

PHYTOREMEDIATION AT PORTS GASEOUS DIFFUSION PLANT

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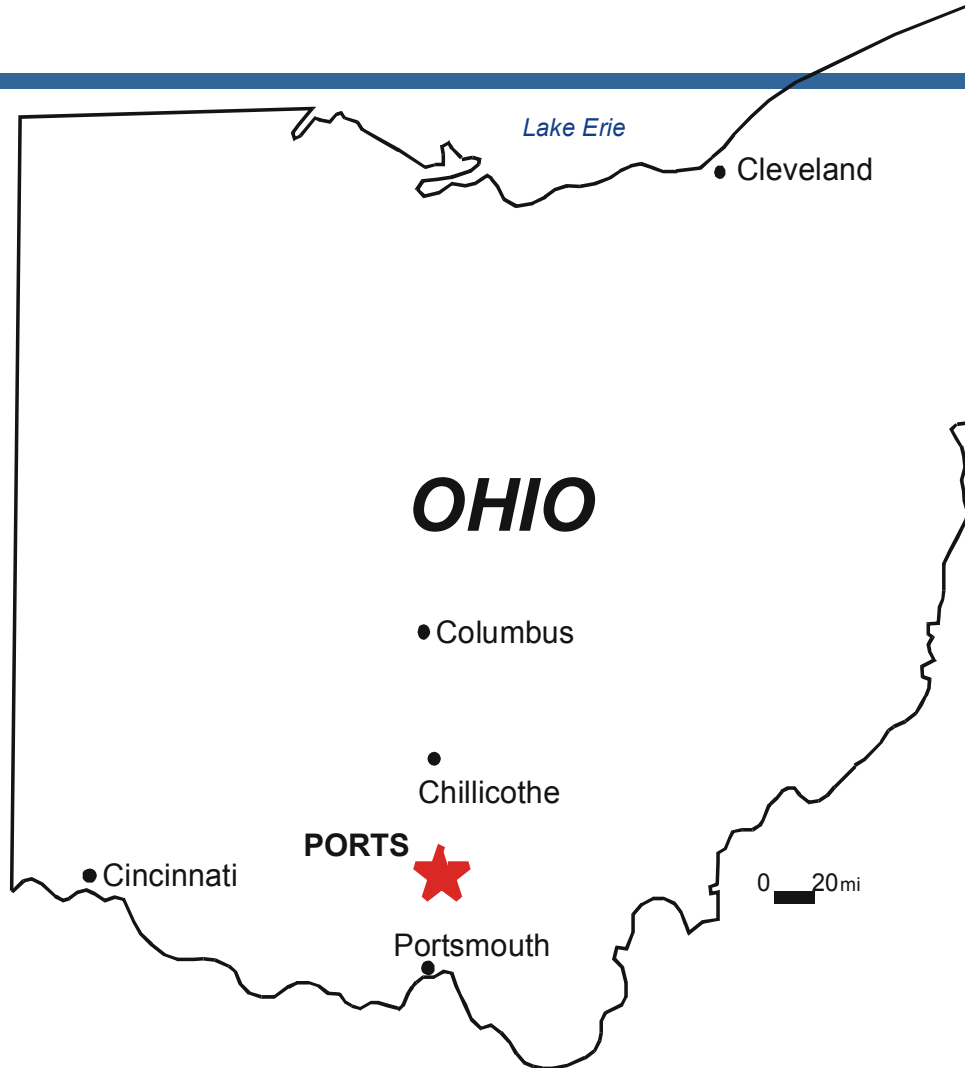


