# Pump & Treat Experience at the NECCO Park Landfill Niagara Falls, New York

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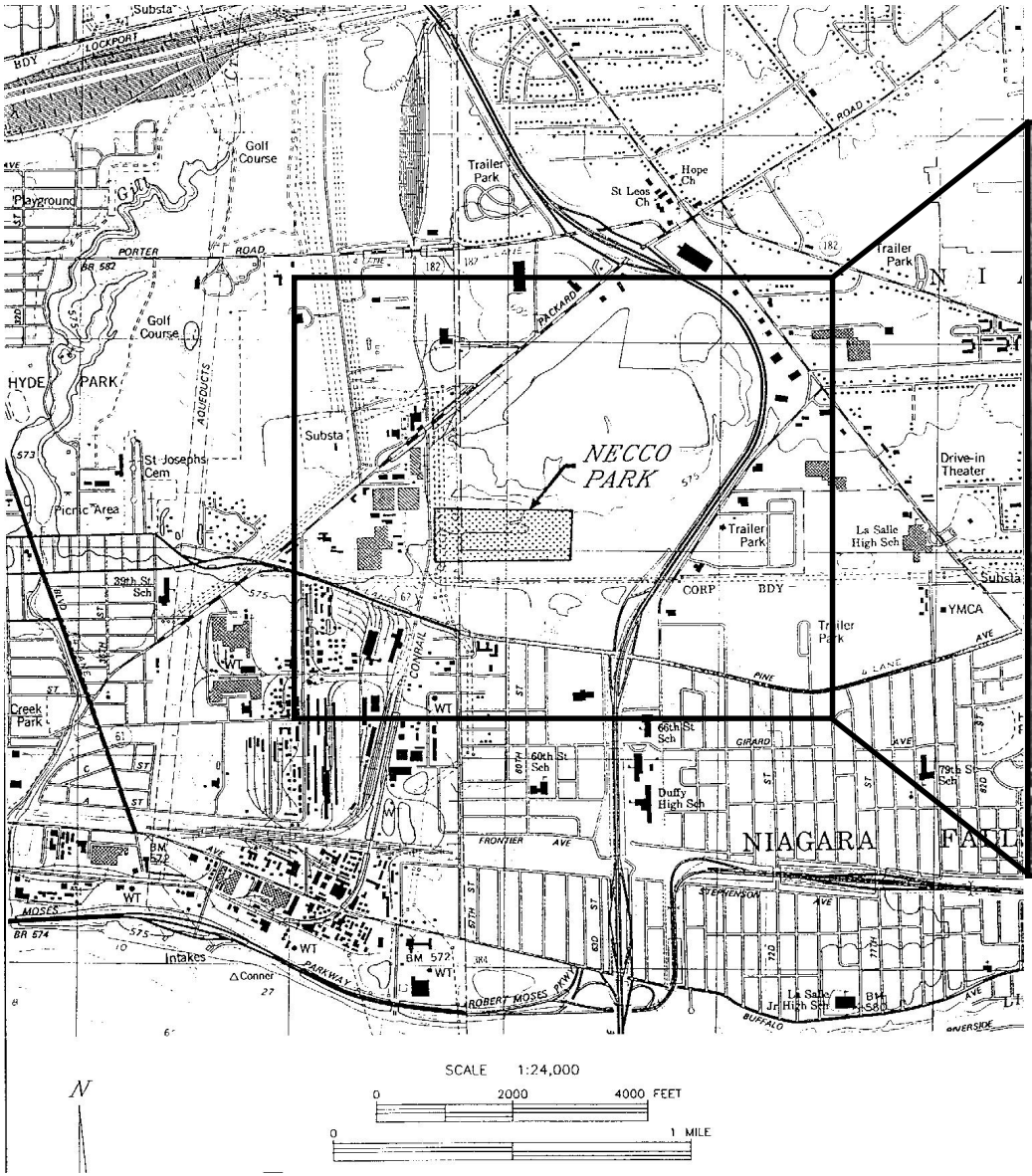
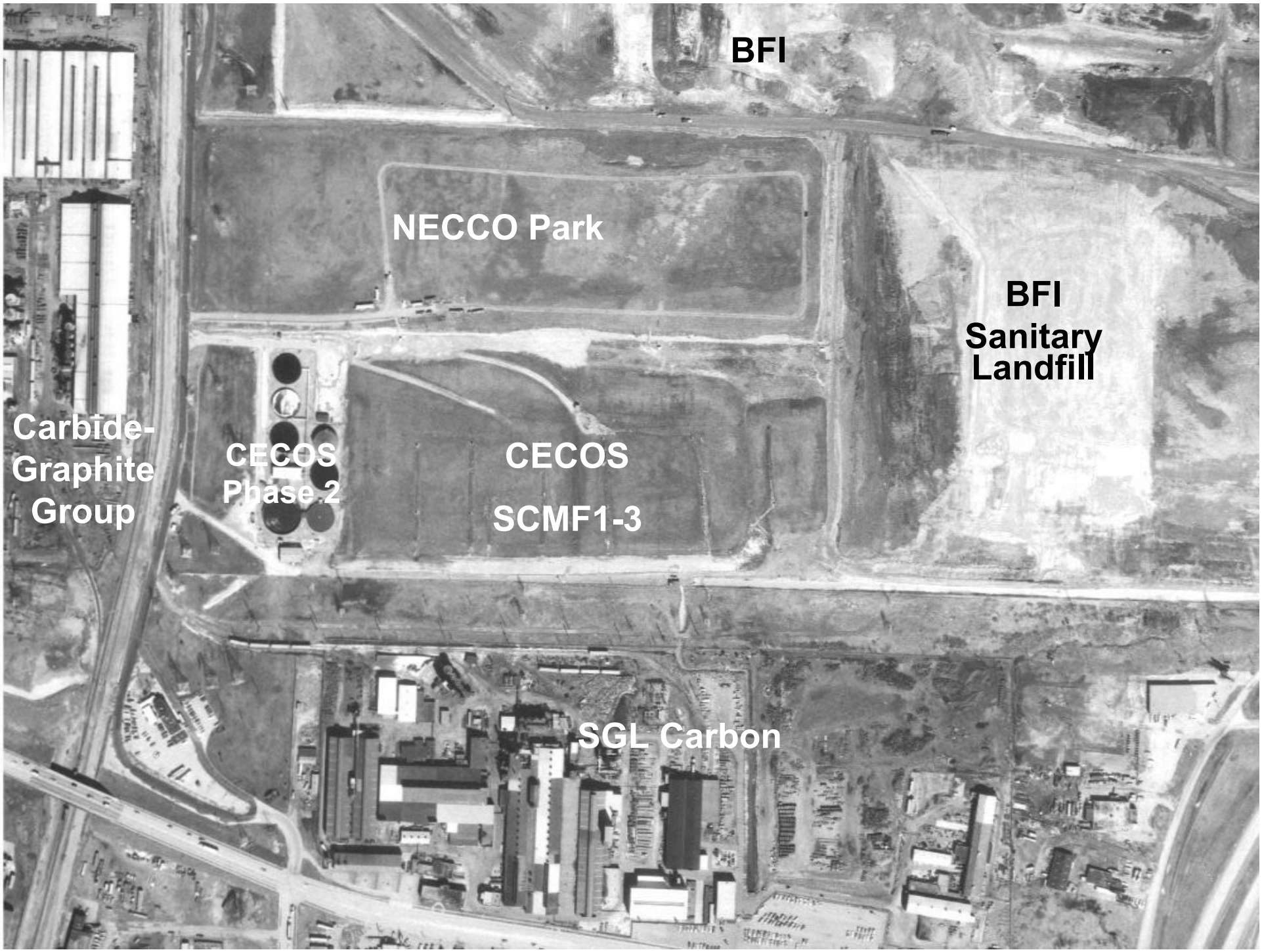
DUPONT Corporate Remediation Group

