

ACTION DESCRIPTION MEMORANDUM
NIAGARA FALLS STORAGE SITE
PROPOSED 1982 INTERIM REMEDIAL ACTION
(R-10 PILE STABILIZATION)

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SUBJECT: Proposed 1982 Interim Remedial Action at the
Niagara Falls Storage Site

SUMMARY OF PROPOSED ACTION AND RELATED ACTIVITIES

As part of its Surplus Facilities Management Program (SFMP) and Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE), Oak Ridge Operations Office, proposes to carry out a project to reconsolidate and stabilize an outdoor storage pile of radioactive residues (R-10 pile) located at the Department's Niagara Falls Storage Site (NFSS) in Niagara County, Lewiston Township, New York (Figure 1). This project will be started and completed during the 1982 construction season. Besides the reconsolidation and stabilization of the R-10 Pile, this project will also provide additional storage capacity for various other radioactive residues located on the site and contaminated drainage ditch sediments that may be recovered as part of additional remedial action work tentatively planned for subsequent fiscal years (dependent on funding).

Specific project actions proposed for Fiscal Year 1982 include:

- Clearing of the small trees and brush from the area around the R-10 pile and on the edge of the pile.
- Excavation of surface soil material in the cleared area that has a radium-226 concentration in excess of 5 pCi/g above background concentrations. The excavated material will be placed on the R-10 pile.
- Construction of a clay dike around most of the R-10 pile. (The wall of the building on the south side of the pile will form part of the southern side of the diked area.) There will be extra capacity within the diked area for storage of an additional 38,000 m³ (50,000 yd³) of contaminated soil material that tentatively will be removed from other parts of NFSS and from offsite drainage ditches in Fiscal Years 1983, 1984, and 1985.
- Construction of a decontamination pad for decontamination of vehicles and other equipment.
- Construction of a diked sedimentation pond and two small holding ponds to receive runoff from within the diked area and wash water from the decontamination facility. A portable (skid-mounted) water-purification system consisting of a filtration unit, a demineralizer unit, and associated pumps and piping will also be installed for any necessary treatment of the water before release to a drainage ditch.

Project activities contemplated for Fiscal Years 1983, 1984, and 1985 (not covered by this ADM) include, but may not be limited to, the following:

- Soil material contaminated with radium-226 at concentrations higher than 5 pCi/g above background will be recovered from the central drainage ditch, both onsite and continuing several kilometers downstream of the NFSS property, and from a drainage ditch west of the NFSS property that intersects the central drainage ditch downstream (north) of the NFSS property. Other onsite material may also be moved to the R-10 pile.
- After consolidation of the contaminated soil material on the R-10 spoil pile, including contaminated sediment in the sedimentation and holding ponds, the entire pile will be covered with a reinforced, synthetic rubber membrane, capped with 1 m (3 ft) of compacted clay, and topped off with 0.3 m (1 ft) of topsoil. The cap material will slope to the top of the dikes, and collection and treatment of the pile runoff will be discontinued.

The Department is also investigating various alternatives for the final disposition of NFSS, including options for the permanent decommissioning of the site. However, both the time that will be required to plan a major project and the funding outlook in the near term suggest that such a project cannot be realistically scheduled in the foreseeable future. It is, therefore, considered good management practice to undertake this proposed interim remedial action to reconsolidate and stabilize the R-10 pile as part of DOE's ongoing maintenance and caretaker operations at NFSS. The extent of future activities will depend on funding levels.

The project work described in this ADM is intended to be compatible with proposed future project plans, but systematic completion of the FY 1982 project components is not dependent on any future project component. In addition, none of the Fiscal Year 1982 project components, nor any of the interim projects planned in Fiscal Years 1983, 1984 or 1985, will significantly limit the options available to DOE to effect the permanent disposition of the NFSS.

HISTORY AND NEED FOR ACTION

The original Niagara Falls Storage Site (NFSS) was a 610-ha (1500-acre) section of the former Lake Ontario Ordnance Works. Beginning in 1944, the U.S. Army Corps of Engineers Manhattan Engineer District (MED) used the site (Figure 2) for storage of the radioactive residues that resulted from the processing of uranium ores during development of the atomic bomb. Additional residues were brought to the site for several years after World War II. Currently, 77 ha (190 acres) of the original site comprise the DOE storage site; the remainder has been released for other uses. About half of the residues currently stored at NFSS belong to the African Metals Corporation (Afrimet). The rest of the residues are owned by the federal government. Some of the residues are stored in buildings--e.g., a concrete silo (formerly a water tower) and concrete bunkers (originally designed for water treatment and storage).

The R-10 pile (Figure 2) contains federally owned residues that were placed on the ground north of Building 411 on the west side of the site (Figure 3). Over the years, some of the sandy residues from this pile have been eroded by wind and water onto other parts of the site and offsite. In the 1960s, when a boron isotope-separation plant was constructed at the site, soil that had been contaminated with windblown R-10 residues was removed from the area between the pile and the boron plant to the east (Figure 3). This material was placed on the R-10 pile. Again in 1972, when parts of the original 610 ha (1500 acres) outside the current 77-ha (190-acre) site were decontaminated, those contaminated soil materials were also placed on top of the R-10 pile.

The R-10 pile covers about 31,000 m² (38,000 yd²) and contains at least 53,000 m³ (69,000 yd³) of soils and residues that have radium-226 concentrations greater than 5 pCi/g--the value that has been selected as a reasonable project control criteria for remedial action at the NFSS. Within the R-10 area, radium-226 concentrations are very variable, ranging from slightly above background around the pile to about 10,000 pCi/g in the pile itself. Some of the residues are exposed at the surface of the pile. Gamma radiation levels at 1 m (3 ft) above the ground surface range from 0.013 to 7 mR/h, and radon concentrations in the air range from 2-440 pCi/L at 1.5 m (4.5 ft) above the surface (Table 1), thus sometimes exceeding the DOE limit of 100 pCi/L for controlled areas (U.S. Dep. Energy 1981a). In addition to the stored residues, some buildings and soils within NFSS, and sediment in drainage ditches that leave the site are radioactively contaminated (Ausmus et al. 1980; Anderson et al. 1981).

