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IBM Corporation
Poughkeepsie, New York

REMEDIAL ACTION AT THE MAIN PLANT SITE

April 1984

Lawler, Matusky & Skelly Engineers
Environmental Science & Engineering Consultants
One Blue Hill Plaza
Pearl River, New York 10965

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LMSE-84/9021&272-047

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CHAPTER 1.0

INTRODUCTION

Since late 1978, the IBM Corporation site in Poughkeepsie, New York; has been carrying out a groundwater assessment and remedial action program. Throughout the execution of this program, IBM has communicated the major findings to the New York State Department of Environmental Conservation (NYSDEC), and also informed NYSDEC of remedial action taken and planned; these communications have been both oral and written. The purpose of the present report is to compile the past written and oral reports into a single report that documents both already completed and ongoing remedial actions, and outlines IBM's commitments for remedial actions still remaining to complete its program.

The IBM main plant site is shown on Figure 1.0-1. It comprises a manufacturing and utility support area, generally the southwestern quadrant of the site, and various research and office support services in the remaining developed portions. The investigative program has shown that chemical problems in the groundwater and soil are confined to the southwestern portion, depicted on Figure 1.0-2.

Also shown on Figure 1.0-2 are those areas discussed in this report where remedial action either has been performed, is going on, or is committed by IBM, or where a combination of these categories applies.

Decisions by IBM to remediate have been made in an orderly fashion, using a rationale depicted on Figure 1.0-3. As shown, a decision to remediate first considered whether regulations to correct the event (such as a spill) were in place at the time of its occurrence; in such cases the remediation is in accordance with these regulations.

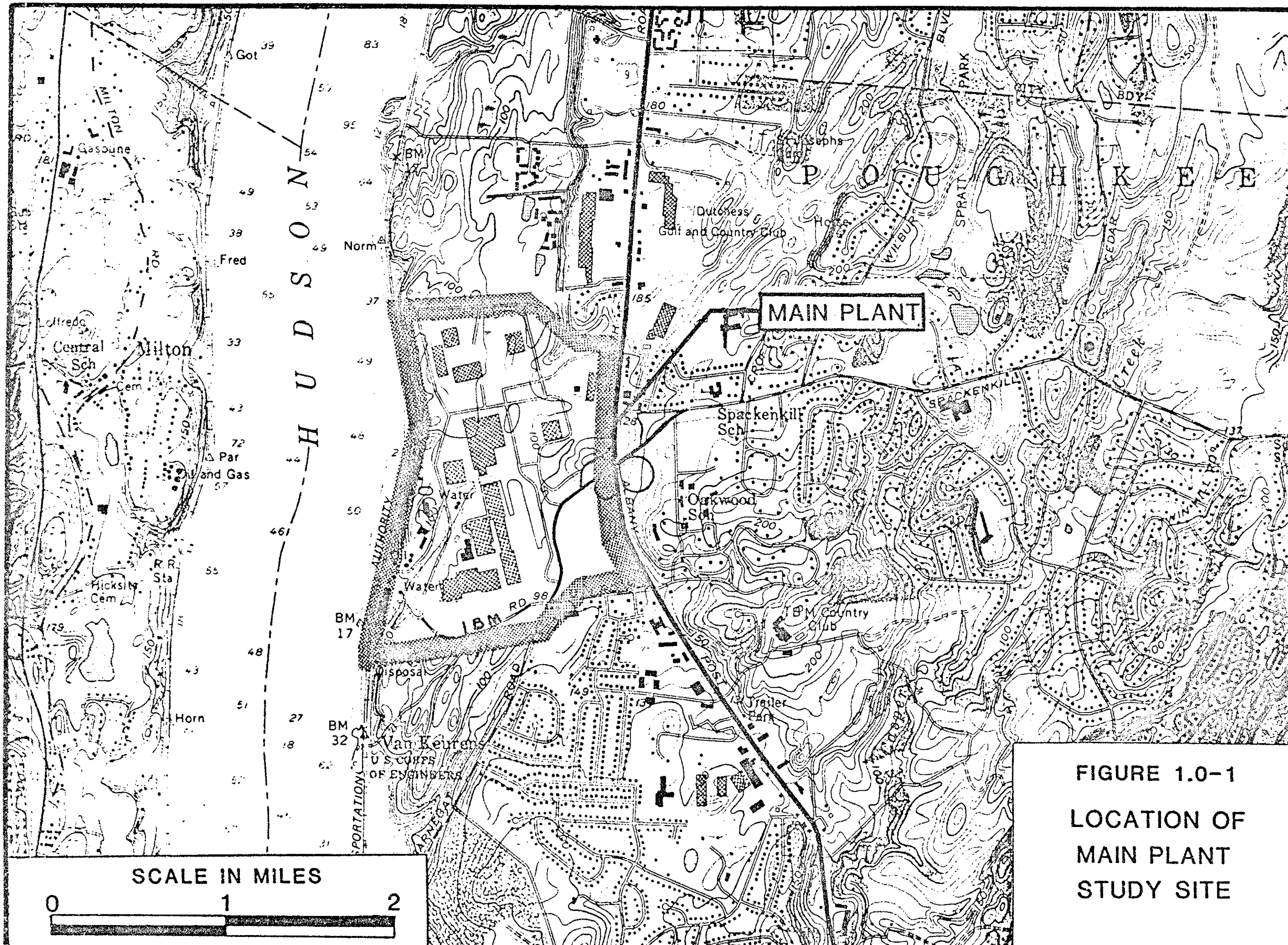


FIGURE 1.0-1

LOCATION OF MAIN PLANT STUDY SITE

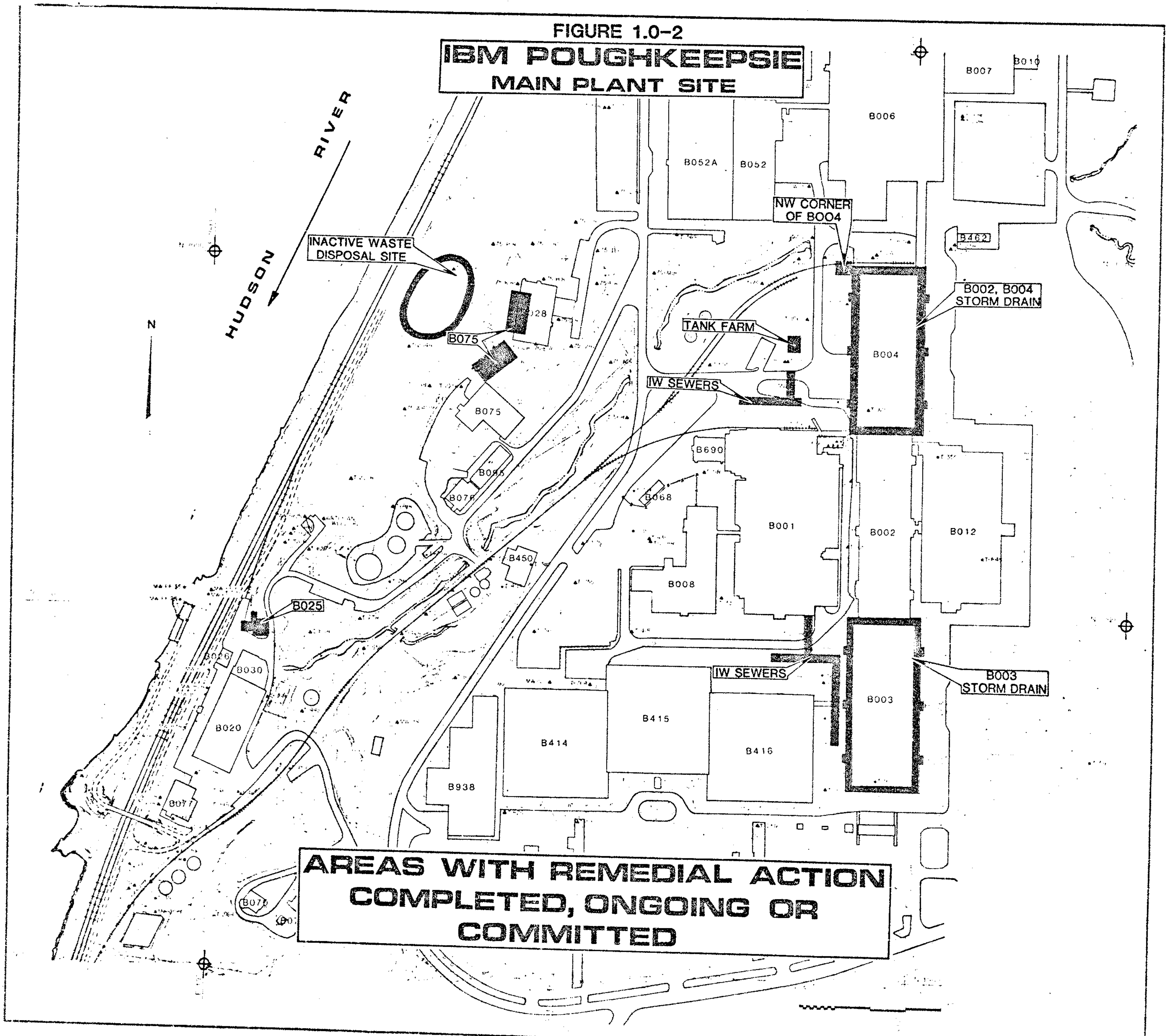
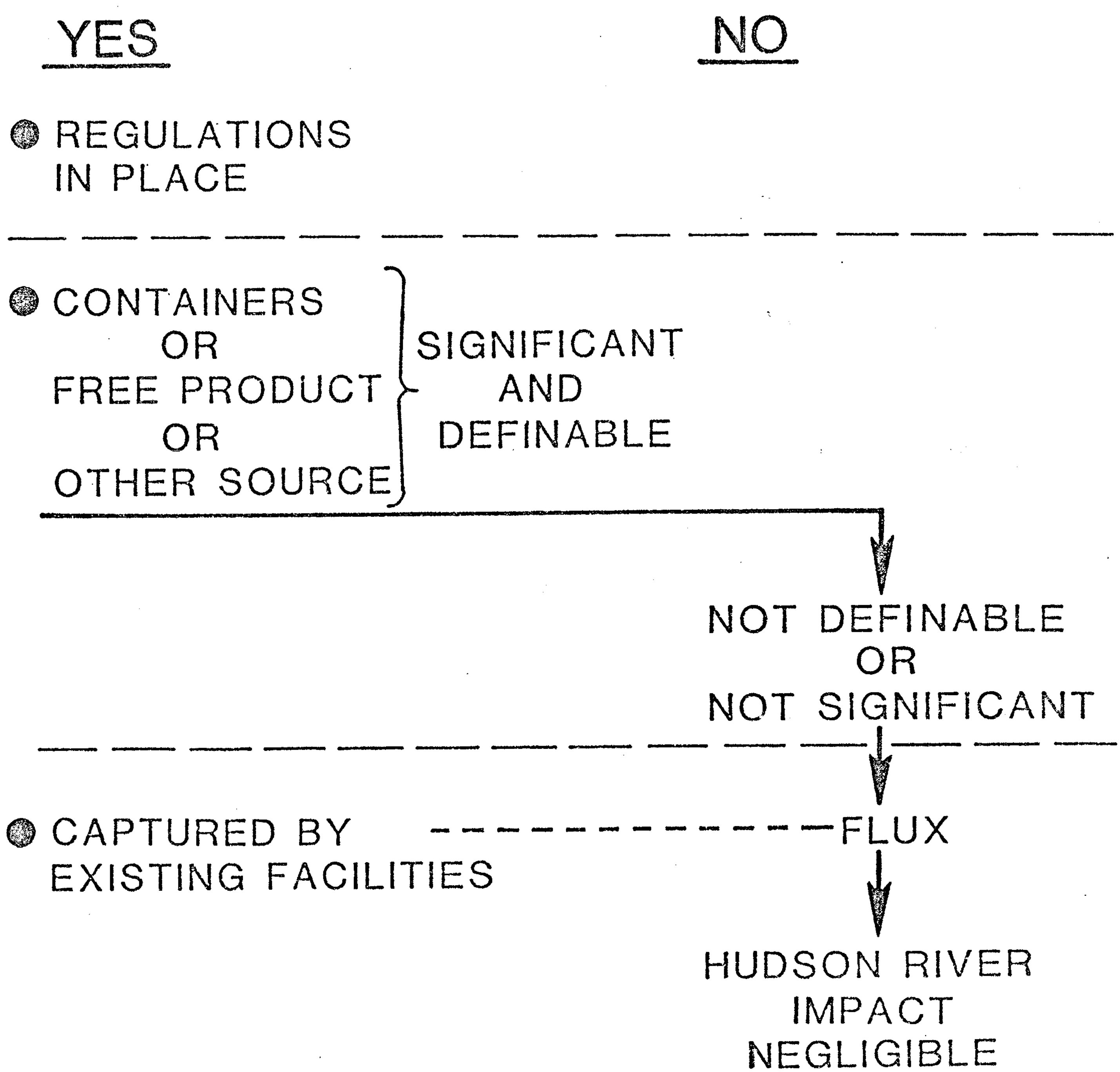


FIGURE 1.0-2
IBM POUGHKEEPSIE
MAIN PLANT SITE
HUDSON RIVER
N
INACTIVE WASTE DISPOSAL SITE
B075
B075
B076
B450
B025
B030
B020
B077
B938
B414
B415
B416
B003
B003 STORM DRAIN
IW SEWERS
IW SEWERS
B008
B001
B002
B012
B068
B690
B004
B002, B004 STORM DRAIN
TANK FARM
NW CORNER OF B004
B462
B052A
B052
B006
B007
B010
AREAS WITH REMEDIAL ACTION COMPLETED, ONGOING OR COMMITTED

FIGURE 1.0-3

REMEDIATION DECISION



Where no regulations existed to require immediate action, which was the case at most of the areas on the main plant site, the first assessment was to determine whether the source, of whatever kind, was both significant and definable. Significance was a judgmental test based both on the scale of the source and the scale of its effect on groundwater, i.e., the apparent mass of chemical in place and/or the area involved, plus the area of groundwater affected and the resulting chemical concentrations in the groundwater. In addition to the test of significance, the definability of the source was considered, i.e., whether the source (of chemicals in groundwater) could be located. If the source did not meet both of these tests, it was considered only with respect to its impact on the Hudson River.

As documented in the Main Plant Site Hydrogeology and Chemistry Reports (LMS 1983, 1984), the impact of the total chemical flux from the site has a negligible and unmeasurable effect on the Hudson River: no remediation was decided upon to alleviate effects in the Hudson. However, there were some sources of groundwater chemicals where facilities (building underdrain systems) already were capturing the chemicals; in these cases, modifications were either put in place or planned to direct the captured water to the Industrial Waste Treatment Plant (IWTP) for treatment.

The remainder of this report is presented in two chapters:

- Chapter 2.0, which documents all remedial actions taken on the site since the program began in 1978, including completed and ongoing actions
- Chapter 3.0, which discusses remedial action not yet begun, but to which IBM has committed itself.

CHAPTER 2.0

REMEDIAL ACTIONS COMPLETED AND ONGOING

2.1 INTRODUCTION

The purpose of this chapter is to document those remedial actions already completed by IBM, and those that have been initiated but are, because of their long-term nature, not yet complete. Table 2.0-1 summarizes those actions in terms of their major characteristics; each is discussed in turn below.

2.2 INACTIVE WASTE DISPOSAL SITE

On 9 March 1979, IBM notified NYSDEC of the presence of the inactive waste disposal site, the approximate location of which was known from internal IBM records. (The location is shown on Figure 1.0-2.) IBM further informed NYSDEC that they intended to remove from this site what was required to avoid further potential impact to the environment: soil containing chemicals, containers of wastes or chemicals, and other forms of waste. The composition and location of the various generic types of wastes presumed to have been disposed of were not known exactly.

The chosen remediation method was removal of the material with disposal in a secured landfill. The procedure was to test material as it was removed to determine whether disposal was required; at the outset this was done by chemical testing. It was soon apparent, however, that visual examination of the material was sufficient for positive segregation; any soil material that looked clean was found in the laboratory to be so. After enough lab testing had been done to confirm this, segregation of material was done in the field.

TABLE 2.0-1

SUMMARY OF REMEDIAL ACTIONS COMPLETED AND ONGOING

REPORT SECTION No.	SITE	TYPE OF PROBLEM	DATE MATERIAL INTRODUCED TO SUBSURFACE	ACTION		
				TYPE(S)	DATE STARTED	DATE COMPLETED
2.2	Inactive waste disposal site	Buried wastes of various types	Before 1978	Soil, waste, and container removal; disposal in secured landfill.	November 1979	April 1980
2.3	Building 025	Spilled chemicals, mainly organic solvents	1968 (major)	Slurry wall installation. Remove soil and water with chemicals. Soil to secured landfill; water to licensed treatment.	November 1980	February 1981
2.4	Building 004, northwest corner	Ammonium persulfate spill	January 1979	Soil removal; disposal at secured landfill.	January 1979	June 1979
2.5	Building 004, storm drain	Metals in D013	Before 1978	Dam in storm drain to capture dry weather flows; pump to IWTP for treatment.	June 1980	Ongoing
2.6	Building 075 (salvage yard)	Free product floating hydrocarbons, with priority organic chemicals, including PCBs	Before 1978	Water level depression pump and floating product skimmer. Water to licensed disposal in NYS; oil (with PCB) to Arkansas.	November 1981	Ongoing
2.2	Inactive waste	Buried wastes of	Before 1978	Soil, waste, and	November 1979	April 1980
2.7	Tank Farm	Leaks in xylene piping, underground	Early 1982	Removal of free product. Removal of soil and water containing xylene. Disposal of all three at licensed NYS facilities.	October 1982	January 1983
2.8	New industrial waste sewers	Old sewers suspected of leaking chemicals to soil and groundwater	Up to 1982	Installation of new double-walled sewer system, with leak detection and quick repair capability.	August 1981	October 1982
2.9	Old industrial waste sewers	Sediment in some pipes a potential continuing source; soil around pipe contains chemicals.	Up to 1983	Sediment flushed from pipe; removed to industrial waste sludge beds for subsequent disposal.	July 1983	July 1983

A typical cross section of the excavated area is shown in Figure 2.0-1. The material had been disposed of on a sandy lens that overlies a clay layer, and directly on bedrock in the eastern portion of the site. The area had been capped with a relatively thin layer of clean fill. In the process of remediation, the clean fill cap was stockpiled, and virtually all remaining material above the sand was removed for disposal. A 1-ft layer of the sand was also removed for disposal, even though it apparently did not contain chemicals. The horizontal boundaries of the excavation were also determined by the combination of laboratory testing and visual examination. Figure 2.0-2 shows the limits of the excavation.

