



**Uranium Stabilization through
Polyphosphate Injection:
Field Studies**

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PNNL-SA-54632

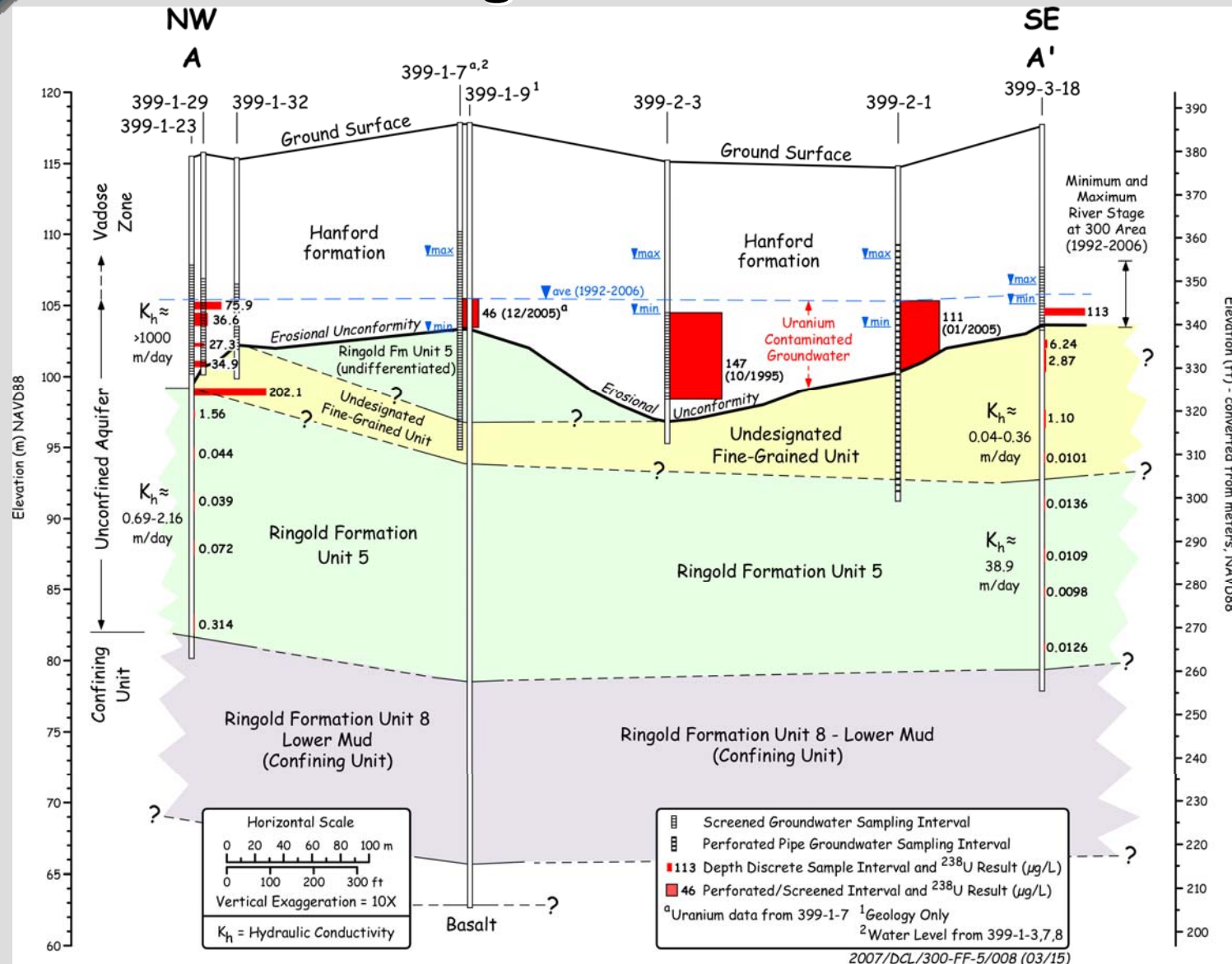
Field-Scale Treatability Testing Activities