Concentrations of radon in the air along the west and south perimeters of the site (near the R-10 pile) have been reported to be about 2 pCi/L at 1.5 m above ground and to range from 20 to 340 pCi/L at the soil surface (Anderson et al. 1981), exceeding the DOE limit of 3 pCi/L for uncontrolled areas (U.S. Dep. Energy 1981a). Based on calculations, short-term maximum concentrations may be as high as 668 pCi/L at the road on the west side of the site (Anderson et al. 1981). Concentrations at the ground surface in the southwest quadrant of the site are reportedly as high as 5000 pCi/L (Figure 4). There are several sources of radon at NFSS, including residues stored in buildings south of the R-10 pile (Figure 3), and it has not been determined to what extent emissions from the R-10 pile contribute to these radon concentrations.

In 1972, about 530 ha (1300 acres) of the MED site were decontaminated to the radiation level recommended by the Surgeon General (50 μ R/h at 1 m [3 ft] above the surface). This land is now under various private and public ownerships (Figure 2). It is probable that portions of this area exceed 5 pCi/g radium-226. Plans are being made to resurvey this area. In 1972, the state of New York recommended a more stringent decontamination standard of 20 μ R/h and has subsequently placed restrictions on the use of this land.

Subsequent to the MED, responsibility for the site has been transferred to the Atomic Energy Commission, the Energy Research and Development Administration, and the Department of Energy. The fenced-in site is currently administered by the Oak Ridge Operations Office of DOE. There are no activities other than maintenance and caretaking at the site.

More detailed information on the extent of the radioactive and chemical contamination on and near the site as well as possible alternatives for

disposition of the Afrimet residues and the entire NFSS can be found in: U.S. Atomic Energy Commission (1974); Cavendish (1978); Ausmus et al. (1980); Acres American Incorporated (1981a, 1981b); Anderson et al. (1981); Battelle Columbus Laboratory (1980); and Bechtel National, Inc. (1982a, 1982b).

SETTING

The Niagara Falls Storage Site is located in Niagara County in western New York (Figure 1), within Lewis Township and adjacent to Porter Township. It is about 30 km (19 mi) north of Buffalo, New York; 16 km (10 mi) north of the city of Niagara Falls; 6.4 km (4 mi) south of Lake Ontario; and 6.4 km (4 mi) east of Canada (Figure 1).

There are several buildings and roads on the site (Figure 3). Most of the site is covered with second-growth forest, shrubs, and grasses. The channeled creeks and ditches are overgrown with cattails and are generally slow-flowing (Ausmus et al. 1980).

Land uses immediately adjacent to the site are varied. A hazardous-waste-disposal facility operated by SCA Chemical Waste Services is located north and east of the site. A sanitary landfill is being constructed to the east by Modern Disposal Inc. South of the site is federal government property controlled by the General Services Administration and a sanitary landfill owned by the town of Lewiston. West of the facility is a Niagara Mohawk Power Corporation transmission line corridor (Acres American Inc. 1981a). All of these properties are located on land that was once part of the original MED site (Figure 2). A KOA campground is located southwest on Pletcher Road. Few residences are located within 1 km (0.6 mi) of the site.

Land uses within 15 km (9.4 mi) of the site are predominantly rural and include farms, orchards, recreation areas, old fields, and second-growth forests. The population of Niagara County, which has declined since 1970, was 227,101 in 1980 (Table 2). The current unemployment rate in the county is about 10%. The villages of Lewiston and Youngstown (Figure 1) have the highest population densities near the site. There are 1.5 million persons in the nearby Buffalo metropolitan area.

Niagara County has a humid, continental climate that is moderated by the lake effects of Lakes Erie and Ontario. Average annual precipitation is 83 cm (33 in.), which is fairly evenly distributed throughout the year. Approximately 140 cm (56 in.) of snow falls primarily between November and March (Acres American Inc. 1981a). The wind is predominantly from the southwest.

The NFSS is located on the southern shore of Lake Ontario, 3.2 km (2 mi) north of the Niagara Escarpment, on the relatively flat terrain of the Erie-Ontario Lowlands physiographic province. Elevations range between 96 and 98 m (315 and 320 ft) MSL, with the lower elevations corresponding to the three man-made drainage ditches. Surface drainage of the site and surrounding areas is shown in Figure 5. The 100-year high-water mark is approximately 97 m (319 ft) MSL (Bechtel Natl. Inc. 1982a), which is approximately 0.6 m (2 ft) above the average ground elevation.

The geology of the region consists of approximately 15 m (50 ft) of overburden that is underlain by a 274-m (900-ft) sequence of Ordovician-age

shales and siltstones of the Queenston Formation. The overburden material is composed of glacial and recent alluvial deposits and includes dense tills, glaciolacustrine clays, and isolated lenses of glaciofluvial sands and gravels (Acres American Inc. 1981a, 1981b).

At NFSS, groundwater is present in both soil and bedrock and generally flows towards the northwest. There are essentially three aquifers underlying NFSS: (1) an areally discontinuous, unconfined, perched soil aquifer in a series of sandy silt or silty sand lenses 3 to 6 m (10 to 20 ft) below the ground surface, and (2) a continuous confined soil aquifer within the brown silty sand unit approximately 9 to 12 m (30 to 40 ft) below ground surface, which is contiguous with (3) a confined bedrock aquifer within the weathered upper meter of the Queenston Formation (Acres American Inc. 1981b). The groundwater of all aquifers underlying NFSS has high concentrations of sulfate and calcium and is of low quality for drinking water (Acres American Inc. 1981a).

Various state and local governing bodies may have jurisdiction over or concern about the proposed remedial action at the site (Table 3). Local residents and interest groups have also shown interest and concern about the site. Newspaper articles have appeared, and private citizens have written letters to DOE and the U.S. Environmental Protection Agency (EPA). A Citizen's Oversight Committee was formed by U.S. Representative John LaFalce in response to public questions raised concerning the potential health hazards at the site (LaFalce 1980). Representative LaFalce has indicated that the purpose of this committee is to advise him regarding NFSS and to work with DOE to ensure that DOE's proposals are sound and acceptable to the committee. In a recent report to New York Assembly Speaker, Stanley Fink, regarding federal involvement in several hazardous-waste sites in the Niagara Falls area (Zweig 1981), NFSS was mentioned as posing a hazard to public health and safety. Awareness and concern about radioactive and other hazardous wastes has been heightened by the publicity about the nearby Love Canal toxic wastes problem, the nearby West Valley high-level radioactive wastes project, and the Three Mile Island nuclear power plant accident (Zweig 1981; U.S. Dep. Energy 1981b).

