United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-92/221
September 1992

EPA

Superfund Record of Decision:

Butterworth #2 Landfill, MI

NOTICE

The appendices listed in the index that are not found in this document have been removed at the request of the issuing agency. They contain material which supplement, but adds no further applicable information to the content of the document. All supplemental material is, however, contained in the administrative record for this site.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-92/221	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Butterworth #2 Landfill
First Remedial Action - Final

5. Report Date 09/29/92

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15. Supplementary Notes
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16. Abstract (Limit: 200 words)

The 180-acre Butterworth #2 Landfill is a municipal landfill in Grand Rapids, Kent County, Michigan. Land use in the area is predominantly residential and industrial. The site, which lies within the 100-year floodplain of the Grand River, contains wetland drainage areas with emergent aquatic communities. Prior to 1967, the area to the east of the stormwater out-fall was used as a municipal landfill (Butterworth #1). This portion of the site was operated as an open landfill where daily cover of refuse was not provided. After the enactment of Michigan Act 87 in 1965, Butterworth #1 was closed, and Butterworth #2 and #3 were opened. Several high-voltage power transmission lines pass through the landfill, and landfilling was not allowed in the areas below the power lines; however, it was discovered that the area was allegedly used to dispose of liquid wastes, such as solvents and paint sludge. Records indicate that from 1967 to 1971, approximately 3,000 to 4,000 cubic yards of waste per day were received at the landfill. In 1988, a surface soil/test pit assay identified PCBs at levels of 800 mg/kg and chromium at levels of 43,000 mg/kg. In 1990, a removal action was initiated to address this contamination, which resulted in 1,100 tons of material being removed from the site. This ROD addresses a final remedy for the landfill via

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Butterworth #2 Landfill, MI
First Remedial Action - Final
Contaminated Media: Soil, debris
Key Contaminants: VOCs (benzene, TCE, xylenes), other organics (PCBs, pesticides), and metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 62
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

Abstract (Continued)

and copper. In 1985, the state and C&D Recycling arranged for the excavation and offsite capping and establishing ACLs for site-specific contaminants of concern in ground water. The primary contaminants of concern affecting the soil are VOCs, including benzene, TCE, and xylenes; organics, including PCBs, and pesticides; and metals, including arsenic, chromium, and lead.

The selected remedial action for this site includes removing and disposing of exposed drums containing hazardous materials at an offsite RCRA facility; upgrading the landfill cover to include a clay cap, and gas venting and treatment systems to meet state standards; revegetating the area; installing additional monitoring wells in the upper and lower aquifers, and implementing a long-term monitoring program for ground water, surface water, sediment, and biota; establishing ACLs for site ground water based on the current level of contamination; mitigating affected wetlands; implementing institutional controls including deed and ground water use restrictions. The estimated present worth cost for this remedial action is $15,230,000, which includes an annual O&M cost of $110,000 for 30 years.

PERFORMANCE STANDARDS OR GOALS: Chemical-specific ground water clean-up goals were not established in this ROD because current contamination levels will be determined through sampling of compliance monitoring wells for eight consecutive quarters over a 2-year period. The indicator parameters to be analyzed quarterly will include all chemicals established as chemicals of concern. After the initial 2-year period of quarterly sampling, ground water shall be monitored for the next 3 years on a quarterly basis; then, analysis will be made for the primary contaminants of concern.

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Butterworth Landfill Site
Grand Rapids, Michigan

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Butterworth Landfill site, in Grand Rapids, Michigan, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the administrative record file for this site.

The State of Michigan does not concur on the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedy will involve capping the landfill and establishing Alternate Concentration Limits for site specific contaminants of concern in ground water. The response action for this remedy will eliminate the primary route of exposure at the site by containing the soils under a cap that will meet the intent of Michigan Act 641 requirements.

The major components of the selected remedy include:

- Institutional controls
- Grading and leveling of the site.
- Removal of exposed drums containing hazardous material, substance or waste, and disposal off-site at a RCRA Subtitle C disposal facility.
- Improvement of the site capping to meet the requirements of a Michigan solid waste cap (MI Act 641) with inclusion of a frost protection layer.
- Establishment of alternate concentration limits (ACLs) for ground water.
- Ground-water, river-water and river-sediments monitoring.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus
Regional Administrator

September 29, 1992
Date

DECISION SUMMARY FOR THE RECORD OF DECISION

SITE NAME, LOCATION, AND DESCRIPTION

The Butterworth Landfill (Butterworth) site is located in Grand Rapids, Kent County, Michigan, about one mile southwest of the Grand Rapids downtown area. The site is approximately 180 acres and its approximate boundaries are the Grand River on the south, Interstate 196 on the west, Butterworth Street on the north and a Consumers Power substation on the east (see Figure 1). A combined storm-water outfall crosses the site (see Figure 2). The site is within the hundred year floodplain of the Grand River.

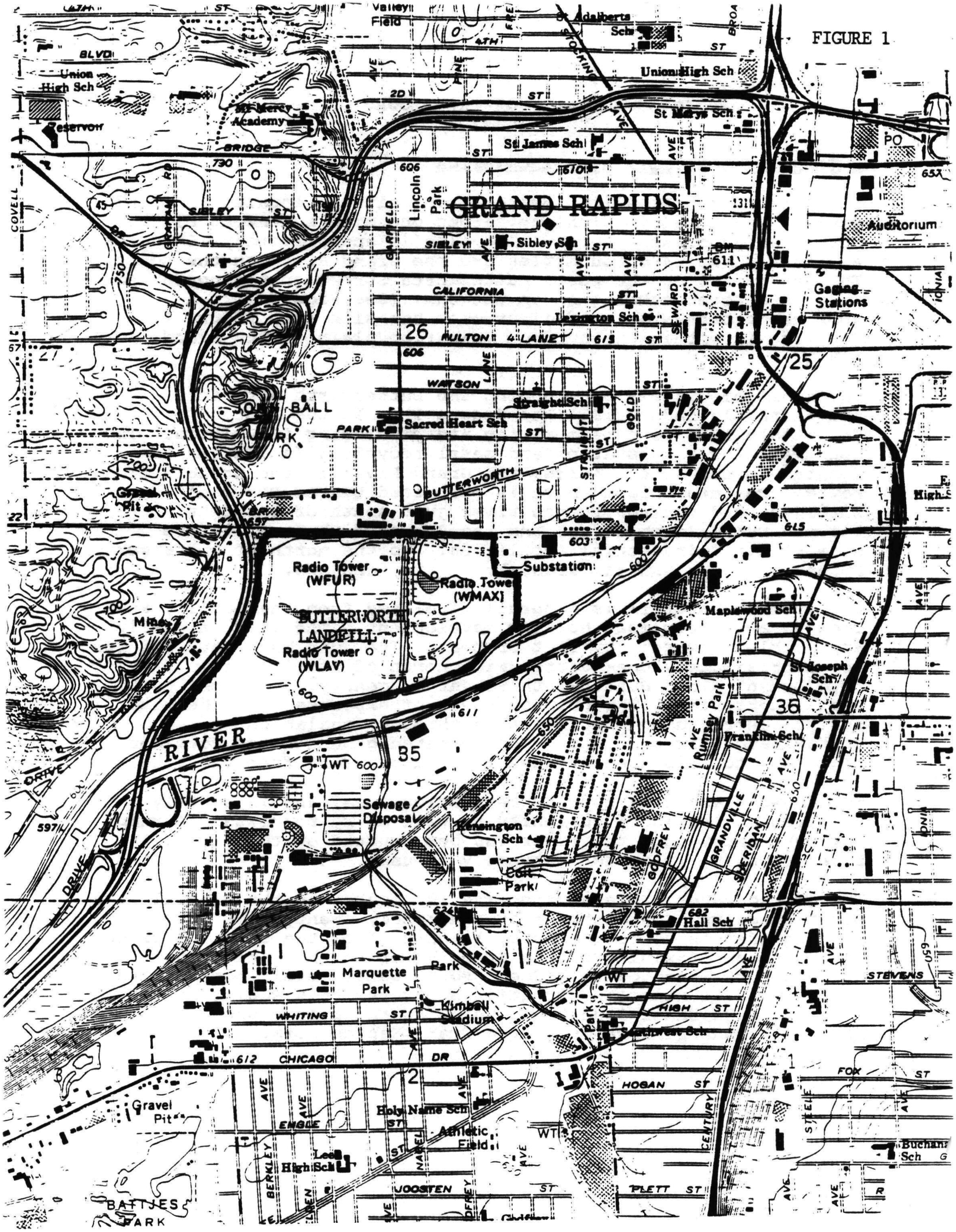
The area immediately surrounding the Butterworth site is predominantly industrial (see Figure 1). To the west of Interstate 196 are gypsum mining and processing facilities. The Consumers Power substation and metal recycling facilities are located to the east. Across the Grand River is the Grand Rapids sewage treatment plant which is permitted by the State of Michigan to discharge to the river just south of the site. Between Butterworth Street and the Butterworth Landfill are several light industrial facilities. To the north of Butterworth Street is a residential area, ball park, and zoo.

