ORO-846

WORK PLAN FOR THE MIDDLESEX MUNICIPAL LANDFILL SITE

APRIL 1984

Prepared by
U.S. DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS OFFICE

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1.0 INTRODUCTION AND OBJECTIVES

1.1 BACKGROUND

The United States Government initiated the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974. It is currently being managed by the Department of Energy (DOE). The objectives (Reference 1) of FUSRAP include:

- Identification of candidate sites
- Determination of whether authority exists for DOE to undertake work, and, if so, characterization of radiological conditions
- Stabilization and/or decontamination of sites as required and pursuant to authorization and appropriation by Congress
- Development of acceptable stabilization and disposal sites in cooperation with the affected states, and ultimately
- Certification of the acceptability of the sites for future use.

1.2 IDENTIFICATION

The Middlesex Municipal Landfill (MML) Site is a DOE FUSRAP site located in northern Middlesex County within the Borough of Middlesex, New Jersey.

1.3 PURPOSE

This work plan describes the engineering design and construction activities relevant to implementation of the DOE-preferred remedial action alternative which is to excavate the above-criteria radioactive wastes and transport them to the Middlesex Sampling Plant (MSP) site. A schedule and cost estimate for implementation of the preferred alternative are also included in this work plan.

2.0 SITE DESCRIPTION

2.1 SITE LOCATION

The MML site is located in northern Middlesex County, New Jersey, 0.8 km (0.5 mi) north-northwest of the MSP site within the corporate limits of the Borough of Middlesex, as shown in Figure 2-1. Newark, New Jersey is approximately 26 km (16 mi) northeast of the site.

The site is approximately 1.2 ha (3 acres) in size, and is part of a formerly active municipal landfill. Figure 2-2 is a vicinity map and Figure 2-3 an aerial photograph of the site. It is situated on the east side of Mountain Avenue, south of Monroe Street, and southwest of Bound Brook. It is bordered on the north by property owned by the Middlesex Presbyterian Church, and on all other sides by property owned by the Borough of Middlesex.

An evaluation of data of past radiological surveys has identified an area of approximately 0.24 ha (0.6 acre) which warrants remedial action. About two-thirds of this portion of the site is owned by the Borough of Middlesex; the remainder is owned by the church, as shown in Figure 2-2. Figure 2-4 is a topographical map of the MML site showing the drainage pattern to Bound Brook.

2.2 RADIOLOGICAL DESCRIPTION

Details of the radiological condition of the MML site are included in References 2 and 3.

2.2.1 Surface Soil Analysis

Surface soil samples were collected at various points throughout the site as part of a 1978 Oak Ridge National Laboratory (ORNL) survey (Reference 2). Most sampling locations were chosen according to a random siting scheme. Several samples were taken in areas with high

