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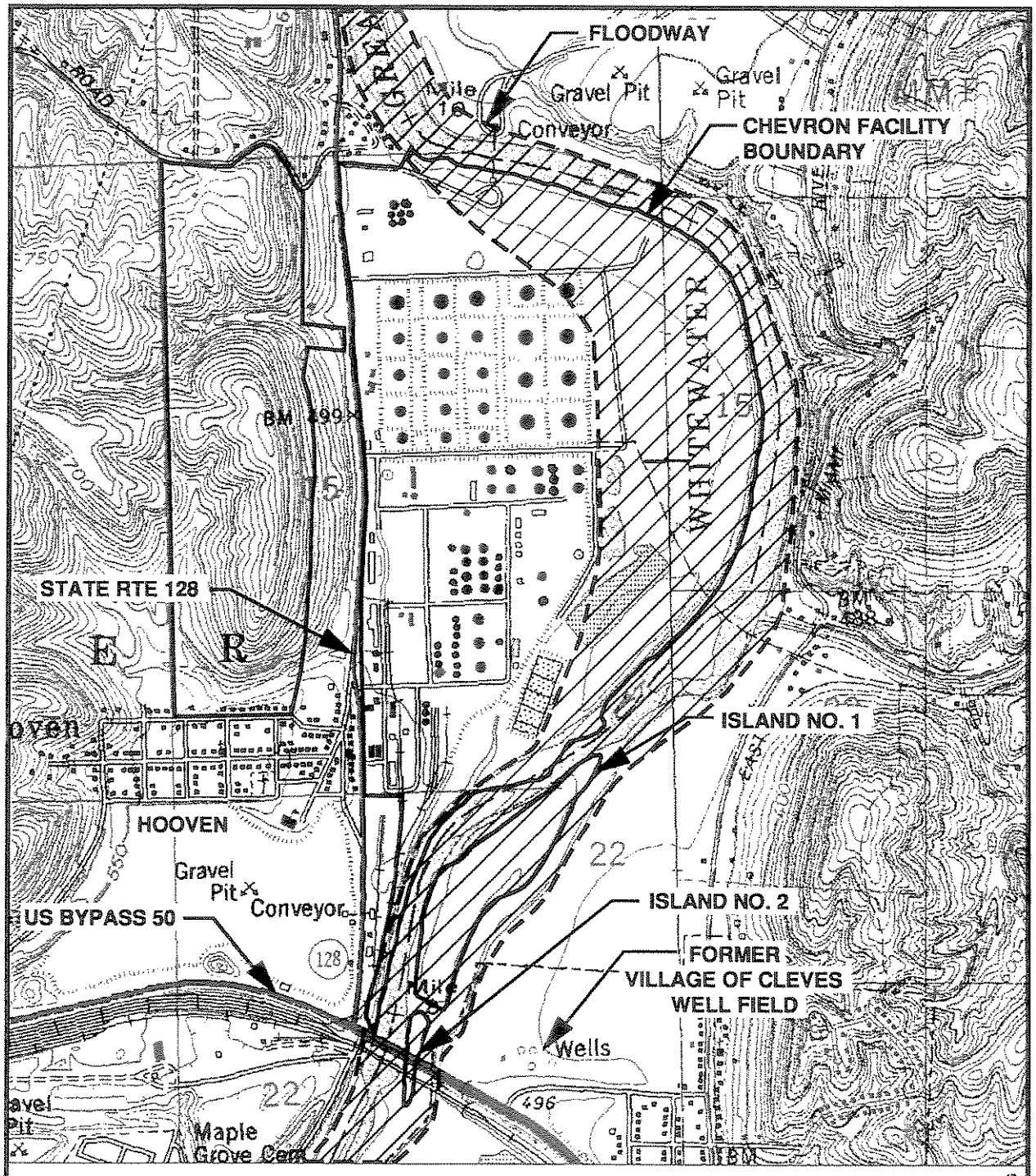

URS

Figure 2-1
Site Location Map
Chevron Cincinnati Facility Site
Hooven, Hamilton County, Ohio

SOURCE: USGS 7.5 MINUTE QUADRANGLE, HOOVEN, OHIO–IND–KY, & ADDYSTON, OHIO–KY, PHOTOREVISED 1987.

hooven.dwg 10/02/01 - AUS

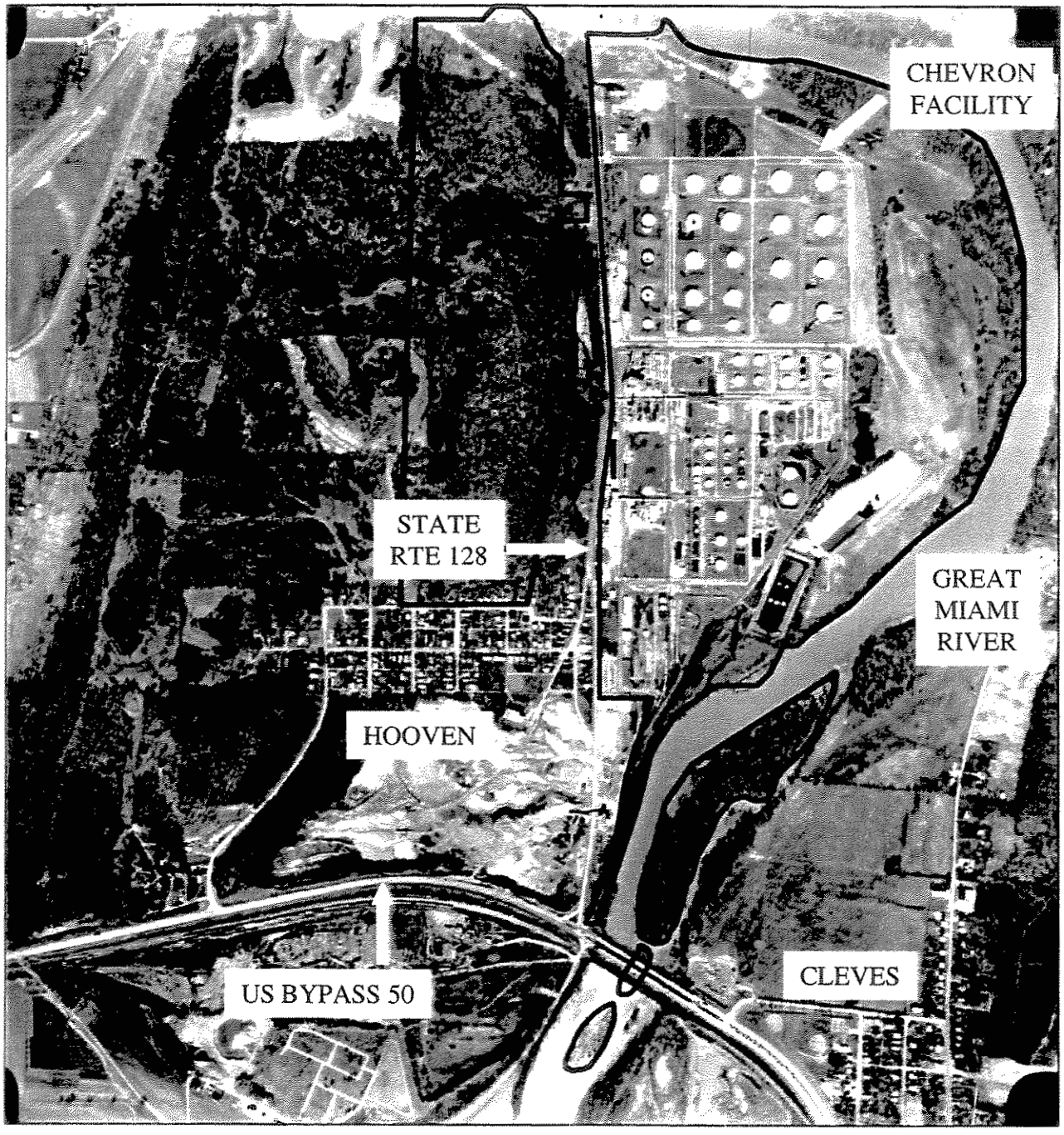

Figure 2-2
Aerial Photograph of the Chevron Cincinnati Facility in March 1975.
Most above grade structures were removed after 1986.

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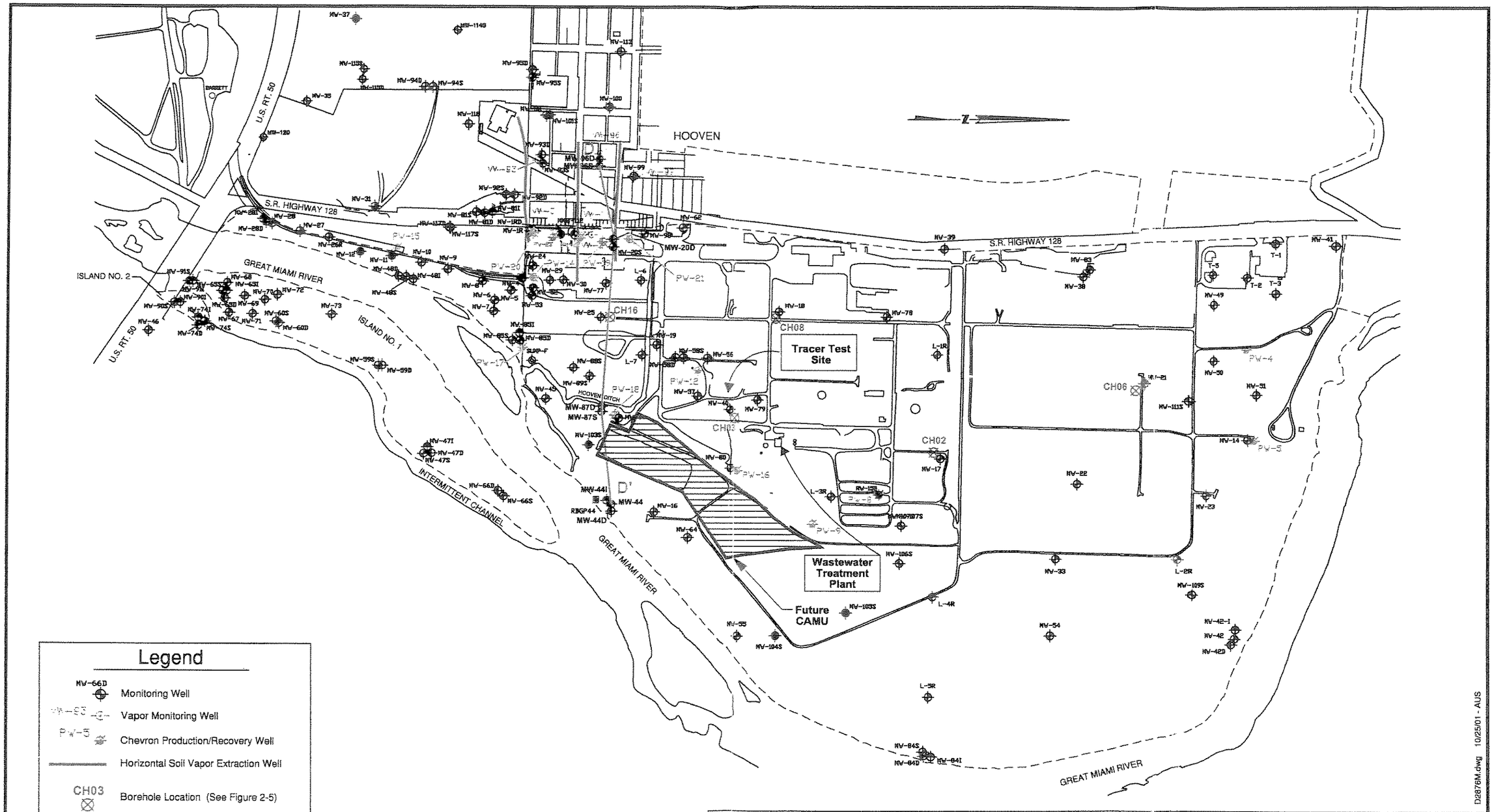

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Facility Diagram
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	Aug 2000	9905115	Figure 2-3

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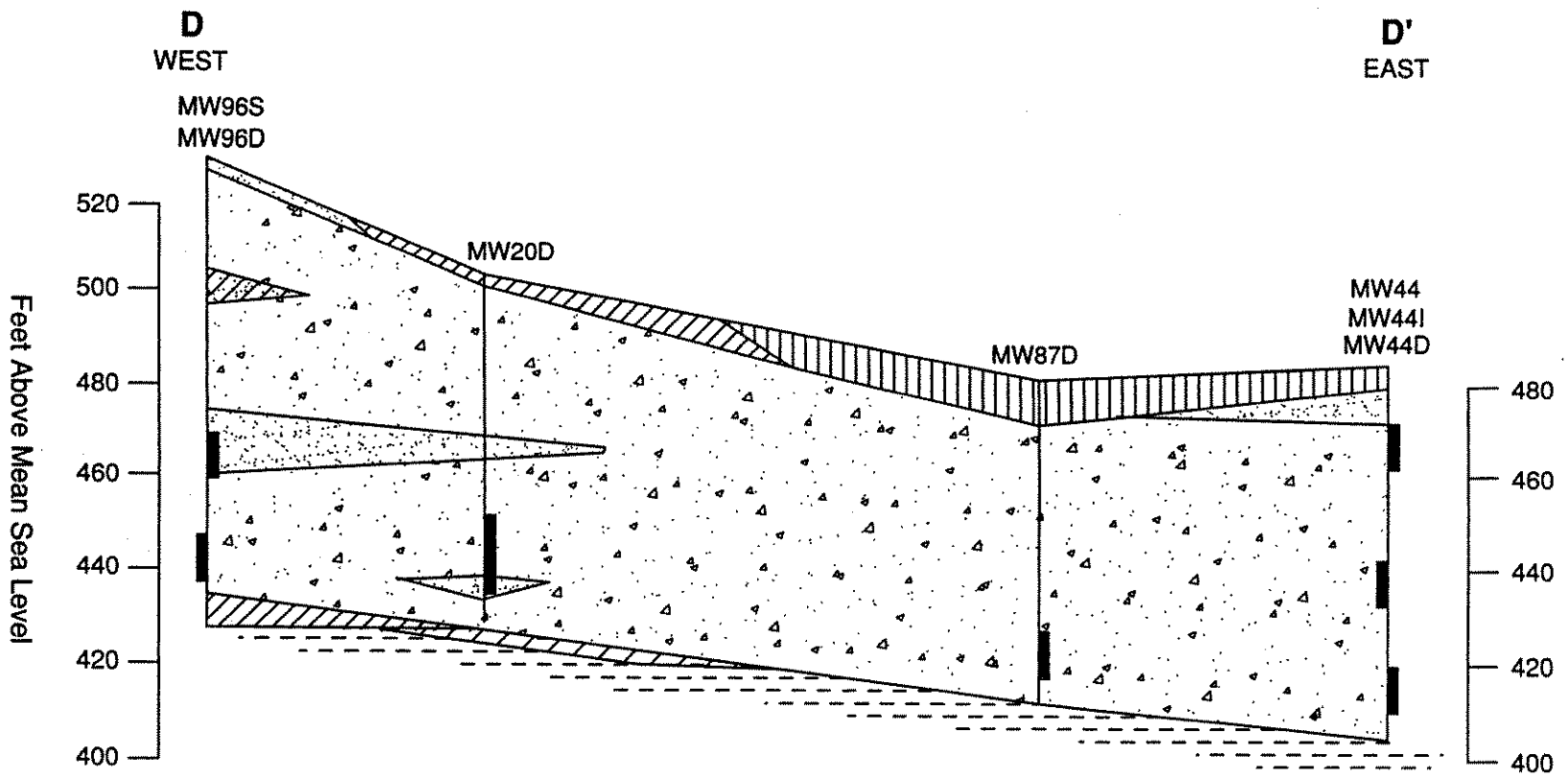

Legend

- Screened Interval Of Well
- Silt & Sand
- Sand
- Sand and Gravel
- Silty Clay
- Shale & Occasional Limestone
- Clayey Sand & Gravel

0 300 600
APPROXIMATE SCALE IN FEET

Figure 2-4
Generalized Geologic Cross Section, D–D'
(See Figure 2-3 for Section Location)

Chevron Products Company
Cincinnati Facility
Hooven, Ohio
4898005

Environmental Science & Engineering, Inc.
A MACTEC Company
KTK 06/15/00
Revised * *

Chevron
gxsw2e

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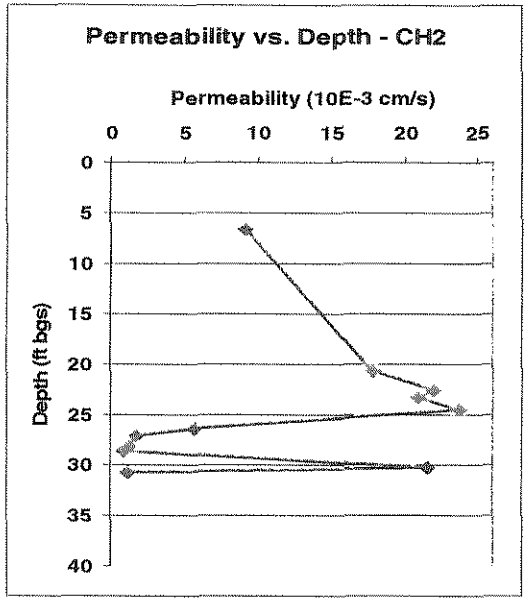

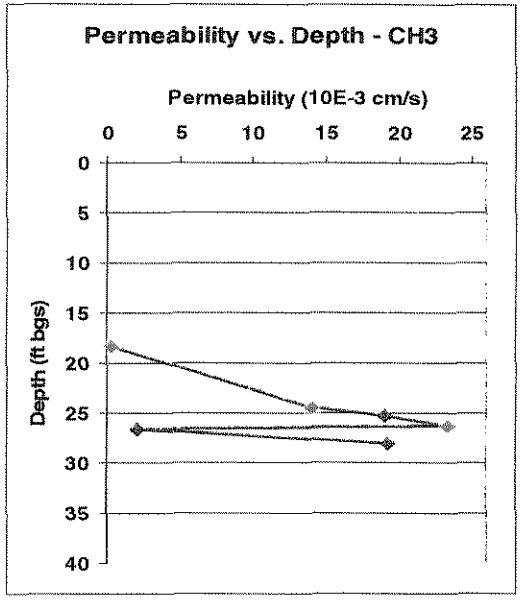

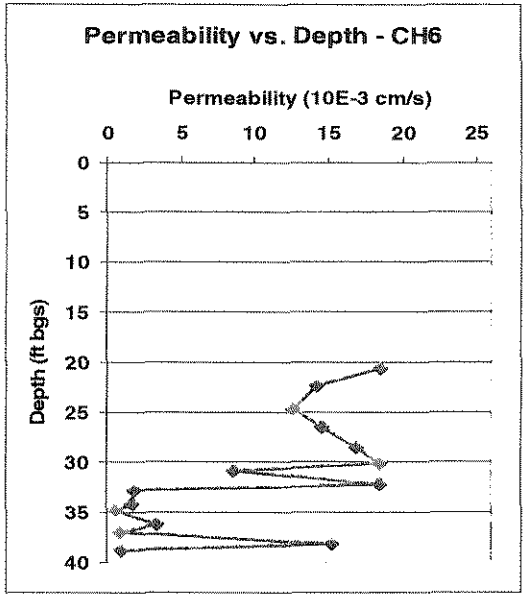

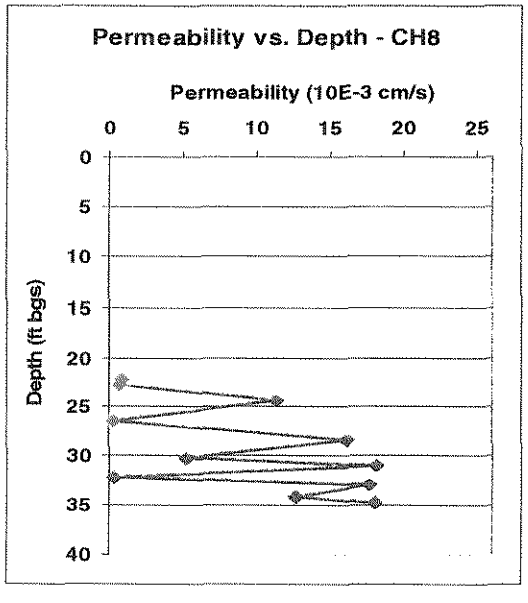

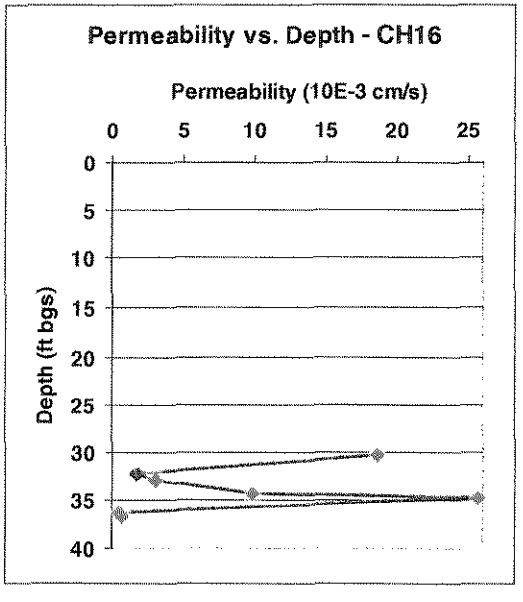

Figure 2-5
Permeability versus Depth
from Borings CH2 - CH16.
(see Figure 2-3
for boring locations)