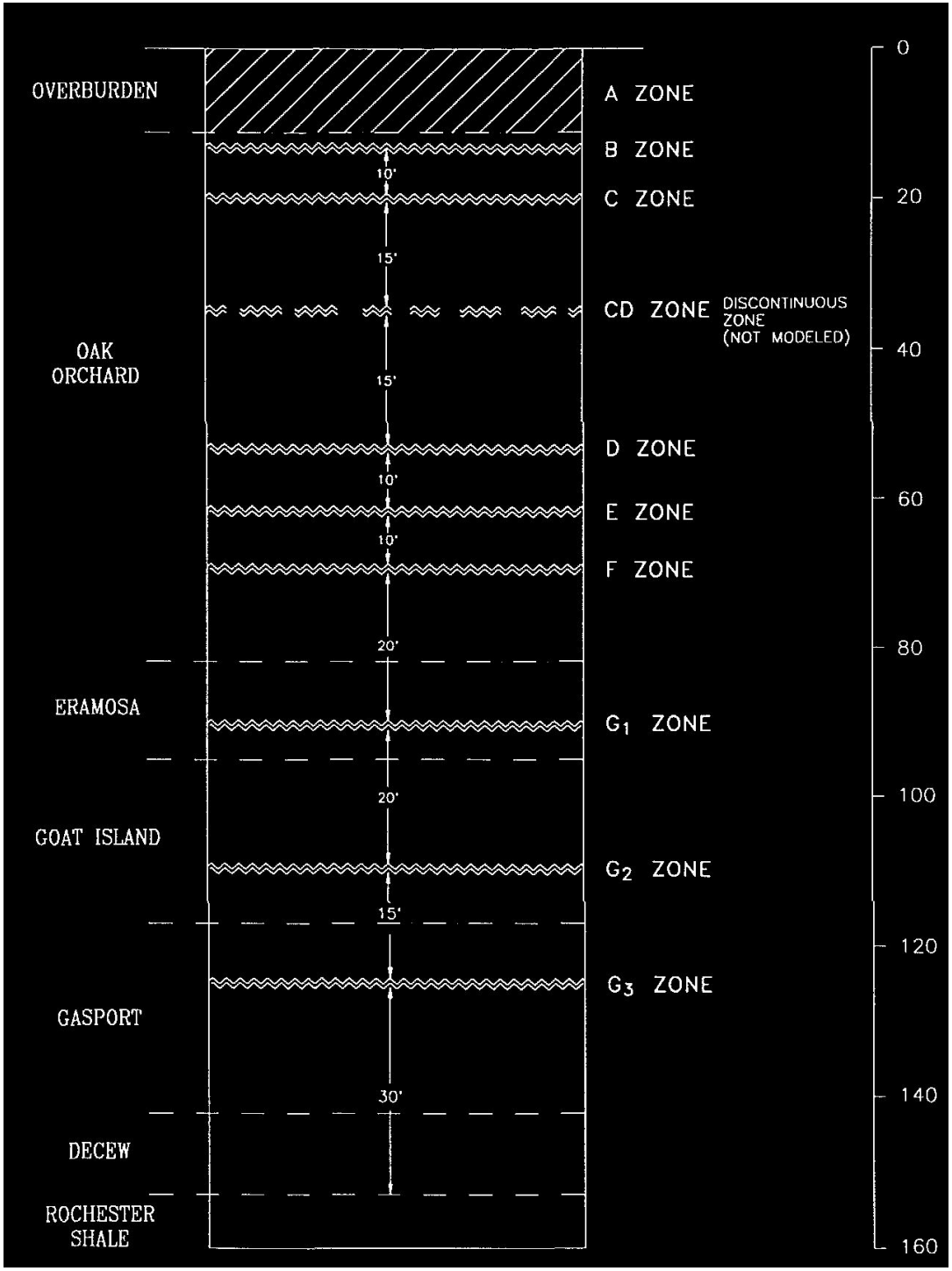

NECCO PARK
HYDE PARK
NIAGARA
Golf Course
Playground
Trailer Park
Hope Ch
St Leos Ch
Drive-in Theater
La Salle High Sch
YMCA
St Josephs Cem
Picnic Area
Creek Park
Duffy High Sch
66th St Sch
60th St Sch
79th St Sch
39th St Sch
Intakes
Substa
PORTER ROAD
PACKARD
PINE
GIRARD
FRONTIER AVE
STEPHENSON
ROBERT MOSES PKWY
BUFFALO
SCALE 1:24,000
0 2000 4000 FEET
0 1 MILE
N


