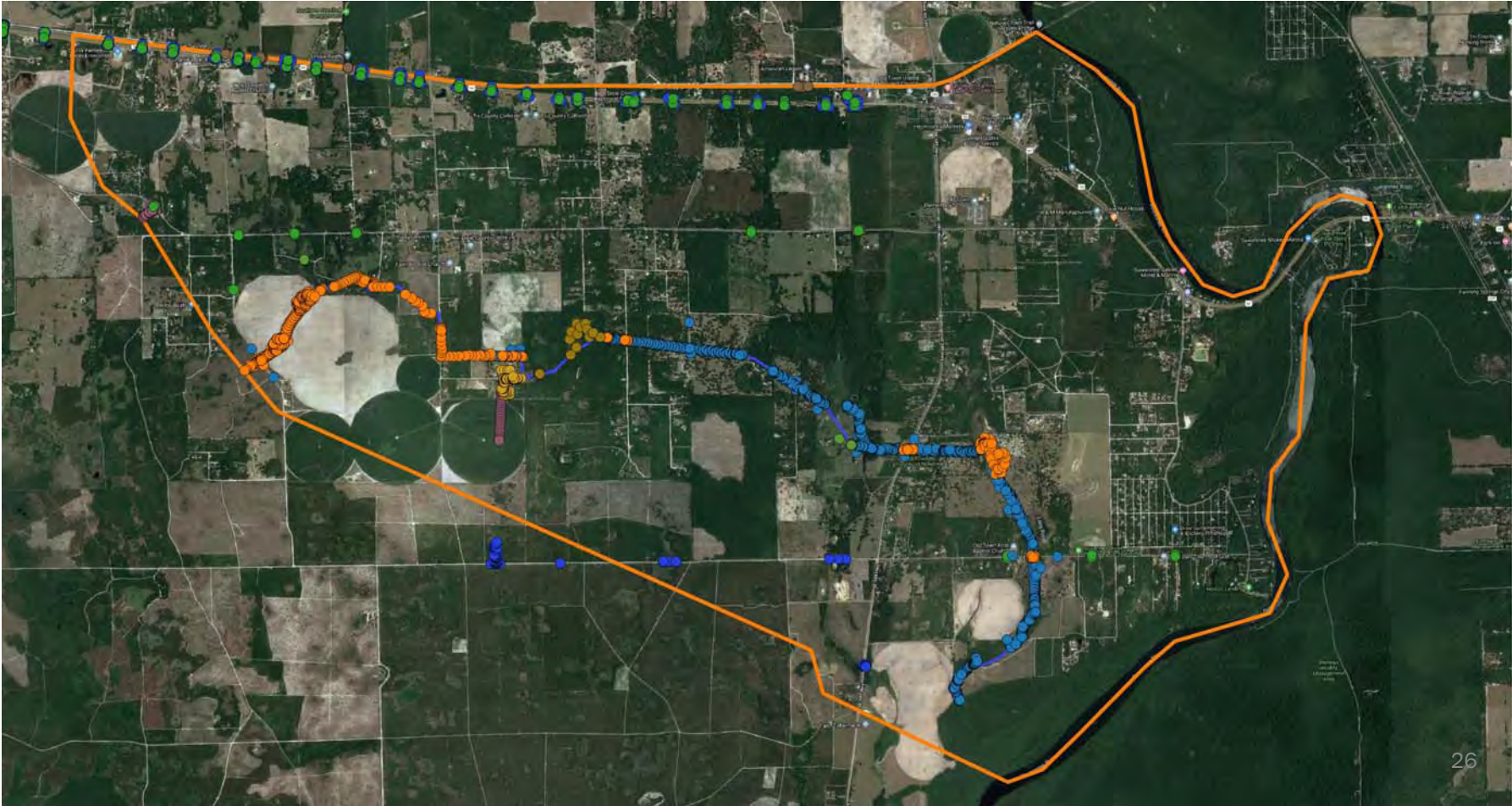
Drummond Carpenter

December Flooding



Drummond Carpenter

Surveying



Surveying



Channel Restoration



clearing effort between 06/2018 and 09/2018



Channel Restoration



clearing effort between 06/2018 and 09/2018



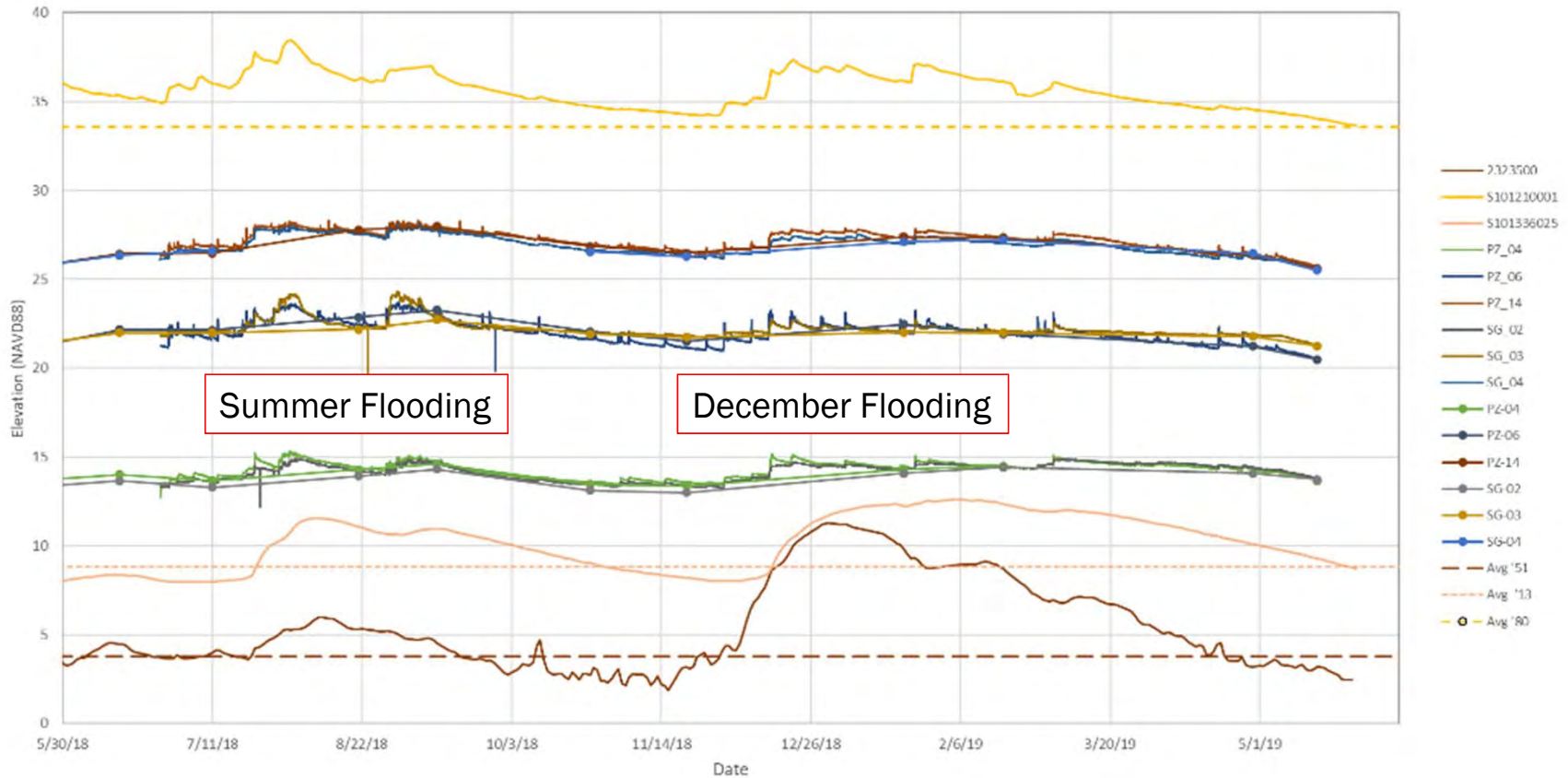
Channel Restoration



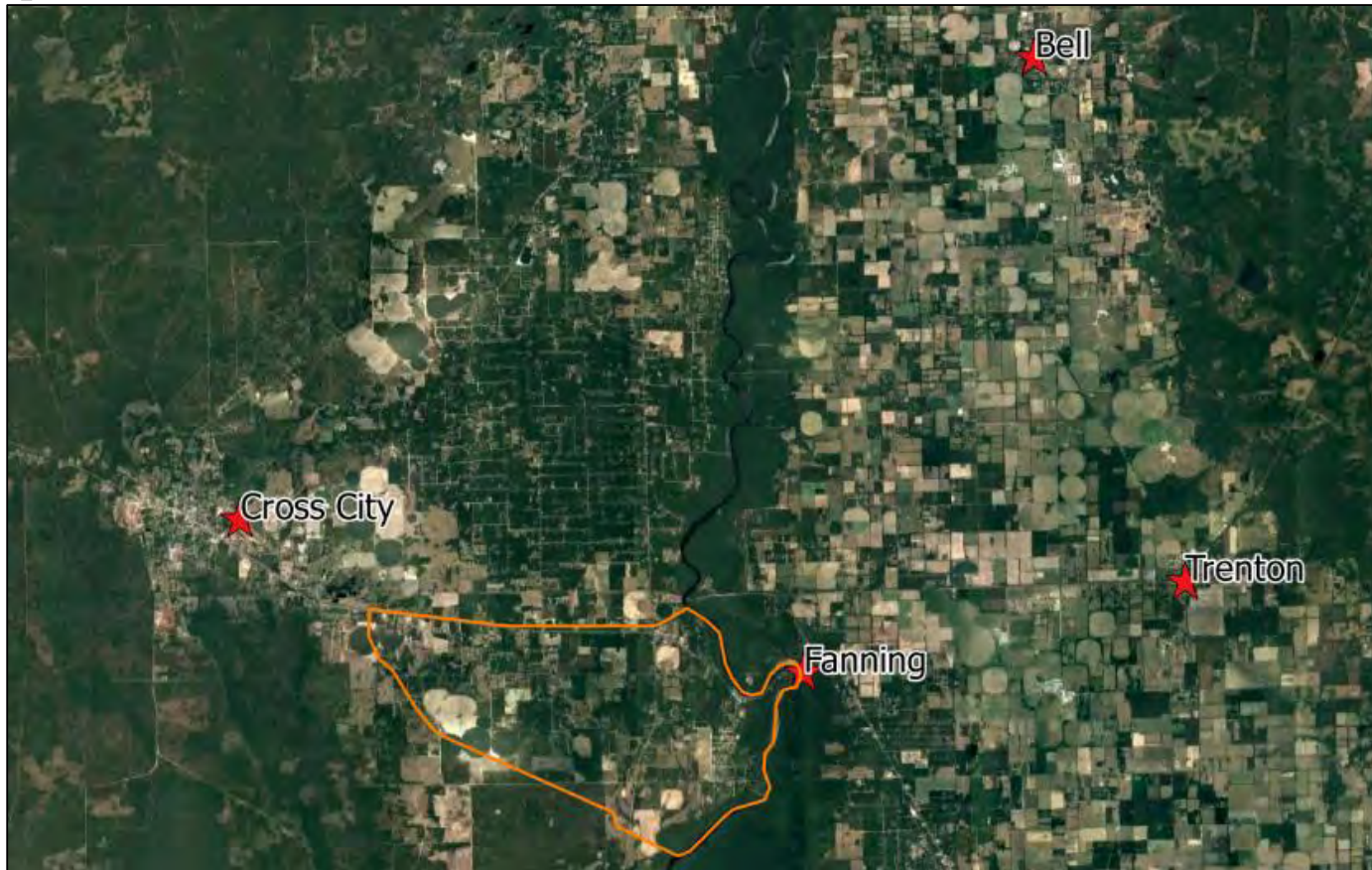
clearing effort between 06/2018 and 09/2018



