Adaptive Hydraulics Modeling (ADH) User Group Workshop: Application to Wetland Environment

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Outline

- Wetland modeling Needs
- Experiences with numerical models
- Critical processes and parameters
- Current wetland modeling activities
- ADH application to a wetland environment

Wetland Modeling: typical questions

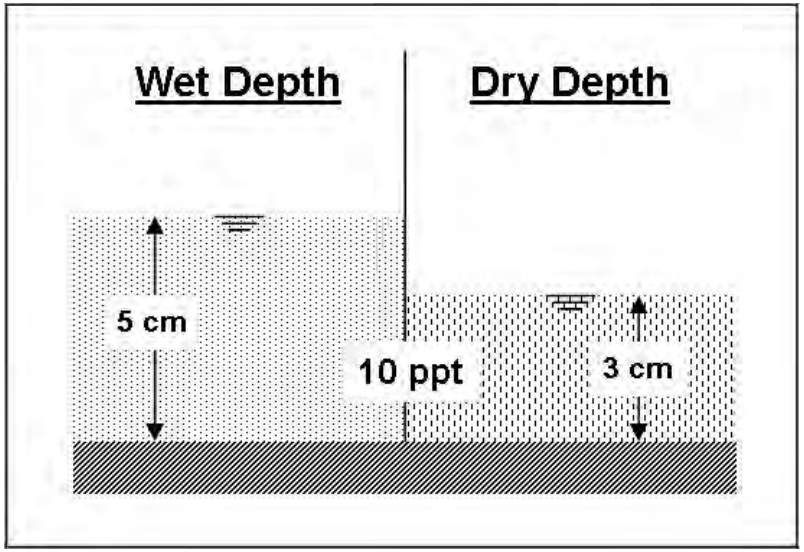
- **Hydrology**
  - Which management scenarios cause portions of a wetland to dry out and for how long?
  - What is the impact of management scenarios on the hydroperiod?
  - Does water depth (duration and frequency) satisfy the needs of plants and wildlife?

Wetland Modeling Concerns

- Water Quality
  - How changes in inflow timing and volume affect water quality?
  - What are the impacts of alternative regulation schedules on water quality?
  - What are the spatial and temporal distributions of a certain constituent?

Wetland Modeling: details!

- Wetting and Drying
  - Can wetting and drying be accounted for?
  - Is there a memory for constituent mass?
    - Do you retain concentration or mass?



Types of Models

- Proprietary
  - Name recognition
  - Closed source
  - Fully documented
- Research codes
  - Open source
  - Steep learning curve
  - Documentation limitations

Types of Models

- Mass Balance
- 1-D, 2-D Linked
- Structured (Cartesian/curvelinear) Grid
- Unstructured Grid

Critical Processes and Parameters

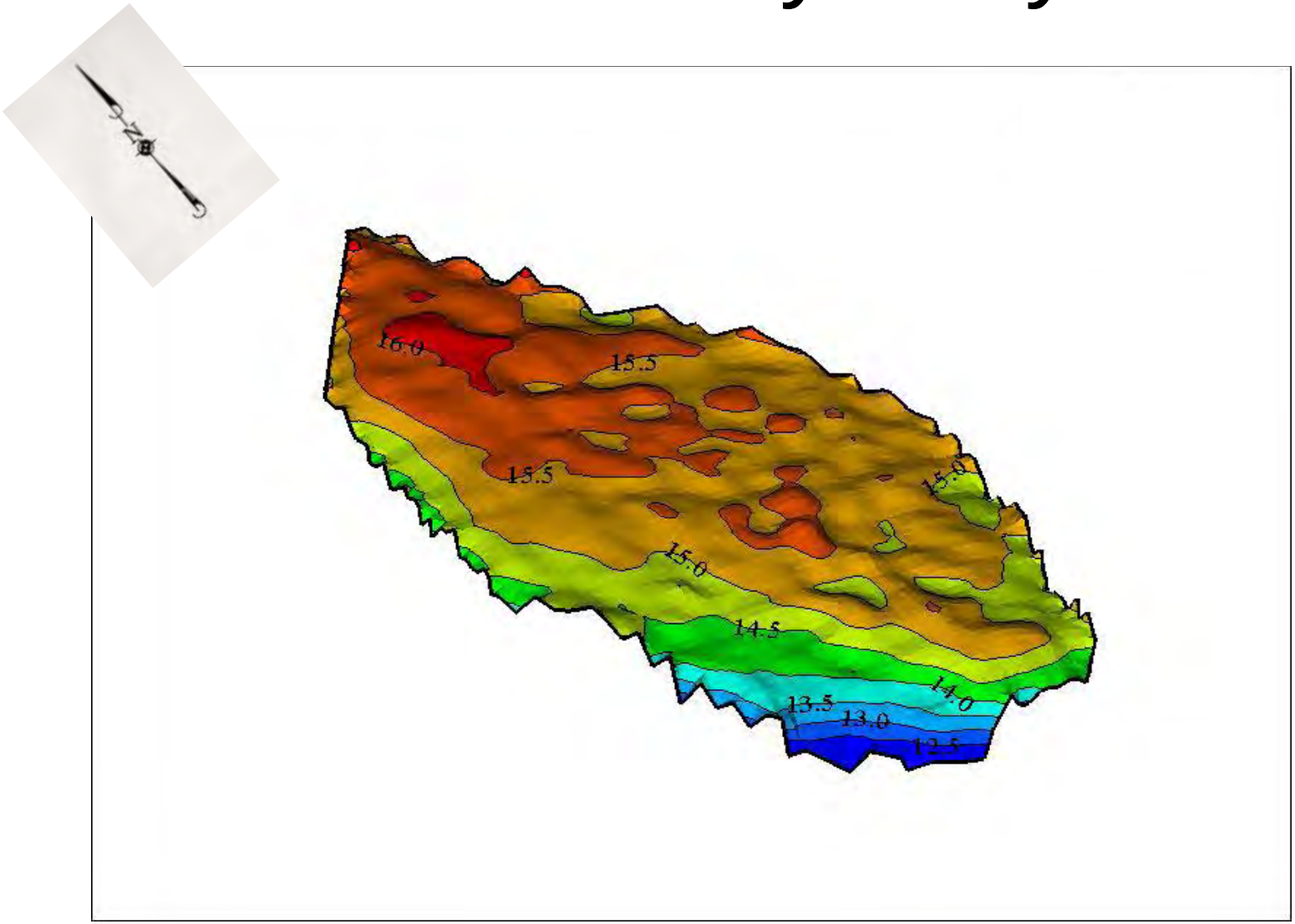
- Hydrology
  - Account for groundwater flows using simple mechanism based on stage
  - Reduce ET with (modeled) depth
  - Include spatially variable sink and source terms (e.g., ET, Precipitation)
  - Use a regulation schedule to model in/outflows (e.g., outflow based on stage)
  - Vary Roughness with depth and vegetation type

Critical Processes and Parameters

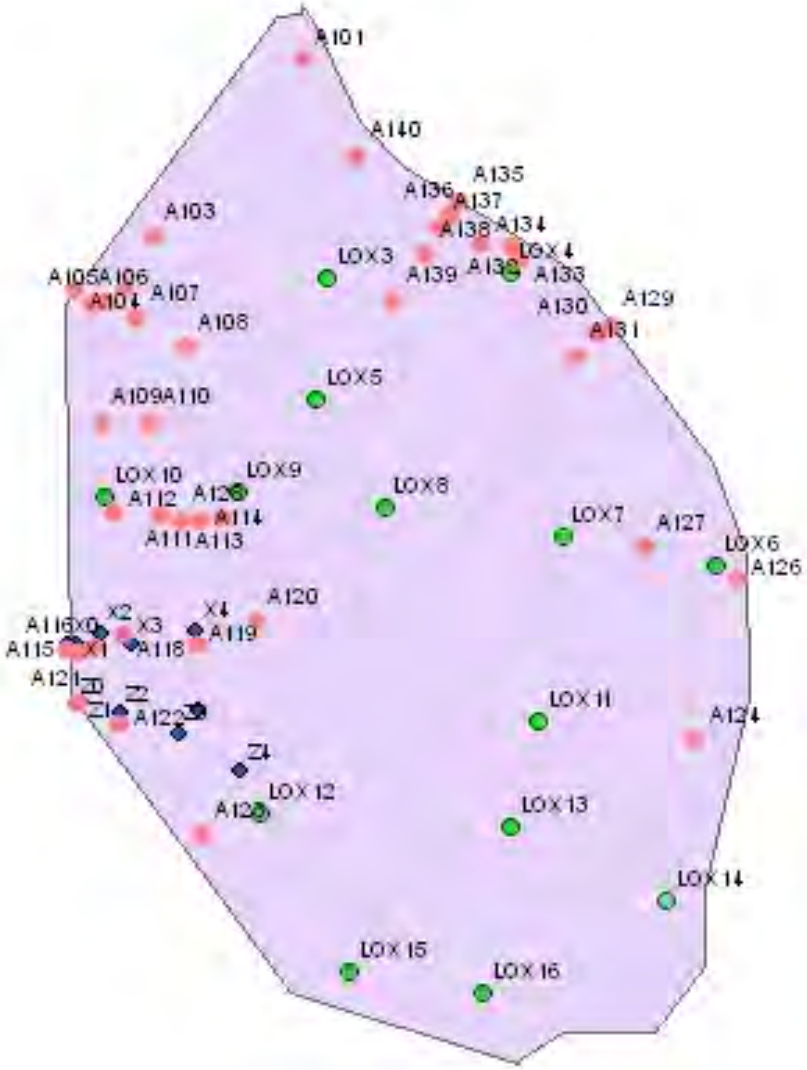
- Constituent Kinetics
  - Full transparency of programmed functions
  - Ability to program multiple kinetics formulations
  - Account for multiple constituent state variables with varying levels of complexity
  - Tailor state variables and their parameters for specific kinetics formulations
    - DMSTA for Total Phosphorus
    - Monod relationship for Sulfate
  - Allow for efficient accounting for spatially variable sinks/sources (Atmos. deposition, transpiration, etc.)