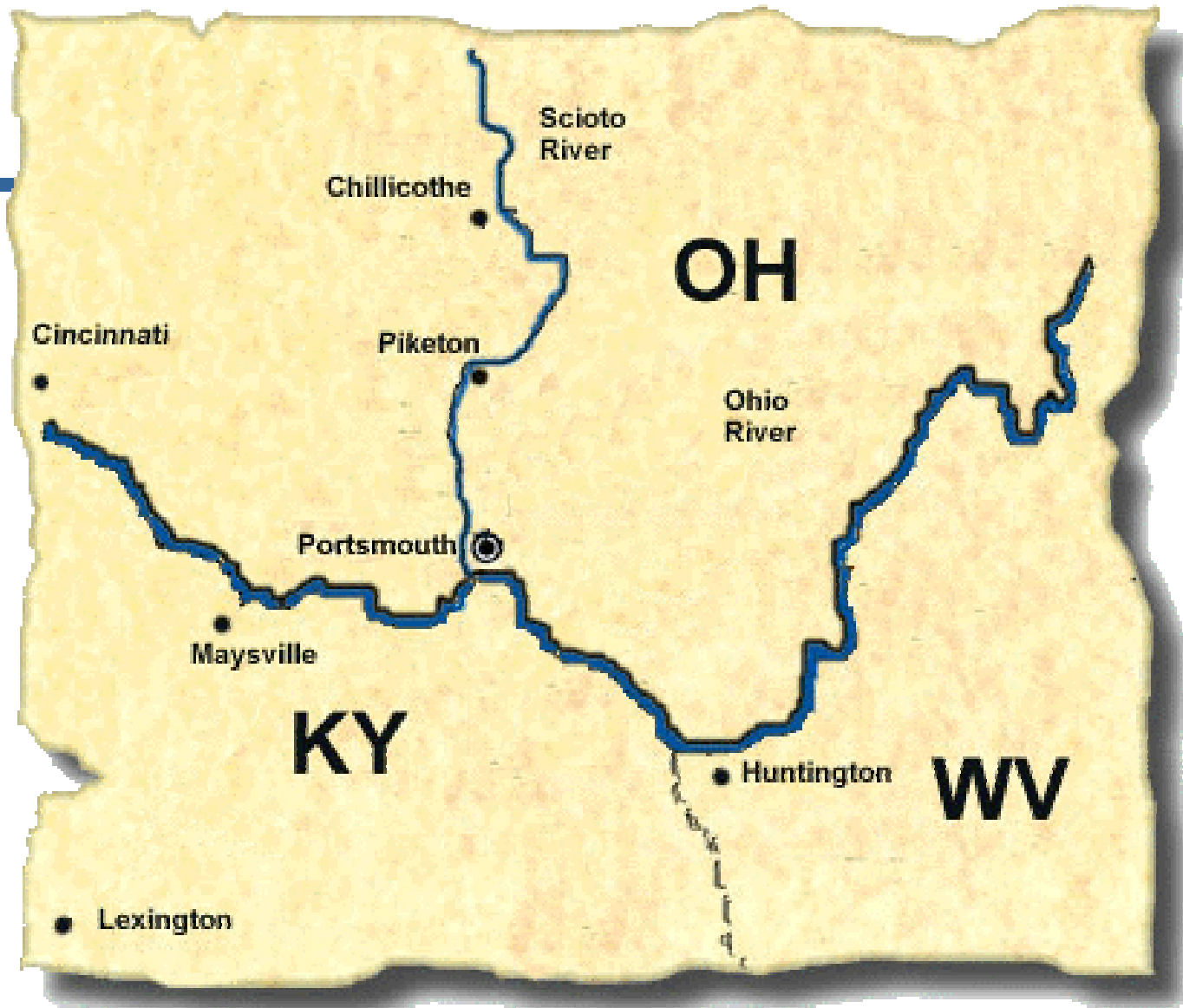
The Plant Site



PORTS looking southwest

LOCATION





Cincinnati

Chillicothe

Scioto River

OH

Piketon

Ohio River

Portsmouth

Maysville

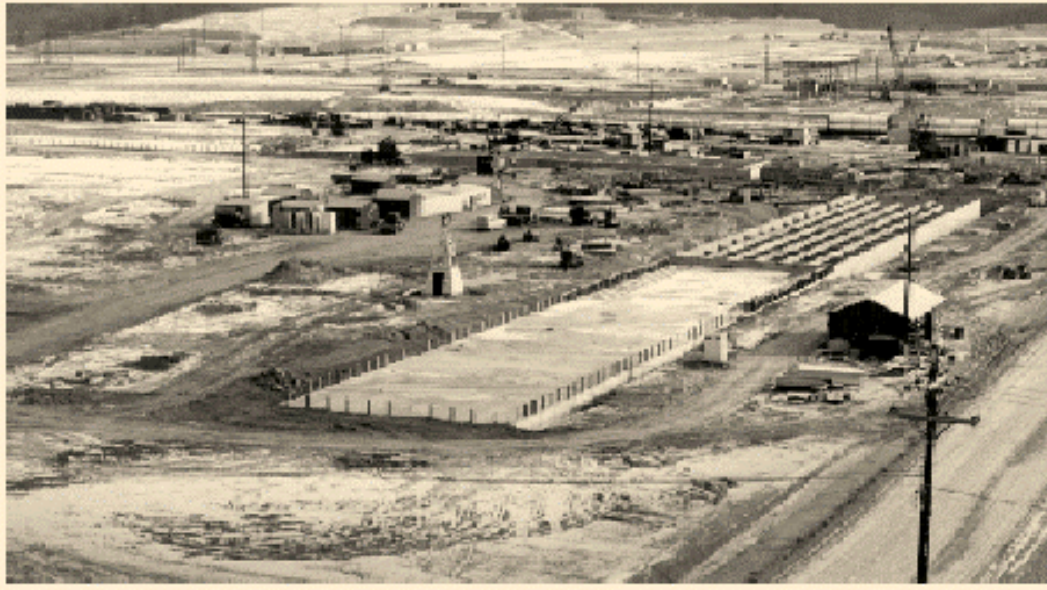
KY

Huntington

WV

Lexington

History



- **August 1952** U.S. government selects Pike County site for new Portsmouth uranium enrichment plant.
- **September 1952** U.S. officials select Goodyear Tire & Rubber Corp. as plant operator. Goodyear creates Goodyear Atomic Corp. to operate plant.
- **March 1956** Plant complete six months ahead of schedule.
Full production begins.

History (cont'd)

- **July 1993**
 - USEC takes over Pad and Ports UE plants.
 - DOE retains legacy responsibilities for ER and WM.
 - USEC contracts with MMUS, for O&M of UE plants.
- **May 2001**
 - USEC ceases enrichment activities at Ports.



Regulatory Issues

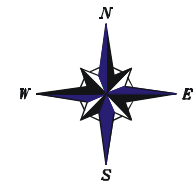
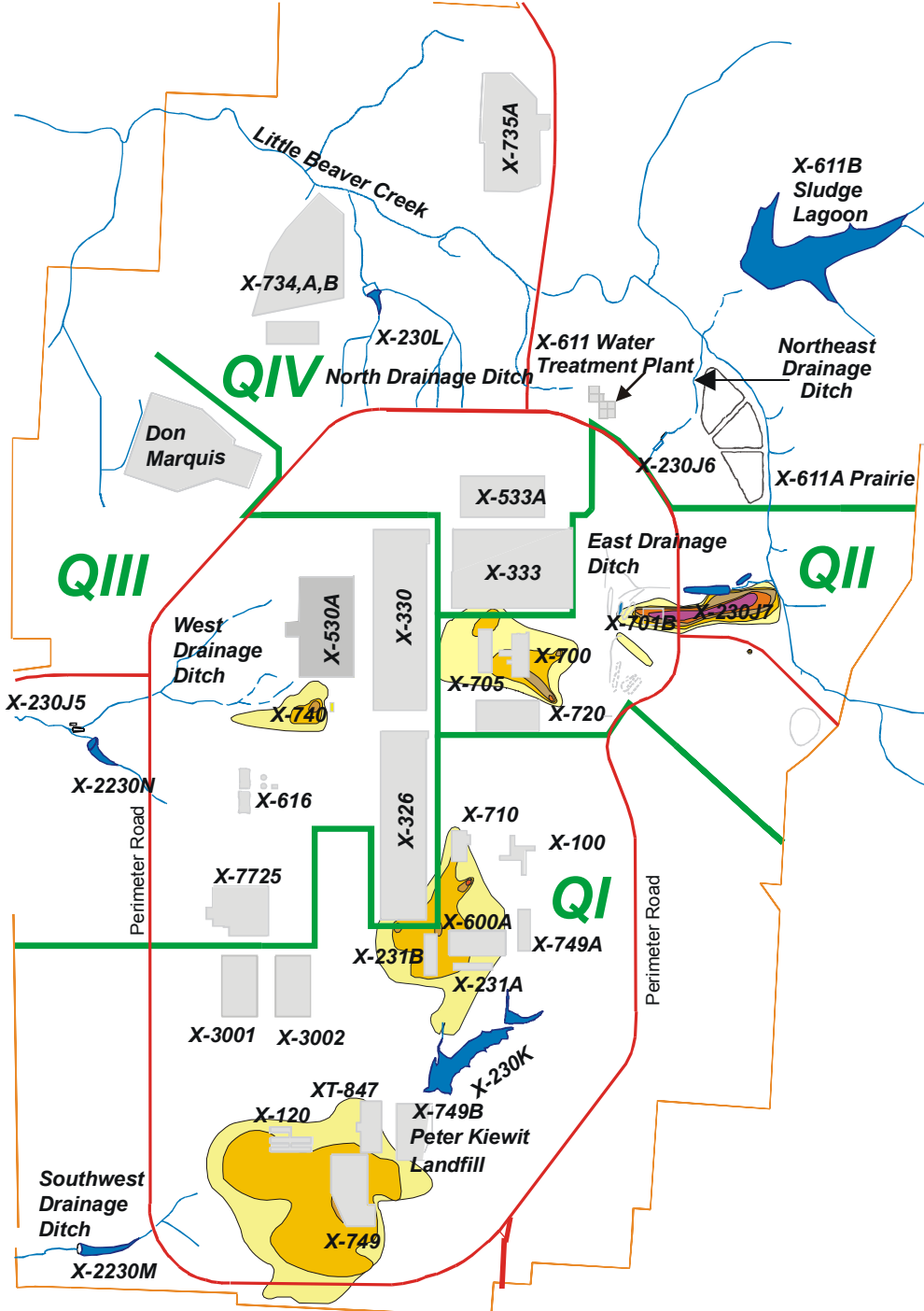
- The **ER Program at PORTS** - 2 enforcement actions.
 - I. A **Consent Decree** issued by the State of Ohio on August 31, 1989
 - II. An **Administrative Order by Consent** (AOC) issued by the U.S. EPA Region V on September 27, 1989
(amended twice since) under the authority of Section 3008(h) of the RCRA of 1976.

Regulatory Issues (cont'd)

- The **Consent Decree** requires a Cleanup Alternatives Study (**CAS**)
- The **AOC** requires a Corrective Measures Study (**CMS**).
- Ohio EPA and U.S. EPA agreed to a **CAS/CMS** report
- The 2nd amendment to the AOC (August 11, 1997) relinquished day-to-day oversight of response action activities to the Ohio EPA.