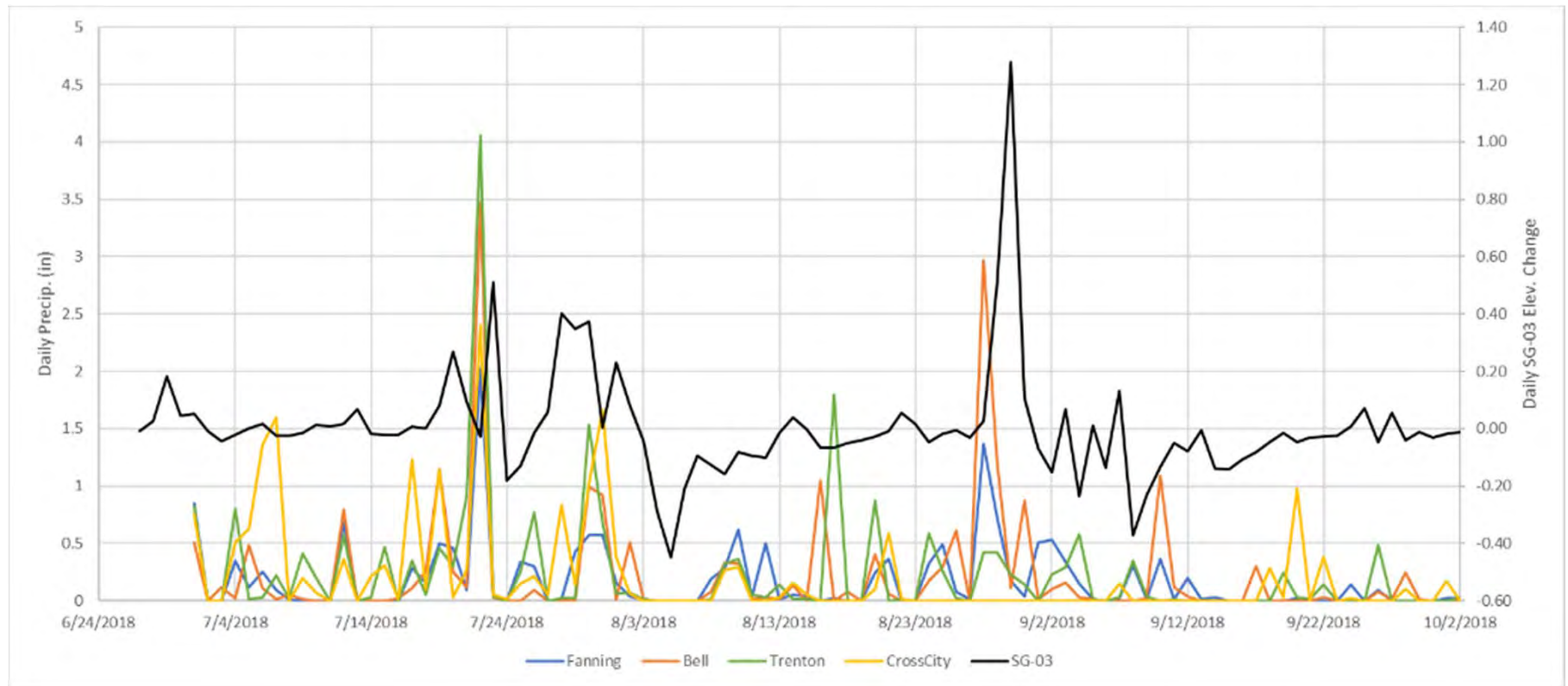
Precipitation Data



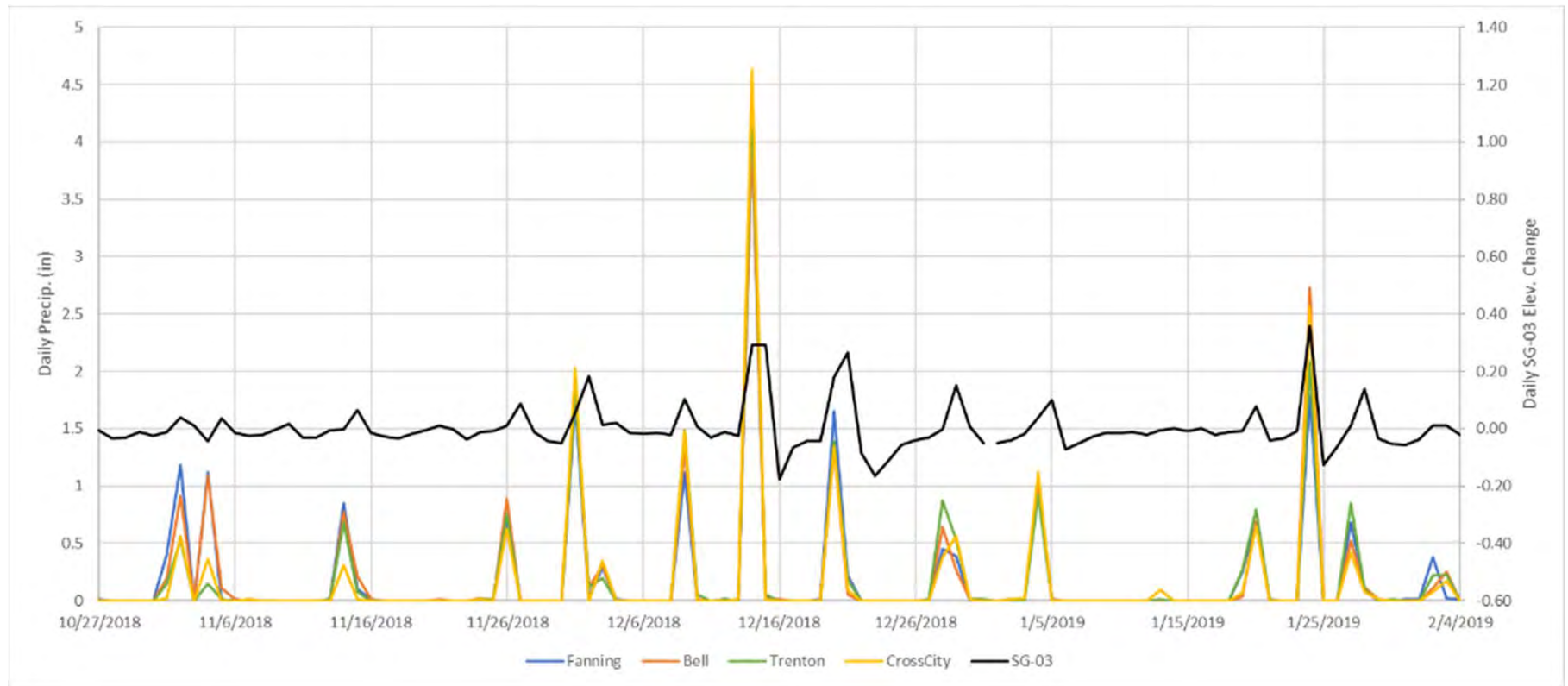
Precipitation Data



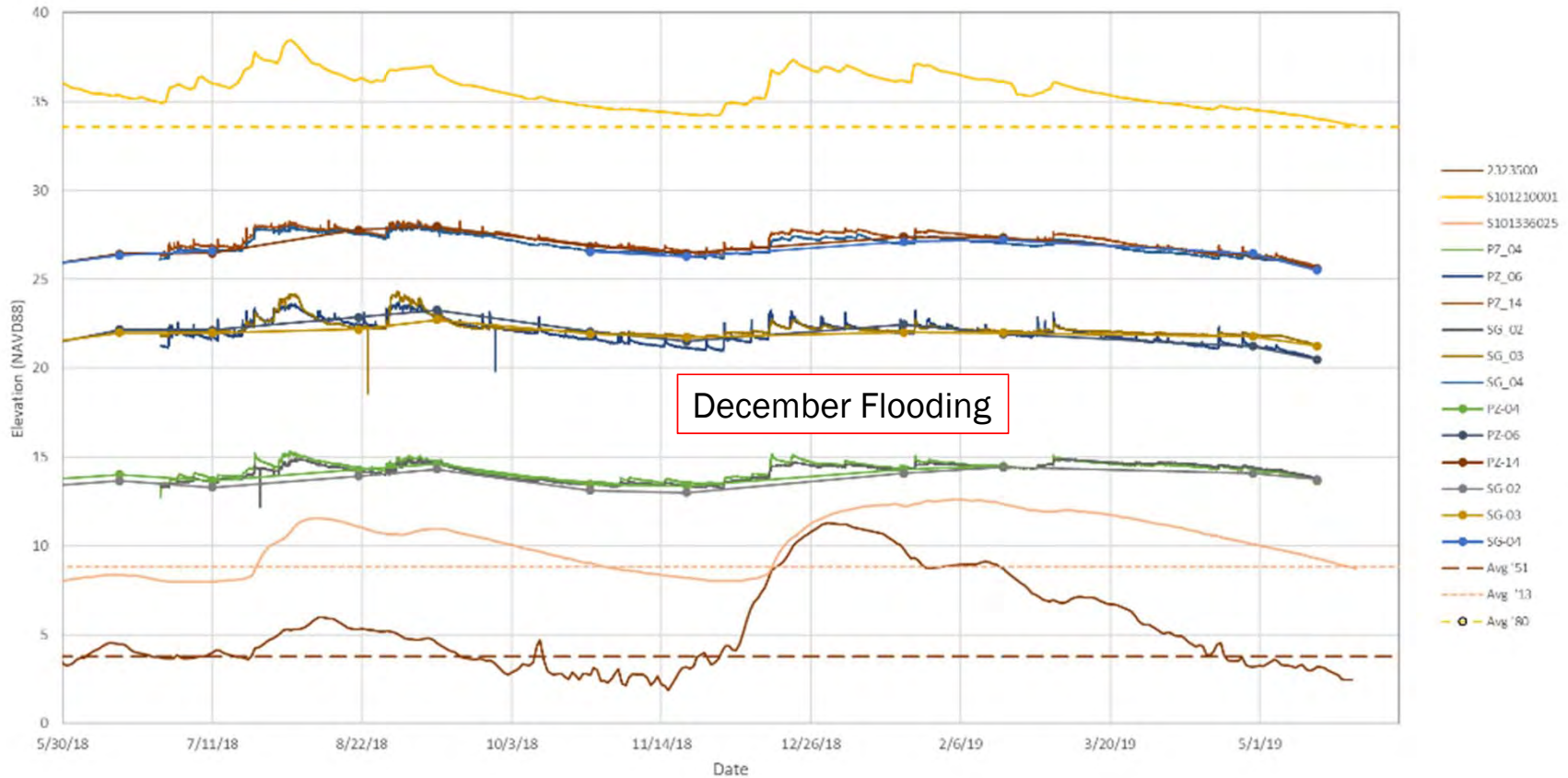
Precipitation Data – July to Sep.



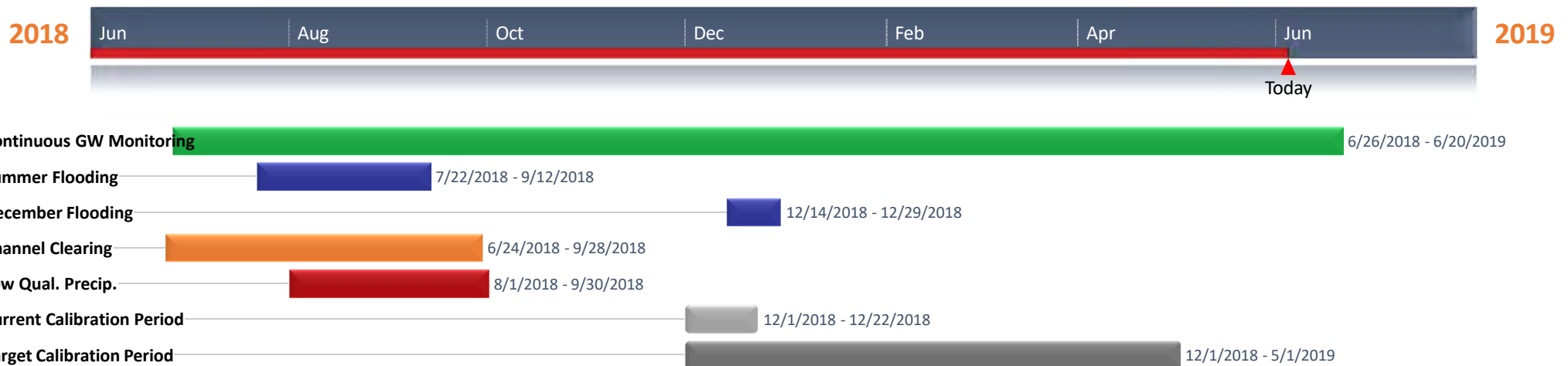
Precipitation Data – Nov. to Jan.