Current Modeling Activities

Marsh Bathymetry



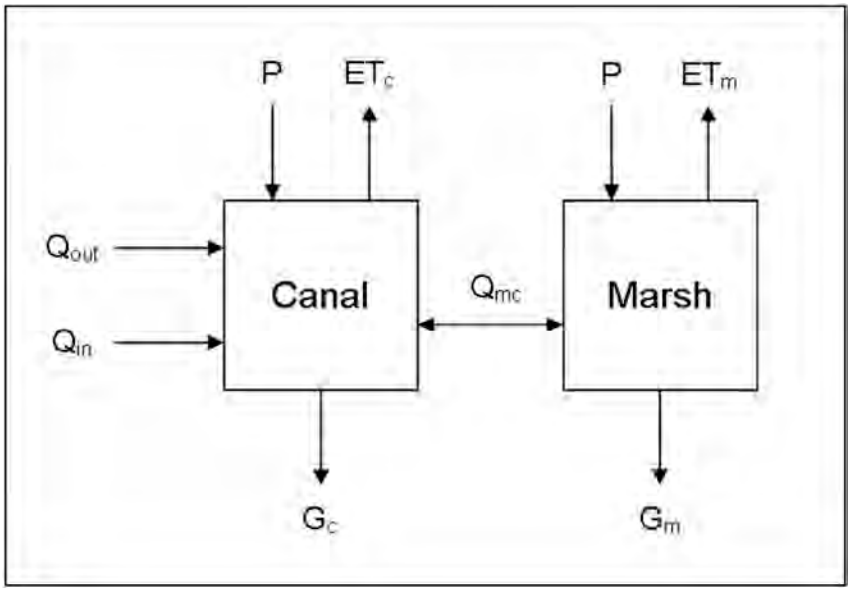
Water Quality Stations

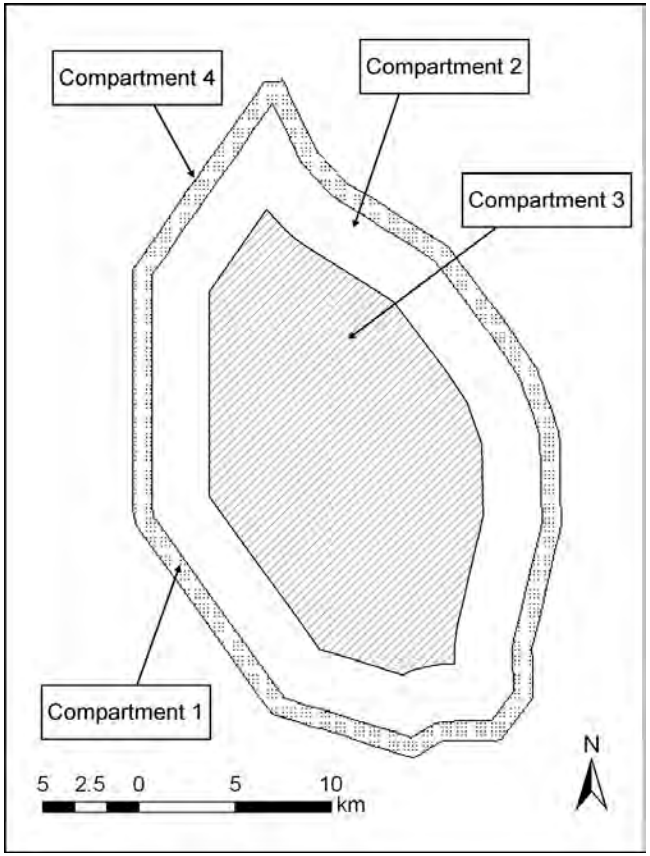


Current Modeling Activities

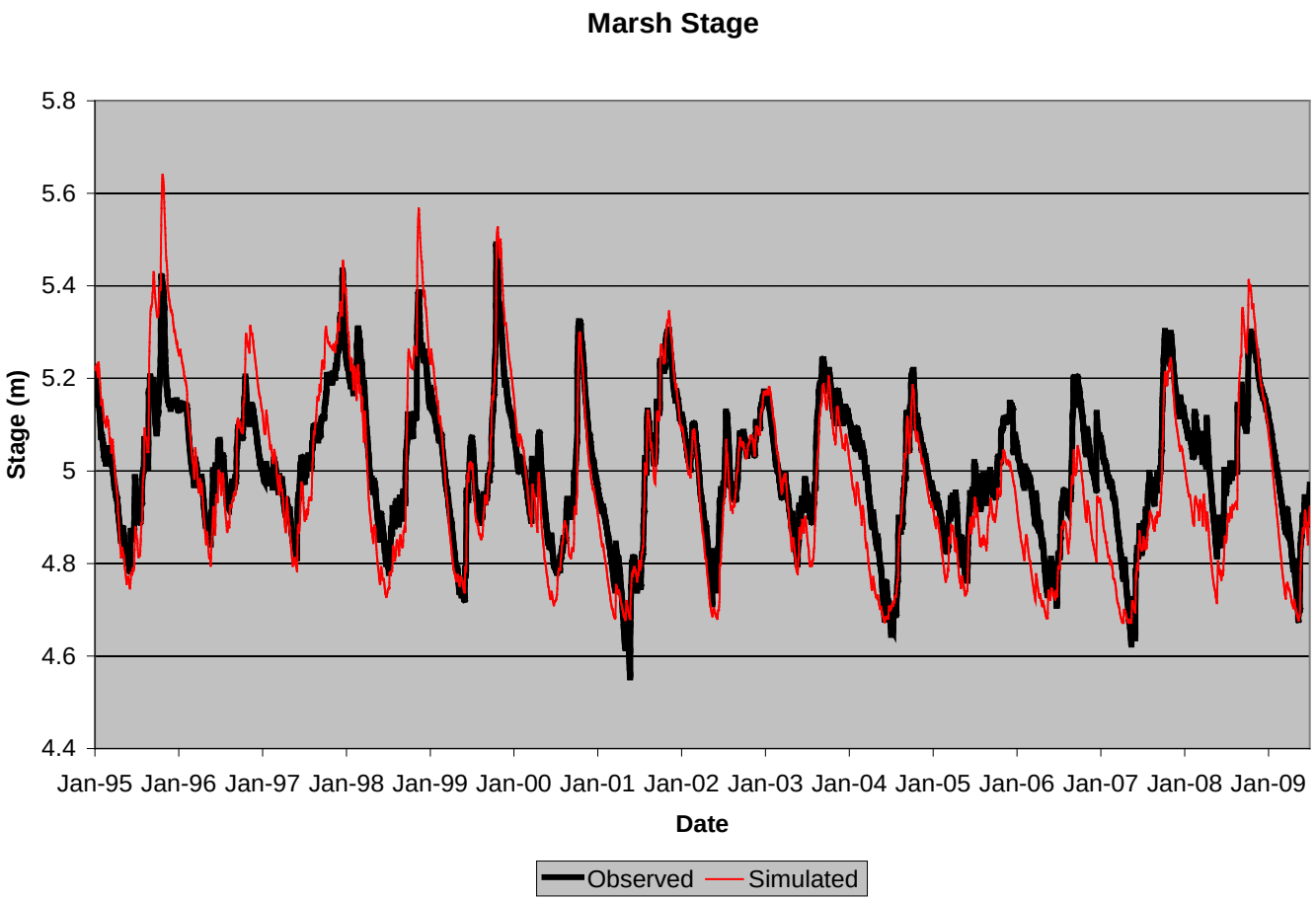
- Compartment Model
  - Simple Refuge Screening Model (SRSM v4)
  - Platform: Berkeley Madonna
  - Long-term simulations
  - Spatially averaged results
- Spatially Explicit Model
  - Platform: MIKE FLOOD
  - Temporal and Spatial variations
    - Jan-00 to Jan-07
    - 400m by 400m grid

