ENVIRONMENTAL RESTORATION PROGRAM

21-03 -02 - - -9407180008

AREA B, OPERABLE UNIT 1
DOE MOUND PLANT

HISTORY OF AREA B

February 1991

DEPARTMENT OF ENERGY

ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM

TECHNICAL SUPPORT OFFICE

LOS ALAMOS NATIONAL LABORATORY

DRAFT

REFERENCE USE ONLY

ENVIRONMENTAL RESTORATION PROGRAM

AREA B, OPERABLE UNIT 1
DOE MOUND PLANT

HISTORY OF AREA B

February 1991

DEPARTMENT OF ENERGY

ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM

TECHNICAL SUPPORT OFFICE

LOS ALAMOS NATIONAL LABORATORY

DRAFT

CONTENTS

1. INTRODUCTION 1

2. AREA B HISTORY 3

3. SITE STRUCTURES 16
   3.1. OVERFLOW POND 16
   3.2. SITE SANITARY LANDFILL 17

4. SUMMARY OF REMEDIAL INVESTIGATIONS 18
   4.1. GROUNDWATER AND SOIL GAS SAMPLING 19
   4.2. RADIOLOGICAL SAMPLING 23
   4.3. SURFACE GEOPHYSICS 23

REFERENCES REF-1

FIGURES

1.1. Mound Plant topographic map with Area B outlined 2
2.1. Area B base map with Area B outlined 4
2.2. Mound Plant, Area B, old gravel pit 5
2.3. 1947 photograph showing western portion of Area B prior to historical landfill operations. View to the north 6
2.4. Historical landfill and burn case in Area B, Mound Plant 8
2.5. June 10, 1970, photograph of historic landfill and associated burn cage. View to the northeast 9
2.6. June 10, 1970, photograph of historic landfill and old gravel pit, Mound Plant. View to the southeast 10
2.7. Location of buried thorium drums, old burial trench, and old landfill in Area B, Mound Plant 12
2.8. June 10, 1970, photograph of historic landfill. View to the southeast 13
2.9. Landfill cells in Area B, Mound Plant 14
4.1. Area B well locations 19
4.2. Soil gas locations adjacent to Area B 21
4.3. Area B geophysical survey area 24

ACRONYMS

DOE	U.S. Department of Energy
FFA	Federal Facilities Agreement
MCL	maximum contaminant level
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
SOP	standard operating procedure
VOC	volatile organic compound

ACKNOWLEDGEMENTS

This report was prepared by Roy F. Weston, Inc., Albuquerque, New Mexico, under subcontract number 9-X58-0146R-1, to the University of California, Los Alamos National Laboratory.

The information in this document was compiled and presented by Jim Brinkman, William Criswell, Eric Larsen, and Tommy Tharp of Roy F. Weston, Inc., and Michael Gerety of Los Alamos National Laboratory. Much of the information was obtained through interviews with long-time Mound Plant employees William Brunner, Richard Burdg, Frank Thomas, and Joe Garner, retired employee. The graphics and report were assembled, edited, and produced by the Roy F. Weston, Inc., Albuquerque Office production staff, led by Judy Jones and Darcel Sandland.

1. INTRODUCTION

Mound Plant, located in Miamisburg, Ohio, is operated by EG&G Mound Applied Technologies for the U.S. Department of Energy (DOE). It is one of seven DOE Albuquerque Operations Office (AL) installations currently being evaluated by the DOE Environmental Restoration (ER) Program. The ER Program was established in 1984 to identify, assess, and remediate environmental contamination associated with release sites that resulted from spills or inadequate management of hazardous substances.

Mound Plant was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA--also known as Superfund) National Priorities List (NPL) on November 21, 1989 (54 Federal Register 48184). Pursuant to its NPL status, DOE signed a CERCLA Section 120 Federal Facility Agreement (FFA) (Administrative Docket Number V-W-'90-C-075) with the U.S. Environmental Protection Agency (EPA) on August 6, 1990. A similar agreement is currently (January 1991) in negotiation between DOE and the Ohio EPA.

The Mound Plant ER Program activities have been distributed among 9 operable units. This technical memorandum has been prepared as a secondary document in support of the ongoing remedial investigation/feasibility study (RI/FS) at Mound Plant, Operable Unit 1, Area B. Area B contains the primary suspected sources of groundwater contamination by volatile organic chemicals. The FFA requires that all deliverables be prepared in accordance with guidance specified in "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA 1988). The FFA also requires the preparation of technical memorandums related to the remedial investigation. The purpose of this technical memorandum is to present the history of waste disposal practices at Area B and a summary of investigations related to Area B.

The 306-acre Mound Plant site is on the outskirts of the city of Miamisburg, in Montgomery County, Ohio, approximately 10 miles south-southwest of Dayton and 45 miles north of Cincinnati. The topography of Mound Plant is shown in Figure 1.1. Mound Plant construction began in 1947 and operations began in 1948. From 1948 to 1954, it was a research facility under the DOE's Oak Ridge Area Office primarily for research and production of polonium-210. During that time, waste disposed of in Area B consisted of urinalysis samples and biological wastes (DOE 1986a). In 1954, the DOE AL began managing Mound Plant, and its mission expanded from research to production of high explosive detonators and initiators, plutonium, and tritium. The production processes used numerous industrial chemicals, including solvents.

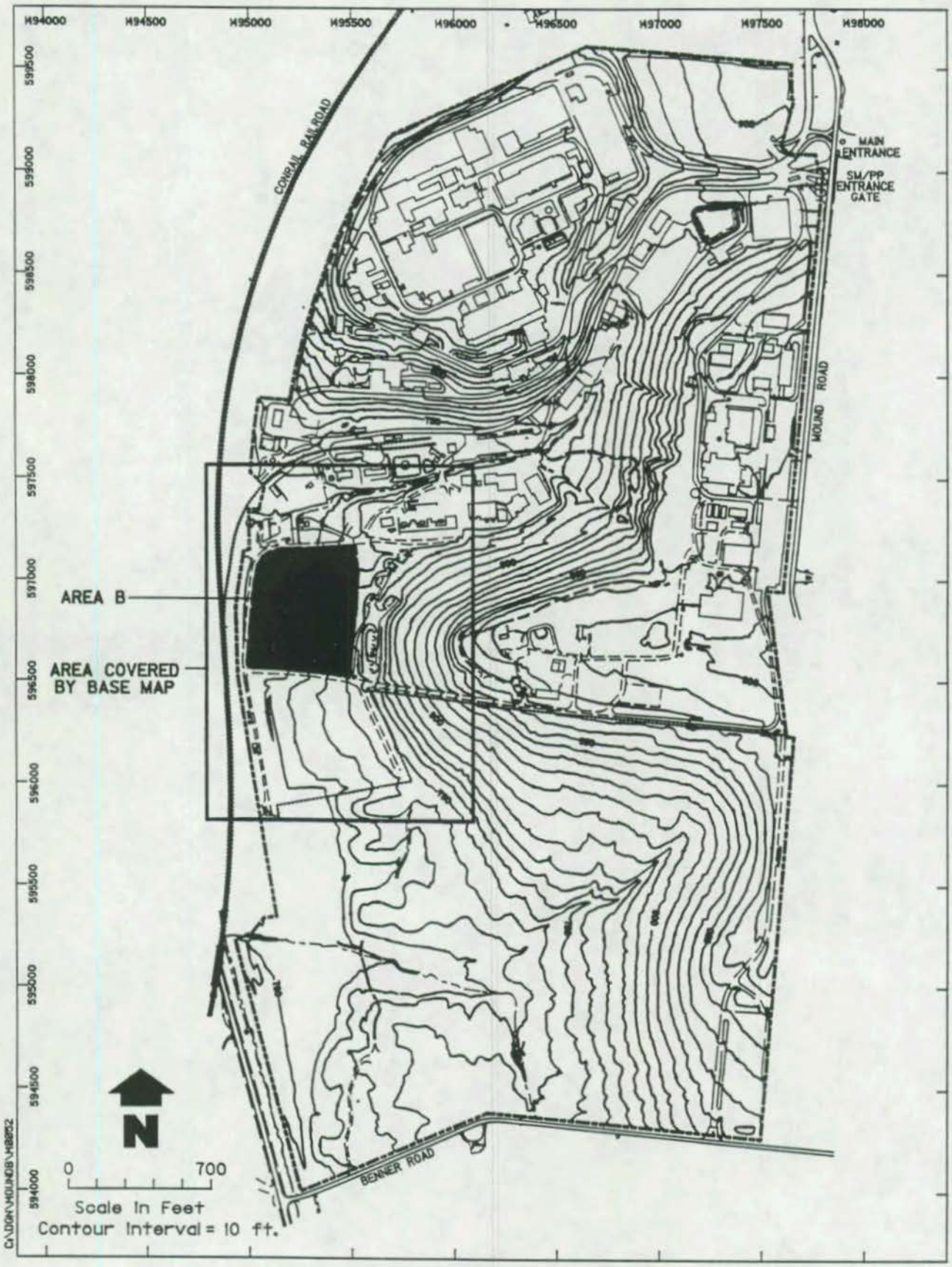


Figure 1.1. Mound Plant topographic map with Area B outlined.

