INTERIM ACTION RECORD OF DECISION DECLARATION

SITE NAME AND LOCATION

North Landfill Subsite, Source Control Operable Unit
North Landfill Subsite, Ground Water Operable Unit
Hastings Ground Water Contamination Site
Hastings, Nebraska

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial actions for the North Landfill for the subsite source control and ground water operable units. The North Landfill subsite is a subsite of the Hastings Ground Water Contamination Site, Hastings, Nebraska. These actions were chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Re-authorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this subsite.

The State of Nebraska concurs with the selected remedies as interim actions for this subsite.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED INTERIM REMEDIES

This interim action Record of Decision contains elements which address both the source control and ground water operable units. The interim source control remedy was developed to protect public health, welfare and the environment by substantially reducing migration of vadose zone contaminants (contaminants in the unsaturated soil overlying the aquifer) to the aquifer. The interim ground water remedy also was developed to protect public health, welfare and the environment by controlling the migration and reducing the volume and mass of contaminants present in the ground water beneath and downgradient from the North Landfill. Both operable unit interim actions will be consistent with all planned future remedial activities. Subsequent ROD(s) will address further actions to be taken at the North Landfill in support of either an interim or a final remedy.

The major components of the selected remedies include:

- **Landfill Surface:** The existing cap will undergo geotechnical testing and will be improved as necessary, based on the testing results. Cap improvements will include regrading and revegetating the landfill surface. A fence will be installed to control site access. Deed restrictions will be imposed to restrict land use, including farming. Subsurface monitoring of the vadose zone at the boundary of the North Landfill will be conducted to assess surface cap effectiveness in reducing the migration of volatiles into the aquifer.

- **Ground Water:** A pump test will be conducted to support design of a groundwater extraction and treatment system. The system will be designed to actively control migration of ground water contaminated with volatile organic compounds and to rapidly remove contaminant mass from the aquifer. Monitoring wells will be installed and ground water sampling and analysis will be conducted to observe the effectiveness and progress of the remediation system.

STATUTORY DETERMINATIONS

These interim actions are protective of public health, welfare and the environment. The actions comply with action-specific and some chemical-specific Federal and State applicable or relevant and appropriate requirements and are cost-effective. Although these interim actions are not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, these interim actions utilize treatment and thus are in furtherance of that statutory mandate. Because these actions do not constitute a final remedy for the subsite, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in these remedies, will be addressed by the final response action. Subsequent actions are planned to address fully the threats posed by the conditions at this subsite. Because these interim remedies will result in hazardous substances remaining on site above health-based levels, a review will be conducted to ensure that these remedies continue to provide adequate protection of human health and the environment within five (5) years after commencement of the remedial action. Review of this subsite and of these remedies will be ongoing as EPA continues to develop remedial alternatives for the North Landfill subsite.

9-30-91

Date

Morris Kay
Regional Administrator
Region VII

Attachments: Decision Summary
Responsiveness Summary
Administrative Record Index

INTERIM ACTION RECORD OF DECISION

DECISION SUMMARY

HASTINGS GROUND WATER CONTAMINATION SITE

NORTH LANDFILL SUBSITE

HASTINGS, NEBRASKA

Prepared by:

U.S. Environmental Protection Agency

Region VII

Kansas City, Kansas

September 30, 1991

Interim Record of Decision

Decision Summary
Contents

Decision Summary
Contents

List of Tables:

List of Figures:

DECISION SUMMARY
NORTH LANDFILL SUBSITE
HASTINGS GROUND WATER CONTAMINATION SITE

SITE DESCRIPTION

The Hastings Ground Water Contamination Site is located in Adams County, Nebraska. The City of Hastings operated the North Landfill from 1961 through 1964. Landfill operations ceased in 1964 and since that time, the landfill property has been used for farming.

The Hastings Ground Water Contamination Site consists of an aquifer contaminated with industrial chemicals, primarily chlorinated volatile organics. Contamination was discovered in 1983 when the Nebraska Department of Health (NDOH) sampled the Hastings public water supply system in response to citizen complaints of foul taste and odor in the drinking water. That same year, NDOH and the Nebraska Department of Environmental Control (NDEC) began investigating wide-spread ground water contamination in the Hastings area. The city, which has a population of approximately 23,000, obtains all of its drinking water supply from the public water supply system which taps the ground water aquifer, known as the High Plains Aquifer from the Pleistocene period. The contamination problems addressed by this interim ROD pertain to this aquifer.

The North Landfill subsite is one of several subsites that make up the Hastings Ground Water Contamination Site in Hastings, Nebraska (Figure 1). The subsite is located just east of the city limits of Hastings, Nebraska and occupies approximately 13.4 acres. The U.S. Land Office designation for the North Landfill is the SW 1/4, SE 1/4, Section 8, Township 7 North, Range 9 West. The landfill surface topography is relatively flat, and the approximate elevation is 1910 feet above mean sea level. The subsite is bounded on the north by the Burlington Northern Railroad, with a trailer park directly north of the railroad tracks, residential and commercial properties directly to the west, U.S. Highway 6 and several commercial properties to the south, and several commercial properties to the east. Figure 2 shows adjacent land use near the North Landfill.

SITE HISTORY

As early as 1938, local brickmakers obtained clay materials from the land which is known today as the North Landfill. The clay was removed unevenly to a depth of 40 feet. In 1961, the Edwards family leased the property to the City of Hastings to operate a municipal landfill. This landfill was in operation from August 1961 through 1964 under a State permit and accepted variety of wastes, including wastes containing volatile organics. According to a former landfill employee, municipal wastes as well as industrial wastes were added to the landfill from the west to the east. In the west, the fill, mainly consisting of construction rubble, was added to a depth of approximately 10 feet. In the southeast section of the landfill, deposits reached a depth of approximately 40 feet. The U.S. Environmental Protection Agency's (EPA) investigation focused in the deeper fill areas. Figure 3 shows the depth of fill in the southeast section of the landfill. When the landfill was closed, a 10-foot layer of clay and silt containing bricks and wood chips was used to "cap" or cover the landfill. In the later 1970's a second 2-foot layer of clay soil was placed on top of the original cover to fill in depressions which had formed due to differential settling. The North Landfill is fenced on the north side and on a portion of the east side but is otherwise completely accessible. The surface of the North Landfill is currently being farmed for alfalfa. There are no buildings or other structures on the subsite.

The City of Hastings Municipal Well No. 12 (M-12) is located near and upgradient of the North Landfill. This well was decommissioned in April 1983 due to trichloroethylene (TCE) contamination. No other municipal wells are located within a half mile radius of the landfill. A second public water supply system, run by Community Municipal Services, Inc. (CMS), supplies customers east of the city limits of Hastings. Two of the three CMS system supply wells, all located downgradient from the North Landfill, have been decommissioned due to contamination.

EPA has been investigating sources of ground water contamination in the Hastings area since 1984. Due to the high levels of VOCs found in three municipal wells, EPA designated the contaminated area as the Hastings Ground Water Contamination Site and placed it on the National Priorities List in 1986. The National Priorities List is a nationwide list of hazardous waste sites that are eligible for investigation and remediation under the Superfund Program.

EPA installed ground water monitoring wells at the subsite from 1986 to 1989. Figure 4 illustrates the location of all subsite monitoring wells. During this period and to the present, EPA has been collecting ground water samples from the contaminated aquifer. As more fully set forth in the Remedial Investigation Report with Addendum and the Feasibility Study Report, the subsurface and the ground water at the subsite are contaminated with volatile organic compounds (VOCs), including but not limited to, TCE, dichloroethene (DCE), vinyl chloride (VC), and benzene. VOCs are organic compounds that evaporate readily at room temperature. TCE was used as a degreasing solvent by metal finishing industries, as well as other industries. DCE and VC are biological breakdown products of TCE. Benzene is a component of gasoline and was used as a general purpose solvent.

EPA conducted its first soil-gas investigation at the North Landfill in 1985. In 1986 and 1988, further investigations were conducted to identify and characterize the extent of VOC contamination within the North Landfill vadose zone. Figure 5 shows the areas where samples were collected during the 1986 and 1988 investigations. Borings D005, D011, D012, and D013 were deep borings (greater than 120 feet deep). Figure 6 shows the levels of TCE found in the soil-gas samples collected from these borings. Analyses of soil-gas samples were used to identify and define areas for further investigation. An investigation, conducted in 1990, focused on the presence of VC in the shallow (less than 28 feet deep) portion of the landfill. The data indicate that wastes buried in the North Landfill have contaminated and may continue to contaminate the ground water beneath and downgradient of the subsite and that the soil-gas within the vadose zone also is contaminated.

All data results are presented in the Remedial Investigation (RI) Report which was released on January 4, 1991. An Addendum to the RI was prepared by EPA which states that the contamination found in the soil-gas is indicative of vadose zone contamination. This Addendum was released in February, 1991. A draft Feasibility Study, based on the RI Report and Addendum to the RI, was released April 4, 1991. A revised Feasibility Study was submitted by the City to EPA on July 23, 1991 and is in review. A Proposed Plan explaining the preferred alternative to mitigate the contamination at the subsite was released June 25, 1991. A Public Comment period was held from June 25 to August 23, 1991 to receive comments from any interested party on the Proposed Plan and other subsite documents.

ENFORCEMENT HISTORY

Potentially Responsible Parties (PRPs) are those individuals or corporations liable for the costs incurred by the EPA for investigation and cleanup of contamination at a Superfund site. In 1985, EPA conducted a PRP search and in September 1985, general notice letters were issued to the following identified PRPs: Bruce Edwards, as owner of the landfill property; the City of Hastings, as operator; Dutton-Lainson Company, and Dravo Corporation (successor corporation to Hastings Industries, Inc.), as generators who disposed of hazardous substances at the subsite. In 1991, after further research, a general notice letter was issued to Bernice Edwards, as owner, and the U.S. Navy, as a generator who disposed of hazardous substances at the subsite.

In January 1987, EPA met with parties who at the time had been noticed at the North Landfill subsite and invited them to make proposals to EPA to undertake the Remedial Investigation and the Feasibility Study (RI/FS). None of the PRPs made an offer at that time. Almost two years later, after EPA had commenced the remedial investigation, the City came forward and offered to complete the RI and perform the FS. On September 26, 1989 EPA and the City of Hastings entered into an Administrative Order on Consent (AOC) pursuant to Section 104 and 122 of CERCLA for the completion of the Remedial Investigation (RI) and performance of the Feasibility Study (FS) at the North Landfill. Pursuant to the requirements of the AOC, the City prepared a RI report and FS report. EPA added an Addendum to the RI report which states that the vadose zone is contaminated and a source control option must be evaluated.

COMMUNITY RELATIONS

Community relations activities for the Hastings Ground Water Contamination Site were initiated by EPA in 1984. Early community relations activities included meeting with City and State officials to discuss the Site (December 1984), conducting interviews with local officials and interested residents (February 1985), establishing an information repository (February 1985), and preparing a Community Relations Plan (October 1985).

Since December of 1984, EPA has conducted periodic meetings with Hastings city officials to update them regarding site work, investigation findings, and most recently, in August 1991, to hear the City's concerns about EPA's Proposed Plan. The Community Relations Plan was revised in January 1988 and again in January 1990 to reflect new community concerns and site activities.

Information on the North Landfill subsite, in the form of fact sheets, has been mailed to public officials, Hastings' businesses, and numerous citizens. EPA held a public comment period from June 25 to August 23, 1991 following the release of the Proposed Plan (June 25, 1991). The Proposed Plan identified the preferred alternative to mitigate the contamination at the North Landfill subsite. On July 18, 1991, EPA held a public meeting to discuss the preferred alternative for the subsite and to receive citizens' comments and questions. Agency responses to these comments are included in the Responsiveness Summary attached to this Decision Summary.

SCOPE AND ROLE OF OPERABLE UNITS

This interim action ROD addresses activities which will mitigate contaminant migration from the source control operable unit and ground water operable unit in the vicinity of the North Landfill and will reduce contaminant mass in the ground water. The ground water contamination is considered the principal threat to human health and the environment. The purpose of the interim action for the source control operable unit is to prevent the infiltration of surface water through the landfill by improvements to the landfill cap. The purpose of the interim action for the ground water operable unit is to begin aquifer restoration and collect additional information on the aquifer's response to remediation. Information collected during implementation also will be used to evaluate aquifer response to remediation.