SRSM: Compartments

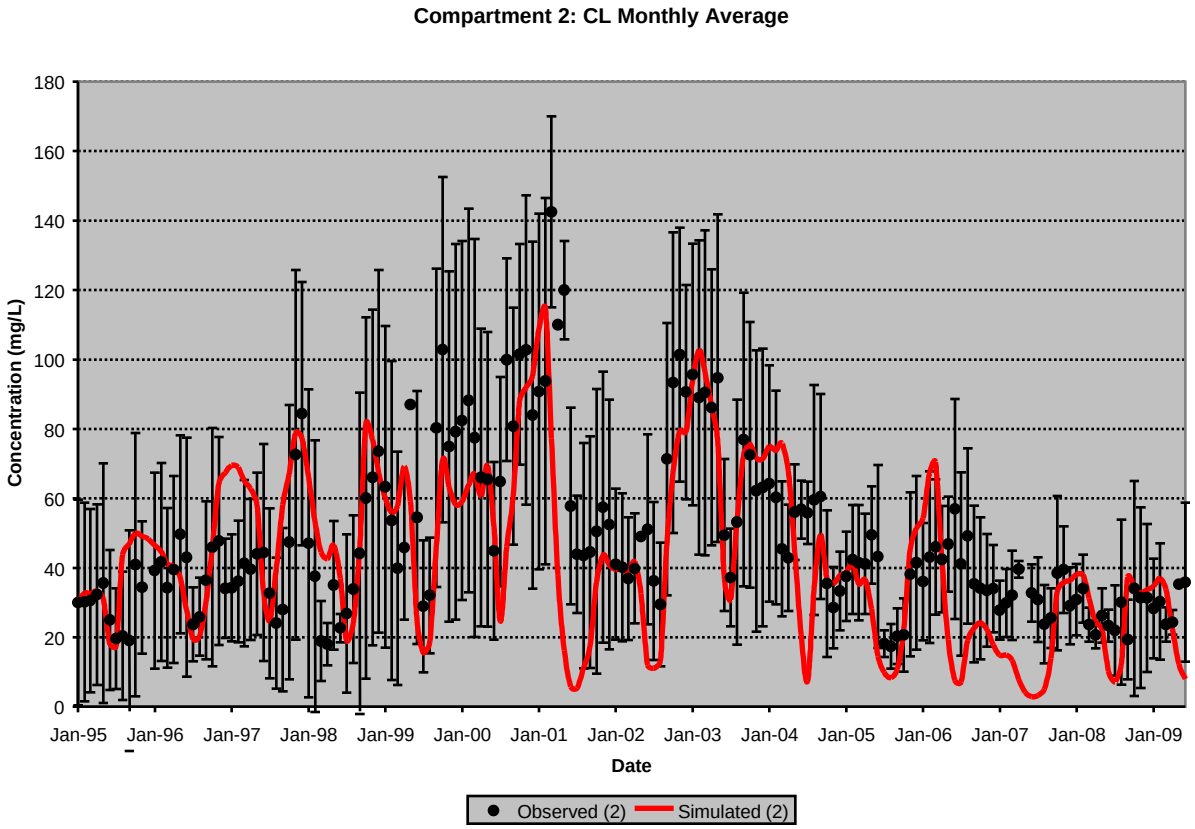




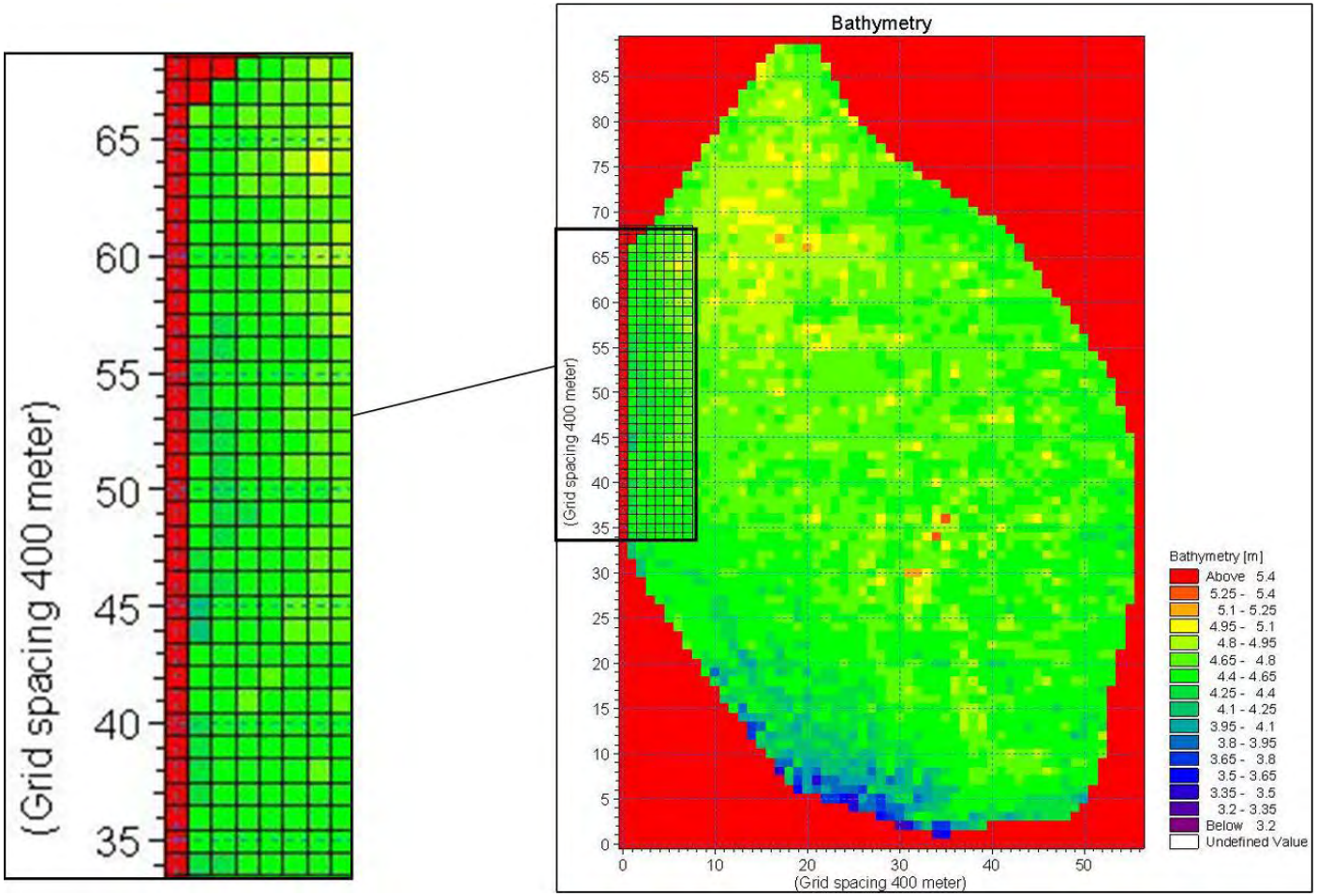
SRSM: Stage Results



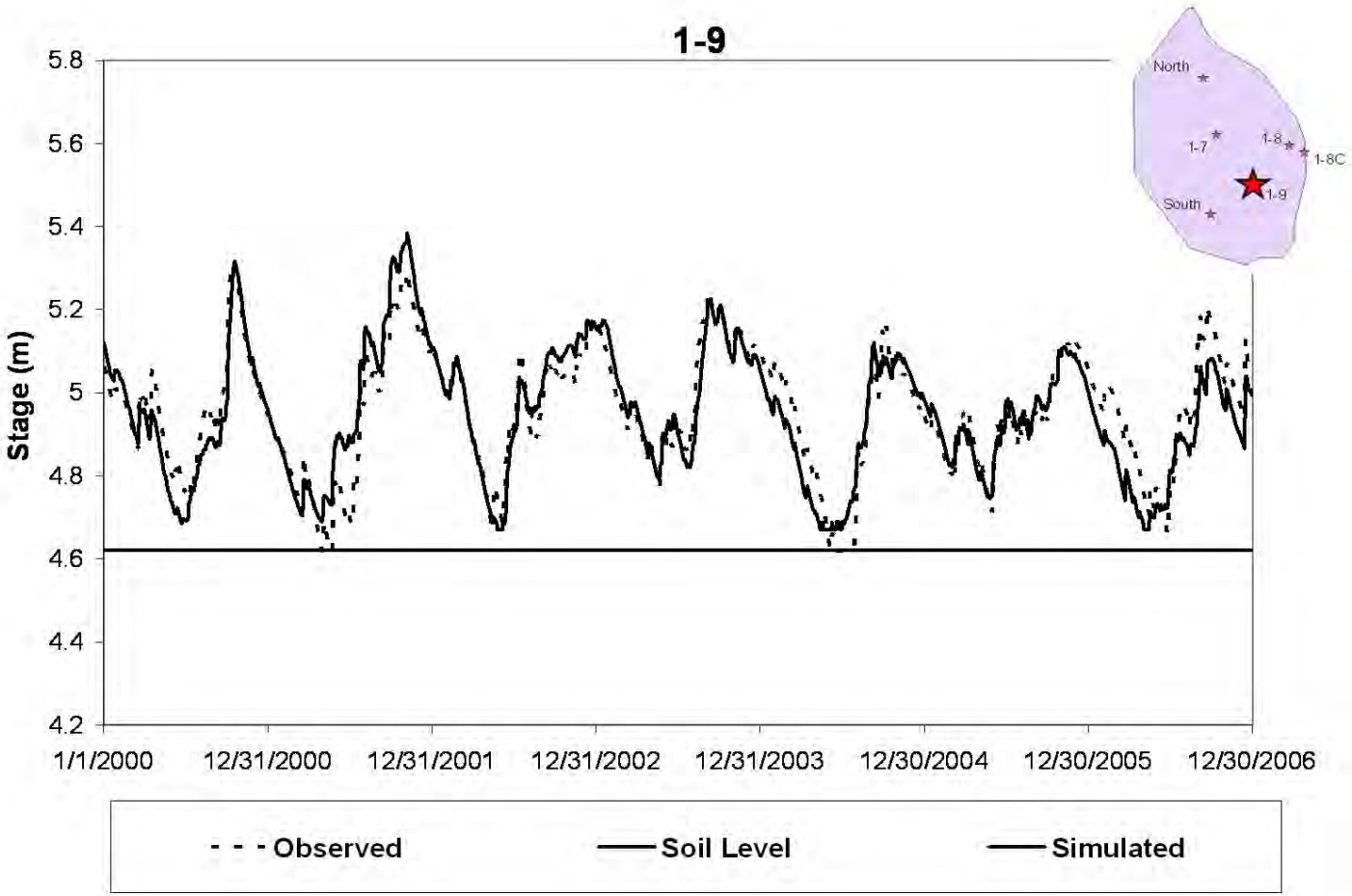
SRSM: Water Quality Results



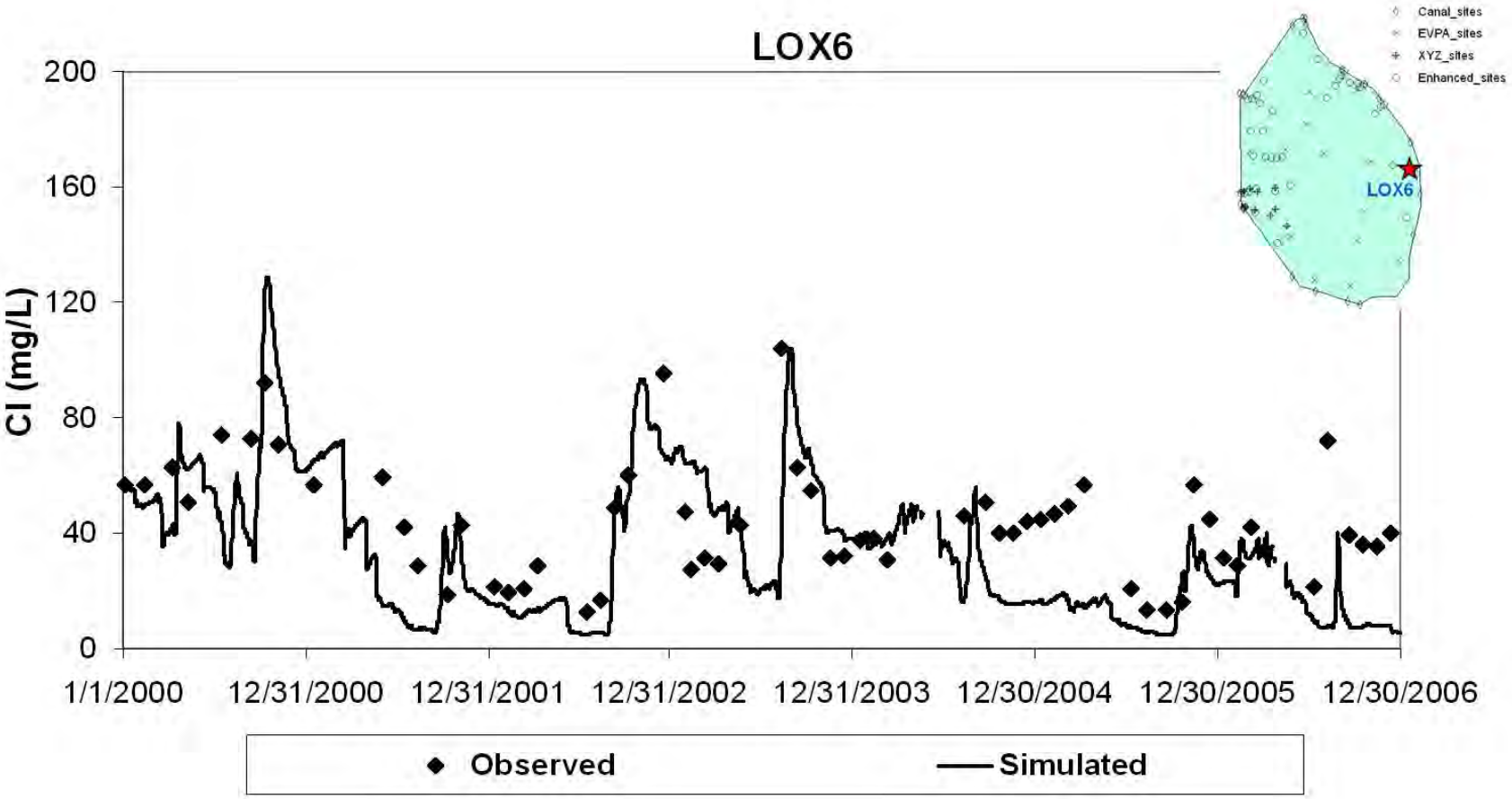
MIKE FLOOD: Model Domain



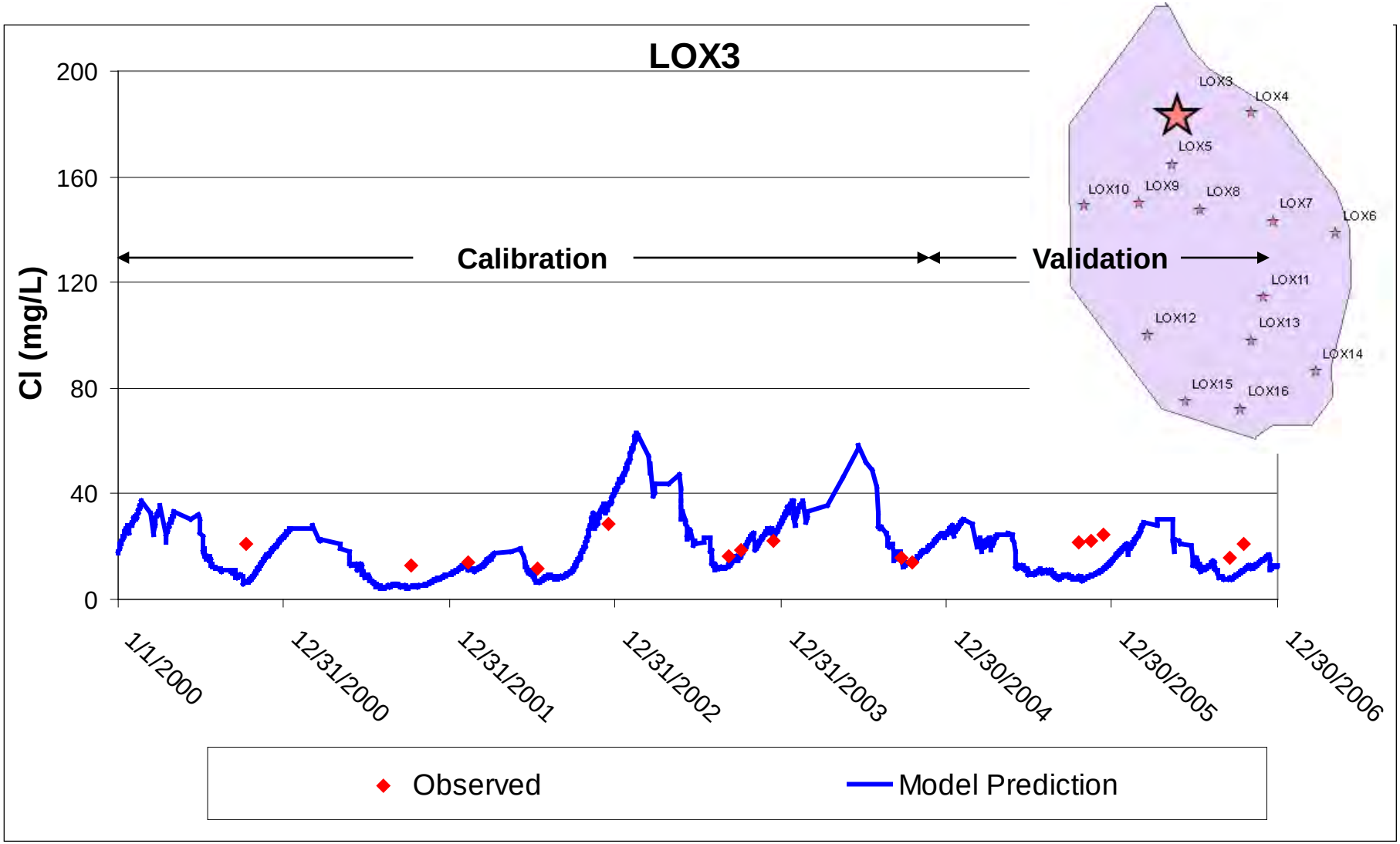
MIKE FLOOD: Stage Results



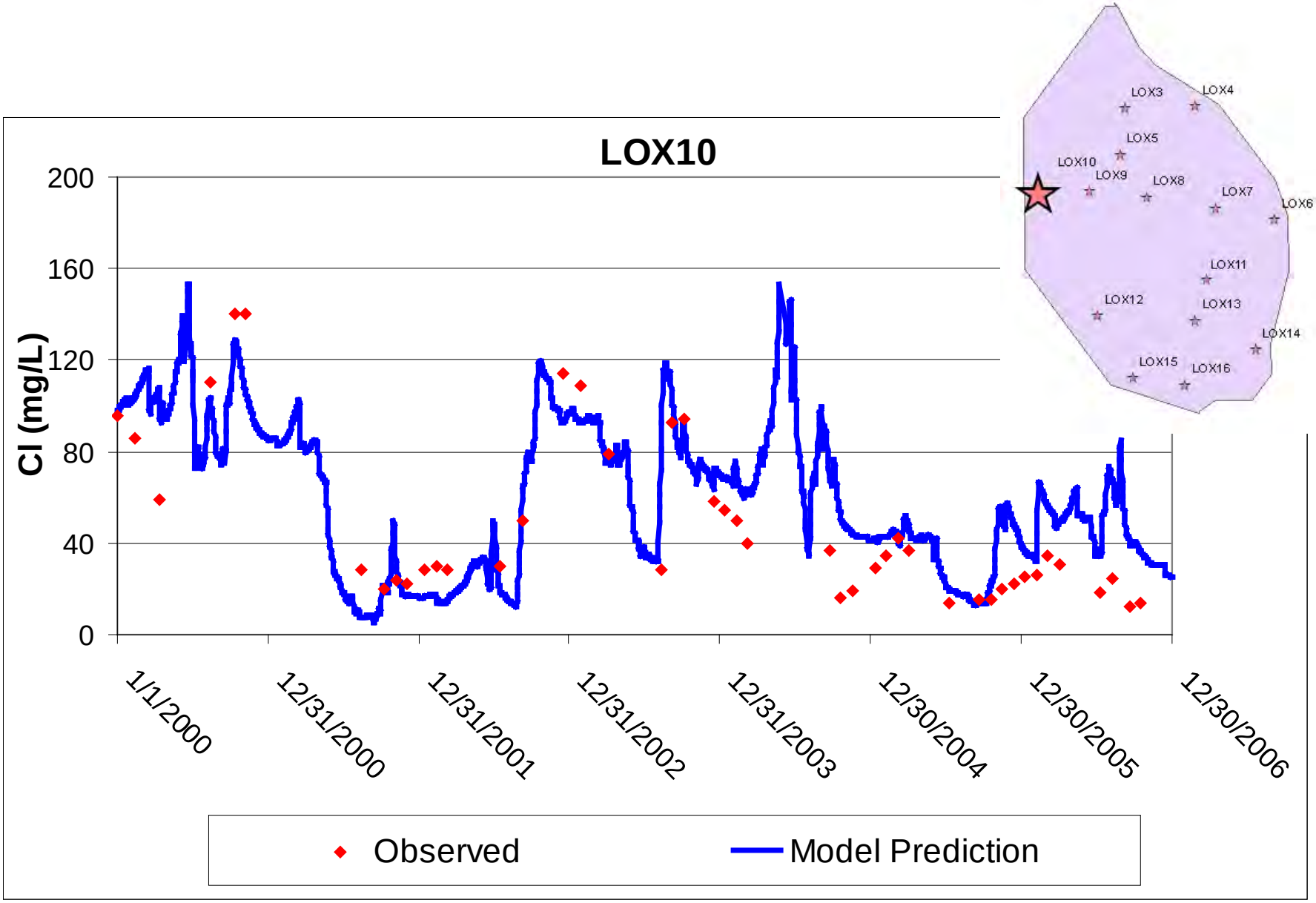