2. AREA B HISTORY

This discussion of the source history and waste disposal practices at Area B from 1948 to the present is based on interviews with Mound Plant employees (Mound 1990a) and information gathered from various Environmental Restoration (ER) Program documents, including the following:

- "Phase I: Installation Assessment Mound [Draft]" (DOE 1986a);
- "Comprehensive Generic Monitoring Plan [Draft] (DOE 1986b);
- "Phase 2: Mound Installation Generic Monitoring Plan/Site Specific Monitoring Plan [Draft]" (DOE 1987a);
- "Remedial Investigation Plan Task AL-MD-1, Stage 3 Investigation Mound Plant Area B and the Main Hill Seeps: Installation Groundwater" (DOE 1989a);
- "Remedial Investigation/Feasibility Study Site-Wide Work Plan [Draft]" (DOE 1990a); and
- "Radiological Site Survey Remedial Investigation Scoping Report [Working Draft]" (DOE 1990b).

Area B is comprised of approximately four acres in the southwestern part of Mound Plant (Figure 2.1). Cut-and-fill activities and refuse and waste disposal have occurred throughout the plant's history. Area B was used for waste disposal by Mound Plant from 1948 to 1977. However, no written manifests of the waste types and quantities exist, and uniform disposal practices were not followed.

Before 1947, Area B was a residential area with two or three small houses and storage buildings. During plant construction, the area was exploited for its gravel deposits. The gravel excavations extended from about the middle of Area B southward to the road and into the hillside to the east. The excavations were deepest along the south part of Area B (estimated at 4 to 6 ft deep) and became progressively shallower to the north. Removal of gravel was routine until Area B was modified by the overflow pond and site sanitary landfill in 1977. Trenches excavated by a front-end loader were cut along a north-south line. These small gravel trenches would typically fill with water during heavy rains, as would the lower, deeper parts of the old excavation.

When Mound Plant began operations in 1948, Area B consisted of a depression remaining from old gravel operations, bounded on the west and south by a dirt road (Figure 2.2). The area would typically flood during heavy rains (Figure 2.3). The old gravel excavation and the disturbed area just north of the excavation were used for landfill, mostly open burning of trash and garbage from plant operations. From 1948 to 1954, only nonradioactive wastes are reported to have been disposed of in Area B. Solid and liquid wastes disposed of in Area B at that time consisted of administrative and laboratory trash,

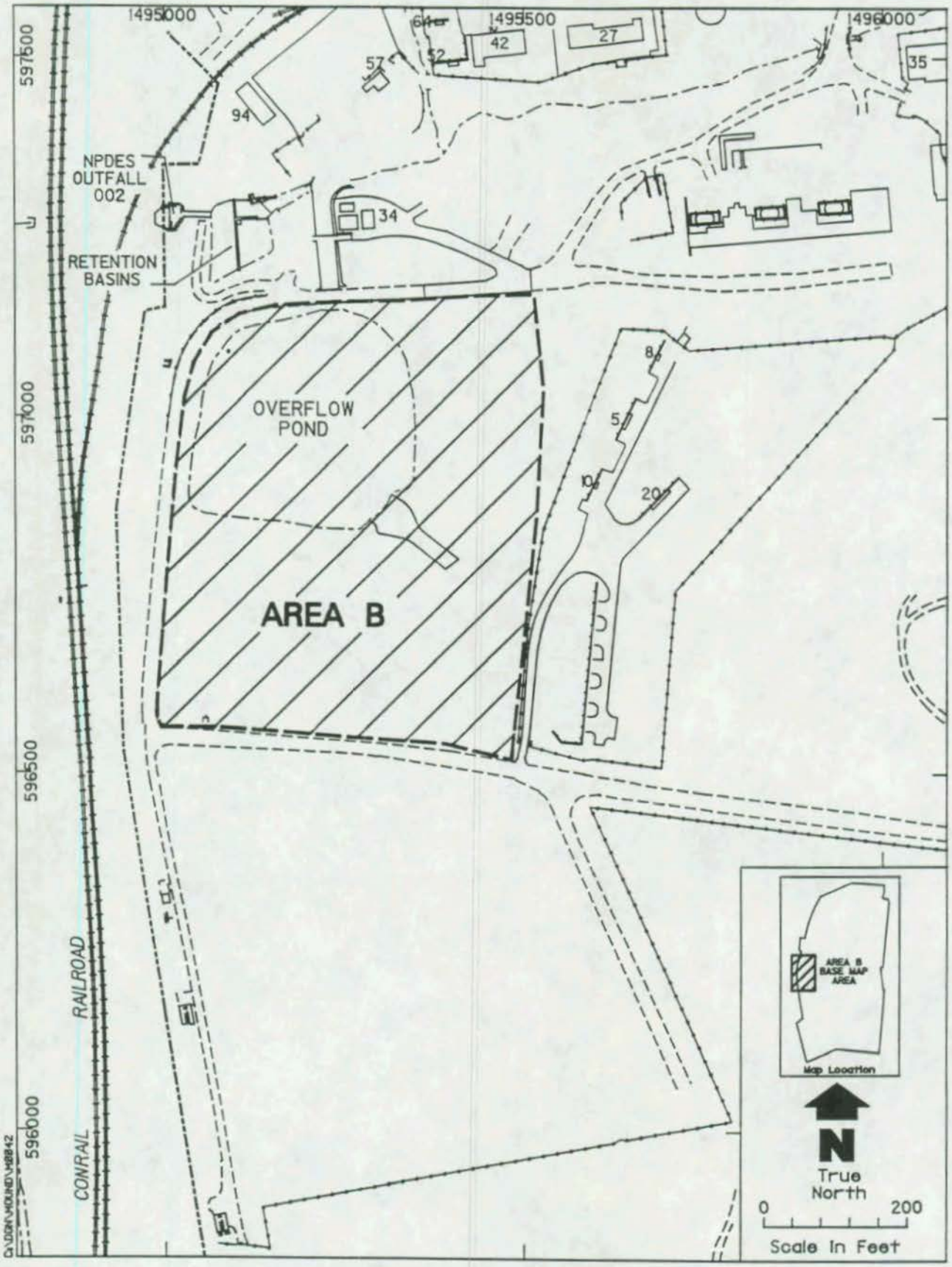


Figure 2.1. Area B base map with Area B outlined.

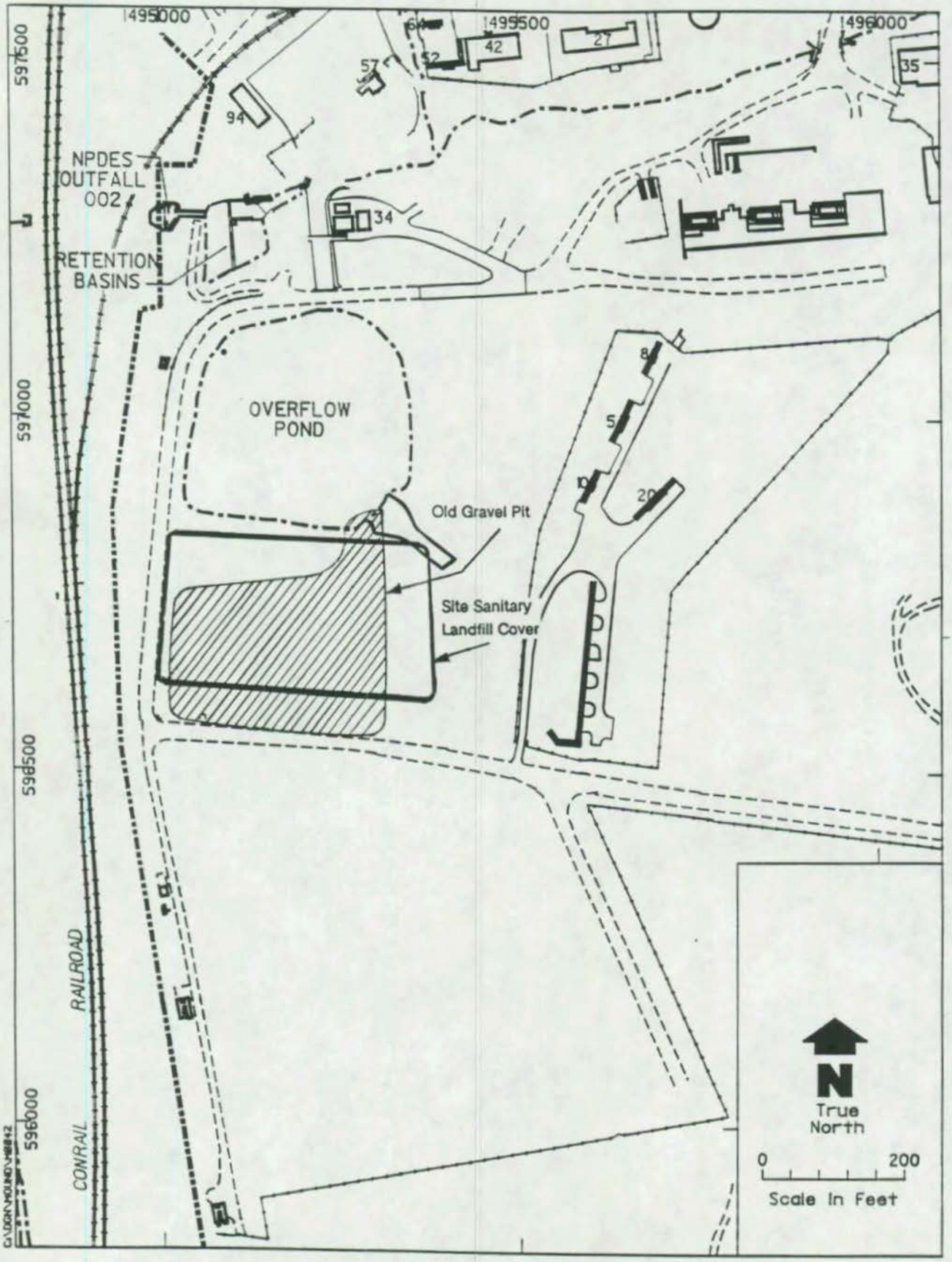


Figure 2.2. Mound Plant, Area B old gravel pit.