Butterworth Landfill is generally isolated from the public, and located away from most housing development. The site is easily accessible, however, by foot or boat. The John Ball Park and Zoo are approximately one-quarter mile north of the landfill. Development along Butterworth Street is generally limited to small industries. The primary route of exposure from the site for the surrounding population is through inhalation of contaminated air and dust. Contaminated ground water does not migrate into this area because it is upgradient from the site.

The Grand River is a popular recreation area, and is heavily utilized by the local community as well as by tourists. A ramp for boat entry into the river was constructed on the landfill site; however, it is not currently in use.

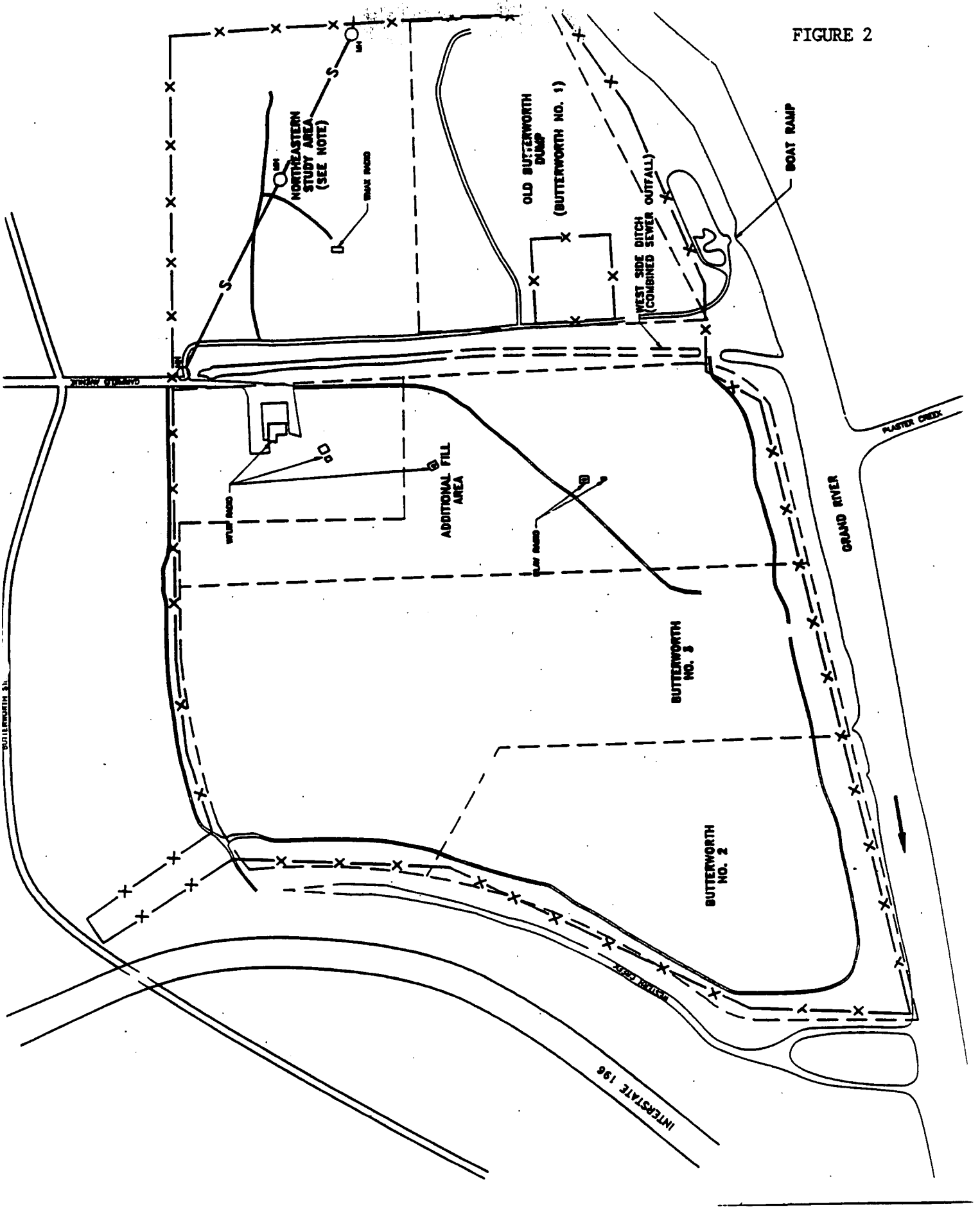
The ground water table at the site is located in the glacial lake plain deposits at a depth of approximately twenty-five feet. This aquifer is contaminated by leachate from the site. Because of the close proximity of the Grand River to the site, river stage can be expected to affect ground water levels beneath the landfill. The Michigan Formation separates this aquifer from the underlying Marshall Sandstone, which is the main source of water for many industrial wells in the Grand Rapids area.

FIGURE 1



GRAND RAPIDS
St Adalberts Sch
Union High Sch
St Marys Sch
St James Sch
PO
Auditorium
Lincoln Park
Sibley Sch
Gaging Stations
Lexington Sch
Union High Sch
Reservoir
St Mercy Academy
BRIDGE
SIBLEY
COVELL
CALIFORNIA
FULTON
WATSON
PARK
Straight Sch
Sacred Heart Sch
BUTTERWORTH
BALL PARK
Gravel Pit
Radio Tower (WFUR)
Radio Tower (WMAX)
Substation
BUTTERWORTH LANDFILL
Radio Tower (WLAV)
Maplewood Sch
St Joseph Sch
Franklin Sch
Rumsey Park
RIVER
DRIVE
WT
Sewage Disposal
Kensington Sch
Park
GODFREY
GRANDVILLE
SHERIDAN
Hall Sch
Marquette Park
STEVENS
WHITING
Kimball Stadium
HIGH
CHICAGO DR
HOGAN
FOX
Holy Name Sch
Athletic Field
ENGLE
Lee High Sch
JOOSTEN
PLETT
BERKLEY
CENTURY
Gravel Pit
BATTJES PARK
Buchanan Sch
IONIA

FIGURE 2


NORTHEASTERN STUDY AREA (SEE NOTE)
OLD BUTTERWORTH DUMP (BUTTERWORTH NO. 1)
WEST SIDE DITCH COMBINED SEWER OUTFALL
BOAT RAMP
ADDITIONAL FILL AREA
GRAND RIVER
PLASTER CREEK
BUTTERWORTH NO. 3
BUTTERWORTH NO. 2
INTERSTATE 196

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Butterworth Landfill site was operated by the City of Grand Rapids, Michigan, and was used for both residential and industrial waste. Landfilling was performed in three general areas at the Butterworth Site (see Figure 2). The limited information available indicates that, prior to 1967, the area to the east of the storm water out-fall was used as a municipal landfill. This area is referred to as the Old Butterworth Dump, or Butterworth #1. This portion of the site was operated as an open landfill where daily cover of refuse was not provided. The refuse was often burned to reduce its volume.

After the enactment of Michigan Act 87 in 1965, and consistent with the federal goal of eliminating open dumping, the Old Butterworth Dump was closed sometime around 1967 and a new site, Butterworth Landfill #2, was opened. This new site occupied an area in the southwest corner of the site.

Later, an additional area, Butterworth Landfill #3, was opened. The combined size of Landfills #2 and #3 was about 80 acres. These areas were used by local residents and industries to dispose of wastes. Several high voltage power transmission lines pass through the middle of Landfill #2 and #3. For safety reasons, landfilling was not allowed in the area below these power lines. However, during the course of the field investigation, some fill material was identified in the area below the power lines. In addition, this area was allegedly used to dispose of liquid wastes such as solvents and paint sludges.

The landfill reportedly received municipal solid waste and industrial wastes. There is no record as to the exact nature of these materials, nor the quantities involved. It is also not clear who all of the potential generators or transporters may have been. Due to the large industrial sector in the Grand Rapids area, industrial waste input to the landfill may have accounted for a significant portion of total waste. There is some indication (based on file records) that industrial wastes disposed of at the landfill were either in drums, which were buried, or simply dumped in liquid form on a working surface. Other disposal methods, if any, are presently unknown. Records indicate that from 1967 - 1971 about 3000 - 4000 cubic yards of waste per day were received at the landfill.

The landfill was constructed on existing native soils at the site. The available data does not show whether a liner or seal material (such as clay) was used prior to initial fill operations. It is reported that a clay dike was constructed around portions of the landfill at some point during its operation. However, the landfill materials are presumed to have been primarily materials that existed on-site.