In all, about 35,000 ft^3 of material was excavated. Approximately 32,000 tons of material containing chemicals was removed to a secured landfill; the clean material was stockpiled and later backfilled. No water was encountered in the excavation. Most of the chemicals detected in laboratory tests were inorganic and relatively insoluble in water; some organic priority chemicals were found. The removed material consisted of:

- Soil
- Rubble
- Metal sludges
- Incinerator waste
- Plating waste
- Drums
- Cyanide waste
- Oily waste

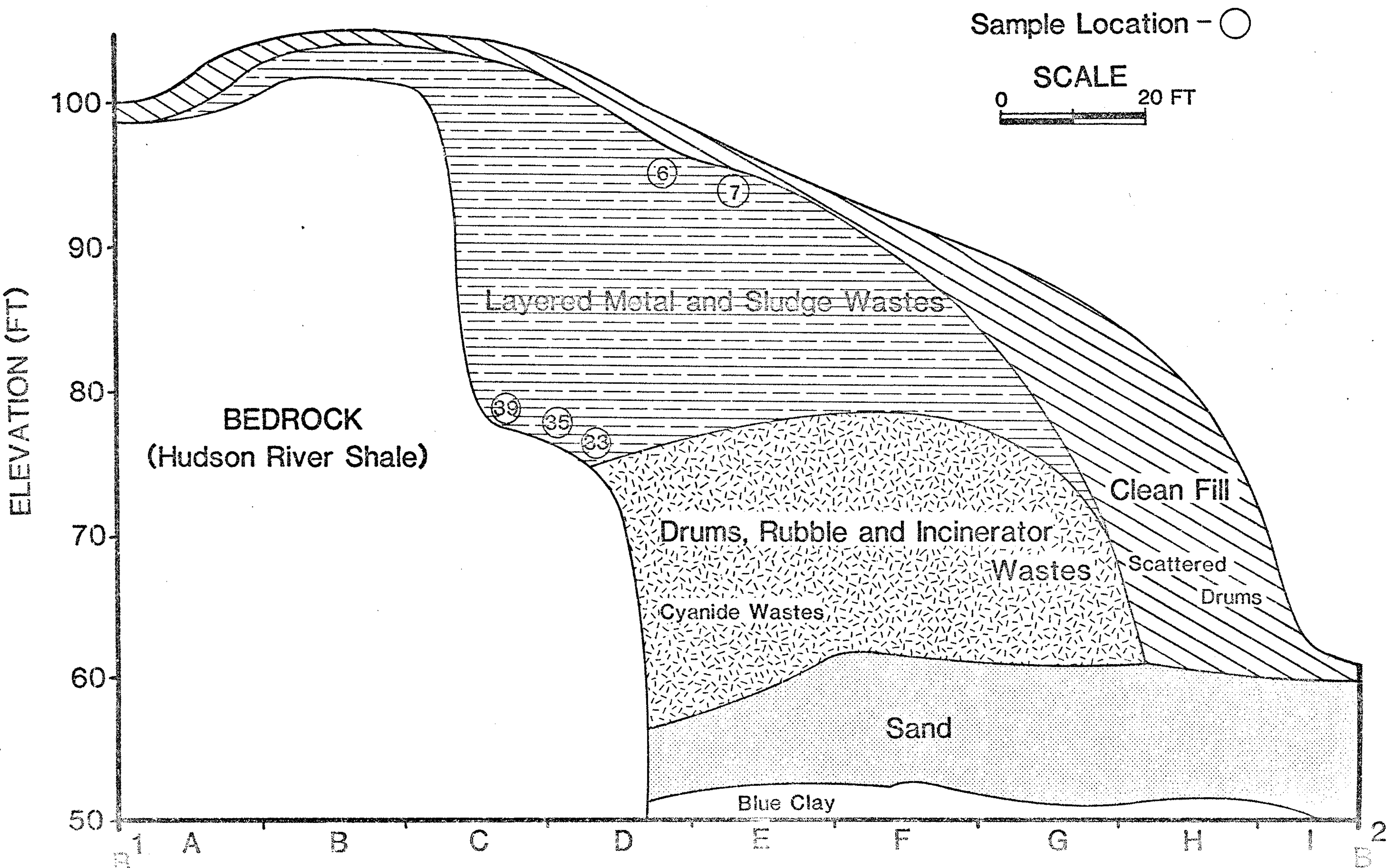
When the excavation of materials requiring removal was complete, the area was regraded, using the stockpiled material to encourage runoff from the site, and planted with grass and seedlings. This project was completed in April 1980.

FIGURE 2.0-1

INACTIVE WASTE DISPOSAL SITE

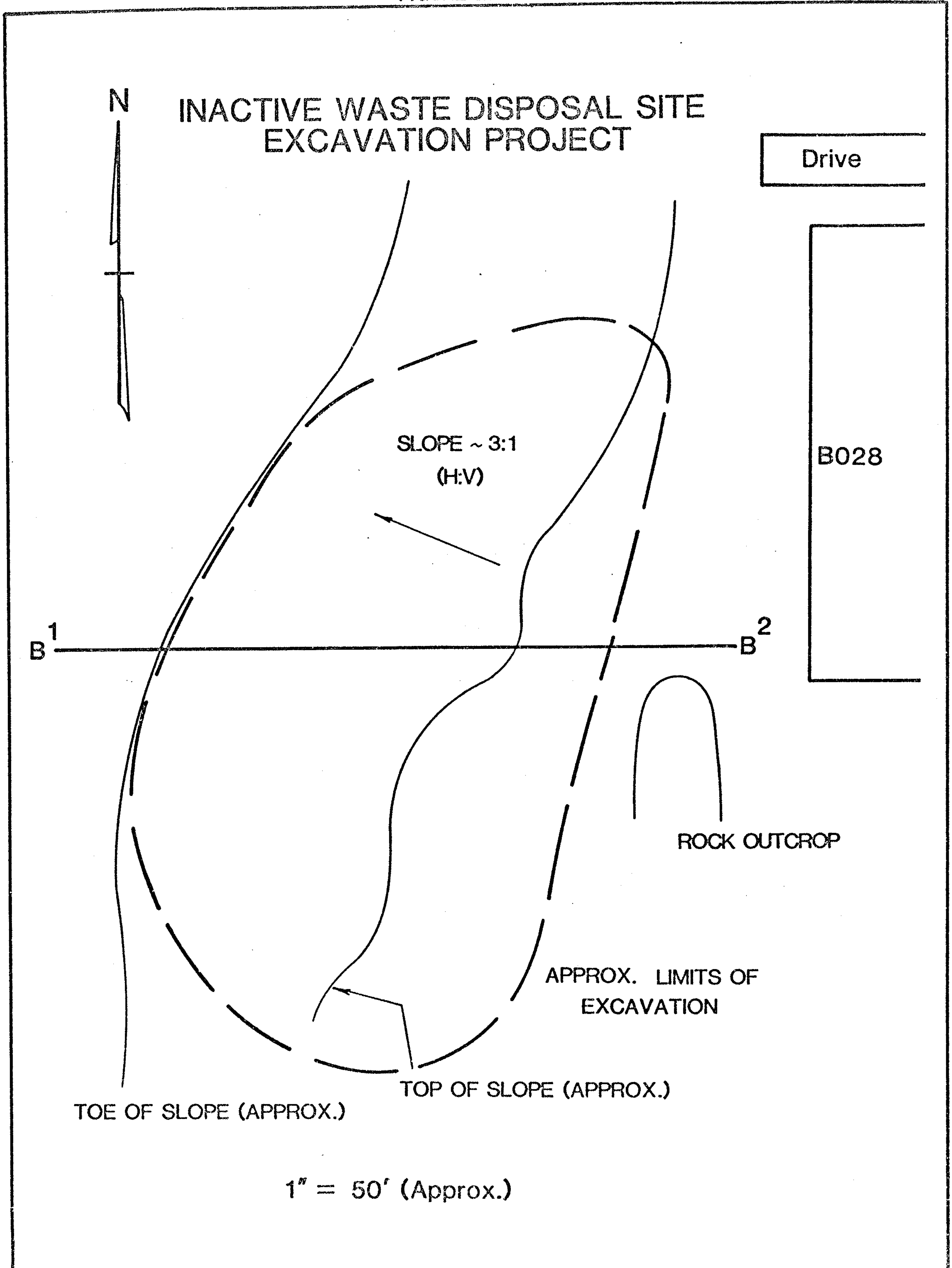
CROSS-SECTION B[1] -B[2]

(Looking South)



VERTICAL EXAGGERATION 2 : 1

FIGURE 2.0-2


N
INACTIVE WASTE DISPOSAL SITE
EXCAVATION PROJECT
Drive
B028
SLOPE ~ 3:1
(H:V)
B1
B2
ROCK OUTCROP
APPROX. LIMITS OF
EXCAVATION
TOP OF SLOPE (APPROX.)
TOE OF SLOPE (APPROX.)
1" = 50' (Approx.)

2.3 REMOVAL OF SOIL AT BUILDING 025

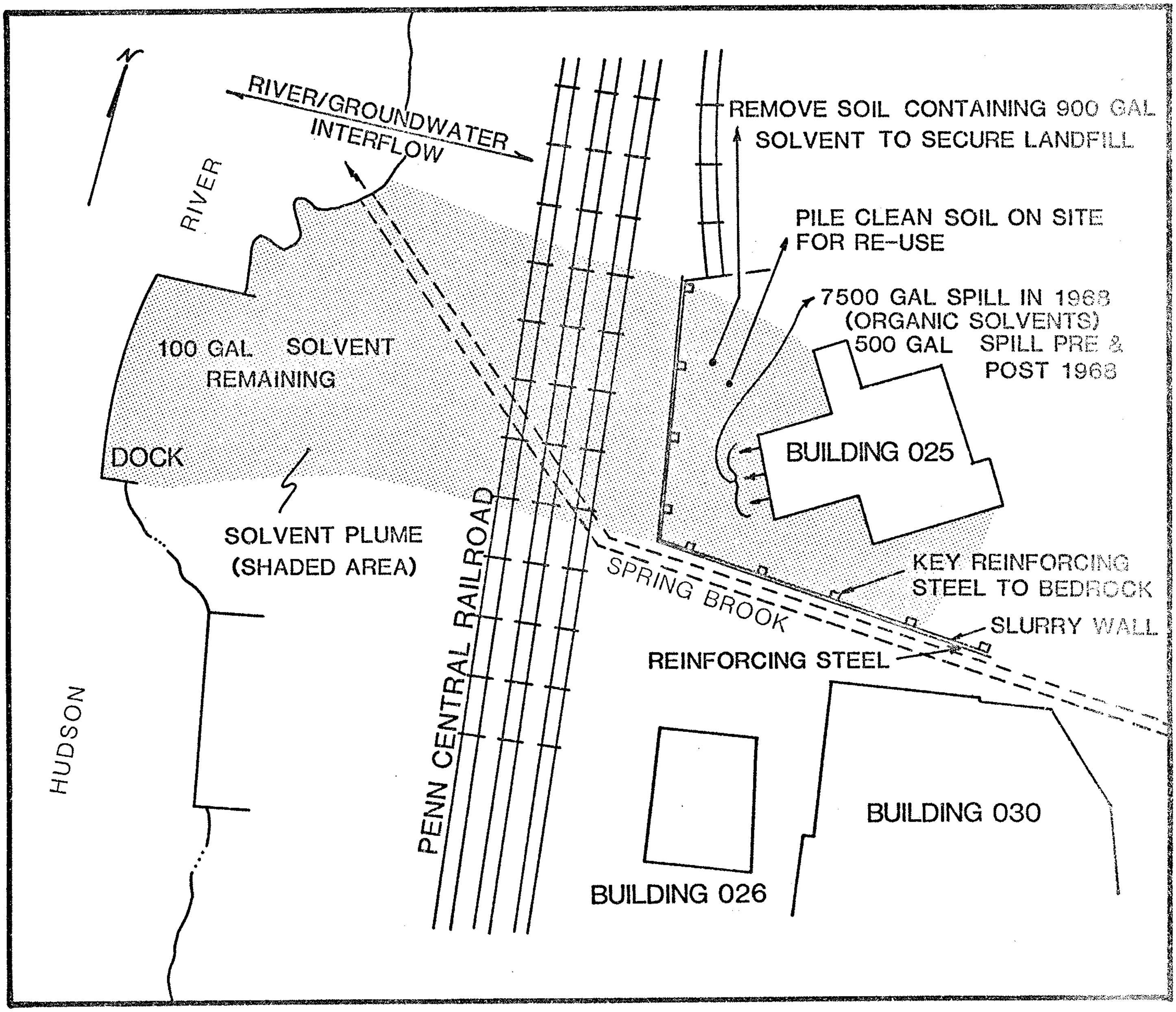
Building 025 was a former pickle factory, part of the original site purchased in 1940. Over the years it had many different uses; in 1968 it was used as a chemical distribution building. Three 2500-gal pickling liquor vats were used to store a mixture of three organic solvents (methylene chloride, freon, and methylchloroform). The vats were porous to these solvents, and within a short time leaked the 7500 gal of solvent to the underlying soil. In the fall of 1978, during the initial stages of the Groundwater Assessment Program, an examination of the groundwater in this vicinity detected the presence of these three solvents (as well as pre-1968 wastes) and chemicals, including carbon tetrachloride, chloroform, and others, that were used in certain manufacturing operations through 1975.

The Building 025 area of the plant site is immediately east of the Penn Central railroad tracks, about 200 ft from the Hudson River. The groundwater table is about 6 ft below grade (mean water) or higher and believed to be strongly influenced by the Hudson River, making well point dewatering an infeasible solution.

The solution decided upon is shown in Figure 2.0-3. It included: (1) construction of a slurry wall along the east side of the railroad ROW to temporarily prevent movement of the spilled chemicals to the river and to provide suitable shoring during excavation; (2) excavation to bedrock, including the rippable portion of the bedrock itself, of approximately 5000 yd of material in the area east of the slurry wall; (3) testing of all excavated material before actual excavation; (4) separation of the overburden, essentially free of chemicals, from the underlying soil; (5) removal of the latter to a secure landfill in western New York (CECOS International Inc., in Niagara Falls); and (6) removal of water containing chemicals to CECOS.

FIGURE 2.0-3

REMOVAL OF SOIL IN THE VICINITY OF BUILDING 025



The project began in November 1980; removal of soil and water-contaminating chemicals was completed by 18 February 1981. Slurry wall construction is a relatively specialized foundation technique in which a bentonite slurry immediately replaces excavated material as a backhoe or other trencher moves along the line of ground to be trenched. The slurry acts as shoring before (normally unreinforced) concrete is poured into the trench and also as a dewatering agent, pushing the water up and out of the trenched section.

In addition to the fact that the whole procedure is a rather specialized construction technique, a unique feature employed here was the placement of reinforcing steel in the slurry wall to reduce the thickness of the wall that otherwise would have been required to resist external pressure on the wall once excavation of the interior contaminated soil began. Reinforcing steel was tied into steel pipe driven at an angle into underlying bedrock at T-sections of trench.

Approximately 3000 yd of upper layer soil was found to conform to chemical limits during the testing process and was set aside, with NYSDEC approval, for eventual filling of the excavated site; 2200 yd of soil material found by testing to contain chemicals was removed to a secure landfill, along with the spent slurry mixture that was considered to contain the solvents it displaced. In addition, 155,000 gal of water was removed to the CECOS facility.

Based on the laboratory testing for solvents in many samples of the excavated material and of material west of the railroad, IBM estimated that about 1000 gal out of an estimated original spill volume of some 8000 gal remained at the time of this effort, some 12 years after the major spill occurred. About 900 gal of solvent was removed in the excavated material trucked to the secure landfill. Another 100 gal was believed to remain in the zone west of the railroad tracks and the bedrock.

2.4 BUILDING 004, NORTHWEST CORNER

On 4 January 1979 a spill of ammonium persulfate occurred from the raw chemical storage tank just west of the northwest corner of B004. The material spread out over an area of approximately 70 x 8 ft in a small depression to the north of the tank; an IBM railroad siding runs through the affected area.

Residual liquid froze on the ground surface and was shoveled into drums. The affected soil material was removed to a depth of about 3 ft; in the railroad area the rails and ties were taken up, and the affected ballast removed. A total of 109,860 lb of soil and ballast were transported to the SCA Chemical Waste Services, Inc., licensed landfill in Model City, New York.

