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DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
BASE REALIGNMENT AND CLOSURE PROGRAM

Decision Document (DD) for Interim Source Control Action for Landfills 6 and 7 at Fort Sheridan, Illinois

Prepared for:
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In accordance with Army Regulation 200-2, this document is intended by the Army to comply with the National Environmental Policy Act of 1969.

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List of Acronyms and Abbreviations

ARARs	Applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	Centimeters per second
cy	Cubic yard
DD	Decision Document
DoD	Department of Defense
ESE	Environmental Science & Engineering, Inc.
FFS	Focused Feasibility Study
GCL	Geosynthetic clay liner
IAC	Illinois Administrative Code
IDNS	Illinois Department of Nuclear Safety
IEPA	Illinois Environmental Protection Agency
K	Hydraulic Conductivity
LFG	Landfill Gas
mg/l	Milligrams per liter
MSW	Municipal Solid Waste
MSWLF	Municipal Solid Waste Landfill
MTV	Mobility, toxicity, and volume
NCP	National Contingency Plan
NGVD	National Geodetic Vertical Datum of 1929
NPDES	National Pollutant Discharge Elimination System
NSSD	North Shore Sanitary District
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
POL	Petroleum, oil, and lubricants
PW	Present Worth
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USATHAMA	U.S. Army Toxic and Hazardous Materials (now the Army Environmental Center)
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
$\mu g/m^3$	micrograms per cubic meter

DECLARATION

Interim Remedial Alternative for Landfills 6 and 7 at Fort Sheridan, Illinois
Department of Defense Operable Unit

Site Name and Location

This Decision Document (DD) has been prepared for interim action at Landfills 6 and 7 located within the Department of Defense (DoD) Operable Unit (OU) at Fort Sheridan, Illinois. Landfills 6 and 7 are located in the southern portion of Fort Sheridan. Landfill 6 is an approximately 3.3-acre area located west of Patten Road and between 9th and 10th Streets. Landfill 7, known during operation and by regulatory permit as Wells Ravine Sanitary Landfill, is an approximately 7.7-acre area located east of Patten Road, opposite Landfill 6 and between Chatfield Court and Gordon Johnston Drive, and extending to the Lake Michigan shoreline. Vicinity and site maps are provided in the Decision Summary section of this Decision Document.

Statement of Basis and Purpose

This DD presents the selected interim remedial action for Landfills 6 and 7 that was chosen in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). This DD explains the factual and legal basis for selecting the response action for Landfills 6 and 7. The information supporting this interim remedial action decision is contained in the Administrative Record (AR) for the site. The Administrative Record (AR) Index is in Appendix A.

This DD has been prepared in accordance with CERCLA, with U.S. Environmental Protection Agency (USEPA) guidance contained in the AR Index (Appendix A), and with Federal and State applicable or relevant and appropriate requirements (ARARs). The interim remedy was selected by the U.S. Army. The Illinois Environmental Protection Agency (IEPA), the U.S. Environmental Protection Agency (USEPA), and the Department of the Navy concur with the selected interim remedy.

This interim remedial action addresses the source (wastes). The DoD RI/FS and Record of Decision will address remaining concerns associated with Landfills 6 and 7 (e.g., groundwater).

Current Environmental Site Conditions

Landfills 6 and 7 were created by the filling of a natural ravine during the period from approximately the late 1940s to 1979. Based on information from investigations, monitoring, and IEPA inspection reports, Landfill 7 is not in compliance with the closure conditions of the sanitary

landfill permit issued by IEPA in 1979. Landfill 6, which was never issued a permit, is also out of compliance with current state landfill regulations.

A storm drain pipe conveying runoff from a 130-acre watershed to Lake Michigan is located beneath the wastes in both landfills. Exceedance of general use water quality standards have been identified both at the inlet (upstream of the landfills) and at the outlet (downstream) of this segment of the storm water drainage system. Leachate is known to be infiltrating into this stormwater drainage system. Leachate seeps to the ground surface and to Lake Michigan have been observed prior to and following the Army's closure of Landfill 7 that was completed in 1982. The existence of a mound of leachate within Landfill 7 has been documented. A leachate collection trench installed at the east end of Landfill 7 in 1982 was not designed or constructed such that it actually collected any leachate and is inoperable. Landfill gas emissions from Landfill 7 have been determined by separate Army and USEPA risk evaluations to present a potential risk to the military residents living in proximity to Landfill 7 that is in the risk management range (greater than $1x10^{-6}$, but less than $1x10^{-4}$; i.e., between one excess cancer risk in 1,000,000 and one in 10,000).

The landfills suffer from multiple problems including excessive leachate generation resulting from poor cap design and construction; leachate discharges due to seeps and infiltration to a storm drain underlying the waste; fissures in the caps resulting from poor cap design, construction, waste settlement and/or landfill gas conditions; landfill gas emissions; and inadequate maintenance. These problems create potential unacceptable risks. The human health risk assessments for Landfill 7 conducted to date, although finding risks within the risk management range, were based on limited data and all potential exposure pathways were not evaluated. Leachate continues to be generated by the landfill and continued degradation of the landfill cover and/or underlying storm drain pose a potential unacceptable risk to the environment by release of leachate.

Actual or threatened releases of hazardous substances from Landfills 6 and 7, if not addressed by implementing the interim response action selected in this DD, may present an imminent and substantial endangerment to public health, welfare or to the environment.

Description of the Selected Interim Remedy

Fort Sheridan has been divided into two separate OUs. The OUs are the Surplus OU and the DoD OU. This DD addresses the interim remedy for Landfills 6 and 7, which are located within the DoD OU. The interim remedial action determined to be necessary at Landfills 6 and 7 consists of:

- Relocation of residents from 68 military residential units bordering Landfill 7; at the end of implementation of this interim remedial action (approximately 5 years), the units will be placed back into use for military personnel;

- Temporary monitoring of the storm sewer outfall consisting of sampling the influent and effluent of the storm drain segment underlying both landfills.
- Installation of a new storm drain system to convey storm water runoff around the landfills;
- Installation of leachate collection and treatment controls to prevent discharge of leachate to shallow groundwater, the ground surface, and Lake Michigan;
- Construction of initial temporary cover improvements on both landfills, consisting of applying fill soil, grading to promote surface water runoff, and reestablishment of a grass cover;
- Completion of a stabilization period, expected to be 3 to 4 years, during which time accumulated leachate will be removed from the landfills resulting in settlement of the landfill cover surfaces;
- Construction of a Resource Conservation and Recovery Act (RCRA) Subtitle C -type landfill cap on both landfills upon substantial completion of leachate extraction and landfill settlement;
- Installation of an active landfill gas collection system and enclosed flare treatment system;
- Long-term operation and maintenance of the leachate and landfill gas collection and treatment systems and maintenance of the landfill covers;
- Implementation of land use controls at Landfills 6 and 7, allowing open space use of the landfill surfaces while preventing potential adverse/damaging activities and allowing unrestricted limited use of the adjacent areas; and
- Continuation of air and groundwater monitoring.

Elements of the selected alternative, including the RCRA and RCRA equivalent cap, will comply with the relevant and appropriate requirements of State of Illinois municipal solid waste landfill regulations Illinois Administrative Code (IAC) [35 IAC 811]. As part of the selected interim remedy, or as a part of the final remedy, the relevant and appropriate requirements of 35 IAC 811 will be attained.

The land use controls to be implemented at Landfills 6 and 7 include restriction of activities that would result in excavation of, or penetration below, the surface of the landfill caps or result in damage to the vegetative cover established on the caps. Because hazardous substances may remain at the site at levels that do not permit unrestricted use, a review will be conducted at a minium of every five years after the commencement of the interim action to ensure that the remedy continues to provide adequate protection of human health and the environment. The public will be kept informed of the status of the remedial action and of results of the site reviews through fact sheets and/or public meetings.

The selected interim remedy provides source controls. Installation of a new storm drain around the landfills and a leachate collection and treatment system will prevent further leachate releases.

Installation of an active landfill gas collection and treatment system and a final landfill cap on each landfill will minimize future leachate generation from percolation through landfill surfaces and release of landfill gas through the landfill surfaces. The interim remedy is expected to be consistent with the final remedy which may, if necessary, include remediation of areas beyond the landfill boundaries (e.g., groundwater remediation) or other controls. The interim remedy controls will not inhibit implementation of expected final remedy elements.

This interim remedy does not address exposure pathways outside the source area (landfills), nor does it include long-term groundwater response action. Additional RI/FS activities, including a risk assessment, will be performed to address these exposure pathways outside the source areas. These RI/FS activities will be conducted concurrently with implementation of this interim response action.

Declaration

This interim remedial action is protective of human health and the environment, complies with the Federal and State of Illinois applicable or relevant and appropriate requirements directly associated with this action, and is cost-effective. This action utilizes permanent solutions and alternative treatment (or resource recovery) technologies for the site's identified environmental problems to the maximum extent practicable, given the limited scope of the action. Because this action does not constitute the final remedy for Landfills 6 and 7, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will not be satisfied by this interim remedial action. Subsequent actions will fully address any principal threats posed by this site, as necessary.

Lead and Support Agency Acceptance of Interim Action Decision Document
Fort Sheridan
Landfills 6 and 7

Signature sheet for the Decision Document for the Landfills 6 and 7 Interim Remedial Action at Fort Sheridan by the U.S. Army, with concurrence by the State of Illinois Environmental Protection Agency and by the U.S. Environmental Protection Agency.

COL James Dries — Date
Director of Environmental Programs
Office of the Assistant Chief of Staff for Installation Management
Department of the Army

Lead and Support Agency Acceptance of Interim Action Decision Document
Fort Sheridan
Landfills 6 and 7

Signature sheet for the Decision Document for the Landfills 6 and 7 Interim Remedial Action at Fort Sheridan by the U.S. Army, with concurrence by the State of Illinois Environmental Protection Agency and by the U.S. Environmental Protection Agency.

HAROLD K. MILLER, JR — Date
Colonel, U.S. Army
Commanding Officer, Fort McCoy

Lead and Support Agency Acceptance of Interim Action Decision Document
Fort Sheridan
Landfills 6 and 7

Signature sheet for the Decision Document for the Landfills 6 and 7 Interim Remedial Action at Fort Sheridan by the U.S. Army, with concurrence by the State of Illinois Environmental Protection Agency and by the U.S. Environmental Protection Agency.

Mary A. Gade Date
Director
Illinois Environmental Protection Agency

Lead and Support Agency Acceptance of Interim Action Decision Document
Fort Sheridan
Landfills 6 and 7

Signature sheet for the Decision Document for the Landfills 6 and 7 Interim Remedial Action at Fort Sheridan by the U.S. Army, with concurrence by the State of Illinois Environmental Protection Agency and by the U.S. Environmental Protection Agency.

William E. Muno — Date
Director of Superfund Division
U.S. Environmental Protection Agency, Region V

Concurring Party Acceptance of the Interim Action Decision Document
Fort Sheridan
Landfills 6 and 7

The US Navy concurs with the foregoing Decision Document.

UNITED STATES OF AMERICA,
DEPARTMENT OF THE NAVY

by: _____

KEVIN P. GREEN — Date
RADM, USN
Commander
Naval Training Center
Great Lakes

DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Fort Sheridan is a 712-acre installation located along Lake Michigan in Lake County, Illinois (Figure 1-1). Fort Sheridan was an active Army base continuously from 1887 until closure in 1993. In 1988, Fort Sheridan was recommended to the Secretary of Defense for closure by the Commission on Base Realignment and Closure (BRAC). At the time of closure in May 1993, the western half of Landfill 6 was realigned, along with approximately 100 acres, to the U.S. Army Reserve. The U.S. Navy purchased approximately 200 acres from the Army, including Landfill 7 and the eastern half of Landfill 6. The purchase agreement between the Navy and the Army sets forth responsibilities for the environmental cleanup of Landfills 6 and 7, which, beyond $1 million at Landfill 7, rests entirely with the Army.

Landfills 6 and 7 are located in the southern portion of Fort Sheridan (Figure 1-2). Landfill 7 was operational from the late 1940s until 1979. Landfill 6 was operational for a few years in the 1960s. Landfill 7 served as the primary landfill at Fort Sheridan and encompasses approximately 7.7 acres while Landfill 6 encompasses approximately 3.3 acres. Landfills 6 and 7 were created by filling of a natural ravine that extended a distance of approximately 2200 feet from the Lake Michigan shoreline to near the west boundary of Fort Sheridan, which borders the city of Highwood. Landfill 7 was also known as Wells Ravine Sanitary Landfill during its operation. It was also identified as such in a permit issued by the IEPA.

It is estimated that Landfills 6 and 7 together contain between 380,000 and 460,000 cubic yards (cy) of wastes and affected native soils. These volume estimates are based on an average impacted soil depth of 10 ft beneath the waste. Landfill 7 contains a minimum of approximately 170,000 cy of waste. Landfill 6 contains a minimum of approximately 50,000 cy of waste. Prior to placing wastes into Wells Ravine, a storm drain pipe was installed along the bottom of the ravine. The drainage area served by this drain pipe is approximately 130 acres, including areas both on Fort Sheridan and in Highwood.

On the basis of available information, Landfill 7 is appropriately described as a municipal co-disposal landfill. In addressing remediation of municipal landfills, USEPA has defined a municipal co-disposal landfill as a landfill that receives both municipal waste and to a lesser extent hazardous waste (USEPA 1991). USEPA (1991) indicates that municipal landfills typically accepted both liquid and solid hazardous waste prior to implementation of RCRA in November 1980. During the period of operation of Landfills 6 and 7, Fort Sheridan included housing, administrative, medical, training and industrial activities such as repair shops for vehicles and other machinery. Available information suggests that wastes placed in Landfill 7 are similar to wastes found in many municipal solid waste (MSW) landfills. Landfill 6 is believed to contain a higher percentage of construction debris, but also reportedly contains domestic and industrial waste (U.S. Army, May 1982).

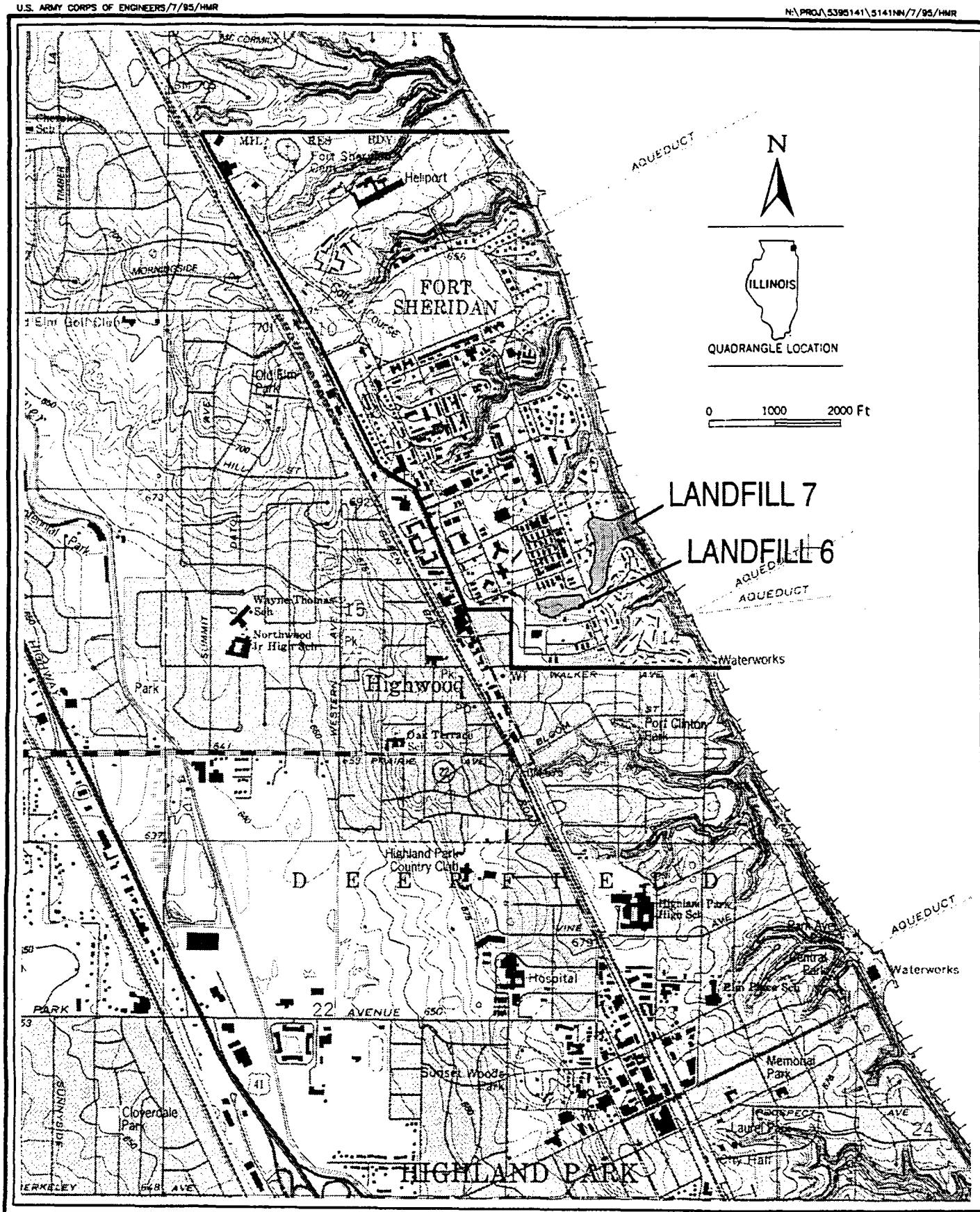

Figure 1–1
FORT SHERIDAN
LANDFILLS 6 AND 7 INTERIM ACTION DECISION DOCUMENT
VICINITY MAP

SOURCE: USGS, 1993

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LOUISVILLE DISTRICT

ENVIRONMENTAL SCIENCE
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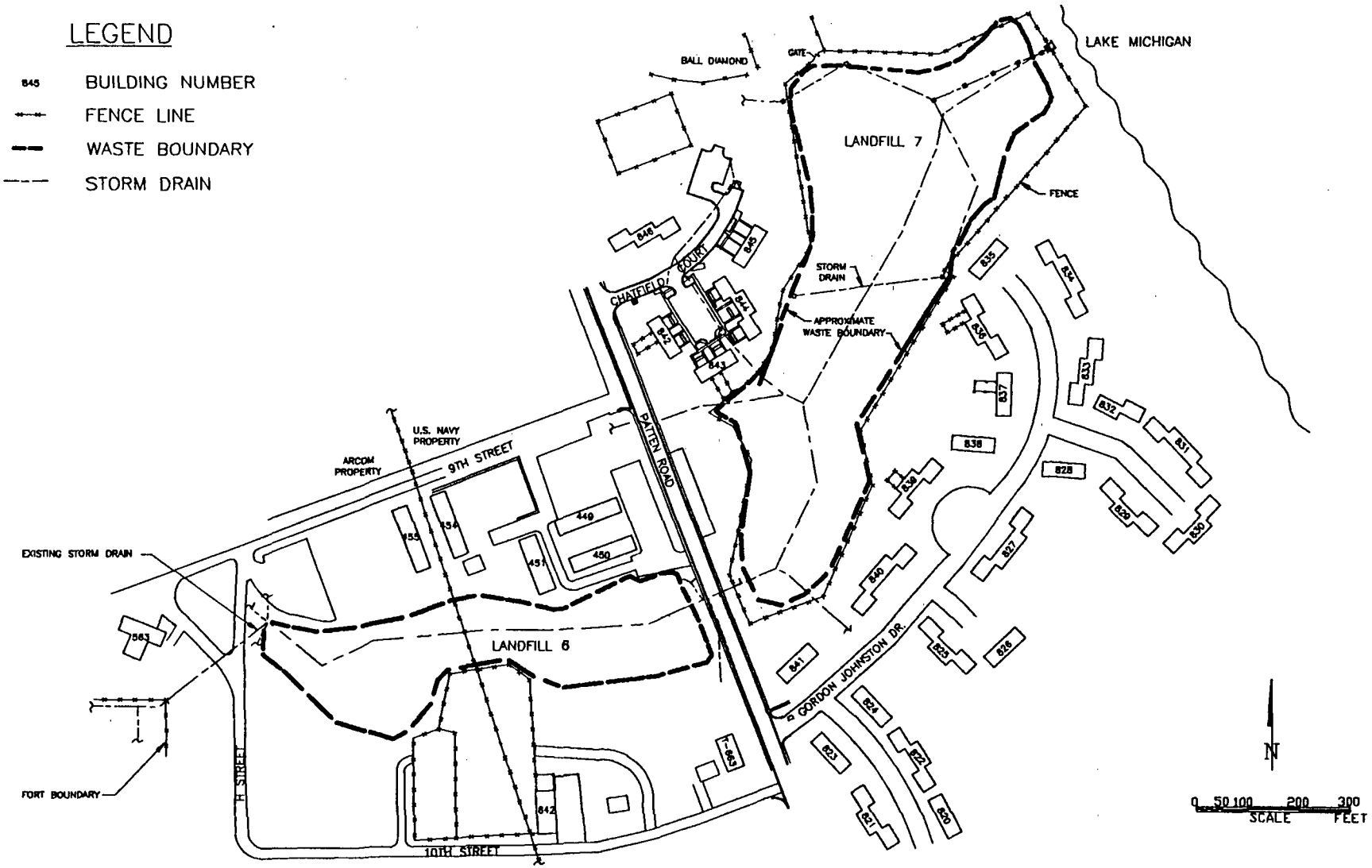

Figure 1-2
FORT SHERIDAN
LANDFILLS 6 AND 7 INTERIM ACTION DECISION DOCUMENT
GENERAL SITE PLAN

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1.1 Topography

The topography of Fort Sheridan is dominated by the steep Lake Michigan bluff and a series of ravines that cross the Fort and terminate at the Lake Michigan shoreline. The upland areas are relatively flat, sloping gently towards the east and Lake Michigan, and range in elevation from approximately 650 to 670 ft NGVD. The average Lake Michigan water level is approximately 581 ft NGVD, or 70 to 90 ft below the upland areas. The natural ravines and the east-facing lake bluffs have steep side slopes ranging from approximately 1.5 horizontal to 1 vertical (67 percent) to 2.5 horizontal to 1 vertical (40 percent).

Landfill 7 ceased receiving waste in 1979 and placement of a 2-ft thick soil cover was completed in 1982. As a result of waste placement and/or the 1982 closure work, the high point of Landfill 7 is approximately elevation 663 ft, or approximately 7 to 8 ft above the adjacent natural ground elevation. A low area exists on the cover and provides a collection area for surface water runoff to enter storm drain inlets leading to the storm drain underlying the waste.

Landfill 6 has a soil cover also, but the landfill remains a low area, receiving runoff from the surrounding area. The waste boundary at Landfill 6 is not visually apparent due to the cover blending into the surrounding ground elevations.

1.2 Geology/Hydrology

The geology of the Fort Sheridan area, which is typical of Lake County, Illinois, is characterized as unconsolidated deposits consisting primarily of fine-grained glacial till. The Wadsworth Till Member of the Wedron Formation is the principal surface unit. It is generally 200 ft thick, but ranges from a few feet to more than 250 ft. It ranges in textural composition from clay to clayey silt or slightly sandy clayey silt. The unit has isolated pockets and lenses of sand, gravel, or silt. It is generally pebbly and contains a few boulders. A generalized cross section of the geology in the vicinity of Fort Sheridan, taken from Larson (1973), is presented in Figure 1-3.

The literature indicates that most clayey portions of the Wadsworth Till occur on the eastern side of Lake County. The Lake Border Morainic System consists of five long, narrow, closely spaced moraines trending north and south, paralleling the shoreline of Lake Michigan.

The clayey Wadsworth Till is divided into two phases, a silty clay phase and a clayey phase. The silty clayey phase is mapped by Larson (1973) in the area of Fort Sheridan.

Information collected during the Phase I RI (ESE, 1992) and other investigations in the vicinity of Wells Ravine corroborate the descriptions of the Wadsworth Till in the regional literature (Larson, 1973). The unconsolidated material in the area of Wells Ravine is predominantly a massive clay-rich

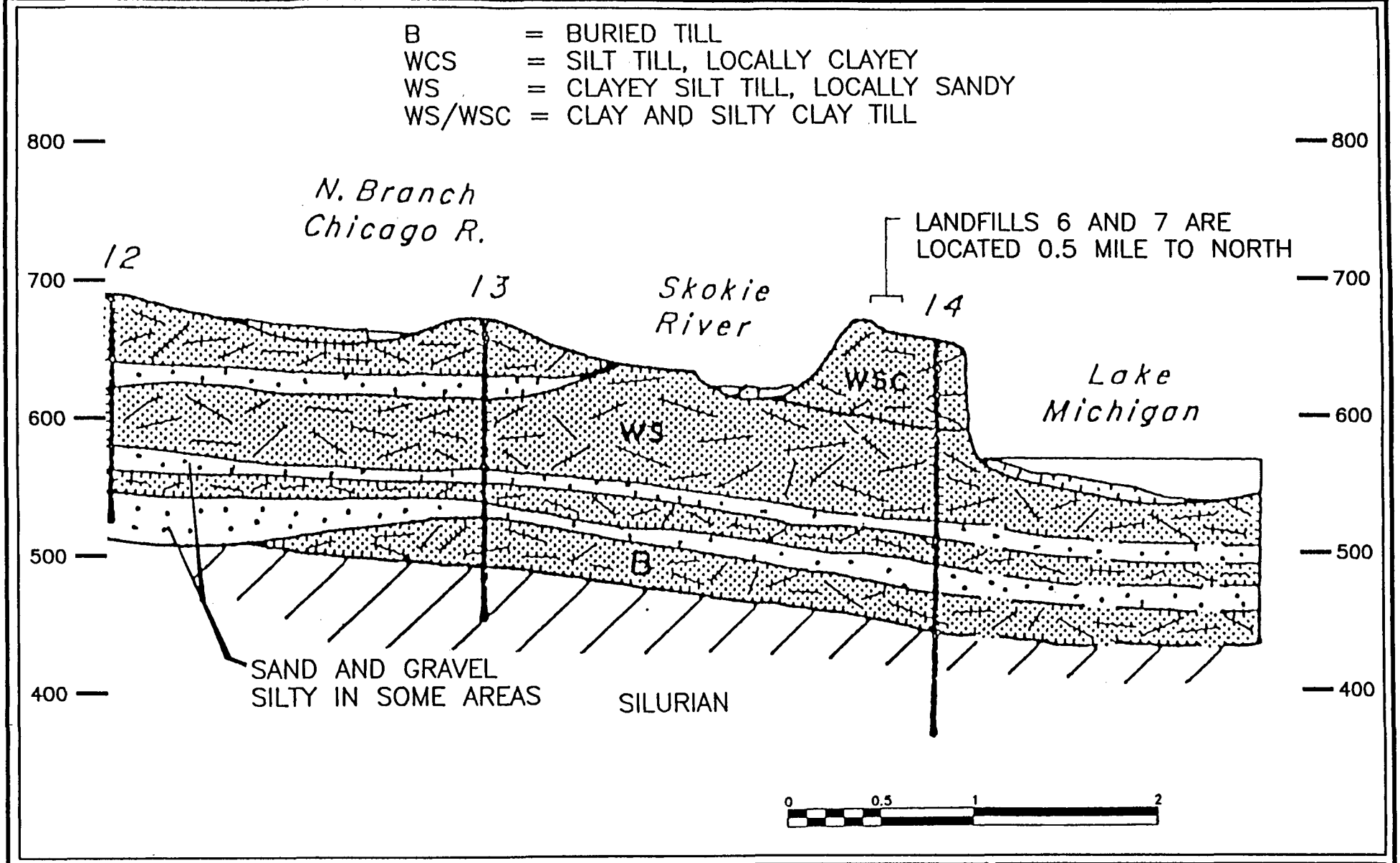

Figure 1-3
FORT SHERIDAN
LANDFILLS 6 AND 7 INTERIM ACTION DECISION DOCUMENT
EAST-WEST GEOLOGIC CROSS SECTION-NEAR FORT SHERIDAN

SOURCE: LARSON, 1973

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till punctuated by relatively thin, discontinuous sand and gravel intervals. Additional investigations are being completed as part of the DoD RI/FS.

The sand and gravel intervals observed in some of the soil borings drilled around Landfills 6 and 7 are relict beach and stream deposits that, for the most part, have been truncated into very localized lenses. As the lenticular nature of these deposits implies, they are not laterally extensive and are completely encased by the clay in which they are found.

Soil borings surrounding Wells Ravine confirm that the till extends at least 50 ft below the former base of the ravine. The regional literature indicates that the till may extend as much as another 100 ft below the deepest soil boring in this area. The till unit is immediately underlain by the Niagrian Dolomite of Silurian Age. The bedrock is nearly horizontal to gently eastward dipping.

Shallow groundwater at Fort Sheridan exists typically within approximately 15 ft of the land surface. The regional groundwater flow direction is towards Lake Michigan. Due to the till soils that are present within approximately 200 ft of the land surface, groundwater flow rates are relatively slow. Steep gradients in the shallow groundwater phreatic surface occur coincident with the Lake Michigan bluff and along the ravines where the eroded ravine intersects the phreatic surface, resulting in groundwater discharge to the ravine. Vertical groundwater gradients exist at Fort Sheridan. In the vicinity of the Lake Michigan shoreline, artesian conditions (upward gradient) exist as documented by the existence of flowing wells. Moving away from the shoreline, the upward vertical gradient diminishes and changes to a more typical slight downward vertical gradient.

Wells Ravine was created by natural erosion by surface water runoff. The existing drainage area is approximately 130 acres and appears to have not been significantly altered by past development. Surface runoff potential is relatively high due to the existence of the natural clayey soils with low infiltration rates and because of the development which exists throughout the drainage area. During filling of Landfills 6 and 7, a 42-inch diameter concrete drain pipe was installed along the bottom of Wells Ravine to carry the surface water runoff under the wastes. Several deep concrete manholes are located along the drain within Landfill 7.

1.3 Geography

Fort Sheridan consists of approximately 712 acres situated within an approximately rectangular area with 8,000 ft of Lake Michigan frontage. The Fort is bordered on the south by the City of Highland Park, on the west by the City of Highwood, and on the north by the City of Lake Forest. The land use immediately surrounding Fort Sheridan is primarily residential with commercial areas associated with the City of Highwood. Landfills 6 and 7 are located approximately 1,000 ft from the south boundary of Fort Sheridan and the west end of Landfill 6 is located approximately 200 ft from a Fort boundary adjacent to Clay and Lakeview Avenues in the City of Highwood.

Within Fort Sheridan, Landfill 7 is located within a residential area. Multi-unit military housing for non-commissioned officers or higher-grade enlisted personnel and their families is located along the north and south boundaries of Landfill 7. Landfill 7 is also bordered by a baseball field and the site of the former Fort Sheridan wastewater treatment plant, which was demolished in approximately 1979. Patten Road, the main north-south base road, borders the west end of Landfill 7 and the east end of Landfill 6. Landfill 6 is immediately bordered on the north by now vacant barracks scheduled for demolition and on the south by open space and a former vehicle maintenance area.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Landfills 6 and 7 were both created by filling Wells Ravine, a natural ravine. Landfilling activities appear to have begun at the east end of Wells Ravine in the late 1940's and progressed westerly, "up" the ravine. Landfill 7, also known as Wells Ravine Sanitary Landfill, was identified as requiring an IEPA landfill permit in the late 1970's. Filling ceased in July 1979 and an operating permit was issued in June 1980. Engineering plans for the closure were submitted to IEPA in 1980 and closure construction was completed in 1980 through 1982. Groundwater and surface water monitoring requirements were established by IEPA under the operating permit. There is no record of an application for a closure permit being submitted to IEPA, other than the submittal of the closure design plans prior to construction. Illinois first promulgated regulations for land disposal facilities under state jurisdiction in April 1966. A final cover for Landfill 6 was installed in the 1960s. However, there is no record of a permit being applied for or issued for Landfill 6. Additional details regarding the history of each landfill follow.

2.1 Landfill 7

Fort Sheridan applied for and received Landfill Development Permit No. 1979-15-DE in 1979. IEPA issued Operating Permit No. 1979-15-OP on June 26, 1980. Construction of the cover, leachate and stormwater systems included in the 1980 Closure Plans was completed in 1982. However, the IEPA did not accept the landfill as having been adequately closed due to continued concerns related to leachate seeps, lack of documentation regarding construction, and groundwater and surface water monitoring results. Information regarding the developmental history of the landfill is available only through aerial photographs and other non-specific or indirect sources of information (e.g., inspection reports, correspondance, etc.).

Materials reportedly placed in Landfill 7 include domestic and industrial wastes. Open burning was conducted at Landfill 7 prior to 1970. Radiological investigations have been completed and indicate no significant radiological exposure hazard (USACHPPM, 1996; IDNS, December 1995). Radiological materials were not detected above background in the groundwater, leachate, or in the soil cover of Landfill 7. Radiological materials were also not detected above background levels in Lake Michigan off-shore from Landfill 7. A partial list of waste types reportedly disposed of includes (USATHAMA, 1989):

- domestic and office refuse
- building debris
- paint and paint thinner
- hospital / veterinary waste
- carbon cleaning compounds radioactive dials and gauges
- solvent
- waste oil
- photgraphic chemicals
- incinerator and heating plant ash
- ammunition boxes that had been treated with pentachlorophenol
- sewage treatment plant sludge
- photographic chemicals

Landfill gas vents were installed in Landfill 7 in 1980 or early 1981. A 6-ft high chain link security fence was installed around Landfill 7 after the 1982 closure. In August 1995, fencing was added around Landfill 7 to encompass a small area of fill that extends outside the previous fence boundary in the northwest corner of the landfill. This fill area is associated with a branch ravine off of the main ravine.