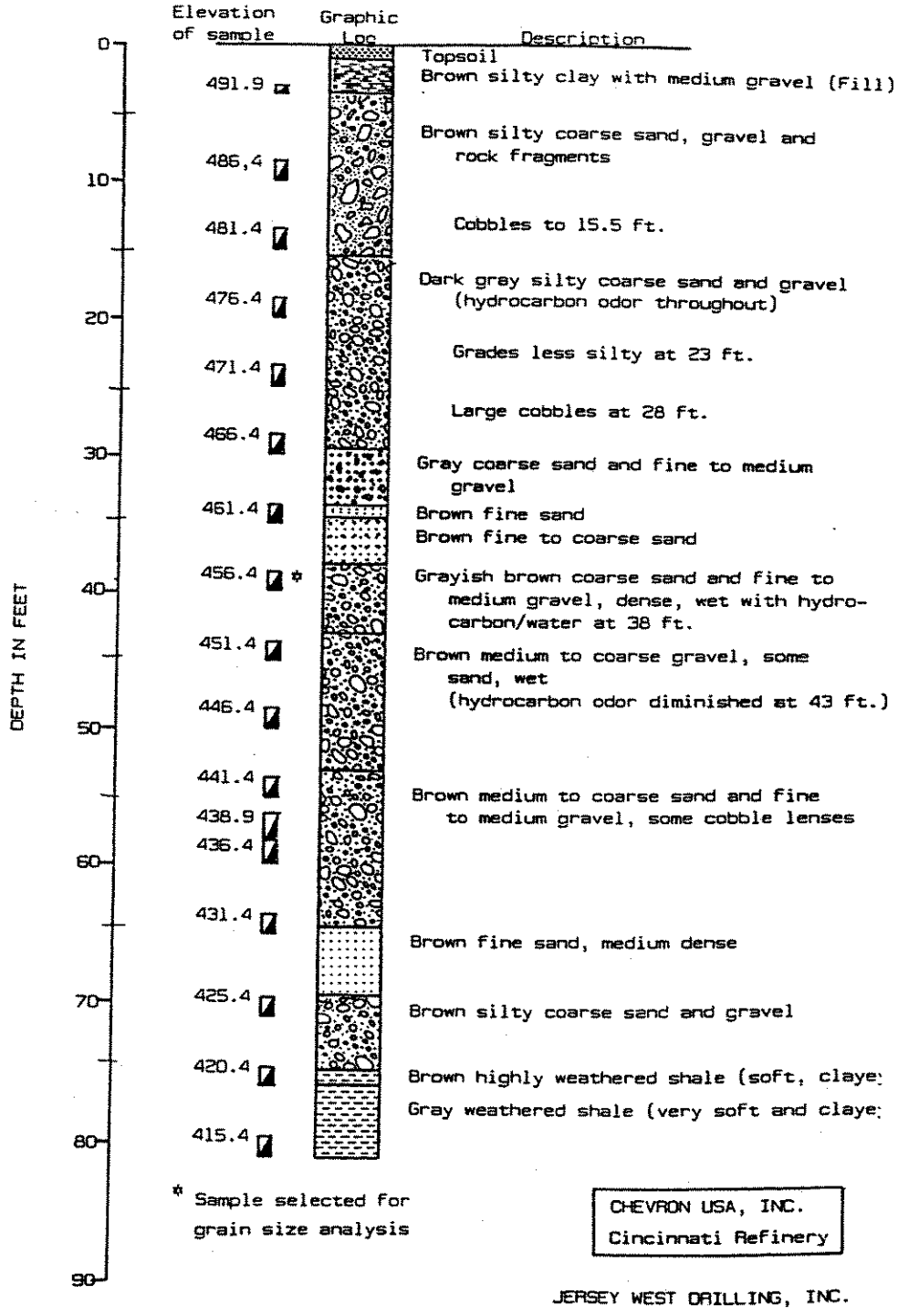

Figure 2-6
Lithology Log of MW-20D

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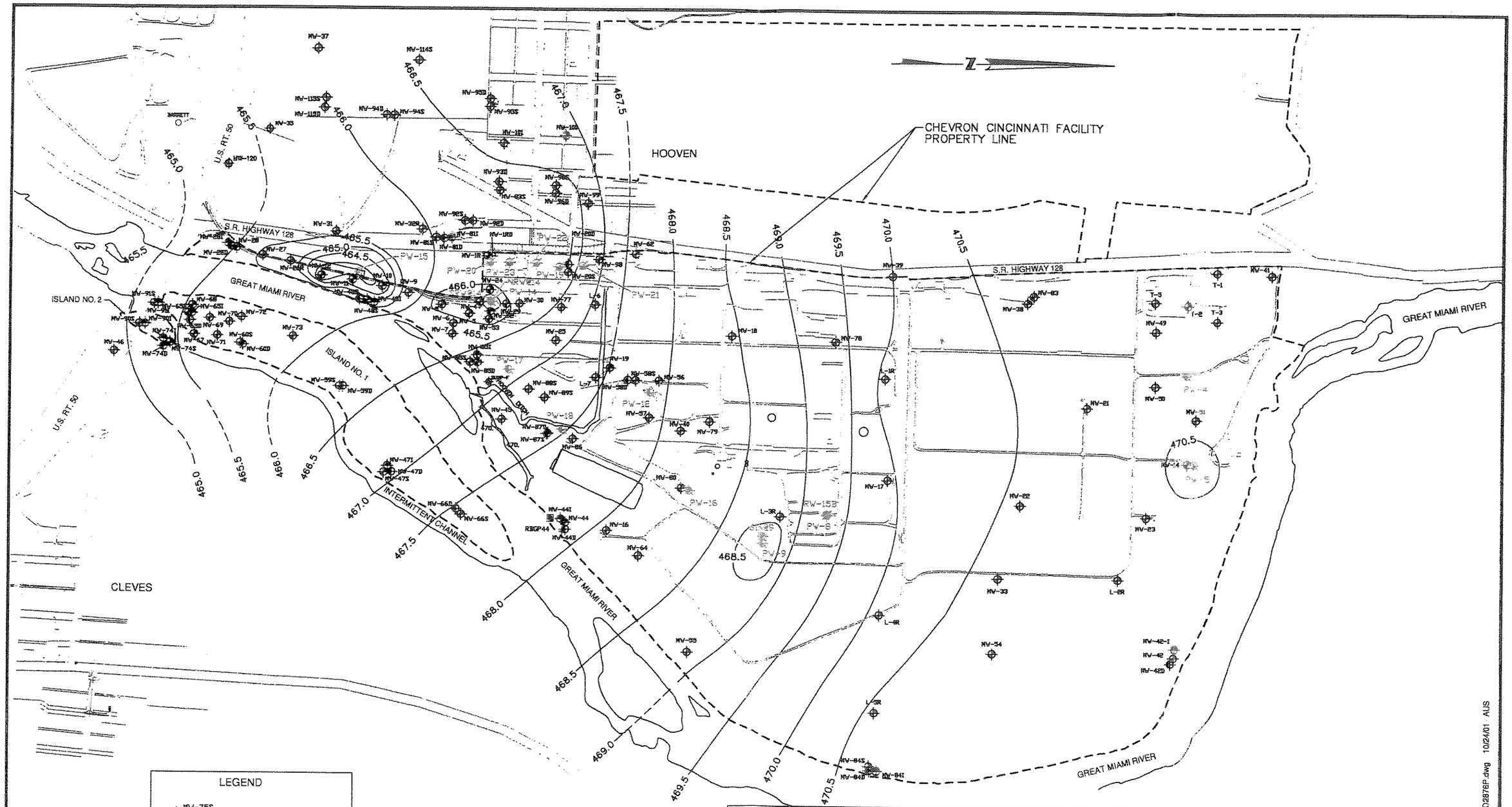

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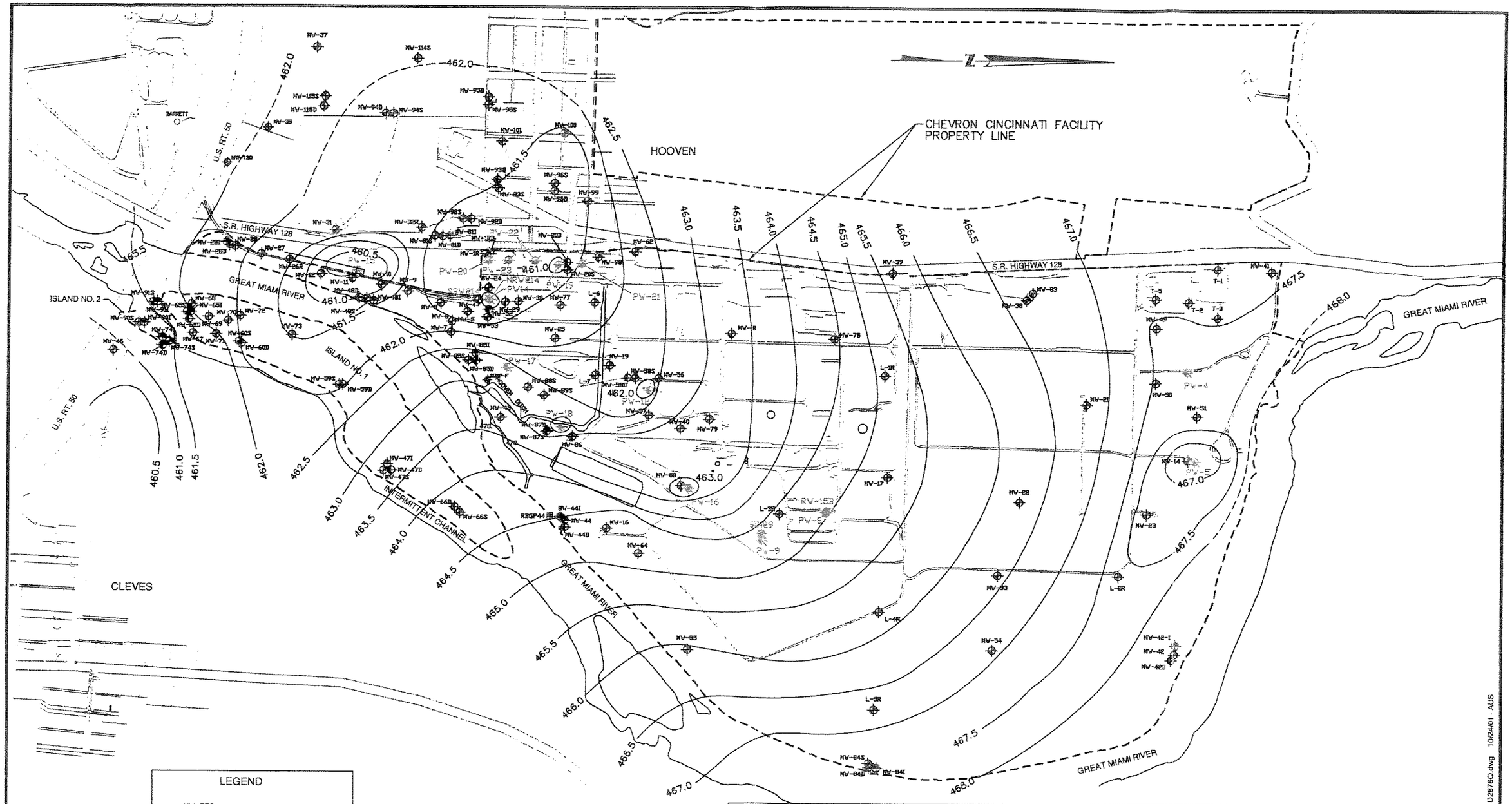
Water Table Contour Map
March 31, 1999; Typical High Water Table
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	APRIL 1999	9905115	Figure 2-7



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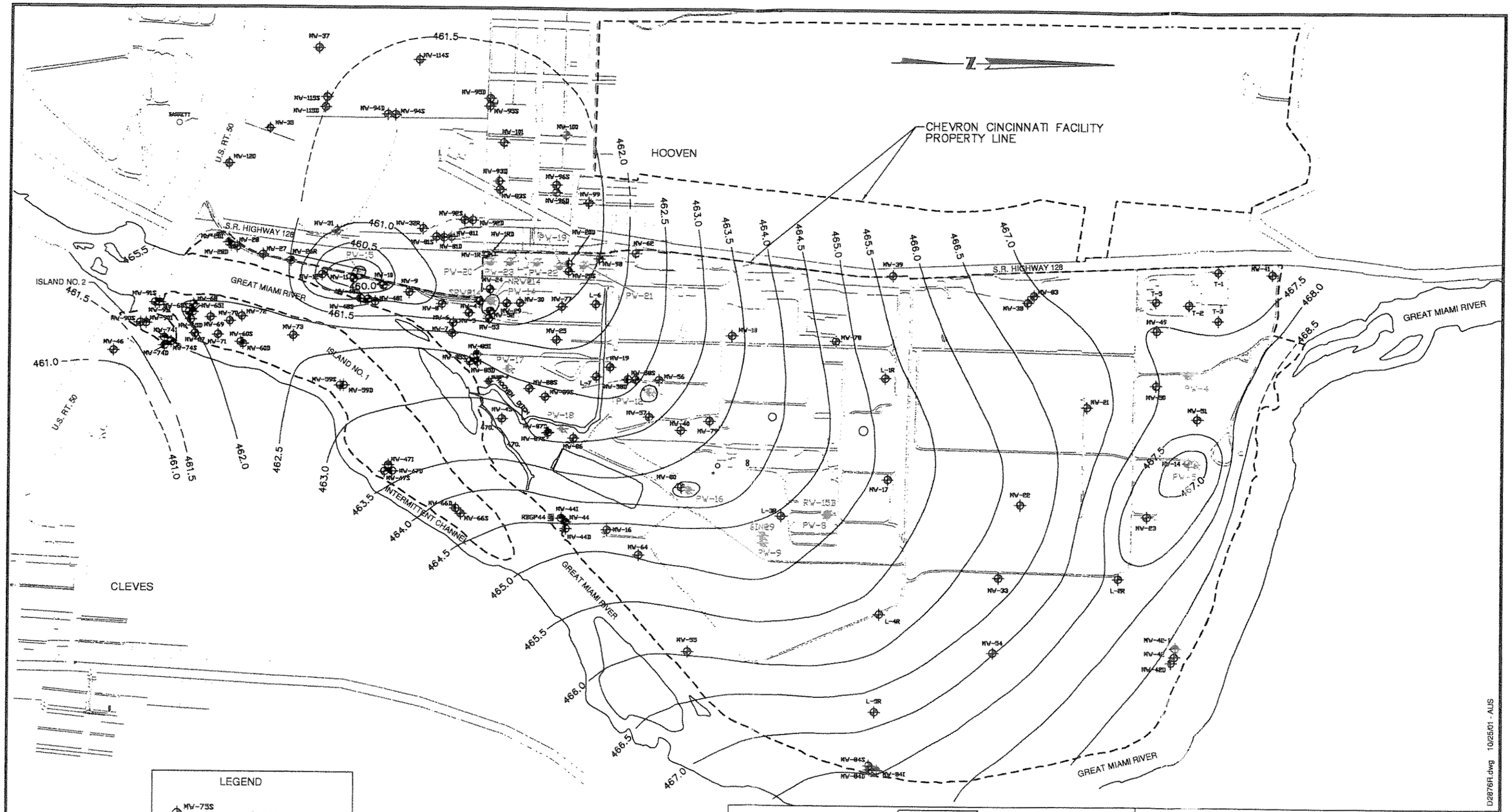
Water Table Contour Map
September 24, 1999; Typical Low Water Table
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	OCT 1999	9905115	Figure 2-8



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Water Table Contour Map
November 22, 1999; Extreme Low Water Table
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	OCT 1999	9905115	Figure 2-9

