



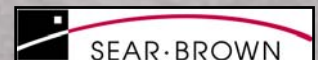
*Influence of Sewers on Groundwater
Flow in the Vicinity of a PRB
in an Urban Setting
Geneva, New York*

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Urban Epi Karst

Surficial Features

- **Superficial networks of altered K**
- **Unrelated to subsurface networks**
- **Connected to subsurface networks**

Subsurface Features

- **Intentional Conduits**
- **Unintentional Conduits**

Example

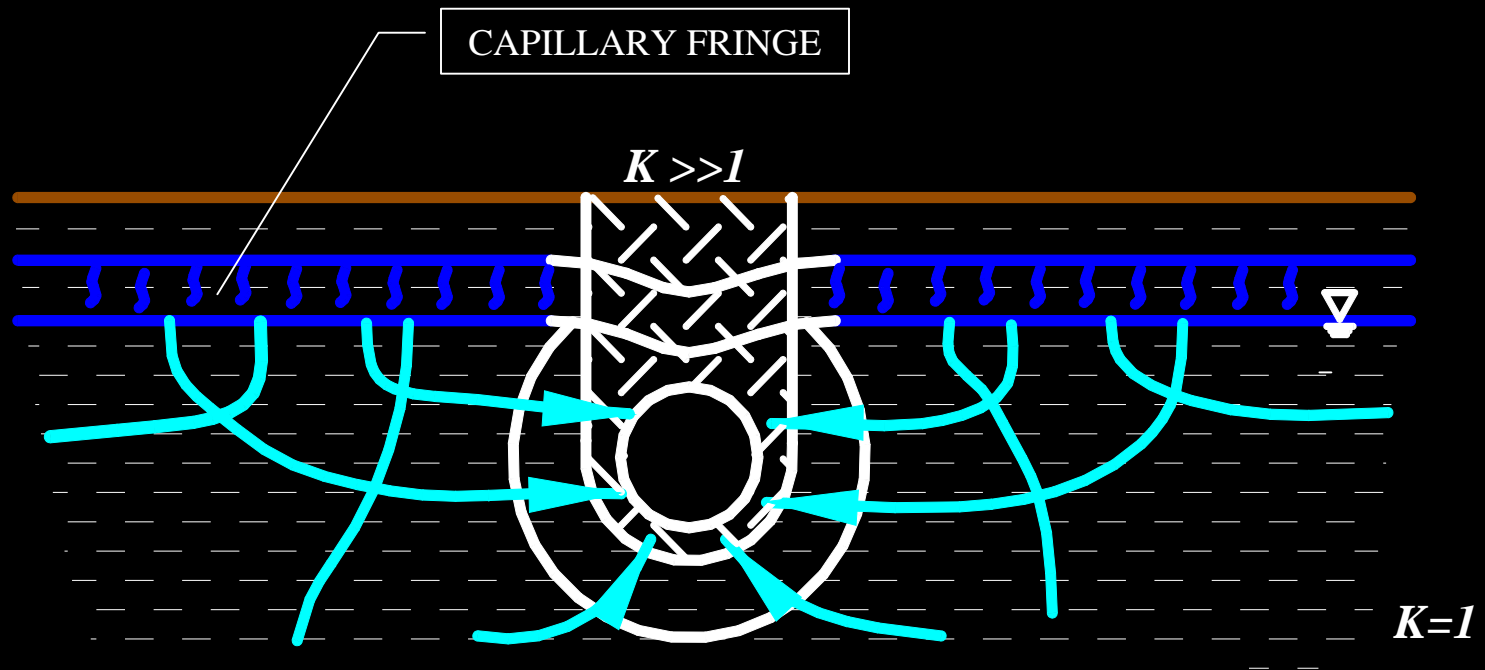
Utility trenches
Fractures in asphalt
Storm drains and manholes