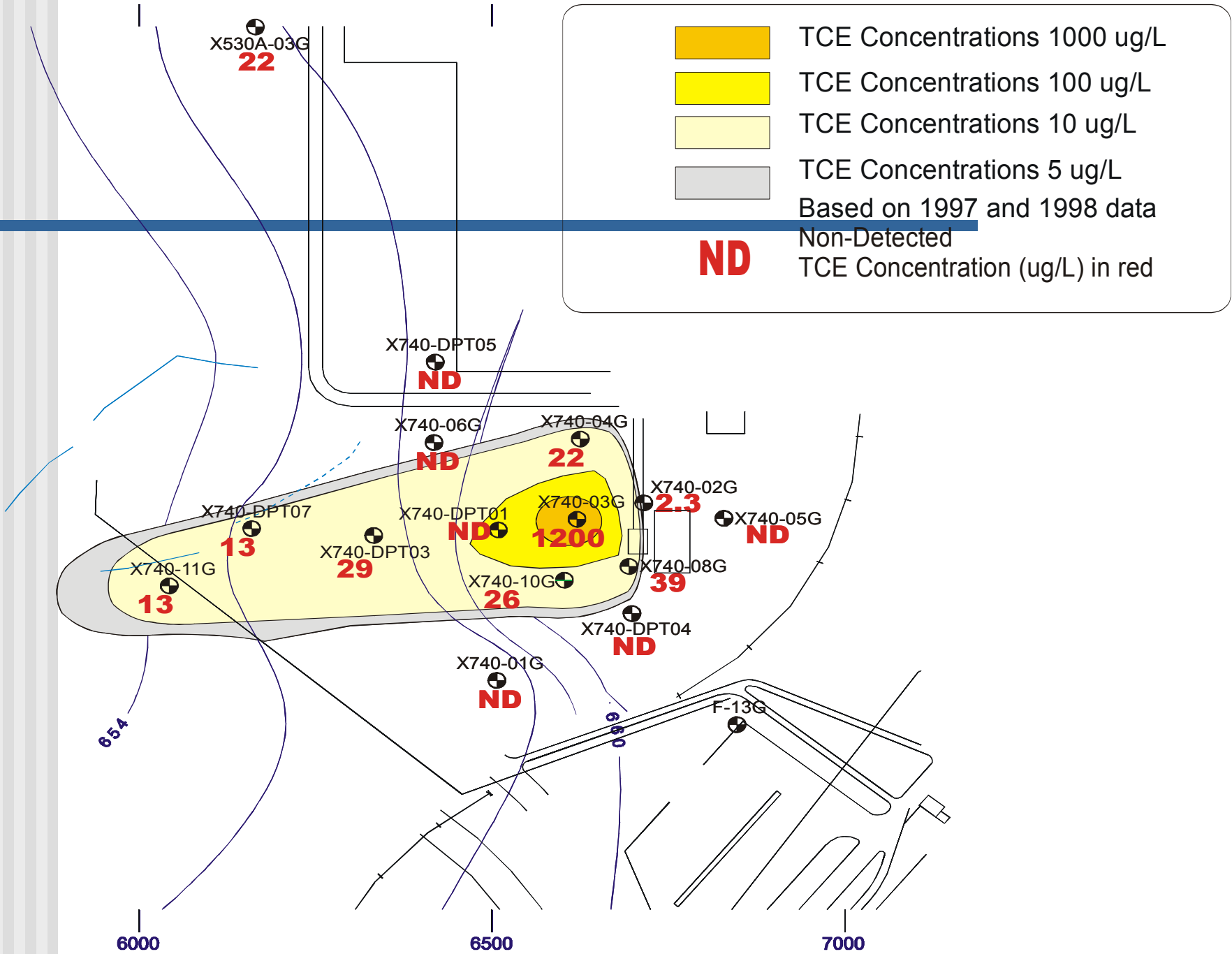
The Problem



LEGEND

TCE Concentrations in Gallia Groundwater in ug/L

- 5 - 100
- 100 - 1,000
- 1,000 - 10,000
- 10,000 - 100,000

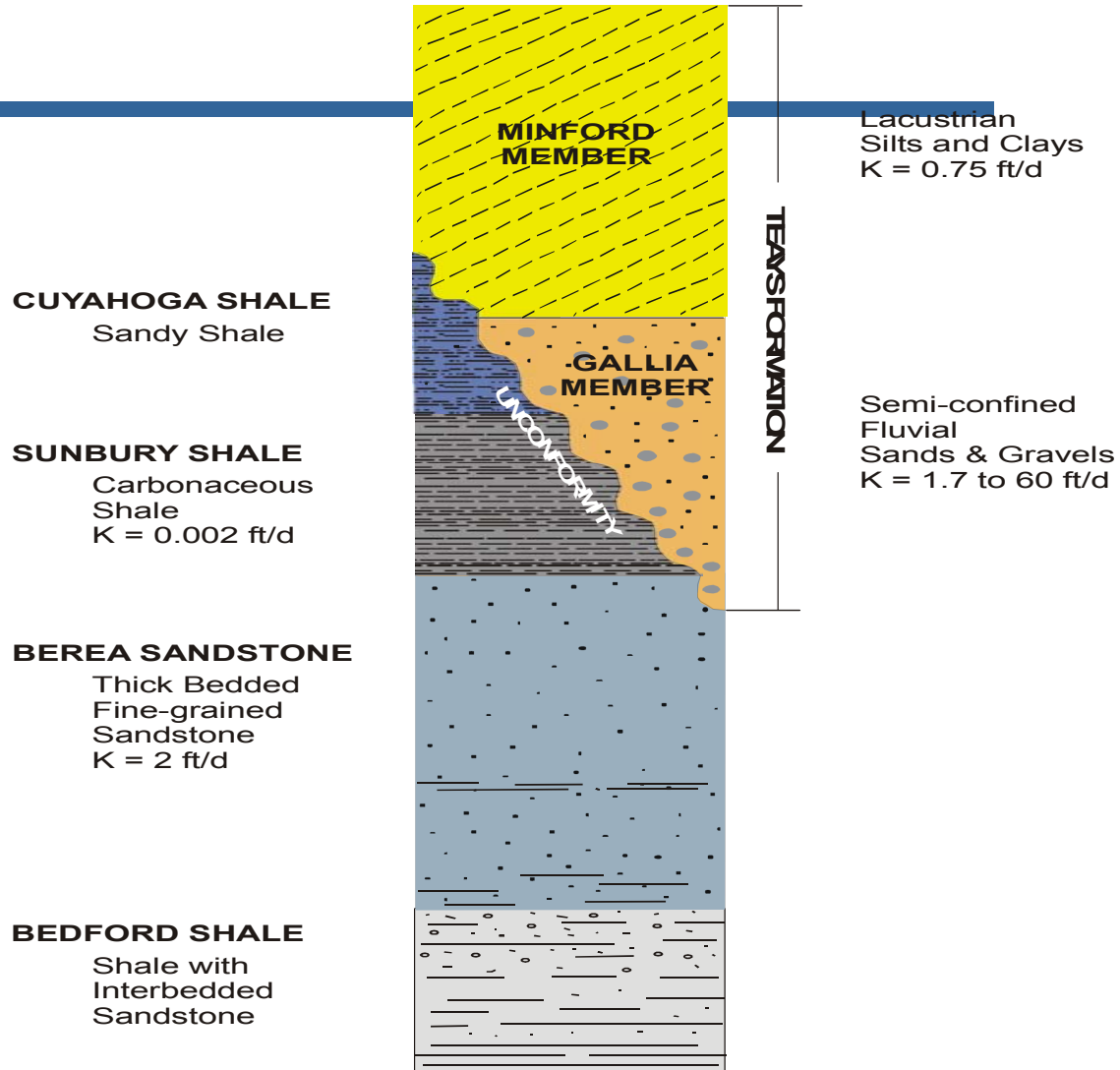




“Stratigraphy”

GEOLOGIC SETTING

PORTS STRATIGRAPHY





Why Phytoremediation?