MIKE FLOOD: Water Quality Results



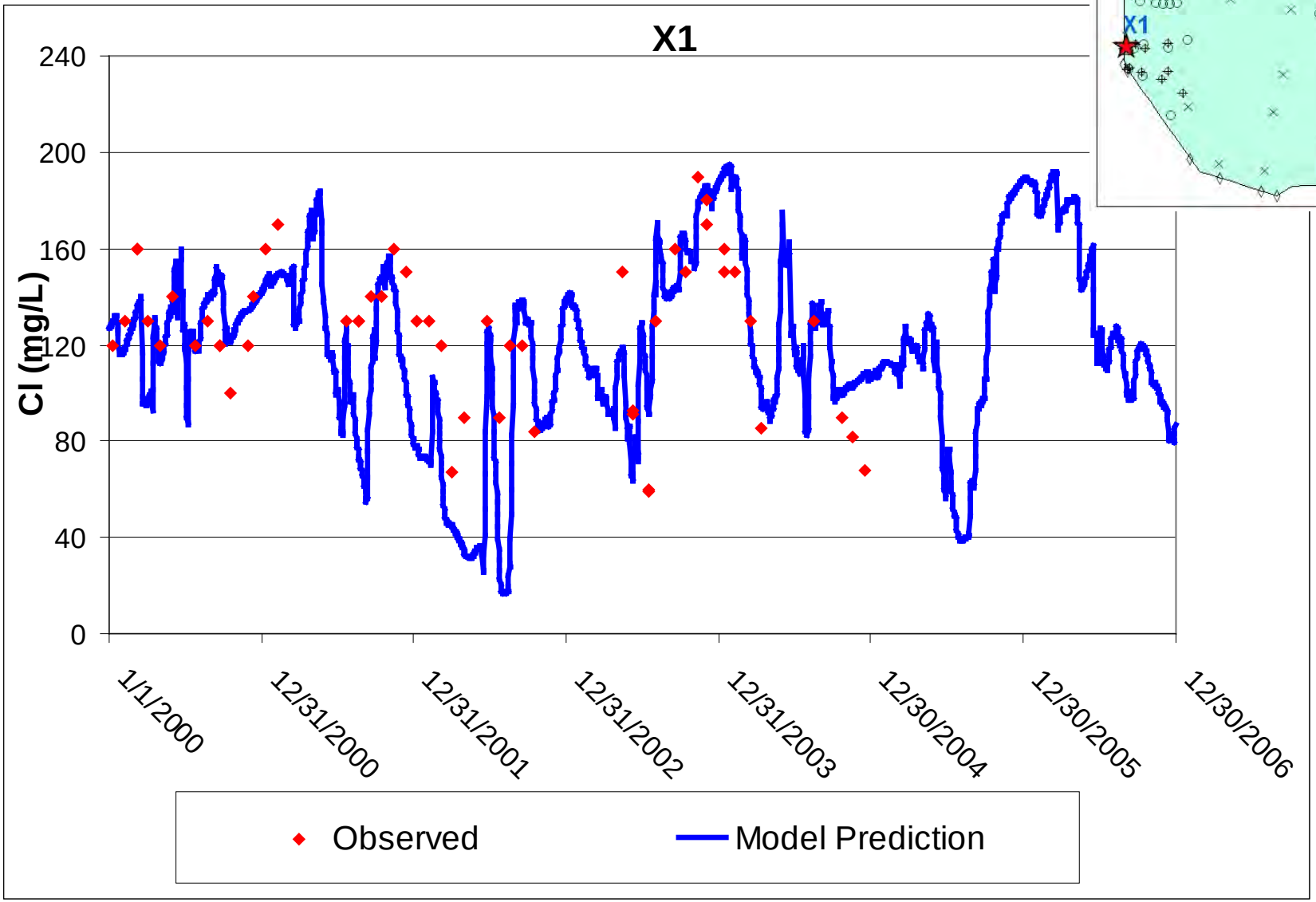
Chloride - EVPA Stations

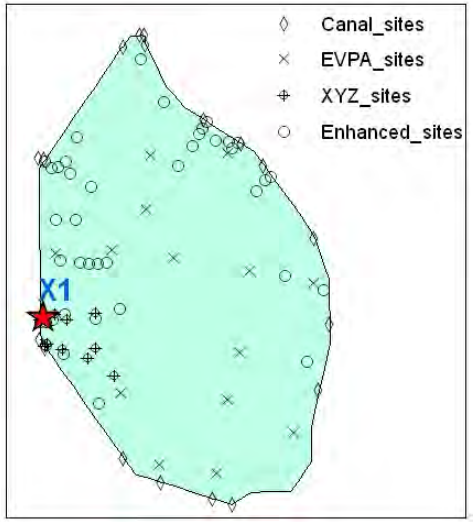


Chloride - EVPA Stations

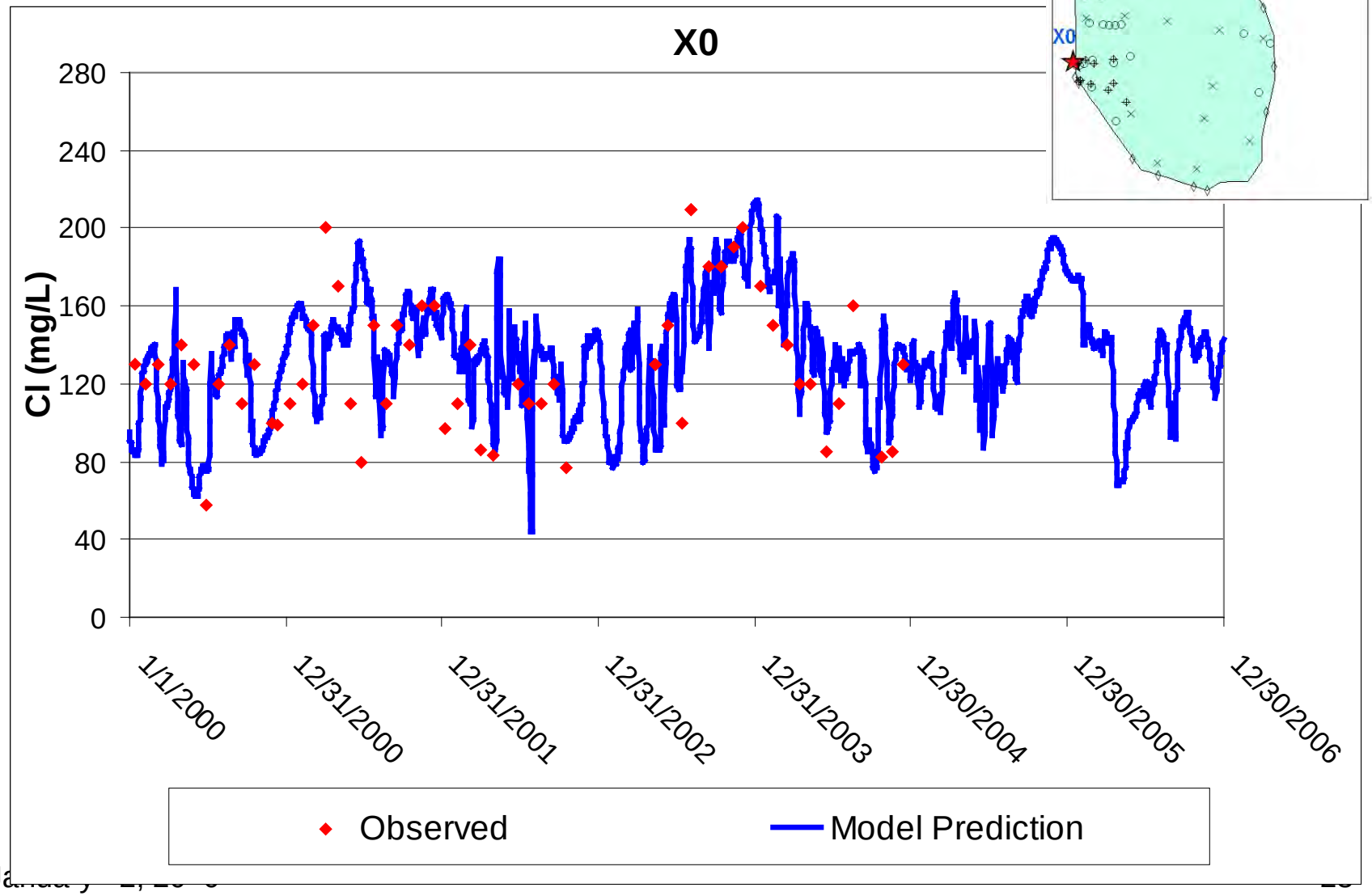


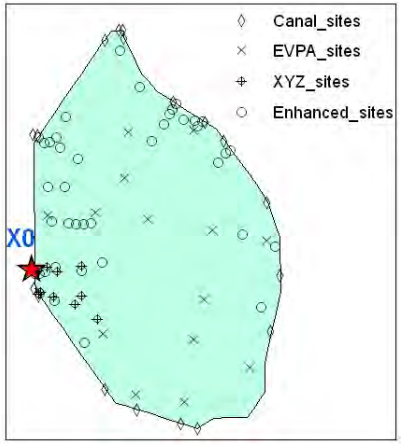
Chloride - XYZ Stations

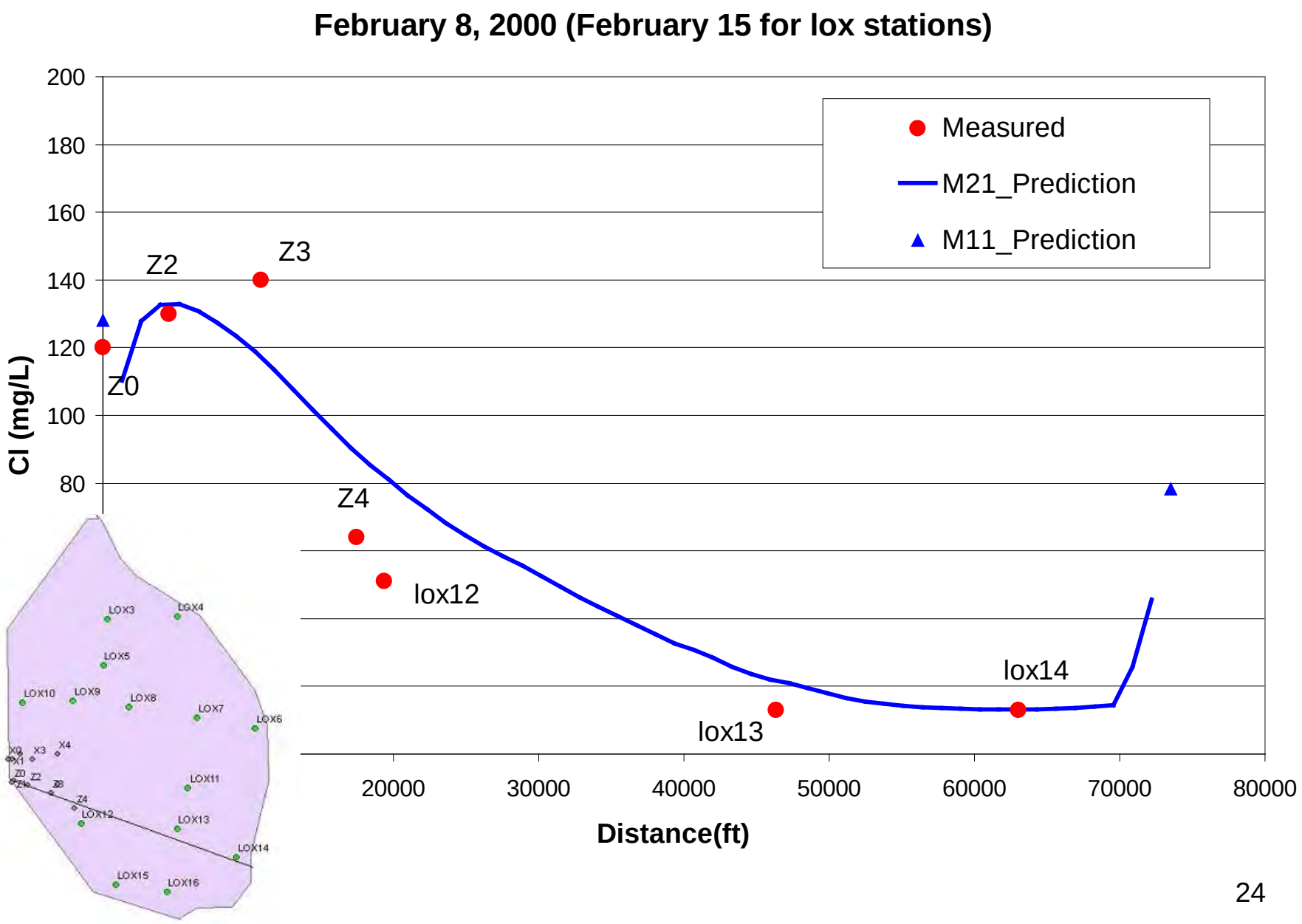