After excavation was complete, the site was restored to its original grade with clean fill, and the railroad siding was replaced. The project was completed on 5 June 1979.

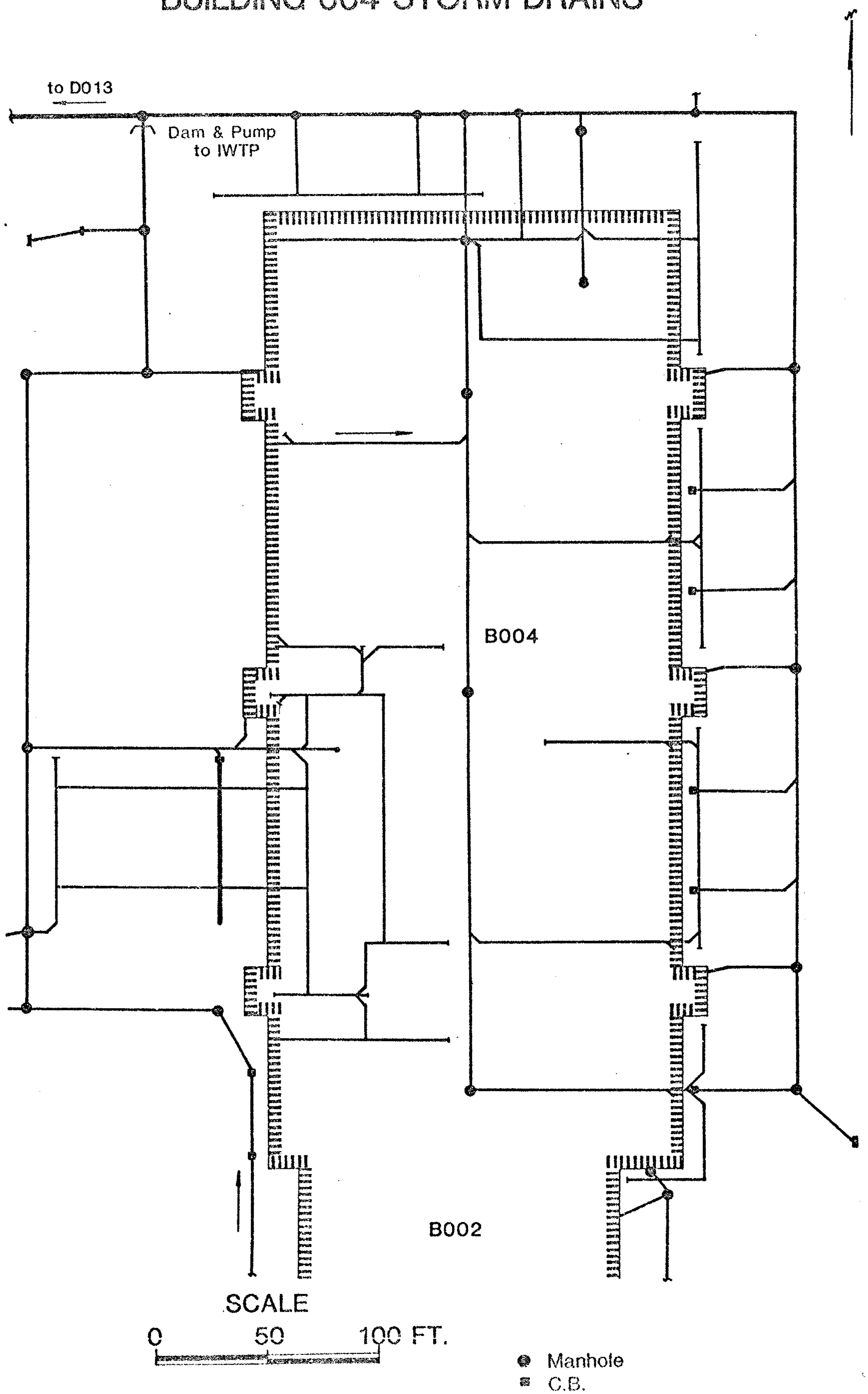
2.5 BUILDING 004, STORM DRAIN

In early 1980 monitoring at D013 (storm drain to Spring Brook) showed elevated levels of copper in dry weather flows, and IBM conducted an investigation into the best way to prevent this discharge. It was assumed that the metal entered the system in the B004 underdrains, which discharge to the storm drain system, because there were no other possible sources of dry weather flow containing metals. A plating operation had been located in B004, so that leakage from the process could have introduced chemicals into the ground that could then leach into the underdrain system. The system is depicted in Figure 2.0-4.

The chosen solution was to install a dam in the storm drain that would capture dry weather flows but allow storm flows to pass with

FIGURE 2.0-4

BUILDING 004 STORM DRAINS



only a minor reduction in capacity. The location of the dam is shown on Figure 2.0-4. A submersible pump behind the dam pumps the collected water to the nearby IW sewer, through which it is carried to the IWTP for metals removal. This system has operated satisfactorily since its installation.

2.6 B075 (Salvage Yard)

In drilling boring T-58 in November 1981 as part of the ongoing Plant Site Program, a significant quantity of hydrocarbons mixed with water was encountered at the 31-ft level. This discovery led to further investigation, which found free product hydrocarbons floating on the groundwater in the general vicinity of T-58, over an area of about 2000 ft^2. The work was then extended to provide information needed for design of remediation: an automatic system for recovery of the hydrocarbons, coincidental recovery of groundwater containing chemicals, and the appropriate disposal of both of these materials.

This remedial action is discussed as follows:

SECTION No.

2.6.1 - Initial Recovery/Testing
2.6.2 - Auto Skimmer Testing
2.6.3 - Seasonal Auto Skimmer Operation
2.6.4 - Year-Round Auto Skimmer Operation
2.6.5 - Disposal of Product and Water

2.6.1 Initial Recovery/Testing

The initial recovery and testing phase lasted from November 1981 through January 1982. The main objective during this period was to attempt to define the amount of free product in the ground, and to make a conceptual design of long-term remediation.

Following the completion of boring T-58, the fluid levels were allowed to stabilize before measurements of static fluid level were obtained. When the initial measurements were made, the fluid level in the boring was 10.5 ft below the top of casing but the static water level was 35 ft below the top of casing. Thus, there was a total thickness of 24.5 ft of floating hydrocarbon product in the boring.

Table 2.0-2 presents the history of initial product recovery testing that was performed at T-58, which indicates that this thick product layer was initially bailed off using a hand bailer. Although the thickness of the product rapidly decreased from the initial 24.5 ft to about 10 ft, a significant thickness of product still remained. The initial product recovery rate was on the order of 50 gal per day, which is very high. For these two reasons, additional measures were taken in the salvage yard area, described below.

At this stage of the project, we did not feel that there was sufficient information to estimate the quantity of free product in place.

2.6.2 Auto-Skimmer Testing

The Auto-Skimmer, a device patented by R.E. Wright Associates, Inc. (REWAI), is used to recover floating free product from borings; its operation is described in detail in Appendix A.

The main objective of this phase of the program was to design the optimal operation of the system, and to attempt to calculate the amount of product in place. Because the product could be induced to flow into T-58 only at the 31-ft level, and the static water level was at about 10 ft, a water table depression pump, in addition to the skimmer, had to be installed.

TABLE 2.0-2

PRODUCT AND WATER REMOVED FROM T-58

November 1981 - January 1982
(Initial Product Recovery Phase)

DATE	COMMENTS	PRODUCT (gal)	WATER (gal)	TIME (hrs)
NOVEMBER 1981				
18 Nov	Pumping of Boring T-58			
	AM test	42.00	-	
	PM test	5.20	-	
DECEMBER 1981				
7 Dec	Interface bailer	11.76	2.52	2
8 Dec	Interface bailer	7.48	4.24	10
9 Dec	Interface bailer	2.77	2.43	10
10 Dec	Interface bailer	18.00	12.00	7
JANUARY 1982				
14 Jan	Interface bailer	6.22	7.22	
22 Jan	Interface bailer	4.25	8.35	
26 Jan	Interface bailer	6.56	24.60	
TOTAL		104.2	61.4	

The sizing, placement, and control of this pump, and the cycle of the skimmer, were the main elements of the design. Ancillary items, such as spill control, water storage tank size, piping, electrical, etc., were also included in the conceptual design.

Table 2.0-3 summarizes the product and water volumes removed during this period.

At the end of this test period, the rate of product recovery had diminished significantly, as shown on Figure 2.0-5. This general pattern of high initial recovery rates, followed by a leveling off at lower rates is to be expected. Based on the data in Figure 2.0-5, it was extrapolated that the total volume of free product in place before recovery had begun was probably on the order of 1000 gal, and that recovery would be infeasibly slow well before all product had been removed.

2.6.3 Seasonal Auto-Skimmer Operation

Based on the conclusion that product could continue to be recovered at a feasible rate, and that the product would not move at a significant rate during periods of nonrecovery, it was decided to install an automatic skimmer system for seasonal operation, i.e., not to winterproof it.

Figure 2.0-6 is a schematic diagram of this installation and the location is shown on Figure 2.0-7. The concrete pad, skimmer system, oil-water separator, and recovered product storage were located at boring T-58, and the recovered water storage is inside the bermed site fuel oil storage area.

The system started up on a temporary basis in July 1982, shut down in August while construction was completed, restarted on 30 August

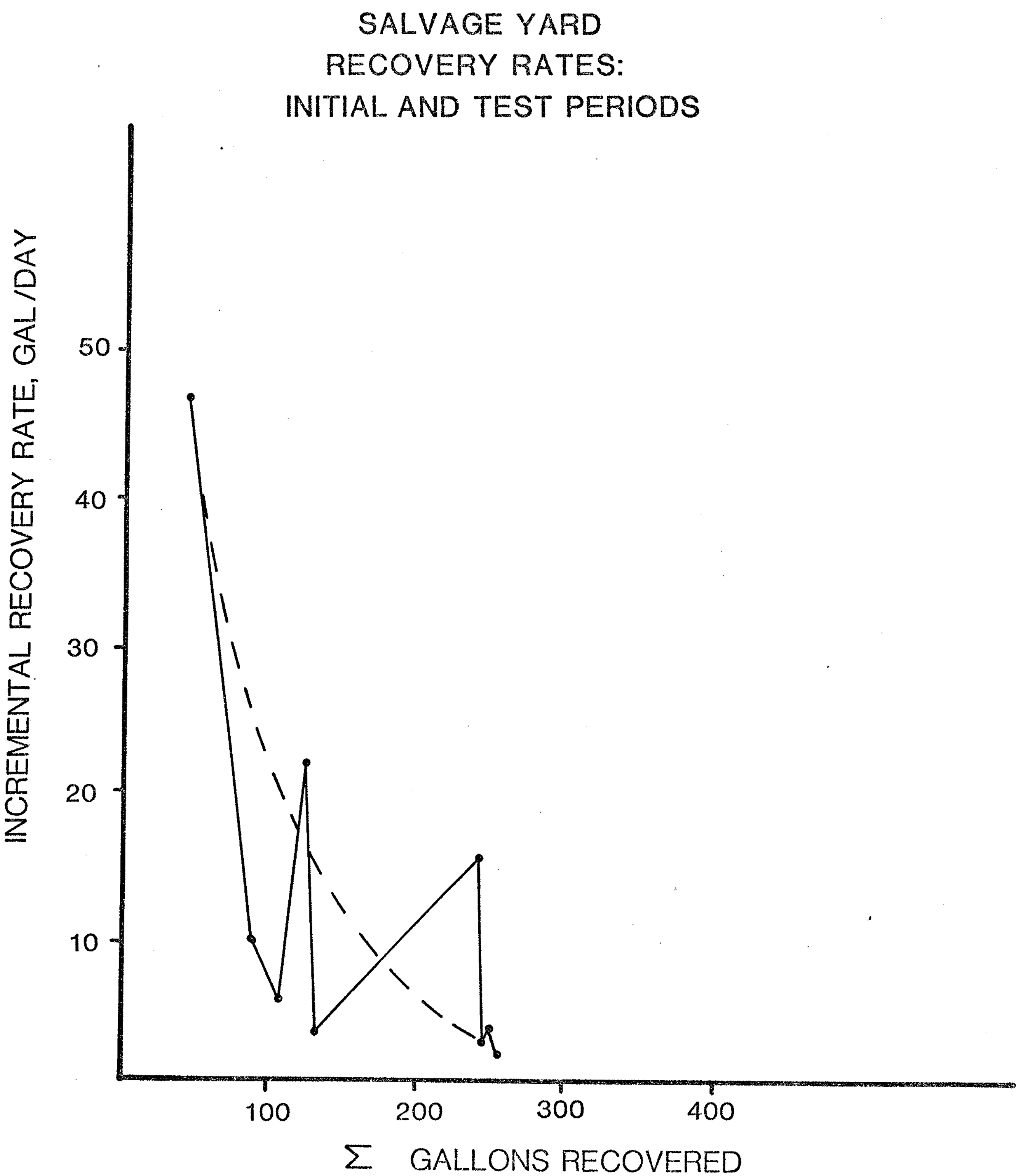
TABLE 2.0-3

PRODUCT AND WATER REMOVED FROM T-58

March - April 1982
(Auto-Skimmer Testing Phase)

DATE	COMMENTS	PRODUCT (gal)	WATER (gal)	TIME (hrs)
MARCH 1982				
30 Mar	Auto skimmer	22.14	35.26	10.25
APRIL 1982				
1 Apr	Auto-Skimmer	4.96	59.88	7.5
2 Apr	Auto-Skimmer	2.46	25.52	unknown
14 Apr	Auto-Skimmer and pumping	16.40	321.00	18
16 Apr	Auto-Skimmer and pumping	6.60	77.00	4
19 Apr	Auto-Skimmer and pumping	15.16		21
20 Apr	Auto-Skimmer and pumping	20.40	1093.00	24
21 Apr	Auto-Skimmer and pumping	16.49		24.5
22 Apr	Auto-Skimmer and pumping	22.00		23.5
26 Apr	Auto-Skimmer and pumping 1200 to 27 Apr 1100	13.00	475.00	23
27 Apr	Auto-Skimmer and pumping 1100 to 1900	2.46	135.00	8
27 Apr	Auto-Skimmer and pumping 1900 to 28 Apr 1100	3.28	272.00	16
28 Apr	Auto-Skimmer and pumping 1100 to 1515	2.46	64.00	4.25
28 Apr	Auto-Skimmer and pumping 1515 to 1930	1.20	29.50	4.25
28 Apr	Auto-Skimmer and pumping 1930 to 29 Apr 1930	2.46	87 (estimated)	12
29 Apr	Auto-Skimmer and pumping (1130 to 1245 - pump was down; auto probes were switched to boring 102; on/off pump cycle is now performed manually) 1130 to 1245, bailed continuously: at 1240 returned Auto-Skimmer to time cycle	2.05	96.9	6.5
29 Apr	Auto-skimmer and pumping 1400 - 1830	0.40	31.98	4.5
Subtotal		131.8	2803.00	
TOTALS TO DATE		258.14	2864.4	

FIGURE 2.0-5



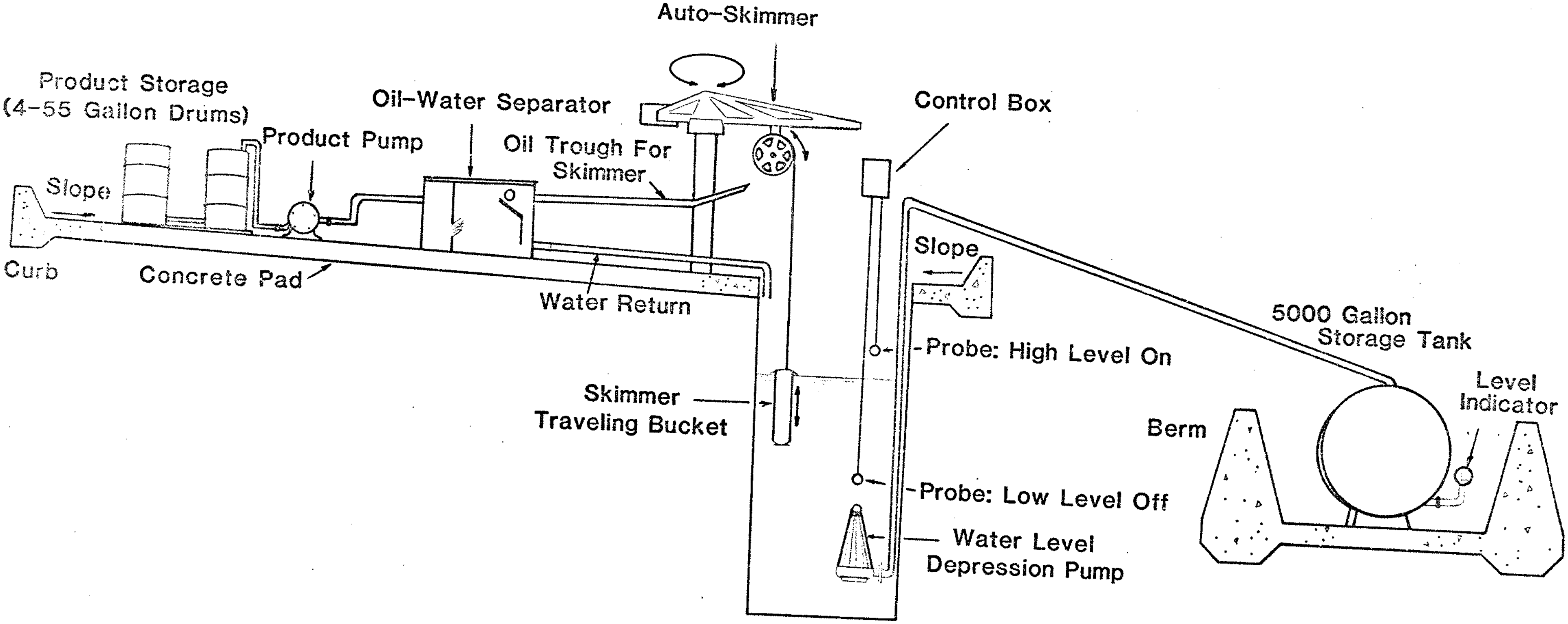
SALVAGE YARD
RECOVERY RATES:
INITIAL AND TEST PERIODS
INCREMENTAL RECOVERY RATE, GAL/DAY
50
40
30
20
10
100
200
300
400
Σ GALLONS RECOVERED