The 1980 Closure Plan included a leachate collection system consisting of a 300-ft long interception trench, or french drain, installed along the east end of Landfill 7, across the mouth of the natural Wells Ravine. The trench as constructed is approximately 10-ft deep, gravel filled, and contains a 6-inch perforated polyvinyl chloride (PVC) drain pipe near the bottom. The drain pipe slopes down to the north and terminates in a leachate collection sump. Leachate was to be pumped via a 4-inch diameter force main from the sump to a sanitary manhole located north of Landfill 7 for discharge to the North Shore Sanitary District (NSSD) via the Fort Sheridan sanitary sewer system. It is reported that the sump never collected leachate and the pump was disconnected (ESE, 1992).

The manhole at which the leachate force main was to terminate has not been located and is believed to have been filled or removed as part of other unrelated site work in the area. The force main exits the leachate collection sump, but there is no verification that it was ever connected to the intended manhole, or even that it was installed as the 1980 plans indicate. NSSD staff have indicated that there was never a permit issued for such a discharge. A construction permit would have been required to make a connection to the manhole.

The 1980 closure included the excavation of up to 40 ft of material from the east slope to attain the designed configuration with slopes of 3 horizontal to 1 vertical between four 10-ft wide benches. Prior to the 1980 closure, leachate seeps at several locations on the slope were frequent, or perhaps continuous, occurrences based on IEPA inspection reports. Subsequent to 1982, leachate seeps have emanated from the above-grade portions of Landfill 7. Leachate periodically discharging from the edge of the cover, as well as storm runoff from the cover and adjacent areas, collects in several small shallow depressions located along the southern side of Landfill 7. The Army placed gravel and soil fill in these low areas in 1995 to reduce the opportunity for the buildup of contaminated water in the depressions.

Landfill leachate is currently entering the underlying storm drain which discharges to Lake Michigan. As reported in the Focused Feasibility Study (FFS), surface water samples have been collected from both the influent and effluent (i.e., upgradient and downgradient of the landfills) of this segment of the storm drain. Exceedances of general use water quality standdards have been identified in both the influent and effluent samples. The Army is currently monitoring both the influent and effluent on a regular basis and will continue a regular monitoring program until the discharge is stopped.

In summary, Landfill 7 has not been closed according to applicable state requirements. Now, after negotiation with IEPA, the Landfill 7 must be closed in accordance with the pertinent requirements of 35 IAC 811.

2.2 Landfill 6

All available information, including a 1972 aerial photograph, indicates that Landfill 6 was inactive and covered prior to 1972. Consequently, Landfill 6 was never permitted by the IEPA. In a 1952 aerial photograph, a portion of the area south of Wells Ravine in the area of Landfill 6 appears to be cleared and used for parking, storage, or other activities. It could not be determined from the 1952 photograph if fill had been placed in this area by that date. It is likely, based on the topography of Wells Ravine indicated on the 1963 USGS map and the 1952 aerial photograph, that the extreme western end of Wells Ravine was filled for the construction of H Street prior to 1952. The type of fill material is unknown, but this activity was not associated with the subsequent major landfilling activities in Landfill 6 which occurred later. The 1962 aerial photograph indicates no apparent landfilling activities in the area of Landfill 6 as of that date. By 1972, Landfill 6 appears to have been completely filled and grass established across the filled area.

Landfill 6 is believed to contain primarily construction debris, reportedly from demolition of World War II barracks during the 1960s. However, Landfill 6 may have also received domestic and industrial waste (U.S. Army, May 1982). There is no known documentation indicating disposal of hazardous materials in Landfill 6, although some petroleum, oils, and lubricants (POL) and solvents were probably disposed of at this location (ESE, 1987). There are no gas vents at Landfill 6.

The area currently defined as Landfill 6 encompasses approximately 3.3 acres. Landfill 6 is not fenced. The Navy and U.S. Army Reserve property boundary and fence cross Landfill 6 near the midpoint.

Landfill 6 should be properly closed, similar to Landfill 7. Consequently, under the requirements established according to CERCLA, Landfill 6 also requires closure according to the pertinent 35 IAC 811 regulations.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

In January 1995, Fort Sheridan assembled a Restoration Advisory Board (RAB), composed of interested citizens from the surrounding communities. Monthly meetings provide an opportunity for the Army to brief the RAB and the public on installation restoration projects and to solicit input from the RAB and from the public. Approximately nine RAB meetings have been held since the initiation of the Landfills 6 and 7 interim action. During those meetings, the RAB was informed regarding the scope and methodology of the site investigations and cleanup alternatives. Four RAB meetings have been held to discuss the interim remedy during the selection of this interim action.

The Focused Feasibility Study (FFS) was made available to the public in June 1996. The Proposed Plan was available for public review and comment from August to September 1996. These two documents are available to the public as part of the Administrative Record and in the information repositories maintained at the following locations.

Highwood Public Library
102 Highwood Avenue
Highwood, IL 60040
Phone: (847) 432-5404
Hours:

Mon. - Thurs:	11:00 am - 7:00 pm
Fri. & Sat.:	10:00 am - 5:30 pm
Sunday	Closed

Lake Forest Library
360 East Deerpath
Lake Forest, IL 60045
Phone: (847) 234-0636
Hours:

Mon. - Thurs:	9:00 am - 9:00 pm
Saturday:	9:00 am - 5:00 pm
Sunday:	Closed

Highland Park Public Library
494 Laurel Avenue
Highland Park, IL 60035
Phone: (847) 432-0216
Hours:

Mon. - Thurs:	9:00 am - 9:00 pm
Friday:	9:00 am - 6:00 pm
Saturday:	9:00 am - 5:00 pm
Sunday:	Closed

Fort Sheridan BRAC Office *
Building 48-G
Fort Sheridan, IL 60037
Phone: (847) 266-6322

Hours: Mon. - Fri.: 8:30 am - 5:00 pm
* Location of Administrative Record

An availability session and public information meeting was held on August 21, 1996 at the Hotel Moraine in Highwood to inform the public of the preferred alternative and to seek public comments. The meeting was announced by publication in the Chicago Tribune (August 7, 1996) and Highland Park News (August 8, 1996). Press releases were also sent to numerous other newspapers and local radio stations. At this meeting, representatives from the USACE, U.S. Army, U.S. Navy, Illinois Environmental Protection Agency (IEPA), and U.S. Environmental Protection Agency (USEPA) addressed questions and received comments about the FFS and Proposed Plan. Attendees at the availability session were informed that a court reporter was present to record comments they wished to have entered into the Administrative Record and to receive a reply.

The public comment period was held from August 7, 1996 to September 9, 1996. No requests for an extension were received. A response to the comments received during the public comment period is included in the Responsiveness Summary.

4.0 SCOPE AND ROLE OF THE RESPONSE ACTION

A Phase I Remedial Investigation (RI) was conducted at Fort Sheridan in 1990-1991. In 1995, the installation was divided into two operable units (OUs) to facilitate the expedited transfer of surplus property. The first OU, designated the Surplus OU, consists of the property still owned by the U.S. Army and planned for disposal and reuse. This area occupies the north end of Fort Sheridan and is primarily composed of the golf course and historic district. The second OU is designated the Department of Defense (DoD) OU since this area will remain the property of the Navy and Army Reserve. It includes most of the area to the south of Bartlett Ravine and the Army Reserve area in the northwest corner of Fort Sheridan. Landfills 6 and 7 are located within the DoD OU. An RI/FS is ongoing for both the DoD OU and the Surplus OU.

The purpose of this Decision Document is to select an interim remedy for Landfills 6 and 7 which are located within the DoD OU. This interim remedy is being taken to address unacceptable conditions at the site related to excessive leachate generation, leachate discharges, insufficient landfill covers, and ineffective landfill gas venting. This interim remedy is a source control remedy, which contains or controls the wastes and releases of leachate and landfill gas from the wastes. The primary purpose of this remedy is to cap the landfills, thereby minimizing the generation of leachate and eliminating any potential risks posed by the release of leachate and landfill gases.

This interim remedy is intended to address only the source of the releases (i.e., the landfill wastes). Any groundwater and surface water in the vicinity of Landfills 6 and 7 that may be affected by hazardous substance releases from the site are not addressed in this DD, but, will instead be addressed by the site-wide DoD OU RI/FS as part of the final remedy.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Waste

Waste includes the actual materials disposed of in the landfills, including any daily cover soils mixed with the waste. Waste characteristics including waste volume and type [e.g., municipal solid waste (MSW)] are significant. Chemical characteristics of the mobile materials associated with the waste, leachate and gas, are also important.

5.1.1 Waste Volume

The total in situ volume of waste and 10 ft of underlying native soils, based on available information and the various assumptions described below, is 380,000 to 460,000 cubic yards (cy).

The waste volume can be best estimated by comparing the topography of the natural Wells Ravine prior to filling to the existing topography within the waste boundaries. Information available to define the natural topography includes the USGS 7.5-minute topographic map dated 1963 (USGS 1963). At the time that mapping was completed there was relatively limited filling of Wells Ravine. Additional information includes the elevations of the existing storm drain pipe that was installed along the bottom of Wells Ravine prior to waste placement and the depths to which landfill gas vent wells, which are located within the horizontal limits of the waste boundary, were bored.

The soils underlying and adjacent to the wastes can be anticipated to have been impacted by leachate and landfill gas migration. Although no sampling information is currently available on which to base an estimated vertical depth of potential impacts, an estimate of 10 ft was used based on the length of time the waste has been in place, soil type, soil permeability (including variation with depth due to weathering and biological modifications such as root penetration and animal burrowing), and the presence of sand lenses located within the lower permeability clayey soils.

5.1.2 Waste Characteristics

Regarding waste classification, the solid waste materials within the landfills have not been tested to estimate what percent of the volume might be characteristically hazardous. All information available from sampling efforts conducted between 1982-1995, including Army and IEPA inspection reports and disposal reports, indicate that the wastes are predominantly typical, putrescible municipal solid wastes and construction debris, but wastes from industrial and commercial facilities at Fort Sheridan were also disposed of at the landfills. Information available indicates that wastes from industrial and commercial sources included those wastes listed in Section 2.1. Samples of the landfill wastes were not collected, but leachate and landfill gas samples indicate contaminants similar to, and at much lower concentrations, than from a typical MSW landfill. Results of the sampling efforts are discussed in the respective sections below.

In accordance with USEPA (1991) guidance, characterization of a landfill's contents is generally not necessary or appropriate for selecting a response action for CERCLA municipal-type solid waste landfills. Rather, existing data are used to determine whether containment (or landfill capping) is appropriate. Existing data and information should include operating records, reliable anecdotal information, state files, closure plans, and/or physical evidence. USEPA states that because it is impossible to fully characterize the source areas of municipal landfills, uncertainty about a landfill's contents is expected and does not call into question the containment approach. However, containment remedies must be designed to take into account the possibility that hot spots are present.

5.1.3 Landfill Gas Sampling

Landfill gas (LFG) emissions from Landfill 7 have been sampled (ESE, 1992; USACHPPM, 1996). The LFG sampling indicates that the constituents in the LFG are similar to, but at much lower concentrations than, emissions from typical active MSW landfills. Sampling completed for the Phase I RI in 1992 included sampling for organic compounds and volumetric flow rate measurements. Sampling completed in August 1995 included collection of eight samples from each of the six gas vents over a five-day time period and analysis for 21 organic compounds. Constituents of concern identified from this sampling include vinyl chloride, benzene, chloroform, and carbon tetrachloride (ESE, July 1996).

Measurements of LFG flow rates are limited to the flows from only the six passive gas vents. The total estimated flow from the six gas vents in 1992 was approximately 14 cubic ft per minute (cfm). It is estimated (ESE, 1996) that the gas vents may contribute only approximately 10 to 20 percent of the total LFG emissions, the remainder occurring as emissions through the cap or through the surrounding soil. Evaluation of the generation rate of LFG (ESE, 1996) indicates that the current generation rate is substantially lower than the peak rate that likely occurred during 1980-85 and that the generation rate will continue to decrease in future years.

5.1.4 Leachate Sampling

Leachate has been sampled from the Landfill 7 gas vent wells and from seeps along the edge of Landfill 7. The leachate analytical results indicate a relatively dilute leachate with metals (iron, zinc, lead) at levels that exceed general surface water quality standards and very few organics above detection limits.

Leachate samples were collected from each of the Landfill 7 gas vents in December 1994. A composite sample was also collected in April 1995. The analytical results indicate relatively low concentrations of constituents that are typically present in municipal solid waste landfill leachate. Constituents of concern include iron, lead, and zinc (ESE, July 1996) with analytical concentrations ranging up to 148, 0.277, and 20.8 mg/l, respectively.

5.2 Geology/Hydrology

5.2.1 Geology

Fort Sheridan is located within the Lake Border Morainic System of the Central Lowlands Physiographic Province. This system consists of five long, narrow, closely spaced moraines that run generally parallel to the Lake Michigan shoreline. The moraines consist of unconsolidated glacial till of Pleistocene Age, deposited during the Wisconsinan glaciation. Fort Sheridan is located along the Lake Michigan shoreline on the Highland Park Moraine, the easternmost moraine in southern Lake County, Illinois (Atwood and Goldwaite, 1908).

The Pleistocene glacial deposits at Fort Sheridan are approximately 200 feet thick. The deposits, associated with the silty clay phase of the Wadsworth Till Member of the Wedron Formation, are composed of a matrix of silt and clay in which sand, gravel, and cobbles are embedded. The upper 50-plus feet is a silty clay; while the lower units are described as a clayey silt with discontinuous fine sand and silt lenses. Sporadic boulders may also be present. The till is yellow to olive brown in the upper 1- to 15-ft oxidized zone, and grey below the water table.

During the Phase I RI investigation in 1992 and continuing through early 1996, 25 soil borings were completed in the vicinity of Landfills 6 and 7, ranging in depth from 15 to 80 ft. These soil borings indicate that the soils in the immediate vicinity of these landfills are similar to soils in other areas of Fort Sheridan and the vicinity in general.

The data from borings and wells in the vicinity of Landfills 6 and 7 corroborate the geologic description of the region and Fort Sheridan in general. The lenticular, discontinuous nature of silt, sand, and gravel lenses within the till suggested by the literature is confirmed by the site specific data. These lenses are observed in the soil borings as the silt, sand, and gravel intervals that were sporadically encountered during completion of soil borings.

5.2.2 Hydrogeology

The groundwater table is encountered within the till at depths of up to 15 feet below ground surface at Fort Sheridan. Groundwater exists under unconfined conditions, but due to the impermeable nature of the till, may be locally perched. Limited groundwater elevation data are available from a installation-wide piezometer network installed in 1984 as part of a sanitary sewer investigation (Zimmer Howell Engineering, Ltd, 1984). The data indicate that regional flow is to the northeast toward Lake Michigan; however, in the vicinity of ravines, shallow groundwater flow tends toward the ravine.

Landfill gas vents installed into Landfill 7 in approximately 1980 provide groundwater/leachate levels in addition to the data from groundwater monitoring wells around these landfills. Leachate levels in

the gas vents show that leachate levels in the eastern half of Landfill 7 are higher than surrounding groundwater levels, and higher than some low areas at the perimeter of Landfill 7. A low leachate level in gas vent GV-1 at the west end of Landfill 7 indicates that leachate is being drained from this area. It is most likely being drained by the storm drain and two storm drain manholes located in the vicinity of GV-1. Leachate seepage can be observed entering these storm drain system manholes through construction joints and cracks.

Permeability of the glacial deposits at Fort Sheridan is relatively low due to its high clay content. Field measurements (slug tests) of K values in native glacial material at Fort Sheridan have ranged from 3.0×10^{-7} to 3.4×10^{-6} cm/sec. Laboratory analysis of silty clay samples indicates hydraulic conductivity (K) values range from 1×10^{-8} to 1.2×10^{-7} cm/sec (0.01 to 0.12 ft/year)(Bretz, 1939 and 1955). These laboratory K values are approximately an order of magnitude lower than those measured in silty clay in the field at Fort Sheridan. The difference between K values from the field and the laboratory is a commonly observed phenomenon.

5.3 Existing Source Controls

Several source controls were installed at Landfill 7 in 1979-82. These controls failed for various reasons and merit description.

Soil covers were placed over both Landfill 6 and Landfill 7. The Landfill 7 cover was part of a closure design; there is no record of a design being developed for the Landfill 6 cover. Existing soil covers for both landfills are approximately 2 ft or more in thickness, but is as thin as 2 inches in some areas of Landfill 7.

The Landfill 7 cover was designed to include an 18-inch thick low permeability layer overlain by 6 inches of topsoil in compliance with IEPA sanitary landfill regulations at the time of design. The cover has several flaws including:

- The 2-ft thickness is insufficient to prevent damage to the low permeability layer from freezing and root penetration;
- Several areas on the cover were constructed with inadequate slope to promote surface water drainage. Settlement due to degradation/consolidation of the waste has resulted in localized depressions on those areas in which water is trapped; and
- Of 23 shallow borings through the Landfill 7 cover, one boring indicated a cover soil thickness of only a few inches and two additional points had slightly less than 24 inches of cover soil. The area with the least cover is a low area within which storm drain inlets are located and which receives runoff from the cover itself and even runon from areas beyond the cover.

A 300-ft long and approximately 10-ft deep leachate interception trench was constructed across the east end of Landfill 7. The system apparently never collected a significant amount of leachate and was deactivated at some time in the past. Piezometer data from 1994 shows that the leachate levels are near the bottom of the interception trench as it was designed. Leachate levels on the slope were probably higher during the time of design in 1979-80 due to the much steeper slope that existed. As much as 40 ft of fill was excavated from the east slope during 1981-1982. However, there is no clear evidence that the leachate collection system ever was operational.

Six landfill gas vent wells were installed in Landfill 7 in 1979. These wells are located within the horizontal boundaries of the waste and extend to depths ranging from 25 to 60 ft. These passive gas vent wells are limited in their effectiveness due to the high level of leachate in the landfill.

6.0 SUMMARY OF SITE RISKS

Because this is an interim action, a baseline risk assessment that considers all chemicals of concern, their potential exposure pathways, and potential additive effects has not yet been completed for Landfills 6 and 7. Risk evaluations with specific but limited objectives, as described below, have been completed. USEPA (1991) states that for the source area of municipal landfills, a quantitative risk assessment that addresses these considerations is not necessary to establish a basis for action if data are available to demonstrate that constituents clearly exceed established standards or if other conditions exist that provide a clear justification for action. Additionally, if risk evaluations determine that the site risk is within the USEPA's risk management range (10^{-4} to 10^{-6}), site-specific considerations should be taken into consideration to determine if an active response action is warranted.

Interim action at Landfills 6 and 7 is based on two aspects of risk. Risk evaluations have indicated that potential risks associated with landfill gas emissions are within the risk management range for military family housing residents living adjacent to Landfill 7 even for a period of 5 years or less. The potential risk would be higher for a lifetime exposure scenario. Other constituent pathways have not yet been thoroughly investigated, but will be addressed in the DoD RI/FS. Potential physical risks such as are associated with methane gas (explosion) and cover subsidence are addressed by standard landfill regulations with which Landfills 6 and 7 do not comply. A summary of information relative to both of these types of risk is presented below.

6.1 Risk Assessment

Risk assessment work completed to date includes a draft Phase I (overall Fort Sheridan) risk assessment and risk evaluations related to Landfill 7 gas emissions. A complete human health and ecological baseline risk assessment for the DoD OU will be completed as part of the RI/FS. To date, media and contaminants documented include air (vinyl chloride, carbon tetrachloride, benzene, chloroform), groundwater (vinyl chloride, phenol, sulfate, total dissolved solids), surface water (total dissolved solids, sulfate), and leachate (lead, zinc, iron). Scheduled DoD OU RI/FS work will verify and/or further define appropriate actions to address other potential migration pathways beyond the extent of waste in Landfills 6 and 7.

The potential risk to human health is estimated by calculating the potential exposure to and toxicity of the contaminants present at the site. For potential carcinogenic (cancer causing) effects, USEPA has established a target risk range that is appropriate for setting remediation goals or determining when remediation is appropriate. This target risk range is $1x10^{-4}$ to $1x10^{-6}$, meaning there is one additional chance (over the background cancer rate) in ten thousand ($1x10^{-4}$) to one additional chance in one million ($1x10^{-6}$) that a person will contract cancer. A cancer risk of $1x10^{-6}$ or less is considered acceptable; a cancer risk of $1x10^{-4}$ or greater is considered cause for action.

At this time, the presence of vinyl chloride in landfill gas emissions has been identified as posing the most significant potential health risk associated with Landfill 7. The Army conducted air monitoring in 1991 during the Phase I RI as well as in 1995. The Army and USEPA completed separate risk evaluations using the 1991 and 1995 air monitoring data. Both agencies determined that the potential cancer risks associated with vinyl chloride emissions for military personnel and their families who live in residential units adjacent to Landfill 7 for a period of not more than 5 years is within the risk management range (i.e., the calculated risk is in the range of $1x10^{-4}$ to $1x10^{-6}$).

Vinyl chloride is known to cause health risks at concentrations less than air monitoring detection limits. The Army determined the potential risk associated with vinyl chloride for a reasonable maximum exposure scenario for a child to be $8.1x10^{-6}$. USEPA performed landfill gas air emissions modeling to estimate exposure concentrations for vinyl chloride below analytical detection limits. USEPA calculated a maximum potential risk for a child for exposure to vinyl chloride to be slightly greater than $1x10^{-5}$.

A safety, or physical, risk is also associated with methane that is generated from the landfills. Accumulation of methane at explosive concentrations has been observed in some storm drain manholes adjacent to the landfills that have solid covers (not having open grates).

Landfill 7 suffers from multiple problems including excessive leachate generation resulting from poor cap design and construction; leachate discharges due to seeps and infiltration to a storm drain underlying the waste; fissures in the cap resulting from poor cap design, construction, waste settlement and/or landfill gas conditions; landfill gas emissions; and inadequate maintenance. These problems create potential unacceptable risks.

The human health risk assessments for Landfill 7 conducted to date did not evaluate all potential exposure pathways. Leachate continues to be generated by the landfill and continued degradation of the landfill cover and/or underlying storm drain pose a potential unacceptable risk to the environment by release of leachate.

6.2 Compliance with Regulatory Standards

The need for interim action at Landfills 6 and 7 is based in part on a need to comply with regulatory requirements and, for Landfill 7, the existing permit. The existing Landfill 7 cover does not meet the applicable standards for landfill covers. Continuous leachate discharges via the storm drain and periodic leachate seeps around the perimeter of the cover are also not in general compliance with IEPA landfill regulations. Methane concentrations in the storm drain system present a safety risk and are also not in general compliance with IEPA landfill regulations. According to IEPA, in addition to the known exceedances of surface water quality standards for several secondary contaminants, the unmitigated release of leachate with unknown constituents to Lake Michigan poses an unacceptable threat to the environment.

6.3 Current Site Conditions

Because the site risks evaluated to date are in the risk management range, site-specific conditions were considered in determining the appropriateness of this interim response action. These site-specific conditions are discussed below.

The Phase I RI (ESE, 1992) and supplemental field work conducted in 1994 and 1995 (ESE, 1996) identified that features of the 1982 Landfill 7 closure were deficient and that the existing covers on Landfills 6 and 7 do not meet the applicable standards for covers. These studies concluded that the design and maintenance of the existing controls, including the landfill cover, storm drainage, and leachate collection systems included fundamental flaws that resulted in failures of those controls. The failures resulted in unpermitted leachate discharges to Lake Michigan, ineffective passive landfill gas vents in Landfill 7, and landfill covers that are ineffective for leachate and gas control. USEPA (1991) states that "where established standards for one or more contaminants in a given medium are clearly exceeded, the basis for taking remedial action is generally warranted . . ".

7.0 DESCRIPTION OF ALTERNATIVES

The interim remedial action selected for Landfills 6 and 7 is the result of a comprehensive evaluation process. A focused Feasibility Study (FFS) was conducted to identify and analyze various alternatives for addressing the unacceptable risks posed by the landfills. The alternatives evaluated in the FFS are defined as (1) no action, (2) capping in place with a Resource Conservation and Recovery Act (RCRA) cap, (3) capping in place with a modified RCRA cap, and (4) waste excavation and off-site disposal. A fifth alternative, identified as 2B, was added and evaluated in the Proposed Plan. Alternative 2B uses the RCRA cap system on both landfills except for the east slope of Landfill 7, where the modified RCRA cap system of Alternative 3 is used.

The following sections present the alternatives evaluated as part of the FFS. There are certain elements that are common to each of the action alternatives. These elements are described only once rather than repeated within each alternative discussion.

7.1 Common Elements

Each of the four action alternatives include leachate collection, on-site treatment, and discharge to the North Shore Sanitary District (NSSD) during an initial three to five year stabilization phase. The leachate components for the three capping alternatives are identical and include long-term management of leachate. Leachate management, particularly the treatment and discharge components, for the excavation alternative is similar to the capping alternatives for the stabilization phase, but there would be no need for long-term leachate management. For all action alternatives, military housing units located adjacent to Landfill 7 would be vacated throughout the implementation of the interim action. Alternative 4 would involve relocation of residents from 299 units, however, compared to only 68 units for Alternatives 2, 2B and 3. After remediation construction is completed, the residential units could be reoccupied by military personnel and their families. Long-term groundwater monitoring would be required for all action alternatives, although the required monitoring period for Alternative 4 could be anticipated to be of shorter duration.

During leachate removal for all action alternatives, improvements will be made to the existing landfill covers to provide improved surface drainage from the landfill surfaces and thereby reduce percolation and leachate generation. These temporary improvements include filling, grading, and temporary re-vegetation.

Leachate collection for all action alternatives will occur by pumping from existing gas vents, construction of new leachate wells at Landfill 6, and construction of a leachate interception trench at Landfill 7 near the Lake Michigan shoreline. Additionally, the existing storm drain system within the confines of Landfills 6 and 7 will be converted to leachate collection for the capping alternatives. The collected leachate will be pumped to an on-site treatment plant. Treatment processes will be selected during design and following a treatability study. The treated leachate would be discharged to the Fort's

sanitary sewer collection system which, in turn, discharges to the sanitary sewer system owned and operated by the NSSD. The leachate recovery rate is anticipated to average approximately 20 gallons per minute (gpm) during the stabilization period.

It is anticipated that settlement of the landfill surface will occur as a result of lowering the level of leachate within the landfills. Consequently, a stabilization period of approximately 4 years is planned, during which most of the landfill settlement is expected to occur as the stored leachate level is lowered.

Consolidation of buried waste and construction debris in areas adjacent to the defined boundaries of Landfills 6 and 7 is included in all of the capping alternatives. The consolidated waste volume will reduce the volume of soil fill required for cover improvements to attain desired grading, although backfill will be required for the waste excavation areas. Consolidated waste will receive a minimum of 18 inches of temporary cover prior to final cap construction.

For the three capping alternatives, the cap would be constructed following the stabilization phase. An active landfill gas collection and treatment system would be constructed at the time of cap construction.

Alternatives 2, 2B and 3 are identical except for details of the cover system layers. In addition to the leachate management system, the landfill gas management system, stormwater management system, final use, and long-term monitoring are the same for all three capping alternatives. The capping alternatives would require 5-year evaluations following completion of construction under CERCLA in addition to more frequent regular inspections completed as part of a site operation and maintenance plan. Monitoring and inspections will be more frequent during the construction phase.

Alternative Descriptions

Alternative 1. NO ACTION

CERCLA requires that the no action alternative be evaluated at every site to establish a baseline for comparison. This alternative assumes no further action other than continued mowing and minor maintenance unrelated to cleanup of the site. Costs for this alternative are summarized below. The discount rate used for present worth estimates for all alternatives is 7 percent and the time period is 30 years.

Estimated Capital Cost:	$0.
Estimated Annual Operation and Maintenance (O&M) Costs:	$16,500.
Maintenance (O&M) Costs:	$16,500.
Estimated Present Worth (PW):	$205,000.
Approximate Time to Implement:	none

Alternative 2. CAPPING IN PLACE WITH A RCRA CAP

The landfills would be closed in place. To provide suitable controls, this alternative includes construction of new landfill covers, a leachate control system, a new stormwater drainage system, a landfill gas control system, and additional shoreline erosion protection. The final cover will be installed after leachate is lowered to the desired level and settlement is determined to be sufficiently complete that remaining settlement would not damage the final landfill cover.

Stormwater runoff from the landfills and upstream areas will be diverted from the existing storm drain beneath the landfills into a new storm drain system during the stabilization phase. The segment of the existing storm sewer within the limits of the landfills will be plugged at the upstream ends to prevent inflow. Any leachate collected in the pipes will be directed to the on-site leachate treatment system.

The final cover will meet the minimum requirements for a RCRA landfill and will consist of the following layers from the surface down: two feet of topsoil, one foot of clean soil fill, one foot of granular (e.g., coarse sand) drainage layer, polyethylene geomembrane liner, and a two-foot thick compacted clay liner with permeability of not greater than 1×10^{-7} centimeters/second (cm/sec). The landfill final cover surfaces will be vegetated and maintained to provide a good grass cover. Acceptable uses would be limited to recreational, including, for example, walking/exercise trails, game courts and fields.

An active landfill gas collection system will be installed prior to installation of the final cover. The collected gas will be directed to a single point. The collection system will use a system of piping and a partial vacuum to collect landfill gas generated by the waste. The collection point would be near the on-site leachate treatment system. The landfill gas will be treated by use of a flare enclosed within a screen to eliminate visibility and reduce noise. Air monitoring will be conducted during remedial activities to assure protection of workers and residents in the surrounding area. The landfill gas management system will comply with ARARs.

Long-term monitoring of groundwater for a minimum of 30 years will detect any potential releases from the landfills that might impact shallow groundwater or the lake.

Estimated Capital Cost (including temporary resident relocation):	$8,662,000.
Estimated PW for O&M (stabilization phase):	$3,970,000.
Estimated PW for O&M (years 5-30):	$4,230,000.
Estimated Total PW:	$16,862,000.
Approximate Time to Implement:	5 years

Alternative 2B. COMBINATION RCRA/MODIFIED RCRA CAP

Alternative 2B uses a combination of the cover systems from Alternatives 2 and 3 and was not evaluated as a separate alternative in the FFS. For this reason, it was evaluated in detail in the Proposed Plan against the nine CERCLA criteria as required in the NCP [40 CFR 300.430(e)].

The RCRA and modified RCRA cover systems included in Alternatives 2 and 3 each has identifiable advantages and disadvantages that are dependent on, among other factors, the site-specific conditions. Alternative 2B was identified for evaluation to take advantage of a combination of these different cover systems at different locations on the landfills, using the more appropriate cover system for location specific conditions. The area-specific advantages and disadvantages of Alternatives 2 and 3 are described in detail in the FFS. This alternative includes use of the RCRA cover as in Alternative 2 on the majority of the landfill and the modified RCRA cover as in Alternative 3 on the steeper, longer, east slope of Landfill 7. The hydraulic conductivity required for the 2.0-ft thick compacted soil layer (maximum K of $1x10^{-6}$ cm/sec) beneath the geocomposite clay liner (GCL) will be more easily constructed on the steeper east slope of Landfill 7 than the 2.0-ft thick compacted clay liner with maximum K of $1x10^{-7}$ cm/sec for the RCRA cap.

Estimated Capital Cost (including temporary resident relocation):	$8,740,000.
Estimated PW for O&M (stabilization phase):	$3,970,000.
Estimated PW for O&M (years 5-30):	$4,180,000.
Estimated Total PW:	$16,890,000.
Approximate Time to Implement:	5 years

Alternative 3. CAPPING IN PLACE WITH A MODIFIED RCRA CAP

Alternative 3 is different from Alternative 2 only in the details of the final cover system. The final cover system for this alternative includes, from the surface down, two feet of soil, including topsoil with grass, two feet of other clean soil fill, synthetic drainage composite layer, polyethylene geomembrane, geocomposite clay liner (GCL), and, overlying the waste, not less than two feet of compacted soil with permeability not greater than $1x10^{-6}$ cm/sec.

Estimated Capital Cost (including temporary resident relocation):	$8,979,000.
Estimated PW for O&M (stabilization phase):	$3,970,000.
Estimated PW for O&M (years 5-30):	$4,230,000.
Estimated Total PW:	$17,129,000.
Approximate Time to Implement:	5 years

Alternative 4. EXCAVATION AND DISPOSAL IN AN OFF-SITE LANDFILL

This alternative includes waste and contaminated soil excavation, transportation off-site (by truck), off-site waste treatment (if required) and final waste disposal in an off-site landfill(s). After leachate is lowered to the desired level during the stabilization phase, excavation would begin and is estimated to

take 4 years. Following excavation, the waste would require additional drying on-site and would be sampled and segregated as needed for disposal. To protect the health and safety of workers and the surrounding community and Lake Michigan during waste excavation, drying and transportation, air monitoring would be conducted, odor controls (chemical application) and/or vapor controls would be implemented, storm water runoff controls would be constructed, and controls for animal disease vectors (disease carrying organisms) would be applied. All on-site military residents (299 units) would be temporarily relocated. Runoff from the landfills and from the watershed west of the landfills would continue to flow through the existing storm drain until the waste was excavated and a new drainage channel could be constructed following excavation. Discharge from the storm drain outlet during dry weather periods, consisting primarily of leachate, would be captured and directed to the leachate treatment system. During runoff periods during the excavation period, leachate would become mixed with stormwater and discharge to Lake Michigan.

Following excavation, the landfill area would be graded and restored by vegetative planting to a natural area. It could not be restored to the topography of the undisturbed natural ravine. Ensuring establishment of desirable vegetation would require monitoring and maintenance for a few years following planting. Groundwater monitoring would also be required for a period of several years following excavation.

The capital cost for Alternative 4 varies widely based on assumptions regarding the volume and characteristics of the materials that would be excavated for off-site disposal. Because the actual cost cannot be determined until the waste is excavated, a range of project conditions and resultant costs is provided.