Figure 2.3. 1947 photograph showing western portion of Area B prior to historical landfill operations. View to the north.

including paper, glass, wood, plastics, kitchen garbage, and bottled urine samples. A burn cage, consisting of a wire mesh structure that caught ashes from burned wood, paper, and other materials was used (Figures 2.4 and 2.5). Figure 2.6 shows a view to the east of the landfill and burn operations, with the east wall of the old gravel excavation visible in the background.

From 1954 to 1969, Area B may have received solid and liquid wastes containing beryllium, mercury, trichloroethene, carbon tetrachloride, nickel carbonyl gas cylinders (that had been evacuated to ensure no gas remained), benzene, alcohol, acetone (contained in paints), photoprocessing solutions, plating materials, small quantities of polychlorinated biphenyl (PCB) oils, and other laboratory, office, and kitchen wastes (DOE 1986a,c). Wastes were generally collected weekly for disposal. Solid wastes, mostly paper, office, and kitchen garbage, were placed in the burn cage and ignited to reduce their volume.

Nonradioactive liquid wastes were picked up on Friday mornings, two to three times a month. The liquid wastes were typically in closed jars, bottles, and cans and usually did not collectively exceed 50 gallons. These containers were dumped on the ground or stacked in groups and ignited. Sometimes other fuels were added to aid in burning; sometimes the liquids simply soaked into the ground (Brunner 1990, Burdg 1990, and Thomas 1990).

Without records, it is difficult to reconstruct the chemical waste volume and composition of wastes disposed of in Area B. By making a few assumptions, however, an estimate of the volume of mixed liquid wastes can be derived. The assumptions and the volume estimate conclusion are as follows:

- From 1948 to 1954, very little liquid chemical wastes were generated, as radiological and biological research as well as urinalyses were being conducted in the only part of Mound Plant that was operational at that time.
- Liquid wastes, including solvents, oils, and chemicals, were dumped in Area B for about 15 years (1954 to 1969).
- Collection was typically not every week but was perhaps two to three times per month (assume 30 times a year).
- The total pickup volumes were typically less than 50 gallons.
- Assuming 50 gallons per dump and 30 dumps per year for 15 years, a quantity of 22,500 gallons of liquid waste may have been disposed of in Area B over the time indicated.

Considering the large possible margin of error in this estimate, the quantity may have varied from 15,000 to 30,000 gallons total. Assuming that 40 percent to 60 percent of the liquid waste was not burned for one reason or another, a volume of 9,000 to 13,500 gallons of liquid waste may have escaped burning or soaked into the ground in Area B.

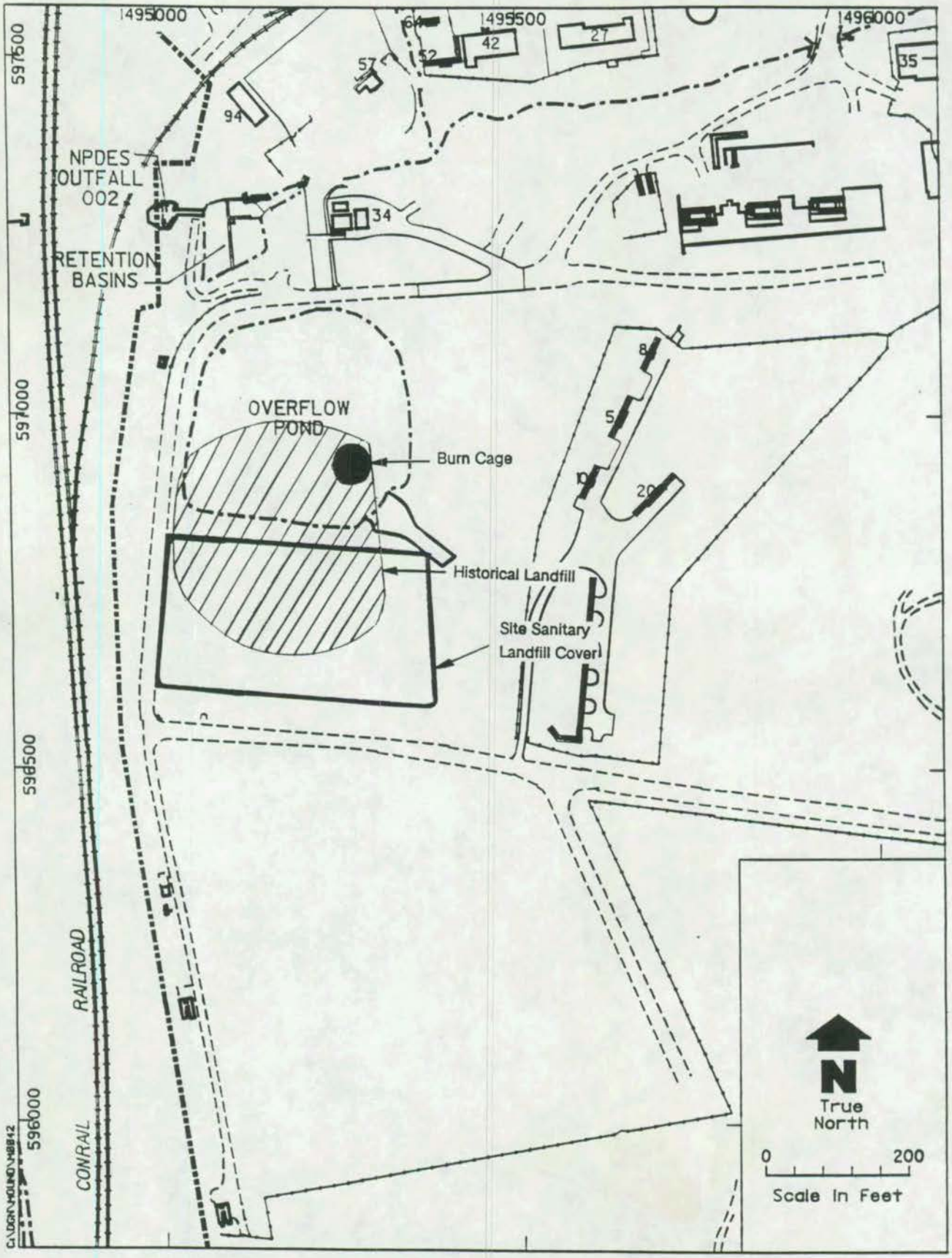


Figure 2.4. Historical landfill and burn cage in Area B, Mound Plant.

Figure 2.5. June 10, 1970, photograph of historic landfill and associated burn cage.
View to the northeast.

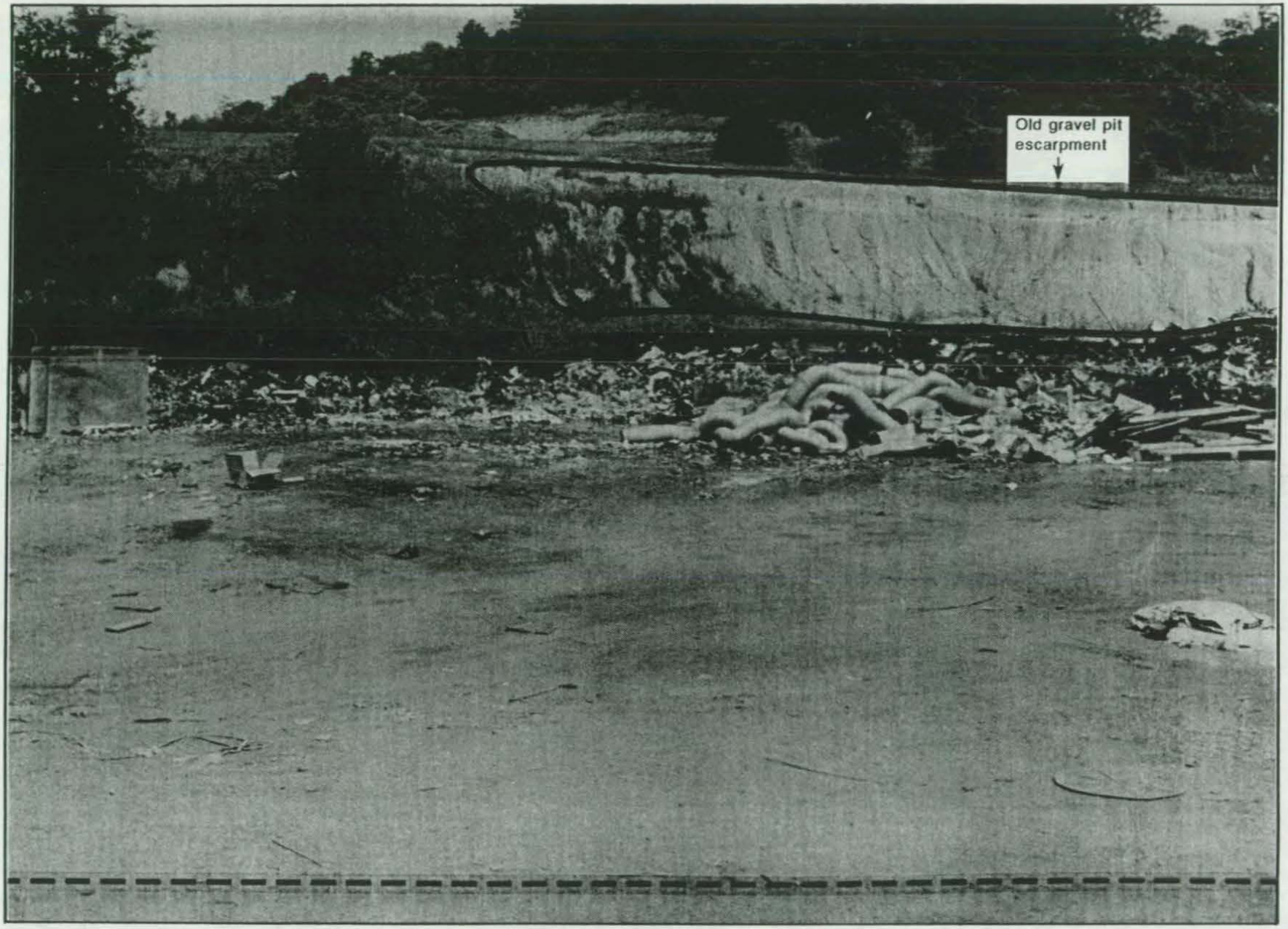


Figure 2.6. June 10, 1970, photograph of historic landfill and old gravel pit, Mound Plant. View to the southeast.