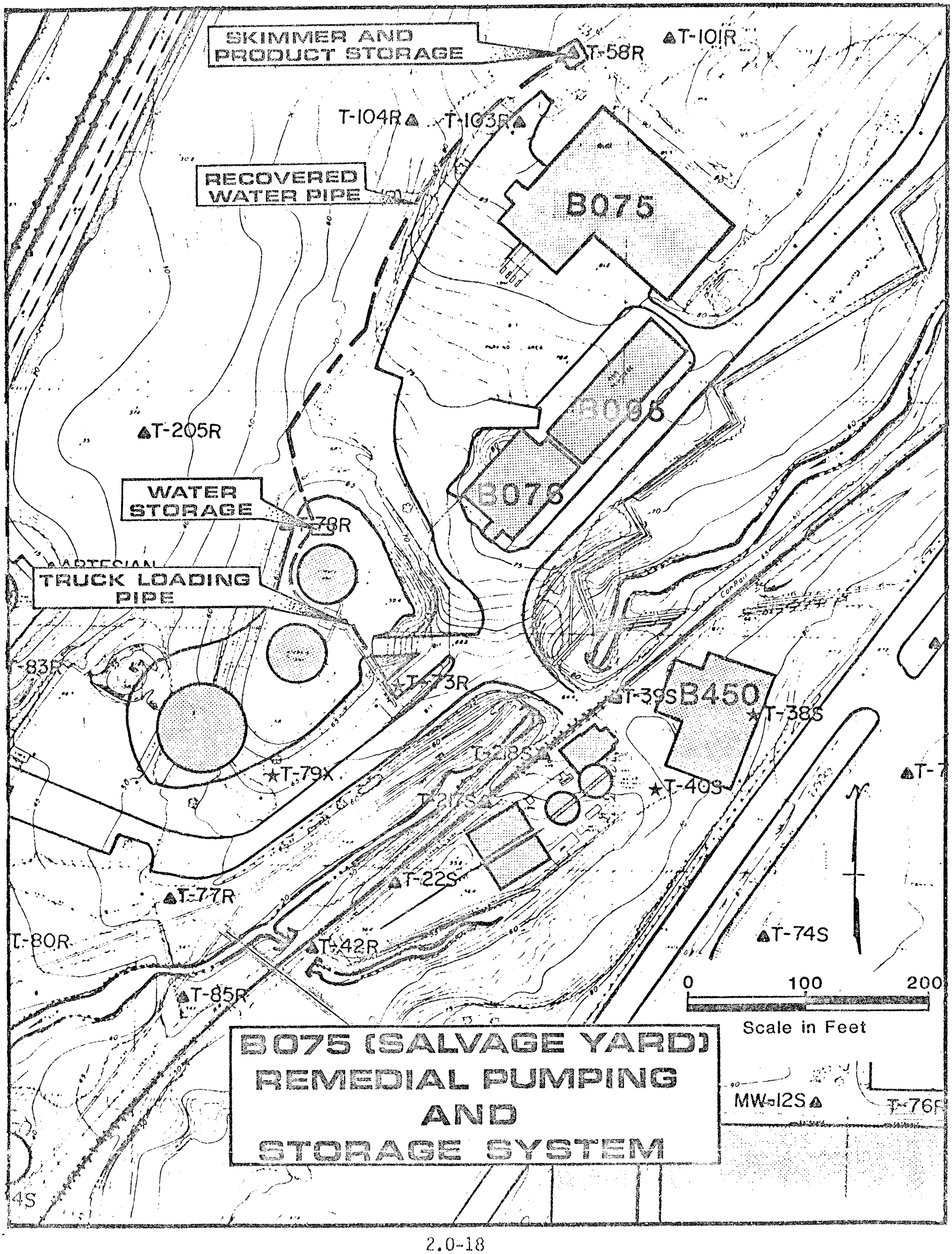
FIGURE 2.0-6

IBM POUGHKEEPSIE

SEASONAL SKIMMER INSTALLATION

(NOT TO SCALE)




SKIMMER AND PRODUCT STORAGE
T-58R
T-101R
T-104R
T-103R
RECOVERED WATER PIPE
B075
B076
T-205R
WATER STORAGE
T-78R
TRUCK LOADING PIPE
T-83R
T-73R
T-39S
B450
T-38S
T-28S
T-79X
T-40S
T-21S
T-22S
T-77R
T-80R
T-42R
T-74S
T-85R
0
100
200
Scale in Feet
MW-12S
T-76R
4S
B075 (SALVAGE YARD) REMEDIAL PUMPING AND STORAGE SYSTEM

1982, and shut down for the winter in November 1982. Table 2.0-4 summarizes the recovery of product and water during that period. Initial (July 1982) recovery was high because no recovery had been done since late April. A similar phenomenon was seen when operation resumed in 1983.

During the September-November 1982 period, the skimmer itself suffered several malfunctions, and was replaced by an improved version before 1983 operation began. The improvements are mainly in the electrical and control circuitry, while the basic operating principles of the unit remain the same.

2.6.4 Year-Round Auto-Skimmer Operation

In November 1983 the system was shut down to allow for winterization, consisting of a heated housing around the skimmmer and product storage, and heat tracing on the water line and water storage tank. The system was started up again in early January 1984, and continues to operate. (The commitment to continue operations is discussed in Section 3.5.)

The operation since January 1984 is summarized in Table 2.0-5. To date, since recovery first began in November 1981, a total of 465 gal of product and 64,818 gal of water have been removed; the recovery is summarized on Figure 2.0-8.

2.6.5 Disposal of Oil and Water

Table 2.0-6 summarizes the chemical characteristics of the T-58 water and free product from samples taken during the investigative phase of the program. Because its PCB concentration was greater than 50 ppm, the free product has been handled as PCB-contaminated waste; the water is classified as hazardous because of its concentration of various priority chemicals, most notably chlorobenzene.

TABLE 2.0-4

PRODUCT AND WATER REMOVED FROM T-58

July 1982 - November 1983
(Seasonal Operation)

DATE		PRODUCT (gal)	WATER (gal)
Jul 1982		55	1,600
Sep 1982		12.8	5,475
Oct 1982		20.2	5,060
Nov 1982	(1-19 Nov)	11.0	2,800
Jun 1983	21 days	20	7,955
Jul 1983	29 days	38	7,715
Aug 1983	31 days	24	6,997
Sep 1983	30 days	5	4,433
Oct 1983	30 days	8	6,800
Nov 1983	13 days	2	3,075
Subtotal		196	51,910
TOTAL TO DATE (12/1/83)		454	54,774

TABLE 2.0-5

PRODUCT AND WATER REMOVED FROM T-58

January 1984 through March 1984
(Year-Round Operation)

DATE	PRODUCT (gal)	WATER (gal)
1984		
Jan	2	4,531
Feb	9	5,513
Subtotal	11	10,044
TOTALS TO DATE	465	64,818

FIGURE 2.0-8

LONG TERM HISTORY OF SALVAGE YARD RECOVERY RATES

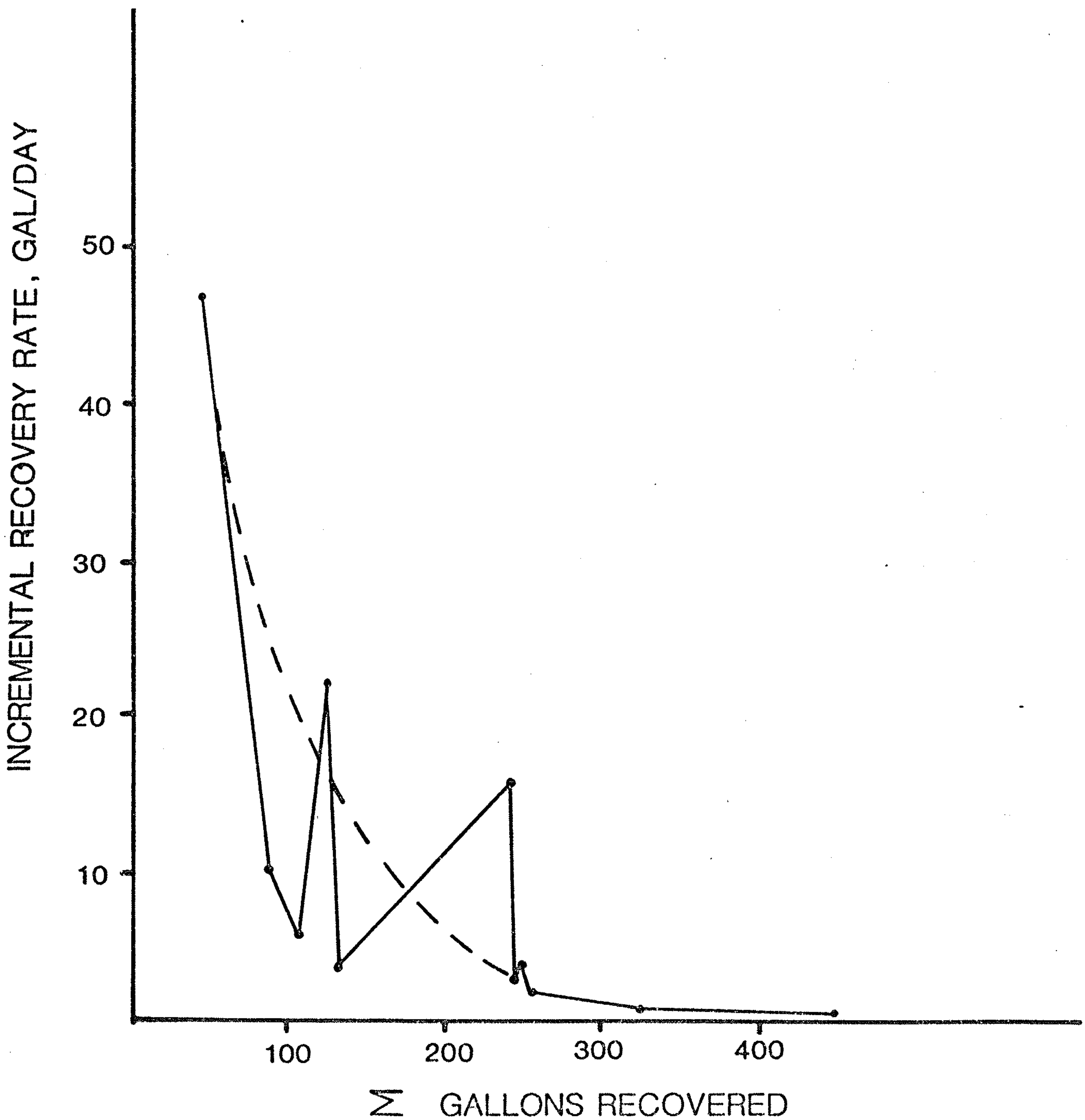


TABLE 2.0-6

SUMMARY OF VOLATILE ORGANICS AND PESTICIDES/PCBs DATA AT BORING T-58

COMPOUNDS	T-58 AQUEOUS 11/4/81 (ppb)	T-58 AQUEOUS 4/21/82 (ppb)	T-58 AQUEOUS 5/5/82 (ppb)	T-58 OIL 11/4/81 (ppb)	T-58 OIL 11/23/82 (ppb)	T-58 OIL 3/31/82 (ppb)	T-58 OIL 4/21/82 (ppb)
VOLATILES							
Priority							
Benzene	14	NR	21	NR	3,700	2,800	3,000
Chlorobenzene	1,400	NR	570	NR	1,100,000	1,200,000	1,300,000
1,1-dichloroethane	-	NR	-	NR	-	-	-
Trans-1,2-dichloro-ethylene	-	NR	15	NR	-	200	-
Ethylbenzene	260	NR	60	NR	460,000	580,000	500,000
Toluene	30	NR	130	NR	38,000	34,000	58,000
Trichloroethylene	-	NR	≤10	NR	-	200	-
Vinyl chloride	-	NR	-	NR	-	-	-
Group A							
Acetone	NR	NR	-	NR	NR	-	-
Xylene	NR	NR	800	NR	18%[a]	>3,000,000	5,000,000
PESTICIDES/PCBs							
Heptachlor	-	-	NR	20	NR	-	-
PCB 1254	-	1.1	NR	-	NR	72,000	-
PCB 1260	1.9	-	NR	3,000	NR	-	-
PCBs	-	-	NR	-	NR	-	28,000

NR - Not run.

[a]Percent is relative to total amount of compounds identified by GC/MS.

Water and oil are generally pumped out, under the supervision of IBM personnel, when the respective storage systems are full, but at no greater interval than 75 days, in order to comply with RCRA regulations. The liquids have been disposed of at:

WATER: CECOS
SCA

PRODUCT: ENSCO, Arkansas

2.7 BULK STORAGE TANK FARM WEST OF B004

2.7.1 Introduction

In early 1982 a mass balance of solvent liquids (xylene and isopropyl alcohol [IPA]) delivered vs. reclaimed at the tank farm west of B004 revealed the probability of a significant loss of these chemicals, most likely in the tank farm area itself. As a result of the mass balance, flanges on the tanks were excavated and tested, confirming that a number of the flanges were leaking. IBM immediately undertook a program of investigation, initial product recovery, design, and remedial action to recover the spilled material, remove groundwater containing chemicals, and prevent a recurrence of this loss.

2.7.2 Investigatory Phase

The objective of the investigatory phase was to make a preliminary estimate of what paths the spilled chemicals might follow, the extent of travel, the concentration in the groundwater, and the likely extent of free product. Borings were drilled in five locations; because of the discovery during drilling of three separate water bearing zones, a total of nine borings were drilled.

Examination of physical and chemical study data led to the conclusion that the chemicals had not migrated far from the immediate tank farm area; in fact, significant levels, mainly of IPA, were found only in the boring in the middle of the tank farm itself.

2.7.3 Conceptual Design

Following the preliminary phase, a second project phase was executed, with the objectives of completing the investigation and performing a conceptual design of remediation. Based on the findings of the first phase, attention was focused on the immediate vicinity of the tank farm itself. Borings were drilled and sampled for free product xylene and xylene, IPA, and other priority chemicals in the groundwater. These data formed the basis for estimating the maximum amount of xylene in place (600 gal), eliminating IPA and other priority chemicals as concerns, and considering remedial action options.

Three options for remediation were formulated and evaluated:

1. Pump groundwater and treat on site for xylene removal.
2. Pump groundwater and haul for off-site treatment and/or disposal.
3. Remove the xylene-containing soil now.

All three options had, as an adjunct, removal of free product xylene and xylene-containing water as an initial step.

Each option was preliminarily designed so that its major characteristics could be quantified. Evaluation factors included cost (capital plus operating), overall effectiveness, associated environmental impacts, duration of project, speed of problem solving, and potential danger. Although Option 3 presented somewhat greater potential danger (of fire or explosion) than the others, it was by far the most preferable in all other categories. A judgment was made that the risks could be reduced to acceptable levels by careful design and execution, and Option 3 was chosen.

2.7.4 Initial Remedial Action

Simultaneous with the development of contract documents for the chosen excavation option, the initial free product recovery was undertaken in October 1982 using the investigatory borings (Figure 2.0-9). The procedure consisted of alternately drawing off free product xylene while reducing the fluid level by pumping the groundwater. Although it had been estimated that 600 gal of free product might be in this area, only 29 gal were removed in this phase. The free product and approximately 2920 gal of water were removed for licensed disposal as a result of this phase. During the short period of storage of these materials on site, the xylene and water were in containers (55-gal drums and a 5000-gal tank truck, respectively) protected by spill containment.

2.7.5 Final Remedial Action

In November 1982 a contract was let to SCA, Inc., for the soil removal project. Table 2.0-7 is an outline of the specifications for this project, demonstrating the care taken for the multiple objectives of personnel health and safety, damage risk reduction, conformance to hazardous material handling regulations, prevention of residual movement of chemicals in the groundwater, and cost effectiveness.