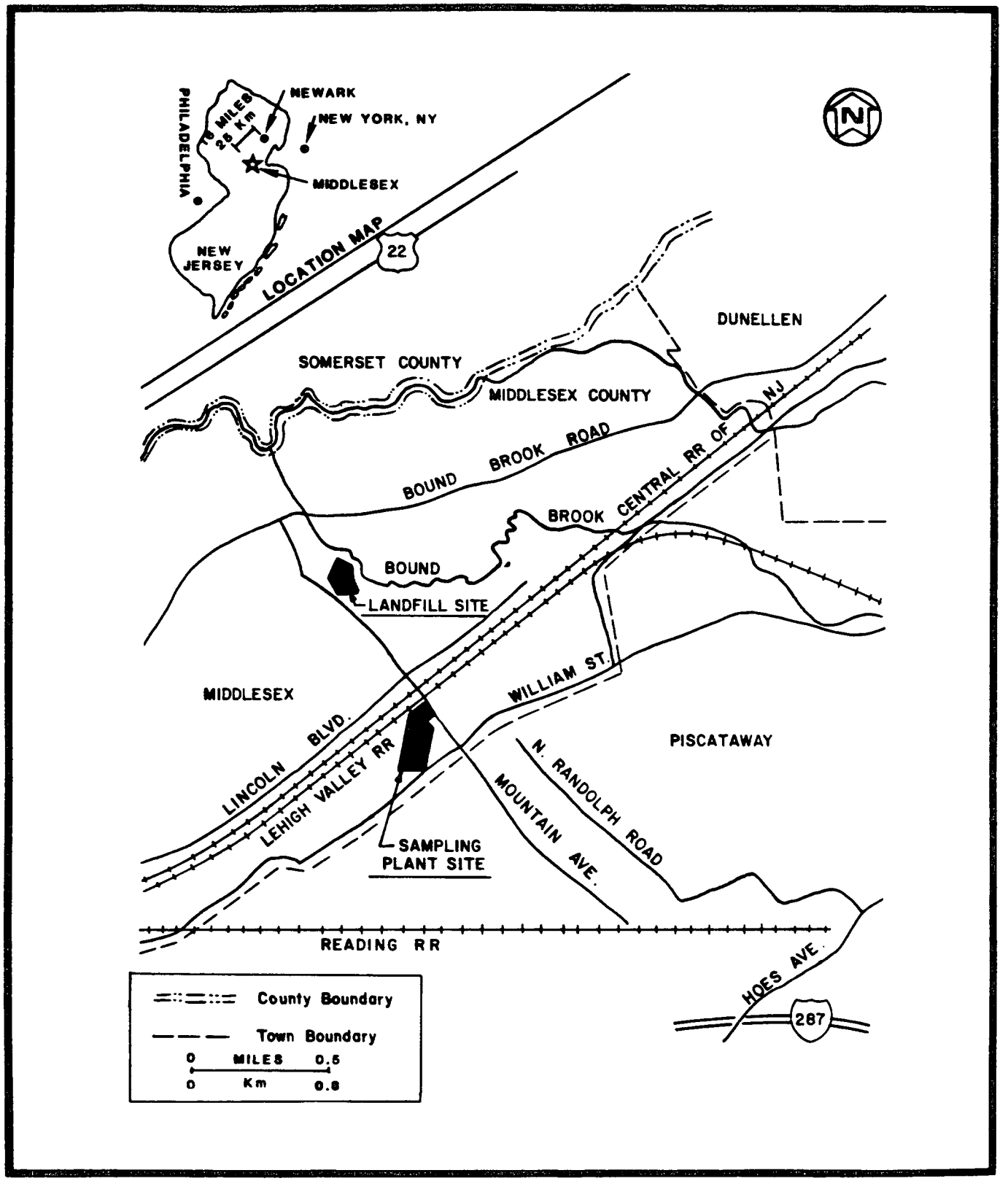

FIGURE 2-1 LOCATION OF THE MIDDLESEX MUNICIPAL LANDFILL (MML) SITE

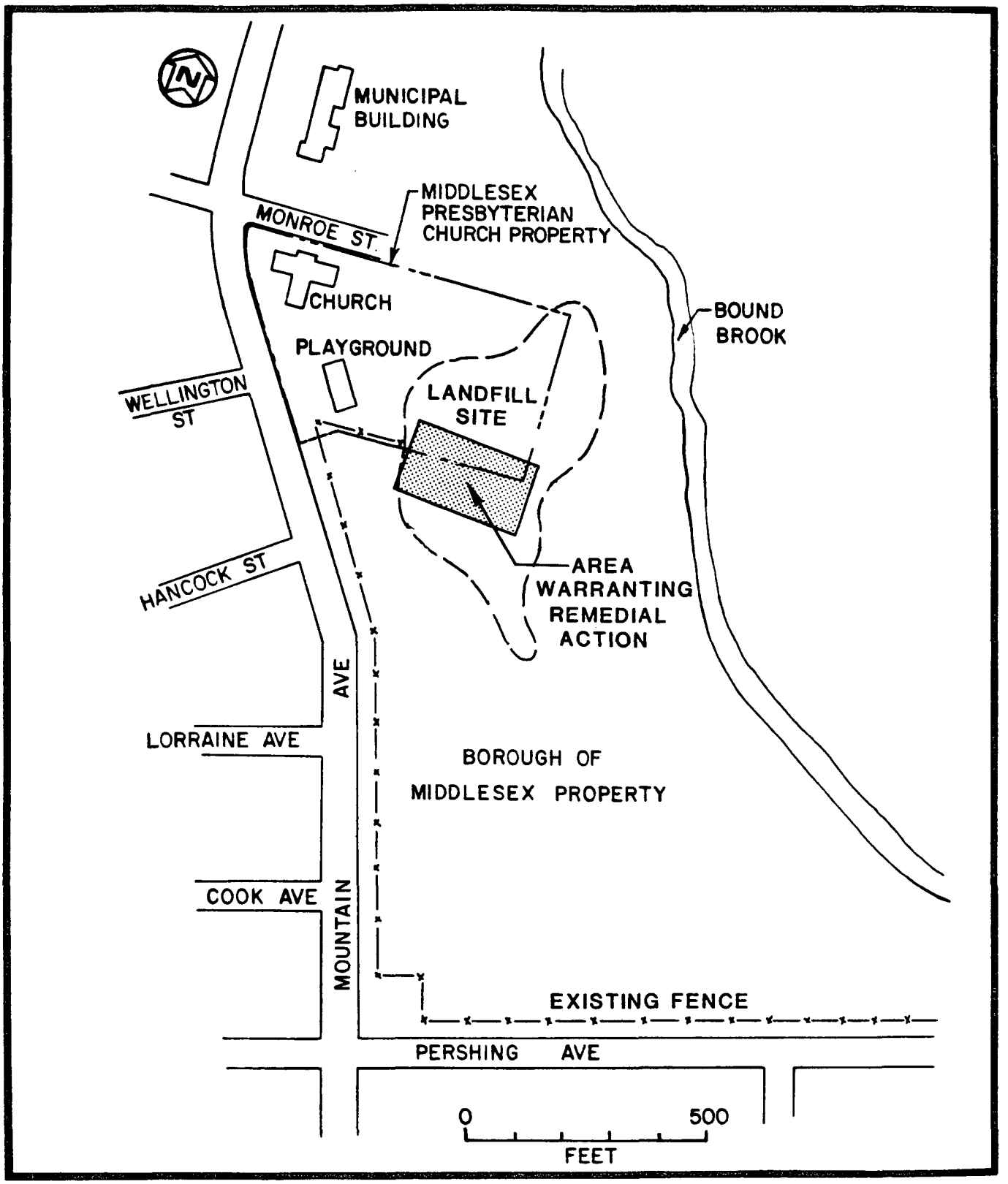

FIGURE 2-2 VICINITY MAP OF THE MML SITE SHOWING LAND OWNERSHIP

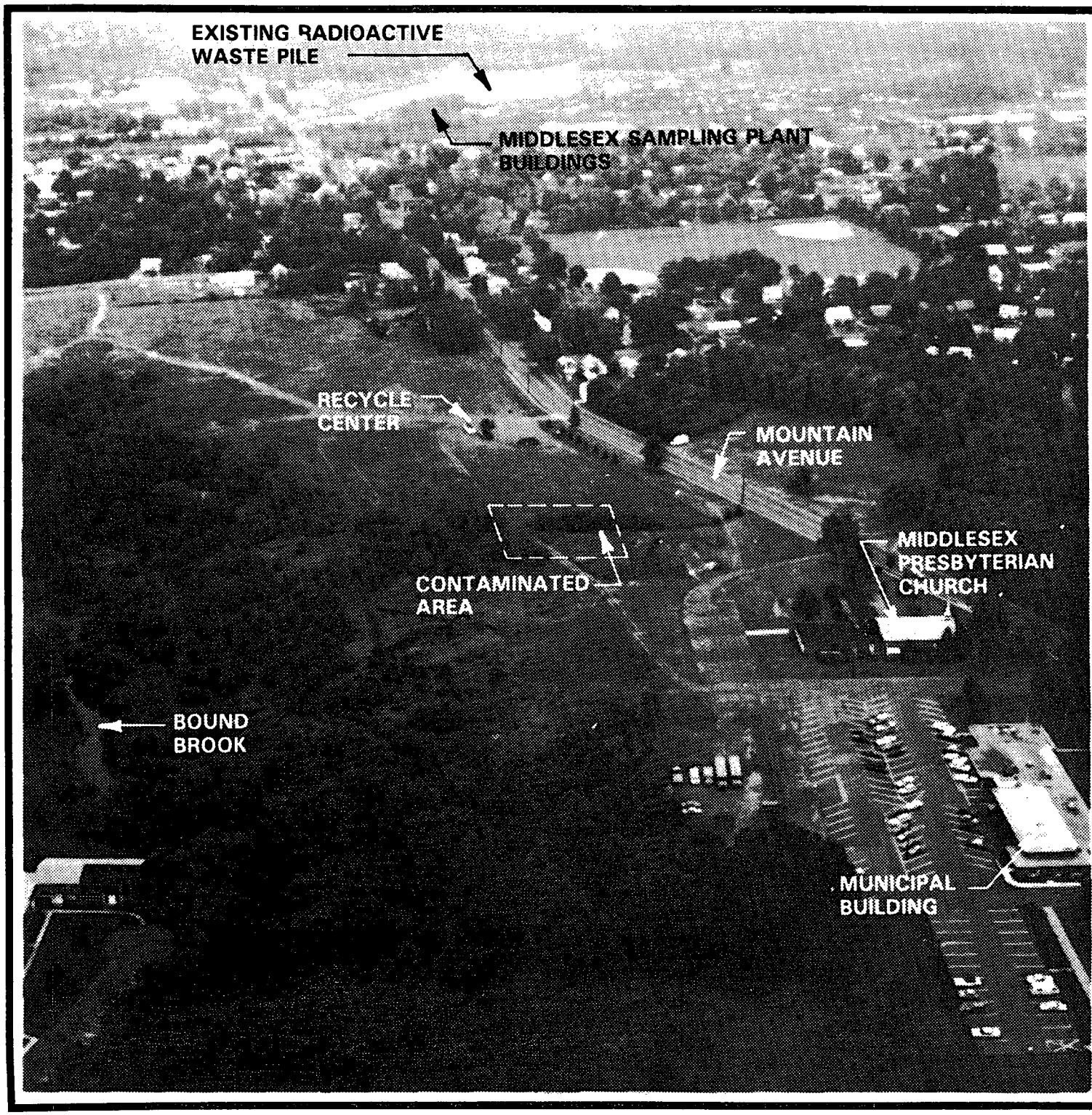

FIGURE 2-3 AERIAL PHOTOGRAPH OF MML SITE (LOOKING SOUTH)