Example

Septic tanks
Sanitary sewer systems
Storm drainage systems
PRBs

Tunnels
Basements
Leaking Sewers
Permeable Sewer Line Bedding

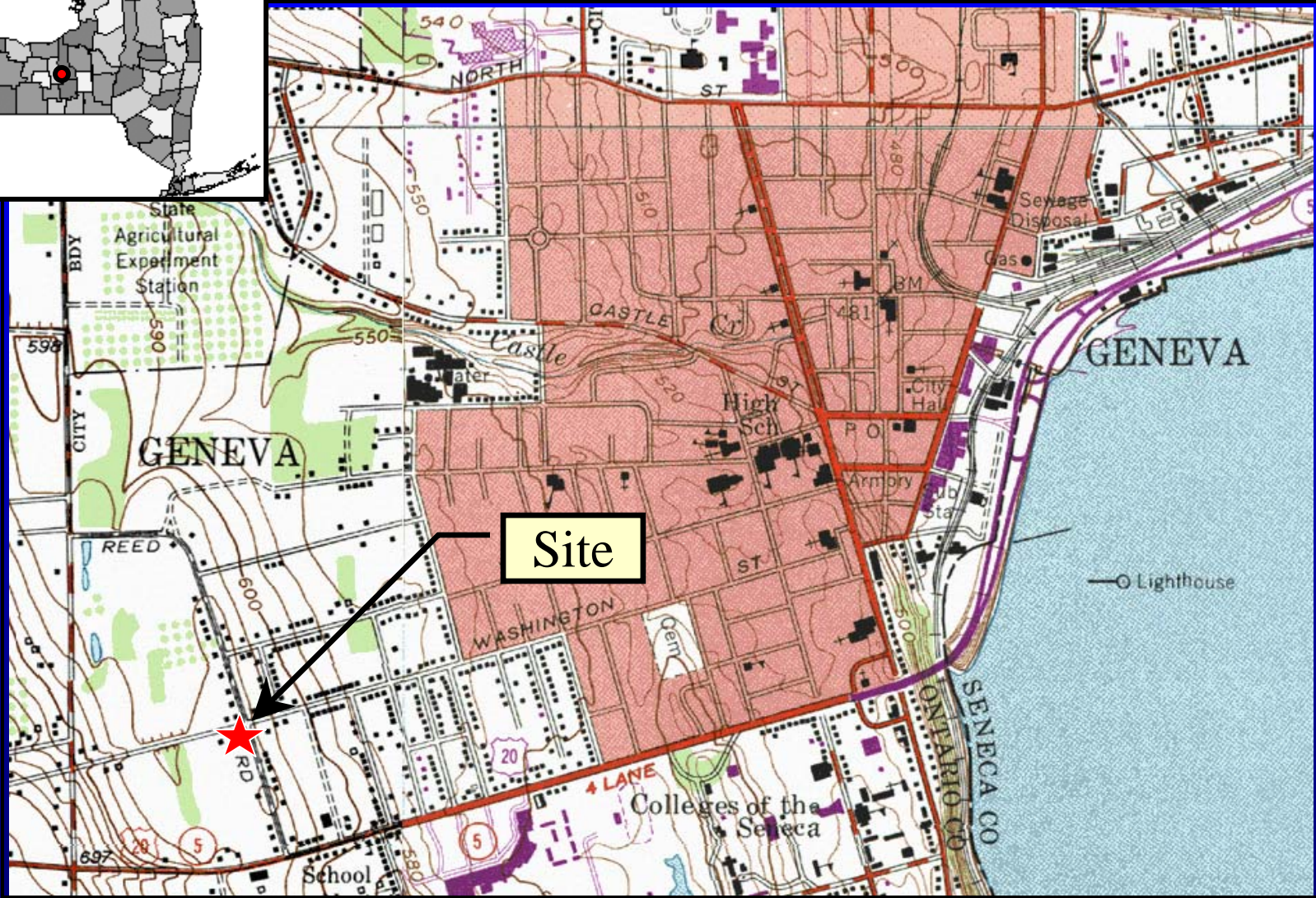
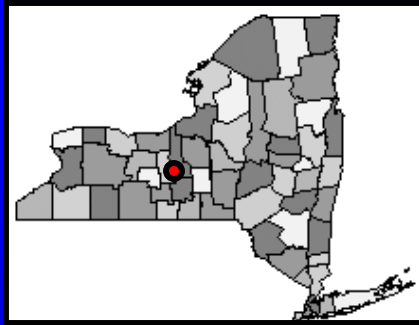
Sewer Flow Net in Low K Setting