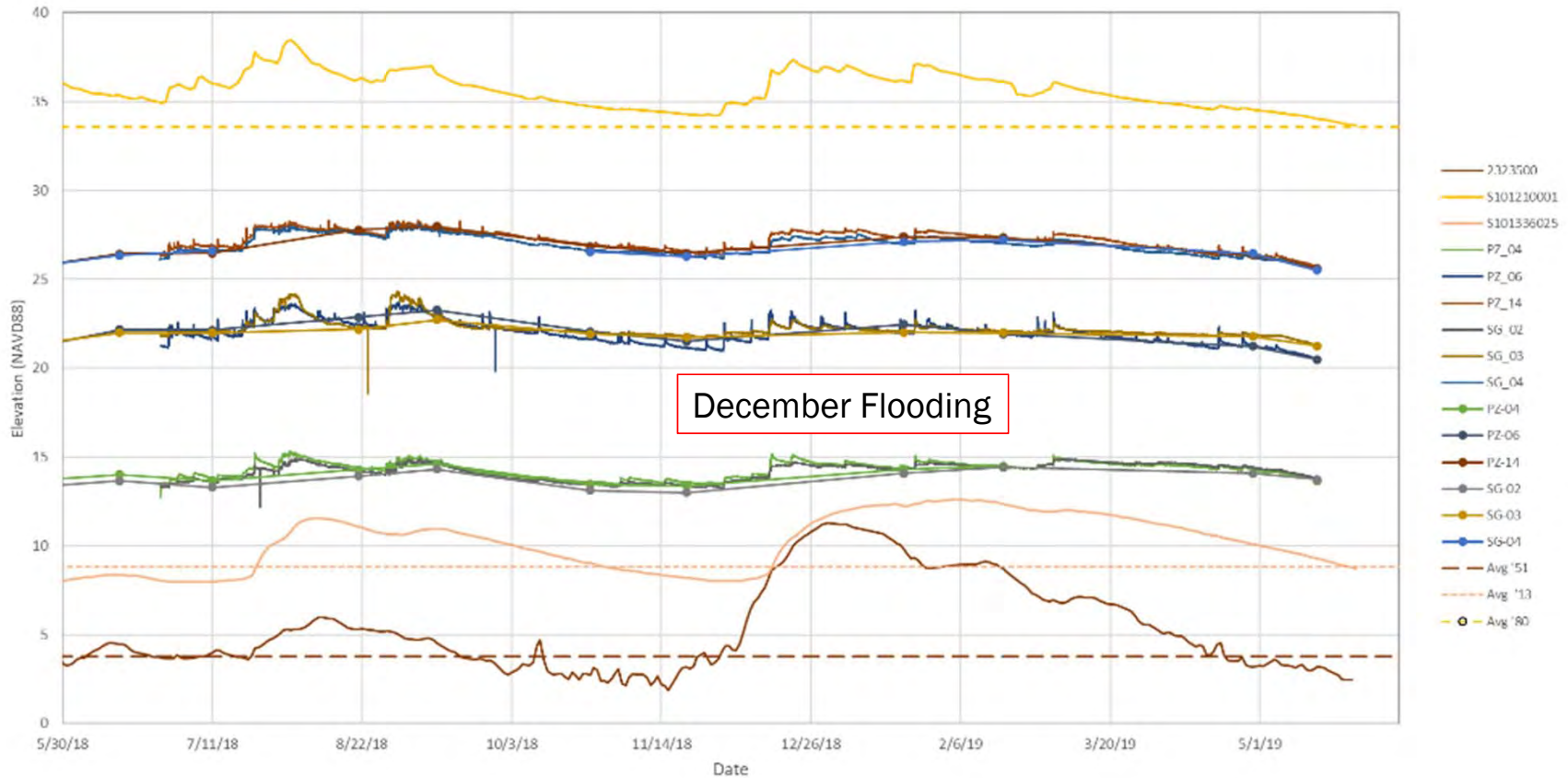
Calibration Period



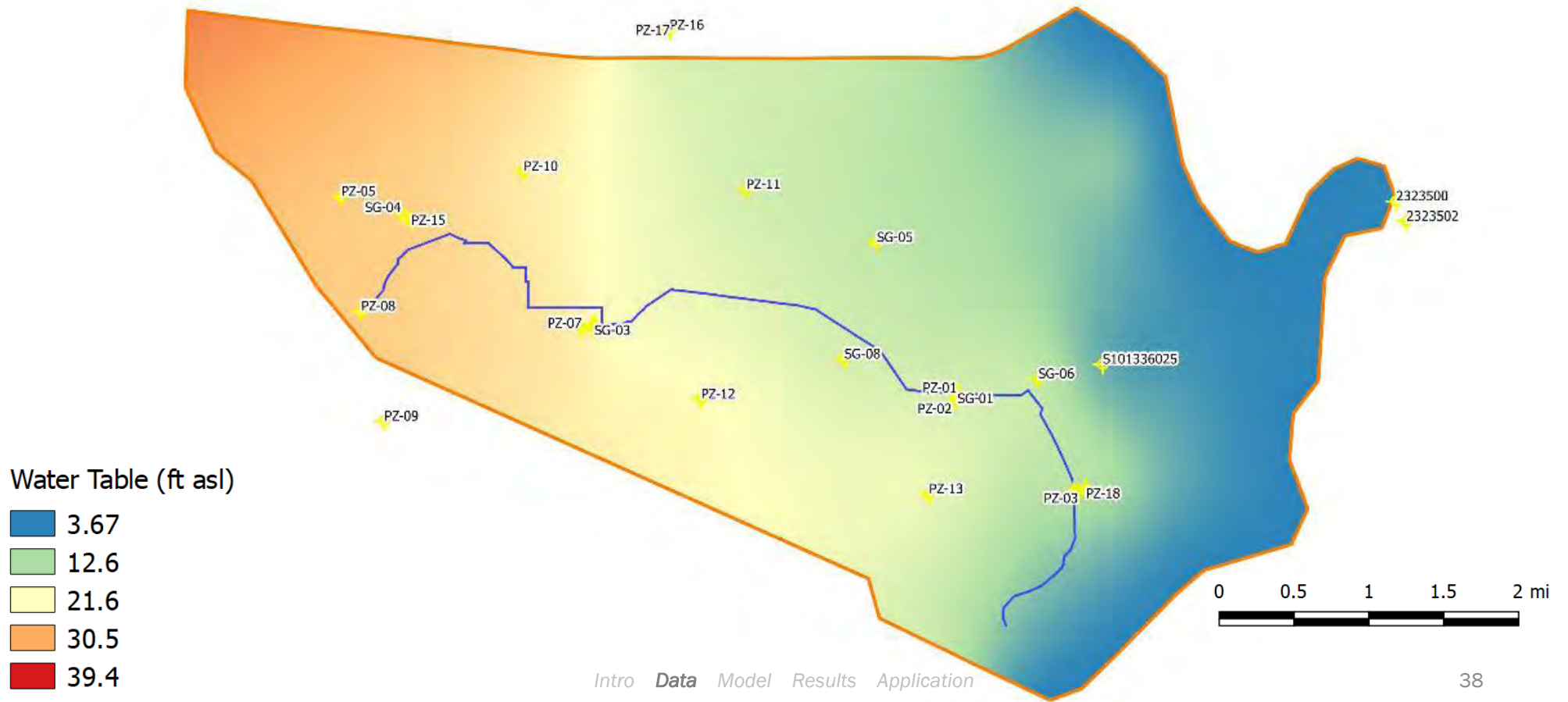
Calibration Period



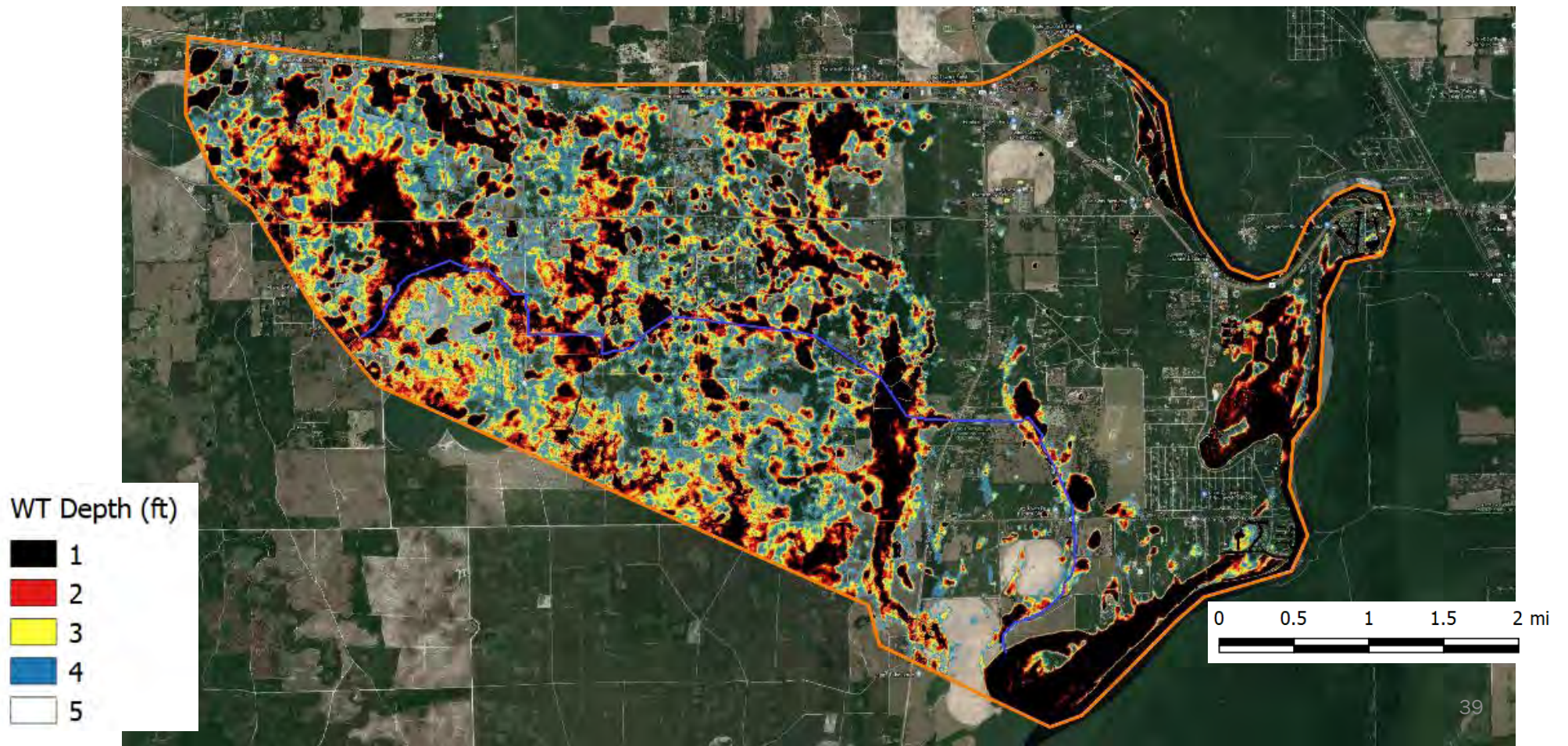
Water Level Monitoring



Water Level Monitoring

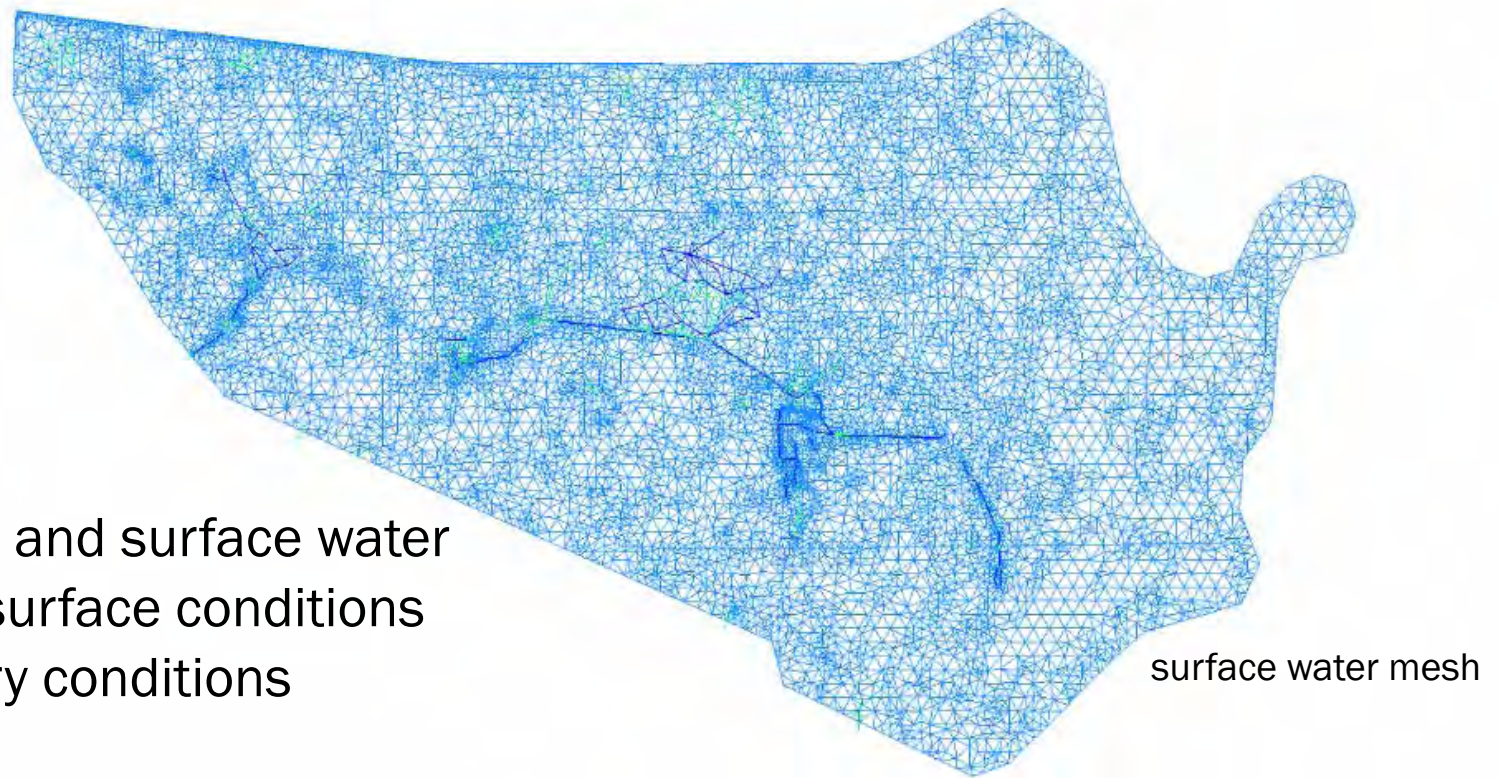


Water Level Monitoring



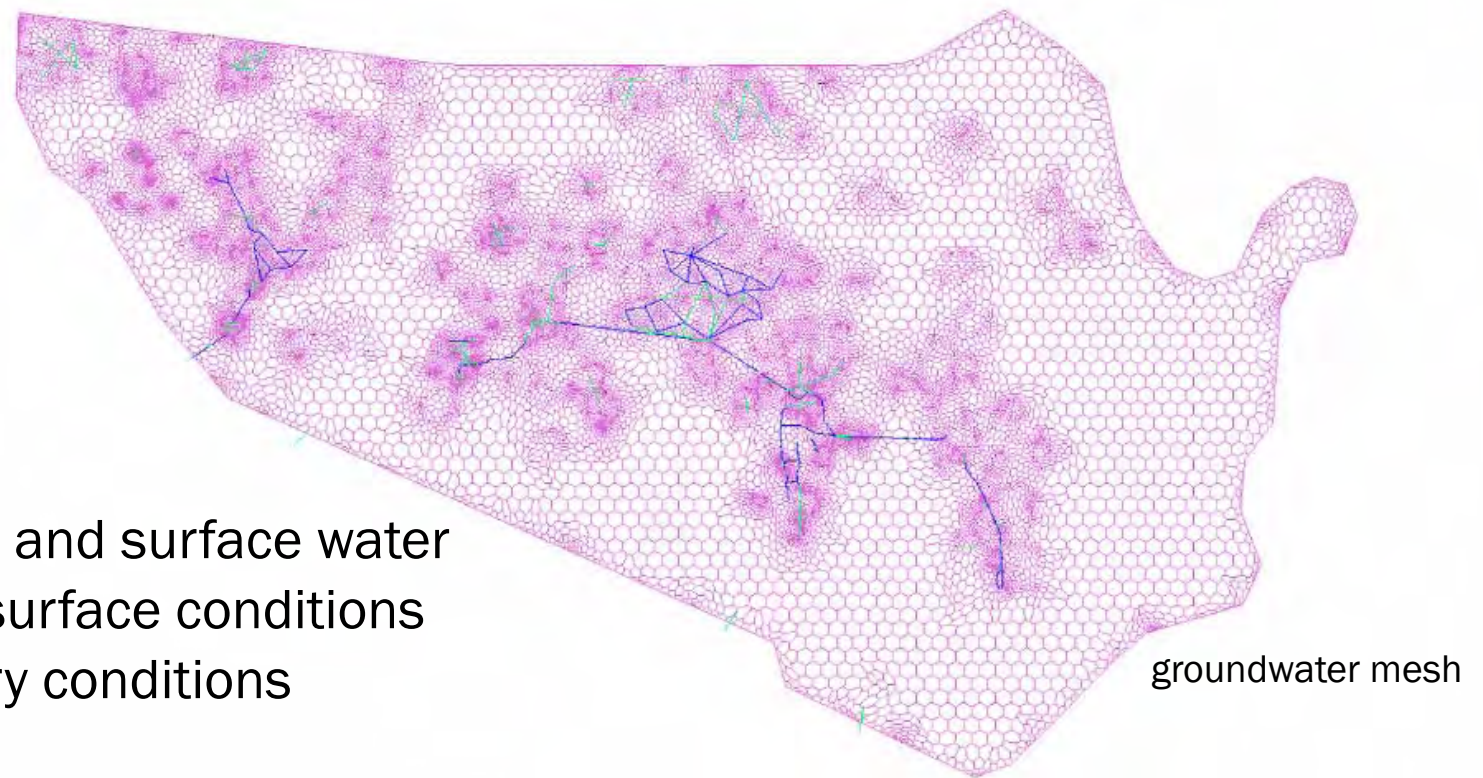
ICPR v4 Model

280 nodes
300 links
coupled groundwater and surface water
spatially varying subsurface conditions
time-varying boundary conditions

