HISTORICAL SITE ASSESSMENT
TOBICO MARSH STATE GAME AREA
Kawkawlin, Michigan

PREPARED FOR:

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

CONTRACT NUMBER ERD-9477
PROJECT NUMBER 9285-01

JULY 1998

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MICHIGAN DEPARTMENT OF NATURAL RESOURCES

Prepared by:

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EXECUTIVE SUMMARY

The Tobico Marsh State Game Area Site (Site) is located in the Tobico Marsh State Game Area, Kawkawlin Township, Bay County, Michigan. The Site, which is currently owned by the Michigan Department of Natural Resources, consists of a three acre disposal area containing hazardous and radioactive wastes. The Site is bounded on the north, east, and west by marsh. The SCA Landfill site is located on the Site's southern boundary. Due to the radioactive materials present, the Site has been placed on the Site Decommissioning Management Plan (SDMP) by the Nuclear Regulatory Commission. The SCA Landfill site is also listed on the SDMP.

This Historical Site Assessment (HSA) has been completed in accordance with the "Multi-Agency Radiation Survey Site Investigation Manual" (MARSSIM)(NRC, 1997). During the HSA, over a thousand individual documents were reviewed and cataloged. The vast majority of these documents relate to the discovery, identification, characterization, and remediation of chemical concerns resulting from the presence of hazardous wastes at the Site. As the focus of this HSA is radiological, reference to chemical concerns at the Site is minimal. The main impact of chemical concerns to the radiological issues for the Site, is that the hazardous materials resulted in a remedial action to contain the wastes. Data collected during the HSA indicates that the radioactive materials present at the Site are encapsulated within this containment structure. The containment structure consists of a clay cap and a slurry wall that is keyed into the clay underlying the Site.

The activity which resulted in the generation of the radioactive materials disposed of at the Site has been identified. The radioactive materials disposed consisted of a magnesium-thorium slurry or slag, a bi-product of aircraft manufacturing operations conducted by Wellman-Dynamics at a plant in Bay City, Michigan. The materials were brought to the Site in roll-off bins and/drums and dumped on the ground surface. Radioactive materials were not segregated from chemical hazardous wastes disposed of at the Site. Other radioactive elements potentially present at the Site include Uranium, Radium, and Potassium, although the presence of these materials is not well documented.

The primary conclusion reached during the HSA, in accordance with guidance provided in MARSSIM, is that the Site is radiologically impacted and that further investigation is required before a decision regarding final source disposition can be reached. Additionally, based on the data gathered and reviewed

during the HSA and the conceptual model developed with that information, impacted and non-impacted areas at the Site have been designated in accordance with MARSSIM. The impacted area has been further subdivided into two survey units. Survey Unit 1 consists of the area inside the Site's slurry wall and, based on the available information, has been classified as Class 1. Survey Unit 2 consists of a 20 meter buffer zone around Survey Unit 1, and based on the available information, has been classified as Class 3. An area consistent with MARSSIM's definition of Class 2, was not identified at the Site.

A non-impacted area potentially suitable for use as a background reference area has been identified. This area is located to the west and north of the Site.

1. INTRODUCTION

This Historical Site Assessment (HSA) report is divided into 9 major sections. Section 1 describes the Federal government's multi-agency approach to sites containing radioactive material. This section also introduces the Tobico Marsh State Game Area (Tobico Marsh SGA) and its basis for consideration by the Nuclear Regulatory Commission (NRC). Section 2 presents the HSA objectives and methods employed to achieve the objectives. The results of the HSA investigative efforts are then initially presented (Section 3) as a chronological site history (Section 4), culminating with the current land use for the Site and surrounding areas. The HSA then develops the regional and site specific environmental setting (Section 5). This regional information is used to evaluate potential isotopic transport pathways for the Site (Section 6). Section 7 presents a site specific model based upon previous remedial efforts and a spatial isotopic contaminant layout. The document closes by re-stating the objectives and presenting conclusions (Section 8). The HSA is supported with references and other technical tools used in the development of this HSA report (Section 9).

1.1 HISTORICAL SITE ASSESSMENT PROCESS

The United States Nuclear Regulatory Commission (NRC) has placed the Site (Tobico Marsh SGA) on their list of sites requiring special attention due to the presence of radioactive material. Listed sites are collectively referred to by the NRC as Site Decommissioning Management Plan (SDMP) sites. The NRC developed the SDMP in 1990 to promote timely and safe cleanup of radiologically contaminated sites that warrant special NRC attention due to unique or complex decommissioning issues. The NRC may place a radiologically contaminated site on the SDMP list if it has any of the following attributes:

- Problems with the viability of the responsible organization;
- Large amounts of soil contamination or unused settling ponds or burial grounds that may make the waste difficult to dispose of;
- The long-term presence of contaminated, un-used buildings;
- A previously terminated NRC license; or
- Contamination or potential contamination of the groundwater from on-site wastes (Doc.511).

On January 5, 1996 the NRC updated the SDMP and identified 47 sites in 11 states. The updated list included the subject Site (Doc. 511). A program leading to the licensing, characterization,

decontamination, and decommissioning of a site must be implemented and completed before the NRC will remove a site from the SDMP.

The Federal government has developed the "Final - Multi-Agency Radiation Survey Site Investigation Manual" (MARSSIM, NRC, 1997) to provide guidance in the cleanup of radiologically contaminated sites. MARSSIM was developed by a multi-agency technical work group consisting of members of the Department of Defense (DOD), Department of Energy (DOE), Environmental Protection Agency (EPA), and the Nuclear Regulatory Commission (NRC). The document was designed to provide a "...nationally consistent approach to conducting radiation surveys and investigation of potentially contaminated sites" (NRC, 1997). MARSSIM provides comprehensive guidance on all phases of decontamination and decommissioning (D&D), from initial site assessment to final status surveys resulting in ultimate license termination.

Once a contaminated site is identified, the first step in the decommissioning process is to perform an HSA. The primary purpose of an HSA is to collect existing information concerning the site and its surroundings. The primary activities of an HSA are: the identification of potential sources of contamination; the identification of areas that pose little or no threat to human health and the environment; the differentiation of impacted from non-impacted areas; to provide input to scoping and characterization survey designs; and to provide an assessment of the likelihood of contaminant migration (NRC, 1997). An HSA is typically performed prior to and also concurrent with other radiological surveying activities.

Following the HSA, additional data are collected during surveys. There are four major types of surveys which are conducted as part of the decommissioning process at a radiological site: 1) Scoping Survey; 2) Characterization Survey; 3) Remedial Action Support Survey; and 4) Final Status Survey. MARSSIM provides detailed guidance on the design, implementation, evaluation, and documentation requirements for each type of survey.

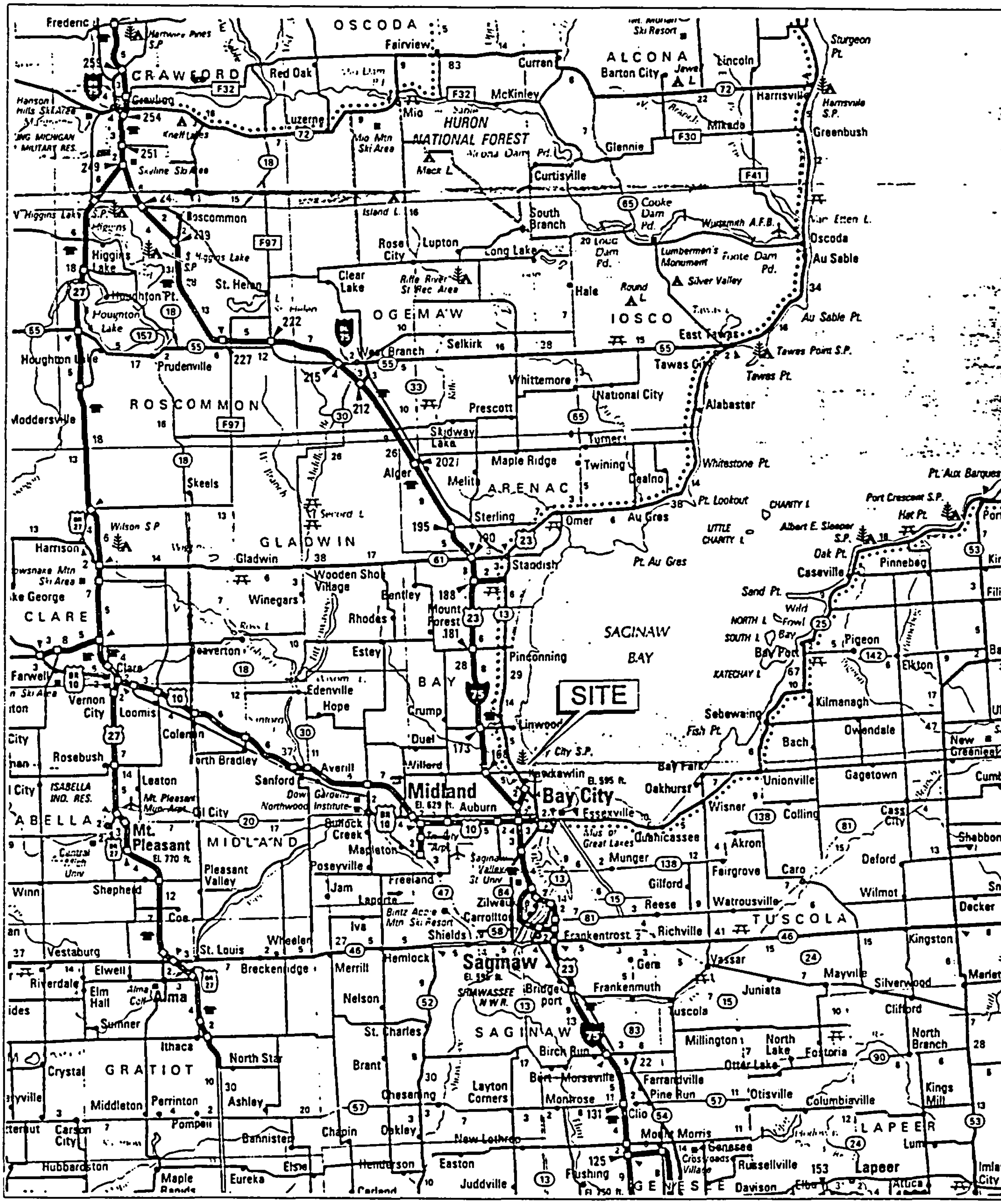
The intent of the Scoping Survey is to gather sufficient data regarding radiological conditions at the site, including background radionuclide levels, so that a Characterization Survey can be completed. Identification of background levels is needed to differentiate "contaminants" from naturally occurring radioactivity. The Characterization Survey includes site sampling, monitoring, and analysis activities to

determine the extent and nature of contamination. The Characterization Survey provides the basis for acquiring necessary technical information to develop, analyze, and select appropriate cleanup methods. The Remedial Action Support Survey evaluates the remediation activities by determining if the site has been effectively remediated or radiologically cleaned up. The Final Status Survey is the mechanism used to demonstrate that residual radioactivity complies with established release criteria.

1.2 PROPERTY IDENTIFICATION

The Tobico Marsh SGA is located in Kawkawlin Township, Bay County, Michigan (Figures 1-1 and 1-2). A former waste disposal facility, referred to as the Hartley & Hartley (H&H) Landfill is located on the southern perimeter of the Tobico Marsh SGA (Figure 1-3). In a land exchange with the owners of the H&H Landfill on February 11, 1974, a 40 acre area was acquired by the Michigan Department of Natural Resources (MDNR). The property exchange was settlement for a trespass suit brought by the State of Michigan against Hartley and Hartley, Inc. (Doc. 55).

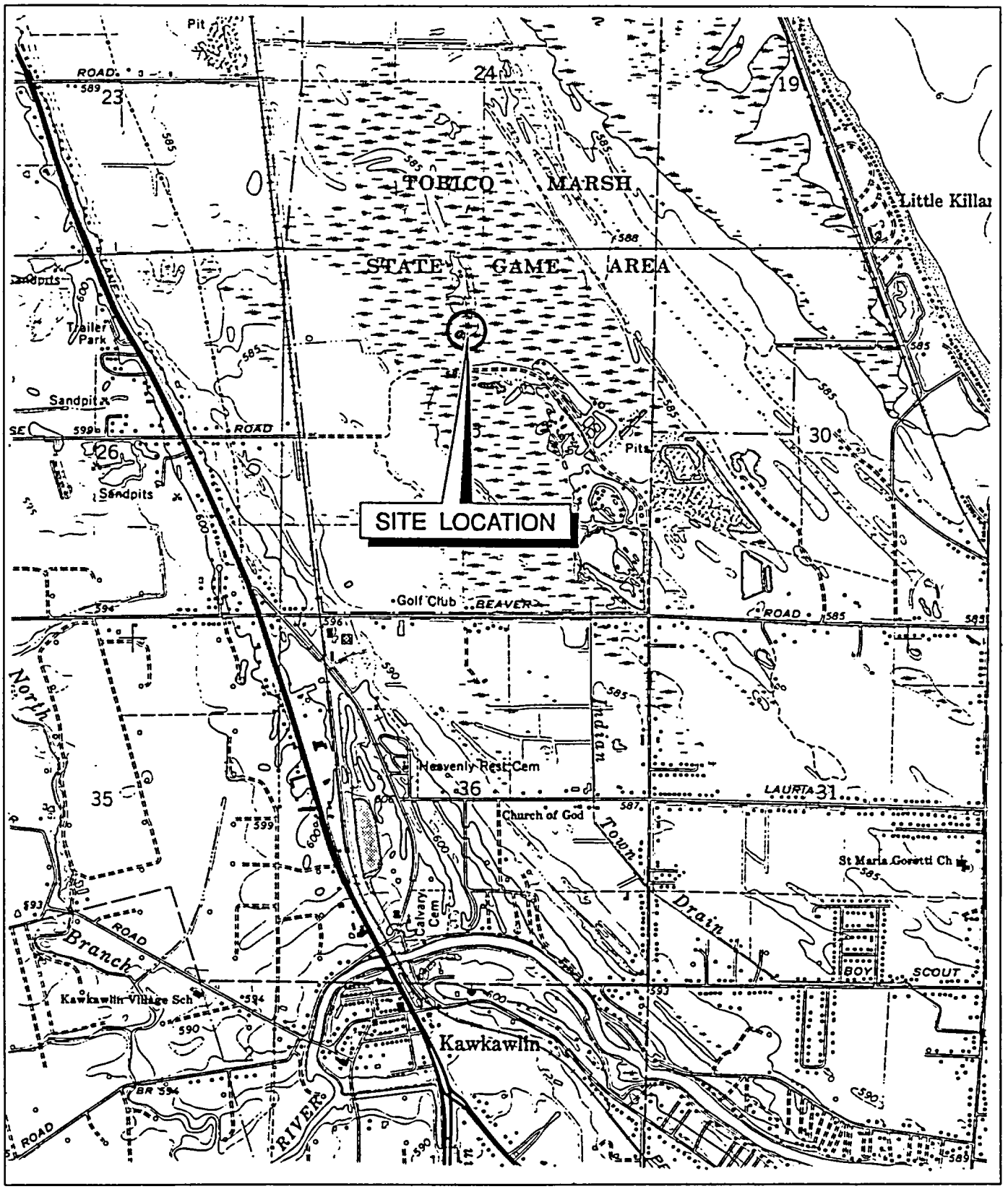
A three acre portion of this 40 acre parcel indicated by Parcel Identification Number 5318, Deed Number 2608, Exchange Number 33131, contains a portion of the former H&H Landfill contaminated with radioactive and chemical materials. These radioactive materials are the subject of this HSA. The address of the state-owned 3-acre portion is 2301 Two Mile Road, Kawkawlin Township, in Bay County, Michigan 48631, which is located in the $SE^1/_4$, $NE^1/_4$, $NW^1/_4$ of Section 25, T.15N, R.4E at the approximate intersection of latitude 43° 41' 23" N and longitude 83° 56' 30" W. The 3-acre portion of the Tobico Marsh SGA is the subject "Site" for the purposes of the NRC License and this HSA report (Figure 1-3).



0 1000 2000 3000 FT.

FIGURE 1-1
REGIONAL LOCATION MAP
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates



Taken from the Kawkawlin, Michigan 7.5 Series U.S.G.S. Topographic Quadrangle Map

0 1000 2000 3000 FT.

QUADRANGLE LOCATION

FIGURE 1-2
SITE LOCATION MAP
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates

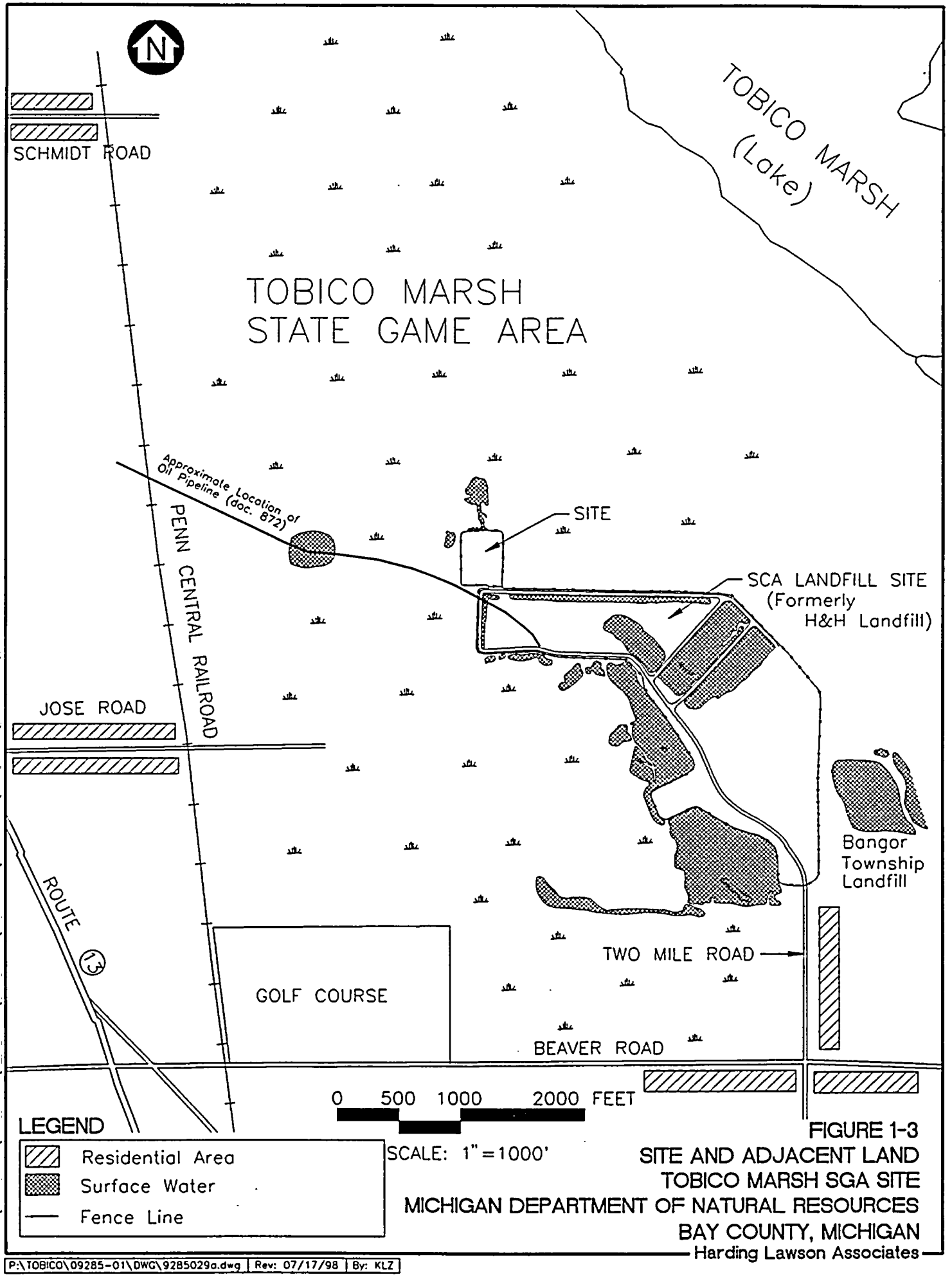


FIGURE 1-3
SITE AND ADJACENT LAND
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN
Harding Lawson Associates

P:\TOBICO\09285-01\DWG\9285029a.dwg | Rev: 07/17/98 | By: KLZ

The Site has been assigned a Michigan Environmental Response Act (MERA) Identification Number, of 090015 due to the chemical (non-radiological) contamination present at the Site (Doc. 290). The study area is limited to the immediate areas surrounding the Site where waste material may still be present from historical H&H Landfill operations. The greater portion of the historic H&H Landfill is currently described as the SCA Landfill and is immediately south of the Site (Figure 1-3). Radiological concerns for the Site and the SCA Landfill are being investigated separately.

2. HISTORICAL SITE ASSESSMENT DATA QUALITY OBJECTIVES

The radiation survey and site investigation process includes the development of Data Quality Objectives (DQOs) for the entire project. The HSA DQOs provide direction and focus for the historical investigative effort. The level of effort can be defined by time, resources and/or economics; however, an acceptable mix of these controlling factors usually defines the quantity of effort. The development and fulfillment of the HSA DQOs ensures that the historical assessment process will result in sufficient quality and quantity of information to support the MDNR in the next step of the radiation survey and investigation process.

The DQOs also control the makeup of technical working groups by the assignment of the decision maker and balancing of radiological and environmental disciplines. The MDNR was identified as the decision maker during the initial development of the radiation survey and site investigation DQOs.

This section of the HSA defines what the minimum recommendations of the HSA should include, a description of the results from implementing the DQOs, and the project specific DQOs.

2.1 HSA-BASED RECOMMENDATIONS

The primary objective of the HSA is to evaluate the current status of the site. Based on the fulfillment of the HSA DQOs, and as outlined in MARSSIM, the MDNR will reach one, or a combination of the following recommendations (NRC, 1997):

1. An emergency action to reduce the radiological risk to human health and environment is required;
2. The site is radiologically impacted and further investigation is required before a decision regarding final resource disposition can be made; and/or
3. The site can be released for subsequent use because there is an extremely low (non-statistical) probability of residual radioactive materials being present.

2.2 RESULTS OF HSA DQO PROCESS

Successful implementation of the HSA DQO Process results in the following:

1. Identification of the HSA technical work group;

2. Concise presentation of the Tobico Marsha SGA Site and its radiological characteristics;
3. Organization of the historical data to support the MDNR in a preliminary radiological classification of impacted areas at the Site; and
4. Organization of the historical data to support the MDNR in deciding if discrete survey units within the Site are appropriate.

These will ultimately support the MDNR in selecting one or a combination of the above HSA recommendations.

2.3 HSA DQOs

The HSA technical work group used the following HSA DQOs to concisely convey the radiological character of the Site and to support subsequent HSA recommendations:

1. Secure any documentation available through the FOIA or other search tools, that identify radiological isotopes that potentially exist at the Site;
2. Secure quantitative data which supports the definition of the Site boundaries, Site layout and isotopic spatial distribution;
3. Secure information which supports the evaluation of whether mixed wastes (i.e. chemical mixed with radiological wastes) are present at the Site;
4. Secure information that could be used to characterize potential mixed wastes for subsequent disposal;
5. Secure chemical information which could be used to protect site workers during the radiological Scoping, Characterization, Remedial Action Support and Final Status Surveys;
6. Obtain information related to the Site's regional environmental setting which supports the evaluation of isotopic transport onto and off of the Site. This includes radiological background considerations.
7. Obtain information related to the anthropogenic (man-made) activities that supports the evaluation of isotopic transport onto and off of the Site; and
8. Obtain data reflecting Site and nearby Site, conditions and activities during the 1960 to 1997 time period.

The above HSA DQOs were used in the planning of the data collection activities performed during the HSA.

3. HISTORICAL SITE ASSESSMENT METHODOLOGY

This section describes the methods used during the HSA data collection and interpretation to achieve the DQOs presented in Section 2.0.

3.1 APPROACH AND RATIONALE

The Tobico Marsh SGA Site and the SCA Landfill have been the focus of regulatory attention since the 1960s when landfill operations began. Prior to the State acquisition of the Tobico Marsh SGA Site, the two sites were not considered separate entities. In the course of these regulatory actions, prior to state acquisition, a large amount of documentation that is not differentiated into two sites was developed. The majority of this documentation, however, focused specifically on physical, environmental, regulatory, or legal aspects of the chemical wastes present and does not address radiological concerns. Understanding of the chemical wastes present is, however, an important component of the HSA DQOs. The HSA methodology was developed and implemented recognizing this condition.

The State of Michigan is in possession of comprehensive files regarding both the SCA Landfill and the Tobico Marsh SGA Site. The HSA data collection effort focused on these files.

The State's files for the SCA Landfill and the Tobico Marsh SGA Site are maintained primarily in the MDEQ Saginaw Bay District office in Bay City, Michigan, and in the MDNR Office of Equal Opportunity and Legal Services located in Lansing, Michigan. Because of the large size of the files, a file review team was established. The file review team traveled to the MDEQ office in Bay City and the MDNR office in Lansing to conduct a physical review of the files. During this cursory review, documents which appeared to be relevant to the HSA DQOs were tagged for copying. Criteria for tagging documents were established for this cursory review. These were as follows:

- any document from the NRC;
- any document containing radiological data or reference to radiological issues;
- any document describing how wastes were handled or disposed of by Hartley;
- any document describing remedial measures in place at the Tobico Marsh SGA site, including the initial sand cover, the cap, the slurry wall, the perimeter fence, or the leachate extraction and treatment system;

- any document summarizing chemical data;
- any document summarizing physical (e.g., geology, hydrogeology, etc.) data;
- any document summarizing fate and transport information for the waste materials;
- any document relating to the generation of the Magnesium-Thorium sludge/slag; and
- any other document relevant to meeting the HSA DQOs.

Prior to reviewing the files located in Bay City, Michigan, the MDNR completed a compilation of all State of Michigan files pertaining to the SCA Landfill and the Tobico Marsh SGA Site. The compilation consisted of the MDNR requesting that all appropriate State agencies (with the exception of the MDEQ) review their files and mail documents regarding the sites to the MDNR. Therefore, the cursory review of the MDNR files effectively addressed files contained by all appropriate State agencies.

The only significant accumulation of known State files relating to the SCA Landfill and the Tobico Marsh SGA Site that were not reviewed were those files relating to legal action associated with cost recovery for chemical waste concerns and the apportionment of liability. These files are maintained in the MDEQ office in Bay City, Michigan. The value of these litigation files was evaluated by the HSA technical work group relative to achieving the HSA DQOs. It was decided that the review of these files would not assist in achieving the HSA DQOs. For this reason, the litigation files were not reviewed during the HSA.

Documents tagged during the cursory review were photocopied and the originals returned to the State's files. The resulting copies were then systematically reviewed and entered into a database to facilitate preparation of this HSA report. Review of documents for the HSA is discussed below.

3.2 DOCUMENTS REVIEWED

The cursory review and photocopying of the MDNR files in Lansing, Michigan, was completed in 3 days. The cursory review and photocopying of MDEQ files in Bay City, Michigan, was also completed in 3 days. The total number of documents reviewed was not tracked, but was probably in excess of 2,500 separate documents. Approximately 1,000 files were identified and photocopied for later review. Appendix A presents a listing of the HSA database developed during this file review.

The documents reviewed consisted of correspondence, records of site visits, site inspections, and interviews, memoranda, sample analytical reports, work plans, investigation reports, photographs, historical aerial photographs, maps, design drawings, as-built drawings, newspaper clippings, and presentation materials from previous public meetings. Shipping manifests associated with the Magnesium-Thorium sludge/slag generated by Wellman-Dynamics were not located during the document review effort.

4. SITE HISTORY AND CURRENT LAND USE

This section presents a summary of the Site's history followed by a discussion of current land use. During the HSA, over a thousand individual documents were reviewed and cataloged. The vast majority of these documents relate to the discovery, identification, characterization, and remediation of chemical concerns resulting from the presence of hazardous wastes at the Site. As the focus of this HSA is radiological, reference to chemical concerns at the Site is minimal. A previously developed (Doc.707) chronology, which considers various chemical issues, is provided in Appendix B. The main impact of chemical concerns to the radiological issues for the Site, is that the hazardous materials resulted in a remedial action to contain the wastes. Discussion of the physical characteristics of the waste containment cell is presented in Section 5.0, as the cell significantly affects the environmental conditions in which the wastes are contained.

The summarization of historical information relevant to the HSA DQOs has been divided into the following subsections. Section 4.1 presents a summary of historical aerial photographs collected and reviewed during the HSA. The photographs provide an objective overview of the Site's history and physical development. Section 4.2 discusses the historical context in which the magnesium-thorium slag was generated, how those materials came to be present at the Site, and how the State became the property owner. Current land use for the Site is discussed in Section 4.3. Adjacent land use is discussed in Section 4.4.

4.1 REVIEW OF HISTORICAL AERIAL PHOTOGRAPHS

Historical aerial photographs of the Site were located in two ways. During the HSA review of files in the possession of the State of Michigan (both MDNR and MDEQ), several historical aerial photographs and snap-shots were collected and reviewed. A database query was also conducted with a national aerial photograph vendor to identify photos of the Site area. Based on the results of this query, aerial photographs for selected years were purchased. Appendix A contains a complete listing of all photographs (both aerial and snap-shots) reviewed during the HSA.

4.1.1 April 1954

The black and white photograph, taken April 11, 1954 at a scale of approximately 1" = 5000', shows the area prior to the initiation of disposal operations by Hartley & Hartley. The most prominent man-made features in the immediately vicinity of the Site are two drainage ditches located south and southwest of the Site. No evidence of disposal activities can be seen at the Site or the northwestern portion of SCA Landfill (Figure 1-3). The pond, currently located north of the Site is not present and this area appears as a raised area that is not marsh (probably a beach sand deposit).

Limited anthropogenic activities are apparent at the northern terminus of Two Mile Road (at the Bangor Township Landfill and immediately west of Two Mile Road) and at the eastern terminus of the Jose Road (possibly a farming operation or a residence). Lands along the western boundary of the Tobico Marsh State Game Area (both east and west of the railroad track) have been cleared, possibly for agricultural use. Surface water bodies currently located south and southwest of the SCA Landfill are not present.

4.1.2 March 1966

The black and white photograph, taken March 13, 1966 at a scale of approximately 1" = 1000', shows disposal operations in progress at the Site, the SCA Landfill, and the Bangor Township Landfill (Figure 1-3). Prominent features apparent at the Site consist of an unimproved road through the center of the Site, small dump piles along the road, a small pond immediately northwest of the Site (shown on Figure 1-3), and the pond to the north of the Site. It is believed that this road was initially constructed through the center of the Site so that the sand deposit located to the north could be accessed and mined.

The circular pond currently located approximately 1,200 feet west of the Site is not present. The trace of the oil pipeline leading to the northwestern portion of the SCA Landfill can be clearly seen. Wetland vegetation and trees cover areas along the western boundary of the State Game Area indicating that use of these areas has ceased, although lands immediately east of the railroad tracks are still clear and appear to be in use. The approximate current outline of both the SCA Landfill and the Bangor Township Landfills can be seen. Surface water bodies currently located south and southwest of the SCA Landfill are present.

4.1.3 July 1969

Several color aerial photographs were taken of the Site by an MDNR photographer on July 1, 1969. These photographs show the Site and its immediate vicinity only. The photographs were taken from a plane circling the Site at a low altitude. Several large accumulations of drums and several waste piles are clearly visible along either side of the road. Some of the piles are white, gray or gray-ish white in color. The appearance of the Site in these photographs has been transferred onto Figure 7-1 (see Section 7.1.1 - Disposal Activities). These photographs provide the best evidence of the locations where waste dumping occurred during the operational history of the Site. The gray-ish white material observed at the Site was later (1983) identified as the Magnesium-Thorium slag. This relationship is further discussed in Section 6.3.3.

4.1.4 May 1983

Several black and white photographs of the Site and the Tobico Marsh were taken by an MDNR photographer on May 11, 1983. The photographs show the Site (and the northwestern portion of the SCA Landfill) as it appeared prior to construction of the cap and slurry wall. The photographs clearly show the outline of the sand cover placed over the site in the early 1970's prior to the State's acquisition of the property. Other prominent features observable at the site include an unimproved road through the center of the site and various piles of material. The unimproved road appears as a gray-ish material which does not support vegetation. The piles appear to be a whitish material that does not support vegetation. Vegetation has developed over other areas of the sand cover. The appearance of some Site features in these photographs has been transferred onto Figure 7-2 (see Section 7.1.1 - Disposal Activities).

4.1.5 June 1987

The black and white photograph, taken June 17, 1987 at a scale of approximately 1" = 2000', shows the Site and the surrounding area essentially as they appear today. The most prominent feature at the Site is the clay cap. The only features visible on the cap are two parallel features going north-south (possibly vehicle tracks) and a faint trace around the site, inside the perimeter of the cap. The origin of this faint trace is not known (it may represent the trace of the slurry wall, but it does not correspond to drawings of the slurry wall's location in the southeastern portion of the Site).

Surface water bodies (including the circular pond located approximately 1,200 feet west of the Site) at the Site and adjacent to the SCA Landfill site appear in their current configuration. No use of the land on the western perimeter of the Tobico Marsh State Game Area (east of the railroad) is apparent in the photograph and vegetation appears to have reclaimed several of the formerly cleared areas. Several trails, possibly used by hunters or MDNR personnel can be seen in the western portion of the State Game Area.

4.2 THORIUM SOURCE HISTORY AND STATE OWNERSHIP

The following subsections present a summary of data reviewed during the HSA concerning the operations that generated the magnesium-thorium sludge/slag, followed by a discussion of the land exchange which resulted in the State of Michigan owning the 3 acre area which is the subject of this HSA.

4.2.1 Thorium Source History

Table 4-1 summarizes the chronology of activities associated with the disposal of radioactive material at the site. Beginning in approximately 1955, the Dow Chemical Company (Dow) manufactured, at a plant in Bay City, Michigan, (Doc.582) castings from magnesium and from a magnesium-thorium alloy, containing 3% to 4% thorium. A waste product of the process was sludge from scrapings from the casting pots. Radioactive sludge from the Dow operations was either sent to an authorized burial ground in Sheffield, Illinois, operated by Nuclear Engineering Company (NECO), or was piled on the Dow plant site (Doc.546).