Low Permeability Setting

- Shallow Depth to Water Table
- High Specific Retention – Thick Capillary Fringe
- Low Recharge – Large Water Table Rise

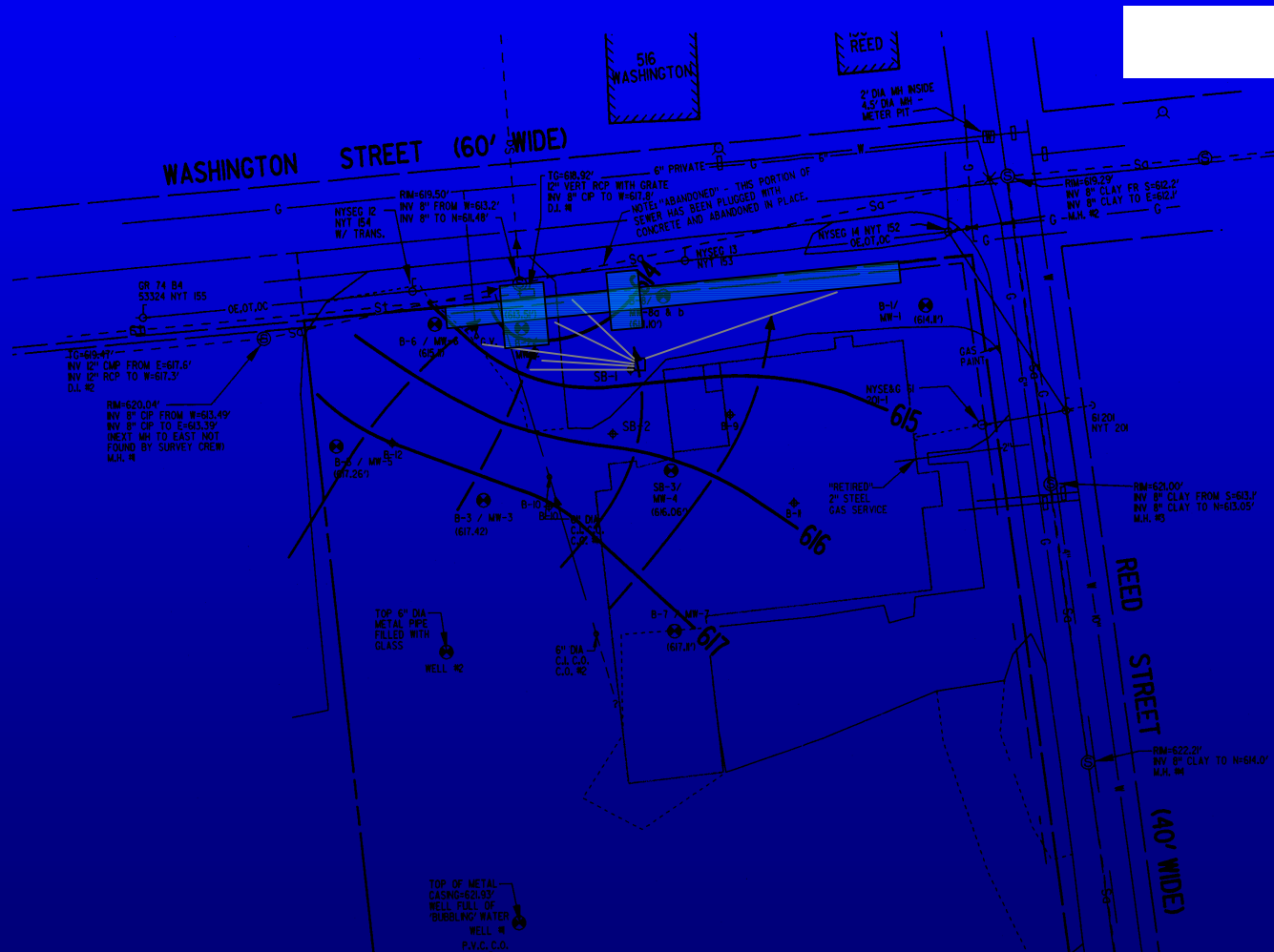
Site Location Map