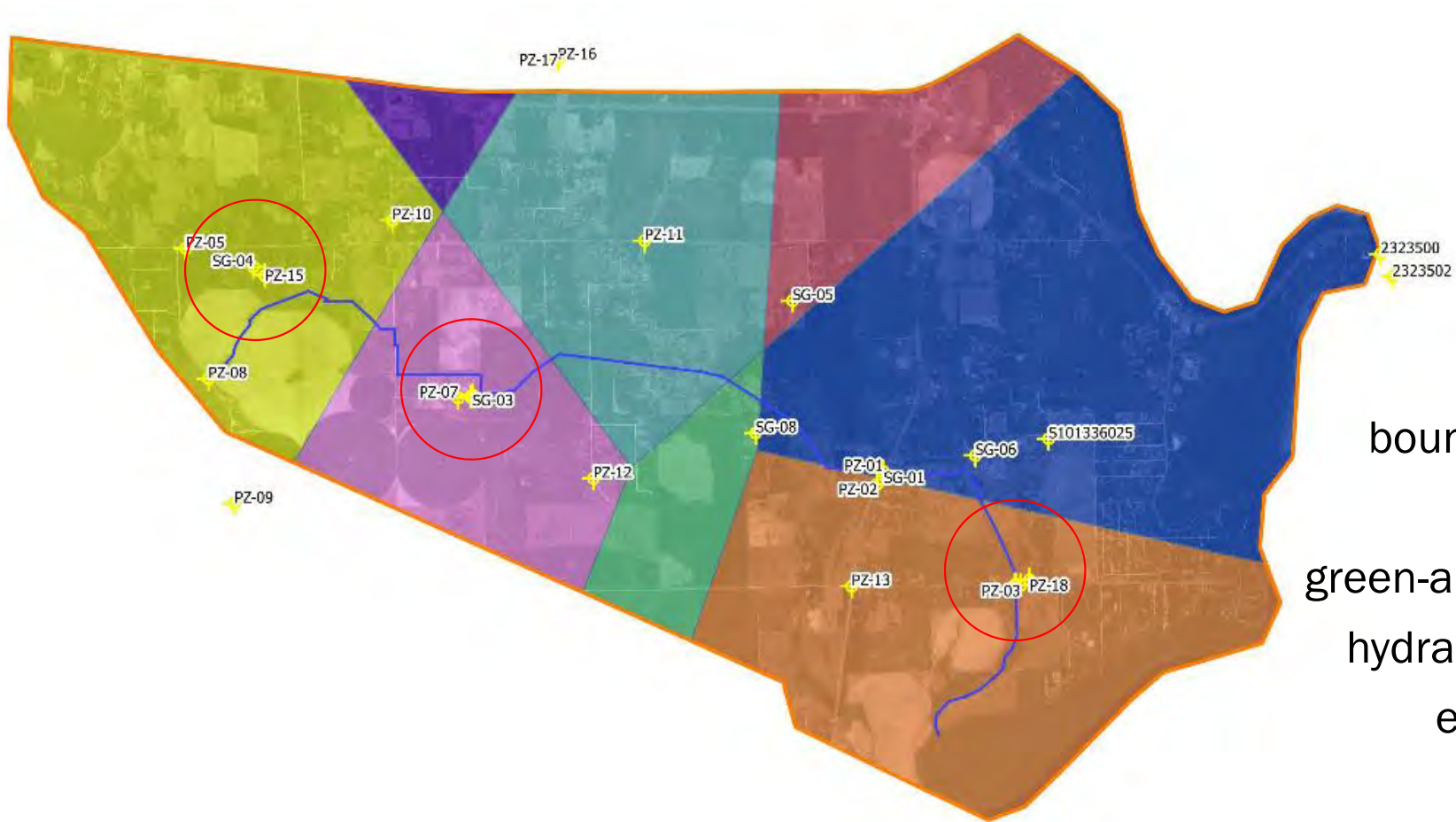


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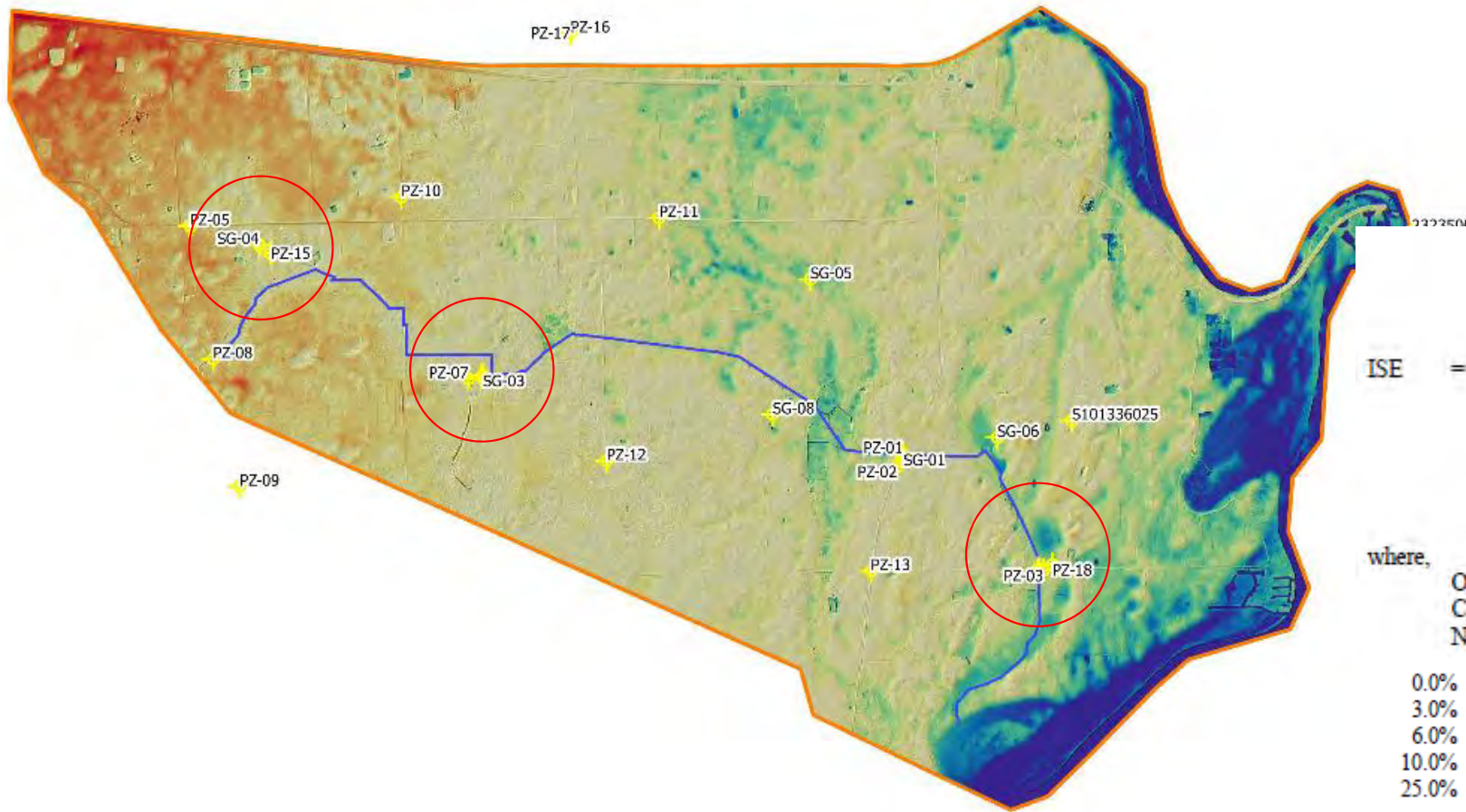


Calibration



boundary conditions
roughness
green-ampt parameters
hydraulic conductivity
effective porosity

Calibration



(Marsalek et al, 1975)

$$ISE = \frac{\left[\sum_{i=1}^N (O_i - C_i)^2 \right]^{1/2}}{\sum_{i=1}^N O_i} \times 100$$

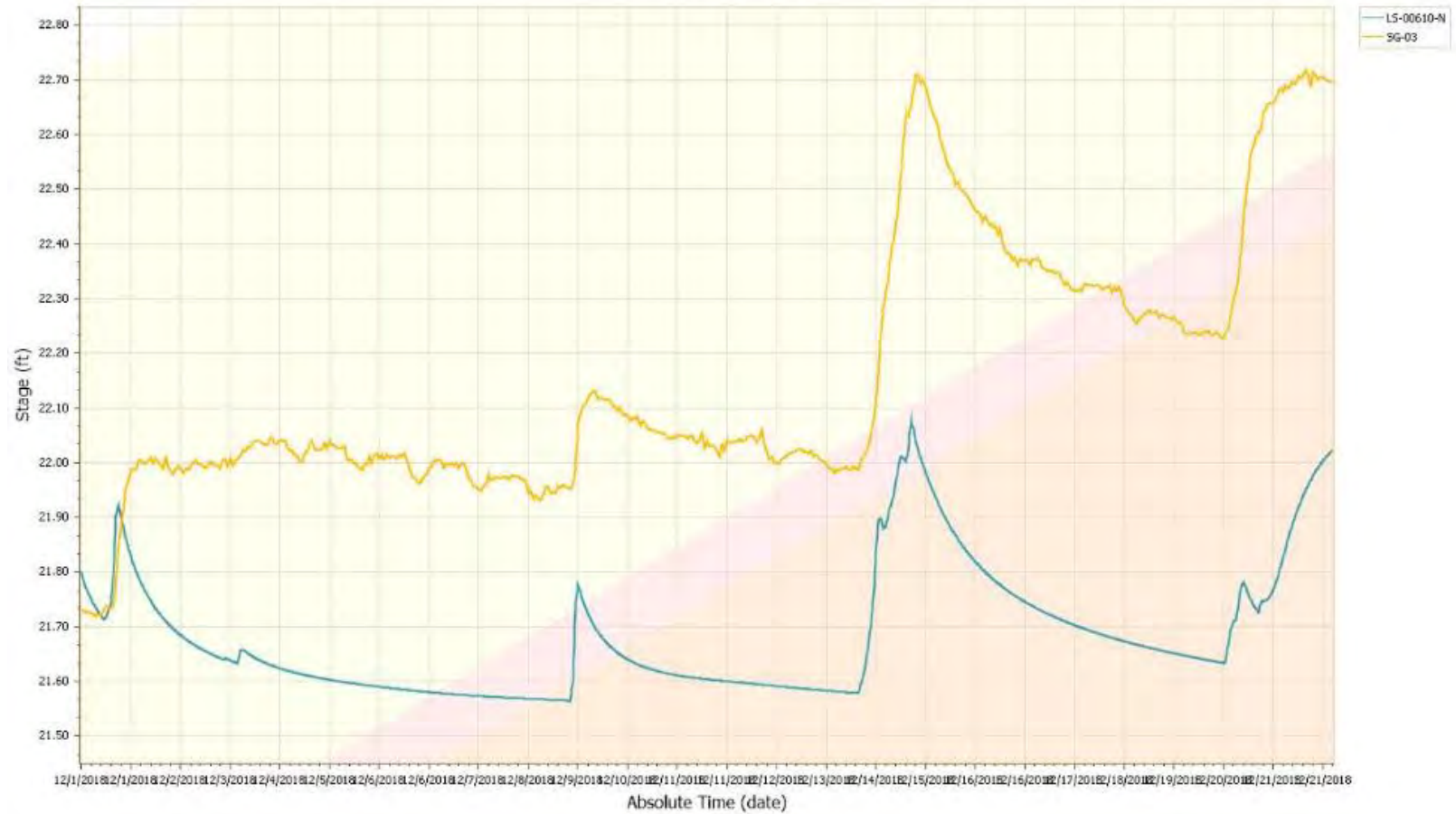
where,

O_i is the observed or recorded depth,
 C_i is the computed depth, and
 N is the number of observations.