This ROD is consistent, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). According to the NCP, the EPA regulation which establishes procedures for the selection of response actions, an interim action is appropriate where a contamination problem will become worse if left unaddressed and where the interim action will not be inconsistent with a final remedial action. Consistent with the principles of the NCP, these remedial actions are designed to promptly initiate a remedial action response which should prevent further degradation of the aquifer and will rapidly reduce contaminant mass. In accordance with the NCP, the interim actions for the North Landfill subsite will complement and be consistent, to the extent possible, with the final remedy for the subsite. The final remedy may include additional source control measures including soil vapor extraction, subsurface monitoring, ground water extraction and treatment options, well head protection and treatment, and institutional controls. Any future actions will be considered and selected based on the requirements of the NCP and remedy selection process as described therein. Because a final remedial action will follow these interim actions, these interim actions need not meet all Federal and State standards for clean-up of the aquifer, nor must they provide a permanent solution to the contamination problems. Prompt remedial response is necessitated because water supply wells in the proximity of the North Landfill that remain in use have been affected and will continue to be affected by the contaminated ground water emanating from the North Landfill, unless these actions are taken.

The interim actions to be conducted at all of the subsites which are part of the Hastings Ground Water Contamination Site will have a common goal to contain and remove contaminants in the ground water and reduce cancer risk levels to correspond to no more than an estimated one additional cancer case in a population of 10,000 based on an assumed 30-year exposure period. Additional goals for the North Landfill subsite interim action include prevention of further ground water quality degradation by eliminating further leaching of contaminants into the ground water via infiltration of surface water through the landfill contents.

Steps have been taken to prevent human exposure to contaminated ground water in the North Landfill area. However, unrestricted water use, though it is not known to be occurring, would pose an immediate threat to human health. Testing results from samples collected during EPA's on-going investigations are supplied to the City and the Nebraska Department of Health (NDOH). If future sampling indicates the chemicals have migrated to other public water supply wells, the NDOH, which has been delegated authority under the Safe Drinking Water Act (SDWA), can cause the public water supplier to provide water which meets the requirements of the SDWA. As previously stated, the CMS currently is comprised of a single well with no additional provisions for an alternate water supply. This system will be compromised should this well become contaminated. Data in the Remedial Investigation report indicate that an interim action is appropriate to prevent further degradation of the aquifer.

SITE CHARACTERISTICS

For remediation, the North Landfill has been divided into two separate operable units, a source control operable unit and a ground water operable unit. The source control operable unit includes the landfill surface and the vadose zone. The ground water operable unit includes the ground water beneath the subsite. Figure 7 shows a cross section of the North Landfill area.

Surface Characteristics

The following current conditions of the landfill surface make the existing cap an ineffective barrier for surface infiltration:

- Composition of the initial cap: The initial cover, installed in 1964, was a heterogeneous mix of clay, silt, wood and brick. Problems of surface subsidence were immediately noticed and, in 1977, an additional 2-foot clay cap was added. This additional clay cap was also ineffective in preventing further problems of subsidence and the formation of surface depressions which tended to pond with rain water.

- Land use: Further enhancement of the infiltration rate of surface water into the active fill area probably has occurred, depending on the crops intentionally and unintentionally raised on the landfill. Crops with extensive root systems will penetrate the clay cap and allow the channeling which will result in a net increase in the vertical permeabilities through the cap. Infiltration of surface water exacerbate both subsidence and leachate formation.

- Climate conditions: Hastings is located in a semi-arid climate and the annual cultivation and harvesting activities would disrupt surface soils and violate the integrity of any existing cap. Differential settlement and subsequent poor drainage has resulted in the ponding of surface water on the landfill cap. Pools of water will provide a driving force for infiltration of surface water into and through the landfilled material. Leachate generated by the introduction of surface water into the body of the unlined landfill will migrate through the underlying vadose zone and into the Pleistocene aquifer.

- Access: Current conditions at the landfill allow unrestricted access to this subsite.

Soil-Gas and Soil Characteristics

Soil-gas investigations conducted by EPA during 1986-1989 indicate vadose zone contamination. TCE and other volatile organic compounds were found to be present at significant concentrations. Refer to Figure 6 for levels of TCE found within the soil-gas boring samples.

The following contaminants were found in soil at low levels: xylene, benzene, toluene, ethyl benzene, polychlorinated biphenyls, and a breakdown product of the pesticide DDT (4,4'-DDD). Based on the soil and soil-gas sample results, EPA concluded that contamination is present within the unsaturated zone. Table 1 is a summary of the soil-gas analytical results. The samples collected in 1989 were from the deep zone (less than 120 feet deep). The samples collected in 1988 and 1990 were from the fill area.

Ground Water Characteristics

The geologic profile (see Table 2) in the Hastings area, from shallowest to deepest deposits of interest, are Quaternary fluvial deposits and Cretaceous marine deposits. Pleistocene deposits make up the majority of the regional unconsolidated deposits and contain the aquifer that supplies the Hastings area. The upper geologic units of the Pleistocene deposits, the Peoria, Loveland and Sappa Formations are finely grained loesses and sandy clays with some sandy lenses. The total thickness of the upper fine grained Pleistocene materials is approximately 50 to 100 feet. The lower Pleistocene deposits consist of fine to coarse sand and gravel with discontinuous layers of silts and clays. These water-bearing deposits are approximately 100 feet thick. The Cretaceous Niobrara Formation, a marine shale with frequent chalky zones, is considered to be bedrock in the Hastings area. The contact between the Pleistocene and Cretaceous formations is a weathered and eroded surface.

The Pleistocene age ground water aquifer is a prolific ground water resource capable of sustaining substantial pump rates of 1000 to 2000 gallons per minute. The regional potentiometric surface slopes toward the east-southeast with a gradient of approximately 0.001 ft/ft to 0.002 ft/ft. Although there are some minor differences between the upper and lower portions of the aquifer, available information indicates that it behaves as a single unconfined aquifer. The transmissivity of the aquifer ranges from 90,000 gallons per day per foot (gpd/ft) to 225,000 gpd/ft. The hydraulic conductivity for the aquifer ranged from 989 gallons per day per square foot (gpd/ft^2) to 2184 gpd/ft^2. The aquifer is recharged by infiltration of precipitation, seepage from streams, and inflow from irrigation to the extent of approximately 1.6 inches per year.

Remedial investigation results have indicated there are sources of contamination in the vadose zone and in the ground water beneath the North Landfill and downgradient of the landfill. During landfill operations, wastes containing VOCs, including chlorinated solvents, were disposed in the landfill. These VOCs have since migrated vertically into the deeper vadose zone and have entered the aquifer. Once the VOCs entered the aquifer, they migrated downgradient primarily in the dominant direction of flow (east-southeast).

Precise ground water plume characterization is made difficult by the fact that the Pleistocene aquifer is highly transmissive and is heavily used. Seasonal stress on the aquifer alters the hydraulic flow patterns in the region substantially; consequently, contaminant concentrations vary seasonally. The present monitoring network is insufficient to fully characterize the extent of the plume but is adequate to establish primary contaminant plume features.

During EPA's investigation, in-situ water samples were collected from each of the deep borings. The following contaminants were found in these water samples: 1,2-DCE, tetrachloroethene (PCE), 1,1,1-trichloroethane (1,1,1-TCA), TCE, and vinyl chloride (VC).

Data from the following monitoring and production wells depicted in Figure 4 were used to characterize and evaluate the North Landfill: DW-1, MW-5, MW-6, MW-7; MW-17 (MW-53), MW-19 (MW-50), MW-21 (MW-54), MW-24, MW-25 (MW-52), MW-26, OW-1S & -1D, OW-2S & -2D, and M-12. These wells are shown on Figure 4. The public water supply well, M-12, was installed in the late 1950's before EPA's investigation of Hastings began. State observation wells, OW-series, were installed in November 1984. Wells MW-5, -6, and -7 were installed in June 1986. Wells MW-17, -19, -21, and -25 were installed in April 1988. Well MW-26 was installed in July 1988. Analyses of samples collected from these wells indicate high levels of TCE, DCE, and VC in the ground water ranging from 1300 - 2300 ug/l, 1300 - 2000 ug/l, and the detection limit to 87 ug/l, respectively. These compounds were found to be the characteristic compounds of the contamination present beneath the North Landfill and the plume downgradient from this location. Although TCE is found at other subsites at the Hastings Ground Water Contamination Site, substantial concentrations of 1,2 DCE and VC, anaerobic degradation products of TCE, are only found in association with the North Landfill subsite. Table 3 is a summary of the ground water data collected from subsite wells.

The primary contaminants of concern found beneath the landfill and in the ground water are: benzene; 1,2-dichloroethane (1,2-DCA), 1,1-DCE, 1,2-DCE, PCE, 1,1,1-TCA, TCE, and VC. All are members of the VOC family and as VOCs they readily form vapors because they have low boiling points. These vapors have a tendency to move through soil pore spaces driven by diffusive and dispersive processes. Further, gravitational forces tend to drive vapors and liquids in a downward vertical direction until they meet ground water. VOCs may then become dissolved in ground water or may be transported in a separate phase if concentrations are great enough.

The volume of ground water affected by VOCs which migrated from the North Landfill is difficult to calculate. Substantial aquifer heterogeneity, a limited monitoring network, and seasonal stress on the aquifer make accurate plume volume estimates difficult. However, for the purposes of developing this interim ROD, such estimates have been made. Figure 8 illustrates the plume concentration area utilized for these calculations. The aquifer was estimated to be approximately 100 feet deep and contaminants were assumed to be present in 30 feet of the aquifer. The volume of contaminated aquifer is approximately 11.3 million cubic feet. This equates to 84 million gallons of contaminated water (assuming 0.28 porosity). This represents an estimate of the volume of water contaminated with more than 500 ug/l of TCE only.

SUMMARY OF SITE RISKS

Superfund requires EPA to seek permanent solutions to protect human health and the environment from hazardous substances. These solutions provide for removal, treatment, or containment of dangerous chemicals so that any remaining contamination does not pose an unacceptable health risk to anyone who might come into contact with them.

EPA also has evaluated potential risks to human health posed by ground water contamination if no remedial action were taken. The Baseline Risk Assessment is based on the results of the contamination studies and evaluates potential carcinogenic and non-carcinogenic risks. In preparing the Baseline Risk Assessment, EPA first determined the most likely ways in which community members might come into contact with site-related chemicals. EPA determined that residents living near the North Landfill subsite might be exposed to contaminants in ground water if they drink ground water, come into direct contact with the ground water while bathing, or inhale ground water vapors while showering. EPA concluded that three chemicals in the ground water at the North Landfill subsite might pose an unacceptable cancer-risk to residents who use the ground water. These chemicals are: VC, TCE and DCE. These interim remedial actions will focus on reducing the risk to human health and the environment that results from exposure to these chemicals.

EPA considers exposure to a chemical an unacceptable cancer risk if it leads to more than one additional case of cancer for every 10,000 (10^{-4}) people exposed to it over a 30-year period. The term "cancer risk" sometimes is referred to as "excess cancer risk" because it is the number of additional cases above the average number of cases that are expected to occur in the general population if the chemicals are not present. EPA's assessment determined that exposure to these contaminants (TCE, DCE, and VC) might lead to between two additional cancer cases per 10,000 (10^{-4}), and two (2) additional cancer cases per 1,000 (10^{-3}) people. The fact that these risk levels are unacceptable has prompted EPA to consider interim actions to rapidly reduce the risk levels while additional remedial action alternatives are being developed. Tables 4a and 4b illustrate the various risk level concentrations for the contaminants of concern.

In addition to estimating potential carcinogenic health effects, the Risk Assessment evaluated potential non-carcinogenic health effects caused by site-related chemicals. Non-carcinogenic health effects are based upon contaminant concentrations and are given a Hazard Index Rating (HI). Compounds with HI ratings greater than or equal to one would pose a health risk whereas those less than one would not pose a health risk (see Table 4b).

The majority of risks associated with ground water at the North Landfill subsite are based upon the presence and concentrations of TCE, DCE, and VC. The results from monitoring well MW-6 were used to characterize the risk associated with this subsite.These contaminants are further described below:

- VC is mutagenic and carcinogenic. It is classified as a known human carcinogen (Group A) by EPA. VC can enter the body through inhalation of vapors or ingestion of contaminated food or water. Acute exposure to VC may cause central nervous system depression. Chronic effects include loss of bone from fingers and toes, circulatory disturbances and adverse effects on the skin, blood, lung, and liver. Angiosarcoma of the liver has been associated with occupational exposure to VC.