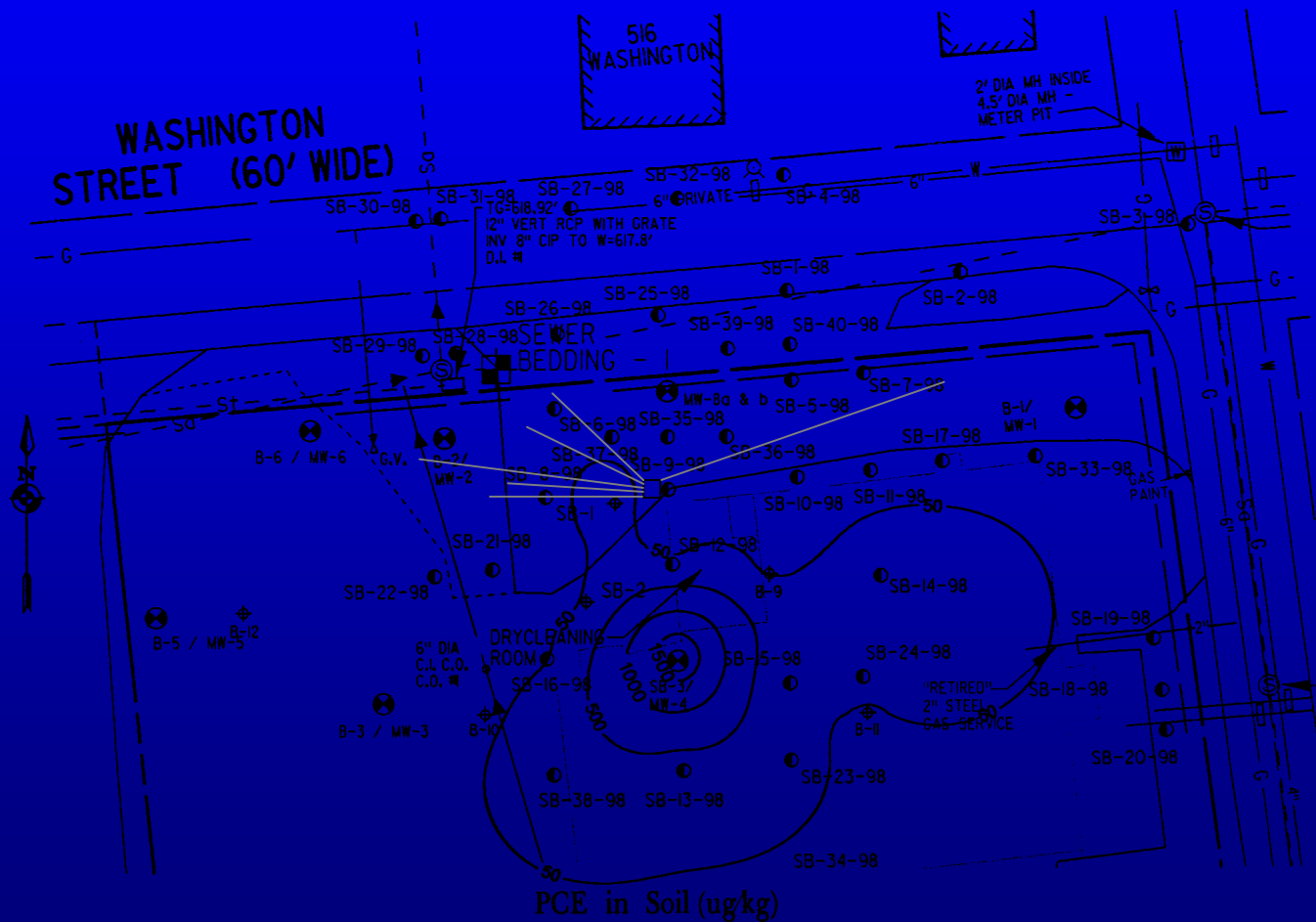
Till Soil Matrix



Pre PRB – Groundwater Flow



PCE Plume in Soil



PCE Plume in Groundwater



CONTOUR PLOT OF
TETRACHLOROETHENE (PCE) IN GROUNDWATER
(ug/L)