In 1961, the Wellman-Dynamics Company leased the thorium- magnesium foundry operation from Dow and operated it until October, 1971. On March 17, 1964 Wellman-Dynamics filed an initial application for an Atomic Energy Commission (AEC) license. Wellman-Dynamics operated under AEC Source Material License No. STB-136. License renewal on July 31, 1967, authorized possession of 4,000 pounds of thorium for use in the manufacture of thorium - magnesium alloy containing less than 4% thorium.

Radioactive sludge from the Wellman-Dynamics operations was placed into dumpsters and hauled to the Dow sludge pile (Doc.546) which was made up of 400 mounds, each mound being a load of sludge (Doc.582). Radioactive sludge was accepted by Dow up until about 1970.

From 1962 or earlier, Hartley & Hartley, an independently owned waste hauler who owned and operated the H&H Landfill, disposed of Wellman-Dynamics' non-radioactive waste at the H&H Landfill. In 1970, after Dow refused to accept additional thorium-magnesium waste, Hartley & Hartley also began disposing of the radioactive thorium-magnesium sludge. No specific areas were designated for the disposal of these sludges at the H&H Landfill and it appears that the sludges were disposed of at both the SCA Landfill and at the Tobico Marsh SGA Site.

On August 13, 1970, Wellman-Dynamics Corporation requested permission from the Michigan Department of Public Health (MDPH), to bury thorium sludge, containing less than 0.5% thorium, in accordance with AEC Regulations. Wellman-Dynamics referred to a contract with Hartley & Hartley to provide the labor and the land for burial. On September 2, 1970, the MDPH approved disposal of the sludge by burial, stating that 0.5% thorium would be exempt from registration since its specific activity is slightly less than that of natural potassium (Doc.35).

Table 4-1
Chronology of Radiological Activities

1955	Dow processing of 3-4% thorium-magnesium begins at Bay City
1961	Wellman-dynamics leases foundry operation from Dow
1962	Hartley & Hartley disposes of non-radioactive wastes from Wellman-Dynamics
March 17, 1964	Initial AEC license application by Wellman-Dynamics
1970	Dow stops accepting radioactive sludge from Wellman-Dynamics
August 13, 1970	Wellman-Dynamics requests permission from state to bury thorium at H & H Landfill
September 2, 1970	MDPH approves burial of sludge up to 0.5% thorium
October, 1971	Wellman-Dynamics stops processing thorium-magnesium
November, 1971	Wellman-Dynamics leaves Bay City
Late '71 or '72	MDNR site covered and seeded
March 7, 1972	U of M conducts survey at Wellman-Dynamics Foundry
April 5, 1972	U of M survey report issued, indicating presence of piles of sludge inside building and outside building and recommends proper disposal of sludge

Table 4-1 Chronology of Radiological Activities	
April 14, 1972	Wellman-Dynamics requests termination of license and release of foundry site. Waste in U of M report disposed of by burial off-site.
May 17, 1972	Wellman-dynamics license terminated

On March 7, 1972, the School of Public Health at the University of Michigan (U of M) conducted a radiological survey of the radioactive foundry operations for Wellman-Dynamics, and prepared a report dated April 5, 1972 (Doc.38). The report stated that Wellman-Dynamics produced and processed alloys containing less than four percent thorium. Operations included production of alloys from a master alloy containing 40 percent thorium, and casting, sandblasting, sawing, grinding, sanding, and polishing the alloys. The location was 801 Andre Street, Bay City, Michigan, which is the address in the AEC license and the location of the foundry leased from Dow.

Thorium in the plant at the time of the U of M survey included two barrels of 40 percent thorium, thorium bearing scrap castings, and sludge pot metal. This useable material was scheduled for shipment to the Creston, Iowa plant of Wellman-Dynamics. Thorium-bearing melting pot sludge had been dumped inside and outside the building. The report recommended that this material be disposed of by burial in accordance with AEC Regulation (10 CFR 20.304), and the agreement with the MDPH.

AEC Regulation, 10 CFR 20.304, allowed burial without prior permission of the AEC as specified:

> "No licensee shall dispose of licensed material by burial in soil unless:
> (a) The total quantity of licensed and other radioactive materials buried at any one location and time does not exceed, at the time of burial, 1000 times the amount specified in Appendix D of this part; and
> (b) Burial is at a minimum depth of four feet; and
> (c) Successive burials are separated by distances of at least six feet and not more than twelve burials are made in any year."

Appendix D (of the regulation) specified 100 microcuries for natural thorium, "Based on alpha disintegration rate of Th-232, Th-230 and their daughter products." (See Federal Register/ Vol. 46, No.

205/ October 23, 1981/ Page 52061 and 10 CFR 20.304, prior to its repeal, effective January 28, 1981.) Regulations permitted thorium burial up to 100 millicuries at a time and 1.2 curies each year. Transfer was permitted only to a recipient authorized to receive it.

On April 14, 1972, Wellman-Dynamics requested that the AEC terminate their license and release the facilities at 801 Andre Street. Wellman-Dynamics stated that the waste mentioned in the report by the University of Michigan had been disposed of by burial under AEC Regulation 10 CFR 20.304 and the agreement with the MDPH. This seems to indicate that between March 7, 1972 (when the U of M survey was made) and April 14, 1972, the remaining sludge was removed from 801 Andre Street. There was no available documentation indicating the final disposition of this material. The AEC terminated the Wellman-Dynamics license on May 17, 1972 and the facilities reverted back to Dow.

In 1983, in response to a request from the MDPH, the NRC made a special inspection to determine if the thorium on the Tobico Marsh SGA Site came from NRC, (formerly AEC) licensed activities. The NRC concluded that the thorium came from activities conducted by the licensee, Wellman-Dynamics. During the period of 1970-1971, Wellman-Dynamics disposed of sludge containing thorium without assuring that the recipient was authorized to receive it and that it was properly buried according to regulation. Since Hartley & Hartley was not licensed, the NRC concluded that Wellman-Dynamics made improper disposals of licensed material from their Bay City, Michigan operations during the period 1970 to 1971 (Doc.546).

4.2.2 Land Exchange

Figure 4-1 depicts the land swap. The eastern half of the 3-acre Tobico Marsha SGA Site was already owned by the MDNR. The western half of the 3-acre Site was acquired by the MDNR in a 40-acre land exchange with the owners of the H&H Landfill. The acquisition of the western half of the 3-acre Site is described by Parcel Identification Number 5318, Deed Number 2608, Exchange Number 33131. This transfer was completed on February 11, 1974 as a result of a 1970 law suit filed by the Michigan State Attorney General against Hartley & Hartley Inc., for trespass (Doc.55). The settlement to the suit offered a disproportionate land exchange to the MDNR that consisted of trading 40 acres of land owned by Hartley for 22 acres of land owned by MDNR. The general intent of the disproportionate land exchange was to create a buffer strip of land between the H&H Landfill and the State owned Tobico

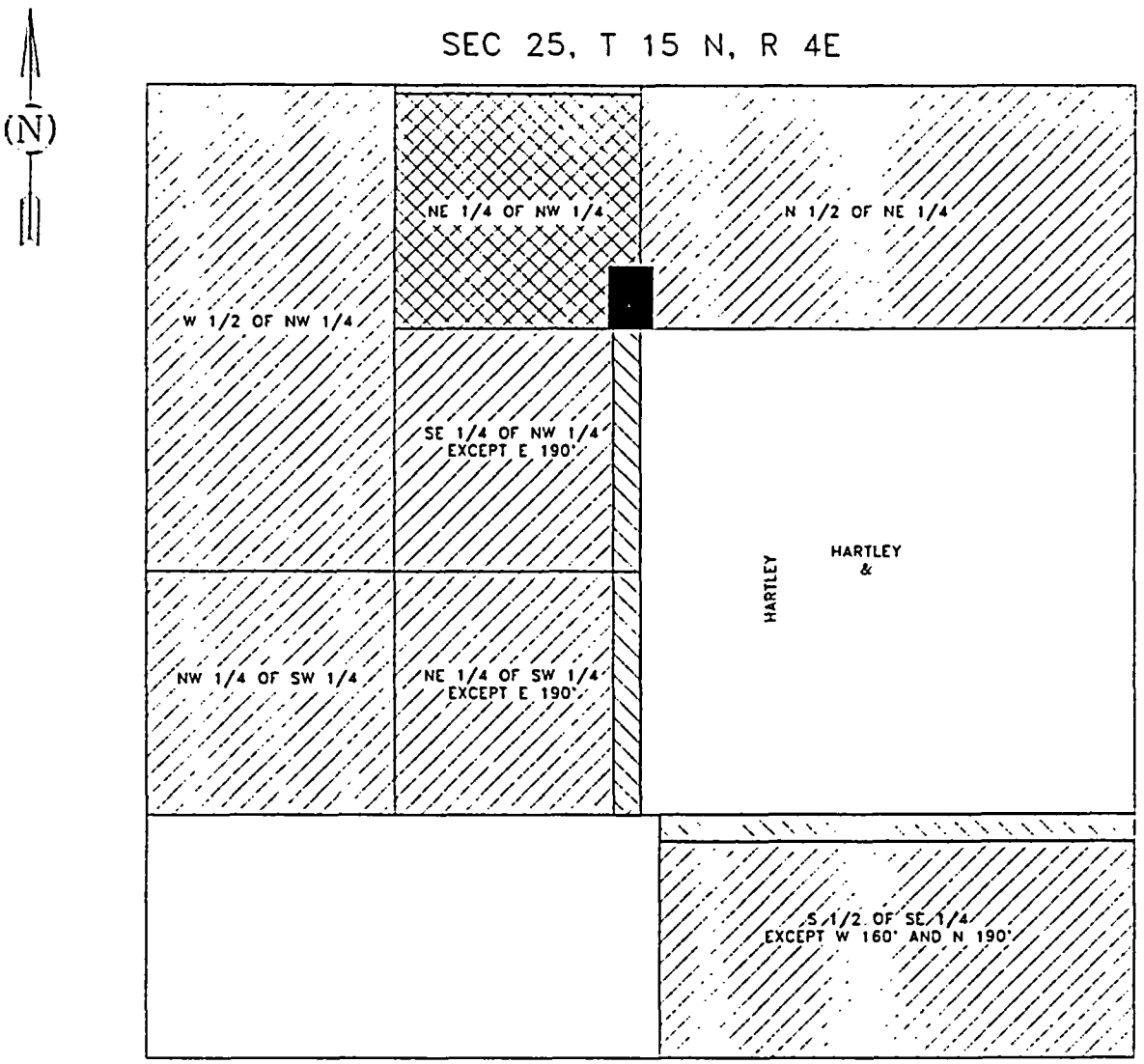


FIGURE 4-1
LAND EXCHANGE
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates

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Marsh SGA and to provide the State of Michigan consideration for its damages caused by H&H Landfill operational trespass.

The information contained in Figure 4-1 is not intended to provide a legal description or presentation of the land exchange. The intent is only to convey a schematic approximation of the land exchange for the purpose of developing Site history. Additional details of the land exchange are described in People Of The State Of Michigan (plaintiff) VS Hartley & Hartley, Inc. (defendant) (Doc.55).

4.3 CURRENT LAND USE

The current land use for the Site is industrial only because industrial wastes are located at the Site. The Site currently is not used for residential, commercial, or recreational purposes. The waste management activity associated with the chemical and radioactive materials previously placed in the landfill. is the only reason for humans to visit the Site. The Site includes a leachate treatment building and subsurface leachate collection system. The leachate collection and treatment system has not been operated (see 5.2 - Site-Specific Environmental Setting). Based on field observations and the geographic distribution of the local population, adult and adolescent trespass does not appear to be a concern. The Site currently has a 10 foot high cyclone fence around the perimeter and vehicle access is restricted to the south entrance. The south entrance to the Site is contained within the northwest portion of the SCA Landfill which is also secured with a cyclone fence. Vehicle access to the Site, with the exception of traversing the surrounding marsh, can only be obtained by driving through the SCA Landfill (see Figure 1-3). The cyclone fence is in good condition and provides adequate security for the Site.

Small and large game hunting do not occur on the Site. Although the Site is located in the Tobico Marsh SGA, it does not sustain a diverse wildlife habitat. The cap is covered only with grasses which support a turtle, frog, and small-rodent population. Although larger mammals (beaver and deer) have been observed adjacent to the Site, it appears the fence and poor habitat diversity make the Site less desirable for wildlife relative to the surrounding marsh. This characterization is solely based on incidental observations during site visits and is not part of an ecological study.

4.4 ADJACENT LAND USE

The adjacent land use for the Site is recreational-gaming, with the exception of the area occupied by the SCA landfill (Figure 1-3). Current land use for the SCA Landfill is the same as the Tobico Marsh SGA site. There are no adjacent residential or commercial land uses at the Tobico Marsh SGA site. The closest residential dwelling to the Site are approximately 2,800 feet to the west, on Jose Road and 3,700 feet to the south, on Two Mile Road (see Figure 1-2 and 1-3). The remaining land uses surrounding the site are typical of a game area. Small and large game hunting, and fishing, have been incidentally observed during Site visits.

5. REGIONAL AND SITE-SPECIFIC ENVIRONMENTAL SETTINGS

This portion of the HSA presents the regional and site-specific environmental settings. This information is used to support an evaluation of the potential isotopic transport pathways for the Site. The site-specific environmental setting focuses on the engineered remedial devices (i.e., cap, slurry wall, treatment system) which have been constructed at the Site to manage non-radiological (chemical) environmental concerns.

5.1 REGIONAL ENVIRONMENTAL SETTING

The Site is located approximately 4,000 feet north of Beaver Road in the Tobico Marsh SGA near Kawkawlin, Michigan. The Site is centered at approximately 43 41' 23" N latitude and 83 56' 30" W longitude (Figure 1-2). A more detailed description of the Site location is provided in Section 1.2 - Property Identification. The topography in the vicinity of the Site is typical of lake plains, i.e., flat with a relief over the Site area of less than 5 feet, except where anthropogenic features (i.e., landfills and excavations) exist. The elevation of the Site is approximately 590 feet above sea level and 5 to 10 feet above the surface of Lake Huron (USGS, 1967).

5.1.1 *Meteorology*

Total average annual precipitation for the area is 27.9 inches. The average annual snowfall is 39.6 inches. In the winter, the average daily temperature is 24.9 degrees F, and the average daily minimum temperature is 17.9 degrees F. In the summer, the average daily temperature is 69.8 degrees F, and the average daily maximum temperature is 80.4 degrees F. The prevailing wind is from the southwest. Average wind speed is highest in March at 12 miles per hour from the southwest (USDA, 1980).

Meteorological observations at the Site support lake effect conditions typical of land bordering the Great Lakes. As low pressure weather systems approach the Site from the west, the wind blows out of the east with increasing intensity until the low pressure system passes over the Site. Moisture-laden air is drawn inland from Lake Huron as the low pressure system approaches the Site. Depending on the season, the moisture in the air is deposited at the Site as snow or rain. Local wind directions can be dramatically varied over a short period of time due to lake effect conditions. The Site is also susceptible to mid-summer on- and offshore breezes due to the faster warming and cooling of land masses relative to Lake Huron.

5.1.2 Stratigraphy

Bay County is located in the Michigan basin which consists of stratified sedimentary rocks. Bedrock underlying the Site is the Verne Limestone, a member of the Saginaw Formation (Pennsylvanian Period). This formation is overlain by 50 to 100 feet of glacial lake and till deposits which were formed by the recession of continental glaciers during the Wisconsin glaciation. These deposits represent a series of retreats and advancements of the ice sheets which formed the alternating layers of glacial lake deposits and till (Dorr and Eschman, 1970).

A thin layer (0 to 10 feet) of beach sand was laid down over the glacial till during the recession of Lake Nipissing, a postglacial lake formed after the last advance of the Wisconsinan glacial period. Temporary pauses in the recession of Lake Nipissing formed parallel beach ridges or strandlines which can be seen to the North-East of the site. Peat deposits are encountered in the poorly drained areas between these ridges. These peat deposits are quite thin (less than 4 feet).

5.1.3 Geology

Approximately 50 to 100 feet of glacial deposits underlie the Site. These consist of glacial till with occasional interbedded layers of glaciolacustrine sediments. This till is overlain by beach sands and peat deposits.

The glacial till is composed of clay and silt with some medium to fine grained sand and a trace of gravel. The till is very dense, unstratified, heterogeneous and is reported to have a permeability of $1x\ 10^{-8}$ cm/sec (Doc.116).

The glaciolacustrine deposits consist of silts and clays with little, coarse to fine grained sand, and a trace of gravel. The silts and clays are high in organic material. These deposits are usually less than 1 foot thick and are surrounded with till (Doc.116).

The post-glacial beach sand deposits overlie the till and consist of clean, fine to medium grained quartz sand which has been well sorted by wave action. The thickness of the sand is four to six feet and can be thicker when making up a ridge. Three beach ridges are located northeast of the Site. Thin peat laminations are encountered in the sand deposits. Peat deposits are thicker in natural topographic

depressions and are reported up to 4 feet thick (Doc.707). In undisturbed areas near the site, a black, highly organic soft topsoil has formed.

The underlying till slopes upward to the west. The till layer has been encountered at one foot below ground surface, 600 feet west of the Site. The sand deposits pinch out west of the Site with a layer less than 6 inches thick encountered 600 feet from the Site. These sand deposits were encountered 6 inches below the surface (Doc.707).

5.1.4 Hydrology and Hydrogeology

Swampy wetland conditions and ponded water prevail in the Tobico Marsh SGA area. Artificial surface drainage patterns have been established with areal drainage by the Indian Town Drain approximately 4,500 feet to the south of the site intersecting Beaver Road. The Indian Town Drain discharges approximately 2.75 miles south of the Site into the Kawkawlin River, which eventually discharges 1.5 miles west into Lake Huron. The groundwater is in direct hydraulic connection with surface water, as would be expected in a marshy area. Groundwater flow directions interpreted from static water levels confirm variable flow directions near the Site (Doc.707).

The postglacial beach sand deposits beneath the site serve as an unconfined aquifer. The aquifer has a saturated thickness of up to 8 feet east of the Site and less than one foot west of the Site where the till layer surfaces. In-situ permeability tests performed on the aquifer indicate its hydraulic conductivity is about $1x\ 10^{-3}$ cm/sec (Doc.707). Due to its shallow depth, groundwater movement on the site is directly influenced by the surface water drainage system, whether anthropogenic (man made) or natural. Accordingly, any changes to, or fluctuations in, the surface water drainage system have a corresponding effect on the groundwater system. Groundwater flow directions interpreted from static water levels confirm the variable flow directions near the Site (Doc.707).

With the exception of the overlying sands, the geologic conditions are not conducive to vertical mobility of water between aquifers. The glacial tills underlying the sands are clayey and are an impediment to vertical migration of groundwater and its contents. The transport of radiological, as well as chemical, contaminants vertically in the aquifer is not expected, based on these geologic conditions.

5.2 SITE-SPECIFIC ENVIRONMENTAL SETTING

Site-specific activities over an extended period of time have altered the regional environmental characteristics described above. Several investigations and remedial response actions have been completed at the Tobico Marsh SGA site to address the chemical contamination issue. The chemical characteristics and interim remedies at the site are summarized in the following sections.

5.2.1 Remedial Investigation Results

In 1986, E.C. Jordan completed a Remedial Investigation Final Report (Doc.707) which focused on chemical contamination outside the Tobico Marsh SGA site encapsulation. The chemical investigation included evaluations of air quality, geophysical characteristics, subsurface soil, groundwater, surface water, sediment, groundwater elevation, and aquifer testing data. The environmental and chemical findings that may have an effect on radiological concerns at the site are summarized below. The limited radiological data associated with this field effort is discussed in Section 6.3 - Availabe Radiologic Data.

- A qualitative air monitoring program was conducted during the field activities using an HNU organic vapor detector. Measurements were made in the vicinity of the cap. No levels above background were detected.

- A terrain conductivity survey was completed on a gridded pattern surrounding the cap on the northeast and west sides and extending 200 feet perpendicularly from the cap in those directions (Appendix B, Figure 3). Areas of high conductivity were found on the east and west sides of the cap. A metal detector survey performed around the cap indicated no significant magnetic anomalies.

- Three monitoring wells (MW-5, 6, and 7) were installed in the wetland areas that had high terrain conductivity values, and were screened in the sandy formation (Appendix B, Figures 5 and 6). Two soil borings (SB-1 and SB-2) were also completed outside the slurry wall to a depth of 56 feet below ground surface (Appendix B). Based on the available geologic data, shallow groundwater exists from 0 to 8 feet below ground surface. This groundwater is underlain by more than 50 feet of clay till, which acts as a lower aquitard.

- One round of groundwater samples were collected from the six MDNR wells (MW-2, 3, 4, 5, 6, and 7) located outside the encapsulation. In addition, surface water and sediment samples were collected from the two ponds and the wetlands area located within the study area (Appendix B, Figure 6).

- Five monitoring wells (MW-2, 3, 4, 6, and 7) located within the upper aquifer were tested for in-situ permeability. Tests indicated the hydraulic conductivity of the aquifer is approximately 1×10^{-3} cm/sec.

- The two adjacent ponds collect excess surface water during spring thaw and periods of excess precipitation, and tend to overflow toward the lowest ground elevations. The shallow groundwater flow appears to be to the east-northeast, but conditions are highly dependent upon seasonal precipitation, surface runoff and proximity to area elevated above the level of the marsh.

- The static water level within the encapsulated area was (in 1986) about three feet higher than the surrounding site groundwater levels.

- Acetone and trans-1,2-dichloroethane were the only volatile organic compounds detected at more than one sampling location. Acetone was detected in soil borings at concentrations ranging from 11,000 to 67,000 parts per billion (ppb); trans-1,2-dichloroethane was detected in exploratory groundwater samples at concentrations ranging from 10 to 64 ppb. Di-n-butyl phthalate was the only semi-volatile organic compound found at consistently elevated concentrations. Surface soil concentrations of di-n-butyl phthalate ranged from 3,100 to 34,000 ppb. Chromium was the only inorganic metal found at levels far exceeding expected background levels in these soils. The maximum chromium concentration was 480 parts per million.

5.2.2 Remedial Actions

The primary intent of the remedial actions at the site was to provide containment and treatment for the chemical wastes disposed at the site. However, the past actions also affect the current evaluation of potential radiological pathways. The following is a list of remedial actions that addressed the management of the chemical wastes disposed at the Tobico Marsh SGA site:

- Consolidation of wastes and debris (drums) present at the site;
- Installation of slurry wall and cap around the wastes;
- Installation of leachate recovery wells within the disposal area;
- Installation of a treatment plant on-site to treat recovered leachate; and
- Installation of a force-main to direct treated leachate to the local sanitary sewer system.
- Installation of a fence on the site perimeter;

Figure 5-1 presents the approximate location of these features including the oil pipeline located at the southwest corner of the Site. The remaining portion of this section describes the anthropogenic characteristics of the Site. A site-specific conceptual model will be developed in Section 7 - Development of Site Conceptual Model, by combining the natural regional environmental setting, anthropogenic characteristics and existing radiological data.

Cap and Slurry Wall

In May 1984, the MDNR was contemplating expedited remedial measures for the management of chemical contaminants at the Site. Isolation and encapsulation alternatives, as well as removal and treatment of the chemical wastes were remedies under consideration. Isolation and encapsulation would be achieved through the installation of a slurry wall and clay cap. The MDNR recognized that these alternatives did not address low level radioactive materials. (Doc.178 and 880). However, the uncontrolled release of chemical contaminants to the Tobico Marsh from the Site was unacceptable and the encapsulation alternative was supported by the MDNR (Doc.190).

During the Spring of 1984, Groundwater Technology Inc. (GTI), a contractor for the SCA Landfill owners, completed construction specifications for a slurry wall, cap and monitoring system for the SCA Landfill (Doc.189). Through negotiations between the SCA Landfill owners and MDNR (Doc.173; Doc.178 and 880; and Doc.180), the SCA landfill owners agreed to construct a slurry wall, cap and monitoring system at the Tobico Marsh SGA Site. In June 1984, GTI amended the SCA

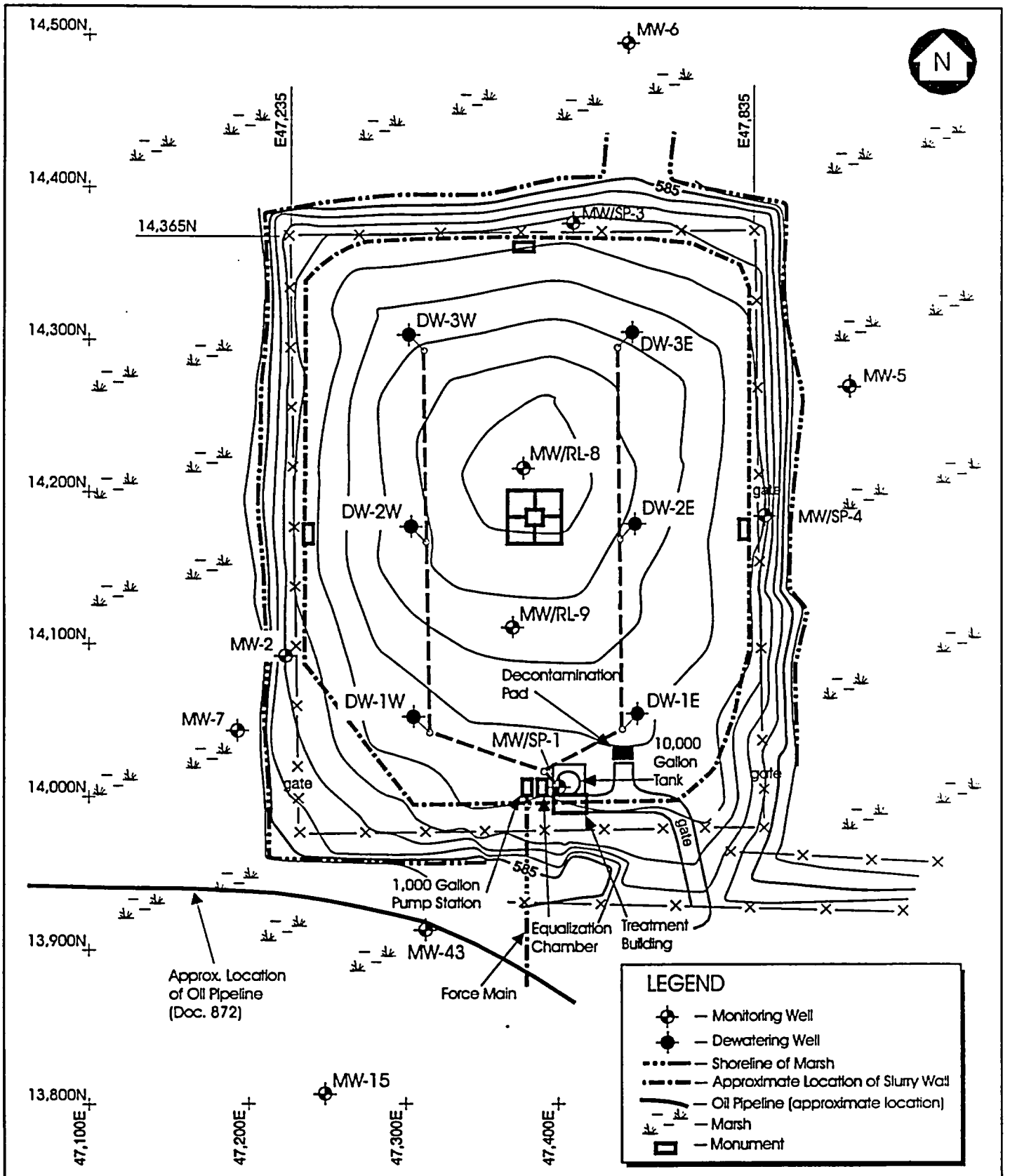

FIGURE 5-1
SITE SPECIFIC RESPONSE ACTIONS
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN
Harding Lawson Associates

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Landfill construction specifications for a slurry wall, cap and monitoring system at the Tobico Marsh SGA Site (Doc.182).

The slurry wall was to key into the underlying clay discussed in Section 5.1 - Regional Environmental Setting. The MDNR suggested in the summer of 1984, that the depth and characteristics of the clay unit at the Tobico Marsh SGA Site be investigated prior to actual slurry wall construction. The MDNR was also concerned about the oil pipeline at the southwest corner of the Site and its impediment to slurry wall construction (Doc.184). On October 30, 1984, eleven investigative borings were drilled along the proposed perimeter trench line of the slurry wall. Results of these borings indicated that the upper surface of the glacial till was consistently at 9-11 feet below ground surface.

Trench excavation for the slurry wall began on the east side of the Site on November 3, 1984. The slurry wall construction progressed in a counter-clockwise direction for six consecutive days, ending on November 8, 1984. The western portion of the slurry wall was relocated 20 feet to the east, because heavy equipment was sinking into the marsh on the west side of the landfill. The primary pieces of heavy equipment used to construct the slurry wall were a hydraulic backhoe and front-end loader. The slurry wall alignment was also adjusted on the southwest corner to parallel the oil pipeline which passes through this area (see Figures 1-3 and 5-1). The relocated trench contained the areas that exhibited high magnetometer readings. Under guidance by the SCA Landfill owners, a clay cap was also placed using a bulldozer and sheepsfoot compactor. Inspection of the clay cap was performed by GTI on December 6, 1984. The SCA Landfill slurry wall construction was previously completed on July 23 through August 3, 1984. Testing of the Site in-situ slurry wall materials indicated a permeability of less than $1x10^{-7}$ cm/sec. The closure certification submitted by GTI on February 16, 1985 (Doc.726) reported conformance with the March 30, 1984 (as amended) construction specifications developed by GTI. GTI's conclusion of specification conformance was based on review of the testing results, and on-site inspections during slurry wall and cap construction (Doc.726). Detailed information regarding slurry wall and cap construction is contained in the GTI closure certification.

Leachate Collection System

The Leachate Collection Treatment System (LCTS) was installed in 1993, based on design specifications developed by the MDNR. The LCTS has not been operated to date and remains inactive.

The leachate collection system consists of six large (approximately 16-inch diameter) collection wells. Each of the six wells is equipped with a pneumatic (compressed air-driven) pump. The wells have 5-foot long screens, to collect leachate from inside the slurry wall, beneath the clay cap. The collection wells are configured in two approximately parallel lines of three wells; one set of wells on the east side of the Site and the second set of wells on the west side (Figure 5-1). The wells in each set are connected by a 2-inch diameter pipe which has a 6-inch outer, secondary containment, pipe. The east and west pipelines are designed to join and discharge to an underground oil/water separator. The oil/water separator is designed to discharge by gravity to the first compartment of an underground two-compartment equalization tank. As designed, the separated water would be pumped pneumatically from the equalization tank through a particle filter (1 micron) located within a treatment building on the southern portion of the Site (Doc.916).

The pretreated leachate would then be processed with an air-stripper located in the treatment building. The contaminant-laden air from the stripper would be treated by two large granular activated carbon units prior to discharge to the atmosphere. The stripped water would be discharged to the second compartment of the two-compartment equalization tank. The second compartment, is designed to gravity discharge to a pump station. The effluent would then be pumped to a 2-inch force-main connected to a sanitary sewer system serviced by the local Public Owned and Operated Treatment Works (POTW). The hydraulic discharge would be metered at a manhole prior to entry to the sanitary sewer collection system (Doc.916). The LCTS (if operated) would discharge to the West Bay County Department of Water and Sewer (local POTW) through the force-main.

A final design evaluation of the as-built LCTS was published in June 1997 (Doc.916). The evaluation offered design changes to the system and also concluded that the design of the LCTS did not address radiological concerns. The design evaluation reported that there is insufficient information to completely address radiological issues associated with the operation of the LCTS. The design evaluation recommended additional radiological characterization of the Site leachate prior to treatment by the LCTS (Doc.916). Historical analytical data on the leachate focused on chemical characteristics. Available data from monitoring wells within the slurry wall indicate elevated levels of volatile aromatics, volatile chlorinated compounds and metals (Doc.916 and Doc.661).

The Woodward-Clyde design evaluation included a list of parameters which were recommended to support the radiological characterization of a potential LCTS discharge. Limited radiological data was available at the time of the design evaluation. Available groundwater data within the encapsulated area of the Site (see Section 6) were from a 1991 sampling and did not include results for isotopic uranium, thorium and radium. These elements and their daughters, are important when evaluating the radiological character of the Site. The design evaluation indicated that the concentration limits listed below may be applicable to the LCTS discharge. These concentrations were taken from 10 CFR 20.2003 for the monthly average concentration of materials readily soluble in water for release into Sanitary Sewers:

- Uranium-238 3.0×10^{-6} uCi/ml
- Thorium-232 3.0×10^{-7} uCi/ml
- Thorium-230 1.0×10^{-6} uCi/ml
- Radium-226 6.0×10^{-7} uCi/ml

The MDNR is currently evaluating the radiological character of the landfill leachate by analyzing samples from recovery wells and monitoring wells completed inside the landfill. This leachate characterization will provide needed radiological data in the event that the LCTS is modified for operation.

5.3 POTENTIAL AFFECTED MEDIA AND PATHWAYS

Soil, is the primary contaminated media at the Tobico Marsh SGA site, based on a review of the HSA-historical and -environmental site information. Other potential, and indirectly, contaminated media from site operations are as follows:

- groundwater;
- surface water;
- sediment;
- LCTS effluent;
- LCTS solid wastes; and
- Air.

The current distribution of radioactive material at the Tobico Marsh SGA site is a function of the transport mechanisms or pathways which exist currently and in the past. Based on the historical information and physical site characteristics, the following potential transport pathways appear to be relevant:

- Inhalation of suspended soil particulates;
- Direct contact with soil, groundwater, sediment and surface water;
- Ingestion of soil (as a result of particulate suspension), groundwater, sediment and surface water;
- Stormwater runoff transport to nearby soil, surface water and sediment; and
- Food chain accumulation (aquatic and terrestrial).

Exposure via several of the potential pathways identified above appears to be unlikely because of the existing remedial measures present at the site (i.e., the clay cap and the slurry wall). More information on the locations and concentrations of radioactive materials at the site will be required to further refine the potential pathways.

Some insight to the potential for human radiation exposure associated with the thorium sludge/slag at the Tobico Marsh SGA site can be gained by evaluating similar material at another site. The characteristics of the sludge/slag at the Dow Chemical plant appears to be similar to the sludge/slag at the Tobico Marsh SGA site. Some of the radioactive sludge/slag at the Dow facility came from the same source as the Tobico Marsh SGA site, Wellman-Dynamics. The Dow sludge pile covered about one acre of land and contained 67,000 pounds or 3.4 Curies of thorium (Doc.582).