- EPA has classified TCE as a probable human carcinogen (Group B-2). Acute exposure to TCE may cause headaches, vertigo, visual disturbance, tremors, nausea, vomiting, eye irritation, dermatitis, cardiac arrhythmias, and paresthesia. Chronic exposure may irreversibly damage the respiratory system, heart, liver, kidneys, and central nervous system.

- EPA has not classified DCE (cis and trans) as a human carcinogen (Group D). Acute exposure to DCE will have similar effects as acute exposure to TCE.

Pursuant to the authority of the Safe Drinking Water Act, SDWA, 42 U.S.C. Section 300(g), EPA has established a Maximum Contaminant Level (MCL) for TCE, DCE, and VC. The MCL refers to the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. MCLs are based on health risk, treatment technology, cost, and analytical methods and are used in developing ground water cleanup levels. The MCL established for TCE is 5 parts per billion (ppb); the MCL for cis 1,2-DCE is 70 ppb, for trans 1,2-DCE is 100 ppb; and the MCL for VC is 2 ppb. The ground water aquifer beneath the North Landfill has concentrations of these contaminants far above these MCLs. For a more detailed description of risk to human health and the environment, refer to the Baseline Risk Assessment which is contained in the administrative record.

DESCRIPTION OF ALTERNATIVES

As presented in the Feasibility Study, the remedial alternatives fall into four (4) general categories. These are: No Action, Limited Action, Ground Water Treatment, and Source Control. Estimated costs for the alternatives are presented in the Feasibility Study. These cost estimates were based on what they would cost today to build (Capital Cost), what they would cost to operate and maintain until the remedial actions are completed (Annual Operation and Maintenance), and Present Net Worth. Present Net Worth is the amount of money that, if invested today at the present interest rate, would pay for the capital and operating and maintenance costs for the life of the project. These alternatives are briefly described below.

No Action

Under the no action alternative, the subsite would remain in its present condition. The potential for exposure of the community to contaminant levels exceeding health standards still would exist. EPA policy requires consideration of a no action alternative to serve as a basis against which the other remedial alternatives can be compared.

The cost for this alternative is zero; implementation time is zero.

Chemical-specific ARARs would not be met. Action-specific and Location-specific ARARs do not apply to this No Action alternative at the North Landfill subsite.

Limited Action

Under the Limited Action alternative, limited cap improvements, access restrictions, and ground water monitoring would be combined to address the remedial action objectives of protection of human health and the environment. At the North Landfill subsite, the access restriction would be implemented to limit future development and any domestic use of the ground water beneath the subsite. In addition, a security fence would be installed around the subsite to prevent entry to the subsite. This alternative does not address the contaminated ground water.

The estimated cost for this action is $560,000 for the Capital Costs and the O&M for 30 years.

Chemical-specific ARARs would not be met. Action-specific and Location-specific ARARs do not apply to this Limited Action alternative at the North Landfill subsite.

Ground Water Treatment

The various technologies for treatment of ground water were assembled in different combinations and analyzed according to EPA's detailed evaluation criteria. Ground water treatment refers to the remedial technologies that restore the ground water to a level that allows for its beneficial use, such as drinking water. The ground water treatment alternatives considered were:

1. Ground Water Recovery & Air Stripping/Reinjection

2. Ground Water Recovery & Air Stripping/Reuse

3. Ground Water Recovery & Ultraviolet/Oxidation/Reinjection and Reuse

Under each ground water treatment technology, extraction wells would be installed and the ground water would be pumped to the surface in order to hydraulically contain the affected ground water that equals and/or exceeds health based levels of 10^{-4}. A subsite-specific pump test would be conducted to determine the appropriate extraction rate of ground water for plume containment and mass removal. Once the pump rate were determined, the need for air emission controls would be evaluated. All air emission alternatives to be evaluated for air emission controls would be based upon cost, since all could be effective and implementable. Air emission controls would be required if the level of contaminants released to the atmosphere exceeds health-based criteria.

To remove VOCs from the extracted ground water, air stripping or UV/Oxidation has been proposed. In the first two ground water technologies, the extracted ground water would be treated by air stripping. Air stripping permanently removes contaminants from the ground water by forcing an airstream through the water, which causes the compounds to volatilize. The difference between reinjection and reuse is the discharge method for the treated ground water. In the first technology, the treated ground water would be reinjected back into the aquifer by means of an injection well after treatment to MCLs; in the second, the treated ground water, which would meet MCLs, would be integrated into the City of Hastings' municipal water distribution system.

In the third ground water technology, the extracted ground water would be treated to MCLs with ultraviolet light (UV) and chemical oxidation (oxidation). UV/oxidation is a chemical process which results in the chemical destruction of the organic compounds in the ground water. The treated ground water would either be reinjected into the aquifer or integrated into the municipal water distribution system.

If any sludges were generated by the water treatment system implemented, the sludges would be treated off-site at a RCRA Treatment, Storage and Disposal (TSD) facility in accordance with all RCRA requirements. The sludges would meet the requirements of the land disposal (LDR) restrictions as set forth in 20 CFR part 268.

Action-specific ARARs for the interim action, such as level of treatment for ground water to meet MCLs, would be achieved. As stated above, the need for instituting air emission controls would be evaluated based upon the rate of VOC emission rate from the air stripper. Location-specific ARARs are not applicable. Chemical-specific ARARs (MCLs) would be met for treated ground water but would not be met in ground water which is not extracted from the aquifer.

Cost estimates for these options vary from $2,000,000 to $4,000,000 for the capital and O&M cost for a 30-year time period.

Source Control

Source control refers to an action or actions to prevent or mitigate the spread of contamination by removing or containing the source of the contamination. Soil-gas data indicates that the vadose zone is contaminated and is thus a source of the ground water contamination. The various source control technologies were assembled in different combinations and analyzed according to EPA's detailed evaluation criteria. Source control could be attained by: 1) installing a cap over the current landfill surface in accordance with the State of Nebraska Title 132 Solid Waste Management Rules; and/or 2) installing a soil vapor extraction system.

An improved cap would provide containment and minimize infiltration through the landfill. The soil vapor extraction (SVE) process, as stated in the Proposed Plan, would remove contaminants from the vadose zone. SVE operates by use of a vacuum system which is placed on an extraction well that is screened in the vadose zone. Volatiles would be removed from the soils and trapped on carbon for treatment.

Cost estimates for the source control operable unit including cap improvement and institutional controls are $180,000 capital costs and $24,500 for annual Operation and Maintenance (O&M) costs. Cost estimates for full-scale SVE are $542,000 for Capital Costs and $36,000 for annual O&M costs.

Chemical-specific ARARs are not met for limited landfill cap improvement and maintenance, but are met for SVE.

<u>SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES</u>

The NCP sets forth nine evaluation criteria which serve as a basis for comparing the remedial alternatives for final actions. Interim actions, such as those proposed here, may not achieve final cleanup levels for the ground water although they are effective in the short term in preventing further degradation and initiating reduction in toxicity, mobility or volume.

Nine evaluation criteria were developed by EPA to serve as a basis for comparing the remedial alternatives for final actions. Interim actions, such as those proposed, may not fulfill the requirements of all nine criteria.

The nine criteria are divided into three categories: Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria. If any remedial alternatives identified during the Feasibility Study do not meet the Threshold Criteria (Criteria 1 and 2), EPA will not consider them as possible final remedies. If the alternatives satisfy the Threshold Criteria, they then are evaluated against the next five criteria, called the Primary Balancing Criteria. These criteria are used to compare the remedial alternatives against each other in terms of effectiveness, degree of difficulty involved, and cost. The final two criteria, state acceptance and community acceptance, are called Modifying Criteria. The alternatives are compared against the Modifying Criteria after the state and the community have reviewed and commented on the Proposed Plan and the other alternatives considered by EPA.

Table 5 presents a comparative analysis of how the remedial alternatives satisfy the Threshold and Primary Balancing Criteria. Evaluation of compliance with the remaining Modifying Criteria is included in the following discussion. The following is a discussion of the nine criteria used by EPA for remedy selection.

Threshold Criteria:

Overall Protection of Human Health and the Environment

EPA assesses the degree to which the alternatives would eliminate, reduce, or control threats to public health and the environment through removal, containment, and/or institutional controls. An alternative is normally considered to be protective of human health if the excess cancer risk is reduced to a range of 1 in 10,000 (10^{-4}) to 1 in 10 million (10^{-6}) and risks do not pose non-carcinogenic health risks.

Two technologies presented for ground water provide overall protection of human health and the environment. The No Action and Limited Action alternatives are not protective. Since the No Action and Limited Action alternatives are not considered protective, the comparative analysis for discussion will focus on the other protective alternatives for plume management.

Both source control technologies offer protection to human health and the environment. In addition, by providing contaminant removal, SVE offers protection of the aquifer.

Compliance with all State and Federal Environmental Regulations

EPA assesses whether the remedial alternatives being evaluated will comply with all applicable or relevant and appropriate regulations, called ARARs, established by the state and federal government. As these are interim actions, full compliance with ARARs may be delayed until implementation of the final action. The ground water interim action will address plume control at a 10^{-4} risk-based level which means that the ground water extraction system is required to pump contaminated ground water at a rate which would stabilize the contaminant migration by rapid mass removal and hydraulic plume control. The ground water interim action will provide for treatment of the extracted ground water to MCLs prior to discharge or reinjection. SVE as a source control alternative will meet ARARs.

There are three (3) types of ARARs to be addressed; i.e., chemical-specific, action-specific, and location-specific.

- Chemical-specific ARARs are requirements that set final concentrations of chemicals of concern in the contaminated material (e.g., ground water, soil) which must be achieved by the remedial action. These interim remedial actions will not attain chemical-specific ARARs (referenced in the State of Nebraska's Title 118 for non-degradation of ground water standards) in the ground water plume as the target concentrations of ground water that would be contained coincides with a 10^{-4} risk level which, for the primary compounds of concern at the North Landfill, exceed MCLs. Chemical specific ARARs will be attained for discharged ground water after treatment. All of the plume management alternatives will comply with MCLs and non-zero MCLs for the disposition of treated ground water.

  For source control, a waiver of ARARs or further source control technologies would be needed if it is determined that contaminants continue to migrate to the ground water.

- Action-specific ARARs are those requirements that set standards on the treatment and discharge components of the remedial action. Action-specific ARARs will apply to the interim and final remedial actions, and were considered in the Feasibility Study. The use of air stripping, with no emission controls, would result in the discharge of VOCs into the atmosphere. NDEC's Title 129 limits discharges of VOCs to 2.5 tons/year. Air emissions will comply with the Clean Air Act, 33 U.S.C. §1251 et. seq., as well as NDEC's Title 129, Air Pollution Control and Regulations.

Technologies for ground water and source control meet action-specific ARARs.

- Location-specific ARARs are requirements that might apply to a remedial action due to the site's unique cultural, archaeological, historical, or physical setting (e.g., wetlands). Location-specific ARARs will not apply to the ground water and source control interim or final remedial action at the North Landfill subsite because there are no such features in the subsite area.

All remedial action alternatives for source control and plume management will comply with the following Federal laws:

Clean Water Act	33 U.S.C. §§1251-1387
Safe Drinking Water Act	42 U.S.C. §§300f-300j-26
Clean Air Act	42 U.S.C. §§7401-7642
Occupational Safety & Health Act	29 U.S.C. §§651-678
Solid Waste Disposal Act, Subtitle C, as amended by the Resource Conservation and Recovery Act of RCRA (1976)	42 U.S.C. §§6901-6992k

In addition, state of Nebraska ARARs for the interim action alternatives for both source control and plume management alternative ARARs are listed in Table 7.

Primary Balancing Criteria:

Long-Term Effectiveness and Permanence

The alternatives are evaluated based on their ability to maintain reliable protection of human health and the environment after the remedial action is completed. This criterion also focuses on the magnitude of health and environmental risks remaining after the remedial action would be completed.

These are interim action remedies and EPA will evaluate the alternatives only on the basis of those wastes which are treated. These interim actions will not achieve final cleanup levels for the ground water at the subsite, although they are effective in the short-term in preventing further degradation and initiating reduction in toxicity, mobility or volume. Also, as mandated by Section 121(c) of CERCLA, EPA will conduct 5-year reviews at the subsite as long as hazardous substances remain above health based criteria. Two years after implementation of the interim actions, EPA will evaluate the information gained to determine the need for soil vapor extraction, as an additional source control measure.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion focuses on the amount and types of hazardous substances that will be destroyed or treated, whether the results of the remedial action are reversible, and whether the alternative includes a treatment process. Remedial actions which include treatment are favored by EPA. EPA evaluates each alternative based on how its treatment methods reduce the harmful nature of the contaminants, limit the ability of the contaminants to migrate, and minimize the amount of contamination remaining after the remedial action is completed.