PROPOSED ACTION AND ALTERNATIVES

The Department of Energy proposes to take an interim remedial action to stabilize the R-10 pile as part of its ongoing maintenance and caretaker operations at NFSS. The current, uncontrolled offsite migration of radioactive materials from the R-10 pile via wind (dust and gases) and surface runoff water will be brought under control and minimized.

Concurrent with the R-10 work, the Department will carry out remedial action to reduce radon emissions from two buildings located south of the R-10 pile (Bechtel Natl. Inc. 1982c) (covered by a separate ADM). Additional future remedial actions are also envisioned at the site; therefore, certain facilities associated with the R-10 stabilization are being designed to handle both the R-10 stabilization work and possible future remedial action work. However, neither these additional actions, nor the final disposition of the site are part of the interim-stabilization action now proposed. Additional remedial actions are under study (Bechtel Natl. Inc. 1982b).

The area around the R-10 pile and on the edge of the pile (Figures 6 and 7) will be cleared of small trees and brush. Larger roots will be grubbed out and placed on the R-10 pile. The vegetation will be stored in a cleared area north of the R-10 pile (Figure 6) until it is surveyed for contamination and either burned or placed on the R-10 pile. If the ashes resulting from burning have concentrations of radionuclides exceeding the guidelines used for this remedial action, the ashes will be placed on the pile.

Contaminated soil material in the cleared area around the pile will then be removed and placed on the pile. For this proposed action, contaminated soil material will be defined as that material having a concentration of radium-226 > 5 pCi/g above natural soil background. Based on previous radiological surveys (Ausmus et al. 1980; Anderson et al. 1981), it is expected that up to 0.6 to 0.9 m (2 to 3 ft) of soil material will have to be removed.

A relatively impermeable clay dike (1.5 m [5 ft] high and 2.4 m [8 ft] wide at the top) will be constructed around most of the R-10 pile (Figure 6) and stabilized with soil and crushed stone. The wall of the building on the south side of the pile will form part of the southern side of the diked area. Clay will be placed against this wall as part of the dike construction. The diked area will be sized to eventually hold an additional $38,000 \text{ m}^3$ ($50,000 \text{ yd}^3$) of soil material that tentatively will be removed from other parts of the NFSS and from drainage ditches in Fiscal Years 1983, 1984, and 1985. It is expected that on the southwest side of the diked area, sand lenses or other permeable soils may be encountered. If encountered, they will be excavated and filled with clay, or if they are too large or too numerous, a clay/soil slurry wall will be constructed down to 4 m (13 ft) beneath the original surface.

There are several boreholes from previous surveys in the R-10 area. At these boreholes, well casings will be pulled and the holes grouted with a cement-bentonite mixture so as to seal potential hydraulic connections between the surface and the subsurface soils in the R-10 area.

The top of the R-10 pile will be graded and covered with a reinforced, synthetic rubber membrane (EPDM)

At the beginning of construction activities, a system of temporary rain-water diversions will be constructed around the work area, and temporary runoff holding ponds will be installed to control the further spread of contamination until the clay dike is built. Runoff from inside the newly diked area will be routed to a permanent diked sedimentation pond that will be constructed on the north end of the R-10 dike (Figure 7). The pond will have a capacity of $4 \times 10^6 \text{ L}$ ($1 \times 10^6 \text{ gal}$). Two smaller holding ponds, constructed within the same dike system next to the sediment pond, will allow for treatment of water before release, if necessary. This sedimentation/holding/treatment system will be designed to treat contaminated dewatering solutions expected to result from FY 1983, 1984 and 1985 activities. To prevent seepage, these three ponds will be lined with the same material used to cover the R-10 pile. A portable (skid-mounted) water-purification system--consisting of a filtration unit, a demineralizer unit, and associated pumps and piping--will be installed. After any necessary treatment and monitoring, water will be discharged to the nearby drainage ditch.

About 14,000 m³ (18,000 yd³) of clay will have to be brought to the site over a period of about 10 weeks. Peak traffic will be four to six trucks per hour. A supplier has not yet been contracted, but it is anticipated that suitable clay can be obtained nearby. Soil for the dike will be taken from the new sediment pond excavation. Additionally, it is anticipated that the rock fill will be obtained locally. Dike materials will probably be brought to the site via Pletcher Road (Figure 2).

If necessary, the clay-hauling dump trucks and other equipment that leave the contamination-control area will be decontaminated (washed) with water at a decontamination pad that will be constructed along the old railroad bed east of the R-10 pile area (Figure 6). This pad will be sized to handle the expected peak traffic of four to six trucks per hour. It will also be designed to last for several years so that it can be used if further remedial action is taken at the site. A drain in the center of the pad will lead to a preformed concrete retention basin. Water will be piped from the basin to the new sedimentation pond north of the R-10 diked area. A bypass road will be constructed around the decontamination pad for vehicles that do not need decontamination.

Water for washing the vehicles will be taken from an existing township hydrant near the pad. Electricity will be supplied from existing powerlines at the site, although additional lines may have to be run onsite near the work area.

It is anticipated that the proposed activities will be completed during the 1982 summer construction season (May through October). There will be about 40 workers, including 20 management and monitoring personnel brought in from outside the area.

A summary of measures to mitigate and monitor potential impacts that will be part of this proposed action is given in Table 4.

There are two basic alternatives to the proposed action: (1) wait and take no action until the permanent disposition of NFSS can be determined, and (2) remove the R-10 pile and dispose of it permanently elsewhere. Neither of the alternatives can effectively satisfy DOE's near term objectives relative to the interim management of the radioactive materials stored at NFSS.

POTENTIAL ISSUES

There are several potential issues associated with the proposed action, including:

1. Public apprehension that the R-10 pile interim stabilization may be the first step toward making NFSS a permanent radioactive waste-disposal site. This perception may be reinforced by public knowledge that there are several other sites in the Niagara/Buffalo area that might need decontamination and that a disposal site would be needed to dispose of any decontamination wastes from those sites.
2. Adequacy of the water retention/treatment/monitoring system to ensure compliance with state and federal waste water discharge regulations (N.Y. State Div. Water Resour. 1975).