In 1954, the first burial in Area B occurred along the southern boundary of the old gravel quarry, just north of and parallel to the east-west road that climbs the SM/PP Hill. An irregularly shaped trench was excavated to the maximum depth obtainable by the backhoe equipment of the day (Figure 2.7). The trench was deepest (estimated at 14 ft) on the east side, and it became shallower to the west toward the road intersection. Residual steel and metal debris, such as rebar and pipe, which resulted from a fire that consumed the Dayton Unit salvage materials on another part of the plant (now Area 13), were progressively buried in the trench. The burial started in the southeast corner of Area B and extended westward toward the road intersection, but it did not fully extend to the intersection. The debris and backfill were regraded to just below the road level. After regrading, a depression was left in the southwest corner of Area B that had remained unaffected by the burial project. The trench was open for about five days, as the excavation and burial project required one work week to complete (Thomas 1990).

During 1955 and possibly parts of 1954 and 1956, empty drums that had contained thorium were buried in the depression in the southwest corner of Area B in the second major burial project. A shallow excavation was made in the depression, and about twenty-five hundred 55-gallon drums were crushed with a crane and wrecking ball and then covered with a thin layer (about 1 to 2 ft) of soil cover (Figure 2.7). The buried drums and backfill were regraded to just below the level of the road.

In 1965, sand contaminated with polonium-210 was also placed in the southwest corner of Area B, and the site was regraded to blend with the landfill and burning operations to the north. The sand had come from the WD Building and was a residual product of the polonium research and production conducted in the early 1950s. Because of its short half-life (138 days), virtually all of the polonium-210 has decayed to stable lead. However, analyses for stable lead have not been performed. Figure 2.8 shows the southeast corner of Area B as it appeared in 1970 after the southern parts were regraded.

From sometime after 1971 until 1976, low-level radioactive sediments dredged from the former flow monitoring station on the lower reach of the plant drainage ditch were routinely placed in Area B. Although these have been called the Area 18 ditch sediments in preceding documents, the dredgings do not appear to have been distinguished from other contamination and were probably incorporated into the site sanitary landfill when it was built in 1977.

Although the waste streams from the plant processing operations were separated into radioactive and non-radioactive streams, radioactive waste was, in one documented case, accidentally sent to Area B. In that incident during 1958 or 1959, some low-level radioactive waste contaminated with plutonium-239 was sent out of the building in the white waste cans and burned in Area B. Normally, the low-level waste (for example, gloves and other disposable items) was shipped offsite. The error was discovered, and the

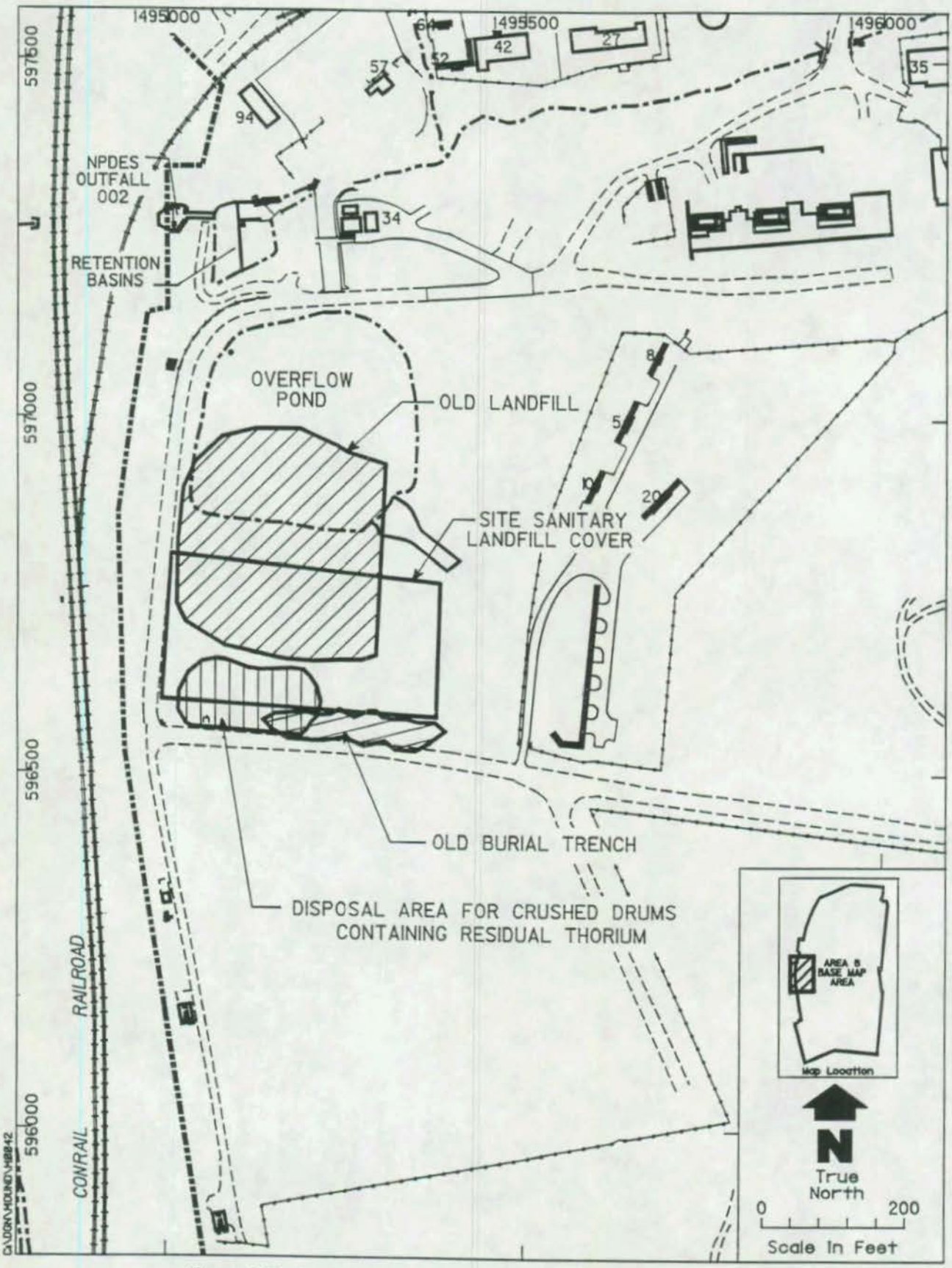


Figure 2.7. Location of buried thorium drums, old burial trench, and old landfill in Area B, Mound Plant.