The average depth of subsurface soil excavation is estimated to be 10 ft beyond the bottom of the waste. This assumption and other information results in an estimated in situ excavation volume of 380,000 cy and the estimated cost of $37,846,000. This cost also assumes no complicating situations are encountered during excavation. If all excavated material were determined to be hazardous by characteristic and the in-place volume of waste and contaminated soil to be excavated is 460,000 cubic yards (the maximum volume expected), but no other complicating situations were encountered, the estimated cost for disposal in a suitable landfill off-site and other components of this alternative is $135,500,000. If the in-place volume to be excavated is 460,000 cubic yards and all excavated material were determined to be subject to land disposal restrictions based on contaminants detected, and therefore requiring treatment, the cost would be $711,530,000.

While the significant cost elements have been identified, several factors could incrementally increase the project cost, including, but not limited to: increased sampling and monitoring, increased stormwater runoff controls, year-around excavation (building required for waste staging and drying), difficulty in drying waste following excavation, and difficulty in site restoration (need for demolition of existing structures, excavating/importing additional fill soil, need for grade stabilization structures, more dense or extensive planting plan, etc.).

The cost estimates resulting from the various waste volume and characteristic assumptions are summarized below:

Estimated Volume	Waste Type	Cost Estimate
380,000 cy	all special	$37,846,000.
460,000 cy	half special/half hazardous	$88,473,000.
460,000 cy	hazardous	$135,500,000.
460,000 cy	land disposal restricted	$711,530,000.

Estimated Capital Cost:	$34,262,000 to $708,077,000
Estimated PW for O&M (leachate treatment/disposal):	$3,453,000.
Estimated PW for O&M (years 5-10):	$131,000.
Estimated Total PW:	$37,355,000 to $711,661,000
Approximate Time to Implement:	4-5 years

Note: O&M for years 5-10 is for groundwater monitoring, a cost that was not included in the costs for Alternative 4 in the FFS.

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with the provisions set forth in CERCLA, SARA, and the NCP, each of the alternatives was evaluated against each other as well as against the nine established criteria. Overall protection of human health and the environment and attainment of applicable or relevant and appropriate requirements (ARARs) are threshold criteria and the primary objectives of a remedial action. In addition, the selected remedial alternative must reflect the best balance among criteria such as short- and long-term effectiveness; implementability; and cost. Support agency and community acceptance are also considered during the evaluation. These nine criteria are as follows:

Threshold Criteria

- **Overall Protection of Human Health and the Environment** determines whether an alternative eliminates, reduces, or controls threats to human health and the environment.
- **Compliance with ARARs** evaluates whether the alternative meets federal and state environmental laws pertaining to the site.

Balancing Criteria

- **Long-term Effectiveness and Permanence** considers the ability of an alternative to protect human health and the environment over time.
- **Reduction of Toxicity, Mobility or Volume Through Treatment** evaluates an alternative's use of treatment to reduce the harmful nature of contaminants, their ability to move in the environment, and the amount of contamination present.
- **Short-term Effectiveness** considers the length of time needed to implement an alternative and the risks it poses for workers, residents, and the environment during implementation.
- **Implementability** considers the technical and administrative feasibility of implementing an alternative.
- **Cost** evaluates estimated capital and O&M costs, as well as present-worth costs.

Modifying Criteria

- **State Acceptance** considers whether the IEPA and USEPA agree with the recommended alternative as presented in the DD.
- **Community Acceptance** considers the public's response to the alternatives described in the FFS and the Proposed Plan. Specific responses to public comments are contained in the Responsiveness Summary section of this DD.

The five alternatives are compared under the various evaluation criteria, profiling the performance of each alternative against the nine criteria. A summary of this comparison is provided in Table 8-1.

Table 8-1. Summary Comparison of Alternatives

Criteria		Alternative 1 No Action	Alternative 2 RCRA Cap	Alternative 2B Selected Alternative	Alternative 3 Modified RCRA Cap	Alternative 4 Excavation and Off-Site Disposal
Threshold Criteria	Protection of Human Health and Environment	—	+	+	+	+/ — (see note)
	Compliance with ARARs	—	+	+	+	—
Balancing Criteria	Long-term Effectiveness	—	+	+	+	+
	Reduction in Toxicity, Mobility and Volume	—	+	+	+	+
	Short-term Effectiveness	—	0	0	0	—
	Implementability	+	0	0	0	—
	Cost (Capital and O&M)	+	+	+	+	—
Modifying Criteria	State Acceptance	—	+	+	+	—
	Community Acceptance	—	+/ —	+/ —	+/ —	+/ —

Key: + = good, **0** = average, — = poor, +/ — = split

Note: Alternative 4 provides good protection for long-term, but poor protection during the excavation.

8.1 Overall Protection of Human Health and the Environment

The No Further Action alternative does not provide protection of human health and the environment for the discharges of leachate or landfill gas. Leachate discharges via seeps to the ground surface adjacent to Landfill 7 and to surface waters (Lake Michigan) via the storm drain system will continue. Landfill gas emissions will continue to present a potential risk to nearby residents.

Alternatives 2, 2B and 3 are protective since they provide containment of waste with RCRA and RCRA equivalent cover systems; leachate collection, treatment and disposal; and active landfill gas collection and treatment systems. Leachate seeps to surface water and groundwater would cease with the capping alternatives. The long-term operation and maintenance plan and requirements will ensure protection for a minimum of 30 years.

Alternative 4 is protective in the immediate area of Landfills 6 and 7 following implementation. The wastes would be moved into a landfill at another location. For the short-term (during excavation and off-site disposal), it could be protective if excavation and transport is done carefully. Because of the activities required, or associated, with excavation of waste, however, significant potential problems related to air emissions, storm water exposure, and spills and accidents during handling may develop. Additionally, while leachate infiltrating into the storm drain would be captured for treatment during dry weather periods, the leachate would be mixed with stormwater and discharged to Lake Michigan during runoff periods.

8.2 Compliance with ARARs

Alternative 1, No Further Action, does not comply with ARARs. Exceedance of Class II groundwater quality standards have occurred and are expected to continue to occur. The 1980 closure of Landfill 7 has not been accepted by the IEPA as complying with the closure requirements; therefore, Alternative 1 does not comply with State MSW landfill regulations.

Alternatives 2, 2B, 3, and 4 would comply with ARARs identified for this interim source control action. These alternatives do not comply with all ARARs that will apply to a final remedy (e.g., shallow groundwater that may have been affected by the landfills) that must be provided for Landfills 6 and 7. All requirements for Alternatives 2, 2B and 3 utilize standard technologies for landfill containment, leachate treatment, and landfill gas collection and treatment. There is no known technical reason Alternative 4 could not comply with ARARs, especially long-term, but compliance during the implementation could be technically and economically difficult. If storm water is not diverted around the landfills during implementation, periodic leachate discharges would occur during runoff periods because the high flows in the storm drain could not be captured and stored for treatment.

Alternatives 2, 2B, 3, and 4 do not include direct remediation of shallow groundwater. While a limited number of violations of Class II groundwater standards have been observed, the available information does not suggest the presence of a well-defined plume. Additional sampling will occur during the Fort Sheridan Phase II DoD OU RI work that would better define the potential effects of the landfills on shallow groundwater. The final remedy for the DoD OU will address compliance with Class II groundwater standards.

The four action alternatives are similar with regard to overall protection through leachate treatment and discharge.

8.3 Long-Term Effectiveness

The No Further Action alternative does not provide reduction of long-term risks. Alternatives 2, 2B and 3 do provide long-term effectiveness and permanence, but require long-term maintenance and eventually replacement/repair of engineered components (e.g., replacement of the leachate collection and treatment systems and repair of the landfill cover caps). Alternatives 2B and 3 are expected to be at least as effective at controlling leachate and landfill gas generation and releases as Alternative 2 due to the lower hydraulic conductivity of the impermeable soil layer in the modified RCRA cap compared to the RCRA cap impermeable soil layer. Alternative 4 provides the best long-term effectiveness, within the vicinity of the landfills' current location, because the source of constituents is removed. However, because the waste is simply relocated, long-term effectiveness and permanence would be similar to that for Alternatives 2, 2B and 3.

8.4 Reduction of Toxicity, Mobility, or Volume (TMV) Through Treatment

Alternative 1 does not provide a reduction of TMV. Alternative 4 removes the waste from the current location and, therefore, entirely eliminates the TMV of solid waste on-site, although it transfers wastes to another off-site location. If waste is excavated and treated under Alternative 4, then TMV would be reduced. Alternatives 2, 2B and 3 provide containment and reduce the mobility of constituents leached from the wastes as well as the volume of leachate, but do not provide a reduction in TMV through treatment of the actual wastes.

Due to the large volume and heterogeneous distribution of waste at the landfills, treatment as a principle element is not considered practicable at Landfills 6 and 7. Thus, this interim remedy does not satisfy the statutory preference for treatment that reduces toxicity, mobility, or volume as a principle element. However, treatment is a secondary element in that landfill leachate and landfill gas will be collected and treated resulting in destruction of hazardous substances.

With regard to leachate and landfill gas, all action alternatives, including capping alternatives and excavation and off-site disposal, result in a continuing, but much reduced, stream of waste to be managed. All action alternatives result in capture and treatment of the landfill gas and leachate. The capping alternatives accomplish this on-site. For Alternative 4, if no treatment is provided, the relocated waste will continue to produce both leachate and landfill gas in the off-site landfill(s) so that the overall volume and toxicity of materials is similar to the capping alternatives, but occurring at a different location.

8.5 Short-Term Effectiveness

Short-term effectiveness is not applicable to Alternative 1, No Further Action, since no short-term action would be taken. Alternatives 2, 2B, and 3 are effective in the short-term. These alternatives do require trucking soil fill and other construction materials to the site, which creates truck traffic safety and related concerns.

Alternatives 2, 2B, and 3 require importing approximately 115,000 cy of soil (equivalent to approximately 8,500 truck loads to the site for final cap construction. The cap would be constructed at the end of the stabilization period and some portion of the soil fill for the caps could be transported to the site during the stabilization period and stockpiled. Doing so would distribute the total number of truck trips over a longer time period.

Alternative 4, excavation, has potential for significant problems regarding short-term effectiveness. Excavation, handling, and transport of the large volume of wastes present would require careful monitoring and controls to prevent adverse effects related to uncontrolled landfill gas releases (explosive conditions from methane, health concerns related to organics, and odors). The volume of truck traffic that would be required for Alternative 4, approximately three times more than that for fill soil for capping alternatives, would create concerns for public safety as well as the potential for spillage. Top soil would need to be imported to the site for restoration of the excavated area for Alternative 4. Based on a minimum of six inches of topsoil, the required volume would be approximately 12,500 cy or more, equivalent to approximately 950 truck loads.

Excavation would expose the wastes, resulting in a potential for discharges of leachate mingled with stormwater runoff during larger storm events where the capacity of temporary stormwater diversion/containment controls may be exceeded. Disease vector control would also be required. Alternative 4 has significantly greater potential risks to workers due to potential for air emissions and other conditions related to excavation.

8.6 Implementation

The implementability of the leachate collection and treatment systems for the four action alternatives is similar. Leachate will not be collected or treated under Alternative 1.

Technical Feasibility

None of the alternatives are considered to present difficulties relative to technical feasibility. Alternative 4 may present more difficult challenges related to the short-term primarily due to the need for monitoring and control of air emissions during excavation and controlling storm water contact and discharge at waste excavation, on-site transport, and processing areas.

Technology Reliability

Alternative 1 applies no active remediation technologies. The RCRA cap included in Alternatives 2 and 2B utilizes standard construction materials and techniques. Obtaining the compaction and permeability requirements for the clay barrier layer is dependent on the clay available for use, weather conditions, and contractor equipment and experience. Alternatives 2B and 3 utilize a geosynthetic clay liner (GCL) barrier layer and other geosynthetics. These materials are widely used and have been proven to be an effective technology in remediating similar sites. Alternative 4 would require leachate, landfill gas, landfill liner and landfill cap systems at the receiving landfill(s) in accordance with the excavated waste classification(s) under Illinois solid waste regulations. Dewatering equipment/processes and landfill gas control equipment/processes would be required at the excavation sites, and the application of these control technologies in an excavation activity may not have a high reliability. The excavated waste may require additional drying, and application of technologies for that purpose can be considered somewhat unusual.

Construction Feasibility

No construction is involved for Alternative 1. For Alternative 2, construction of the compacted clay barrier layer on the steeper slopes at Landfill 7 to meet specified requirements could be difficult. A GCL barrier layer is included in Alternative 3 and on the east slope for Alternative 2B. Installation of the GCL to meet the same performance standards as the clay barrier layer included in Alternative 2 is anticipated to be more easily and more reliably accomplished on the steep slopes because of the higher permeability (and therefore less compaction effort) allowable for the compacted clay layer. The GCL does not require compaction with heavy equipment.

Waste disposed of in landfills can not exceed a moisture content specified by regulations. For Alternative 4, adequate dewatering of the wastes to allow excavation, transport, and disposal in a landfill may be difficult due to a moisture content required that is lower than provided by simple gravity drainage. Draining and drying may be accomplished on drying pads with leachate collection and air controls. Additionally, Alternative 4 would require surface drainage controls that would make construction difficult.

Ease of Taking Further Remedial Action

Because Alternative 1 results in no changes, it does not affect the ease of taking further remedial action.

Ease of further remedial action is similar for Alternatives 2, 2B and 3. Further remedial action potentially required beyond the boundary of the landfill covers would not be adversely affected by the covers and would be no more difficult than for Alternatives 1 or 4. Potential remedial action requiring access to areas underlying the cap would require either subsequent repair of the affected cap area or, in the event that boring/well installation is required, use of directional drilling from beyond the cap boundaries might alternatively be used. Either situation would be more difficult due to the existence of the landfill cap.

Because Alternative 4 results in only restored landscaping, further remedial action is not impaired.

Monitoring Considerations

Alternative 1 includes no monitoring. Alternatives 2, 2B, 3, and 4 will all require groundwater, storm drain, and air emissions monitoring during construction to ensure compliance with air emissions regulations and normal permit conditions. Some air monitoring for worker protection will also be required during construction activities. Alternative 4 has the most extensive monitoring requirements during construction, including groundwater, surface water, and especially air emissions. Long-term monitoring to ensure effectiveness would be required for each capping alternative. Monitoring of groundwater would also be required for Alternative 4 for a period of several years to assure compliance with groundwater standards. Long-term groundwater and air monitoring will also be required at the off-site landfill used for disposal under Alternative 4. Since none of the alternatives include shallow groundwater remediation, groundwater monitoring is common to all action alternatives.

Availability of Services and Materials

Alternative 1 requires no materials or services other than mowing the landfills.

Alternatives 2, 2B and 3 utilize standard materials, equipment, and processes that are expected to be available.

Alternative 4, because of the uncertainty related to classification and characteristics of the waste, also has uncertainty regarding the actual services and materials that would be required (i.e., landfill disposal versus waste treatment followed by landfill disposal). If the wastes are determined to be non-hazardous, thereby allowing them to be disposed of in a non-hazardous landfill, suitable landfills are available in the vicinity. If the material is hazardous or requires treatment, facilities to provide these services may be less readily available.

Administrative Feasibility

Because Alternative 1 includes no further action, there are no administrative requirements.

Alternatives 2, 2B and 3 have similar administrative requirements. Capping and landfill leachate and gas controls are common remedies, as indicated by USEPA guidance (USEPA, 1991), and administrative requirements would be expected to reflect that the activities are common practices.

Alternative 4 would have extensive administrative requirements that could be difficult to accomplish. The excavation and off-site disposal of the landfill materials would require implementation of relatively unique operations in the form of materials handling, transportation, leachate handling and monitoring requirements.

8.7 Cost

The anticipated present worth cost of Alternative 4 is much higher than the $16,862,000 to $17,179,000 range for Alternatives 2, 2B, and 3. Even for the best case scenario under which all waste is determined to be special waste, and not hazardous waste, the cost of Alternative 4 is still more than two times larger than the capping alternatives. The cost differences between capping alternatives are only approximately 2 percent.

Aside from the cost variation for the excavation alternative associated with waste classification and its effect on off-site disposal fees, there is greater uncertainty in cost estimates for Alternative 4 than for the capping alternatives. The greater uncertainty, the reasons for which are discussed in the Focused Feasibility Study (ESE, 1996), is related to the inherent unknowns and also to problems in managing the exposed waste and air emissions. The capping alternatives involve construction activities and conditions that are relatively common compared to the Alternative 4 and, therefore, costs can be more accurately estimated.

8.8 State Acceptance

Neither the state agency, IEPA, nor USEPA find Alternative 1 to be acceptable. The IEPA has indicated that they believe implementation of Alternative 4 may be difficult. Cost, short-term effectiveness, and the ability to meet ARARs during implementation, have been identified by IEPA as shortcomings of this alternative. Short-term risks associated with Alternative 4 are significantly greater than for Alternatives 2, 2B or 3. Alternatives 2 and 2B include a RCRA cap which is the standard for hazardous waste landfills and, therefore, are expected to be acceptable to IEPA and USEPA. The modified RCRA cap is considered to be equivalent in performance, constructibility and other criteria to the RCRA cap and should, therefore, be equally acceptable to IEPA and USEPA. The 2-ft thick soil buffer layer underlying the GCL provides protection from puncture for both the GCL and the geomembrane equivalent to that provided by the 2-ft thick compacted

clay layer below the RCRA cover geomembrane. The modified RCRA cap utilizes manufactured materials that have not been as widely used nor used for as long as compacted clay liners and, therefore, have less long-term performance information available.

8.9 Community Acceptance

The concerns raised by the public during the public comment period are summarized in the Responsiveness Summary.

The No Further Action alternative is not acceptable to the local community due to the discharge of leachate into Lake Michigan, a local water supply source, among other uses. Alternatives 2, 2B and 3 result in landfills remaining in the community and adjacent to residences. Control of leachate and air emissions alleviates concerns of some local community representatives while some representatives are unconvinced that these controls will be reliable. Some local community members are concerned regarding the potential impacts of Lake Michigan shoreline erosion on Landfill 7 and constructed controls.

Some representatives of the local community find Alternative 4 unacceptable based on the transportation of odorous, potentially hazardous, waste through commercial and residential areas and the potential risks associated with accidents. Conversely, Alternative 4 removes the landfills from the community, a factor some representatives believe desirable.

The U.S. Navy and the Army Reserve, owners of the property on which Landfills 6 and 7 are located, fully support the selection of Alternative 2B and would not support excavation of the landfills.

9.0 SELECTED REMEDY

The Army, USEPA and IEPA have conducted an analysis of the potential interim remedies and have selected Alternative 2B as the interim remedial action for Landfills 6 and 7. This alternative was selected because it is protective, feasible, and cost-effective.

9.1 Detailed Description of the Selected Remedy

Alternative 2B includes placement of a RCRA cap over Landfills 6 and 7. The east slope of Landfill 7 would receive a modified RCRA cap. Leachate collection and treatment, installation of a new storm drain around the perimeter of the landfills, and installation of an active landfill gas collection and treatment system will also be provided. Additionally, Alternative 2B includes institutional controls. Land use controls will be implemented to protect the cap and associated leachate and landfill gas systems while allowing open access to the landfill surfaces following cap construction. These land use controls would be implemented and enforced by the respective Department of Defense (DoD) property owners until such time that the property is transferred outside of DoD. If the property is to be deed transferred outside of the federal government, all requirements of CERCLA Section 120(h) will be complied with. If deemed appropriate after consultation with IEPA and USEPA representatives and after obtaining any necessary authority from General Service Administration (GSA) to do so, future land use restrictions may be incorporated into the deed or other transfer documentation to further ensure adequate future protection of human health and the environment.

A three- to five-year stabilization/construction period is anticipated prior to construction of the final cap for Alternative 2B. The stabilization/construction period duration is determined by two factors. The first, and most unalterable, is the need to allow anticipated settlement of the waste to occur as a result of removal of leachate from the landfills. Because the landfills have most likely been saturated throughout much of the total depth of waste since the waste was placed, it is expected that significant settlement may occur upon dewatering. Installation of the final cover prior to the completion of the majority of the expected settlement would likely lead to a major repair or even total reconstruction. The anticipated minimum period of stabilization is approximately three years. The settlement/stabilization period is related to the leachate removal rate and any surcharge loading (additional weight, e.g., soil) that would be placed on top of the existing covers. The second factor related to duration of the stabilization period is the time required to recover, treat, and discharge the stored leachate in the landfills in an economically practical approach.

To implement the selected interim remedial action, the following strategy has been developed. The Navy would temporarily vacate 68 housing units adjacent to Landfill 7 during the anticipated five-year stabilization and construction period. After the final cover is constructed, those 68 units would again be used for military housing. The new storm drain system would be installed as one

of the first construction tasks. Construction of the storm drain system could require most of a single construction season. Construction of leachate collection and treatment facilities could occur during that same time.

Prior to the plugging and re-routing of the existing storm sewer, the Army will continue a regular sewer outfall monitoring program consisting of sampling the influent and effluent of the storm drain underlying Landfills 6 and 7. Temporary parameters and monitoring frequency shall be as outlined in the 14 November, 1996 IEPA letter to the Army, regarding: Unmonitored Point Source Discharge to Lake Michigan. The temporary monitoring program will continue until the final monitoring program is identified as part of the NPDES permitting process, which will be initiated by a permit application from the Navy, or until the storm sewer is plugged, whichever occurs first. This Interim Remedial Action is necessary, in part, to eliminate the discharge of leachate, which contributes to the storm sewer outfall, from Landfills 6 and 7. Nonetheless, because the discharge of leachate into the storm sewer is not part of, or a result of, the interim response action, effluent standards and limitations, water quality standards, and associated permitting requirements are not ARARs with respect to the storm sewer outfall. To the extent the storm sewer outfall is out of compliance with any applicable requirements, the Army, in accordance with any independent duty it may have to comply with the Clean Water Act, will take specific steps to achieve compliance in the shortest reasonable period of time consistent with the guidelines and requirements of the Clean Water Act and the Illinois Environmental Protection Act.

Security fencing will be installed around appropriate parts of the remediated areas and remain until completion of the final cover construction. Following completion of construction, only leachate and landfill gas management facilities may be enclosed in security fencing.

Leachate will be discharged to the North Shore Sanitary District (NSSD) sanitary sewer system through the Fort Sheridan sanitary sewer system. Regulations require that the leachate meet established discharge conditions, including maximum concentrations for certain constituents. An on-site leachate pre-treatment system will be required to meet those discharge limits. The discharge rate of treated leachate to the NSSD treatment plant is practically limited to a rate acceptable to NSSD. Based on discussions with NSSD, effluent quality considerations, and not hydraulic loading (i.e, the volume of water discharged), appear to be the most limiting factors that would determine the final negotiated discharge rate. The Navy will not place limits on discharge rate to the Fort Sheridan sanitary sewer collection system.

Leachate storage, treatment and disposal facilities would be in-place prior to the start of leachate extraction. Construction of these facilities is expected to require approximately six months, or less, following permit issuance from NSSD. The leachate treatment plant will be located north of Landfill 7, near the existing entrance gate to the landfill and on the site of the former Fort Sheridan wastewater treatment plant.

It is assumed that the untreated leachate may be, at least at times, characteristically hazardous. Therefore, the piping from the leachate collection points to the on-site leachate treatment system and the leachate treatment system/facility itself will require secondary containment.

Construction of cover improvements for the stabilization period on both landfills will begin as soon as leachate storage/discharge conditions are such that surcharging of the waste through placement of additional cover fill soils will not result in an increased discharge of leachate at existing seeps or the creation of new seeps. Cover improvements will provide a positive slope for efficient surface drainage from the landfill covers to the new storm drainage system.

Waste that may be encountered beyond the boundary defined during design may be consolidated on the landfills. This includes waste located at the northwest corner of Landfill 7, extending into a natural branch of Wells Ravine that was located immediately south of Building 843. Consolidation may provide for a more cost-effective and practical cap on Landfill 7 and storm drain alignment.

The six existing gas vent wells in Landfill 7 will be used as leachate recovery wells for much of the leachate that has accumulated in Landfill 7. The vent wells are 6-inch diameter pipe, which provide an adequate cross section to accommodate a small capacity leachate pump and tubing and continue serving as gas vents. While the existing storm drain underlying Landfill 6 will be converted to a leachate collection system as described below, the efficiency of that system is uncertain and access is limited. Therefore, two to three leachate recovery wells will be installed at Landfill 6. These wells will be constructed to function as combined leachate and landfill gas collection wells, similar to the existing Landfill 7 gas vent wells, after installation of the final cover.

The existing storm drain will also be converted to a leachate collection system component. Upon completion of the new stormwater drainage systems, the existing storm drain under waste in Landfills 6 and 7 will be isolated by plugging the pipes at the upstream ends. After the leachate level is lowered, a terminal manhole, or sump, will be installed at the downstream end of the existing pipe (upstream of the existing outfall) and a leachate pump installed. The pump will discharge to the on-site treatment system. Holes will be drilled into the walls of the storm drain system in Landfills 6 and 7 to provide additional leachate extraction capability to the leachate management system.

The existing storm water energy dissipation structure (i.e., the concrete structure at the storm drain outlet near the Lake Michigan shoreline) will be removed, along with the required upstream piping, to ensure that a subsurface conduit for leachate seepage from the landfill does not remain. The local storm drainage system piping that is located within the landfill waste will either be abandoned in place or incorporated into the leachate collection system.

The third component of the leachate collection system is an interception trench to be located between the Lake Michigan shoreline and the east end of Landfill 7. This interception trench will capture leachate released from the waste and carried toward Lake Michigan by shallow groundwater flow.

After a period of approximately three or four years, the leachate level within the landfills will be lowered to the desired long-term maximum level and the majority of resulting landfill settlement will have occurred. The stabilization period cover improvements, which may include periodic addition of fill and grading to offset landfill settlement, will provide the desired slopes and grading so that the final cap can be constructed without significant additional filling and rough grading.

The final caps will be RCRA caps, except that a modified RCRA cap will be constructed on the east slope of Landfill 7. The RCRA cap will consist of the following layers from the top down:

- vegetated soil top layer (2-ft minimum)
- soil fill layer (1-ft minimum)
- lateral drainage layer (1-ft minimum)
- flexible membrane (40-mil minimum)
- low permeability (not greater than 1×10^{-7} cm/sec) soil barrier layer (2-ft minimum)

The modified RCRA cap will consist of the following layers from the top down:

- vegetated soil top layer (2-ft minimum)
- soil fill layer (2-ft minimum)
- lateral drainage geocomposite (equivalent to 12-inch drainage aggregate)
- flexible membrane (40-mil minimum)
- geocomposite clay liner (GCL)
- low permeability (not greater than 1×10^{-6} cm/sec) soil barrier layer (2-ft minimum)

For construction of the RCRA and modified RCRA caps, standard procedures for construction and quality control testing of compacted clay, geomembrane, and GCL liners will be used. The existing cover soil and temporary cover soils to be placed at the start of construction will be incorporated into the final cap cover to the extent practical to reduce imported soil requirements. Final cover slopes will conform to USEPA guidance and IEPA landfill regulations.

For the RCRA cap, a 1-foot thick layer of aggregate materials (e.g., sand) will be placed above the geomembrane to serve as a drainage layer. A geotextile fabric will be deployed above the drainage layer to serve as a barrier between the drainage layer and the fill soil placed over the drainage layer. Topsoil will be placed as the final layer and conditioned, fertilized, seeded and mulched to prepare for a vegetated cover.

A gas collection and treatment system will not be installed during the stabilization phase because the housing units immediately adjacent to Landfill 7 will be vacated during this period. Air monitoring will be conducted for worker protection and protection of residents living in housing beyond those units that will be vacated. At the time of construction of the final cover, an active landfill gas collection and treatment system will be installed for both landfills. The existing gas vents and new leachate recovery wells will be converted to also serve as active gas collection wells. Additional shallow gas collection wells or short trenches excavated to the top surface of the waste may be required for complete landfill gas control, a determination that will be made during final design.

A blower, or compressor, and gas discharge point will be located near the leachate treatment system north of Landfill 7. The gas header will carry gas to the discharge point. The header pipe will cross under Patten Road to Landfill 7 at the same location as the new storm drain system. Condensate from the gas collection system will be discharged to the on-site leachate collection system for treatment. An enclosed flare with an auxiliary fuel source will be used to treat the landfill gas before discharge. There is an existing 2-inch gas line near the flare point that was previously used to supply gas to the former wastewater treatment plant. However, that gas line has been removed from service and installation of a new gas line will be required.

Lake Michigan shoreline and bluff erosion is occurring in the region in which Fort Sheridan is located. This long-term erosion is of concern for the eastern end of Landfill 7. There is no current imminent threat to Landfill 7 as a result of this erosion. However, protective measures in addition to riprap protection provided in the selected interim remedy may be required. Regular monitoring of erosion of the shoreline and bluffs immediately adjacent to Landfill 7 will be provided as part of the regular Landfill 7 operation and maintenance inspections and the less frequent 5-year evaluations.

Alternative 2B meets the pertinent requirements of the State MSW landfill regulations (35 IAC 811) through installation of a RCRA cap along with leachate and landfill gas controls (i.e., source controls). Compliance with all State MSW landfill regulation requirements, and other requirements, will be determined through the DoD remedial investigation/feasibility study, risk assessment, and decision making process as required by CERCLA.

9.2 Rationale for Selection

After careful consideration of the technical, environmental, institutional, public health, and cost criteria, the selected interim remedial action for the Landfills 6 and 7 is Alternative 2B (containment with leachate collection and treatment, landfill gas collection and treatment, capping with RCRA and modified RCRA cap, and storm water diversion). Implementation of Alternative 2B will provide prompt action to address the unacceptable existing conditions and, based on

analysis of site conditions, alternatives, and available relevant presumptive remedy guidance for municipal solid waste landfills, is anticipated to be consistent with the final remedy.

10.0 STATUTORY DETERMINATIONS

To comply with the requirements of Section 121 of CERCLA, as amended by SARA the selected remedy must satisfy the following statutory requirements:

- Protect human health and the environment;
- Comply with ARARs;
- Be cost effective;
- Utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable; and
- Satisfy the preference for treatment as a principal element, or provide an explanation as to why this preference is not satisfied.

The implementation of Alternative 2B satisfies the requirements of CERCLA, as amended by SARA, as detailed below.

10.1 Overall Protection of Human Health and the Environment

Alternative 2B provides overall protection of human health and the environment relative to the objective of the interim remedial action, which is source control. Containment, including capping and leachate and landfill gas control, is the presumptive remedy for CERCLA MSW landfills, including military MSW landfills. The site geology and other characteristics are well suited to the containment presumptive remedy. Regardless of the presumptive remedy guidance, however, detailed evaluation in the Focused Feasibility Study and Proposed Plan indicates that Alternative 2B will be protective. Alternative 2B provides controls for leachate and landfill gas releases in addition to providing a physical barrier to contain the waste.

10.2 Compliance with ARARs

The selected alternative will comply with federal and state ARARs that are specific to the interim remedial action. A listing of ARARs associated with the selected alternative is found in Tables 10-1 and 10-2. These ARARs, which are discussed below, will be attained.

The selected remedy will comply with pertinent parts of State MSW landfill regulations (35 IAC 807 and 811). In general, 35 IAC 811 requirements are applicable to newly constructed MSW landfills with constructed liner and leachate collection systems. Certain sections are not relevant or appropriate (e.g., leachate recycling standards and minimum leachate storage volume requirements). The selected remedy does not address groundwater releases and will not

Table 10-1. Chemical-Specific ARARs (mg/L) for Surface Water, Landfills 6 and 7

Contaminants	Illinois General Use Water Quality Standards	Secondary Contact on Indigenous Aquatic Life Standards
Ammonia (un-ionized)	---	0.1
Chloride	500	---
Sulfate	500	---
Total Dissolved Solids	1000	1500
Dissolved Iron	1.0	0.5
Total Iron	---	2.0
Manganese (total)	1.0	1.0
Mercury (total)	---	0.0005
Zinc	1.0	1.0
Lead (total)	---	0.1
Boron	1.0	---

-- Not established.
Source: 35 IAC 302

Table 10-2. Action-Specific ARARs

Action	Citation	Comments
Closure in place	40 CFR 264.310, et. seq.	Landfill closure design and cover requirements
	40 CFR 122.26	Pertinent sections of the surface water runoff requirements.
	40 CFR 264.552	Corrective action management units
	35 IAC 807	Requirements for solid waste disposal facilities closed before September, 1992
	35 IAC 810-815	Pertinent sections of the solid and special waste landfill requirements
Generation of hazardous waste	40 CFR 262	Manifesting, transporting, and recordkeeping for generators of hazardous waste
Discharge of treated leachate to a POTW	40 CFR 403.5	Discharge requirements
	35 IAC 307.1101-.1103	Sewer discharge criteria
	35 IAC 309.202	Construction permit requirements for new wastewater source
	35 IAC 310	POTW pretreatment requirements
Air emissions from excavation or active gas collection	Clean Air Act Section 109	National Ambient Air Quality Standards (NAAQS)
	40 CFR Subparts Cc and WWW	Air emissions regulations and standards for municipal solid waste landfills
	29 CFR 1910, 1926	OSHA Worker Exposure Standards
	35 IAC 211-228 (Subchapter C)	Emission standards for stationary sources

necessarily provide compliance with groundwater quality standards. As part of the DoD OU final remedy a comprehensive, long-term groundwater monitoring system will be developed for Landfills 6 and 7 which includes applicable 35 IAC 620 action levels beyond the zone of attenuation. The selected remedy will comply with water quality standards for surface waters by diverting storm drain flow and runoff around the landfills and providing containment of the wastes. Sections of 35 IAC 811 that are generally relevant and appropriate, and therefore ARARs, for Landfills 6 and 7 are:

Surface Water Drainage (811.103),
Closure and Written Closure Plan (811.110),
Post-Closure Maintenance (811.111),
Leachate Treatment and Disposal (811.309),
Landfill Gas Monitoring (811.310),
Landfill Gas Management System (811.311),
Landfill Gas Processing and Disposal System (811.312),
Intermediate Cover (811.313),
Final Covers (811.314),
Plugging and Sealing of Drill Holes (811.316),
Final Slope and Stabilization (811.322),
Corrective Action Measures for MSWLF Units (811.324), and
Selection of Remedy for MSWLFs (811.325).