In April, 1971 (Doc.582), Dow conducted an evaluation to determine if the sludge/slag material had drifted with the wind or had been leached into the subsurface soils below the Dow dump pile. Samples of soil from around the pile were taken by the MDPH and by Dow. Results showed that "essentially no drifting or blowing of the sludge occurs or has occurred during the time that the sludge has been in the present location." Samples were also taken from the breathing zone of the bulldozer operator who stirred the pile to allow core sampling below the pile. The operator's film badge indicated no exposure and a membrane filter indicated no radiation detectable above the sensitivity of the test. The test sensitivity was not reported. Because the radioactive sludge/slag disposed of at the Tobico Marsh SGA site appears

to be similar to the sludge/slag at the Dow property, it appears that the radioactive material at the Tobico Marsh SGA site is not readily susceptible to becoming suspended particulate .

The Dow sludge pile was located adjacent to a pond and approximately 800 to 900 feet from the Saginaw River. Samples of pond ice and bottom sediments were obtained during the Dow study. Also, soil samples were obtained by coring below the sludge pile. Background samples were obtained from borings 200 feet from the Dow sludge pile. The borings indicated that thick clay deposits existed from 6 to 24 feet bgs. The subsurface geology, specifically the clay layer, is thus similar to the Tobico Marsh SGA site characteristics. The Dow study indicated that the magnesium/thorium sludge did not leach into the ground and contaminate groundwater or subsurface soils. Due to the similarities between the Dow and Tobico Marsh SGA site, similar distribution of the radioactive material may exist at the Tobico Marsh SGA site.

6. IDENTIFICATION OF RADIOLOGICAL ISOTOPES

The primary radioactive material known to be present at the Site is thorium. The source history of the thorium is discussed in Section 4.2 - Thorium Source History and State Ownership. This section presents a summary of information gathered during the HSA that is relevant to the identification of the radiological isotopes known to be, or suspected of being present at the Site.

Section 6.1 describes the naturally occurring radioactivity that may be present on the Site from natural occurrence and from anthropogenic enhancement. Section 6.2 identifies the potential radioactive isotopes that may be present. Section 6.3 presents a summary of available data indicating the presence, quantity and distribution of the radioactivity on the Site.

6.1 NATURALLY OCCURRING RADIOLOGICAL MATERIAL - MICHIGAN REGULATED

Terrestrial materials which make up the earth's crust contain radioactive material. Naturally Occurring Radioactive Material, NORM, is defined by the State of Michigan as any radioactive material that exists in nature and is not man-made. In Michigan, the state regulates NORM. The NRC regulates uranium and thorium and all man made radioactive material. During the HSA, information concerning the potential presence of NORM at the Site was sought. Documented activities that may have resulted in the presence of NORM at the Site are discussed in this section. One such activity, for which the best documentation was available, concerns the disposal of oil brines and brine sludges conducted by Hartley & Hartley during the Site's operational period.

NORM is typically associated with facilities or equipment involved in the production of oil and gas or other minerals. Current Michigan disposal guidelines for sites contaminated with Radium-226 allow any NORM wastes containing Radium-226 at any concentration resulting from oil and gas extractions in Michigan to be disposed of downhole during plugging and abandonment operations. Michigan allows contaminated soil or debris containing Radium-226 concentrations not exceeding 50 picocuries per gram to be accepted in a Type II solid waste landfill. Higher concentrations must be disposed of at a licensed radioactive waste disposal facility.

Twenty percent of the oil wells in Michigan have NORM (Doc.463). Oil production activities involving NORM may include: 1) the receipt and storage of used production equipment, such as tanks, separators,

heat treaters, well casing, piping, and other tubulars; 2) the salvage or recycling of used production equipment and associated operations; and 3) the processing of sludge or other waste materials potentially contaminated by NORM (Doc.749).

One of the oil production activities that produces waste materials potentially contaminated by NORM involves the removal of brine solutions from the geological formation to increase oil production. Radium, in the form of crystalline barium/radium sulfate, is transported to the surface in the oil and brine. Oil is separated from the brine and placed into tanks installed close to the oil wells for interim storage. Sludge that collects in the bottom of these tanks is periodically removed for disposal.

6.1.1 Hartley & Hartley Brine Disposal Operations

Hartley & Hartley applied for a license to transport all types of liquid waste for "incineration, neutralization and chemfix" (Doc.30 and Doc.59). The materials they hauled included brine transported to deep wells for disposal and brine sold to local county road commissions (Doc.119). Hartley & Hartley was approved for hauling oil and gas well production brine containing 50,000 to 300,000 ppm chloride. In 1969 (Doc.863), a Michigan state geologist reported waste seepage onto state land from ponds at the H&H Landfill where oil sludge had been burned. Dead trees were attributed to brine contamination from oil field brine and brine solids collected from Kawkawlin oil fields. Groundwater monitoring wells indicated that lateral diffusion of brine had taken place from the H&H Landfill. It appeared that chloride migration had occurred within the sands above the clay layer underlying the Tobico Marsh area.

Ponding of oil at the landfill was reported in 1971 (Doc.733). Two ponds measuring 100 feet by 200 feet and 300 feet by 200 feet were described. On this occasion they contained oil from an emergency oil recovery operation at American Oil Company that overloaded the storage and incineration capacity of Hartley & Hartley facility. Oil and other liquid industrial wastes were periodically burned in ponds at the landfill. In 1974 (Doc.734) pits were dug at the landfill for disposal of the contents of the oil ponds. Oil sludges that had been absorbed with asbestic fibers were removed from the ponds and placed into the pits for final disposal. These pits were dug down into the clay layer, with a surrounding clay dike. Even though the pits were below the water level of the surrounding marsh, they remained dry because of the low permeability of the clay.

Apparently there were many locations at the H & H landfill where oil field brine and sludge may have been dumped, burned and re-located. It is not known whether the Site contains NORM contaminated brine and sludges from these operations.

6.1.2 Oil Pipeline

A pipeline was installed across the Tobico Marsh State Game Area (see Figure 1-3) to transport oil to refining operations in Bay City. The trace of the pipeline can be clearly seen on the March 1966 aerial photograph. This pipeline passes near the southwest corner of the Site. It is believed that the southwest corner of the Site's slurry was moved inward so that the wall would not be compromised by the presence of the pipeline. A leak occurred in this pipeline in the early 1970's approximately 1,200 feet west of the Site. Response actions conducted by the State of Michigan at the source of the leak consisted of a soil removal action which resulted in the creation of the pond located approximately 1,200 feet west of the site.

6.1.3 Potassium in Site Leachate Samples

Three rounds of sampling from the leachate collection wells at the site were collected in 1996 and 1997 (Section 6.3.13). During first round of sample collection, gross beta measurements indicated the presence of activity in the leachate which could not be accounted for by the isotopic analyses completed. Potassium 40 was suspected to be a contributor to the observed beta activity. Subsequent isotopic measurements (during the second and third rounds of leachate sampling) identified the presence of K-40 in the leachate. No documentation was located concerning the source of the K-40.

6.2 POTENTIAL RADIOACTIVE ISOTOPES

The radioactive isotopes that may be present on the Tobico Marsh SGA Site were identified during the implementation of the HSA DQOs. The available evidence is a combination of verifiable facts and recollections from persons formerly associated with the Site or with H&H Landfill operations. When these facts are shown to verify, or at least be consistent with, personal recollections, the combined matrix of evidence provides a reasonable target list of radioisotopes for the Site. The target list of radioisotopes for the Site is as follows:

- thorium (Th-227, Th-228, Th-230, and Th-232);
- radium (Ra-226 and Ra-228);
- uranium (U-234, U-235, and U-238); and
- potassium (K-40).

Thorium was contained in magnesium-thorium sludge disposed of at the H&H Landfill. Radium is NORM from brine and brine sludge disposed of at the H&H Landfill. Uranium was identified at the site during sampling completed by Oak Ridge Associate Universities (ORAU) (Doc.221 and 690). Potassium is NORM, the source of which is not confirmed.

6.3 AVAILABLE RADIOLOGICAL DATA

A number of radiological investigations have been conducted at the Site over the years by various state and federal agencies and other contract organizations. The methodology, instrumentation and site configuration at the time of each investigation were different. Therefore, direct comparison of investigation results should be considered with caution. However, the conclusions from the investigations, when viewed in total, provide substantial information about the radiological characteristics of the Site. Table 6-1 provides a brief description and summary of the various radiological investigations. Each of the radiological investigations is described in the following subsections.

Table 6-1
Summary Of Previous Radiological Investigations

Section No.	Ref. No.	Date of Survey	Type of Radiological Investigation
6.3.1	(Doc. 140 and 812)	1970's	Sample from Dow Chemical sludge pile.
6.3.2	(Doc. 582)	4/23/71	Dow sludge pile; air, sludge, soil, and water samples. Same material as Site sludge.
6.3.3	(Doc. 140 and 812)	4/20/83	MDNR and USEPA radiological survey of the Site. Sludge Sample.
6.3.4	(Doc. 546)	8/10/83	NRC radiological survey of the Site. Soil samples.
6.3.5	(Doc. 754)	6/1/83	MDPH Soil, background, marsh surface water samples.
6.3.6	(Doc. 754)	7/15/83	MDPH Residential drinking water well samples.
6.3.7	(Doc. 221 and 690)	7/84-6/85	ORAU survey, before and after encapsulation. Field scan, soil and water samples. An extensive survey.
6.3.8	(Doc. 684)	6/85 to 5/91	MDNR and SCA annual monitor well samples.
6.3.9	(Doc. 707)	11/85 to 8/86	MDNR Remedial Investigation Report. Limited radiological measurements outside encapsulated area.
6.3.10	(Doc. 551)	1987	Radium in Michigan drinking water wells.
6.3.11	(Doc. 680)	6/91	Radiological results from Site monitoring wells (within encapsulation).
6.3.12	(Doc. 720)	6/10/94	ABB scan of Site.
6.3.13	(ABB, 1997)	1996 - 1997	Radiological evaluation of leachate from extraction wells. Three rounds of sampling.

6.3.1 Dow Chemical Sludge Sample (1970's)

The MDPH (currently the MDEQ) compared analytical results in a sample of sludge taken in the 1970's from the Dow Chemical sludge pile located in Bay City, Michigan to a 1983 Tobico Marsh SGA Site sample. Analysis for Thorium-232 by GeLi gamma spectroscopy, yielded 1,500 pCi/gm thorium in the Dow 1970 sample. Analyses were also made for magnesium and iron by atomic absorption spectroscopy

for the purpose of establishing a relationship between the Dow 1970 sample and the 1983 Tobico Marsh SGA Site sample. The MDPH appeared to conclude that the 1983 Tobico Marsh SGA Site sample was "... probably from Dow or Wellman-Dynamics operations." The 1983 Tobico Marsh SGA Site sample results are discussed further below (see Section 6.3.3).

6.3.2 Dow Chemical Sludge Pile (April, 1971)

The radiological characteristics of the sludge pile at the Dow plant are pertinent to the Tobico Marsh SGA Site in that the sludge pile appears to consist of the same material that was deposited at the Site (see Section 4.0). Dow performed a radiological evaluation of the pile, including sampling from above, within, around and under the sludge pile. The pile covered approximately one acre and was not sheltered from the outside weather conditions. The thorium radioactivity, measured using gamma spectroscopy, in 41 samples of sludge from within the pile ranged from 1 pCi/gm to 7,000 pCi/gm with an average value of 1,700 pCi/gm. The range for 57 readings taken at two feet above the surface of the sludge pile was 0.5 mR/hr to 8.4 mR/hr with an average of 3.1 mR/hr. These measurements were made using a Victoreen 440 ionization chamber survey meter. At 5 to 15 feet from the sludge pile, no radioactivity above background was measured with the survey meter. Background for this survey was reported at 0.5 mR/hr.

Soil samples were taken by Dow at the ground surface and at one foot below the ground surface around the pile. Six of the 26 samples, had values above background, with the highest at 2.0 pCi/gm. Another five surface soil samples around the pile and one pond sediment sample were collected by MDNR and duplicated by Dow. The results ranged from 1.6 pCi/gm to 5.5 pCi/gm. Seven soil borings were completed under the pile and an additional two soil borings were completed away from the pile. Soil samples were collected from 2 through 24 feet below ground surface. All values were within 1 to 2% of the background count from the average value used for calibration purposes.

6.3.3 Site Survey By MDNR and US EPA (April 20, 1983)

Representatives from the MDNR and the USEPA conducted a survey on a portion of the Site on April 20, 1983. This survey was conducted before the clay cap and slurry wall were constructed at the Site. Measurements were made with a Micro R meter approximately one meter above the ground surface, along a path generally in a north-south direction. Ten areas above 20 µR/hr measuring approximately 15 to 50 feet in diameter, were mapped as a result of the field effort. A schematic presentation of the findings has been excerpted from the subject report and provided in Appendix C. In one area with a high

reading, a drum was uncovered. The drum contained a "gray-ish-white... clumpy to powdery substance." A sample of this material was collected for laboratory analysis. Upon analysis of the material, Thorium (Th)-232 was detected with all daughter materials. The survey results are provided in the following table:

Site Survey By MDNR and US EPA (April 20, 1983)		
Media	**Source**	**Value**
Direct radiation, Background	Gamma exposure	3 to 5 μ R/hr.
Direct Radiation, Sludge covered areas	Gamma Exposure	background to 80 μR/hr.
Sludge sample from buried drum	Th-232 (All daughters present)	670 ± 40 pCi /gm

6.3.4 NRC Inspection of Tobico Marsh SGA and SCA Sites (1983)

At the request of the MDPH, the NRC conducted an inspection from August 9, 1983 to October 29, 1983, to determine if thorium found on the Tobico Marsha SGA Site came from NRC (formerly AEC) licensed activities. As part of that inspection, the NRC conducted direct radiation measurements on both the Tobico Marsha SGA Site and on the adjacent SCA property. The NRC also collected samples of soil and rock. The rock materials were the sludge/slag materials that have been previously discussed. The exact locations of the measurements and sampling could not be discerned, based on the available information. The results of the inspection are provided in the following table:

NRC Radiation Measurements, MDNR and SCA Sites		
Media	**Source**	**Value**
Direct radiation, background	Gamma exposure	5 to 6 μR/hr.
Direct Radiation, sludge covered areas	Gamma Exposure	100 to 600 μR/hr.
Soil	Th-232	52 to 165 pCi/gm
Soil	Th-230	71 to 356 pCi/gm
Soil	Th-228	39 to 120 pCi/gm
Soil	Presence of Pb-212, Pb-214, Tl-208, Bi-214, Ac-228, Cs-137, Bi-212, Pa-234 and K-40	

6.3.5 MDPH Media Samples (June, 1983)

Soil and surface water samples were collected by the MDPH on June 1, 1983. Results from these samples were reported to the NRC Region III on May 23, 1984. These samples were identified as from the Tobico Marsh SGA Site; however, their location could not be discerned based on the available information. The results of the sampling activities are provided in the following table:

Site Soil and Water Samples		
Media	**Source**	**Value**
Soil, Background (5 to 6 feet from the RAM)	Thorium	1.4 to1.9 ± 0.3 pCi/gm
Soil, Radioactive Material (RAM)	Thorium	39 to 124 pCi/gm
Marsh water (surface water)	Th-232	< 7 pCi/l

6.3.6 Residential Well Water Samples (July 1983)

The MDPH report submitted to the NRC (discussed in Section 6.5.5) also included analytical results for seven residential drinking water well samples collected on July 15, 1983. The analytical results are provided in the following table:

Residential Well Water Samples		
Media	**Source**	**Value**
Seven drinking water samples	Th-232	< 7 pCi/l

6.3.7 Oak Ridge Associate Universities Survey (July 1984 and June 1985)

ORAU conducted two surveys of the Tobico Marsh SGA Site. The first survey was in July, 1984 before the encapsulation of the site by the slurry wall and clay cap. The slurry wall and cap were completed in late 1984. ORAU conducted a second survey in June, 1985, subsequent to the site encapulation. Radiological measurements were made for direct radiation levels and for radionuclide concentrations in surface soil, sediment and water samples at the Site. Also, surface soil and water samples were obtained from the Bay City region to provide baseline concentrations of radionuclides for comparative analysis. The ORAU Site scans and sampling used a grid layout to locate the measurement points. The grid was located relative to Site monuments to provide a reproducible study.

The Bay City regional background radiation values obtained by ORAU are provided in the following table:

ORAU Background Radiation Measurements, Bay City Region		
Media	**Source**	**Value**
Direct radiation, surface contact or at 1 meter	Gamma exposure	7 to 9 µR/hr.
	Beta gamma dose	9 to 38 µrad/hr.
Soil	Th-232	0.28 to 0.85 pCi/gm
	Th-228	0.10 to 0.47 pCi/gm
	U-238	<0.74 to 1.41 pCi/gm
	Ra-226	0.37 to 0.80 pCi/gm
Sediment	Th-232	0.57 to 0.96 pCi/gm
	Th-228	0.26 to 0.89 pCi/gm
	U-238	<0.49 to 1.35 pCi/gm
	Ra-226	<0.55 to 0.35 pCi/gm
Surface Water	Gross Alpha	0.21 to 8.02 pCi/l
	Gross Beta	5.77 to 14.8 pCi/l

The following table of radiation measurements presents the data in a "before and after encapsulation" scenario. ORAU measured direct radiation levels at the grid line intersections, both before (see Item A) and after (see Item B) the Site encapsulation. Gamma exposure rates were measured at one meter above the surface and at surface contact. Beta-gamma dose rates were measured at the surface. A walkover survey before encapsulation located areas between the grid lines that had elevated radiation. The locations with elevated levels before encapsulation lay within an area approximately 30 meters, oriented on a north - south line. This distribution is consistent with the statement by Mr. Hartley that the sludge had been placed in a strip down the center of the property to make a road (Doc. 690).

Soil samples were collected at the grid line intersections and at locations with high values of direct radiation before encapsulation (see Item C). The radionuclide concentrations in the majority of the

samples at the grid line intersections were within the range of the baseline background samples (Doc. 690). The higher levels were from the locations with high contact radiation levels identified in the walkover scan. The maximum concentrations of Th-228 and Th-232 were from samples taken at a 25 to 35 cm depth before encapsulation (see Item E). Radionuclide concentrations below this layer dropped to baseline levels.

Before site encapsulation, three sediment samples were collected from the wetland areas and one from the pond located on the north side of the site (see Item F). Surface water samples were collected at each location where a sediment sample was collected (see Item G).

After site encapsulation, the grid was re-established and surface soil samples were collected at randomly selected grid line intersections (see Item D). Also, water samples were collected from four monitoring wells located just outside the site and two surface water samples were collected from surface water bodies located adjacent to the site (see Item H). The following table summarizes the results of the before and after encapsulation" study.

Radiation measurements after encapsulation indicated that the shielding provided by the clay cover caused the surface radiation to drop considerably.

ORAU Radiation Measurements, MDNR Site			
Item	**Media**	**Source**	**Value**
A	Direct Radiation (Before Encapsulation) 1 Meter	Gamma	7 to 110 µR/hr.
	Contact	Gamma	7 to 470 µR/hr.
	Contact	Beta-Gamma	21 to 470 µrad/h.r
B	Direct Radiation (After Encapsulation) 1 Meter	Gamma	6 to 9 µR/hr.
	Contact	Gamma	6 to 9 µR/hr.
	Contact	Beta-Gamma	7 to 31 µrad/hr.
C	Surface Soil (Before Encapsulation)	Th-232	<0.06 to 69.5 pCi/gm
		Th-228	<0.09 to 72.8 pCi/gm
		U-238	<0.11 to 5.7 pCi/gm
		Ra-226	<0.06 to 2.53 pCi/gm

ORAU Radiation Measurements, MDNR Site			
Item	Media	Source	Value
D	Surface Soil (After Encapsulation)	Th-232	<0.31 to 0.78 pCi/gm
		Th-228	0.18 to 0.75 pCi/gm
		U-238	<0.60to<1.09 pCi/gm
		Ra-226	0.30 to 1.04 pCi/gm
E	Soil, 25 to 35 cm depth (Before Encapsulation)	Th-232	561 pCi/gm max
		Th-228	527 pCi/gm max
F	Sediment (Before Encapsulation)	Th-232	<0.12 to 14.6 pCi/gm
		Th-228	0.20 to 15.4 pCi/gm
		U-238, Ra-226	Values not elevated
G	Surface Water (Before Encapsulation)	Gross Alpha	<15 pCi/l
		Gross Beta	30.4 pCi/l max
H	Surface Water & 4 Wells (After Encapsulation)	Gross Alpha	0.46 to <5.29 pCi/l
		Gross Beta	3.46 to 17.3 pCi/l

6.3.8 Annual MonitorWell Samples (June 1985 to May 1991)

A number of monitoring wells have been installed within and around the Tobico Marsha SGA site and in the adjacent SCA landfill area (MW-43) for monitoring potential chemical and radionuclide migration from the landfill sites. The location of the monitoring wells on a portion of the SCA and the Tobico Marsh SGA Site are depicted in Figure 5-1 and Appendix D which is an excerpt from a 1991 NRC report (Doc.684). The following table summarizes the monitoring results for wells located at and near the Site starting in 1985.

Monitoring Well Radionuclide Concentration (pCi/l), MDNR Site								
Well	Date	Gross Activity		Isotopic Thorium			Isotopic Radium	
No.		Alpha	Beta	Th - 232	Th - 228	Th - 230	Ra - 226	Ra - 228
MW - 1	6/85	4.1 ±0.8	14 ± 15					
	11/85	No Sample						
	11/86	3.5 ± 0.9	19 ± 14					
	11/87	1.4 ± 0.6	-15 ± 13					
	11/88	1.3 ± 0.7	90 ± 20					
	11/89	0 ± 5	-30 ± 20					

Monitoring Well Radionuclide Concentration (pCi/l), MDNR Site								
Well	Date	Gross Activity		Isotopic Thorium			Isotopic Radium	
No.		Alpha	Beta	Th - 232	Th - 228	Th - 230	Ra - 226	Ra - 228
MW - 2	6/85	4.3 ± 1.1	12 ± 27					
	11/85	3.4 ± 0.9	17 ± 13					
	11/86	2.9 ± 0.9	21 ± 14					
	11/87	2.9 ± 0.9	10 ± 14					
	11/88	4.6 ± 1.3	-10 ± 15					
	11/89	11 ± 6	0 ± 20	.011± .038	-.05 ± .05	-.06 ± .05	.22 ± .08	2 ± 2
MW - 3	6/85							
	11/85	7.1 ± 1	21 ± 13	.11 ± .04	.13 ± .08	-27 ± .12		
	11/86	3.6 ± 0.9	-7 ± 13					
	11/87	20 ± 4	45 ± 16	.07 ± .03	.18 ± .07	.09 ± .08	.55 ± .09	14 ± 3
	11/88	2.8 ± 1.2	19 ± 16					
	11/89	4 ± 6	11 ± 25					
MW - 4	6/85							
	11/85	15 ± 2	13 ± 13	.12 ± .04	.17 ± .07	-.27 ± .12		
	11/86	9 ± 2	14 ± 14	.05 ± .03	.08 ± .05	.06 ± .06		
	11/87	19 ± 4	14 ± 15	0 ± .03	-.03 ± .06	.16 ± .08	.16 ± .07	
	11/88	11 ± 2	.2 ± 15	-.012± .033	.05 ± .03	-.06 ± .07	.18 ± .06	.8 ± 1.1
	11/89							
MW - 5	6/85							
	11/85							
	11/86	1 ± 6	-20 ± 30	-.07 ± .06	.12 ± .14	-.06 ± .20		
	11/87	2 ± 4	20 ± 30					
	11/88							
	11/89							
MW - 6	6/85							
	11/85							
	11/86	3.3 ± 0.9	8 ± 13					
	11/87	12 ± 2	49 ± 15	.07 ± .03	.05 ± .06	-.06 ± .08	.35 ± .11	
	11/88	2 ± 0.4	1 ± 1.4					
	11/89	4 ± 2	-3 ± 9					
MW - 7	6/85							
	11/85							
	11/86							
	11/87							
	11/88							
	11/89	5 ± 7	-10 ±20					

Monitoring Well Radionuclide Concentration (pCi/l), MDNR Site								
Well	Date	Gross Activity		Isotopic Thorium			Isotopic Radium	
No.		Alpha	Beta	Th - 232	Th - 228	Th - 230	Ra - 226	Ra - 228
MW - 43	6/85							
(Discontd.	11/85	4.2 ± 1.4	14 ± 3					
after 1989.	11/86	2.2 ± 1.1	-7 ± 15					
See	11/87	8 ± 2	45 ± 16	-.01 ± .03	.01 ± .06	-.01 ± .08	1.9 ± .12	2 ± 3
MW - 43A)	11/88	28 ± 4	-1 ± 11.6	.04 ± .04	.27 ± .05	-.14 ± .08	.51 ± .10	-1.5 ± 1.4
	11/89	0 ± 4	13 ± 20					

6.3.9 MDNR Site Evaluation By E.C. Jordan . (November, 1985 to August, 1986)

A Remedial Investigation was conducted on the Tobico Marsha SGA Site for MDNR by ABB (formerly E. C. Jordan Co.) during the period November 1985 to August 1986. The investigation, which was conducted after encapsulation, focused on chemical contaminants in areas outside the encapsulation. The investigation did however, include a radiation field scan that did not detect radiation above background.

6.3.10 Radium In Michigan Well Water (1987)

A radiological study of water from wells in four Michigan counties was conducted by MDNR staff in October 1990. The data used in the study was collected in 1987. The study included Bay County where the Tobico Marsh SGA Site is located. Concentrations of Radium 226 and 228 were measured in the study wells. A total of 108 bedrock-screened wells and 41 glacial drift-screened wells were included in the study. In every county, the average radium concentration in the bedrock wells was 25 to 50 percent higher than the average concentration in the glacial drift-screened wells. In Bay County, the value for the total radium concentration in glacial drift-screened and bedrock-screened wells ranged from 0.4 to 19.6 pCi/l and 1.8 to 108.7 pCi/l, respectively. The mean values in glacial drift-screened and bedrock-screened wells in Bay County were 4.2 and 12.8 pCi/l, respectively. These are the highest mean concentrations of the four counties measured.

6.3.11 Monitoring Well Samples (May 1991)

Monitoring well samples were collected in May 1991, from three wells located inside the encapsulated area of the Tobico Marsh SGA Site. It appears that the Michigan Department of Natural Resources - Environmental Response Division collected the samples presented below. Radiological analyses were

conducted for gross alpha and beta and for gamma emitting isotopes. The gamma emitting isotopes measured were Mn-54, Co-58, Fe-59, Co-60, Cs-134 and Cs-137. These isotopes were at less than the detectable levels. The results for gross alpha and gross beta are provided in the following table.

Site Monitoring Well Measurements After Encapsulation		
Media (Total residue from suspended and dissolved solids in water samples.)	Source	Value (pCi/l)
SP-1 (MW - 1)	Gross Alpha	<1.8
	Gross Beta	7.1 ± 1.6
RL - 8 (MW - 8)	Gross Alpha	<3.6
	Gross Beta	100.6 ± 4.3
RL - 9 (MW - 9)	Gross Alpha	3.8 ± 2.8
	Gross Beta	70.7 ± 3.6

6.3.12 Site Field Scan By ABB (June 1994)

A radiological survey of the Site (after encapsulation) was made to obtain direct radiation measurements at the surface and at one meter above the surface. Locations measured were at the intersections of a grid with ten meter intervals. The survey area measured 100 meters north to south and 80 meters east to west and corresponded to the area measured in the ORAU survey.

Two instruments were used to conduct the survey: a sodium-iodide scintillator; and a Bicron tissue equivalent organic scintillator. The organic scintillator was used to calibrate the sodium-iodide scintillator to yield the direct gamma radiation exposure rate in µrem/hr. The results of the field scan are provided in following table:

ABB Survey Measurements, MDNR Site		
Media	**Source**	**Value**
Direct radiation, Background, Surface	Gamma	4 µrem/hr
Direct radiation, Background, 3 Feet Level	Gamma	4 µrem/hr
Direct radiation, Surface (Includes Bkgnd)	Gamma	7.0 to 13.0 µrem/hr
Direct radiation, 3 Feet Level (Includes Bkgnd)	Gamma	6.0 to 12.0 µrem/hr

6.3.13 Leachate Samples (ABB, 1997)

Three rounds of leachate samples were collected from wells located at the Site (ABB, 1997). The purpose of the sample collection was to evaluate the potential presence of radioactivity in the leachate within the Site's containment cell. Round I samples were collected in August, 1996; Round II samples in November, 1996; and Round III samples in April, 1997. Wells sampled (see Figure 5-1) included the six extraction wells (DW-1W, DW-2W, DW-3W, DW-1E, DW-2E, and DW-3E), and three wells inside the cell, but not attached to the LCTS (MW/RL-8, MW/RL-9, and MW/SP-1). One well located outside of the cell to the north (MW-6) was sampled during Rounds II and III as a reference. Analyses of soluble and insoluble radioactivity were completed for all samples. The following tables summarize the results of the sampling.

Soluble Radioactivity Analyses in Site Leachate Samples
Summary of Highest Concentration and Applicable Limits (in pCi/liter)

		NRC (License App.) Discharge Limit[1]		State of Michigan Discharge Limit[2]	
Radionuclide	Highest Measured Concentration	Surface Water	Sanitary Sewers	Surface Water	Sanitary Sewers
U-234	1.9	300	3,000	30,000	900,000
U-235	0.045	300	3,000	30,000	800,000
U-238	1.6	300	3,000	40,000	1,000,000
Th-227	4.2	2,000	200	20,000	500,000
Th-228	3.6	200	2,000	7,000	200,000
Th-230	1.1	100	1,000	2,000	50,000
Th-232	1.8	30	300	2,000	50,000
Th-234	<MDA[3]	5,000	50,000	20,000	500,000
Ra-226	6.34	60	600	30	400
Ra-228	10	60	600	30	800
K-40	193	4,000	40,000	3,000	90,000

(1) Limits as defined in U.S. Code of Federal Regulations, Title 10, Part 20.
(2) Limits as defined in Rules 261 through 270 of the current Michigan Ionizing Radiation Rules
(3) Radioactive material above the analytical MDA was not identified.

Insoluble Radioactivity in Site Leachate Samples
Summary of Highest Measured Concentration and Applicable Limits (in pCi/liter)

		NRC (License App.) Discharge Limit[1]		State of Michigan Discharge Limit[2]	
Radionuclide	Highest Measured Concentration	Surface Water	Sanitary Sewers[3]	Surface Water	Sanitary Sewers
U-234	1.2	300	0	30,000	900,000
U-235	<MDA[4]	300	0	30,000	800,000
U-238	0.62	300	0	40,000	1,000,000
Th-227	<MDA	2,000	0	20,000	500,000
Th-228	2.1	200	0	10,000	400,000
Th-230	1.7	100	0	30,000	900,000
Th-232	0.72	30	0	40,000	1,000,000
Th-234	<MDA	5,000	0	20,000	500,000
Ra-226	1.1	60	0	30,000	900,000
Ra-228	10	60	0	30,000	700,000
K-40	<MDA	4,000	0	3,000	90,000

(1) Limits as defined in U.S. Code of Federal Regulations, Title 10, Part 20.
(2) Limits as defined in Rules 261 through 270 of the current Michigan Ionizing Radiation Rules
(3) The NRC does not allow discharges of insoluble radioactive material to sanitary sewers.
(4) Radioactive material above the analytical MDA was not identified.

7. CONCEPTUAL MODEL AND AREA DESIGNATIONS

This section of the HSA briefly summarizes information relevant to the HSA objectives and assimilates this information into a general site conceptual model. The model concisely presents an overall understanding of the Tobico Marsh SGA site and supports the HSA conclusions and the selection of HSA recommendations. The available MARRSIM HSA recommendations were previously established in the DQO discussion. The basic conceptual model is then used to further designate impacted areas, survey units, and classes according to MARSSIM.

7.1 SUMMARY OF SUPPORT INFORMATION

The following presentation summarizes the key findings of the historical data review. The key information for constructing a site conceptual model focuses on site historical disposal activities, remedial response actions and concise presentation of radiological Site data.

7.1.1 Disposal Activities

The Tobico Marsh SGA site consists of a former industrial waste disposal area where an estimated 18,000 barrels of spent solvents, oils, and other liquid wastes were disposed of during the 1960's and early 1970's. Low-level radioactive waste in the form of magnesium-thorium slag was also disposed of at the site, which is located in the marsh.

Based on a review of historical aerial photographs and available documentation, the first activity to take place on the parcel now occupied by the site was the construction of a road in the late 1950s. The road was apparently constructed to excavate sand deposits located immediately north of the site. It is likely that fill material was used during construction of the road to create the road bed. This sand excavation created the pond currently located immediately north of the site's cap.

Following construction of the road in the late 1950s, Hartley & Hartley began dumping wastes along the sides of the road. Detailed information concerning the wastes disposed of on the site have not been located. However, it is known that Hartley & Hartley received and disposed of foundry sands, drummed liquid chemicals, cutting oils, oil-field tank bottoms, oil field brines and that the contents of drums were reportedly emptied on the ground. No records have been located indicating that wastes were buried.

Review of an aerial photograph from 1969 shows the numerous waste piles (the piles are mounds of a gray or white material) and numerous drums on the ground at the site. The locations of the road through the site, the pond north of the site, waste piles, and drums have been transferred from the 1969 aerial photograph on to Figure 7-1.

Current site features (the edge of the clay cap, the slurry wall, and the perimeter fence) are also shown on Figure 7-1 for reference.

In the early 1970's, Hartley & Hartley placed a sand cover over a significant portion of the site. This sand cover, shown on Figure 7-2, covered the areas where drums and waste piles where observed in the 1969 aerial photograph. The sand cover was seeded and vegetation developed on the cover. The source of the sand used for covering the site has not been identified.

Limited disposal activities continued on the site after the placement of the sand cover, until at least 1974 when the property was acquired by the State of Michigan. Although no information has been located regarding the nature and quantity of material dumped at the site following placement of the sand cover in the 1970's, review of aerial photographs from 1983 (prior to placement of the site's clay cap) indicates the presence of several white and gray piles on the sand cover along the trace of the former road through the center of the site. The location of these piles have been transferred from the 1983 aerial photographs on to Figure 7-2. Additionally, gray material (similar in appearance to that observed in the piles) appears to have been used as road bed material. The trace of this "gray road" is also shown on Figure 7-2.