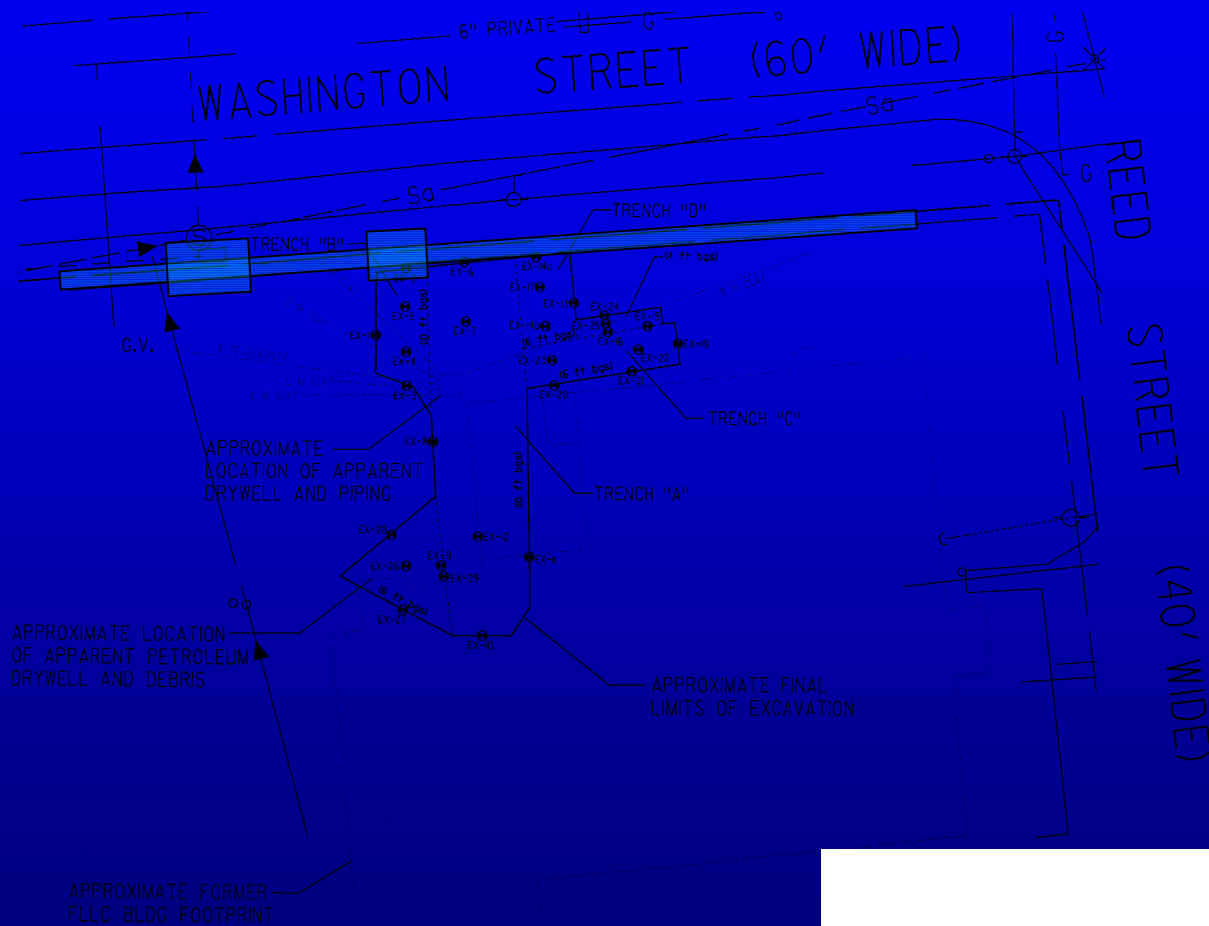
Soil Removal Program