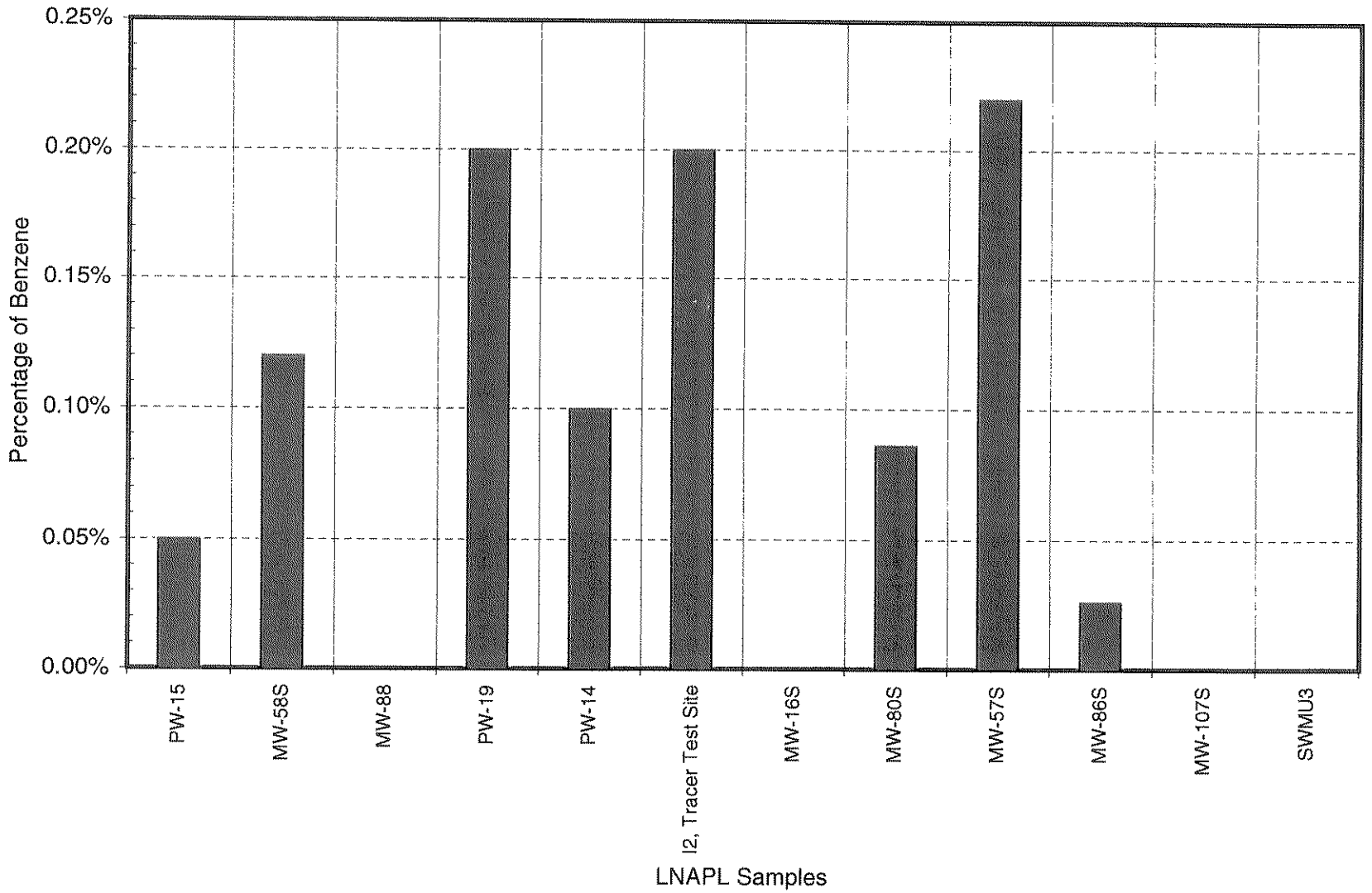


Figure 2.10. Summary of Benzene Analyses of LNAPL Samples

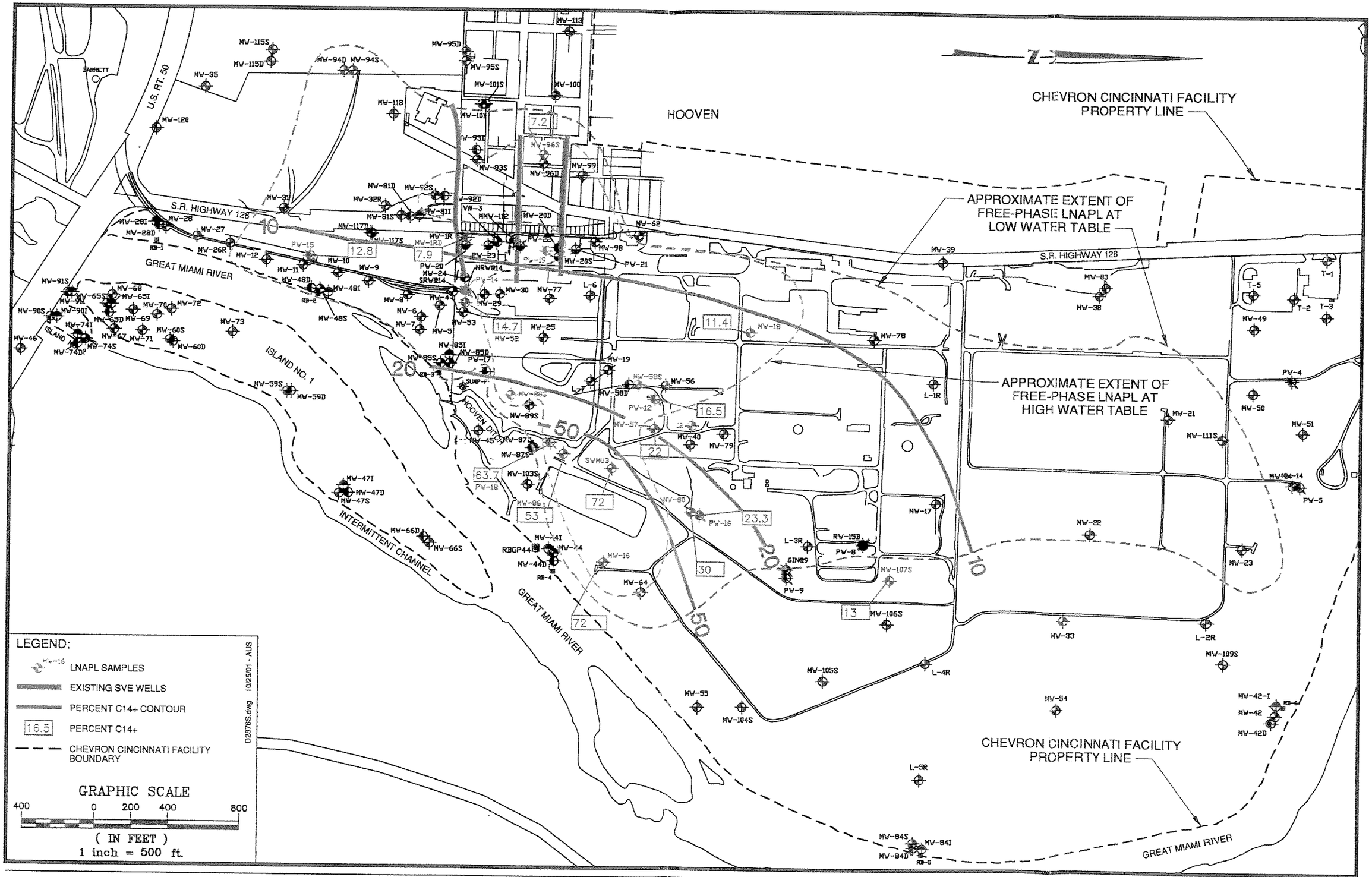
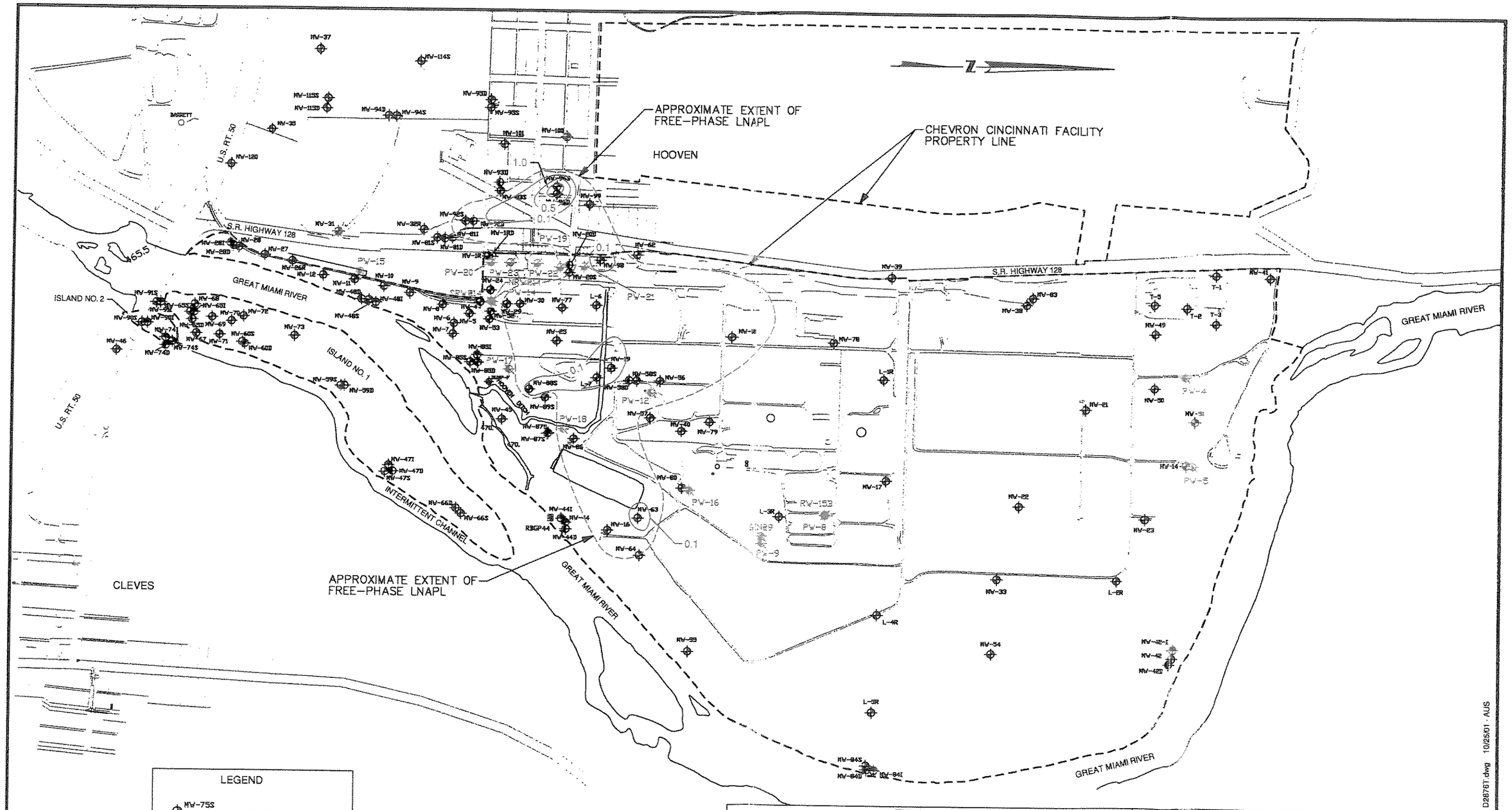


Figure 2-11. Distribution of Hydrocarbon Fractions Heavier than C14



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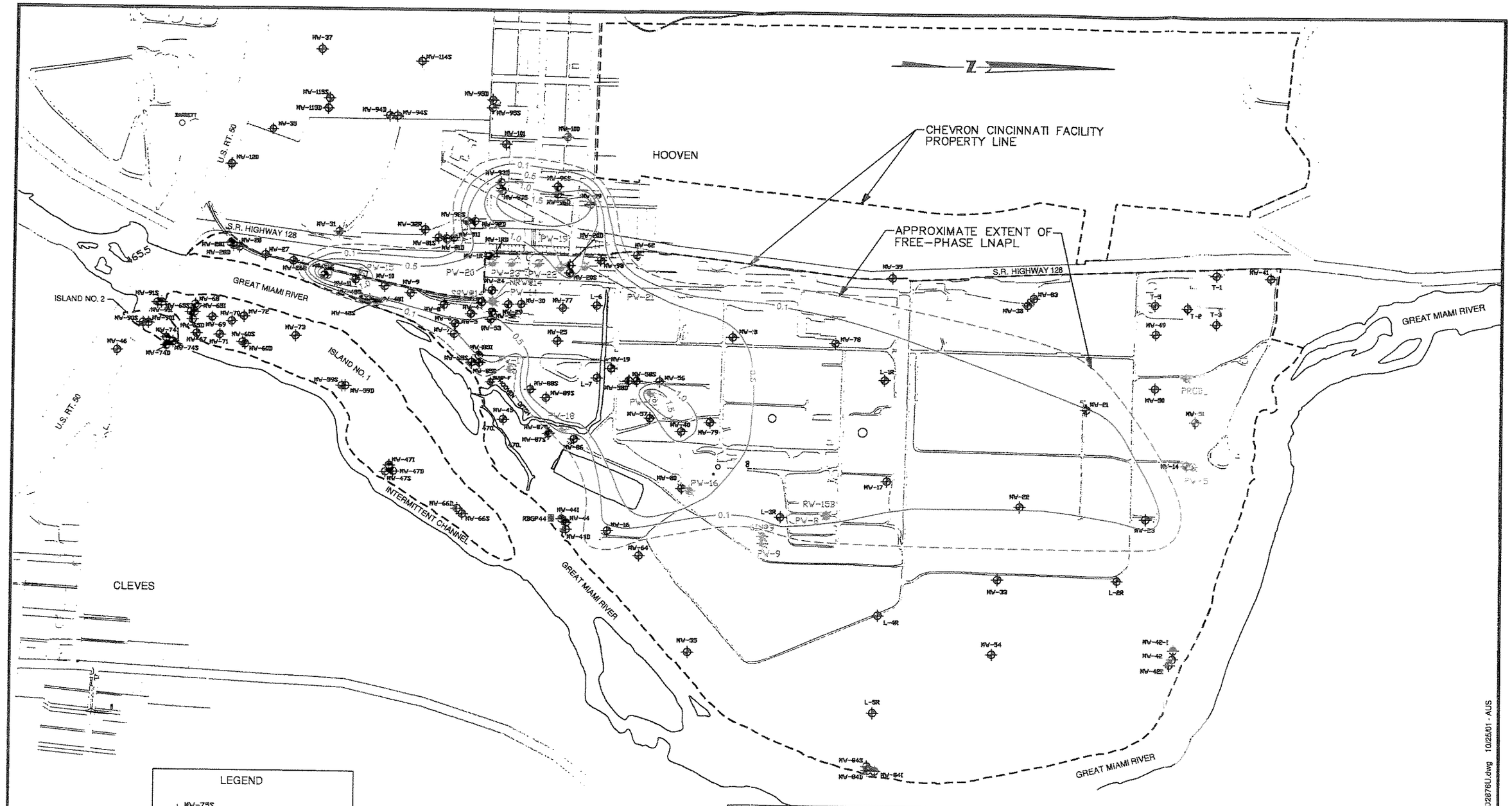
Extent of Free-Phase LNAPL during Typical High Water Table Conditions; March 31, 1999
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	APRIL 1999	9905115	Figure 2-12



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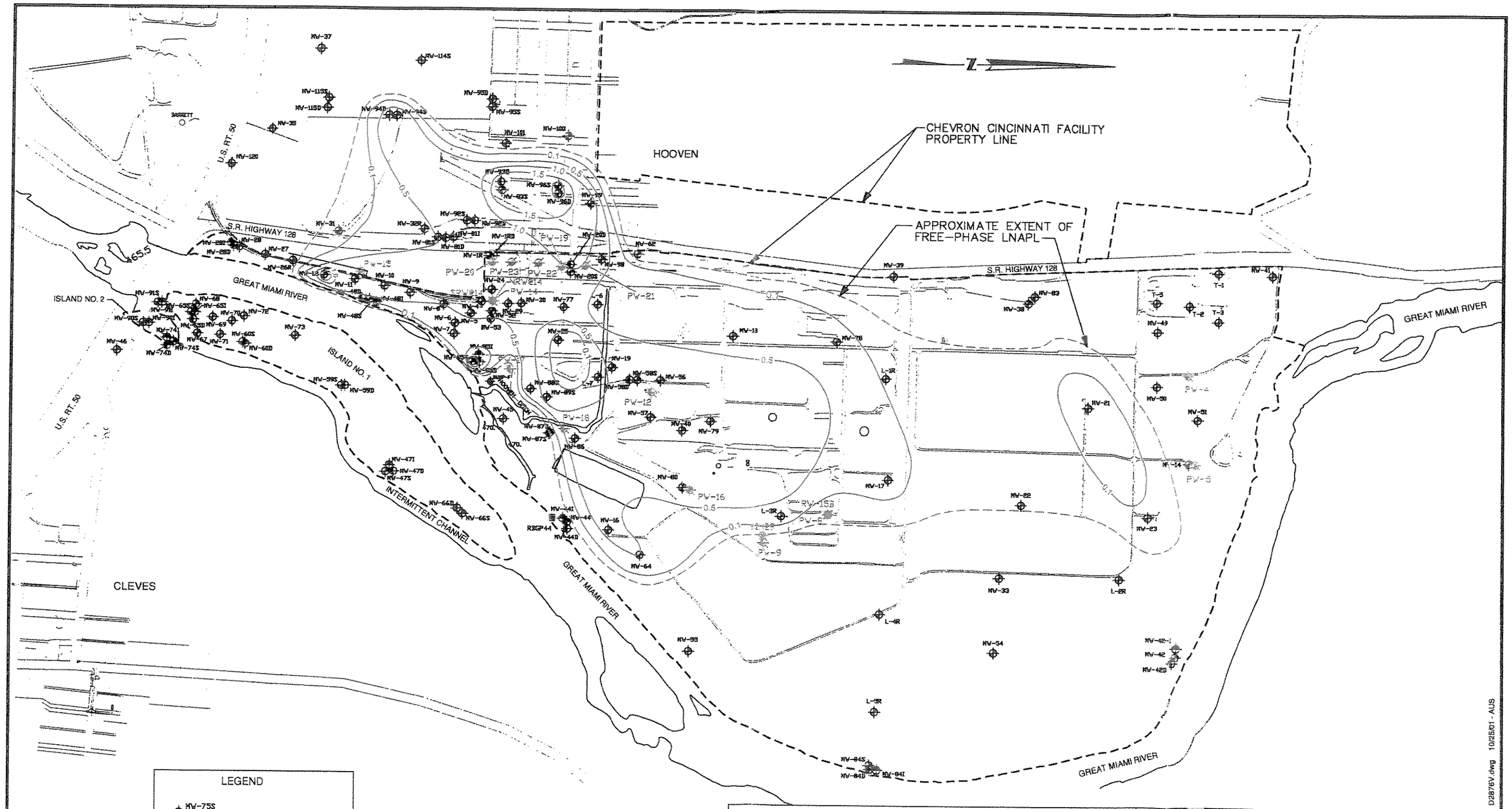
Extent of Free-Phase LNAPL during Typical Low Water Table Conditions; September 24,1999
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	April 1999	9905115	Figure 2-13



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Extent of Free-Phase LNAPL during Extreme Low Water Table; November 22, 1999
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: JK	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY: KCO	AS SHOWN	April 1999	9905115	Figure 2-14

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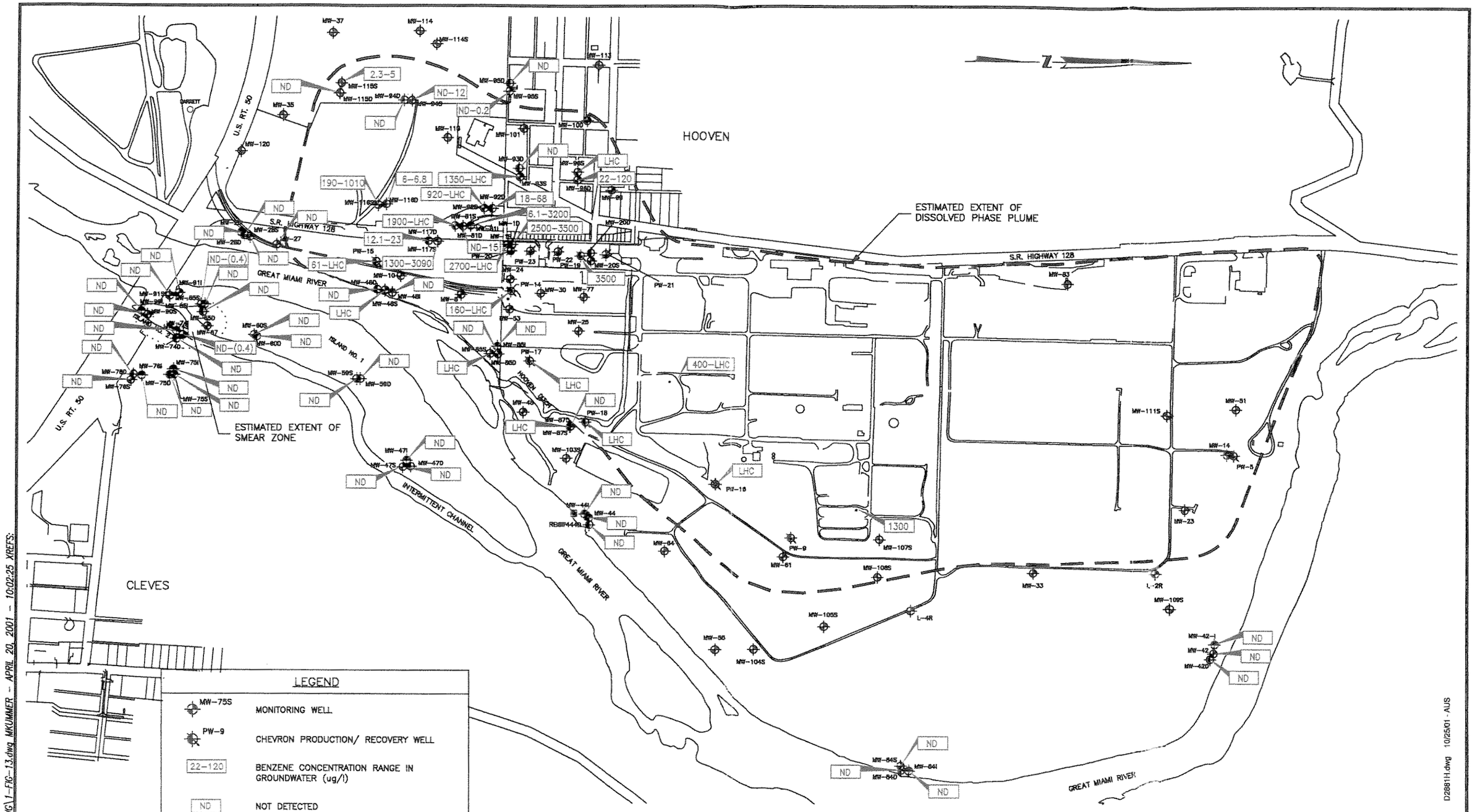