The appearance of the site depicted on Figure 7-2 is believed to represent the site as it appeared during the 1984 ORAU survey (Section 6.3.7) completed prior to the encapsulation.

7.1.2 Remedial Response Actions

In 1983, following a geophysical survey by the State of Michigan (Doc.152) to locate buried metallic materials, the site's clay cap and slurry wall were constructed. The clay cap is reported to be at least 2 feet thick. The slurry wall is reported to be 3 feet wide, keyed into the glaciofluvial sediment, and extended up to the cap (Doc.707).

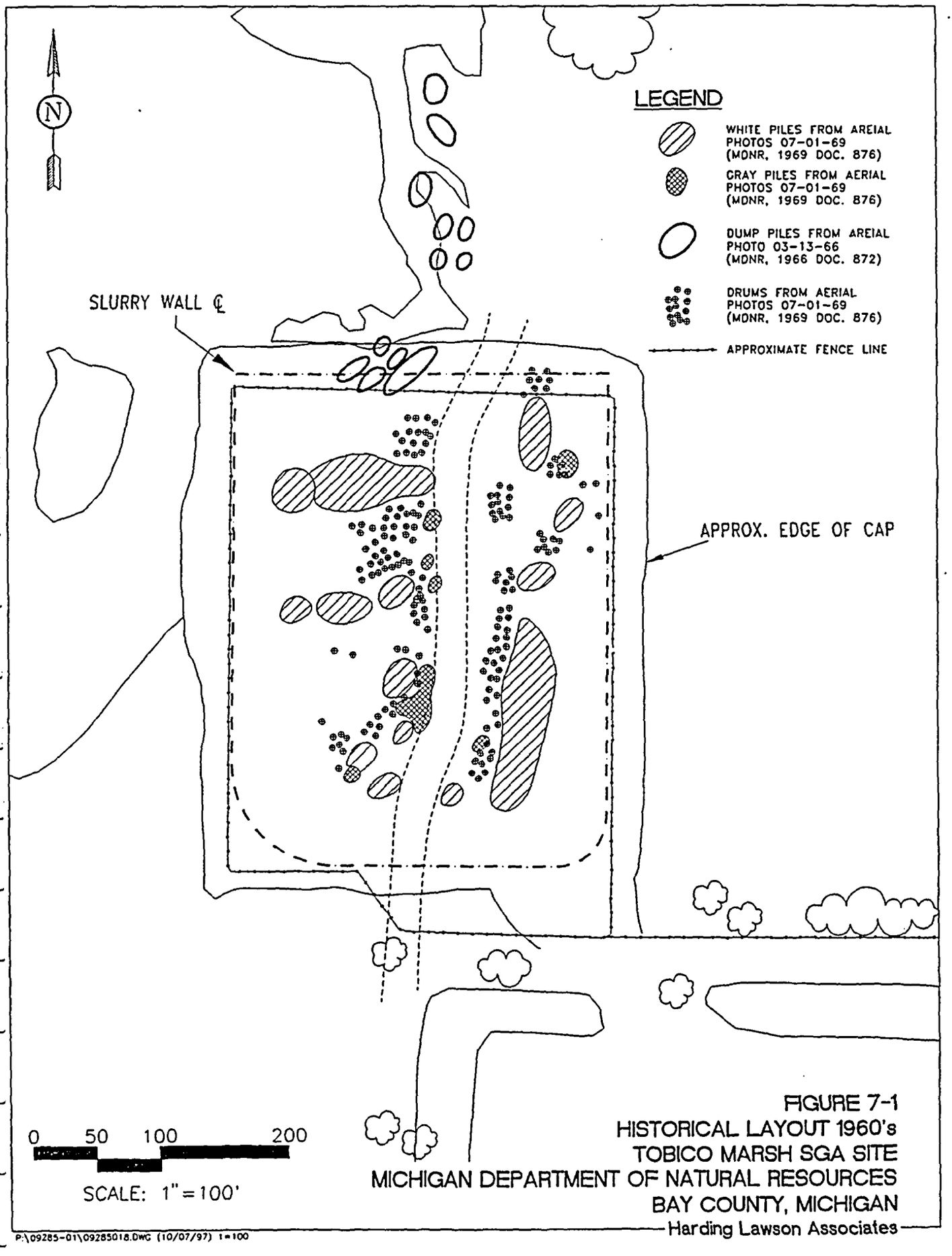

FIGURE 7-1
HISTORICAL LAYOUT 1960's
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates

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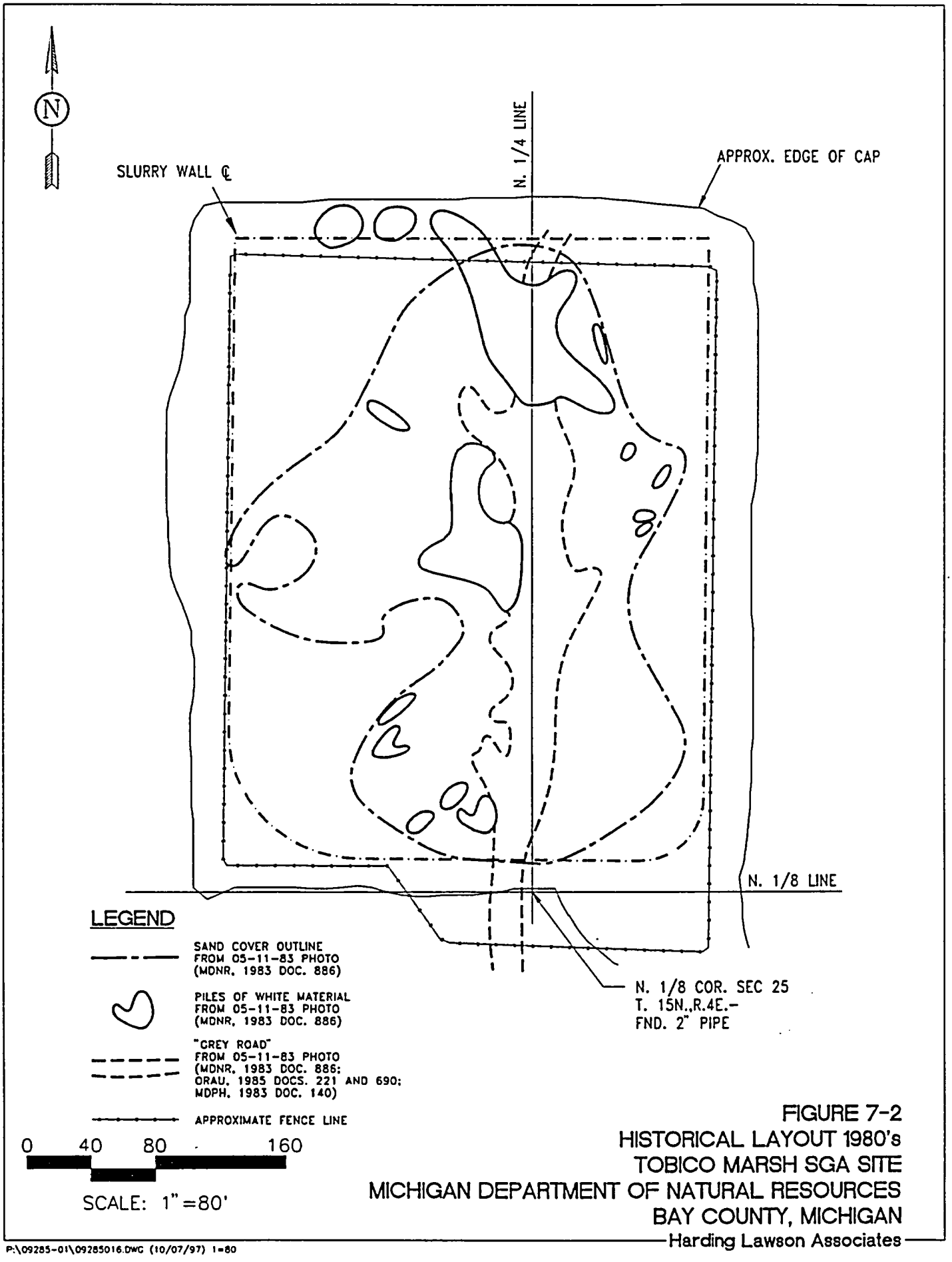

FIGURE 7-2
HISTORICAL LAYOUT 1980's
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN
Harding Lawson Associates

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No documentation has been located regarding how the area for capping was established. It is believed, however, that the 1983 geophysical survey was used to place the cap and slurry wall so that the buried metallic materials would be within the encapsulated area. No documentation was located to indicate that the presence of the magnesium-thorium slag was considered during the determination of the area for encapsulation. Review of data gathered during the HSA (and depicted on Figures 7-1 and 7-2) regarding the extent of disposal activities, and the known locations of the cap and slurry wall strongly suggest that the area chosen for encapsulation covers the area where disposal activities were known to occur.

A follow-up radiological survey was completed by the NRC following placement of the cap and slurry wall. This survey indicated that radiation levels on top of the cap were similar to background (see Section 6.3.7).

In 1993, the leachate collection and treatment system (LCTS) was constructed by GZA Remediation Services under contract to the MDNR (currently the MDEQ) following the observation that leachate levels within the capped, slurry-walled portion of the site were higher than the ambient water level in the marsh. The LCTS consists of six extraction wells, a piping system leading from the wells to the treatment building, and a leachate treatment facility. A force main was also installed to carry treated effluent from the LCTS to the local sanitary sewer system. The LCTS has not been brought on-line and has never been operated.

7.1.3 Radiological Data Layout.

Data from two surveys have been used to summarize the disposition of radioactive material at the Site prior to placement of the cap and slurry wall. Between 1983 and 1985, radiological surveys and radiological sample analyses were completed at the Site by the State of Michigan and the NRC. The results of these surveys and sampling, which indicates the presence of radioactive materials at the site, are discussed in Section 6.3 and are summarized on Figure 7-3.

Figure 7-3 was constructed by transferring data from the 1983 State of Michigan survey (Doc.140 and 812) and the July 1984 ORAU pre-encapsulation survey (Doc.221 and 690) onto a figure showing the known locations of the Site's cap, slurry wall, and perimeter fence. The location of the Site's sand cover has also been placed on the figure for reference. Radiological data presented on the figure was taken directly from the referenced documents.

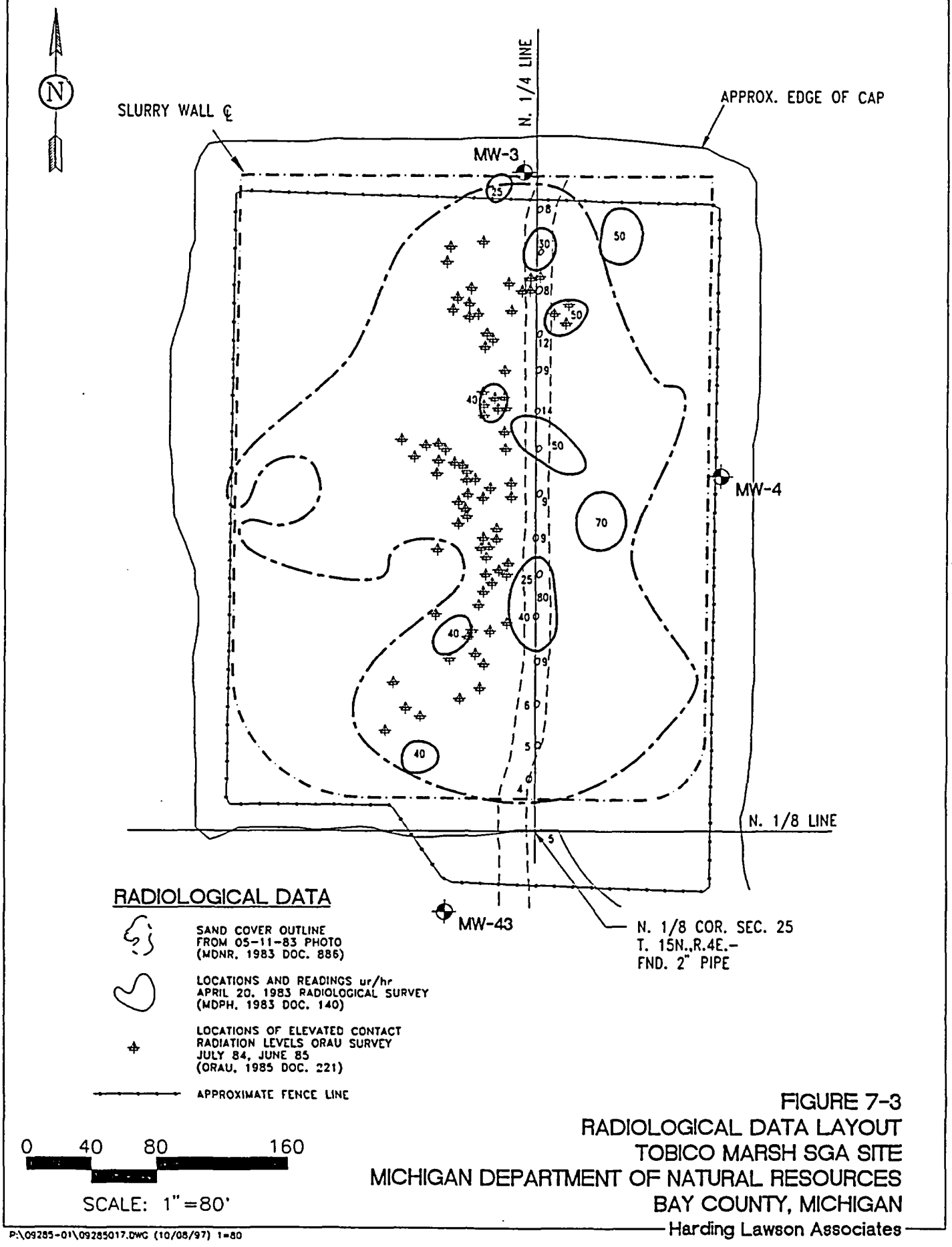

FIGURE 7-3
RADIOLOGICAL DATA LAYOUT
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates

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Based on the development of Figure 7-3, it appears that radiological surveying completed at the site prior to encapsulation occurred within the encapsulated area and that areas where elevated radioactivity was identified prior to encapsulation are within the encapsulated area. No data were located to indicate the extent to which the distribution of radioactive materials, as presented on Figure 7-3, was disturbed during construction of the cap.

In 1996 and early 1997, three rounds of leachate/groundwater samples were collected from wells at site (see Figure 5-1). Wells sampled included the six extraction wells (DW-1W, DW-2W, DW-3W, DW-1E, DW-2E and DW-3E) connected to the LCTS, the three monitoring wells (MW/SP-1, MW/RL-8 and MW/RL-9) located within the capped slurry-walled portion of the site (but not connected to the LCTS), and one monitoring well (MW-6) located north of the site (outside of the capped area). This sampling detected trace levels of both soluble and insoluble radioactivity in some wells from within the capped, slurry-walled portion of the site, but in general indicates that the magnesium-thorium slag disposed of at the site is not readily soluble in water (ABB, 1997).

7.2 SITE CONCEPTUAL MODEL

During active waste disposal at the site, radioactive waste in the form of magnesium-thorium slag, was dumped on the ground surface. No data indicating burial of the materials (prior to encapsulation) were located. The initial placement of the magnesium-thorium slag is believed to have occurred primarily on the road through the central portion of the site or in areas immediately adjacent to the road where the surrounding marsh had been filled. Delivery of the slag to the site (in either roll-off bins or drums) would have placed a physical limit to the distance the material could have been placed from the road (as the trucks required for delivery would sink in the marsh). This model premise is supported by the reports of heavy equipment sinking in the swap during slurry wall construction.

After the materials were placed on the ground, it is likely that any further migration or re-distribution of the materials would have been limited to physical agents. The magnesium-thorium slag is not readily soluble in water and, therefore, the potential for the materials to dissolve in water and spread with the migration of water is very low (USGS, 1989). Physical transport of the materials after they were placed on the ground, however, may have occurred via runoff and subsequent disposal operations.

Physical transport via runoff (rain water or snow melt flowing over the ground surface carrying entrained solid material) may have moved the material from its initial location to the lateral margin of the disposal area. At the disposal area margin, the potential for the runoff to move entrained solid material would be significantly diminished, resulting in the deposition of any entrained material at the interface of the disposal area and the marsh. Disposal operations at the Site (including truck traffic, bull dozing, etc.) subsequent to the placement of the radioactive material on the ground surface may have re-distributed some of the material. The extent to which this re-distribution would have occurred is limited by the presence of the marsh (it is believed that heavy equipment did not travel routinely from the fill areas out on to the marshy areas).

Disposal operations at the Site, may have also generated limited amounts of dust which would have moved in the prevailing wind direction away from the initial disposal area. Generation of dust from the Site is believed to be limited because truck traffic did not routinely pass through the disposal area. The configuration of the Site, as noted in several photographs, indicate that trucks came into the site, off-loaded whatever they were carrying, turned around and left. This out-and-back traffic pattern used the dirt access road on the south side of the Site. This two-track road would not have supported relatively high speed (greater than 15 miles/hr.) truck traffic. Therefore, the generation of dust in copious amounts typically associated with a multi-lane dirt road, is unlikely. Furthermore, the monitoring of heavy equipment operators during the re-working of the Dow Chemical piles in Bay City (see Section 5.3 - Potential Affected Media and Pathways) which contained similar sludge/slag material, did not indicate a dust concern.

It is assumed, therefore, that the radioactive materials brought to the site prior to placement of the sand cover remain essentially in their original spatial distribution, with subsequent re-distribution of the material being limited and primarily the result of physical agents. Re-distribution of the material via physical agents, to the extent that it occurred, would have resulted in the movement of the materials primarily within the disposal area or to the marsh at the edges of the disposal area.

Magnesium-thorium slag may also have been brought to the site in the early 1970s after placement of the sand cover and prior placement of the clay cap. If so, limited physical re-distribution of the material may have occurred via the agents discussed above. This physical re-distribution, if it occurred, would have resulted in the movement of materials from their initial location into the marsh at the edge of the sand

cover. The vegetative cover, which developed on the sand cover, would have limited re-distribution of the materials via runoff.

With the placement of the clay cap and the slurry wall in the mid 1980s, it is assumed that magnesium-thorium slag became encapsulated in a cell bounded by the glaciofluvial sediments on the bottom, the slurry wall on the sides, and the cap on the top. This encapsulation effectively ended any further physical transport of the radioactive materials.

7.3 IMPACTED AND NON-IMPACTED AREAS

The above conceptual model has been used to designate portions of the Tobico Marsh SGA site. The broadest designation is impacted versus non-impacted (see Figure 7-4), Areas with some potential for radiological residual contamination are identified as "impacted areas." Areas that have no reasonable potential for residual contamination are designated "non-impacted." (NRC 1997). In accordance with MARSSIM, the impacted areas are further defined using survey units and the MARSSIM classification scheme.

7.3.1 Impacted Areas

In accordance with MARSSIM (NRC, 1997), a graded approach has been employed to further divide the impacted areas into survey units. The graded approach places greater survey emphasis on areas that have the highest potential for radiological contamination. A survey unit is a physical area consisting of a specific size and shape for which a separate decision will be made regarding the radiological release of the land. The release decision will be made by comparing the future final status survey results to the site release criteria.

The conceptual model supports the division of the Site into two survey units: Survey Unit 1, the area inside the slurry wall; and Survey Unit 2, a 20 meter band outside the slurry wall (see Figure 7-4). The size and shape of the survey units at the Site were based on the following factors:

- potential for radiological contamination;
- expected distribution of contamination;

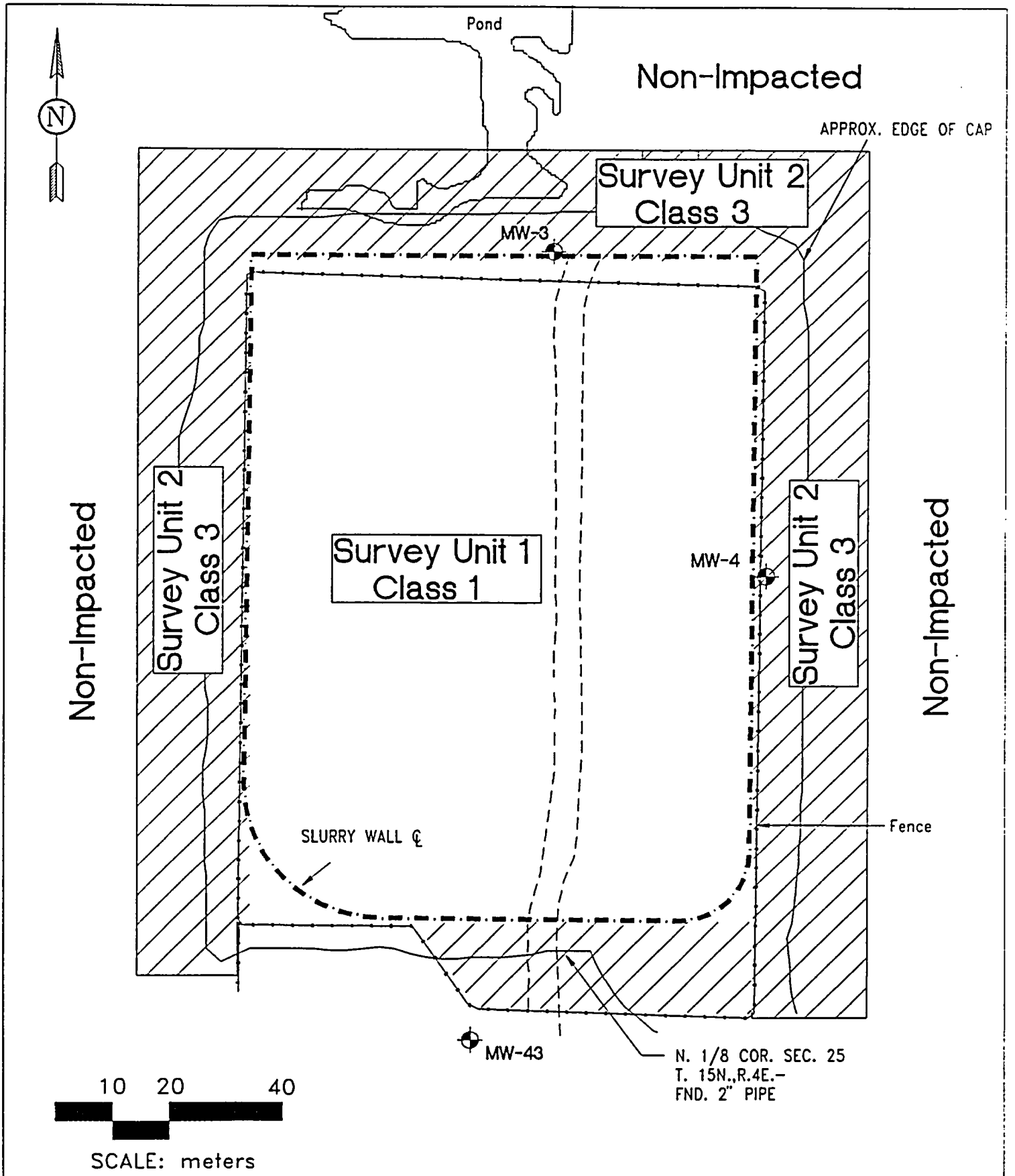

FIGURE 7-4
SURVEY UNITS 1 AND 2
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates

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- regional and site-specific environmental characteristics; and
- engineered remedial controls (encapsulation and LCTS).

Subsequent radiological scoping and characterization activities will be concentrated in Survey Unit 1. Survey Unit 2 addresses the proximal areas that may not be radiologically impacted but do not initially qualify as "non-impacted" areas in accordance with MARSSIM.

The initial operating assumption required by MARSSIM is that all impacted areas being evaluated for release have a potential for radioactive contamination above acceptable release criteria (NRC, 1997). This initial assumption means that all areas at the Site would be classified as Class 1 areas, unless some basis for re-classification exists. The conceptual model, which considers the information collected during this HSA, supports re-classification of a portion of the site. The Site survey units are classified in accordance with MARSSIM as follows:

- Survey Unit 1 - Class 1 area; and
- Survey Unit 2 - Class 3.

A Class 1 area is an area that has, or had, prior to remediation, a potential for radioactive contamination or known contamination. The evaluation is based on known operating history or radiological survey results. MARSSIM specifically identifies former burial or disposal sites as example of a Class 1 area (NRC, 1997). The portion of the Site within the slurry wall matches the above Class 1 description.

A Class 2 area is an area that has or had, prior to remediation, a potential for radioactive contamination or known contamination, but is not expected to exceed release criteria (NRC, 1997). The conceptual model does not support a Class 2 designation for Survey Unit 2. Substantial contamination in Survey Unit 2 is unlikely based on Site encapsulation and limitations on how far the radioactive material could be deposited from the road without sinking in the swamp.

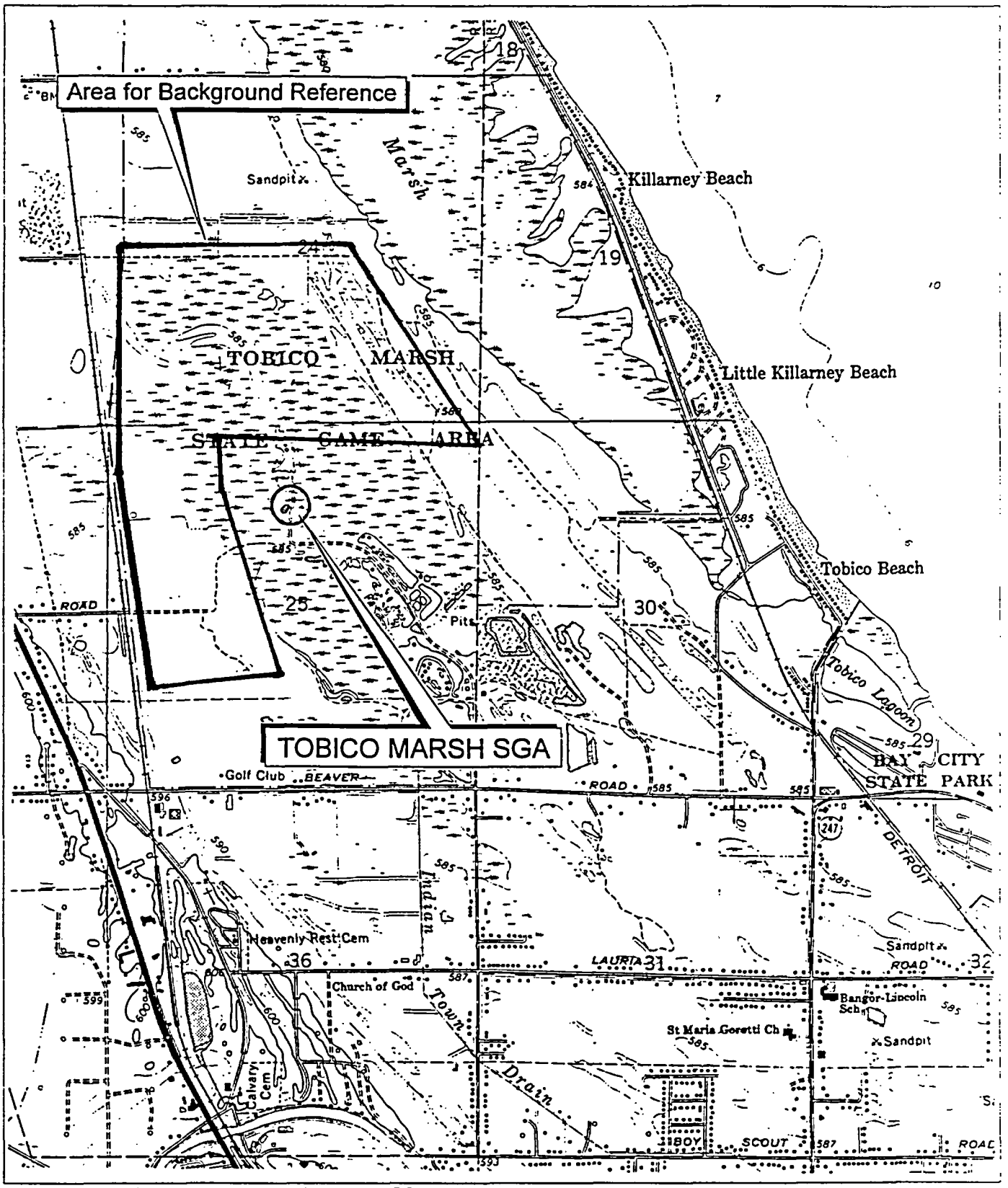
A Class 3 area is impacted, but not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the release criteria. This classification is based on operating history and previous radiological surveys. These areas have a very low potential for residual contamination but insufficient information to justify a "non-impacted" classification.

MARSSIM specifically identifies the buffer zone around a Class 1 or 2 area as an example of a Class 3 area (NRC, 1997). The portion of the Site occupying a 20 meter band outside the slurry wall has been selected as this Class 3 buffer zone.

7.3.2 Non-Impacted Areas and Background Reference

Areas that have no reasonable potential for radiological contamination are identified as "non-impacted areas" (NRC, 1997). These areas do not require any level of survey coverage associated with characterizing contamination from site operations. The non-impacted areas are acceptable locations for background reference sampling. Based on the information presented herein, all areas outside Survey Unit 2 (Class 3), except the SCA site, should be considered non-impacted with respect to Tobico SGA site operations.

A suitable nearby non-impacted area is proposed as a background reference area for the site (Figure 7-5). This background reference area is similar to the site with respect to its physical characteristics (soils, geology, and hydrogeology), and its biological community. This similarity has been demonstrated earlier in this report (see Section 5.1 - Regional Environmental Setting). Additionally, review of the historical photographs indicates that operations conducted at the Hartley & Hartley Landfill did not extend or affect the background reference area. The radioactivity present in the background reference area is expected to be the same as Survey Units 1 and 2, prior to the on-set of operations at the site by Hartley & Hartley.



Taken from the Kawkawlin, Michigan 7.5 Series U.S.G.S. Topographic Quadrangle Map

QUADRANGLE LOCATION

FIGURE 7-5
BACKGROUND REFERENCE AREA
TOBICO MARSH SGA SITE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
BAY COUNTY, MICHIGAN

Harding Lawson Associates

8. CONCLUSIONS AND RECOMMENDATIONS

The primary objective of the HSA is to evaluate the current status of the site. The following conclusions are based on the fulfillment of the HSA DQOs:

- There are residual radioactive materials present at the Tobico Marsh SGA site and the primary element of radiological concern is Thorium.

- Other radioactive materials that may be present at the site include Uranium, Radium and Potassium;

- An emergency action to reduce the radiological risk to human health and environment is not required;

- The Site is not suitable for unrestricted release when considering residual radioactive materials;

- The encapsulation of the Site has reduced radiation levels at the surface, as demonstrated by the pre- and post-encapsulation study conducted from 1984 to 1985. The encapsulation has also created a physical barrier to the transport of radioactive material off-site. However, the leachate collection and treatment system (when and if operated) would create a potential transport pathway off-site to the sanitary sewer system;

- The Site is divided into Survey Unit 1, a MARSSIM Class 1 area, and Survey Unit 2, a MARSSIM Class 3 area. Survey Unit 1 is the area inside the slurry wall and Survey Unit 2 is a 20 meter band outside the slurry wall. Survey Unit 1 is known to contain radioactive contamination and Survey Unit 2 is not expected to contain any residual radioactivity above background; and

- The area depicted in Figure 7-5 is suitable as a background reference area.

Based on the above HSA conclusions, and in accordance with MARSSIM, the HSA recommendations are as follows:

- The Tobico Marsh SGA site is radiologically impacted and further investigation is required before a decision regarding final resource disposition can be made;

- Subsequent investigations should evaluate the proposed background reference area; and

- Subsequent investigations should consider the potential for co-existing hazardous chemical and radiological isotopes within Survey Unit 1.

9. REFERENCES

ABB Environmental Services of Michigan, Inc., (ABB) 1997. Evaluation of Analytical Results. Groundwater/Leachate Samples, ABB, Farmington Hills Michigan , August 9, 1997.

Dorr, J. A. and Eschman, D. F. 1970. Geology of Michigan. University of Michigan Press, Ann Arbor. Michigan

Nuclear Regulatory Commission (NRC) 1997. Multi-Agency Radiation Survey And Site Investigation Manual - Final (MARSSIM), NUREG-1575 and EPA 402-R-97-016, December 1997.

United States Department of Agriculture (USDA) 1980. Soil Conservation Service. Soil Survey of Bay County, Michigan.

United States Geological Survey (USGS) 1989. Study and Interpretation of the Chemical Characteristics of Natural Water, Third Edition, by Hem, J.D., USGS Water - Supply Paper 2254 pp. 149 -150.

USGS 1967. Kawkawlin Quadrangle, Michigan - Bay County 7.5 Minute Series Topographic Map. United States Geological Survey. Reston, Virginia.