The Decision Process

■ Quad III RFI

- Occurred in 2 phases
 - Phase I : April to August 1992
 - Phase II: April to July 1994
- OEPA final approval received September 5, 1997.

■ A Baseline Ecological Risk Assessment (BERA)

- Approved by OEPA February 7, 1997

The Decision Process (cont'd)

- A Background Sampling Investigation (BSI) of Soil and Groundwater
 - Approved by the OEPA May 16, 1996.
- Data from RFI, BERA, and BSI used to support the CAS/CMS Document

Alternatives Considered

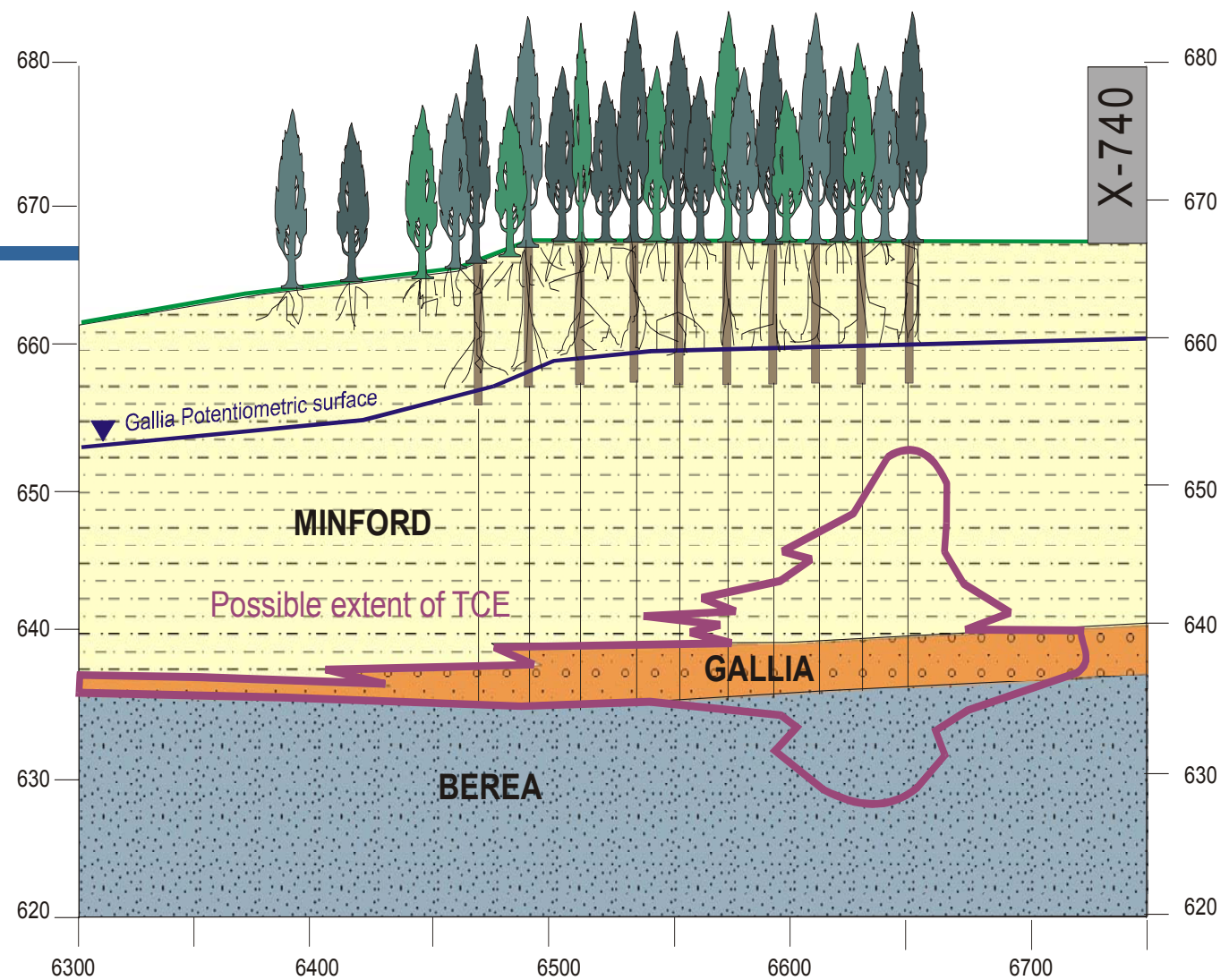
- Option 1- Do Nothing
- Option 2- I.C. & Monitoring
- **Option 3- I.C. & Phytoremediation**
- Option 4- I.C. & Pump & Treat
- Option 5- I.C. & VER

Alternative Costs

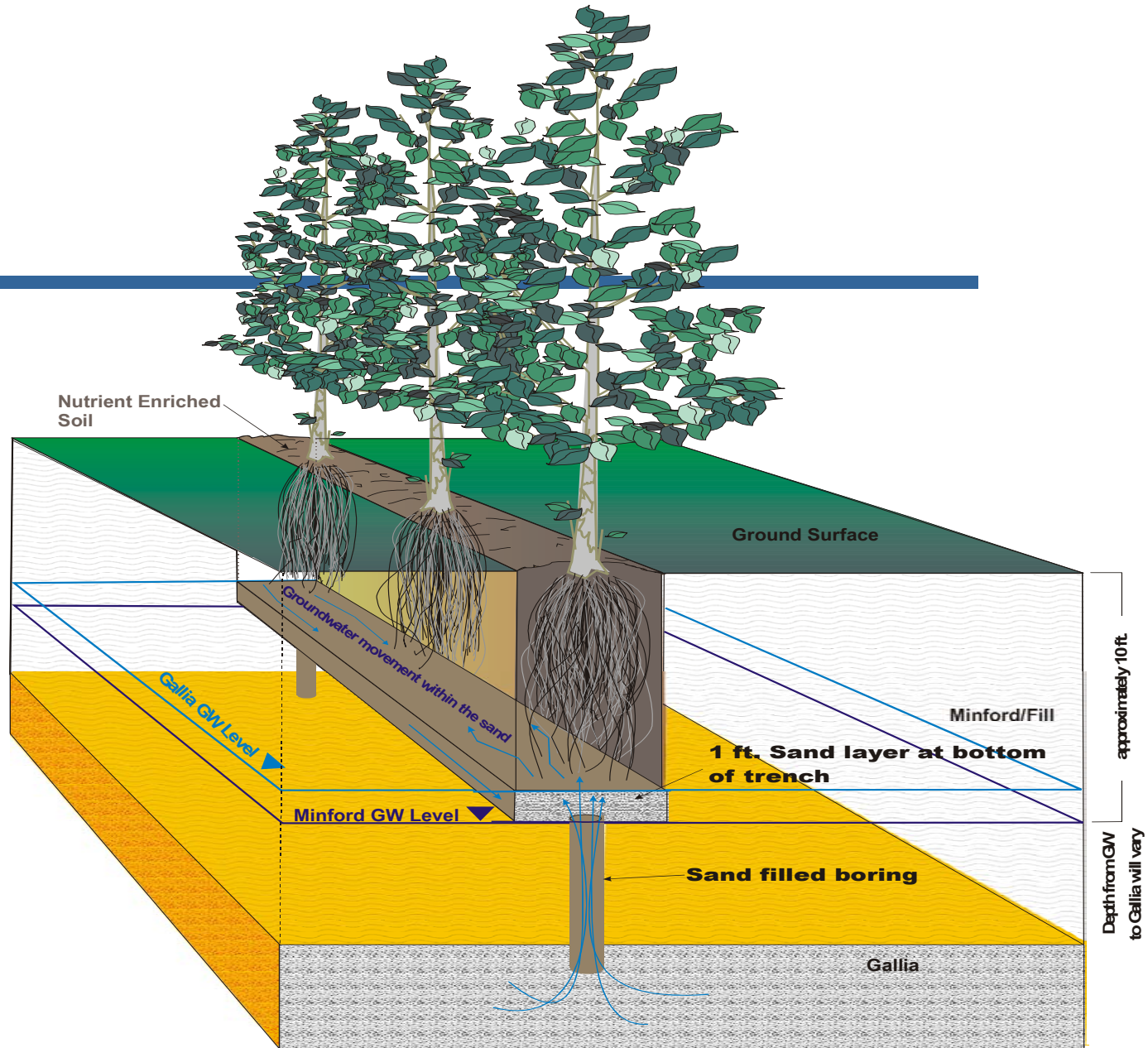
- Option 1- \$0
- Option 2- \$603 Thousand
- **Option 3- \$638 Thousand**
- Option 4- \$1.12 - \$1.51 Million
- Option 5- \$2.53 - \$3.53 Million