Butterworth was nominated for the National Priorities List (NPL) and was placed on the NPL in December 1982. The Remedial Investigation/Feasibility Study (RI/FS) was initiated in June 1986.

In 1988 the surface soil/test pit assay conducted during the RI located a hot spot of polychlorinated biphenyls (PCBs) at levels of 800 mg/Kg and chromium (total) at levels of 43,000 mg/Kg. A removal action was initiated to address this contamination and was completed in June 1990. Approximately 1100 tons of material were removed from the site. The PCB contaminated soil was sent to Alabama for disposal in a RCRA Subtitle C landfill.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

An extensive community relations program was undertaken at the site. Public meetings and availability sessions, usually held every two to three months, were held to keep the public informed of progress at the site and address their concerns. A Technical Assistance Grant was made available to one local community organization to provide assistance in interpretation of site related information and documents.

The RI Report, FS Report and the Proposed Plan for the Butterworth Landfill site were released to the public for comment on May 26, 1992. These documents were made available to the public in both the administrative record and information repositories located at the Main Branch of the Grand Rapids Public Library, the West Side Branch of the Grand Rapids Public Library and the U.S. EPA Region 5 office in Chicago, Illinois. The notice of availability for these documents was published in the Grand Rapid's Press newspaper on May 21, 1992, and The West Side Advance newspapers on May 26, 1992. A public comment period on the documents was held from May 26, 1992, to July 24, 1992. In addition, a public meeting was held on June 11, 1992. At this meeting, representatives from U.S. EPA and Michigan Department of Natural Resources (MDNR) answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD. The public participation requirements of CERCLA Sections 117 and 113(k)(2)(B)(i-v) have been satisfied.

SCOPE AND ROLE OF THE RESPONSE ACTION

This ROD will eliminate the primary route of exposure at the site by containing the soils under a cap that will meet the intent of Michigan Act 641 requirements. Exposure to site soils poses the primary danger to human health and the environment because of the risks from possible inhalation, ingestion or dermal contact.

There is also the threat of contaminant migration from the soils into the underlying ground water that discharges into the Grand River. The purpose of this response is to reduce contaminant migration into the ground water, surface water, and air, and prevent direct contact with the contaminants.

These goals will be met through the proposed action, which will involve improving the landfill cover, the establishment of Alternate Concentration Limits (ACLs) for ground water and ground water monitoring to ensure the continued absence of impact from the site on the Grand River. ACLs are site-specific ground water contaminant concentration levels that will be established through a process which meets the criteria set forth in Section 121(d)(2)(B)(ii) of CERCLA. Frequent monitoring of ground water, river water and river sediments will be undertaken to ensure that the ACLs will not be exceeded. The establishment of ACLs provides an enforceable limit for contamination levels in ground water. If either the new levels are exceeded or if a change in the river quality indicates that the site is now having an impact on the river, then further response action for ground water will be considered in accordance with CERCLA.

Information gathered during the Remedial Investigation indicates that due to the location of the site, the direction of ground water flow and the remedy proposed in this ROD, ACLs are appropriate for addressing the contamination of ground water at the Butterworth site. The Superfund Amendments and Reauthorization Act (SARA) provides for a process for the establishment of ACLs in Section §121(d)(2)(B)(ii). This section states that "...a process for establishing alternate concentration limits to those otherwise applicable for hazardous constituents in ground water may not be used to establish applicable standards...except where- (I) there are known and projected points of entry of such ground water into surface water; and (II)...there is or will be no statistically significant increase of such constituents from such ground water in such surface water...and (III) the remedial action includes enforceable measures that will preclude human exposure to the contaminated ground water at any point between the facility boundary and all known and projected points of entry of such ground water into the surface water." The Preamble to the National Contingency Plan (NCP) (55 FR 8754) elaborates that "EPA's policy is that MCLs or MCLGs above zero should generally be relevant and appropriate requirements for ground water...and that a waiver is generally needed in situations where...(they)...cannot be attained. If, however, a situation fulfills the CERCLA statutory criteria for ACLs...documentation of these conditions for the ACL is sufficient and additional documentation of a waiver of the MCL or MCLG is not necessary."

The decision to establish ACLs must be based on whether the site fulfills the three requirements specified in CERCLA and whether

remediation of the aquifer to MCLs or non-zero MCLGs is impracticable. This site meets those requirements. The ground water discharges into the Grand River (requirement I), there is no statistically significant impact on river quality that can be attributed to the site (requirement II), and the fill material (i.e., the site) extends to the edge of the Grand River allowing for enforceable measures to preclude human exposure (requirement III). Additionally, the risk associated with ground water is not considered significant, calculated to be $9x10^{-5}$, and it does not exceed the upper bound acceptable risk established in the NCP of $1x10^{-4}$. Fill material from the landfilling operations extends into the aquifer throughout the site and it is impracticable to remove this material from the site ground water. For this reason, implementation of an active ground-water remediation would not significantly impact the quality of the ground water in the shallow aquifer beneath the site. Furthermore, because the fill actually extends into the river, any active ground water remediation would likely bring a significant amount of river water into the landfill. Consequently, the depth of fill material in combination with the proximity of the fill to the river makes remediation of the aquifer to MCLs or non-zero MCLGs impracticable. For these reasons, the Agency believes that it is appropriate to establish ACLs for site ground water.

SUMMARY OF SITE CHARACTERISTICS

GEOLOGY

The bedrock formations underlying the Grand Rapids area are of sedimentary origin, formed from sand, clay, or limey mud. The bedrock strata in the area is covered almost everywhere by glacial drift. In the Grand Rapids area the rocks that form the bedrock surface beneath the drift are, from oldest to youngest: Coldwater Shale, the Marshall Formation, the Michigan Formation and the Bayport limestone, all of the Mississippian age; the Parma sandstone and a very small area of outcrop of Saginaw Formation, both of Pennsylvanian age. The bedrock formations are exposed along the Grand River in the southern part of Grand Rapids and at points in Wyoming, Paris, Gaines, and Walker Townships.

Well records within a five mile radius of Butterworth Landfill indicate that the Michigan Formation exists below the surface sand deposits. This formation consists of about seventy-five feet of alternating layers of gypsum and hard shale. The Michigan Formation at the site was found to range in thickness from 75 feet to 116 feet. Most of the Michigan formation appeared dry and free of water.

Below this is the Marshall Formation consisting of some 300 feet of poorly cemented sandstone and hard shale. The Marshall

formation extends to 370 feet below the surface and is the upper unit of the Mississippian Aquifer System. Both of these formations dip in a northerly direction.

The fill materials deposited at the Butterworth site are directly on top of Pleistocene near shore lake plain deposits that extend for about twenty-five feet. Beneath this is approximately fifteen feet of gypsum, which appears to be present in several continuous layers. Below the gypsum is twenty-five feet of shale, which is underlain by about ten more feet of gypsum.

In the northern part of the landfill, the fill material was found to extend from the surface to an estimated forty feet below the surface. The glacial and alluvial deposits lying below the fill material and unconformably above the Michigan Formation are found at or near the surface in the north of the site and at depth of twenty feet below the surface near the river. The glacial materials are composed of gray, medium to coarse sands interbedded with fine gravels. The glacial and alluvial deposits were found to range from coarse gravels to silts. Fine sands were shown to be most abundant. A few small clay lenses are also present at the site.

HYDROLOGY

The Grand River has the second largest drainage basin of any stream in Michigan. It drains an area of about 5,570 square miles, of which 4,900 square miles lie upstream from Grand Rapids. The river is about 300 miles long and has a total fall of more than 500 feet. It rises in the northeastern part of Hillsdale County, flows northwestward, and empties into Lake Michigan at Grand Haven. Principal tributaries are the Rogue, Thornapple, Flat, Maple, Lookinglass, and Red Cedar Rivers.

The annual average flow of the Grand River at Grand Rapids from 1983 to 1988 was estimated to be 4,710 cubic feet per second (cfs), with the greatest daily flows occurring during February, and to a lesser extent in March. Ten year, seven day low flow has been reported as 696 cfs. The maximum discharge in this area (recorded period 1901-1978) occurred during the flood of 1904, when a flow of 54,000 cfs was recorded. This flood resulted in the complete inundation of the area now occupied by Butterworth Landfill.

Mean annual precipitation in Kent County is about 33.5 inches per year, with a mean annual evapotranspiration rate of 30 inches per year. Thus, net percolation to the water table is 3.5 inches per year. Infiltration rates are generally high in the area. High stream flow occurs during spring because of snow melt.

Drainage at the landfill site is accomplished by two drainage swales, one to the north and one to the west. These areas join and drain into the Grand River.