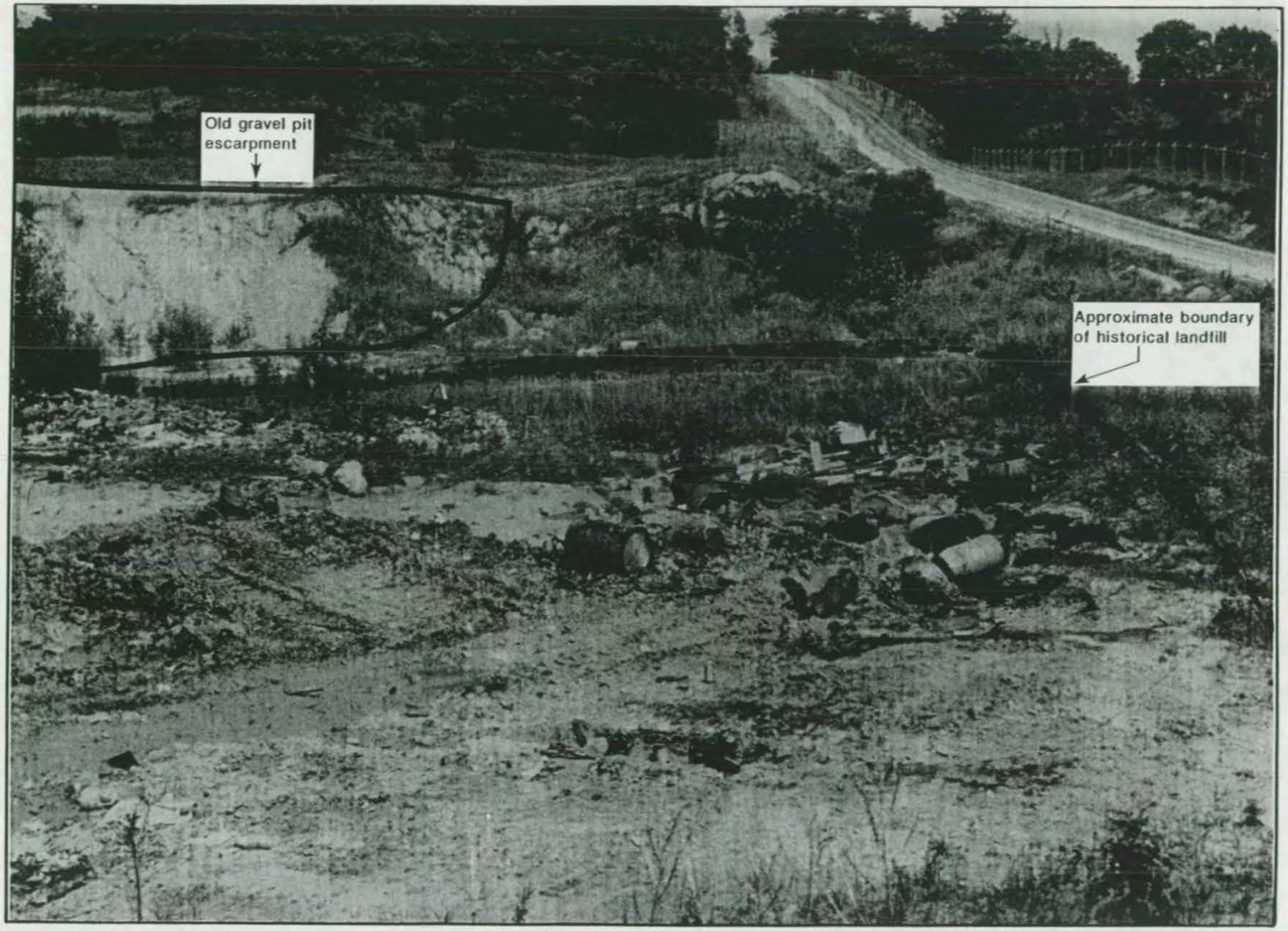


Figure 2.8. June 10, 1970, photograph of historic landfill. View to the southeast.

contaminated soils and burned materials in Area B were removed and disposed of as radioactive wastes (Garner 1991).

In 1969, the state of Ohio banned open burning, and Mound Plant prohibited open burning of solid and liquid wastes in Area B. Hazardous liquid wastes were collected and disposed of offsite. Solid wastes were placed in east-west-trending trenches cut by a bulldozer (Figure 2.9). Solid waste was dumped in the middle of Area B and moved by bulldozer to the trenches, where it was compressed and covered by a few inches of soil cover. Solid waste was rarely dumped directly into the trenches because of the muddy conditions in the area. The solid waste typically consisted of plastic bags containing paper, plastic, glass, cloth, other unknown office and laboratory trash, food scraps from the cafeteria, and plastic sample vials containing urine and liquid scintillation "cocktails". About 4 ft of soil cover was placed over the filled trenches to complete the landfill cells. The southernmost trench was not used before the area was remodeled for the overflow pond and sanitary landfill (Brunner 1990).

Sometime during 1972 or 1973, soil materials were excavated from the west-central portion of Area B and relocated to a ravine along the upper reach of the plant drainage ditch to serve as fill material and facilitate the construction of a parking lot behind the firehouse. This area along the drainage ditch will be addressed as part of Operable Unit 5. The relocated material probably consisted of natural fill and some burned and solid waste. The exact volumes of waste and fill involved are unknown.

Prior to construction of the overflow pond and site sanitary landfill, Area B was surveyed for trash using soil boreholes and test pits installed by Dames and Moore (1976a) and Bowser and Morner (1975). The trash to be excavated was defined in the Bid Invitation Specifications Document (DOE 1977) as "normally non-nuclear contaminated refuse from laboratory operations." The trash was described as consisting of two types: the first type was "unburned materials consisting of plastic bags containing paper, plastic, glass, cloth, other unknown office and laboratory trash, food scraps from the cafeteria, and plastic bottles of urine;" the second type of trash to be excavated was described as "burnt materials consisting of residues of metal scraps, tin cans, heavy plastic, wood, wire, short lengths of pipe, smashed drums, sheet metal, and laboratory trash" in well-defined layers.

The borehole samples were visually inspected and described, and monitored by Mound Plant health physicists, but samples were not analyzed chemically. Some of the original borehole logs indicate a "strong odor of solvent of some sort," and organic odors and layers were prominent. Distillates from the borehole samples were analyzed for tritium by plant personnel, and tritium concentrations were very low or not detected. During construction, no attempt was made to define trash by any means other than by visual inspection.

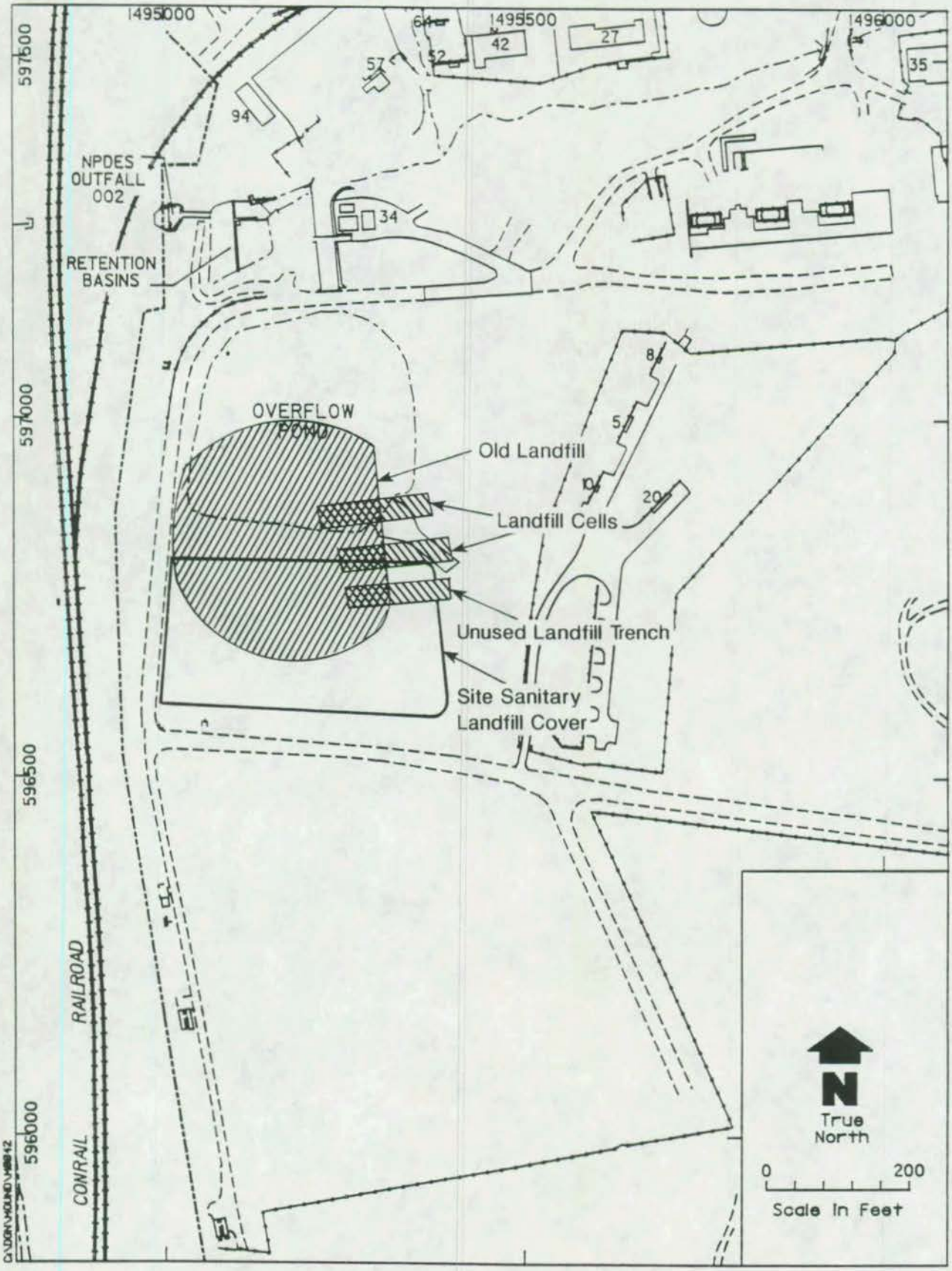


Figure 2.9. Landfill cells in Area B, Mound Plant.

In 1977 and 1978, the overflow pond and site sanitary landfill were constructed on the site of Area B. The overflow pond was built to complement the low-flow retention basins, which were constructed on the lower reach of the plant drainage ditch during 1976. Much of the solid waste in the historic landfill was excavated and moved to the site sanitary landfill. Generally, debris from the Dayton Unit fire in the first trench and empty, crushed drums that had contained thorium in the second trench were not excavated and remained under the landfill. The volume excavated was limited by the volume required for the pond construction. The overflow pond and site sanitary landfill are discussed further in section 3.

The entire overflow pond project was monitored by Mound Plant health physicists. Only a small bucket (<5 gallons) of soil with an elevated plutonium level above 100 pCi/g was removed from the overflow pond construction area. Other than the dredged materials from the former flow channel that may have been mixed with other general soil materials, no known radioactive materials were included in construction of either the interior or the cover of the new site sanitary landfill. However, only material with plutonium levels of greater than 100 pCi/g was considered hazardous during pond construction.

In 1990, Area B stands much as it did in 1978 after the overflow pond and site sanitary landfill were constructed. The road along the north and west boundary has been paved, and a bridge was built in the 1980s over the overflow channel from the plant drainage ditch to the overflow pond. Numerous monitoring wells have been installed around Area B as part of environmental investigations of the area. The "Site Scoping Report: Volume 2 - Geologic Log and Well Information Report [DRAFT]" (DOE 1990c) contains a well location map and detailed construction logs for all of the wells in the area.