The contractor performed most of the excavation by vacuum truck, which simultaneously reduced time and risk. On-site testing of excavated soil material was used to separate acceptable material for

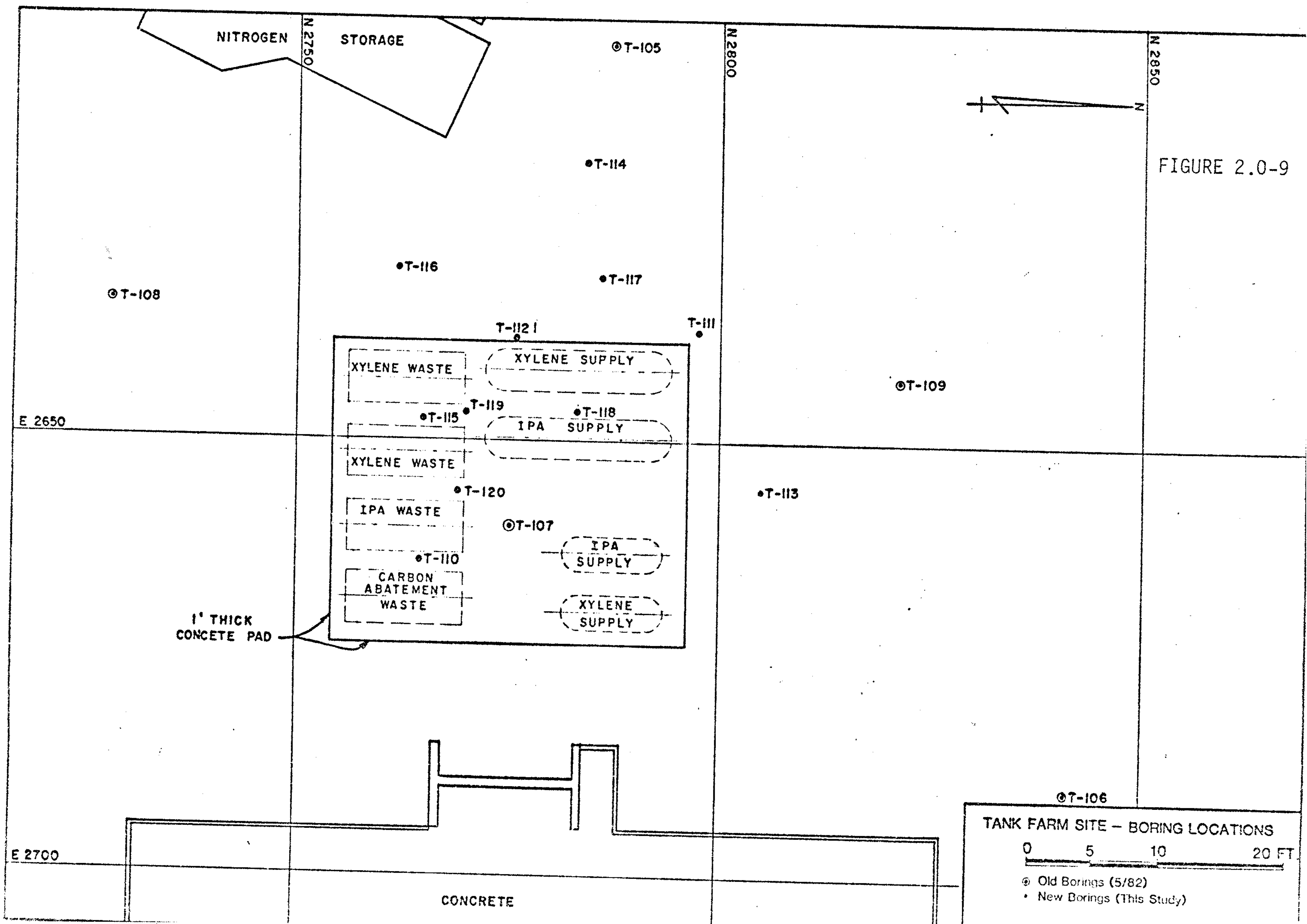

NITROGEN STORAGE
N 2750
N 2800
N 2850
N
E 2650
E 2700
T-105
T-114
T-116
T-117
T-108
T-112
T-111
T-109
T-119
T-118
T-115
T-120
T-113
T-107
T-110
T-106
XYLENE WASTE
XYLENE SUPPLY
IPA SUPPLY
XYLENE WASTE
IPA WASTE
IPA SUPPLY
CARBON ABATEMENT WASTE
XYLENE SUPPLY
1' THICK CONCETE PAD
CONCRETE
TANK FARM SITE – BORING LOCATIONS
0 5 10 20 FT.
Old Borings (5/82)
New Borings (This Study)

FIGURE 2.0-9

TABLE 2.0-7 (Page 1 of 3)

OUTLINE OF EXCAVATION PROJECT SPECIFICATIONS

1. SAFETY ITEMS, XYLENE HANDLING

   a. Equipment and Tools

      Shovels — All spark-proof (beryllium brass)
      Picks
      Backhoe bucket teeth
      Bars
      Pipe wrenches
      Spark arrester on mobile equipment exhaust pipes

   b. Personnel Protection

      Supplied air/respiratory protection:
      - supplied air
      - canister
      - cartridge

      in decreasing order of protection: depends on concentration in air

      Protective clothing - e.g., PVC- better than vinyl unpregnated paper "TYVEX"
      Gloves, boots, hard hats
      Face shields or goggles
      Encapsulated suits as standby (for extreme case)

   c. De-contamination Trailer - use at end of day and before lunch

   d. Monitoring

      LEL meter
      Drager tubes:
        Ethylbenzene
        IPA
        Xylene

2. INTEGRITY OF CHEMICAL SYSTEM

   Essential that xylene and IPA feed systems remain in operation throughout project.

   a. Method of Pipe Support

   b. Order of Excavation

      Side slopes - Flatter than normal cut-backs to relieve soil pressure on tanks

      Tank bracing optional

TABLE 2.0-7 (Page 2 of 3)

OUTLINE OF EXCAVATION PROJECT SPECIFICATIONS

c. Anchoring System

Optional

3. OUTLINE OF CONTRACT DIVISIONS — UNIT

Unit Price Contract - Because quantities of xylene-containing soil and pumped water are unknown, a unit price contract is recommended.

a. Mobilization/De-mobiliation

Includes fence removal and replacement — Lump sum

b. Fill De-watering

Based on (now 25,000 gallon) engineer's estimate of Quantity; owner might specify method, i.e., by means of existing 4"ø wells, or allow contractor to propose method. — $ /gallon

c. Plain Excavation

- Includes de-watering after fill de-watering
- Measurement by "neat" excavation, i.e., cut-backs necessary for system protection to be included in neat excavation price
- Excavation to include un-contaminated soil (to be stockpiled) as well as contaminated (to be hauled to disposal). Owner to classify material during excavation.
- Owner will probably specify de-watering method, e.g., sump in corner of excavation. Owner to supply estimate of de-watering rate (now, .2-.3 gpm).

d. Disposal at Approved Site

1. Water: — $ /gallon, $ /load

1 load ≤ 5,000 gallons

a. Carbon treated

b. Incinerated

2. Soil — $ /ton + $ /load

1 load ≤ 20 tons

TABLE 2.0-7 (Page 3 of 3)

OUTLINE OF EXCAVATION PROJECT SPECIFICATIONS

	UNIT
e. Borrow - (Clean backfill)	
To replace soil disposed of	$ /c.y.
f. Backfilling	
Tamp at 6" lifts Tamper (J type) equipped with spark arrester Quantity equals plain excavation quantity	$ /c.y.
g. Clean-up	
Topsoil Raked Hay	Lump sum

backfill from that requiring secure landfilling; cut-off level was 50 ppb of xylene. The water table was depressed to below the slab level (see Figure 2.0-9) by the contractor's mud pump, with water pumped to a tank truck (on a spill containment pad), followed by hauling to approved disposal. Before backfilling, the flange gaskets that had been found to leak were replaced with Viton 1/8 in. thick gaskets to prevent recurrence of the problem; subsequent leak testing has demonstrated the integrity of the system.

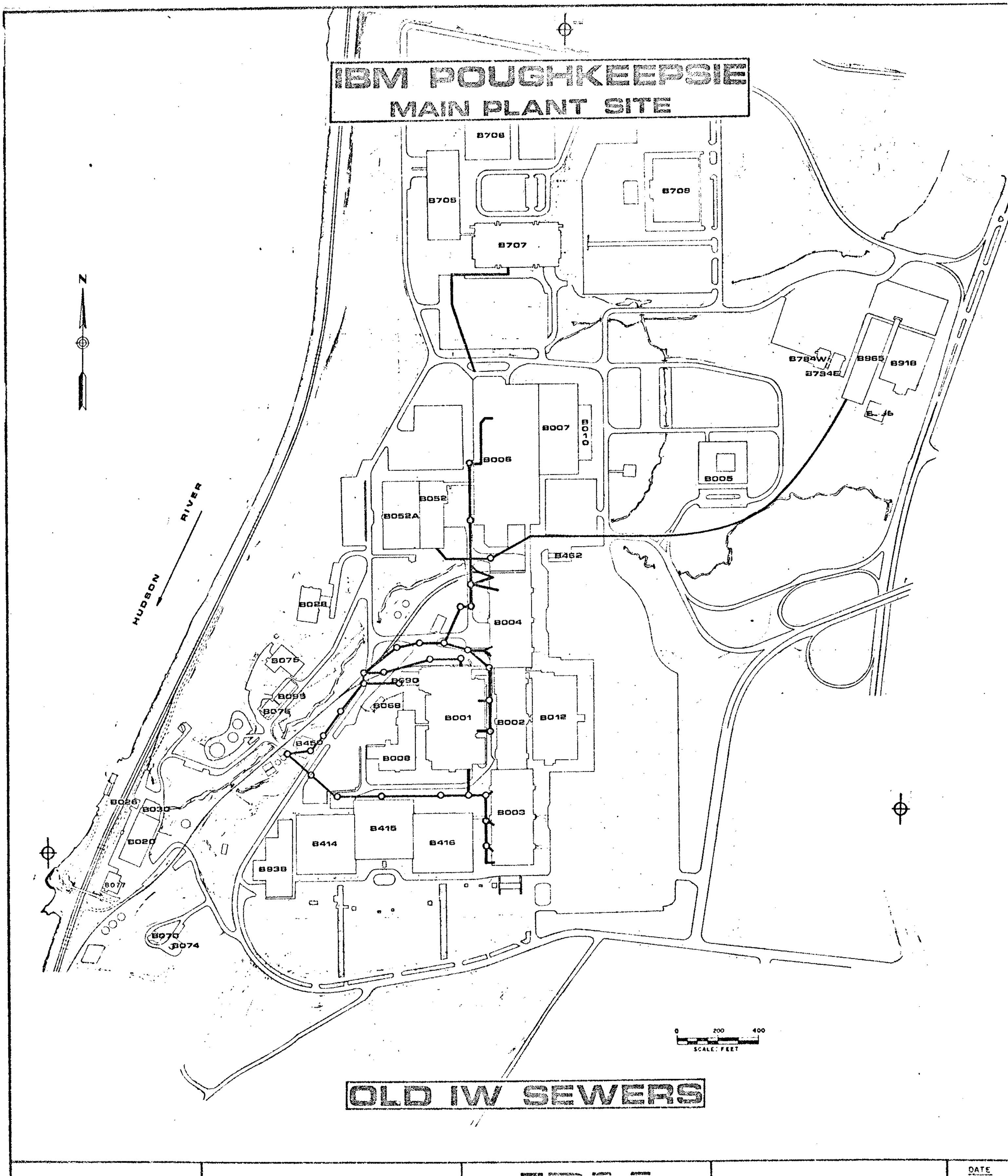
The project, including site restoration, was completed in January 1983; 459 tons of soil and 8622 gal of water containing chemicals, as well as the 29 gal of xylene recovered in the initial period, had been removed and disposed of at SCA's licensed facilities. No further free product had been found during the final remediation phase.

2.7.6 Result of Action

Testing of groundwater in representative borings in this area in 1983 showed no boring with a priority chemical concentration exceeding 50 ppb.

2.8 NEW INDUSTRIAL WASTE SEWERS

At the outset of IBM's groundwater assessment program in the late 1970s, the industrial waste sewer in the manufacturing portion of the site (Figure 2.0-10) was mainly 20- to 30-year-old clay tile pipe with jute or mortar joints and brick and concrete manholes. Although the sewer was in relatively good condition outside the manufacturing area, because of more modern materials of construction, in the manufacturing area itself acid wastes had caused serious deterioration of the joints and manholes. It was assumed that the leaks were resulting in a migration of priority chemicals into the soil and groundwater along at least some portions of the



Lawler, Matusky & Skelly Engineers
Environmental Science & Engineering Consultants

Poughkeepsie, N.Y.

FIGURE 2.0-10

DATE

DWG NO.

manufacturing area sewer, and that that portion of the sewer should be replaced. (Later investigation, discussed in Section 2.9, showed that the assumption of chemical migration was correct.) Design and installation of the new pipe system proceeded through several phases:

- Initial conceptual design - December 1978 - May 1979
- Detailed conceptual design - January 1980 - September 1980
- Prototype installation - October 1980 - December 1980
- Final design - January 1981 - June 1981
- Complete installation - August 1981 - October 1982

IBM's objective was to replace completely the old pipe system in the manufacturing area to the IWTP, and from the IWTP to the effluent holding system in the southwest corner of the site with a system that would be fail-safe against further effects on groundwater quality. This was to include building connections as well as sewer mains, and would have the following design and operational characteristics:

- The system was to be fully contained, i.e., a double-walled or "pipe-within-a-pipe" system was needed.
- No interruption of the manufacturing process was allowed during the construction phase.
- A monitoring and alarm system was needed to detect, and notify of, any system leakage.
- The inner, or carrier, pipe was to be removable for ease of repair.
- Pipe material was to be resistant to attack by the variety of chemicals used at the site.
- The new system was to cause as little disturbance as possible to the 19 existing underground utility systems on the site, and no interruption of the service of any of these utilities was allowed. Notwithstanding this requirement, it was to be a gravity system.

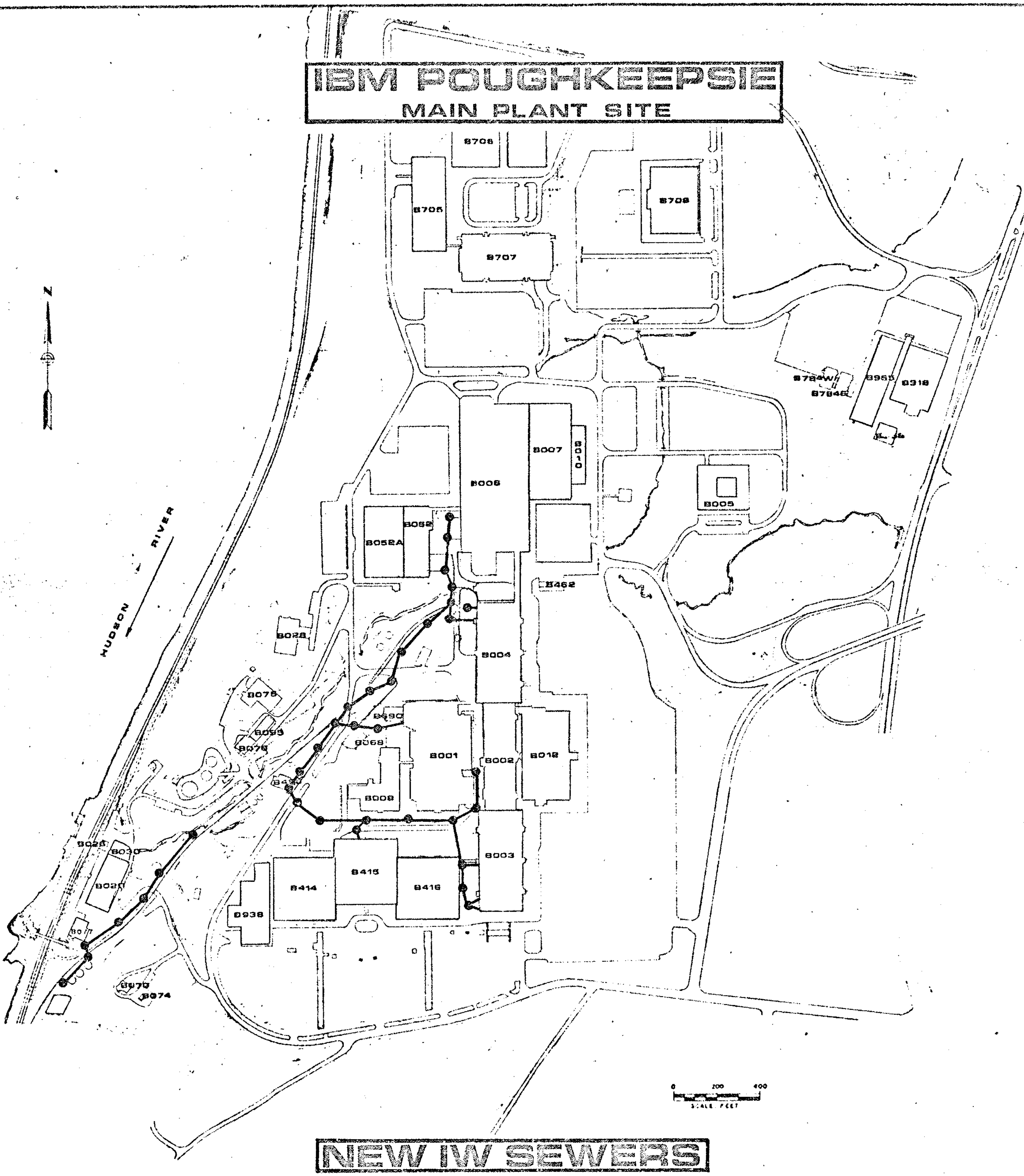
After consideration of several options, a polyethylene pipe system was selected. Figure 2.0-11 shows the routes of the new pipe system, which includes approximately 5550 linear feet of new main and building connections. The prototype portion, installed in the railroad bed south of the IWTP, proved the feasibility of the system.