BFI
NECCO Park
BFI
Sanitary
Landfill
Carbide-
Graphite
Group
CECOS
Phase 2
CECOS
SCMF1-3
SGL Carbon

# Bedrock Geology

Fractured dolomite bedrock (Lockport Formation)

- horizontal bedding plan fracture zones (high K)
- vertical fracturing (moderate to very low K)
- vertical and horizontal K decrease with depth
- eight zones identified:
  - upper bedrock (B and C zones)
  - middle bedrock (D,E, and F zones)
  - lower bedrock (G1,G2, and G3 zones)



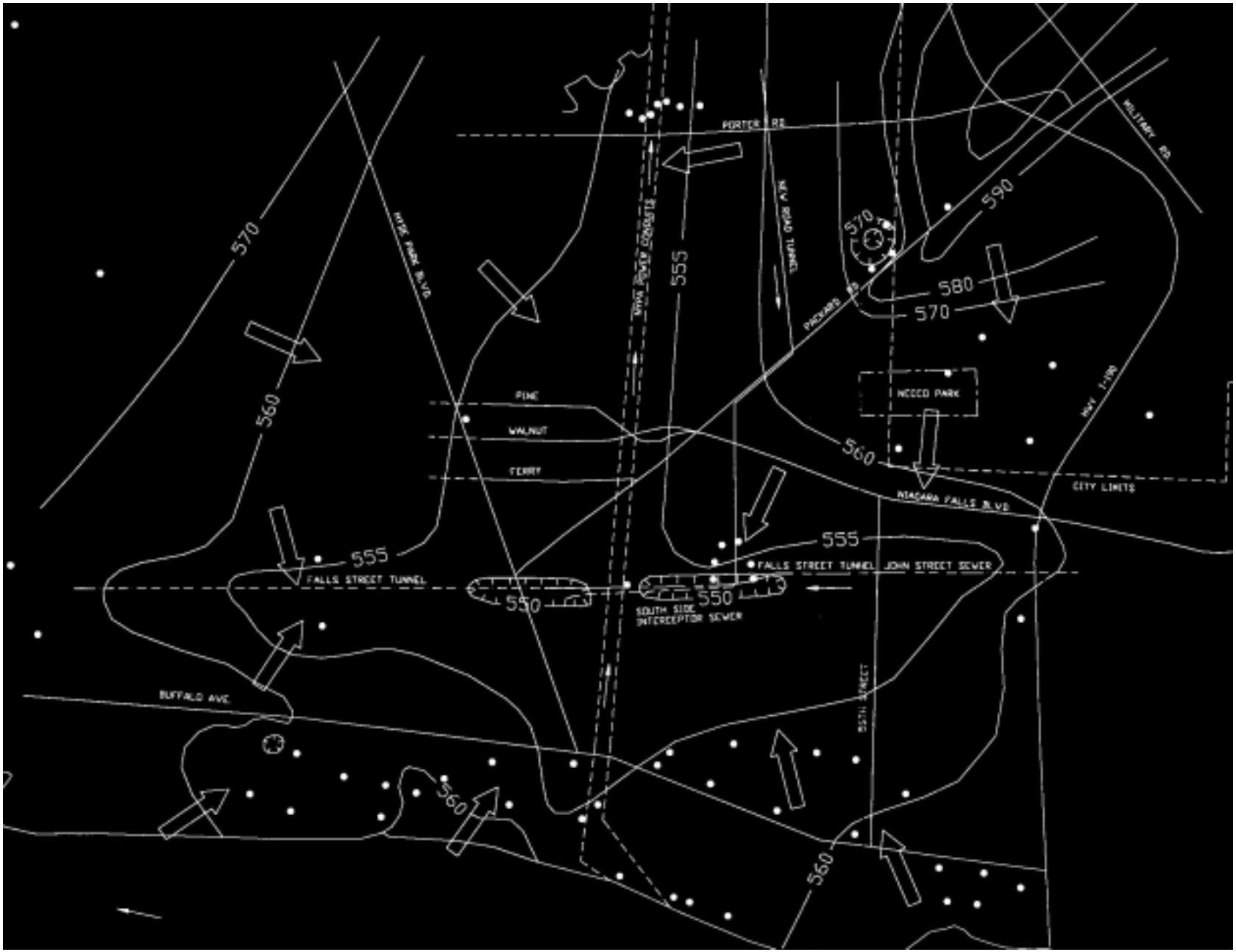

# Bedrock Stratigraphy

# Groundwater Flow

## Bedrock

- Flow regime dominated by high conductivity of horizontal fracture zones
- Regional flow: effects of bedrock sewers and NYPA conduits
- Flow direction:
  - south for shallow zones (B/C)
  - west for D,E,F, and G zones