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Benzene Concentrations in Groundwater

CHEVRON PRODUCTS COMPANY
Cincinnati Facility

Hooven, Hamilton County, Ohio

DWN. BY: MTM	SCALE:	DATE:	PROJECT NO:	FIGURE NO:
CHKD. BY: RLB	AS SHOWN	JULY 2000	200049	Figure 2-15

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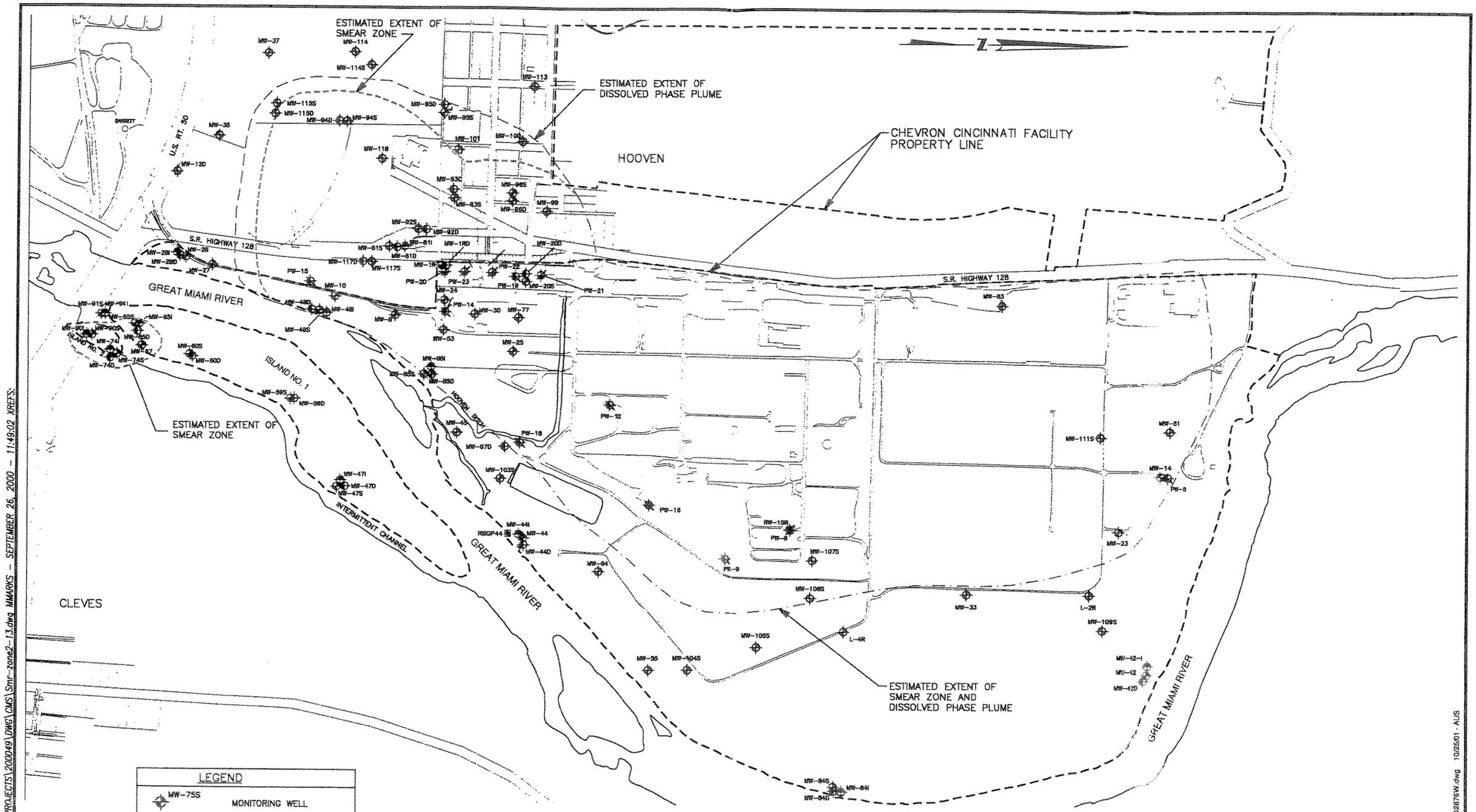

LEGEND

MW-75S	MONITORING WELL
PW-9	CHEVRON PRODUCTION/ RECOVERY WELL
	ESTIMATED EXTENT OF SMEAR ZONE
	ESTIMATED EXTENT OF DISSOLVED PHASE PLUME
	ESTIMATED EXTENT OF SMEAR ZONE AND DISSOLVED PHASE PLUME

SCALE: 1"= 600'

0 600 1200

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Estimated Extent of LNAPL Smear Zone and Dissolved Phase Plume
CHEVRON PRODUCTS COMPANY
Cincinnati Facility
Hooven, Hamilton County, Ohio

DWN. BY: MEB	SCALE:	DATE:	PROJECT NO:	FIGURE NO:
CHKD. BY: RLB	AS SHOWN	JULY 2000	200049	Figure 2-16

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CHEVRON CINCINNATI FACILITY PROPERTY LINE

Legend

MW-55 — Existing Monitoring Well to be Sampled

PW-16 — Existing Production Well to be Sampled

MW-81S 23 — Concentration of Total Arsenic Detected during Phase II RFI (ug/L)

MW-96S (<10) — Concentration of Total Arsenic Detected during Phase I RFI or subsequent Hooven Investigation (ug/L)

20 — Arsenic concentration Isopleth (dashed where uncertain)

GRAPHIC SCALE

300 0 150 300 600

(IN FEET)

Figure 2-17
Arsenic in Groundwater Isopleth Map

RCRA Facility Investigation
Chevron Products Company
Cincinnati Facility
Hooven, Ohio
4898005

Environmental Science & Engineering, Inc.
A MACTEC Company

RED 01/13/00 chevron/rfireport
Revised RED 03/08/00 arsgwiso

D2876X.DWG 10/25/01 - AUS

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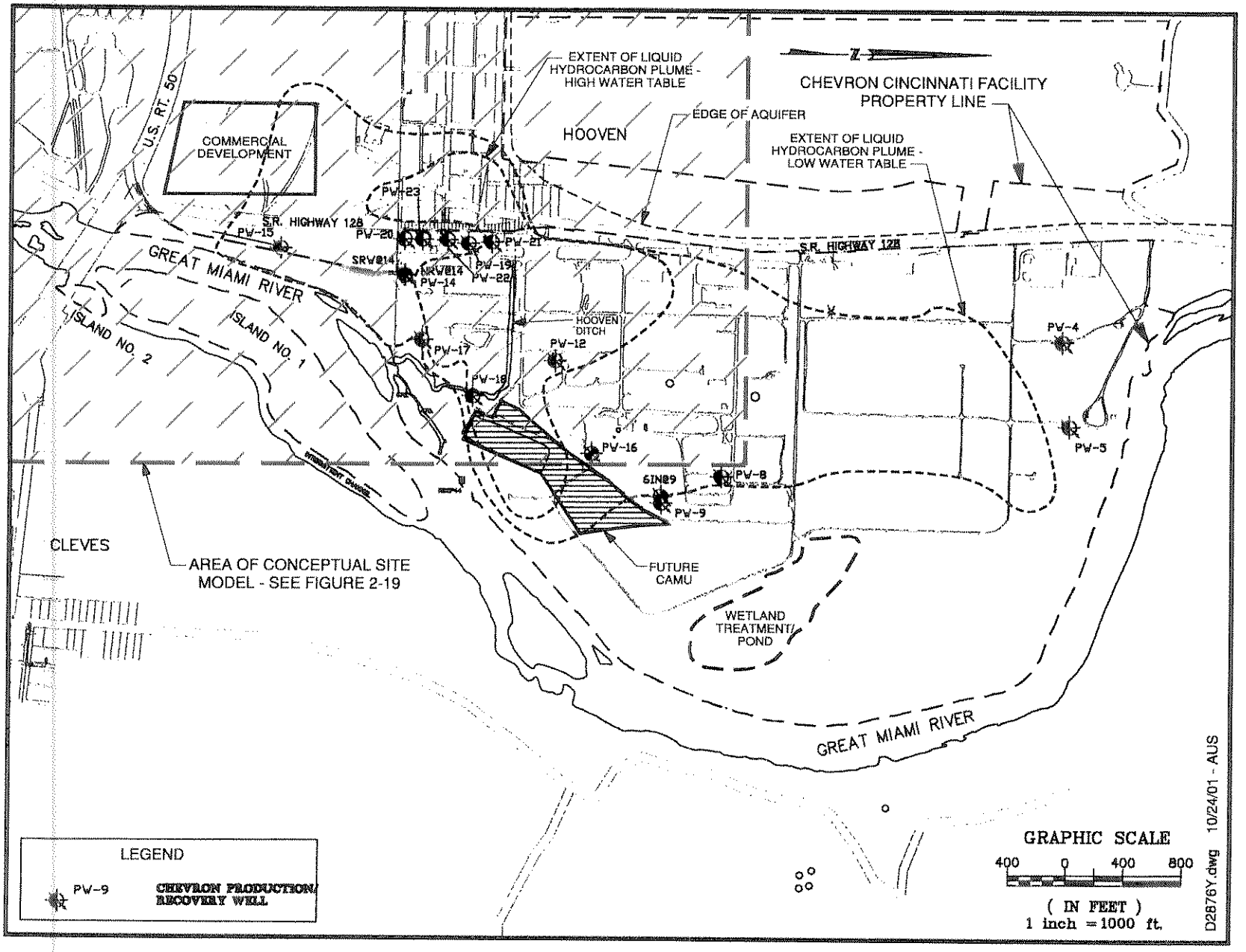


Figure 2-18. Site Map

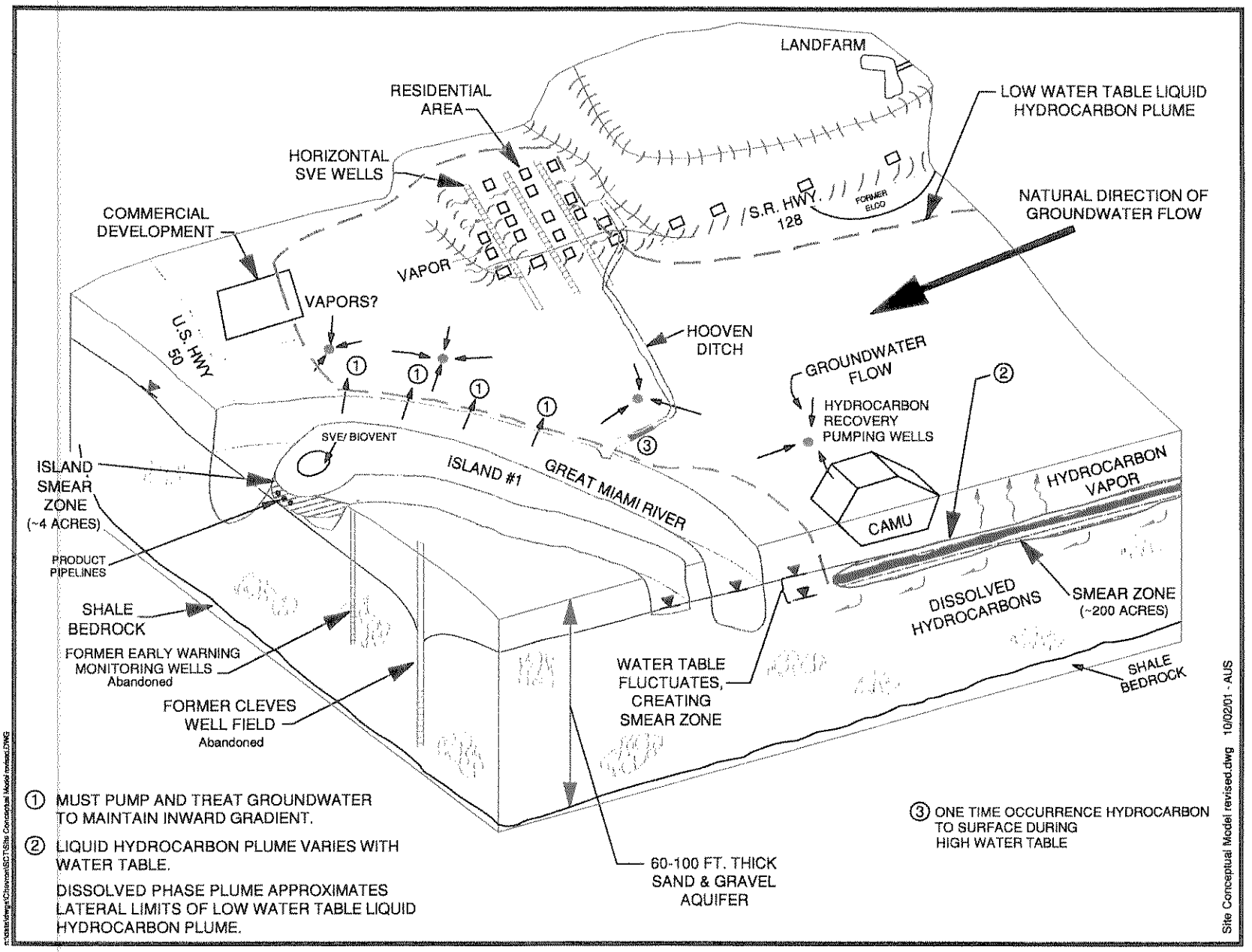
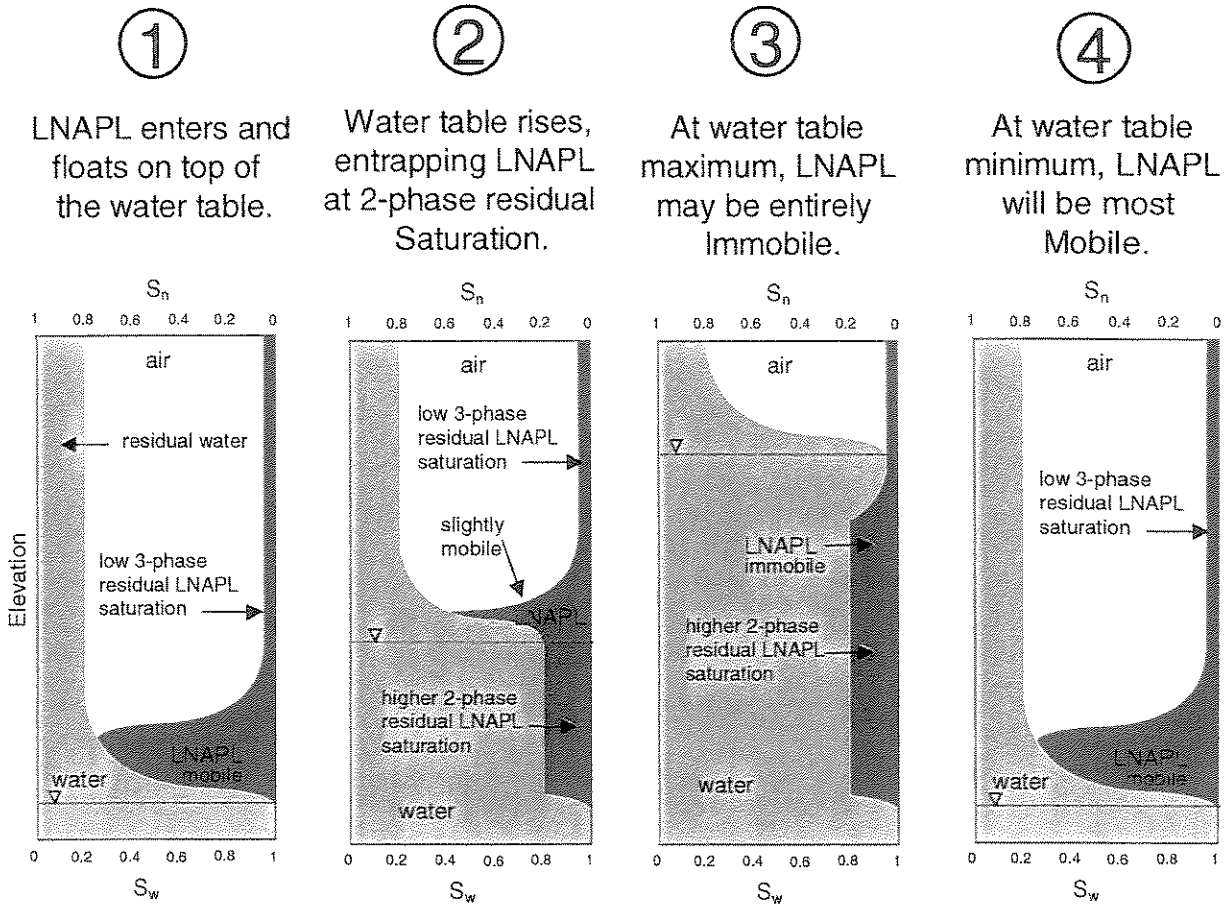