$0.0\% \leq ISE \leq 3.0\%$	excellent
$3.0\% \leq ISE \leq 6.0\%$	very good
$6.0\% \leq ISE \leq 10.0\%$	good
$10.0\% \leq ISE \leq 25.0\%$	fair
$25.0\% \leq ISE$	poor

Calibration

Sim: Yansen



Calibration



Calibration



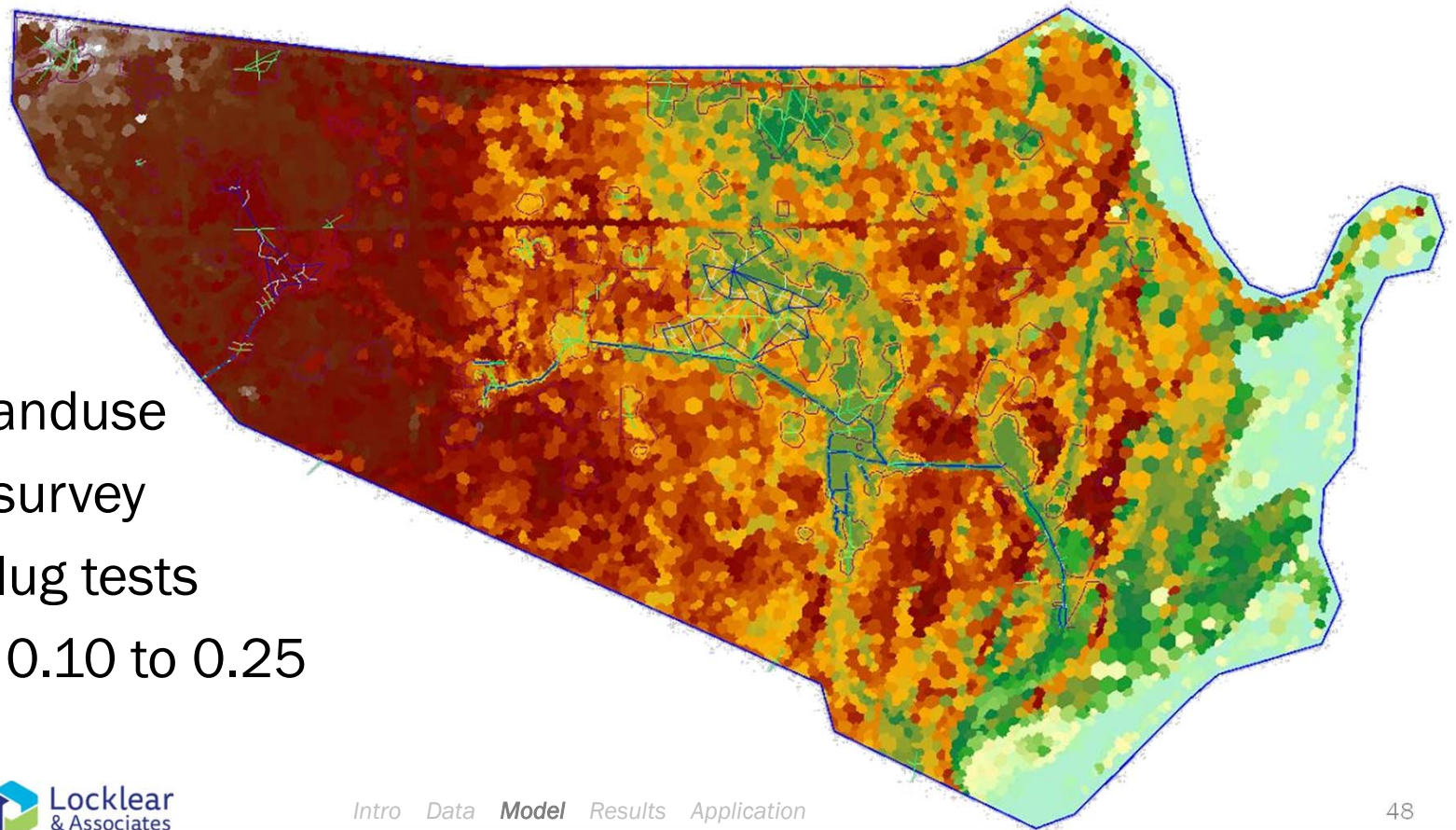
Drummond Carpenter

Calibration

Sim: Cont_20181201_20181222



Calibration



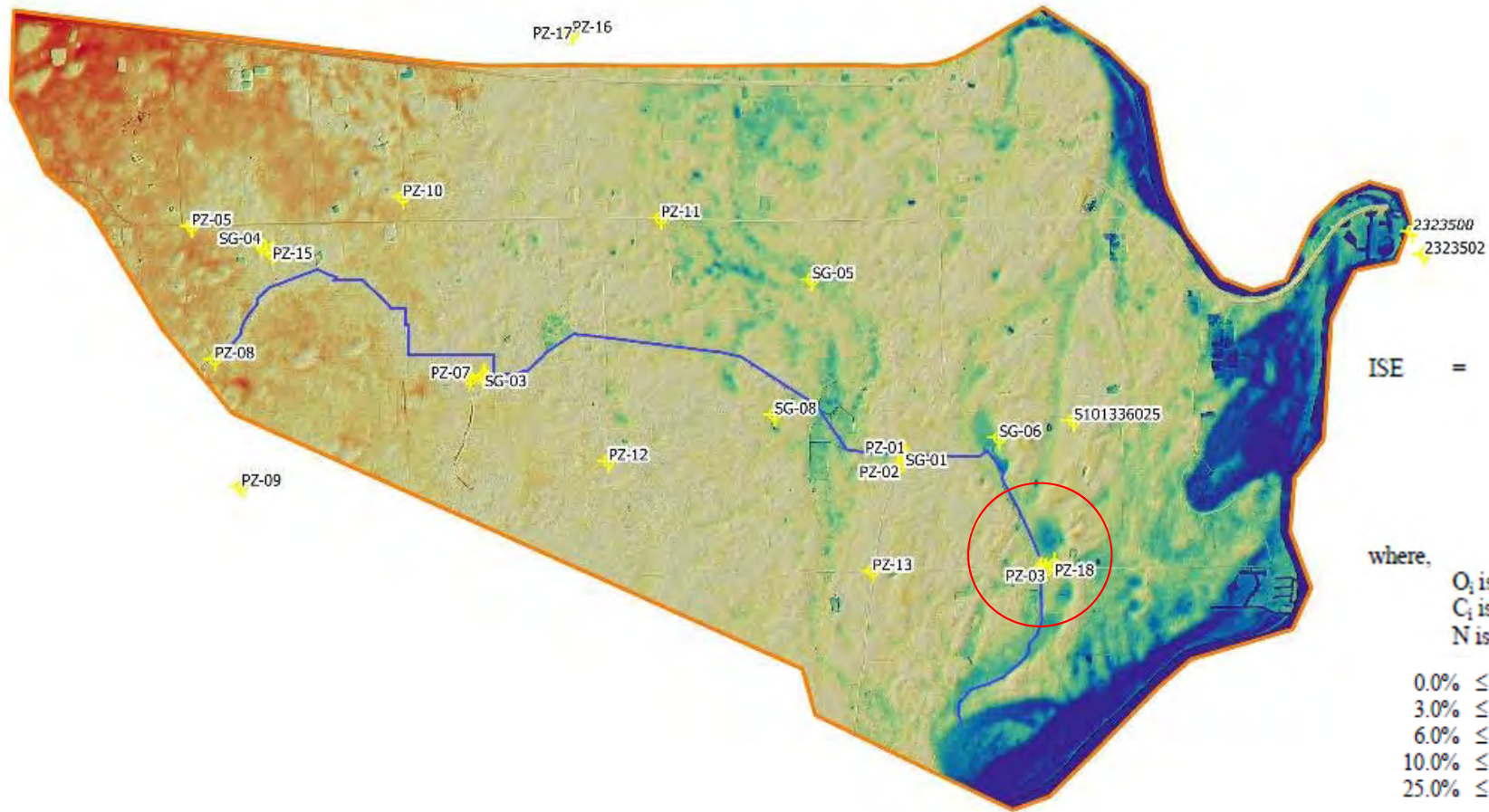
roughness – landuse

ga – web soil survey

hyd. cond. – slug tests

eff. porosity – 0.10 to 0.25

Calibration Results



(Marsalek et al, 1975)

$$ISE = \frac{\left[\sum_{i=1}^N (O_i - C_i)^2 \right]^{1/2}}{\sum_{i=1}^N O_i} \times 100$$

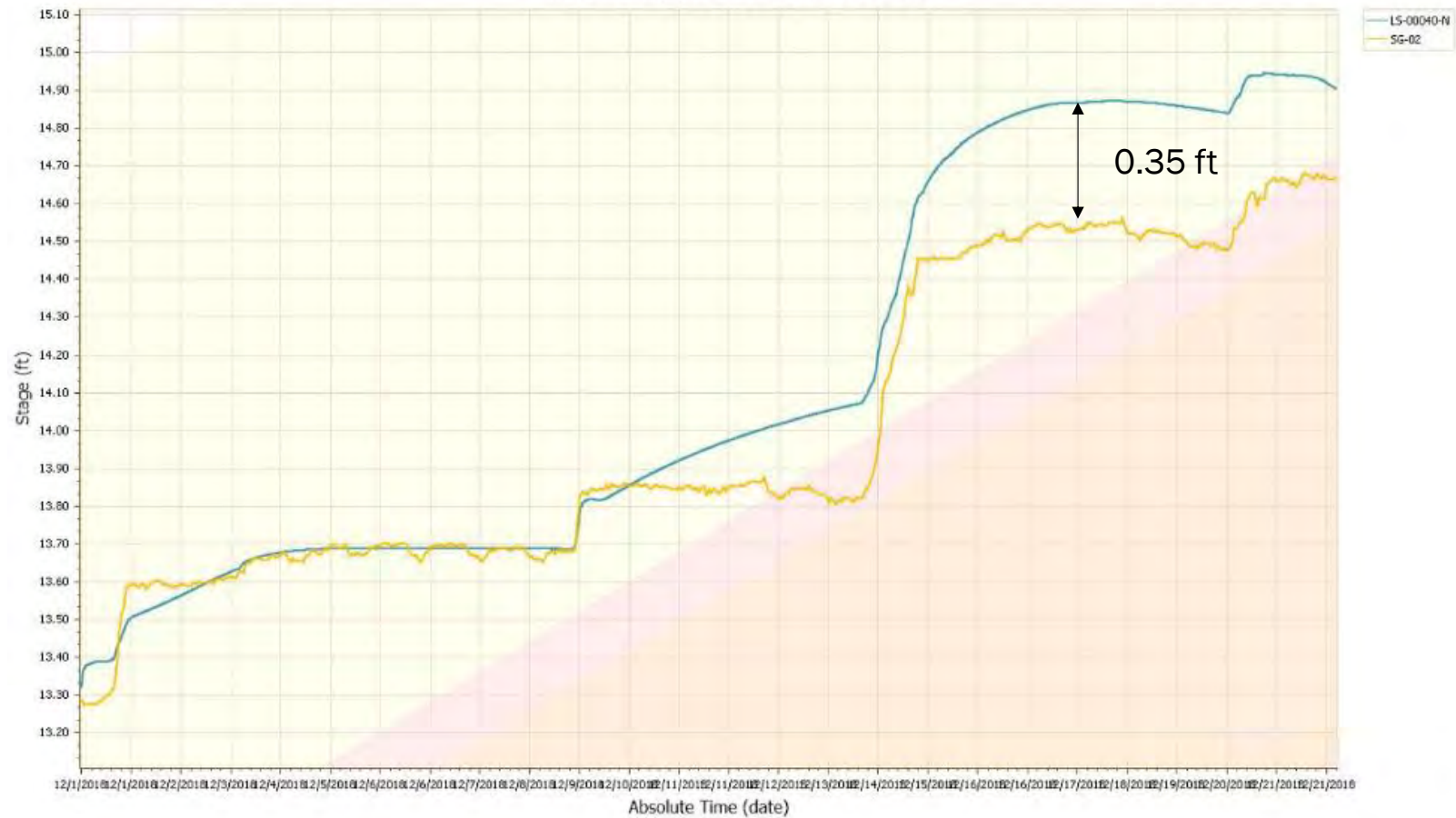
where,

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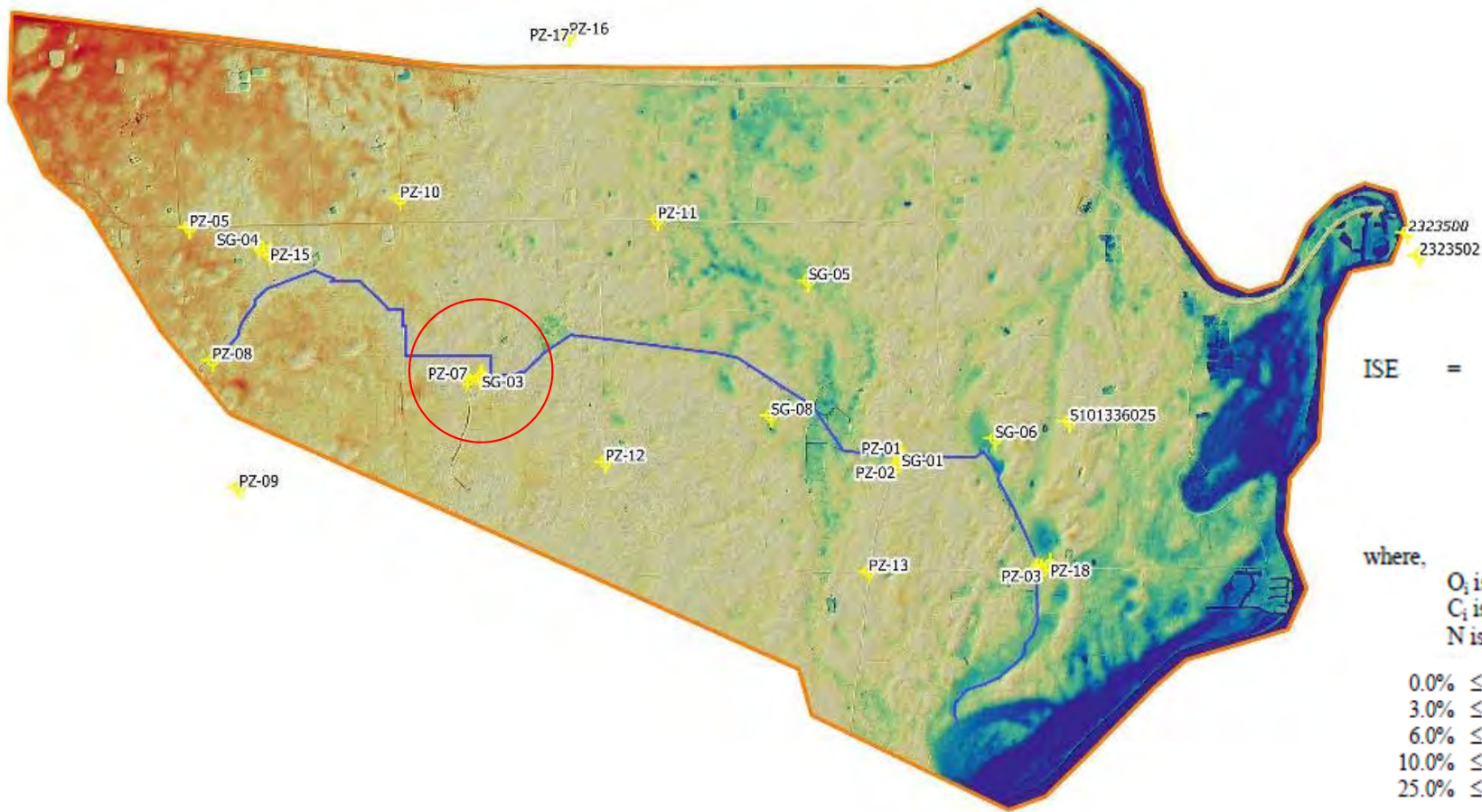
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10.0% ≤ ISE ≤ 25.0%	fair
25.0% ≤ ISE	poor