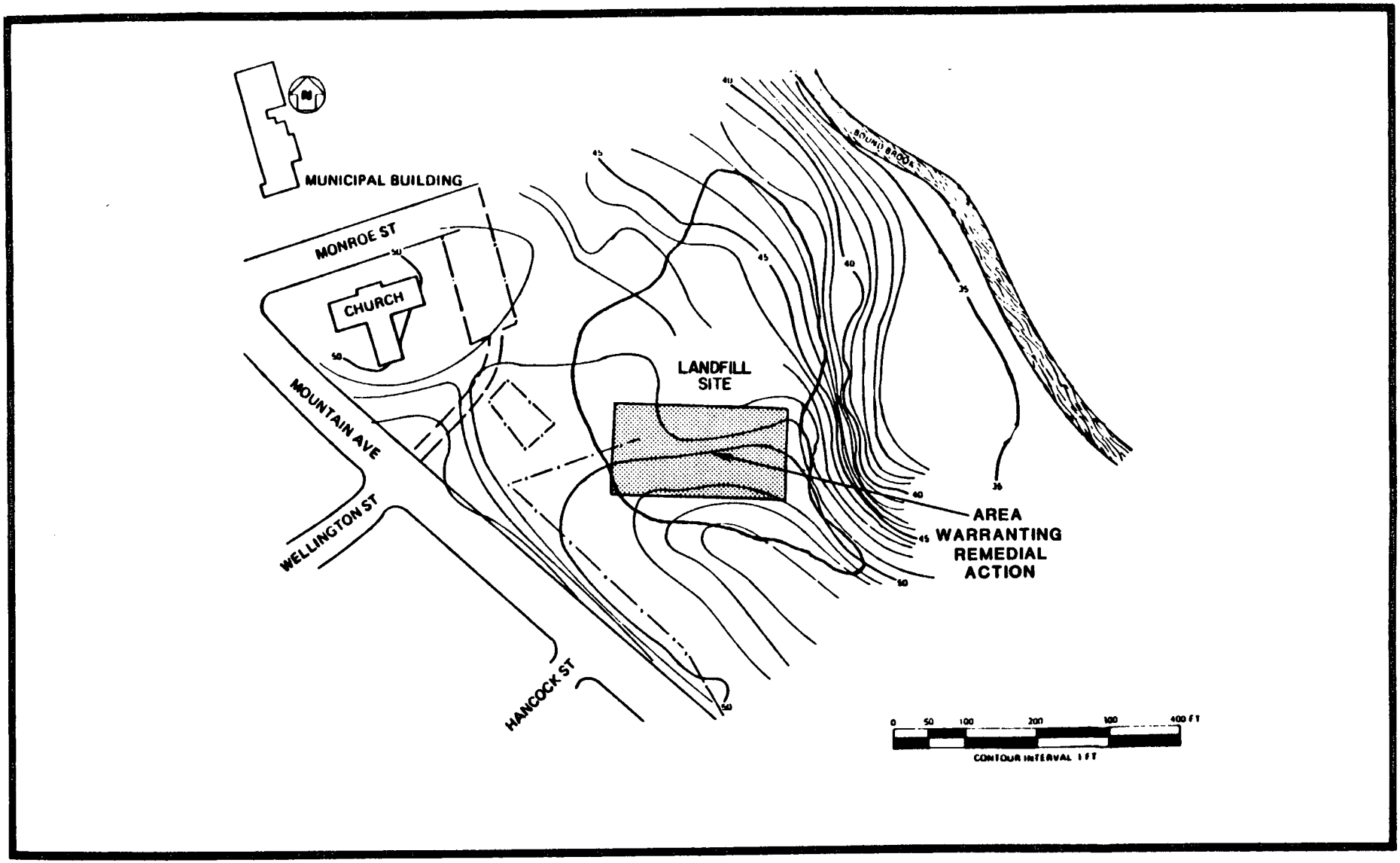

FIGURE 2-4 TOPOGRAPHICAL MAP OF MML SITE

radioactive contamination. Radium-226 concentrations in the random samples were as high a 1.8 pCi/g. The maximum uranium-238 measurement in the random samples was 2.3 pCi/g. The average concentrations of radium-226 and uranium-238 for all surface samples were less than 1.0 pCi/g and 1.22 pCi/g, respectively. These values can be considered background concentrations. A sample taken at one biased location measured a radium-226 concentration of 150 pCi/g. This location coincided with the maximum observed gamma and beta-gamma radiation levels.

2.2.2 Subsurface Soil Analysis

Subsurface soil samples were obtained by coring techniques and were analyzed as part of a survey conducted by the AEC in 1974 (Reference 3), and as part of the 1978 ORNL survey (Reference 2). The analysis indicates that elevated radiological readings exist over about 2 ha (5 acres) of the former landfill, which occupied about 13 ha (33 acres). The data indicate that the subsurface contamination is below the FUSRAP criteria except for a surface area 35 m by 75 m (110 ft by 250 ft) or 0.24 ha (0.6 acre). In this area the subsurface samples were obtained by coring techniques and were analyzed as part of the 1974 AEC and 1978 ORNL surveys. The analysis indicates radium-226 contamination exceeds 15 pCi/g of soil to depths of 3.7 m (12 ft).

2.2.3 Radon Emanation and Gamma Radiation

The 1978 ORNL survey found radon emanation rates to be indistinguishable from natural background levels at the MML sites. The radiological survey estimated that radon levels are less than 0.001 pCi/l above the minimum background. Radon daughter concentrations are estimated to be 0.0001 working level (WL).

In an approximate 46-m^2 (500-ft^2) area, the survey indicated an elevated gamma radiation level which averaged 30 R/hr.

2.2.4 Water Samples and Analyses

Sampling of Bound Brook and Ambrose Brook indicated that the waters did not have radium and uranium concentrations that are greater than background (Reference 2). A series of monitoring wells was drilled into the MML site in late Fall 1981. The groundwater has been routinely sampled and analyzed. Results of the analyses indicate that all samples except one were within U.S. Environmental Protection Agency (EPA) drinking water guidelines for radioactivity. Although most of the data are near the minimum detectable levels for radium and uranium, the radium data for one well (81-6 on Figure 2-5) have indicated concentrations higher than the drinking water standard, but below the DOE criteria. The drinking water standard is 10 percent of DOE's allowable limit for unconditional release (Reference 4).

2.3 SITE GEOLOGY AND HYDROLOGY

In December 1981, 15 exploratory holes were drilled into the inactive MML site to determine the geohydrological features of the landfill including the characteristics and stratigraphy of the earth beneath the site. The holes were also used to conduct permeability tests and were developed as groundwater observation wells. In July 1983, five additional holes were drilled to determine the degree of hydraulic interconnection between groundwater aquifers above and below the clay layer. Data collected from the exploratory holes, the locations of which are shown in Figure 2-5, included core logs, water-level measurements, chemical water analyses, and permeability measurements.

During the drilling program, it was determined that a 0.9 to 3.7-m (3 to 12-ft) thick layer of clay (weathered shale) exists at a depth of 6.1 m (20 ft) and separates the landfill and overburden materials from bedrock. The bedrock in the MML area is a very thick (305 m) (1000 ft) layer of shale that is part of the Brunswick Formation. The clay layer lies between two aquifers, the upper of which is