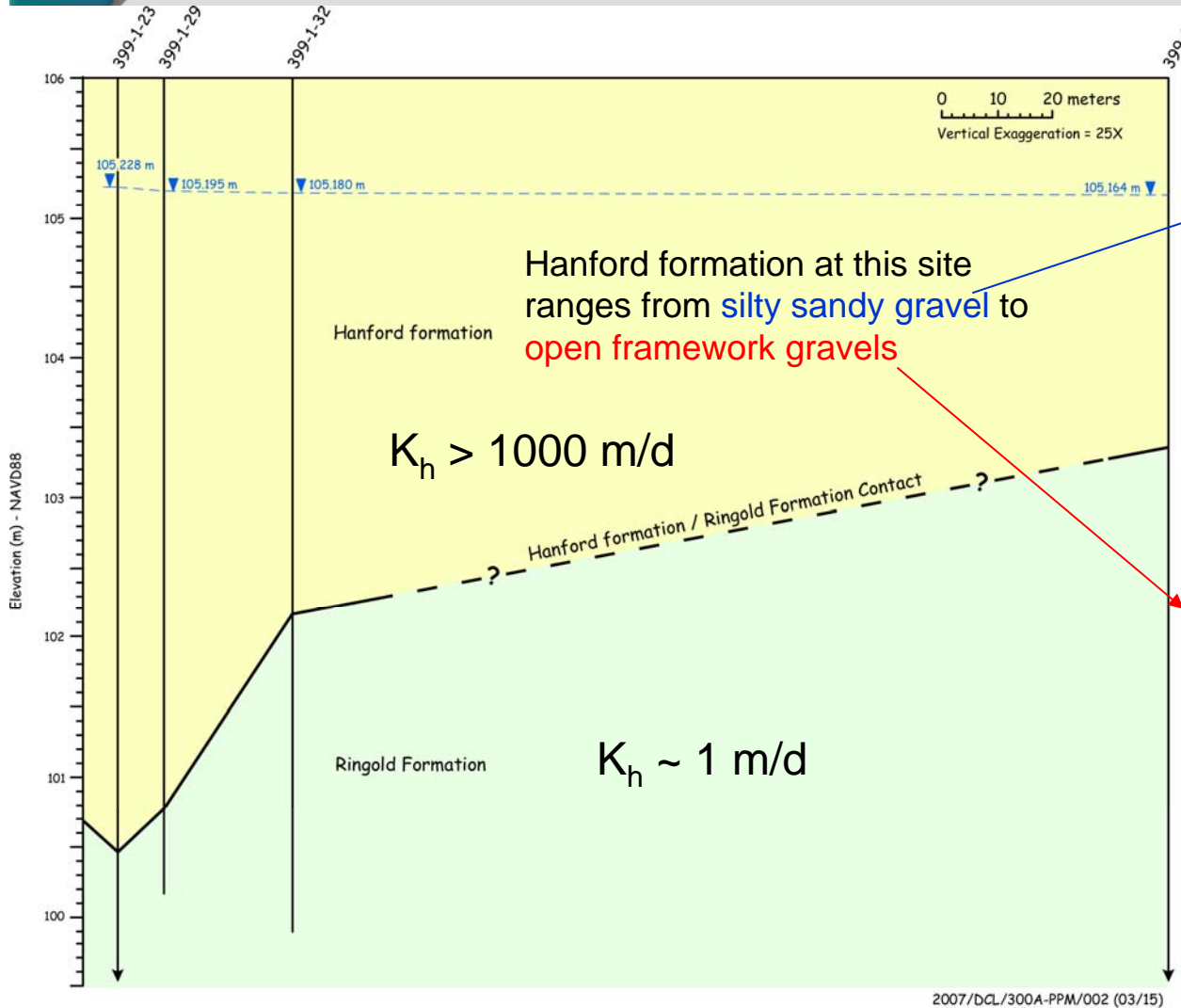
- ▶ Site specific characterization
 - Installation of well network
 - Hydrogeologic characterization
 - Hydraulic testing
 - Tracer injection test

- ▶ Polyphosphate injection design analysis
 - Development of local-scale flow and transport model
 - Incorporation of site specific characterization data
 - Calibrate to fit observed tracer drift
 - Evaluation of historic trends in GW flow direction