Calibration Results – 18% Error

Sim: Cont_20181201_20181222



Calibration Results



(Marsalek et al, 1975)

$$ISE = \frac{\left[\sum_{i=1}^N (O_i - C_i)^2 \right]^{1/2}}{\sum_{i=1}^N O_i} \times 100$$

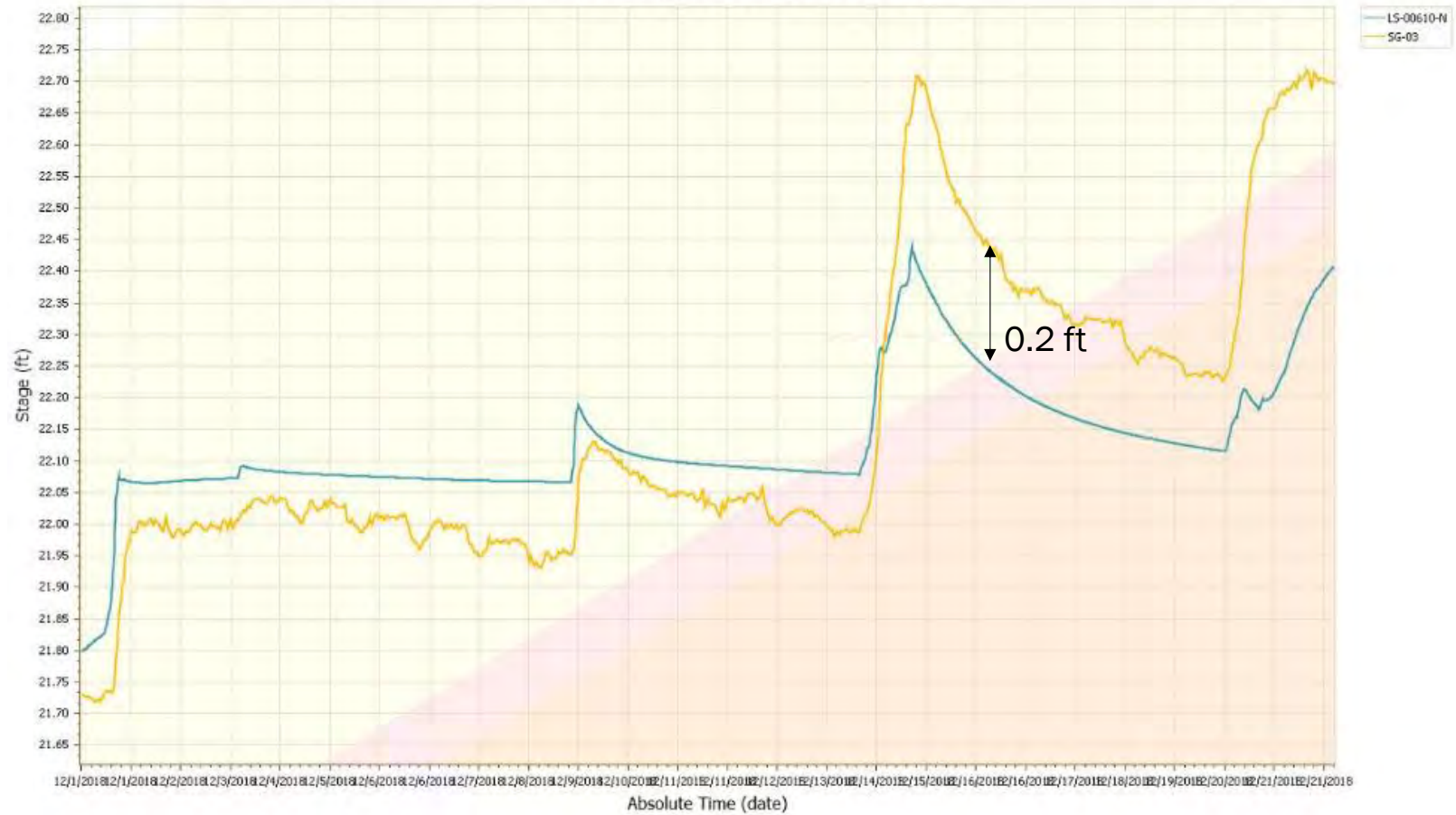
where,

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6.0% ≤ ISE ≤ 10.0%	good
10.0% ≤ ISE ≤ 25.0%	fair
25.0% ≤ ISE	poor

Calibration Results – 4% Error

Sim: Cont_20181201_20181222



Calibration Results



(Marsalek et al, 1975)

$$ISE = \frac{\left[\sum_{i=1}^N (O_i - C_i)^2 \right]^{1/2}}{\sum_{i=1}^N O_i} \times 100$$

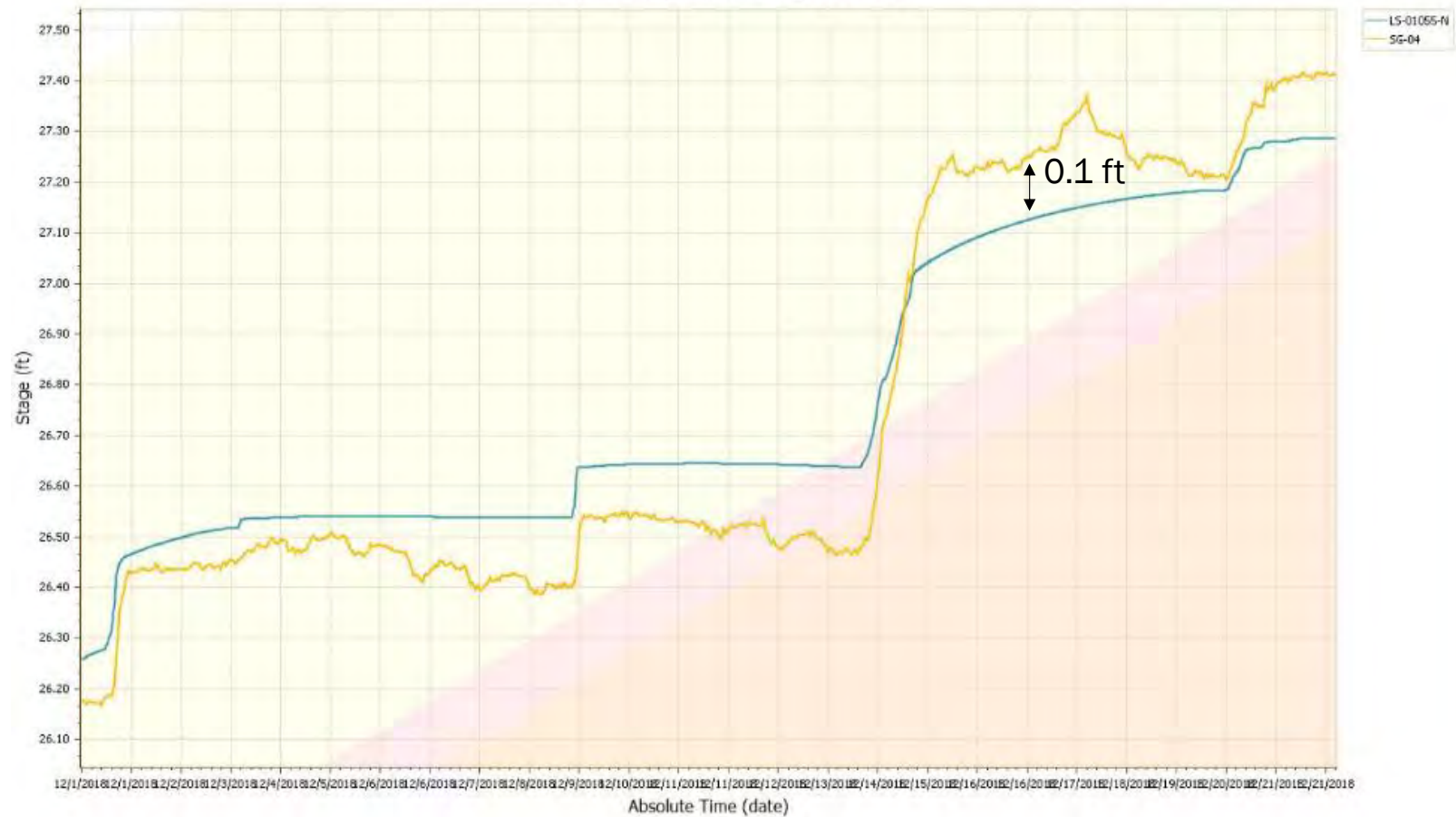
where,

O_i is the observed or recorded depth,
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 N is the number of observations.

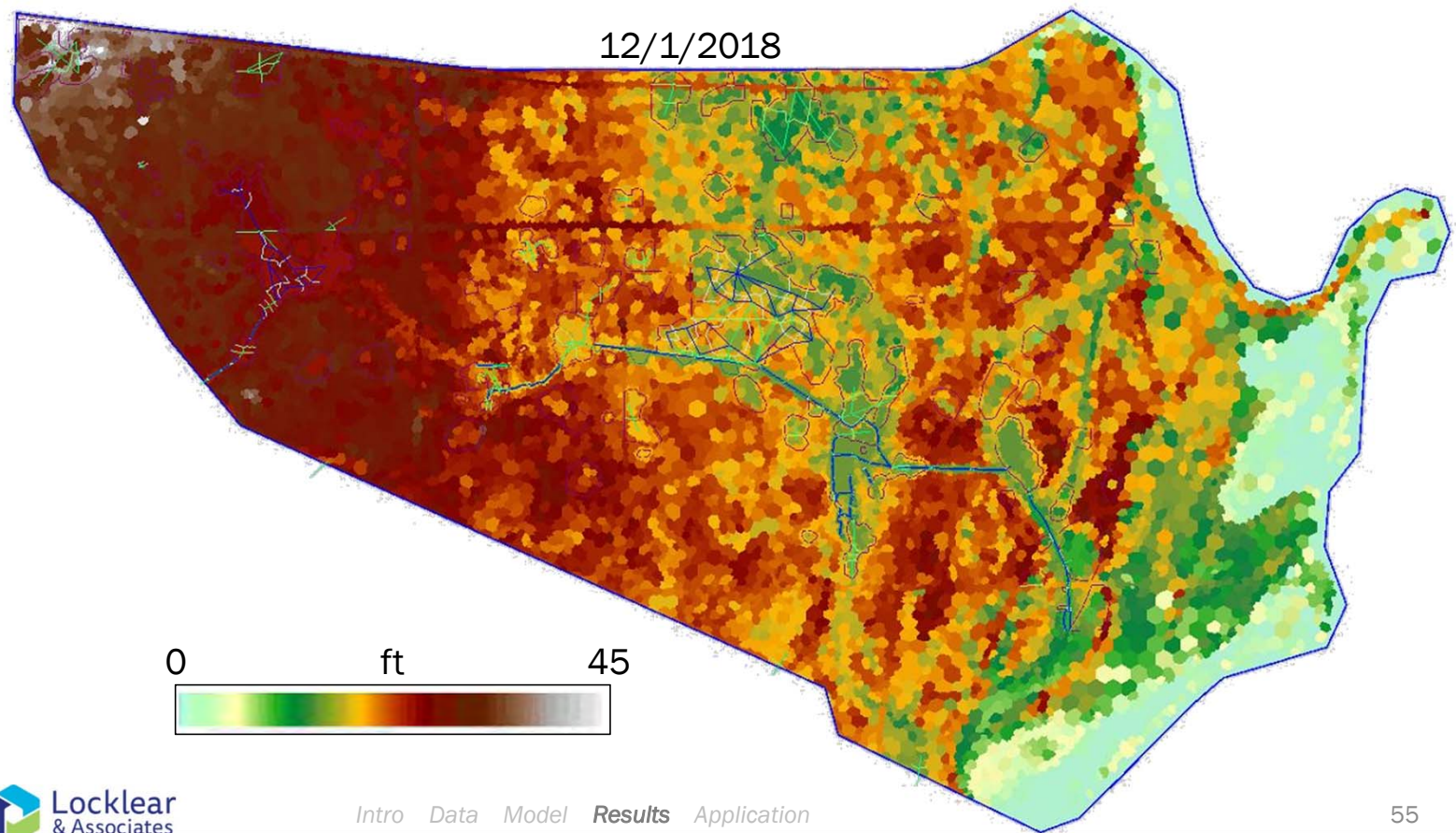
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$10.0\% \leq ISE \leq 25.0\%$	fair
$25.0\% \leq ISE$	poor