Figure 2-19. Site Conceptual Model, CHEVRON CINCINNATI FACILITY



Note: S_w = Saturation of water, S_n = Saturation of LNAPL

Figure 2-20

Schematic of LNAPL Redistribution by a Fluctuating Water Table

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Fig1.CDR-9/19/01-GRA

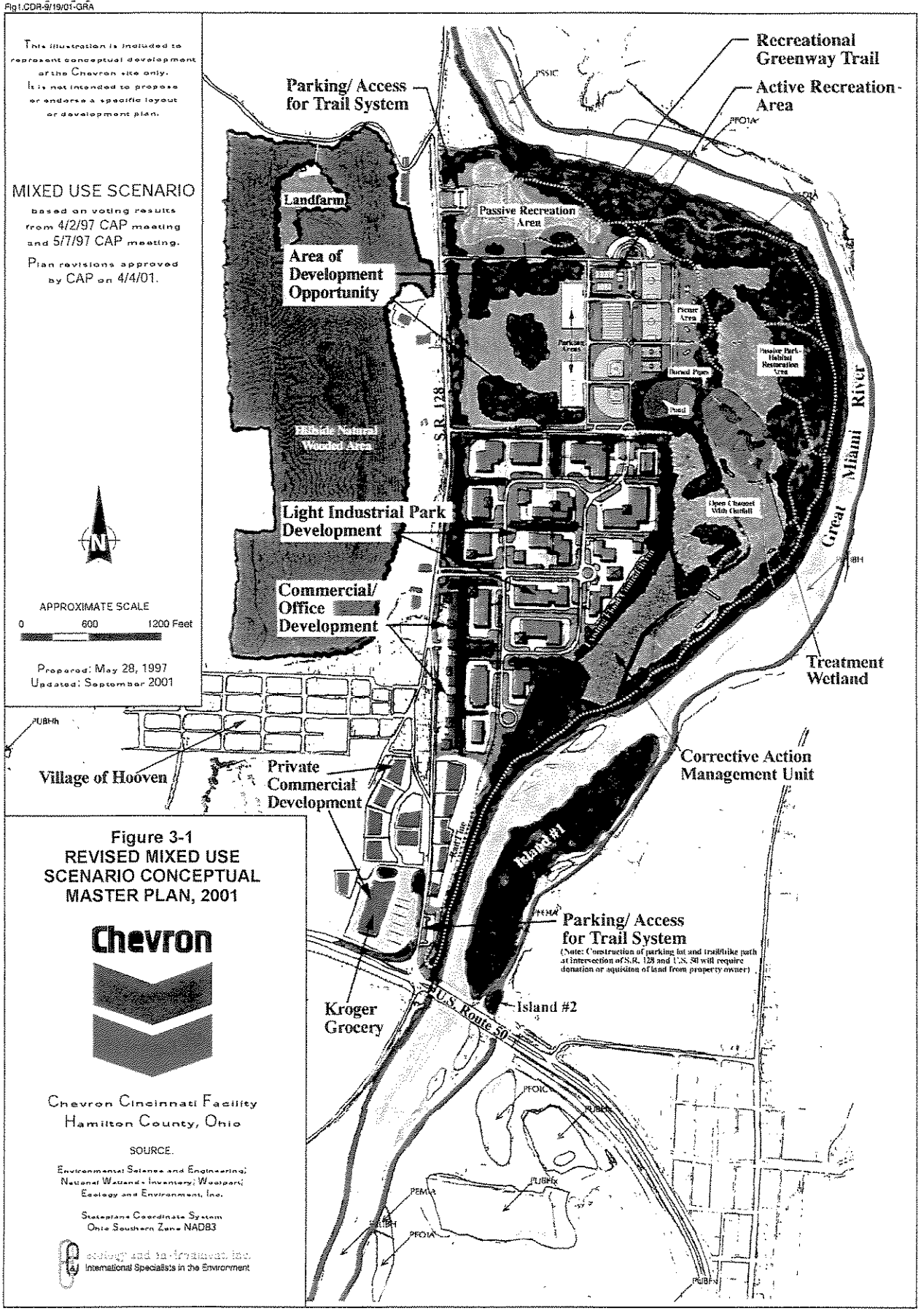


Figure 3-1
REVISED MIXED USE SCENARIO CONCEPTUAL MASTER PLAN, 2001

Chevron

Chevron Cincinnati Facility
Hamilton County, Ohio

SOURCE:

Environmental Science and Engineering; National Wetland Inventory; Westport; Ecology and Environment, Inc.

Stateplane Coordinate System
Ohio Southern Zone NAD83

ecology and environment, inc.
International Specialists in the Environment

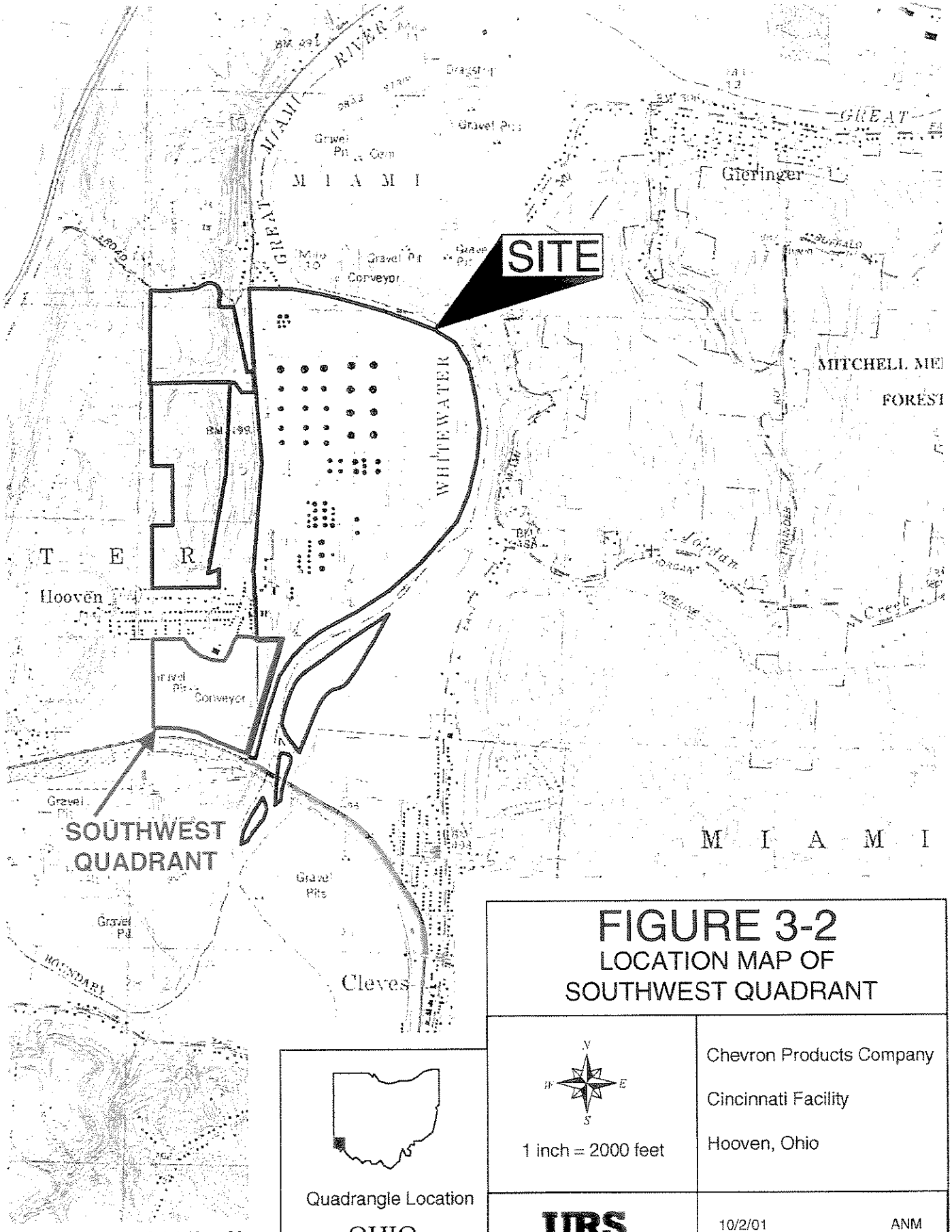
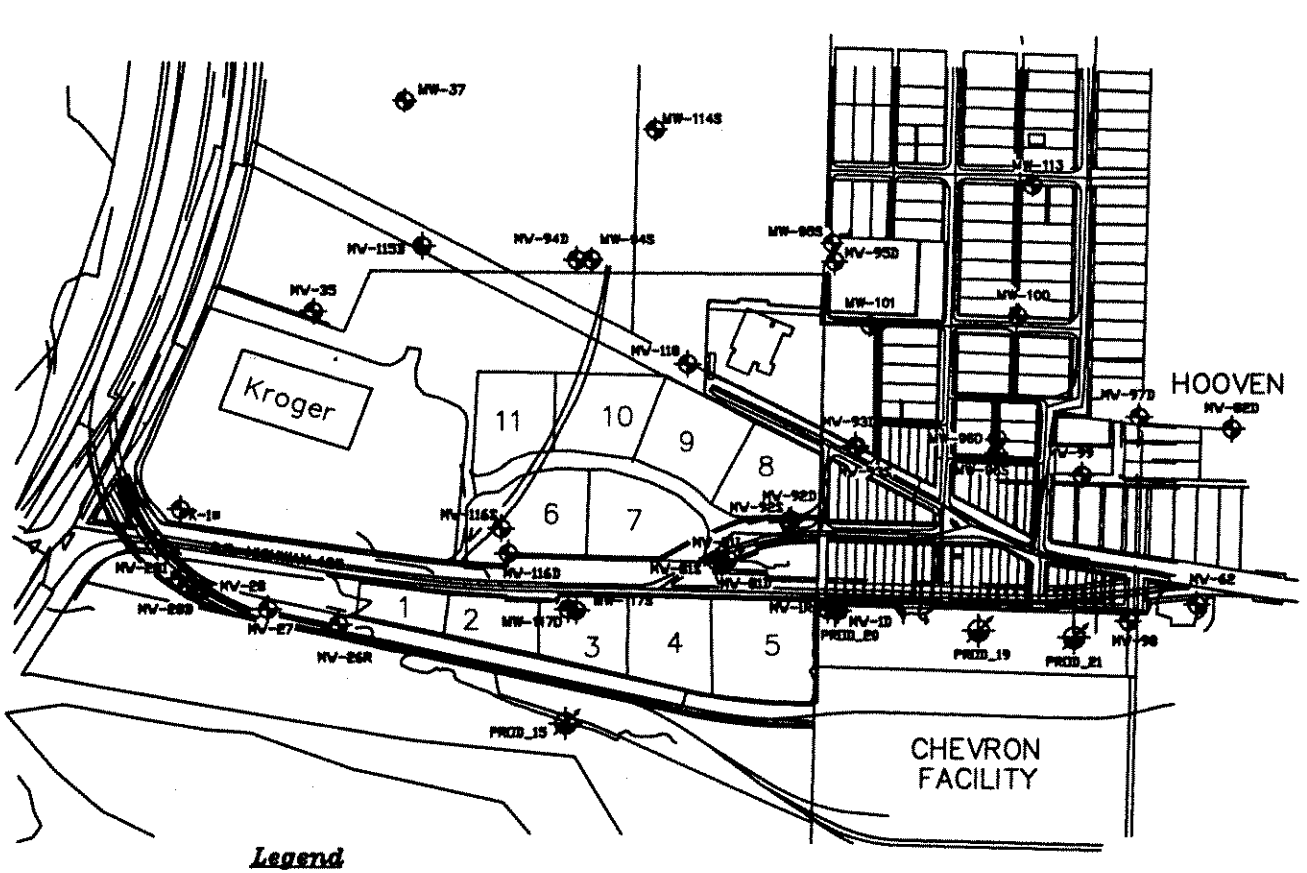


FIGURE 3-2
LOCATION MAP OF SOUTHWEST QUADRANT

Adapted from United States Geological Survey 7.5 Minute Series 1996, Hooven and Addyston Quadrangles



Legend

- 7 — Golsch parcels in Southwest Quadrant
- MW-26R — Monitoring Well Location
- PROD_15 — Chevron Facility Production Well Location

* MW-K-1 has been abandonded *

approx.
0 400 800
feet

Figure 3-3
Southwest Quadrant and Hooven Area

Chevron Products Company
Managed by Chevron EMC
Cincinnati Facility
Hooven, Ohio
Hamilton County

Harding ESE
A MACTEC Company

KTK 5/21/01
Revised * *

chevoogle
quadbase

D2881B 08/30/01 - AUS

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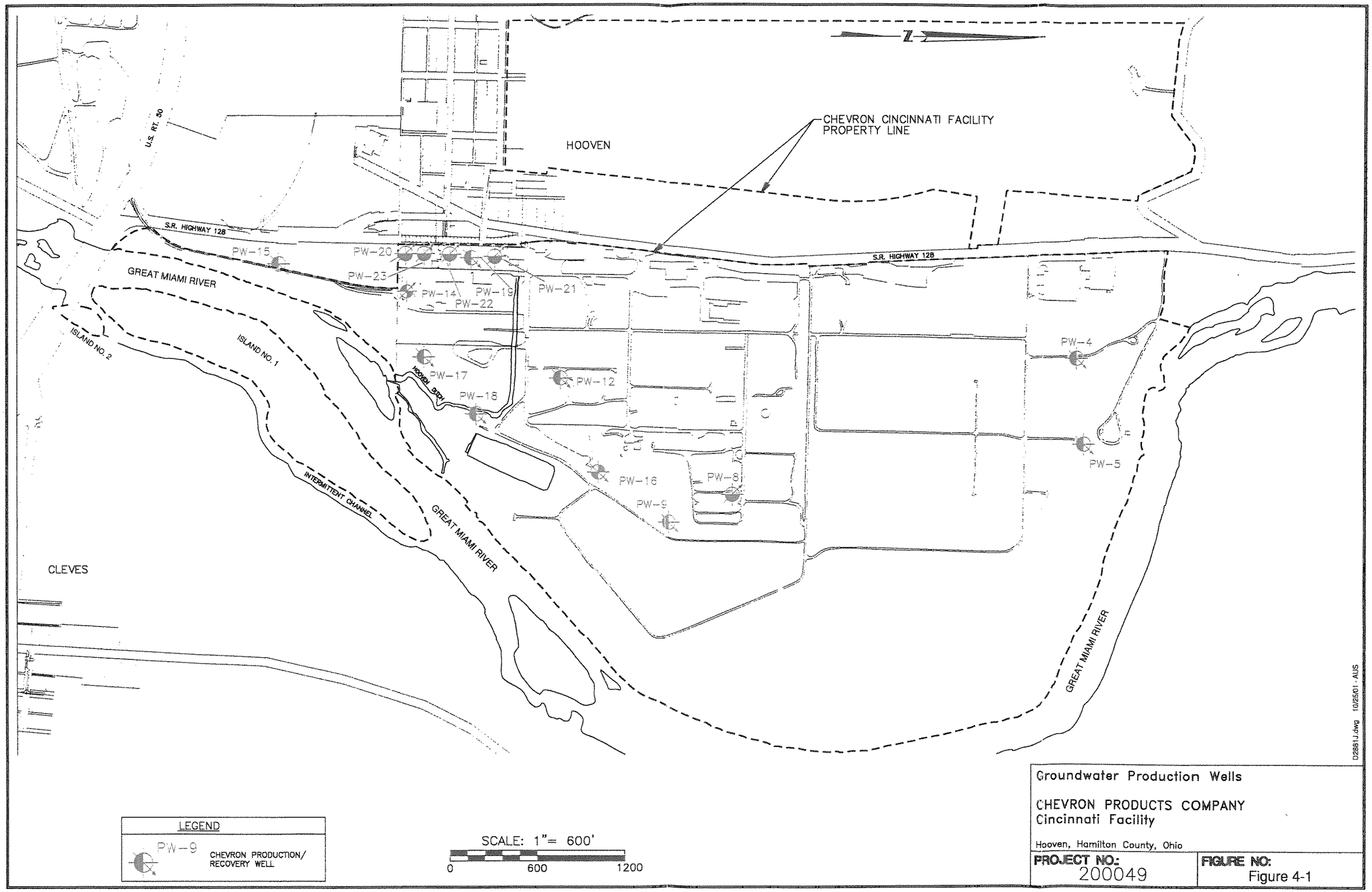


Groundwater Production Wells

CHEVRON PRODUCTS COMPANY
Cincinnati Facility

Hooven, Hamilton County, Ohio

PROJECT NO:	FIGURE NO:
200049	Figure 4-1

controlled by measuring the effluent dissolved oxygen (DO) concentration and the oxygen feed is set so that the effluent DO remains at 1.5 mg O_2/L (see Figure 4-2).

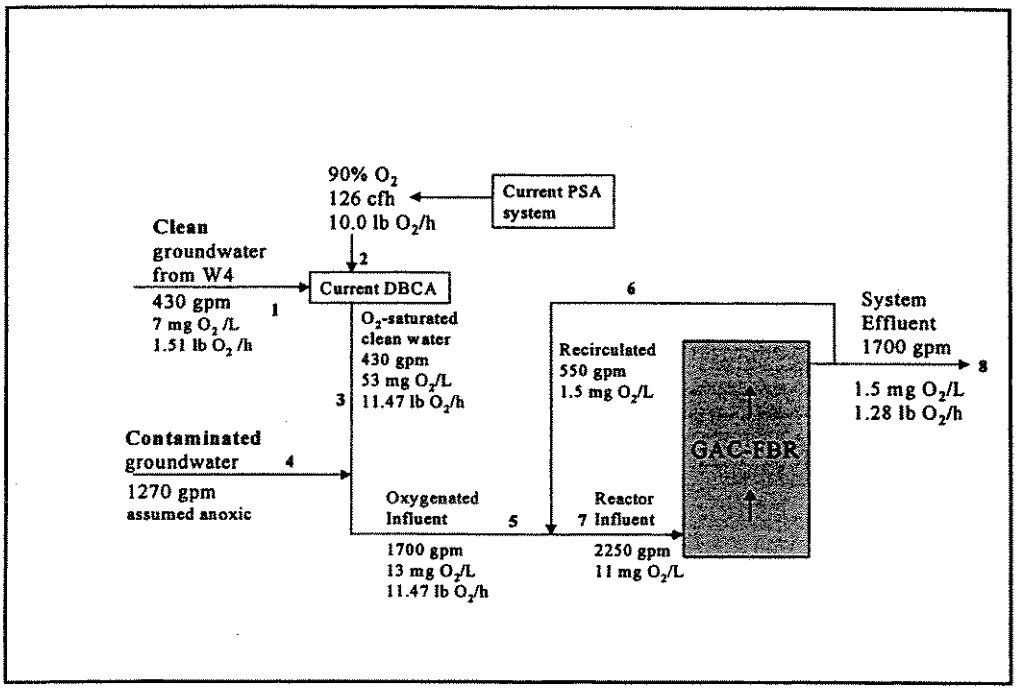


Figure 4-2
Chevron Cincinnati GAC-FBR System Schematic for High Water Table Operation

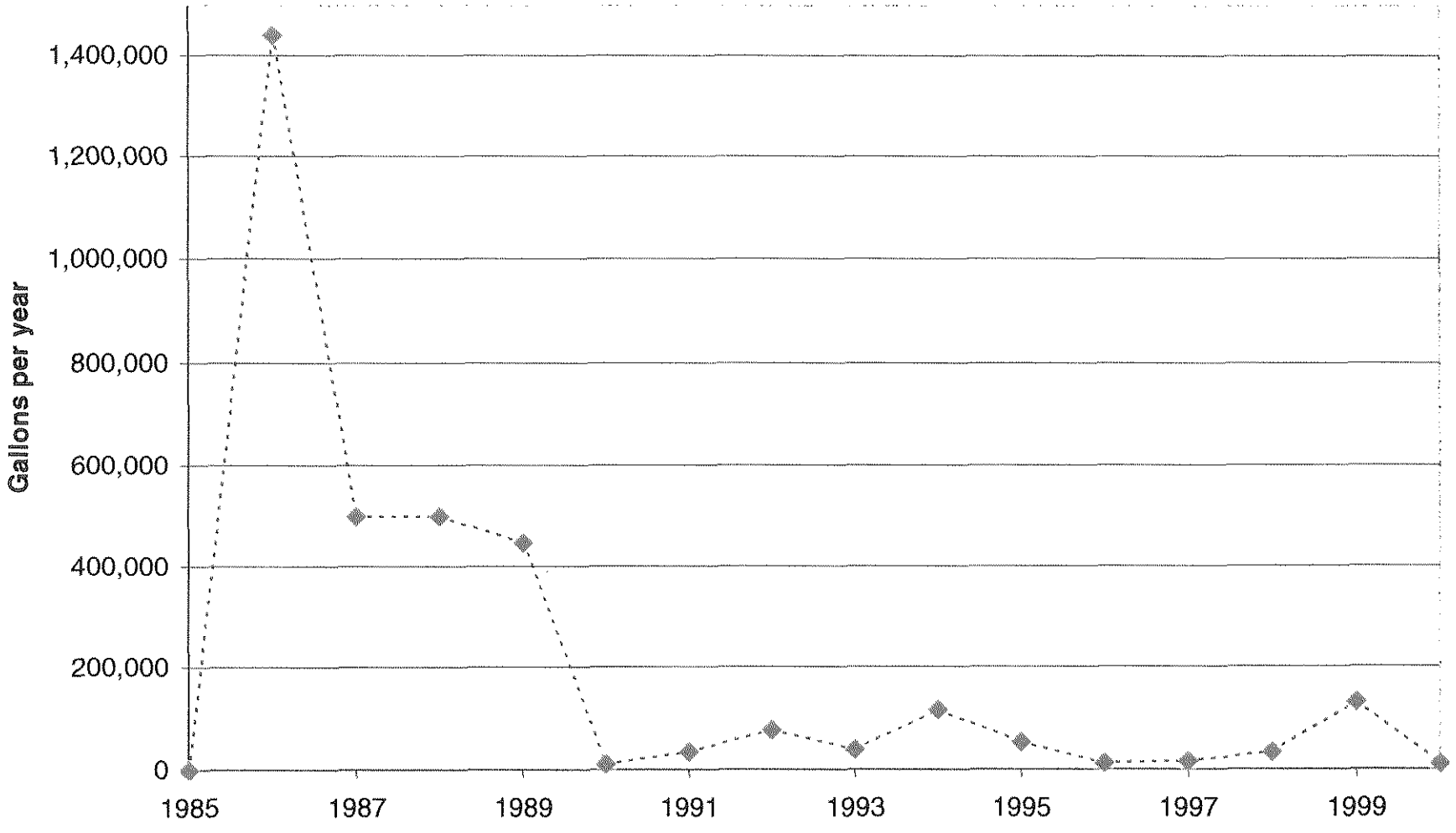
During fall and winter, the focus of the pump-and-treat operation shifts to free-phase LNAPL recovery. As a result, the groundwater pumping rate may double, to 3400 gpm, of which 860 gpm is clean oxygen carrier water from PW 4 or 5. This requires that both treatment trains be used; in essence two of the systems depicted in Figure 4-2 are operated in parallel. At times, the system is oxygen-limited, i.e., even with the full 340 cfh oxygen generating capacity in use, the water flow rate must be reduced to meet the 1.5 mg O_2/L parameter in the system effluent.