A unique feature of the double pipe design at Poughkeepsie is the ability to remove the entire section of pipe between any two contiguous manholes quickly and easily, facilitating immediate and rapid repair of leaks or other damage. This was achieved by: welding the entire section of pipe rather than using more traditional methods (e.g., dresser couplings); using a removable flanged coupling at each manhole; and, knowing the achievable radius of curvature of bending and the temperature coefficient of expansion of the inner pipe, designing the manholes to permit the entire welded section to be pulled out of a manhole upon unbolting the flanged coupling. During such a repair, flow would be pumped via an above grade conduit around the section under repair by use of riser sections in the manholes, thus avoiding a plant or process shutdown.

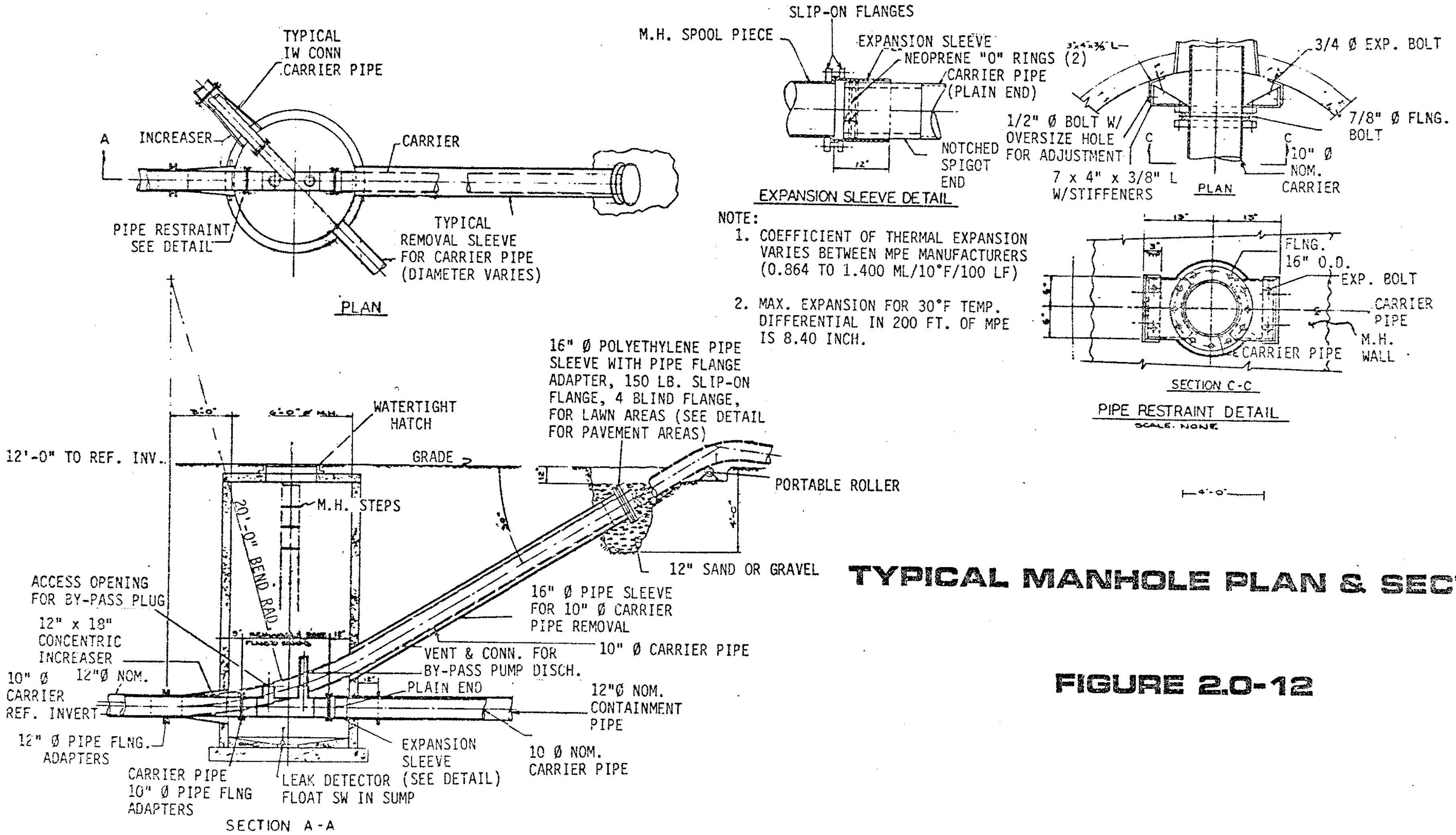
A plan view and section of a typical manhole are shown in Figure 2.0-12; the section also shows, schematically, the method of removing the inner pipe. Leaks are monitored by installation of collection lips in the outer pipe at each manhole; when leaked liquid waste or infiltrated water collects therein, an alarm is triggered. To date, no leaks in the inner pipe have occurred.

2.9 OLD INDUSTRIAL WASTE SEWERS

After the new IW sewer system had been installed, the old system was examined to determine whether remediations were required because of:



Lawler, Matusky & Skelly Engineers Environmental Science & Engineering Consultants	Poughkeepsie, NY	FIGURE 2.0-11	DATE DWG. NO.



TYPICAL MANHOLE PLAN & SECTION

FIGURE 2.0-12

1. Sediment in the sewer that might act as a continuing source of chemical leaching to the soil and groundwater outside the pipe
2. Soil outside the pipe that exceeded acceptable levels of chemicals
3. The pipe acting as a conduit, carrying water from one portion of the site to another

The system examination has been reported on in LMS 1983. Based on that examination, IBM executed the first phase of a remediation program in 1983. This consisted of removing the sediment from the system and plugging the manholes. The second phase, removal of portions of the pipe system and the soil around it, will be done in 1984. (See Section 3.4.)

The system was cleaned by an outside contractor with standard sewer jet cleaning equipment. Water was injected into the sewer by way of a traveling set of high-pressure nozzles. All sediment, both that on the bottom and any adhering to the walls of the pipes and manholes, was flushed down the pipe and captured by pumping into a holding tank. The pipe was cleaned one section at a time, starting upstream and working downstream. Two 55-gal drums of sediment separated from the water were transported to the industrial waste sludge beds for subsequent disposal; the water was discharged to the IWTP. During the period of discharge, the wastewater was batch-treated with powdered activated carbon to remove any residual priority organics. Insoluble materials or heavy metals in this water were also removed by the normal coagulation/sedimentation treatment at the IWTP.

CHAPTER 3.0

REMEDIAL ACTIONS COMMITTED

This chapter discusses several remedial actions to which IBM has committed itself to complete its programs of solving existing groundwater problems that meet the criteria discussed in Chapter 1.0. A summary of these committed actions is given in Table 3.0-1; each is discussed in turn below.

3.1 B004 STORM DRAINS

As discussed in Section 2.5, there has been a drain and pumping system in place in this storm drain system since 1980, installed for the purpose of capturing groundwater containing copper and directing it to the IWTP for treatment. In 1983 this system was investigated to determine the source of a small amount of priority organic compounds in D013, where this system discharges.

The results of this investigation are shown in Figure 3.0-1. This figure shows that the only significant source of priority organics is upstream of the dam and pump; flux calculations show that the flux downstream of the dam is negligible, i.e., the dam already removes the main flux of priority organics. The location of the existing dam is the only one at which the dual objectives of capture and discharge to the IWTP can be easily accomplished.

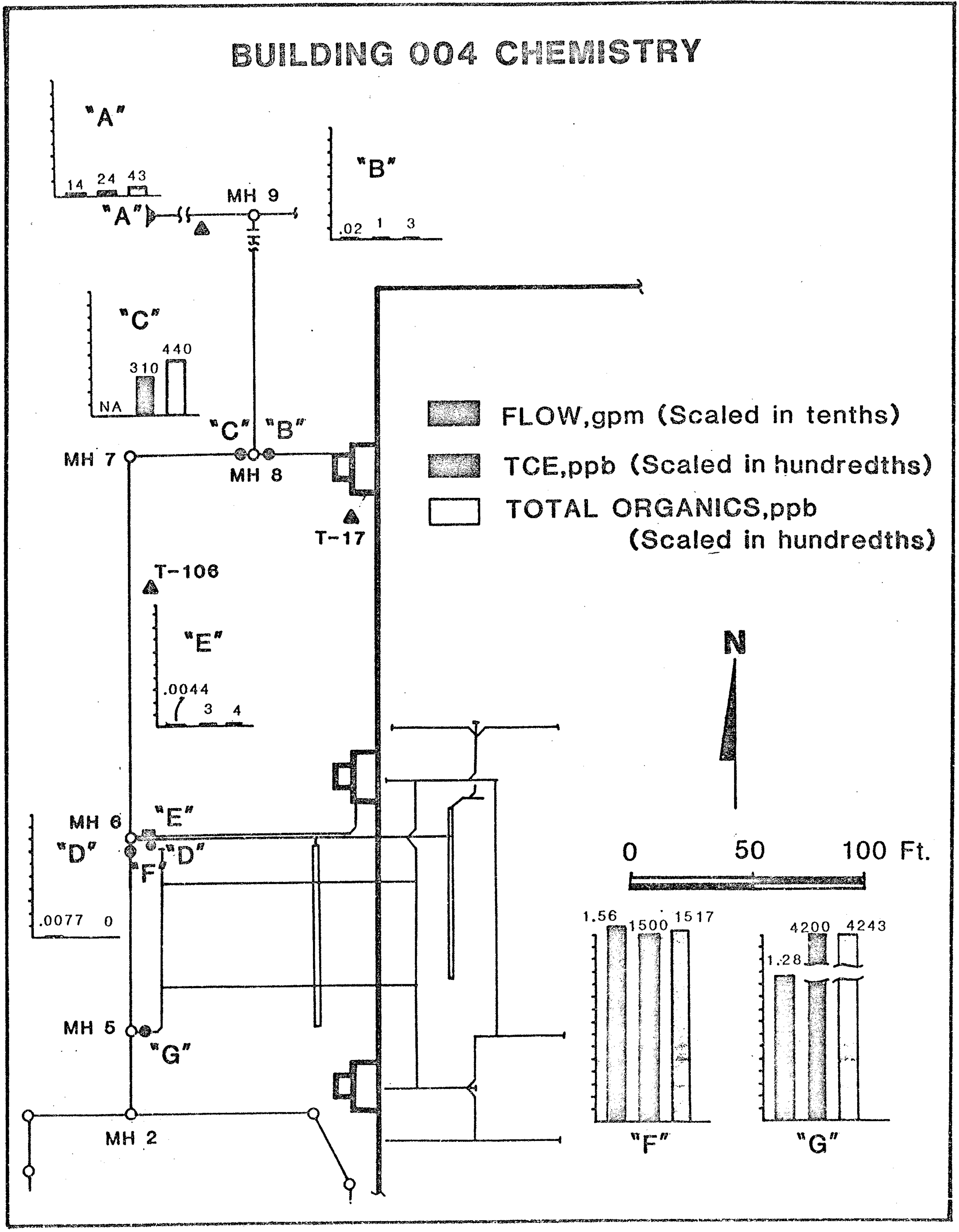
IBM has committed itself to continue the operation of this system indefinitely, until neither copper nor priority organics enter the system in significant concentrations.

TABLE 3.0-1

SUMMARY OF REMEDIAL ACTIONS COMMITTED

REPORT SECTION No.	SITE	SITUATION TO BE REMEDIATED	TYPE OF ACTION PROPOSED	DURATION
3.2	B004 storm drain	Metals in underdrains (see Section 2.5); organics found in underdrains in 1983 investigation.	Continue operation of existing dam and pump to IWTP.	Indefinite
3.3	B003 storm drain	Organics in underdrain system, found in 1982/1983 investigation.	Dam and pump, similar to B004 system.	Indefinite
3.4	B002 storm drain	Freon (refrigerant) found in underdrains in 1983 investigation.	Look for leak(s) in cafeteria refrigeration system. If found, repair.	Do in 1984
3.5	Old IW sewers	Priority chemicals in soil surrounding pipe in two locations. Some groundwater effluent.	Remove sections of pipe and soil in two locations.	Do in 1984
3.6	B075 (salvage yard)	Free product recovery not yet completed.	Continue to operate existing recovery system.	Continue until no longer cost effective.

FIGURE 3.0-1


BUILDING 004 CHEMISTRY
"A"
14 24 43
"A"
MH 9
"B"
.02 1 3
"C"
NA 310 440
"C" "B"
MH 7
MH 8
T-17
FLOW,gpm (Scaled in tenths)
TCE,ppb (Scaled in hundredths)
TOTAL ORGANICS,ppb (Scaled in hundredths)
T-106
"E"
.0044 3 4
N
MH 6
"E"
"D"
"D"
"F"
.0077 0
0 50 100 Ft.
1.56 1500 1517
4200 4243
1.28
MH 5
"G"
MH 2
"F"
"G"

3.2 BUILDING 003 STORM DRAIN

The investigation of the B003 storm drain system was reported on in LMS 1983; confirmatory sampling was conducted after the publication of that report, also in 1983. A summary of the chemistry findings from that study is given in Figure 3.0-2, which shows that the major input of priority chemicals to the system is in the underdrain portion, i.e., upstream of manhole 30 where the B003 (and B002) underdrains discharge to the sewer that also carries storm water from the east side of the buildings.

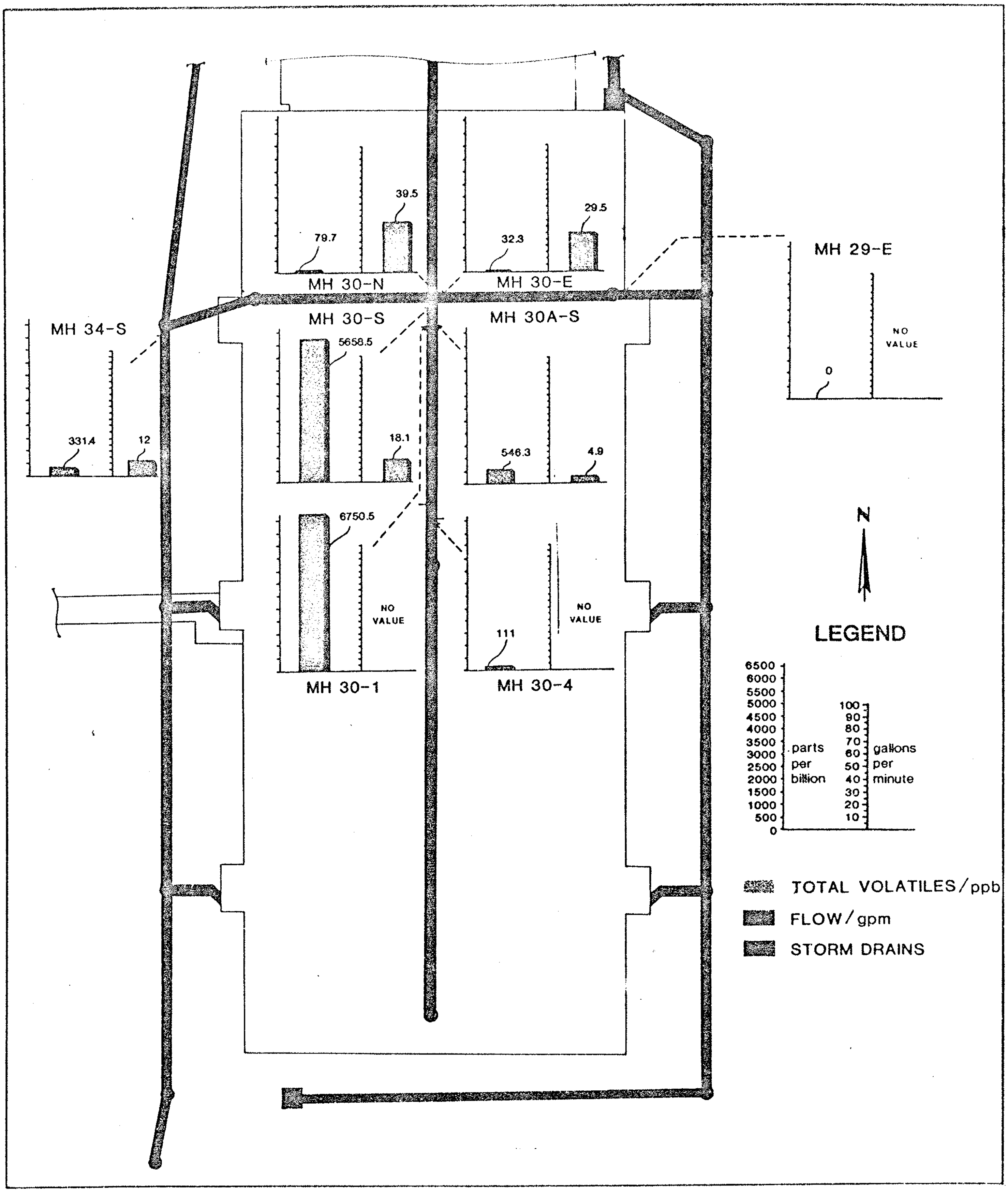
Thus, there is an opportunity to install a drain and pumping system similar to that already in place at B004, with the advantage at B003 that there need be no provision for passage of storm flows.

IBM has committed itself to a drain and pump system in the main underdrain pipe just upstream of MH 30. The pump will be capable of handling 15 gpm, the maximum flow rate observed in the pipe; if feasible, some noncontact cooling water that now discharges to this system will be rerouted (still to discharge at D009) to relieve the hydraulic load on the IWTP. The estimated underdrain flow is about 5 gpm of the 15 gpm observed at MH 30.