Geologic Cross Section



Local-Scale Geologic Cross Section



399-1-23, 33.5-34.5 ft



399-1-23, 37.8-38.5 ft



399-1-23, 48.5-49.5 ft
sandy gravel

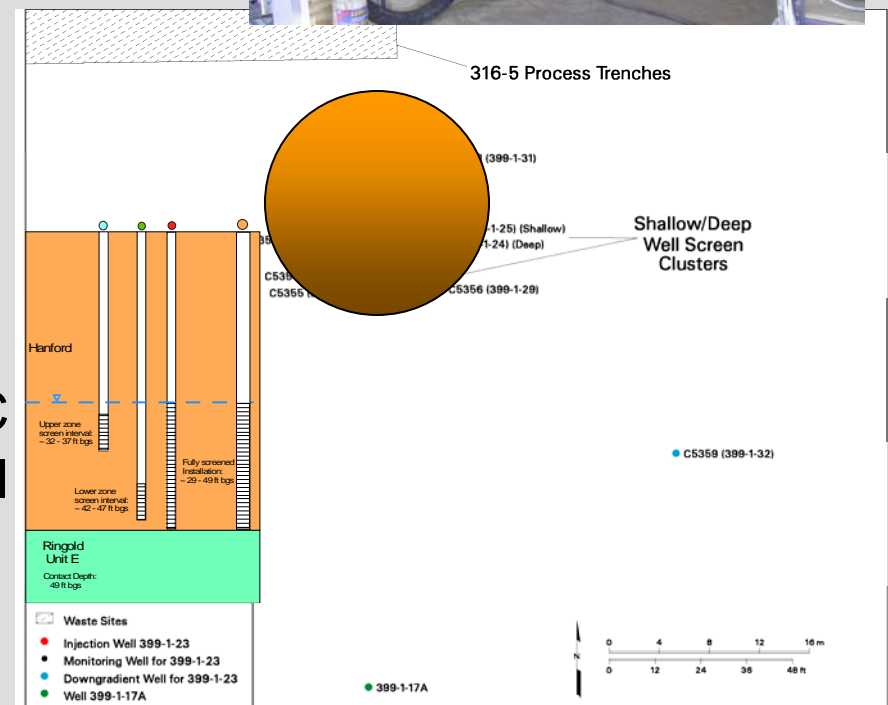


399-3-20, 55-56 ft
gravel

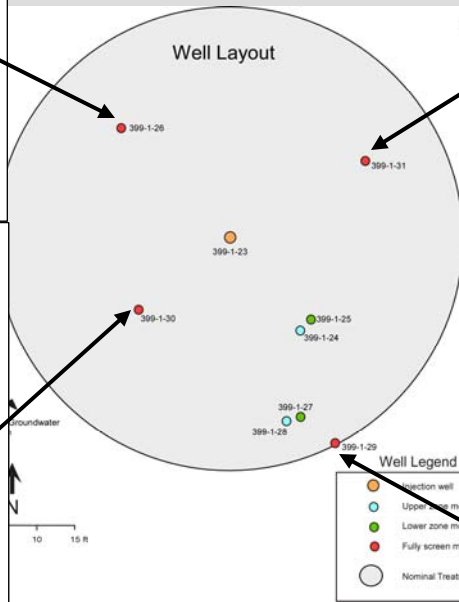
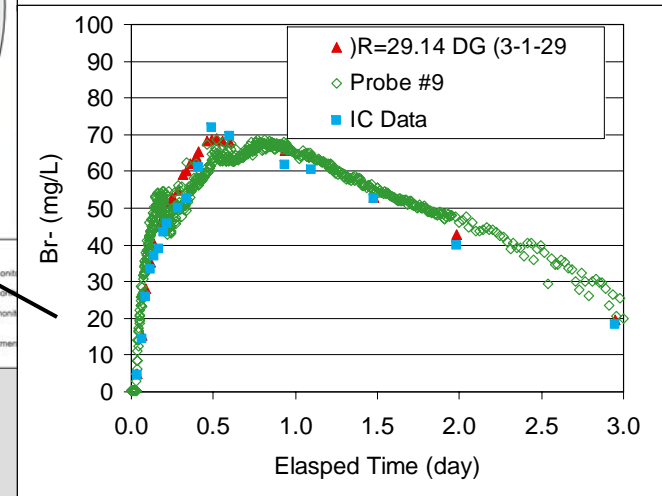
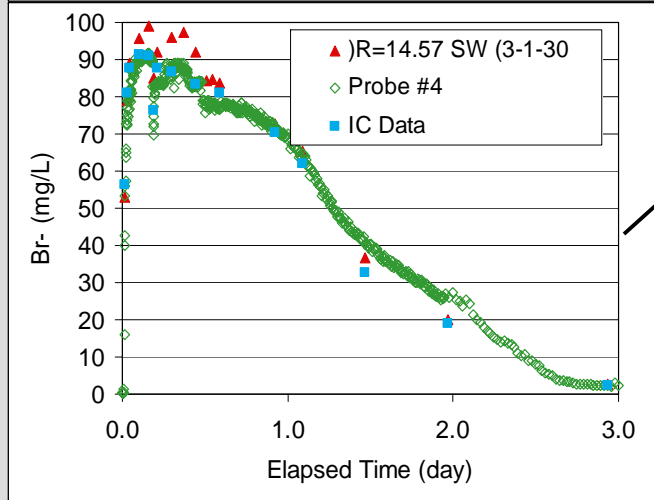
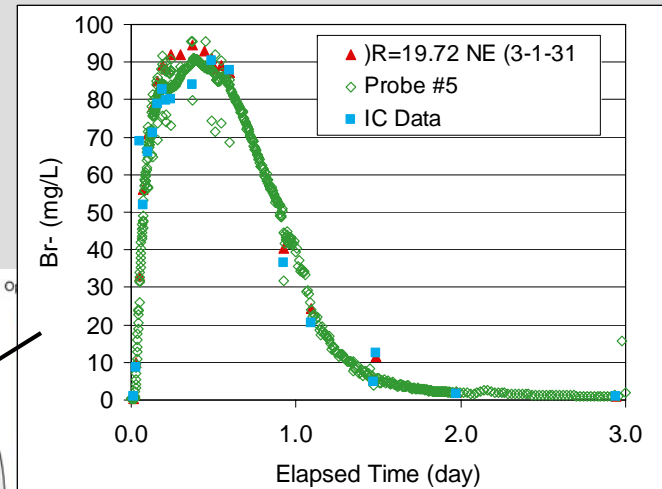
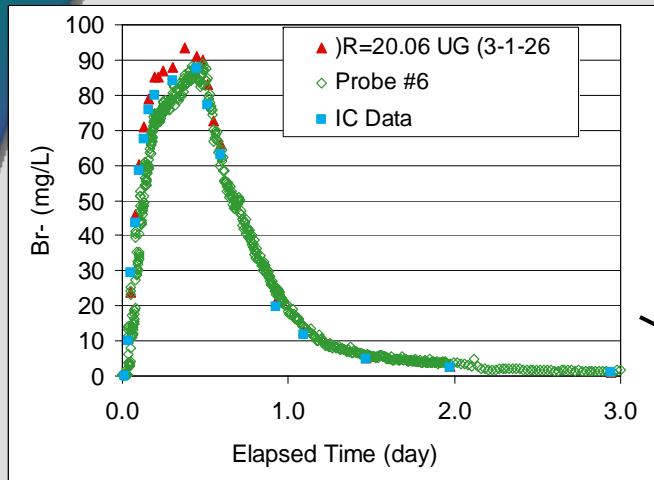
2007/DCL/300A-PPM/002 (03/15)

300 Area Polyphosphate Treatability Test Tracer Injection Test

- ▶ NaBr tracer test on Dec. 13, 2006
 - Injection Well: 399-1-23
 - Targeted 60 ft diam. treatment volume
 - Injected Volume: 143,000 gallons
 - 200 gpm for 11.9 hrs
- ▶ Inline tracer mixing with water from Well 399-1-7 (620 ft DG)
- ▶ Br⁻ conc. measured in injection stream and surrounding monitoring wells
 - Samples analyzed on site with ISE
 - Archive samples → verification by IC
 - Downhole ISE probes installed in all monitoring wells