Groundwater evaluation and monitoring regulations (35 IAC 811.317--320) will be met as part of the final remedy. Requirements related to deed notation in 35 IAC 811.110g are only effective when the property is transferred outside of the government, and not while the property is under government control.

10.3 Cost-Effectiveness-Effectiveness-Effectiveness

The present worth cost estimate for Alternative 2B is only less than 10 percent greater than the lowest cost action alternative (Alternative 2) and is approximately one-half of the estimated minimum cost to implement Alternative 4. Because of extensive experience with the technologies included in Alternative 2B (as well as other capping alternatives), the costs can be estimated with much greater reliability than the costs for Alternative 4.

10.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The preferred alternative is believed to provide the best balance of trade-offs among the alternatives with respect to criteria used to evaluate the remedies.

10.5 Preference for Treatment as a Principal Element

Because of the large volume and heterogeneous distribution of waste at the landfills, treatment as a principle element is not considered practicable at Landfills 6 and 7. Thus, this interim remedy does not satisfy the statutory preference for treatment that reduces toxicity, mobility, or volume as a principle element. However, treatment is a secondary element in that landfill gases and leachate will be treated resulting in destruction of hazardous substances.

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RESPONSIVENESS SUMMARY

Summary of Public Comments

Both written and verbal comments on the Proposed Remedial Action Plan for the Interim Action at Landfills 6 and 7 were received during the public comment period, which extended from August 7 to September 9, 1996. Written comments were submitted by various organizations and individuals. Verbal comments were taken by a court reporter (Sonntag Reporting Service, Ltd.) at the public meeting on August 21, 1996.

All significant comments received have been addressed. The comments and responses are included herein. Similar comments were received from more than one commenter on several topics. In these cases, responses have been provided for the first comment and subsequent similar comments are referenced to the first response. In most cases, the comments have been paraphrased for clarity. Some commenters submitted lengthy text from which the significant comments and/or questions have been abstracted and paraphrased.

Because of the number and complexity of the comments received, a summary of comments by topic has been provided with references to related comment numbers. Comments have been assigned a number indicating the arbitrarily assigned commenter number followed by a sequential number for comments from that commenter.

The primary concerns communicated by the commenters are:

- There are insufficient data as well as an insufficient understanding of the geology/hydrogeology of Landfills 6 and 7 to determine if containment (preferred alternative) can be successful.
- The installation of a RCRA "final cap" does not seem to be appropriate for an interim remedy; if constructed, the expenditure for the cap would bias the final remedy selection.
- How can a decision regarding alternatives be made without analytical testing to characterize the waste?
- The Army had a bias for the selected alternative and did not fairly evaluate the excavation alternative.
- The Army should not excavate the waste because this excavation would result in unnecessary risks to the surrounding community due to the release of air emissions and transportation of the excavated wastes through the surrounding community.

Index of Comments by Topic

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Waste	1-1, 1-18, 1-20, 1-23, 1-32, 2-1A, 8-13, 17-1, 17-3, 17-5, 22-1
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Evaluation of Preferred Alternative:	
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Leachate Management System	1-5, 1-7, 1-9, 1-29, 6-3, 8-7, 8-11, 12-3, 13-3, 17-4, 27-3, 27-4, 28-2, 30-5
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RESPONSES TO COMMENTS
INTERIM ACTION – FORT SHERIDAN LANDFILLS 6 AND 7

LOCAL GOVERNMENT REPRESENTATIVES

1. Cities of Highland Park and Highwood (Mayor Raymond J. Geraci, Highland Park, and Mayor John Sirotti, Highwood)

1-1 . . . given the nature of the historic military activities at Fort Sheridan, the lack of adequate site characterization of Landfills 6 and 7 and the relationship of those landfills to the Ravine and Lake Michigan, the selection of a presumptive remedy such as capping, even on an interim basis, requires assumptions about Landfills 6 and 7 which are unlikely, and for which there has been little effort to validate. Military activities at Fort Sheridan are not comparable to normal industrial, commercial or residential activities.

Response:
Sufficient information is available to determine that Landfills 6 and 7 are sufficiently similar to municipal solid waste (MSW) landfills that implementation of a presumptive remedy is appropriate. The presumptive remedy guidance [U.S. Environmental Protection Agency (USEPA, September 1993)] describes waste in MSW landfills as "usually present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste." As discussed in the Draft Final RI Report (ESE, 1992) as well as the Focused Feasibility Study (FFS) (ESE, July 1996), these are the types of waste contained in Landfills 6 and 7. In addition, leachate sampling was conducted as part of the Phase I Remedial Investigation (RI) and the FFS and the samples were analyzed for a wide range of compounds. These analyses did not detect the presence of any compounds that are not normally found in MSW landfills. Moreover, the concentrations of the compounds observed above detection limits are, in fact, relatively low in comparison to literature values for MSW leachate (Bagchi, 1994; Kreith, 1994; USEPA, September 1980). Furthermore, the guidance document, Application of the CERCLA Municipal Presumptive Remedy to Military Landfills (Interim Guidance) (USEPA, 1996), states that although waste types may differ between MSW and military landfills, these differences do not preclude use of capping as the primary remedy. In fact, an evaluation of 51 military landfills showed that the wastes most frequently deposited at these military landfills were municipal-types of wastes.

The Army wishes to emphasize that it did not rely on the USEPA presumptive remedy approach in selecting a preferred alternative for Landfills 6 and 7. The presumptive remedy approach does not require the completion of a FFS. Even the guidance for military landfills requires only that the presumptive remedy (capping) and the no-action alternative be evaluated in an FFS. Although USEPA's presumptive remedy guidance supports the Army's selection of a capping interim remedy, the Army independently concluded, as supported by the FFS, that capping is the appropriate interim remedy for Landfills 6 and 7. In conclusion, the Army believes that Landfills 6 and 7 are sufficiently similar to municipal solid waste (MSW) landfills that implementation of a presumptive remedy is appropriate.

The Army is aware that the interim remedy addresses only the source (i.e., the waste in Landfills 6 and 7). The Army agrees that the proximity of Lake Michigan and residential areas is important in the selection of the final remedy. Therefore, the Phase II RI currently being conducted for the Department of Defense Operable Unit (DoD OU) will collect

additional data regarding the effect of Landfills 6 and 7 on Lake Michigan as well as the surrounding groundwater.

1-2 The proposal to cap Landfills 6 and 7 as an interim measure was explained at the public meetings as necessitated by the escape of vinyl chloride gas. Specifically, we were advised that the risk factor for this gas is such that interim action must be taken at this time. Surprisingly, however, the Navy has left it to the individual discretion of the residents proximate to Landfills 6 and 7 as to whether they wish to relocate. There seems to be a significant inconsistency between the Army's rush to judgement to install a cap and the Navy's determination with respect to the relocation of the adjacent residents.

Response:
Implementation of an interim remedial action at Landfills 6 and 7 is necessary to address unacceptable releases from the landfill to the environment and to comply with state and federal environmental regulations. Releases of landfill gas and leachate require action. The landfill covers are in poor condition and allow excessive infiltration of surface water resulting in leachate generation. The landfill gas sampling and risk evaluations conducted indicate no immediate risks for the military residents based on existing conditions and a maximum period of 5 years living adjacent to the landfills. Navy personnel currently allocated to the adjacent housing live in these units no more than 5 years. The Navy is relocating residents in preparation for construction, not due to short-term risks.

Although there is no immediate, imminent health threat associated with the escape of vinyl chloride gas, the level of potential risk is such that other factors were weighed into the decision. The other factors identified above, therefore, were also considered in determining the need for this interim remedial action. The combination of potential risks due to landfill gas emissions and other site specific conditions as justification for the interim action has been discussed in detail in numerous public meetings as well as being discussed in the FFS and the Proposed Plan. In conclusion, the Army's decision is not inconsistent with Navy actions and is supported by the Navy. Implementation of an interim remedial action at Landfills 6 and 7 is necessary to address unacceptable releases from the landfill to the environment and comply with state and federal environmental regulations.

1-3 The cost of installing the cap is significant and we have been told that, in all likelihood, the cap to be installed would be an integral part of the final remedy. Given the estimated cost of the interim remedy, we can fully understand why the Army would be unwilling to undo such an expensive interim measure. However, by investing such sums in that interim measure, the ultimate remedy is, in effect, being determined albeit under the guise of an interim solution.

Response:
The Resource Conservation and Recovery Act (RCRA) cap accounts for only about 25 percent of the estimated total present worth cost of the preferred alternative and less than 10 percent of the estimated minimum cost of the excavation alternative. The National Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) Part 300], which must be followed when undertaking any CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) action, requires an interim remedy to be consistent with the expected final remedy. Specifically, the NCP states that interim actions "should not be inconsistent with nor preclude implementation of the expected final remedy." This requirement must be met,

regardless of the cost of the interim action. As the cap is the expected final remedy, the placement of a RCRA cap on the landfills as an interim action would be a component of, and consistent with the expected final remedy. Additionally, the NCP requires that the full range of alternatives be considered during selection of the final remedy.

Inadequate Site/Waste Characterization

1-4 As stated in the FFS, there are only limited data available for Landfills 6 and 7. Use of an interim remedial measure (IRM) should be implemented if there is an adequate understanding of the nature and extent of contamination, as well as the potential off-site pathways for the contaminants.

Response:
Adequate data are available to evaluate, select, and proceed with an interim remedial action at Landfills 6 and 7. USEPA (1991) guidance indicates that where established standards for one or more media are clearly exceeded, the basis for taking remedial action are generally warranted. The limited data referred to in the comment applies only to the characterization of the waste in the landfills. Sufficient data are available from landfill records, Phase I sampling, and sampling conducted for the FFS to determine that Landfills 6 and 7 are similar to MSW landfills. Although the data regarding the wastes in the landfills may be limited, the data available are still adequate to evaluate, select, and proceed with an interim remedial action at Landfills 6 and 7.

Regarding potential off-site pathways, as stated in the response to Comment 1-1 above, the interim remedy addresses only the source (i.e., the waste in Landfills 6 and 7). The Army agrees that the proximity of Lake Michigan and the presence of groundwater in the vicinity of the landfills is important in the selection of the final remedy. Therefore, the Phase II RI currently being conducted will collect additional data regarding the effect of Landfills 6 and 7 on Lake Michigan as well as the surrounding groundwater. This data will be used to determine whether any actions, in addition to capping will be necessary to protect human health and the environment and to bring the landfills into compliance with environmental regulations.

1-5 Why doesn't the capping alternative include a cost for leachate removal under the 100% hazardous waste scenario? There are several instances in the FFS where the cost of excavation was predicated upon a worst case scenario, while the cost of capping was predicated upon a best case analysis. The result, not surprisingly, favors the remedy which was proposed. Cost comparisons under such circumstances are neither valid nor objective.

Response:
In fact, the cost estimates in the FFS assume the worst case scenario for the capping alternatives, and a range from the best-to-worst cases for the excavation alternatives. Cost estimates for the capping alternatives in the FFS reflect that both 100% of the waste and 100% of the leachate would be hazardous waste. The cost estimates include a leachate collection/treatment/discharge system and the RCRA cap which are suitable for hazardous waste conditions.

For the excavation alternative, the cost estimates were based on a range of conditions relative to waste characteristics from best case (special waste) to worst case (land banned hazardous waste). Probabilities of these scenarios were not estimated in the FFS, although it was recognized that the majority of the waste would likely be classified as special waste.

Therefore, the cost of the capping alternatives is predicated upon a worst case scenario while the lowest excavation alternative cost estimate is predicated upon a best case scenario.

Some commenter's state that the Army assumed a worst case waste/disposal volume for the excavation alternative cost estimate. The cost estimates in the FFS were based on an assumed 10-foot average depth of native soil requiring excavation due to contamination in addition to the volume of the waste. Some commenters stated that 10-feet is too large and unjustified. The Army believes that the 10-foot assumption is not unreasonable as explained in the response to Comment 8-6, but to address this concern, the Army has estimated the cost based on an assumed 3-foot average soil excavation depth. The cost estimate for that scenario, assuming entirely special waste, is $29,016,000.

Interim Action versus Final Remedy

1-6 By establishing the containment alternative as an IRM, the need to comply with all applicable and relevant and appropriate requirements (ARARs) is not required as it would be under a Final Remedy as long as the action does not preclude implementation of the final remedy. In addition, since the site still requires characterization, ARARs may not be completely defined, but the IRM can still proceed. As stated in the report, since excavation can only be considered as a Final Remedy, the evaluation of ARARs were far less stringent for a capping alternative then they were for excavation. Normally, this would not be an issue, and IRMs are commonly performed. However, a much better understanding of exposure pathways for these two landfills is necessary to adequately evaluate potential ARARs.

Response:
The FFS is thorough in its identification and discussion of ARARs for the capping and excavation alternatives evaluated. The Army believes that the evaluation of potential ARARs for each alternative evaluated in the FFS is complete because the potential ARARs for capping, excavation, leachate collection and treatment, landfill gas collection, etc. are well defined. Thus, the ARARs evaluation in the FFS for the capping alternative was equally stringent as for the excavation alternative. In addition, the NCP is very clear that any interim action taken must comply with ARARs unless a waiver is invoked. Any waiver from a specific ARAR granted for an interim action only applies between the time the interim action is implemented and the final remedy is implemented. At the time the final remedy is implemented, the ARARs waived for the interim action must be met. As stated in previous responses, the interim action proposed for Landfills 6 and 7 addresses only the source (the landfill wastes only). Any ARARs for any subsequent actions, if such actions are required as part of a final remedy, will be identified at that time and complied with by the Army. Therefore, the Army believes that the ARARs for each of the alternatives evaluated were described in detail in the FFS and will be complied with.

Inadequate Alternative 2B Evaluation

1-7 The selection of Alternative 2B, The Modified RCRA Cap, was made without adequate investigation and evaluation of some performance related aspects of the remedy. . . . The success of capping alternatives depend on removal of leachate. . . . It was implicitly assumed for the purpose of evaluating the potential cost and effectiveness of these alternatives that one or more of the leachate extraction procedures could be implemented and would meet the objective. This assumption is inappropriate because:

- Little is known about leachate levels in the landfills
- Hydraulics of flow between the waste and adjacent groundwater are unknown
- Physical and hydraulic properties of waste are unknown
- Use of soil cover during operations can create compartmentalized and isolated cells of waste

Therefore, the ability to achieve and maintain predetermined leachate level with uniformity throughout the landfill can not be assumed.

Response:
Leachate levels are relatively well defined for Landfills 6 and 7 and information is sufficient to design an adequate leachate collection system. At the time the FFS was completed, leachate levels had been determined at nine locations in Landfill 7 (six gas vent wells and three temporary piezometers) and one location very near Landfill 6 (LF6MW04S). These are in addition to 16 groundwater monitoring wells immediately around the landfills.

In addition, hydraulic conditions related to leachate/ groundwater interactions are relatively well understood. The hydrogeology of the native till soils is discussed extensively in the FFS and in other responses to comments (see Index of Comments by Topic). The hydraulic conductivity of the waste is anticipated to be characteristic of MSW landfill waste which, while variable based primarily on variations in daily cover material usage, can be expected to be significantly larger than the surrounding natural till soils. Schroeder et. al. give a typical value of hydraulic conductivity for MSW of $1x10^{-3}$ cm/sec. Even if the conductivity of these landfills is 1 percent of this typical value, it is still greater than the conductivity of the native till soils. Because Landfill 7 was the primary solid waste landfill at Fort Sheridan, it received a variety of wastes typical of MSW landfills. Additionally, Illinois Environmental Protection Agency (IEPA) inspection reports in the late 1970's identified a deficiency of soil cover as a concern at Landfill 7. The flow characteristics are, therefore, expected to be typical of MSW landfills. The wording of the comments suggests an opinion that there may be some unique aspect to the hydraulics at the interface of the waste with the native soil. The waste/soil interface presents no hydraulic conditions to complicate the understanding of groundwater/leachate flow beyond those normal hydraulic parameters associated with the two media. Water levels are relatively well defined. Therefore, the Army disagrees with the commenter's statement that the hydraulics of flow between the waste and adjacent groundwater are unknown.

Use of clay soils for daily cover can create pockets and perched conditions as the commenter notes. However, when the overall leachate level in the landfill is lowered, the leachate that may be held above a soil lens will seep downward at a rate dependent on the soil layer. As noted above, IEPA inspection reports noted a deficiency in use of cover soils at Landfill 7.

The installation and use of leachate collection systems is standard procedure with landfills, including those that received a variety of waste types. In fact, RCRA regulations require the installation of leachate collection systems for hazardous waste landfills. The Army believes that the proposed system of approximately 8 recovery wells and leakage through the joints of at least 8 manholes and approximately 2200 feet of drainage pipe at the bottom of the waste will effectively collect the leachate. In conclusion, the Army believes that leachate levels are relatively well defined for Landfills 6 and 7 and information is sufficient to design an adequate leachate collection system.

1-8 There is a direct impact on gas control by leachate. Gas extraction and flow can only occur in the unsaturated zone of the waste. The zone of effectiveness or "radius of influence" of gas wells becomes unacceptable and impractically small when the ambient leachate level is high. If leachate levels could not be controlled as planned, the mitigation of toxic gases would also be in jeopardy.

Response:
As demonstrated in the response to Comment 1-7, the leachate levels in Landfills 6 and 7 will be effectively lowered and, thus, any gases generated after installation of the interim remedial action will be effectively captured. The leachate levels will be lowered during the stabilization period such that, with installation of a final cap and active landfill gas collection system, the gas wells should function throughout most, if not all, of their depth. The response to Comment 1-7 addresses the ability to lower the leachate level in the waste. Additional gas collection points will be installed in both landfills near the end of the implementation of the interim action to provide efficient gas collection from all waste areas.

1-9 At a minimum, several leachate extraction test wells should be constructed, operated, and monitored prior to selecting interim remedy 2B to demonstrate that leachate extraction and control is in fact a reasonable expectation.

Response:
As indicated in response to Comment 1-7, the Army believes sufficient information is available to determine a leachate collection system would be effective. Please see the response to Comment 1-7.

Inadequate Alternative 4 Evaluation

1-10 The difficulties of dewatering (leachate management) during waste removal are overstated. Experience has shown that once opened up, free drainage occurs fairly rapidly. The obstacles to extraction of leachate from the in-place refuse . . . . are removed by large-scale exposure of the waste face. The free draining leachate could be collected in temporary ditches and sumps in front of the excavation face.

Response:
Dewatering using the open face method would be no more effective than the in-situ method proposed in response to Comment 1-7 and would present added problems. While the commenter is correct that free drainage may occur along an open face, the rate and extent of this free drainage is controlled by the same characteristics that control extraction of leachate from in-place refuse. These characteristics were pointed out in Comment 1-7 (e.g., low

permeability wastes and isolation by compacted daily cover soils). The Army expects neither free draining conditions nor poor flow conditions regarding the ability to recover leachate to be the exclusive condition encountered within the landfills. It is more likely that either condition may exist in some locations based on the heterogeneity of the waste.

This comment suggests that the best approach to dewatering of the waste is by "large-scale exposure" of the waste face. The Army believes such an excavation approach would result in unacceptable risks to adjacent and nearby residents as well as workers implementing the remedy. Exposing such a large area of waste would be expected to result in odor problems and uncontrolled gas emissions. Also, runoff from a significant storm event may exceed the capacity of the existing drainage system, resulting in surface overflow onto the landfills. Such an overflow may result in uncontrolled sloughing of the exposed waste face, thus increasing the risks of discharge of leachate and even solid materials into Lake Michigan under these conditions. These risks could only be reduced, not eliminated, due to the random nature of storm events and the prolonged period over which the waste face would be exposed. Therefore, the Army believes that dewatering using only the open face method would be no more effective than the in-situ method proposed and would present added problems.

1-11 Additional dewatering before loading would not likely be required. If it were, it could be accomplished by baling. . . This would squeeze out free liquid without extended and odorous air-drying and would reduce the bulk volume . . . . Technology to wrap baled material in plastic is already in common use which would minimize odors and exposure risk between excavation and disposal.

Response:
Baling the excavated wastes would not eliminate the concerns associated with dewatering. Baling would certainly cause a portion of the moisture in the saturated waste to drain during and immediately following the baling operation. Baling, which applies a pressure of up to 300 psi to create bales measuring approximately 3 ft by 4 ft by 5 ft, may cause relatively slow drainage from the interior of the bale due to the trapping of water within the bale during compaction resulting in slow "dripping" from the bales over a longer period of time. Plastic wrapping could not be relied upon to contain leachate or gas emissions from the bales due to punctures and tears. The bales would either have to be stored on site on a draining pad or provisions made to handle the leachate draining from the bales during transport. It is problematic as to whether the material sampled from bales would pass the moisture content test required for disposal in a landfill. Baling, therefore, still results in more than a single handling operation. In addition, storage of the bales prior to transport would result in exposure of the bales for a period of time of at least several days, during which odors, gases, leakage, and vectors (disease carrying organisms) would have to be managed. Baling is used in some municipal solid waste operations and the material baled is new solid waste. The Army is not aware of an application of baling for MSW waste that has degraded for 20 to 40 years in a saturated condition. Thus, baling the excavated wastes does not eliminate the concerns associated with dewatering.

1-12 Odors from open face could be minimized by installing an extraction well system.

Response:
While odors and potential release of toxic gases such as vinyl chloride could be reduced by installing and operating an air control system of some type, they could not be controlled or eliminated by such a system. Landfill gases and other gases potentially produced by volatilization will continue to be generated during the remediation implementation. Gas control would, therefore, be required during excavation and not only prior to the start of excavation. An extraction well system would be inappropriate for gas control during excavation for the following reasons:

1) Such a system would require handling and treatment of large air volumes due to the necessity of placing the vapor extraction wells in close proximity of the open face and the resulting dilution of landfill vapors with ambient air. Removal of materials from the landfill would be dynamic and the extraction wells would need to be moved constantly, a process which would interfere with and slow the excavation process.

2) Assurance of adequate vapor control would require careful placement of gas control well points. This would be extremely difficult due to the changing excavation configuration and the need to constantly change well positions.

3) The large air flow rates resulting from the need to treat much dilution air would require a major air treatment system.

4) Variations in permeability across the landfill due to material heterogenity and moisture content would further complicate well placement and reduce the effectiveness of a gas control system of the type required to control gas and odor emissions.

A realistic control system to control odors would require excavation to be conducted inside an enclosed temporary structure which could be operated with a negative internal pressure to draw in air from outside and exhaust air and landfill vapors through an air treatment system. This option, however, increases the potential for worker exposure, increases the cost significantly and also slows the excavation process since the building would need to be moved periodically and access for transport vehicles would be more restricted.

However, as stated in the response to Comment 1-10, odor is only one concern regarding implementing an open face method. The remaining concerns (e.g., storm events) are such that implementation of the open face method would still result in unacceptable risks if the odors were reduced. Also, since odors would only be reduced and not controlled or eliminated, odor and gas emissions would still occur during an open face excavation.

1-13 Rail transportation of solid waste is currently practiced in several parts of the country. A rail spur already exists onto the Fort Sheridan site.

Response:
The Army's research and experience indicate that rail transportation of the waste from Landfills 6 and 7 would create additional risk over that of truck transportation, is administratively more complicated, and is more costly. The Army is aware that rail transport of solid waste is currently practiced. The site specific conditions, however, have to be

considered. The use of rail transportation would still require the use of trucks to convey the excavated wastes to a transfer station. At the transfer station, the wastes would be transferred from the trucks to the rail cars. Rail transport would also require storing the excavated material on-site for a longer period until a practical volume of material was available for dispatching The additional handling and storage that will occur at the transfer station over direct truck transport provides additional opportunities for leaks, spills, gas emissions, and worker exposure. In order to transport the waste via rail, a rail spur would need to be constructed. The spur would have to either be a new rail spur crossing private property and public roads in Highwood or be a near-total reconstruction and extension of the old rail spur at Fort Sheridan, which is located within the Historic District. In addition, a suitable transfer station would need to be constructed. While rail transport would be a feasible mode of transport once the waste were loaded, the rail spur construction and loading and staging facilities would be very difficult facilities to permit, gain public support for, and operate.

See response to Comment 8-9 regarding cost for rail transport.

1-14 Another aspect not evaluated is the economy of scale that could be realized by combining all the wastes on one of the sites such as Landfill 7, or by moving all the wastes into a new, engineered and properly constructed on-site disposal cell.

Response:
The Army did not evaluate complete consolidation in the FFS because such an alternative would present the same risks as the excavation alternative and the cost savings that might result from a smaller total landfill cap area would not offset the increased costs of excavating and moving the waste. If the wastes were to be consolidated, the waste would still require excavation, resulting in potential risks due to odors and gas emissions as well as the need for dewatering the wastes prior to transport to the consolidation location. The wastes would need to be transported to the consolidation location, thus providing opportunities for spills and increased worker exposure. If Landfill 6 wastes were consolidated on Landfill 7, the overall size of the cap could not be significantly reduced and may actually increase. For example, if the excavated volume from Landfill were 80,000 cy and the average depth of waste placed on/adjacent to Landfill 7 is 10 ft, the area required would be nearly 5 acres, more than the Landfill 6 cap area for the preferred alternative. This is a result of the deep and relatively steep side slopes of the ravine in which the waste was placed relative to maximum above-grade slopes for a landfill cover. In addition, the consolidation of Landfill 6 wastes on Landfill 7 would not only render the site of Landfill 7 unusable for recreational purposes due to the height of the fill but make the site less pleasing aesthetically for the adjacent residents. If the consolidated wastes were to be spread over a larger area to reduce the height, several additional Navy housing units would require removal. Even if the regulatory agencies would approve the construction of an new, engineered on-site disposal system, there is no suitable location on Fort Sheridan that would be of a size to accommodate the volume of waste and underlying affected soil that would be excavated.

1-15 It is incorrectly assumed that moving the waste to a lined landfill does not reduce long-term environmental risk. Moving the wastes from an in-filled ravine with no liner or leachate collection system to a permitted landfill with composite clay/HDPE liners, full blanket leachate collection systems, composite final covers, and groundwater monitoring which makes such

sites fully acceptable for disposal of today's solid waste is obviously a major improvement in the security of the wastes in Landfills 6 and 7 at Fort Sheridan.

Response:
The Army, IEPA, USEPA and the Lake County Health Department believe that containment of the landfills, along with any non-source control measures that may be determined necessary as part of the final remedy, will result in a reliable and protective alternative that meets all requirements, is more cost-effective, and avoids the administrative and environmental disadvantages associated with the implementation of the excavation alternative. Hydraulic conductivity information indicates that the native material is nearly as impermeable as a typical landfill liner, which is in the range of $1x10^{-7}$ cm/sec. A leachate collection system is planned as part of the interim remedial action. As presented in the response to Comment 1-7, this collection system will effectively collect the leachate. The composite cap that will be installed will meet the same RCRA requirements that a permitted landfill would need to meet. Groundwater evaluations and monitoring will also be implemented as part of the final remedial action. Therefore, the Army believes that the long-term effectiveness of the preferred capping remedy is nearly equal to that of an off-site permitted landfill. However, the excavation and transportation that would be necessary for the off-site landfill option would present potential unacceptable short-term risks to human health and the environment which would be difficult to control. Furthermore, removing the wastes to another location does not absolve the Army of its responsibility for the waste. Therefore, the Army believes that containment of the landfills, along with any non-source control measures that may be determined necessary as part of the final remedy, will result in a reliable and protective alternative that meets all requirements, is more cost-effective, and avoids the administrative and environmental disadvantages associated with the implementation of the excavation alternative.

Use of Presumptive Remedy for CERCLA Municipal Landfills

1-16 The landfills have been insufficiently characterized in order to assume a presumptive remedy.

Response:
Please see the response to Comment 1-1.

Previous Investigations

1-17 Is it acceptable procedure that an FFS be done when no site-specific RI has been completed? The scope of the "Phase I RI/RA"..resembles a normal Phase I broad-scoped (entire base) confirmation/quantification investigation. . . Was additional work added in the subsequent phases of the RI/RA to meet the normal requirements of an RI to warrant the designation as a Phase I RI/RA, and has this investigation been completed? Typically an RI includes . . . fate and transport discussions evaluating all pathways for migration .... When, if any, is additional investigation planned and when will results be released for public review/comment?

Response:
Yes, it is acceptable for an FFS for an interim action to be performed prior to completion of a site-specific remedial investigation (RI). The NCP encourages implementation of an interim action at a site early in the investigation process. Interim actions typically address specific,

defined issues at a site, such as source control or "hot spot" removal. These actions typically address sub-units at a site, such as a waste lagoon or drum disposal area. The NCP specifically encourages action prior to, or concurrent with, conducting a remedial investigation/feasibility study (RI/FS) as information sufficient to support remedy selection is obtained. In describing the interim action, the NCP states that data sufficient to support the interim action decision is to be extracted from the on-going RI/FS and an appropriate set of alternatives evaluated.

The commenter is correct in stating that the Phase I RI/RA performed for Fort Sheridan was a broad-scoped confirmation/quantification investigation. Conducting RI's in phases is an accepted approach. The Phase I RI focused on the entire installation. Subsequent to the completion of the Phase I RI, the installation was split into two operable units. Both a Phase II and Phase III RI have been conducted at the Surplus Operable Unit (OU). A Phase II RI is currently being conducted on the Department of Defense OU (DoD OU) which includes collecting additional data regarding the effect of Landfills 6 and 7 on Lake Michigan and the surrounding groundwater. Landfills 6 and 7 were just two of the many study areas investigated during the Phase I RI and subsequent Phase II RI for the DoD OU. The Phase II RI will include site characterization of affected media; identification of potential constituents of concern; and fate and transport discussions regarding each appropriate pathway. Data from the Phase II DoD OU RI is expected to be available for public review and comment in the Summer of 1997.

The Army wishes to restate that it believes sufficient information is currently available to evaluate and select an interim remedial action for Landfills 6 and 7 and that implementing an interim action prior to completion of the DoD OU RI is an acceptable procedure.

Surface Water/Sediments

1-18 Any adverse impacts of long-term leachate discharge can not be evaluated and sufficiently addressed/incorporated into the IRM/Final Remedy without characterizing the waste or leachate, and without sampling the sediment or groundwater/surface water interface beneath the lake bed.

Response:
The evaluation of any adverse impacts of long-term leachate discharge will be evaluated and sufficiently addressed in the final remedy. The Phase II RI currently being conducted will collect additional data regarding the effect of Landfills 6 and 7 on Lake Michigan and the surrounding groundwater. These additional data will include further characterization of the leachate, surface water and sediment in Lake Michigan. The DoD RI will identify the potential baseline risks and will be used to support any necessary additional actions as part of the final remedy. The interim remedy provides source control. See also response to Comment 1-21 regarding the interim remedy leachate collection system.

1-19 Concerns about contamination sources other than Landfills 6 and 7 was given as a reason to not have sampled Lake Michigan sediments to investigate potential impacts of Landfills 6 and 7 or Fort Sheridan. There are technologies which can be used to reduce the uncertainty of off-site influences.

Response:
The Army will collect surface water and sediment samples in Lake Michigan as part of the Phase II DoD OU RI. The Army conducted lake sampling during the Phase II effort on the surplus property. However, because there have been no constituents unique to Landfills 6 and 7 found in any leachate or groundwater sampling at the two landfills so far, it will be difficult to reduce the uncertainty of off-site influences. Therefore, during public meetings, the Army requested input from the public and private sectors in developing an approach for reducing this uncertainty. We appreciate your recommendations provided here. The Army has adopted a similar approach that will be implemented as part of the surface water and sediment sampling in Lake Michigan to be conducted as part of the DoD OU Phase II RI.

1-20 PCBs may be in Landfill 7 per the Phase I RI/RA. Given the persistent nature of PCBs and the health risk associated with exposure, we are at a loss to understand the failure to address this issue.

Response:
Due to the general nature of the materials disposed of in the landfills, PCBs were analyzed for in groundwater and soil samples collected in the vicinity of Landfills 6 and 7. PCBs were also analyzed for in leachate samples. All results were less than detection limits. Thus, there is no supporting evidence that would indicate the presence of PCBs at concentrations exceeding the analytical detection limit.

Depth of Fill

1-21 The bottom elevation of fill is uncertain. What is the deepest elevation? If the waste extends below the base of the ravine at the eastern end, the water table is at, or just below, the base of the waste. This bottom contact will provide a continued migration pathway for contaminants in the waste to impact the groundwater and ultimately discharge to the lake. This groundwater/surface water pathway has not been investigated and should be evaluated before an interim remedial measure is selected.

Response:
The bottom elevation of fill is 580-585 feet NGVD. This elevation corresponds with the elevation of the bottom of the natural Wells Ravine and the storm drain pipe was installed prior to fill placement. The known elevation of the storm drain pipe agrees with the information available regarding the natural Wells Ravine bottom profile. This information is discussed in the FFS.

The maximum depth of waste is expected to be located over the centerline of the natural ravine at a point near the top of the east slope of Landfill 7 and not at the lowest elevation of the waste (i.e., at the outlet of Wells Ravine), as stated by the commenter.

The commenter's statement that, if the waste extends to the end of the ravine and is at an elevation of 585 feet NGVD, then the water table "is at, or just below, the base of the waste" is incorrect. Information in the FFS (Figure 1-7 and Table 1-2) shows that the "water table" (i.e., the phreatic surface) is at 590-592 feet NGVD along the east end of Landfill 7, approximately 20-40 ft upland from the beach. The "water table" also clearly rises very steeply to the west and is within the waste. The commenter's point seems to be that, because

of the existence of this contact with existing "water table" level and waste, this condition will result in a continued migration pathway for constituents to groundwater and the lake. The commenter appears to have misunderstood the groundwater conditions near the eastern end of Landfill 7 and the leachate collection system included in the preferred remedy. A leachate interception trench will be located along the entire eastern end of Landfill 7, near the head of the beach. The trench will be located eastward of waste. An important point is that this entire area is also a groundwater discharge area under existing conditions and also would be a groundwater discharge area under natural conditions (based on conditions near the landfills). A groundwater discharge would occur when the water level within the ravine/landfill waste is at a lower elevation than the surrounding groundwater. This condition will be created by the leachate collection system. Constituents conveyed from the waste with, or influenced by, groundwater flow will be carried along in the upper layers of the groundwater flow zone and be captured in the interception trench. Groundwater data show a substantial upward gradient based on water levels at the beach well pairs (i.e., the water levels from the deep wells are artesian).

