

# Case Studies Soluble Substrates Part B

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Evaluation of In Situ Bioremediation of  
Chlorinated Organic Solvents in Ground Water

National Association of Remedial Project  
Managers (NARPM) Annual Training  
Conference

Portland, Oregon, July 9, 2008.

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# ESTCP/AFCEE Project #9920

## Demonstration at Vandenberg AFB

April 2003

Status Update



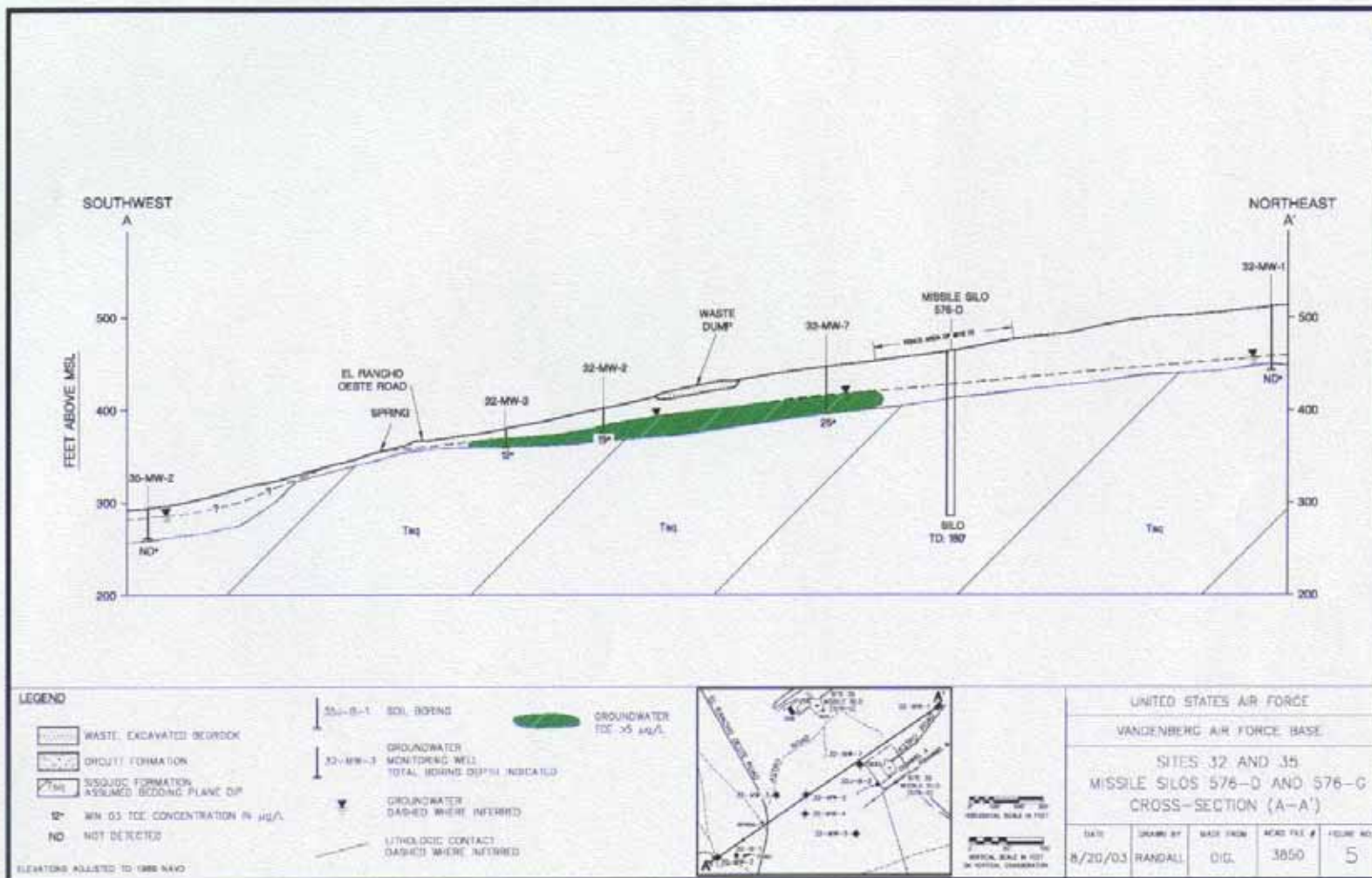
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# Vandenberg AFB - Summary

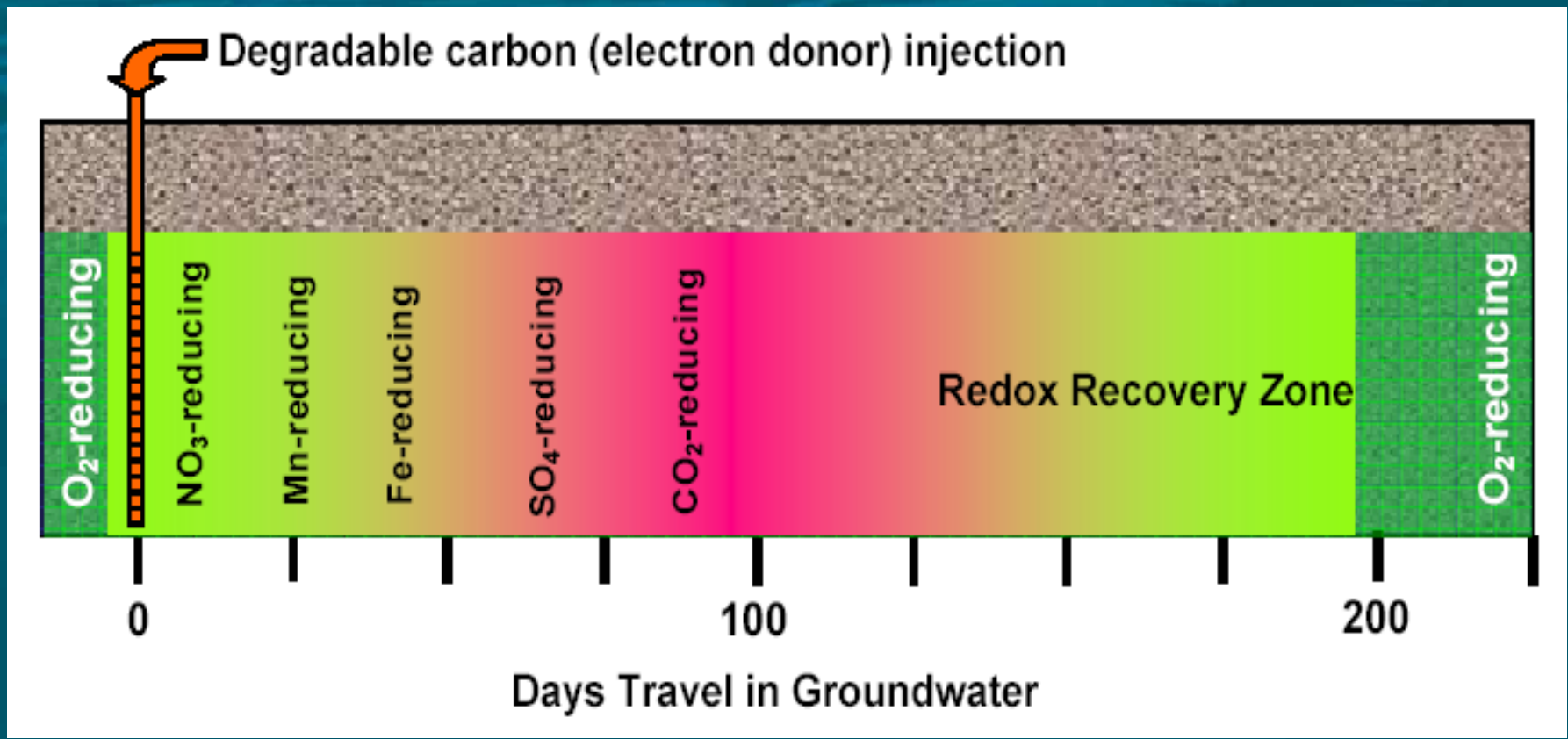
- Historic TCE use at missile silo (Site 35)
- Aerobic site: DO >3mg/L, ORP 150-400 mV
- Initial TCE 2-6 ppm, only by-product was cis-DCE at trace levels
- Molasses injections started in February 2001 at 3 injection wells. 30 injection events performed to date.
- Buffered injections started in October 2002
- Six full or abbreviated monitoring events, 26 process monitoring events performed to date