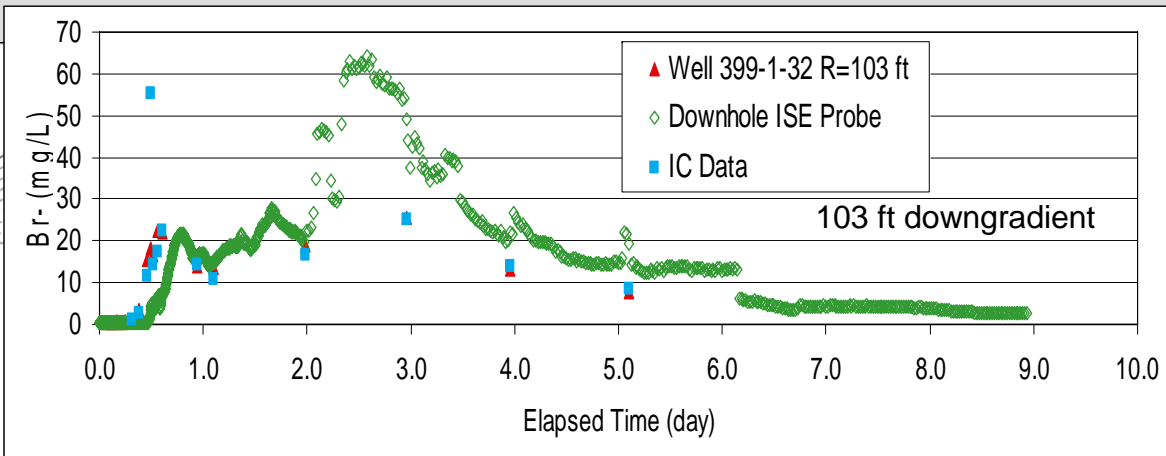
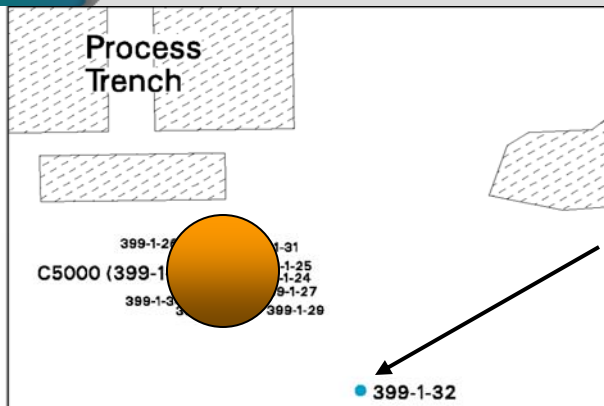
Tracer Test Results within Targeted Treatment Volume



\bar{n}_{eff} (based on tracer arrival) = 0.18

- Consistent with LFI porosity estimates based on physical property analysis

Tracer Results for Downgradient Wells 399 1-32 and 399-1-7

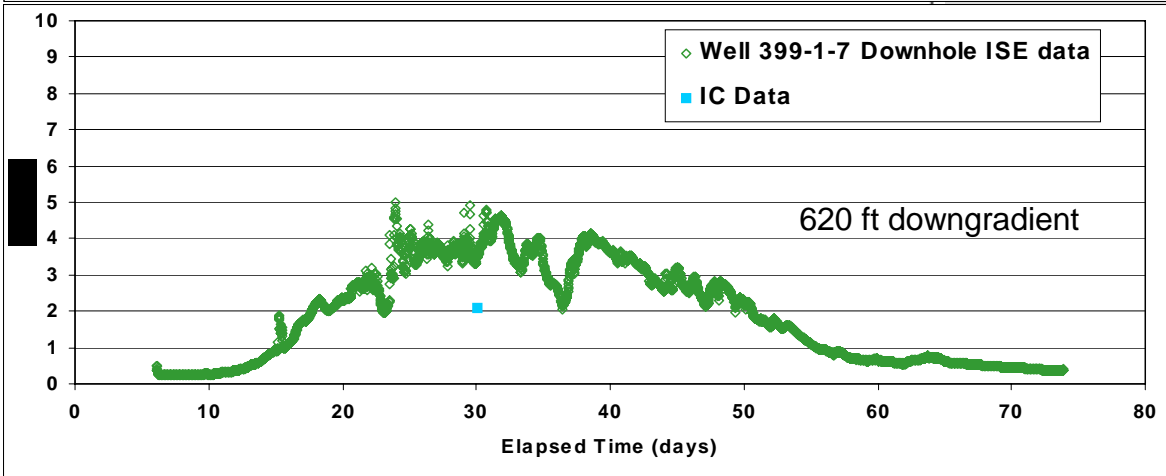


399-1-32 tracer drift data

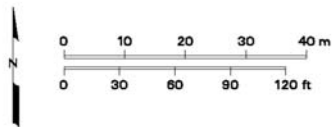
- Arrival in ~ 2 days
- $v = 50$ ft/d (15 m/d)
- $K = 14,000$ ft/d (4,300 m/d)
- $K_{fast} = 20,000$ ft/d (6,100 m/d)

399-1-7 tracer drift data

- First arrival after ~ 12 days
- Tracer plume well dispersed



- ☒ Waste Sites
- Well 399-1-23
- Monitoring Well for 399-1-23
- Downgradient Well for 399-1-23
- Other Monitoring Wells