Calibration Results – 4% Error

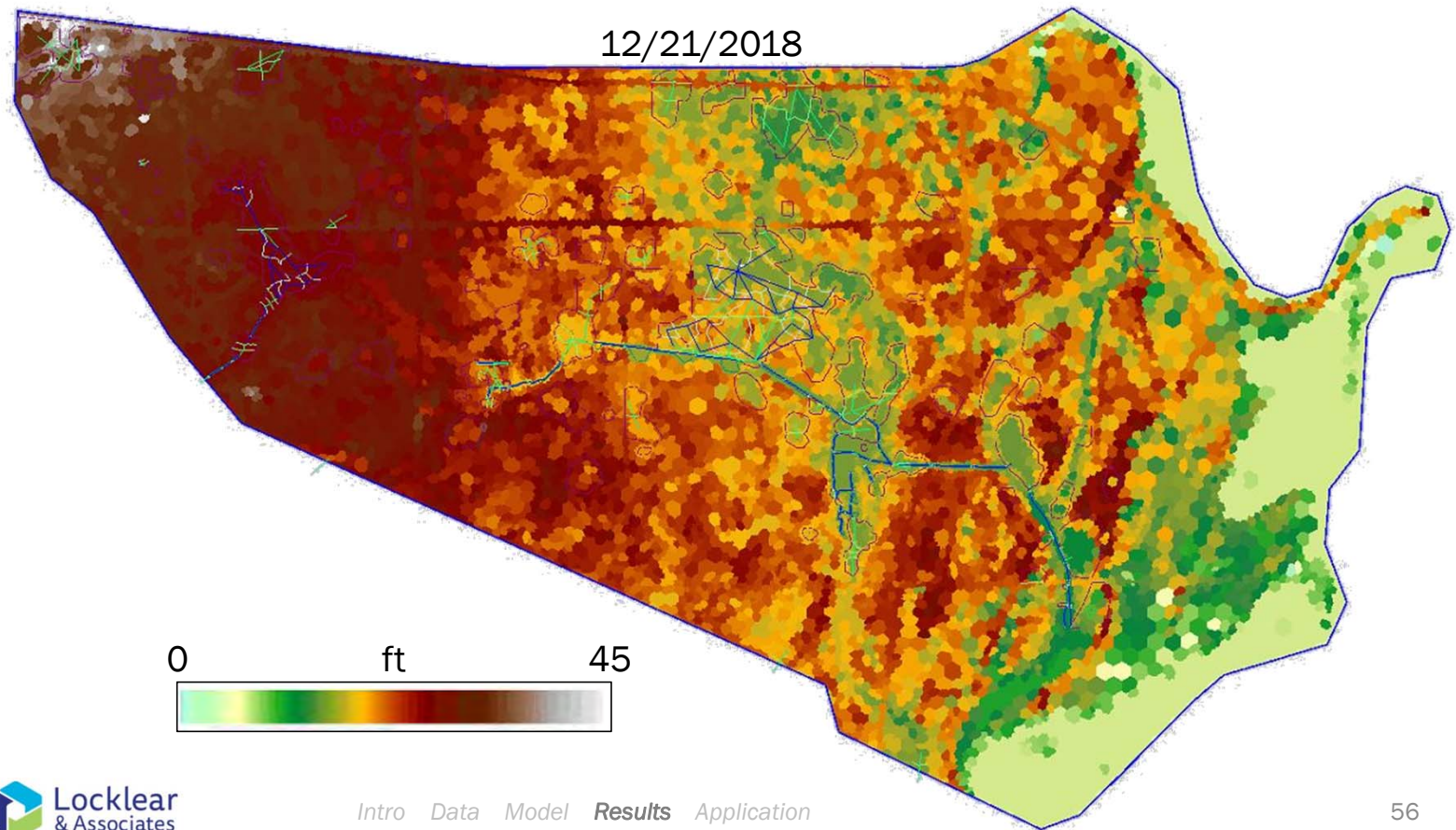
Sim: Cont_20181201_20181222



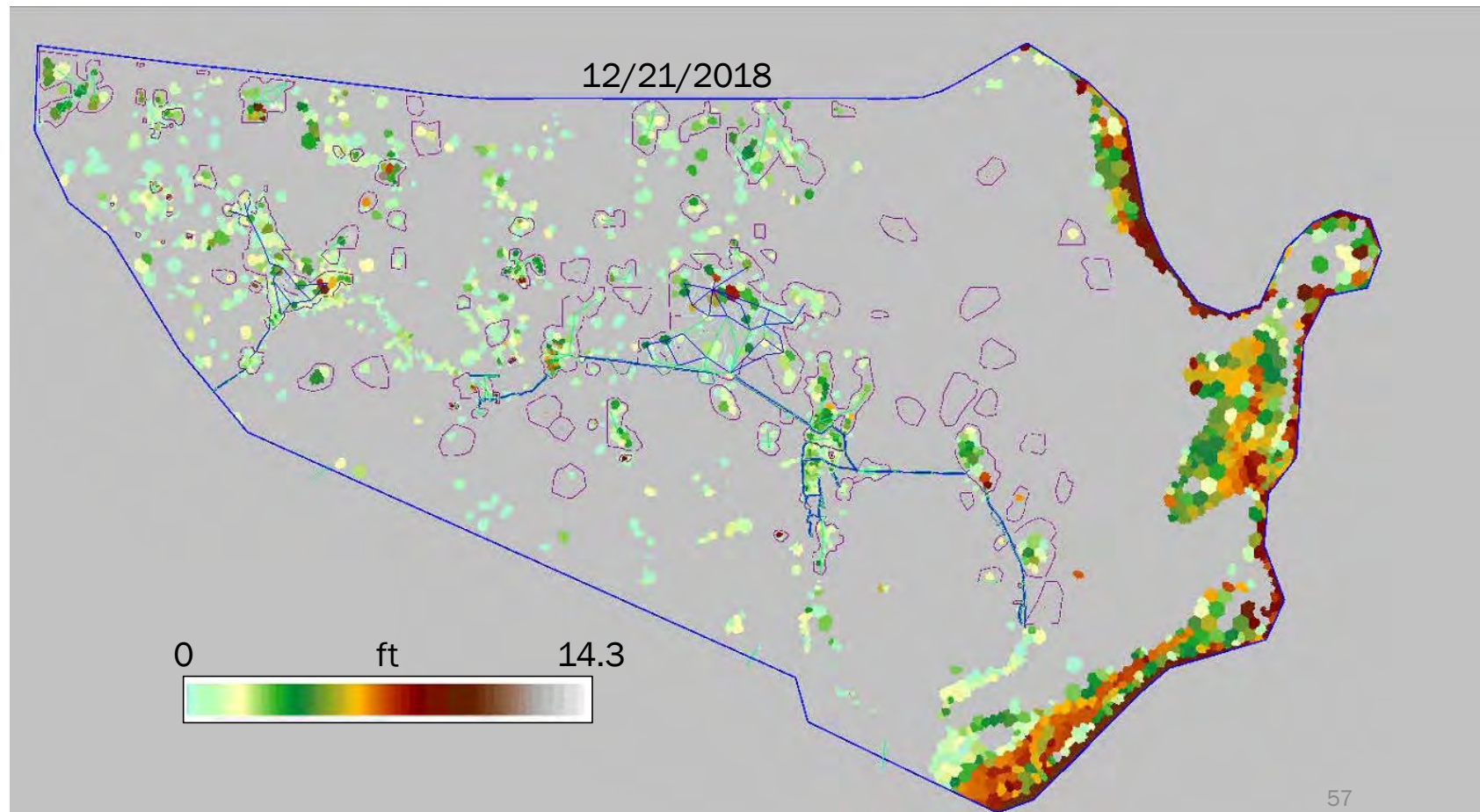
Modeling Results



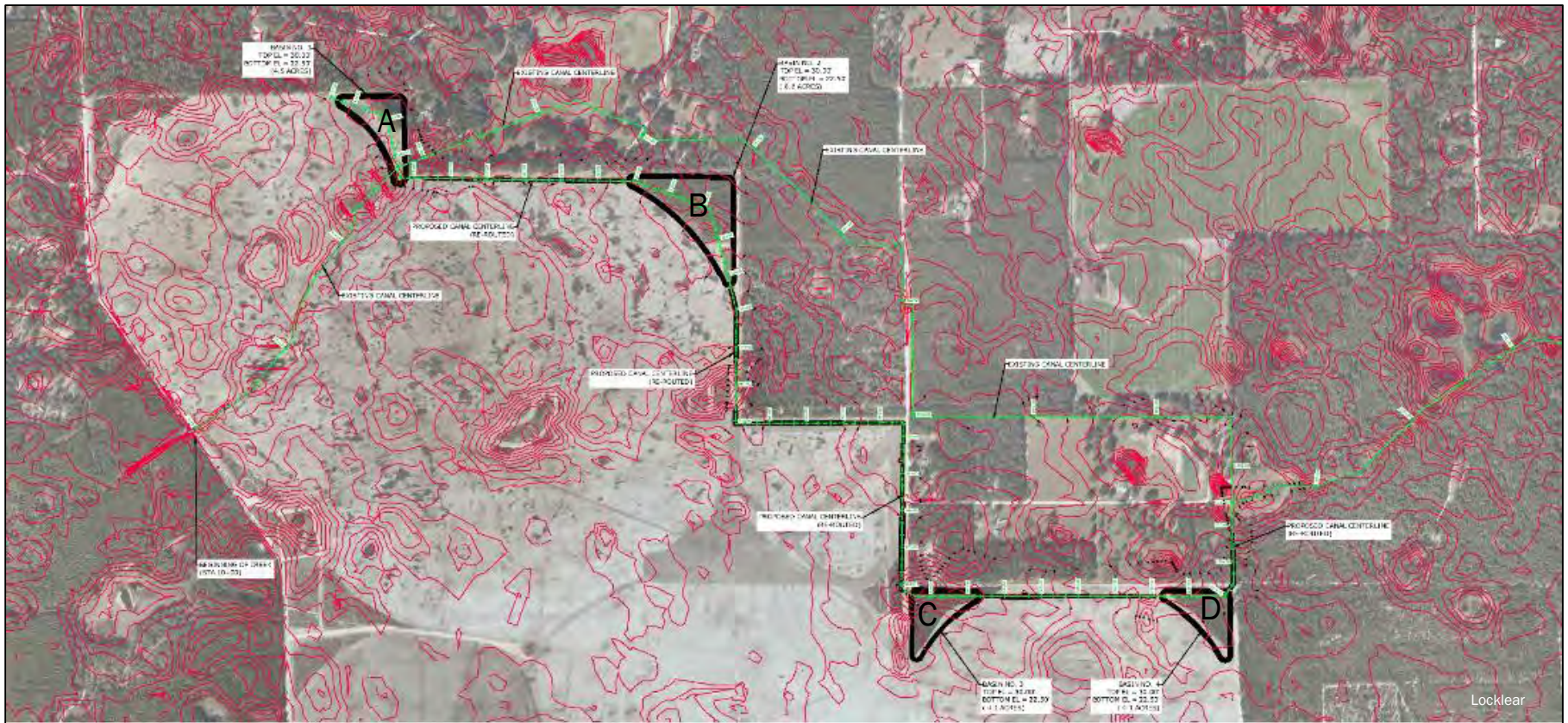
Modeling Results



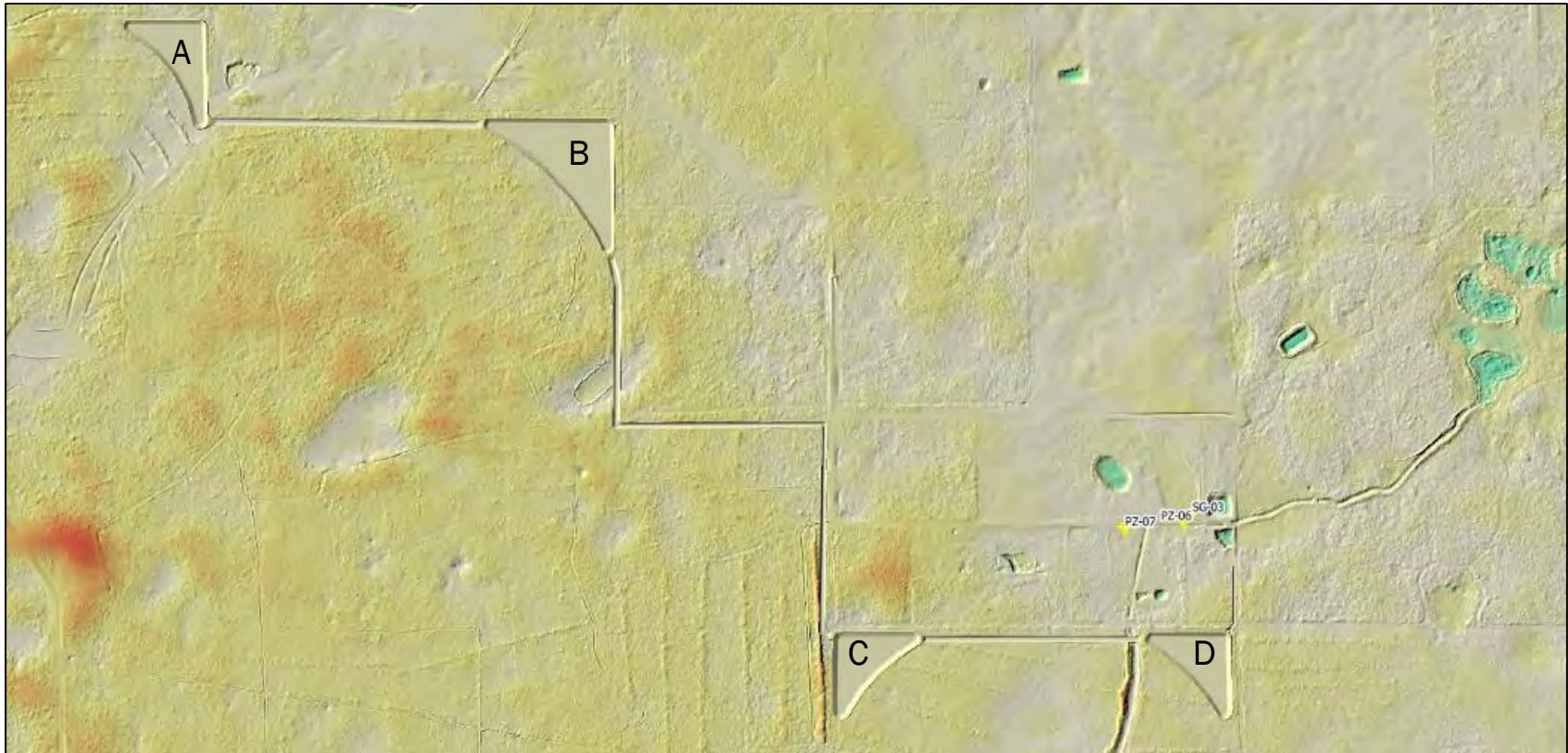
Modeling Results



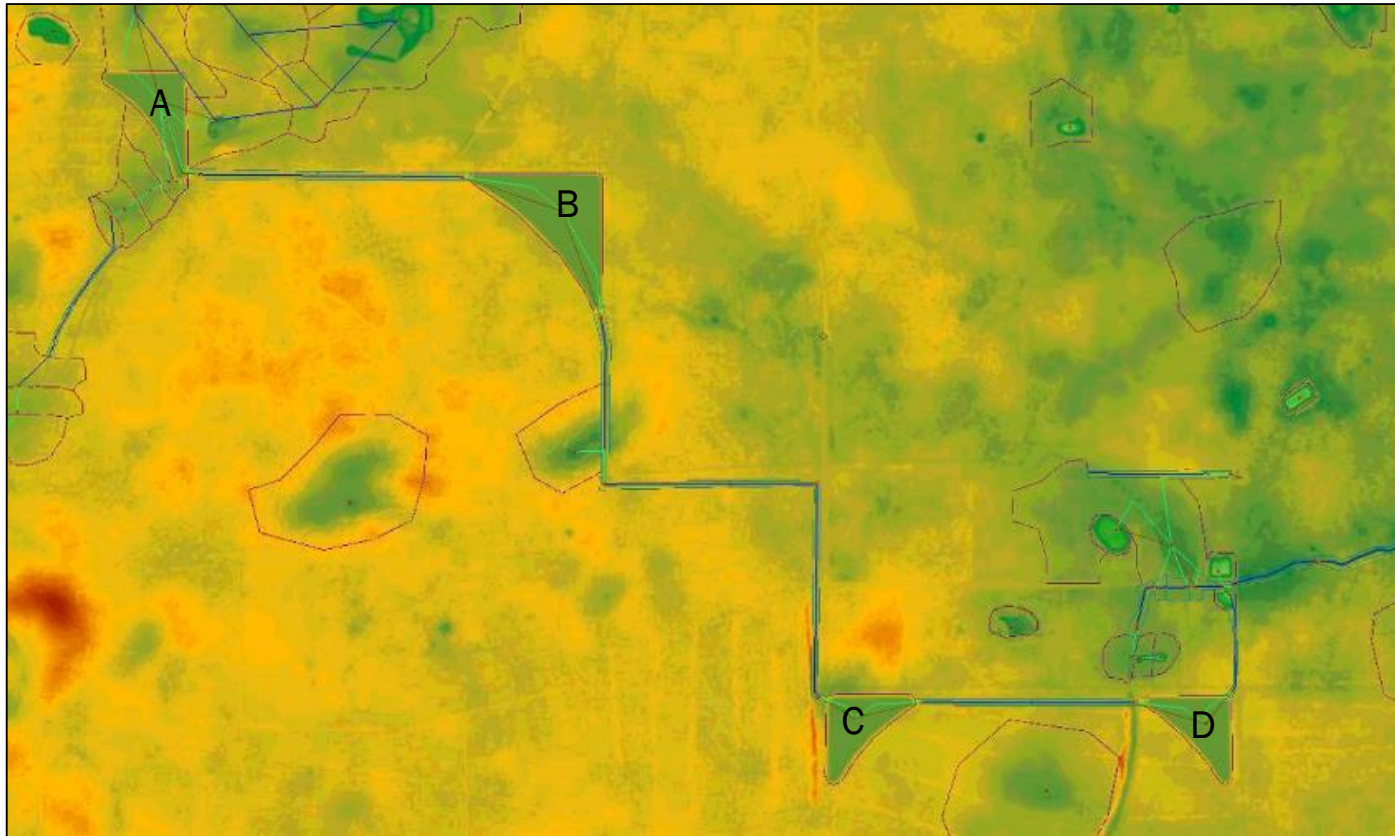
Model Application



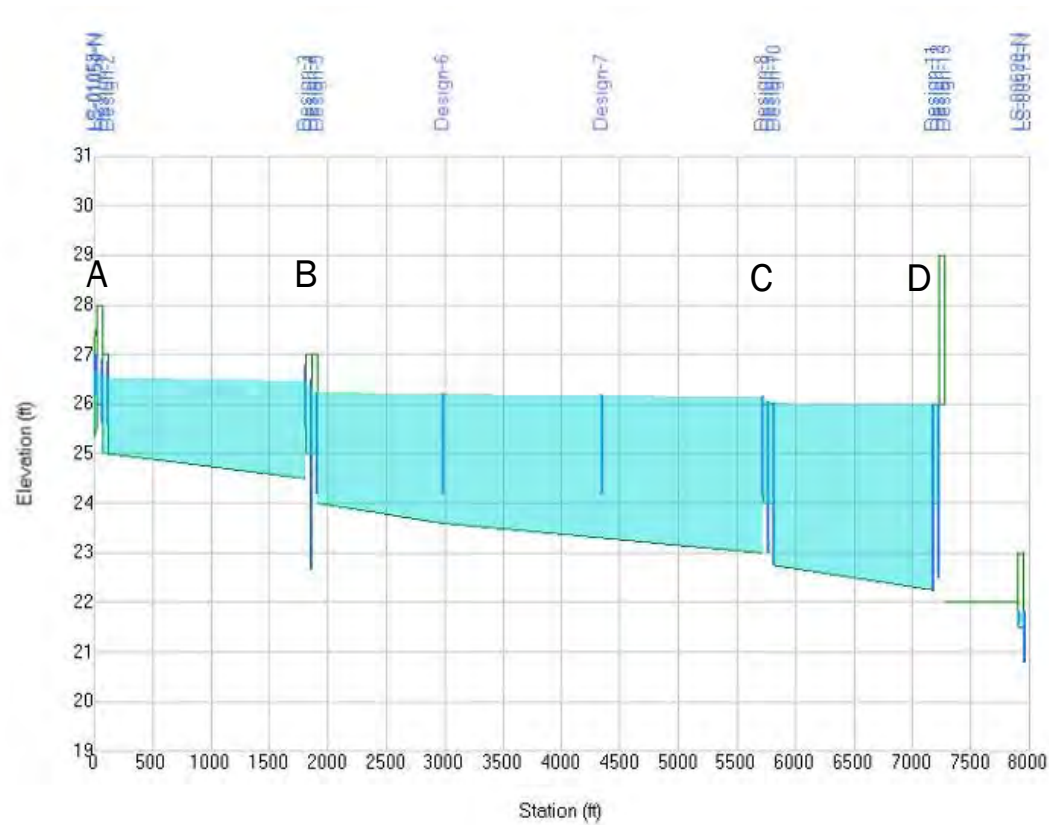
Model Application



Model Application

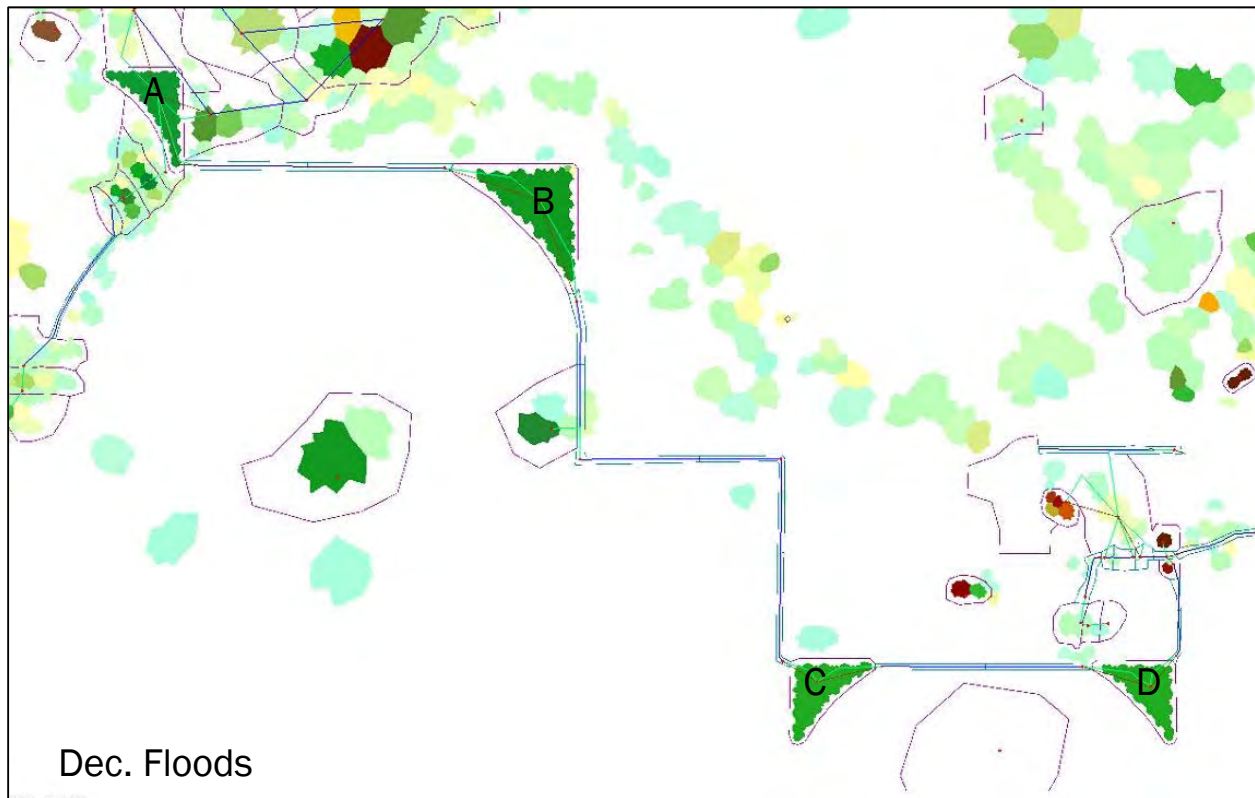


Model Application – Design Storms



100YR_024HR

Model Application - Continuous



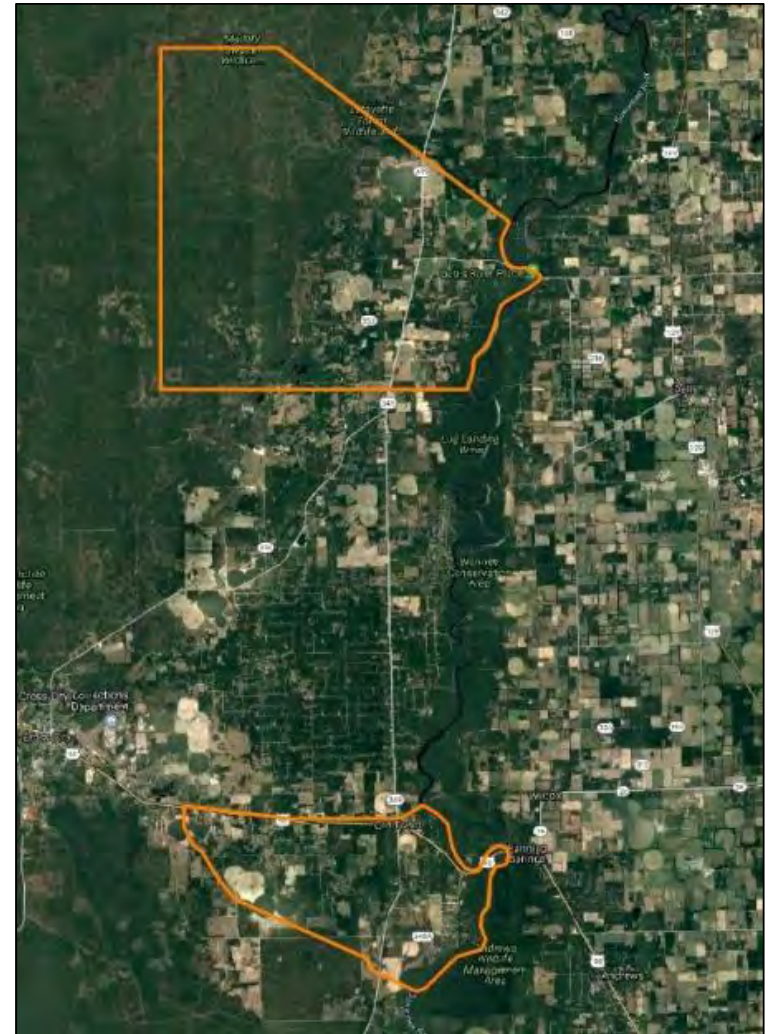
comparison with
calibrated model

800,000 sq. ft. in new
recharge area

additional 150 mgd of
recharge over period

Future Works

long-period calibration
restoration design testing
stakeholder engagement
model extension/connection



Conclusions

developed ICPR v4 model
two dimensional
coupled groundwater/surface
water
prelim. calibrated
applied restoration testing
recharge opportunities



Questions?

Special thanks to:

DC

Rachel Pieschek

Don Carpenter

Chad Drummond

Ryan Hupfer

Locklear

Lisa Baker

John Locklear

Walker Wrenn

Jered Lizotte

Dixie Co

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Duane Cannon

SRWMD

Bob Heeke

Fay Baird