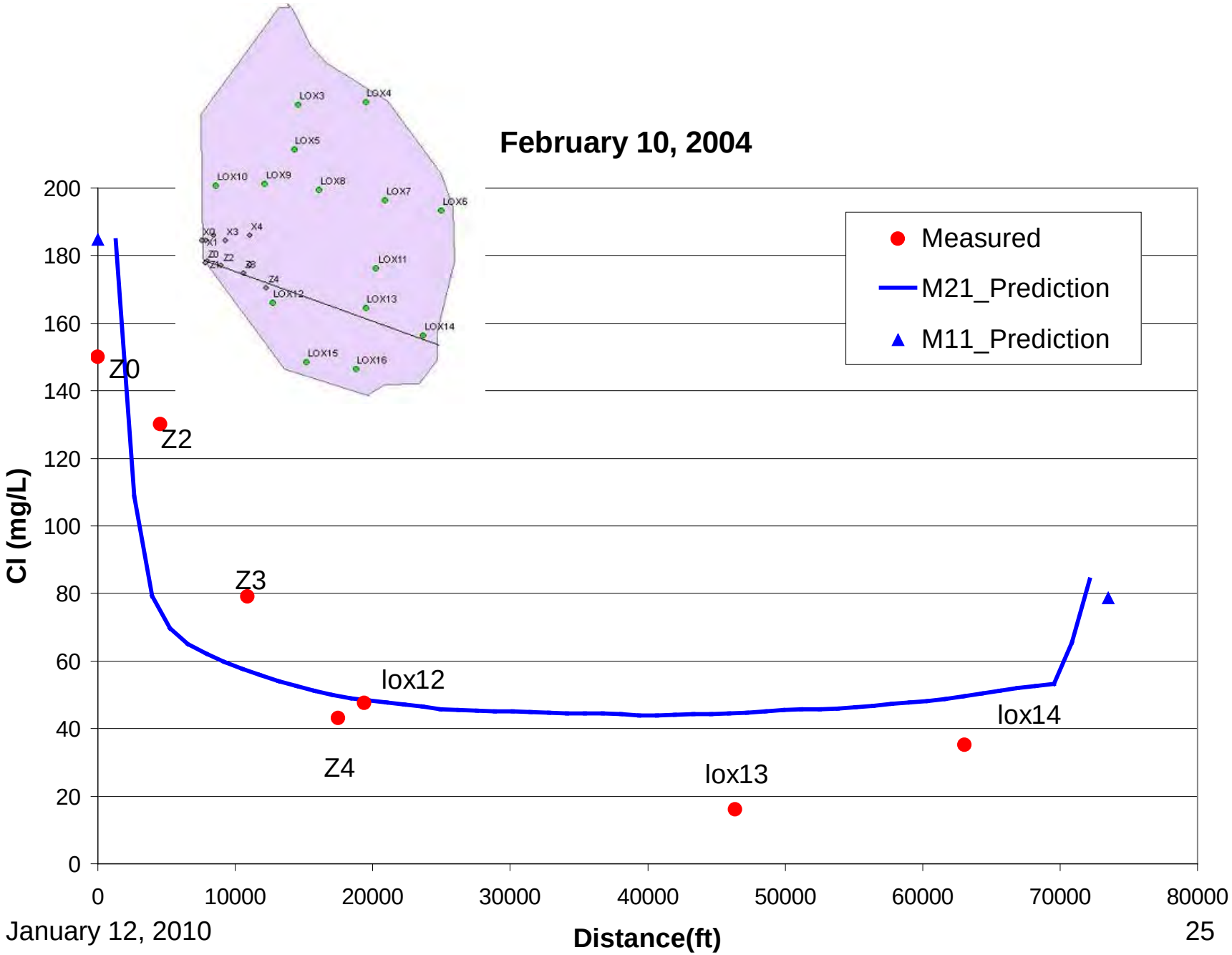


Chloride - Canal Results

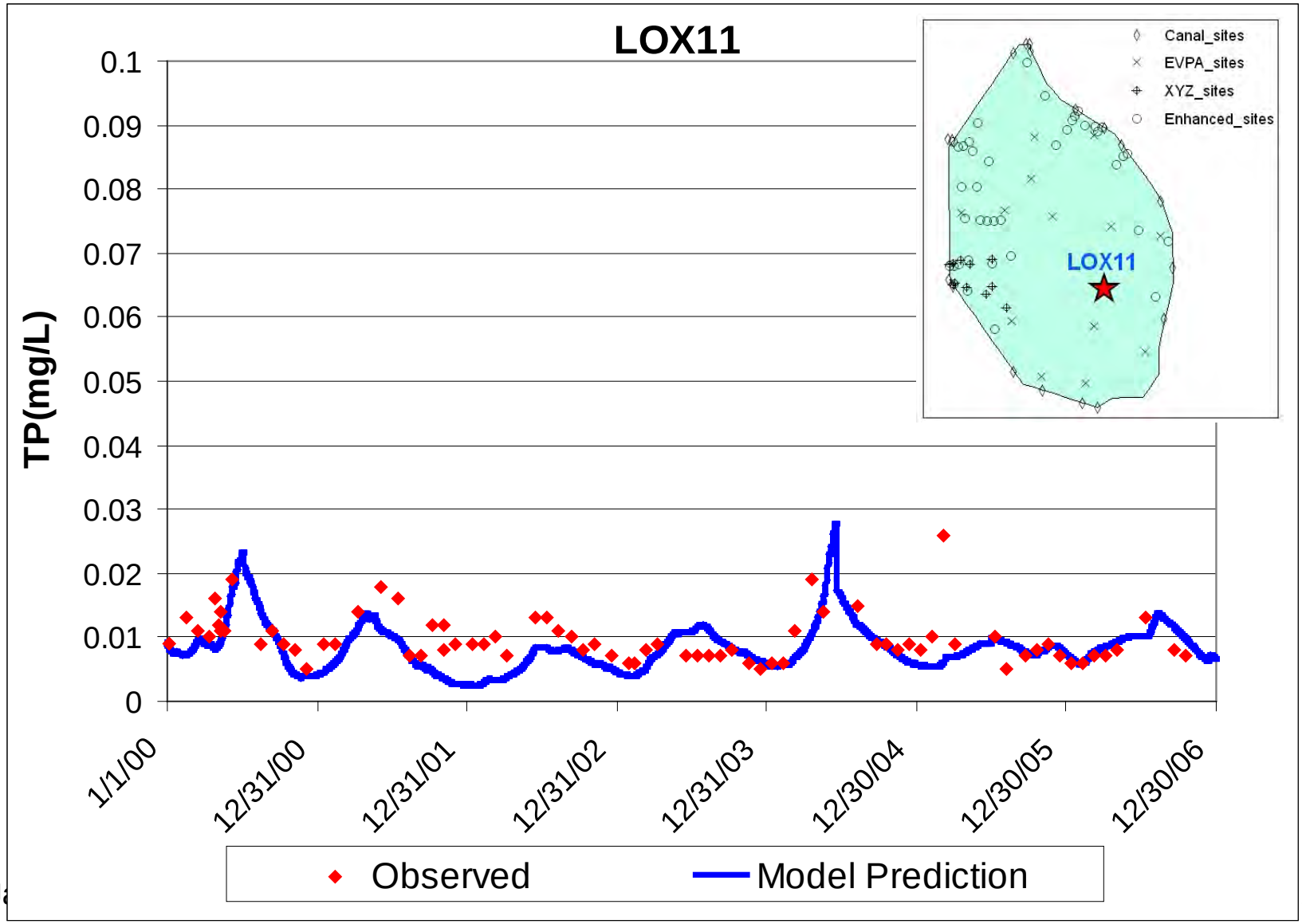




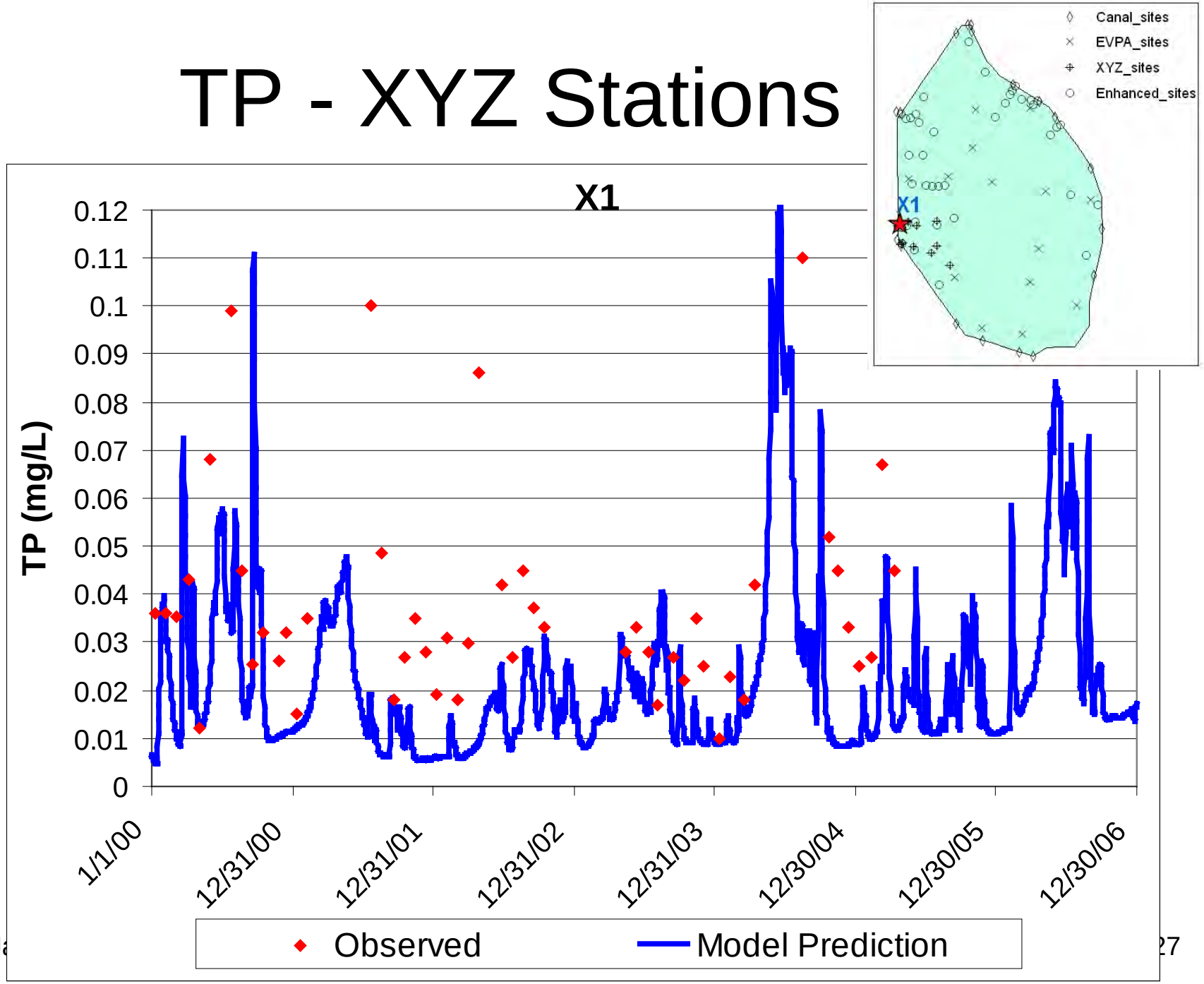

February 8, 2000 (February 15 for lox stations)
Cl (mg/L)
200
180
160
140
120
100
80
Measured
M21_Prediction
M11_Prediction
Z0
Z2
Z3
Z4
lox12
lox13
lox14
20000
30000
40000
50000
60000
70000
80000
Distance(ft)
LOX3
LOX4
LOX5
LOX10
LOX9
LOX8
LOX7
LOX6
X3
X4
LOX11
LOX12
LOX13
LOX14
LOX15
LOX16


February 10, 2004
Measured
M21_Prediction
M11_Prediction
Cl (mg/L)
Distance(ft)
0
20
40
60
80
100
120
140
160
180
200
0
10000
20000
30000
40000
50000
60000
70000
80000
Z0
Z2
Z3
Z4
lox12
lox13
lox14
LOX3
LOX4
LOX5
LOX6
LOX7
LOX8
LOX9
LOX10
LOX11
LOX12
LOX13
LOX14
LOX15
LOX16
X3
X4
Z0
Z2
Z4