HYDROGEOLOGY

Ground water in the Grand Rapids area occurs in both bedrock and unconsolidated glacial drift deposits. It is used by practically all the population and industries outside the area served by the cities of Grand Rapids, East Grand Rapids, Walker, and Wyoming. The quantity and quality of the ground water available are dependent on the geology. In general, the aquifers in the Grand Rapids are recharged by precipitation that falls within the area. Declines in ground water level occur because of evaporation, drainage to adjacent streams and discharge from wells.

The Marshall formation lies immediately above the Coldwater Shale and is the only bedrock formation in the area that yields large quantities of water. The formation is composed almost entirely of sandstone that is relatively permeable. The formation contains a shaly area that separates the formation into an upper and lower part.

The ground-water table at the site is located in the twenty-five feet of glacial lake plain deposits that lie just below the fill. Because of the close correlation between snowmelt, rainfall, and ground-water level, particularly in areas with sand soils, the elevation of the ground water at the site fluctuates with precipitation.

Because of the close proximity of the Grand River to the Butterworth Landfill, river stage can be expected to affect ground-water levels beneath the landfill. In general, it can be expected that ground water will flow from the water table beneath the landfill to the Grand River. The total discharge from the site, based on ground-water flow and infiltration, is calculated to be 0.138 cfs as compared to the 4,710 cfs average annual flow of the Grand River.

ECOLOGY

The entire landfill site is overgrown with tall grass, brush and scattered small trees. Larger trees, generally willow and cottonwood, are located along the Grand River. The wetland drainage areas to the north and east of the landfill contain emergent aquatic communities such as grasses, sedges, and cattails.

Animal burrows are present throughout the site. Representative rodents that are likely to be present on the site are muskrats, gophers, opossum, shrews, mice, and rats.

The freshwater fish predominantly found in this area of the Grand River include bass, yellow perch, sunfish, crappie, rock bass, and suckers. A survey was conducted by the State of Michigan Water Resources Commission on the Grand River to determine heavy metal concentrations in fish. Concentrations were not found to exceed FDA or Canadian tolerance limits.

SUMMARY OF SITE RISKS

During the RI/FS, an evaluation was conducted to estimate the health or environmental problems that could result if the contamination at the site was not addressed. This evaluation is commonly referred to as a baseline risk assessment. In conducting this assessment, the focus was on the health effects that could result from exposure to contaminated soil, contaminated ground water and water from the Grand River that could have been impacted by contaminated ground water.

The potential routes of exposure evaluated were ingestion, inhalation and dermal contact with soil, ingestion and dermal contact with Grand River water, and ingestion of ground water.

As in most landfills, there is a large number of contaminants at the Butterworth Landfill contributing to the risks associated with the site. However, the number of contaminants that constitute over 95% of the risk in each medium is relatively small. In ground water, the compounds that cause 95% of the elevated risk levels are the metals antimony and arsenic, the volatile organic compounds 1,1-dichloroethane and vinyl chloride, and the semivolatile organic compounds bis(2-ethylhexyl) phthalate, and polychlorinated biphenyls (PCBs). The contaminants in soils that cause 95% of the elevated risk levels are the metals arsenic, beryllium, and chromium; and the semivolatile organic compounds polynuclear aromatic hydrocarbons (PAHs), PCBs, and the pesticide dieldrin.

Cancer potency factors (CPFs) have been developed by U.S. EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CPFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Excess lifetime cancer risks are determined by multiplying the intake level with the CPF. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). an excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Reference doses (RfDs) have been developed by U.S. EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting non-carcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse non-carcinogenic effects to occur.

Potential concern for non-carcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

The baseline risk assessment evaluated several different categories of people who could potentially be affected by the contamination at the site. These included adults working on the site, children playing on the site, and those using the Grand River for recreational purposes.

The category of children playing on the site had the highest estimated health risk from non-carcinogenic (not cancer producing) substances. This health risk was from contact, ingestion and inhalation of site soils. The non-carcinogenic hazard index for this category is estimated at 13. The U.S. EPA considers a hazardous index of 1 as a level of acceptable risk. A hazard index above 1 could possibly result in an unacceptable risk to human health. Therefore, a hazard index of 13 indicates that there is an increased chance of adverse health effects posed by the site to children who play on the site.

For risks of cancer, the baseline risk assessment estimated the excess lifetime cancer risk posed to an adult, working on the site and drinking contaminated ground water to be $3.0x10^{-4}$. Put another way, if the site was not cleaned up and 10,000 adults were exposed to contaminants from the site over their lifetimes,

3 individuals might develop cancer under the conditions of the exposure assessment.

It is important to note that this health risk estimate was based on the assumption that individuals would be working full time on the site. Under this scenario, workers would be exposed to site contaminants via dermal contact, soil ingestion, particle inhalation, and by drinking water from a well placed into the contaminated aquifer. Presently, residences near the site use the city's water supply, which comes from Lake Michigan, and not from the ground water contaminated by this site.

Actual or threatened releases of hazardous substances from this site, if not addressed by the preferred alternative or one of the other active measures considered, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF ALTERNATIVES

The alternatives analyzed for the site are presented below. Detailed information on each of the alternatives is available in the Feasibility Study (FS) Report. After consideration of all alternatives presented in the FS, the U.S. EPA has shortened the list of alternatives to four alternatives. This short list was chosen because it represents the full spectrum of alternatives presented in the FS without the redundancy of the matrix established in that document.

The four alternatives evaluated for this site are as follows:

- Alternative 1: No action. Under this alternative, no remedial action would be taken; the site would remain in its present condition.

- Alternative 2: Access restrictions, site monitoring, cap improvements, installation of additional on-site and off-site monitoring wells, establishment of Alternate Concentration Limits.

- Alternative 3: Access restrictions, site monitoring, cap improvements, up-gradient slurry wall.

- Alternative 4: Access restrictions, site monitoring, cap improvements, down-gradient slurry wall, on-site ground-water extraction wells, discharge of contaminated ground water to either a publicly owned treatment works or on-site treatment and discharge to the Grand River.

COMMON ELEMENTS. Except for the "no action" alternative, all of the alternatives now being considered for the site include a

number of common elements. These elements are access restrictions, measures to mitigate the impact of flooding of the Grand River, mitigation of any impacted wetlands, surface controls, drum disposal contingency plan and long-term monitoring. The access restrictions include maintaining the current site fence, establishing deed restrictions to restrict excavation and construction at the site and to restrict the use of ground water. The drum disposal contingency plan will address removal of any drums containing hazardous waste identified during the remedial action.

ALTERNATIVE 1:
NO ACTION.

ESTIMATED CAPITAL COST: $0
ESTIMATED ANNUAL OPERATION AND MAINTENANCE (O&M) COST: $0
ESTIMATED PRESENT NET WORTH: $0
YEARS TO IMPLEMENT ACTION: 0

The NCP (the Superfund implementation rule) require the U.S. EPA to consider a "no action" alternative for every Superfund site. Under this alternative, U.S. EPA would take no further action at the site to protect human health and the environment.

ALTERNATIVE 2:
SOIL CAP (MICHIGAN ACT 641 CAP) WITH ESTABLISHMENT OF ALTERNATE CONCENTRATION LIMITS (ACLs) FOR GROUND WATER.

ESTIMATED CAPITAL COST: $13,530,000
ESTIMATED ANNUAL OPERATION AND MAINTENANCE (O&M) COST: $110,000
ESTIMATED PRESENT NET WORTH: $15,230,000
YEARS TO IMPLEMENT ACTION: 3-7

This alternative calls for improving the landfill cover to meet Michigan Act 641 requirements for solid waste landfill covers. The requirements for Michigan Act 641 landfill covers consist of a minimum of 2 feet of compacted clay with a cap slope not to exceed 1 foot vertical to 4 feet horizontal nor less that 2%. To establish a more permanent cap as well as reduce long-term operation and maintenance cost, a frost-protection or freeze-thaw layer will be incorporated into the Michigan Act 641 cap requirements.

Currently, all information indicates that ground water in the shallow aquifer under the site is discharging into the Grand River, which is the physical and hydrogeologic boundary for the site. The discharging ground water has no detectable impact on the river. Since fill material extends into the shallow aquifer under the landfill, it is not practicable to remove all fill material in order to restore the shallow aquifer to beneficial use. Further, it is not practicable to install active ground water remediation because the result would be to effectively draw water from the river into the site. For these reasons, ACLs, which are site specific chemical concentrations for ground water

at a site, would be established. ACLs are established by developing baseline ground-water quality levels for the shallow aquifer at the site and then employing a statistical analytical method to determine what level of contamination would cause a statistically significant impact to the Grand River. If future sampling confirms a statistically significant increase in the concentrations of the compounds of interest, U.S. EPA would then make a decision regarding the need to implement a subsequent remedial action.