All of the plume management alternatives will employ treatment to reduce the toxicity, mobility or volume of the ground water plume. For source control, the cap improvements will minimize migration of contaminants to the ground water which will decrease the volume of contaminants entering the aquifer and mobility of the ground water contaminated at this subsite.

Short-Term Effectiveness

The length of time needed to implement each segment of the alternative is considered, and EPA considers the risks that conducting a particular activity may pose to site workers, nearby residents, or the local environment.

A Health and Safety plan will be prepared for the implementation of the response actions which will be conducted. This plan will provide all the procedures for all site workers to follow during the testing of the landfill cap, the improvements to the cap, the installation of the landfill fence, and the installation of the extraction wells and all associated equipment needed for the ground water treatment system. Extra care will be required if the UV treatment system is selected. The UV technology requires the careful handling of highly toxic chemicals used for treatment. Health and safety issues will be addressed at each phase of these interim response actions.

Implementability

EPA considers the technical (e.g., how difficult the alternative is to construct and operate) and administrative (e.g., how other government agencies and EPA will coordinate monitoring programs) feasibility of a remedy, including the availability of goods and services and personnel (e.g., disposal services, storage capacity) needed to implement and manage the alternative.

All of the plume management alternatives will be implementable, although the UV system may require extra time to test the innovative process.

For the source control, both technologies are implementable.

Cost

EPA considers capital costs, operation and maintenance costs, and Present Net Worth which is the cost of the activities that will take place until the remedial action is completed. Capital costs apply to activities such as construction, land and site development, and disposal of waste materials. Annual operation and maintenance costs are spent on activities such as on-going operation of equipment, insurance and periodic site reviews.

All of the plume management alternatives are considered cost effective based on current information. There is cost uncertainty for UV which would have to be refined during design. The costs are presented in Table 5. Improvements to the landfill cap are presented in Option 2 (Limited Action) of the FS. SVE is presented as FS Option 9 .

Modifying Criteria:

State Acceptance

The state concurs with the selected remedy as an interim action for these operable units.

Community Acceptance

EPA held a public comment period to allow the community to comment on the preferred alternative as set forth in the Proposed Plan and the other alternatives considered. EPA received substantial feedback from the community during the public comment questioning the benefits and cost of SVE at this subsite. Consistent with 40 CFR 300.430(f), these comments have prompted EPA to modify aspects of the preferred alternative. EPA has selected an interim remedy which is consistent with the preference expressed by the majority of the commentors. EPA's responses to these comments are included in the Responsiveness Summary section of this document.

SELECTED REMEDIES

EPA selects the following interim actions to address the source control and ground water operable units at the North Landfill subsite. These selected remedies do not contain the use of SVE as part of the source control alternative. EPA evaluated the available information and determined that additional site information was needed to evaluate the benefit of SVE for site remediation.

SOURCE CONTROL

- Verifying the integrity of the landfill cap and improving the cap as necessary;

- Grading the surface of the landfill to promote surface water run-off and prevent surface water run-on;

- Fencing the landfill area to restrict access and unsuitable land use such as farming of unsuitable deep root plants;

- Requiring deed restrictions by the property owner to prevent construction and ensure cap integrity;

- Monitoring subsurface (vadose zone) conditions to determine effectiveness of the selected interim action remedy.

GROUND WATER

- Extraction of contaminated ground water, (extraction rate to be based on subsite pump test);

- Treatment of contaminated ground water (treatment and treated water discharge options to be based on implementability, costs and effectiveness); and

- Monitoring subsurface (saturated zone) conditions to determine effectiveness of the selected interim action remedy.

The selected remedies call for the design and implementation of interim actions to protect human health and the environment. The goals of these actions are to prevent further infiltration of surface water into the landfill and to prevent further migration of the ground water. The ultimate level of remediation to be attained will be determined in a final remedial action for this subsite. These interim actions will be monitored to determine source control effectiveness and to ensure hydraulic control of the contaminated plume. A final ROD for the source control and ground water operable units, which specify the ultimate goal, remedy and anticipated time-frame, will be prepared after a period of time as determined by EPA. Upon completion of the final action RI/FS, this interim system may be incorporated into the design of the subsite remedy specified in the final action ROD.

EPA has identified these interim actions as its selected alternatives because they provide the best balance among other alternatives with respect to the evaluation criteria based on the information available. Each of these actions, explained below, shows a preference for treatment.

The EPA has information from generators of wastes disposed at the North Landfill that the North Landfill received RCRA-type hazardous wastes. Since the landfill operated prior to the enactment of RCRA (November 19, 1980) the RCRA Subtitle C closure standards are not applicable. However, the standards have been determined by EPA to be relevant and appropriate due to the type of wastes disposed and the circumstances of the release. Closure of the disposal areas will comply with appropriate portions of the RCRA regulations affecting landfill closure and operation and maintenance. The final cover for this interim action will be designed and constructed in accordance with the Nebraska Solid Waste Management Rules (NDEC Title 132, Chapter 6).

The Nebraska Solid Waste Management Rules (NDEC Title 132, Chapter 6) require that a final cover of compacted earth at least two (2) feet thick be placed over the surface of any solid waste management disposal area when it is closed. The final grading must promote surface runoff and prevent surface runon and must support a grass vegetated cover. This final grade will be maintained as necessary. Since the present cap was not constructed under an approved plan and is not presently promoting runoff, the North Landfill cap effectiveness and degree of cap improvement or replacement that is necessary will be evaluated. An evaluation of the present cap will be initiated. This evaluation will include testing of the cap for permeability and surface characteristics which will determine the amount and type of improvements necessary. Cap improvements would be performed under an approved plan to satisfy the NDEC Title 132 requirements and the remedial action objectives for the landfill contents.

In addition to the State of Nebraska guidelines, EPA guidance documents which address recommended cap construction design, cap performance criteria, and selection of appropriate vegetative cover will be consulted during the design of any cap which will be applied to the North Landfill subsite.

In addition to grading the surface of the landfill and evaluating the integrity of the cap, the surface will be revegetated to stabilize the soil surface and decrease erosion. Access restriction at the subsite will be required in order to maintain the cap integrity. Subsurface monitoring of the vadose zone and groundwater aquifer will be conducted to assess and monitor subsurface conditions and the interim action effectiveness. Two years after implementation of the interim action, EPA will evaluate the information gained to determine the need for soil vapor extraction as an additional source control measure.

In order to pump and treat the contaminated aquifer, ground water extraction wells will be installed near and downgradient of the subsite. The ground water will then be pumped to the surface at a rate that will prevent further off-site migration of contaminants and rapidly reduce the contaminant mass in the aquifer. The treated ground water will either be reinjected or reused to promote conservation of ground water. System design will be based on a subsite pump test. The implementation of either air stripping or UV oxidation for ground water treatment will be based primarily on three criteria: cost, short-term effectiveness for air emission controls, and implementability. The EPA will issue an explanation of significant differences which includes a public notice upon determining the preferred ground water treatment technology. Based upon current information, both treatment technologies afford a similar degree of effectiveness.

EPA estimates that the interim action will cost $1.0 million dollars in capital. The Present Net Worth of the remedy, based on operating costs for a 30-year life, is estimated to be $2.3 million dollars. These costs are explained in Table 5 and are based upon information presented to EPA from the PRPs. The costs presented in Table 5 assume that limited cap improvements will be necessary. In addition, the costs prepared by the City do not include installation of additional monitoring wells, a pump test, or emission controls. Based upon the above assumptions, EPA believes that remedial costs could be greater than those presented in Table 6. EPA has evaluated the cost/benefit relationships of the alternatives to the extent possible and has selected the most cost effective alternatives which meet interim remedial action guidelines.

STATUTORY DETERMINATIONS

The selected remedies will achieve substantial reduction in risks by initiating the reduction of the toxicity, mobility and volume of ground water contaminants, by containment and removal of ground water contamination to a 10^{-4} cancer risk level, and by reducing environmental risks associated with the contaminated ground water.

The selected remedies meet those ARARs appropriate to this action, based on the following Federal and State standards as identified in Section 5 of the FS. Federal Standards: Safe Drinking Water Act; Clean Air Act; Resource Conservation and Recovery Act; Occupational Safety and Health Act; and Clean Water Act. The State of Nebraska Standards is the Nebraska Environmental Protection Act, which includes: Water Quality Standards; Ground Water Quality Standards; Air Pollution Control Regulations; National Pollutant Discharge Elimination Systems; Pretreatment Regulations; Injection Wells Regulations; Solid Waste Management Regulations; and Hazardous Waste Management Regulations. Table 7 lists Action-Specific State of Nebraska ARARs.

The selected interim remedies will protect human health and the environment because the interim actions will reduce contaminant concentrations in the aquifer to a level that poses significantly reduced risk. This level will be at or below 10^{-4}, or a risk of less then one case in 10,000 due to exposure to contamination. This will provide a significant level of protectiveness to human health. In addition to risk reduction, the interim actions will stabilize the ground water contaminant migration and prevent further degradation of the ground water through rapid mass removal and hydraulic plume control. Specifically, the threat to private well users and the exposure from irrigation wells will be significantly abated. These interim actions represent the best balance of trade-offs among alternatives with regard to implementability, effectiveness and cost. A final remedial action will be prepared.

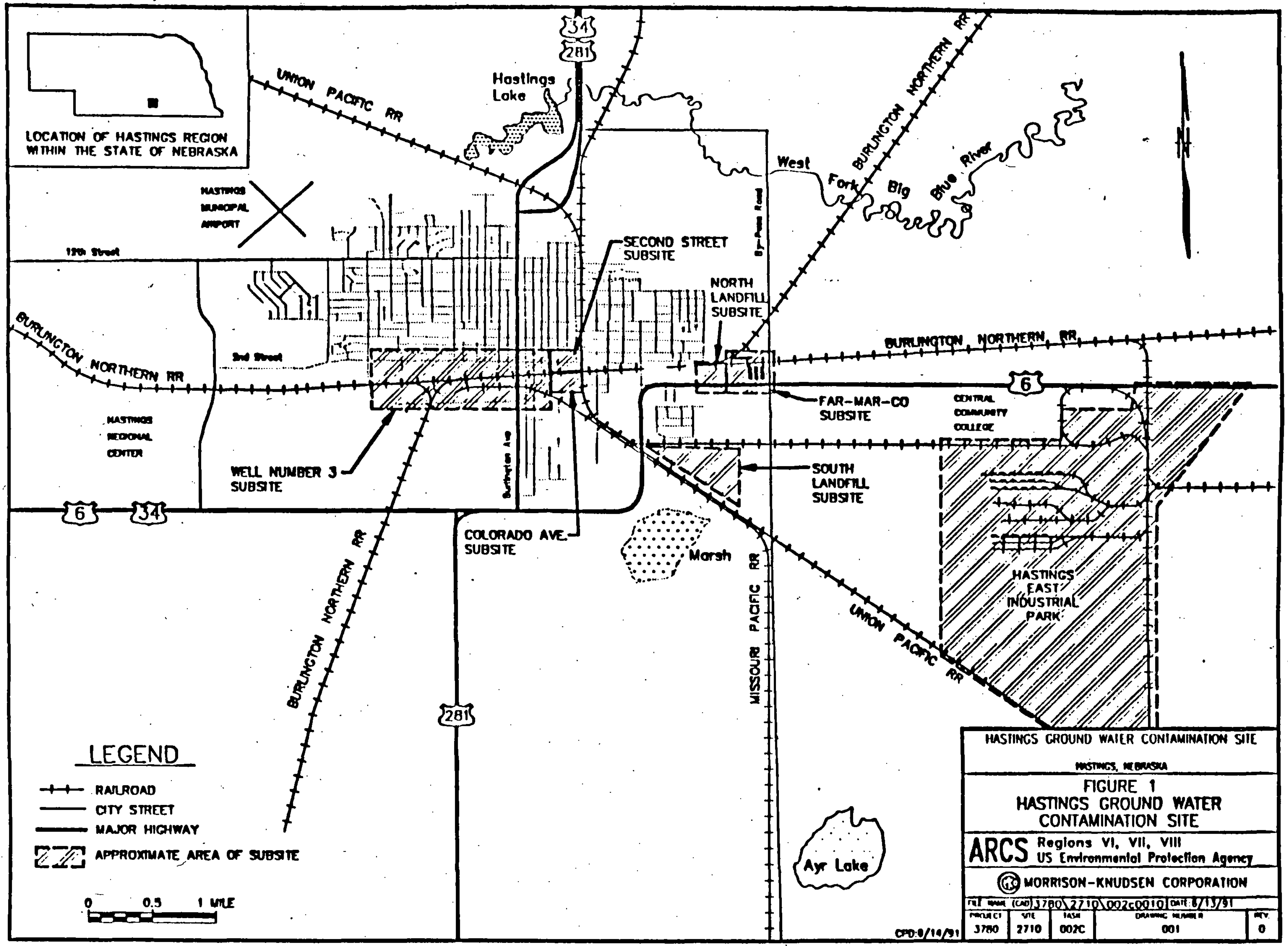
Because this remedy will result in hazardous substances remaining on site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five (5) years after commencement of the remedial action. Review of this subsite and of these remedies will be ongoing as EPA continues to develop remedial alternatives for the North Landfill subsite.