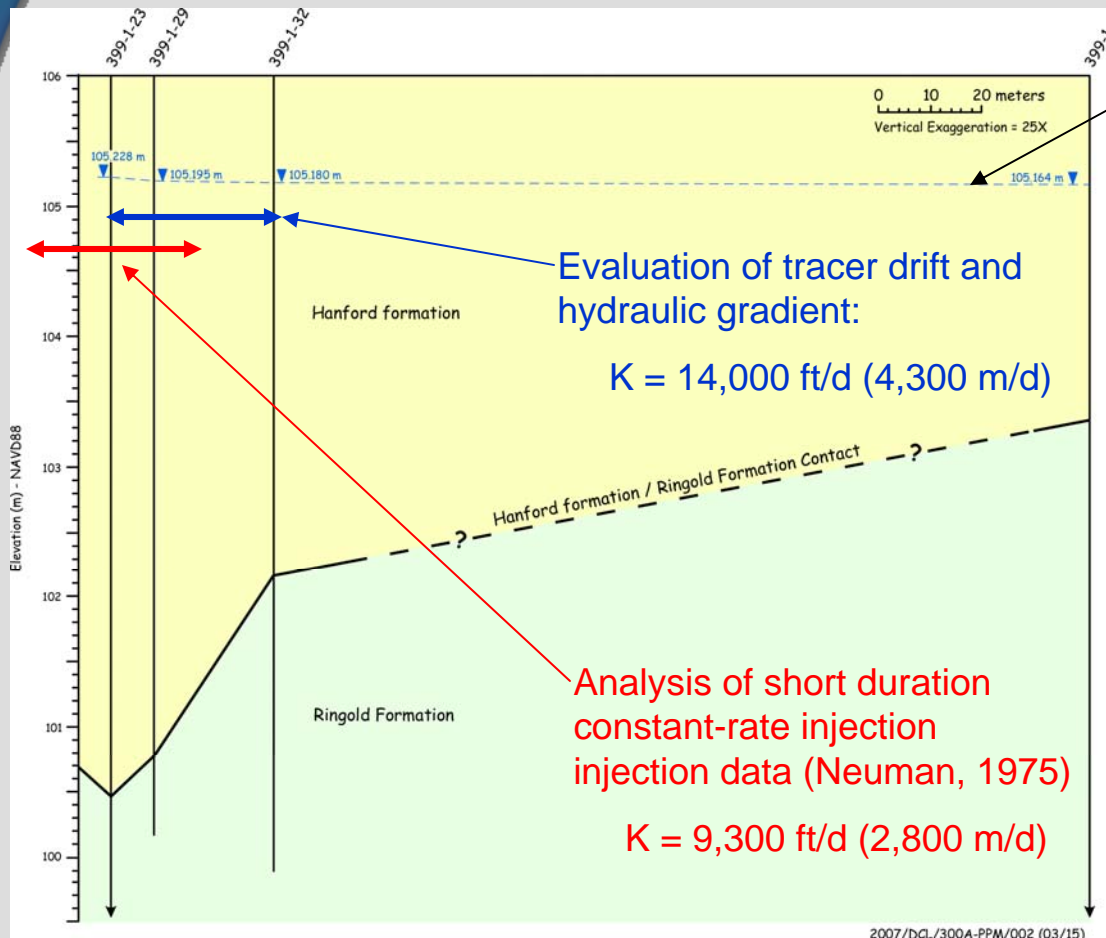


399-1-3 ● 399-1-7

**** Tracer drift data will be evaluated using a local-scale flow and transport model**

can_wi06_13 September 08, 2006 11:17 AM

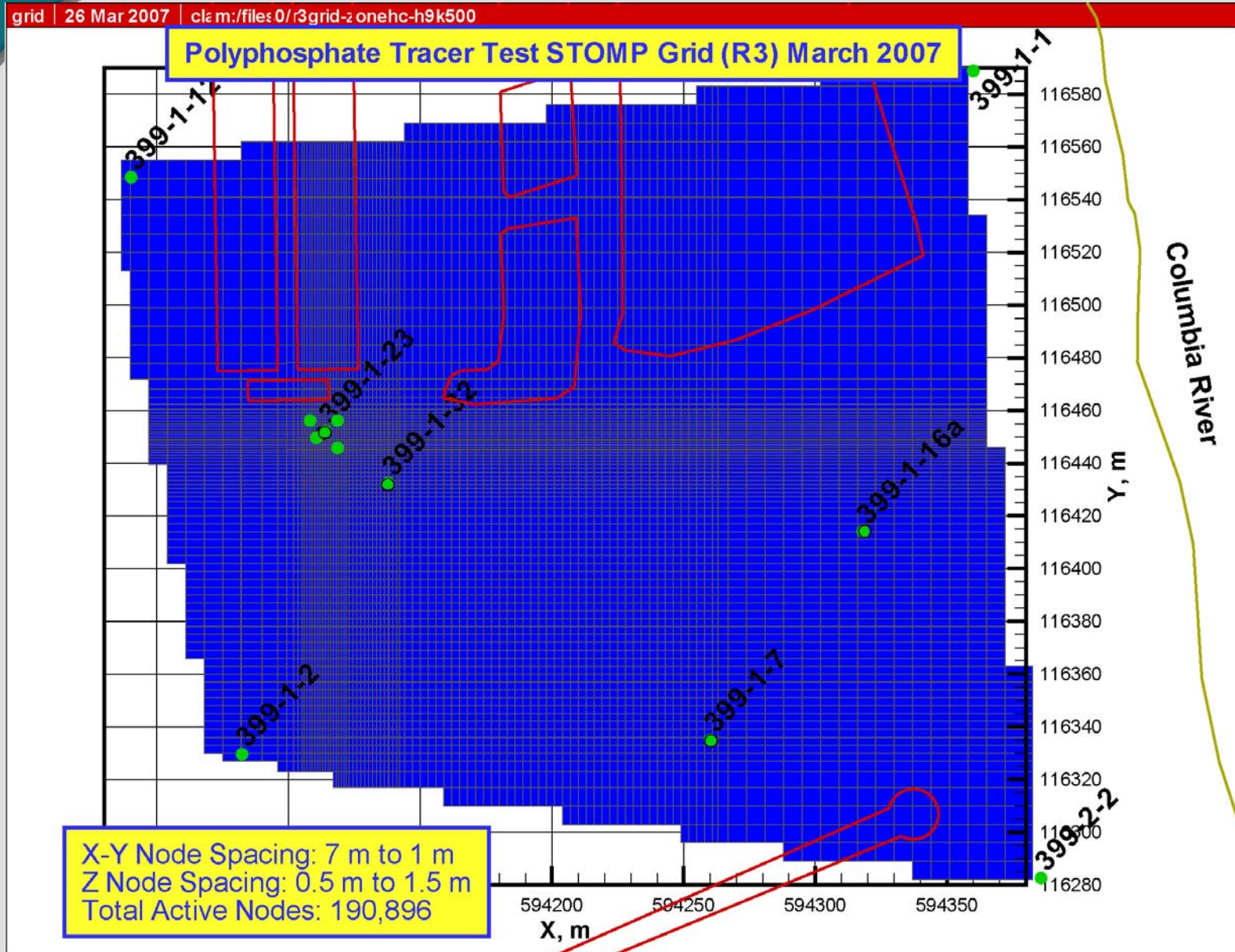
Summary of Gradient and Hydraulic Conductivity Estimates