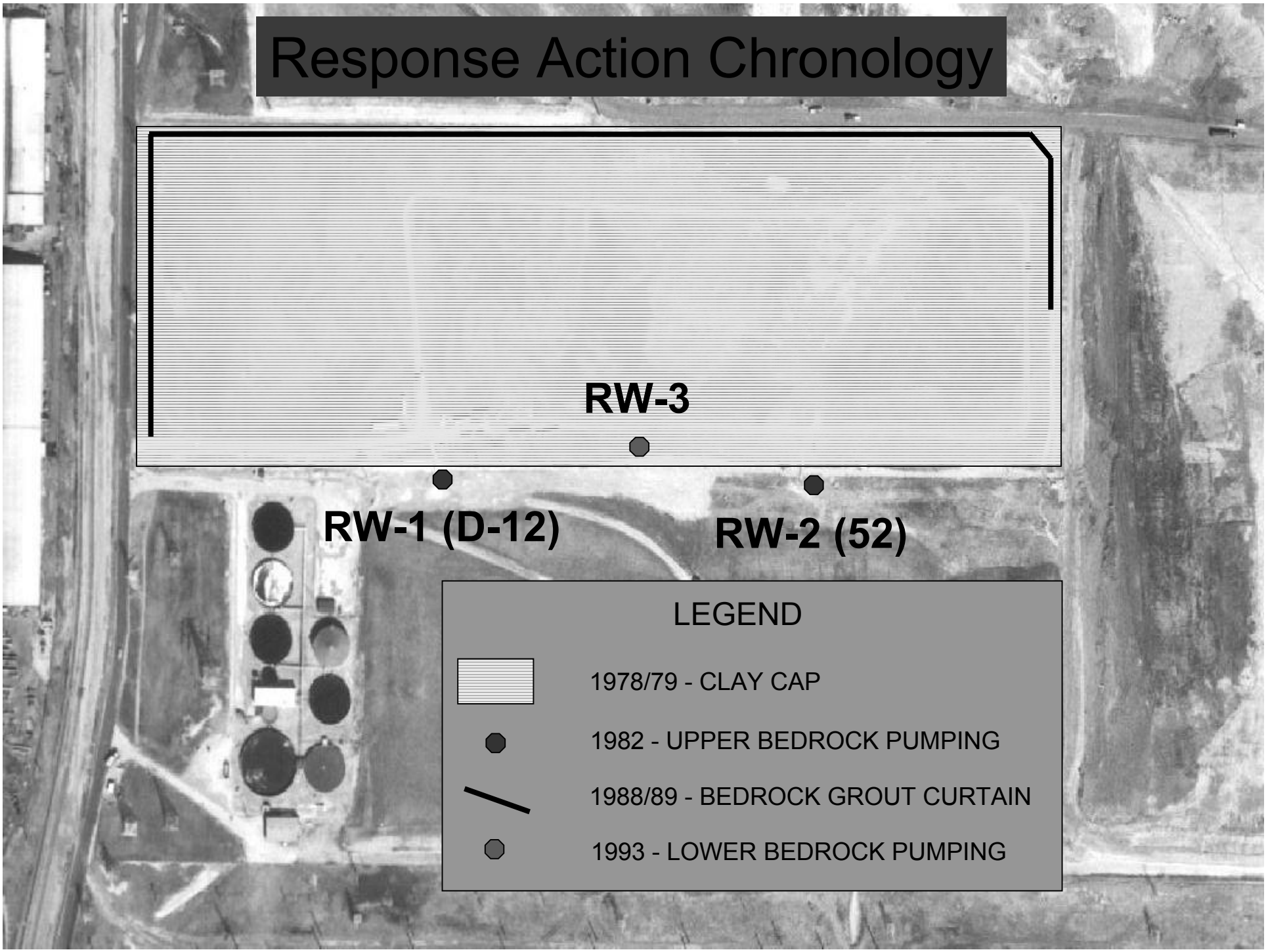
# Regional Groundwater Flow



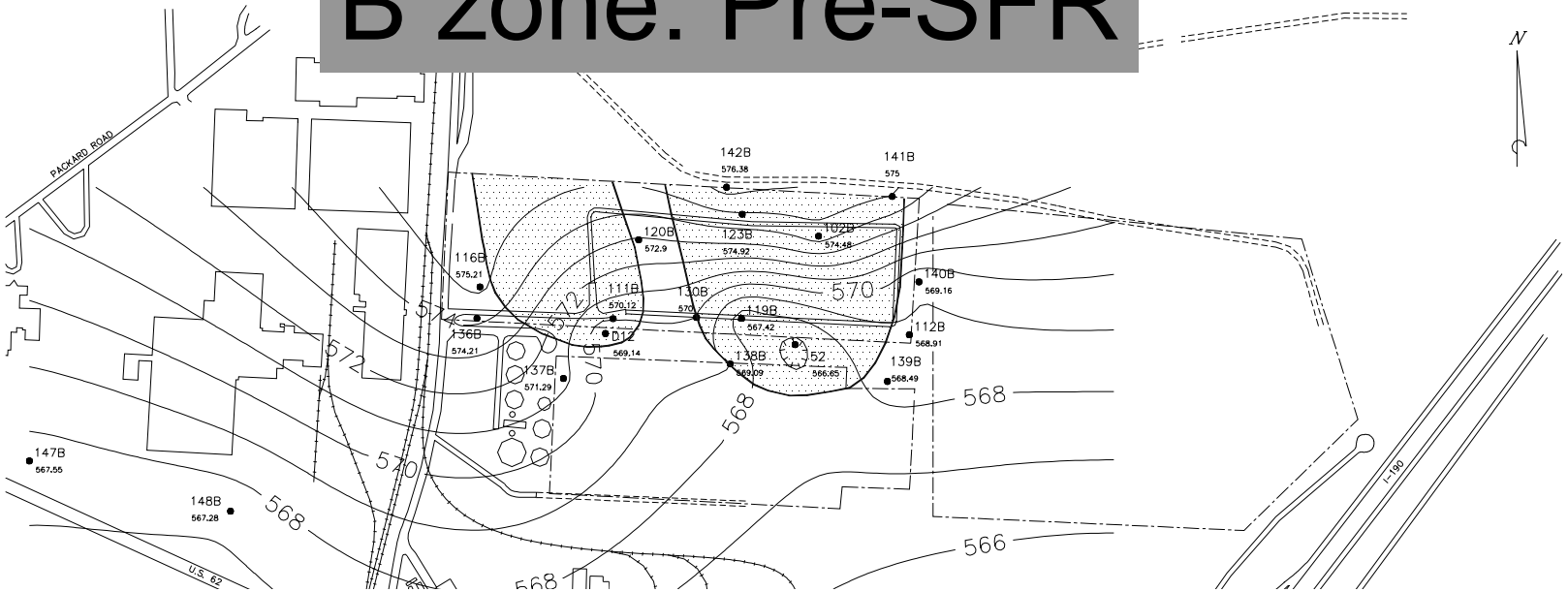
# Aquifer Response to Pumping

- Individual fracture zones act as semi-confined aquifers
- Efficient transmission of changing hydraulic pressures throughout fracture when stressed
- Although conductivity of fracture varies laterally, application of porous flow equations appropriate on large scale