3. SITE STRUCTURES

3.1. OVERFLOW POND

The areas of the historic landfill site and gravel pit site were recontoured to permit construction of the overflow pond (Dames and Moore 1976a). The purpose of the pond is to retain storm flows, settle sediment, and support compliance with National Pollutant Discharge Elimination System (NPDES) discharge standards for suspended solids. The bottom of the overflow pond is lined with a 3-ft-thick layer of natural clay distributed over an area of approximately 90,000 square ft (DOE 1986a; Mound 1977).

During the design phase of the overflow pond project, the Mound Plant environmental monitoring group installed several PVC-cased groundwater monitoring wells as part of the Potable Water Standards Project (Dames and Moore 1976a). All of the PVC well casings, except for Well 0055, were filled with concrete prior to construction of the overflow pond. The PVC well casings were destroyed by heavy equipment operation during construction. During construction of the pond, Well 0055 was not removed, so it could remain a

permanent monitoring well. As excavation and construction progressed, the PVC well casing for well 0055 was protected, and the top of the casing was cut off by hand as the pond bottom was cut and lowered.

In the construction of the overflow pond, glacial till was excavated and used for construction of the surrounding road embankments. On the east side, the pond embankment was benched into the hillside. Areas with steep slopes and areas of potentially concentrated runoff were lined with riprap, asphalt, or concrete for erosion protection. On the north and west sides, the road was elevated and constructed to specifications for water impoundment. The north side contains an overflow channel from the plant drainage ditch and the low-flow retention basins installed the year before. The pond liner is a natural clay-bearing glacial till deposit that was tested for conformance with geotechnical specifications before and during construction and is at least 3 ft thick.

The pond is built with earthen dikes and has a 5,000,000-gallon capacity. This capacity will allow the pond, if it is nearly empty, to retain all facility effluents for five days if a contaminant spill occurs. Effluent in the overflow pond is discharged through a standpipe in the northwest corner of the pond to the stilling basin below the low-flow retention basins. It then goes to the Miami-Erie Canal and to the Great Miami River through NPDES Outfall 002 at a rate of approximately 660,000 gallons per day (Mound 1990b).

3.2. SITE SANITARY LANDFILL

The site sanitary landfill was constructed during excavation of the overflow pond areas in 1978. A thin (<2-ft-thick) layer of burned trash on the west side was excavated directly beneath the landfill site. The site sanitary landfill was constructed to provide containment of solid waste removed from the historic landfill. The site sanitary landfill was constructed with a 4- to 5-ft-thick clay liner consisting of onsite materials (Mound 1977: Mound Drawings FSD 16978 and FSD 17044). The clay liner was compacted to ensure a proper seal and integrity over time. Clay berms were constructed on the landfill to prevent runoff from pooling on the top of the landfill and to direct it to the overflow pond. A leachate collection system was constructed, using collection drains at the top of the lower clay liner of the landfill (Mound 1977: Mound Drawings FSD 16978 and FSD 17044). The drains located in the landfill allow for drainage of any landfill liquids into the adjacent overflow pond. Five french drains were installed 2 to 25 ft below the landfill liner (Mound 1977: Mound Drawings FSD 16667 and FSD 16668). These drains were installed partially in a fine gravel/sand layer and partially in a silty clay layer. The purpose of these french drains is to drain moisture from under the site sanitary landfill to ensure soil slope stability.

The site sanitary landfill cap, 3 ft of clay with 2 to 5 ft of low-permeability topsoil, was designed to minimize infiltration of precipitation and snowmelt into the landfill and subsequent flow through contaminated soils and debris, and thereby to reduce leachate generation. In addition, the cover prevents direct contact with

potentially contaminated surface soils and controls contaminant migration by way of air, surface water, and sediment pathways.

The base, berms, and liner of the landfill were constructed entirely of clean fill excavation from undisturbed slopes east and north of the waste disposal area. The geotechnical studies conducted as part of the preconstruction activities indicated enough clay-rich soil existed onsite that additional materials would not be needed. Clean fill and trash-filled excavations within the pond area had been identified from the soil boreholes. Clean fill was defined as soil that did not have visible trash or debris. However, the chemical content of the clean fill was not analyzed. Trash, excavated from the previously identified areas and compacted into the liner in 2-ft lifts, consisted of burned and unburned debris mixed with soil. The base and berms of the landfill were compacted to 90 percent dry density. As the construction of the landfill progressed, the compacted density of the fill material was increased to 95 percent to form the landfill liner. The liner was designed to be 5 ft thick, but it is probably closer to 10 ft thick (Burdg 1990). Before filling with trash began, the liner was surveyed for interior dimensions, and a perforated drain pipe was installed to drain any liquid into the new overflow pond to the north. As the construction neared the top of the designed landfill, the trash was overlain by clean fill that was compacted to 95 percent dry density so that the liner essentially surrounded and covered the trash. The compacted liner material extends to the surface and is covered with a thin layer of topsoil.

Approximately 100,000 cubic yards of trash were moved from the overflow pond site to the landfill (DOE 1987a). According to personal accounts, some of the trash was saturated during excavation and the drain pipe flowed liquid into the pond for six months afterward (DOE 1987b). No known samples of this leachate were collected. No known drainage has occurred since the initial six-month period (DOE 1986c). However, in the 1986 Resource Conservation and Recovery Act (RCRA) Part B application, it is stated that "no leachate has been observed in the drain during the past 14 years" (DOE 1986c).

Slightly more material was cut from the pond area than was needed. The extra material was used on the east side of the new sanitary landfill. The height of the landfill is within design specifications; however, the east slope is more gradual than specifications because of the extra fill placed there. The height of the landfill was surveyed and checked for settling a year or two after construction; although no known written report exists, a verbal report suggests little or no settling occurred (Burdg 1990).

4. SUMMARY OF REMEDIAL INVESTIGATIONS

Mound Plant personnel (EG&G) began periodic water sampling programs in 1984. ER Program RIs at Area B were begun in 1987 and focused on observations of groundwater contamination. To date, two stages of RI have been completed and a third is ongoing (DOE 1989a). Stage 1 consisted of sampling existing wells

at Mound Plant to assess the adequacy of the existing groundwater monitoring network and performing a soil gas survey to aid in optimally locating new wells. Stage 2 consisted of the installation and sampling of new monitoring wells to fill in data gaps and replace old wells. Stage 3 consists of new well installations and further sampling to support a baseline risk assessment and an FS. Well construction details and map locations for all wells within and adjacent to Mound Plant can be found in the "Site Scoping Report: Volume 2 - Geologic Log and Well Information Report [DRAFT]" (DOE 1990c). Some radiological and surface geophysical data have also been collected.

4.1. GROUNDWATER AND SOIL GAS SAMPLING

Between 1984 and 1986, personnel at Mound Plant periodically sampled groundwater and analyzed for priority pollutants. The sampled wells consisted of onsite and offsite monitoring wells, the three Mound Plant supply wells, and nearby domestic wells. Figure 4.1 shows the locations of the sampled wells in Area B.

Although they were later viewed as "reconnaissance only" due to problems with well construction methods and upkeep, the results of the sampling by Mound Plant did lead to the identification of groundwater contamination and the designation of Area B. Two volatile organic compounds (VOCs), trichloroethene and chloroethene, exceeded their respective maximum contaminant levels (MCLs). They were found at their highest concentrations near the encapsulated landfill and overflow pond area.

Monitoring well 0055 was installed along the southern edge of the overflow pond. During peak runoff periods, the water level in the pond rises above the base of the well. Under current conditions, this well may serve as a direct conduit of contamination from the overflow pond to the Buried Valley aquifer. It is suggested that this well be properly abandoned.

Stage 1 of the RI included reconnaissance sampling of the existing monitoring locations already sampled by Mound Plant. Stage 1 reconnaissance sampling was completed partly to confirm the results of sampling previously completed by Mound Plant. Stage 1 sampling was completed according to the Standard Operating Procedures (SOPs) contained in the Stage 1 monitoring plan (DOE 1986b).

The Stage 1 analytes included volatile and semivolatile organic compounds; pesticides and PCBs; some metals; and the radionuclides tritium, plutonium, thorium, and uranium. VOCs detected in two of the onsite monitoring wells in Area B (0055 and 0063) during the Stage 1 RI included tetrachloroethene, trichloroethene, 1,2-*trans*-dichloroethene, trichloromethane, ethylbenzene, and trichlorofluoromethane. No