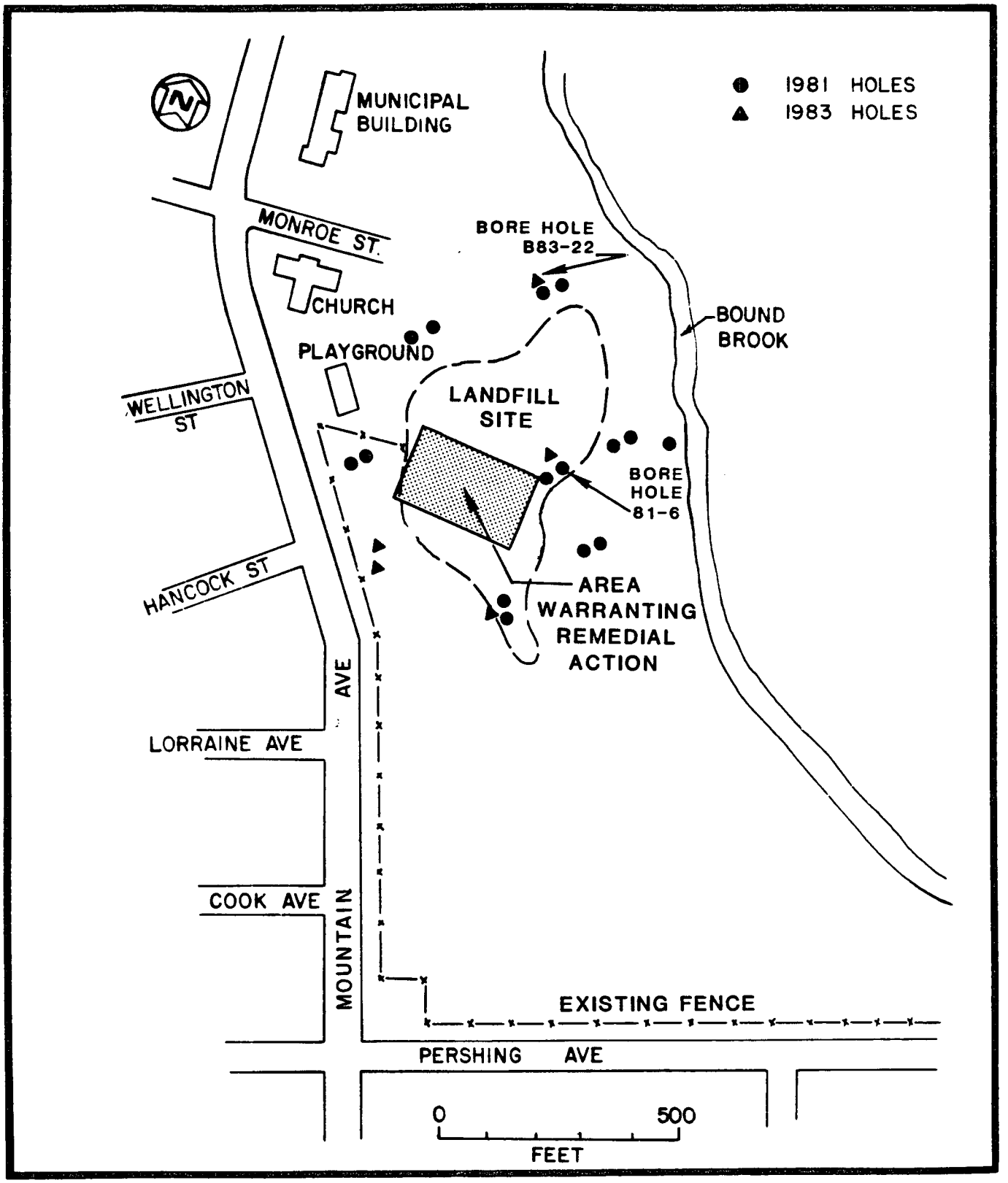

FIGURE 2-5 LOCATIONS OF EXPLORATORY HOLES DRILLED AT MML SITE

contained in the overburden (fill material) within the site. The lower aquifer is contained in the fractured surface of the shale bedrock. Additional results of the drilling tests are presented in Reference 5.

2.4 HAZARDOUS WASTE FINDINGS

During January 1984, 6 boreholes were drilled to obtain composite soil samples and to analyze for volatile organic priority pollutants, acid extractables, base neutral extractable priority pollutants, pesticides, herbicides, PCB's, selected metals, cyanide and total phenol (Reference 6).

The results indicate that concentrations of the below listed substances are such that Occupational Safety and Health Administration (OSHA) Standards for Occupational Exposure to Airborne Contaminants could be exceeded during remedial action activities. The required safety plan is discussed in Section 4.7.9.

METALS	BASE-NEUTRAL EXTRACTED ORGANICS
cadmium	coal components
nickel	phosphate fertilizer/pesticide residue
lead	phthalates
chromium	
copper	
zine	
arsenic	
mercury	

ACID EXTRACTABLE ORGANICS	PESTICIDES AND PCB'S
phenol	PCB 1254
	4,4 DDT
	4,4 DDE
	4,4 DDD

Combustible gases were encountered in each of the 6 boreholes, 2 boreholes would not vent and as a result only minimum sample recovery was achieved in the southeast corner of the location in Figure 2-5 entitled "Area Warranting Remedial Action."

Observations indicate a high potential for surface fires and explosions if excavations are completed under current conditions. Operational precautions and personnel protection will be quite restrictive to reduce risks to an acceptable level.

3.0 MANAGEMENT APPROACH

All FUSRAP sites are under the direction of the DOE Assistant Secretary for Nuclear Energy, through the Office of Terminal Waste Disposal and Remedial Action, and the Division of Remedial Action Programs (DRAP).

DOE Headquarters (DOE-HQ) has the responsibility for the development of overall policy applicable to the FUSRAP. DOE-HQ provides broad guidance and establishes the program budget.

The Oak Ridge Operations Office (ORO), Technical Services Division (TSD) manages the FUSRAP on a day-to-day basis and oversees the work of the Project Management Contractor (PMC) chosen to implement project activities. In addition to the technical and administrative management of the FUSRAP, ORO-TSD manages the authorized project budget.

The PMC, Bechtel National, Inc. (BNI), acts as DOE's representative in the planning, management, and implementation of the FUSRAP. As PMC, BNI is responsible for analyzing site conditions and planning, recommending, and engineering remedial actions for the various FUSRAP sites. Upon approval from ORO-TSD, BNI implements remedial actions as required. BNI administers construction subcontracts, coordinates the sequence of operations, controls the relationships among subcontractors, and assures completion of each authorized project according to plan.

In implementing approved remedial actions at a specific site, BNI will focus on subcontracting in the local region to the extent that it is cost-effective and expedient to the program.

At each FUSRAP site, BNI is responsible for defining and implementing quality assurance procedures and environmental monitoring, safety, and radiological programs. BNI is responsible

for monitoring and controlling all activities at the site through close cooperation with its radiological support subcontractor, Eberline Instrument Corporation (EIC), and all remedial action subcontractors.

Argonne National Laboratory (ANL) is responsible for the National Environmental Policy Act (NEPA) process, as outlined in the Council on Environmental Quality, NEPA regulations, and implementing DOE guidelines. Through the NEPA process, DOE will advise federal, state, and local agencies and the public of the results of preliminary engineering evaluations, environmental analyses, and conclusions regarding options for disposition of contaminated materials. As part of its NEPA responsibilities, ANL will perform the levels and types of environmental assessment necessary to support work activities.

4.0 WORK PLAN

4.1 REMEDIAL ACTION CRITERIA

The radiological guidelines determined by DOE to be applicable to cleanup of radioactive materials under the FUSRAP are summarized in Table 4-1 and defined in detail in the FUSRAP Design Criteria (Reference 7). The Design Criteria present additional details regarding applicable federal regulations, including: design codes, guides, and standards; radiation protection; land disposal of radioactive wastes; and handling, transportation, and storage of wastes. Water quality guidelines are also presented.

The general criteria for remedial action at FUSRAP sites are based on conservative calculations of the potential dose to the maximally exposed individual. These dose calculations take into account the following exposure pathways; direct external exposure, inhalation of radioactivity in the form of dusts and gases, and ingestion of radioactivity by drinking contaminated water and by eating plants and animals grown in the contaminated environment. Dose calculations assume uniform soil contamination over the entire site including underneath a habitable structure.

For many sites being evaluated for remedial action, most of the exposure pathways considered in setting these guidelines are not applicable for a calculation of a realistic estimate of dose (and therefore risk). The most common instance is where the contamination is localized in a few small areas, thus greatly reducing the potential for exposure. In some instances, the cost of engineered remedial action may exceed the worth of any benefit derived from that action.

TABLE 4-1

RESIDUAL CONTAMINATION GUIDELINES FOR FORMERLY UTILIZED

SITES AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

Radionuclide	Soil Criteria pCi/g above background[1,2,3]
Natural Uranium	75
A curie of natural uranium means the sum of 3.7×10^{10} dis/s from uranium-238 plus 3.7×10^{10} dis/s from uranium-234 plus 1.7×10^{5} dis/s from uranium-235. One curie of natural uranium is equivalent to 3,000 kg or 6,600 lb of natural uranium.	
Uranium-238	150
Assumes that no other uranium isotopes are present.	
Radium-226	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface and less than 1.5 m below the surface.
Thorium-230	15
The thorium-230 guideline is 15 pCi/g to account for ingrowth of radium-226 as thorium-230 decays. Radium-226 is a limiting radionuclide because its decay product is radon-222 gas.	
Thorium-232	15

[1] In the event of occurrence of mixtures of radionuclides, the fraction contributed by each radionuclide to its limit shall be determined, and the sum of these fractions shall not exceed 1. If radium-226 is present, then the fraction for radium-226 should not be included in the sum if the radium-226 concentration is less than or equal to the thorium-230 concentration. If the radium-226 concentration exceeds the thorium-230 concentration, then the sum shall be evaluated by replacing the radium-226 concentration by the difference between the radium-226 and the thorium-230 concentrations.

[2] Except for radium-226, these criteria represent unrestricted-use residual concentrations above background averaged across any 15-cm thick layer to any depth and over any contiguous 100-m^2 surface area. The same conditions prevail for radium-226 except for soil layers beneath 1.5 m, the allowable radium-226 concentration may be affected by site-specific conditions and must be evaluated accordingly.

[3] Localized concentrations in excess of these limits are allowable provided that the average over 100 m^2 is not exceeded (see Hot Spot Criteria, Table 4-2).

Consequently, proposed "hot spot" criteria defined in Table 4-2 have been developed which will permit unrestricted use of such areas without significant increase in risk to the maximally exposed individual or the environment.

The proposed hot spot criteria are to be the "reasonable upper limits" for determining the need to remove small areas of contamination. In general, if a hot spot is in an area where cleanup can be accomplished in a manner that is reasonable from an economic and the ALARA radiation protection concept, then the area should be cleaned to the general criteria. However, if a hot spot is in an area of limited access, for example at the edge or under a busy roadway, then the application of the hot spot criteria would be reasonable and prudent.