3. Adequacy of the criterion that will be applied to decontamination of the soils around the R-10 pile.
4. Investment in construction of facilities to handle additional actions which are not part of the currently proposed action.
5. Continued migration of contaminants from the R-10 area via groundwater. Installation of the cover over the R-10 pile and construction of the impermeable clay dike around the perimeter will decrease the potential for pile saturation and subsequent leaching of contaminants to groundwater. However, saturation of the pile may still occur during periods of seasonally high groundwater, and water may also flow under pressure from the lower confined soil aquifer into the contaminated materials through any undetected, hydrological conveyances.

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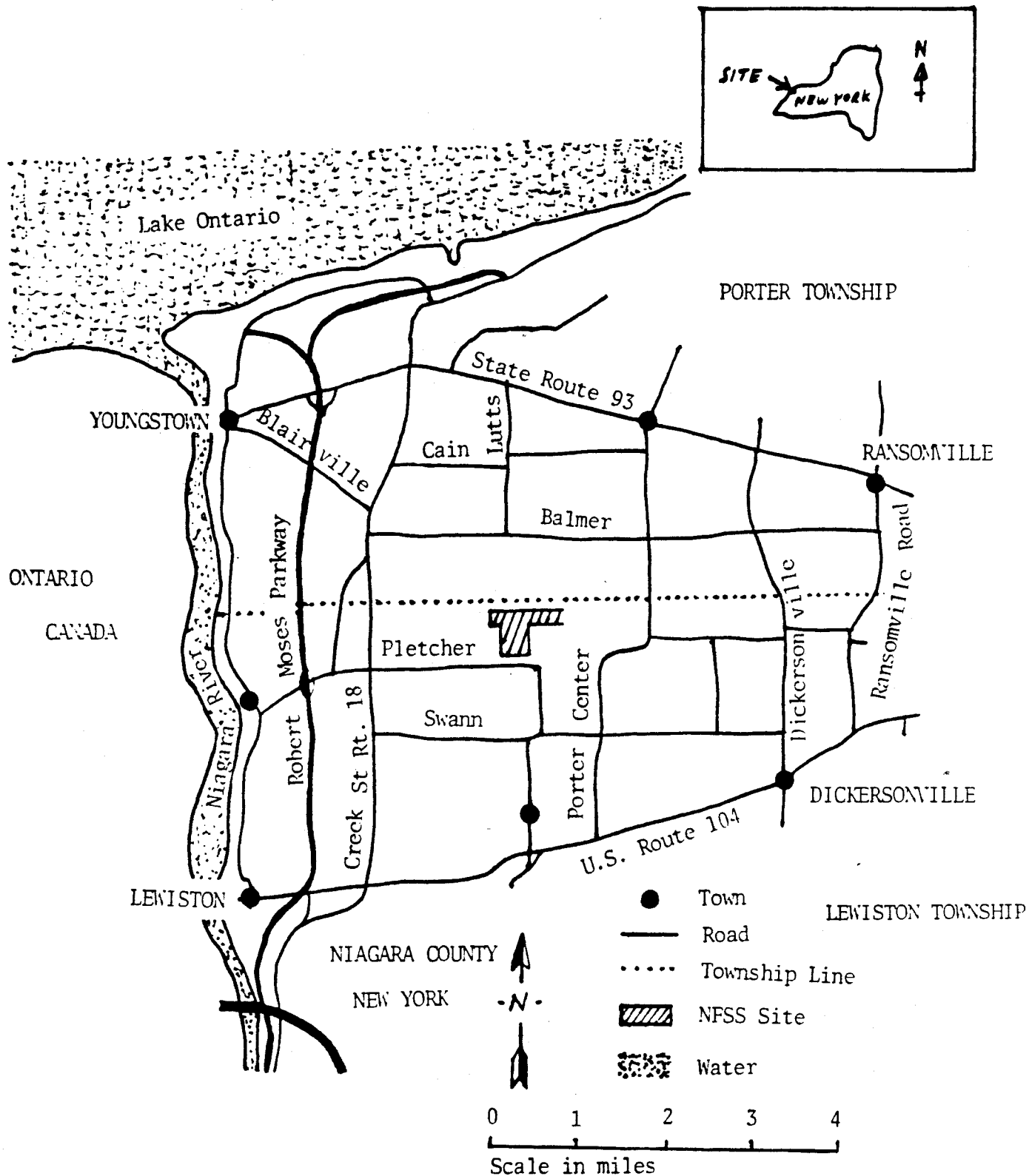


Figure 1. Niagara Falls Storage Site Location Map.
Adapted from Ausmus et al. (1980).