Additional monitoring wells would be installed on both sides of the Grand River to insure that all ground water continues to discharge to the river and that concentrations of contaminants in the ground water do not increase and exceed ACLs. A monitoring program of Grand River water and sediments will be instituted to ensure that there is no future impact from the site on the Grand River. If a significant impact from site contaminants is detected in either river water or sediments, then an additional action will be undertaken to mitigate any impact.

ALTERNATIVE 3:
LOW PERMEABILITY CAP (MICHIGAN ACT 64 CAP) WITH CONSTRUCTION OF AN UPGRADIENT VERTICAL BARRIER FOR GROUND WATER.

ESTIMATED CAPITAL COST: $24,880,000
ESTIMATED ANNUAL OPERATION AND MAINTENANCE (O&M) COST: $110,000
ESTIMATED PRESENT NET WORTH: $26,540,000
YEARS TO IMPLEMENT ACTION: 3-7

The provisions of this alternative include improving the landfill cover to meet Michigan Act 64 requirements for hazardous waste landfill covers and installing an upgradient ground-water barrier. In contrast to the Michigan Act 641 cap, the requirements for a Michigan Act 64 landfill cover consist of a vegetated soil layer at least 1 foot thick, a drainage layer at least 1 foot thick, and 3 feet of compacted clay with permeability of less than or equal to $1x10^{-7}$ cm/sec. An in-ground barrier, such as a slurry wall, would be constructed on the northern, western and eastern boundaries of the site to minimize the migration on-site of ground water in the shallow aquifer and thereby into the Grand River. The barrier would be constructed so that it would extend down the entire depth of the aquifer to ensure that ground water could not bypass the barrier.

ALTERNATIVE 4:
LOW PERMEABILITY CAP (MICHIGAN ACT 64 CAP) WITH CONSTRUCTION OF A DOWNGRADIENT VERTICAL BARRIER AND GROUND-WATER EXTRACTION.

ESTIMATED CAPITAL COST: $27,970,000
ESTIMATED ANNUAL OPERATION AND MAINTENANCE (O&M) COST: $140,000
ESTIMATED PRESENT NET WORTH: $30,150,000
YEARS TO IMPLEMENT ACTION: 3-7

This alternative provides for improving the landfill cover to meet Michigan Act 64 requirements for landfill covers, install a downgradient ground-water barrier, and extract ground water for treatment. An in-ground barrier would be constructed on the southern side of the landfill to isolate the site ground water from the Grand River. Extraction wells would be installed in the fill material near the in-ground barrier to maintain a balance between the hydraulic pressure from the ground water and that exerted by the river. Contaminated ground water collected by this system would either be discharged to the City of Grand Rapids publicly owned treatment works (POTW) for treatment off-site or extensively treated on-site prior to discharge to the Grand River. The ground-water extraction system would be required to operate in perpetuity.

COMPARATIVE ANALYSIS OF ALTERNATIVES: THE NINE CRITERIA

In accordance with the NCP, the relative performance of each alternative is evaluated using the nine criteria, 40 CFR Section 300.430 (e) (9) (iii), as a basis for comparison. An alternative providing the "best balance" of trade-offs with respect to the nine criteria is determined from this evaluation.

The following two threshold criteria; overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements, are criteria that must be met in order for an alternative to be selected.

1. Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether a remedy eliminates, reduces, or controls threats to human health and to the environment.

The major exposure pathways of concern at the Butterworth Landfill site are the potential for inhalation, ingestion and dermal contact with contaminated site soils. Based upon these pathways of concern, the alternatives were evaluated on their ability to reduce exposure to those soils.

Alternative 1 does not provide any reduction in the risk to human health and the environment. For this reason, Alternative 1 is eliminated from further evaluation as an acceptable alternative to remediate this site.

Alternatives 2,3 and 4 are protective of human health and the environment because these alternatives eliminated the major exposure pathway by preventing contact with site soils through construction of a landfill cover.

2. Compliance with Applicable or Relevant and Appropriate Requirements

This criterion evaluates whether a remedy meets applicable or relevant and appropriate requirements set forth in Federal and State environmental laws pertaining to the site or proposed actions or if a waiver is justified. ARARs are discussed in more detail in Statutory Determinations.

All of the alternatives, except for the no action alternative, will comply with Federal and State ARARs. The major ARARs that will be complied with include: RCRA and Michigan Hazardous Waste Management Act (Act 64), which address the handling of hazardous materials (including requirements for incineration, transportation, land disposal restrictions, and minimum technology requirements for landfills, and hazardous waste landfill covers); the Clean Air Act and Michigan's Air Pollution Control Act (Act 348), which address air emissions from the excavation; Michigan Water Resources Commission Act (Act 245), which addresses ground water quality; and Michigan Environmental Response Act (Act 307), which addresses cleanup type; Federal Safe Drinking Water and State Safe Drinking Water Act (Act 399); and landfill closure ARAR Michigan Act 641.

Alternative 2 requires that ACLs be established for contaminated ground-water pursuant to CERCLA section 121(d)(2)(B)(ii). This replaces the water quality standards set forth in Act 307 and Act 245.

3. Long-Term Effectiveness and Permanence

This criteria refers to the ability of an alternative to maintain reliable protection of human health and the environment over time (lower residual risk) once the clean-up goals have been met.

Alternatives 2, 3 and 4 provide long-term effectiveness by containing the landfilled waste on-site through engineering controls. Long-term maintenance of the landfill cover will be required to insure the continued future performance of the cover.

Alternative 2, 3 and 4 reduce infiltration of precipitation into the landfill mass through construction of the landfill cover and thereby reduce the production of leachate. In addition, Alternative 3 further minimizes, but does not eliminate, the production of leachate by reducing the amount of ground water entering the site through construction of an upgradient vertical barrier. Alternative 4 significantly reduces the production of leachate by decreasing the amount of ground water entering the site through construction of both upgradient and downgradient vertical barriers and through collection of any leachate formed. This alternative involves continual extraction of leachate and ground water to prohibit the production of leachate.

4. **Reduction of Toxicity, Mobility, or Volume Through Treatment**

This criterion evaluates treatment technology performance in the reduction of chemical toxicity, mobility, or volume. This criteria addresses the statutory preference for selecting remedial actions which include, as a principal element, treatment that permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants.

This criteria and the statutory preference are not met for any of the alternatives since none of the alternatives involve treatment as a principal element.

5. **Short-Term Effectiveness**

Short-term effectiveness considers the time to reach clean-up objectives and the risks an alternative may pose to site workers, the community, and the environment during remedy implementation until clean-up goals are achieved.

Alternatives 2, 3, and 4 involve containment of the landfilled waste on-site and are expected to require approximately the same length of time to implement. Community and worker health can be protected during improvement of the landfill cap through safety control measures including dust suppression.

Alternatives 3 and 4 would require trenching to install the vertical barriers. Community and worker health would be more difficult to protect due to the activity of excavating the landfilled waste from the trenches. Uncovering waste would increase the potential for exposure to hazardous constituents by direct contact and inhalation.

6. **Implementability**

This criterion considers the technical and administrative feasibility of implementing an alternative.

Alternatives 2, 3 and 4 will involve an increase in traffic through the local communities. Measures will be evaluated during design to insure that the increase in traffic due to construction activities will have minimal impact on residents and the local community.

No significant implementation problems are projected for the capping components of Alternatives 2, 3 and 4. Cap materials are expected to be obtainable from nearby sources. The engineering expertise and construction practices and equipment for installation, operation and maintenance of this component of these alternatives' are available and proven. Some special consideration for both the radio towers and high-tension towers

located on the site will be required during design and construction. Access to areas outside of the Butterworth Landfill property is necessary for Alternative 2 for installation of the ground-water monitoring system including the construction of the additional monitoring wells. Although, statutory authority provides U.S. EPA the legal right access those areas, the potential exists that acquiring access might cause a delay.

Installation of the downgradient vertical barrier in Alternative 4 will be difficult due to the proximity of the fill material to the river as well as the fact that the river will place substantial hydraulic pressure on the barrier. Alternative 4 also requires treatment of the extracted ground water through use of the local POTW. Potential problems exist in Alternative 4 due to the questionable ability of the Grand Rapids POTW to treat the contaminated ground water, development of an appropriate pretreatment system to allow discharge to the POTW, or in design and construction of an on-site ground-water treatment facility.

7. **Cost**

This criterion compares the capital, operation and maintenance, and present worth costs of implementing the alternatives at the site.

The costs for each alternative are as follows:

ALTERNATIVE	CAPITAL COST	ANNUAL O&M COST	PRESENT NET WORTH
1	$0	$0	$0
2	$13,530,000	$110,000	$15,230,000
3	$24,880,000	$110,000	$26,540,000
4	$27,970,000	$140,000	$30,150,000

Present Net Worth calculated for 30 years at 5%. Calculation of Present Net Worth is an estimate of the value of money used to pay future costs in "today's" dollars. The calculation is based on the assumption that an existing dollar will earn interest and therefore has a greater value than a future dollar.