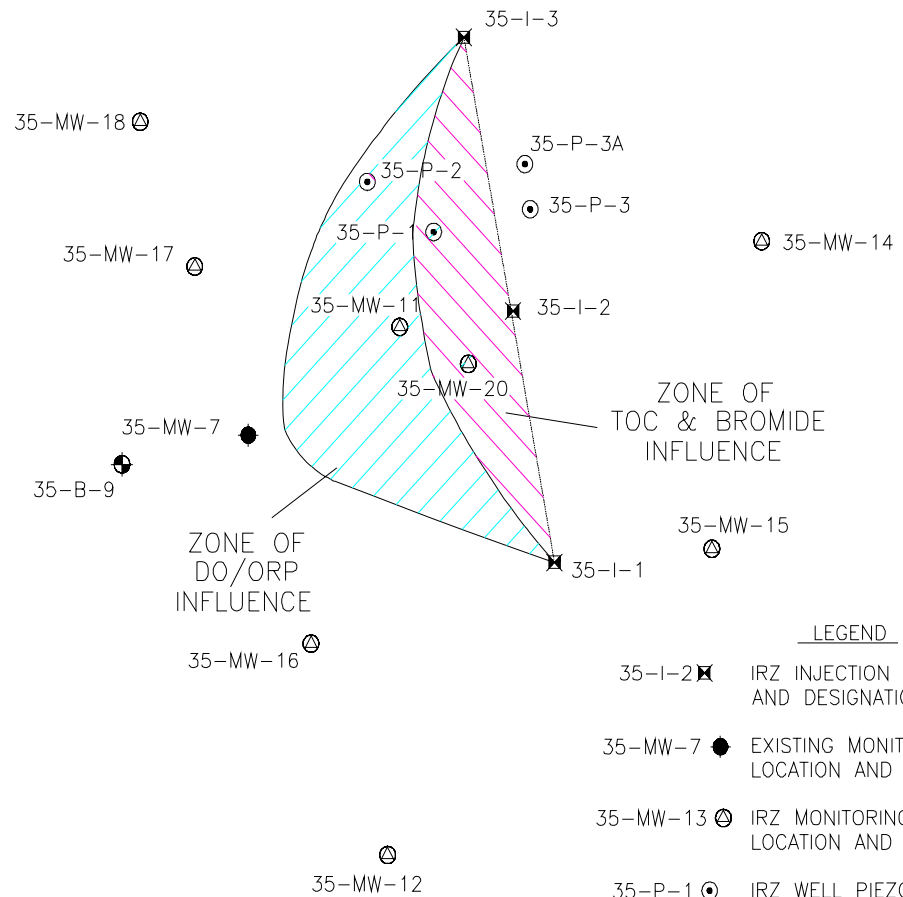
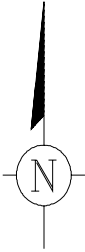


# Site 32 Groundwater TCE Plume



# Reductive IRZ for CAH Dechlorination



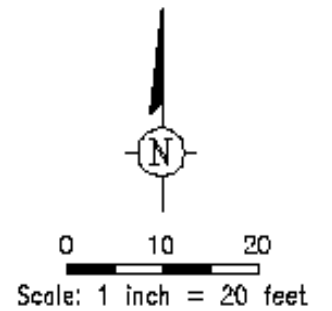
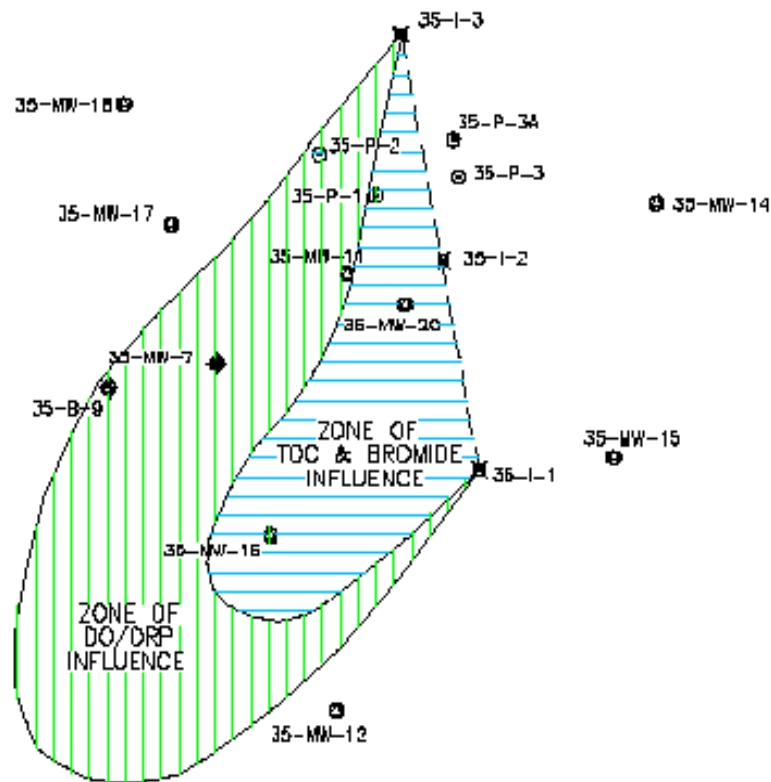


**April 2001,  
2 months  
operation**










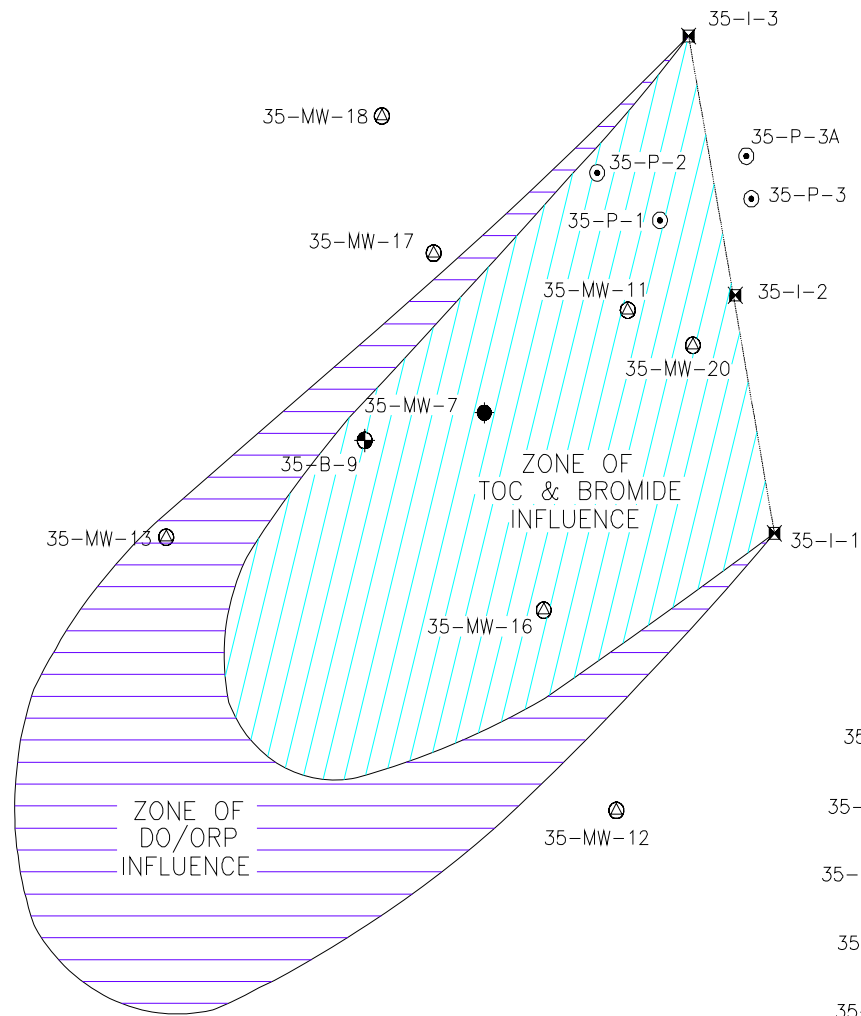
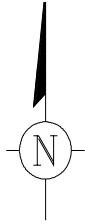
August 2001,  
6 months  
operation