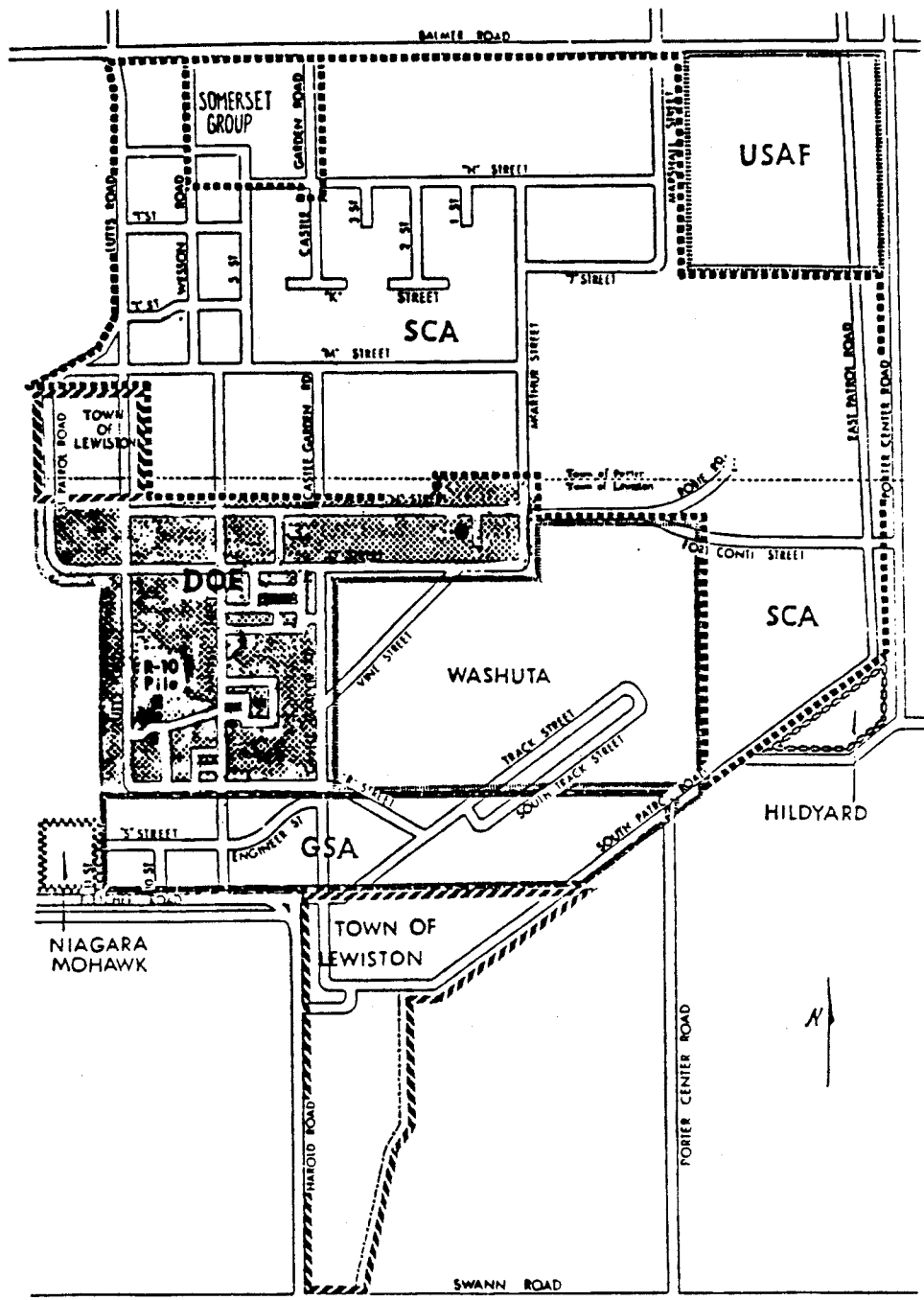


Figure 2. Current Ownership of the Original Manhattan Engineer District Site at the Lake Ontario Ordnance Works. Adapted from Drawing Serial No. 00002, Rev. 2 (NLO, Inc.).

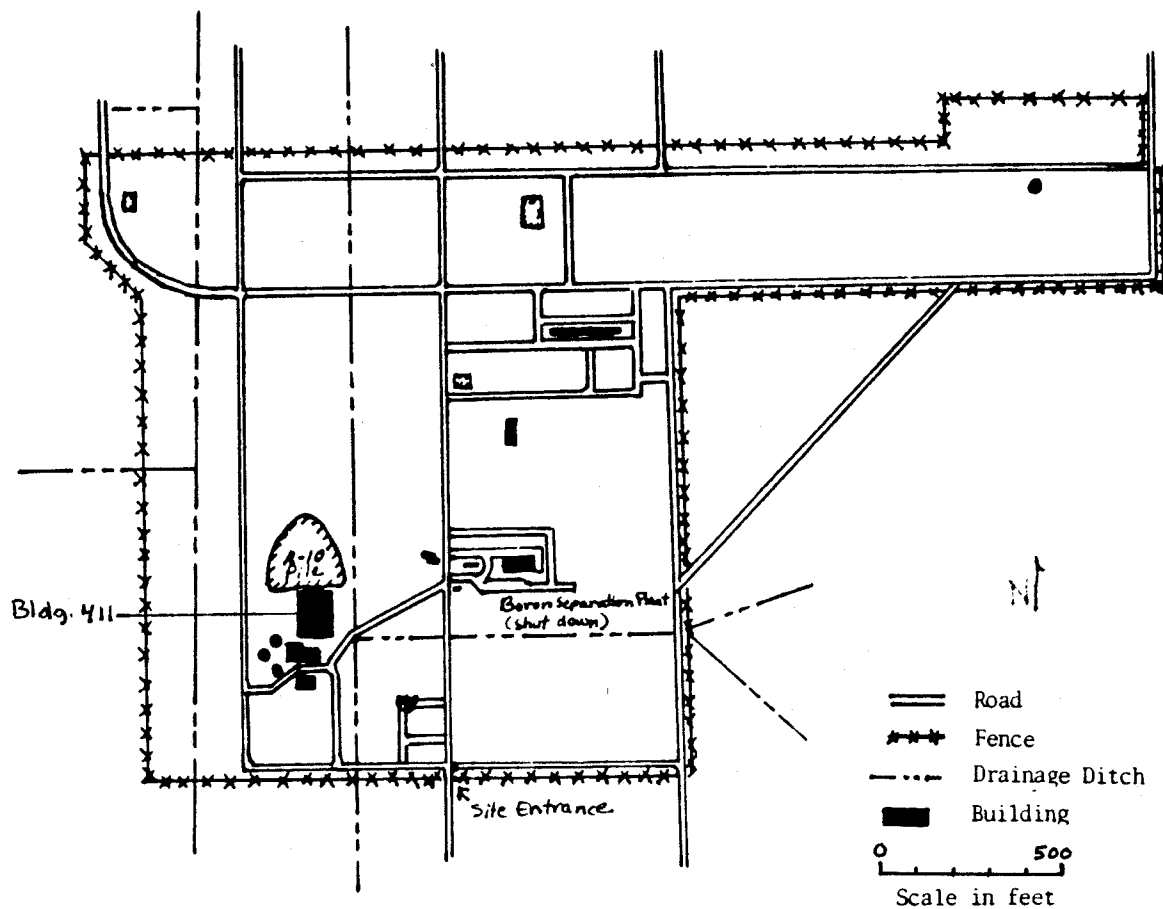


Figure 3. Map of the Niagara Falls Storage Site.
Adapted from Englert and Hinnefeld (1981).