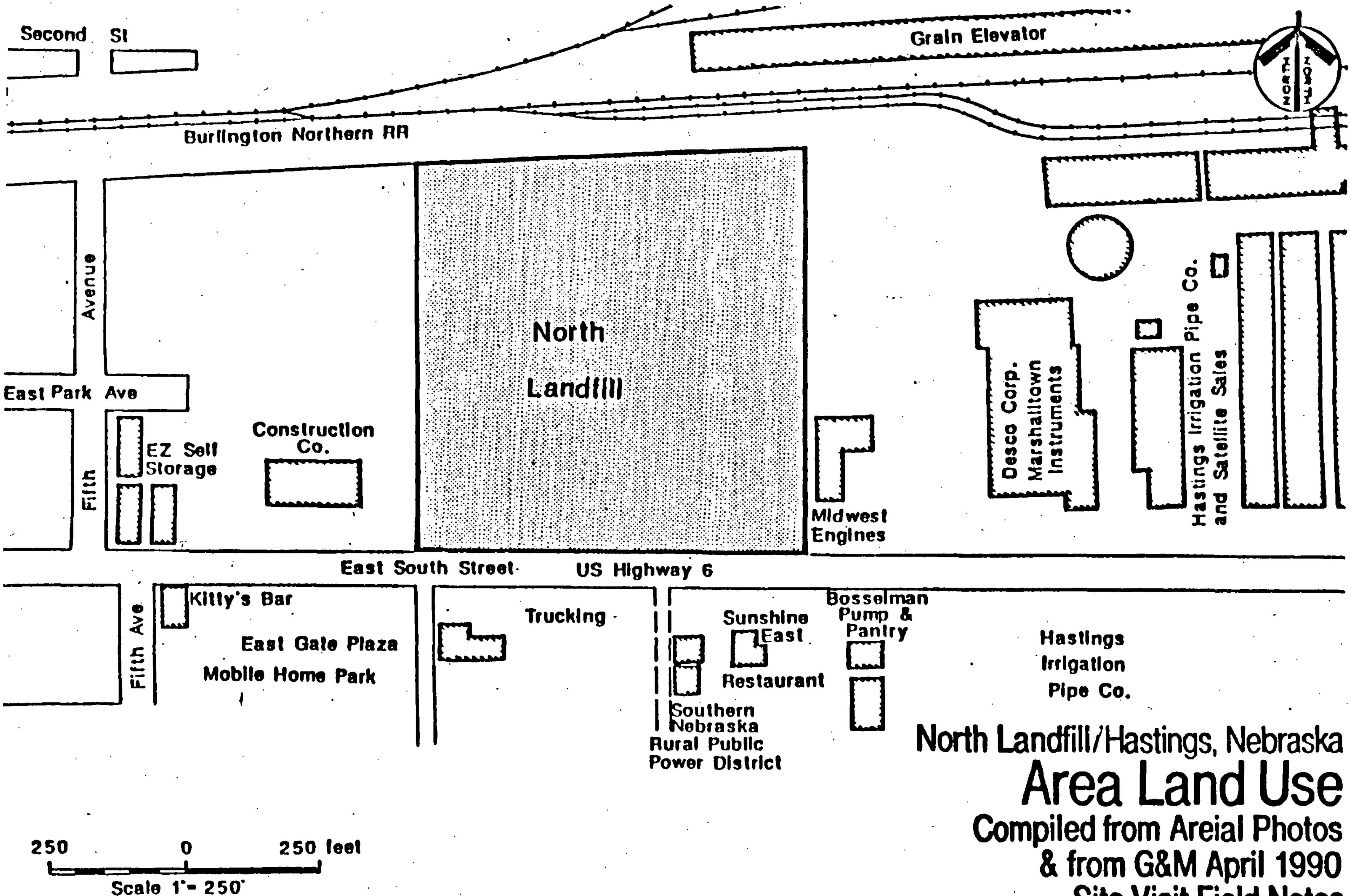
DOCUMENTATION OF SIGNIFICANT CHANGES

The soil vapor extraction (SVE) component provided for in the Proposed Plan document released by EPA on June 25, 1991 will not be implemented at this time. During the public comment period, EPA evaluated both direct (soil-gas) and indirect (ground water) analytical results to estimate the amount of contamination in the vadose zone. EPA determined that insufficient information was available to complete and justify the cost of the SVE component in comparison to the amount of contamination currently present within the vadose zone. Monitoring of the vadose zone will be conducted during the source control interim action. Two years after implementation of the source control interim action, EPA will reevaluate the information gained to determine the need for soil vapor extraction as an additional source control measure.

NORTH LANDFILL SUBSITE

TABLES AND FIGURES

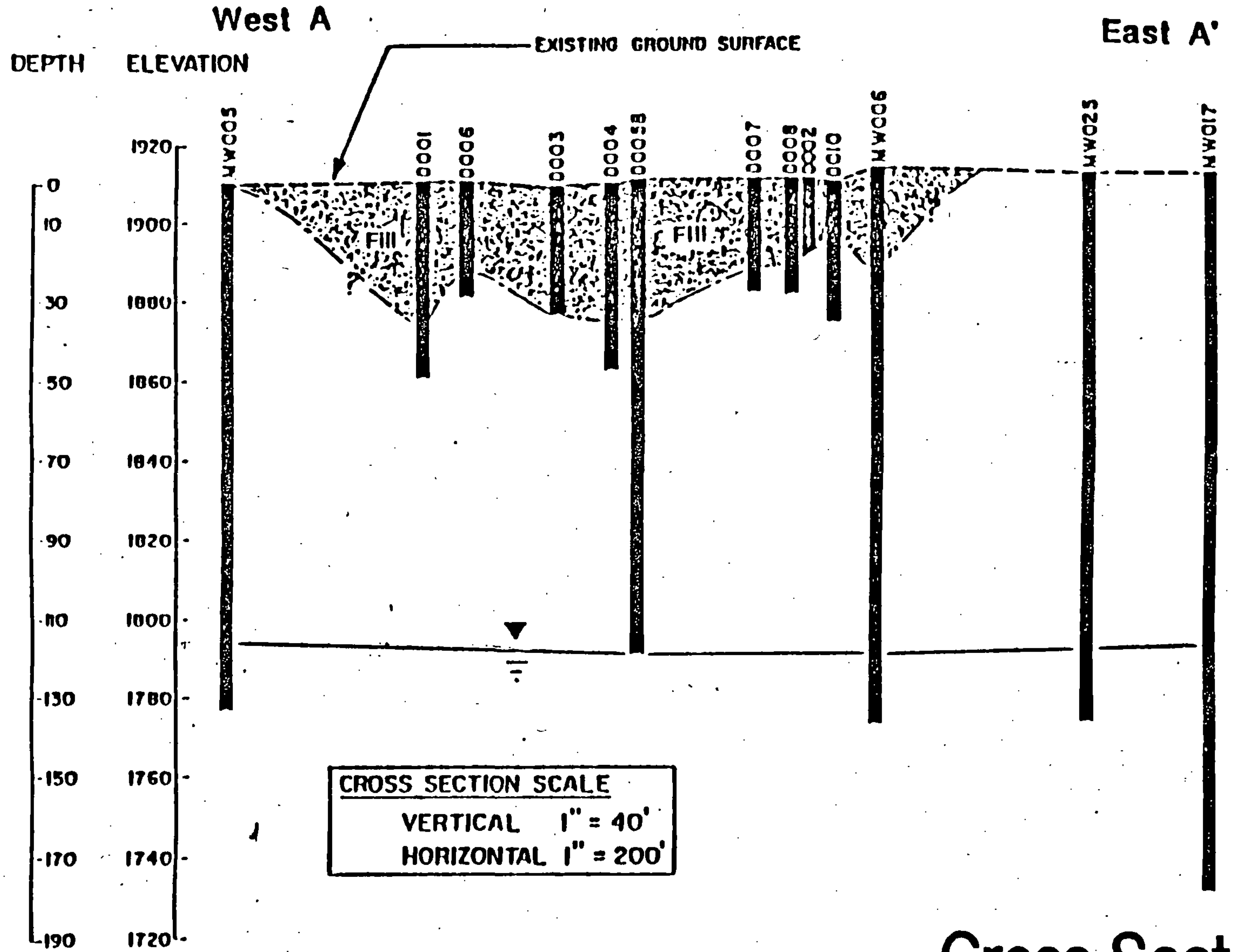

LOCATION OF HASTINGS REGION WITHIN THE STATE OF NEBRASKA
34
281
Hastings Lake
UNION PACIFIC RR
BURLINGTON NORTHERN RR
West Fork Big Blue River
HASTINGS MUNICIPAL AIRPORT
12th Street
SECOND STREET SUBSITE
By-Pass Road
NORTH LANDFILL SUBSITE
BURLINGTON NORTHERN RR
2nd Street
6
FAR-MAR-CO SUBSITE
CENTRAL COMMUNITY COLLEGE
HASTINGS REGIONAL CENTER
WELL NUMBER 3 SUBSITE
Burlington Ave
SOUTH LANDFILL SUBSITE
6
34
COLORADO AVE. SUBSITE
Marsh
BURLINGTON NORTHERN RR
MISSOURI PACIFIC RR
UNION PACIFIC RR
HASTINGS EAST INDUSTRIAL PARK
281
LEGEND
RAILROAD
CITY STREET
MAJOR HIGHWAY
APPROXIMATE AREA OF SUBSITE
0
0.5
1 MILE
Ayr Lake
CPD:8/14/91
HASTINGS GROUND WATER CONTAMINATION SITE
HASTINGS, NEBRASKA
FIGURE 1
HASTINGS GROUND WATER CONTAMINATION SITE
ARCS Regions VI, VII, VIII
US Environmental Protection Agency
MORRISON-KNUDSEN CORPORATION
FILE NAME (CAD) 3780\2710\002c0010 DATE: 8/13/91
PROJECT 3780
SITE 2710
TASK 002C
DRAWING NUMBER 001
REV. 0



North Landfill/Hastings, Nebraska
Area Land Use
Compiled from Areial Photos
& from G&M April 1990
Site Visit Field Notes

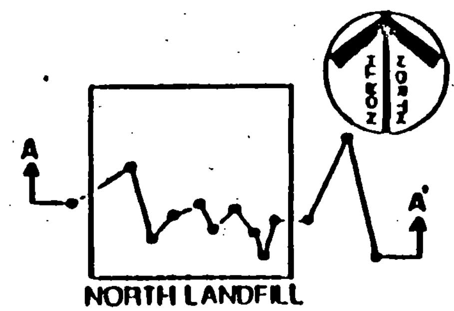
Source: Geraghty & Miller, Inc.