LEGEND

- 35-I-2  IRZ INJECTION WELL LOCATION AND DESIGNATION
- 35-MW-7  EXISTING MONITORING WELL LOCATION AND DESIGNATION
- 35-MW-13  IRZ MONITORING WELL LOCATION AND DESIGNATION
- 35-P-1  IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
- 35-B-8  SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION





⊗ 35-MW-19A  
 ⊗ 35-MW-19

**January 2002,  
 11 months  
 operation**

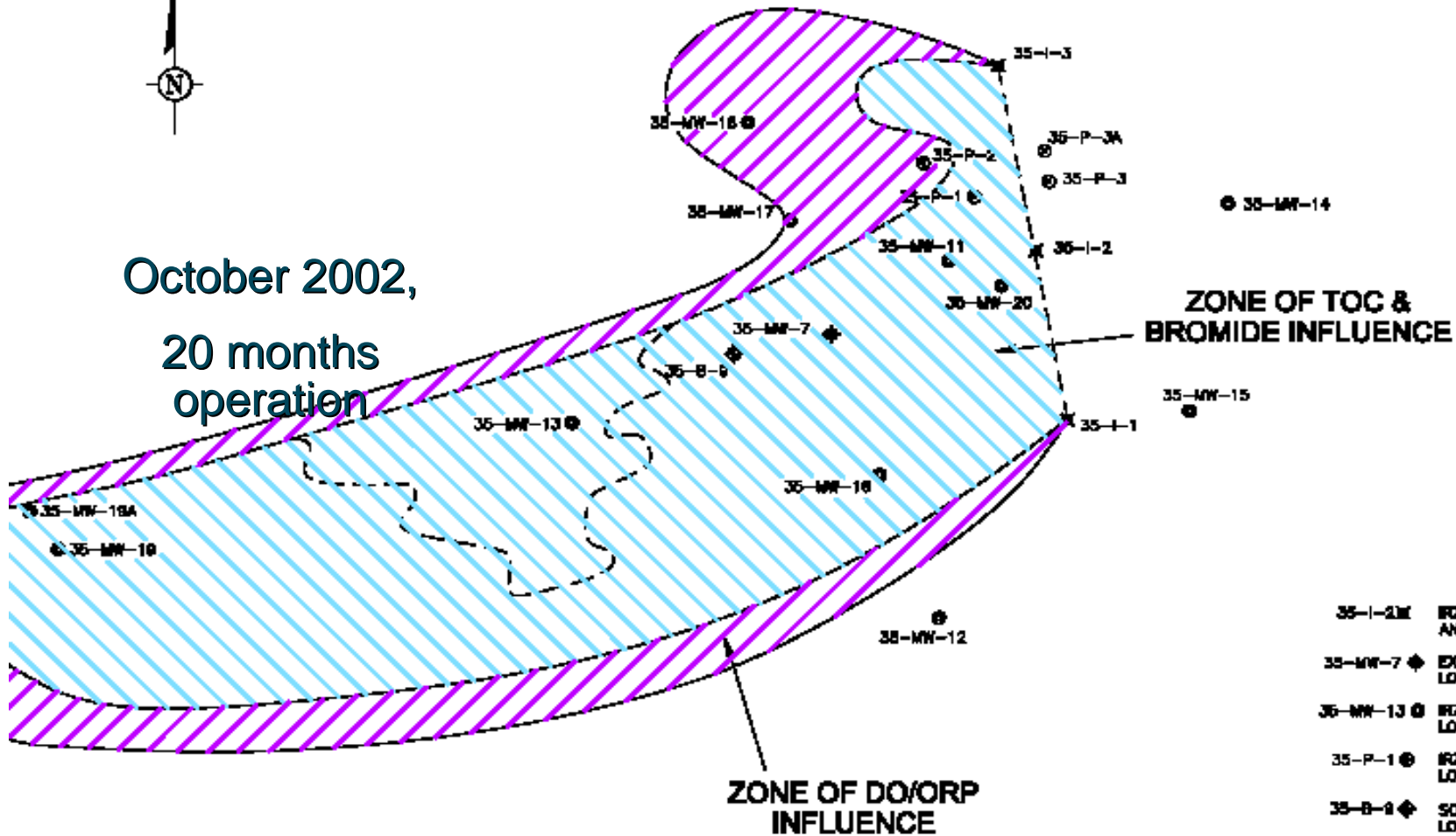
- LEGEND**
- 35-I-2 ⊠ IRZ INJECTION WELL LOCATION AND DESIGNATION
  - 35-MW-7 ● EXISTING MONITORING WELL LOCATION AND DESIGNATION
  - 35-MW-13 ⊗ IRZ MONITORING WELL LOCATION AND DESIGNATION
  - 35-P-1 ⊙ IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
  - 35-B-9 ⊕ SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION

0 10 20  
  
 Scale: 1 inch = 20 feet





October 2002,  
20 months  
operation



- LEGEND**
- 35-I-2W IRZ INJECTION WELL LOCATION AND DESIGNATION
  - 35-MW-7 EXISTING MONITORING WELL LOCATION AND DESIGNATION
  - 35-MW-13 IRZ MONITORING WELL LOCATION AND DESIGNATION
  - 35-P-1 IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
  - 35-B-5 SOIL BORING/HYDROPLUNCH LOCATION AND DESIGNATION