DOCUMENTS IN HSA DATABASE

APPENDIX A
Documents Reviewed for the Development of HSA

ID	DOC TYPE	TITLE	TO	FROM	DATE	REC ORIGIN
1	REPORT	REPORT OF RESISTIVITY AND BORING SURVEY			2/11/65	BAY CITY
2	CORRESPONDENCE	BURNING AT HARTLEY DUMP	JAMES WALDIE	NEAL R. MOORE	7/2/65	LANSING
3	CORRESPONDENCE	BUREAU OF WATER MANAGEMENT AND WATER RESOURCES COMMISSION	JOHN BOHUNSKY	K. E. CHILDS	10/20/69	LANSING
4	CORRESPONDENCE	INSPECTION OF TOBICO GAME AREA	JEROME MASLOWSKI	PAUL R. REARICK	7/10/69	LANSING
5	SITE INFORMATION	HARTLEY & HARTLEY - BANGOR TOWNSHIP DUMP			7/7/69	LANSING
6	CORRESPONDENCE	TRESPASS AND POLLUTION OF TOBICO GAME AREA LAND FROM HARTLEY & HARTLEY COMMERCIAL DUMPING OPERATIONS	RALPH PURDY - BUREAU OF WATER MANAGEMENT	D. W. DOUGLASS, GAME DIVISION	6/18/69	LANSING
7	CORRESPONDENCE	PROPOSED EXCHANGE, TOBICO GAME AREA	LaVerne A. DAVENPORT, HABITAT DEVELOPMENT AND MANAGEMENT	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	6/11/69	LANSING
8	PERMIT		WAYNE HARTLEY	CHARL G. OVIATT, AIR POLLUTION CONTROL SECTION	5/28/69	LANSING
9	CORRESPONDENCE		PHILIP A. HART, UNITED STATES SENATE	RALPH W. PURDY, WATER RESOURCES COMMISSION	10/30/70	LANSING
10	CORRESPONDENCE	TOBICO TRESPASS MEETING	NELS JOHNSON, REGIONAL GAME BIOLOGIST	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	10/30/70	LANSING
11	COURT	STATE OF MICHIGAN IN THE COURT FOR THE COUNTY OF BAY			9/10/70	LANSING
12	CORRESPONDENCE		D. VANFAROWE, DEPARTMENBT OF PUBLIC HEALTH	S. J. SIMMONS, WELMAN DYNAMICS CORPORATION	8/13/70	LANSING
13	CORRESPONDENCE		S. J. SIMMONS, INDUSTRIAL RELATIONS DIRECTOR	JAMES CAMBURN, DIVISION OF OCCUPATIONAL HEALTH	2/2/70	LANSING
14	REPORT	AERIAL SURVEILLANCE OF HARTLEY & HARTLEY AREA, SEC. 25 (KAWKAWLIN TOWNSHIP, (15N-4E) BAY COUNTY	ARLOW BOYCE, PRIVATE LAND HABITAT MANAGEMENT	O. J. BENNETT, ASSISTANT REGIONAL MANAGER	9/2/70	LANSING
15	DATA	HARTLEY & HARTLEY - BANGOR TOWNSHIP DUMP			8/20/70	LANSING
16	CORRESPONDENCE	AERIAL SURVEILLANCE OF HARTLEY & HARTLEY AREA, KAWKAWLIN TOWNSHIP, (15N-4E) BAY COUNTY	C. T. YODER, REGION II MANAGER	W. W. SHAPTON, DEPUTY DIRECTOR, FIELD OPERATIONS	8/10/70	LANSING
17	CORRESPONDENCE	JULY 27 TRIP TO BAY CITY REGARDING HARTLEY & HARTLEY	C. D. HARRIS, DEPUTY DIRECTOR	ARLOW BOYCE, GAME DIVISION	7/30/70	LANSING
18	REPORT	NUMBER OF GALLONS BROUGHT INTO COMPANY, MAY JUNE-JULY 1970			7/1/70	LANSING
19	CORRESPONDENCE		MAURICE S. REIZEN, DIRECTOR, DEPARTMENT OF PUBLIC HEALTH	RALPH A. MacMULLAN, DIRECTOR, MDNR	7/14/70	LANSING
20	CORRESPONDENCE	HARTLEY & HARTLEY INSPECTION	OWEN J. BENNETT, ASSISTANT REGIONAL MANAGER	CRAIG B. SMITH, DISTRICT LAW SUPERVISOR, MDNR	7/7/70	LANSING
21	REPORT	APPLICATION OF HARTLEY & HARTLEY FOR A SOLID WASTE DISPOSAL LICENSE		HEARING EXAMINER, MDNR	7/2/70	LANSING
22	REGULATION	VIOLATIONS OF ACT 87, PUBLIC ACTS OF 1965 BY HARTLEY & HARTLEY INC.		RALPH A. MacMULLAN	6/9/70	LANSING
23	CORRESPONDENCE	HARTLEY & HARTLEY WEEKLY INSPECTION	OWEN BENNETT, REGIONAL LAW SUPERVISOR, MDNR	CRAIG B. SMITH, DISTRICT LAW SUPERVISOR, MDNR	5/19/70	LANSING

APPENDIX A
Documents Reviewed for the Development of HSA

24 CORRESPONDENCE	HARTLEY AND HARTLEY WEEKLY REPORT	KARL K. KIDDER, ASSISTANT REGIONAL MANAGER, MDNR	CRAIG B. SMITH, DISTRICT LAW SUPERVISOR, MDNR	5/8/70	LANSING
25 CORRESPONDENCE	FIELD INSPECTION - HARTLEY & HARTLEY COMMERCIAL DUMP AND BANGOR TOWNSHIP SANITARY LANDFILL, APRIL 8, 1970, BAY CITY	D. W. DOUGLASS - CHIEF, GAME DIVISION	ARLOW BOYCE - PRIVATE LAND HABITAT MANAGEMENT, MDNR	4/13/70	LANSING
26 CORRESPONDENCE	HARTLEY & HARTLEY COMMERCIAL DUMPING - BANGOR TOWNSHIP - SANITARY LANDFILL	KARL KIDDER, ASSISTANT REGIONAL MANAGER, MDNR	CRAIG B. SMITH, DISTRICT LAW SUPERVISOR, MDNR/THOMAS PRAWZIK, DISTRICT GAMA BIOLOGIST	3/12/70	LANSING
27 CORRESPONDENCE	INSPECTION OF HARTLEY & HARTLEY COMMERCIAL DUMPING OPERATIONS AND BANGOR TOWNSHIP SANITARY LANDFILL OPERATIONS ADJOINING THE TOBICO GAME AREA IN BAY CITY	C. TROY YODER, REGIONAL MANAGER, REGION II	W. W. SHAPTON, DEPUTY DIRECTOR - FIELD	2/2/70	LANSING
28 MEETING	HARTLEY & HARTLEY TRESPASS CASE - SECOND MEETING	PC. D. HARRIS - DEPUTY DIRECTOR, RESOURCES MANAGEMENT	ARLOW BOYCE, PRIVATE LAND HABITAT MANAGEMENT, GAME DIVISION	1/16/70	LANSING
29 CORRESPONDENCE	DEMONSTRATIONS BY CHEM-FIX CORP. FIXATION OF LIQUID SLUDGE	J. COSENS, J. BOHUNSKY	T. HICKS	7/28/71	LANSING
30 LICENSE	APPLICATION FOR LICENSE TO REMOVE AND TRANSPORT LIQUID INDUSTRIAL WASTE	HARTLEY & HARTLEY	MDNR	1/6/70	LANSING
31 CORRESPONDENCE	TOBICO AND HARTLEY & HARTLEY	CHARLES HARRIS, DEPUTY DIRECTOR, RESOURCES MANAGEMENT, MDNR	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	10/9/71	LANSING
32 CORRESPONDENCE		FRED B. KELLOW, CHIEF, MICHIGAN DEPARTMENT OF PUBLIC HEALTH	C. D. HARRIS, DEPUTY DIRECTOR, MDNR	11/3/71	LANSING
33 INSPECTION		JEROME MASLOWSKI, DEPARTMENT OF ATTORNEY GENERAL	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	11/10/71	LANSING
34 CORRESPONDENCE	PRAWDZIK AND VAHOVIK REPORTS	H. A. YOUNG,RONALD D. SHAVER	HARTLEY & HARTLEY INC.	11/24/71	LANSING
35 CORRESPONDENCE		ROBERT L. LAYFIELD, U. S. ATOMIC ENERGY COMMISSION, MDNR	S. J. SIMMONS, WELLMAN DYNAMICS CORPORATION	4/14/72	LANSING
36 CORRESPONDENCE		MAURICE REIZEN, DIRECTOR, DEPARTMENT OF PUBLIC HEALTH	C. D. HARRIS, DEPUTY DIRECTOR, MDNR	1/4/72	LANSING
37 CORRESPONDENCE	HARTLEY & HARTLEY INC. - BAY COUNTY	DONALD L. LAW, HOUSE OF REPRESENTATIVES	MAURICE S. REIZEN, DIRECTOR MD	2/28/72	LANSING
38 CORRESPONDENCE	RADIOLOGICAL SURVEY OF THE BAY CITY FACILITIES OF THE WELLMAN DYNAMIC CORPORATION	S. J. SIMMONS, WELLMAN DYNAMICS CORPORATION	T. JORDAN POWELL/G. HOYT WHIPPLE, UNIVERSITY OF MICHIGAN	4/5/72	LANSING
39 CORRESPONDENCE		ROBERT L. LAYFIELD, U. S. ATOMIC ENERGY COMMISSION, MDNR	S. J. SIMMONS, WELLMAN DYNAMICS CORPORATION	4/14/72	LANSING
40 CORRESPONDENCE	EXCHANGE 32309-X	DIRECTOR	ROBERT G. WOOD, LANDS DIVISION/MERRILL L. PETOSKY, WILDLIFE DIVISION/ A. GENE GAZLAY, DIRECTOR	12/7/72	LANSING
41 CORRESPONDENCE	STATE VS. HARTLEY & HARTLEY INC.	MERRILL L. PETOSKY, WILDLIFE DIVISION	MARREN SNYDER, ASSISTANT ATTORNEY GENERAL	12/4/72	LANSING
42 CORRESPONDENCE	POLLUTION OF GROUNDWATER TOBICO WILDLIFE AREA	NELS JOHNSON, REGIONAL WILDLIFE BIOLOGIST, MDNR	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	3/23/73	LANSING
43 CORRESPONDENCE	INSPECTION HARTLEY'S SANITARY LANDFILL	NELS JOHNSON, MDNR	THOMAS PRAWDZIK, MDNR	3/26/73	LANSING
44 CORRESPONDENCE	INSPECTION OF HARTLEY & HARTLEY OPERATIONS ADJACENT TO TOBICO GAME AREA, BANGOR TOWNSHIP, BAY COUNTY	WARREN R. SNYDER, ASSISTANT ATTORNEY GENERAL	L. A. DAVENPORT	3/28/73	LANSING
45 CORRESPONDENCE	INSPECTION TOBICO MARSH GAME AREA	NELS JOHNSON, MDNR	THOMAS PRAWDZIK, MDNR	6/21/73	LANSING
46 INSPECTION	INSPECTION OF HARTLEY & HARTLEY LANDFILL	NELS JOHNSON, MDNR	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	7/24/73	LANSING
47 CORRESPONDENCE	TOBICO MARSH PROPERTY BOUNDRY SECTION 14, T15N R4E	TOMAS PRAWDZIK, MDNR	KENNETH J. OSTLING, REGIONAL SUPERVISOR	7/24/73	LANSING

APPENDIX A
Documents Reviewed for the Development of HSA

48 INSPECTION	INSPECTION OF HARTLEY & HARTLEY PREMISES JULY 30, 1973	JOHN BOHUNSKY	JOHN COSENS	8/16/73	LANSING
49 INSPECTION	FIELD INSPECTION - HARTLEY & HARTLEY AND BANGOR TOWNSHIP WASTE DISPOSAL FACILITIES - BANGOR TOWNSHIP, BAY CITY - AUGUST 29, 1973	MERILL L. PETOSKEY, MDNR	ARLOW P. BOYCE, MDNR	9/7/73	LANSING
50 CORRESPONDENCE		TYRUS W. HARTLEY, V. P., HARTLEY & HARTLEY	JOHN M. BOHUNSKEY, MDNR	9/10/73	LANSING
51 REPORT	HARTLEY AND HARTLEY LIQUID AND SOLID WASTES OPERATION	JOHN BOHUNSKY	JOHN COSENSA	11/1/73	LANSING
52 CORRESPONDENCE	HARTLEY & HARTLEY INC. SOLID WASTE DISPOSAL FACILITY, BAY COUNTY	PAUL SCHUBERT	FRED B. KELLOW, ENVIRONMENTAL PROTECTION BRANCH/LARRY R. THORNTON, ENVIRONMENTAL SANITATION	12/17/73	LANSING
53 REPORT	HARTLEY & HARTLEY LIQUID AND SOLID WASTE LANDFILL OPERATION, BANGOR TOWNSHIP, BAY COUNTY	JOHN BOHUNSKY	JOHN COSENS	1/25/74	LANSING
54 SITE INFORMATION	TAX AGREEMENT		WAYNE HARTLEY	2/4/74	LANSING
55 COURT	STATE OF MICHIGAN IN THE CIRCUIT COURT FOR THE COUNTY OF BAY			2/11/74	LANSING
56 SITE INFORMATION	SURETY BOND - ACCEPTED FORM - LIQUID INDUSTRIAL WASTE HAULERS	HARTLEY & HARTLEY	MDNR	2/15/74	LANSING
57 CORRESPONDENCE	SETTLEMENT OF HARTLEY & HARTLEY DAMAGE CASE AT TOBICO STATE GAME AREA	C. T. YODER, MDNR	W. W. SHAPTON, MDNR	2/28/74	LANSING
58 CORRESPONDENCE	APPLICATION OF HARTLEY & HARTLEY DIVISION OF CHEM-TROL POLLUTION SERVICES, INC. FOR SOLID WASTE DISPOSAL AREA LICENSE	MDNR	SAMUEL R. HUNT, III, SCA	3/1/74	LANSING
59 LICENSE	APPLICATION FOR LICENSE TO REMOVE AND TRANSPORT LIQUID INDUSTRIAL WASTE	HARTLEY & HARTLEY	MDNR	3/3/74	LANSING
60 CORRESPONDENCE	HARTLEY & HARTLEY, INC., KAWKAWLIN, MICHIGAN	JOHN COSENS/JOHN BOHUNSKEY/DAVID DENNIS, MDNR	JOHN SHAUVER, MDNR	3/5/74	LANSING
61 LICENSE	APPLICATION FOR LICENSE TO REMOVE AND TRANSPORT LIQUID INDUSTRIAL WASTE	HARTLEY & HARTLEY	MDNR	3/21/74	LANSING
62 CORRESPONDENCE		SAMUEL R. HUNT, III, SCA SERVICES, INC.	JOHN M. SHAUVER, MDNR	4/15/74	LANSING
63 CORRESPONDENCE	WATER QUALITY EFFLUENT CRITERIA FOR BANGOR TOWNSHIP SOLID WASTE DISPOSAL FACILITY, BAY COUNTY	FRED KELLOW, MDNR	JOHN BOHUNSKEY, MDNR	7/25/74	LANSING
64 LICENSE	SOLID WASTE DISPOSAL AREA LICENSE	HARTLEY & HARTLEY	MDNR	4/7/74	LANSING
65 CORRESPONDENCE	TOBICO MARSH STATE GAME AREA	MERRILL L. PETOSKEY, WILDLIFE DIVISION	ROBERT G. WOOD, LANDS DIVISION	7/31/74	LANSING
66 CORRESPONDENCE		HARTLEY & HARTLEY	ROBEERT J. COURCHAINE, MDNR	8/2/74	LANSING
67 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID WASTE HAULER INSPECTION	FILE NOTE	BOB KETTNER, WATER RESOURCES COMMISSION	9/25/74	LANSING
68 CORRESPONDENCE	INSPECTION OF HARTLEY & HARTLEY AND BANGOR TOWNSHIP LANDFILLS ADJOINING THE TOBICO STATE GAME AREA, BANGOR TOWNSHIP, BAY COUNTY	C. T. YODER, MDNR	W. W. SHAPTON	11/15/74	LANSING
69 CORRESPONDENCE	INSPECTION OF HARTLEY & HARTLEY AND BANGOR TOWNSHIP LANDFILLS ADJOINING THE TOBICO STATE GAME AREA, BANGOR TOWNSHIP, BAY COUNTY	THOMAS PRAWDZIK, MDNR	JACK BUTTERFIELD, MDNR	11/24/74	LANSING
70 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID AND SOLID WASTE LANDFILL FACILITY INSPECTION	DAVID DENNIS, MDNR	RONALD SHAVER, MDNR	11/7/74	LANSING
71 CORRESPONDENCE	INSPECTION OF HARTLEY & HARTLEY AND BANGOR TOWNSHIP LANDFILLS	NELS JOHNSON, MDNR	THOMAS PRAWDZIK, MDNR	11/8/74	LANSING

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72 DATA	CHEMICAL ANALYSIS WASTE WATER				LANSING
73 ARTICLE	REGIONAL DISPOSAL SITE FOR YOUR CHEMICAL WASTES				LANSING
74 CORRESPONDENCE	BANGOR TOWNSHIP SOLID WASTE DISPOSAL FACILITY, BANGOR TOWNSHIP, AND HARTLEY & HARTLEY INC., KAWKAWLIN TOWNSHIP, BAY COUNTY	CHARLES D. HARRIS	FRED B. KELLOW, ENVIRONMENTAL PROTECTION BRANCH/LARRY R. THORNTON, ENVIRONMENTAL SANITATION	1/6/75	LANSING
75 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID WASTE FACILITY INSPECTION	RONALD SHAVER, WATER RESOURCES COMMISSION	ROBERT KETNER, WATER RESOURCES COMMISSION	1/23/74	LANSING
76 SITE INFORMATION		HARTLEY & HARTLEY	DOW CORNING CORPORATION	2/28/75	LANSING
77 CORRESPONDENCE	HARTLEY AND HARTLEY INC., DIVISION OF CHEM-TROL POLLUTION SERVICES, INC., A SUBSIDIARY OF SCA SERVICES INC., SOLID WASTE DISPOSAL FACILITY (SANITARY LANDFILL), SECTION 25, KAWKAWLIN	PAUL R. SCHAUBERT, HARTLEY & HARTLEY	LARRY R. THORNTON, ENVIRONMENTAL SANITARIAN	2/19/75	LANSING
78 CORRESPONDENCE		DON BRADY, HARTLEY & HARTLEY	ROBERT A. KETTNER	2/27/75	LANSING
79 DATA		HARTLEY & HARTLEY	JACK L. SHENEBERGER, DOW CORNING	3/14/75	LANSING
80 CORRESPONDENCE	ANALYSIS OF DPR GELS - METHYLS FROM 325 AND 317, HSiCl3 FROM 309 BUILDING	J. POLLACK	DONALD INGEBRIGTSON	3/17/75	LANSING
81 CORRESPONDENCE		DONALD BUBLITZ, DOW CORNING CORP.	FRED B. KELLOW, ENVIRONMENTAL PROTECTION BRANCH/LARRY R. THORNTON, ENVIRONMENTAL SANITATION	5/2/75	LANSING
82 CORRESPONDENCE		TYRUS HARTLEY	JOHN M. SHAUVER, MDNR	10/20/75	LANSING
83 SITE INFORMATION		JOHN M. SHAUVER	DONALD G. BRADY, HARTLEY & HARTLEY	12/17/75	LANSING
84 DIRECTORY	SCA SERVICES, CORPORATE DIRECTORY			1/1/76	LANSING
85 CORRESPONDENCE	BAY CITY CHEVROLET PLANT	BOB MILLER	BEN WHITE	7/27/76	LANSING
86 CORRESPONDENCE	HARTLEY & HARTLEY INC., SOLID WASTE DISPOSAL FACILITY (SANITARY LANDFILL), BEING A PART OF SECTION 25, T15N, R4E, KAWKAWLIN TOWNSHIP, BAY COUNTY	TYRUS HARTLEY	LARRY R. THORNTON, MDNR	7/28/76	LANSING
87 CORRESPONDENCE		DONALD G. BRADY, HARTLEY AND HARTLEY	DELBERT RECTOR, AIR QUALITY DIVISION, MDNR	7/30/76	LANSING
88 REPORT	HARTLEY AND HARTLEY INC., DIVISION OF CHEM-TROL POLLUTION SERVICES, INC., A SUBSIDIARY OF SCA SERVICES INC., SOLID WASTE DISPOSAL FACILITY (SANITARY LANDFILL), SECTION 25, KAWKAWLIN	TYRUS HARTLEY, PRESIDENT HARTLEY & HARTLEY	LARRY R. THORNTON, MNDR	10/25/76	LANSING
89 ARTICLE	OIL FIELD SPILL CLEAN-UP			1/1/97	LANSING
90 CORRESPONDENCE		TYRUS HARTLEY, HARTLEY & HARTLEY	DIANE M. CARLSON, AIR QUALITY DIVISION, MDNR	5/27/77	LANSING
91 REPORT	STAFF REPORT, BIOLOGICAL AND CHEMICAL SURVEY OF TOBICO MARCH GAME AREA, INDIAN TOWN DRAIN AND KAWKAWLIN RIVER IN ASSOCIATION WITH HARTLEY & HARTLEY INC	MDNR	JOHN WUYCHECK, MDNR	6/2/77	LANSING
92 REPORT	REPORT OF OIL SPILL		MDNR	7/31/77	LANSING
93 CORRESPONDENCE	HARTLEY & HARTLEY, INC., BAY COUNTY	FRED B. KELLOW	LARRY R. THORNTON, MDNR	1/31/78	LANSING
94 ARTICLE	TOXIC FACILITY OKAYED			2/27/78	LANSING
95 MAP	EDMOND'S ENGINEERING INC. 1501 WEST THOMAS BAY, MI 48707			3/9/78	LANSING

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96 INSPECTION		D. H. JENKIND, MDNR	MARVIN K. JOHNSON, MDNR	5/8/78	LANSING
97 CORRESPONDENCE	HARTLEY & HARTLEY INC., SOLID WASTE DISPOSAL FACILITY (SANITARY LANDFILL), BEING A PART OF SECTION 25, T15N, R4E, KAWKAWLIN TOWNSHIP, BAY COUNTY	JAMES TRUCHAN, ENVIRONMENTAL ENFORCEMENT DIVISION	LARRY R. THORNTON, MDNR	5/12/78	LANSING
98 CORRESPONDENCE	OIL LOSS TOBICO MARCH	NELS JOHNSON	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	5/19/78	LANSING
99 CHRONOLOGY		MDNR	HARTLEY & HARTLEY	5/24/78	
100 CORRESPONDENCE	SUMMARY OF BRINE TESTING WITH DAPHNIA MAGNA	J. F. LEIGEB	J. E. CARROLL J. HOBBS	6/6/78	LANSING
101 COURT	HARTLEY & HARTLEY	ROBERT COURCHAINE/DEL RECTOR/GEORGE DAHL, MDNR	JACK D. BAILS, MDNR	6/28/78	LANSING
102 CORRESPONDENCE	TOBICO MARSH - OIL DAMAGE TO HABITAT AND WILDLIFE, SW1/4 OF NW1/4, SECTION 25, T15N, R4E BAY COUNTY	NELS JOHNSON, MDNR	MARVIN JOHNSON, MDNR	7/20/78	LANSING
103 CORRESPONDENCE	TOBICO MARSH WATER PROBLEM	MARVIN JOHNSON, MDNR	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	7/20/78	LANSING
104 CORRESPONDENCE	HYDROGEOLOGICAL INVESTIGATION - HARTLEY & HARTLEY SITE, BAY COUNTY	JACK BAILS, MDNR	B. P. SHAH, MDNR	7/31/78	LANSING
105 CORRESPONDENCE		THOMAS L. MUNSON	JACK BAILS, MDNR	8/4/78	LANSING
106 CORRESPONDENCE		TOM NAPIER, HARTLEY & HARTLEY	ARTHUR L. CADEN, MDNR	8/8/78	LANSING
107 CORRESPONDENCE		DAVID DENNIS, MDNR	J. E. JOHNSON, PRESIDENT WYANOT PIPE LINE COMPANY	8/10/78	LANSING
108 CORRESPONDENCE	WYANOT PIPELINE COMPANY SOIL DISPOSAL	FRED B. KELLOW, MDNR	W. G. TURNEY, MDNR	8/15/78	LANSING
109 CORRESPONDENCE	TOBICO MARSH OIL SPILL	JACK BAILS, MDNR	JAMES G. TRUCHAN	8/29/78	LANSING
110 CORRESPONDENCE		TOM NAPIER, HARTLEY & HARTLEY INC.	WILLARD A. GREVEL, WASTE WATER TREATMENT PLANT	9/11/78	LANSING
111 CORRESPONDENCE	WE PROJECT NO. 02337170	B. P. SHAH, MDNR	ROBERT D. MUTCH, WEHRAN ENGINEERING	10/6/78	LANSING
112 CORRESPONDENCE	HARTLEY & HARTLEY INC. KAWKAWLIN, MICHIGAN, (WE PROJECT NO. 02337170)	B. P. SHAH, MDNR	ROBERT D. MUTCH, WEHRAN ENGINEERINR	10/6/78	LANSING
113 CORRESPONDENCE	HARTLEY & HARTLEY INC. KAWKAWLIN, MICHIGAN, (WE PROJECT NO. 02337170)	B. P. SHAH, MDNR	ROBERT D. MUTCH, WEHRAN ENGINEERINR	10/25/78	
114 REPORT			HOWARD A. TANNER, MDNR	11/25/78	LANSING
115 CORRESPONDENCE	HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN	WILLIAM TURNEY	JACK BAILS, MDNR	11/15/78	
116 REPORT	HYDROGEOLOGIC INVESTIGATION AND CLOSURE CERTIFICATION, HARTLEY & HARTLEY INC., SANITARY LANDFILL, KAWKAWLIN, MICHIGAN			9/19/79	LANSING
117 CORRESPONDENCE		LARRY THORNTON, MDNR	PETER DUNLAP, SCA CHEMICAL WASTE SERVICES DIVISION	10/12/79	LANSING
118 CHRONOLOGY	HARTLEY & HARTLEY	PROBLEM EVALUATION COMMITTEE, MDNR	DENNIS SWANSON, MDNR	7/10/79	LANSING
119 CORRESPONDENCE	HARTLEY POLLUTION CONTROL SERVICES	RONALD SHAVER	ROBERT KETTNER	6/1/79	LANSING

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120 COURT	AMENDMENT TO NOVEMBER 7, 1980 CONSENT ORDER FOR CLOSURE			11/7/80	LANSING
121 REPORT	MONITORING WELL INSTALLATION, KAWKAWLIN LANDFILL, SECTION 25, KAWKAWLIN TOWNSHIP, BAY COUNTY MICHIGAN, FIELD REPORT AND METHODOLOGY PREPARED FOR SCA SERVICES, INC., JULY 9, 1981	JOHN SHAUVER	FRED GOTTSCHALK, MDNR	8/27/81	LANSING
122 DATA	MONITORING WELLS	F. GOTTSCHACK ROSCOMMON	MDNR	11/9/81	
123 CORRESPONDENCE		JOHN DOURJALEAN, U.S. EPA	FRED GOTTSCHALK, MDNR	2/8/82	
124 CORRESPONDENCE	HARTLEY & HARTLEY -KAWKAWLIN, MICHIGAN	ROSS POWERS, U.S. EPA	TECHNICAL ASSISTANCE TEAM, U.S. EPA	2/12/82	LANSING
125 REPORT	LAGOON SURFACE AREA AT HARTLEY & HARTLEY		EPA	4/22/82	LANSING
126 CORRESPONDENCE		TOM PRAWDZIK, MDNR	CHUCK NELSON, MICHIGAN DUCK HUNTERS ASSOCIATION	5/10/82	LANSING
127 CORRESPONDENCE		FRED GOTTSCHALK, MDNR	VIRGIL L. POLAND, SCA CHEMICAL WASTE SERVICES, INC.	5/18/82	LANSING
128 REPORT	BIOLOGICAL SURVEY OF HARTLEY & HARTLEY COMPANY AREA, KAWKAWLIN, MICHIGAN (TDD5-8205-2)	ROSS POWERS, U.S. EPA	TECHNICAL ASSISTANCE TEAM, U.S. EPA	6/2/82	
129 CORRESPONDENCE	HARTLEY & HARTLEY SITE, BAY COUNTY	JOHN SHAUVER, MDNR	FRED W. GOTTSCHALK, MDNR	6/3/82	LANSING
130 CORRESPONDENCE	HARTLEY & HARTLEY DISPOSAL SITE, BAY COUNTY	GARY BOUSHELLE	FRED GOTTSCHALK, MDNR	9/13/82	LANSING
131 CORRESPONDENCE	HARTLEY & HARTLEY SITE, BAY COUNTY	JOHN SHAUVER, MDNR	FRED GOTTSCHALK, MDNR	11/11/82	
132 CORRESPONDENCE	HARTLEY & HARTLEY DISPOSAL SITE - BAY COUNTY	RICHARD MAHONEY, SCA	FRED W. GOTTSCHALK, MDNR	12/13/82	LANSING
133 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL SUBMISSION OF MONITORING DATA	FRED GOTTSCHALK, MDNR	RICHARD B. MAHONEY, SCA	12/15/82	LANSING
134 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL, PRELIMINARY ASSESSMENTS IN NW CORNER	LARRY THORNTON, MDNR	RICHARD MAHONEY, SCA	12/17/82	LANSING
135 CORRESPONDENCE		GEORGE S. KUSH, SCA	JACK D. BAILS, MDNR	3/21/83	LANSING
136 CORRESPONDENCE	SCA CLEANUP OF OLD HARTLEY & HARTLEY DUMP, TOBICO MARSH, BAY COUNTY	TERRENCE P. GRADY, MDNR	JACK BAILS, MDNR	4/6/83	LANSING
137 CORRESPONDENCE	SCA CLEANUP OF OLD HARTLEY & HARTLEY DUMP, TOBICO MARSH, BAY COUNTY	STEWART FREEMAN	JACK BAILS, MDNR	4/11/83	LANSING
138 CORRESPONDENCE	HARTLEY & HARTLEY	DAN SCHULTZ, MDNR	JANET FEKETE, MDNR	4/14/83	LANSING
139 CORRESPONDENCE	HARTLEY & HARTLEY TOBICO MARSH, BAY COUNTY	BILL BRADFORD/DAVE DENNIS, MDNR	DAN SCHULTZ, MDNR	4/28/83	LANSING
140 REPORT	RADIOACTIVITY SURVEY OF MDNR LAND NEAR BAY CITY, MICHIGAN	JOSEPH HENNIGAN, NUCLEAR FACILITIES AND ENVIRONMENTAL MONITOING SECTION	ROBERT L. DeHAAN, ENVIRONMENTAL MONITORING UNIT	2/5/83	LANSING
141 CORRESPONDENCE	RADIOLOGICAL SURVEY AT HARTLEY & HARTLEY LIQUID INCINERATION AND TREATMENT PLANT, KAWKAWLIN, MICHIGAN. TDD# 5-8304-12	ROBERT BOWDEN	TECHNICAL ASSISTANCE TEAM	5/2/83	LANSING
142 CORRESPONDENCE	HARTLEY & HARTLEY -SCA	JACK BAILS, MDNR	BILL BOARFORD, MDNR	5/12/83	LANSING
143 CORRESPONDENCE	SCA/HARTLEY & HARTLEY	FILES, MDNR	GARY GETTEL, MDNR	5/13/83	LANSING

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144 CORRESPONDENCE		JAMES MILLER, U. S. NRC	GEORGE W. BRUCHMANN, RADIOLOGICAL HEALTH SERVICES DIVISION	5/16/83	
145 REPORT	FIRST LAGOONS OBSERVED IN STUDY AREA			5/16/83	LANSING
146 DATA	RADIOLOGICAL			11/1/83	
147 REPORT	HARTLEY & HARTLEY SITE			5/16/83	LANSING
148 CORRESPONDENCE	SCA/HARTLEY & HARTLEY	ROSS POWERS, U.S. EPA	GARRY GETTEL, MDNR	5/17/83	LANSING
149 CORRESPONDENCE	DYING OAKS - TOBICO MARSH STATE GAME AREA	GARY BOUSCHELLE	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	5/20/83	LANSING
150 SITE INFORMATION	SAMPLES FROM TOBICO MARSH AREA-FORMER HARTLEY & HARTLEY LANDFILL			7/2/83	BAY CITY
151 REPORT		SCA/HARTLEY & HARTLEY	MDNR	6/1/83	LANSING
152 REPORT	MAGNETOMETER SURVEY, HARTLEY & HARTLEY LANDFILL, NW1/4 OF NE1/4 SECTION 25 15N R4E, BAY COUNTY		BETH A. MURSCH, MDNR	7/1/83	LANSING
153 CORRESPONDENCE		JAMES R. MILLER, U.S. NRC	GEORGE W. BRUCHMANN, RADIOLOGICAL HEALTH SERVICES DIVISION	7/12/83	
154 CHRONOLOGY	LETTERS IN JOE HENNIGAN'S FILE			8/10/83	BAY CITY
155 REPORT	SCA/HARTLEY & HARTLEY SITE VISIT OF 8/9/83 AND 8/10/83	FILES, MDNR	GARY GETTEL, MDNR	8/12/83	LANSING
156 CORRESPONDENCE	SCA CLEANUP, HARTLEY & HARTLEY, BAY COUNTY, MICHIGAN	DAN SRENIAWSKI	GARY GETTEL, MDNR	8/28/83	LANSING
157 DATA	ATTACHMENT 4		U.S. DOE	9/19/83	
158 CORRESPONDENCE	SCA SERVICES/HARTLEY & HARTLEY	JOHN SHAUVER, MDNR	ROBERT TOEK, ASAD KHAN, MDNR	10/10/83	LANSING
159 CORRESPONDENCE	SCA'S PROPOSAL FOR HARTLEY & HARTLEY SITE	GARY GETTEL, MDNR	RON KOOISTRA/DAN SCHULTZ, MDNR	9/19/83	LANSING
160 REPORT	SCA/ HARTLEY & HARTLEY TOBICO MARSH, BAY COUNTY, MICHIGAN			9/1/83	LANSING
161 CORRESPONDENCE		JOHN J. DINAPOLI, HARTLEY & HARTLEY SITE, SCA CHEMICAL SERVICES	JACK D. BAILS, MDNR	11/24/83	LANSING
162 CORRESPONDENCE	JOE HENNIGAN'S NOTES			11/2/83	BAY CITY
163 CORRESPONDENCE	SCA/HARTLEY & HARTLEY	FILES, MDNR	GARY GETTEL, MDNR	11/4/83	LANSING
164 INSPECTION		DOW CHEMICAL/WELLMAN DYNAMICS CORPORATION	U.S. NRC	11/20/83	
165 CORRESPONDENCE	UPDATE SCA SERVICES/HARTLEY & HARTLEY, INC.	DAN SCHULTZ, MDNR	JOHN SHAUVER, MDNR	11/29/83	LANSING
166 CORRESPONDENCE	PLAN FOR CLEANUP OF CONTAMINANT GROUNDWATER AND SURFACE WATER, TOBICO MARSH/HARTLEY & HARTLEY LANDFILL, BAY COUNTY	JACK D. BAILS, MDNR	CHARLES J. GUENTHER, MDNR	11/30/83	
167 CORRESPONDENCE	SCA SERVICES/HARTLEY & HARTLEY SITE, KAWKAWLIN, MICHIGAN	RICK JOHNS, MDNR	JACK D. BAILS, MDNR	12/1/83	LANSING