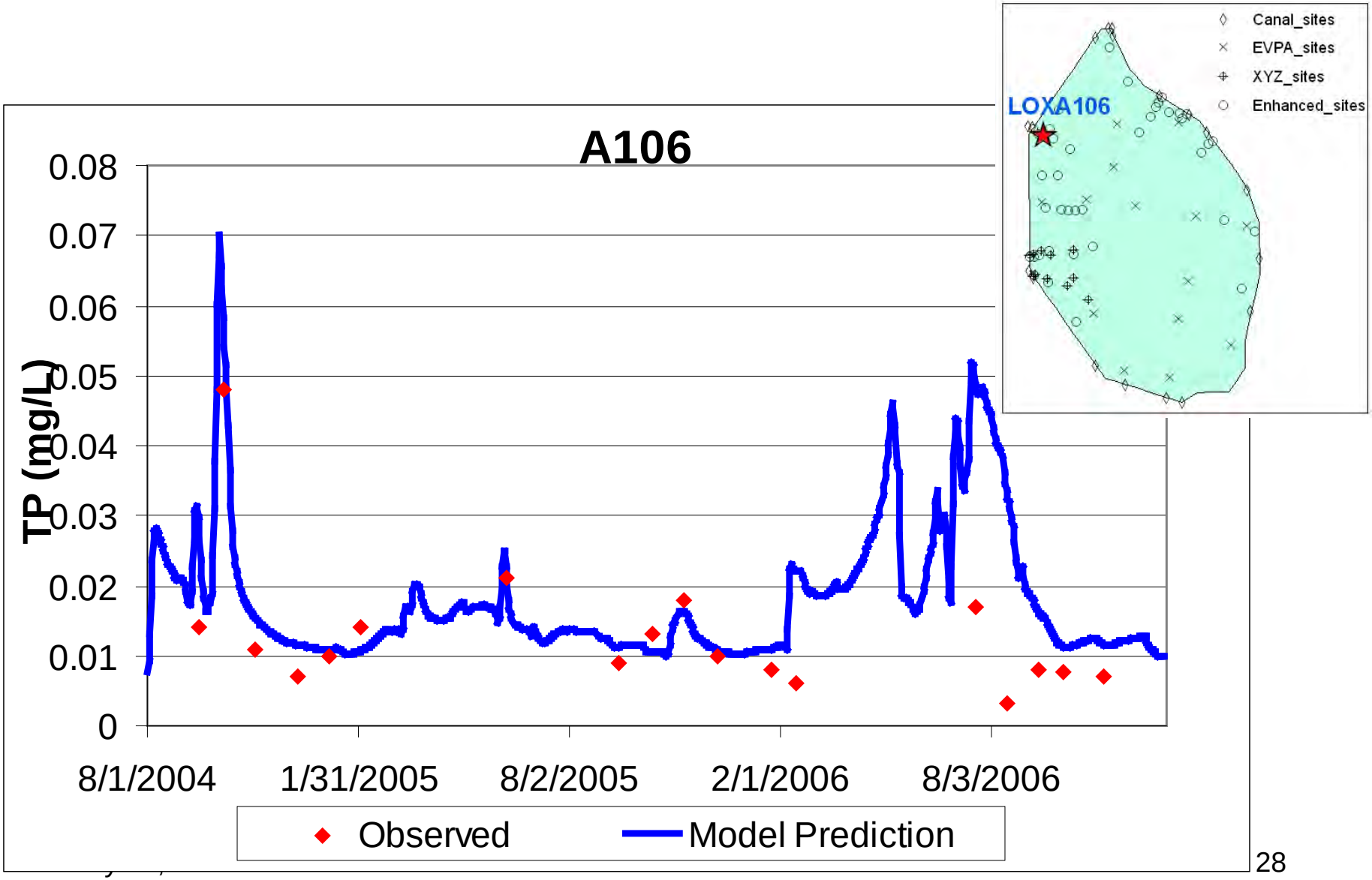
TP - EVPA Stations



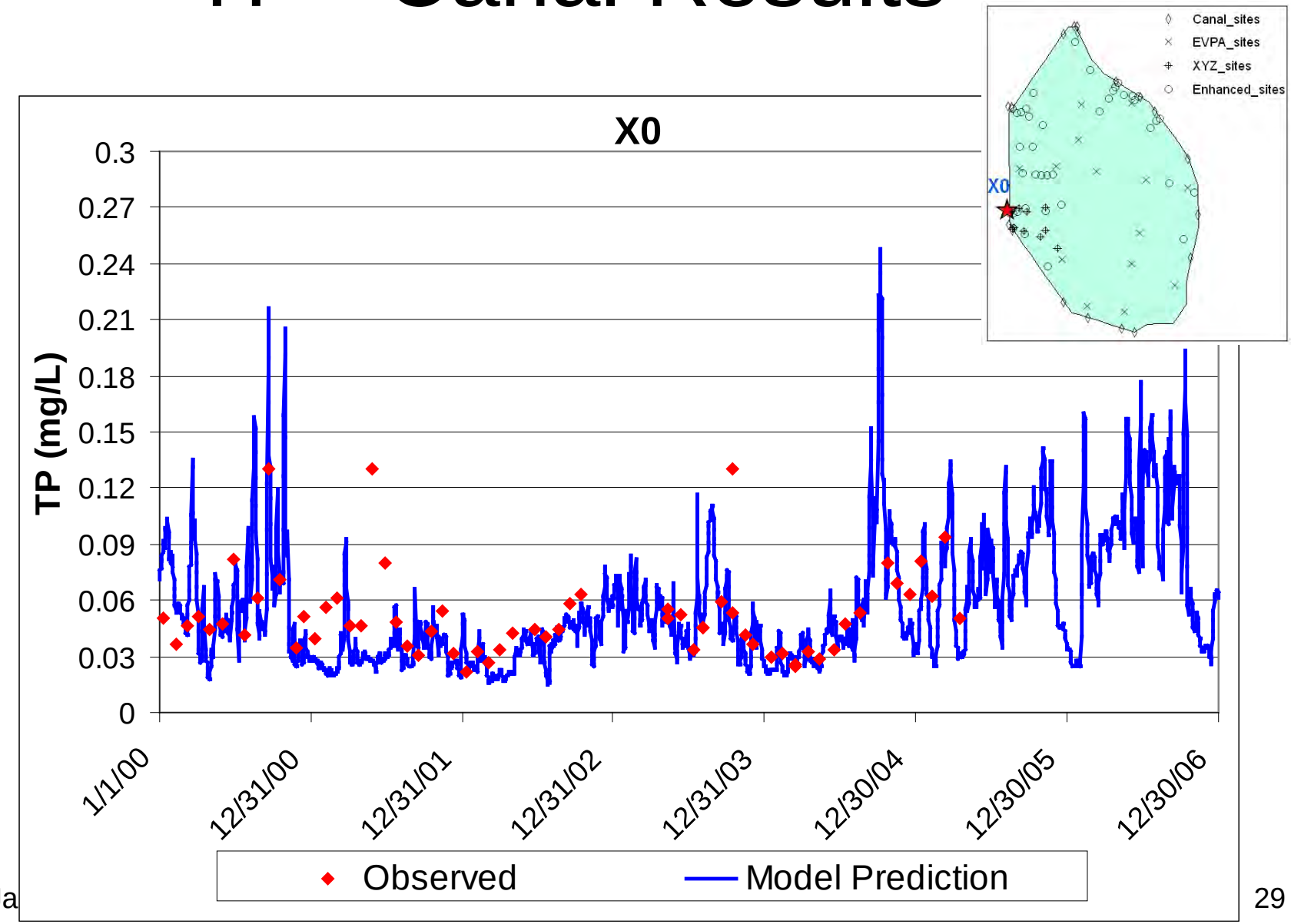
TP - XYZ Stations



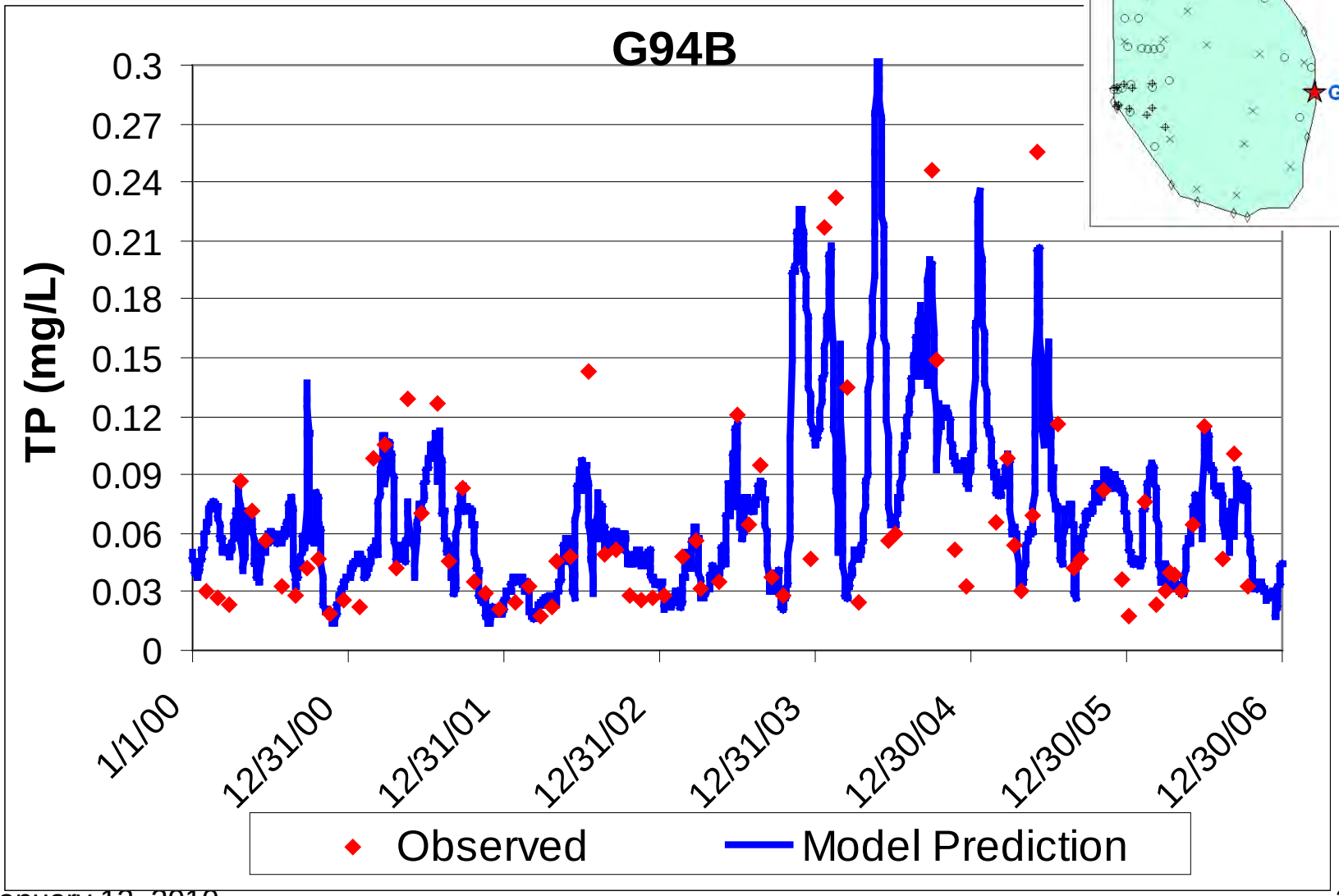
TP - Enhanced Stations

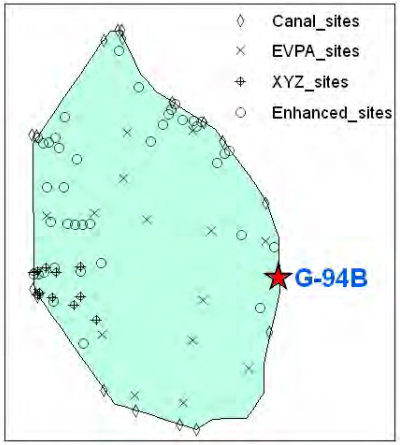


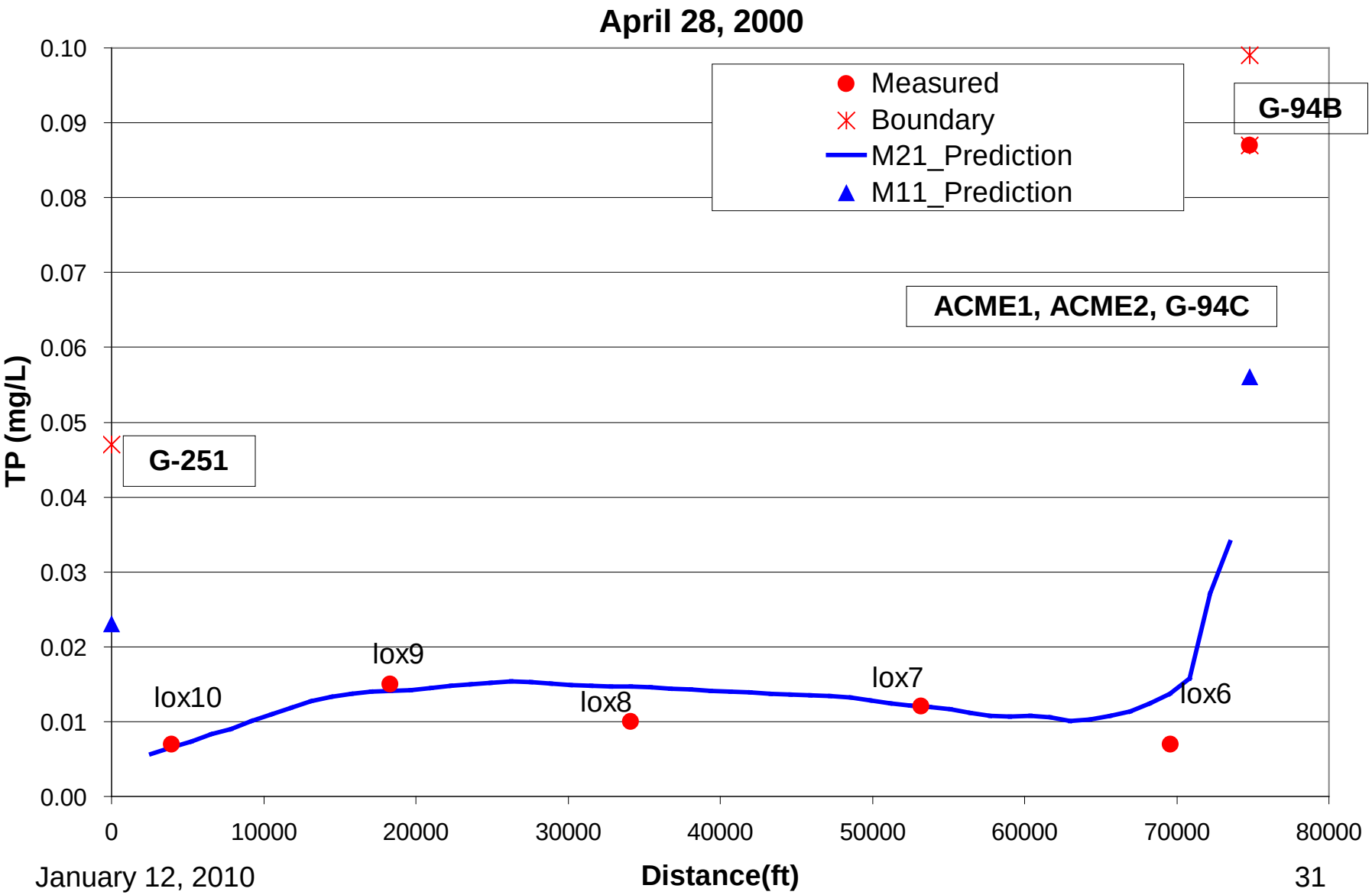
TP - Canal Results

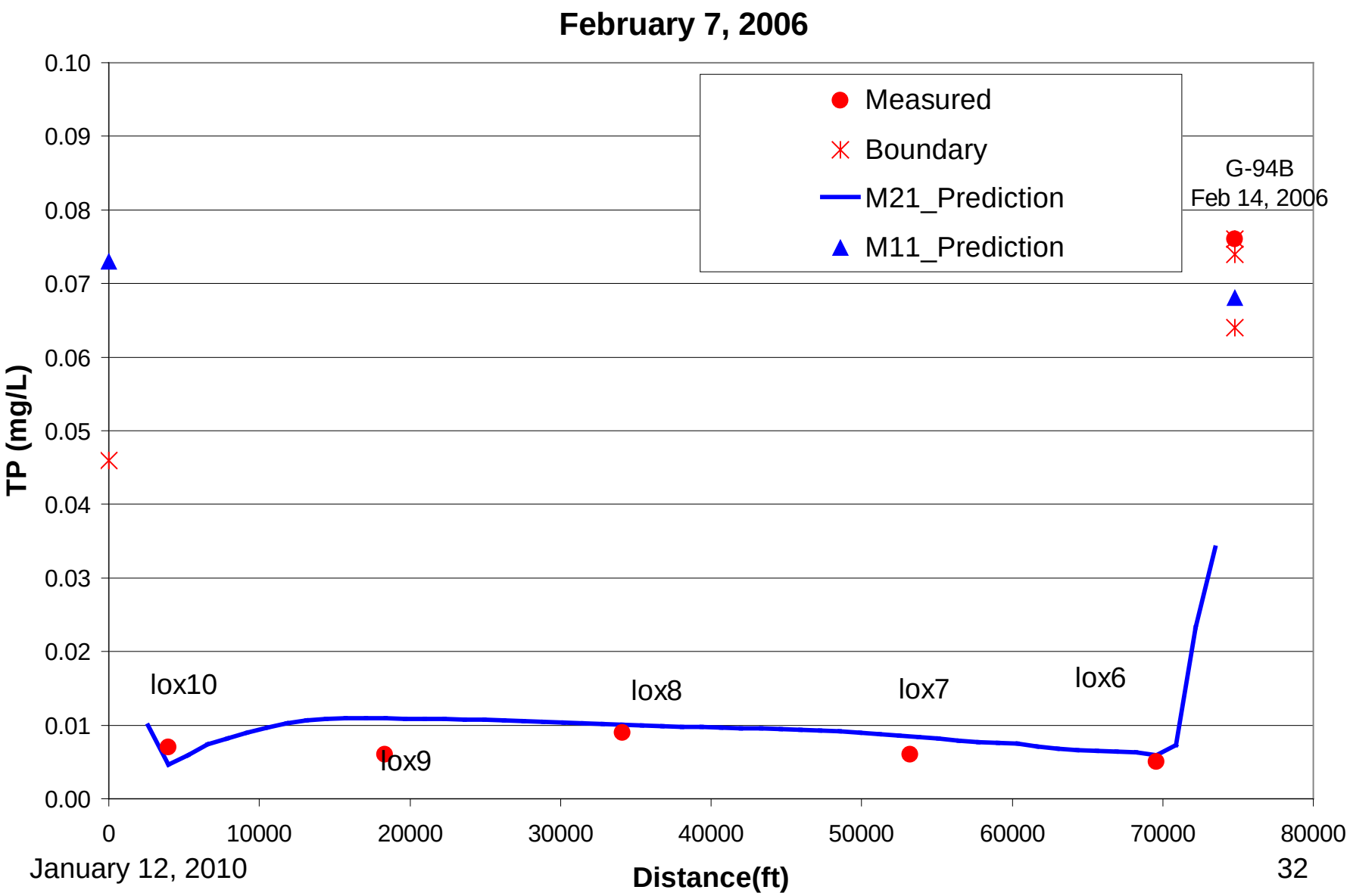


TP - Canal Results



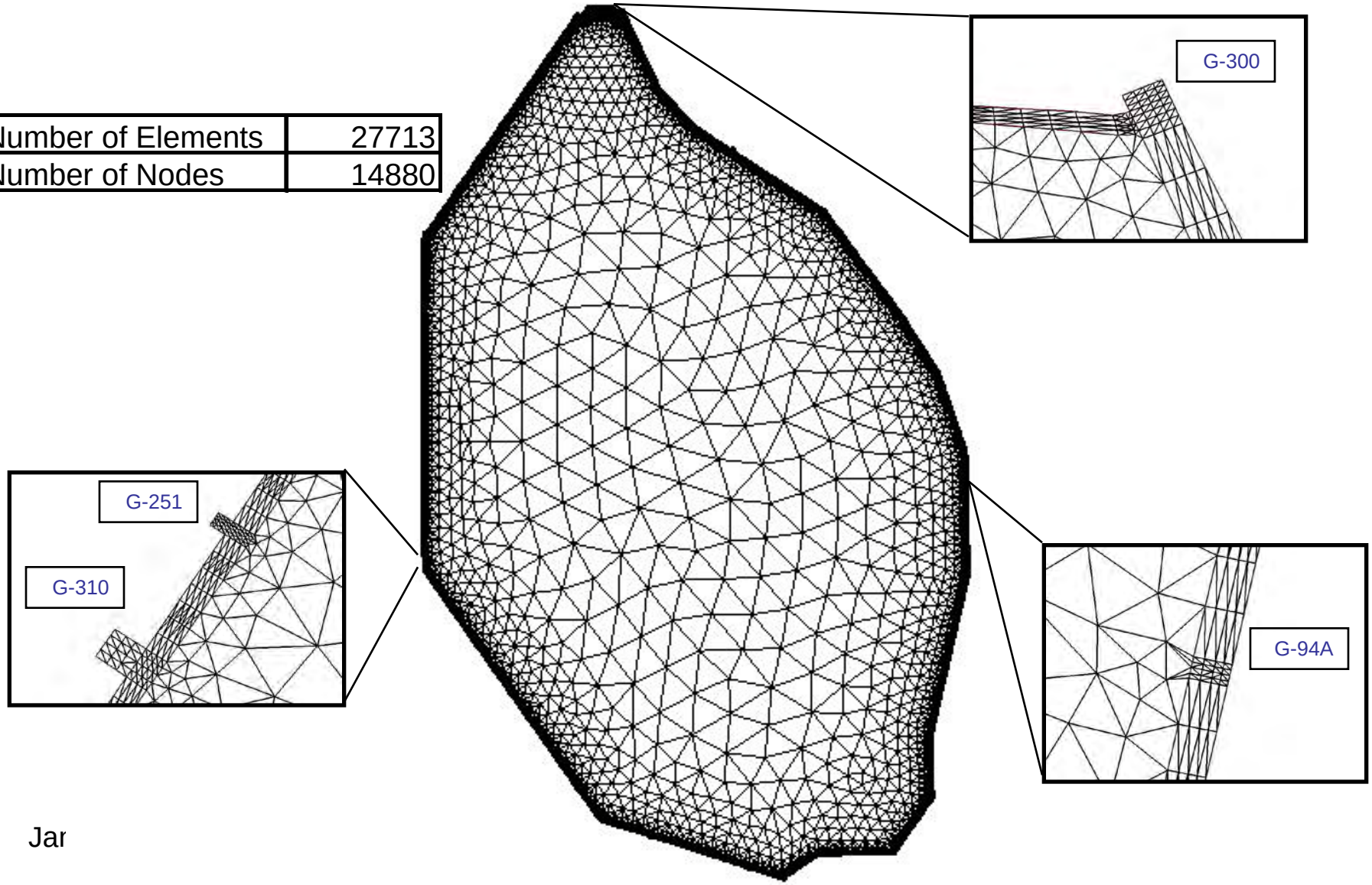



April 28, 2000
Measured
Boundary
M21_Prediction
M11_Prediction
G-94B
ACME1, ACME2, G-94C
G-251
lox10
lox9
lox8
lox7
lox6
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