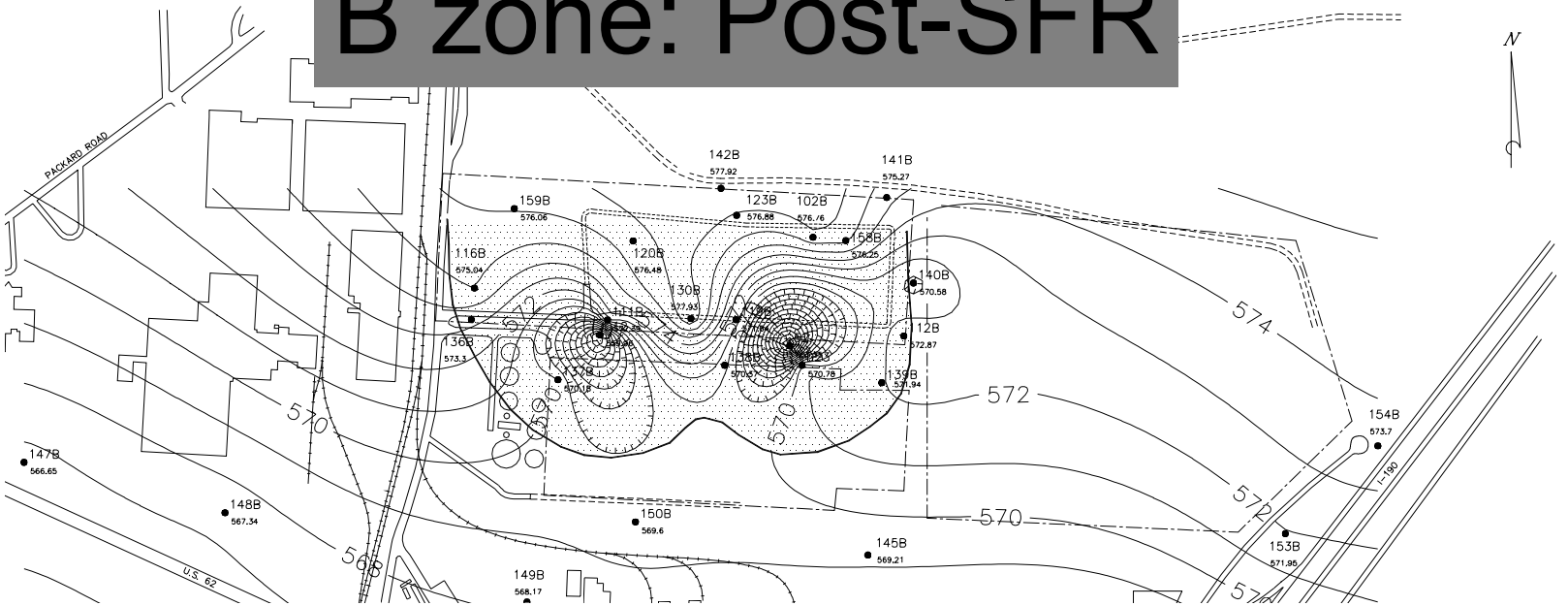
# Response Action Chronology



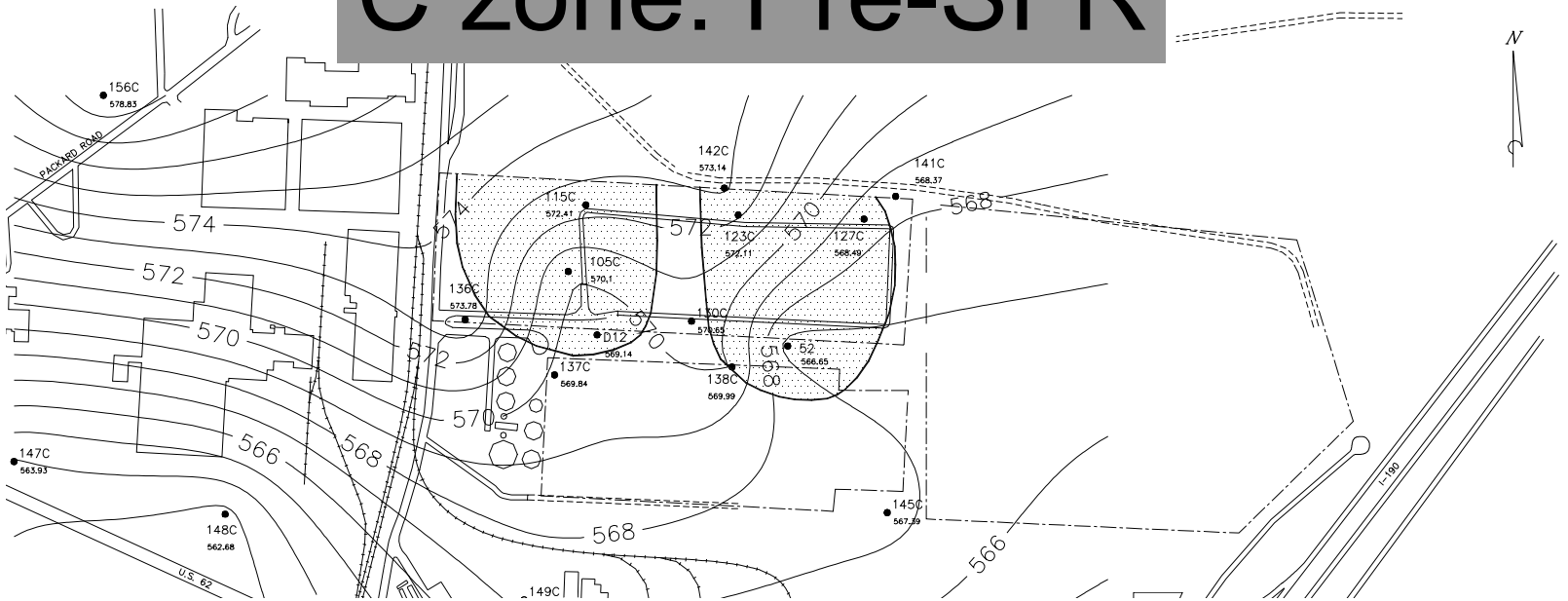
# B zone: Pre-SFR



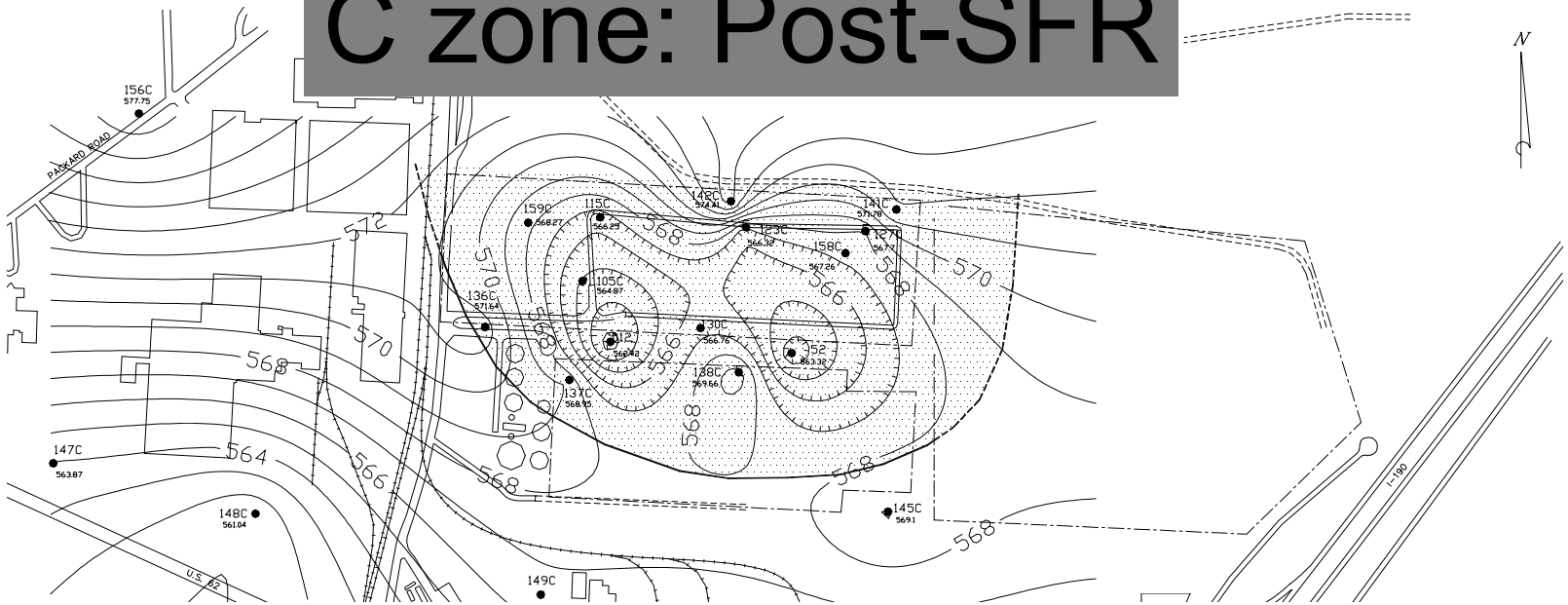

# B zone: Post-SFR



# C zone: Pre-SFR



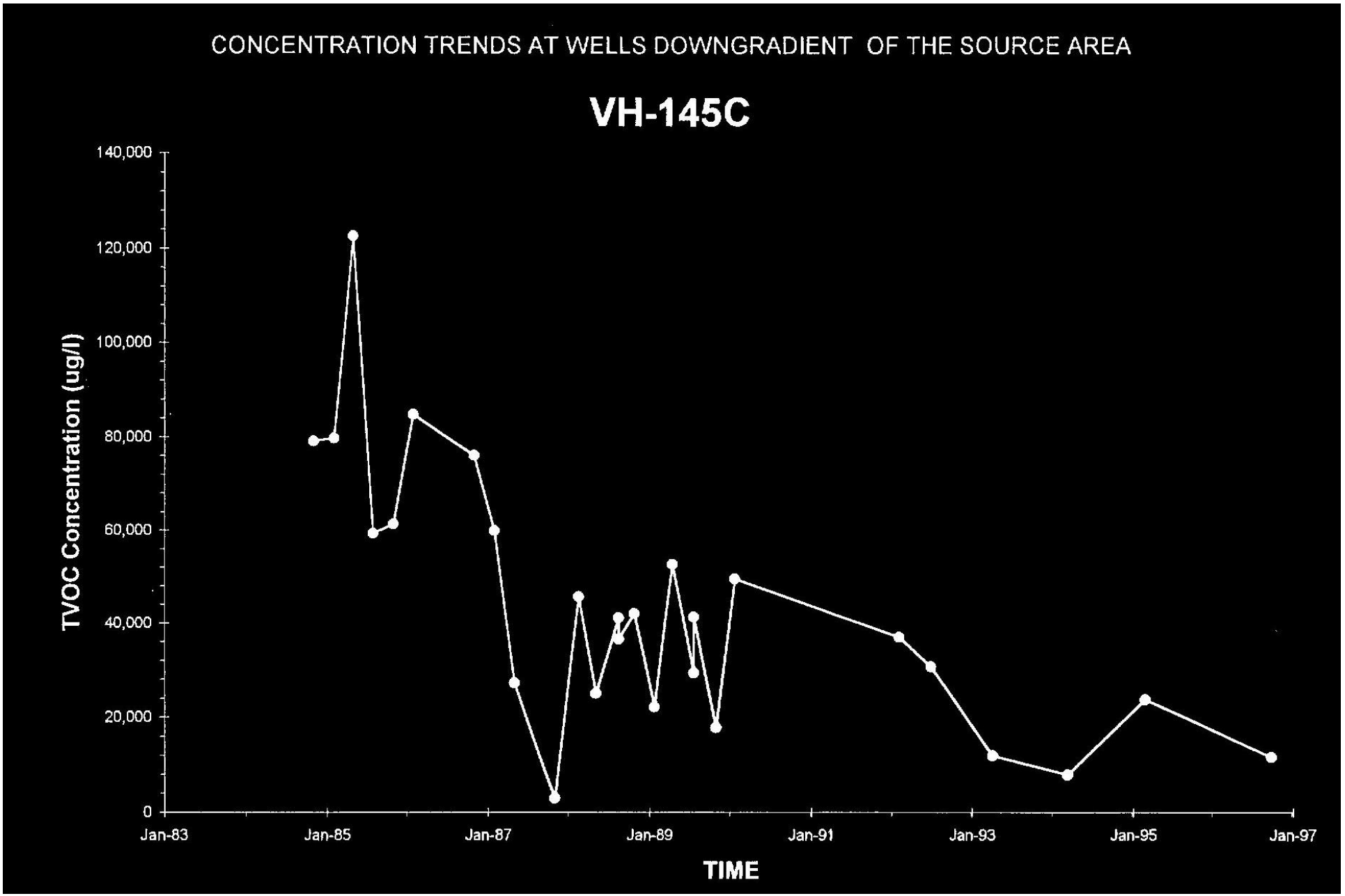

# C zone: Post-SFR

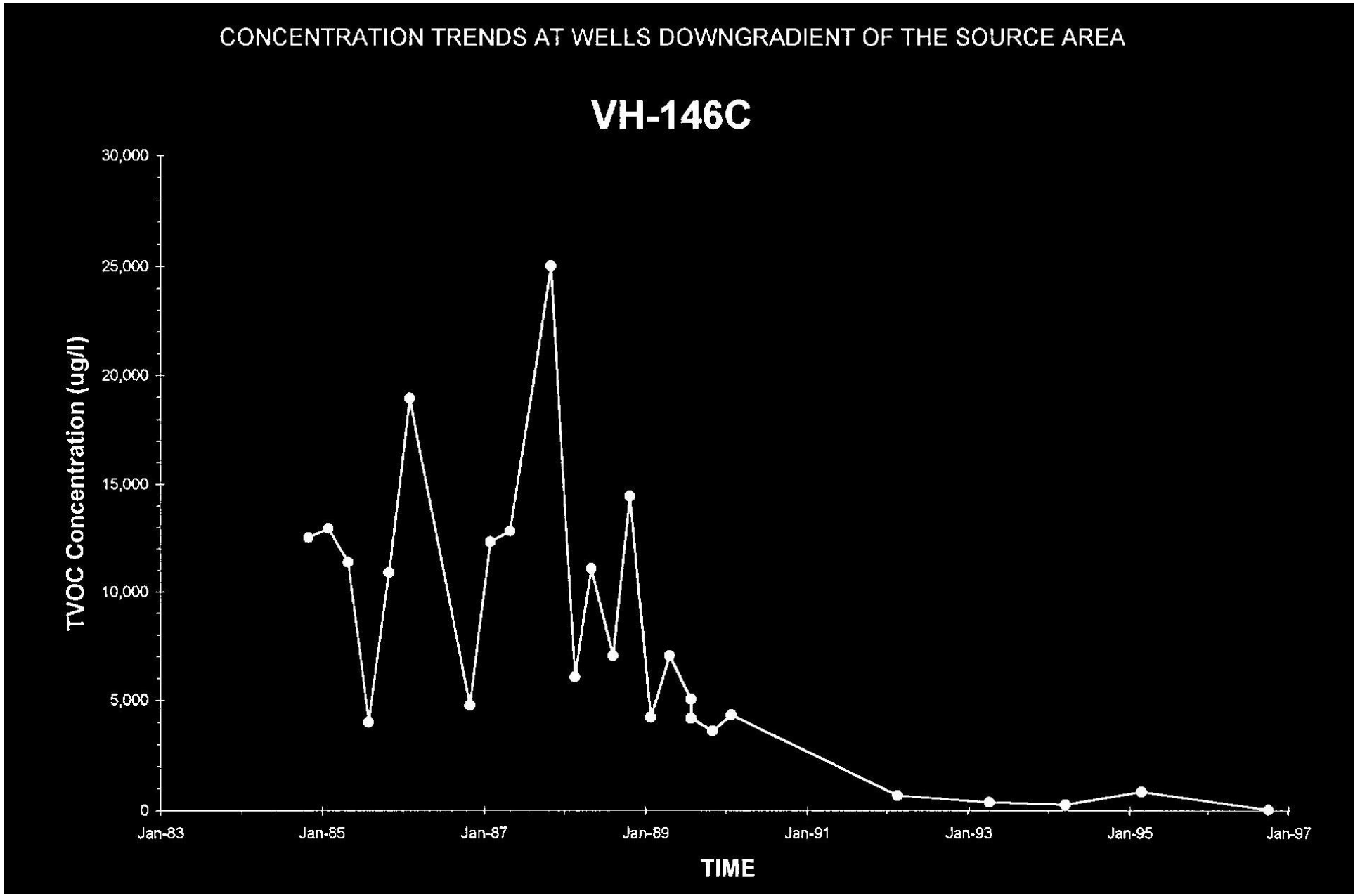


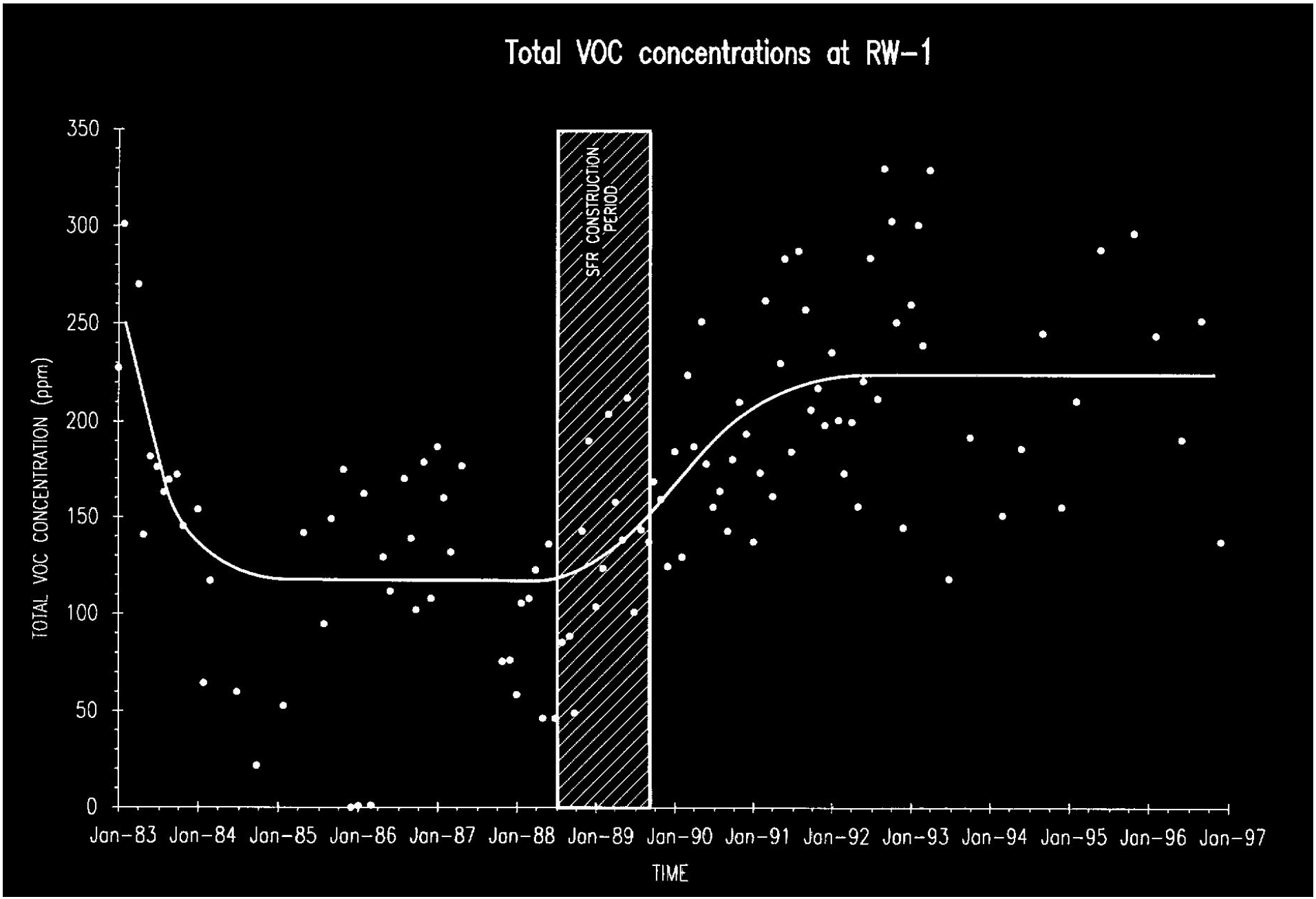
# Pumping System Effectiveness

- Increased drawdown, increase in hydraulic capture zones following installation of grout curtain (SFR)
- Concentration changes at RW-1
- Decrease in aqueous concentrations at several upper bedrock wells directly downgradient of source area