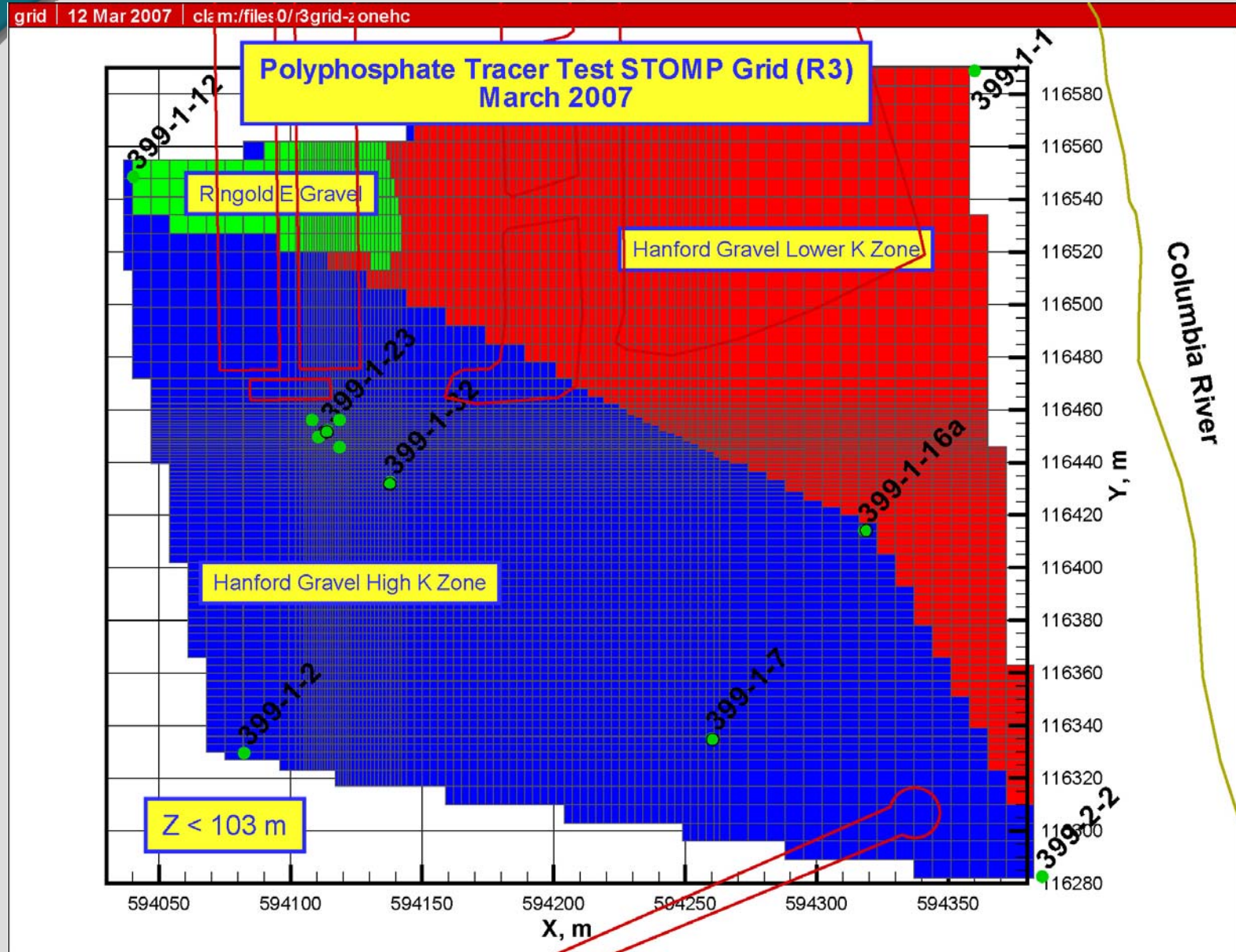
Hydraulic gradients based on average conditions during a period of stable river stage in Feb-07:

- 1-23 to 1-29 → $3.7E-3$ ft/ft
- 1-29 to 1-32 → $6.0E-4$ ft/ft
- 1-32 to 1-7 → $1.5E-4$ ft/ft