As presented above, the Army is certain in its determination that the bottom elevation of the fill is 580-585 feet NGVD.

Groundwater Monitoring System/Potential Off-Site Migration

1-22 The existing groundwater monitoring system is inadequate to monitor deeper flow paths toward the lake . . . the current groundwater monitoring system is inadequate in establishing either the full extent of potential groundwater impacts or in providing any reliable measure of potential adverse impacts to the Lake.

Response:
Upon completion of the Phase II DoD RI, the groundwater monitoring system in the vicinity of Landfills 6 and 7 will be adequate to monitor deeper groundwater as well as establish the extent of potential effects of the landfills on surrounding groundwater and the lake. The interim remedial action is a source control remedy. Because the interim remedy will lower leachate in the landfills, groundwater flow directions in areas currently influenced by the leachate mound will be reversed to flow into the waste/ravine similar to natural conditions. See details in response to Comment 1-21. Additional wells are being installed as part of the DoD OU RI to evaluate potential migration pathways. The Army installed three new monitoring wells at the toe of the east slope of Landfill 7 in October 1996. The deepest of these wells extends to a depth of 106 feet below ground surface (bgs).

Groundwater Sampling Concerns

1-23 Trichloroethane (TCE) and perchloroethene (PCE) were not included in any of the sampling events conducted at the landfills.

Response:
The compounds TCE and PCE were analyzed for in samples collected during the Phase I RI and subsequent sampling events but were not detected above analytical detection limits. The commenter is apparently referring to the fact that TCE and PCE are not shown in Table 1-6, 1-7, 1-8, 1-14 or 1-15 of the FFS. Compounds were included in these tables only if they were

observed above detection limits in any sample collected. TCE and PCE were not detected above their analytical detection levels (<3 and <1.6 µg/L, respectively). A list of organic compounds, including TCE and PCE, analyzed for but not detected in soil or groundwater samples and their respective detection limits is presented in Table 1-9 of the FFS. Therefore, TCE and PCE were analyzed for but not observed above analytical detection limits in any sample collected.

Emission Rates from Gas Vents

1-24 The gas vent emission rates as measured and reported are 14 scfm. This represents approximately 3% of our estimated gas generation, and 18% of ESE's emission estimate. Both of these estimates are in the ball park as EPA estimates gas vents collect 10 to 20% of the total gas emissions from an uncontrolled landfill.

Response:
Comment noted.

Analysis of the Composition of Vent Gas Analysis in ESE

1-25 Review of data in Table 1-16 of the FFS indicates there are many errors in reported data in the table. The data presented in Table 1-16 contains averages from Table 1-17. Data from samples exceeding holding times were used to determine the toxicity level of the gas vents. For an accurate analysis of the health effects on each house, a complex dispersion analysis would have to be performed. This was not done by ESE.

Response:
In response to the comment, data in Table 1-16 have been reviewed and no errors have been identified. As the title and text indicate, Table 1-16 is a summary of gas sampling data from the Phase I RI in 1991 and does not present averages of data presented in Table 1-17 as stated in the comment. Data from the Army sampling completed in 1995 are presented in Table 1-17.

The FFS indicates that holding time exceedances occurred for a number of samples. A more precise description is appropriate, however. USEPA has not established a holding time for the analytical method used. The manufacturer of the equipment used has tested holding times up to 14 days without loss of accuracy, and the holding time referenced is in fact based on that 14 day time. However, spike surrogates were analyzed and surrogate recoveries of these samples ranged from 87 to 112 percent indicating no significant loss of target chemicals. As such, the extended time between collection and analysis of the samples had no significant affect on the results of the study. The USEPA also concurred that use of the data was acceptable given the supporting information.

Regarding the comment on the dispersion analysis, the FFS clearly indicates that the USEPA performed detailed modeling of the various sources of landfill gas emissions (the individual gas vents and emissions through the cap), the distances to receptors, and dispersion.

Analyses of Gas Vents and Comparison to Typical Landfill Gases

1-26 Reduced sulfur compounds were not analyzed in the gas vents. They represent a high health threat. These compounds represent the predominant odor component from the landfills. It is unfortunate that no testing of s&w and reduced sulfur compounds were performed in the gas vent analysis.

The only compounds that were analyzed for health risk are recognized carcinogens.

It is clear that the compound concentrations in Landfill 7 are significantly less than those the EPA typically expects. This could mean that the landfill has digested more quickly than estimated by the emission prediction,or there is a lot of construction debris.

Since this comparison is done in concentration and not by emission rate we, can compare the concentrations and evaluate the landfill from these emissions. However, we have no data on the carbon dioxide, carbon monoxide, sulfur and reduced sulfur compounds. The landfill is continuing to digest, and the lower than expected VOC's could also indicate the slowing down of the digestion processes, which also means that the land odor problem will decrease very slowly, or It could simply mean that there are low levels of solvents and petroleum products in the landfill.

Response:
Both carcinogenic and non-carcinogenic compounds, including hydrogen sulfide were analyzed for in the gas vents and at the perimeter. Also, the low concentrations of volatile organic compounds (VOCs) detected indicate that significant quantities of solvents and petroleum products do not exist in Landfill 7.

USACHPPM analyzed both carcinogenic and non-carcinogenic compounds, including hydrogen sulfide (the most reduced form of sulfur), both in the gas vents and at the landfill perimeter. These data were used to calculate both potential carcinogenic and non-carcinogenic risks (USACHPPM, 1995). Both carcinogens and non-carcinogens were also analyzed for in the air emission sampling conducted during the Phase I RI. Hydrogen sulfide was measured at gas vents and monitoring wells in 1994. The results are reported in Table 1-18 of the FFS. The highest concentration was 8.6 ppmv (11,975 $\mu g/m^3$) in GV-6. Since there is no odor except immediately adjacent to the gas vents, chronic exposure of the residents to unacceptable concentrations of hydrogen sulfide is unlikely.

As presented in Appendix B of the FFS, USEPA focused on a carcinogen, vinyl chloride, in their risk analysis because vinyl chloride is a potent human carcinogen and concentrations that are of concern regarding potential adverse health effects are below the detection limit for air sample analysis.

The commenter is correct in that the Army and USEPA focused on carcinogenic compounds in their risk assessment. These compounds have the lowest concentrations for concern and potentially pose the greatest risk to human health.

The commenter's observation that the digestion process could be slowing down is as predicted based on landfill gas generation modeling results presented in the FFS.

Analysis for carbon dioxide or carbon monoxide may provide additional information on the status of gas production at the landfill (carbon dioxide much more so than carbon monoxide). However, the toxicity of both compounds is usually a concern in enclosed spaces. Elemental or oxidized sulfur are not constituents of landfill gas. As stated above, data are available regarding hydrogen sulfide concentrations. The observation that the VOC concentrations are relatively low, while not providing conclusive information regarding the waste, presents an important indication that significant quantities of solvents and petroleum products do not exist in Landfill 7.

Threshold Limit Value Comparison with Existing Exhausts

1-27 TLV is the level of a compound that health officials believe an adult working person can be exposed to for an 8 hr period. This calculation with corrected averages of the gas vents comes to the same conclusions that ESE came to, when looking only at the ESE gas vent analysis. The vinyl chloride is the largest hazard of the compounds ESE tested for. It appears, however, that the hazards exceed acceptable levels by 2 times, while ESE showed it was barely acceptable. It also appears that the second ranked hazard was benzene with a barely acceptable level of emission. (See Appendix 2, Gas Vent Concentrations - Ranked by Health Risk.)

All analyses should be viewed with consideration of the variability and accuracy of testing methods. The emission rate for vinyl chloride was reported as 81 1 E-6g/m^3 by ESE and 146.6 1E-6g/m^3 by R.E. after eliminating questionable data.

Response:
USEPA has previously stated in response to review of the Phase I RI that comparison of gas constituents to threshold limit values (TLV) is an inappropriate evaluation for non-work place exposure scenarios. Since this approach was used in the Phase I RI and referenced in the FFS, however, the comments regarding the evaluation will be addressed.

The commenter's calculation of the part per million-volume (ppmv) for vinyl chloride is incorrect and, thus, overstates vinyl chloride's exceedance of the threshold limit value (TLV). It is not clear how the commenter arrived at the "ppmv" concentrations provided in the referenced table (Appendix 2 of the comment). It appears that the gas concentration values reported in the Phase I RI and FFS were incorrectly converted from micrograms per cubic meter (μg/m^3). Conversion from μg/m^3 to ppmv requires dividing by the molecular weight of the compound and multiplying by a conversion factor of 0.02447 (assuming standard conditions for pressure and temperature). The correctly calculated conversion values for ppmv are lower than those shown in the commenters Appendix 2 by a factor of approximately 9.16. Comparing the correct ppmv values with TLV shows vinyl chloride levels to be only 0.6% of the vinyl chloride TLV (5 ppmv). The benzene concentration is 0.3% of the TLV. It should also be noted that the values for gas concentrations in the FFS were taken at the gas vents. Exposure to these concentrations must be considered "worst case". Even so, the commenter's calculation of the ppmv for vinyl chloride overstates vinyl chloride's exceedance of the TLV.

Alternative 2.3

1-28 Fugitive emissions -- The EPA estimates that Gas Collection systems are approximately 60 to 85% efficient with an average of 75%. There is no reason to expect that the design of this collection system would be any different than this estimate. Therefore, 25% of the gaseous emissions will be exhausted to the surroundings at ground level. Without a complete analysis of the gases coming from the vents now, as well as dispersion analysis, it is impossible to gauge the exact hazards and odors expected to be faced by the residents.

Response:
The landfill gas collection system will be designed and operated to provide adequate protection of human health considering the proximity of residential areas and proposed unrestricted recreational use. The efficiency of active gas collection system is totally dependent on the extent of the collection system (e.g., extraction point spacing) and the pressures and air flow built into the system. The commenter's reference appears to be USEPA's AP-42, Emissions Factors. The commenter concludes that, given an average efficiency of 75% from AP-42, 25% of the landfill gas will be discharged to the atmosphere around/at the landfills. It should be noted that the landfills on which AP-42 data is based would not generally include a less permeable RCRA cover. With the ability to vary the extraction point spacing, pressures and air flow in the system, a collection system can be designed to maximize efficiency.

As stated in previous responses, landfill gas sampling and air dispersion modeling has been done. As noted in the response to Comment 1-26, gas production at the landfills peaked around 1979 and has since declined. Gas production decreases by a factor of 50% approximately every 15 years. Therefore, sufficient site specific data is currently available to design and operate a gas collection system protective of the nearby residents. For additional assurance, the Army will be required to monitor this system to ensure the safety of recreational users and adjacent residents.

1-29 Collection and treatment of off-gases from the leachate treatment system are not discussed in the FFS. Contaminants will volatilize and escape. However, since flow rates are low, it is reasonable to expect that leachate treatment equipment can be covered, and vented, and this air treated by a thermal oxidizer also.

Response:
Section 3.1.3 of the FFS discusses the collection and treatment of the off-gases from the leachate treatment system. Off-gases from the leachate treatment process(es) will be collected and treated, if necessary, in compliance with ARARs. The details of the treatment system will be provided as part of the system design documents.

Other Pertinent Observations

1-30 In light of the materials purportedly disposed of in Landfill 7, how was the Army able to apply for and receive a sanitary landfill permit? If the landfill received the purported materials which are used to rationalize the interim action, then was the Army's application for a permit to operate Landfill 7 a misrepresentation to the State? Or, if Landfill 7 is correctly characterized as a sanitary landfill, is the list of materials purportedly disposed a

misrepresentation before the public with the effect of negatively portraying the excavation alternative?

Response:
The Army has not, nor has it any intention of, misrepresenting any information to the state or to the public. Until 1980, the only regulations addressing the disposal of solid wastes were sanitary landfill regulations. Landfills 6 and 7 received wastes up until 1979. Therefore, Landfill 7 was able to receive a sanitary landfill permit. Although the term hazardous waste was legally defined when RCRA was promulgated in 1976, the technical definition of the term and the processes by which hazardous wastes were to be regulated were not established until regulations were promulgated by USEPA in 1980. RCRA was enacted, in part, to address the issue addressed in the comment: hazardous wastes disposed of in sanitary landfills. Thus, the Army acted in compliance with landfill regulations in existence at the time and has not misrepresented any information.

1-31 What statistical tests have been used to analyze multimedia data. This question is posed along the lines of Ill. Adm. Code 811.320(e) and Statistical Methods for Groundwater Monitoring (Gibbons, Robert D. John Wiley & Sons, Inc.), but is not limited in consideration to only groundwater data. With respect to the 1995 gas vent sampling data (Table 1-17. Draft Final Focused Feasibility Study), how were those data from August 10-11, 1995 treated in the USACHPPM and USEPA risk assessments?

Response:
A statistical analysis of the analytical data collected as part of the Phase I RI was not performed in the FFS because such an analysis was not necessary in order for the Army to determine the need for implementing the interim remedial action and to evaluate alternatives. As stated in previous responses, the interim remedial action is a source control remedy. As such, only information regarding releases from the landfills are necessary to determine the need for action and to evaluate alternatives. The releases of leachate and vinyl chloride gas are documented and sufficient information regarding the general nature of the waste material are provided in the FFS. Also, please see the response to Comment 1-4. A statistical analysis of the data would not alter the determination that action is necessary to address unacceptable releases to the environment and comply with existing state and federal regulations. A statistical analysis consistent with the references cited will be performed on both Phase I and Phase II data as part of the DoD OU RI.

Details regarding the use of data in the USACHPPM risk assessment can be found in the published report (USACHPPM, 1995). Appendix B of the FFS contains a summary of the USEPA risk assessment.

1-32 The source/genesis of the vinyl chloride has not been adequately investigated. If vinyl chloride is the degradation of DNAPLs, where is the evidence of degradation intermediates? The Agency has stated that adequate investigation of DNAPLs has not occurred. Without understanding this, the proposed hybrid cap may be ineffective because it will not address a problem that is not understood. Has the Army evaluated the possibility of vinyl chloride as the reaction product of polyvinyl chloride well casing materials and light non-aqueous phase liquids (LNAPLs) from suspected sources upgradient of the landfills?

Response:
Sufficient information regarding the wastes in Landfills 6 and 7 is available to design a hybrid cap that will be protective of human health and the environment. It is not necessary to know the source of the vinyl chloride to construct a containment (capping) remedy protective of human health and environment. Previous investigations of landfill leachate have included sampling for chemicals, including chlorinated solvents, which, in high enough concentrations, can enter free phase. Contrary to the implication of the comment, the term DNAPL (dense non-aqueous phase liquid) does not generically refer to chlorinated solvents, which the commenter correctly notes may be the precursors to vinyl chloride. DNAPL specifically refers to a denser than water liquid when it is in the liquid, not dissolved, phase. Some chlorinated solvents are capable of forming DNAPLs; however, the presence of vinyl chloride does not directly imply that DNAPLs are present. None of the Landfill 6 or 7 investigations have shown any evidence of the presence of DNAPLs either in the form of elevated concentrations or widespread detections of potential DNAPL forming chemicals. Examination of Tables 1-6 and 1-7 show minimal detections of compounds that, if present in sufficient concentrations, would be expected to form DNAPLs. The only compounds capable of forming DNAPLs that have been detected in any of the over 50 groundwater or leachate samples collected to date are carbon disulfide, which can be naturally occurring, and the two isomers of 1,2-dichloroethene. Thus, there is no evidence that the presence of vinyl chloride is the result of the degradation of DNAPLs.

Even if DNAPL's were present, that condition does not make capping the landfills "ineffective". The caps would still function as intended. The leachate collection system is capable of capturing DNAPLs, but can not be assumed to capture any DNAPL potentially present. This does not mean that the system would allow release of a DNAPL, but rather, the collection system may not cause limited pockets of potentially present DNAPL to efficiently drain to the collection system. Therefore, the Army believes that sufficient information regarding the wastes in landfills 6 and 7 is available to design a hybrid cap that will be protective of human health and the environment.

It is unlikely that the vinyl chloride detected is the result of a reaction between the polyvinyl chloride (PVC) well casing material and LNAPLs. First, it requires very high concentrations of organics to degrade PVC well casing. Nielson (1991) suggests that concentrations greater 1 percent (100,000 mg/L) are required. Most organic constituents are not soluble in water at these concentrations meaning that an LNAPL would be present. Second, no LNAPLs have been detected and no concentrations of potential LNAPL compounds have been detected that might be indicative of an LNAPL during any of the gas vent sampling. Third, the National Sanitation Foundation has strict guidelines regarding the levels of residual vinyl chloride monomer (RVCM) allowed in PVC pipe and there are no known documented cases of RVCM occurring in groundwater (Nielson, 1991). Fourth, vinyl chloride is an expected constituent in samples collected from MSW landfills. PVC well casing has been used on 50 wells installed at the installation, and vinyl chloride has been detected in only one well (LF6 MW045) to date. Therefore, the presence of vinyl chloride is not the result of LNAPL interaction with the PVC well casings.

See also the response to Comment 1-23 regarding the lack of detections of TCE and PCE.

1-33 The characterization given in the Proposed Plan of the risk assessment by USEPA is incomplete...How applicable is an industrial model to the landfills at issue? What other

models might be appropriate? Were the invalid August 10-11, 1995 USACHPPM data used in the ISCST3 model? What errors are associated with this model's calculations and what are their impacts upon the modeled risks?

Response:
In determining to proceed with implementation of the interim action, the Army has followed the NCP, which requires analysis and evaluation of potential risks to human health and the environment. Although the USEPA's risk analysis for Landfills 6 and 7 was never formally published other than as summarized in the December 7, 1995 memorandum to the Fort Sheridan RAB (included as Appendix B of the FFS), it is not necessary to have a complete risk assessment to evaluate and implement an interim remedial action. The NCP specifically encourages action prior to or concurrent with conducting an RI/FS as information sufficient to support remedy selection is obtained. A complete human health risk assessment for Landfills 6 and 7 will be included as part of the DoD OU RI.

The Industrial Source Complex (ISC) model is recognized by USEPA as the best method for predicting point and non-point dispersion of air emissions from industrial sources. Landfills are considered "industrial" sources by USEPA, in contrast to residential sources such as autos and lawn mowers. USEPA believes that the ISC model is the only model appropriate in this instance. It is conceivable that other models could be applied, but only to supplement the ISC runs.

Please see the response to Comment 1-25 regarding the validity of the USACHPPM data.

The actual calculations were performed mathematically by computer, on a thoroughly checked current version of USEPA software. The Army and USEPA believe that the calculation errors are not significant when compared to the practical limitations of data. Regardless of the mathematics of the model, the estimated potential cancer risks will vary as a linear function of two factors: 1) the measured concentration of toxic substances in the gas vents; and 2) the proportion of landfill gas assumed to be emitted through the landfill cap versus the gas vents.

It is not possible to measure vinyl chloride in ambient air at concentrations that represent a health risk to children. Therefore, the only risk assessment method available is to model the dispersion of the toxic compounds that can be measured. It should also be noted that the actual ambient residential concentrations of vinyl chloride are just as likely to be greater than predicted by the model as they are to be less than predicted.

1-34 The proposed plan is predicated upon the risk to various members of the population. We have difficulty determining precisely the risk which the proposed action is designed to address. Landfill gas generation peaked at least a decade ago. Current conditions present a risk that does not require immediate action, and future conditions will represent a risk that requires even less of an immediate action. What is the risk against which the Interim Remedy is being implemented?

Response:
Please see the response to Comment 1-2.

1-35 In summary, the Cities are concerned that:

1. The data collected is adequate and complete.
2. The conclusions drawn should be reviewed after better data is secured.
3. The magnitude of this remediation work is large enough to justify a careful assessment of all options after securing adequate data.
4. The health hazards to area residents need to be further and carefully evaluated.

Response:
The Army firmly believes that it is in both the Army's and the communities' best interests to take action now with regard to Landfills 6 and 7. This action is necessary to stop the uncontrolled leachate discharge and gas emissions from the landfill as well as to bring the landfills in compliance with current state and federal regulations. As supported by the above responses, sufficient information exists for the Army to determine the need for action and to evaluate options to address the existing regulatory violations and to protect potential adverse effects on human health and the environment posed by the landfills. The Army performed a careful assessment of remedial options and this assessment is documented in the FFS and Proposed Plan. As the Army has repeatedly stated, the interim remedial action is a source control remedy. The potential migration of landfill constituents into the surrounding groundwater and Lake Michigan is of paramount concern to the Army. These migration pathways will be carefully investigated and the data evaluated to determine if additional actions will be required as part of the final remedy for the DoD OU.

2. Lake County Health Department, Mr. Michael F. Kuhn

2-1 From my perspective, remediating in place, according to the proposed design plan, appears to offer the best short term protection of public health and the environment and good long-term effectiveness and permanence.

Response:
Comment noted.

2-1A A perception of the preferred alternative over excavation is that it was based primarily on economics. As a result, it is difficult to convince those questioning the preferred alternative that landfill excavation is not a viable option. . . it is requested that consideration be given to better characterize the contents of the landfills in order to address the issues . . . mentioned.

Response:
The Army's evaluation of the implementability of the excavation alternative identified significant potential problems with the excavation process. The selection of the preferred interim action was, therefore, not based solely on economics. There are eight other criteria under the NCP that are required to be evaluated. These other criteria include compliance with ARARs, overall protection of human health and the environment, long- and short-term effectiveness, and reduction of mobility, toxicity, or volume of the constituents of concern.

Potential problems identified by the Army were also recognized by USEPA, IEPA, and the Lake County Health Department (as outlined in your letter of July 13, 1995) and are, in part, the basis for containment being identified as the presumptive remedy for CERCLA MSW

landfills similar to Landfills 6 and 7. These problems are also the reason that no instances of excavating similar landfills approaching the volume of Landfills 6 and 7 have been identified.

Regarding the comment requesting further characterization of the landfill contents, please see the response to Comments 1-1 and 1-4.

2-2. A unified decision, acceptable to both the community and the Army, is important.

Response:
The Army certainly has a goal of reaching a decision acceptable to the community, if possible and if consistent with the other legal requirements the Army must meet. Accordingly, the Army has attempted to involve the broadest cross-section of the community during the decision making process. It included the federal, state and local regulatory agencies, charged with ensuring public well-being, in every step. It convened local citizen representatives at large in a Restoration Advisory Board (RAB) and provided up-to-date information on the process monthly. It provided relevant information in the Fort Sheridan Administrative Record which is available to the public. The Army also has held other public meetings to gather input and reactions, as well as answer questions. The staff members of the BRAC Environmental office even went door to door to over 150 residents of Highland Park and Highwood to present information to residents, answer questions and obtain feedback.

Through these many contacts and interactions, the Army has been made aware of the wide range of opinions among the many groups and individuals with an interest in the Landfill 6 and 7 decision, all of which, constitute the larger "community." This experience leads to the conclusion that a unified decision from "the community" may not be possible in this case. The NCP defines community as "all interested parties" and it directs that community concerns are but one factor to be assessed on a site-specific basis, while also considering the demands of varying site conditions and legal requirements.

The Army believes it has succeeded in meeting its obligations to discover and assess these concerns, conditions, and needs. However, the Army has other factors to consider and to comply with, as described in CERCLA for comparing the various remedial alternatives. The appropriate use of resources is one of these factors and is a legal requirement. This requirement applies to the CERCLA work at Fort Sheridan, as well as to CERCLA work carried out by the Army at hundreds of other sites in the U.S. with similar concerns as at Ft. Sheridan. The presence of this requirement assures the community around Ft. Sheridan that decisions affecting use of resources at other sites are made according to legal criteria. It also assures the broader "community", the U.S. taxpayers, that the same criteria apply to decisions at Fort Sheridan.

In a situation where most of the selection factors argue equally for either of two options, and local community comments do not identify information or concerns that have not been addressed, then cost of the options is a regulatory factor that can appropriately decide the selection. Such an outcome should meet the needs of the local community and the U.S. taxpayer community to the extent possible. At Fort Sheridan, not only is cost an argument for capping, but more importantly, short term effectiveness for the proposed capping alternative is greater than for the excavation alternative. Thus, after considering all factors, the Army believes the proposed alternative satisfies the legal requirements of CERCLA and addresses local community concerns.

3. The Honorable Cornelius B. Waud, Mayor, City of Lake Forest

3-1 While The City of Lake Forest is in total agreement with its neighboring communities that the subject sites must be cleaned up to protect human health and the environment, we are vehemently opposed to any plan that would transport the waste material off-site by truck. Removal of material by truck and rail are not acceptable alternatives.

Response:
The Army agrees with the cities of Lake Forest, Highwood, and Highland Park that protection of human health and the environment by the interim remedial action is paramount.

The Army believes that removal of the material would be a difficult project to implement, regardless of the mode of transport. That was one factor in the Army's selection of capping the landfills as the preferred alternative. In addition, the Army believes that the potential risks associated with excavation of the waste as well as transportation of the wastes through the community would be unacceptable to human health and the environment.

4. Councilman Pete Koukos, Highland Park

4-1 The Army contracted for a conceptual plan report for closure of Landfill 7 previously (after failure of the existing cap). Excavation was not even considered. Even that earlier report told you that a final cover was not practical.

Response:
The Army's studies have concluded that construction of a cap over Landfills 6 and 7 is practical and protective of human health and the environment. State landfill regulations require that landfills be capped, therefore, to evaluate the integrity and effectiveness of the existing cover on Landfills 6 and 7, the Army completed a conceptual plan study in 1994 and a preliminary design investigation study prior to that. Neither of those studies concluded that a final cover was not practical. The studies concluded that the design of the existing controls, including the landfill cover, storm drainage, and leachate collection systems, included fundamental flaws that resulted in failures of those controls. In addition to the studies conducted pursuant to state regulations, the Army also has an obligation to evaluate the landfills under CERCLA. This evaluation, as presented in the FFS and Proposed Plan, demonstrates that construction of a cap over Landfills 6 and 7 is practical and protective of human health and the environment.

4-2 By failing to remove the landfill, you will have long-term monitoring and maintenance costs, installation costs for a final cap, difficulties in maintaining the slope and the reconstructed ravine, long-term risk potential, continuing degradation of the environment and cost of construction and operation of the leachate treatment facility. Where is the cost-risk-benefit analysis that considers those matters and measures them against excavation factors. What happens when you discover that, in fact, that is not municipal waste but, rather hazardous waste? What will your annual recurring costs be then?

Response:
The FFS provides the documentation of the cost-risk-benefit analysis for the proposed interim action in its evaluation of the nine NCP criteria. The costs for the cap, long-term monitoring, and maintenance are all factored into the evaluation completed and documented in the FFS (except that there is no reconstructed ravine for the capping alternative). In addition, the FFS and the proposed plan discuss the long-term effectiveness of the proposed cap. The implications of the waste and/or leachate being hazardous were considered in the FFS. In fact, in the FFS, the Army evaluated landfill caps that would be protective, even if all the landfill waste is hazardous. Thus, the cost increase associated with the assumption that the waste is hazardous is zero since the preferred alternative assumes hazardous waste. Please also see the response to Comment 1-5.

4-3 I urge the Army to respond in a forthright manner that it will take no further action on selection of an interim remedy until the Army has satisfied the local community that the Army's sampling techniques are adequate, that all information has been provided to the public for review and comment, and that there are no adverse public health or environmental consequences for the remedy selected, and that the Army's decision on this matter is based on sound environmental management and not cost.

Response:
The Army believes that (1) the sampling techniques used to obtain the data on which the decision to proceed with the interim remedial action is based are adequate; (2) the information is regularly presented to the community and available for public review; (3) the proposed interim remedial action is protective of human health and the environment; and (4) the selection of the preferred remedy is based on sound environmental management as reflected by the nine NCP evaluation criteria. The Army has completed sampling under a stringent quality control plan approved by the IEPA and the USEPA and sampling procedures and results are audited by these agencies. Relevant information collected during the Phase I RI and subsequent sampling events is provided in the Fort Sheridan Administrative Record, as required by law. As part of the Installation Restoration Program, the Army meets with and receives input from a Restoration Advisory Board (RAB) composed of local citizen representatives. The Army regularly provides up-to-date information to the RAB at their monthly meetings and to the community through the publication of the RAB meeting minutes, fact sheets, and press releases.

The Army is responsible for the environmental conditions related to Landfills 6 and 7 for the long-term and has nothing to gain and much to lose by taking short cuts rather than selecting the best long-term solution that meets all environmental requirements. Although cost was considered in the selection of the preferred alternative, evaluation of overall protection of human health and the environment; short- and long-term effectiveness; compliance with ARARs; and reduction of contaminant mobility, toxicity, or volume were also factors that were considered in the Army's selection of the preferred alternative. Therefore, the Army assures the community that its sampling techniques are adequate; the information on which the Army's decision is based is available for public review and comment; the proposed interim remedy is protective of human health and the environment; and the selection of the preferred remedy is based on an evaluation of nine objective criteria as required by the NCP.

5. Metropolitan Water Reclamation District of Greater Chicago, Hugh McMillan

5-1 Capping materials could include biosolids material rather than top soil. Would reduce cost.

Response:
The use of biosolids in the cap will be evaluated during the design phase. Use of biosolids as a substitute, or amendment, for topsoil is a potential approach that could be considered in design. Use of biosolids, if acceptable based on site-specific design considerations, might lower the cost of the capping alternative by avoiding the purchase of the substituted volume of topsoil. Biosolids would need to be shown to be a suitable substitute for topsoil and approved by the IEPA. This may require the substitution in a RCRA landfill cover design being approved by the Illinois Pollution Control Board if the IEPA staff consider the substitution to present a significant variation to the landfill cap requirements.

RESTORATION ADVISORY BOARD (RAB) MEMBERS

6. Chris Adamson, RAB member, Glencoe

6-1 I do not see that we have enough long-term information to consider capping Landfills 6 and 7.

Response:
Please see the responses to Comments 1-1 and 1-4.

6-2 In the next 10 to 50 years, additional compounds will likely be declared unsafe. Will the landfill situation go through another long evaluation period?

Response:
The preferred interim remedial action will be protective of human health and the environment over the life of the remedy. Although the protection standards that will be met by the preferred remedy are those that are contained in existing regulations, the interim remedy, along with the final remedy, will be reviewed for protectiveness every five years. This five-year review is stipulated by the NCP, which the Army is required to follow. Specifically, the NCP states that if hazardous substances remain on site as part of the selected remedial action, the remedial action must be reviewed no less often than every five years [40 CFR 300.430(F)(4)(ii)]. In implementing this requirement, the USEPA anticipated the concern expressed by the commenter as evidenced by the preamble to the NCP. The preamble specifically states that although the protection standards (ARARs) to be met by the selected remedy are "fixed" or "frozen" at the time of the ROD, this "freezing" will not sacrifice protection of human health and the environment because the remedy will be reviewed every five years for protectiveness. New or modified environmental requirements will be considered at the five-year review if there is reason to believe that the remedy is no longer protective of human health and the environment. Through the process required by the NCP, the Army will insure that the preferred interim remedial action will be protective of human health and the environment over the life of the remedy.

6-3 In the future, higher population density associated with development at Fort Sheridan will put greater impact on the water table and runoff situation.

Response:
The leachate collection system and storm water drainage system improvements are adequately designed to handle expected changes in the water table and runoff situations. The geology of Fort Sheridan does not provide an aquifer adequate for a water supply. Increased development would be expected to decrease groundwater recharge and increase runoff as a result of increased impervious area and associated drainage improvements. Thus, the amount of groundwater available to infiltrate the landfill and create leachate will actually decrease.

With regard to stormwater runoff, the hydraulic requirements applicable to the preferred alternative are more stringent than normally applied to other types of development. The storm sewer system would be designed to safely convey a 100-year storm event without damage to the landfill facilities (cap, etc.). This capacity should be adequate to support drainage of the area around the landfills, even if there is increased development. Therefore, the Army believes that the leachate collection system and storm water drainage system improvements are adequately designed to handle changes in the water table and runoff.

6-4 Suggest wider buffer zone between landfill and any building (e.g., 200 ft).

Response:
The proposed interim remedial action has been designed to be protective of the existing housing units. The alternatives evaluated included continued residential use of the areas immediately adjacent to the landfills. The Navy has requested that the landfills be capped in a manner that will leave the landfill surfaces available as open space with public access (i.e., not fenced). The preferred alternative will provide for monitoring to ensure that the constructed leachate and gas control systems function as designed and that any damage to the facilities or to the landfill are repaired. Because the Navy's existing housing is slab on grade construction (which minimizes opportunities for gases from the landfills to migrate into the houses), the Army agrees that if future construction around the landfill would include basements, buffer zones may be required.

7. Dr. Wolfgang-Martin Boerner, RAB member, Northbrook

7-1 Not convinced at all that satisfactory measures have been taken to assess the leachate emanating from Landfills 6 and 7 — from the lake-surface way down to the bottom of aquifer interconnecting drain channels of the shore-side lakebed, extending most likely several kilometers into the lake and below the depth of about 100 meters.

Response:
The leachate collection system component of the interim remedial action will effectively capture the leachate that is currently discharging directly to the surface and to Lake Michigan. The potential migration of leachate into the surrounding groundwater will be evaluated in the DoD OU RI. The interim actions being taken by the Army are source control measures directed at controlling the source but not addressing constituents that have migrated beyond the waste. The measures included in the preferred alternative, leachate collection and capping, have been shown to be

effective source controls for the specific problems to which they are addressed for MSW and hazardous waste landfills. There is no information, from either regional geologic investigations or Fort Sheridan geologic investigations, suggesting that "drainage channels", either shallow or deep, exist in the till deposits overlying bedrock. The fact that high levels of leachate exist in Landfills 6 and 7, resulting in surficial seeps along the edges of Landfill 7, indicates that the hydraulic discharge routes from the landfills are very limited.