The effluent from the FBR system is conveyed to an impoundment where it is polished before discharge to the Great Miami River.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Figure 4-3: Summary of Chevron Cincinnati Facility Free-Phase LNAPL Recovery



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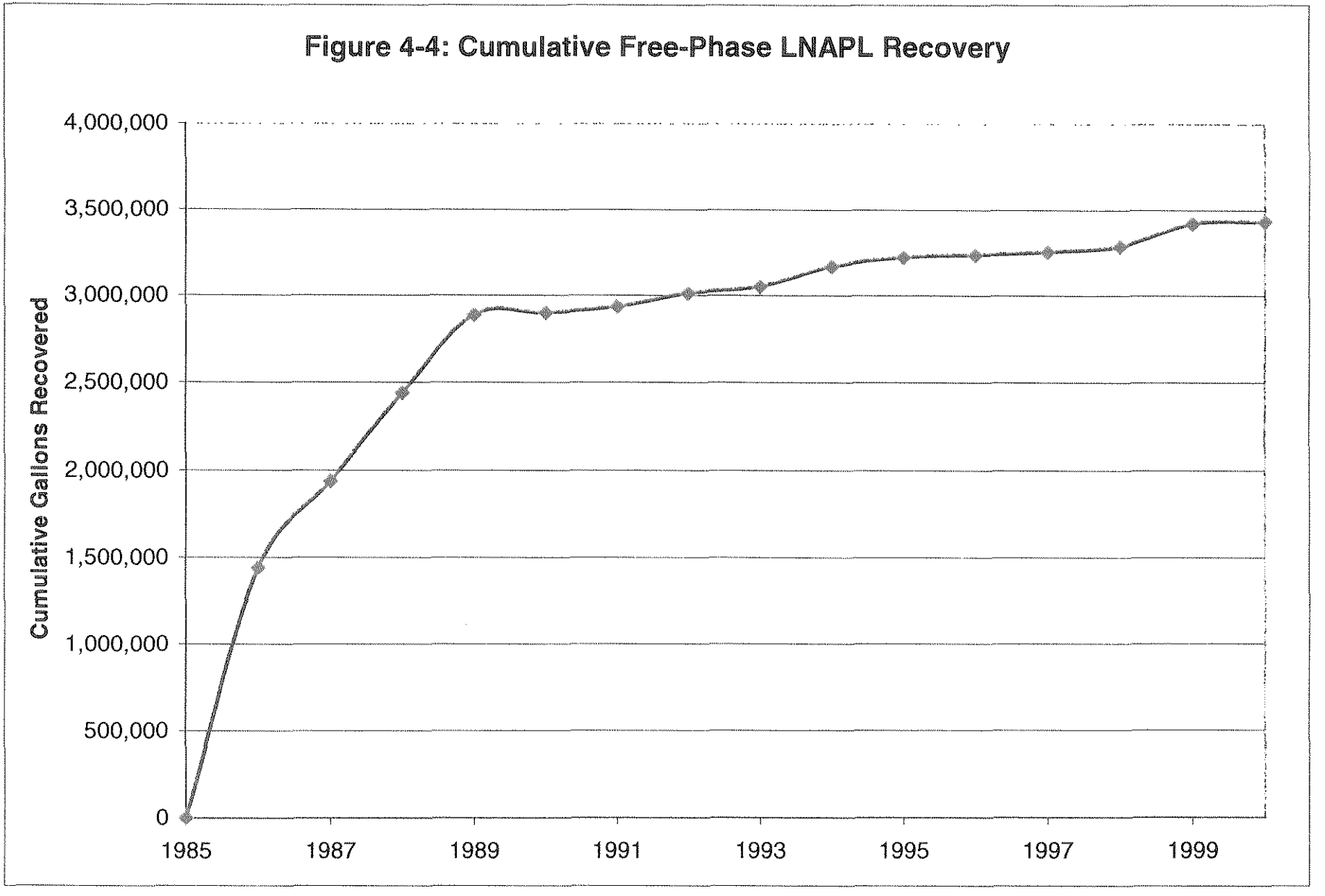

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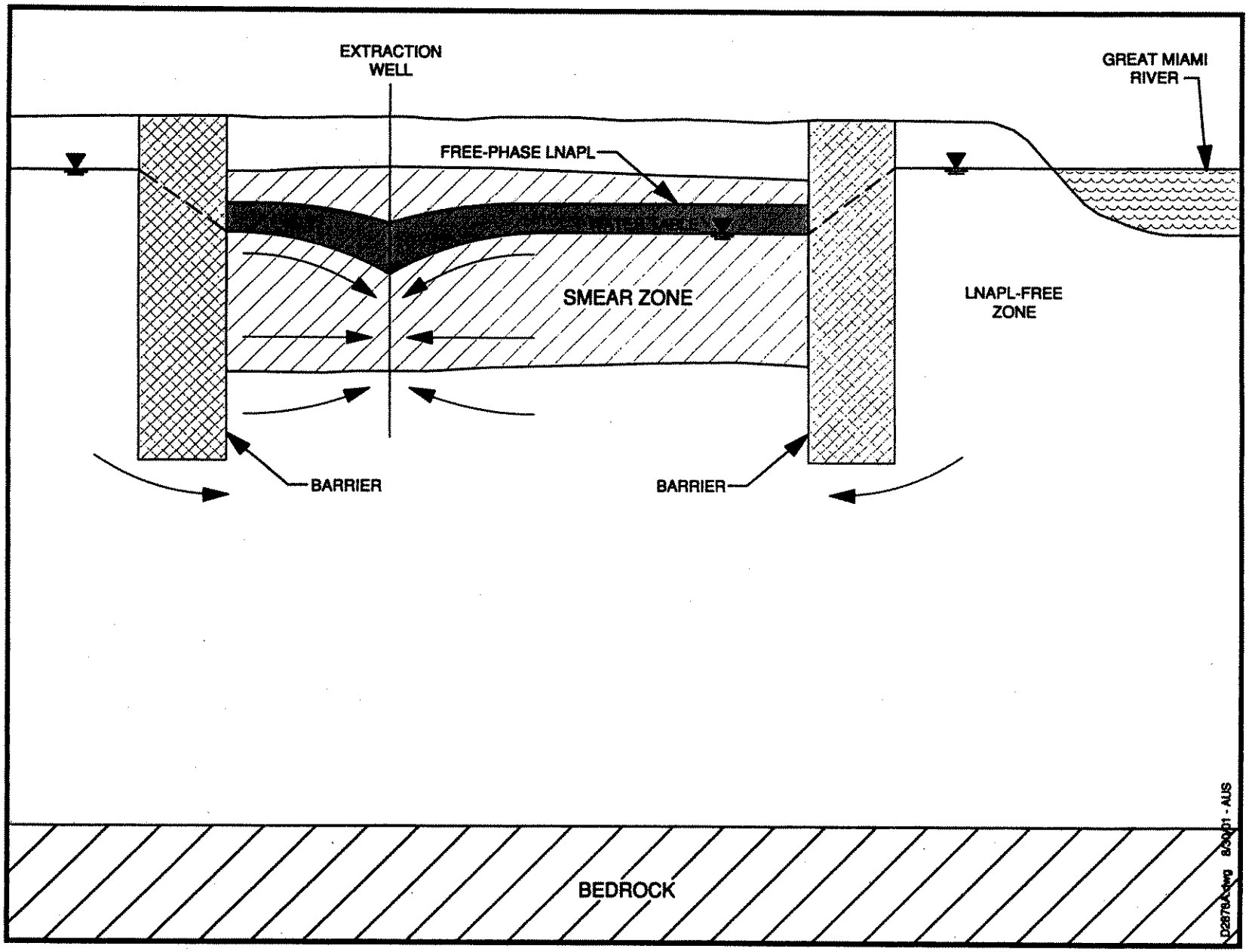

Figure 6-1. Conceptual Design of Partially-Penetrating Barriers at the Chevron Cincinnati Facility

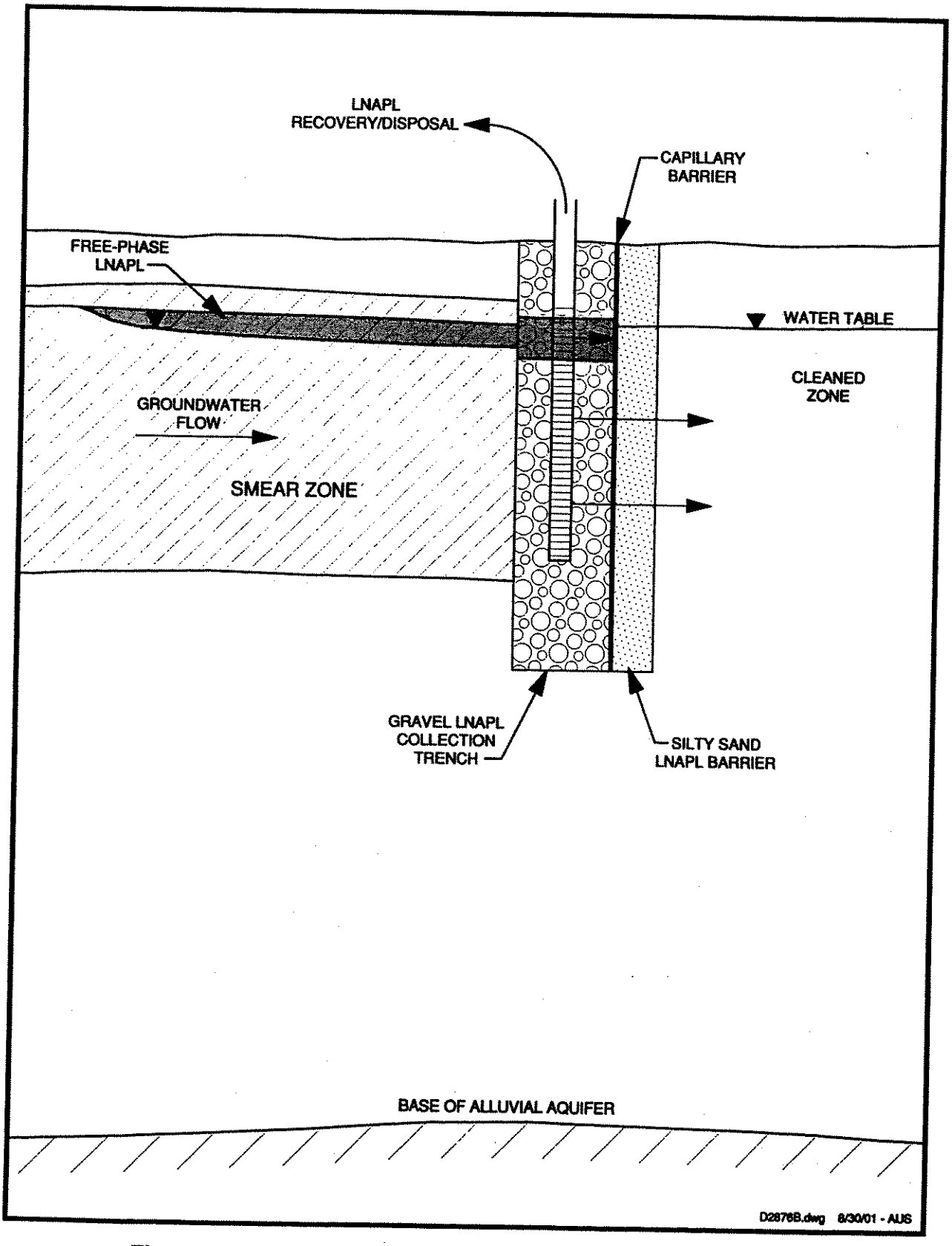

Figure 6-2. Conceptual Design of Capillary Barrier System at the Chevron Cincinnati Facility

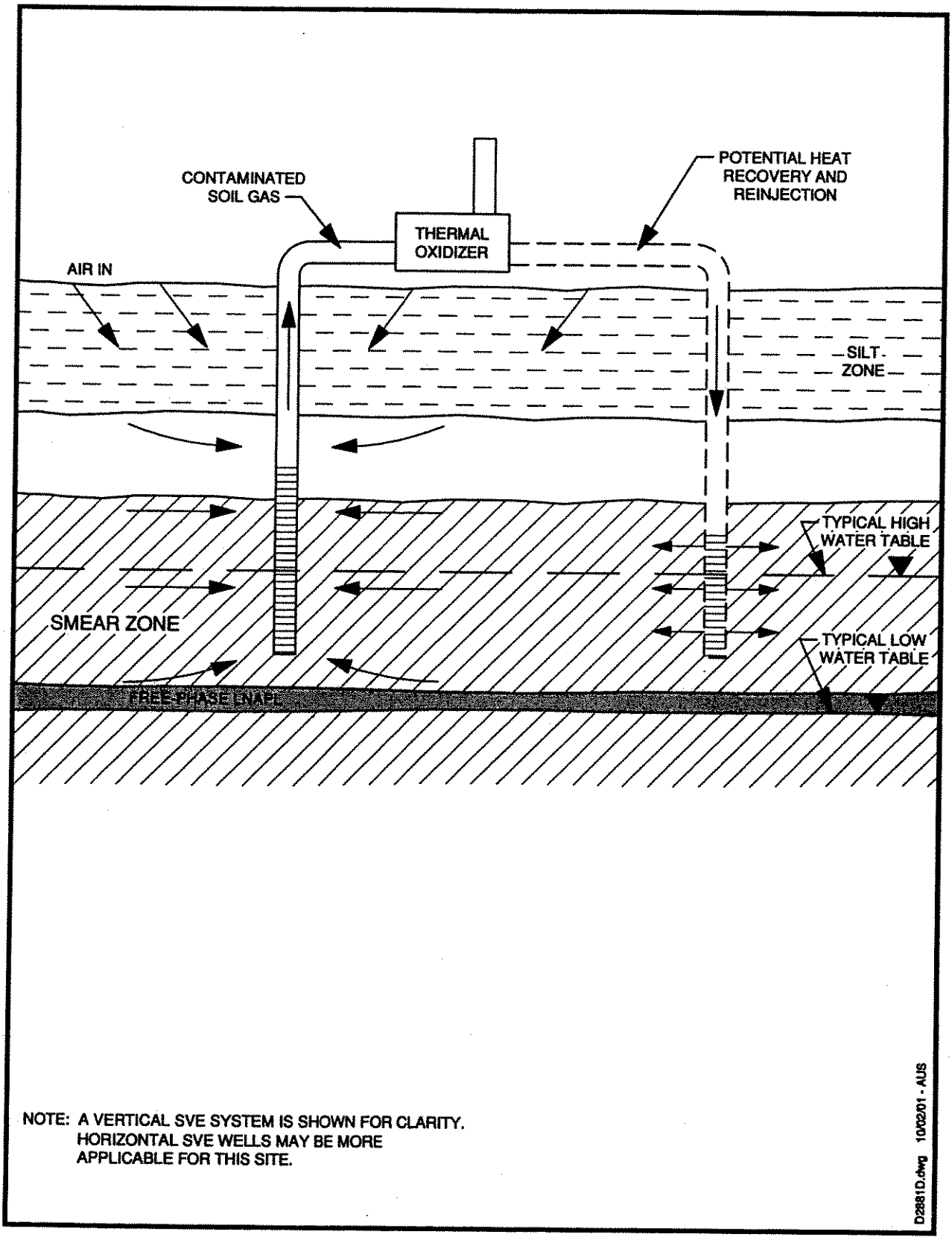

Figure 6-3. Conceptual Design of SVE at the Chevron Cincinnati Facility

US EPA ARCHIVE DOCUMENT

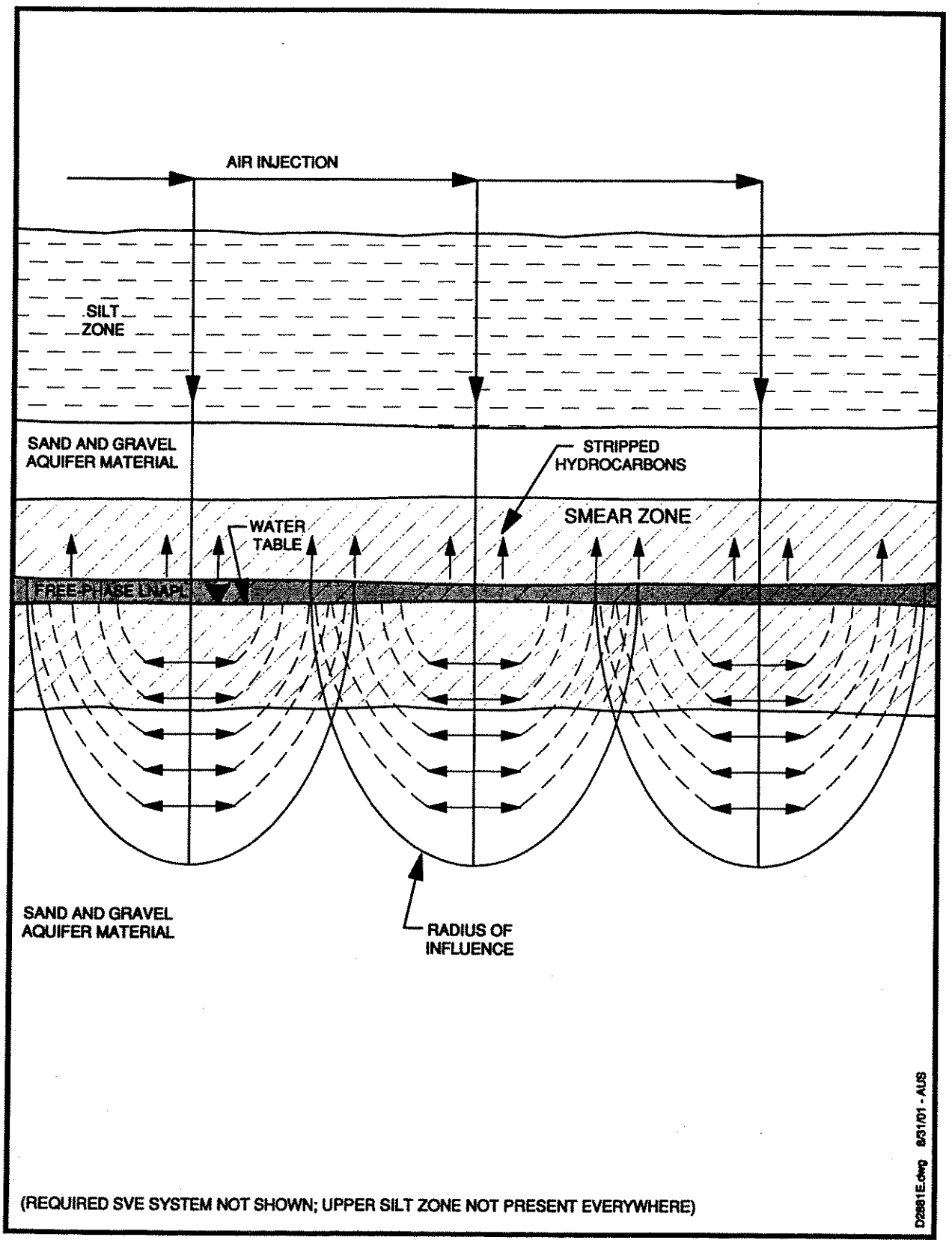

Figure 6-4. Conceptual Design of In-Situ Air Sparging System at the Chevron Cincinnati Facility