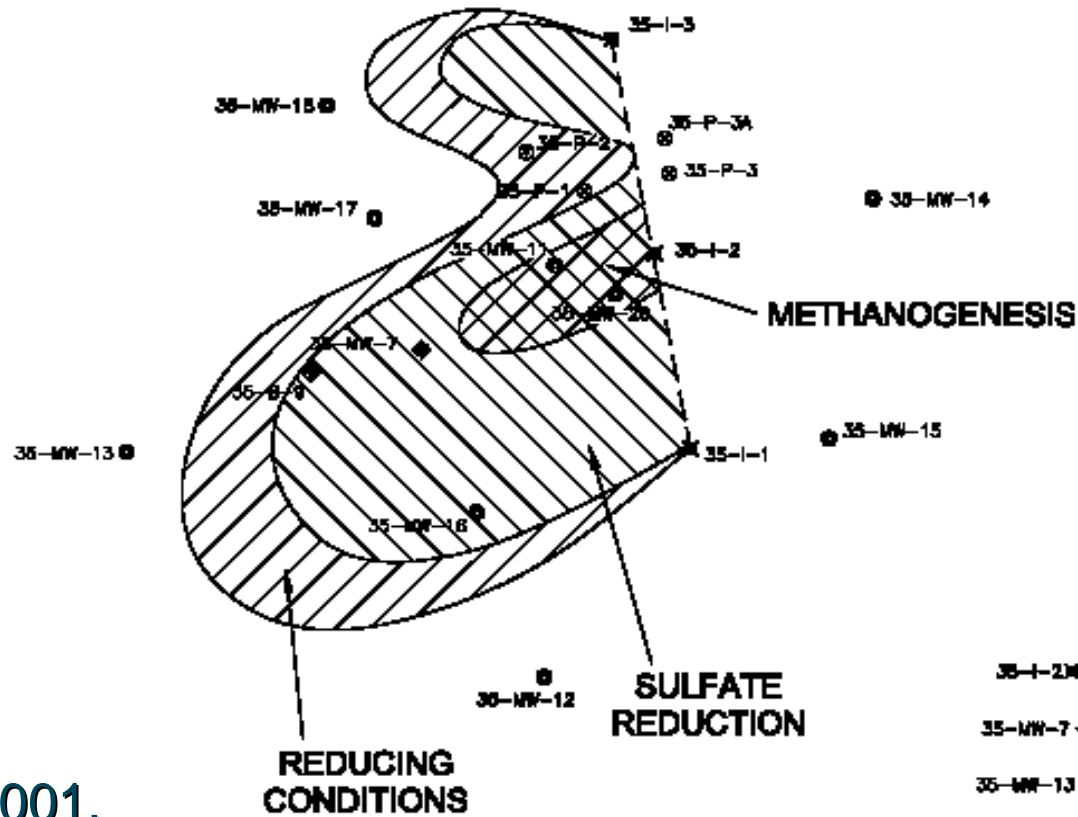
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Scale: 1 Inch = 20 feet





35-MW-1BA  
35-MW-1B

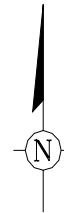
October 2001,  
8 months  
operation



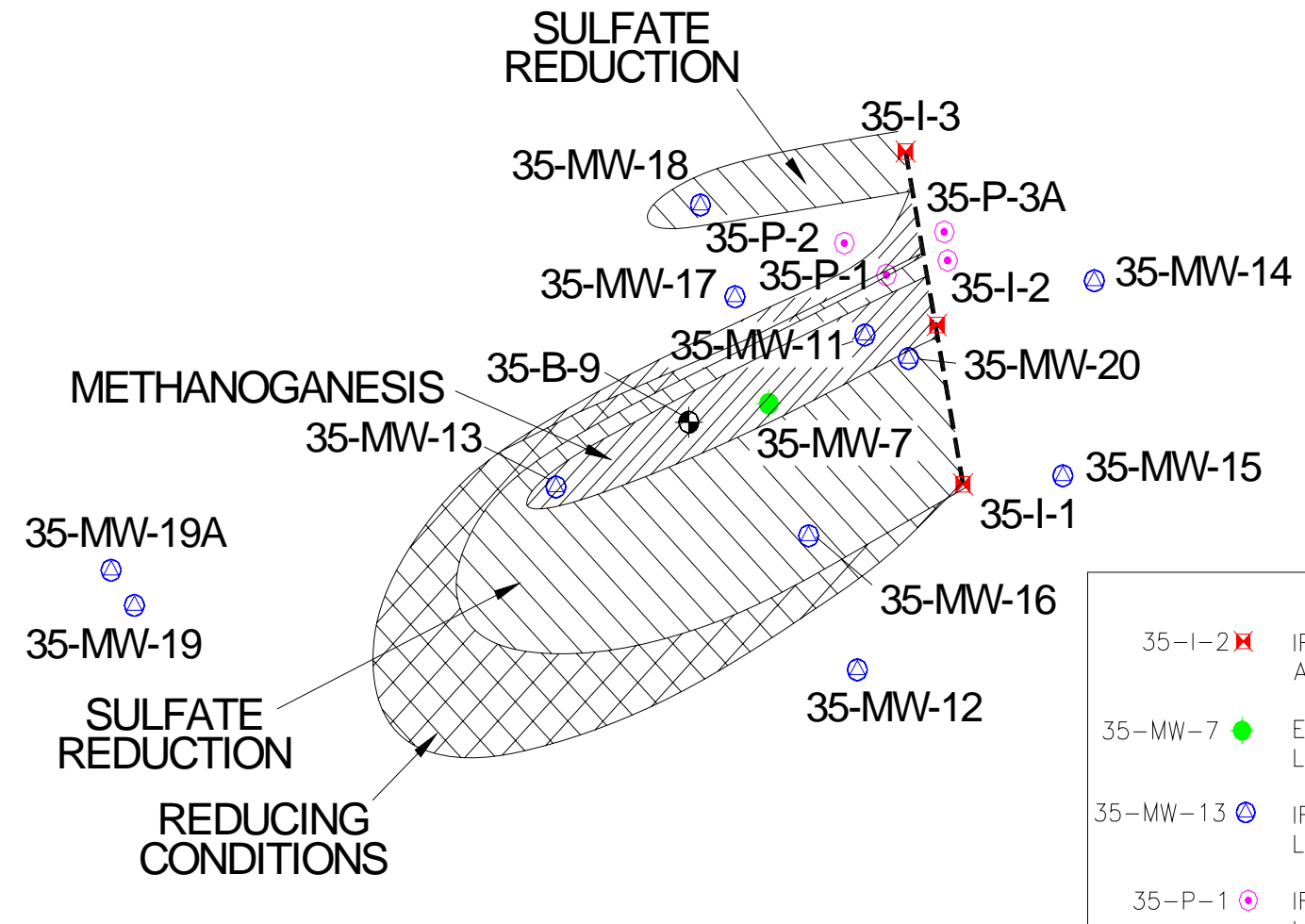
- LEGEND**
- 35-I-2M IRZ INJECTION WELL LOCATION AND DESIGNATION
  - 35-MW-7 EXISTING MONITORING WELL LOCATION AND DESIGNATION
  - 35-MW-13 IRZ MONITORING WELL LOCATION AND DESIGNATION
  - 35-P-1 IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
  - 35-B-9 SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION

0 10 20  
Scale: 1 inch = 20 feet





**April 2002,  
14 months  
operation**



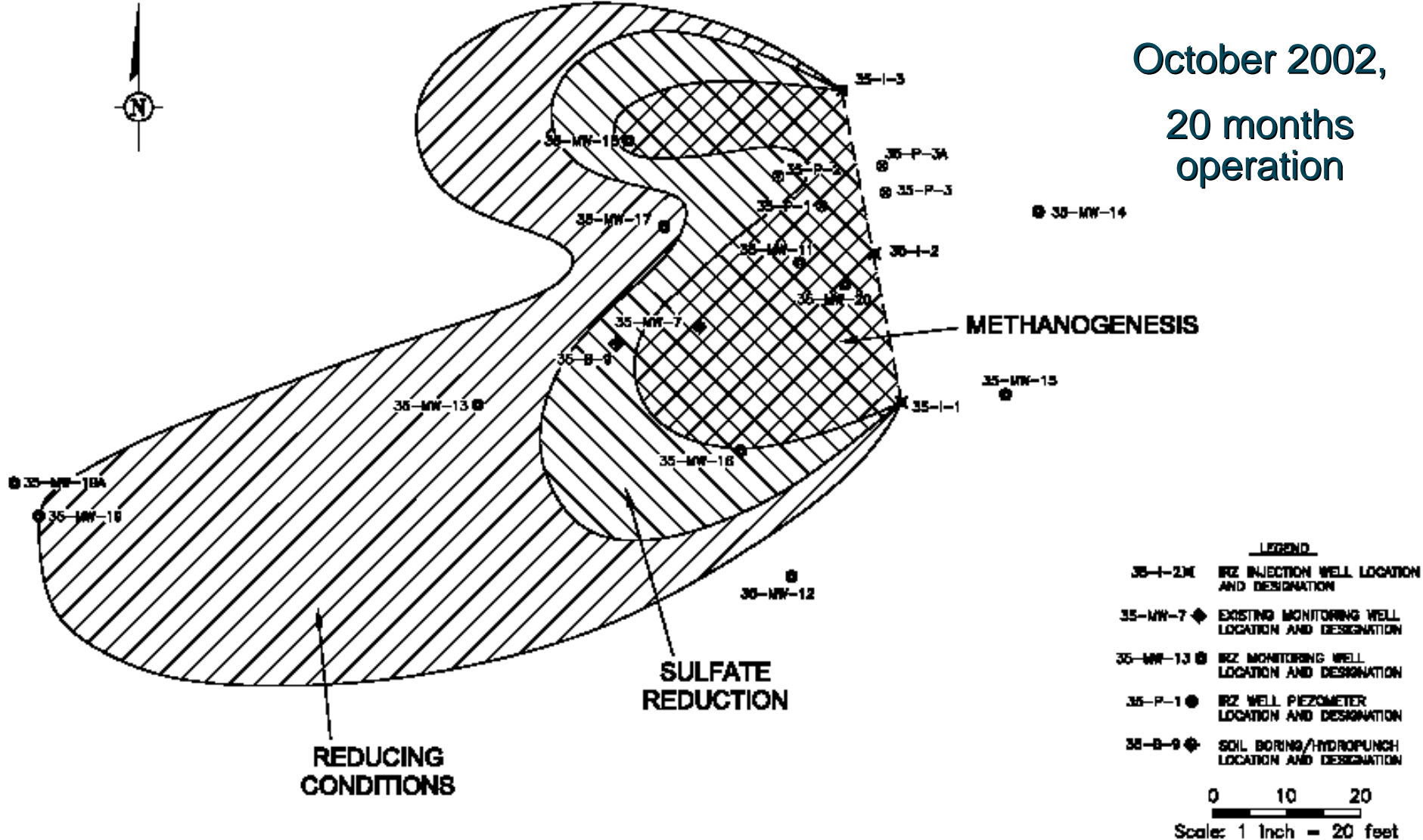
LEGEND	
35-I-2	IRZ INJECTION WELL LOCATION AND DESIGNATION
35-MW-7	EXISTING MONITORING WELL LOCATION AND DESIGNATION
35-MW-13	IRZ MONITORING WELL LOCATION AND DESIGNATION
35-P-1	IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
35-B-9	SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION



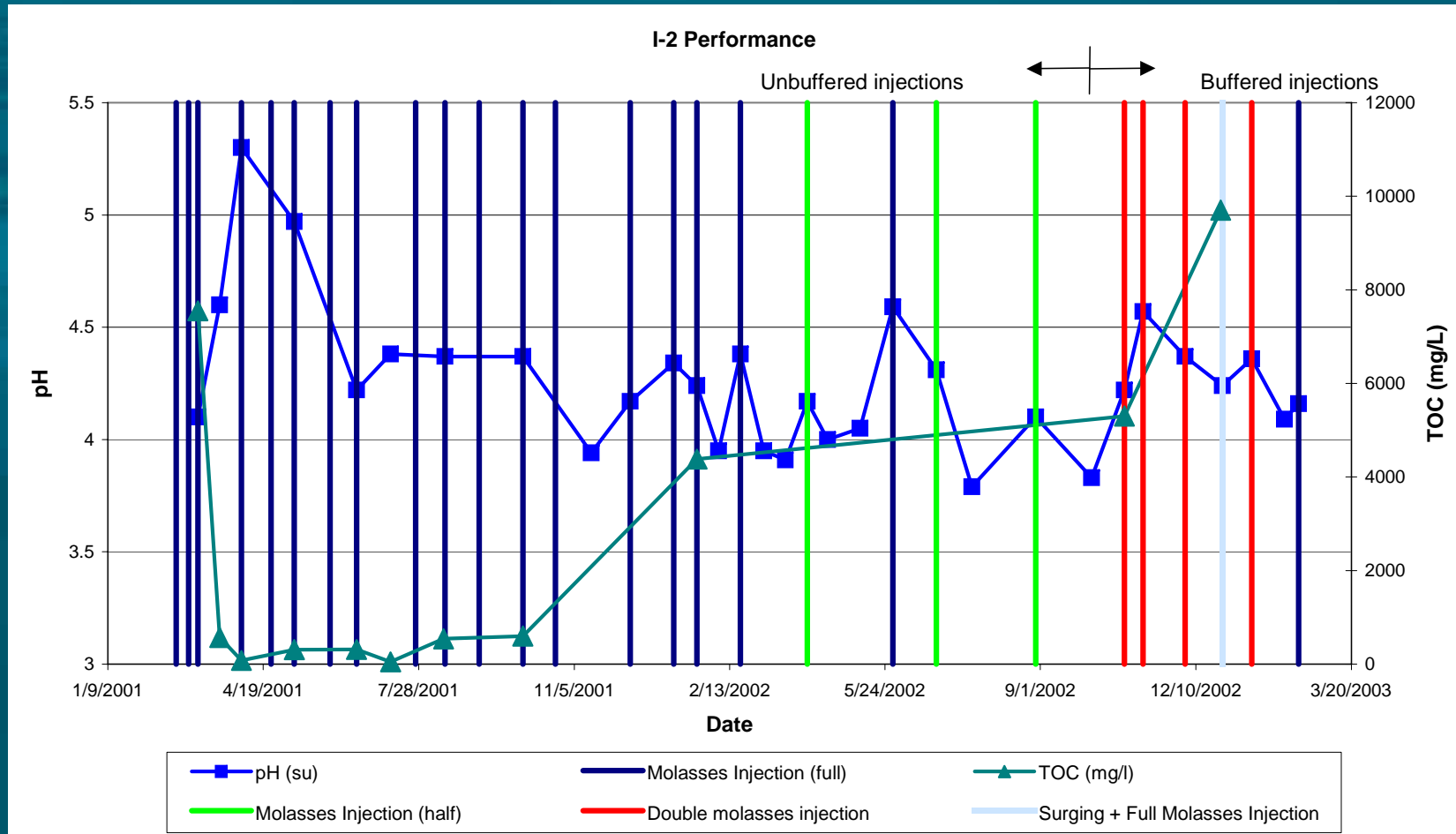
Scale: 1 inch = 20 feet



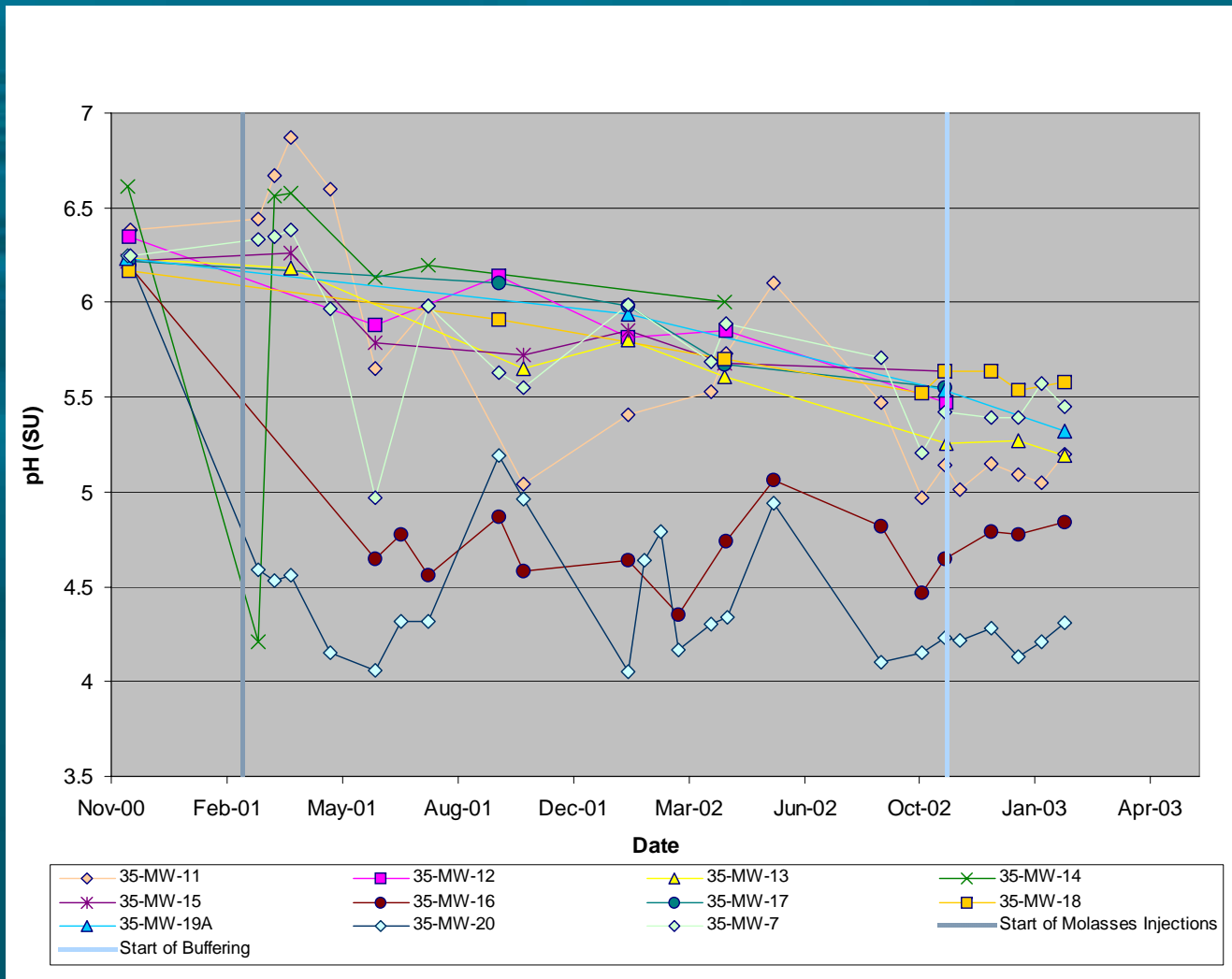
October 2002,  
20 months  
operation

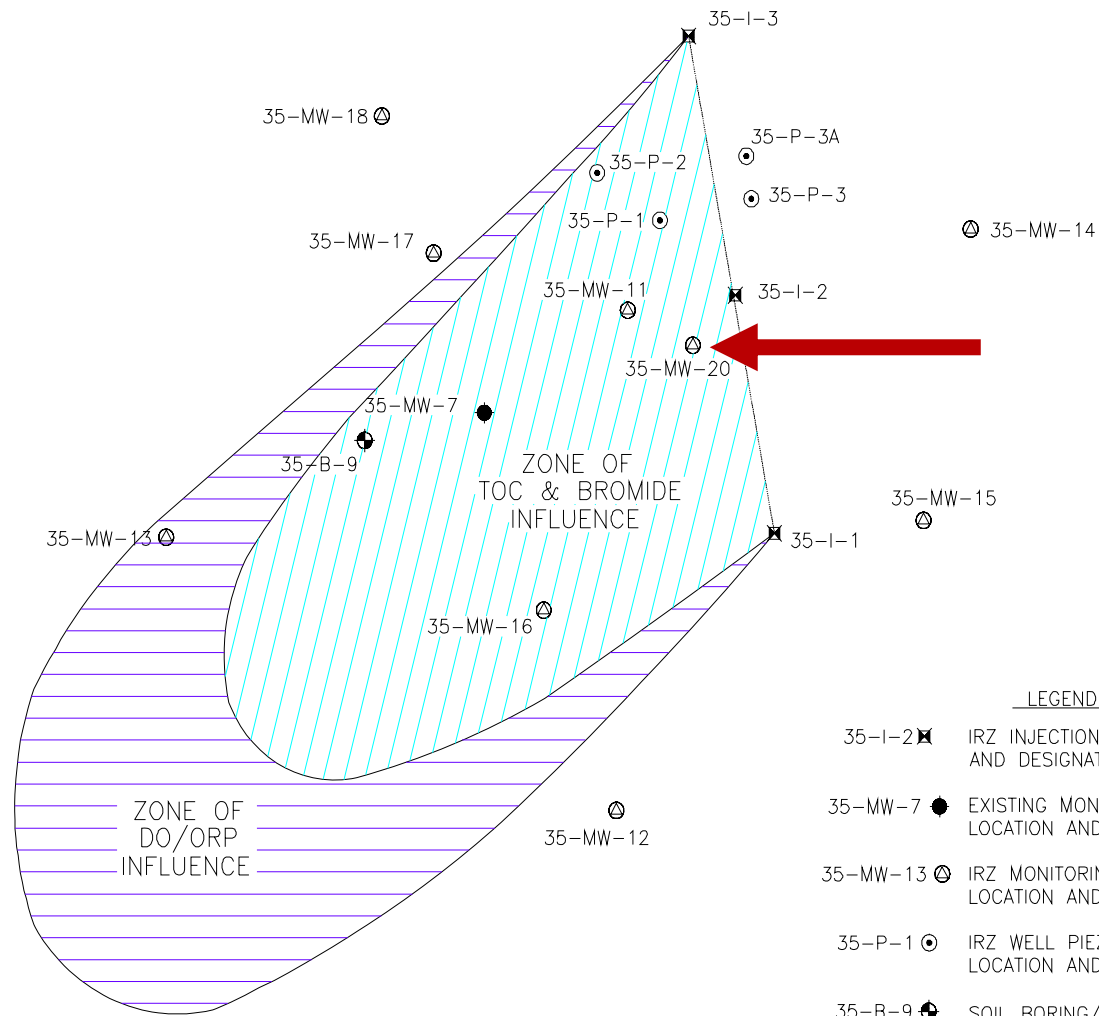
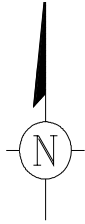