3.3 BUILDING 002 STORM DRAIN

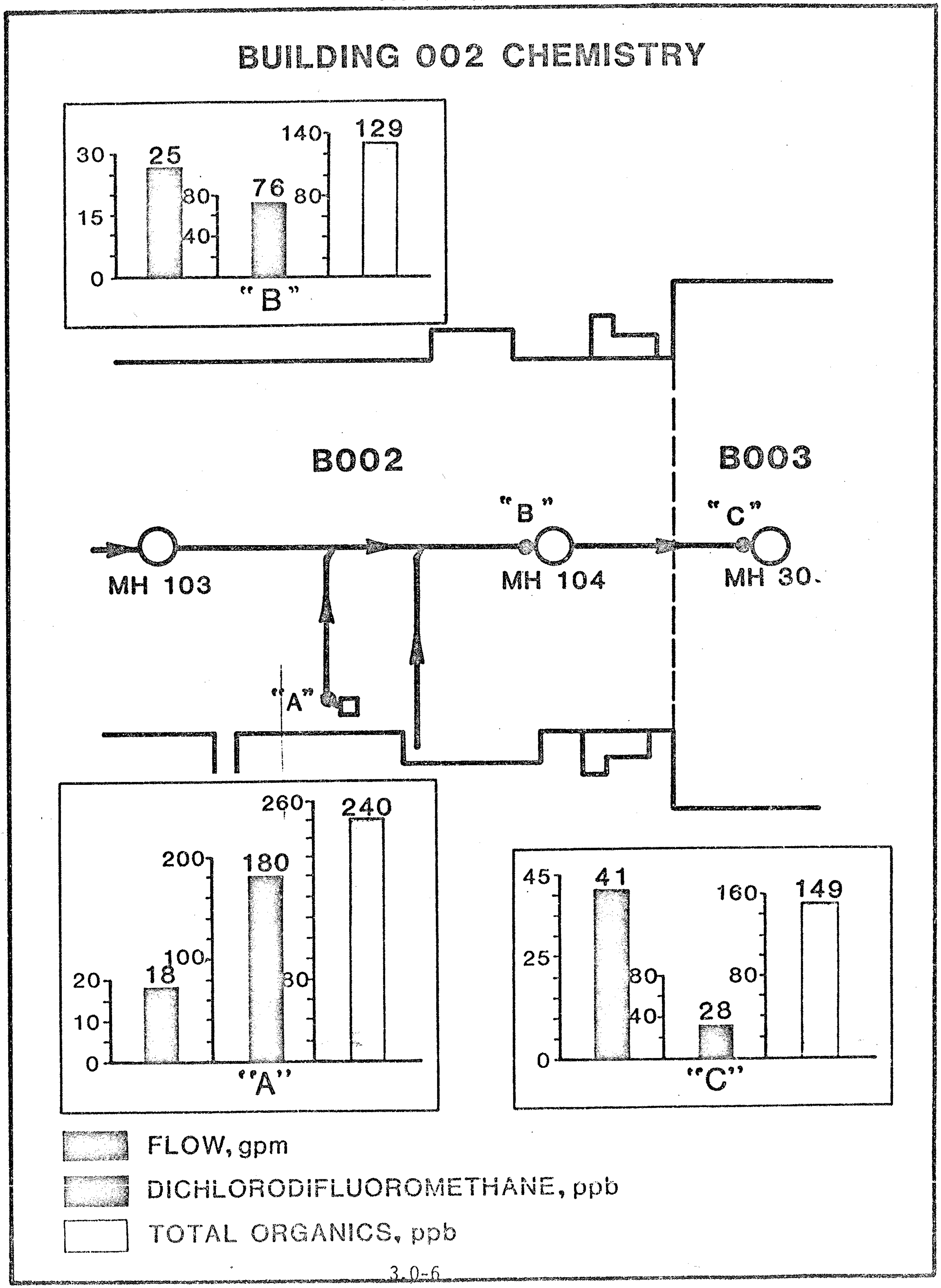
Figure 3.0-3 summarizes the chemistry findings from the 1983 investigation of this underdrain system. The chemical that dominates, whose source can be located, is dichlorodifluoromethane, a refrigerant freon. The source is in the cafeteria area, and is apparently the cafeteria refrigeration system. A leak of a magnitude not unusual in the refrigeration business, about 15 lb/yr, is indicated by the data.

FIGURE 3.0-2



BUILDING 003 CHEMISTRY SUMMARY

FIGURE 3.0-3



BUILDING 002 CHEMISTRY
30
15
0
25
80
40
76
140
80
129
"B"
B002
B003
"B"
"C"
MH 103
MH 104
MH 30.
"A"
260
200
100
20
10
0
18
180
80
240
"A"
45
25
0
41
80
40
28
160
80
149
"C"
FLOW, gpm
DICHLORODIFLUOROMETHANE, ppb
TOTAL ORGANICS, ppb

It might not be possible to find this leak. However, IBM has committed itself to search for it, and to correct it if it can be found and is correctable.

3.4 INDUSTRIAL WASTE SEWERS COMPLETION

LMS examined the data on priority chemicals in the soil outside of the old IW pipes and reviewed the possible relationships between chemicals in the sewer sediments and surrounding soils and local groundwater quality. Two areas were found to warrant remediation:

- The area west of B003, exhibiting both elevated concentrations in the soil and effect on groundwater
- The area just south of the tank farm, exhibiting a probable effect on groundwater

These two conclusions are obtained from Tables 3.0-2 and 3.0-3, respectively. Table 3.0-2 shows that the soils surrounding the pipe in the vicinity of B003 (see Plate 1) have elevated concentrations of priority chemicals. Furthermore, the chemical fingerprint of T-209 water is similar to that in the IW sediment and the soils, exhibited most strongly by the presence of tetrachloroethylene. This differentiates it from the other possible sources affecting T-209: the site gravel, the storm drain, and the general soils west of B003. It is further differentiated from the storm drain by its lack of freon (dichlorodifluoromethane).

Table 3.0-3 shows chemistry from two manhole sediment samples south of the tank farm, and in the local borings. The table indicates that the IW sewer is probably the source of the chemical findings in MH 19, mainly because of its relatively high tetrachloroethylene and low 1,1,1-trichloroethane concentrations. A tentative conclusion had been drawn early in the groundwater assessment program that the

TABLE 3.0-2

PRIORITY CHEMISTRY IN THE VICINITY OF T-209

				IW				
							SOILS	
COMPOUND	T-209	T-33	T-28	D009	MH-25	MH-27	IW-3	IW-4
Trichloroethylene	881	288	5	441	5,610	5,260	2,815	4,305
Tetrachloroethylene	113	-	1	-	431	3,370	-	695
Trans-1,2,-dichloroethylene	77	-	-	143	<50	342	187	295
1,1,1-trichloroethane	9	-	66	4	1,420	1,100	-	-
Dichlorodifluoromethane	-	-	-	19	-	-	-	-

All concentrations in ppb.

- = Not detected or Below Method Duration Limit.

Concentrations are arithmetic averages of all samplings.

TABLE 3.0-3

PRIORITY CHEMISTRY IN THE VICINITY OF MW-19

			IW	
COMPOUND	MW-19	T-9	MH-11	MH-9
Trichloroethylene	284	1,171	55	<50
Tetrachloroethylene	42	2	140	474
Trans-1,2,-dichloro-ethylene	41	208	109	8,760
1,1,1-trichloroethane	16	1,411	50	-

All concentrations in ppb.

- = Not detected or Below Method Duration Limit.

Concentrations are arithmetic averages of all samplings.

chemistry in T-9 and MW-19 were related, but we now believe that leakage from the IW sewer is a better explanation for MW-19's chemistry. Even though elevated concentrations were not found in the surrounding soil in this area, the presence of the chemicals in the groundwater is prescriptive evidence that the soil has also been affected.

Based on these findings, IBM has committed itself to the removal of these two portions of the old IW pipes and manholes and that soil immediately surrounding the pipe found to contain elevated chemical concentrations. The extent of the the project will be:

at B003:	manhole 25 to manhole 27, or about 300 lineal feet
south of the tank farm:	from manhole 9 to manhole 11, or about 175 lineal feet

IBM plans to execute this project in 1984.

3.5 B075 COMPLETION

IBM is committed to operating the product recovery system as long as the rate of recovery remains at a feasible level. When recovery has fallen off to a low level, it can be assumed that potential downgradient impacts have been alleviated.

It is our opinion that the project should continue for a minimum of one more year, and beyond that, if necessary, until the recovery rate is consistently less than 0.1 gpd of free product. IBM is committed to this program.

REFERENCES CITED

Lawler, Matusky & Skelly Engineers (LMS). 1983. Final report: hydrogeology and chemistry of main plant site. Prepared for IBM, Poughkeepsie.

Lawler, Matusky & Skelly Engineers (LMS). 1984. Data update: hydrogeology and chemistry of main plant site. Prepared for IBM, Poughkeepsie.

APPENDIX A

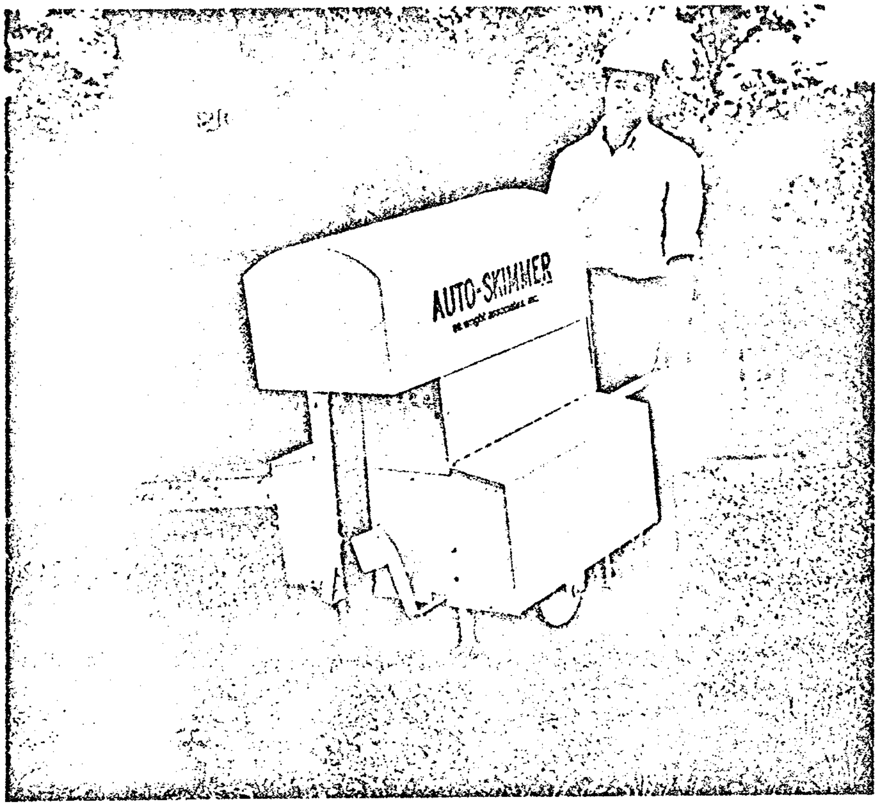
DESCRIPTION OF AUTO-SKIMMER

AUTO-SKIMMER™ PATENT PENDING

"Patented — U.S. No. 4,404,093"

Portable • Explosion Proof

Completely Automatic Recovery

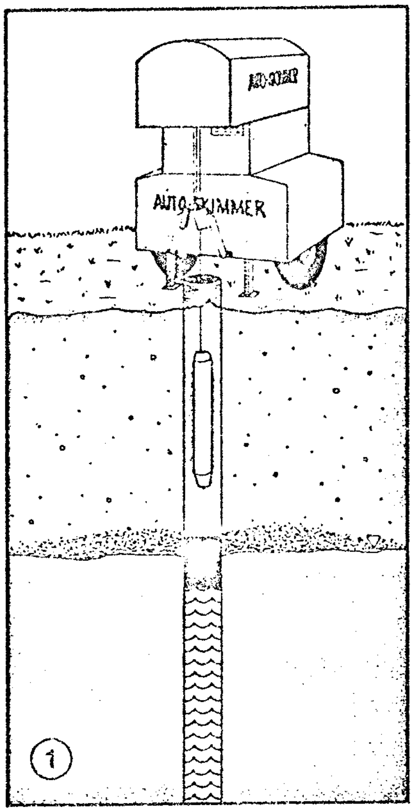


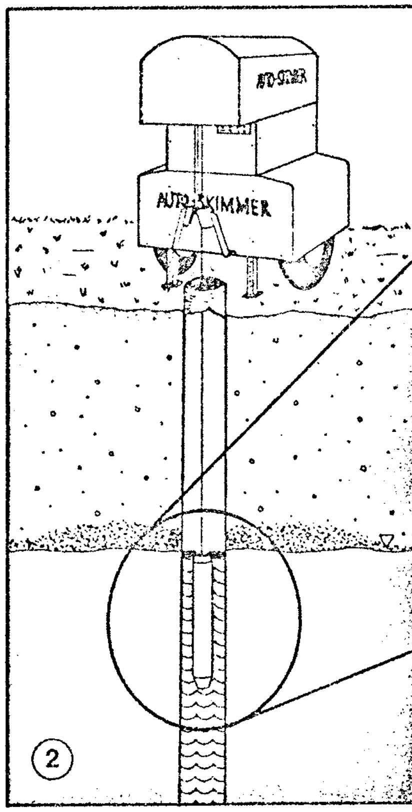
AUTO-SKIMMER™ is *The Practical Alternative* to expensive large diameter recovery wells, clogging filters, fouling probes and expensive maintenance that escalate the costs of your recovery program.

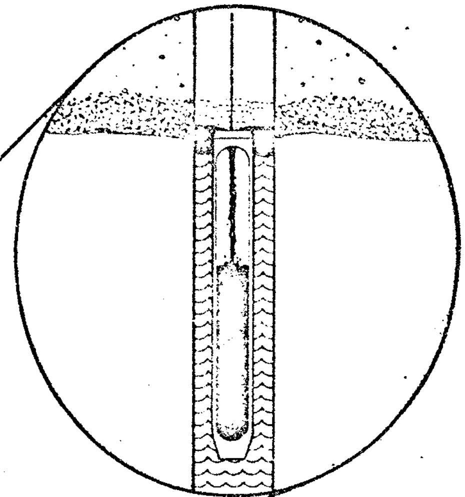
Characteristics	AUTO SKIMMER™	Double Pump Systems	Filter Pumping Systems
Recovers Product from 2-inch diameter wells	**yes**	no	no
Recovers Product from 4-inch diameter wells	**yes**	no	no
Recovers Product from 6-inch diameter wells	**yes**	no	no
Minimum Well Size Required	**2-inch**	10-inch	24-inch
Works with or without groundwater depression pump	yes	no	yes
Automatically adjusts to changing water levels	yes	no	yes
Operates without filters	yes	yes	no
Operates without probes	yes	no	yes
Works equally well in light or heavy (viscous) products	yes	no	no
Installs in less than 20 min.	yes	no	no
Moved easily by one person from well to well	yes	no	no
Leaves no measurable free product on the water surface	yes	no	no

AUTO-SKIMMER™ PATENT PENDING

Automatic Skimming Cycle



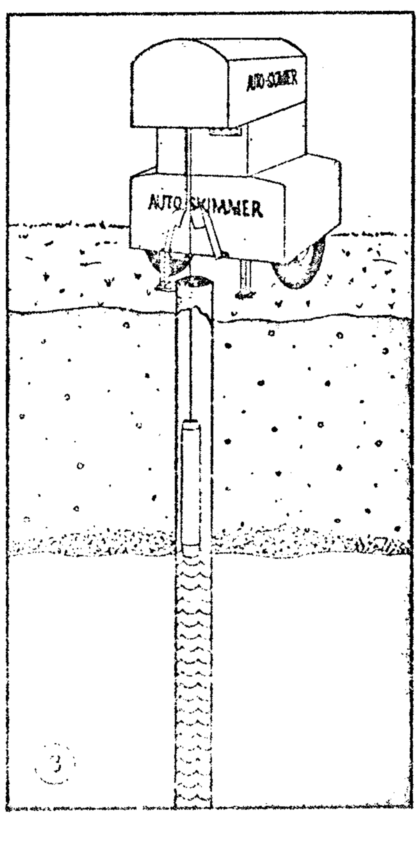


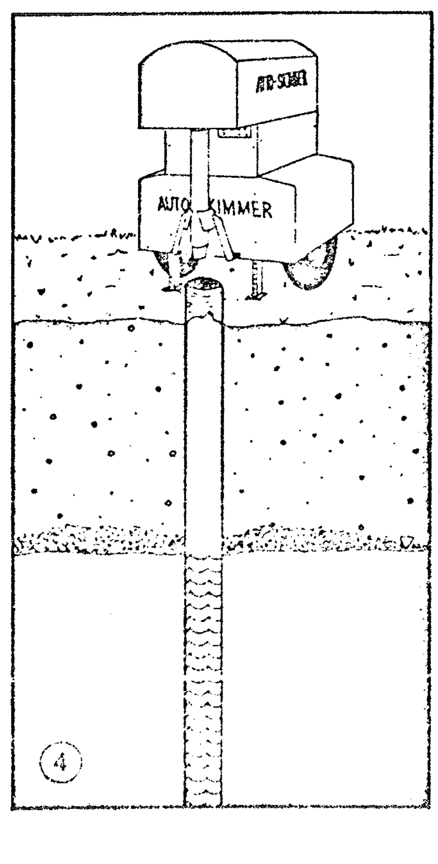


Pulsing action can be set to as little as 1/4″ intervals to allow for efficient skimming of even small product thicknesses.