The Army recognizes that the investigations and information available do not prove that higher flow channels do not exist underlying the landfills. However, the preponderance of the information, including both local and regional geologic and hydrologic, indicates that such channels, even if they exist at depth, are not receiving any significant flow of leachate from Landfills 6 and 7. The additional studies to be completed as part of the DOD OU RI/FS will evaluate these potential migration pathways from the landfills to the lake and identify if additional actions are necessary.

7-2 No test results nor adequate geological, marine-floral (lake bottom vegetation), marine-fauna (crustaceans such as crayfish and zebra muscles, plankton and algae), lakeshore limnological assessment studies were made in spite of various requests raised by BRAC E'RAB members during the Fort Sheridan BRAC E'RAB meetings. Precisely this kind of study must be carried out by the US Army before any decisions on either capping or excavating Landfills 6 and 7 can be made.

Response:
Please refer to the response to Comment 1-19. In addition to the sampling proposed in the response to Comment 1-19, the DoD OU RI will evaluate the potential risks to aquatic flora and fauna through limited near-shore sampling of surface water, sediment, and groundwater, as well as through conducting bioassay tests.

7-3 The entire issue of National Military BRAC Environmental Restoration and Hazard Remediation efforts is much too serious and of such long-term importance that it cannot remain a local issue! We need to get our foremost National Military R&D Laboratories and T&E Centers involved...Conduct another Environmental Assessment...far into the lake...of the extensive mortar and anti-aircraft shelling exercises...employing more advanced sensing and imaging technology currently being developed...

Response:
The Army agrees that the new investigation technologies being developed in the military should be considered when developing sampling plans for Fort Sheridan. However, the Army must take into account that many of the researchers developing these technologies have very specific requirements that must be met before they are willing to commit to the application of their technologies. Due to limited available funding, many of these researchers require that the technology demonstration sites meet optimal conditions. We are very appreciative of your efforts in putting us in contact with the ordnance detection researchers at the Naval Surface Warfare Center, Panama City, Florida. As you are aware, the recent presentation to the Army by yourself and Dr. Gough may result in the application of one of the Navy's innovative technologies using Synthetic Aperture Sonar (SAS) to locate unexploded ordnance (UXO) in Lake Michigan. The Army is currently discussing the potential application of this technology

at Fort Sheridan with the Navy research laboratory. The Army agrees that innovative investigation technologies may not only benefit our local environmental investigations at Fort Sheridan, but may also play a broader role in advancing technologies that may have application nationwide.

8. Ms. Carol Dorge, RAB member, Lake Bluff

8-1 The public meeting was a public relations ploy, not a true public meeting.

Response:
The format of the public meeting was most suitable to allow interested parties to discuss the many aspects and details of the alternatives with representatives from the Army, Navy, IEPA, USEPA, and the Army's consultant. The more than 65 community members who attended the meeting were able to discuss in detail both their individual concerns and other attendee's questions and comments. The Army and other agencies commonly use this same format for other CERCLA projects. The Army received favorable comments regarding the meeting format from several parties (see Comment 21-1). As is almost always true with any action, there are advantages and disadvantages to different approaches and the Army selected what it believed to be most appropriate. The Army's intent was to encourage understanding and discussion by community members and not to limit or influence input from the community. The lengthy and detailed comments and responses to the 31 commenters indicates the Army's intention to receive and consider community input.

8-2 The Army has not given fair consideration to the feasibility or cost effectiveness of an excavation remedy . . . the Army's remedy is inconsistent with the National Contingency Plan, and the analysis that went into its selection was deficient. It is also not appropriate as an interim remedy with the meaning of the applicable regulations.

Response:
The Army has followed the NCP in completion of the FFS, the Proposed Plan, and other activities associated with evaluation of interim actions at Landfills 6 and 7. In doing so, the Army gave fair consideration to both the feasibility and cost effectiveness of each of the alternatives evaluated through evaluation of the nine criteria required by the NCP. While the NCP does not provide a precise definition of an interim action, it does discuss interim actions in terms of being discrete actions that comprise incremental steps toward a final remedy. Interim actions can be as broad as a geographical portion of a site (e.g., the northwest quadrant) or as narrow as a specific site problem (e.g., a drum disposal area or landfill). Therefore, the Army believes that implementation of an interim action for Landfills 6 and 7 is appropriate and fully consistent with the NCP's definition.

8-3 . . . this is not a typical municipal solid waste landfill due to its ravine setting and proximity to Lake Michigan. The Army's garbage should be removed and Wells Ravine restored to its natural beauty.

Response:
It is the Army's priority to protect and preserve Lake Michigan as a valued natural resource and as a drinking water source. However, for the various reasons discussed in responses to

Comments 1-10, 1-13, 1-15 and 8-13, the Army does not concur that removal of the waste is the best means of protecting Lake Michigan. Through the use of proven control methods/technologies and regular maintenance, the landfill cap and other containment components will be protective of Lake Michigan and will be protected from Lake Michigan bluff recession.

Many MSW landfills nationwide operated during the same time period as Landfills 6 and 7. These landfills were not constructed according to current landfill standards and were located in places such as floodplains and natural ravines where tracts of "unproductive" land were cheaply available and the need for excavation was minimal, much like Landfills 6 and 7. The majority of these landfills are capped. There is nothing unique to Landfills 6 and 7 that would preclude the effectiveness of a cap and thus compromise the ability of the preferred interim remedy to adequately protect human health and the environment. The Army is not aware of any engineering, natural resource, or other restrictions or considerations that would automatically make an existing closed landfill site bordering Lake Michigan an atypical landfill for which a properly designed, installed and monitored cap would not be effective.

8-4 The Army. . . downplays the fact that its selected remedy - the RCRA cap - would require the importation of over 100,000 cubic yards of soil by truck, roughly equivalent to a truck every 15 minutes during working hours for a full year. An excavation remedy need not require the use of trucks for hauling the waste, at all, if rail or barges were used to transport the materials. In fact, in light of the volume of material in question one would almost think that shipment by rail or barge would be considered, first, as the transport mechanism most likely to be cost effective.

Response:
The FFS does discuss the potential risks associated with the need to truck in cover material for the capping alternative. The need to import cover soil for capping alternatives was identified in Section 4.2.2.2.5. However, the potential adverse effects associated with trucking waste material are greater due to the potential toxicity of the waste and the potential for leaking during transport as well as a release in the event of an accident. In addition, the volume of the waste is probably three times, or more, than that of the cover material. Thus, the effect of waste transport on local health and safety and traffic patterns is much greater than for the cover material. Several commenters expressed concerns and/or opposition to the transport of waste, by either truck or rail (see Comments 3-1 and 25-1).

Please see the responses to Comments 1-13 and 8-9 regarding transport by other modes.

8-5 The cost estimate for excavation has been manufactured using unreasonable assumptions. There is absolutely no information suggesting that a large fraction of the waste would be hazardous waste . . . as the Army lets this garbage sit year after year, it is being flushed by rain water conveniently leaching. . . hazardous constituents. . . It is reasonable to assume that most or all of the material could be handled as special waste, not hazardous waste, at minimal cost.

Response:
The Army has consistently stated that it does not believe the majority of the waste would prove to be hazardous if tested. Since the data available regarding the waste characteristics are

inconclusive, the Army thought it only appropriate to estimate the cost range for the possibilities, without implying the probability of any one assumed scenario. For evaluation purposes related to cost, one has only to consider the lower end of the cost range for excavation, which is still much greater than the estimated cost for capping, even if hazardous waste is assumed for the capping alternative.

The Army agrees that leaching into Lake Michigan has occurred in the landfills via the storm drain and continues to occur. That is one reason the Army wants to take interim action now rather than waiting for the completion of additional studies.

8-6 The volume estimates for excavation are inflated . . . It's trumped up volumetric figure includes an assumption that 10 feet of clay underlying the ravine will have to be removed with absolutely nothing in the record suggesting that this will be required.

Response:
The volume estimates presented in the FFS were based on the Army's primary concern to protect human health and the environment. Costs were presented in the FFS assuming that an average of 10 ft of soil underlying the waste requires excavation. The Army used the 10-foot average depth assumption so that Alternative 4 would be adequately protective. For evaluation of alternatives, cost is one CERCLA criterion, but cost is subordinate to both protection of human health and the environment and compliance with ARARs.

The geology in which the landfills are located is a relatively low permeability clay material with isolated lenses of silts, sand and gravel. The upper 3 to 5 feet of the soil was naturally altered before the ravine was filled with wastes by weathering, including freezing, and biological activity, including root growth and animal burrowing. The occasional sand and silt seams will convey constituents throughout the extent of these isolated lenses which may be several feet into the side walls of the ravine. The native soils are relatively impermeable, however, it would be very difficult to ensure removal of any contaminated soils around these isolated lenses without removing some clean soil that may be between the more deeply impacted points. The Army believes the assumption of excavating an average of 10 feet is sufficient to account for the original altered soil horizon of the ravine and potential confined migration into occasional sand and silt seams. See also response to Comment 1-5 regarding cost estimates for excavating 3 feet of underlying soils.

8-7 If 10 ft of clay is contaminated, it should be cause for concern. Suggests that there will be further migration.

Response:
The excavation alternative assumption in the FFS for removal of an average of 10 feet of underlying soils does not necessarily suggest further migration. The geology in which the landfills are located is a relatively low permeability clay material with isolated lenses of silts, sand and gravel. Because of the relative impermeability of the native clays, any contamination migration is likely restricted to these isolated sand/gravel lenses. In addition, clayey soils normally provide attenuation (decrease in contaminant mass transported with distance from the source) of constituents due to adsorption and cation exchange. The reasons for the 10-ft average depth assumption are provided in the response to Comment 8-6.

Potential migration of leachate into the underlying soils and groundwater is a central issue for Landfills 6 and 7 and has been considered. The interim action would implement a source control through containment, including leachate level reduction resulting in shallow groundwater gradients into the ravine and into the leachate collection system, rather than away from the ravine. Any migration of constituents that has occurred that requires remediation will be addressed by the final remedy (as it would also for the excavation alternative) through either additional excavation or other means.

8-8 The Army has proven to me that they do not know how or where to install monitoring wells. They have wells at the beach monitoring what is, for all practical purposes, clean "lake water" which interfaces with shallow groundwater along the beach, and wells along the bluff at the north end of the fort which do not appear to be along the expected path of groundwater flow which should be toward another ravine in that area. (According to the Army's consultants the groundwater previously flowed into the ravine, but now bounces off the refuse in the ravine and flows toward the lake. This seems to be an absurd notion given the likely porosity of the refuse.) Another prime example of the Army's improper placement of monitoring wells was a ridiculous attempt to monitor migration from a sump in the northwest corner of the fort by placing one well 500 feet northwest of the sump and another 500 feet southwest, not knowing which way the groundwater was flowing. Standard practice is to begin looking for any such migration in the vicinity of the sump itself.

Response:
The groundwater monitoring system that will be in place in the vicinity of Landfills 6 and 7 at the completion of the DoD OU RI will be adequate to monitor deeper groundwater as well as establish the extent of potential effects of the landfills on surrounding groundwater and the lake.

The relevance/point of this comment in regard to the FFS at Landfills 6 and 7 is not clear. However, in general, the Army would like to state that during the course of its environmental investigations the Army has installed over 70 wells at Fort Sheridan. These wells have been installed at various locations, and the purpose behind the installation of each of the wells is as varied as their locations. The beach wells to which the commenter refers were constructed with their screens located at the gradational interface between the beach sand deposits and the underlying clay till (approximately 8 to 10 feet-below beach level). These wells perform a dual purpose: 1) to monitor the groundwater quality at the point the groundwater discharges to Lake Michigan; and 2) to provide potentiometric data from the shallowest part of the saturated interval as part of a nested pair of wells at each location. The data from the nested pair of wells at each location facilitates evaluation of the complex groundwater flow regime along the lakeshore. Based on the Army's evaluation of the data collected to date, the beach wells appear to be performing their function as designed.

The Army believes that the groundwater monitoring system that will be in place in the vicinity of Landfills 6 and 7 at the completion of the DoD OU RI will be adequate to monitor deeper groundwater as well as establish the extent of potential effects of the landfills on surrounding groundwater and the lake. Regarding the wells along the bluff, it is unclear exactly which monitoring wells are being referred to in this statement. It is assumed that the bluff monitoring wells referred to are not related to Landfill 6 or 7. However, it is common practice to install monitoring wells at locations that are known or suspected to be either up-

or sidegradient to a potential source of constituents of concern to facilitate evaluation of the potentiometric and groundwater quality data from the study area.

It is assumed that the comment regarding groundwater "bouncing off the refuse" applies to Landfills 6 and 7. Groundwater flow direction is not controlled by porosity, as implied by the commenter, but by hydraulic pressure gradients. Under the natural Wells Ravine condition, the shallow groundwater flow direction in the vicinity of the ravine would have had a directional component toward the ravine as a result of the topography (ravine) providing a seepage discharge route from the water table, similar to other existing ravines at Fort Sheridan. For the existing condition, the groundwater/leachate level is higher within Landfill 7 waste (as evidenced by leachate levels in 6 gas vents) than in the native soils surrounding Landfill 7, as indicated by Figure 1-7 in the FFS. The resulting water table configuration creates a depression, or "trough", along the sides of Landfill 7. Discharge of groundwater concentrated at these troughs is expected to be primarily by seepage to the storm drain system and by evapotranspiration, rather than to Lake Michigan via the native till soils, as evidenced by the lack of a water table gradient toward Lake Michigan displayed by Figure 1-7.

The two monitoring wells installed on the north end of the installation related to the sump were installed to assess the potential for mission related constituents originating on the DoD Operable Unit (OU) to migrate onto the Surplus OU, not, as the commenter incorrectly states, to evaluate the sump as a source of potential constituents. The sump itself is located on the DoD OU and consequently was not evaluated as part of the Surplus OU Phase II RI. It is precisely because the direction of groundwater flow could not be determined with certainty that these wells were installed at their selected locations, which, the commenter has incorrectly stated are 500 feet northwest and southwest of the former sump location.

8-9 Assumed cost of excavation at "$50 per cubic yard" seems high; should be on order of $25/cy. Barge/rail would be less and unit cost would be less for larger volume. With adjustments, cost might be near capping in place.

Response:
Costs used for excavation, transport, and disposal of special wastes are representative of the best case and could be higher based on complications during excavation or disposal in a landfill more than approximately 20 to 30 miles from Fort Sheridan. The commenter's cost estimate appears to only include the disposal fee, which for special waste is typically on the order of $25/cy, but might be as low as $20/cy for a special, large volume situation.

There are additional transport costs for disposal in a special waste landfill in the region which are estimated to be approximately $15/cy, or approximately $225/truck load. This cost is representative of a one-way transport distance of approximately 20 miles. This estimate was based on information from discussions with Waste Management and remediation companies and cost estimating guides (Means, 1995; ECHOS, 1995). Longer haul distances and/or hazardous materials would increase this cost.

Costs for rail transport of the waste would not be competitive with trucking for destinations within several hundred miles of the site. Even without consideration of costs associated with construction of a required new rail spur and the additional handling operations, rail transport costs alone would be approximately $30 to $40/cy (Union Pacific Railroad, personnel communication; ECHOS, 1995).

Finally, there are additional costs for waste excavation which are estimated to be $10/cy with consideration of the constraints on excavation activities presented by the need to minimize excavation area to control leachate, odor, and gas and by worker safety requirements. It should be recognized that excavation of a landfill is significantly different than excavation of soil for a construction project. Health and safety concerns, regulatory requirements, analytical testing, dewatering and leachate management issues, contractor risk, and odor control will result in greater costs.

Therefore, the excavation costs of $50 per cubic yard of special waste are appropriate and include the costs of excavation, transport by truck, as well as waste disposal costs.

8-10 . . . gas emissions are clearly a concern although this concern has never stopped the United States Environmental Protection Agency from selecting excavation alternatives at other truly hazardous sites. I would like to know whether some sort of vapor extraction could be performed before excavation commenced, minimizing the releases during excavation. I would also like to know whether the dewatering process, which will be required before excavation, could include treatment of these vapors. . . If the Army's remedy is selected. . . a continuous stream of vapors will be produced. . . the vapor extraction systems typically used to control these vapors. . . . are only partially effective, perhaps on the order of 50%. The Army is trying to scare the public with gas emissions scenarios. Gas extraction might be used.

Response:
While odors and potential toxic gases such as vinyl chloride could be reduced by installing and operating an air control system of some type, they could not be controlled or eliminated by such a system. Landfill gases and other gases potentially produced by volatilization will continue to be generated during the remediation implementation. Gas control would, therefore, be required during excavation and not only prior to the start of excavation. This technology would be inappropriate for gas control during excavation for the following reasons:

1) Such a system would require handling and treatment of large air volumes due to the necessity of placing the vapor extraction wells in close proximity of the open face and the resulting dilution of landfill vapors with ambient air. Removal of materials from the landfill would be dynamic and the extraction wells would need to be moved constantly, a process which would interfere with and slow the excavation process.

2) Assurance of adequate vapor control would require careful placement of gas control well points. This would be extremely difficult due to the changing excavation configuration and the need to constantly change well positions.

3) The large air flow rates resulting from the need to treat much dilution air for such a system to be effective would require a major air treatment system.

4) Variations in permeability across the landfill due to material heterogenity and moisture content would further complicate well placement and reduce the effectiveness of a gas control system of the type required to control gas and odor emissions.

A realistic control system to control odors would require excavation to be conducted inside an enclosed temporary structure which could be operated with a negative internal pressure to

draw in air from outside and exhaust air and landfill vapors through an air treatment system. This option, however, increases the potential for worker exposure, increases the cost significantly and also slows the excavation process since the building would need to be moved periodically and access for transport vehicles would be more restricted.

However, as stated in the response to Comment 1-10, odor is only one concern regarding implementing an open face method. The remaining concerns (e.g., storm events) are such that implementation of the open face method would still result in unacceptable risks if the odors were reduced. Also, since odors would only be reduced and not controlled or eliminated, odor and gas emissions would still occur during an open face excavation.

8-11 The design of the groundwater extraction system is clearly inadequate and the system will probably be running forever. I suspect the groundwater extraction system associated with the cap could very well end up pumping "clean" groundwater that is coming in laterally, and not necessarily capture pockets of truly contaminated groundwater. This contamination may not be detected by monitoring wells. One way to manage groundwater movement into the landfill from areas outside the landfill is by installing a slurry wall and then designing an appropriate groundwater extraction system. This would be costly, driving the cost of the cap up substantially. I imagine the whole system, properly designed, could easily cost more than the low end excavation remedy.

Response:
There is no groundwater extraction system included in the proposed interim remedy. It is assumed that the commenter is referring to the leachate collection system. The commenter does not indicate why she believes the planned "groundwater" extraction system is clearly inadequate. The system is not yet "designed"; however, the concept is based on collection of leachate while minimizing collection of clean groundwater. The collection system includes the storm drain underlying the wastes, recovery wells, and the interception trench along the beach. If any one of these three separate leachate collection components were found through monitoring to consistently produce only clean water, use of that component of the system could end. It is unclear why the commenter believes that groundwater would so freely flow to the collection system while the leachate in the waste would not. The waste has significantly higher hydraulic conductivity than the native soil (see response to Comment 1-7). There certainly may be pockets of leachate within the landfill that do not move as readily as the majority of the leachate due to heterogeneity of the fill material. However, any "trapped" volume would eventually drain downward after the leachate level surrounding it is lowered. Leachate collection systems designed for all current state of the art MSW and hazardous waste landfills function under this same assumption that leachate will flow through the waste to the collection system.

The commenter also suggests that groundwater inflow into the waste would be substantial, making it beneficial to construct a slurry wall to reduce the volume of leachate that requires removal. The substantial amount of available information indicates that groundwater flow into the waste would be small. The groundwater classification information for Fort Sheridan indicates that the natural formation, down to an elevation below the base of the ravines, has a hydraulic conductivity too low to allow the formation to be useful as a groundwater supply. Hydraulic conductivity information indicates that the native soil has approximately the same permeability as typical well designed bentonite slurry walls, which are in the range of $1x10^{-6}$ to $1x10^{-8}$ cm/sec (USEPA, 1985). Additionally, none of the other natural ravines near the

landfills have been observed to discharge high base flows resulting from groundwater discharges to the ravines. Therefore, there appears to be no reason to suspect that construction of a slurry wall, or other means of limiting lateral groundwater inflow to the waste, would be significantly beneficial in reducing the amount of groundwater recovered and treated.

See also responses to Comments 1-7 and 1-9 related to the leachate collection system and Comment 27-3 related to groundwater inflow control.

8-12 Monitoring is not "common" to all alternatives. Far more extensive monitoring should be associated with the Army's RCRA cap that with an excavation remedy.

Response:
Although the duration and cost of monitoring would not be the same for the capping alternatives and the excavation alternative, monitoring is a component of each of these alternatives. The cost estimates for "long-term monitoring" reflect that. For the excavation alternative, the monitoring cost is assumed to be $36,000 per year for six years following excavation. For the capping alternatives, the monitoring cost is based on $36,000 per year for 26 years following capping. The monitoring cost for the stabilization phase was assumed to be $72,000 per year for all alternatives.

8-13 Action is not "interim". A truly sensible interim remedy would be to begin the dewatering which is required whether the cap is installed or the waste is excavated, and possibly vapor extraction, and to address the stormwater outfall which is discharging leachate into Lake Michigan . . . While this is being done, more careful consideration could be given to whether excavation and elimination of the problem once and for all is feasible.

Response:
In determining to proceed with implementation of the interim action, the Army has followed the CERCLA process as outlined in the NCP. The NCP encourages implementation of an interim action at a site early in the investigation process. Interim actions typically address specific, defined issues at a site, such as source control or "hot spot" removal. These actions typically address sub-units at a site, such as a waste lagoon, drum disposal area, or a landfill. The NCP specifically encourages action prior to or concurrent with conducting an RI/FS as information sufficient to support remedy selection is obtained. In describing the interim action, the NCP states that data sufficient to support the interim action decision is to be extracted from the on-going RI/FS and an appropriate set of alternatives evaluated. As indicated in the FFS, in the Proposed Plan and in responses to previous comments, enough information is available now regarding the nature of the waste, the geology of the area, and site risks to evaluate interim action alternatives such as capping and excavation in accordance with the CERCLA requirements.

Information relied on includes the fact that Landfills 6 and 7 do not currently comply with state and federal environmental regulations because of the poor condition of the Landfill 7 cap and because of the leachate discharge from the landfills into Lake Michigan. The Army agrees that steps must be taken to bring conditions into compliance with the applicable state and federal regulations and standards. In addition, potential health and environmental risks from long-term exposure to the landfill gas emissions, combined with concerns about the threat for additional unacceptable releases from the landfills, are sufficient to warrant an

interim cleanup action under CERCLA. Including a complete, rather than partial, remedy to the known releases is evidence of the Army's commitment to address the source of the problems associated with these landfills.

Also as stated in previous responses, the interim action addresses only the source, or waste itself. A Phase II RI is currently being conducted on the DoD OU, which includes Landfills 6 and 7, to collect additional data regarding the effect of Landfills 6 and 7 on Lake Michigan and the surrounding groundwater, as well as other issues. This Phase II RI will also include a comprehensive human health and environmental risk assessment evaluating exposure pathways not remediated by the interim action. The Phase II RI/FS will evaluate whether any additional actions, beyond the selected interim remedy, will be necessary to ensure the protection of human health and the environment.

Please note that the risks and liability of the landfills are not eliminated by excavation, they are simply moved elsewhere. Please refer to responses to Comments 1-15, 1-35, 18-2, 27-2, and 29-1 for further discussion on this.

9. William Dytrych, RAB member, Highland Park

9-1 Thus, conditions at present represent a risk that does not require immediate action; conditions in the future will 'not require immediate action' to an even lesser degree.

Response:
Please see the response to Comment 1-2.

9-2 As a less costly action, I propose that the Army install open-grate covers at those storm drain manholes where methane accumulation is an issue and relocate residents from impacted military housing. While the relocation is being carried out, the Army can develop an innovative excavation and reprocessing plan that seeks both BRAC and Federal 'innovative technology' funding.

Response:
The escape of methane gas is only a minor factor in the determination by the Army to proceed with an interim remedial action at Landfills 6 and 7. The determination to proceed with the interim action is mainly based on the poor condition of the existing cover that allows direct contact with leachate and the fact that these landfills are in violation with Illinois Environmental Protection Agency (IEPA) landfill regulations. In addition, the poor condition of the existing covers allows the continued infiltration of water into the landfill, thus creating leachate and increasing the potential for migration of the leachate into the surrounding groundwater and Lake Michigan. Although there is no immediate, short term endangerment to human health associated with the escape of methane and vinyl chloride gas, the other factors identified above necessitate the determination to proceed with the interim action. Uncontrolled leachate discharge from any landfill is not an acceptable condition, regardless of risk assessment evaluations.

As stated in the FFS, USEPA's presumptive remedy guidance for MSW landfills was used in evaluating various alternatives for Landfills 6 and 7. As part of the development of this guidance, USEPA researched many conventional and innovative technologies in determining

how best to deal with MSW landfills. The result of this extensive evaluation is that there are only a few technologies that are feasible to implement in dealing with MSW landfills and that containment (capping) is protective of human health and the environment and the most appropriate technology for implementation.

A proprietary process known as the Neutralysis process (Neutralysis Industries Pty LTD) has been brought to the Army's attention since the FFS was completed. The Army has evaluated this innovative technology for application to Landfill 6 and 7 waste and believes it is not a viable alternative.

Based on marketing information provided to the Army, the Neutralysis process produces a marketable lightweight aggregate by processing the waste through four stages: (1) drying, (2) gasification, (3) oxidation, and (4) vitrification. This process is stated to convert MSW waste into a lightweight aggregate, with clay and sludge being added in the process. Materials with recyclable value are removed from the waste stream prior to these four stages.

The Army understands (personal communication, Mr. John Robison) that the company currently holds a long-term lease on a closed MSW incineration plant in East Chicago, Indiana and intends to convert the facility to Neutralysis facility. At this time construction of the plant has been indefinitely delayed from its previously anticipated 1996 construction date. The plant might be constructed in 1998. The current focus for the East Chicago site is as a separating/recycling facility. The Neutralysis process is moving ahead, however, at a plant located in Green Bay, Wisconsin. There the plant will be co-located with a paper mill in Wisconsin where the mill's paper sludge will produce a uniform, steady materials supply. The construction and permitting cost for the Green Bay plant is expected to be $35 million.

Costs, or "tipping fees", for the Neutralysis process are expected to be similar to landfill tipping fees, or approximately $40-$45/ton (personal communication, John Robison). The Army expects that, if this process could be used for Landfill 6 and 7 waste, a temporary plant could be built and permitted at Fort Sheridan or the excavated wastes transported to the East Chicago facility. Construction and permitting of a processing plant at Fort Sheridan, or development of a mobile plant, would likely have a higher cost and transport of the material to an existing plant (i.e., East Chicago) would be the more practical approach if this technology could be implemented.

While the Neutralysis process would reduce the amount of material requiring disposal in a landfill as a result of the required material screening/recycling that is an integral component of the Neutralysis process, the concerns related to the excavation alternative remain -- health and safety during excavation, handling, and transport; potential for landfill gas and leachate releases; administrative complexity, and high cost of implementation. It is likely that processing the materials removed from Landfills 6 and 7 would less desirable, and profitable, than a raw MSW stream due to the decomposition of the waste that has occurred and the moisture content.

10. Mr. Bert Herskee, RAB Member, Lake Forest

10-1 Believes that there is no viable alternative other than capping. Excavating would be high risk and messy.

Response:
The Army believes that excavation of the waste and restoration of the area could potentially be accomplished in compliance with all ARARs. However, excavation is expected to be an environmentally difficult project as documented in the FFS, especially with regard to odor control and worker safety. Additionally, the cost for the excavation alternative may very well exceed the cost estimate in the FFS due to the uniqueness of the project, resulting in a large administrative effort and high contractor costs as a safeguard against uncertainties.

11. Ms. Judy Johnston, RAB Member, Highwood

11-1 Would like for the RAB and concerned individuals to address the possible bluff erosion.

Response:
Please see the response to Comment 12-7.

12. Ms. Joyce O'Keefe, RAB Member, Highland Park

12-1 The format of the public meeting limits input from public and interaction between public.

Response:
See response to Comment 8-1.

12-2 I question why the Army should proceed with an Interim Action at this time.

Response:
See responses to Comments 1-35 and 8-13.

12-3 Concerned about potential for discharge of pollutants to lake. The fragile bluffs/beaches are subject to erosion.

Response:
The measures included in the preferred alternative will contain and capture leachate. See responses to Comments 8-3 and 8-11. Regarding the bluff erosion, please see response to Comment 12-7.

12-4 If capped in place, the landfills will have a deleterious effect on surrounding land use and property values.

Response:
Implementation of the preferred capping remedy will allow the land to be put back into recreational use, a positive effect over the current condition of the landfills. Landfill 7 has been in the community for over 50 years as unproductive space. The surrounding property is currently owned by the Navy and the Army Reserve, which support the preferred alternative. Navy concerns and requirements for future use were considered in the development of the

preferred alternative. Any future decisions regarding sale or exchange of the property as permitted by legislation will be made by the Secretaries of the Navy and Army.

12-5 Failure of the prior cap argues for a different approach.

Response:
The Army is committed to addressing known releases and violations in a manner that is protective of human health and the environment. The Army also desires to restore the landfills to open, recreational use. The 1981-82 capping project for Landfill 7 can not be viewed as an indication of the ability to construct and maintain an effective cap at Landfills 6 and 7. The existing cap that was constructed in 1981-82 was poorly designed in terms of today's engineering and regulatory standards. In addition, the cap was never properly maintained. The improper maintenance, combined with the poor landfil design and inadequate leachate and gas management systems, resulted in damage to the cap in only a few years. Some of the design problems of the existing cap include: (1) the existing landfill cap was constructed with flat portions in the center area which allowed water to stand and infiltrate through the cap; (2) the cap was not designed to prevent storm water runoff from surrounding area from flowing onto the cap surface; and (3) landfill gas was not effectively vented from beneath the cap. The primary maintenance problem is that the leachate collection system did not work.

Landfill regulations and engineering practices have developed and improved greatly since the existing Landfill 7 cap was designed and constructed. Landfill caps designed and constructed under current regulations and according to current engineering standards are held to much higher quality standards. The proposed capping system, when combined with proper maintenance and controls of activities on the cap, will virtually eliminate water and gas movement through the cap and avoid the problems that were inherent in the design and construction of the existing cap for Landfill 7.

12-6 Urges Army to investigate excavation, including sampling and more detailed evaluation of excavation process and transport which would determine whether excavation would expose community to new and unacceptable risks.

Response:
See responses to Comments 8-2, 8-3, 8-4, 8-5, 8-6, 8-9 and 8-10 related to excavation and transport of the waste.

12-7 If capping is selected, more attention to shoreline erosion is necessary.

Response:
Shoreline erosion is certainly an issue that is of concern with regard to the preferred alternative for capping Landfill 7. However, the relatively slow rate at which erosion may occur will allow for monitoring and installation of structural controls that can be expected to be effective indefinitely. There are numerous potential controls that could be installed at relatively minor cost to provide protection of the east end of the landfill cap for periods of 50 or 100 years. On-shore controls include riprap, revetment and sea walls (e.g., sheet pile) over the approximately 300-foot long shore frontage.

Several comments were received regarding shoreline erosion (see also Comments 12-3 and 11-1). One commenter pointed out that the Lake Michigan shoreline in the vicinity of Fort Sheridan is an eroding shoreline. The commenter references a USGS study (Jibson and Staude, 1991) which discusses bluff recession rates. The USGS study indicates an average bluff recession rate for the Highland Park Moraine (till) bluffs, the bluff area in which Fort Sheridan is located, during the years 1872 and 1987 of 13.2 cm/year. Mr. Randall Jibson stated (personal communication, November 25, 1996) that the average bluff recession rate for the Highland Park segment for 1937 to 1987 was 22.5 cm/year and that for the several segments near Landfill 7 used in the study the estimates ranged from 10 to 70 cm/year, with an average of approximately 20 cm/year. Over the next 30 years, a bluff in this area would be expected to recede approximately 6 meters, or 18 feet. Based on available information related to Landfill 7, there has been no apparent movement of the beach relative to the storm drain system structures in the last 15 years. As noted by Mr. Jibson, recession tends to occur as sporadic events rather than a continuous process.

The shoreline in the vicinity of Fort Sheridan is assumed for purposes of the FFS and proposed remedy to be subject to erosion in the future. As noted by Jibson and Staude (1991), groins constructed years ago have had apparent variations in effectiveness at reducing bluff recession rate, but newer groins and other control measures should provide improved control of recession. Jibson and Staude (1992) point out that the data and conclusions from their study "are relevant for regional planning rather than for site-specific engineering," and that any construction must plan for some amount of bluff recession.

The Army understands that if significant erosion of the bluff north and south of the eastern end of Landfill 7 occurs, then, ultimately, erosion could begin to threaten not only the lake-facing east end of Landfill 7, but also the north and south sides of the landfill nearest the beach. The threat of erosion on the north and south sides can occur only after significant erosion of the bluffs adjacent to the landfill. Potential controls for that problem are the same as those for the lake-facing east end, retaining walls, sea walls, revetment, etc., and can be installed in conjunction with controls for the east end. These controls would be "wrapped around" the end and extended as far as necessary. The extent (length) of the landfill potentially requiring protection within 50-100 years is relatively small, even compared to the east end of Landfill 7, due to the long-term rate of bluff recession.

The Army is aware that erosion occurs as a series of sporadic events dictated by many site-specific factors, and not as a continuous, steady loss of material from the bluffs. A sliding or sloughing failure of the east end of Landfill 7 should not be viewed as entirely analogous to failures of the natural bluff, such as were referenced. The extreme eastern end of landfill 7 will not be allowed to be impacted; it will either be protected by conservatively designed engineering controls that have been long-used for protection of waterfront structures or, if and when necessary, enough of the east face of the landfill removed to provide stable conditions. The existing slope has proven to be stable, even during high leachate/groundwater conditions.