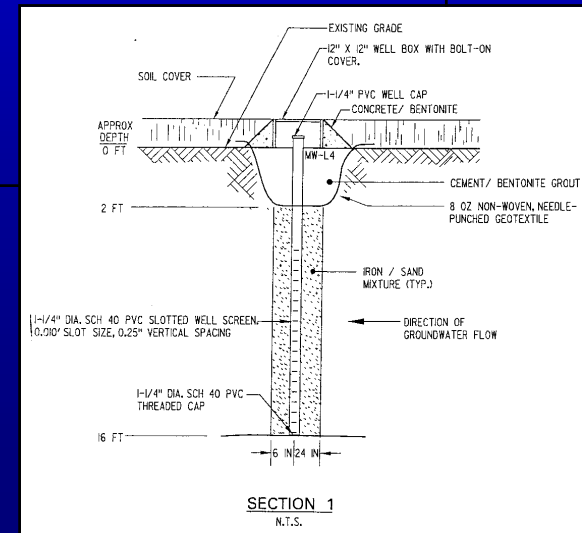
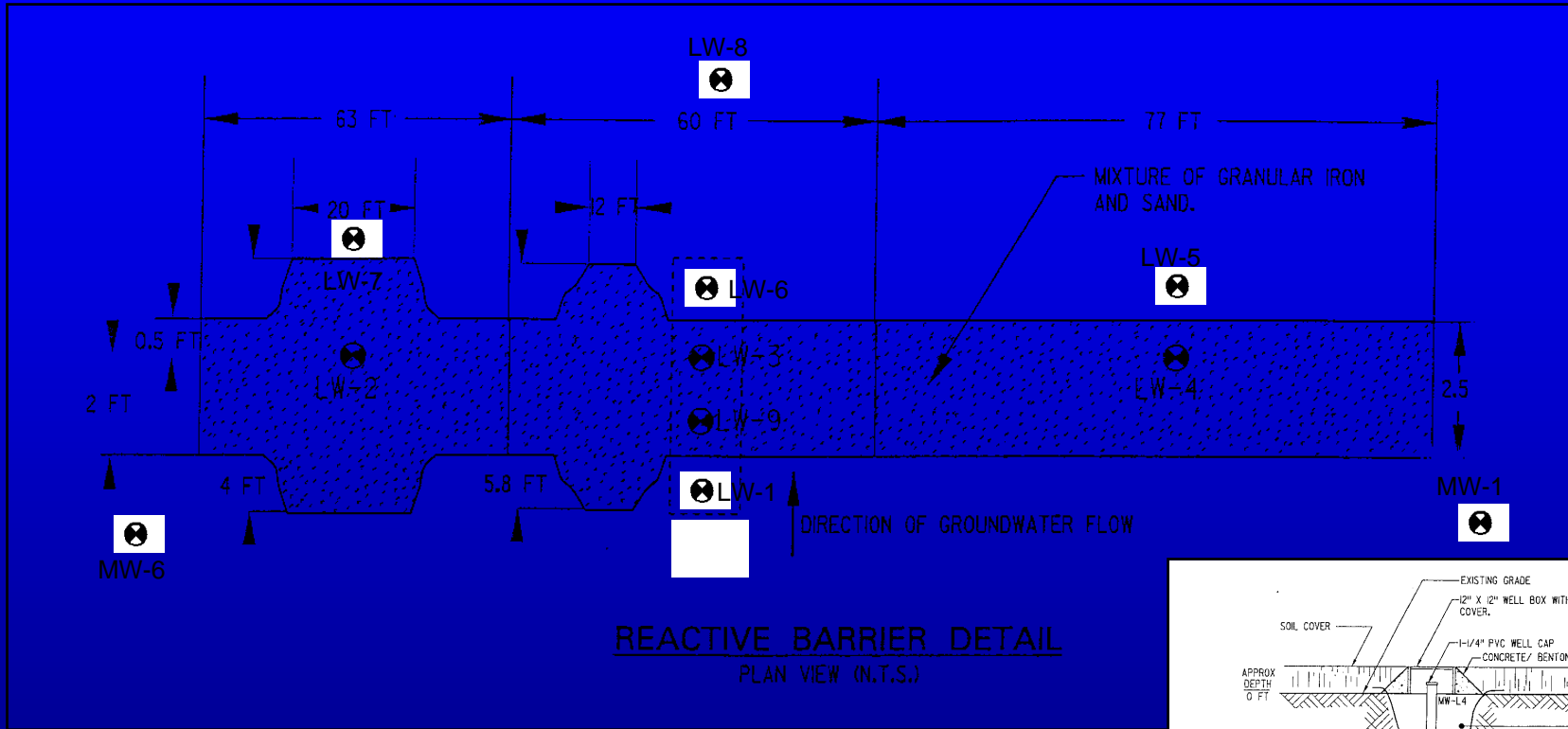
PRB Construction