Figure 2



NOTES:

1. CROSS-SECTION CONSTRUCTED FROM INFORMATION CONTAINED IN BORING LOGS PREPARED BY PRC ENVIRONMENTAL MANAGEMENT, INC.
2. ALL ELEVATIONS ARE U.S.G.S. DATUM
3. QUESTION MARKS INDICATE THE CONTACTS ARE INFERRED



LEGEND:

MW005 MONITORING WELL DESIGNATION
D001 SOIL BORING DESIGNATION
— — — GROUND SURFACE
—·— EXTENT OF FILL MATERIAL
—▼— GROUND-WATER ELEVATION

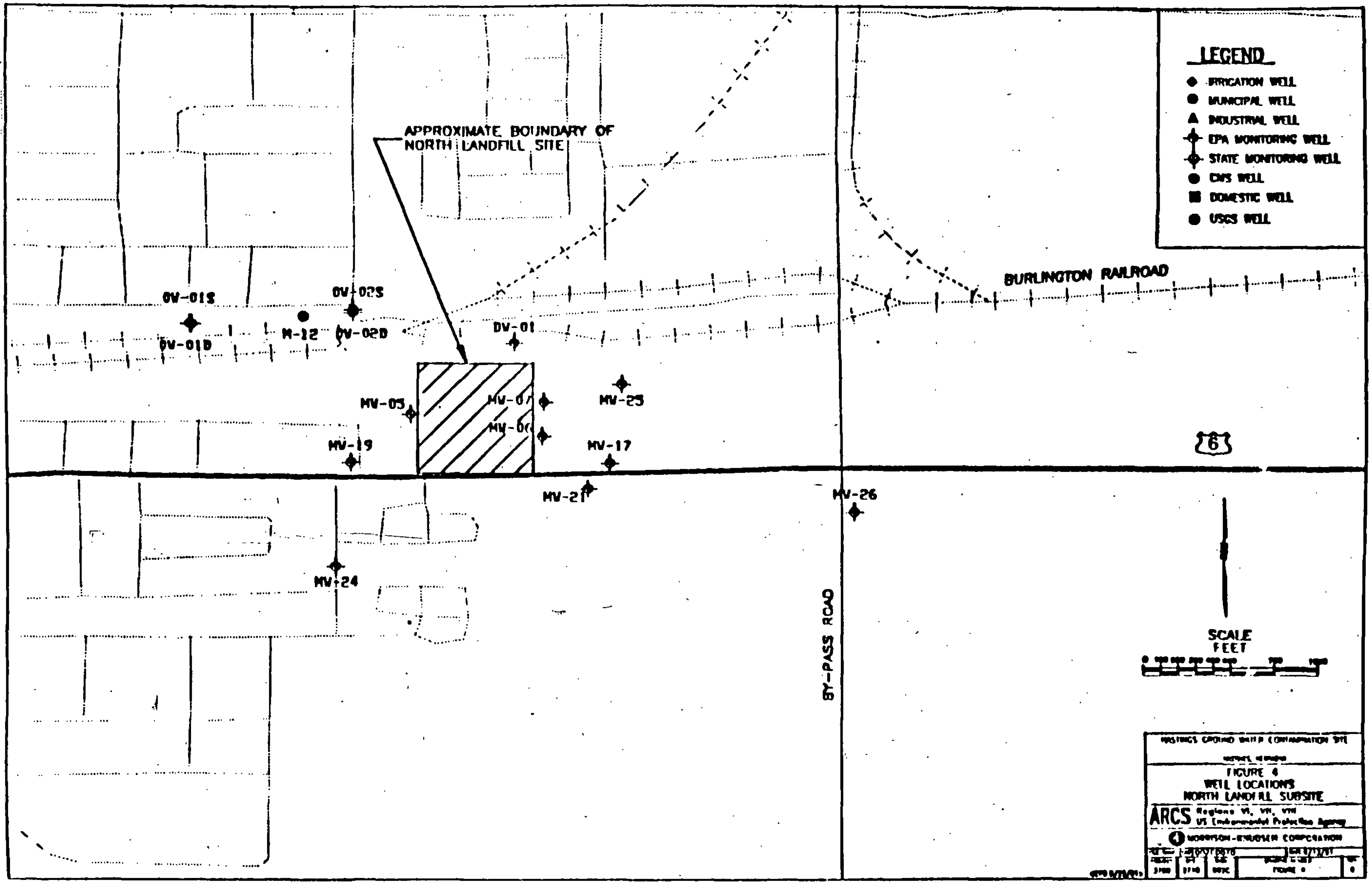
North Landfill/
Hastings, Nebraska

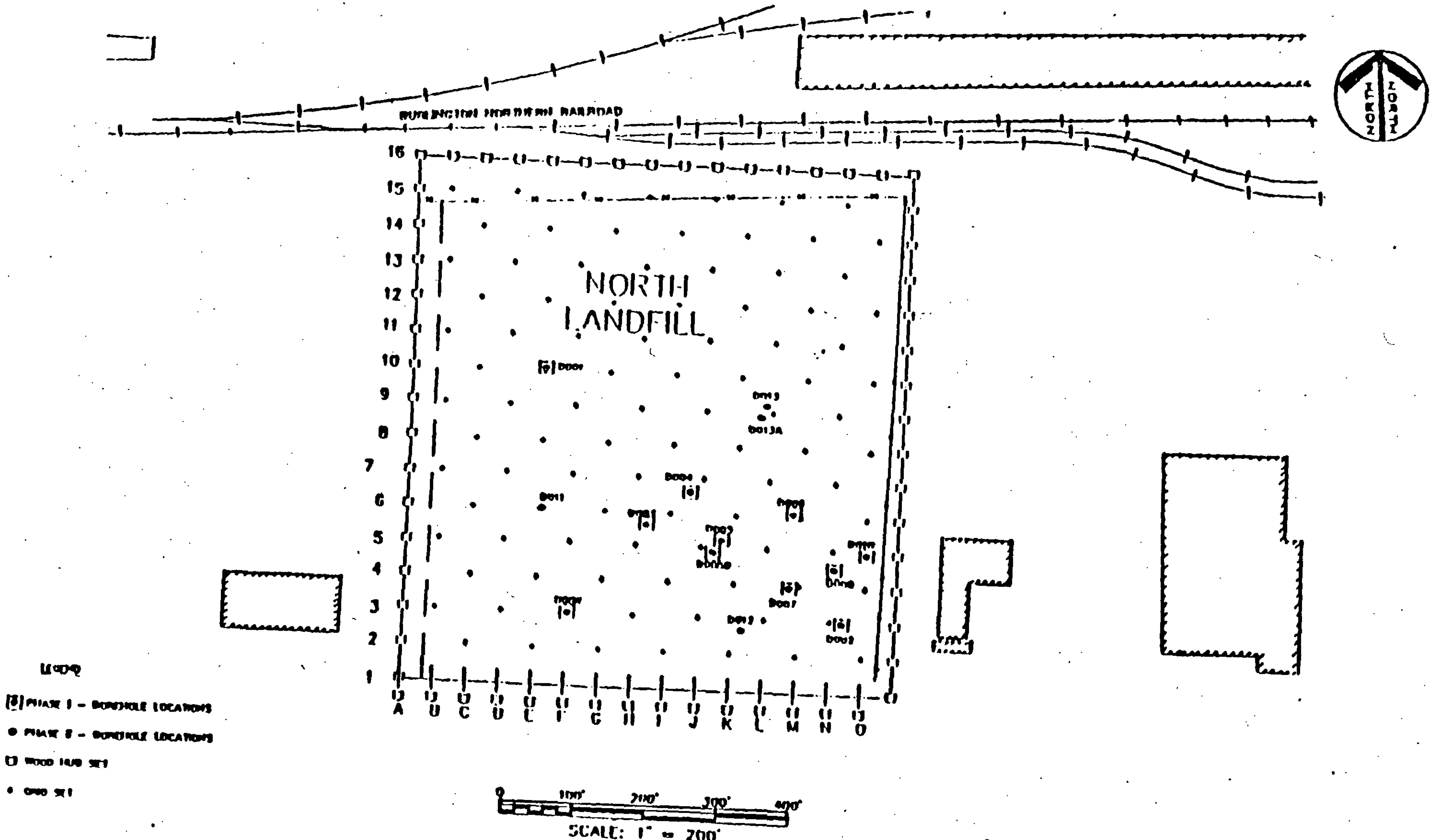
Cross Section Showing Fill

Based on Boring & Well Log Data from PRC
From 1989 Figure by G&M Consulting Engineers, Inc.
Environmental Management, Inc.

Source: Geraghty & Miller, Inc.

Figure 3

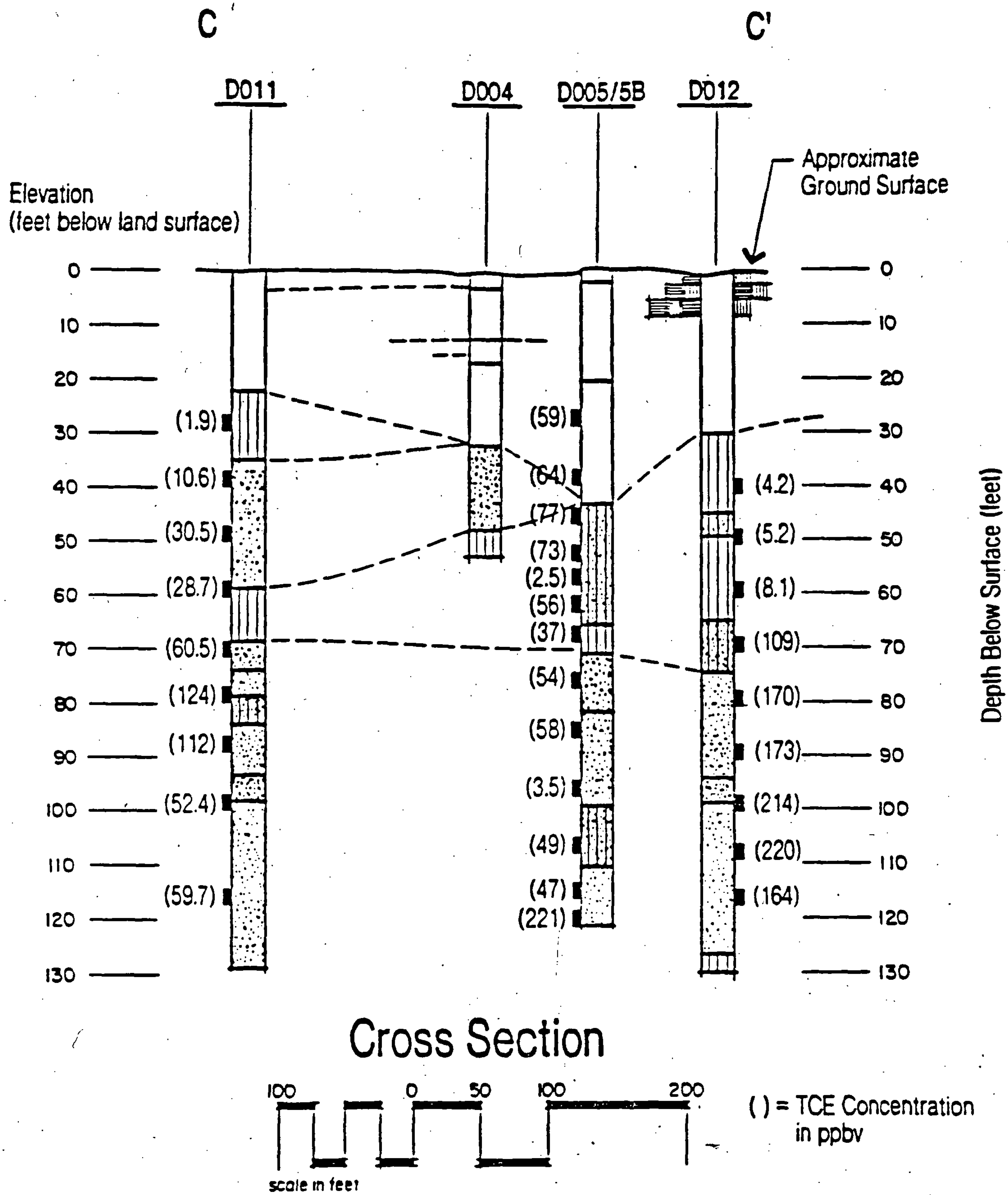

LEGEND
IRRIGATION WELL
MUNICIPAL WELL
INDUSTRIAL WELL
EPA MONITORING WELL
STATE MONITORING WELL
CWS WELL
DOMESTIC WELL
USGS WELL
APPROXIMATE BOUNDARY OF NORTH LANDFILL SITE
BURLINGTON RAILROAD
BY-PASS ROAD
6
DV-01S
DV-01D
M-12
DV-02S
DV-02D
DV-01
MV-05
MV-07
MV-06
MV-25
MV-19
MV-17
MV-21
MV-26
MV-24
SCALE
FEET
FIGURE 4
WELL LOCATIONS
NORTH LANDFILL SUBSITE
ARCS
MORRISON-KNUDSEN CORPORATION



North Landfill/Hastings, Nebrask
Soil Boring Location
(April 1988,January & February 1989