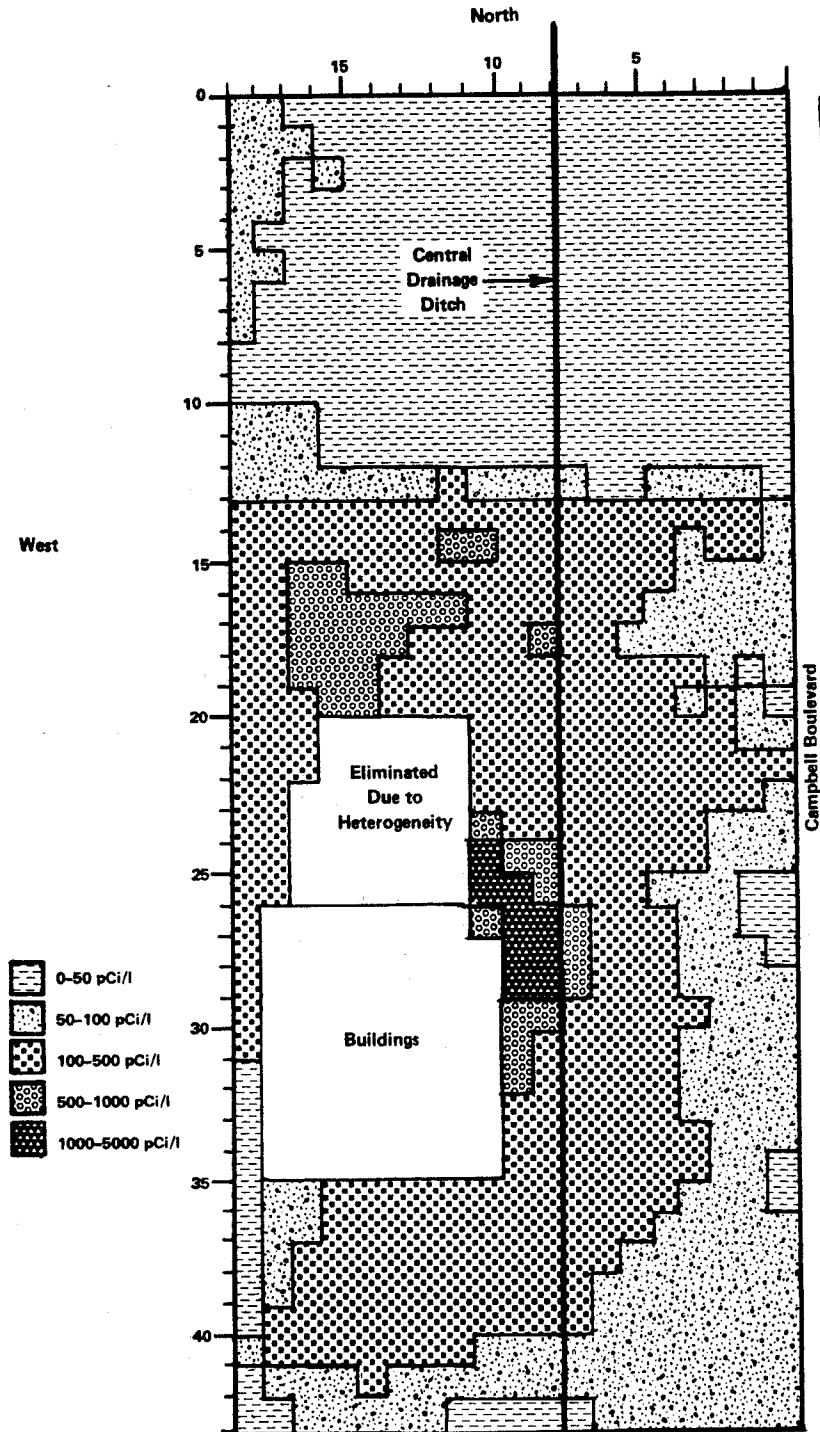


Figure 4. Near-Surface Radon-222 Concentrations in the Southwest Quadrant of the Site. Source: Anderson et al. (1981--Figure 5-8).