10000
20000
30000
40000
50000
60000
70000
80000
Distance(ft)


February 7, 2006
Measured
Boundary
M21_Prediction
M11_Prediction
G-94B
Feb 14, 2006
lox10
lox9
lox8
lox7
lox6
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
10000
20000
30000
40000
50000
60000
70000
80000
Distance(ft)

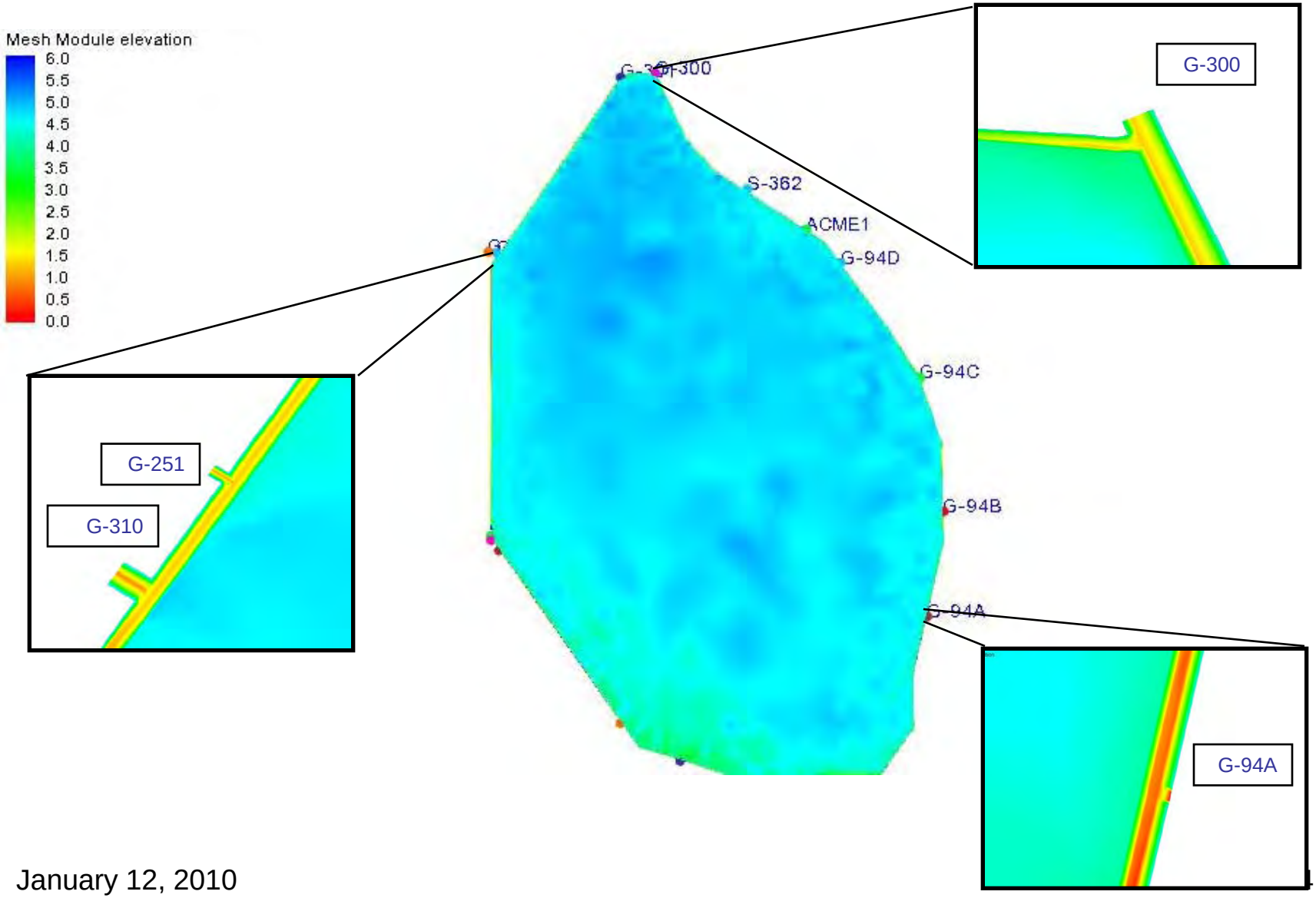
Setup of ADH to the Lox Refuge

Number of Elements	27713
Number of Nodes	14880

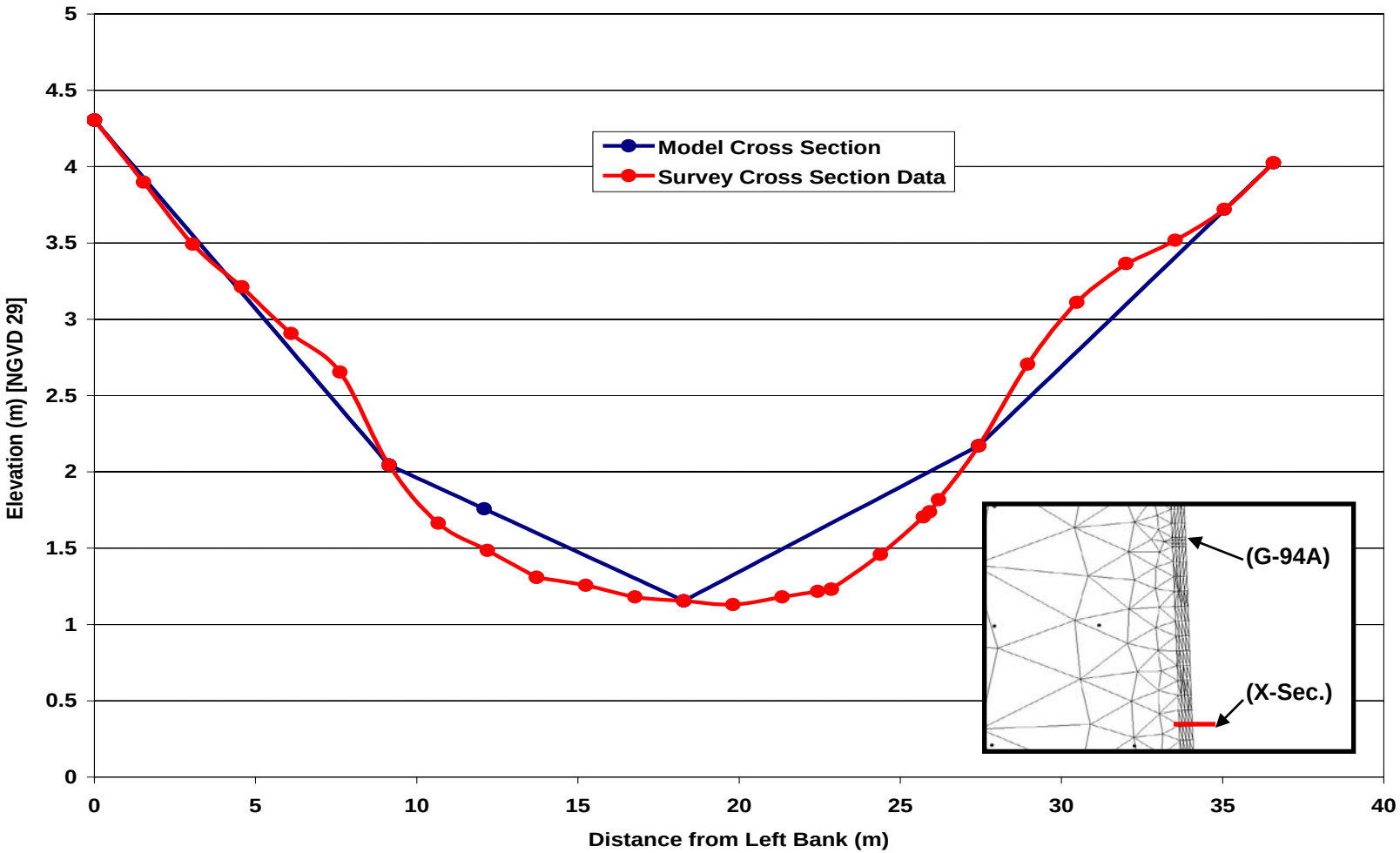


Jar

Elevation Contour



Mesh Vs. Observed XS (South of G-94A)



Questions?