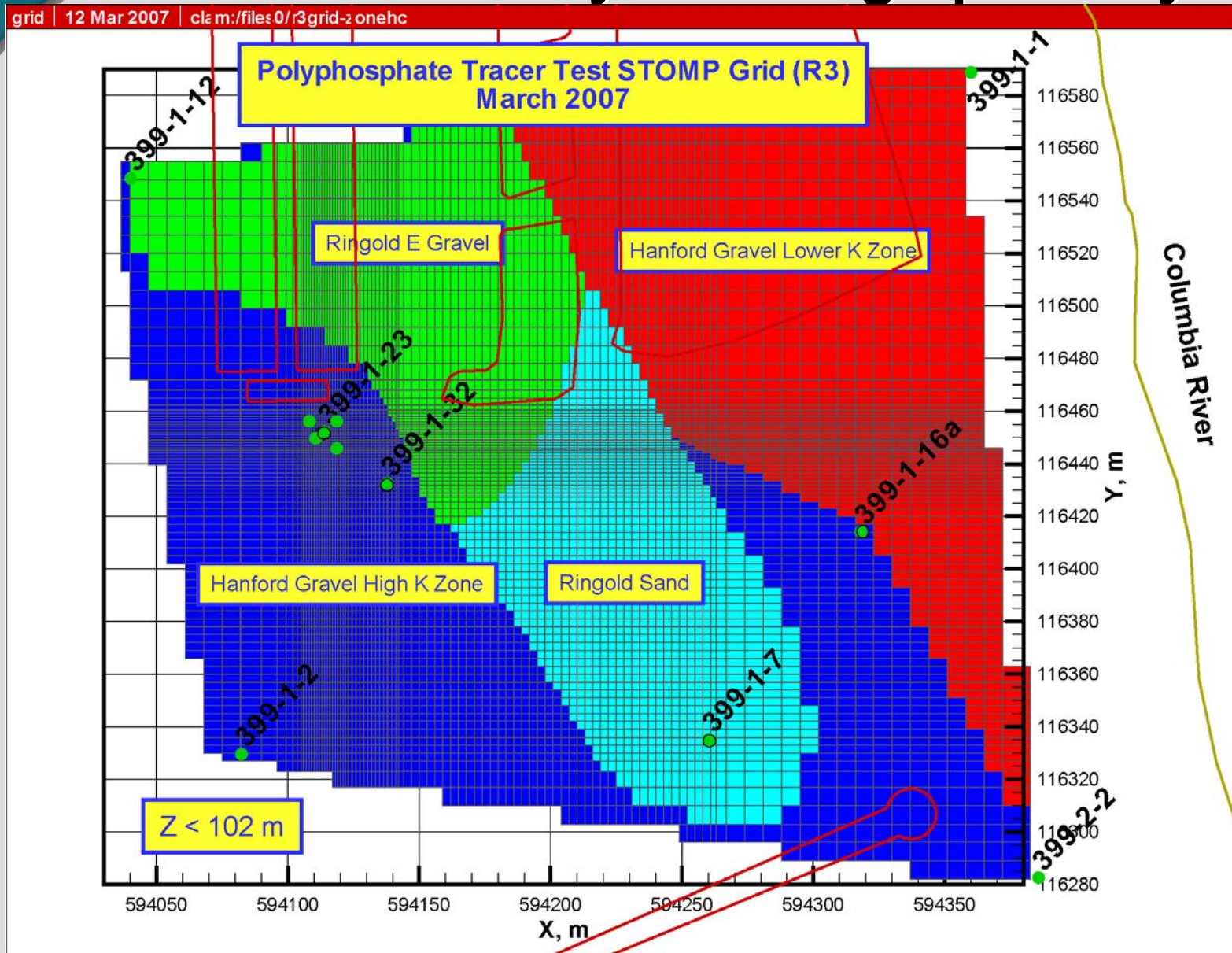
Tracer Test Model - Domain



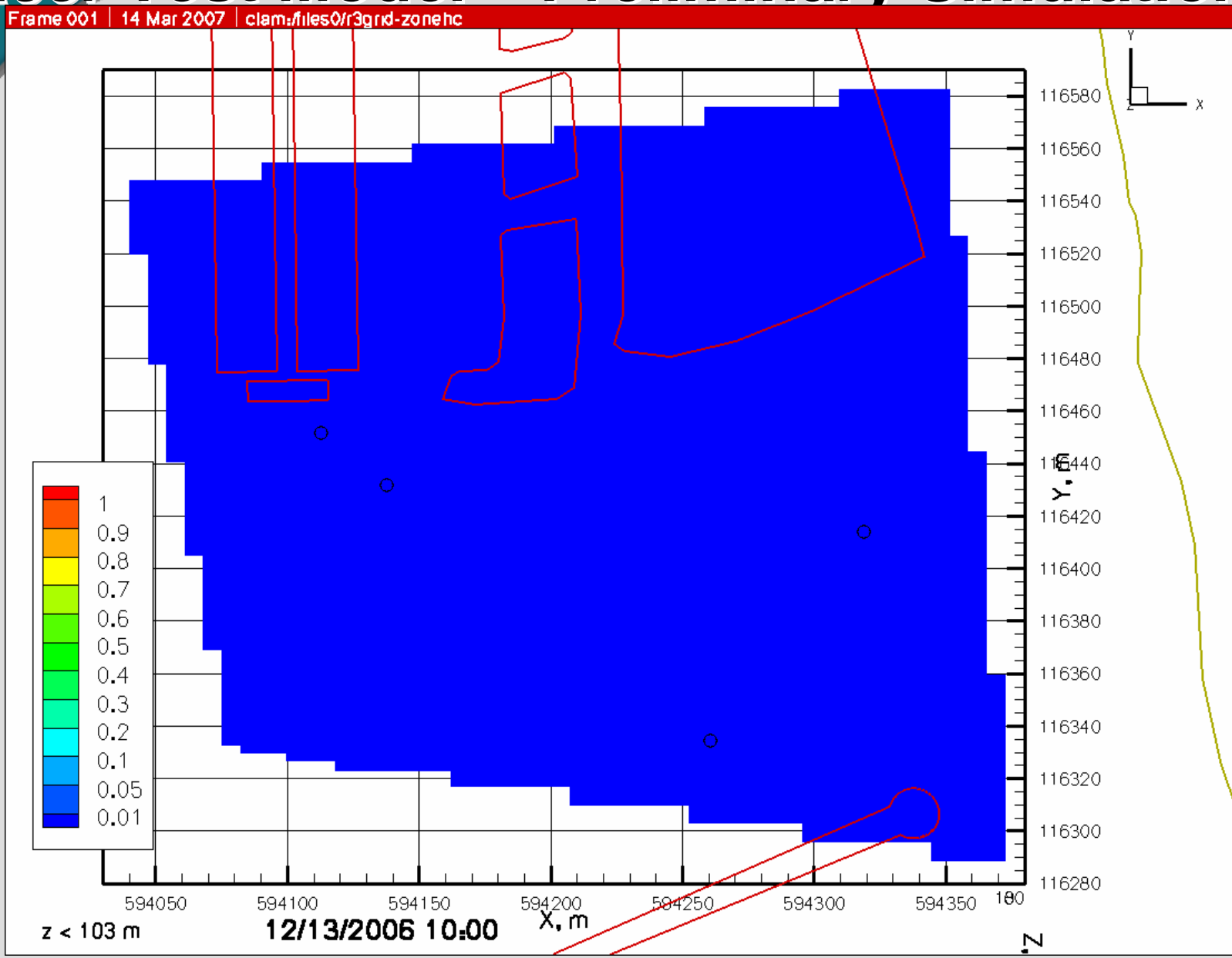
Tracer Test Model – Hydrostratigraphic Layers