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168 CORRESPONDENCE	LICENSE NO. STB-433. TERMINATED LICENSE NO. STB-136	S. J. SIMMONS, WELLMAN DYNAMICS	JAMES G. KEPPLER, NRC		LANSING
169 CORRESPONDENCE	SCA/HARTLEY & HARTLEY	DAN SCHULTZ, MDNR	ROBERT TEOH, MDNR	2/13/84	LANSING
170 CORRESPONDENCE	LICENSE NO. STB-433. TERMINATED LICENSE NO. STB-136	JAMES G. KEPPLER, U. S. NRC	PHILIP E. JOHNSON, ATTORNEY	2/15/84	LANSING
171 CORRESPONDENCE		JOHN J. DiNAPOLI, SCA	DAN SCHULTZ, MDNR	4/11/84	LANSING
172 CORRESPONDENCE		DON SCHULTZ, MDNR	LARRY JENSEN, U.S. EPA	4/17/84	LANSING
173 CORRESPONDENCE		DON SCHULTZ, MDNR	JOHN J. DiNAPOLI, SCA	4/19/84	LANSING
174 REPORT	CONSTRUCTION SPECIFICATIONS, HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, MICHIGAN				LANSING
175 REPORT	RADIOLOGICAL RESULTS			5/1/84	
176 CORRESPONDENCE	EPA RADIOACTIVITY RESULTS, MAY 1983 - TOBICO MARSH WATER SAMPLES	DAN SCHULTZ, MDNR	GEORGE W. BRUCHMANN	5/21/84	LANSING
177 CORRESPONDENCE		C. J. PAPERIELLO, U. S. NRC	GEORGE BRUSHMANN	5/23/84	LANSING
178 CORRESPONDENCE	HARTLEY & HARTLEY/SCA	RICH JOHNS, MDNR	DAN SCHULTZ, MDNR	4/24/84	LANSING
179 CORRESPONDENCE	SCA/HARTLEY & HARTLEY CLEANUP	RICH JOHNS, MDNR	H JOHN SHAFFER	6/8/84	LANSING
180 CORRESPONDENCE		DAN SCHULTZ, MDNR	JOHN J. DiNAPOLI, SCA	5/12/84	LANSING
181 REPORT	HARTLEY & HARTLEY SITE PROJECT MEETING @ MDNR IN SAGINAW, MICHIGAN			6/13/84	LANSING
182 REPORT	CONSTRUCRION SPECIFICATIONS, SLURRY WALL, CAP AN MONITORING SYSTEM, HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, MICHIGAN	SCA	JEFFREY L. DUNCAN, GROUNDWATER TECHNOLOGY, INC.	6/29/84	LANSING
183 CORRESPONDENCE		MARTIN C. SCHUMACHER, NRC	JAMES D. BERGER, OAK RIDGE	7/5/84	BAY CITY
184 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL SITE CONTAINMENT	DAN SCHULTZ, MDNR	LEONARD LIPINSKI, MDNR	7/16/84	LANSING
185 REPORT	LABORATORY ANALYSIS REPORT		U.S. NRC		BAY CITY
186 CORRESPONDENCE		DAN SCHULTZ, MDNR	JOHN J. DiNAPOLI, SCA	7/24/84	LANSING
187 ARTICLE	PACT REACHED ON HARTLEY LANDFILL CLEANUP, FORMER HARTLEY & HARTLEY DUMP			7/25/84	LANSING
188 CORRESPONDENCE	MEETING WITH DNR AND PUBLIC HEALTH			7/30/84	BAY CITY
189 REPORT	CONSTRUCTION SPECIFICATIONS, HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, MICHIGAN			8/1/84	LANSING
190 CORRESPONDENCE	TOBICO MARSH	DENNIS HALL, MDNR	DAN SCHULTZ, MDNR	8/3/84	LANSING
191 CORRESPONDENCE	HARTLEY & HARTLEY HAZARDOUS WASTE SITE	ANDREW GANBEL, REMEDIAL ACTION SECTION	BRIAN MONROE, REMEDIAL ACTION SECTION	8/15/84	LANSING

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192 CORRESPONDENCE		DAVID DENNIS, MDNR	DEPARTMENT OF THE ARMY	8/21/84	LANSING
193 CORRESPONDENCE	SCA CLEANUP	DAN SCHULTZ, MDNR	ROBERT TEOH, MDNR	8/2/84	LANSING
194 CORRESPONDENCE		MARTIN SCHUMACHER, NRC	JOSEPH M. HENNIGAN, MICHIGAN DEPARTMENT OF PUBLIC HEALTH	8/16/84	LANSING
195 REPORT	DESCRIPTION - STATE PROPERTY, SECTION 25, KAWKAWLIN TOWNSHIP			9/4/84	LANSING
196 CORRESPONDENCE	SCA SERVICES, INC., KAWKAWLIN, MICHIGAN	JOHN W. VOELPEL	THOMAS F. SCHIMPF, ASSISTANT ATTORNEY GENERAL	8/22/84	
197 CORRESPONDENCE		DANIEL SCHULTZ, MDNR	M. C. CHIEF, U.S. NRC	9/4/84	LANSING
198 CORRESPONDENCE	SCA SERVICES - HARTLEY & HARTLEY NEGOTIATIONS	DAN SCHAUVER, MDNR	THOMAS F. SCHIMPK, ASSITANT ATTORNEY GENERAL	9/10/84	
199 CORRESPONDENCE	SCA/WASTE MANAGEMENT	DEL RECTOR/RICK JOHNS, MDNR	JACK D. BAILS, MDNR	9/18/84	LANSING
200 COURT	STATE OF MICHIGAN IN THE CIRCUIT COURT FOR THE COUNTY OF INGHAM			9/28/84	LANSING
201 COURT	EMERGENCY ORDER TO CEASE AND DESIST		MDNR	9/28/84	LANSING
202 PERMIT		WAYNE & VERNELLDA HARTLEY	MDNR	10/1/84	LANSING
203 CHRONOLOGY			JOHN C. ARNSMAN, MDNR	10/15/84	LANSING
204 CORRESPONDENCE	SCA	GEORGE, MDPH	ERIC, MDPH	10/17/84	LANSING
205 REPORT	INVESTIGATION REPORT		MDNR	10/29/84	
206 REPORT	SCA LANDFILL, KAWKAWLIN., MICHIGAN	REGION III FILES	M. C. SCHUMACHER	11/7/84	LANSING
207 CORRESPONDENCE	SCA/WASTE MANAGEMENT	STEWART FREEMAN, ASSISTANT ATTORNEY GENERAL	JACK D. BAILS, MDNR	11/9/84	LANSING
208 CORRESPONDENCE		DANIEL SCHULTZ, MDNR	DONALD A. COOLURANIUM PROCESS LICENSING SECTION, NMSS	11/9/84	LANSING
209 CORRESPONDENCE	HARTLEY & HARTLEY/SCA	RICK JOHNS, MDNR	DAN SCHULTZ, MDNR	11/15/84	LANSING
210 REPORT	IN-PLACE BACKFILL MATERIAL TESTING, HARTLEY & HARTLEY LANDFILL	BERNARD TARRALLE, RECOSOL	DAVID W. BIRD, GROUNDWATER TECHNOLOGY INCORPORATION	11/20/84	
211 CORRESPONDENCE	RE: 84-8-203W GENERAL PERMIT	TYRUS HARTLEY, HARTLEY & HARTLEY	HAL F. HARRINGTON, MDNR	12/7/84	LANSING
212 CORRESPONDENCE	RE: MDNR FILE #84-8-197	TYRUS HARTLEY, HARTLEY & HARTLEY	HAL F. HARRINGTON, MDNR	12/19/84	LANSING
213 REPORT	WELLPOINT INSTALLATION			12/8/84	LANSING
214 CORRESPONDENCE	HARTLEY PROPERTY, BANGOR TOWNSHIP, BAY COUNTY	FILE	ED HAAPALA	11/22/85	LANSING
215 REPORT	RADILOGICAL RESULTS ON MONITORING WELLS			10/26/85	LANSING

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216 CORRESPONDENCE		JEFF PASSENO	W. D. SHAFER, U.S. NRC	10/21/85	LANSING
217 CORRESPONDENCE	HARTLEY & HARTLEY FACILITY, KAWKAWLIN, MICHIGAN	MARTIN SCHUMACHER, U.S. NRC	W. JEFF PASSENO, WASTE MANAGEMENT OF NORTH AMERICA, INC.	10/9/85	LANSING
218 CORRESPONDENCE		MARTIN SCHUMACHER, U.S. NRC	MICHAEL C. O'TOOLE, WASTE MANAGEMENT INC.	8/27/85	LANSING
219 CORRESPONDENCE		GEORGE W. BRUCHMANN, MDPH	W. D. SHAFER, U.S. NRC	7/26/85	LANSING
220 REPORT	HARTLEY & HARTLEY FILE			7/24/85	LANSING
221 REPORT	RADIOLOGICAL SURVEY OF THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES LANDFILL SITE, BAY CITY, MICHIGAN. DRAFT REPORT			7/1/85	LANSING
222 CORRESPONDENCE		DANIEL SWEENEY	C.J. PAPERIELLO	6/4/85	LANSING
223 COURT	PEOPLE VS. WAYNE TYRUS HARTLEY	GREGORY C. EAGLE, MDNR	NWIL P. WACKERLY, ASSISTANT PROSECUTING ATTORNEY	1/9/85	
224 REPORT		MARGARET CORNISH, MDNR	JIM PALMER	2/20/86	LANSING
225 REPORT		DAVID ERTZ, E. C. JORDAN COMPANY	MARGARET CORNISH, MDNR	3/13/86	LANSING
226 REPORT		NORM HARDNER, E.C. JORDAN	SUE KAELBIN, SAGINAW GWQ	5/29/86	LANSING
227 CORRESPONDENCE		GEORGE W. BRUCHMANN, MDPH	W.D. SHAFER, U.S. NRC	6/17/86	LANSING
228 CORRESPONDENCE		DAVID MILLER, WMI	W. D. SHAFER, U.S. NRC	6/24/86	LANSING
229 CORRESPONDENCE		DAVID ERTZ, E.C. JORDAN	MARGARET CORNICH, MDNR	7/9/86	LANSING
230 CORRESPONDENCE	HARTLEY & HARTLEY, TAX REVERTED LANDS	JOHN SHAUVER, MDNR	DAN SCHULTZ, MDNR	9/11/86	LANSING
231 CORRESPONDENCE		MARTIN SCHUMACHER, U.S. NRC	DAVID R. MILLER, WASTE MANAGEMENT OF NORTH AMERICA, INC.	9/29/86	
232 CORRESPONDENCE	WAYNE HARTLEY ILLEGAL FILL/ LED CASE # 217-095-84	DENNIS HALL, MDNR	SGT. GREGORY C. EAGLE, MDNR	10/9/86	LANSING
233 CORRESPONDENCE		DAVID MILLER, WMI	M. SCHUMACHER	10/11/86	
234 CORRESPONDENCE	WAYNE HARTLEY, CASE # 217-095-84	SGT. GREG EAGLE, MDNR	MARGARET CORNISH, MDNR	10/20/86	LANSING
235 COURT	WAYNE HARTLEY/DOCKET # 84-1029-SN	JEFF LEAMAN, PROBATION DEPARTMENT	SGT. GREGORY C. EAGLE, MDNR	10/30/86	LANSING
236 CORRESPONDENCE	SAMPLE COLLECTION AT THE SCA/WMI DISPOSAL SITE IN KAWKAWLIN TOWNSHIP, MICHIGAN	FILE	KEITH ANDRE, NRC	12/1/86	LANSING
237 CORRESPONDENCE		ANNE R. HACHTEL, BAY COUNTY CONVENTION AND VISITORS BUREAU, INC.	GORDON E. GUYER	12/10/86	LANSING
238 CORRESPONDENCE	WAYNE HARTLEY/DOCKET #84-1030H	ABEL TORREZ, ASSISTANCE BAY COUNTY PROSECUTION ATTORNEY	SGT GREGORY C. EAGLE, MDNR	3/16/87	
239 REPORT	WORK PLAN HARTLEY & HARTLEY LANDFILL SITE CONCEPTUAL DESIGN/FEASIBILITY STUDY, BAY CITY, MICHIGAN			8/19/87	LANSING

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240 CORRESPONDENCE	HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN, SAMPLING EVENT NOVEMBER 1987	MARTIN SCHUMACHER, U.S. NRC	DAVID MILLER, WASTE MANAGEMENT OF NORTH AMERICA	9/22/87	
241 CORRESPONDENCE		GEORGE W. BRUCHMAN, MDPH	MARTIN SCHUMACHER, U.S. NRC	10/6/87	LANSING
242 CORRESPONDENCE		DAVID R. MILLER, WMI	MARTIN SCHUMACHER, U. S. NRC	10/6/87	LANSING
243 CORRESPONDENCE	SAMPLE COLLECTION AT THE SCA/WMI LANDFILL SITE IN KAWKAWLIN TOWNSHIP, MICHIGAN	FILE	KEITH ANDRE, NRC	11/12/87	LANSING
244 DEED				9/13/88	
245 REPORT	FEASIBILITY STUDY REPORT, HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN				LANSING
246 REPORT	MEETING WITH DOW CHEMICAL COMPANY AND STATE OF MICHIGAN AGENCY REPRESENTATIVES - TRIP REPORT	CHARLES E. NORELIUS, DIVISION OF RADIATION SAFETY AND SAFEGUARDS	W. D. SHAFER, U. S. NRC		LANSING
247 CORRESPONDENCE		GEORGE W. BRUCCHMAN, MDPH	M. C. SCHUMACHER, U. S. NRC	10/19/88	LANSING
248 CORRESPONDENCE		MARTIN SCHUMACHER, U. S. NRC	DAVID MILLER, WASTE MANAGEMENT OF NORTH AMERICA	10/3/88	
249 CORRESPONDENCE		GEORGE W. BRUCHMAN, MDPH	M. C. SCHUMACHER, U. S. NRC	10/19/88	LANSING
250 CORRESPONDENCE	DEED FOR THE HARTLEY & HARTLEY PROPERTY, KAWKAWLIN, MICHIGAN	RHONDA KHLANN, MDNR	DAVID MILLER, WASTE MANAGEMENT OF NORTH AMERICA, INC.	4/25/89	LANSING
251 CORRESPONDENCE	HARTLEY & HARTLEY SAMPLING EVENT, KAWKAWLIN, MICHIGAN, NOVEMBER, 1989	MARTIN SCHUMACHER, U. S. NRC	MICHAEL W. REARDON, WASTE MANAGEMENT OF NORTH AMERICA, INC.	10/2/89	
252 CORRESPONDENCE		MICHAEL W. REARDON, WASTE MANAGEMENT OF NORTH AMERICA INC.	MARTIN SCHUMACHER, U. S. NRC		LANCING
253 DATA	ANALYTICAL RESULTS FROM WELLS INSIDE ENCAPSULATION ON MG/1				LANSING
254 REPORT	TREATMENT OF STATE-OWNED HARTLEY & HARTLEY LANDFILL LEACHATE AT WEST BAY COUNTY WWTP, BAY CITY	KATHY BREWER, MDNR	LISA BOETTCHER, MDNR	9/13/90	LANSING
255 REPORT	FINAL WORK PLAN, HARTLEY & HARTLEY LANDFILL SITE REMEDIAL DESIGN				LANSING
256 CORRESPONDENCE		LARRY	LISA BOETTCHER, MDNR	10/9/90	LANSING
257 CORRESPONDENCE		LAURA MAKUCH, WASTE MANAGEMENT OF NORTH AMERICA INC.	MARTIN C. SCHUMACHER, U. S. NRC		LANSING
258 REPORT		LISA BOETTCHER, MDNR	NANCY GASSEL	1/3/91	LANSING
259 MAP		GASSEL	LISA BOETTCHER, MDNR	1/4/91	LANSING
260 CORRESPONDENCE	LANDFILL LEACHATE AT WEST BAY COUNTY WWTP	BILL SHAW, PERMITS/BILL CREAL, GLEAS	KATHY BREWER, SAGINAW DISTRICT	1/16/91	LANSING
261 CORRESPONDENCE	EASEMENT AT THE HARTLEY & HARTLEY LANDFILL/CLEANUP SITE; BAY COUNTY; TO CREATE A RIGHT-OF-WAY FOR A STATE CONSTRUCTED SEWER LINE	JAY SCHAFER, MDNR	ALLAN BROUILLET, MDNR	1/31/91	LANSING
262 CORRESPONDENCE		LISA BOETTCHER, MDNR	DAVE DOMZAL, EAGLE VALLEY RECYCLE AND DISPOSAL FACILITY	2/8/91	LANSING
263 CORRESPONDENCE		LISA BOETTCHER, MDNR	JOHN H. AUSTIN, NMSS	2/18/92	LANSING

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264 CORRESPONDENCE		BOB KOLTUNIAK, ABB	LISA	2/5/91	
265 CORRESPONDENCE	REQUEST FOR POWER LINE INSTALLATION, KAWKAWLIN, MICHIGAN	ENERGY REQUEST CENTER	LAURA L. MAKUCH, WASTE MANAGEMENT OF MICHIGAN NORTH, INC.	3/12/91	LANSING
266 CORRESPONDENCE	SEWER LINE EASEMENT AND RIGHT-OF-WAY	LISA BOETTCHER, MDNR	DAVID A. DOMZAL, WASTE MANAGEMENT OF NORTH AMERICA	3/21/91	LANSING
267 CORRESPONDENCE	E-1724, SEWER LINE EASEMENT	LISA BOETTCHER, MDNR	JAY A. SCHAFER, REAL ESTATE DIVISION	4/17/91	LANSING
268 CORRESPONDENCE		BRUCE KNAPP, WASTE MANAGEMENT OF NORTH AMERICA	DONALD J. SRNIAWSKI, FUEL FACILITIES AND CONTAMINATED SITE	4/22/91	BAY CITY
269 CORRESPONDENCE	SEWER LINE EASEMENT AND RIGHT-OF-WAY				LANSING
270 DATA			WW ENGINEERING AND SCIENCE	5/15/91	LANSING
271 CORRESPONDENCE		TELEDYNE	LISA M. BOETTCHER, MDNR	5/3/91	LANSING
272 CORRESPONDENCE	SAMPLE COLLECTION AT THE WMI/MDNR - HARTLEY LADNFILL SITE IN KAWKAWLIN TOWNSHIP, MICHIGAN - NON LICENSEE	REGION III FILES	KEITH E. ANDRE, U. S. NRC		LANSING
273 CORRESPONDENCE		LISA M. BOETTCHER, MDNR	BRONIA GROB, TELEDYNE ISOTOPES	5/17/91	LANSING
274 CORRESPONDENCE	DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER		TELEDYNE ISOTOPES		LANSING
275 CORRESPONDENCE	TOBICO MARSH STATE GAME AREA, HARTLEY & HARTLEY LANDFILL, PROJECT NO. 35-8141	DOUGLAS E. MORGAN, MDNR	GREGORY M. EDWARDS, MDNR	5/20/91	LANSING
276 CORRESPONDENCE	RE. HARTLEY & HARTLEY WWES PROJECT NO. 27654	LISA BOETTCHER, MDNR	LISA GRIFHORST, EE ENGINEERING & SCIENCE, INC.	5/28/91	LANSING
277 CORRESPONDENCE	MDNR ENGINEERING PLANS FOR TOBICO MARSH LEACHATE EXTRACTION SYSTEM	LISA BOETTCHER, MDNR	LAURA MAKUCH, WASTE MANAGEMENT OF NORTH AMERICA	6/3/91	LANSING
278 CORRESPONDENCE	HARTLEY & HARTLEY	LISA BOETTCHET, MDNR	TERRY WALKINGTON, MDNR	6/5/91	LANSING
279 PROCEDURE	DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER (SUSPENDED SOLIDS)		TELEDYNE ISOTOPES		LANSING
280 CORRESPONDENCE		KENNETH MILLER, WASTE WATER TREATMENT PLANT	KEITH E. ANDRE, U. S. NRC		LANSING
281 CORRESPONDENCE		PAT NELIS	LISA BOETTCHER, MDNR	6/10/91	LANSING
282 CORRESPONDENCE	GROUNDWATER CLEANUP WASTEWATER DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)	AL HOWARD, MDNR	BOB BABCOCK, MDNR	6/18/91	LANSING
283 REPORT		LISA BOETTCHER, MDNR	B. GROB, TELEDYNE ISOTOPES	6/20/91	LANSING
284 CORRESPONDENCE	TREATMENT OF LEACHATE FROM THE STATE-OWNED PORTION OF THE HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, BAY COUNTY AT THE WEST BAY COUNTY WASTE WATER TREATMENT PLANT, BAY CITY	DENNIS HAHN, MDNR	LISA BOETTCHER, MDNR	7/9/91	LANSING
285 REPORT	GAMMA ANALYSIS RESULTS OF MDNR WELLS PLUS SURFACE WATER RESULTS	LISA BOETTCHER , MDNR	KEITH ANDRE, U. S. NRC	8/1/91	LANSING
286 CORRESPONDENCE	08/08/91 MEETING RE: SITE REMEDIATION	KAWKAWLIN/WASTE MENEGEMENT FILE	DENNIS R. HAHN, MDNR	8/8/91	LANSING
287 CORRESPONDENCE		LISA BOETTCHER, MDNR	JACK D. PARROTT, U. S. NRC		LANSING

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288 CORRESPONDENCE	RESULTS OF HARTLEY AND HARTLEY SAMPLES	LISA BOETTCHER, MDNR	HEITH ANDRE, U. S. NRC	9/30/91	LANSING
289 CORRESPONDENCE		KATHY BREWER, SWQD	LISA BOETTCHER, MDNR	10/10/91	LANSING
290 REPORT	SITE DESCRIPTION			10/17/91	LANSING
291 CORRESPONDENCE		RICK JOHNS, MDNR	LISA BOETTCHER, MDNR	11/1/91	LANSING
292 REPORT	ORGANIC CHEMICAL CONTENT OF HARTLEY AND HARTLEY SAMPLES	SAM POLE, DOE-RESL	LISA BOETTCHER, MDNR	12/11/91	LANSING
293 CORRESPONDENCE		TERRY SMART, WASTE MANAGEMENT OF NORTH AMERICA	O. LARRU DULL, DEPARTMENT OF WATER AND SEWER	12/13/91	LANSING
294 CORRESPONDENCE	REMEDIAL ACTIONS FOR THE NON-RADIOLOGICAL PARAMETERS AT THE STATE-OWNED PORTION OF THE HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, BAY COUNTY, MICHIGAN	GARRELL WEIDEMAN/JACK PARROTT, U. S. NRC	LISA BOETTCHER, MDNR	12/17/91	LANSING
295 COURT	STATE OF MICHIGAN IN THE CIRCUIT COURT FOR THE COUNTY OF INGHAM				LANSING
296 REPORT	H_2O WELL RECORDS			10/1/80	LANSING
297 DATA	NRC REGION III DATA			6/20/84	
298 REPORT	SUMMARY OF ALL SAMPLES				
299 REPORT	HARTLEY & HARTLEY BAY COMPANY SEMI ANNUAL REPORT MAY/NOV				
300 CORRESPONDENCE	MDNR PUNCH LIST				LANSING
301 COURT	STATE OF MICHIGAN IN THE CIRCUIT COURT FOR THE COUNTY OF BAY				LANSING
302 REPORT	LEACHATE COLLECTION AND PRETREATMENT SPECIFICATIONS				LANSING
303 ARTICLE	CLEANUP PLAN FOR HARTLEY & HARTLEY DUMP SITE EXPECTED WITHIN A WEEK				LANSING
304 ARTICLE	LOW LEVELS OF RADIOACTIVITY FOUND NEAR FORMER HARTLEY DUMP SITE				LANSING
305 REPORT	SITE DESCRIPTION/EXECUTIVE SUMMARY				
306 SITE INFORMATION	SELECTED MONITORING LOCATIONS WASTE MANAGEMENT - MNDR SITES KAWKAWLIN, MI				BAY CITY
307 REPORT	HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN, FACT SHEET			4/1/93	LANSING
308 REPORT	STAFF REPORT				LANSING
309 ACTIVITY REPORT	ACTIVITY REPORT			1/15/92	LANSING
310 CORRESPONDENCE		CLASSIFIED DEPARTMENT	LISA BOETTCHER, MDNR	1/22/92	LANSING
311 CORRESPONDENCE	REQUEST FOR THE EXTENSION OF THE EASEMENT	TERRY SMART, WASTE MANAGEMENT OF NORTH AMERICA	LISA BOETTCHER, MDNR	2/12/92	LANSING

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312 ARTICLE	1. NOTICE OF A PROPOSED PLAN FOR REMEDIAL ACTION. 2. DNR TO CONTROL LEAKING AT HARTLEY LANDFILL				LANSING
313 CORRESPONDENCE		LISA BOETTCHER, MDNR	JOHN H. AUSTIN, U. S. NRC		LANSING
314 CORRESPONDENCE	HARTLEY & HARTLEY SEWER LINE EASEMENT	LISA BOETTCHER, MDNR	TERRY SMART, WASTE MANAGEMENT OF NORTH AMERICA	2/25/92	LANSING
315 CORRESPONDENCE	HARTLEY & HARTLEY SYSTEM	LEEMONN, DNRDC	MIKE JURY, DNRDC	2/25/92	LANSING
316 CORRESPONDENCE	HARTLEY & HARTLEY INC.	ANDREW HOGARTH, MDNR	BRETT D. HEINRICH, WASTE MANAGEMENT OF NORTH AMERICA	3/3/92	LANSING
317 ACTIVITY REPORT	ACTIVITY REPORT, INDUSTRIAL PRETREATMENT MEETING AT WEST BAY COUNTY WWTP			3/6/92	LANSING
318 REPORT	TRIP REPORT - PUBLIC MEETING AT KAWKAWLIN TOWNSHIP HALL, BAY COUNTY, MICHIGAN, FEBRUARY 25, 1992	MDNR FILES	D. G. WEIDMAN, MDNR		LANSING
319 ARTICLE	1. HOT SPOT NEAR SAGINAW RIVER. 2. WASTE IS ALSO BURIED AT HARTLEY SITE. 3. NO RADIATION RISK. 4. TEST BEGAN AT OLD DUMP IN KAWKAWLIN			3/29/92	LANSING
320 CORRESPONDENCE	NORTH LABORATORY ANALYTICAL DATA. HARTLEY & HARTLEY LANDFILL SITE.	LISA BOETTCHER, MDNR	N. RICK DUNKIN, ABB ENVIRONMENTAL SERVICES	4/1/92	LANSING
321 CORRESPONDENCE	SECY-92-106 ACTION PLAN TO ENSURE TIMELY REMEDIATION OF SITES LISTED IN THE SITE DECOMMISSIONING MANAGEMENT PLAN	JAMES TAYLOR, U. S. NRC	SAMUEL J. CHILK, U. S. NRC	4/6/92	LANSING
322 CORRESPONDENCE	NRC APPROVES ACTION PLAN TO ASSURE TIMELY CLEANUP OF SITES CONTAMINATED WITH RADIOACTIVE MATERIAL		U. S. NRC	4/8/92	LANSING
323 CORRESPONDENCE	6377-03 HARTLEY & HARTLEY LANDFILL PHASE II BID PACKAGE	RICK DUNKIN, ABB	JASON BELL, ABB	4/9/92	LANSING
324 CORRESPONDENCE		LISA BOETTCHER, MDNR	JOHN H. AUSTIN, U. S. NRC		LANSING
325 REPORT	SPECIFICATIONS ON HARTLEY EXCAVATION				LANSING
326 REGULATION	REGULATORY GUIDE 1.86				LANSING
327 REPORT	STATEMENT OF WORK LEACHATE MANAGEMENT SYSTEM HARTLEY & HARTLEY CLOSED LANDFILL, KAWKAWLIN, MICHIGAN				LANSING
328 ACTIVITY REPORT	ACTIVITY REPORT FOR HARTLEY & HARTLEY LANDFILL			5/5/92	LANSING
329 REPORT			MICHAEL JURY, MDNR	5/19/92	LANSING
330 CORRESPONDENCE	NRC LICENSING OF THE HARTLEY & HARTLEY SITE	LISA BOETTCHER, MDNR	JACK PARROTT, U. S. NRC	5/28/92	LANSING
331 CORRESPONDENCE	HARTLEY LICENSE FOR POSSESION OF THORIUM	LISA BOETTCHER, MDNR	DARRYL WEIDEMAN, U. S. NRC	6/9/92	LANSING
332 CORRESPONDENCE	HARTLEY & HARTLEY EASEMENT	STANLEY PRUSS, ASSISTANT ATTORNEY GENERAL	LISA BOETTCHER, MDNR	6/10/92	LANSING
333 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL (KAWKAWLIN TOWNSHIP) 1992 GROUNDWATER AND SURFACE WATER ANALYSIS	LISA BOETTCHER, MDNR	MICHAEL REARDON, WOODLAND MEADOES RECYCLING AND DISPOSAL FACILITY	6/15/92	LANSING
334 CORRESPONDENCE		LISA BOETTCHER, MDNR	GEORGE, CHEMICAL WASTE MANAGEMET, INC.	6/27/92	LANSING
335 REPORT	AGREEMENT FOR FURNISHING LICENSE APPLICATION SERVICES FOR MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR)				LANSING

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336 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	7/14/92	LANSING
337 CORRESPONDENCE		LISA BOETTCHER, MDNR	JOHN AUSTIN, U. S. NRC	7/21/92	LANSING
338 CORRESPONDENCE	INSTITUTIONAL CONTROL	BILL LAMONT	TERRENCE CONNELLY, U. S. EPA	7/30/92	LANSING
339 CORRESPONDENCE	ADDITIONAL THORIUM DISPOSAL AREA HARTLEY & HARTLEY LANDFILL SITE, KAWKAWLIN, MICHIGAN	JACK PARROTT, U. S. NRC	THOMAS J. KERN, WASTE MANAGEMENT PARTNERS INC.	8/3/92	LANSING
340 CORRESPONDENCE	SOURCES OF RADIONUCLIDES IN LEACHATE	THOMAS J. KERN, WASTE MANAGEMENT PARTNERS INC.	RUSS OGLE	8/7/92	LANSING
341 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	9/9/92	LANSING
342 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	10/12/92	LANSING
343 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	10/19/92	LANSING
344 CORRESPONDENCE		GENE BOYCE	MICHAEL R. JURY, MDNR	10/27/92	LANSING
345 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	M. C. SCHUMACHER, U. S. NRC		BAY CITY
346 CORRESPONDENCE	SITE SAFETY AND HEALTH PLAN FOR THE SCA/HARTLEY ABOVE GROUND GAMMA RADIATION SURVEY		CWM REMEDIAL SERVICES, NUCLEAR REMEDIAL SERVICES	11/6/92	LANSING
347 CORRESPONDENCE	ABOVE GROUND GAMMA RADIATION SURVEY FOR THE SCA/HARTLEY LANDFILL CHARACTERIZATION PROJECT - DRAFT		CWM REMEDIAL SERVICES, NUCLEAR REMEDIAL SERVICES	11/4/92	LANSING
348 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	11/12/92	LANSING
349 MAP			RUST ENVIRONMENTAL AND INFRASTRUCTURE	12/1/92	BAY CITY
350 MEETING	MINUTES OF REGULATORY AGENCY MEETING HELD IN BAY CITY, MICHIGAN ON NOVEMBER 9, 1992 REGARDING THE HARTLEY & HARTLEY LANDFILL (M2150)	THOMAS KERN, WASTE MANAGEMENT OF NORTH AMERICA	RUSS OGLE, SEC DONNHUE ENVIRONMENT AND INFRASTRUCTURE	11/23/92	LANSING
351 CORRESPONDENCE	HARTLEY & HARTLEY RAW DATA SUBMITTAL	LISA BOETTCHER, MDNR	A. SAMI EL-NAGGAR, COAST-TO-COAST ANALYTICAL SERVICES	12/4/92	LANSING
352 CORRESPONDENCE	CHANGE ORDER REQUEST FOR ADDITIONAL WORK AT THE FORMER HARTLEY & HARTLEY LANDFILL	MICHAEL JURY, MDNR	EUGENE W. BOYCE, TERRA ENVIRONMENTAL CORPORATION	12/4/92	LANSING
353 CORRESPONDENCE	HARTLEY & HARTLEY, BAY COUNTY. PHASE I HAZARDOUS WASTE REMEDIAL ACTION. APPROVAL TO CHANGE ORDER REQUEST FOR TERRA	CY BALDWIN, MDNR	MIKE JURY, MDNR	12/8/92	LANSING
354 CORRESPONDENCE	SECOND SEMI-ANNUAL ENVIRONMENTAL MONITORING AT HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, MICHIGAN	LISA BOETTCHER, MDNR	JEFFREY A. WOJTALA, WASTE MANAGEMENT OF NORTH AMERICA	12/9/92	LANSING
355 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL CONTRACT EXTENSION	MICHAEL JURY, MDNR	MARK STEPHENS, TERRA ENVIRONMENTAL CORPORATION	12/10/92	LANSING
356 CORRESPONDENCE	RADIOLOGICAL CRITERIA FOR DECOMMISSSIONING OF NRC-LICENSED FACILITIES, WORKSHOP (SP-92-172)		CARLTON KAMMERER, U. S. NRC	12/17/92	LANSING
357 CORRESPONDENCE		JOHN ENGLER, GOVERNOR OF MICHIGAN	IVAN SELIN, U. S. NRC	12/21/92	LANSING
358 CORRESPONDENCE	STATUS OF STATE OWNED HARTLEY & HARTLEY LANDFILL, BAY COUNTY	AL HOWARD, MDNR	BRENDA J. BROUILLET, MDNR	1/7/93	LANSING
359 CORRESPONDENCE	RESPONSE TO THE 12/21/93 LETTER TO GOVENOR ENLGANDER			1/13/93	LANSING