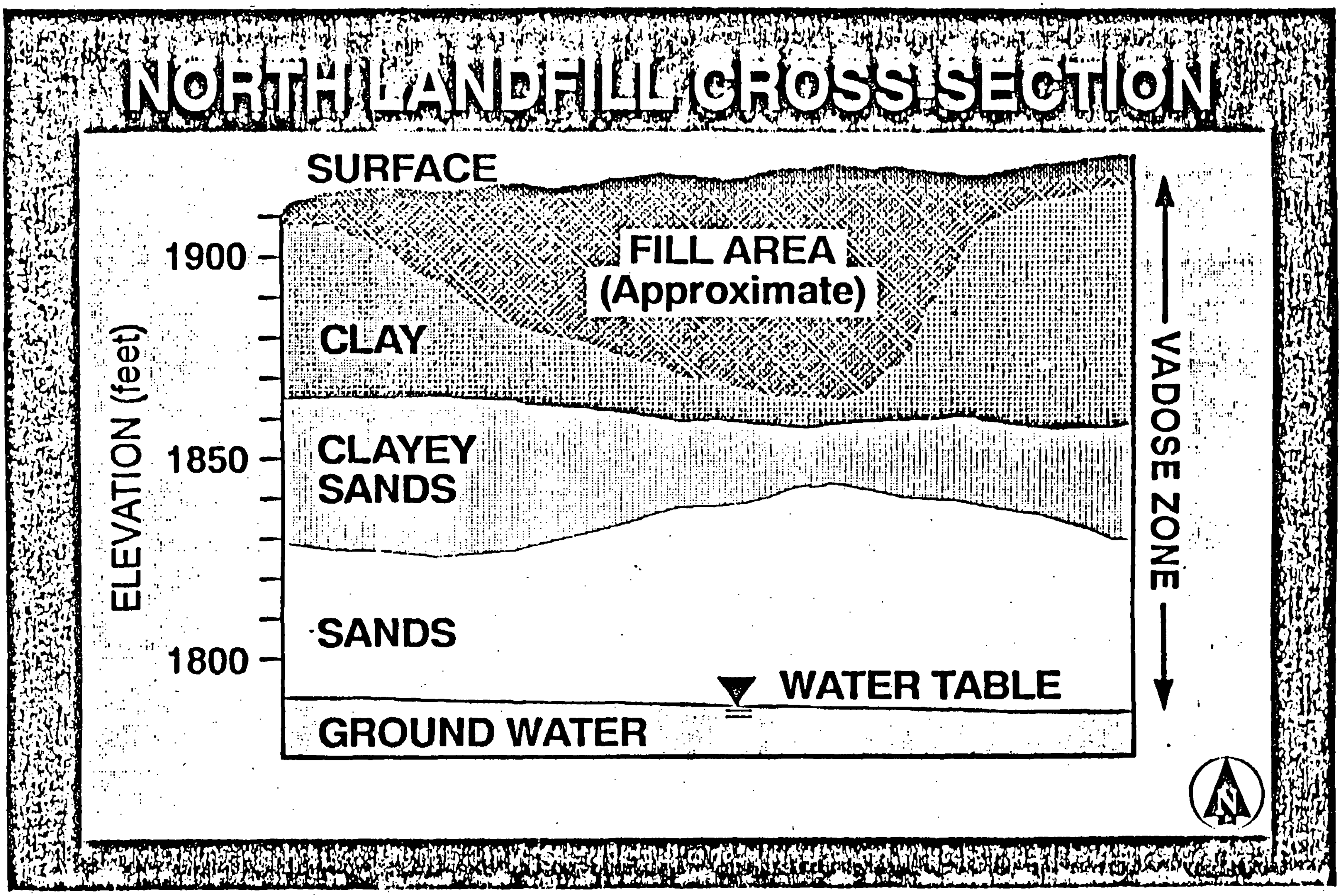
Source : Geraghty & Miller, In

Figure 5



North Landfill/Hastings, Nebraska

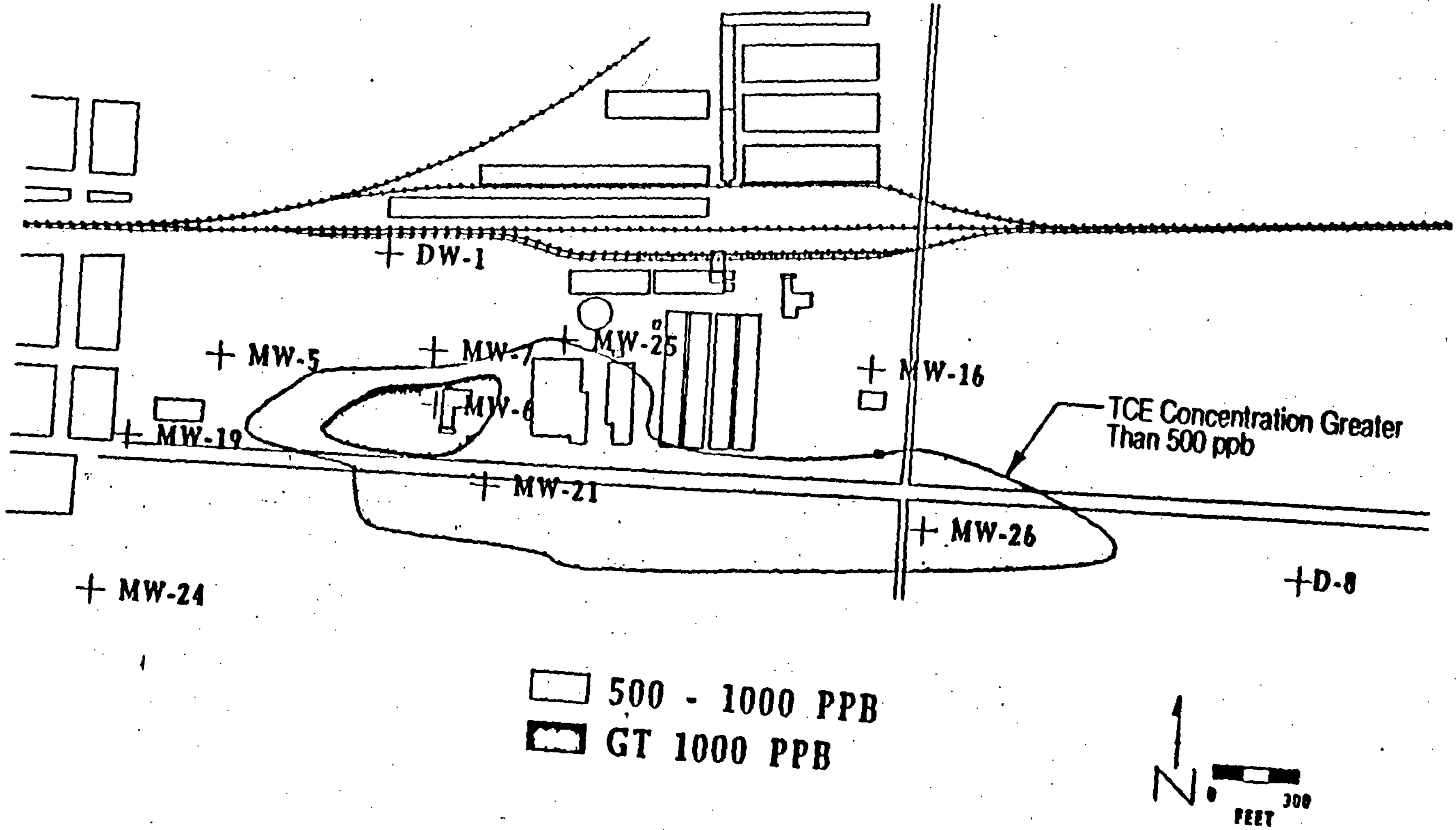
Trichloroethylene Chemical Concentrations in Soil-Gas Versus Depth



North Landfill/Hastings, Nebraska

Simplified Cross Section of Area

Figure 7



North Landfill/Hastings, Nebraska

TCE Plume

(Based on Mean 1989 Concentrations)

Figure 8

Constituent	SQL	Frequency of Detects	Range of Detects	Mean	UCL
1988 Data (23 samples)					
Benzene	1	9	15 - 560	45	91
Carbon tetrachloride	1	1	4.3	0.67	0.95
1,2-Dichloroethylene	2	14	3.4 - 462	53	97
Tetrachloroethylene	1	2	1.3 - 1.7	0.59	0.69
Trichloroethylene	1	14	1.5 - 77	26	36
1989 Data (30 samples)					
Benzene	10	0	ND	ND	ND
Carbon tetrachloride	1	0	ND	ND	ND
1,2-Dichloroethylene	R	R	R	R	R
Tetrachloroethylene	1	5	1.6 - 3.1	1.2	1.4
Trichloroethylene	1	22	0.1 - 220	52	75
1990 Data (9 samples)					
Benzene	0.4 - 4.0	1	0.18	1.6	2.1
Carbon tetrachloride	0.85 - 8.5	0	ND	ND	ND
1,2-Dichloroethylene	0.3 - 3.0	3	3.3 - 5.5	3.1	4
Tetrachloroethylene	0.2 - 2.0	0	ND	ND	ND
Trichloroethylene	0.2 - 2.0	2	0.4 - 1.4	1.6	2
Vinyl chloride	0.3 - 3.0	5	4.0 - 20	7.2	11
Total					
Benzene	-	10	0.2 - 560	32	64
Carbon tetrachloride	-	1	4.3	0.67	0.95
1,2-Dichloroethylene	-	17	3.3 - 462	39	71
Tetrachloroethylene	-	7	1.3 - 1.7	0.95	1.1
Trichloroethylene	-	38	0.4 - 220	35	47
Vinyl chloride	-	5	4.0 - 20	7.2	11

All data are reported in milligrams per cubic meter (mg/m3) and are estimated values.

ND Not detected.
R Rejected data.
SQL Sample quantitation limit.
UCL Upper 95 percent confidence limit.

North Landfill/Hastings, Nebraska

Summary of Soil-Gas Data

Source : Geraghty & Miller, Inc.

Table 1

AGE	STRATIGRAPHIC GROUP/FORMATION	STRATIGRAPHIC MEMBER/LITHOLOGY	ORIGIN	THICKNESS
PLEISTOCENE: VISCONSINAN GLACIAL STAGE	Peoria Formation (Medial Visconsinan)	(a) Peoria loess: light brown-white silt	Aeolian	Up to 100 ft (average 40 ft)
		(b) Todd Valley Sand: greenish-gray fine sand (present only in some places)	Fluvial	0 ft up to 60 ft
Sangamonian Interglacial				
ILLINOIAN GLACIAL STAGE	Loveland Formation (Late Illinoian)	(a) Loveland Loess: reddish-brown calcareous silt with minor amounts of sand and clay	Aeolian	0 ft up to 200 ft
		(b) Crete Sand and Gravel (present only in some places)	Fluvial	Up to 30 ft
Yarmouthian Interglacial				
KANSAN GLACIAL STAGE	Sappa Formation (Late Kansan)	Greenish-gray clay and fine sand with a layer of volcanic ash at the bottom (Pearlette Ash Member)	Aeolian/Fluvial (minor volcanic)	Up to 140 ft (generally thinner)
	Grand Island Formation (Late Kansan) **	Sand and gravel (coarsest at base)	Fluvial	Up to 170 ft
Aftonian Interglacial				
NEBRASKAN GLACIAL STAGE	Fullerton Formation (Late Nebraskan) **	Dark calcareous silt, clay, and fine sand	Fluvial/Aeolian	Up to 40 ft
	Holdrege Formation (Late Nebraskan) **	Sand and gravel (coarsest at base)	Fluvial	Up to 170 ft
Unconformity				
MIOCENE	Ogallala Formation	Lenticular deposits of uncemented to slightly cemented sand, silt, clay, and minor volcanic ash. (Largely eroded under Hastings area)	Fluvial/Aeolian (minor volcanic)	Up to 500 ft (thickens toward west, up to 113 ft under Adams Co.)
Unconformity				
CRETACEOUS	Niobrara Formation	Chalky shale and chalk (bedrock)	Marine	Up to 300 ft

** These classifications follow Johnson (1960) but more recent work (Dreeszen, 1985) indicates that these classifications are being revised.

From PRC Environmental Management, Inc., 1990b

North Landfill/Hastings, Nebraska

Regional Stratigaphy of the Hastings Area

Source: Geraghty & Miller, Inc.