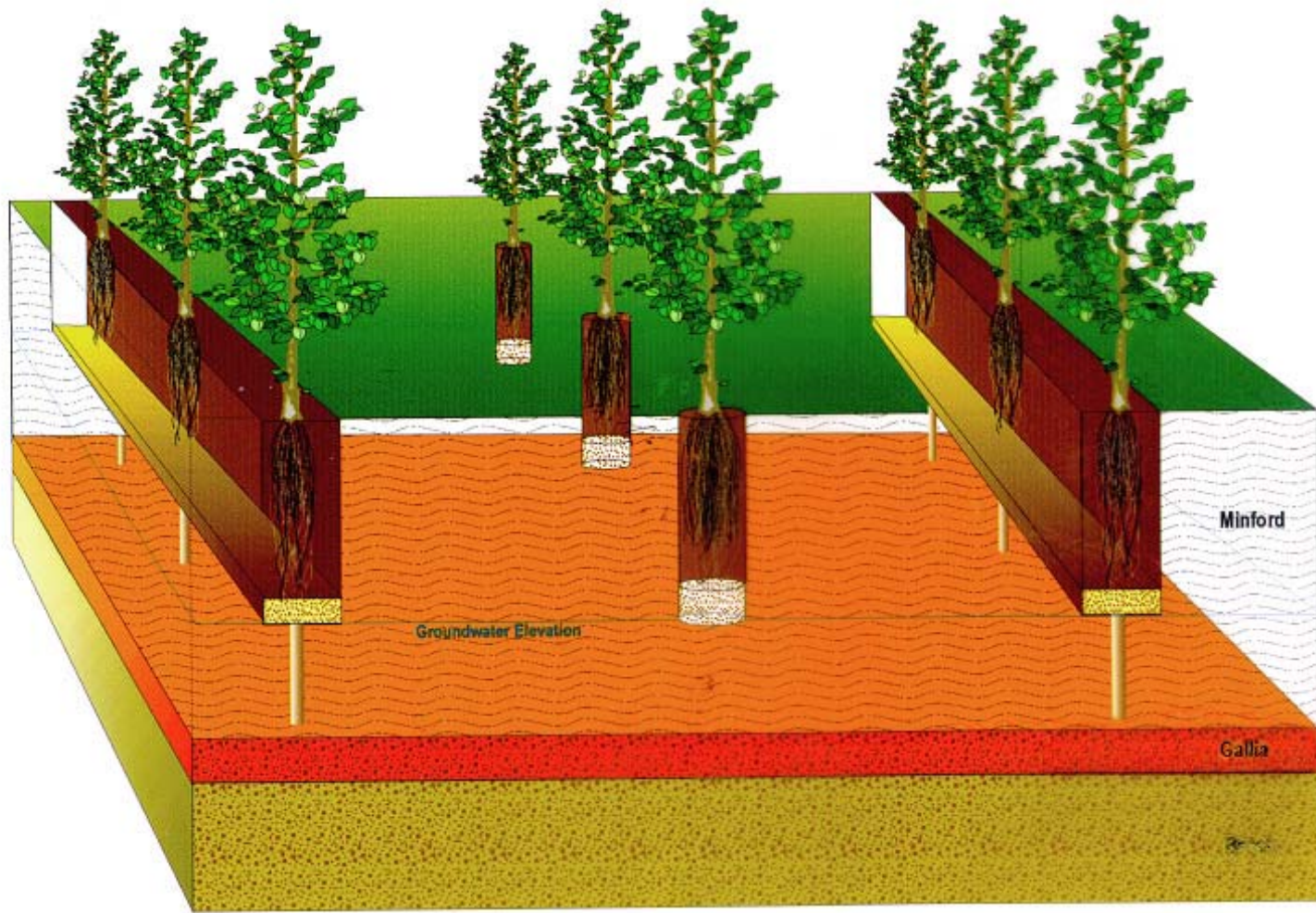
Project Design

W**Cross Section View****E**

Sand-filled borings allow contaminated Gallia groundwater to flow into bottom of trenches. Trees planted between trenches compete for surface infiltration.