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360 CORRESPONDENCE		IVAN SELIN, U. S. NRC	JOHN ENGLER, GOVERNOR	1/22/93	LANSING
361 CORRESPONDENCE	DATA REVIEW OF HARTLEY & HARTLEY LANDFILL COAST-TO-COAST ANALYSIS SERVICES	LISA BOETTCHER, MDNR	VEI-SHI HO, MDNR	1/19/93	LANSING
362 CORRESPONDENCE		HOWARD WETTERS, HOUSE OF REPRESENTATIVES	ALAN HOWARD, MDNR	2/1/93	LANSING
363 CORRESPONDENCE	HARTLEY/SCA STATUS	LISA BOETTCHER, MDNR	RUSS OGLE	2/10/93	LANSING
364 CORRESPONDENCE	HARTLEY & HARTLEY BAY COUNTY NUCLEAR REGULATORY (NRC) LICENSE SIGNATURE	ALAN HOWARD, MDNR	BRENDA J. BROUILLET, MDNR	2/10/93	
365 CORRESPONDENCE	U. S. NRC LICENSE	LISA BOETTCHER, MDNR	ELI A. PORT, RSSI	2/12/93	LANSING
366 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL NUCLEAR REGULATORY LICENSING FEE	KATHY CRAWLEY	LISA BOETTCHER, MDNR	2/16/93	LANSING
367 CORRESPONDENCE	SUBMITTAL OF DRAFT QUALITY ASSURANCE PROJECT FOR THE HARTLEY & HARTLEY LANDFILL REMEDIAL INVESTIGATION/FEASIBILITY STUDY	LISA BOETTCHER, MDNR	RUSSELL A. OGLE, RUST ENVIRONMENTA & INFRATSTRUCTURE	2/17/93	BAY CITY
368 CORRESPONDENCE	ISSUES AT HARTLEY & HARTLEY		LISA BOETTCHER, MDNR	2/18/93	LANSING
369 LICENSE	LICENSE APPLICATION FOR POSSESSION OF MATERIAL - HARTLEY & HARTLEY LANDFILL MICHIGAN STATE OWNED PORTION	DARREL WEIDEMAN, U. S. NRC	BRENDA J. BROUILLET, MDNR	2/24/93	LANSING
370 PROCEDURE	ALPHA AND BETA (GROSS ACTIVITY) IN WATER AND SOIL LEACHATE RADIOCHEMICAL COUNTING METHOD		OAK RIDGE ANALYTICAL SERVICES	6/9/93	LANSING
371 CORRESPONDENCE	STATE OF MICHIGAN-OWNED PORTION OF HARTLEY AND HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	JOHN AUSTIN, U. S. NRC	BRENDA J. BROUILLET, MDNR	2/24/93	LANSING
372 CORRESPONDENCE	HARTLEY & HARTLEY SITE BAY COUNTY	LISA BOETTCHER, MDNR	IAN HALBEISEN, MDNR	2/25/93	LANSING
373 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/5/93	LANSING
374 CORRESPONDENCE		B. HOUSE, U. S. NRC	JOHN AUSTIN, U. S. NRC		LANSING
375 FIELD NOTES	HARTLEY - STATE			3/15/93	LANSING
376 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/15/93	LANSING
377 CORRESPONDENCE		JACK PARROTT, U. S. NRC	BRENDS BROUILLET, MDNR	3/18/93	LANSING
378 CORRESPONDENCE		LYDIA A. KUYAWA, RUSR ENVIRONMENT & INFRASTRUCTURE	JOHN AUSTIN, U. S. NRC	3/18/93	LANSING
379 CORRESPONDENCE	SAMPLING AT HARTLEY & HARTLEY LANDFILL, BAY COUNTY	MITCH ADLEMAN, MDNR	MICHAEL HARRIS, MDNR	3/19/93	LANSING
380 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/22/93	LANSING
381 CORRESPONDENCE	HARTLEY & HARTLEY (STATE)	LISA BOETTCHER, MDNR	LISA FUNKE, WW ENGINEERING & SCIENCE	3/23/93	LANSING
382 CORRESPONDENCE	PHASE I	LISA BOETTCHER, MDNR	KATHY, MICHIGAN PIPE SUPPLY	4/5/93	LANSING
383 CORRESPONDENCE	HARTLEY & HARTLEY 090015 BAY COUNTY	BRRENDA BROUILLET, MDNR	CARRIE OLMSTED, MDNR	4/5/93	LANSING

APPENDIX A
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384 REPORT	HARTLEY & HARTLEY LANDFILL LEACHATE COLLECTION AND TREATMENT SYSTEM				LANSING
385 CORRESPONDENCE		BRENDA BROUILLET, MDNR	JOHN AUSTIN, U. S. NRC		LANSING
386 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	5/13/93	LANSING
387 CORRESPONDENCE		THOMAS KERN	JACK PARROTT, U. S. NRC		LANSING
388 CORRESPONDENCE		BRENDA BROUILLET, MDNR	JOHN AUSTIN, U.S. NRC		LANSING
389 CORRESPONDENCE		MATT JERUE, ABB-ES	LISA BOETTCHER, MDNR	6/2/93	
390 CORRESPONDENCE		WAYNE HARTLEY	JOHN GROBE, U. S. NRC		LANSING
391 CORRESPONDENCE		NAN LEHMAN, MDNR	SYLVIA B. LOWRY, LOWRY ENGINEERING	7/1/93	LANSING
392 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	7/8/93	LANSING
393 CORRESPONDENCE	FORTHCOMING MEETING WITH REPRESENTATIVES OF SCA SERVICES, INC.	JOHN AUSTIN, U. S. NRC	JACK PARROTT, U. S. NRC		LANSING
394 CORRESPONDENCE	WORK PLAN FORMER HARTLEY & HARTLEY LANDFILL	LISA BOETTCHER, MDNR	N. RICK DUNKIN, ABB-ES	7/26/93	LANSING
395 REPORT	ACTIVITY REPORT		MDNR	7/27/93	LANSING
396 CORRESPONDENCE	HEALTH & SAFETY PLAN HARTLEY & HARTLEY LANDFILL SAGINAW, MICHIGAN				LANSING
397 PERMIT	FENCE INSTALLATION AT THE HARTLEY & HARTLEY LANDFILL LOCATED IN BAY COUNTY, MICHIGAN	MIKE JURY, MDNR	LYDIA, A. KUYAWA, RUST ENVIRONMENT & INFRASTRUCTURE	8/31/93	LANSING
398 FIELD NOTE	HEALTH PHYSICS DAILY LOG BOOK, SEPT/OCT. 1993				BAY CITY
399 CORRESPONDENCE	SUMMARY OF STRATEGY FOR RADIOLOGICAL ANALYSIS O SAMPLES FROM THE HARTLEY & HARTLEY SITE	FILE	RITA VASSILAKIS	9/8/93	BAY CITY
400 CORRESPONDENCE	WORK PLAN HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, MICHIGAN			9/24/93	LANSING
401 CORRESPONDENCE		JOHN AUSTIN U. S. NRC	BRENDA BROUILLET, MDNR	10/1/93	LANSING
402 CORRESPONDENCE		MICHAEL JURY	RUSSELL A. OGLE, RUST ENVIRONMENT & INFRASTRUCTURE	10/7/93	LANSING
403 CORRESPONDENCE		RUSSELL OGLE, RUST ENV. & INFRA	DANNY L. COLEMAN, SCA HARTLEY	10/11/93	LANSING
404 CORRESPONDENCE	LICENSE FOR POSSESSION OF MATERIAL STATE OWNED HARTLEY & HARTLEY LANDFILL, KAWKAWLIN MICHIGAN	JOHN AUSTIN, U. S. NRC	MICHAEL JURY, MDNR	10/12/93	BAY CITY
405 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	10/13/96	LANSING
406 CORRESPONDENCE		BRENDA BROUILLET, MDNR	JOHN AUSTIN, U. S. NRC		LANSING
407 PERMIT	INSTALL A CHAIN LINK FENCE APPROXIMATELY 2400 FEET THROUGH WETLAND TO SECURE AN AREA OF KNOWN CONTAMINATION AT HARTLEY & HARTLEY LANDFILL	SCA SERVICES, INC.	MDNR	10/26/93	BAY CITY

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408 PERMIT		MDNR	MICHAEL JURY, MDNR	10/28/93	LANSING
409 DATA	WATER LEVELS HARTLEY & HARTLEY LANDFILL				BAY CITY
410 PERMIT		MARK REED, MDNR	MICHAEL JURY, MDNR	11/4/93	BAY CITY
411 PERMIT		MICHAEL JURY, MDNR	MARK REED, MDNR	11/15/93	LANSING
412 CORRESPONDENCE	ACTIVITY REPORT		MDNR	11/16/93	BAY CITY
413 CORRESPONDENCE		THOMAS KERN, SCA SERVICES INC.	JOHN AUSTIN, U. S. NRC		LANSING
414 CORRESPONDENCE		JACK PARROTT, U. S. NRC	MDNR	12/17/93	LANSING
415 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	12/7/93	LANSING
416 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	1/11/94	LANSING
417 CORRESPONDENCE	SUMMARY OF MEETING WITH WEST BAY COUNTY WASTE WATER TREATMENT PLANT REGARDING THE HARTLEY & HARTLEY SITE, BAY COUNTY, MICHIGAN	THOMAS KERN, SCA	RUSSELL OGLE, RUST ENV. & INFRA.	1/18/94	LANSING
418 REGULATION	SOLUBILITY CRITERIA FOR LIQUID EFFLUENT RELEASES TO SANITARY SEWERAGE UNDER THE REVISED 10 CFR PART 20		U. S. NRC	1/28/94	BAY CITY
419 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MDNR	ALL PARTIES LISTED IN ATTACHMENT B	A. MICHAEL LEFLER, MDNR	3/1/94	BAY CITY
420 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL - WELLMAN DYNAMICES NEXUS TO SITE	GARY L. FINKBEINER, ASSISTANT ATTORNEY GENERAL	MICHAEL T. KAY, ATTORNEY, DOW CHEMICAL	4/12/94	LANSING
421 REGULATION	EXTENSION OF THE POLICY ON ENFORCEMENT OF RCRA SECTION 3004(J) STORAGE PROHIBITION AT FACILITIES GENEARTING MIXED RADIOACTIVE/HAZARDOUS WASTE		EPA		BAY CITY
422 CORRESPONDENCE		MICHAEL JURY, MDNR	JOHN AUSTIN, U. S. NRC		LANSING
423 SCHEDULE	CHEMICALS CONTRIBUTION SCHEDULE	HARTLEY & HARTLEY SITE	ADVANCEED ANALYTICAL SOLUTIONS, INC.	6/21/94	BAY CITY
424 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL, BAY COUNTY	GARY L. FINKBEINER, MDNR	VERONICA PLETSCH, McBRIDE BAKER & COLES	6/27/94	LANSING
425 CORRESPONDENCE	ROUTINE INSPECTION CONDUCTED OF THE FORMER HARTLEY & HARTLEY LANDFILL, KAWKAWLIN, MICHIGAN	MICHAEL JURY, MDNR	GARY U SHEAR, U. S. NRC		LANSING
426 ARTICLE	1. LANDFILL SUITS COME AS LITTLE SURPRISE. 2. LAW SUITS FILED OVER POLLUTION. 3. BIG COMPANIES BEING TAUGHT KID'S LESSON. 4. DOW, DOW CORNING SUED OVER LANDFILL.				BAY CITY
427 CORRESPONDENCE	SUMMARY OF MDNR COMMENTS TO WORK PLANS HARTLEY & HARTLEY SITE, BAY CITY, MICHIGAN	MICHAEL JURY, MDNR	RUSSELL OGLE, RUST ENV. & INFRA.	8/2/94	
428 CORRESPONDENCE		GARY FINKBEINER, MDNR	MICHAEL KAY, DOW	8/10/94	BAY CITY
429 ARTICLE	1. TOBICO MARSH BECOMING A FLAWED GEM (HARTLEY LANDFILL A THREAT TO TOBICO). 2. WILDLIFE NEEDS NATURAL FLOW OF WATER (LANDFILL AREAS THREATEN TOBICO MARSH. 3. BAY NOT AN AQUATIC WAREHOUSE.			9/15/94	BAY CITY
430 CORRESPONDENCE		MICHAEL JURY, MDNR	ABB-ES	9/23/94	LANSING
431 CORRESPONDENCE	AUGUST 2, 1994 RESPONSE TO MDNR COMMENTS TO WORK PLANS HARTLEY & HARTLEY SITE, BAY CITY, MICHIGAN	RUSSELL OGLE, RUST ENV. & INFRA.	MATHEW E. HARTMAN, MDNR	9/23/94	BAY CITY

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432 CORRESPONDENCE	SUBMITTAL OF PHASE II WORK PLANS FOR SCA/HARTLEY SITE, BAY COUNTY, MICHIGAN	MATHEW HARTMAN, MDNR	RUSSELL OGLE, RUST ENV. & INFRA	9/28/94	
433 CORRESPONDENCE	FIELD INVESTIGATION ACTIVITIES SCA/HARTLEY & HARTLEY SITE BAY COUNTY MICHIGAN	JACK PARROTT, U. S. NRC	RUSSELL OGLE, RUST ENV. & INFRA	9/28/94	BAY CITY
434 CORRESPONDENCE	RE-SUBMITTAL OF HEALTH & SAFETY PLAN FOR SCA/HARTLEY & HARTLEY SITE, BAY COUNTY, MICHIGAN	MATHEW HARTMAN, MDNR	RUSSELL OGLE, RUST	6/10/94	BAY CITY
435 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	10/13/94	LANSING
436 CORRESPONDENCE		MICHAEL KAY, DOW CHEMICAL	RICHARD A. MESERVE, CONVINGTON & BURLING	10/14/94	BAY CITY
437 CORRESPONDENCE		MICHAEL JURY, MDNR	JOHN AUSTIN, U. S. NRC	10/14/94	LANSING
438 CORRESPONDENCE		RUSSELL OGLE, RUST ENV.	U. S. NRC		LANSING
439 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	8/11/94	BAY CITY
440 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	11/28/94	BAY CITY
441 CORRESPONDENCE	HARTLEY & HARTLEY JOINT TECHNICAL/NRC MEETING	DISTRIBUTION	JOHN CROMER, CROMER EAGLESFIELD	12/22/94	LANSING
442 CORRESPONDENCE	SCOPE OF WORK FOR NRC SPECIAL COUNCIL AND SPECIAL TECHNICAL REPRESENTATIVE	HARTLEY & HARTLEY STEERING AND TECHNICAL DISTRIBUTION	CROMER EAGLESFIELD & MAHR	12/6/94	BAY CITY
443 CORRESPONDENCE	TIMELINESS IN DECOMMISSIONING NUCLEAR MATERIALS FACILITIES AND PROPOSED CRITERIA FOR DECOMMISSIONING NUCLEAR FACILITIES	SDMP LICENSEE	JOHN GLEN	12/23/94	BAY CITY
444 CORRESPONDENCE	INSTALLATION OF A LEACHATE COLLECTION AND TREATMENT SYSTEM FORMER HARTLEY & HARTLEY LANDFILL RADIATION PROTECTION PLAN	MDNR	ABB-ES		BAY CITY
445 COURT	TOBICO STATE GAME AREA HARTLEY & HARTLEY SITE LIST OF OTHER POTENTIALLY RESPONSIBLE PARTIES				LANSING
446 COURT	STATE OF MICHIGAN IN THE CIRCUIT COURT FOR THE COUNTY ON INGHAM				BAY CITY
447 CORRESPONDENCE		JOHN CROMER, CROMER EAGLESFIELD & MAHER	RICHARD MESERVE, CONVINGTON & BURLING	1/9/95	BAY CITY
448 CORRESPONDENCE		DON INMAN/ DAN SCHULTZ, MDNR	MICHAEL JURY, MDNR	1/9/95	LANSING
449 CORRESPONDENCE	NRC LICENSING AND LICENSING EXEMPTION	HARTLEY & HARTLEY PRP GROUP	RICHARD MESERVE, COVINGTON & BURLING	1/9/95	BAY CITY
450 CORRESPONDENCE	HARTLEY & HARTLEY SITE	JOHN CROMER, CROMER EAGLESFIELD & MAHER	RICHARD MESERVE, COVINGTON & BURLING	1/9/95	BAY CITY
451 CORRESPONDENCE		MICHAEL JURY, MDNR	RICHARD MESERVE, COVINGTON & BURLING	1/17/95	LANSING
452 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	2/1/95	LANSING
453 REPORT		MDNR	MDNR LAB	2/1/95	LANSING
454 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	2/19/95	BAY CITY
455 CORRESPONDENCE	ACTION MEMORANDUM/HARTLEY & HARTLEY LANDFILL SITE	LINDA BROUILLET, MDNR	PATRICIA McKAY, MDNR	2/9/95	LANSING

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456 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	2/17/95	BAY CITY
457 CORRESPONDENCE	LETTER FROM NUCLEAR REGULATORY COMMISSION	AL HOWARD, MDNR	MICHAEL JURY, MDNR	3/15/95	LANSING
458 CORRESPONDENCE	MDNR LEACHATE COLLECTION SYSTEM			4/4/95	BAY CITY
459 CORRESPONDENCE	LEACHATE COLLECTION SYSTEM EFFLUENTS AND DISCHARGES. SYSTEM DESIGN AND OPERATIONAL ISSUES			4/5/95	BAY CITY
460 CORRESPONDENCE	SITE NRC LICENSING ISSUES			4/5/95	BAY CITY
461 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	2/22/95	BAY CITY
462 CORRESPONDENCE		BRENDA BROUILLET, MDNR	MICHAEL WEBER, U. S. NRC	3/8/95	BAY CITY
463 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	4/5/95	BAY CITY
464 CORRESPONDENCE		MICHAEL WEBER, U. S. NRC	GARY FINKBEINER, ASSISTANT ATTORNEY GENERAL, MDNR	4/12/95	LANSING
465 CORRESPONDENCE	ISSUANCE OF SOURCE MATERIALS LICENSE NO. SUC-1565 TO SCA SERVICES INC. TO POSSESS CONTAMINATED MATERIAL AT THE SCA SITE	THOMAS KERN, SCA SERVICES INC.	MICHAEL WEBER, U. S. NRC	6/14/95	BAY CITY
466 CORRESPONDENCE	HARTLEY & HARTLEY SITE	GARY FINKBEINER, ASSISTANT ATTORNEY GENERAL, MDNR	DAVID TRIPP, DYKEMA GOSSETT	6/15/95	LANSING
467 CORRESPONDENCE	STATEMENT OF INTENT FOR NRC DECOMMISSIONING FUND	MATHEW HARTMAN	MARK DRISCOLL	6/22/95	BAY CITY
468 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	6/27/95	BAY CIY
469 CORRESPONDENCE	DRAFT WORK PLAN HARTLEY & HARTLEY - MDNR SITE RADIOACTIVE (SOURCE) MATERIAL LICENSE APPLICATION AMENDMENT AND TECHNICAL SUPPORT			7/13/95	BAY CITY
470 CORRESPONDENCE	DRAFT WORK PLAN - HARTLEY & HARTLEY MDNR SITE	DAVID TRIPP, DYKEMA GOSSETT	JOHN SEYMOUR, WOODWARD CLYDE	7/14/95	LANSING
471 REPORT	DRAFT OUTLINE BASIS OF DESIGN REPORT - HARTLEY & HARTLEY STATE SITE			7/18/95	BAY CITY
472 PERMIT	PUBLIC NOTICE.		NDMR	7/19/95	LANSING
473 REPORT	HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN, FACT SHEET #3 AUGUST 4995				BAY CITY
474 CORRESPONDENCE	AUGUST 1, 1995 BRIEFING TOBICO MARSH WILDLIFE AREA DUMP SITE, KAWKAWLIN TOWNSHIP, BAY COUNTY			8/1/95	LANSING
475 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL - LEAD RESPONSIBILITY	AL HOWARD, MDNR	BRENDA BROUILLET, MDNR	8/4/95	BAY CITY
476 CORRESPONDENCE	NOTIFICATION OF HAZARDOUS WASTE ACTIVITIES	DENISE GRUBEN, MDNR	JOHN LEOFFLER, MDNR	8/16/95	LANSING
477 CORRESPONDENCE	HARTLEY & HARTLEY - PHASE II	MICHAEL JURY, MDNR	GREG RYAN, WOODWARD-CLYDE	8/25/95	LANSING
478 PERMIT	TECHNICAL SUPPORT DOCUMENT 10 CFR 40 LICENSE APPLICATION FOR THE STATE-OWNED PORTION OF THE HARTLEY & HARTLEY LANDFILL			9/5/95	BAY CITY
479 CORRESPONDENCE	HARTLEY & HARTLEY	GRUBEND DNRDC	HALLD2 – DNRDC	9/21/95	LANSING

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480 CORRESPONDENCE	FUND OPTIONS HARTLEY & HARTLEY	DENNIS HALL, MDNR	AL HOWARD, MDNR		LANSING
481 CORRESPONDENCE	NRC INSPECTION (REPORT NO. 040-09015/95001(DNMS)) AT THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR) OWNED PORTION OF THE HARTLEY & HARTLEY LANDFILL, BAY COUNTY, KAWKAWLIN, MICHIGAN	DENISE GRUBEN, MDNR	J. W. McCORMICK-BARGER, U. S. NRC	10/16/95	LANSING
482 CORRESPONDENCE		ROLAND HARMS, MDNR	MICHAEL WEBER, U. S. NRC	10/20/95	LANSING
483 CORRESPONDENCE		JOSEPH BASTA, DYKEMA GOSSETT	MICHAEL WEBER, U. S. NRC	11/22/95	LANSING
484 CORRESPONDENCE	BRIEFING MEMO ON CLEANUP OF RADIOACTIVE WASTE IN TOBICO MARSH, BAY COUNTY	ED MEADOWS, MDNR	DENNIS HALL, MDNR	8/4/95	BAY CITY
485 REPORT	MDNR s NRC TECHNICAL SUPPORT DOCUMENT FOR THE STATE-OWNED PORTION OF THE HARTLEY & HARTLEY SITE	MICHAEL JURY, MDNR	JEAN-CLAUDE DEHMEL, SC&A	8/12/95	BAY CITY
486 CORRESPONDENCE	NOTIFICATION OF HAZARDOUS WASTE ACTIVITIES	DENISE GRUBEN, MDNR	JOHN LOEFFLER, MDNR	8/16/95	BAY CITY
487 CORRESPONDENCE	STATEMENT OF INTENT - TOBICO MARSH WILDLIFE AREA - HARTLEY & HARTLEY LANDFILL	DENNIS ADAMS, MDNR	GARY FINKBEINER, MDNR	8/17/95	BAY CITY
488 CORRESPONDENCE	MDNR s DECOMMISSIONING FUNDING PLAN FOR THE STATE-OWNED PORTION OF THE HARTLEY & HARTLEY SITE	MATHEW HARTMAN, MDNR	JEAN-CLAUDE DEHMEL, SC&A	8/18/95	BAY CITY
489 CORRESPONDENCE		MATHEW HARTMAN, MDNR	JEAN-CLAUDE DEHMEL, SC&A	8/22/95	BAY CITY
490 LICENSE		JEAN-CLAUDE DEHMEL, SC&A	ROBERT SKOWRONEK, MDPH	8/23/95	BAY CITY
491 CORRESPONDENCE		KATHY WAARSZAWSKI, BAY MEDICAL CENTER	MICHAEL JURY, MDNR	8/24/95	BAY CITY
492 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	8/28/95	BAY CITY
493 CORRESPONDENCE	PHASE IIB INTRUSIVE INVESTIGATION SCHEDULE AND PROCEDURES SCA - HARTLEY & HARTLEY LANDFILL (KAWKAWLIN TOWNSHIP), MICHIGAN	MATHEW HARTMAN, MDNR	CARL SHAW, RUST ENV. & INFRA	8/28/95	BAY CITY
494 CORRESPONDENCE	AMENDED MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR) APPLICATION FOR A 10 CFR PART 40 RADIOACTIVE MATERIAL LICENSE	JACK PARROTT, U. S. NRC	RONALD HARMES, MDNR	8/5/95	BAY CITY
495 CORRESPONDENCE		MATHEW HARTMAN, MDNR	MICHAEL KAY, DOW CHEMICAL COMPANY	8/28/95	BAY CITY
496 ACTIVITY REPORT	ACTIVITY REPORT		NMDNR	9/8/95	BAY CITY
497 REPORT	ACTIVITY REPORT		MDNR	9/15/95	BAY CITY
498 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	9/19/95	BAY CITY
499 CORRESPONDENCE	RESPONSES TO MDNR COMMENTS ON TECHNICAL MEMORANDUM: PHASE IIA NONINTRUSIVE INVESTIGATION, SCA/HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	MATHEW HARTMAN, MDNR	RANDALL PATCHETT, RUST ENV. & INFRA	10/3/95	BAY CITY
500 INSPECTION	NRC INSPECTION (REPORT NO. 040-09015/95001 (DNMS)) AT THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR) OWNED PORTION OF THE HARTLEY & HARTLEY LANDFILL, BAY COUNTY, KAWKAWLIN, MICHIGAN	DENIS GRUBEN, MDNR	J. W. McCORMICK-BARGER, U. S. NRC	10/16/95	BAY CITY
501 PERMIT		JIM HENDERSON, MDEQ	W. BRAD SIMS, RUST ENV. & INFRA	10/16/95	BAY CITY
502 PERMIT	PUBLIC NOTICE		MDNR	10/23/95	BAY CITY
503 PERMIT	MDNR PERMIT	SCA SERVICES INC.	MDEQ	11/13/95	BAY CITY

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504 CORRESPONDENCE	MODIFICATIONS TO THE PHASE IIA NONINTRUSIVE INVESTIGATION SCA - HARTLEY & HARTLEY RI/FS	RUSSELL OGLE, RUST	CARL SHAW, RUST	11/16/95	
505 CORRESPONDENCE	DRAFT RADIOLOGICAL ADDENDUM FROM SCA AND WOODWARD-CLYDE	MICHAEL JURY, MDEQ	DAVE MINNAAR, MDPH	11/27/95	BAY CITY
506 ACTIVITY REPORT	ACTIVITY REPORT		MDEQ	12/12/95	BAY CITY
507 ACTIVITY REPORT	ACTIVITY REPORT		MDEQ	12/14/95	BAY CITY
508 REPORT	RADIOLOGICAL ADDENDUM TO THE DESIGN EVALUATION REPORT OF THE LEACHATE COLLECTION AND TREATMENT SYSTEMS	HARTLEY & HARTLEY	S. COHEN & ASSOCIATES, INC.		BAY CITY
509 REPORT			MDNR	12/14/95	LANSING
510 REPORT	DESIGN EVALUATION REPORT OF THE LEACHATE COLLECTION AND TREATMENT SYSTEMS	HARTLEY & HARTLEY	WOODWARD-CLYDE	1/11/95	BAY CITY
511 CORRESPONDENCE	NRC ISSUES UPDATED SDMP LIST OF CONTAMINATED SITES	DREW LONERGAN, ABB-ES CT	LORENZO CABRERA, ABB-ES MI	8/23/96	LANSING
512 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL, MDNR SITE, NRC LICENSE ACTIVITIES, KAWKAWLIN, MICHIGAN	DAVID TRIPP, DYKEMA GOSSETT	DENISE GRUBEN, MDNR	1/25/96	BAY CITY
513 CORRESPONDENCE	RECOMMENDATIONS FOR LEACHATE COLLECTION AND TREATMENT SYSTEM (LCS) DESING, HARTLEY & HARTLEY LANDFILL, MDNR SITE	DAVID TRIPP, DYKEMA GOSSETT	JOHN SEYMOUR, WOODWARD-CLYDE	2/7/96	LANSING
514 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL - STATUS REPORT	DENISE GRUBEN, MDNR	M. LEONARD, ABB-ES MI	2/19/96	LANSING
515 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL - PHASE II	DENISE GRUBEN, MDNR	JOSEPH FOGLIO, GZA GEOENVIRONMENTAL TECHNOLOGIES, INC.	2/28/96	LANSING
516 REGULATION	NRC INFORMATION NOTICE 96-18. COMPLIANCE WITH 10 CFR 20 FOR AIRBORNE THORIUM		U. S. NRC	3/25/96	LANSING
517 CORRESPONDENCE	CONTRACT DOCUMENTS FOR THE LEACHATE TREATMENT FACILITIES AT THE HARTLEY & HARTLEY LANDFILL SITE	HARTLEY & HARTLEY	WOODWARD-CLYDE	7/1/96	BAY CITY
518 CORRESPONDENCE	SITE ACCESS FOR FIELD INVESTIGATION WORK. MDNR/HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	DENISE GRUBEN, MDNR	W. BRAD SIMS, RUST ENV. & INFRA	7/25/96	LANSING
519 CORRESPONDENCE	MONTHLY PROGRESS REPORT - JUNE 1996. SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ	THOMAS KERN, WASTE MANAGEMENT, INC.	7/11/96	LANSING
520 CORRESPONDENCE	MONTHLY PROGRESS REPORT - JULY 1996. SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ	THOMAS KERN, WASTE MANAGEMENT, INC.	8/12/96	LANSING
521 CORRESPONDENCE	COST RECOVERY SUMMARY, HARTLEY & HARTLEY SITE UPDATE, BAY COUNTY, SITE # 090015	MIKE JURY, MDEQ	BARBARA FOX, MDEQ	8/13/96	LANSING
522 CORRESPONDENCE		KELLI SOBEL, MDNR	MICHAEL WEBER, NRC	8/14/96	LANSING
523 CORRESPONDENCE	NRC INSPECTION (REPORT NO. 040-09015/96001(DNMS)) AT THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR) OWNED PORTION OF THE HARTLEY & HARTLEY LANDFILL, BAY COUNTY, KAWKAWLIN, MICHIGAN	DENISE GRUBEN, MDNR	CYNTHIA PEDERSON, NRC	9/3/96	LANSING
524 CORRESPONDENCE	MONTHLY PROGRESS REPORT - AUGUST 1996. SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ	THOMAS KERN, WASTE MANAGEMENT INC.	9/12/96	LANSING
525 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL SITE STATUS, LEACHATE COLLECTION SYSTEM DESIGN, KAWKAWLIN, MICHIGAN	HARTLEY & HARTLEY LANDFILL STATE SITE GROUP	JOHN SEYMOUR, WOODWARD-CLYDE	9/19/96	LANSING
526 CORRESPONDENCE	MONTHLY PROGRESS REPORT - SEPTEMBER 1996. SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ	THOMAS KERN, WASTE MANAGEMENT INC.	10/23/96	LANSING
527 CORRESPONDENCE	SUBMISSION OF DOSE CALCULATION REPORT SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	JACK PARROTT, NRC	WASTE MANAGEMENT INC.	10/23/96	LANSING

528 CORRESPONDENCE	NOTICE - MEETING WITH SCA SERVICES REGARDING DECOMMISSIONING OF THE FORMER HARTLEY & HARTLEY LANDFILL IN MIDLAND MICHIGAN	MICHAEL WEBER, NRC	JACK PARROTT, NRC	10/30/96	LANSING
529 CORRESPONDENCE	MONTHLY PROGRESS REPORT - OCTOBER 1996. SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ/ JACK PARROTT, NRC	THOMAS KERN, WASTE MANAGEMENT INC.	11/8/96	LANSING
530 CORRESPONDENCE	MEETING WITH SCA SERVICES, INC. ON THE DECOMMISSIONING OF THE HARTLEY & HARTLEY LANDFILL	JOHN W. N. HICKEY AND OTHERS, NRC	JACK PARROTT, NRC	12/3/96	LANSING
531 CORRESPONDENCE	MONTHLY PROGRESS REPORT - NOVEMBER 1996. SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ	THOMAS KERN, WASTE MANAGEMENT INC.	12/13/96	LANSING
532 CORRESPONDENCE		THOMAS KERN, SCA SERVICES INC.	JACK PARROTT, NRC	12/11/96	LANSING
533 MEETING	AGENDA HARTLEY & HARTLEY LANDFILL MDNR SITE MEETING, DECEMBER 18, 1996			12/18/96	LANSING
534 ACTIVITY REPORT	ACTIVITY REPORT		MDEQ	12/18/96	LANSING
535 REPORT	TASK SUMMARY AND PROGRESS REPORT. HARTLEY & HARTLEY LANDFILL, KAWKAWLIN TOWNSHIP, BAY COUNTY				LANSING
536 REPORT	HARTLEY & HARTLEY LANDFILL - ASSESSMENT OF FUNDING SOURCES PRE-1997 COSTS AND POST-1997 COSTS - BOND FUND - STATE FACILITY FUND SPECIAL LEGISLATIVE APPROPRIATION				LANSING
537 CORRESPONDENCE		JACK PARROTT, NRC	DENISE GRUBEN, MDNR	1/2/97	LANSING
538 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL	MICHAEL JURY, MDEQ	JOSEPH FOGLIO, GZA REMEDIATION INC.	1/14/97	
539 CORRESPONDENCE		MICHAEL WEBER, NRC	KELLI SOBEL, MDNR	2/5/97	LANSING
540 CORRESPONDENCE	MONTHLY PROGRESS REPORT - FEBRUARY 1997, SCA/HARTLEY & HARTLEY LANDFILL SITE, BAY CITY, MICHIGAN	MATHEW HARTMAN, MDEQ	THOMAS KERN, WASTE MANAGEMENT INC.	3/15/97	LANSING
541 CORRESPONDENCE		KELLI SOBEL, MDNR	JOHN HICKEY, NRC	3/21/97	LANSING
542 CORRESPONDENCE		MIKE JURY, MDEQ	LEWIS GOODROAD, WMX TECHNOLOGY CENTER INC.	4/18/97	LANSING
543 CORRESPONDENCE	WORK PLAN ADDENDUM FOR ADDITIONAL SITE CHARACTERIZATION AND LEACHATE TREATABILITY STUDIES. SCA/HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	MATHEW HARTMAN, MDEQ	W. BRAD SIMS, RUST ENV. & INFRA	7/22/96	BAY CITY
544 CERTIFICATE	INSTRUMENT CALIBRATION INFORMATION			9/23/93	BAY CITY
545 DATA	PERSONNEL AND EQUIPMENT CONTAMINATION SURVEY FORMS			10/7/96	BAY CITY
546 INSPECTION	NRC INSPECTION AT SAGINAW MICHIGAN. SCA SERVICES LANDFILL AND MICHIGAN DEPT. OF NATURAL RESOURCES (MDNR) PROPERTY NEAR KAWKAWLIN MICHIGAN. DOW CHEMICAL COMPANY IN MIDLAND MICHIGAN WELLMAN	DOW CHEMICAL/WELLMAN DYNAMICS	NRC	11/17/83	BAY CITY
547 CORRESPONDENCE	HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN	DAN SCHULTZ, MDNR	DAVID MILLER, WASTE MANAGEMENT OF NORTH AMERICA	3/28/89	BAY CITY
548 DATA		MDNR	MDNR	5/5/89	BAY CITY
549 CORRESPONDENCE					BAY CITY
550 CORRESPONDENCE	TREATMENT OF STATE-OWNED HARTLEY & HARTLEY LANDFILL LEACHATE AT WEST BAY COUNTY WWTP, BAY CITY	KATHY BREWER, MDNR	LISA BOETTCHER, MDNR	9/13/90	BAY CITY
551 CORRESPONDENCE		LARRY	LISA BOETTCHER, MDNR	10/9/90	BAY CITY