4.2 SITE CHARACTERIZATION

The MML site had been adequately characterized from geohydrological and radiological standpoints, but required some additional (supplemental) characterization from a hazardous waste standpoint. DOE approved the following two-stage action program to characterize the MML site for hazardous wastes. First, observation wells at the MML site were sampled and analyzed for hazardous chemicals. Second, based on the sample analysis results, a program was established to test the landfill section that exceeds the radioactive contamination cleanup criteria in order to properly characterize the waste for chemicals. These two activities were completed in January, 1984 (see Section 2.4).

The hazardous waste characterization was necessary in order to establish proper operating procedures to protect workers and the environment and to provide data for design engineering. Segregation will be performed using the method presented in Figure 4-1, Logic Diagram for Sorting MML Excavated Materials.

TABLE 4-2

HOT SPOT CRITERIA FOR APPLICATION
TO FUSRAP SITES

Radionuclide or Chain	Limit In pCi/g
Uranium - Natural	750
^{232}Th + All Daughters	75
^{226}Ra + All Daughters	50
Thorium-230	75

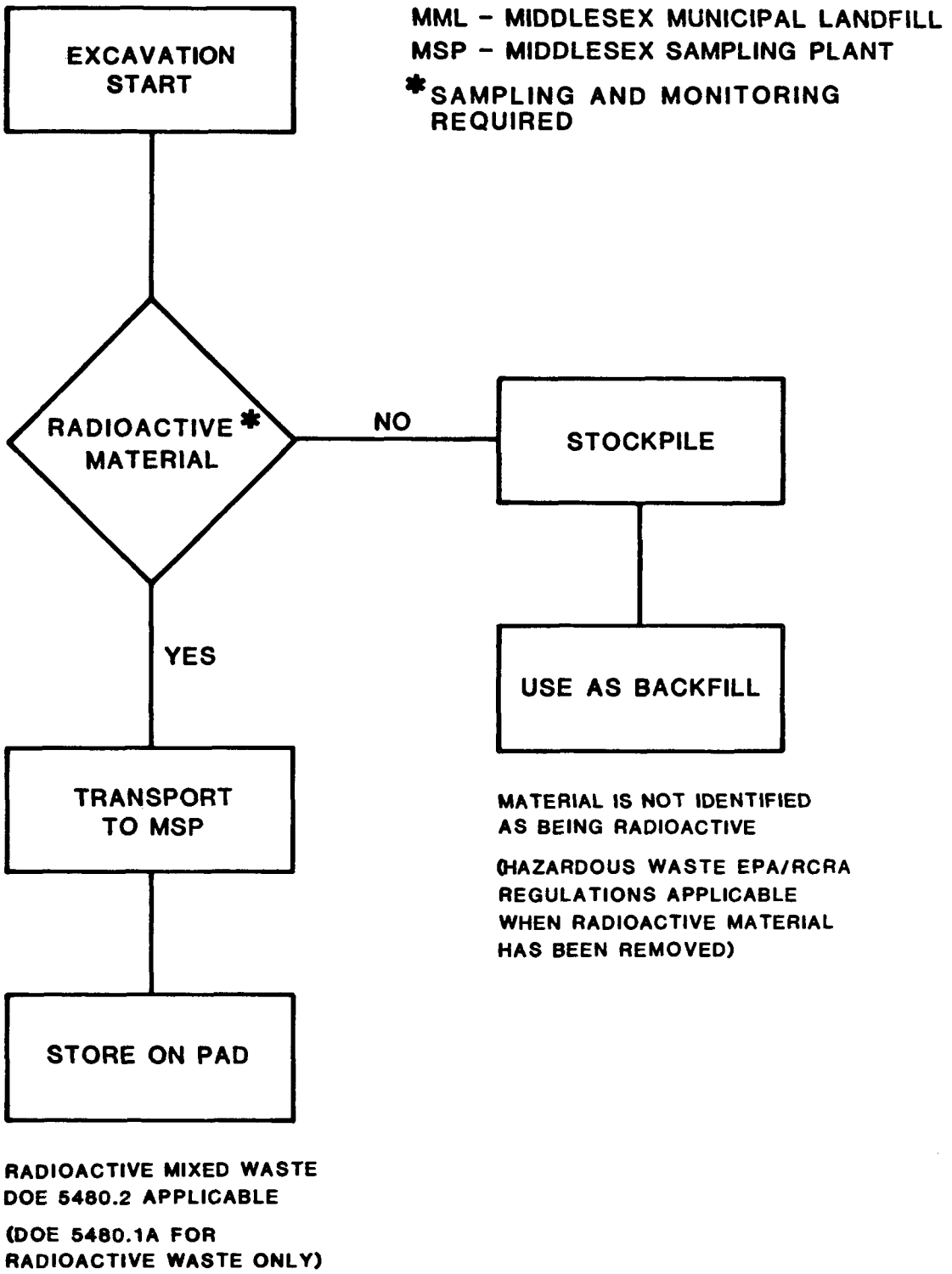

FIGURE 4-1 LOGIC DIAGRAM FOR SORTING MML EXCAVATED MATERIALS

4.3 PRELIMINARY ENGINEERING ALTERNATIVES

Four alternatives are evaluated in the Preliminary Engineering Evaluation (Reference 8). They are:

- o Alternative 1: Surveillance and Monitoring
- o Alternative 2: Minimal Action
- o Alternative 3: In-Situ Stabilization
- o Alternative 4: Decontamination and Restoration.

DOE-ORO has tentatively selected decontamination and restoration of the MML site as the preferred alternative. This alternative considers the MML site a vicinity property associated with the MSP and is consistent with the remedial action developed for the MSP -- interim storage of radioactive waste at the MSP site.

The radioactive waste at the MML site will be removed and stored at the MSP. The details of the work plan for the preferred alternative are presented in Section 4.7 of this document. The final decision regarding a selected remedial action will be based on the outcome of the NEPA process. However, for the purpose of this work plan, it is assumed that the NEPA process will support the DOE-preferred alternative.

4.4 NEPA

Preliminary engineering options will be evaluated through the NEPA process as outlined in the Council on Environmental Quality NEPA regulations and implementing DOE guidelines. The DOE, through this process, will advise the appropriate federal, state, and local agencies and the public of the results of the preliminary engineering evaluation, the environmental analysis, and the options and alternatives being considered for final site disposition.

The NEPA analysis is underway. An Action Description Memo (ADM) is scheduled to be completed by April 20, 1984.

4.5 DESIGN ENGINEERING

In October 1983, BNI started design engineering to support the NEPA activities and develop the engineering packages necessary to support the remedial action (detailed cost estimates, drawings, specifications, schedules, and requisitions) as described in Section 4.7 below.

4.6 ACCESS AGREEMENTS

DOE has access agreements with the two property owners (Borough of Middlesex and Middlesex Presbyterian Church). These access agreements will be reviewed and modified, as necessary, for the DOE remedial action alternative described herein before the start of construction activities.

4.7 REMEDIAL ACTIONS

Due to the small area of above-criteria radioactive contamination located at the MML site, the proposed remedial action is to decontaminate and restore this site as described below. The decontamination and restoration process requires working at two sites simultaneously, the MML site and the MSP site. A portion of the MSP will be used to store the waste received from the MML site. The remedial actions necessary at the MML site are:

- Site preparation
- Clearing
- Haul road and access road construction
- Surface water control
- Construction of decontamination facilities
- Excavation and segregation of wastes
- Transporting the radioactive waste to the MSP
- Backfilling and grading.

The activities at the MSP site include:

- Receiving the wastes from the MML site
- Placing and compacting the waste
- Activating the decontamination facilities
- Installing an impervious membrane to contain the waste.

Descriptions of each of the activities are included in this work plan. Figure 4-2 shows the MML work area and necessary support facilities.

Work at the MML and MSP sites will be managed as one site due to their close proximity, about 0.8 km (0.5 mi) apart. Estimates of waste quantities are defined in Section 4.10.