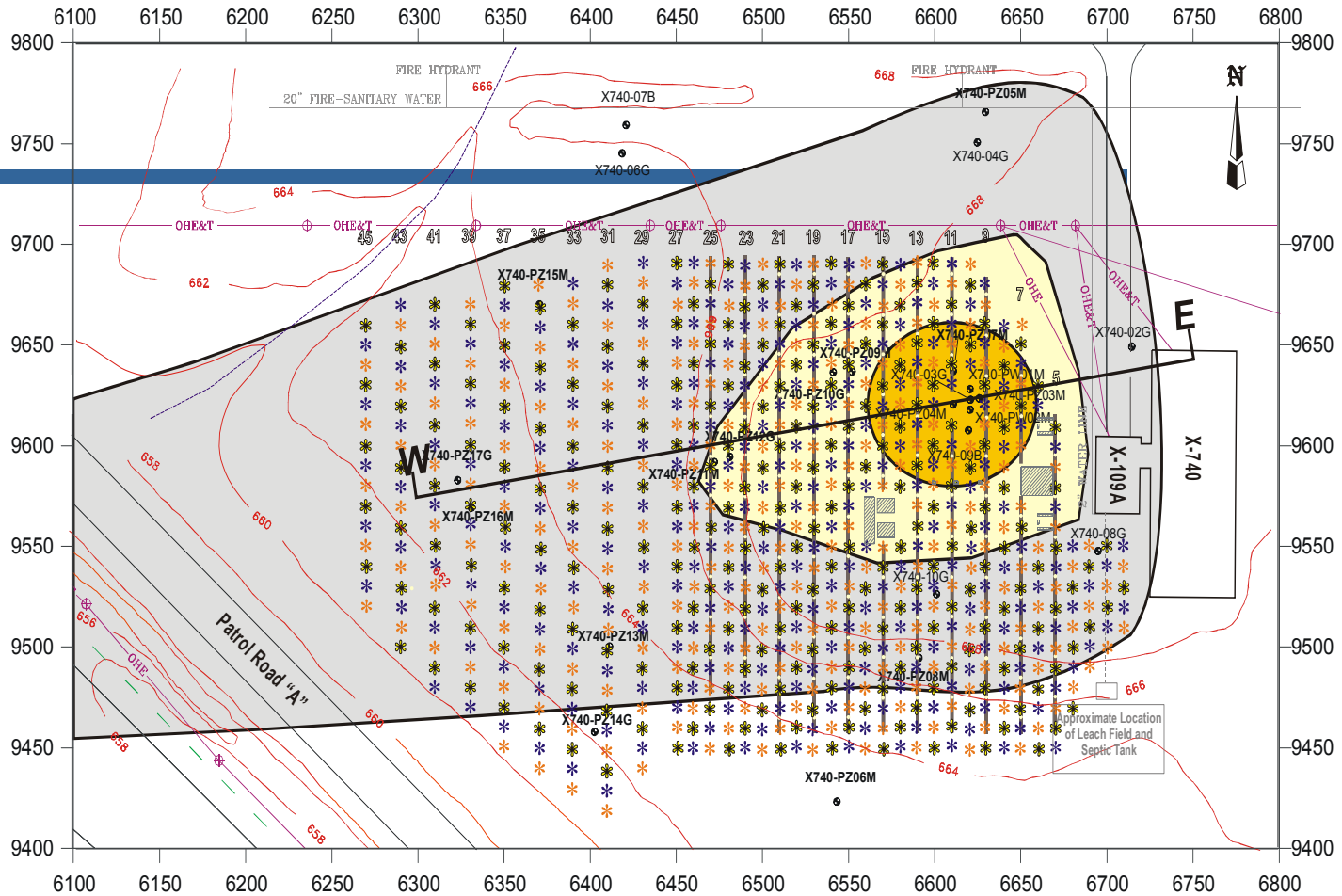


Block diagram of the phytoremediation system showing Poplar tree plantings in a shallow trench to the water table with sand-filled borings to the Gallia



PHYTOREMEDIATION DESIGN

Map View



Legend	
— Installed Trench	■ TCE Concentrations 1000 ug/L
○ Installed Sand Filled Boring X740-04G Existing Well	■ TCE Concentrations 100 ug/L
● X740-PZ05M Installed Piezometer	■ TCE Concentrations 10 ug/L
	Hybrid Poplar Tree Species
	★ NE-19 P. nigra x nigra
	★ NM-6 P. nigra x maximowiczii
	★ DN-34 P. deltoides x nigra
	— Security Fence
	— Ground Surface Elevations above Sea Level
	— Overhead Powerlines with Locations of Poles

Tree planting design with trenches and wells at X-740

Project Construction

X-740

X-740 Project Details

- Species Used:
 - ❖ P. deltoides x P. nigra (DN-34)
 - ❖ P. nigra x P. maximowiczii (NM-6)
 - ❖ P. nigra x P. nigra (NE-19)
- Acreage: 4.3
- Total No Trees planted: 765
- Trenches (10ft Deep) 2,060 ft.
(0.39 mi)
- Sand Stacks 107
- 24" Borings 559











Full-Service Truck Leasing Company













The First Trench





































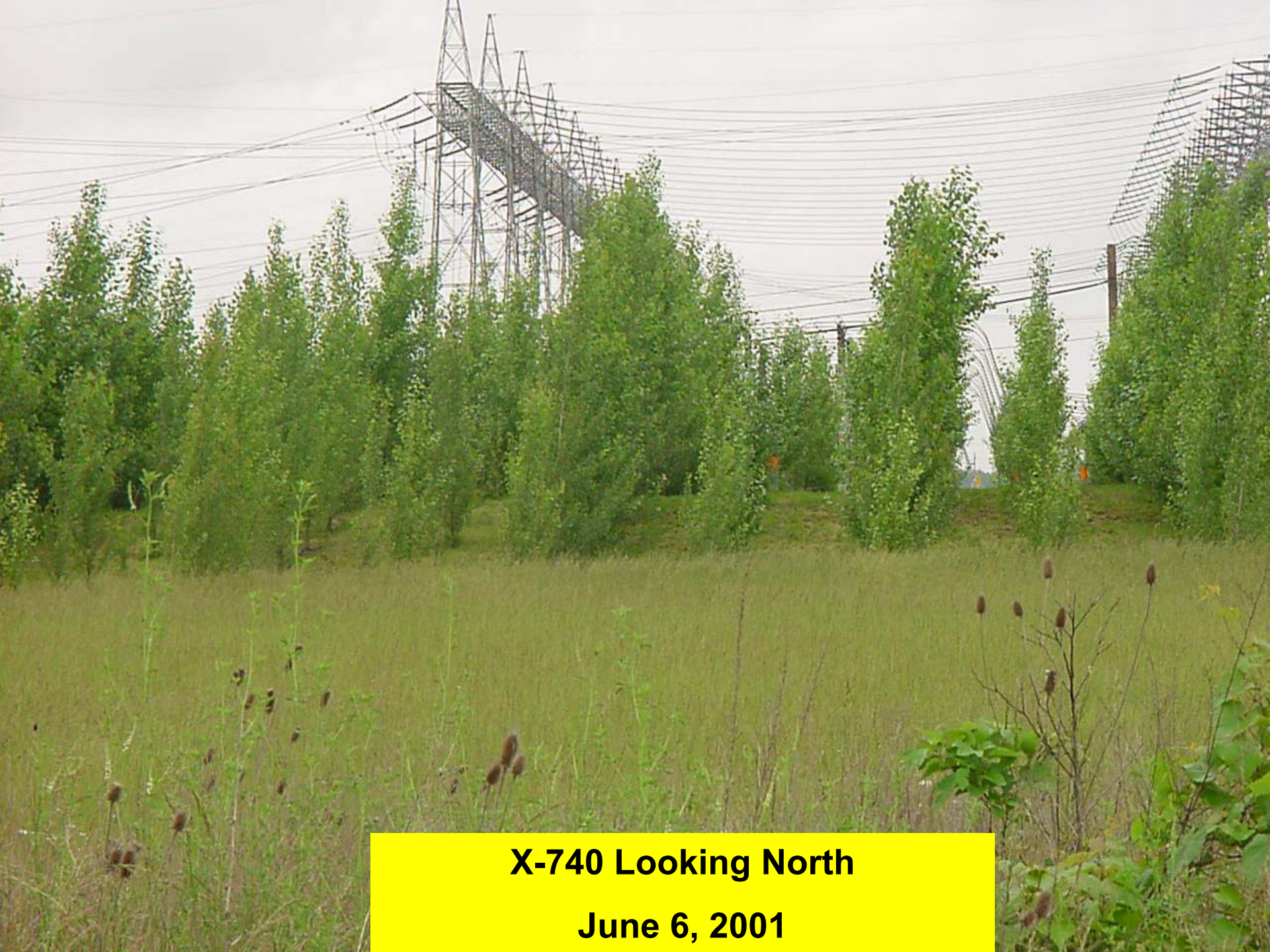






X-740 Looking N.E.

June 6, 2001



X-740 Looking North

June 6, 2001



X-740 Looking South

June 6, 2001

Mary, Mary,.....