While erosion of the bluffs occurs as a series of events, a single event is very unlikely to consist of a large, sudden failure affecting an entire section of bluff such that, if it occurred on the bluff adjacent to Landfill 7, it would pose a significant potential threat to the landfill. The landfill monitoring plan will have investigation and assessment of bluff and shoreline erosion as a regular item to be performed. The 5-year evaluations that will be required under CERCLA will provide additional assurance that this will be evaluated.

ORGANIZATIONS/GROUPS

13. Lake Michigan Federation

13-1 . . in the current circumstance, the Army is recommending the selection of an interim remedial action before the risk assessment is completed. The Federation respectfully questions the selection of an interim action to remediate the landfills without appropriate analysis and evaluation of the human health and the ecological risks to the environment, including the lake.

Response:
In determining to proceed with implementation of the interim action, the Army has followed the CERCLA process as outlined in the NCP. The NCP encourages implementation of an interim action at a site early in the investigation process. Interim actions typically address specific, defined issues at a site, such as source control or "hot spot" removal. These actions typically address sub-units at a site, such as a waste lagoon, drum disposal area, or a landfill. The NCP specifically encourages action prior to or concurrent with conducting an RI/FS as information sufficient to support remedy selection is obtained. In describing the interim action, the NCP states that data sufficient to support the interim action decision is to be extracted from the on-going RI/FS and an appropriate set of alternatives evaluated. Because some problems require interim action, the Army believes it needs not, and should not, wait. As stated in previous responses, the Army's evaluation of alternatives in the FFS included evaluation of the overall protection of human health and the environment.

Also, as stated in previous responses, the interim action addresses only the source, or waste. A Phase II RI is currently being conducted on the DoD OU, which includes Landfills 6 and 7, to collect additional data regarding the effect of Landfills 6 and 7 on Lake Michigan and the surrounding groundwater, as well as other issues. This Phase II RI will also include a comprehensive human health and environmental risk assessment evaluating exposure pathways not remediated by the interim action. The Phase II RI/FS will evaluate whether any additional actions, beyond the selected interim remedy, will be necessary to ensure the protection of human health and the environment.

13-2 The Army has scheduled a baseline risk assessment to be completed in conjunction with the commencement of the Army's chosen interim remedial alternative - to cover the landfills with a RCRA cap. The problem from the Federation's perspective is that in the event the risk assessment suggests that contaminant removal, rather than capping, is necessary to protect human health and the environment, the financial allotment and resource commitment for this remediation project would have been significantly reduced.

Response:
The Army recognizes this concern expressed by several commenters (see Comments 1-3 and 14-1). The NCP requires that interim actions not be inconsistent with the expected final remedy. The Army has determined adequate information is available to consider capping to be sufficiently protective as well as being the expected final remedy.

13-3 LMF does support commencement of the initial phase of the interim remedial action plan, the de-watering of the landfills, which is necessary to prevent continual leaching and

contamination of Lake Michigan and potential class I groundwater sources and provides essential data for the remedial investigation and risk assessment. However, the capacity of the Army's proposed design of the de-watering system to prevent further leachate migration to Lake Michigan needs further evaluation.

Response:
See response to Comment 8-13 regarding extent of the interim action.

The leachate collection, or de-watering, system will consist of the following components: the six existing gas vent wells in Landfill 7; two new leachate collection wells in Landfill 6; conversion of the existing storm drain system underlying the waste into a leachate collection system; and installation of a leachate interception trench on the down-gradient end of the landfills, between the east end of Landfill 7 and the Lake Michigan shoreline. The storm drain has been documented by two flow measurements as contributing approximately 10 gpm of flow (leachate and groundwater) between the upstream end of the landfills and the outlet at the Lake Michigan shoreline in its existing condition (it was "sealed" in certain segments underlying Landfill 7 as part of the 1982 landfill closure project). As part of the conversion of the storm drain to leachate collection, holes would be drilled in the walls of the eight concrete manholes in Landfill 7 to make that component even more efficient (these manholes could act, essentially, as wells).

These three separate leachate collection components, two of which are distributed through the landfills and one of which is a barrier to down-gradient movement, have the capacity to lower the leachate levels well below ambient groundwater levels. The Army received several comments expressing concern regarding the ability of the proposed leachate collection system to function as anticipated. However, after reviewing the comments, the Army found none of the comments adequately supported by either factual information or by hypotheses that are supported by, and consistent with, site information and conditions that can reasonably be expected based on site information. Regardless of any reasonable amount of investigations and analyses, there would never be certainty regarding the leachate collection system until the plan is actually implemented. If there were certainties, there would be no reason for monitoring. Finally, while the Army does not anticipate inadequacies in the leachate collection system, if there is an inadequacy that is detected by monitoring, the worst case would require additional wells be installed extending the leachate collection system. Wells can be added by drilling either vertically through the waste and even the final cover, if necessary, or by drilling at an angle from beyond the edge of the cap to reach any point underlying the waste. These additional components can be added at a relatively insignificant cost compared to the overall cost of any alternative.

See also responses to Comments 1-7 and 1-9 regarding performance of the leachate collection system.

14. League of Women Voters of Lake Forest-Lake Bluff

14-1 We are concerned that, despite uncertainties about the landfill contents, the Army has chosen Alternative 2b (capping the landfill) over Alternative 4 (excavation the landfill) as the recommended "interim action" plan. Clearly, this plan has nothing "interim" about it, but would constitute a final and irreversible choice.

Response:
Please see the responses to Comments 1-3 and 8-13.

14-2 We therefore strongly recommend that the Army's proposed plan be modified, so that a single set of procedures is used for the initial steps which are common to Alternatives 2B.

Response:
After review and consideration of the comments received, the Army anticipates selection of the preferred alternative (2B) as defined in the Proposed Plan. The initial steps (i.e., the components) that will be implemented for the preferred alternative occur during the stabilization phase of the alternative prior to construction of the final cap and the active landfill gas collection and treatment system. These initial components include the installation of a new storm drain, improvements to the landfill covers, and construction and operation of the leachate collection and treatment system. The only one of these components that is significantly different in the capping alternatives than the excavation alternative is the storm drain. For the excavation alternative, it was assumed that drainage improvements would be made to reduce leachate generation, but that the existing storm drain systems would continue to function.

While the Army anticipates that capping will be verified by the DoD OU Phase II RI/RA to be a component of the final remedy, the timing of the completion of the DoD OU RI/RA clearly allows re-evaluation of the final cap component should significant new information be available that indicates reevaluation is appropriate.

14-3 . . . there is no indication that the Army was aware of the 1991 report from the U.S. Geological Survey, which analyzed erosion rates along the Lake Michigan shoreline, including the Fort Sheridan area. This report directly contradicts the assumption made in the Feasibility Study (page 184, Section 3.1.6), that effective protection against erosion can be provided by riprap, groins, sea walls etc.

Response:
Please refer to the response to Comment 12-7. As indicated by this response, the authors of that report have stated that the data and conclusions from that study "are relevant for regional planning rather than for site-specific engineering." The Army recognizes that some bluff recession will occur and has adequately planned for this in the FFS.

14-4 . . . there is a strong likelihood that the solid waste and the backed up gallons of leachate within the landfill could cascade into the lake if a landslide were to destroy the landfill cap or erode the adjacent bluff, which encloses the sides of the ravine landfill.

Response:
Please refer to the response to Comment 12-7 regarding bluff recession and shoreline erosion controls. There is no reason to expect that the eastern slope of Landfill 7 will slide into Lake Michigan. The slope has remained in place for 15 years in a stable condition with high leachate levels in the landfill. The preferred alternative would immediately begin to lower the leachate level in Landfill 7, thereby reducing the pressure of the leachate and increasing the

resistance to slope failure. A slope stability analysis under earthquake conditions has been performed and the slope determined to be stable.

The Army's evaluation indicates that there is no immediate threat of potential failure of the landfill slope. If and when future erosion of the shoreline and/or adjacent bluffs leads to a potentially threatening condition, protective measures can be taken. These measures may include structural controls as described in response to comments 12-7 and 14-3 (above) and, if necessary and appropriate, could also include some excavation of the east end of the landfill. It is significant that borings completed in late 1996 for the DoD OU in the east slope of Landfill 7 indicate primarily clay fill in the east slope, as expected based on leachate gradient considerations (Focused Feasibility Study, page 15).

14-5 We also believe that more detailed information should be released to the public about the waste removal and disposal alternatives proposed for landfill excavation (i.e., Alternative 4). Since heavy truck traffic is anticipated under the present proposal, alternatives to this should be explored in greater depth. This should include consideration of removal by railway and barge, of the route to be used, and of the disposal sites available for different categories of waste and their accessibility by rail, barge, or truck. If the removal were via barge, which port would allow waste transport? Also, since the cost estimate for Alternative 4 ranges from $37.7 million to $711.5 million and since these cost differences are mainly attributable to different disposal fees for the 3 different types of waste, it is important that information be provided on how these disposal fees were determined.

Response:
Please refer to responses to Comments 1-13, 3-1, and 8-9 regarding transportation of excavated waste via truck and rail. Considerations similar to those for rail transport are applicable to barge transport. A dock and conveyor system would have to be constructed and the overall waste transportation cost would be higher than the costs assumed in the FFS for transporting by truck. The waste would eventually pass through a receiving port and along highways to a receiving landfill. Additional details regarding excavation transport routes and destinations are typical of those that would be developed during design studies.

Please refer to responses to Comments 2-1A, 8-9, and 30-1 regarding cost differences for excavation, including disposal costs. Competitive fees for hazardous waste disposal in landfills are equally as well known as those for special wastes.

Please also refer to responses to Comments 1-10, 1-12, 1-26, and 1-27 regarding waste excavation and handling risks.

14-6 With respect to the landfill capping alternatives, would the Army, the local communities, or some other entity have the responsibility for landfill monitoring and for bearing the associated cost? Also, since the feasibility study only planned ahead for 30 years, please indicate who will be responsible thereafter for the costs of monitoring, maintenance, and replacement of the cap and replacement of other structures and equipment.

Response:
The Army is responsible for the long-term monitoring and maintenance of the landfills. While the NCP requires comparison of alternatives on the basis of 30 years, the Army will be responsible for the maintenance and operation of the facility until and unless those responsibilities are legally transferred to another entity.

To better assure the local community of the Army's commitment, the decision document will include a statement that the Army will regularly keep the public informed through fact sheets and/or public meetings regarding the status of the landfills and results of inspections.

14-7 It is difficult to see how there could be any validity to the risk analysis for landfill gases when the FFS includes such statements as "available information does not allow full assessment of potential health risk" . . . Also, the risk analysis is limited principally to vinyl chloride gas, for which the threshold for long term exposure is reported as 0.021 micrograms/cubic meter (p. 82). There is no information as to the source of that figure and no mention of the population on which it was based. Given the long-term exposure faced by persons living close to the landfill, more details about the risk analysis should be provided.

Response:
The Army believes that the risk analysis performed on the landfill gases were sufficient to determine that potential unacceptable risks exist due to the release of these gases. The risk analyses for landfill gas emissions were performed by USEPA and USACHPPM. The Army's full report is included in the Administrative Record and the information available from USEPA is included in the FFS. USEPA's risk analysis focused principally on vinyl chloride because of the gases detected in the landfills, vinyl chloride is the most toxic (it is a potent known carcinogen). The USACHPPM risk assessment evaluated both carcinogenic and non-carcinogenic risks. The threshold value presented in the FFS corresponds to USEPA's Preliminary Remediation Goal (PRG) for vinyl chloride (0.027 $\mu g/m^3$) that the agency normally uses as a screening value for determining if further risk assessment is necessary. The PRG corresponds to a concentration that represents a one in a million excess cancer risk in a lifetime of exposure. A comprehensive risk assessment will be performed as part of the DoD OU RI and will include an evaluation of the potential risks associated with any expected gas emissions subsequent to implementation of the preferred remedy.

15. League of Women Voters of Highland Park

15-1 The League. . . has reviewed the letter from the League of Women Voters of Lake Forest/Lake Bluff and the League of Women Voters of Lake County Fort Sheridan Task Force, and concurs with the concerns, questions and suggestions raised.

Response:
Comment noted. Responses are provided for the League of Women Voters of Lake Forest/Lake Bluff.

16. League of Women Voters of Lake County

16-1 The Fort Sheridan Task Force of the League of Women Voters of Lake County has reviewed the statement made by the League of Women Voters of Lake Forest-Lake Bluff. . . . the Board of Directors of the League of Women Voters of Lake County approved concurrence with this statement and signs on to the testimony made. . .

Response:
Comment noted. Responses are provided for the League of Women Voters of Lake Forest/Lake Bluff.

17. Sierra Club, Illinois Chapter, Great Lakes Critical Lands Project (Charles Norris, Geo-Hydro, Inc.)

General Comments on the FFS

17-1 One is struck in the FFS by the discrepancy between qualitative descriptions of waste in the sections on Alternatives 2 and 3 and the descriptions of the waste quality in alternative 4 . . . The discrepancy may originate with a predisposition toward capping rather than excavating and hauling the waste. It may also originate from the recognition that the contents of these landfills are simply not reliably known. . . the more dangerous or hazardous the material is to excavate and haul from an urban setting, the less appropriate it is to leave the material in the urban setting, in an unlined, only partially confined facility. It is also increasingly likely that the problem will outlast the lifetime of the proposed cap(s) and other engineered structures and the cost, timing, and implementability of replacing these features have not been factored into the capping alternatives.

Response:
The risk associated with the waste is directly dependent on the extent to which human or environmental communities will be exposed to the waste. The differences in risk associated with the various alternatives can be attributed to the differences in risk associated with releases from waste contained in the ground and exposure to wastes if the wastes are excavated and handled. Please see the responses to Comment 1-1 regarding waste characterization, to Comments 1-5, 8-5 and 8-6 regarding reasonableness of the Army's evaluation of the excavation alternative, and to Comments 8-7 and 17-9 regarding hydrogeology/leachate containment.

The operation and maintenance costs for the capping alternatives were evaluated over a period of 30 years, as required by the NCP. This evaluation included replacement costs for pumps, structures, and other appurtenances that have lives of less than 30 years. The cap itself is expected to function adequately for 30 years or more with regular maintenance. The "life" of a suitably designed and constructed RCRA landfill cap can generally be expected to be limited by localized failures due to unanticipated settlement and long-term erosion of the soil cover, potentially exacerbated by plugging of the lateral drainage layer by fine soil particles or biological growth (inadequate subsurface drainage will increase surface erosion potential). While experience with the durability of synthetic materials used in RCRA cap construction (e.g., HDPE, VLDPE) does not extend over periods of 30 years, laboratory testing suggests that the life of these materials should exceed 30-years unless damaged by chemicals with which it is not compatible. Ii is also noted that a cap and other controls for

the landfill(s) that might receive the waste under the excavation alternative would have similar useful life expectancies and replacement needs. It should be recognized that, even if a major cap repair (i.e., "replacement") is required, this activity is not similar to the original construction. The soil and aggregate materials used are already in place, requiring only, at worst case, that the synthetic materials used in the various layers be replaced.

For the excavation alternative, the Army would not only pay for the long-term maintenance through the disposal fee charged by the facility but also retain liability for the waste in the new landfill(s). It should be recognized that the present worth of expenditures for repairs 30 years in the future is approximately 13 percent of the future cost assuming a 7 percent discount rate (e.g., a $3 million expenditure 30 years from now for cap repairs has a present worth of only approximately $394,000 based on 7 percent).

The commenter's concerns regarding the need to more completely characterize the waste are not supported by a reason to do so. Indeed, the USEPA has determined that for CERCLA MSW landfills, including military landfills, there is generally no need or justification for attempting to characterize the waste. As stated in response to Comment 1-1, USEPA has determined that for MSW landfills investigated under CERCLA (i.e., Superfund sites), including military landfills, complete characterization is generally not necessary or justified. Investigation results conducted thus far on Landfills 6 and 7 for both leachate and landfill gas emissions show consistent concentrations below those found in many "typical" co-disposal landfills which have been capped.

17-2 Neither gas generation nor existing leachate discharge should continue unmonitored and unmitigated. . . The FFS does not. . . indicate where such (explosive) concentrations exist, . . . whether or not individual residences are in danger of the build-up of methane to explosive concentrations, or whether a monitoring program exists to track methane concentrations and migration in drains, residences or utility corridors. Also unaddressed in the FFS are existing programs or plans . . . to monitor or mitigate the migration of other landfill generated gases (vinyl chloride at least). It is also unacceptable to continue the existing lake discharge without mitigation prior to implementation of one of the alternatives. . . The current plan is for the discharge to continue unabated for years while a selected alternative is implemented.

Response:
The Army agrees that the leachate discharge should not continue unmonitored and unmitigated. The Army has initiated regular monitoring of the discharge and is proposing this interim action to eliminate the discharge. This monitoring will continue until the discharge is eliminated. The Army desires to implement appropriate controls as quickly as anyone. As the Army is required by law to conduct the environmental cleanup of Landfills 6 and 7 (including stopping the leachate discharge) consistent with CERCLA, the interim action is proceeding at a pace that is as rapid as practical given the legal, technical, and community involvement considerations required by the CERCLA process. The USEPA and IEPA are in concurrence with the approach and schedule. It is anticipated that the leachate releases to Lake Michigan will be eliminated within one year of the final selection of the interim action, not years as the commenter presumes.

Regarding landfill gas generation, the interim action also includes controls to mitigate landfill gas generation. Again, the Army is required by law to follow the CERCLA process when taking action to control these landfill generated gases. The landfill gases have been measured

during several sampling events as described in Section 1.2.3.8 of the FFS. The landfill gas sampling and risk evaluations conducted indicate no immediate risks for the military residents based on existing conditions and a maximum period of 5 years living adjacent to the landfills. Navy personnel currently allocated to the adjacent housing live in these units no more than 5 years. For further discussion, please see Comments 1-2 and 14-7. Methane concentrations were measured on and around Landfill 7. These results are presented in Table 1-19 and discussed in Section 1.2.3.8 of the FFS. The homes around Landfill 7 are slab on grade construction, minimizing gas migration into the homes. In the one known point outside the landfill where explosive conditions exist, the Army did take quick action to install additional fencing to secure access to a manhole with a solid lid. No other significant explosive conditions related to landfill gas have been detected outside the landfill.

Landfill gas emissions will also be monitored upon implementation of the interim action. While the interim action will not immediately control landfill gas emissions, the Navy will relocate the adjacent residents prior to initiation of construction for the interim action

Waste and Leachate Characterization

17-3 Characterization of waste and leachate is inadequate to reasonably define and choose among alternative actions. At least one waste stream that can greatly affect the choice among alternatives, (presumably low level) radioactive wastes, is identified as expected to be present, yet no attempt to evaluate it or its presence in leachate or groundwater is reported. The descriptions of the waste are very generalized, and on page 38 the FFS provides the following egregious *non sequitor* in discussion of the composition of the waste:

Sample results to date indicate constituent concentrations that are within typical ranges for MSW landfills operated during the period from 1950 to 1980. There has been no sampling of the solid materials in the landfill.

Response:
See responses to Comments 1-1 and 17-1 regarding waste characterization. The commenter has apparently overlooked the radiological assessment report prepared by the State of Illinois Department of Nuclear Safety that was provided in the FFS as Appendix I which concludes there is no significant exposure hazard resulting from radioactive materials potentially disposed of in Landfill 7. Investigations included surveys of Landfill 7 and collection of water samples from the storm drain that were analyzed by the IDNS Radiochemistry Laboratory. In addition, the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) conducted a radiological survey at Landfill 7. USACHPPM surveyed soil, leachate, and groundwater at Landfill 7 and surface water from Lake Michigan and no radiological materials were detected above background levels. The results of USACHPPM's investigations (USACHPPM, 1996) concur with the IDNS study that no radiological health expsosure hazards were identified at the landfill. The USACHPPM survey report is part of the Administrative Record for the site.

It is not clear what the commenter finds so inconsistent in the referenced quote from the FFS. Although the statement might have been rendered more clear by beginning the first sentence as follows, "Leachate sample results to date...", it is clear from the context of the complete discussion that the first sentence refers to leachate sampling and the second refers to sampling of the solid waste material. One might expect to find certain constituents in the leachate

based on materials reported to have been disposed of in Landfill 7 that were listed in the FFS immediately preceding the abstracted quote (solvents, waste oils, paints, paint thinners). These are materials commonly disposed of in MSW landfills prior to 1980 and MSW leachate data reported in the literature are expected to reflect that. Leachate analyses completed included testing for approximately 150 organic compounds. The fact that selected solid samples have not been randomly removed from the waste for analytical testing does not mean that nothing is known about the ability to remediate and contain these wastes. In fact, constituents that may be present in solid materials but immobile are of little concern to the capping alternatives. Analytical testing of solid materials in MSW landfills is infrequently performed because of the variability of landfill materials and difficulty in obtaining a meaningful "representative" sample. The concern is with mobile constituents such as liquids or materials leached from solids.

17-4 In spite of the occurrence of gas-phase vinyl-chloride, none of the leachate samples or storm drainage samples show detectable concentrations of vinyl chloride or precursor compounds . . . Consequently, projecting treatment costs and processes for any alternatives based upon the existing data may not be valid and are potentially highly inappropriate for actual leachate(s) that exist in the landfills.

- Why is it not found in leachate? Inconsistency seen as questioning validity of leachate treatment costs.

Response:
An analysis of concentrations of vinyl chloride in the landfill gas and in the groundwater/leachate shows that, for vinyl chloride concentrations within the ranges detected in the gas vents, the equilibrium vinyl chloride concentrations in water are below the analytical detection limit for vinyl chloride in water (<2.0 µg/L). Thus, it is not unexpected that vinyl chloride was not detected in the leachate samples collected from the landfills.

17-5 In spite of the vinyl chloride evidence suggesting DNAPLs, no investigation has been undertaken to identify and locate these compounds. The presence or absence of DNAPL accumulations will impact the cost, effectiveness, and appropriateness of all alternatives except the no-action alternative.

Response:
Please see the response to Comment 1-32.

17-6 Concentrations of constituents in the storm drain sampling at upstream and downstream points does not support the interpretation of 10 gpm leachate into the storm drain. Unless and until the chemical differences can be explained, it must be concluded that the low-flow storm drain effluent is not primarily leachate. It follows that any alternatives using the contrary conclusions as a foundation are potentially not valid.

Response:
The visual observations and hydrological considerations conclusively show that the dry weather storm drain effluent is primarily leachate. The storm drain pipe is located within the waste, therefore, any infiltration, whether groundwater or surface water, would come in

contact with the waste (and, therefore, be leachate) before seeping into the storm drain. Seepage inflow has been observed through manhole joints. The head on the storm drain pipe is large and any cracks or joints are likely to allow seeps. Leachate levels in the vicinity of gas vent GV-1 are low, at least partially, if not entirely, as a result of the observed seepage into the nearby storm drain manholes. The measured 10 gpm gain in storm drain flow is expected by a combination of both groundwater and surface water infiltration into the waste. The hydrological conditions at the site suggest the primary source of the leachate would be through surface water infiltration (see response to Comment 17-15).

Additionally, the basis for the commenters statement that there is a chemical difference between the leachate and the outflow from the storm drain is unclear. The initial sampling of the leachate and the storm drain outflow indicates that they are chemically very similar.

See also related Comment #17-15 and response.

17-7 A number of additional inconsistencies in the FFS are observed in the discussions of possible impacts of leachate migration into and through groundwater . . . monitoring well pair LF6MW04S and LF6MW04D installed between the landfills clearly show responses indicative of leachate migration through the soils between the landfills . . .

Response:
Examination of geochemistry from site monitoring wells shows a difference in the chloride/sulfate balance between LF6MW04S and LF6MW04D. The two wells are located approximately in the center of what was the original Wells Ravine near the lowest point of Landfill 6. The shallow well (LF6MW04S) installed to a depth of 29 feet shows chloride to be the dominant anion. The boring log for this monitoring well indicates that it is in road fill for the upper 24 feet. The well is likely influenced by leachate due to its proximity to waste material in Landfill 6. The Patten Road fill in which the monitoring well is installed may have been placed prior to or during landfilling activities and the materials and construction are not known in detail. The material is fill, however, and will have a higher permeability than native soils. In contrast, LF6MW04D installed to a depth of 74 feet at the same location is in native material below the bottom of the ravine. Unlike its shallow paired well, LF6MW04S, the deeper LF6MW04D shows sulfate to be the dominant anion. The geochemistry for this well is consistent with that observed in the other landfill monitoring wells which show sulfate to be the dominant anion.

It is worth noting that sulfate is the Class II groundwater quality standard (400 mg/L) most frequently exceeded in landfill monitoring wells (see FFS Section 1.2.3.5). The source of these sulfate concentrations appears to be naturally occurring. Eight monitoring wells in proximity to Landfills 6 and 7 exceed the Class II standard. Sulfate concentrations in the affected LF6MW04S are less than 100 mg/L, lower than the 400 mg/L sulfate Class II groundwater standard and the sulfate concentration in the unaffected LF6MW04D which exceeds the state Class II groundwater standard.

17-8 . . . it is absolutely unacceptable to accept as unknown the impact of changing leachate levels on gas generation rates. Whether generation rates increase or decrease is particularly critical to the evaluation of the capping alternatives, where active gas collection is to be undertaken late relative to the action of lowering the leachate levels.

Response:
There is insufficient information to accurately predict how the landfill gas generation will be altered by lowering the leachate levels. There are fundamental physical, chemical, and biological phenomena involved, some of which will have a tendency to reduce gas generation (such as a reduction in water content) and others which will have a tendency to increase gas generation (such as a potential increase in temperature within the waste). Lowering the water level within the waste will increase the air permeability and increase the efficiency of the gas collection system.

The Army is not aware of any information that suggests a large change in landfill gas generation will result from the lowering of the leachate level over an approximately 3-year long period. Landfill gas monitoring will be conducted during the stabilization phase that will occur prior to installation of an active landfill gas collection system. Landfill gas collection and treatment can be added at any time during the stabilization phase with little cost impact to the project. The increased costs would be those associated with installation of a temporary landfill gas collection piping system and earlier installation and operation of the landfill gas flare.

Monitoring of landfill gas emissions will be conducted during the leachate lowering and, if conditions dictate, additional action will be taken. Military residents nearest the landfills will be relocated during this period due to considerations related to both landfill gas and other construction activities.

Geology and Hydrogeology

17-9 The overall perception of the area of Fort Sheridan as one of low-permeability clay sediments and encased isolated lenses of silt, sand and gravel , with slow rates of transmission for groundwater, is not supported by the topographic character of the area itself, the data within FFS, or by background ground water quality. The very existence of the multiple ravines that cut deeply and sharply into the clay ridge of the of eastern-most lake-border moraine over the short distance between Lake Michigan and the Skokie River is evidence of efficient transmission of ground water through and under the ridge. The ravines advance landward of the lake primarily through undercutting or sapping in response to efficient groundwater flow through fracture systems or interconnected silt and sand stringers, not primarily through downcutting of surface drainage. The ravines not only influence groundwater seepage into the ravines, as observed in Section 1.2.1.4, Hydrology, of the FFS, they were created by the same seepage alluded to in the reference to bluff instability in the same Section.

Response:
As stated previously the Army's characterization of the unconsolidated geology at Fort Sheridan is entirely consistent with the regional descriptions published in the literature (Larson, 1973; Bretz, 1939; Bretz, 1955; Atwood and Goldwaite, 1908). In addition the extensive environmental investigation has provided a plethora of geologic data which uniformly supports the characterization of the geology as a massive low permeability clay, punctuated by occasional sand lenses that are neither extensive nor interconnected. A reasonably complete collection of the data collected prior to 1995 is included in the Fort Sheridan Groundwater Classification Document (ESE, February 1996). The data collected subsequent to 1995 supports the conclusions of this document.

The commenter is correct that sapping and undercutting are a component of ravine development at Fort Sheridan and along the north shore bluff. However, the process importance in ravine development is overstated and the conclusion that the ravines are evidence of an efficient groundwater flow system is not supported by the preponderance of other data. The processes of sapping and undercutting do not require the existence of an efficient groundwater flow system. They only require a zone of structural weakness such as a sand lens or a fractured interval. These weakened zones were occasionally encountered by the streams as the ravines developed, thus contributing to the ravine development.

The general absence of springs in the bluff face and ravine sidewalls indicates that the sand lenses and fracture zones exposed by erosion are not a continuing source of groundwater flow. Additionally, the absence of a pronounced benching or terracing effect in the sidewalls suggests that the primary erosive agent is the stream in the ravine bottom and mass flow due to gravity and not continued groundwater flow through the sandy or fractured zones.

Monitoring well development and pre-sample purging data demonstrating the inability of wells screened in sand lenses to sustain even minimal groundwater yields, further support the Army's characterization of the geology at Fort Sheridan. These data are included in the aforementioned Groundwater Classification Document.

Illinois State Geological Survey staff (Mike Chrzastowski, personnel communication, November 25, 1996) currently studying the Lake Michigan bluff recession in the area have stated that they concur with the characterization of the sand and gravel lenses as non-continuous features, truncated and isolated by the massive clay deposit. Mr. Chrzastowski noted that the formation is 70 to 85% clay, with little sand and gravel for beach material.

Mr. Chrzastowski also stated that he believes that the ravines were formed by conditions that existed 5,000 to 10,000 years ago, during a period when the shoreline was much further east than its current location. He stated that he believes the ravines, while still experiencing instability of the ravine walls, are not continuing to downcut naturally as a result of surface drainage erosion due to insufficient flow. It is recognized that some ravines may experiencing down-cutting as a result of development impacts.

17-10 The existence of the system of interconnected, secondary porosity is documented by the observations of entirely different phenomena at different scales. The discussions in the FFS of the results of laboratory and slug testing for permeability correctly note that the combined data support an interpretation of a flow system with a fracture (or other) secondary flow network. The implications of this observation, however, are not explored. The groundwater migration rate calculations provided in Section 1.2.4.2 Groundwater, and on Figure 1-8 are based not upon flow through a secondary system but on an assumed matrix effective porosity of 10%. If, for example, the secondary porosity produces a secondary porosity of 1%, the travel time is 10-fold less than that represented in the FFS.

. . . The high sulfate concentrations observed in the groundwater are the direct result of chemical changes to wetland soils induced by urbanization and development (oxidation of sulfide-bearing wetland soils as water tables are lowered) and reflect travel times through the ridge system measured in decades, not centuries.

Response:
The commenter correctly notes the inverse relationship between bulk porosity and average groundwater velocity as demonstrated by the following formula for average groundwater flow velocity:

$$V_{\bar{x}} = \frac{Ki}{\eta_e}$$

Where:

$V_{\bar{x}}$ = *average linear groundwater flow velocity*
K = *hydraulic conductivity of the porous media*
i = *hydraulic gradient*
η_e = *effective porosity of the porous media*

As effective porosity decreases, average groundwater flow velocity increases and travel time decreases. The above equation can be used to estimate average linear groundwater flow velocity for the bulk porous media using average values of porosity, hydraulic conductivity, and gradient assuming certain conditions exist. However, the relationship between primary and secondary porosity and groundwater flow velocity is not as simple as the commenter implies. Using this formula, or a similar one representing the same relationship, to estimate groundwater flow velocities for primary and secondary porosities separately (as the commenter apparently did) is inappropriate if one continues to use the average values of the other arguments (i.e. hydraulic conductivity and gradient). In addition, the groundwater flow through the fractures when treated separately, may violate the assumptions inherent to the relationship expressed in the above equation. From a practical standpoint it is difficult, if not impossible, to obtain separate values of hydraulic conductivity and effective porosity for primary and secondary porosity. Consequently, average or bulk values for the porous medium as a whole are most commonly used in evaluating groundwater flow rates (Dominico and Schwartz, 1990). In order to use the average values of hydraulic conductivity and gradient one must combine the secondary and primary porosity, which would result in a higher porosity (11% vs. 10%) and a slower average groundwater flow velocity. However, characterizing the groundwater flow in this manner would be just as misleading as the commenter's use of the secondary porosity alone. Consequently the Army took the middle ground of a reasonable approximation based on the obtainable data.

Based on the information above and the fact that secondary porosity is generally much smaller than primary porosity, it is apparent that the shortest travel time to Lake Michigan based on secondary porosity velocities could be less than the time identified in the FFS that was based on total effective porosity. However, it is also noted that secondary porosity in unconsolidated sediments (e.g. till) has been shown to decrease with depth, with an accompanying decrease in hydraulic conductivity, due to the pressure of the overlying sediments which would offset the effects of the secondary porosity. This phenomenon has been observed at Fort Sheridan where the occasional fractured areas observed die out at depth.

The significance of the secondary porosity travel time to Lake Michigan and the more general issue of secondary porosity appears to be minor, however. The Army does not contend that constituents have not moved from Landfill 7 to Lake Michigan or to any of the even closer six

monitoring wells on the beach. The date of the start of landfilling activity at the east end of Landfill 7, over 50 years ago, indicates that constituents present could have migrated that distance based on water flow velocity. As indicated in the FFS, analytical data from monitoring wells do not indicate a clearly defined plume. Some exceedances of water quality standards have occurred. It should be noted that sampling of leachate within the waste (i.e., from the gas vents) also does not indicate high concentrations of constituents.

Aside from the information discussed above, three other empirical observations support the contention that neither sand lenses nor fractures are acting as conduits for preferential groundwater flow at Fort Sheridan: 1) The mounding of groundwater in Landfill 7 clearly indicates that the native till is a significant barrier to groundwater flow that is preventing the meteoric water that preferentially infiltrates through the present cap from dispersing; 2) the dramatic horizontal and vertical hydraulic gradients observed around the installation, and; 3)the absence of alteration areolae around the fractures that were observed in the near surface till. High hydraulic gradients are indicative of resistance to groundwater flow. Alteration areolae along fractures are caused by the rapid transport of oxygen rich meteoric water into the normally reducing atmosphere of the subsurface. The absence of these areolae suggests that the fractures are not preferentially transporting groundwater to a significant degree.