8. **State Acceptance**

The State of Michigan has assisted in the development and review of the Administrative Record. However, the State of Michigan has indicated that it does not agree with the use of ACLs at this site and, therefore, does not concur with the selected alternative.

9. **Community Acceptance**

Based on the comments received by the U.S. EPA, the selected alternative appears to be acceptable to the community. Community concerns are addressed in the attached Responsiveness Summary.

SELECTED REMEDY

Based upon considerations of the requirements of CERCLA and the NCP, balancing of the nine criteria, and public comment, the U.S. EPA has determined that Alternative 2 is the most appropriate remedy for the Butterworth Landfill site.

The components of the selected remedy are as follows:

1. Institutional Controls:

   Institutional controls may include, as necessary, restrictions to control future development of the landfill area and to prohibit the installation of ground-water drinking water supplies at the Butterworth Landfill property and an isolation zone consisting of land within the area between the Butterworth Landfill property and 1000 feet to the north, east, south and west of the lateral extent of the landfilled waste as defined in the Remedial Investigation Report.

   Restrictions regarding the installation of ground-water drinking water wells outside of the point of compliance (the landfill boundary), within the isolation zone noted above, may be lifted as to individual locations if U.S. EPA determines that: contaminant levels within ground water have fallen and will remain below MCLs or MCLGs for contaminants detected at the site.

2. Additional Monitoring Well Installation:

   Additional monitoring wells in the upper and lower aquifers shall be installed to provide data on these aquifers. The number of wells installed shall be, at a minimum, 17 wells in the upper aquifer generally located between the fill material and the Grand River. The location of the wells shall be determined by use of a statistically stratified plan. The plan shall consist of dividing the approximately 4250 foot landfill/river front boundary into 17 equal partitions approximately 50 feet by 250 feet in size. One well shall be located within each partition. To induce a statistical randomness into the design location for each well, each partition shall be subdivided and numbered. A random number table shall be employed to select the numbered subdivision in which the well shall

be placed. The random number chosen for each partition shall be recalculated using the random number table. The data from sampling of these wells shall be used to help institute the statistical data needed to establish the Alternate Concentration Limits. The number and location of these wells shall be specified in the Remedial Design.

Additional monitoring wells shall be installed in the upper and lower aquifers on the opposite side of the Grand River from the landfill. These wells shall be used to verify that the Grand River continues to function as a hydrogeologic boundary. The number and location of these wells shall be specified in the Remedial Design.

Sampling and analysis of these additional monitoring wells shall be incorporated into the final ground-water monitoring program, as appropriate. The installation of these wells shall be completed during the Remedial Design.

3. Installation and Implementation of Ground-water Monitoring Program:

A ground-water monitoring program shall be implemented. This program will be identified in the Remedial Design. The ground-water monitoring program shall be designed to detect contaminants, changes in contaminant characteristics and increases/decreases in the concentration of hazardous substances, pollutants and contaminants in the upper and lower aquifers at and near the site.

Ground-water monitoring shall include collection and field and laboratory analysis of samples from selected monitoring wells. At a minimum, field analysis shall include ground-water elevation, pH, temperature, specific conductivity, and redox potential. Laboratory analysis performed shall include organic compounds and inorganic analytes from U.S. EPA's Target Compound List (see Table 1) on an annual basis for at least the first 2 years (2 annual samplings and analyses). At the end of the initial 2 year monitoring period, U.S. EPA may re-evaluate the frequency of monitoring and the number of analytes and compounds that shall be analyzed for in ground water.

The ground-water monitoring program shall continue until at least 30 years after the completion of construction at the site. At the end of 30 years, U.S.

EPA will determine the need to extend the period of monitoring.

If, at any time, additional information indicates that the ground-water monitoring program should be changed, U.S. EPA may require modifications to the program. Modifications may include, but are not limited to, a change in the number and selection of ground-water monitoring wells to be sampled, installation of additional ground-water monitoring wells, the selected laboratory analysis parameters, and/or the compounds and analytes which shall be monitored for in ground water.

4. Surface-Water/Sediment/Biological Monitoring:

A surface-water/sediment/biological monitoring program shall be implemented and shall be identified in the Remedial Design. Streams, intermittent streams, combined sewer overflow, and the Grand River waters and sediment as well as selected fish and benthic lifeforms shall be sampled and analyzed quarterly for the first two years and annually thereafter. The surface-water/sediment/biological sampling points and analytes shall be specified in the Remedial Design.

The surface-water/sediment/biological monitoring program shall continue until at least 30 years after the completion of construction at the site. At the end of 30 years, U.S. EPA will determine the need to extend the period of monitoring.

If, at any time, additional information indicates that the surface-water/sediment/biological monitoring program should be changed, U.S. EPA may require modifications to the program. Modifications may include, but are not limited to, additional surface-water/sediment/biological monitoring points, a change in the frequency of monitoring, and/or analysis of additional parameters.

5. Establish Alternate Concentration Limits

ACLs shall be established for site ground water and be based on the current level of contamination. To quantify the current contamination levels, baseline ground-water quality levels shall be established. These levels shall be determined through sampling of compliance monitoring wells for 8 consecutive quarters over a 2 year period. The indicator parameters to be analyzed quarterly shall include, but are not

necessarily limited to, all chemicals established as chemicals of concern in ground water at the site (see Table 2). The frequency, timing, and protocol shall be developed in the Remedial Design with the objective of gathering representative data of ground-water quality and its variation over a 2 year period. A statistical test which accounts for the variation of the data shall be employed to measure compliance, and shall be equivalent to or the same as the "Cochran's Approximation to the Behrens-Fisher Student's t-test" provided in 40 CFR Part 264 Subpart F, Appendix IV.

The monitoring wells used to determine and subsequently verify ground-water quality shall be located downgradient between the landfill mass and the river to which the plume discharges. The number of monitoring wells designated for sampling as well as the frequency of sampling and the parameters sampled shall be determined in the Remedial Design. Monitoring wells to be sampled shall include existing ground-water monitoring wells and additional ground-water monitoring wells determined and specified by U.S. EPA.

After the initial 2 year period of quarterly sampling used to develop the baseline ground-water quality statistic, ground water shall be monitored for the next 3 years on a quarterly basis. At a minimum, Analysis shall be made for the primary contaminants of concern. At the end of this 3 year period, U.S. EPA may re-evaluate the frequency of monitoring and number of compounds and analytes that shall be analyzed for in ground water. At a minimum, ground water shall continue to be monitored on an annual basis.

For subsequent monitoring events, a new statistic shall be developed and compared to the baseline water quality statistic derived during the first 8 quarters of monitoring. If the new statistic exceeds the baseline statistic at the 95% confidence limit there is high probability that a statistically significant increase of a parameter(s) has occurred. The statistic may apply to each compound in Table 2 or to the sum of the compounds or to both. At the end of the 3 years of compliance monitoring, U.S. EPA may re-evaluate the frequency of monitoring and the number of compounds and analytes that shall be analyzed for in ground water. At a minimum, ground water shall continue to be monitored on an annual basis.

If U.S. EPA should determine that it is appropriate to reduce the frequency of ground-water monitoring events and during a subsequent monitoring event an ACL is

exceeded at the 95% confidence level at any one of the compliance points defined in the Remedial Design, quarterly monitoring shall be reinstated and be conducted, at a minimum, over a 1 year period to confirm or reject the initial results. If an ACL is exceeded at the 95% confidence level for 2 consecutive quarters, then the Remedial Action Plan (RAP) shall be implemented to address the ACL exceedance. The RAP shall be developed as part of the Remedial Design and shall consist of pre-determined response actions to address ACL exceedances. The RAP shall be designed to mitigate an impact on the Grand River or a threat to human health and the environment. Examples of potential engineering response actions Include, but are not limited to, identification and removal of a source hot spot, installation of slurry walls to reduce or eliminated interaction between the ground water and the river, and/or installation of a ground-water extraction system.

6. Landfill Cover

New landfill covers shall be installed, or the existing landfill covers shall be repaired/retrofited to meet the requirements of Solid Waste Management Act 641 (1978), as amended, Michigan Code of Laws (MCL) Sections 299.401 through 299.436. The landfill caps shall cover all landfilled waste at the site.

The landfill cap shall include, but not be limited to:

* GAS VENTING AND TREATMENT SYSTEM: the cap shall have a final cover system capable of allowing removal and treatment (if needed) of generated gas from within the landfill.