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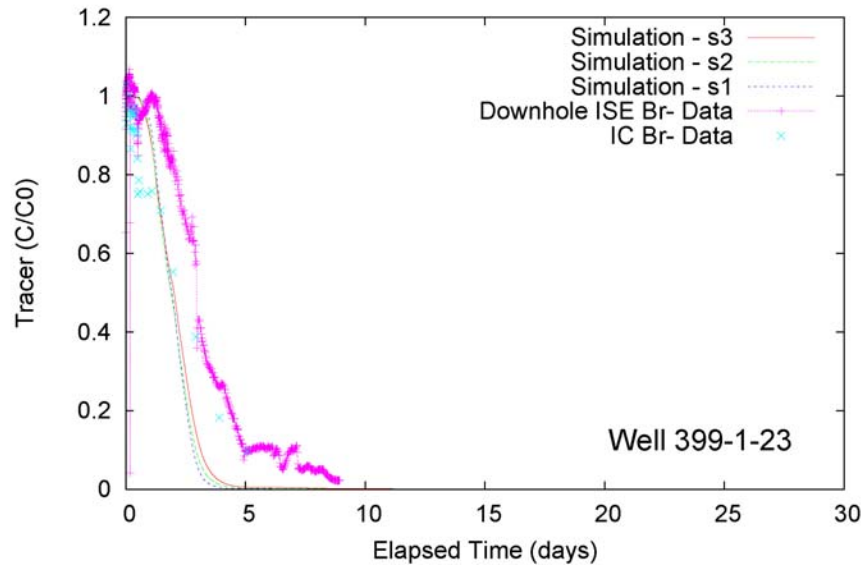


Tracer Test Model – Preliminary Simulation

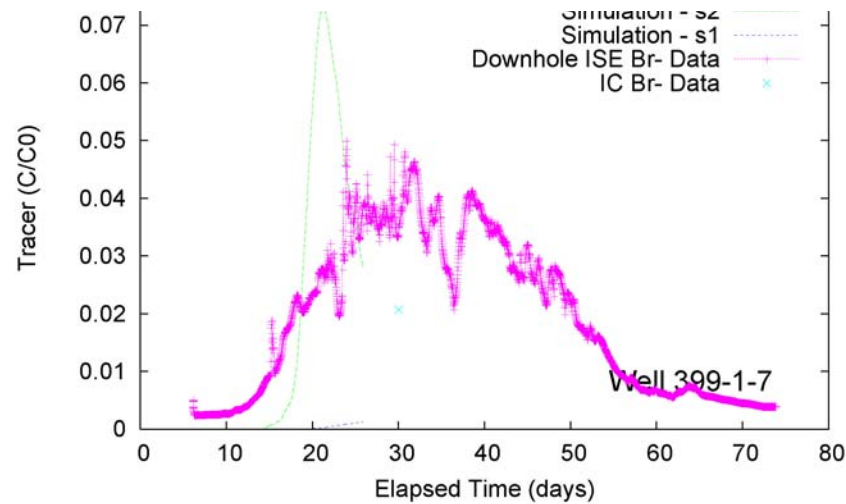
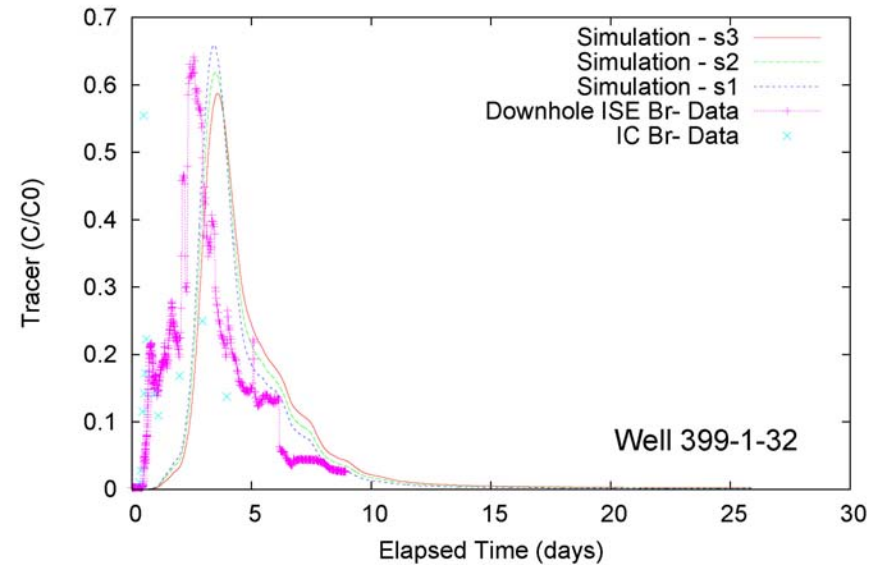


Tracer Test Model – Preliminary Simulation

300 Area TT Site R3HZC 3/14/07: Hanford K=9000/500 Ringold K=150



300 Area TT Site R3HZC 3/14/07: Hanford K=9000/500 Ringold K=150



Ongoing Injection Design Activities

- ▶ Develop hydraulic property zonation in the vicinity of the test site
 - Lithologic descriptions
 - Hydraulic test data
 - Changes in hydraulic gradient
 - EBF testing (vertical distribution of K_h)
 - Tracer arrival data
- ▶ Perform predictive simulations to evaluate transport under high river stage conditions
 - Polyphosphate injection planned for June 07 (high water table conditions)