**How does your garden
grow?.....**



June 3, 1999
1 week after planting



August 3, 1999
9 weeks after planting



September 10, 1999

15 weeks after planting



X-740 Our Favorite Tree

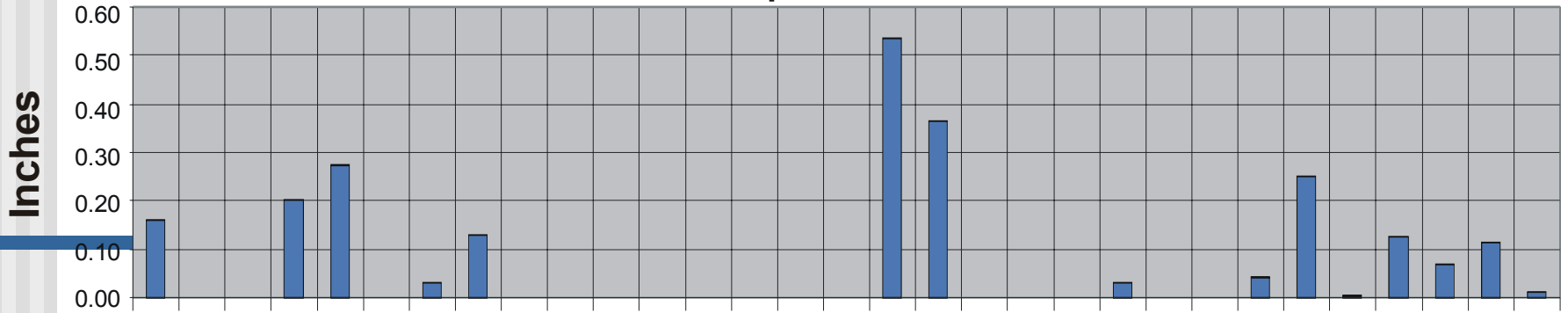
October, 2000



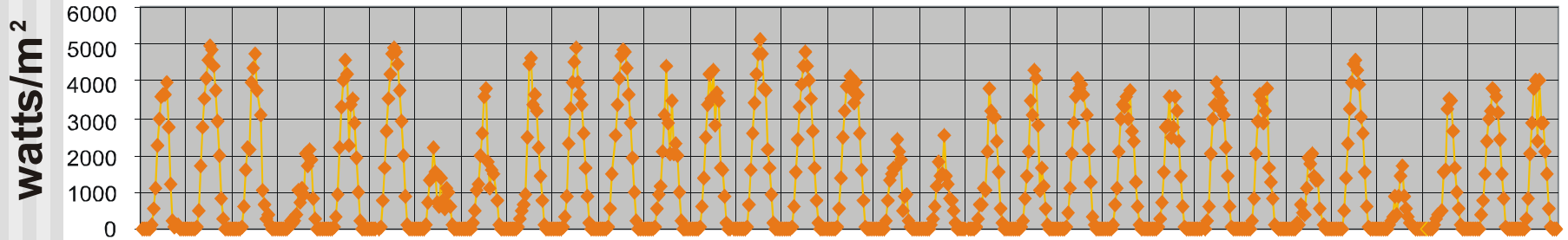
X-740 Our Favorite Tree

June 6, 2001

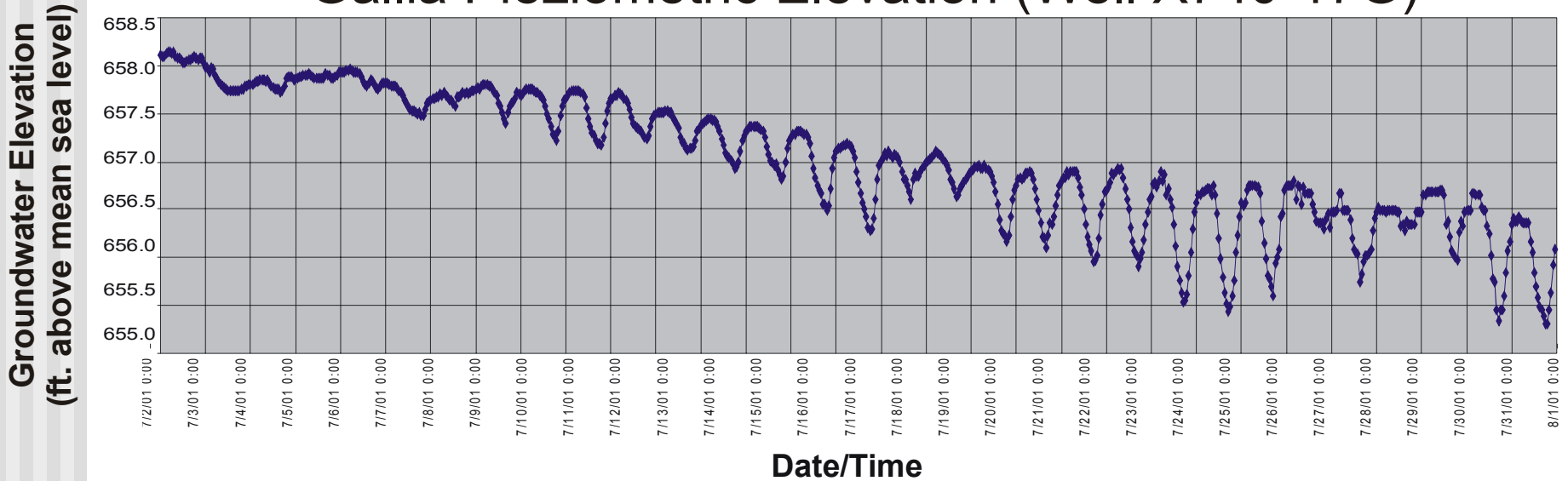
Precipitation



Solar Radiation

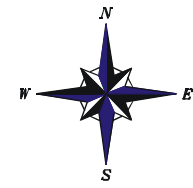
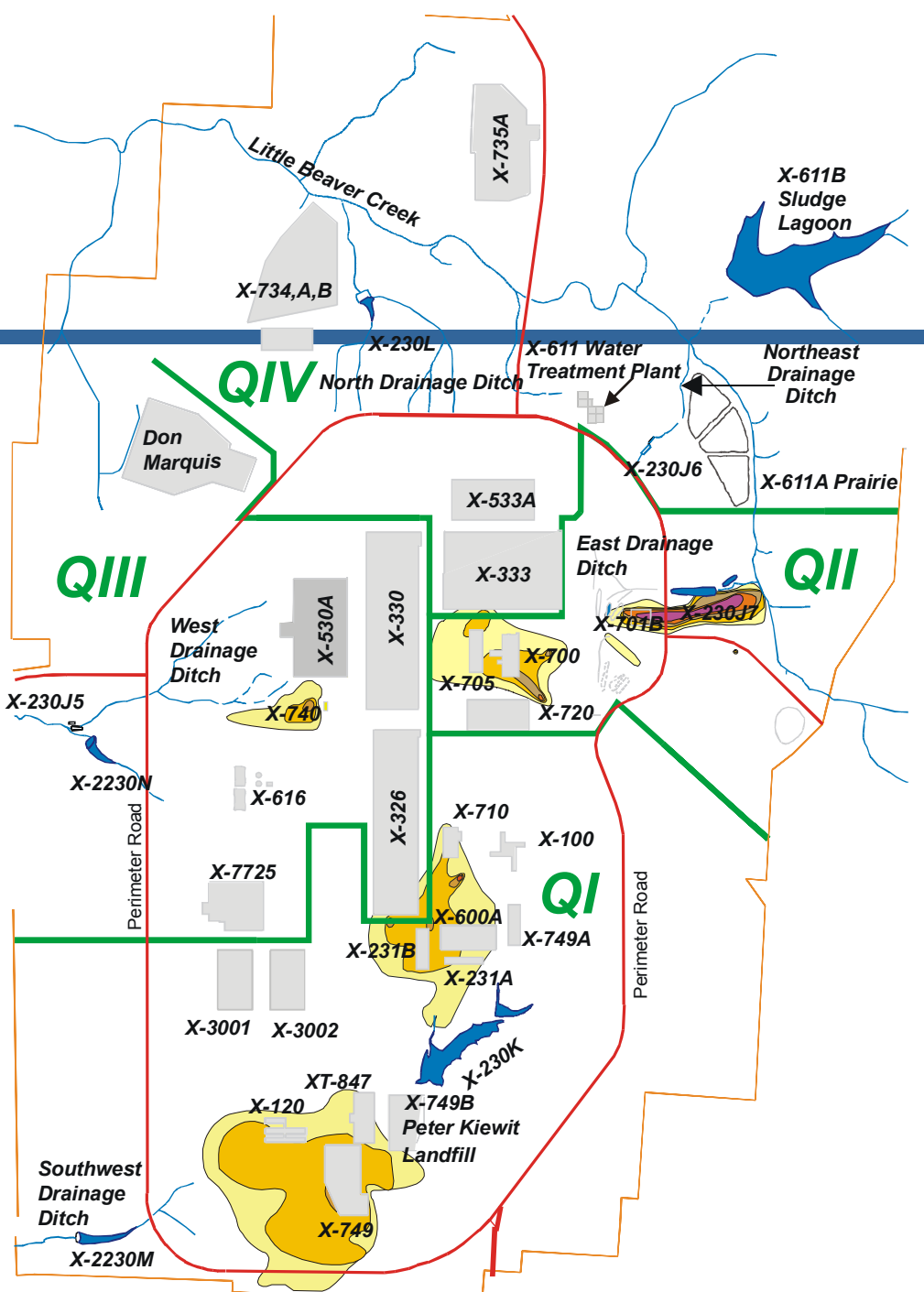


Gallia Pieziometric Elevation (Well X740-17G)



Project Construction

X-749 / 120



LEGEND

TCE Concentrations in Gallia Groundwater in ug/L

- 5 - 100
- 100 - 1,000
- 1,000 - 10,000
- 10,000 - 100,000

X-749/120 Project Details

- **Species Used:**
 - ❖ P. nigra x P. maximowiczi (NM-6)