* CLAY CAPPING LAYER: a minimum 2 foot thick clay cap shall be designed to provide a low hydraulic conductivity barrier to percolation. The specific specifications of the clay capping layer are listed within MDNR Act 641.

* FREEZE-THAW LAYER: a cover layer that provides additional rooting depth for vegetation and protects the clay capping layer from damage due to freeze-thaw and desiccation.

* TOPSOIL: a minimum of 6 inches of topsoil shall be designed over the cover layer to support the proposed vegetation.

* REVEGETATION: Seed and fertilizer shall be applied to the topsoil layer to establish a vegetation cover. The seed type and amount of fertilizer applied shall be proposed in the Design and Specifications Plan and will depend on the type and quality of topsoil and compatibility with both native vegetation and the final site use.

* SLOPE: The slope of the final cover shall not exceed 1 vertical to 4 horizontal and shall not be less than 1 vertical to 50 horizontal.

* FLOOD PREVENTION: Appropriate measures as defined in the Remedial Design shall be undertaken to mitigate any impact, or potential impact, from flooding of the Grand River.

Adequate noise and dust suppressant measures shall be taken to protect the community from the effects of construction. Earthen berms and/or plant materials (i.e., trees or shrubs) shall be placed around the landfill area perimeters to control dust and noise impacts. Adequate measures shall be employed to protect surface waters from siltation during construction and post-closure.

7. Mitigation of Wetlands

Any wetlands impacted by activities conducted as a result of this remedial action shall be mitigated as deemed appropriate by U.S. EPA.

8. Drum Removal and Disposal

Drums, either currently exposed or uncovered during activities conducted as part of the Remedial Action, which are determined to contain hazardous material, substances, or waste in any amount which would constitute a release or spill of such hazardous material, substance, or waste, shall be removed and disposed of in accordance with all applicable or relevant and appropriate regulations for the material.

Based on information obtained during the RI and FS, U.S. EPA believes that the selected remedy will meet these goals.

Mitigative measures will be taken during remedy construction activities to minimize the impacts of noise, dust and erosion run-off to the surrounding community and environs. Fugitive dust emissions shall not violate the National Ambient Air Quality Standard for particulate matter smaller that 10 microns (PM-10). Potential runoff, silting and sedimentation problems from

construction shall be mitigated to comply with MI Acts including, but not limited to, Public Acts 203 (1979), 346 (1972) and 347 (1972) for wetland protection, inland lakes and streams, and soil erosion and sedimentation control, respectively.

The landfilled waste will continue to be contained on-site. Since this landfilled waste is the source of the contaminants, hazardous constituents will therefore remain at the site. A review of site conditions, the remedy's progress toward achievement of remediation standards and the availability of new emerging technologies which could further reduce the toxicity, mobility or volume of hazardous constituents remaining at the landfill shall, at a minimum, be reviewed every 5 years after the initiation of the remedial action.

STATUTORY DETERMINATIONS

The selected remedy must satisfy the requirements of Section 121 a through f of CERCLA to:

1. Protect human health and the environment;
2. Comply with ARARs or Justify a Waiver;
3. Be cost effective;
4. Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and
5. Satisfy a preference for treatment that reduces toxicity, mobility, or volume as a principal element of the remedy.

The implementation of the selected alternative at the Butterworth Landfill site satisfies these requirements of CERCLA section 121 as follows:

1. Protection of Human Health and the Environment.

Implementation of the selected alternative will reduce and control potential risks to human health posed by exposure to contaminated site soils. Capping the landfill, in addition to reducing any potential further risk posed by exposure to landfill contaminants, will reduce precipitation infiltration through the cap and maintain that reduction over time. Improvement of the cap will reduce ground-water contaminant loading to the aquifer.

No unacceptable short-term risks will be caused by implementation of the remedy. The community and site workers may be exposed to noise and dust nuisances during construction of the cap. As above, mitigative measures will be taken during remedy construction activities to minimize impacts of construction upon the surrounding community and environs.

2. Compliance With ARARs

The selected remedy will comply with the Federal and/or State, where more stringent, applicable or relevant and appropriate requirements (ARARs) listed below:

a. Chemical-specific ARARs

Chemical-specific ARARs regulate the release to the environment of specific substances having certain chemical characteristics. Chemical-specific ARARs typically determine the extent of clean-up at a site.

Federal ARARs

Maximum Contaminant Levels (MCLs) and to a certain extent non-zero Maximum Contaminant Level Goals (MCLGs), the Federal drinking-water standards promulgated under the Safe Drinking Water Act (SDWA), are applicable to municipal water supplies servicing 25 or more people. At the Butterworth Landfill Site, MCLs and MCLGs are not applicable, but are relevant and appropriate since the aquifer in the area of contamination is suitable for use as a source of drinking water in the future. MCLGs are relevant and appropriate when the standard is set at a level greater than zero (for non-carcinogens), otherwise, MCLs are relevant and appropriate. CERCLA Section 121(d)(2)(B)(ii) provides for the establishment of ACLs under limited circumstances. Those circumstances are present at this site. Pursuant to CERCLA Section 121(d)(2)(B)(ii) ACLs may not be used except where (I) there are known and projected points of entry of such ground water into surface water; (II) ... there is or will be no statistically significant increase of such constituents from such ground water in such surface water at the point of entry ...; and (III) the remedial action includes enforceable action which will preclude human exposure ...

ACLs are also discussed in the Preamble to the NCP (55 FR 8754), which states that "ACLs may be used if the conditions of CERCLA § 121(d)(2)(B)(ii) are met and cleanup to MCLs or other protective levels is not practicable (emphasis added). If these statutory criteria for ACLs, including a finding that active restoration of the ground water to MCLs or non-zero MCLGs is deemed not to be practicable, documentation of these conditions for the ACL is sufficient and additional documentation of a waiver of the MCL or MCLG is not necessary."

The decision to implement ACLs must be based on whether the site fulfills the three requirements specified in SARA. This meets those requirements. The ground water discharges into the Grand River (requirement I), there is no statistically significant impact on river quality that can be attributed to the site (requirement II), and the fill material extends to the edge of the Grand River, therefore precluding human exposure (requirement III). The risk associated with ground water does not exceed the acceptable risk range established in the NCP and the fill material extends into the aquifer throughout the site. Additionally, the depth of fill material in combination with the proximity of the fill to the river, makes remediation of the aquifer to MCLs impracticable.

State ARARs

The substantive provision of Michigan Act 307 and the Part 22 rules of Act 245 are ARARs at the Butterworth Landfill Site. However, as explained above, with respect to ground water, the establishment of ACLs pursuant to CERCLA Section 121(d)(2)(B)(ii) replaces the State ground-water quality standards. In any event, the remedies described in Alternatives 3 and 4 are impracticable due to the presence of fill material in the shallow aquifer and extending into the Grand River. These facts make the attainment of MCLs, or more stringent state ground-water quality standards impracticable.

b. Location-specific ARARs

Location-specific ARARs are those requirements that relate to the geographical position of a site. These include:

Federal ARARs

Executive Order 11988 - Protection of Flood Plains - are relevant and appropriate for this site. The landfill is currently within the 100-year floodplain of the Grand River. Any portion of the remedy that is constructed within the 100-year flood plain must be adequately protected against a 100-year flood event (e.g., geotextiles should be used to secure topsoil, etc.)

Section 404 of the Clean Water Act regulates the discharge of dredged or fill material to waters of the United States. Activities during the remedy may be regulated under section 404 of the CWA; therefore, the substantive requirements of section 404 would be

relevant and appropriate to the remedial action at the site.

Executive Order 11990 - Protection of Wetlands - is an applicable requirement to protect against the loss or degradation of wetlands. The site does contain wetlands. Remedy activities may pose a threat to these wetlands. The scope of the impact has not yet been determined. Mitigative efforts will be applied to the clean-up based on the impact on the wetlands.

State ARARs

The substantive provision of the Goemaere-Anderson Wetland Protection Act 203 of 1979 (Act 203) regulates any activity which may take place within wetlands in the State of Michigan. Act 203 is relevant and appropriate to the remedial action at the Butterworth Landfill site.

The substantive provision of the Inland Lakes and Streams Act 346 of 1972, as amended, regulates inland lakes and streams in the State. Act 346 would be applicable to any dredging or filling activity on Grand River bottomlands.

The substantive provision of the Soil Erosion and Sedimentation Control Act 347 of 1972 regulates earth changes, including cut and fill activities, which may contribute to soil erosion and sedimentation of surface waters of the State. Act 347 would apply to any such activity where more than 1 acre of land is affected or the regulated action occurs within 500 feet of a lake or stream. Act 347 would be applicable to the cap and ground-water monitoring system construction activities since these actions could impact the Grand River, which is less than 500 feet from the landfill area.

c. Action-specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances.