# Injection Well I-2 Response to “Tuning” and Buffering



# pH Trends in Monitoring Wells





⊗ 35-MW-19A  
⊗ 35-MW-19

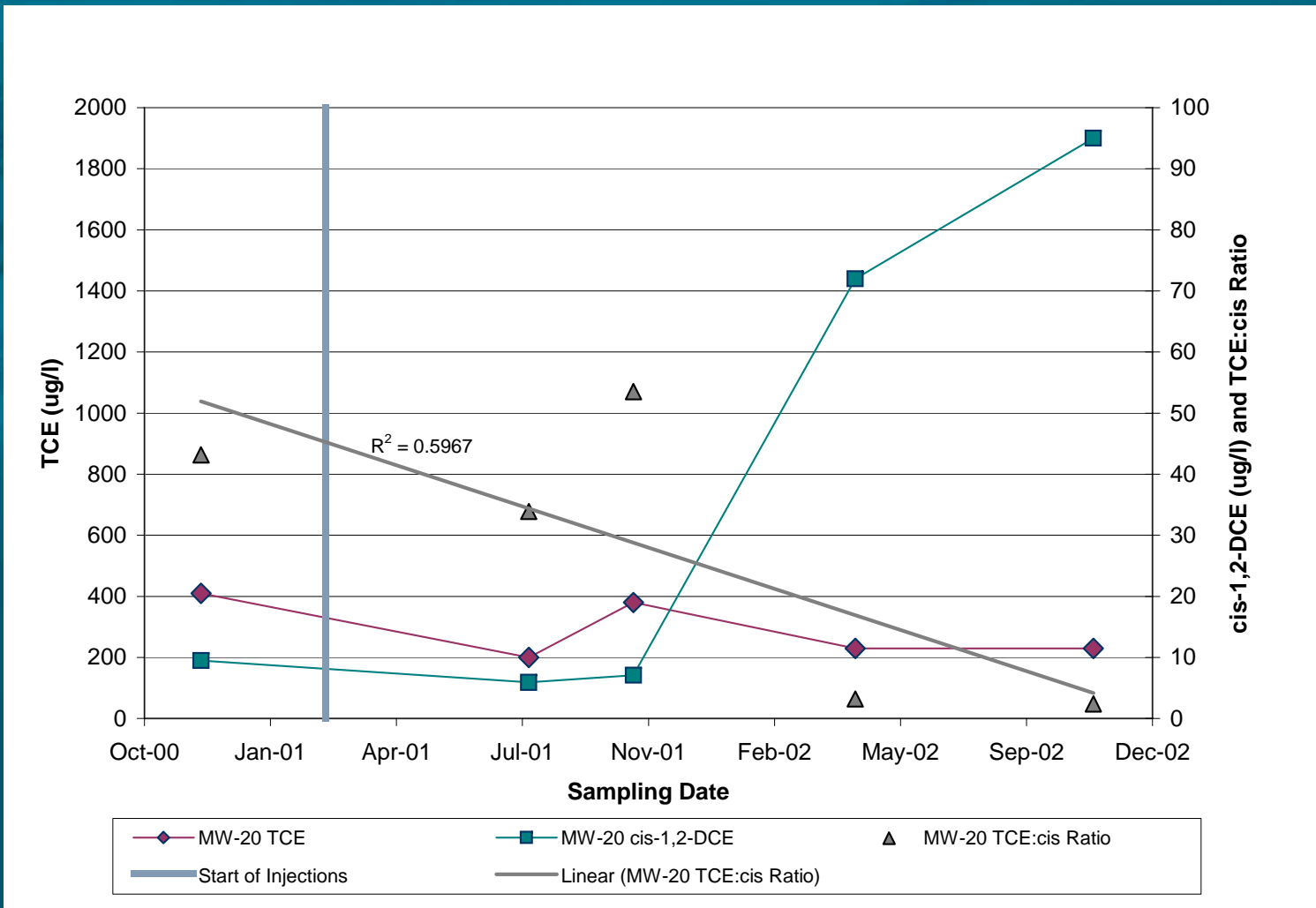
**January 2002,  
11 months  
operation**

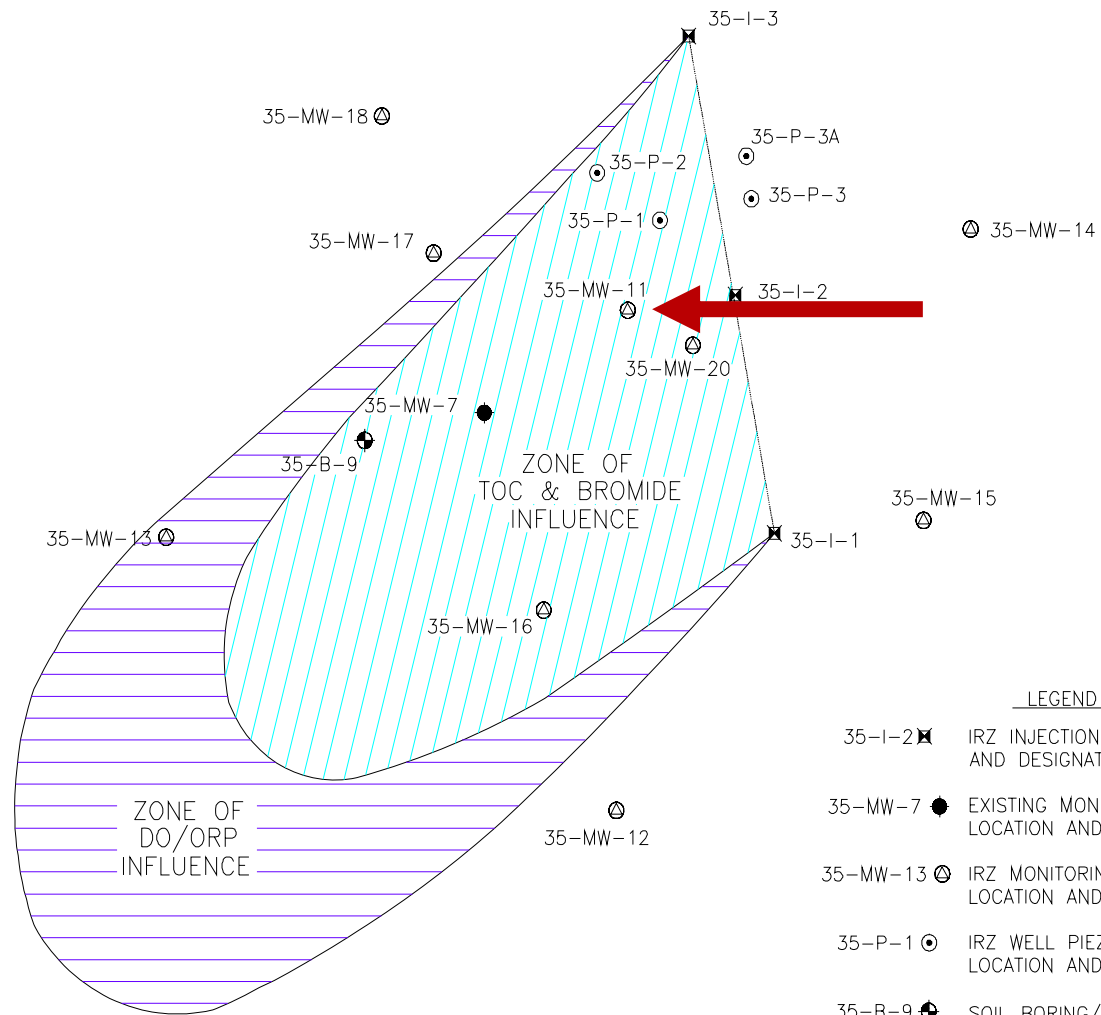
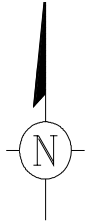
- LEGEND
- 35-I-2 ✕ IRZ INJECTION WELL LOCATION AND DESIGNATION
  - 35-MW-7 ● EXISTING MONITORING WELL LOCATION AND DESIGNATION
  - 35-MW-13 ⊗ IRZ MONITORING WELL LOCATION AND DESIGNATION
  - 35-P-1 ⊙ IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
  - 35-B-9 ⊕ SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION

0 10 20  
Scale: 1 inch = 20 feet



# CAHs at 35-MW-20





⊗ 35-MW-19A  
⊗ 35-MW-19

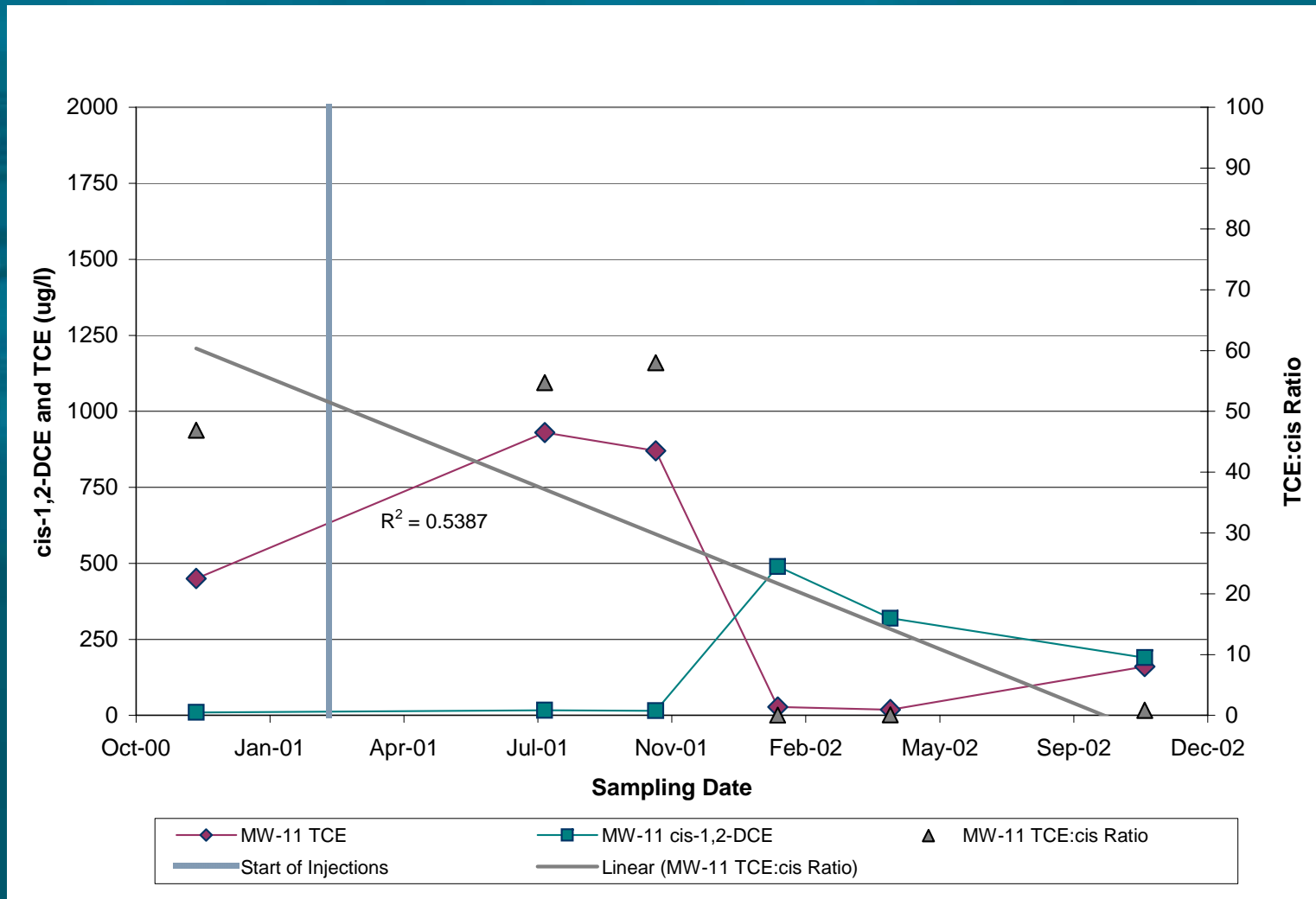
**January 2002,  
11 months  
operation**

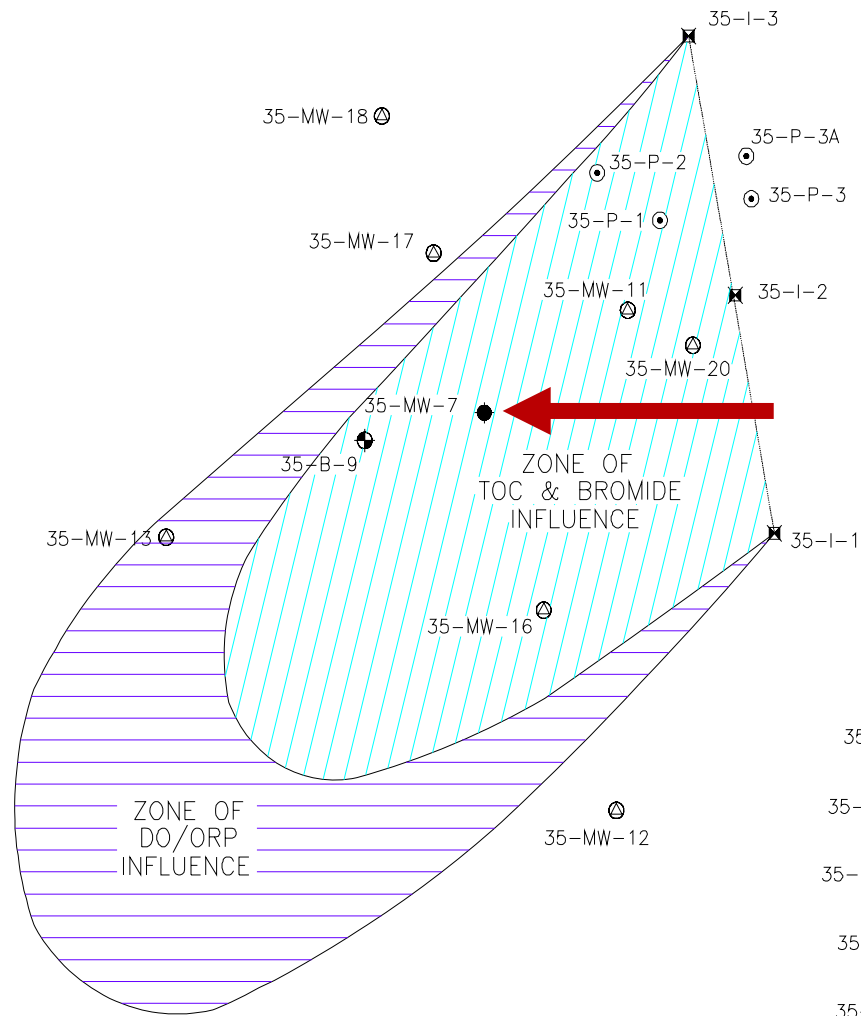
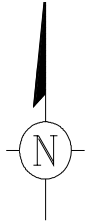
- LEGEND
- 35-I-2 ✕ IRZ INJECTION WELL LOCATION AND DESIGNATION
  - 35-MW-7 ● EXISTING MONITORING WELL LOCATION AND DESIGNATION
  - 35-MW-13 ⊗ IRZ MONITORING WELL LOCATION AND DESIGNATION
  - 35-P-1 ⊙ IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
  - 35-B-9 ⊕ SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION

0 10 20  
Scale: 1 inch = 20 feet



# CAHs at 35-MW-11





⊗ 35-MW-19A  
⊗ 35-MW-19

**January 2002,  
11 months  
operation**

- LEGEND
- 35-I-2 ✕ IRZ INJECTION WELL LOCATION AND DESIGNATION
  - 35-MW-7 ● EXISTING MONITORING WELL LOCATION AND DESIGNATION
  - 35-MW-13 ⊗ IRZ MONITORING WELL LOCATION AND DESIGNATION
  - 35-P-1 ⊙ IRZ WELL PIEZOMETER LOCATION AND DESIGNATION
  - 35-B-9 ⊕ SOIL BORING/HYDROPUNCH LOCATION AND DESIGNATION

0 10 20  
Scale: 1 inch = 20 feet



# CAHs at 35-MW-7