4.7.1 Site Preparation

Site preparation at the MML will include installation of a security fence around the contaminated area to control access during remedial action. A screen could be placed on the west side to shield the construction activities from view from the adjacent church property. The security fence (and screen, if used) will be removed after the completion of remedial action at the site. A 24-hour guard service will be considered during the construction period.

At the MML site, office trailers will be required for the major subcontractors. In addition, a radiation monitoring trailer will be used as the control point for personnel access to the site and as office space for BNI site supervisory personnel. Temporary sanitary facilities will be required for the construction workers.

4.7.2 Clearing

Approximately 2.02 ha (5 acres) of light clearing will be required. The cleared material will be chipped and spread over areas not requiring excavation.

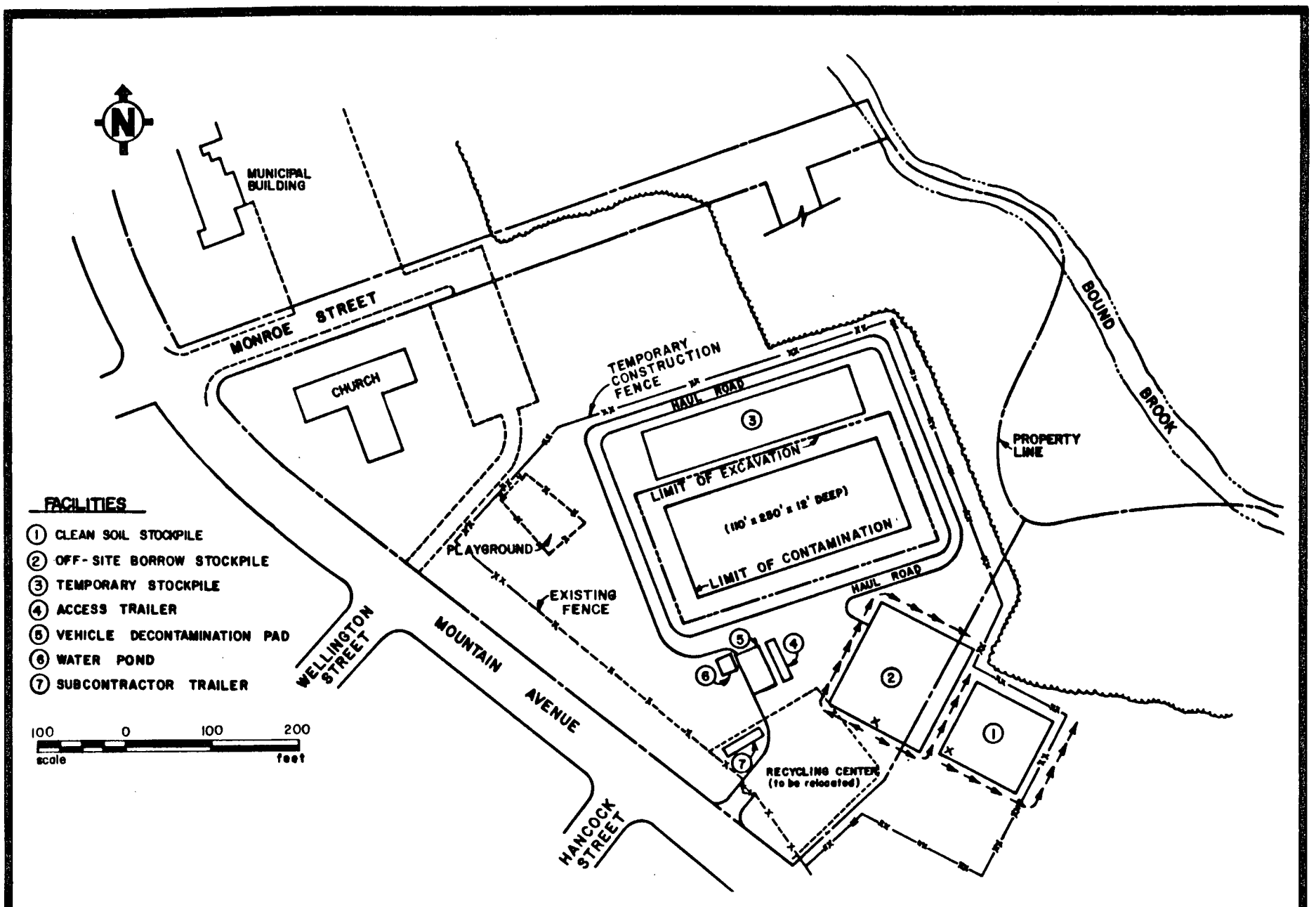

FIGURE 4-2 MML SITE CONSTRUCTION FACILITIES

4.7.3 Haul and Access Roads and Surface Water Control

New on-site haul roads and upgrading of existing on-site access roads will be required before any excavation activities commence at the MML site. Drainage ditches will be required to control rainwater runoff.

4.7.4 Vehicle Decontamination Areas

Vehicle decontamination facilities will be installed at both the MML and MSP to prevent contaminated materials from being carried offsite by construction vehicles and equipment. Each area will contain wash water and will be equipped with a sump pump. Water/steam-cleaning spray equipment will be at the MML, and firehose washdown from existing onsite decontamination facilities will be utilized at the MSP.

The most extensive decontamination will be at the MML. Decontamination will be accomplished with steam and recycled water passing through sand filters to minimize the accumulation of contaminated water. A collection tank will be constructed to temporarily store any accumulated decontamination water overflow from the decontamination facility at the MML site. Overflow water will be radiologically tested and discharged back into the excavation if it is within DOE release guidelines. If the water is found to be above radiological release guidelines, it will be tanked and transported to the MSP and used for moisture conditioning on the waste storage pile. Current plans do not include radiological or chemical water treatment. These plans are subject to review by EPA and/or State of New Jersey officials.

Water from decontamination activities at the MSP is expected to be minimal. It will be collected and used for moisture conditioning on the storage pile.

4.7.5 Excavation at the MML

The cleanup of the contaminated materials at the MML will be done using an excavation and sorting procedure. The surface projection of the contaminated area is approximately 35 m x 75 m (110 ft x 250 ft) as shown in Figure 4-2. The contamination zone extends to a depth of about 3.7 m (12 ft) below ground surface as shown in Figure 4-3.

Before any excavation begins the radioactively contaminated area will be staked and separated into five 9-m (30-ft) wide strips. Incremental cuts of 0.3 m (1-ft) and side slopes of 2 horizontal: 1 vertical will be utilized for excavation of each strip. The 0.3-m (1-ft) lifts were deemed necessary as a safety precaution, and were determined to be a depth that is reasonable to pre-screen and monitor for radioactive material prior to excavation. Each strip will be radiologically tested prior to each lift and will be classified as either radioactively contaminated waste, or radioactively clean soil. Chemical testing will also be employed to record the chemical characteristics of the radiological contaminated material transported to MSP. Augered holes will be installed in the excavation area to release any landfill gases prior to excavation, if required.

The work will be performed such that any water which may come in contact with the waste will drain back into the excavation. Water from decontamination operations will be tested and handled as discussed in Section 4.7.4.

Excavation plans have been developed so that excavation equipment (backhoe) will remain at original grade for excavating the 9-m (30-ft.) strips. The excavated strips will be backfilled immediately in a benched fashion to minimize the time period the excavated strip will be exposed. Work will proceed from the west to the east in 9-m (30-ft.) strips. The radioactively contaminated