- **Acreage:**
 - Phase 1: 2.3 Phase 2: 41
- **Total No Trees planted:**
 - Phase 1: 709 Phase 2: 2,774
- **Trenches (12ft Deep)**
 - Phase 1: 4,986 ft* Phase 2: 14,040 ft
(1.34 mi) (2.66 mi)
- **Trenches (15ft Deep)**
 - Phase 1: 0 Phase 2: 13,700 ft
(2.59 mi)
- **Sand Stacks**
 - Phase 1: 354 Phase 2: 1,387
- **24" Borings**
 - Phase 1: 0 Phase 2: 0

*10ft deep trenches in Phase I



X-749
Feb. 5, 2003



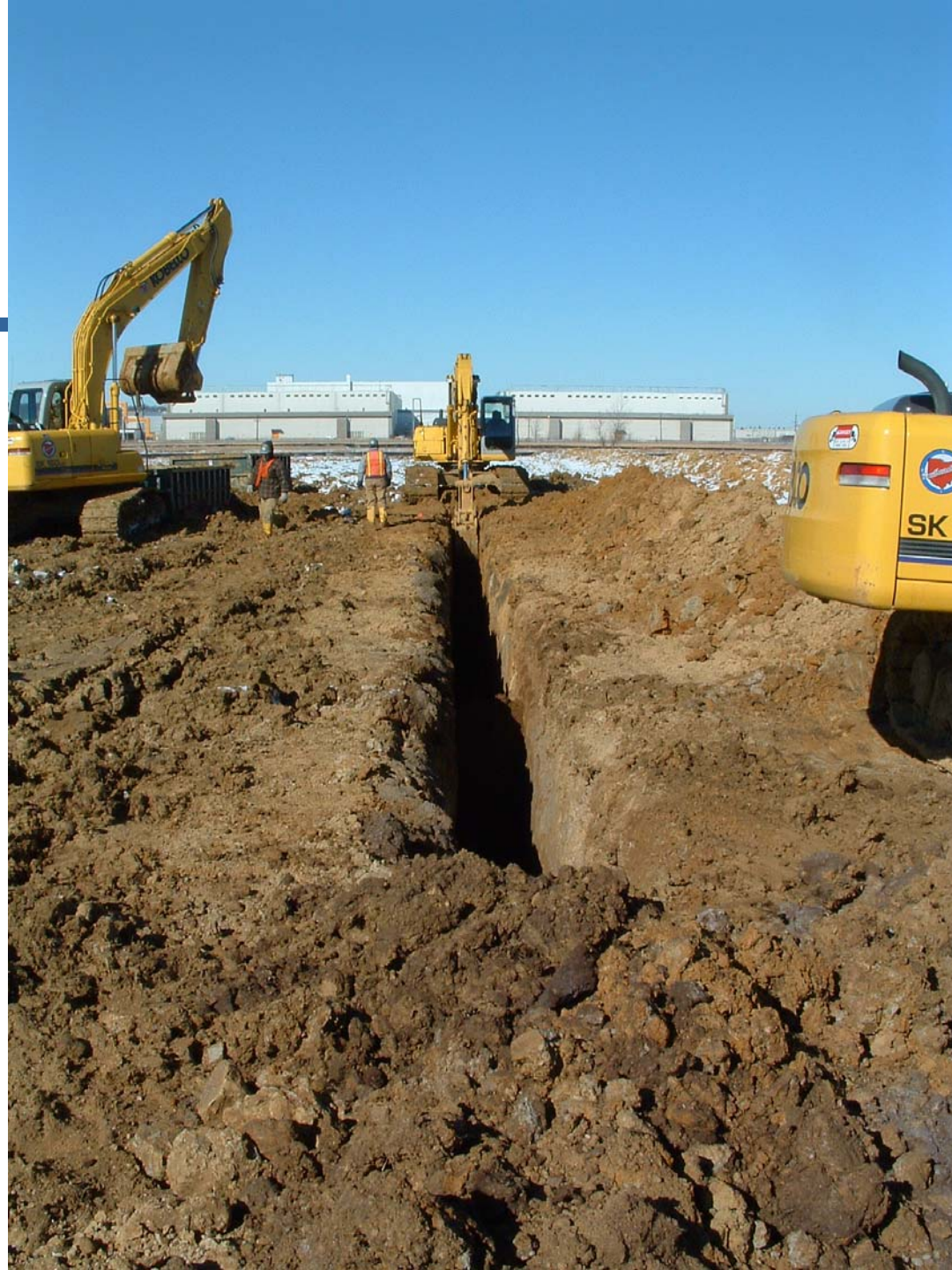
X-749
Feb. 5, 2003



X-749
Jan. 24, 2003



X-749
Jan. 24, 2003



X-749
Feb. 5, 2003



X-749
Jan. 24, 2003



X-749
Jan. 24, 2003

PORTSMOUTH SUMMARY

(SO FAR)

➤ **Acreage:**

45+ acres

- **Total No Trees planted:** 4,214
- **Trenches (Total)** 34,786 ft.
(6.6 miles)
- **Sand Stacks** 1,848
- **24" Borings** 559