- All changes consistent with site conceptual model for flow and transport

CONCENTRATION TRENDS AT WELLS DOWNGRADIENT OF THE SOURCE AREA




CONCENTRATION TRENDS AT WELLS DOWNGRADIENT OF THE SOURCE AREA
VH-146C
TVOC Concentration (ug/l)
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-83
Jan-85
Jan-87
Jan-89
Jan-91
Jan-93
Jan-95
Jan-97
TIME


Total VOC concentrations at RW-1
TOTAL VOC CONCENTRATION (ppm)
350
300
250
200
150
100
50
0
SFR CONSTRUCTION PERIOD
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
TIME

# Technologies Implemented

- Groundwater Pump & Treat
  - effective for source area control
- Physical Barrier - bedrock grout curtain
  - effective at enhancing capture area for pumping system
- Landfill Cap
  - eliminate direct contact
  - reduce infiltration
- DNAPL Recovery
  - removal from wells were observed

# Other Technologies Evaluated

- Accelerated Anaerobic Bioremediation - reduce source more efficiently
  - reductive dechlorination identified through field testing
  - many unknowns for effective distribution of substrate
  - lack of confidence in long-term savings
- Circumscribing physical barriers - presumed benefit to control mobile NAPL
  - high capital cost
  - no field evidence for unmonitored mobile NAPL mass
  - formation grouting could cause more harm than good

# Summary

- Detailed characterization of fracture zones is critical
  - Necco wells monitor discrete individual fracture zones, no long open rock hole wells
- Fractured flow in the Lockport is predictable enough that pump & treat is effective/efficient method for source containment.
  - Hydraulic & chemistry changes all consistent with site conceptual model
  - Consistent with other Niagara Frontier remedies
- Current focus on meeting RD/RA Order requirements for source area containment.
  - TI waiver granted for source area