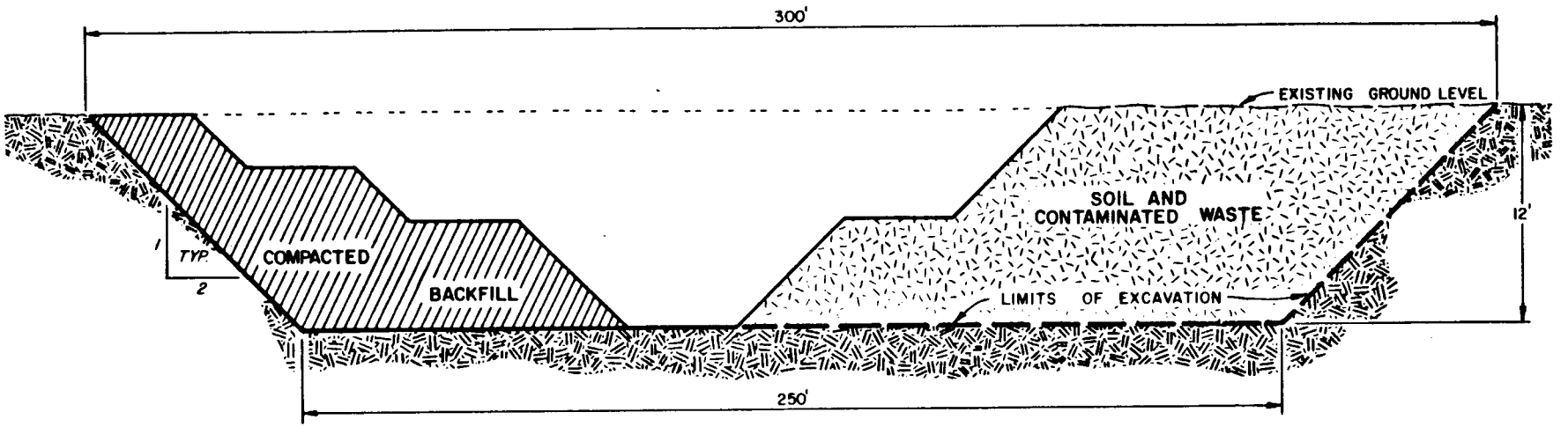

FIGURE 4-3 MML SITE EXCAVATION AND BACKFILL OPERATIONS
(NOT TO SCALE)

waste will be segregated from the backfill being placed in the excavation as shown in Figure 4-3. The excavation plans will be in accordance with DOE Order 5480.2 (Reference 9), which includes requirements of 40 CFR 260-265.

4.7.6 Transport of Radioactively Contaminated Waste

The radioactive waste will be transported to the MSP, approximately 0.8 km (0.5 mi) from the MML site for interim storage. These wastes will be placed in watertight truck beds and covered with a tarpaulin. Trucks will be limited to a total dead weight of 18 t (20 tons) (truck plus load). This is the load limit on a bridge on the planned route to the MSP.

4.7.7 Backfilling and Grading

The excavation will be backfilled as soon as operations allow. This will minimize the period during which water can enter the excavation or particulates could become airborne. Water conditioning will be employed during the backfill operation as required to control dusting and permit proper compaction.

After backfilling, the site will be graded to the original grade maintaining positive drainage and then seeded. The stockpiled radioactively uncontaminated material will be used as backfill and clean borrow material from offsite sources will be brought in as required. This remedial action would end with site ownership being retained by the current owners.

4.7.8 Storing the Waste at MSP Site

The wastes from the MML site will be stored at the MSP site. An existing asphalt pad will be utilized for this storage. A liner that is impervious to water leakage and compatible with co-contaminated chemicals will be constructed to contain the

wastes. This liner will be material such as EPDM or Hypalon. An initial 15-cm (6-in) layer of sand above and below the bottom liner will be provided as a base for the waste pile to prevent sharp or protruding objects from puncturing the bottom of the liner. As wastes are received, they will be placed on the pad and compacted. Trucks will be ramped to the stockpile to eliminate contaminating them during unloading. However they will be radiologically surveyed and decontaminated if necessary before leaving the site. During placement of the wastes at the MSP site, a temporary cover will be placed over the stockpile when rain is forecast and on weekends to eliminate runoff of co-contaminated water. At completion of the work, the wastes will be covered and sealed with an EPDM or Hypalon cover which is impervious to water infiltration.

4.7.9 Safety Plan for Workers and the Environment

Based on analytical results of the 6 composite soil samples taken from the excavation site (see Section 2.4), there is concern that excavation could take place in areas of mixed hazardous and radioactive waste. The concentrations of arsenic, PCB, and lead in addition to combustible gases are of major concern. Excavation precautions to minimize airborne migration will be necessary. The excavation process will be completed with due regard for safety of the workers, nearby residents, and the environment.

The chemical characterization of the hazardous wastes involved establishing baseline data from selected soil boring locations within the defined excavation area. This characterization provided information regarding the presence of hazardous wastes and appropriate safety procedures will be implemented in accordance with the Site Health and Safety Plan.

Following the requirements of DOE Order 5480.2, the following safety guidelines for workers and associated equipment may be necessary:

- Baseline medical examinations
- Medical surveillance program

- Termination physical examination
- Personnel hygiene program including shower facilities, work clothes washing and cleaning, record keeping, etc.
- Radiological personnel monitoring equipment
- Use of respiratory protection devices
- Air monitoring near personnel and equipment moving contaminated material, and of the environs
- Fire protection equipment
- Combustible gas monitoring program
- Monitoring of haul trucks prior to their entry onto public streets.

Soil samples will be tested for hazardous chemical content from approximately every 300 cubic yards of contaminated soil transported to the MSP. Results of these tests will be used to ensure that the hazardous and radioactive mixed waste is stored in accordance with applicable EPA standards. They will also be used to establish final disposal requirements for the mixed waste.

The above safety requirements will result in an extended schedule for the remedial action (see Section 5.1) but should not cause any delays in the construction activities planned for DOE Fiscal Year 1984.

4.8 OCCUPATIONAL EXPOSURE

The Preliminary Engineering Evaluation (Reference 8) summarizes the occupational exposures of the various alternatives from a radiological standpoint. It is concluded that the radiological risks from occupational exposure are insignificant for each of the alternatives. It was also concluded that the hazardous wastes that are present represent a greater occupational and environmental hazard than the radioactive waste. The safety plan for protecting workers from hazardous wastes is discussed in Section 4.7.9.

4.9 VERIFICATION SAMPLING AND ANALYSIS

Radiological measurements are required to implement the removal of contamination above remedial action criteria and to certify that the remedial action is complete.

4.9.1 Excavation Monitoring and Control

Excavation will proceed downward and laterally until the applicable soil decontamination criterion are met, as determined by the following field measurements. If the extent of contamination, as determined in the field, differs significantly* from the extent shown in the remedial action access agreements with the property owners, DOE will advise the owner, and excavation will proceed only after a suitable agreement has been reached.

Primary Excavation Control

Excavation will proceed downward in each affected area by removal of soil to the contour indicated by the preliminary soil coring and logging data. As material is removed to the specified depths, primary "real time" excavation control will be provided by near-surface gamma measurements taken with a directionalized (downward looking) scintillation probe with 2" x 2" sodium iodide (NaI) crystal mounted 30 cm (12 in) above the ground and connected to a single channel analyzer. An iterative application of soil removal and near-surface gamma measurements will continue until the measurements indicate a level equal to or less than the applicable criterion in the soil has been reached.

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*A "significant" variation is defined as one which affects structures, other improvements, or actions not included in the original property owner/DOE Memo Agreement.

Supplementary Soil Sampling Analysis

Soil samples will occasionally be collected from the excavated area and evaluated in the field laboratory using a rapid scan counting technique on the 4" x 4" NaI detector. These measurements will be used as a continuing calibration check on the primary excavation control instrument.

"Hot Spot" Detection and Monitoring

In conjunction with the near-surface measurements, a surface gamma scan will continuously follow and guide the excavation for removal of small areas exceeding the hot spot criterion. This scan will be conducted with an unshielded 2" x 2" sodium iodide crystal connected to a pulse rate meter with aural monitoring capability. The following procedure will be used for hot spot monitoring.

a. Background for the area will be obtained by taking several (at least 5) readings at random locations in the area of construction and arithematically averaging these 5 readings.

b. Using a count rate meter with a 2" x 2" unshielded NaI crystal probe the general area of the hot spot will be scanned by swinging the probe back and forth over the ground just a few inches above the ground and listening for count rate increases.

c. The area found to exceed the count rate corresponding to the hot spot criteria will be marked by stakes or spray paint directly on the ground.

d. Each area so marked will be measured by the cone shielded 2" x 2" NaI crystal detector attached to a ratemeter/scaler to estimate the pCi/g concentration of radionuclide(s) in the marked area.

e. A soil sample of the top 15 cm. of soil in the marked area will be taken and evaluated in the laboratory on a quick turnaround basis (10 min. count time).

f. All results will be evaluated to determine if additional remedial action is warranted based on application of hot spot criteria.

g. Guidance will be provided for soil removal in areas where soil removal has been decided upon.

h. In those areas where additional soil is removed the area will be rescanned to confirm that the hot spots have been removed and the level remaining will be documented.

i. After the above procedure has been completed, the certification and documentation measurements will be made and the certification soil samples collected.