Location of Soil Removal Area and PRB



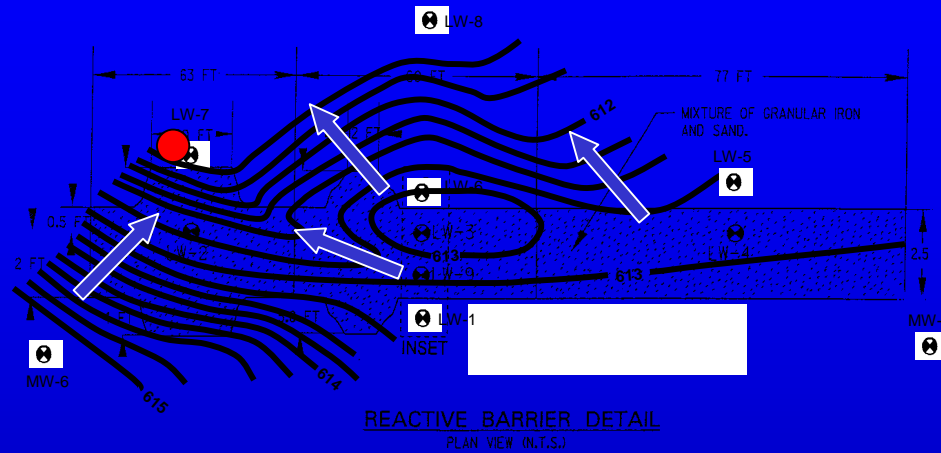
As-Built Schematic of PRB



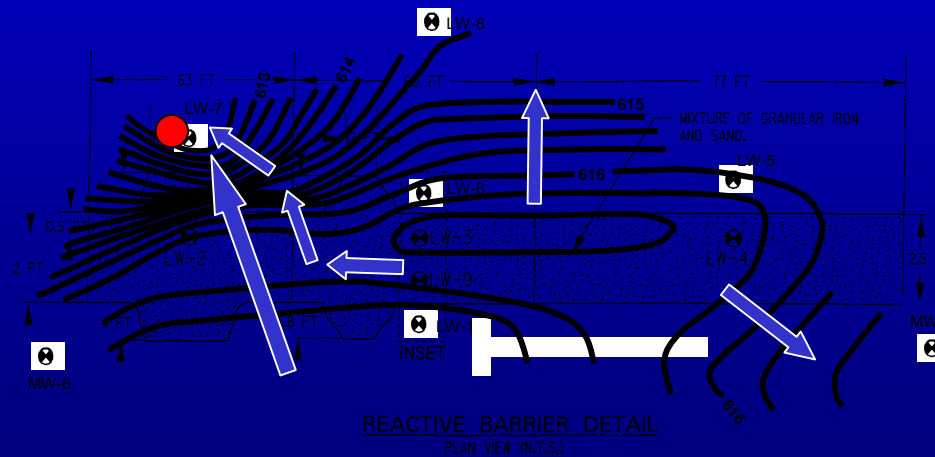
Finished Ground Surface With Monitoring Well Location