Nevertheless, relative to the preferred alternative, secondary porosity and its influence on travel time do not appear to be significant issues. Lowering of the leachate in the wastes will result in expanded upward and inward hydraulic gradients causing flow into the waste.

The Army does not agree with the commenter's analysis of the groundwater sulfate concentrations and the conclusions drawn from this analysis. While, in general, the oxidation of sulfide bearing soils due to developmentally driven dewatering is not an unheard of phenomenon, the Army believes its application to Fort Sheridan is not strongly supported by the data. Additionally, the commenter did not provide any specific references to support this theory.

The preponderance of data, both regional and installation specific, indicate that the rate of groundwater movement through the glacial till underlying Fort Sheridan is extremely slow. Please see the response to Comment 16-8. Assuming that the commenter's theory of sulfate enrichment of the groundwater is valid, the slow rates of groundwater transmission (documented by other sources) would require a localized occurrence. Available information, including historical aerial photos dating back to the 1930's and site descriptions predating the development of Fort Sheridan, indicate that the installation and the area immediately surrounding it have not historically been characterized by wetlands.

Additionally, with the exception of a few samples (e.g., LF7MW05S) collected near the discharge of water from Landfill 7 the characterization of the groundwater sulfate values as "high" is questionable. The range of sulfate values detected at Landfills 6 and 7, although variable, are within reason for an unconfined glacial water bearing zone (Dominico and Schwartz, 1990; Wiley Interscience, 1990). Consequently, while the theory of sulfate enrichment of groundwater, in general, may have some validity, the Army believes that it does not constitute proof of the existence of an effective groundwater transmission system at Fort Sheridan.

17-11 The groundwater potentiometric map presented in Figure 1-7 of the FFS does not represent all data that is presented in the FFS and available for use. Water levels in G-101, G-102, and LF7MW01 were not used in construction of the map. . . If these heads were included in the map on Figure 1-7, the complexity of the head distributions in and around landfills 6 and 7 are far more apparent. Including the head of G-101 alone in the mapped potentiometric surface would clearly demonstrate that the reduced head at GV-1 is far more locally restricted than suggested in Figure 1-7. This in turn suggests that the ability to effectively use the existing, deep storm drain system or gas vent wells is likely to be far less effective at draining the leachate than is implied in the FFS.

Response:
The observation by the commenter that the Figure 1-7 potentiometric map (showing phreatic surface contours) does not use water levels obtained from G-101, G-102, or LF7MW01 is correct. It would be incorrect to use data from those sources to construct the potentiometric map. The figure provides a mapping of the elevation of the saturated, or phreatic, surface. Water levels from the three wells identified were not used because these locations act as piezometers with screened intervals well below the phreatic surface. The wells for which data were used to develop the map have screened intervals nearer the phreatic surface. One has only to compare the water levels from the various monitoring points and the screened intervals of those various wells to observe that there is a significant vertical gradient. This is readily visible at LF6MW04S and LF6MW04D and at the beach monitoring well pairs. To use data from the wells that are screened at lower elevations would produce a map that would be physically meaningless and misleading.

The commenter points out that if G-101 were used, the resulting mapping would suggest a decreased ability of the storm drain system to collect leachate. The Army disagrees. For purposes of this discussion, ignoring a vertical gradient at G-101 results in a groundwater level at that location of approximately 653.5 ft (Table 1-2 in the FFS). This level is 22.5 ft higher than the leachate level in GV-1 which is located less than 100 ft away and in the waste. This information shows that a relatively impermeable material exists at some location, at least, between the two points. It is highly unlikely that the low permeability material resulting in this large head difference is the waste in which the storm drain system and GV-1 are located and not the till soil in which G-101 is located. This information, in fact, suggests the opposite, that the storm drain system does act as a good leachate sink in that location. A refinement to the groundwater contour map (Figure 1-7) is appropriate. The head at G-101 is approximately 653.5 feet, higher than mapped. The contour mapping is incomplete at this point. A 650-ft elevation contour would fall southeast of G-101. This 650-ft contour is most likely associated with the Landfill 7 mound and not the 650-ft contour located around Landfills 6 and 7. It may be an isolated high resulting from the poor surface drainage in that portion of Landfill 7. This refinement does not significantly change the groundwater mapping. Borings and a piezometer installed for the DoD OU in the vicinity of GV-1 are consistent with Figure 1-7.

17-12 The relatively low heads of "excluded wells" and sink at GV-1 may not necessarily be due to deep storm drain but may alternatively have a geological component.

Response:
Again, as noted in the previous response, the commenter is apparently not aware that the wells are screened at different depths and all wells do not represent the phreatic surface. The

excluded wells (see Comment 17-11) were excluded because they are monitoring a different potential than the other wells. There is no evidence, and the Army has not hypothesized, that these excluded wells are lower due to either seepage into the storm drain system or due to other geologic components. Conversely, there is evidence, including observed seepage through the storm drain manhole joints, that there is leakage into the storm drain at this location resulting in low leachate level in GV-1.

17-13 LF6MW01 may be downgradient from Landfill 6 during wet periods when a recharge mound exists under the landfill as a result of runoff collecting on the landfill surface.

Response:
This scenario is theoretically possible, but very unlikely. While there are depressions on Landfill 6 where surface water collects and stands until percolating or evaporating, there are storm inlets which limit the depth of ponding to a maximum of a few inches. While this condition results in potential for a high normal recharge rate, the storm inlets and ground surface elevations allowing excess ponding depth to drain away from the area would not allow an extremely wet period to result in a similarly large increase in recharge nor a prolonged high recharge resulting from surface storage (i.e., there is insufficient surface water storage due to the surface drainage to allow large or long-lasting volumes of surface water to carry over following the brief episodes of high runoff). Even if a temporary reverse gradient does occasionally occur, it would be a small percentage of the time, and groundwater flow/contaminant migration would be dominated by the normal direction of movement. LF6MW01 is approximately 100 ft from the defined waste boundary, a significant distance for migration of constituents through these clayey soils.

17-14 The hydrogeologic conceptualization of the landfills relies heavily upon permeabilities obtained from slug tests from only three wells at the landfills and two wells elsewhere on Ft. Sheridan. Of the three wells, only one tested in situ soil materials below the ravine and none test in situ materials adjacent to the ravine. The interpretations of the three site slug tests, obtained from the Remedial Investigation (ESE, 1992), show that certainly in one case (LF7MW04S), and possibly a second case (LF6MW04D), the interpretive model selected is inappropriate based upon the response of the well to the test. The data should be re-evaluated correctly.

Response:
The commenter did not indicate why he felt the interpretive model was inappropriate for the two wells mentioned. The Army has reviewed the analysis for the three rising head permeability (slug) tests collected from LF6MW04S, LF6MW04D, and LF7MW04S. Monitoring well response was analyzed based on Bouwer and Rice (1976), Bouwer (1989), and Bouwer (1989b). The assumptions for this method are that the well partially or completely penetrates an unconfined aquifer. These assumptions are met for the slug tests questioned. These methods are commonly used and are technically acceptable when applied in similar conditions and for similar purposes. It is acknowledged that Bouwer and Rice methodology incorporates the simplifying assumption of steady state conditions making the solution an approximation. The error introduced by this assumption is generally limited to a factor less than two (Nielsen, 1991). This magnitude of error is relatively small compared to other assumptions and approximations inherent in slug tests.

Of greater significance than the methodology of slug test analysis is the acknowledged need to obtain additional hydraulic conductivity data from landfill monitoring wells. Additional hydraulic conductivity data will be obtained during the Phase II RI. Existing data available from Fort Sheridan monitoring wells indicates a consistency in hydraulic conductivity values obtained from rising head permeability tests (i.e. note LF6MW04D, LF2MW08D, LF5MW04S).

17-15 The interpretation of the measured 10 gpm dry-weather flow rate in the storm drain as leachate infiltrating the storm drain is unsupported by either chemical or hydrogeologic/geologic data. This interpretation requires 13 inches of some 33 inches of average precipitation infiltrate annually and drain through the landfill into the storm drain. This would have to be in addition to precipitation that must infiltrate to provide leachate that is observed as seepage from the flanks and east face, drainage into shallow storm and surface drains, and flow into surrounding and underlying native soils. The 13 inches stated, let alone the undetermined total infiltration required, stretches credulity. Further, there appears to have been no effort to evaluate even qualitatively the seasonal fluctuations of heads, a direct indication of the infiltration component of water balance.

Response:
The 10 gpm flow rate was the result of measurements of flow in the storm drain system on two occasions during dry weather. By measuring flow at inflow points to the storm drain underlying the waste (three points) and at the outflow point, the infiltration occurring within the segments underlying waste was estimated. This net flow rate includes seepage into shallow storm drains as well as the larger, deeper drain pipe. Given this clarification of the contributing sources to the 10 gpm flow, it is assumed that the commenter is not questioning the measured 10 gpm flow rate, but rather the sources of the flow and/or the assumption of the value as a reliable annual average.

With regard to how the chemical data from storm drain sampling correspond to the flow sources, it must be noted that all leachate sampling to date shows very dilute leachate with constituent concentrations that are little different from what may be in the storm drain flow either upstream or downstream of the landfills. Because of the similarity of constituent concentrations in the storm drain flow and leachate, it would be unreliable to attempt to identify flow sources from constituent mass balances. See also the response to Comment 17-6.

The commenter questions whether a flow of 10 gpm could be sustained by infiltration/ percolation from the landfill surface area. The commenter may have neglected to consider that both landfill surfaces receive surface runoff from surrounding areas, including impervious surfaces such as roofs, streets, and paved parking areas. Additionally, the evaluation summarized in the FFS does not assume that all 10 gpm is generated from landfill surface percolation. The storm drain provides a discharge for groundwater flow that may be generated beyond the 12.5 acres of landfill cover. The groundwater contour map in the FFS indicates that a mild inward gradient toward Landfill 6 is expected as well as an inward gradient at the west end of Landfill 7. Therefore, assuming lateral groundwater seepage into the waste is 3 gpm, the infiltration generated by percolation through the cover is then 7 gpm. If the surrounding area contributing runoff to the landfill area is 10 acres and 30% of the precipitation runs off from that area, the water supplied to the landfill covers is equivalent to more than 40 inches annually, not just 33 inches, which is the direct precipitation onto the landfill surfaces. As indicated in the FFS, surface water on the landfill covers can find routes through the cover into the waste in the form of crevasses around manholes in addition to

percolation through the cover soil. In fact, settlement has resulted in some manhole inlet grates being a few inches above the landfill surface, resulting in ponding and percolation around these manholes.

The Army would like to note an apparent inconsistency in the commenter's position regarding the rate of infiltration to the landfill. In this comment the commenter appears to be suggesting that the rate of infiltration is incredibly high. While in previous comments the commenter has indicated that the steep hydraulic gradients directed outward from Landfill 7 may be explained by a very high rate of groundwater flow rather than by a low hydraulic conductivity, as the Army contends. Based on the commenter's own qualitative water balance estimates, the water to support this very high rate of groundwater flow from the waste into the native soil would require an even higher rate of infiltration than the Army is hypothesizing.

It must be recognized that the 10 gpm is the result of two flow measurements occurring in the fall of 1994 under similar hydrologic conditions. To rely on the 10 gpm rate as being a highly accurate average of annual infiltration into the storm drain would not be appropriate. However, much additional information exists on which to evaluate the water budget for the landfills,including leachate generation. The most apparent is the fact that a mound of leachate exists at all, which clearly indicates that leachate can not escape from the waste rapidly. The Army agrees that the calculated percolation rate is relatively high, and more likely to overstate the percolation than to underestimate it. If the 10 gpm infiltration into the storm drain is correct, and if a lower estimate of vertical percolation is assumed, groundwater seepage inflow increases. But that appears to contradict all other information that indicates low rates of groundwater movement and flow between the landfills and groundwater, including: 1) the existance of a leachate mound, 2) the very low productivity of the many wells at Fort Sheridan that have been purged during groundwater investigations, and 3) the general hydrogeologic characterization of the formation that the landfills are located within.

Leachate seeps appear to still occur around the flanks of the above-grade landfill. The leachate seeps may, in fact, be much diluted by runoff from upland areas beyond the landfills. Regardless, the runoff and leachate that may collect in those shallow depressional areas is trapped and, except for evaporation, percolates when the underlying leachate level falls. The amount of leachate potentially lost through evaporation in these ponding areas can be seen to be relatively insignificant. Based on 36 inches/year evaporation rate, the evaporation from a 10 ft by 200 ft ponded area is equivalent to 0.086 gpm, much less than other components of the water budget being considered.

Finally, regarding seasonal fluctuations, groundwater/leachate levels in wells and gas vents are available from measurements taken during hydrologically dry periods (August and September 1994) and wet periods (April 1995). Groundwater levels are typically highest in later winter and spring, such as April 1995. Based on this range of groundwater/leachate conditions, the seasonal fluctuation was approximately 5.0 ft. Leachate levels have been lowest during summer and fall months when evapotranspiration is highest, a typical condition for shallow groundwater levels. A 5-ft soil column with 10% drainable porosity would hold approximately 6 inches of water, or approximately half of the estimated 13 inches/year percolation. The net groundwater/leachate loss during that same six months would also be approximately 6.5 inches. Therefore, the annual head fluctuation is consistent with the estimated infiltration rates.

17-16 The MODFLOW model made no attempt to match any transient behavior of the landfill, an absolutely critical step in establishing the validity of any numerical modeling. The modeling done in support of the 10 gpm interpretation appears at best circular reasoning and, as described, the structure of the model seems inadequate to actually test the concept. The flow net provided in Figure 1-8 is distinctly in conflict with the parameterization of the "successful" model. The former shows a flow pattern through landfill material and native soils that have little contrast in hydraulic properties (little or no deflection of potentiometric lines or flow lines at the contact between materials), whereas the model had a 500-fold contrast between the landfill waste and the native soils. However, the model is not documented in the FFS for critical review, and this is a major deficiency for the study. The 10 gpm interpretation is so questionable and so fundamental to the evaluation of the various capping alternatives that it cannot be accepted based upon anything less than full critical review of all supporting evidence, including the modeling that is referenced.

Response:
Groundwater and leachate discharge conditions are relatively well established by the multiple sources of consistent information available, including regional geologic descriptions, site-specific field testing, monitoring and observations, and hydrologic analyses of which the referenced MODFLOW analysis is only one tool. The Army does not view this MODFLOW model, or any other potential groundwater model that might be developed, as critical for the purpose of evaluating this interim action in view of the other available information.

It is agreed that to establish a "valid" model, calibration and testing of the model under varying conditions is normally required. However, emphasis was not placed on the description of the MODFLOW modeling exercise or results in the FFS because the MODFLOW modeling was completed prior to much of the leachate level and other relevant information becoming available and prior to conducting the FFS. In addition, the level of effort for the modeling task was not consistent with the emphasis the commenter places on such modeling. The modeling information was included in the FFS for completeness of available information and was not intended to represent a critical analytical effort. The Army regrets any implications that occurred as a result of calling it a "successful" model.

Additionally, the measured 10 gpm flow rate provides the only direct measurement of any of the several components, or "fluxes", of the water budget model. However, even without this measurement, there is other available information on which to estimate all other leachate/groundwater flow components, including leachate generation. The most apparent is the fact that a mound of leachate exists at the east end of Landfill 7, which clearly indicates that leachate can not escape from the waste rapidly. In addition, the low productivity of the many wells at Fort Sheridan and the general hydrogeological characterization of the formation that the landfills are located within supports the conclusion that the rate of groundwater movement and flow between the landfills and groundwater is low.

While the Army is aware of and recognizes certain limitations of the available information, the Army does not concur that the 10 gpm estimate is highly questionable (see response to Comment 17-15).

The commenter does not indicate why he believes the 10 gpm estimate is fundamental to evaluation of the capping alternatives and the Army presumes the concern is associated with the cost of leachate treatment and discharge rates. The Army is not aware of any limitations that groundwater seepage into the waste presents other than the facilities, and associated cost,

to capture, treat, and discharge that rate of flow. The measured 10 gpm in question is currently discharging at the storm drain outlet and there would appear to be no reason to doubt that this flow, whatever the source, could be captured. However, other ravines in the vicinity that are near-natural ravines with respect to groundwater conditions are ephemeral (personnel communication, Mike Chrzastowski), lacking high groundwater discharge rates. The Army is aware of no information that would suggest that lateral groundwater seepage into the waste will exceed a few gallons per minute after cover and drainage improvements are completed to reduce percolation into the landfills, as was described in the FFS.

COMMUNITY MEMBERS

18. NON-RESPONSIVE, Highland Park

18-1 Don't move the landfill. Install drainage tiles along both sides. Plug storm drain at each end.

Response:
Installation of a new storm drain and cover improvements to promote surface drainage will minimize percolation into the landfills. The storm drain will be diverted at each point where it enters the landfill and the pipe plugged. The downstream end will be terminated at a collection sump and pumping station. If a drainage tile were installed along each side of the landfills, it would collect clean groundwater from the upgradient side (away from the landfills) and potentially collect leachate from the landfill side of the drain tile, depending on the depth of the drain. It is better to collect the leachate from within the waste through the leachate recovery wells and converted storm drain as included in all of the action alternatives evaluated. See related response to Comment 27-3.

18-2 Moving the waste would put the problem somewhere else.

Response:
This statement is correct and is one of several disadvantages of the excavation alternative identified by the Army. While the other landfill(s) into which the waste would be placed would be a landfill presumably located through the required landfill siting process, it would still displace a waste volume that would result in an earlier expansion of that landfill or siting a new landfill. Siting new landfills is a politically difficult process. Additionally, even new landfills present some risk and, therefore, require long-term monitoring and maintenance.

19. NON-RESPONSIVE Highland Park

19-1 Believes the past Army commanders should pay part of the cleanup since they had advice against filling the ditches from engineers and members of the civilian work force.

Response:
Landfill 7 received a sanitary landfill permit from IEPA. Use of the ravine for a landfill was done in accordance with the regulations in effect during the time the landfills were operational. The Army is responsible for problems caused by past practices at its installations.

20. NON-RESPONSIVE Highland Park

20-1 My question is how come many families have lived on the base for years, no concern of the dangerous condition that they say exists. Now, because a developer has found a way to become a very greedy wealthy person, it becomes a big issue because he does not want to spend his money to be able to build as many homes on the property for his gain.

Response:
Please see the responses to Comments 1-2 and 1-34. Addressing the landfill problems is not a new effort, but rather a requirement established by the Army's permit for Landfill 7 and the commitment the Army made to the Navy when the property was transferred prior to any involvement by developers.

21. NON-RESPONSIVE, Highland Park

21-1 Was expecting a presentation. Was pleasantly surprised to see the documents and information so available and clear, and people so available to answer questions.

Response:
The Army selected a forum for the public meeting that provided the maximum opportunity for the community to review the available information and ask questions of the Army and agencies. Many people prefer this forum and it is a frequently used approach for CERCLA public meetings.

22. NON-RESPONSIVE Northbrook

22-1 It appears that Alternative 4, excavation, has been avoided in large part due to insufficient information about the character of the waste in Landfills 6 and 7.

Response:
The Army disagrees that Alternative 4 has been avoided. Both the FFS and Proposed Plan have evaluated the various alternatives and determined through a logical and thorough process that the proposed interim remedy is the appropriate remedy for implementation. The evaluation in the FFS and the Army's selection of the preferred interim action was based on the nine criteria required to be evaluated by the NCP. These criteria include compliance with ARARs, overall protection of human health and the environment, long- and short-term effectiveness, and reduction of mobility, toxicity, or volume of the constituents of concern. Alternative 4 is not as desirable as the preferred alternative for reasons including cost, short-term problems related to implementation, and the fact the waste is only being moved to another landfill. The Army believes that analytical testing of the waste would find that most of

the volume would be special waste. Even with that best case assumption, the Army would not select the excavation alternative due to the reasons cited above.

23. Name withheld upon request, Highland Park

23-1 Government has no right to place residents at risk during excavation due to the air emissions. Recommend capping in place.

Response:
As stated previously, the difficulty in controlling air emissions during excavation is one of the reasons the Army has chosen to implement a capping alternative for the interim remedy at Landfills 6 and 7.

24 NON-RESPONSIVE Highland Park

24-1 . . . the Army's "Preferred Alternative" (2b) of capping has been persuasively investigated and described in great detail . . . On the other hand, the long-term and obviously preferred alternative (4) of the nearby residential communities. . . is lacking in detailed information . . . . as well as totally unknown costs . . . Those of us who will be greatly impacted . . . have insufficient information at present upon which to evaluate these two options. It would seem to be imperative that an equally detailed (and equally persuasive) investigation and description of the excavation alternative be made and publicized in order for a best solution to be arrived at.

Response:
The Army received a number of comments representing a diversity of interests in Fort Sheridan. The content of these comments do not support your conclusion that excavation is the "obviously preferred alternative". See responses to Comments 1-1, 1-5, 2-1A, 8-5, 8-6, 14-5, 17-1, 22-1, and 30-4 regarding the excavation alternative.

24-2 Construction traffic, in any case, should use only the north gate and Westleigh Road to 41.

Response:
Truck traffic would likely not use Walker Avenue and the south entrance gate to Fort Sheridan because Westleigh Road and Highway 41 is the most likely highway routes for construction traffic. The Fort Sheridan Truck Gate, and not the "north gate" would be used. It is noted (Comment 3-1) that the City of Lake Forest indicates that waste will not be allowed to pass through the City by either truck or rail.

25. NON-RESPONSIVE Highland Park

25-1 Concerned about truck traffic that might occur on Walker Avenue along the south boundary of Fort Sheridan.

Response:
Please see the response to Comment 24-2.

26. NON-RESPONSIVE Chicago

26-1 In areas as sensitive as Fort Sheridan, where waste is close to Lake Michigan, site restoration would seem logical.

Response:
Restoration of the site would require removal of the wastes. The Army expects that everyone would agree that it would be nice to have a restored natural area where Landfills 6 and 7 are located. The overall evaluation of the alternatives indicates that the required excavation is not the best alternative. Please see responses to comments listed under Evaluation of Excavation Alternative (Index of Comments).

27. NON-RESPONSIVE Highland Park

27-1 Supports selection of containment interim action. Capping is tried and true method.

Response:
Comment noted.

27-2 Excavation would use tax dollars that could be spent on other environmental cleanups without providing additional benefits in terms of human health and environment.

Response:
The Army agrees with the commenter. While the Army's selection of the preferred interim action was not based solely on economics, cost was one of the criteria. The FFS and Proposed Plan have evaluated capping and excavation alternatives and determined, through the objective process required by law, that the proposed interim remedy offers the best short term protection of public health and the environment and good long term effectiveness and permanence, at an estimated cost of only half that of the least expensive excavation alternative. This objective process required under CERCLA requires the Army evaluate cleanup alternatives against nine criteria including compliance with ARARs, overall protection of human health and the environment, long- and short-term effectiveness, reduction of mobility, toxicity, or volume of the constituents of concern, and cost. Beyond cost, the Army's evaluation of the implementability of the excavation alternative also identified significant potential problems with the excavation process itself. While the excavation alternative might provide some long-term benefits locally compared to the preferred alternative, it would move the waste containment problem to a new location with little additional benefit to protection of human health and the environment or of other criteria on which remedy selection was based. See also response to Comment 18-2.

27-3 A groundwater diversion trench upstream of landfills should be provided, contingent on detailed analysis of its effectiveness, implementability, and cost during remedial design.

Response:
A groundwater interception, or diversion, trench located upstream of the landfills was considered in the FFS and no significant benefit was found Further, the groundwater flow rates are low through the low permeability soils so the benefit of installation of a trench,

which would have to be relatively deep and lengthy, is minimal. The anticipated groundwater inflow to the leachate collection system is less than 5 gpm and a portion of that may not be prevented by even a relatively extensive diversion trench. Additionally, such a trench, if effective, would need to be located far enough from the waste so that it would not capture any contaminants released from the waste. If it did, the captured water, originally intended to be diverted, would potentially need to be treated. In the event that with future knowledge a trench is deemed to be needed, it could be completed with little or no impact on other remedial measures already in place.

A related comment was that it may be necessary or appropriate upgradient of the landfills to install a slurry wall, a vertical barrier of low permeability used to reduce groundwater flow through an area, normally constructed by excavating a trench and backfilling it with a slurry containing bentonite or other low permeability material mixed as a slurry. Slurry walls typically have permeabilities of approximately $1x10^{-6}$ cm/sec (1 ft/year) to $1x10^{-8}$ cm/sec, approximately the same permeability of the soil materials surrounding the landfill. Quality control for slurry wall construction is difficult because the work is done at depth and is inaccessible for viewing. Further, there is little to be gained by the installation of a slurry wall. The natural groundwater flow rate is very low and the hydraulic conductivity of the soil is not significantly different than that of the slurry wall, making it superfluous.

27-4 The implementation concept for the interim action does not provide adequately for management of off-gas from the leachate treatment system. The landfill gas treatment system needs to be operational at the same time that leachate treatment begins.

Response:
See response to Comment 1-29.

27-5 Gas should be collected during stabilization period.

Response:
The landfill gas emissions have been found to not present an immediate problem under existing conditions. During the stabilization phase the residents near the landfills will be relocated. The Army has determined that, since residents are being relocated anyway, there is insufficient benefit to justify the expense and operational difficulties that would accompany such an interim system.

28. NON-RESPONSIVE Highland Park

28-1 Agrees with capping approach.

Response:
No response necessary.

28-2 A leachate collection and treatment system should be installed in the appropriate location. A gas collection system "should be installed under the cap" and run at just under atmospheric pressure to avoid volatilizing the liquids in the landfill.

Response:
Leachate and landfill gas collection systems, as described in the comment, are planned to be installed with the RCRA cap installation.

28-3 Technologies in addition to capping and leachate collection may be appropriate. Injection of non toxic material to increase mobility of contaminants. [note: commenter submitted a separate comment indicating that he had discussed this technology with an expert and determined it to be to untested or not viable for this application].

Response:
Flushing or washing of materials, including use of agents to mobilize contaminants, is a relatively new remediation technology that is generally considered an innovative technology for contaminated soil. Some researchers have proposed leachate recirculation, or even use of clean water, to wash municipal solid waste in constructed lined landfills to speed stabilization of the waste. The Army questions the appropriateness of this technology for an unlined landfill. While available information indicates that leachate migration from Landfills 6 and 7 is limited by the low permeability soils, intentionally increasing the mobility of contaminants would not be desirable because this approach would increase the leachate treatment requirement during the washing phase. The commenter has noted that his referenced expert also indicated this would not be a viable alternative.

29. NON-RESPONSIVE Highland Park (lives adjacent to Fort Sheridan)

29-1 Concerned that work will be "never-ending" if capped

Response:
Any landfill cap, whether the cap is at Fort Sheridan, or elsewhere if the waste is moved, will require subsequent routine maintenance for the life of the cap. This would typically include monitoring, equipment operation and maintenance, cap maintenance, etc. Landfill caps, if properly designed, constructed, and maintained should last indefinitely, therefore, work beyond routine maintenance, such as total cap reconstruction is unlikely. As discussed in response to Comment 12-5, the existing Landfill 7 cap performance and resulting work should not be considered indicative of future maintenance requirements for a properly designed and constructed cap.

30. NON-RESPONSIVE Highland Park

30-1 The cost to haul garbage is well known - should be $37 - $57/cy for industrial waste. Wide cost range shows uncertainty. Should be tested.

Response:
The cost to transport waste is relatively well known. The cost of dewatering to allow excavation, excavating, testing, providing additional dewatering/drying/processing required for transport and disposal, disposal fees, and the many additional costs associated with the excavation alternative have been accounted for in the excavation cost estimates provided in the FFS. Since the waste has not been characterized for regulatory classification (i.e., special waste or hazardous), the FFS assumes the range of possibilities. Even under the best case

assumptions, excavation is much more expensive than the proposed interim remedy considering all costs for implementing the alternatives and providing any required maintenance for a period of 30 years (a time period required by law to use for cost estimating purposes). It is unnecessary to further characterize the waste if the proposed remedy is protective even under an assumption of hazardous waste. The other alternative, excavation, is much more expensive under best case assumptions.

30-2 Public health and safety is paramount. The waste should be moved. There is an increasing number of landfill excavations - e.g., Vincennes County

Response:
The Army agrees that health and safety is paramount. CERCLA identifies protection of human health and the environment as one of two threshold criteria that alternatives must satisfy to be selected. The other threshold criteria is compliance with ARARs. The Army has carefully evaluated the alternatives with regard to these two CERCLA criteria and believes that both the capping and excavation alternatives evaluated can satisfy these criteria. The Army's evaluation indicates, however, that the excavation alternative has a greater potential for not being able to satisfy these criteria than does the capping alternative. The Army has reviewed all information, including comments received from the public, and has not identified factual information or supported hypotheses that cause the Army to anticipate that the selected alternative will not comply with all CERCLA criteria, including the two threshold criteria. Conversely, factual information has not been identified that reduces the Army's concerns regarding the known and potential risks associated with excavation of the wastes and transport to an off-site landfill for disposal.

There have been relatively few sites where a solid waste landfill or a portion of a solid waste landfill, hazardous or not, has been excavated. The Army, USEPA, and IEPA are not aware of any similar type landfills approaching the size of Landfills 6 and 7 having been excavated, even considering the many landfill sites that have less suitable geological conditions for implementing a containment approach than exist at Landfills 6 and 7.

30-3 Nuisances during excavation can be managed by working in manageable sections. Odor control using sprays and wind barriers. Plastic collection tanks for contaminated runoff.

Response:
These types of nuisances and potential controls have been identified, considered, and factored into the excavation alternative evaluation. There are many potential conditions related to the excavation alternative that are not mere nuisances. These include releases of toxic gases during excavation, handling and transport of waste, releases of leachate during precipitation events that exceed the capacity of the runoff controls, and accidents resulting from transportation of the wastes. The consideration of these conditions and the problems and uncertainty inherent to control measures associated with them played a significant role in the selection of the preferred alternative. See also responses to Comments 1-10, 1-11, 8-4, and 30-4.

30-4 A detailed excavation plan is more protective than capping alternatives.

Response:
The FFS and Proposed Plan have evaluated capping and excavation alternatives and determined, through the objective process required by law, that the proposed interim remedy offers the best short term protection of public health and the environment and good long-term effectiveness and permanence. This conclusion is supported by USEPA, IEPA, and the Lake County Health Department; all agencies whose missions are to uphold public safety. This objective process required under CERCLA requires the Army evaluate cleanup alternatives against nine criteria including compliance with ARARs (i.e., state and federal regulations), overall protection of human health and the environment, long- and short-term effectiveness, and reduction of mobility, toxicity, or volume of the constituents of concern. Beyond cost, the Army's evaluation of the implementability of the excavation alternative also identified significant potential problems with the excavation process itself. These problems are recognized by USEPA and are, in part, the basis for containment being identified as the presumptive remedy for CERCLA MSW landfills similar to Landfills 6 and 7. These problems are also the reason that no instances of excavating similar landfills approaching the volume of Landfills 6 and 7 have been identified. See also the response to Comment 30-3.

30-5 Has the excavation of a trench all around the landfills backfilled with an impermeable material to prevent leachate leaving the sides of the landfill, been considered? [Verbal comment to court reporter]

Response:
The commenter is referring to what is commonly known as a slurry wall. See response to Comment 8-11 and 27-3.

30-6 Has the Army considered testing the soil on the banks of the lake to determine if it may have been impacted by contaminants from the landfill. [Verbal comment to court reporter]

Response:
The Army has performed sampling of the soils and will complete additional sampling of the nearshore sediments in the lake as part of the DoD RI/FS. This information will determine if additional measures are required for the final remedy, but is not necessary to support the source control interim action.

31. NON-RESPONSIVE Highland Park

31-1 Concerned about health effects of excavation.

Response:
Please see the responses to Comment 23-1.

31-2 Public notice should have been more extensive.

Response:
The Army appreciates your concern and recognizes the difficulty in reaching a large majority of the community. The Army's efforts to date in providing the community with information relating to the environmental cleanup of Landfills 6 and 7 include many public meetings, fact sheets, press releases, newsletters, and the establishment of information repositories at the Fort Sheridan BRAC Office and the local public libraries. However, the Army is committed to keeping the community informed and involved of all cleanup activities at Fort Sheridan and will strive to identify and implement any new and innovative methods of reaching the community at large.

The Army has met specific community relations requirements under CERCLA and the Superfund Amendments and Reauthorization Act (SARA) for the cleanup of Landfills 6 and 7. All relevant information regarding the selection of the preferred alternative was provided in the Fort Sheridan Administrative Record before and during the 30-day public comment period, as required by law. As part of the Installation Restoration program, the Army meets with and receives input from a Restoration Advisory Board composed of local citizen representatives. The Army has specifically discussed Landfills 6 and 7 at Fort Sheridan RAB meetings dating back to April of 1995 and has followed up with a series of timely discussions relating to the development of the Focused Feasibility Study, Proposed Plan, and specific comments received as part of the Proposed Plan.

In addition to the legal requirements, the Army believes it has exceeded these requirements by developing a series of fact sheets and newsletters which have kept the community informed of the status of the landfill cleanup process. These fact sheets and newsletters are distributed to the local libraries, the media, RAB members, and a large mailing list of citizens interested in the cleanup activities at the fort. In fact, the August fact sheet, which invites local residents to the public information meeting and details the proposed plan and other alternatives studied, was delivered door to door and explained to over 150 area residents living adjacent to Fort Sheridan. In addition, through regularly scheduled press releases, the Army has been assisted by the local media with extensive coverage in such papers as the Chicago Tribune, Chicago Sun Times, Waukegan News Sun, and Highland Park News. The Army will continue these proactive efforts in providing the community with information and also attempt to identify any new and effective methods to reach the community.

31-3 Oppose excavation.

Response:
Comment noted.

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