4.9.2 Post Decontamination Survey

When the criteria have been reached, as determined by measurements by the primary excavation control instrument and field soil sample analysis, the radiological status of the cleaned area must be documented prior to backfilling. The post decontamination survey will consist of ground level beta-gamma measurements, near-surface gamma ray measurements, and systematic soil sampling. Soil samples will be evaluated in the field laboratory using a rapid scan technique. Aliquots of soil samples will also be sent to the Radiological Support Subcontractor laboratory for a standard isotopic radiological analysis.

4.9.3 Certification Report

During the cleanup operations, Bechtel will collect and document data from analyses of soil samples and in situ radiological measurements to determine the adequacy of the remedial action.

Results of measurements and sample analyses documenting the final radiological condition will be presented in a final report for each designated site.

4.10 WASTE VOLUME PROJECTIONS

Based on existing FUSRAP criteria, the quantity of landfill waste that is expected to be radioactively contaminated is estimated as 3100-4600 m^3 (4,000-6,000 yd^3). This is approximately one-third to one-half of the total volume of material excavated, the remainder will be returned to the landfill as backfill.

4.11 QUALITY ASSURANCE

The provisions of the DOE FUSRAP Plan for Quality Assurance comply with DOE Order 5700.6 (Reference 10), and apply to BNI as PMC, to subcontractors, architect-engineers, construction and service subcontractors, and other subcontractors as may be identified.

Quality assurance requirements apply to all work being performed on the MML site and at the MSP. BNI will carry out the Project Quality Assurance Program in accordance with the above parameters. Effectiveness of implementation will be appraised by the BNI's quality assurance organization, and by DOE-ORO as it deems appropriate.

5.0 SCHEDULE AND COST

5.1 SCHEDULE

Figure 5-1 illustrates the preliminary schedule prepared by BNI for the actions required to implement the DOE-preferred option, decontamination and restoration. This schedule assumes that the excavation will be performed in a carefully controlled manner utilizing proper safety precautions for radioactive and other wastes. Excavation is estimated to require at least one month due to the required strip excavation plan.

5.2 COST

The cost for the decontamination and restoration of the MML site as described and scheduled in this work plan is estimated to be approximately $2,134,000 for FY 1984 and 1985 or $2,868,000, including prior years' costs.

The cost includes construction activities with the major cost items being mobilization and site preparation, excavation, storage of waste, transport and stockpiling of the radioactive waste at the MSP site, and site closure. A 30 percent contingency has been included in the 1984 and 1985 costs. The cost excludes the ultimate disposal of the radioactive material.

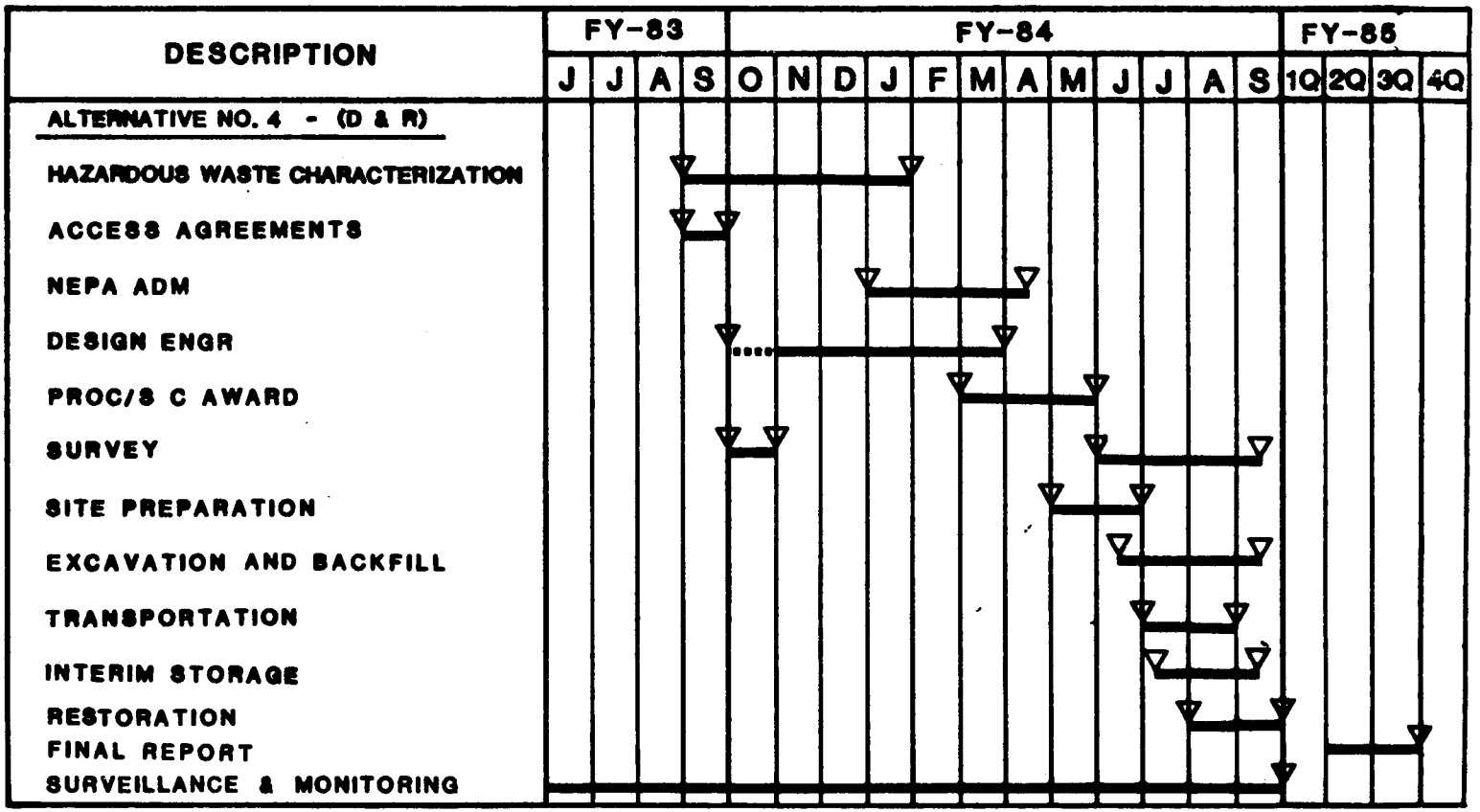

FIGURE 5-1 REMEDIAL ACTION SCHEDULE, DECONTAMINATION AND RESTORATION AT THE MML SITE

REFERENCES

1. U.S. Department of Energy. Description of the Formerly Utilized Sites Remedial Action Program, ORO-777, Oak Ridge, TN, 1980 (as modified by DOE, October 1983).

2. Oak Ridge National Laboratory. Radiological Survey of the Middlesex Municipal Landfill Site, Middlesex, New Jersey, DOE/EV-005/20, Oak Ridge, TN, 1980.

3. U.S. Atomic Energy Commission. U.S. Atomic Energy Commission Radiation Survey Report of the Middlesex Landfill Site, March 25-April 4, 1974, Germantown, Maryland, 1974.

4. U.S. Department of Energy. Interim Residual Contamination and Waste Control Guidelines for Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites, March 1984.

5. Bechtel National Inc. Geologic Report, Middlesex Municipal Landfill Site, San Francisco, CA, March 1984.

6. Princeton Testing Laboratory. Report of Analysis; Middlesex Municipal Landfill Composite Soil Samples, Feb. 13, 1984.

7. U.S. Department of Energy. Design Criteria for FUSRAP and SFMP Project, 14501-00-DC-01, Oak Ridge, TN, March 1984.

8. Bechtel National, Inc. Preliminary Engineering Evaluation of Remedial Action Alternatives For Middlesex Municipal Landfill Site, April 1984.

9. U.S. Department of Energy. Order 5480.2, Hazardous and Radioactive Mixed Waste Management, December 13, 1982.

10. U.S. Department of Energy. Order 5700.6, Quality Assurance -- ORO Site Implementation Plan, March 3, 1982.