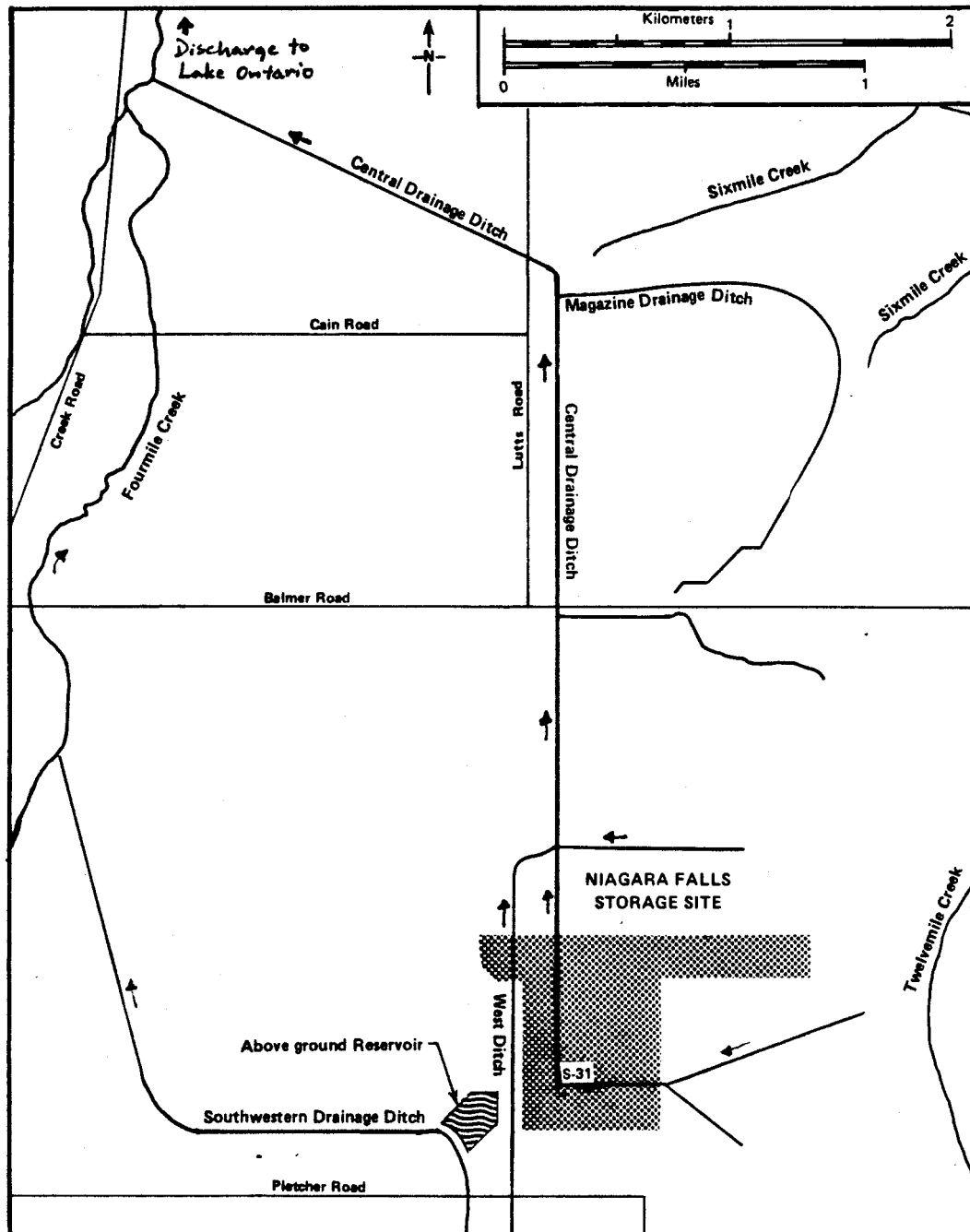


Figure 5. Surface Water Drainages at the Niagara Falls Storage Site. Adapted from Anderson et al. (1981).

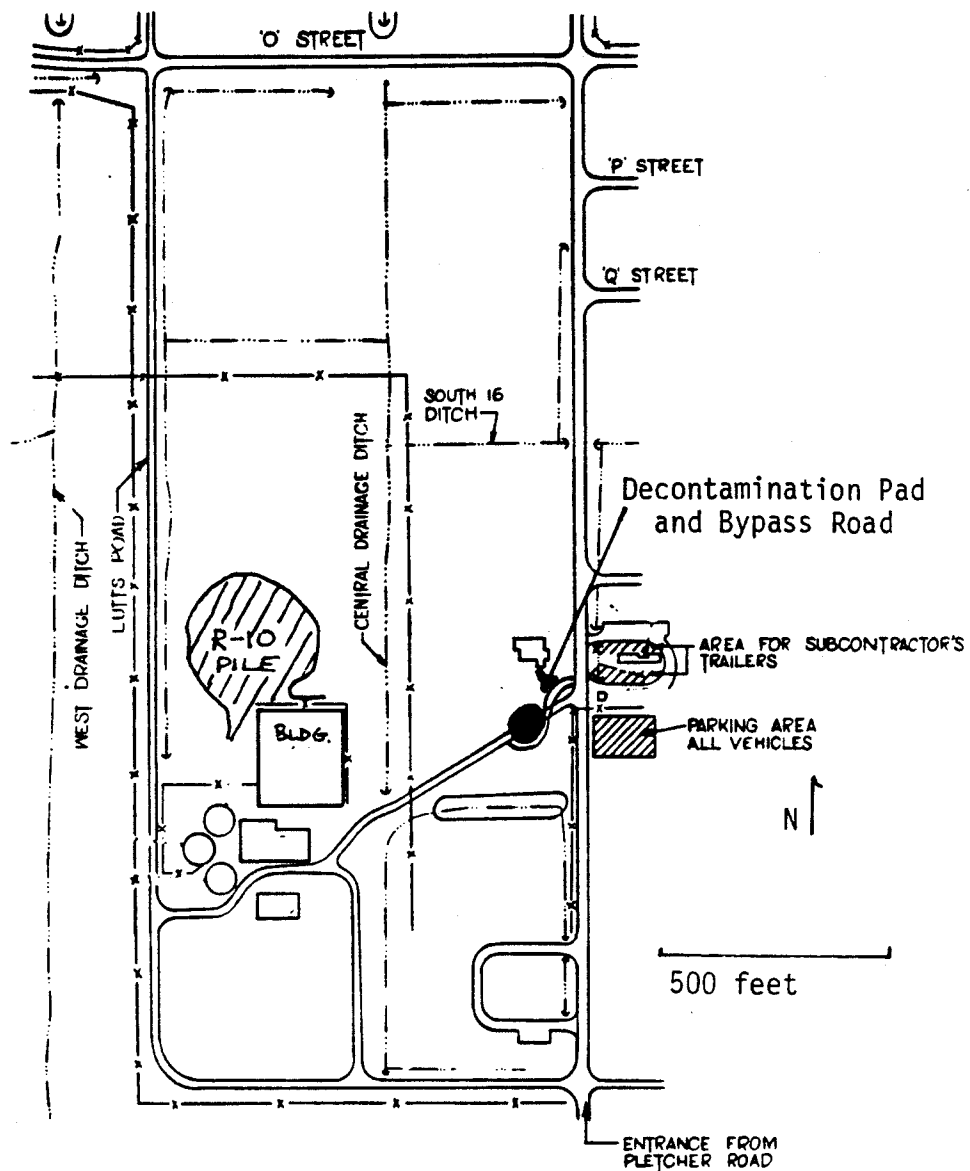


Figure 6. 1982 Work Areas at the Niagara Falls Storage Site. Adapted from Bechtel National, Inc. (1982a-- Drawing 15-C-03).