US EPA ARCHIVE DOCUMENT

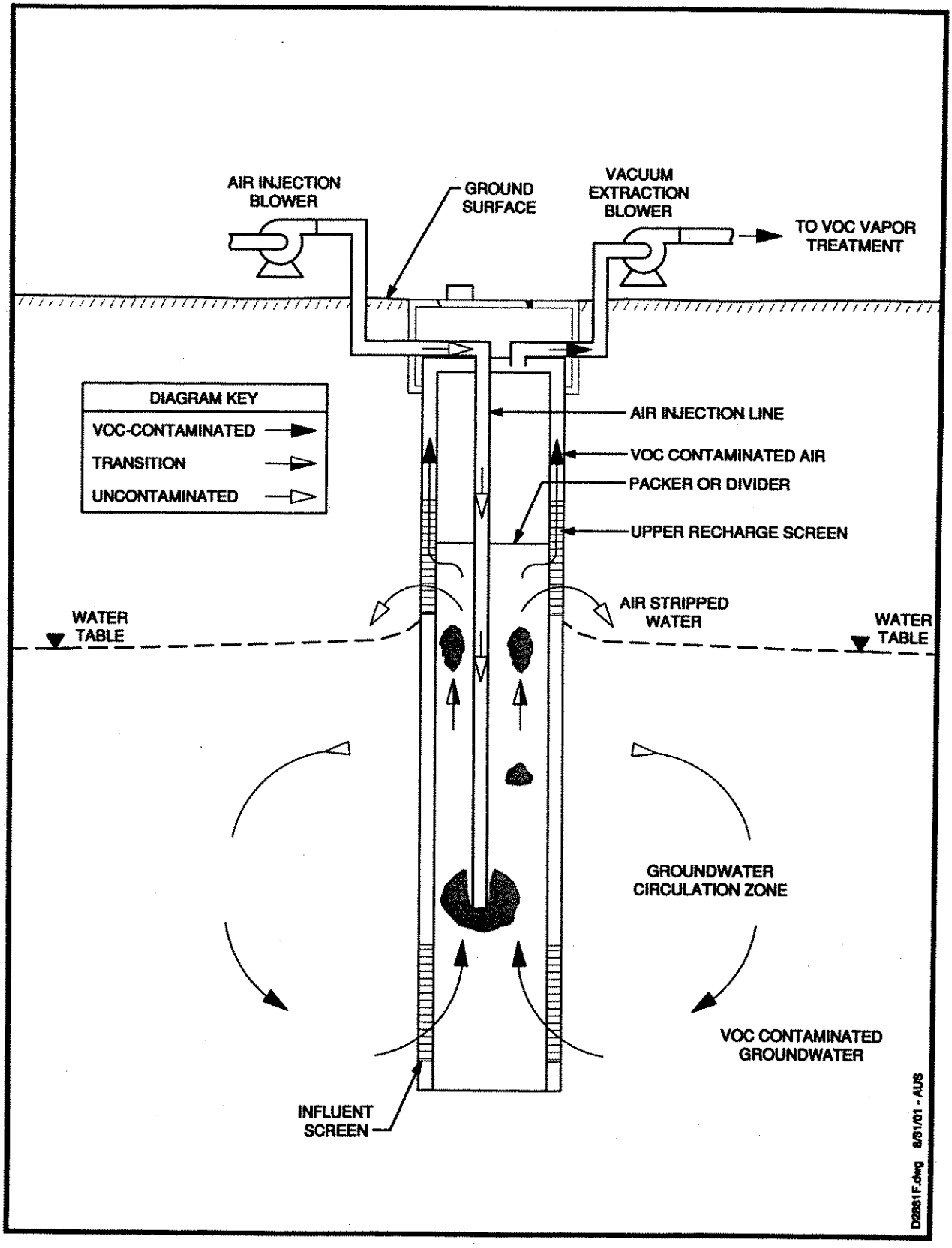

Figure 6-5. Conceptual Design for Groundwater Circulation Well Technology at the Chevron Cincinnati Facility

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

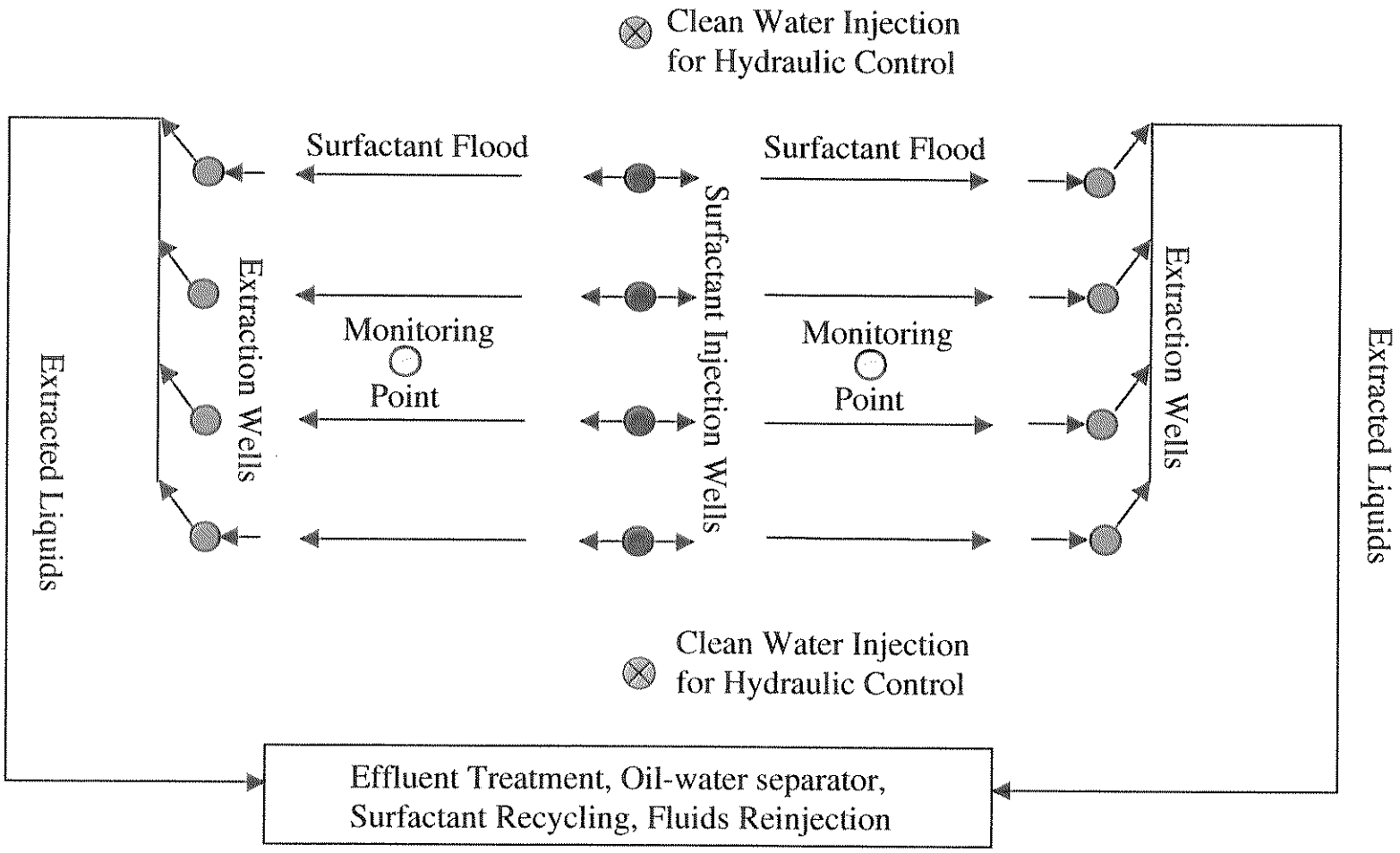

Figure 6-6
Illustration of Dual Line Drive for Surfactant Flooding (Plan View)

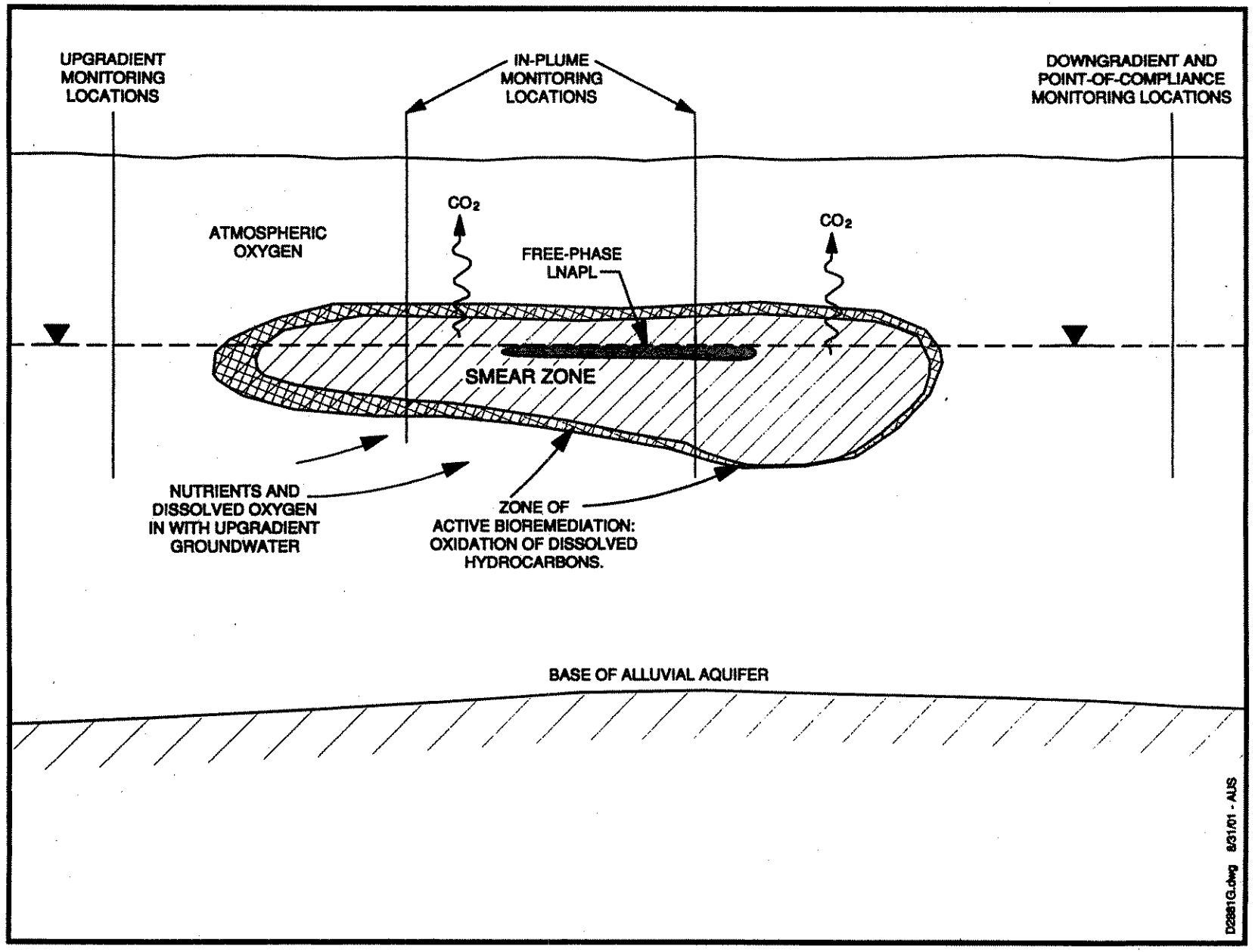

Figure 6-7. Conceptual Design for Monitored Natural Attenuation Technology at the Chevron Cincinnati Facility