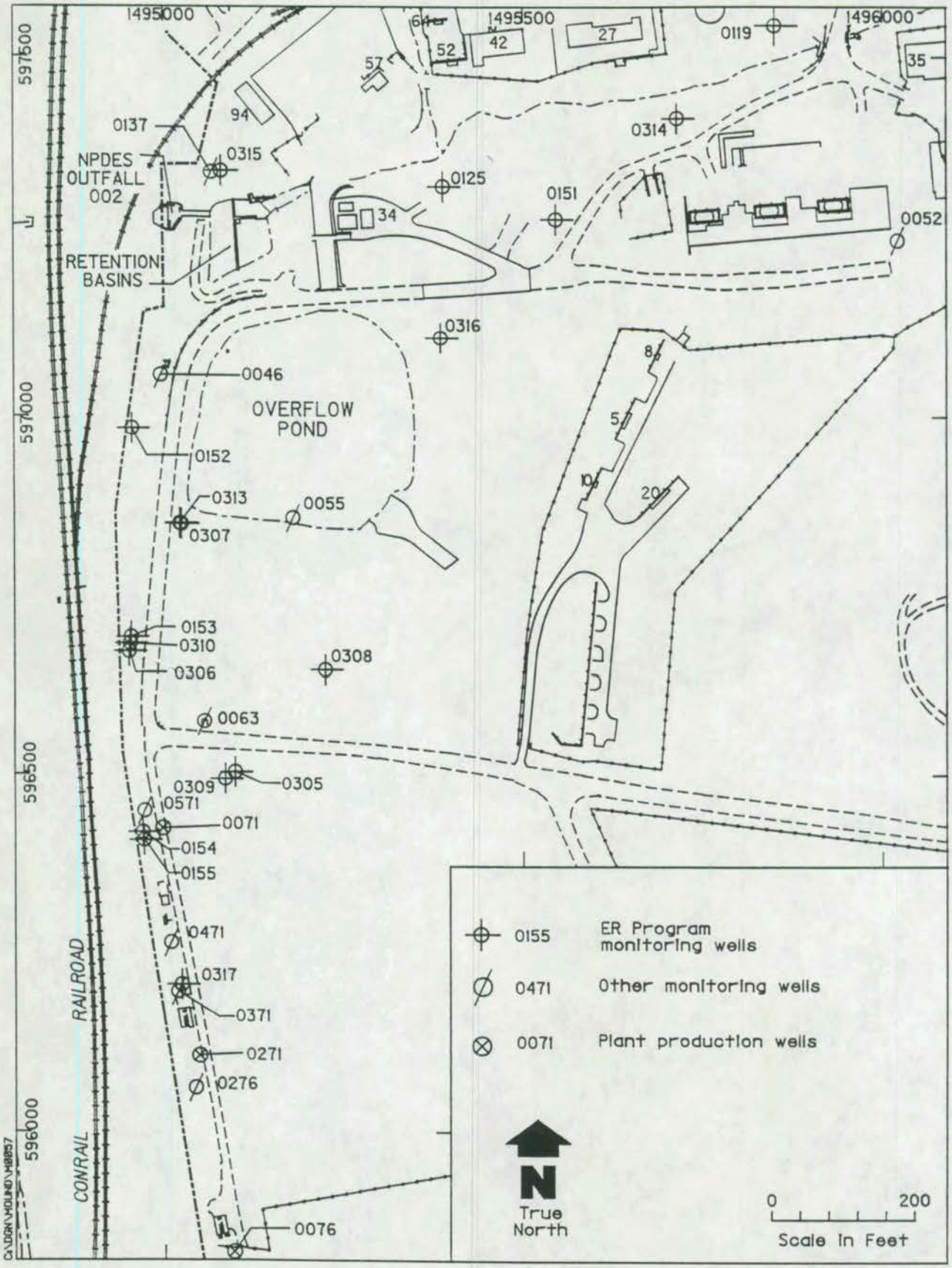


Figure 4.1. Area B well locations.

other constituents, except tritium, were detected at concentrations above MCLs or proposed MCLs (DOE 1989a).

A soil gas survey of VOC concentrations was used to optimize the locations of the monitoring wells installed in Stage 2 of the RI (DOE 1987a; 1989a). Soil gas samples from 58 onsite locations were analyzed for trichloroethene, 1,2-*trans*-dichloroethene, chloroethene, benzene, ethylbenzene, and toluene. These VOCs were detected at 19 locations adjacent to Area B (Figure 4.2).

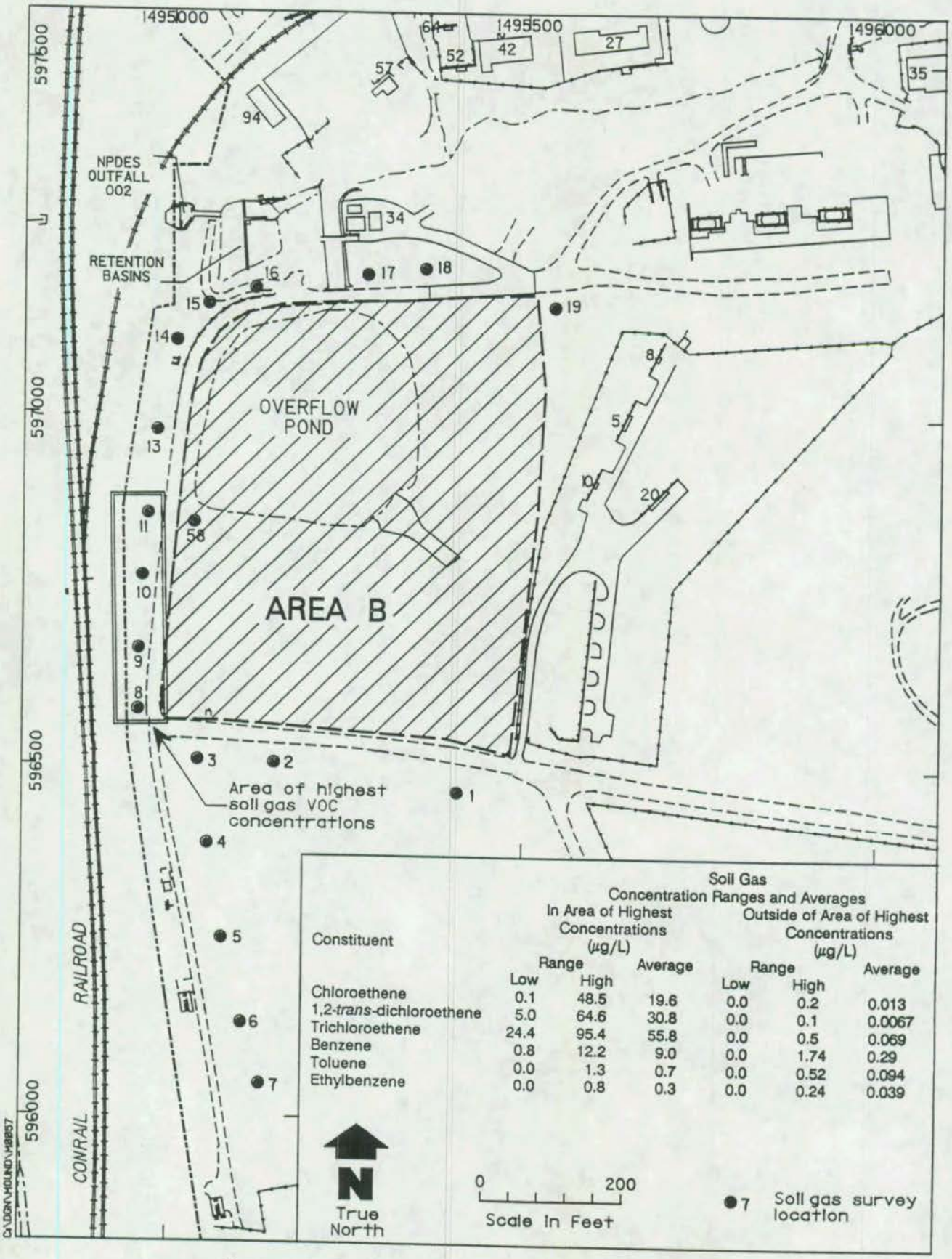
After deficiencies were identified with the existing monitoring network and monitoring wells and after the results of the soil gas survey were incorporated into the conceptual model of contaminant migration, a revised RI plan was developed (DOE 1987b), and Stage 2 of the monitoring program was initiated. Twenty-eight new monitoring wells were installed during October and November of 1987; twenty-one wells were completed in alluvium, and seven wells were completed in bedrock. The new monitoring wells were sampled in December 1987 and March, June, and September of 1988. The Stage 2 analytes included volatile and semivolatile organic compounds; pesticides and PCBs; explosives (RDX, HMX, and PETN); some metals; and the radionuclides tritium, thorium, and uranium. The semivolatile compounds, PCBs, and explosives were not included in the analytical list for the samples collected in March 1988.

In Stage 2, the analytes identified with concentrations near or above present or proposed MCLs included trichloroethene, 1,2-*trans*-dichloroethene, tetrachloroethene, iron, manganese, and styrene. Only one sample contained styrene, with a concentration 20 percent above the MCL of 5 micrograms per liter (μg/L) (40 CFR 141). Although groundwater samples contained manganese and iron at concentrations that exceeded the secondary drinking water standards, ambient groundwater in the area also contains concentrations that exceed these standards (Spieker 1968).

Stage 3 of the groundwater sampling program is ongoing and is designed to further define the groundwater system to support evaluation, selection, and design of remedial alternatives. Partial groundwater quality analyses are now available for samples collected in January through July 1990. The reported data indicate the following:

- The same VOCs present in the old and Stage 2 monitoring wells are present in the samples from the Stage 3 monitoring wells.
- Trichloroethene, 1,2-dichloroethene (total), styrene, chloroethene, and tetrachloroethene were detected above present or proposed regulatory limits.

In January 1990, tritium was detected in Area B monitoring wells 306 and 310 at concentrations of 12.6 and 14.2 nanocuries per liter (nCi/L), respectively. These wells are west of the site sanitary landfill (Figure 4.1). These results confirm that tritium still exists in the groundwater at and adjacent to Area B; however, these



Constituent	Soil Gas Concentration Ranges and Averages: In Area of Highest Concentrations (µg/L) Range Low	Range High	Average	Outside of Area of Highest Concentrations (µg/L) Range Low	Range High	Average
Chloroethene	0.1	48.5	19.6	0.0	0.2	0.013
1,2-*trans*-dichloroethene	5.0	64.6	30.8	0.0	0.1	0.0067
Trichloroethene	24.4	95.4	55.8	0.0	0.5	0.069
Benzene	0.8	12.2	9.0	0.0	1.74	0.29
Toluene	0.0	1.3	0.7	0.0	0.52	0.094
Ethylbenzene	0.0	0.8	0.3	0.0	0.24	0.039

Figure 4.2. Soil gas locations adjacent to Area B.

concentrations are below the drinking water standard of 20 nCi/L (40 CFR 141). These preliminary conclusions are based upon partial reporting of laboratory analyses. Additional results are pending, and additional sampling and analyses are planned through 1991.