Operating Principle

1. The control mechanism automatically lowers a recovery vessel into the well until it has partially entered the liquid, and becomes slightly buoyant.
2. The weight change resulting from the bouyancy causes the control mechanism to begin lowering the recovery vessel in a series of short pulses, pausing momentarily at each interval to permit the smooth skimming of free product over the slightly submerged rim of the vessel.
3. When the recovery vessel is approximately 3/4 full, the unit mechanically senses its increased weight and automatically raises the vessel before it overfills.
4. Upon return of the recovery vessel to the surface, its contents are automatically pumped into the built-in oil/water separator from which the product is simultaneously pumped to a collection tank, and water is either returned to the well or to surface disposal.

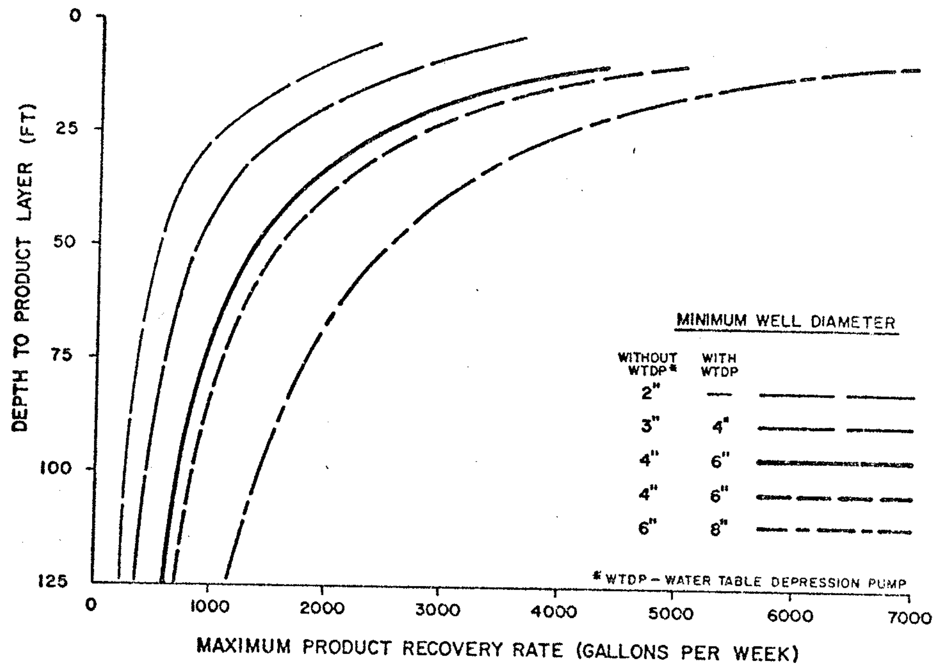




AUTO-SKIMMER™ PATENT PENDING

Recovers up to 6000 gallons per week

Performance Curves



Recovery Capability

The maximum recovery rate of the Auto-Skimmer™ is a function of the well diameter and the depth to the product layer as illustrated by these performance curves. However, the actual long term recovery rate of a given well will be governed by the product yield of that well.

Automatically Adjusts to Changing Liquid Level

Because it mechanically senses the buoyancy of the empty recovery vessel as it becomes partially submerged, the Auto-Skimmer™ will lower the vessel until it automatically locates the liquid level each time it enters the well. As this function *is mechanical,* there is no reliance on electrical probes, which tend to become coated with hydrocarbons and malfunction. Instead, Auto-Skimmer's mechanical system reliably adjusts to any change in liquid level resulting from tidal, seasonal, or storm events; even periodic cycling of pumps in nearby wells, or an optional water table depression pump in the same well.

Additionally, Auto-Skimmer's™ ability to automatically locate the liquid level saves considerably on time and cost when moving from well to well, since no adjustments are required for any variation in the depth to the product layer.

Continuous Recovery Mode

Auto-Skimmer™ offers a continuous recovery mode for high rates of free product entry into the well. Activated by a single switch on the Master Control Panel, the recovery vessel will continuously travel in and out of the well, pausing only to skim product and for its contents to be pumped into the separator. As the recovery capability of the Auto-Skimmer™ in continuous recovery mode, typically exceeds the product yield of the well, product will be removed as rapidly as it accumulates in the well.

Timed Recovery Mode

When the product yield of the well is low compared to Auto-Skimmers'™ maximum recovery rate in continuous run, the unit may be operated in a timed recovery mode. Under this operating mode, any time delay of several seconds to thirty hours between skimming cycles may be selected.

Timed recovery mode is an option which provides for the efficient removal of small quantities of product while maintaining the water surface in an essentially product-free condition. This mode of operation may be selected simply by turning the continuous recovery mode switch off, and setting the timed recovery mode timer to the desired interval.

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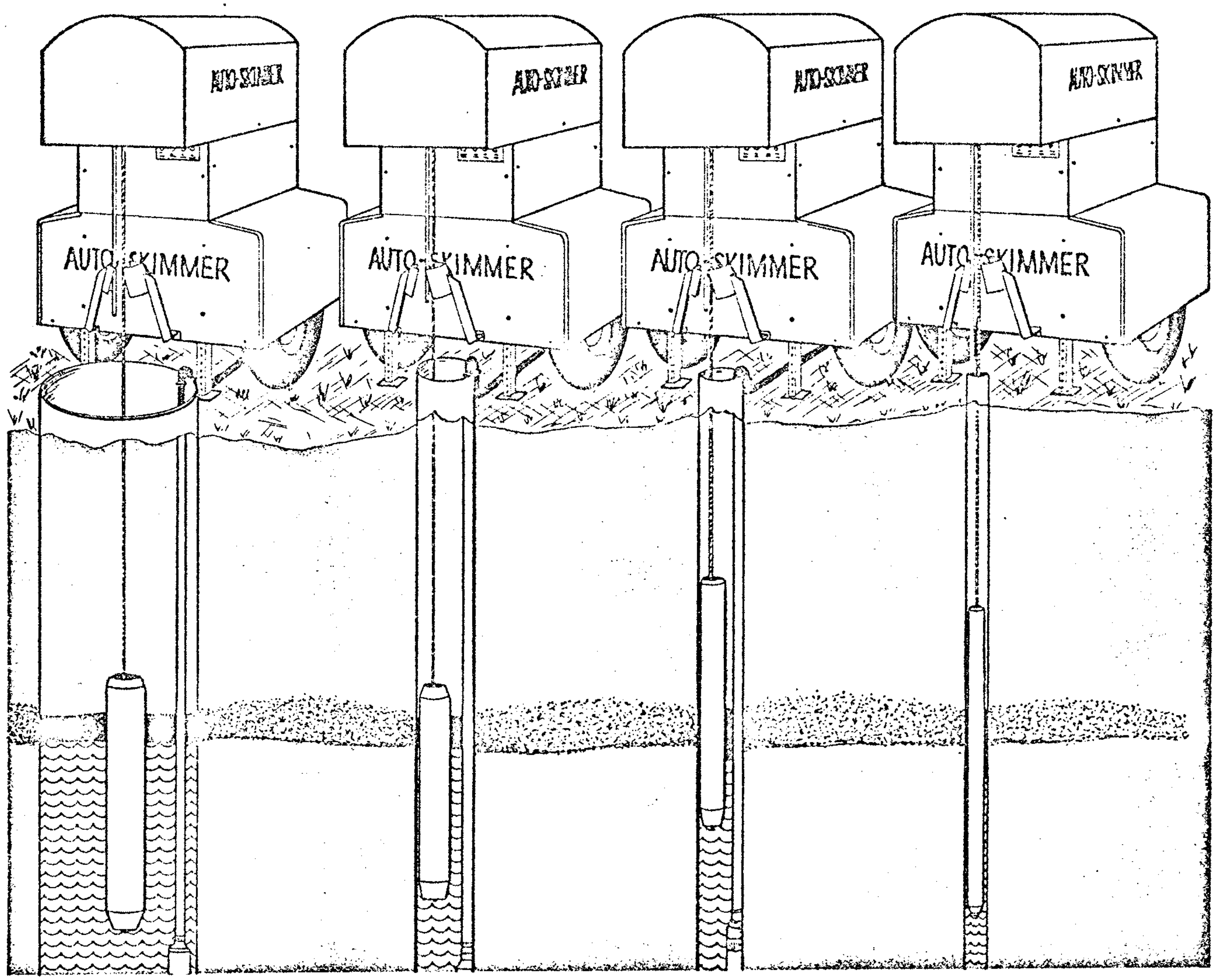
Operational Versatility



24-inch well with optional water table depression pump.

6-inch well with optional water table depression pump.

4-inch well with optional water table depression pump.

2-inch well without water table depression pump.

Because of its unique design, the Auto-Skimmer™ can effectively recover product from any well with a diameter of 2-inches or greater. Where a water table depression pump is desired, it may be used in conjunction with the Auto-Skimmer™ in wells that are 4-inches in diameter, or larger.

The Auto-Skimmer™ can be modified to fit any of the configurations shown above in less than 30 minutes.

This extreme versatility to quickly and easily access wells of different diameters provides great flexability to any recovery program. Recovery centers may be changed with no lost time or additional well construction expense by utilizing existing observation wells for recovery. The Auto-Skimmer™ may also be periodically rotated between various recovery wells and observation wells to improve the recovery efficiency.

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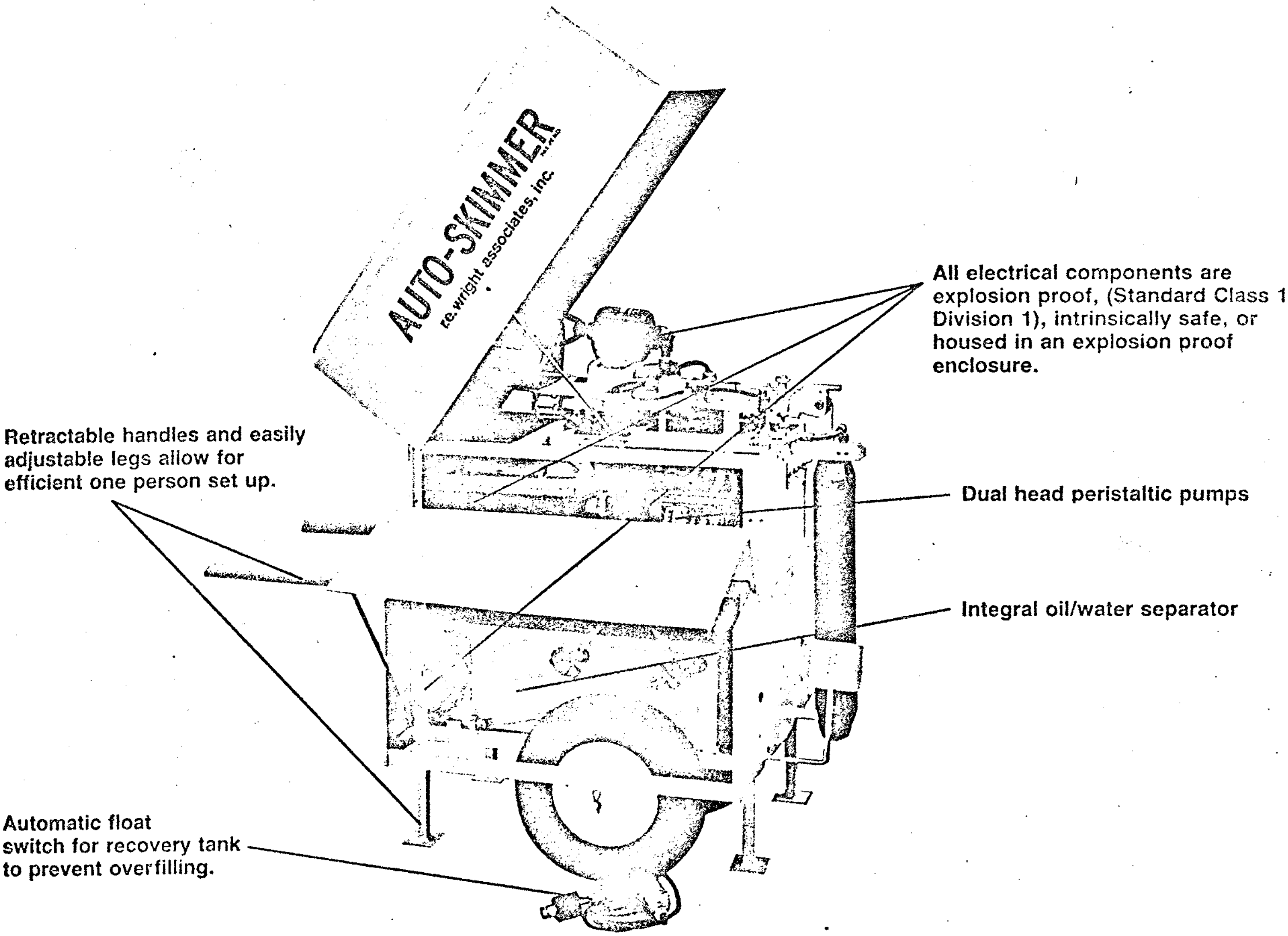
Specifications



Equipment Specifications

Weight	450 lbs.
Dimensions	32 W × 38 L × 50 H inches
Power Requirements	110 volts 15 amps
Standard Vessel Size	3.5 × 24 inches
Oil Water Separator	flow through
Adjustable Leveling Feet	1/2 inch increments
Peristaltic Pump Tubing	Tygon Special™

Optional Equipment or Accessories

Winterizing Kit.
Explosion proof water table depression pump and controls.
Special chemically resistant tubing for peristaltic pump.
Recovery vessels from 1 5/8" O.D. to 4 1/2" O.D.
Class I, Division II explosion proof components.
Non-explosion proof components.

AUTO-SKIMMER™ PATENT PENDING
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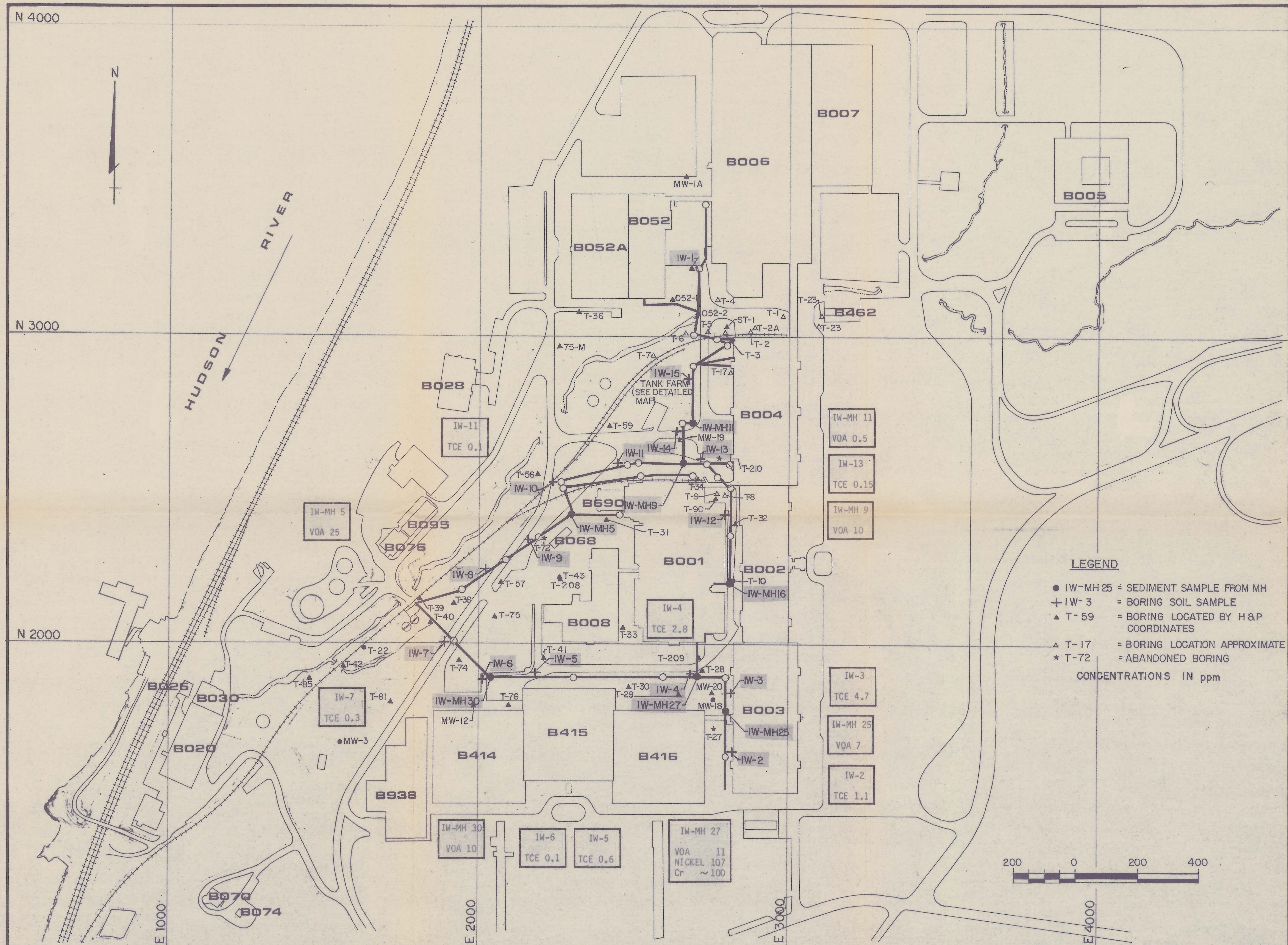

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INDUSTRIAL WASTE SEWERS
SAMPLING SITES AND CHEMISTRY

PLATE 1