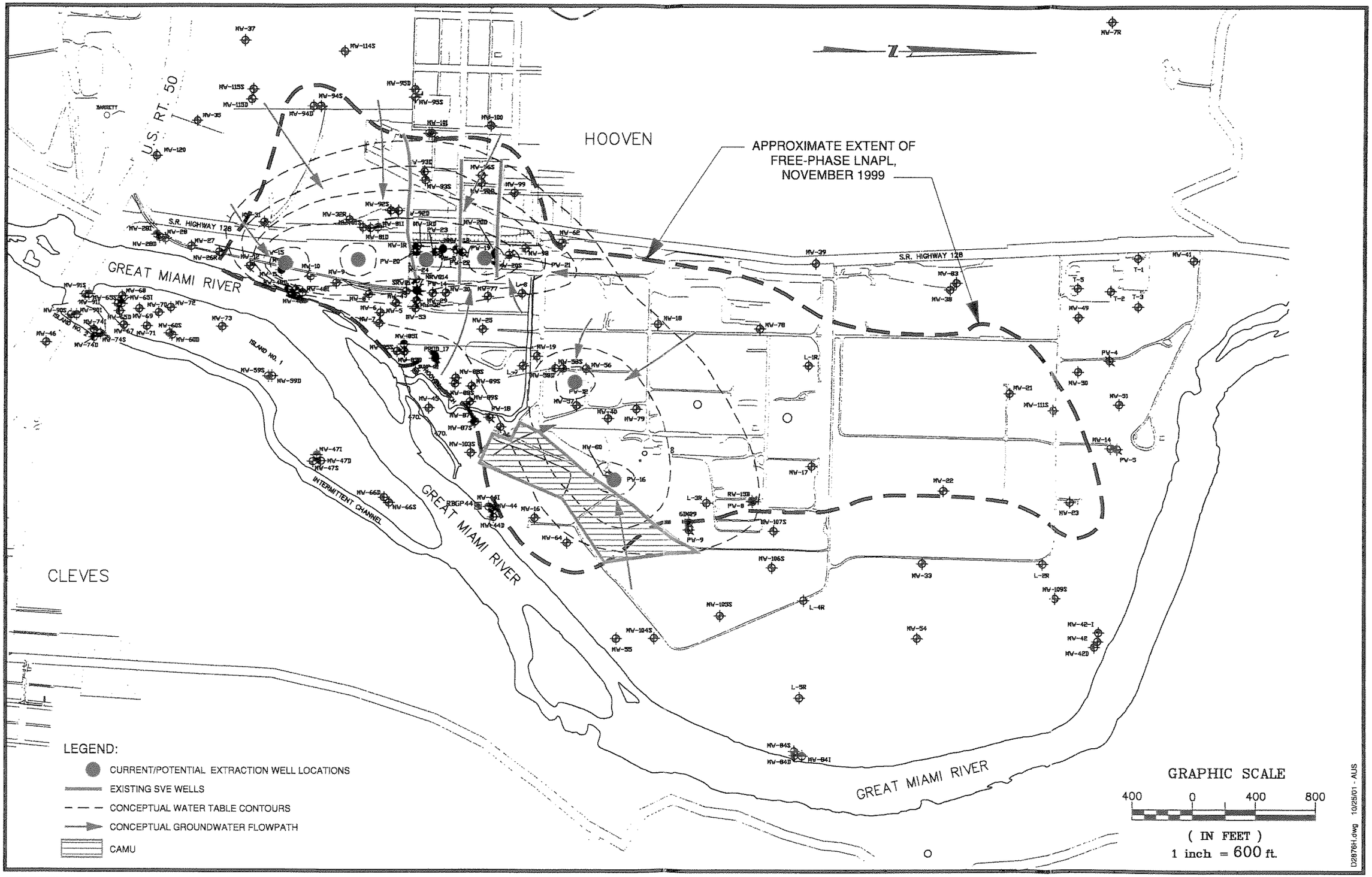

Figure 7-1: Alternative 1: Containment

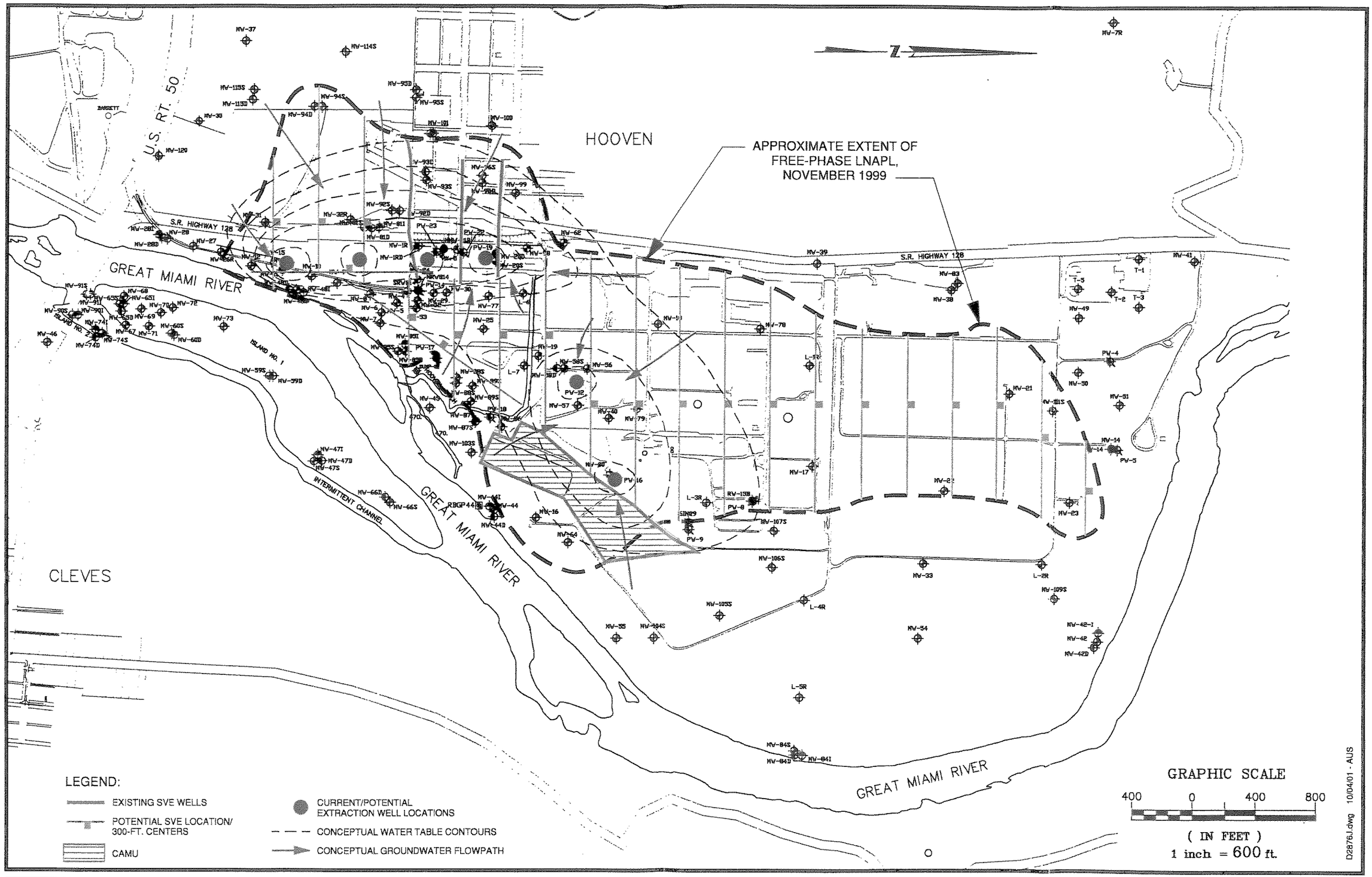

Figure 7-2: Alternative 2: Containment & SVE

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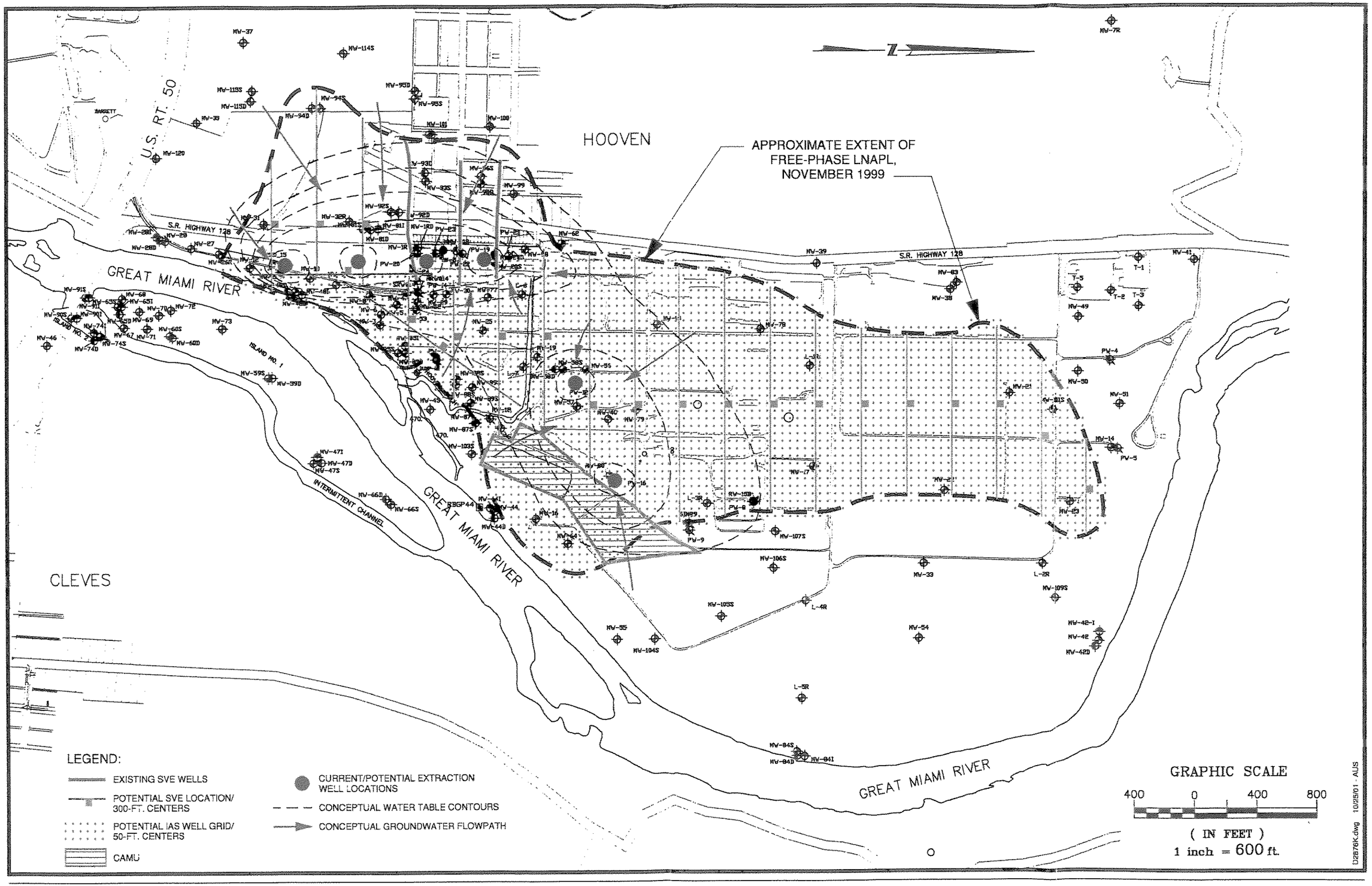

Figure 7-3: Alternative 3: Containment & SVE & IAS

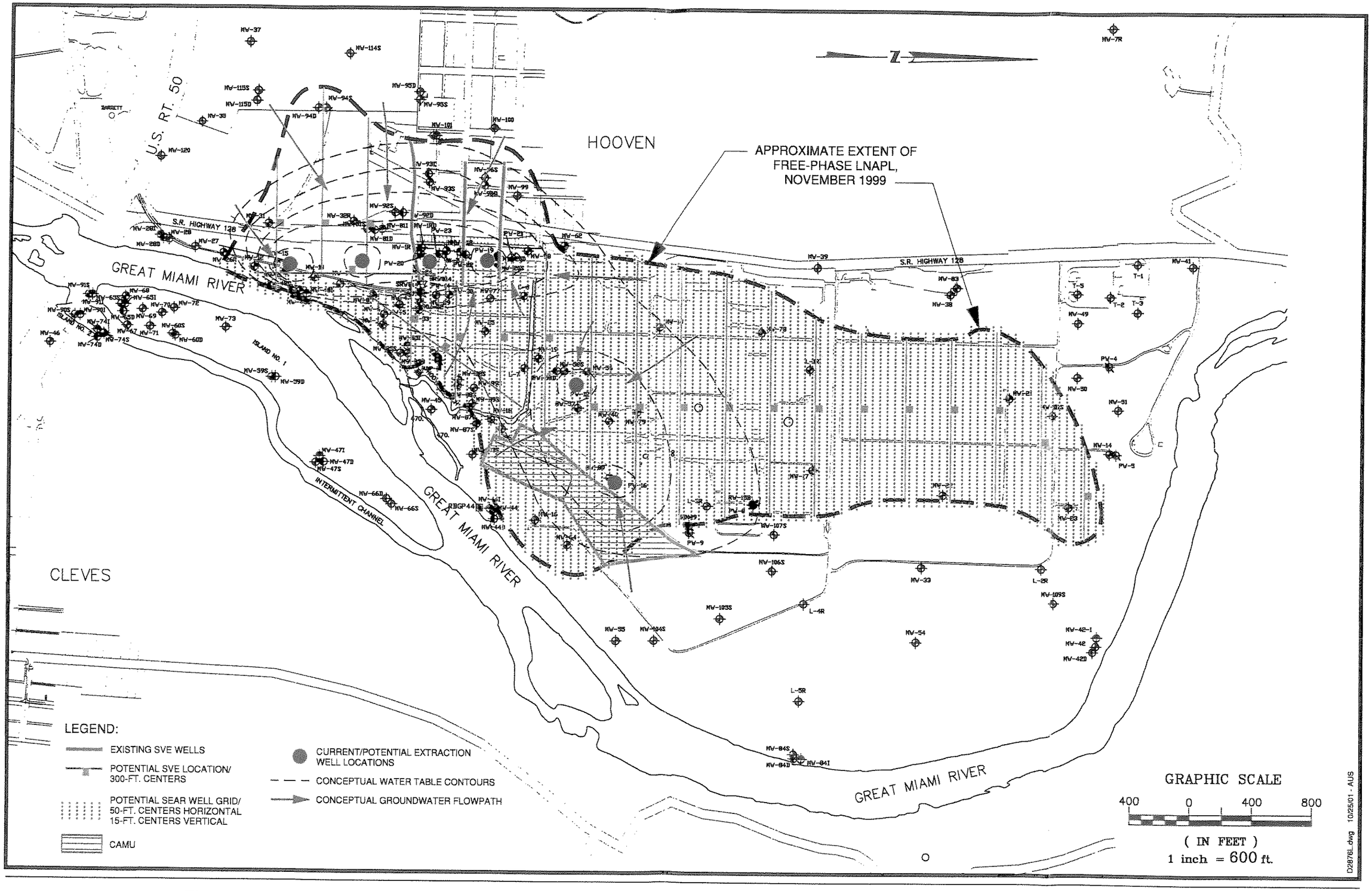

Figure 7-4: Alternative 4: Containment & SVE & SEAR

Table 7-2

Estimated Time from Present Needed for the Groundwater Benzene Concentration to Drop Below the MCL (5μg/L)

Alternative	Initial Source Removal Technology	Time after Initial Source Removal Years	Duration of Initial Source Removal Years	Total Duration Years from Present
1	None	458	0	458
2	SVE	294	12	306
3	SVE + IAS	233	10	243
4	SVE + SEAR	93	8	101

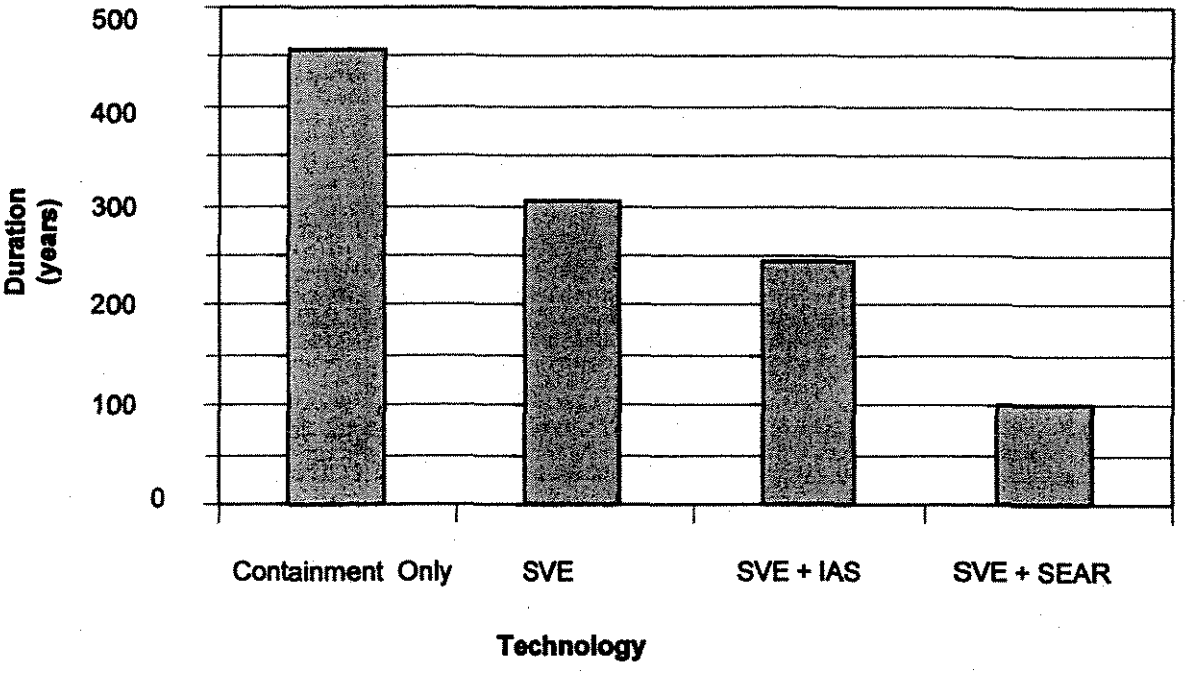

Figure 7-5

Projected Durations from Present to 5 μg/L Benzene, versus Technology

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Table 7-4

Present Worth of All Costs Associated with Alternatives 1 through 4

Alternative	Initial Source Removal Technology	Present Worth ($ millions)			
		Initial Source Removal		Ongoing Site Ops.	Grand Total[1]
		Capital	O&M		
1	None	0.00	0.00	49.20	50.45
2	SVE	18.74	23.77	49.08	92.84
3	SVE + IAS	24.78	32.08	48.64	106.74
4	SVE + SEAR	89.76	16.45	42.22	149.68

[1] Includes $1.25 million in fixed costs, as discussed in Appendix B.

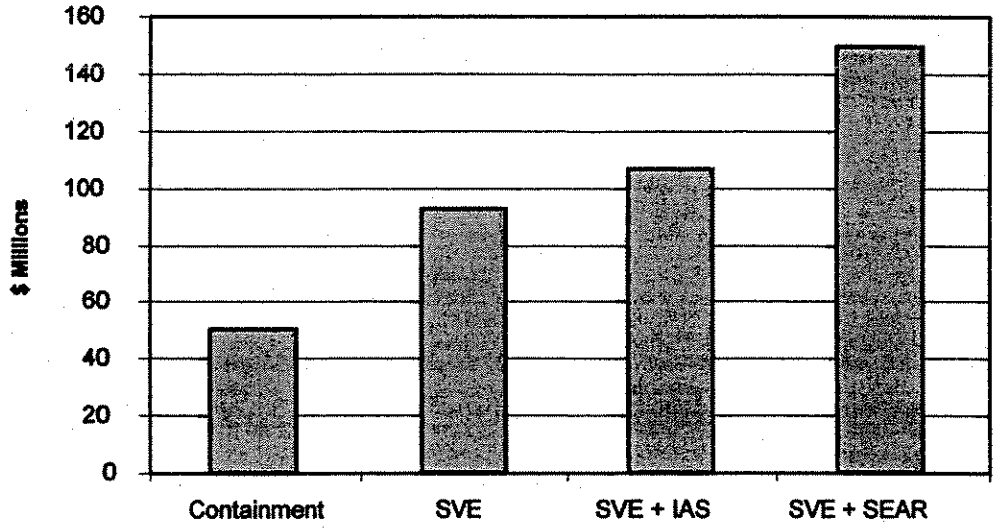

Figure 7-6 Present Worth of Alternatives

The following observations can be made:

- Total present worth costs increase significantly as increasingly aggressive source removal technologies are applied: Alternative 1 (Containment) < Alternative 2 (Containment + SVE) < Alternative 3 (Containment + SVE + IAS) < Alternative 4 (Containment + SVE + SEAR).
- Alternative 4 (Containment + SVE + SEAR) is the fastest alternative, as discussed in Section 7.4.1. It is also the most expensive alternative.

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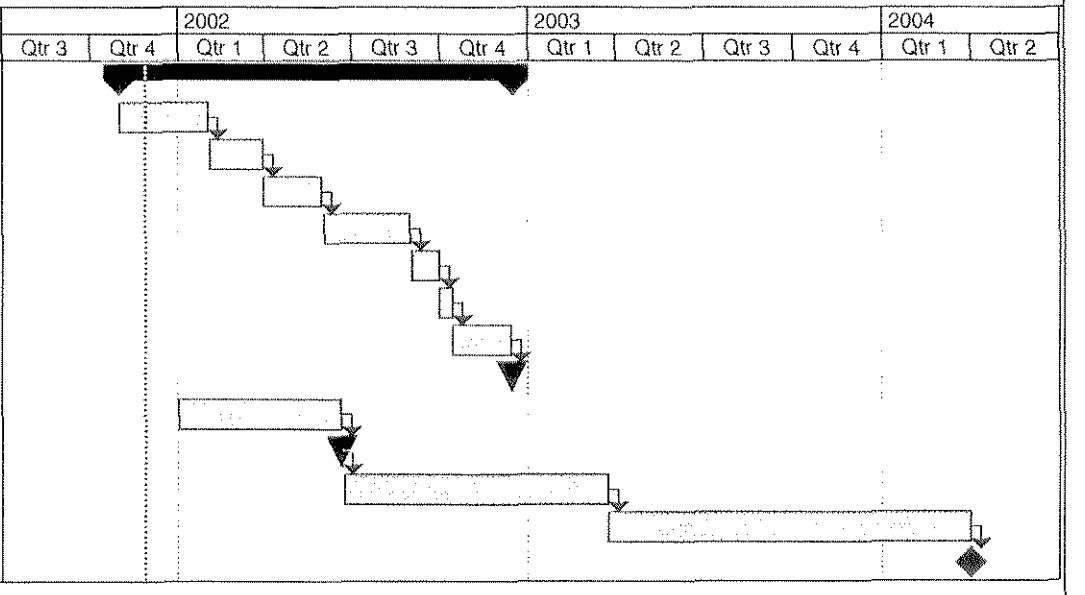
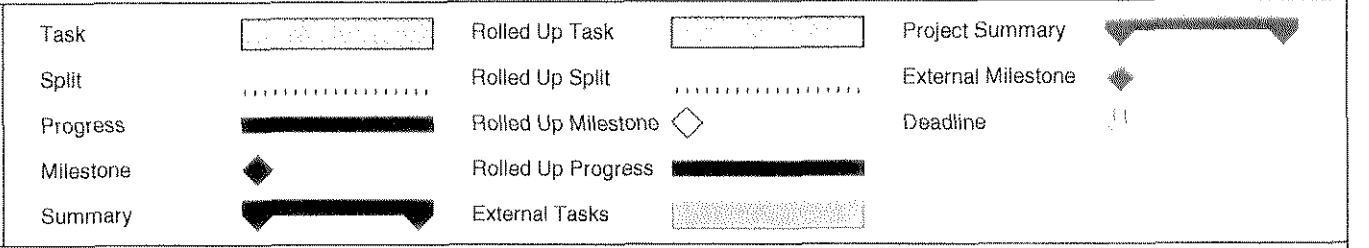
Figure 10-1
Chevron Cincinnati
Groundwater Remedy Implementation Schedule

ID		Task Name
1		**CMS Process**
2		Chevron Submits Draft GWCMS to EPA
3		EPA Submits comments to Chevron
4		Chevron Submits a response to comments
5		EPA approves the GWCMS
6		EPA submits Statement of Basis to Public
7		Public Hearing (probably corresponding with a C
8		End of Comment Period
9		Final Decision Response to Comments
10		Evaluation of Containment Options
11		Selection of Containment Options
12		Design of Selected Option
13		Construction of Selected Option
14		Start of long-term O&M





Note: The actual design and construction times will be dependent upon the complexity of the selected containment option.