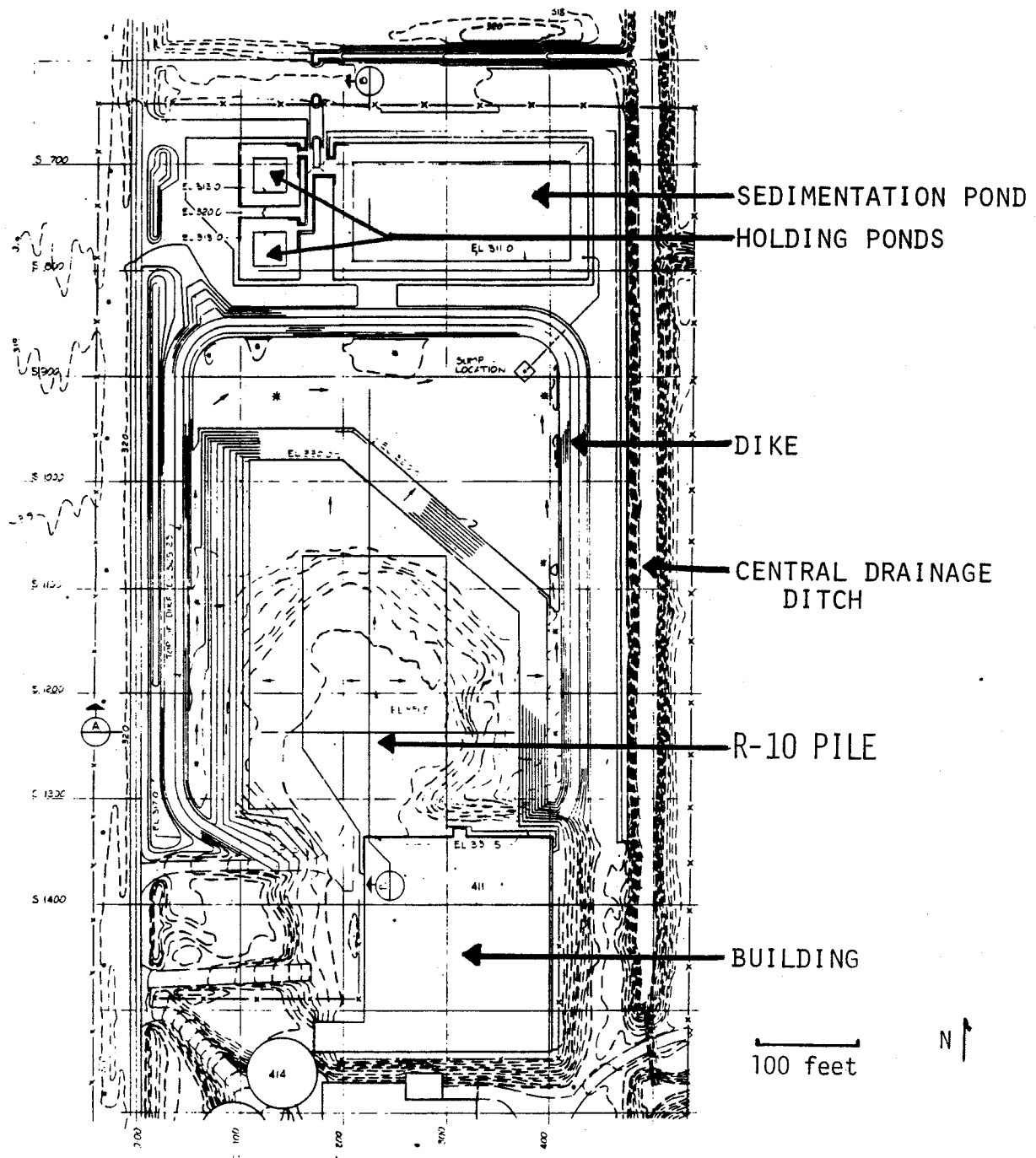


Figure 7. Diagram of the R-10 Pile Stabilization at the Niagara Falls Storage Site. Adapted from Bechtel National, Inc. (1982a--Drawing 15-C-05).

Table 1. Summary of Radiological and Nonradiological Characteristics of the R-10 Pile Area

Characteristic	Range of Values
<u>Radiological</u>	
Gamma (1 m)	13-7000 μ R/h
Beta-gamma (1 cm)	0.06-4 mR/h
Surface radium-226	4-9400 pCi/g
Total uranium	1-145 mg/g
Depth of radium-226	6 m (20 ft)
Total volume of radium-226 >5 pCi/g† ¹	53,340 m ³ (1.9 × 10 ⁶ ft ³)
Radium-226 in vegetation	5.4 pCi/g
Radon (1.5 m above surface)	2-440 pCi/L
Radon (at soil surface)	15-1200 pCi/L
<u>Nonradiological</u>	
Arsenic	0.5-5 ppm
Barium	100-500 ppm
Cerium	5-100 ppm
Chromium	20-30 ppm
Cobalt	50-5000 ppm
Copper	20-3000 ppm
Fluorine	3-100 ppm
Lead	3-650 ppm
Nickel	20-5000 ppm
Strontium	50-200 ppm
Titanium	1000-3000 ppm
Vanadium	30-1000 ppm
Zirconium	10-1000 ppm

†¹ Includes contaminated subsurface soil and spoil pile.

Source: Anderson et al. (1981).

Table 2. Population and Housing Units

Location	Population			No. of Housing Units		
	1970	1980	% Change	1970	1980	% Change
Niagara County	235,720	227,101	-3.7	74,695	85,037	13.8
Lewiston Township	15,888	16,214	2.1	4,160	4,948	18.9
Lewiston	3,292	3,326	1.0	1,024	1,292	26.2
Porter Township	7,429	7,258	-2.3	2,306	2,531	9.8
Youngstown	2,169	2,196	1.2	667	763	14.7
Ransomville	1,034	1,101	6.5	263	317	20.5

Data from U.S. Census Bureau, New York Regional Office.

Table 3. Governmental Agencies with Potential Regulatory Control
Over the Proposed NFSS Interim Remedial Action

Federal

Nuclear Regulatory Commission
Environmental Protection Agency
Department of Energy
Department of Transportation

State of New York

Department of Environmental Conservation
Department of Health
Department of Labor
Department of Transportation
Energy Research and Development Authority

Niagara County

Finance, Public Health, and Public Safety Committee
Health Department
Board of Health
Environmental Management Council
Planning Board

Town of Lewiston

Town Board
Building and Zoning Inspector
Zoning Board of Appeals
Environmental Conservation Committee

Data from Politech Corporation (1980).

Table 4. Measures to Mitigate and Monitor Potential Impacts

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- Controls over further spread of contamination--including establishment of a contamination control zone, decontamination of vehicles and equipment, erosion and runoff control measures, and worker monitoring.
 - Prompt seeding and mulching of disturbed areas to minimize erosion.
 - Standard contamination and worker radiation-exposure controls for rework of the surface of the R-10 residues and construction of the southwest portion of the dike.
 - Routing of traffic one-way through the site and potential purchase of clay from land adjacent to the site so as to avoid heavy traffic or tie-ups on local highways.
 - Air and water quality monitoring for radioactive substances.
 - Informing local authorities, nearby property owners, and concerned citizens of the proposed action and designating a public liaison person.
-