4.2. RADIOLOGICAL SAMPLING

From 1982 to 1985, Mound Plant collected radiologic data on the sanitary landfill cap (previously described as Area 18) and in the vicinity of an area used for the disposal of crushed empty thorium drums and polonium-210-contaminated sand filters (previously described as Area 2).

A scoping report required by the FFA (Site Scoping Report: Volume 3 - Radiological Survey Report) and the next Area B technical memorandum describing the extent of contamination, both currently in preparation, will include results from, and analysis of, the sampling.

4.3. SURFACE GEOPHYSICS

In September 1990, magnetic field strength data were collected in the southwest corner of Area B to locate the disposal area of 2,500 crushed steel drums that had contained thorium (Figures 2.7 and 4.3). These crushed empty drums are under the clay berm to the south of the landfill.

As a result of these data, several additional probable disposal areas have been delineated. Zone B-1 is interpreted to be the location of the 2,500 empty thorium drums (previously referred to as Area 2). Zones B-2 and B-3 are locations in which large amounts of ferrous materials have been disposed. These data were interpreted in conjunction with detailed maps of ferrous features and power lines on the surface. In this way, magnetic anomalies related to known cultural features have been excluded from this interpretation.

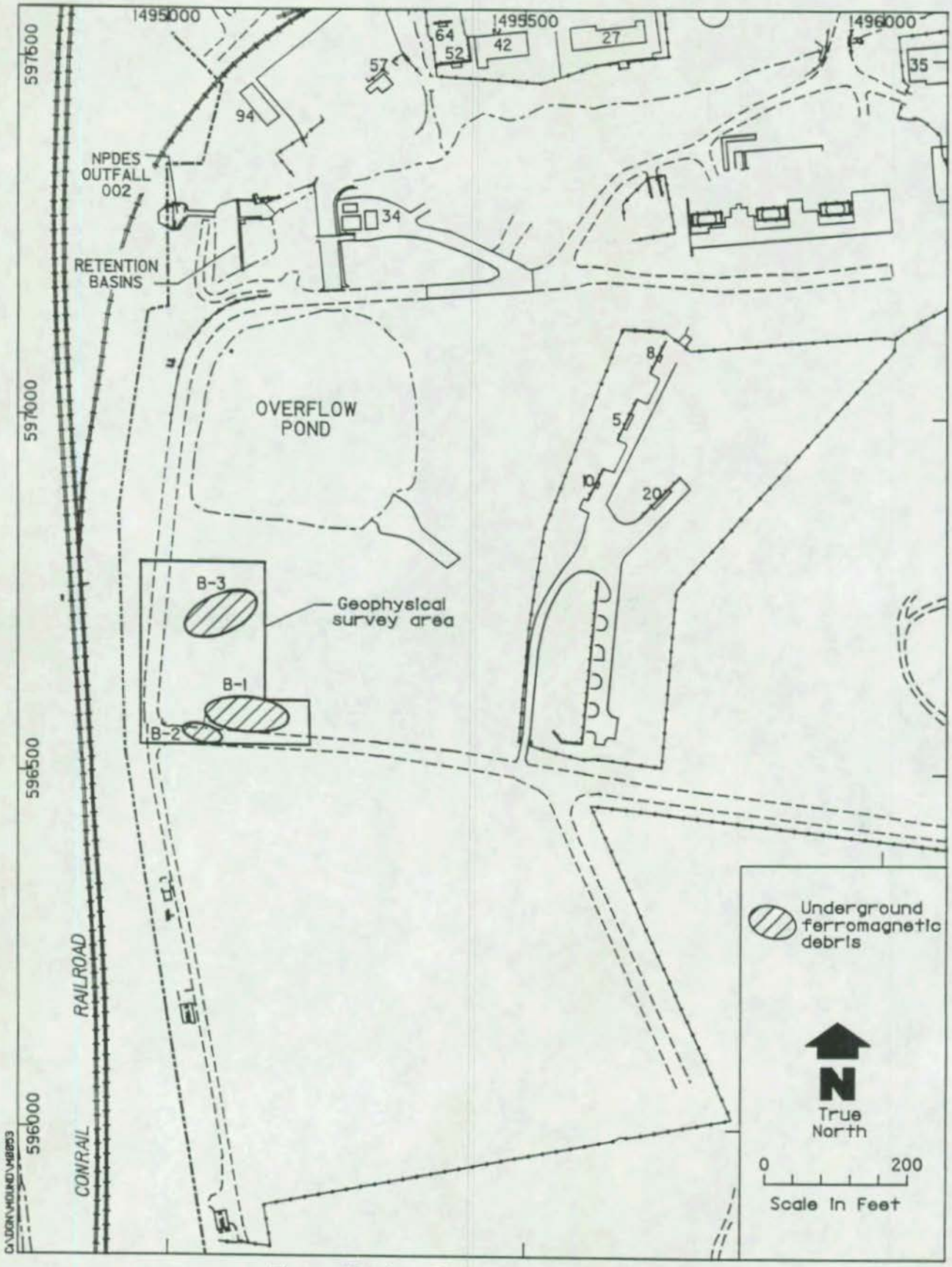


Figure 4.3. Area B geophysical survey area.

REFERENCES

Bowser and Morner. 1975. "Soil Investigation and Construction Drawings for Proposed Low Flow Retention Basin." Report prepared for Monsanto Research Corporation, Cincinnati, Ohio.

Brunner, W. 1990. EG&G Mound Applied Technologies, Miamisburg, Ohio. Personal communication to C. W. Criswell (WESTON), Albuquerque, NM.

Burdg, R. 1990. EG&G Mound Applied Technologies, Miamisburg, Ohio. Personal communication to C. W. Criswell (WESTON), Albuquerque, NM.

Dames and Moore. 1976a. "Hydrologic and Soils/Foundation Investigations Proposed Overflow Pond Mound Laboratory for Monsanto Research Corporation." Cincinnati, Ohio. March 1976.

DOE. 1977. "Specifications and Bidding Documents for Overflow Pond, Mound Laboratory, Miamisburg, Ohio." U.S. Department of Energy, Energy Research and Development Administration, Albuquerque Operations Office, Dayton Area Office, Miamisburg, Ohio. Prepared by Monsanto Research Corporation. May 2, 1977.

DOE. 1986a. "Phase I: Installation Assessment Mound [DRAFT]." Comprehensive Environmental Assessment and Response Program. U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, NM.

DOE. 1986b. "Comprehensive Generic Monitoring Plan [DRAFT]." Comprehensive Environmental Assessment and Response Program. U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, NM. July 1986.

DOE. 1986c. "RCRA Part B Permit Application." Submitted to U.S. EPA by U.S. DOE, Mound Laboratory, Miamisburg, OH. November 1986.

DOE. 1987a. "Phase 2: Mound Installation Generic Monitoring Plan/Site Specific Monitoring Plan [DRAFT]." U.S. Department of Energy, Albuquerque Operations Office. Albuquerque, NM.

DOE. 1987b. Environment, Safety, and Health Office of Environmental Audit, Environmental Survey Preliminary Report. Mound Plant, Miamisburg, OH. March 1987.

DOE. 1989a. "Remedial Investigation Plan Task AL-MD-1, Stage 3 Investigation Mound Plant Area B and the Main Hill Seeps: Installation Groundwater." Environmental Restoration Program. U.S. Department of Energy, Albuquerque Operations Office. Albuquerque, NM. February 1989.

DOE. 1990a. "Remedial Investigation/Feasibility Study Site-Wide Work Plan [DRAFT]." Environmental Restoration Program. U.S. Department of Energy, Albuquerque Operations Office. Albuquerque, NM. April 1990.

DOE. 1990b. "Radiological Site Survey Remedial Investigation Scoping Report [WORKING DRAFT]." Environmental Restoration Program. U.S. Department of Energy, Albuquerque Operations Office. Albuquerque, NM. June 1990.

DOE. 1990c. "Site Scoping Report: Volume 2 - Geologic Log and Well Information [DRAFT]." U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, NM. December 1990.

Garner, J. 1991. Personal communication from retired Mound Plant employee to J. Brinkman (WESTON) describing accidental disposal of low-level radioactive waste in Area B. Albuquerque, NM. January 28, 1991.

Mound. 1977. Mound Drawings FSD 16656, 16669, 16978, 16667, and 17044.

Mound. 1990a. Personal communication from Mound Plant employees to Eric Larsen (WESTON) describing past waste disposal activities at Area B and NPDES system specifications. June 15, 1990, November 29, 1990.

Mound. 1990b. Personal communication from Mound Plant employees to Tom Tharp (WESTON) describing past waste disposal activities at Area B and workings of the surface water system. November 13, 1990.

Spieker, Andrew M. 1968. Groundwater hydrology and geology of the lower Great Miami River Valley, Ohio: U.S. Geological Survey Professional Paper 605-A, 37pp, 8 figs, 2 pts; Abs. North America Geology, May 1969, p. 779.

Thomas, F. 1990. EG&G Mound Applied Technologies, Miamisburg, Ohio. Personal communication to C. W. Criswell (WESTON), Albuquerque, NM.