Federal ARARs

For landfill closure, RCRA Subtitle C requirements are not applicable since the hazardous substances of concern were disposed of prior to November 1980. Since fill material extends in the ground water beneath the site, the effectiveness of an impermeable hazardous waste cap would be diminished. Therefore, while

Subtitle C is relevant, it is not appropriate for technical (effectiveness) reasons due to the circumstances of this site.

RCRA Land Disposal Restrictions (LDR or Land Ban) would not be applicable since no "placement" of RCRA hazardous waste would be occurring at this site.

RCRA Subtitle C requirements, including LDR, would be relevant and appropriate if wastes were to be excavated and managed and these wastes were determined to be characteristic RCRA Subtitle C hazardous wastes.

The only foreseeable manner in which the selected remedy may store or dispose of hazardous waste is when or if drums located during the closure operations contain RCRA hazardous wastes. The RCRA waste generation and temporary storage regulations under 40 CFR Part 262 would then be applicable to the storage of those drums prior to off-site disposal.

State ARARs

The State of Michigan administers RCRA within the State. Under Hazardous Waste Management Act 64 of 1979, as amended, the State regulates the generation, transport, treatment, storage, and disposal of hazardous waste. Act 64 also regulates the closure, and the postclosure care, of hazardous waste disposal facilities in the State. As with RCRA Subtitle C, above, Act 64 is not applicable or relevant and appropriate to closure of the landfill. Act 64 would be applicable to the treatment or storage of hazardous landfill contents such as drums.

The substantive provision of the Michigan Solid Waste Management Act (Act 641) is applicable or relevant and appropriate for closure of the landfill. The landfill cover design required by regulation promulgated under this State statute provides adequate protection from direct contact with the landfilled waste and minimizes leachate produced by the site.

The State of Michigan has identified the Michigan Environmental Response Act (referred to as Act 307) and its implementing rules as ARARs for this site. U.S. EPA finds that only Rules 705(2) and (3), 707 - 715, 717(2), 719(1) and 723 qualify as ARARs in compliance with Section 121(d)(2) of CERCLA. These rules provide for the selection of a remedy which attains a degree of cleanup which conforms to one or more of three levels of cleanup - Type A, B, or C. A Type A cleanup

generally achieves cleanup to background or non-detectable levels (R299.5707); a Type B cleanup meets specified cleanup levels in all media (R299.5709 - 5715 and 5723) and a Type C cleanup is based on a site specific risk assessment [R299.5717(2) and 5719(1)]. U.S. EPA does not consider the other provisions of Act 307 and its implementing rules identified by the State as ARARS because they are either procedural, not more stringent or do not establish cleanup standards. Additionally, U.S. EPA believes that even if certain of these provisions were considered as ARARs, the remedial actions and cleanup standards selected for this site are in compliance with these State identified ARARs since they have been selected in accordance with CERCLA and the NCP.

The selection of a cap for containment of contaminated soils along with establishment of ACLs for site ground water is in accordance with a site specific risk assessment conducted for the site which meets the requirements of CERCLA and the NCP and therefore, a Type C cleanup, as allowed by R299.5703(2) and (3), 5717(2) and 5719(1).

3. Cost-effectiveness

Cost-effectiveness compares the effectiveness of an alternative in proportion to its cost of providing its environmental benefits. The table under Part 7 of the Section entitled Comparative Analysis of Alternatives lists the costs associated with the implementation of the alternatives.

Alternative 1 is the least expensive alternative; however, it does not provide adequate protection of human health and the environment, does not meet ARARS, and does not provide effectiveness over the long term.

Alternative 2 (the selected alternative) is considered cost-effective. The greatest threat to human health and the environment is through contact, inhalation or ingestion of site soils which will be controlled through installation of a solid waste landfill cover. The risk associated with site ground water is within U.S. EPA's accepted risk range and currently does not pose a threat to the Grand River. Establishment of ACLs with continued long-term monitoring will insure continued lack of degradation of the Grand River.

Alternatives 3 and 4 are more expensive than Alternative 2, do not provide any additional reduction in site risks and are therefore not considered to be cost-effective for this site.

4. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for this site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the U.S. EPA has determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity , mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, and considering State and community acceptance.

5. Preference for Treatment as a Principal Element

The statutory preference for treatment as a principal element of a remedy is not satisfied by the selected alternative.

Due to the large volume of landfilled waste that would need to be treated, treatment of this low level threat waste is considered impracticable. Instead, the remedy employs engineering controls which will be protective of human health and the environment to address the low level threat posed by the landfilled waste.

TABLE 1
U.S. EPA TARGET COMPOUND LIST

Chloromethane	74873	Bromomethane	74839
Vinyl chloride	75014	Chloroethane	75003
Methylene chloride	75092	Acetone	67641
Carbon Disulfide	75150	1,1-Dichloroethene	75354
1,2-Dichloroethane	75343	1,2-Dichloroethene	540590
Chloroform	67663	1,2-Dichloroethane	107062
2-Butanone	78933	1,1,1-Trichloroethane	71556
Carbon tetrachloride	56235	Vinyl acetate	108054
Bromodichloromethane	75274	1,2-Dichloropropane	78875
cis-1,3-Dichloropropene	10061015	Phenol	108952
bis(2-Chloroethyl)ether	111444	2-Chlorophenol	95578
1,3-Dichlorobenzene	541731	1,4-Dichlorobenzene	106467
Benzyl alcohol	100516	1,2-Dichlorobenzene	95501
2-Methylphenol	95487	4-Methylphenol	106445
bis(2-Chloroisopropyl)ether	108601	Trichloroethene	79016
Dibromochloromethane	124481	1,1,2-Trichloroethane	79005
Benzene	71432	Bromoform	75252
trans-1,3-Dichloropropene	10061026	4-Methyl-2-pentanone	108101
2-Hexanone	591786	Tetrachloroethene	127184
Toluene	108883	Chlorobenzene	108907
1,1,2,2-Tetrachloroethane	79345	Ethyl benzene	100414
Styrene	100425	Xylene (Total)	1330207
N-Nitrosodi-n-propylamine	621647	Hexachloroethane	67721
Nitrobenzene	98953	Isophorone	78591
2-Nitrophenol	88755	2,4-Dimethylphenol	105679
Benzoic acid	65850	2,4-Dichlorophenol	120832
bis(2-Chloroethoxy) methane	111914	Naphthalene	91203
1,2,4-Trichlorobenzene	120821	4-Chloroaniline	106478
Hexachlorobutadiene	87683	4-Chloro-3-methylphenol	59507
2-Methylnaphthalene	91576	2-Chloronaphthalene	91587
Hexachlorocyclopentadiene	77474	2-Nitroaniline	88744
2,4,6-Trichlorophenol	88062	Dimethylphthalate	131113
2,4,5-Trichlorophenol	95954	Acenaphthylene	83329
2,4-Dinitrotoluene	606202	3-Nitroaniline	99092
Acenaphthene	51285	4-Nitrophenol	100027
Dibenzofuran	132649	2,4-Dinitrotoluene	121142
Diethylphthalate	84662	Fluorene	86737
4-Chlorophenylphenyl ether	7005723	4-Nitroaniline	100016
4-6-Dinitro-2-methylphenol	534521	alpha-BHC	319846
beta-BHC	319857	delta-BHC	319868
Heptachlor epoxide	1024573	Endosulfan I	959988
Dieldrin	60571	4,4'-DDE	72559
Endrin	72208	Endosulfan II	33213659
4,4'-DDD	72548	Endosulfan sulfate	1031078
4,4'-DDT	50293	Methoxychlor	72435
Endrin ketone	53494705	alpha-Chlordane	5103719
gamma-Chlordane	5103742	Toxaphene	8001352
Arochlor-1016	12674112	Arochlor-1221	11104282
Arochlor-1232	11141165	Arochlor-1242	53469219
Arochlor-1248	12672296	Arochlor-1254	11097691
Arochlor-1260	11096825		

TABLE 1
(continued)

Aluminum	Antimony
Arsenic	Barium
Beryllium	Cadmium
Calcium	Chromium
Cobalt	Copper
Iron	Lead
Magnesium	Manganese
Mercury	Nickel
Potassium	Selenium
Silver	Sodium
Thallium	Vanadium
Zinc	Cyanide

TABLE 2
CONTAMINANTS OF CONCERN IN GROUND-WATER

INORGANIC	ORGANIC
Antimony	Benzene
Arsenic	Beta-BHC
Barium	Bis(2-ethylhexyl)phthalate
Chromium	Chloroethane
Cyanide	1,1-Dichloroethane
Lead	1,2-Dichloroethene (total)
Manganese	Arochlor 1242 (PCBs)
Nickel	Trichloroethylene
Silver	Vinyl Chloride
Vanadium	Xylenes (total)
Zinc	