Water Table Contour Plots



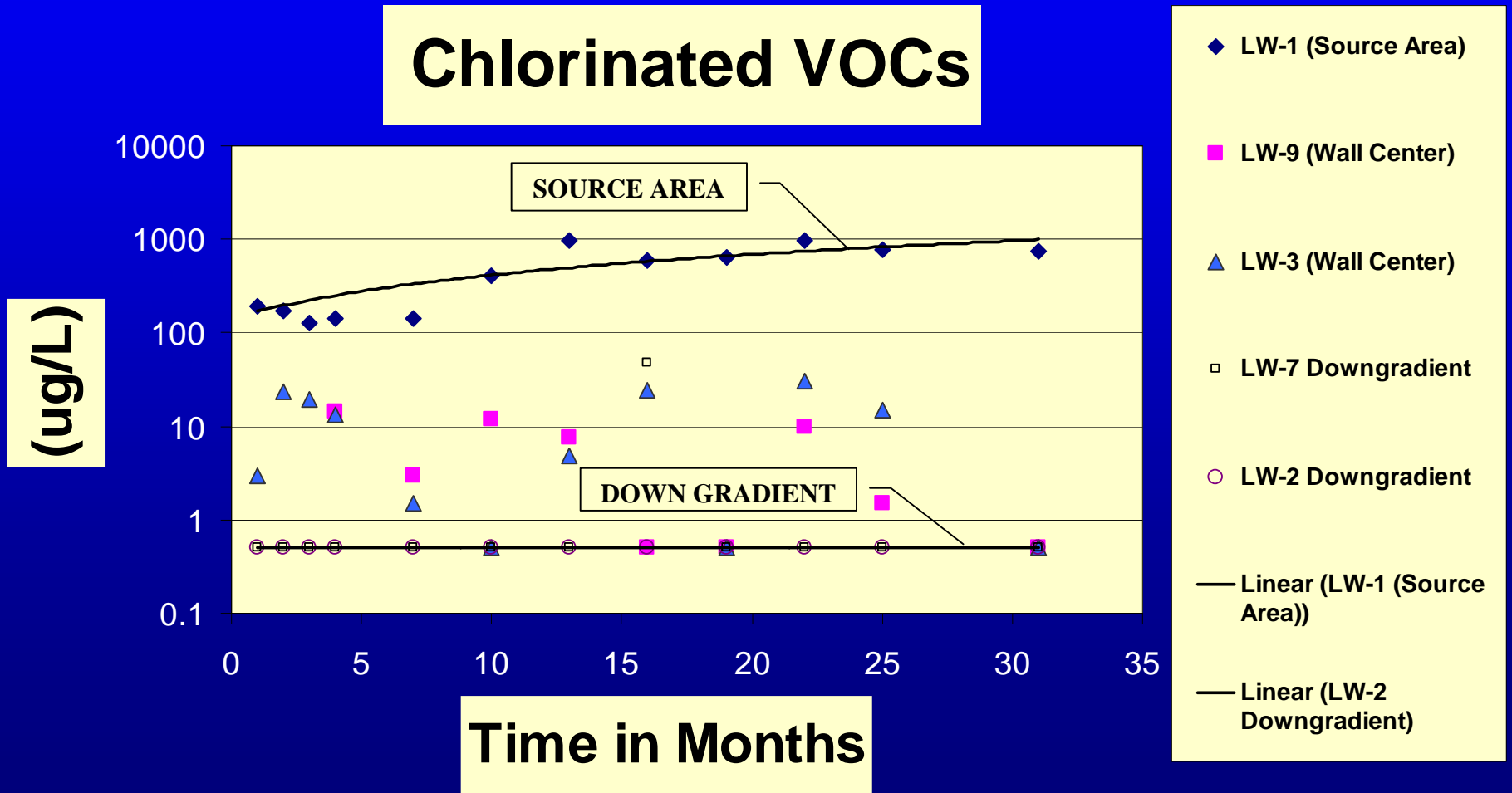
Seasonal Low Condition – 10/30/02



Seasonal High Condition – 4/2/03

Water Quality Trends

Chlorinated VOCs



Conclusions

- **Leaking Sanitary Sewer Creates Localized Groundwater Depression**
- **Flow Inside PRB Becomes More Longitudinal**
- **Residence Time of Groundwater Inside PRB Is Increased**
- **Effects Can Be Characterized During RI and Avoided/Exploited During Remedial Design/Construction**