Table 2

Constituent	Range of SQLs	Site Wells				MW-6			
		Frequency	Range (a)	Mean	UCL	Frequency	Range (a)	Mean	UCL
Acetone	10 – 130	1/32	110	12	19	1/13	110	21	38
Benzene	0.1 – 63	10/38	1.0 – 17	5.6	7.7	9/16	4.0 – 17	10	14
Bromodichloromethane	0.1 – 63	1/36	9.0	4.7	6.8	1/12	9.0	4.8	8.2
2-Butanone	10 – 100	1/29	48	8.7	12	1/11	48	13	23
Carbon tetrachloride	0.1 – 5.0	1/33	0.41	2.2	2.4	0/19	–	–	–
Chloroform	0.1 – 63	6/36	1.0 – 18	4.9	7.1	3/11	2.0 – 4.0	2.1	2.7
Chloromethane	0.1 – 110	2/34	0.5 – 13	8.3	12	1/10	13	6.1	7.5
Dibromochloromethane	0.1 – 63	2/36	5.0 – 7.0	4.8	6.9	1/11	7.0	2.7	3.6
1,2-Dichloroethane	0.1 – 63	8/36	8.0 – 27	8.1	11	8/14	8.0 – 27	17	22
1,1-Dichloroethylene	0.1 – 63	14/36	1.0 – 29	7.5	10	2/14	1.0 – 26	9.3	15
1,2-Dichloroethylene	0.1 – 5.0	23/36	4.0 – 2,000	620	840	14/14	6.0 – 2,000	1,500	1,800
1,2-Dichloropropane	0.1 – 50	6/34	1.0 – 5.0	3.1	4.3	5/11	2.0 – 5.0	2.6	3.3
Methylene chloride	0.2 – 110	4/36	38 – 150	16	23	4/14	38 – 150	34	52
Toluene	0.2 – 63	1/34	10	4.9	7.1	0/13	–	–	–
Tetrachloroethylene	5.0 – 63	24/41	2.0 – 19	7.9	9.7	12/16	5.0 – 11	8.6	9.7
1,1,1-Trichloroethane	0.1 – 63	15/41	2.0 – 76	13	17	2/19	4.0 – 76	12	19
1,1,2-Trichloroethane	0.1 – 63	7/36	10 – 23	7.0	9.4	7/14	10 – 23	14	19
Trichloroethylene	5.0 – 49	39/41	6.9 – 2,300	820	1,000	19/19	36 – 2,300	1,500	1,800
Vinyl chloride	0.2 – 130	14/35	0.28 – 87	19	25	7/13	14 – 87	39	51
Xylene (total)	0.1 – 5.0	1/28	0.9	2.4	2.5	1/10	0.9	2.3	2.6

All data are in micrograms per liter (ug/l).

a Range of detected concentrations.

SQLs Sample quantitation limits.

UCL Upper 95 percent confidence interval of the mean.

North Landfill/Hastings, Nebraska

Summary of Ground Water Data for On-Site Wells (MW-6, MW-7, & DW-1)

Source : Geraghty & Miller, Inc.

Table 3

TABLE 4a

TARGET CONCENTRATIONS FOR POTENTIAL CARCINOGENIC CHEMICALS DETECTED IN GROUNDWATER AT THE HASTINGS CITY NORTH LANDFILL SITE

Chemical (d)	Weight of Evidence (a)	Slope Factor (mg/kg-day)-1 [Source] (b)		Target Concentrations for Cancer Risk Range (ug/liter)		
		Oral	Inhalation	1X10-4	1X10-5	1X10-6
Benzene	(A)	0.029 [IRIS]	0.029 [HEAST]	140	14	1.4
Chloroform	(B2)	0.0061 [IRIS]	0.081 [HEAST]	94	9.4	0.94
1,2-Dichloroethane	(B2)	0.091 [IRIS]	0.091 [HEAST]	45	4.5	0.45
1,1-Dichloroethene	(C)	0.60 [IRIS]	1.20 [HEAST]	4.5	0.45	0.045
Tetrachloroethene	(B2)	0.051 [HEAST]	0.0018 [HEAST] (c)	150	15	1.5
Trichloroethene	(B2)	0.011 [HEAST]	0.017 [HEAST]	290	29	2.9
Vinyl Chloride	(A)	1.9 [HEAST]	0.29 [HEAST] (c)	3.7	0.37	0.037

a) EPA weight of evidence classification scheme for carcinogens: A--Human Carcinogen, sufficient evidence from human epidemiological studies; B1--Probable Human Carcinogen, limited evidence from epidemiological studies and adequate evidence from animal studies; B2--Probably Human Carcinogen, inadequate evidence from epidemiological studies and adequate evidence from animal studies; C--Possible Human Carcinogen, limited evidence in animals in the absence of human data; D--Not classified as to human carcinogenicity; and E--Evidence of noncarcinogenicity.

b) Source: IRIS = the chemical files of EPA's Integrated Risk Information System (as of 6/1/91); HEAST = Health Effects Assessment Summary Tables (as of January, 1991); HA = Health Advisory (Office of Drinking Water).

c) The inhalation slope factors were estimated from the following unit risk values:
5.2x10-4 per mg/m3 for tetrachloroethene, and 8.4x10-2 per mg/m3 for vinyl chloride.
An inhalation rate of 20 m3/daywas assumed for a 70-kg adult.
Example calculation: (5.2x10-4/mg-m3)*(70kg/20m3-day) = 0.0018 per mg/kg-day.

d) 1,2-dichloroethene is not included because no cancer slope factors or unit risk values are available; it has a Weight of Evidence Classification of "D" (IRIS).

17-Sep-91 Table4b.wk1

TABLE 4b

TARGET CONCENTRATIONS FOR POTENTIAL NONCANCER RISKS FOR CHEMICALS DETECTED IN GROUNDWATER AT THE HASTINGS CITY NORTH LANDFILL SITE (a)

Chemical (e)	K (c)	Inhalation RfC (mg/m3)	Inhalation RfD (mg/kg-day)	Oral RfD (mg/kg-day)	Target Concentration Based on Hazard Index of One (ug/L)
Chloroform	0.84	NA	0.010 (b)	0.010 IRIS	190
1,1-Dichloroethene	0.95	NA	0.0090 (b)	0.0090 IRIS	161
1,2-Dichloroethene (total)	0.94	NA	0.010 (b)	0.010 HEAST (d)	180
Tetrachloroethene	0.77	NA	0.010 (b)	0.010 IRIS	198
Trichloroethene	0.83	NA	0.0074 (b)	0.0074 HA	140

(a) Source of toxicity information: IRIS = the chemical files of EPA's Integrated Risk Information System (as of 6/1/91); HEAST = Health Effects Summary Table (as of January, 1991); HA = Health Advisory (Office of Drinking Water).
(b) In the absence of an inhalation RfD, the oral RfD is used for both oral and inhalation exposures.
(c) K is the constant ratio between the inhalation and the oral dose.
(d) Chronic RfD for cis-1,2-dichloroethene was used for 1,2-dichloroethene (total).
(e) Benzene, 1,2-dichloroethane, and vinyl chloride are not included because toxicity criteria for noncarcinogenic effects are not available.
NA - not available

TABLE 5 -- COMPARATIVE ANALYSIS OF ALTERNATIVES

ALTERNATIVES	CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH ARARS	LONG-TERM EFFECTIVENESS AND PERMANENCE	SHORT-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	IMPLEMENTABILITY	COST (Expressed in thousands; Present Net Worth is for 30 years)
1. No Action	None	None	None	None	None	Yes -- alternative required by NCP	Cost estimates not prepared
2. Limited Action	Yes	None	None	None	None	Yes -- alternative involves installing a fence, monitoring ground water, and maintaining the landfill cover	Capital Cost: $180 Annual O&M: $24 Present Net Worth: $587
3. Ground Water Recovery and Air Stripping/Reinjection	Yes	May not be able to meet chemical-specific ARARs; a waiver to this ARAR may be necessary	Yes	Moderately high degree of short-term effectiveness; construction will require dust control and personal protective equipment for workers	Yes	Yes	Capital Cost: $865 Annual O&M: $72 Present Net Worth: $2,013
4. Ground Water Recovery and Air Stripping/Reuse	Yes	May not be able to meet chemical-specific ARARs; a waiver to this ARAR may be necessary	Yes	Moderately high degree of short-term effectiveness; construction will require dust control and personal protective equipment for workers	Yes	Yes	Capital Cost: $1,050 Annual O&M: $87 Present Net Worth: $2,384
5. Ground Water Recovery and UV/Oxidation, Reuse/Reinjection	Yes	May not be able to meet chemical-specific ARARs; a waiver to this ARAR may be necessary	Yes; however, UV/oxidation process may generate potentially hazardous by-products	Moderately high degree of short-term effectiveness; construction will require dust control and personal protective equipment for workers	Yes	Moderately low degree of implementability for UV/oxidation system	Capital Cost: $1,307 - $1,484 Annual O&M: $153 - $182 Present Net Worth: $3,668 - $3,954
6. Nebraska Sanitary Cap with Ground Water Alternative 3	Yes	See #3 above	Yes	Yes	Yes	Yes	Capital Cost: $1,868 Annual O&M: $72 Present Net Worth: $3,008
7. Nebraska Sanitary Cap with Ground Water Alternative 4	Yes	See #4 above	Yes	Yes	Yes	Yes	Capital Cost: $2,020 Annual O&M: $87 Present Net Worth: $3,384
8. Nebraska Sanitary Cap with Ground Water Alternative 5	Yes	See #5 above	See #5 above	See #5 above	Yes	See #5 above	Capital Cost: $2,276 - $2,433 Annual O&M: $153 - $182 Present Net Worth: $4,635 - $4,924
9. Soil Vapor Extraction	Yes	Yes	Yes	Yes	Yes	Yes	Capital Cost: $542 Annual O&M: $36 Present Net Worth: $1,086

TABLE 6

ESTIMATED COSTS OF THE SELECTED REMEDY
(all values in thousands)

Capital Costs:	
Treatment Component Costs	Estimated
Landfill Cap Testing and Improvements	$ 125
Site Work	129
Concrete/Building	65
Process Equipment	265
Institutional Controls	55
	$ 639
Contingency (20%)	128
Total Construction Costs	$ 767
Legal Costs (5%)	38.5
Engineering (15%)	115
Construction Management (10%)	76.5
Total Capital Costs	$ 997
Annual Operation and Maintenance:	
Monitoring	$ 35
Inspection and Maintenance	7.5
Utility/Labor/Misc.	41.5
Annual Costs	$ 84
Present Net Worth:	
15 year O&M PNW (pwf = 10.38)	$ 872
Total Capital Costs	997
Total 15 Year PNW	$ 1,869
30 year O&M PNW (pwf = 15.37)	$ 1,291.3
Total Capital Costs	997
Total 30 Year PNW	$ 2,2882

Table 7

POTENTIAL STATE ARARS	CITATION
I. Nebraska Environmental Protection Act	Neb. Rev. Stat. Ch. 81, Article 15
A. Rules and Regulations Governing the Nebraska Pretreatment Program	Neb. Adm. Rules & Regs Title 127
B. Effluent Guidelines and Standards	Neb. Adm. Rules & Regs Title 121
C. Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System	Neb. Adm. Rules & Regs Title 119
D. Rules and Regulations for Underground Injection and Mineral Production Wells	Neb. Adm. Rules & Regs Title 122
E. Air Pollution Control Rules and Regulations	Neb. Adm. Rules & Regs Title 129
F. Nebraska Surface Water Quality Standards	Neb. Adm. Rules & Regs Title 117
G. Ground Water Quality Standards and Use Classification	Neb. Adm. Rules & Regs Title 118
H. Rules and Regulations Pertaining to Solid Waste Management	Neb. Adm. Rules & Regs Title 132
I. Rules and Regulations Governing Hazardous Waste Management in Nebraska	Neb. Adm. Rules & Regs Title 128
J. Rules and Regulations Pertaining to the Management of Wastes	Neb. Adm. Rules & Regs Title 126
II. Water Well Standards and Contractors' Licensing Act	Neb. Rev. Stat. Ch. 46 Article 12
A. Regulations Governing Licensure of Water Well and Pump Installation Contractors and Certification of Water Well Drilling and Pump Installation Supervisors	Neb. Adm. Rules & Regs Title 178
III. Nebraska Safe Drinking Water Act	Neb. Rev. Stat. Ch. 71 Article 53
A. Regulations Governing Public Water Supply Systems	Neb. Adm. Rules & Regs Title 179
IV. Statutes Relating to Disposal Sites	Neb. Rev. Stat. Ch. 19, Articles 21 & 41
V. Statutes Relating to Ground Water	Neb. Rev. Stat. Ch. 46 Article 5