552 REPORT	WATER RESOURCES REPORT				BAY CITY
553 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	12/28/77	BAY CITY
554 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	8/18/77	BAY CITY
555 CORRESPONDENCE		BENJAMIN WHITE, MDNR	ARTHUR PESCH, HARTLEY & HARTLEY	10/7/77	BAY CITY
556 PERMIT	APPLICATION FOR NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (PUBLIC LAW 92-500). PERMIT BY HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN TO DISCHARGE TREATED LIQUID INDUSTRIAL WASTEWATER	HARTLEY & HARTLEY	MICHIGAN WATER RESOURCES COMMISSION	9/16/77	BAY CITY
557 CORRESPONDENCE	HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN	FILES	FRANK BALDWIN, PERMITS SECTION	10/20/77	BAY CITY
558 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	10/19/77	BAY CITY
559 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	12/7/76	BAY CITY
560 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	12/14/76	BAY CITY
561 LICENSE		MRS. JAMES WALDIE	ROBERT MILLER	1/14/77	BAY CITY
562 CORRESPONDENCE		BENJAMIN WHITE, MDNR	TYRUS HARTLEY, HARTLEY & HARTLEY	1/15/77	BAY CITY
563 ACTIVITY REPORT	ACTIVITY REPORT			2/16/77	BAY CITY
564 CORRESPONDENCE		DIANE CARLSON, MDNR	TYRUS HARTLEY, HARTLEY & HARTLEY	4/8/77	BAY CITY
565 CORRESPONDENCE		DIANE CARLSON, MDNR	TYRUS HARTLEY, HARTLEY & HARTLEY	5/13/77	BAY CITY
566 CORRESPONDENCE		TYRUS HARTLEY, HARTLEY & HARTLEY	DIANE CARLSON, MDNR		BAY CITY
567 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	11/18/76	BAY CITY
568 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	8/23/76	BAY CITY
569 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	8/23/76	BAY CITY
570 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	8/24/76	BAY CITY
571 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	9/9/76	BAY CITY
572 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	9/22/76	BAY CITY
573 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	9/22/76	BAY CITY
574 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	10/1/76	BAY CITY
575 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	10/5/76	BAY CITY

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576 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	10/8/76	BAY CITY
577 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	10/21/76	BAY CITY
578 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	11/3/75	BAY CITY
579 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	11/3/76	BAY CITY
580 ACTIVITY REPORT	ACTIVITY REPORT		MDPH	11/4/76	BAY CITY
581 ACTIVITY REPORT	ACTIVITY REPORT	LISA BOETTCHER,MDNR		7/24/90	BAY CITY
582 CORRESPONDENCE		BEN WHITE, MDNR	DEC	12/21/77	BAY CITY
583 CORRESPONDENCE	HARTLEY & HARTLEY REQUESTED PERMISSION TO BURN				BAY CITY
584 CORRESPONDENCE			JIM HATTLER, HARTLEY & HARTLEY		BAY CITY
585 REPORT	SOIL & MATERIALS ENGINEERS, INC. WELLPOINT INSTALLATION				BAY CITY
586 SITE INFORMATION			HARTLEY & HARTLEY		BAY CITY
587 ARTICLE	'WE'RE KNEE DEEP IN GARBAGE AND HAPPY'		BUSINESS WEEK	10/20/73	BAY CITY
588 REPORT	WELLPOINT INSTALLATION			12/6/84	BAY CITY
589 CORRESPONDENCE	ANONIMOUS NOTES REGARDING INCENERATOR SMOKE COMPLAINTS				BAY CITY
590 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	6/2/78	FARMINGTON HILLS
591 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	6/30/78	FARMINGTON HILLS
592 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	6/28/78	FARMINGTON HILLS
593 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	6/27/78	FARMINGTON HILLS
594 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	7/7/78	FARMINGTON HILLS
595 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	7/25/78	FARMINGTON HILLS
596 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	6/2/78	FARMINGTON HILLS
597 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/3/78	FARMINGTON HILLS
598 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/10/78	FARMINGTON HILLS
599 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/9/78	FARMINGTON HILLS

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600 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/28/78	FARMINGTON HILLS
601 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/28/78	FARMINGTON HILLS
602 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	4/5/78	FARMINGTON HILLS
603 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/23/78	FARMINGTON HILLS
604 REPORT	ACTIVITY REPORT		MDNR	3/2/78	FARMINGTON HILLS
605 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	1/11/78	FARMINGTON HILLS
606 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	1/17/78	FARMINGTON HILLS
607 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	8/29/78	FARMINGTON HILLS
608 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	8/22/78	FARMINGTON HILLS
609 ACTIVITY REPORT	ACTIVITY REPORT		MDNR	3/7/79	FARMINGTON HILLS
610 CORRESPONDENCE		THOMAS, NAPIER, HARTLEY & HARTLEY	CHANG, BEK	1/13/78	FARMINGTON HILLS
611 ARTICLE	WASTE BURNING CLEANUP ORDERED		TIMES BAY CITY MICHIGAN		FARMINGTON HILLS
612 ACTIVITY REPORT	MDNR AIR QUALITY DIVISION, STAFF ACTIVITY REPORT.	HARTLEY & HARTLEY	MDNR	3/21/78	FARMINGTON HILLS
613 DATA	PLUME OBSERVATION DATA SHEET		MDNR	2/3/78	FARMINGTON HILLS
614 CORRESPONDENCE	BOND FOR NEW BERLIN WASTE DISPOSAL FACILITY	C. J. GUENTHER, MDNR	JACK BAILS, MDNR	2/13/78	FARMINGTON HILLS
615 CORRESPONDENCE		DONALD BRADY, HARTLEY & HARTLEY	DELBERT RECTOR, AIR QUALITY DIVISION, MDNR	7/30/76	FARMINGTON HILLS
616 CORRESPONDENCE	HARTLEY & HARTLEY SOLID WASTE DISPOSAL FACILITY (SANITARY LANDFILL), BEING PART OF THE S1/2, NE1/4 AND N1/2, SE1/4, SECTION 25, T15N -R4E, KAWKAWLIN TOWNSHIP, BAY COUNTY	JAMES TRUCHAN, ENVIRONMENTAL ENFORCEMENT DIVISION	LARRY THORNTON, RESOURCE RECOVERY DIVISION, MDNR	5/12/78	FARMINGTON HILLS
617 CORRESPONDENCE		BENJAMIN WHITE, MDNR	THOMAS NAPIER, HARTLEY & HARTLEY	3/24/78	FARMINGTON HILLS
618 CORRESPONDENCE		KIMBERLY BUCHANAN, MDNR	DALE SCHERGER, ENVIRONMENTAL CONTROL TECHNOLOGY CORPORATION	11/20/84	FARMINGTON HILLS
619 CORRESPONDENCE		WAYNE HARTLEY, HARTLEY & HARTLEY	BRENDA BROUILLET, MDNR	12/16/85	FARMINGTON HILLS
620 COURT	PEOPLE VS. WAYNE HARTLEY	MIKE BUCKINGHAN, BAY COUNTY COURTHOUSE	GREGORY EAGLE	11/14/85	FARMINGTON HILLS
621 CORRESPONDENCE	HARTLEY & HARTLEY INC.	DELBERT RECTOR, MICHIGAN AIR POLLUTION CONTROL	JOHN VOELPEL, ATTORNEY FOR HARTLEY & HARTLEY INC.	6/14/78	FARMINGTON HILLS
622 DATA	WASTE STREAM ANALYSIS	HARTLEY & HARTLEY	MDNR	4/21/78	FARMINGTON HILLS
623 ARTICLE	HEARING SET JUNE 8 ON AIR POLLUTION				FARMINGTON HILLS

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624 CORRESPONDENCE		BENJAMIN WHITE, MDNR	THOMAS NAPIER, HARTLEY & HARTLEY	8/17/78	FARMINGTON HILLS
625 ARTICLE	CITIZENS WIN WASTE LEGAL BATTLE		SAGINAW NEWS	8/15/78	FARMINGTON HILLS
626 CORRESPONDENCE	HARTLEY & HARTLEY, KAWKAWLIN	BENJAMIN WHITE, MDNR	RICK JOHNS, MDNR	8/2/78	FARMINGTON HILLS
627 CORRESPONDENCE	HARTLEY & HARTLEY	JACK BAILS, MDNR	GEORGE SU, MDNR	7/31/78	FARMINGTON HILLS
628 CORRESPONDENCE	HARTLEY & HARTLEY	JACK BAILS, MDNR	GEORGE SU, MDNR	8/28/78	FARMINGTON HILLS
629 CORRESPONDENCE	STATEMENT OF HARTLEY & HARTLEY INC. REGARDING A NRE USE OF SURFACE WATERS IN KAWKAWLIN TOWNSHIP, BAY COUNTY MICHIGAN		WATER RESOURCES COMMISSION		FARMINGTON HILLS
630 ARTICLE	GAME AREA CLEANUP SEEMS POSSIBLE		ANN ARBOR MICHIGAN NEWS		FARMINGTON HILLS
631 CORRESPONDENCE		TON MAPIER, HARTLEY & HARTLEY	GEORGE SU, MDNR	7/24/78	FARMINGTON HILLS
632 DATA		ROBERT MILLER, MDNR	TOM NAPIER, HARTLEY & HARTLEY		FARMINGTON HILLS
633 CORRESPONDENCE		TON NAPIER, HARTLEY & HARTLEY	GEORGE SU, MDNR	7/26/78	FARMINGTON HILLS
634 CORRESPONDENCE	HARTLEY & HARTLEY - SCA	JACK BAILS, MDNR	W. G. TURNEY, MDNR	7/28/78	FARMINGTON HILLS
635 CORRESPONDENCE	HARTLEY & HARTLEY SAMPLING	BENJAMIN WHITE, MDNR	BOB MILLER, MDNR	7/7/78	FARMINGTON HILLS
636 CORRESPONDENCE	HARTLEY & HARTLEY	ROBERT COURCHAINE, MDNR	JACK BAILS, MDNR	6/28/78	FARMINGTON HILLS
637 ARTICLE	VAPORIZING MAY HAVE LEFT PBB TRACES IN BAY AREA		SAGINAW, MI NEWS	7/13/78	FARMINGTON HILLS
638 CORRESPONDENCE		IMMEDIATE RELEASE	MDNR	7/13/78	FARMINGTON HILLS
639 ARTICLE	HARTLEY BURNED PBB TO SHUT INCINERATOR		BAY CITY MI TIMES	7/14/78	FARMINGTON HILLS
640 CORRESPONDENCE	HARTLEY & HARTLEY VISIT	FILE, MDNR	GEORGE SU, MDNR	7/14/78	FARMINGTON HILLS
641 CORRESPONDENCE		WHOM IT MAY CONCERN	WILLIAM SOPER, HARTLEY & HARTLEY	7/18/78	FARMINGTON HILLS
642 CORRESPONDENCE		THOMAS NAPIER, HARTLEY & HARTLEY	GEORGE SU, MDNR	7/19/78	FARMINGTON HILLS
643 CORRESPONDENCE	INVENTORY OF FLUIDS HARTLEY & HARTLEY YARD STORAGE	JACK BAILS, MDNR	RONALD SHAVER, MDNR	7/19/78	FARMINGTON HILLS
644 ARTICLE	HARTLEY MAY ALSO CLOSE ITS KAWKAWLIN LANDFILL		BAY CITY, MI TIMES	7/19/78	FARMINGTON HILLS
645 ARTICLE	MDNR DENIES HARTLEY BURNED PBBs		BAY CITY, MI TIMES	7/18/78	FARMINGTON HILLS
646 ARTICLE	INCINERATOR POLLUTANTS NOT PBB?		SAGINAW, MI NEWS	7/18/78	BAY CITY
647 CORRESPONDENCE		DANIEL SCHULTZ, MDNR	JOHN DiNAPOLI, SCA CHEMICAL SERVICES	2/2/84	FARMINGTON HILLS

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648 CORRESPONDENCE	CELL #5 OF THE HARTLEY & HARTLEY LANDFILL FACILITY AT KAWKAWLIN MICHIGAN	DELBERT RECTOR, MDNR	JAMES POLLACK, DOW CORNING	6/8/78	FARMINGTON HILLS
649 CORRESPONDENCE	SUMMARY OF BRINE TESTING WITH DAPHNIA MAGNA	J. W. POLLACK, J. F. LEIGEB	J. E. CERRO	6/6/78	FARMINGTON HILLS
650 ARTICLE	MDNR CITES KAWKAWLIN FIRM FOR WASTE DISPOSAL VIOLATIONS		BAY CITY, MI TIMES	6/9/78	FARMINGTON HILLS
651 CORRESPONDENCE	HARTLEY & HARTLEY INC.	DEL RECTOR, MDNR	JOHN VOELPEL, ATTORNEY FOR HARTLEY & HARTLEY INC.	6/8/78	FARMINGTON HILLS
652 CORRESPONDENCE	SCA CLEANUP	DAN SCHULTZ, MDNR	ROBERT TEOH, MDNR	8/2/84	FARMINGTON HILLS
653 CORRESPONDENCE	SCA/HARTLEY & HARTLEY CLEANUP	RICHARD JONES, MDNR	JOHN SHAFER, MDNR	6/8/84	FARMINGTON HILLS
654 CORRESPONDENCE		THOMAS NAPIER, HARTLEY & HARTLEY	BENJAMIN WHITE, MDNR	6/27/78	FARMINGTON HILLS
655 CORRESPONDENCE	HARTLEY & HARTLEY INC.	DEL RECTOR, MDNR	JOHN VOELPEL, ATTORNEY FOR HARTLEY & HARTLEY INC.	6/2/78	
656 CORRESPONDENCE	HARTLEY & HARTLEY INC.	JOHN VOELPEL	DELBERT RECTOR, AIR QUALITY DIVISION, MDNR	6/6/78	FARMINGTON HILLS
657 COURT	COMMENTS OF THE MICHIGAN UNITED CONSERVATION CLUBS TO THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR) REGARDING THE PROPSED CONSENT ORDER WITH SCA SERVICES, INC. (HARTLEY & HARTLEY)			6/8/78	FARMINGTON HILLS
658 CORRESPONDENCE		DAN MEYER	BEN WHITE	6/7/77	FARMINGTON HILLS
659 CORRESPONDENCE	HARTLEY & HARTLEY DISPOSAL	GEORGE SU, MDNR	DAN MEYER	6/9/78	FARMINGTON HILLS
660 CORRESPONDENCE	HARTLEY AND HARTLEY INC.	GEORGE SU, MDNR	DELBERT RECTOR, AIR QUALITY DIVISION, MDNR	6/13/78	FARMINGTON HILLS
661 CORRESPONDENCE	HARTLEY & HARTLEY	LISA BOETTCHER, MDNR	JOHN EMRICH, WW ENGINEERING & SCIENCE INC.	5/11/90	FARMINGTON HILLS
662 REPORT		MDNR	WW ENGINEERING & SCIENCE	5/20/91	FARMINGTON HILLS
663 ARTICLE	AREA FIRM TO CONTINUE BURNING TOXIC WASTES		BAY CITY MI TIMES	6/20/78	FARMINGTON HILLS
664 REPORT	MDNR AIR QUALITY DIVISION STAFF ACTIVITY REPORT		MDNR	6/20/78	FARMINGTON HILLS
665 CORRESPONDENCE	HARTLEY & HARTLEY	BEN WHITE, MDNR	BOB MILLER, MDNR	6/21/78	FARMINGTON HILLS
666 CORRESPONDENCE		WAYNE HARTLEY, HARTLEY & HARTLEY		5/28/69	FARMINGTON HILLS
667 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	W. D. SHAFER, MDNR		BAY CITY
668 REPORT			THERMO ANALYTICAL INC.	12/23/86	BAY CITY
669 REPORT	FEASIBILITY STUDY REPORT HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	MDNR	GZA/DONOHUE		BAY CITY
670 REPORT	WORK PLAN: HARTLEY & HARTLEY LANDFILL SITE CONCEPTUAL DESIGN / FEASIBILITY STUDY, BAY CITY, MICHIGAN	MDNR	GZA/DONAHUE	8/19/87	BAY CITY
671 CORRESPONDENCE	HARTLEY & HARTLEY	LISA BOETTCHER, MDNR	LISA GRIFORST, WW ENGINEERING & SCIENCE	6/11/91	BAY CITY

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672 CHRONOLOGY	CHRONCLOGICAL SUMMARY AND BRIEF HISTORICAL REPORT, HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN				BAY CITY
673 REPORT	FINAL - HEALTH & SAFETY PLAN SITE CHARACTERIZATION. SCA/ HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	SCA SERVICES	RUST ENV. & INFRA	10/1/94	BAY CITY
674 REPORT	TECHNICAL MEMORANDUM. HISTORICAL DATA EVALUATION. SCA/HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	SCA SERVICES	RUST ENV. & INFRA	1/1/95	BAY CITY
675 REPORT	FINAL - REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN. SCA/HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	SCA SERVICES	RUST ENV. & INFRA	9/1/94	BAY CITY
676 REPORT	FINAL - FIELD SAMPLING PLAN. SCA/HARTLEY & HARTLEY LANDFILL, BAY COUNTY, MICHIGAN	SCA SERVICES	RUST ENV. & INFRA	9/1/94	BAY CITY
677 REPORT	FINAL REPORT - HARTLEY & HARTELY LANDFILL SITE, REMEDIAL INVESTIGATION.	MDNR	E.C. JORDAN CO.	12/1/86	BAY CITY
678 REGULATION	ACT 307 MASTER DAT FORM				BAY CITY
679 CORRESPONDENCE	HARTLEY & HARTLEY WASTE DISPOSAL AREA, SECTION 25, T15N, R4E, KAWKAWLIN TOWNSHIP, BAY COUNTY	CHARLES HARRIS, MDNR	JOHN BYERLAY, MDNR	10/2/69	BAY CITY
680 REPORT		LISA BOETTCHER, MDNR	TELEDYNE ISOTOPES	6/20/91	BAY CITY
681 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	W. D. SHAFER, MDNR		BAY CITY
682 CORRESPONDENCE	RADIOACTIVITY SURVEY OF MDNR LAND NEAR BAY CITY MICHIGAN	JOSEPH	ROBERT DEHAAN	5/2/83	BAY CITY
683 PROCEDURE	RADIOLOGICAL SITE ASSESMENT PROGRAM			7/1/85	BAY CITY
684 CORRESPONDENCE		KENNETH MILLER, WASTE WATER TREATMENT PLANT	KEITH ANDRE, NRC		BAY CITY
685 CORRESPONDENCE	SAMPLE COLLECTION AT THE WMI/MDNR - HARTLEY LANDFILL SITE IN KAWKAWLIN TOWNSHIP, MICHIGAN - NON LICENSEE	REGION III FILES, NRC	KEITH ANDRE, NRC		BAY CITY
686 REPORT				11/1/89	BAY CITY
687 DIRECTORY	U. S. ATOMIC ENERGY COMMISSION DIRECTORATE OF REGULATORY OPERATIONS	U. S. ATOMIC ENERGY COMMISSION		1/1/72	BAY CITY
688 CORRESPONDENCE		WELLMAN-DYNAMICS CORP. S.J. SIMMONS, DIRECTOR INDUSTRIAL RELATIONS & PROCUREMENT	W L AXELSON J.G. KEPPLER CHIEF MATERIALS & SAFEGUARDS BRANCH		BAY CITY
689 CORRESPONDENCE	U. S. NUCLEAR REGULATORY COMMISSION REGION III		NRC REGION III		BAY CITY
690 REPORT	RADIOLOGICAL SURVEY OF THE MDNR LANDFILL SITE, BAY CITY MICHIGAN			7/1/85	BAY CITY
691 CORRESPONDENCE		JOHN VOELPEL	CHANG BEK	2/22/80	BAY CITY
692 ARTICLE	STATE PAYS FOR LANDFILL CLEANUP		BAY CITY TIMES	5/21/97	BAY CITY
693 ACTIVITY REPORT	HARTLEY & HARTLEY - STATE OWNED PORTION (MDNR)		MDEQ	4/28/97	BAY CITY
694 ACTIVITY REPORT	HARTLEY & HARTLEY - WMNA		MDEQ	3/21/97	BAY CITY
695 REPORT	MONTHLY PROGRESS REPORT	MATHEW HARTMAN, MDEQ	THOMAS KERN, WMI	12/13/96	BAY CITY

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696 CORRESPONDENCE	MEETING WITH SCA SERVICES ON THE DECOMMISSSIONING OF THE HARTLEY & HARTLEY LANDFILL	JOHN HICKEY, LLDP BRANCH	JACK PARROTT, NRC	12/3/96	BAY CITY
697 CORRESPONDENCE	WORK PLAN ADDENDUM WASTE CHARACTERIZATION ACTIVITIES SCA/HARTLEY & HARTLEY LANDFILL SITE	MATHEW HARTMAN, MDNR	THOMAS KERN, WMI	11/26/96	BAY CITY
698 CORRESPONDENCE	SEMI-ANNUAL WATER LEVEL MEASUREMENTS - NOVEMBER 1996, HARTLEY & HARTLEY LANDFILL	MATHEW HARTMAN, MDNR	CARL SHOW, RUST	11/13/96	BAY CITY
699 CORRESPONDENCE	SUBMISSION OF DOSE CALCULATION REPORT SCA/HARTLEY & HARTLEY LANDFILL SITE	JACK PARROTT, NRC	THOMAS KERN, WMI	11/23/96	BAY CITY
700 INSPECTION	NRC INSPECTION OF MDNR LANDFILL	DENISE GRUBEN, MDNR	CYNTHIA PEDERSON, NRC	9/3/96	BAY CITY
701 ACTIVITY REPORT	ACTIVITY REPORT ANNUAL NRC INSPECTION		MDEQ	8/8/96	
702 CORRESPONDENCE	SEMI-ANNUAL WATER LEVEL MEASUREMENTS - NOVEMBER 1995	MATHEW HARTMAN, MDNR	CARL SHAW, RUST	1/10/96	BAY CITY
703 PERMIT	FENCE INSTALLATION AT THE HARTLEY & HARTLEY LANDFILL	MIKE JURY, MDNR	LYDIA KUYANA, RUST	8/31/93	BAY CITY
704 CORRESPONDENCE	SCA CLEANUP	DAN SCHULTZ, MDNR	RJHT, MDNR	8/2/84	BAY CITY
705 SITE INFORMATION				2/1/90	BAY CITY
706 TAPE	TAPE TRANSCRIPT			8/3/83	BAY CITY
707 REPORT	REMEDIAL INVESTIGATION FINAL REPORT. PREPARED FOR MDNR			12/1/86	BAY CITY
708 REPORT	CONSTRUCTION SPECIFICATIONS. SLURRY WALL CAP AND MONITORING SYSTEM FOR SCA SITE			3/30/84	BAY CITY
709 REPORT	HARTLEY & HARTLEY LITIGATION REPORT			1/1/90	BAY CITY
710 CERTIFICATE	CERTIFICATE OF MERGER OF CONSOLIDATED VENDORS CORPORATION INTO SCA SERVICES OF MICHIGAN				BAY CITY
711 REPORT	HARTLEY & HARTLEY LITIGATION REPORT			1/1/90	BAY CITY
712 REPORT	HARTLEY & HARTLEY LITIGATION REPORT			1/1/90	BAY CITY
713 CORRESPONDENCE	HARTLEY & HARTLEY LAB RESULTS 1984-1986				BAY CITY
714 MAP	MONITORING WELL LOCATION MAP SCA SERVICES, INC.			7/1/81	BAY CITY
715 CHRONOLOGY	HARTLEY & HARTLEY 1969 CHRONOLOGY				BAY CITY
716 REPORT	DRAFT TECHNICAL MEMORANDUM. BACKGROUND RADIONUCLIDE CONCENTRATION DETERMINATION AND PROCEDURE FOR STATISTICAL COMPARISON OF SURVEY AND REFERENCE RADIONUCLIDE DATA. PREPARED FOR			7/1/96	BAY CITY
717 REPORT	TECHNICAL MEMORANDUM. HISTORICAL DATA EVALUATION. SCA/HARTLEY & HARTLEY LANDFILL. VOLUME 2 OF 2. PREPARED FOR SCA			1/1/95	BAY CITY
718 REPORT	TECHNICAL MEMORANDUM. HISTORICAL DATA EVALUATION. SCA/HARTLEY & HARTLEY LANDFILL. VOLUME 1 OF 2. PREPARED FOR SCA			1/1/95	BAY CITY
719 CORRESPONDENCE	HARTLEY & HARTLEY SITE	LISA BOETTCHER, MDNR	IAN HALBEISEN, MDNR	2/25/93	BAY CITY

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720 DATA		MICHAEL JURY, MDNR	MEG MacLEOD, H.P. ABB ES	9/23/94	BAY CITY
721 CORRESPONDENCE	DATA EVALUATION, SOIL BORING SAMPLES, HARTLEY & HARTLEY, NOVEMBER 1991	RICK DUNKIN, ABB	JAN WILLIAMS	1/17/92	BAY CITY
722 DATA	DEQ LAB REPORT			12/14/95	BAY CITY
723 DATA	DNR LAB REPORT			2/2/95	BAY CITY
724 REPORT	CONSTRUCTION SPECIFICATIONS HARTLEY & HARTLEY LANDFILL			3/30/84	BAY CITY
725 REPORT	HARTLEY & HARTLEY SANITARY LANDFILL, HYDROGEOLOGICAL INVESTIGATION AND CLOSURE CERTIFICATION	PETER DUNLAP, SCA	SALVATORE ARLOTTA, WEHRAN ENGINEERING	9/19/79	BAY CITY
726 REPORT		DAVID ERTZ, E. C. JORDAN	MARGARET CORNISH, MDNR	11/18/85	BAY CITY
727 CORRESPONDENCE	HARTLEY & HARTLEY FINAL REMEDY			2/26/90	BAY CITY
728 DATA	RESULTS FROM 11/91 SAMPLING EVENTS			11/1/91	BAY CITY
729 REPORT	HARTLEY & HARTLEY LANDFILL SITE, FIELD DATA CONFIRMATION PHASE. SHALLOW SOIL SAMPLING AND ANALYSIS				BAY CITY
730 INSPECTION	INSPECTION OF TOBICO GAME AREA	JEROME MASLOWSKI	PAUL REARICK	7/10/69	BAY CITY
731 INSPECTION	INSPECTION OF HARTLEY & HARTLEY AND BANGOR TOWNSHIP LANDFILLS	CRAIG SMITH	KARL KIDDER	2/23/70	BAY CITY
732 MAP	HARTLEY & HARTLEY - BANGOR TOWNSHIP DUMP			8/20/70	BAY CITY
733 CORRESPONDENCE	SUBJECT PONDING OF OIL - HARTLEY & HARTLEY, INC.	H. A. YOUNG	R. SHAVER	11/11/71	BAY CITY
734 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID AND SOLID WASTE LANDFILL OPERATIONS	JOHN BOHUNSKY	JOHN COSENS	1/25/74	BAY CITY
735 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID AND SOLID WASTE LANDFILL INSPECTION	DAVID DENNIS, MDNR	ROLAND SHAVER	11/7/74	BAY CITY
736 CORRESPONDENCE	FIELD INSPECTION, HARTLEY & HARTLEY	D. H. JENKINS, MDNR	MARVIN JOHNSON, MDNR	5/8/78	BAY CITY
737 CORRESPONDENCE	HARTLEY & HARTLEY SOLID WASTE DISPOSAL FACILITY	JAMES TRUCHAN, ENVIRONMENTAL ENFORCEMENT DIVISION	LARRY THORNTON, MDNR	5/12/78	BAY CITY
738 CORRESPONDENCE	SAMPLES FROM TOBICO MARSH, DOWNWIND FROM HARTLEY & HARTLEY	JACK BAILS, MDNR	THOMAS ROHRER	10/19/78	BAY CITY
739 CHRONOLOGY	HARTLEY & HARTLEY	PROBLEM EVALUATION COMMITTEE	DENNIS SWANSON, MDNR	7/10/79	BAY CITY
740 CORRESPONDENCE	HARTLEY & HARTLEY PROGRESS REPORT - ONGOING CORRECTIVE ACTION.	LARRY THORNTON, MDNR	ART CADEN, MDNR	6/15/79	BAY CITY
741 CORRESPONDENCE	HARTLEY & HARTLEY	LARRY THORNTON, MDNR	ART CADEN, MDNR	4/17/79	BAY CITY
742 DATA	SURVEY RECORD OF WELL LOCATION			11/15/79	BAY CITY
743 CORRESPONDENCE	DOW CORNING DPR GELS	FILES, MDNR	ARTHUR CADEN, MDNR	6/15/78	BAY CITY

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744 SITE INFORMATION	FIGURE 1 - PLAN MAP OF WELL 1, 2 & 4				BAY CITY
745 CORRESPONDENCE		MARTIN SCHUMACHER, NRC	LINDA SOWELL, OAK RIDGE	8/17/84	BAY CITY
746 CORRESPONDENCE	MEETING WITH NRC AND MDPH ON AUGUST 8, 1991	HARTLEY & HARTLEY	MIKE JURY, MDNR		BAY CITY
747 CHRONOLOGY					BAY CITY
748 CORRESPONDENCE	SCA CLEANUP OF CLOSED HARTLEY & HARTLEY LANDFILL	STEWART FREEMAN	JACK BAILS, MDNR	10/31/83	BAY CITY
749 REGULATION	INTERIM STANDARDS FOR THE CONTROL OF NORM ASSOCIATED WITH THE OIL AND GAS INDUSTRY IN MICHIGAN				BAY CITY
750 CORRESPONDENCE	FAIR HARTLEY ENERGIES, WEBER TRUST #1-25	C. TROY YODER, MDNR	DANIEL BERTALAN, MDNR	12/14/79	BAY CITY
751 CORRESPONDENCE	FAIR HARTLEY ENERGIES	FAIR HARTLEY ENERGIES	BENJAMIN CUNNING, MDNR	2/4/82	BAY CITY
752 CORRESPONDENCE	FAIR HARTLEY ENERGIES	FAIR HARTLEY ENERGIES	BENJAMIN CUNNING	9/4/80	BAY CITY
753 CORRESPONDENCE		BENJAMIN CUNNING	TYRUS HARTLEY	5/10/82	BAY CITY
754 CORRESPONDENCE		MARTIN SCHUMACHER	JOSEPH HENNIGAN	8/16/84	BAY CITY
755 CORRESPONDENCE	SCA LANDFILL, KAWKAWLIN - RADIOACTIVE MATERIAL MONITORING CRITERIA	THOMAS SCHIMPH	GEORGE BRUCHMANN	8/16/84	BAY CITY
756 REGULATION	NORM GUIDE N.1. GUIDANCE FOR CONDUCTING SCREENING SURVEYS FOR NATURALLY-OCCURRING RADIOACTIVE MATERIAL (NORM)				BAY CITY
757 REGULATION	NORM GUIDE N.2. GUIDANCE FOR CONDUCTING SURVEYS FOR NATURALLY-OCCURRING RADIOACTIVE MATERIAL (NORM) TO ALLOW RELEASE FOR UNRESTRICTED USE				BAY CITY
758 CORRESPONDENCE	HARTLEY & HARTLEY - TOBICO MARSH	BILL BRADFORD, MDNR	DAN SCHUTZ, MDNR	4/18/83	BAY CITY
759 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	M. SCHUMACHER		BAY CITY
760 REPORT	RADIOLOGICAL SURVEY OF HARTLEY & HARTLEY PROPERTY.				BAY CITY
761 CHRONOLOGY					BAY CITY
762 CHRONOLOGY					BAY CITY
763 CHRONOLOGY	RHSD CHRONOLOGY ON SCA (MDNR) LANDFILL				BAY CITY
764 DATA	MDEQ ENVIRONMENTAL LABORATORY			5/2/96	BAY CITY
765 MAP	SCA CHEMICAL SERVICES INC. SITE PLAN. DATED 3/30/84.			3/30/84	BAY CITY
766 MAP	SCA CHEMICAL SERVICES INC. EXISTING FACILITIES MAP			3/12/84	BAY CITY
767 MAP	SCA CHEMICAL SERVICES INC. SITE PROFILE AND SECTIONS			6/28/84	BAY CITY

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768 MAP	SCA CHEMICAL SERVICES INC. CONTOUR MAP OF CLAY CAP			2/2/84	BAY CITY
769 MAP	EASEMENT ACROSS THE FORMER HARTLEY & HARTLEY LANDFILL FOR THE MDNR				BAY CITY
770 MAP	SCA SERVICES, HARTLEY & HARTLEY			9/28/94	BAY CITY
771 MAP	SCA SERVICES, HARTLEY & HARTLEY			9/24/94	BAY CITY
772 MAP	HARTLEY & HARTLEY RECYCLING AND DISPOSAL FACILITY, BAY COUNTY, MICHIGAN			5/1/92	BAY CITY
773 MAP	HARTLEY & HARTLEY RECYCLING AND DISPOSAL FACILITY, BAY COUNTY, MICHIGAN			5/1/92	BAY CITY
774 MAP	HARTLEY & HARTLEY RECYCLING AND DISPOSAL FACILITY, BAY COUNTY, MICHIGAN.				BAY CITY
775 MAP	HARTLEY & HARTLEY RECYCLING AND DISPOSAL FACILITY, BAY COUNTY, MICHIGAN.				BAY CITY
776 MAP	SCA CHEMICAL SERVICES, INC. PERIMETER PROFILE AS BUILT. MDNR SITE			2/16/85	BAY CITY
777 MAP	SCA CHEMICAL SERVICES, INC. HARTLEY & HARTLEY LANDFILL MAGNETOMETER SURVEY			3/10/83	BAY CITY
778 CORRESPONDENCE	INDUSTRIAL AND OIL FIELD WASTE DISPOSAL PROBLEM	JOHN BYERLAY, MDNR	V. F. SARGENT, MDNR	7/17/69	BAY CITY
779 CORRESPONDENCE	FIELD INPSECTION - HARTLEY & HARTLEY COMMERCIAL DUMP AND BANGOR TOWNDHIP SANITARY LANDFILL	D. W. DOUGLASS, MDNR	ARLOW BOYCE, MDNR	4/13/70	BAY CITY
780 REPORT	AERIAL SURVEILLANCE OF HARTLEY & HARTLEY AREA	ARLOW BOYCE	O.J. BENNETT	9/2/70	BAY CITY
781 CORRESPONDENCE		JEROME MASLOWSKI	THOMAS PRAWDZIK, DISTRICT WILDLIFE BIOLOGIST, MDNR	11/10/71	BAY CITY
782 CORRESPONDENCE	HARTLEY & HARTLEY POND DIKE FAILURE	J. BOHUNSKY	L. VAHOVICK	11/11/71	BAY CITY
783 ARTICLE	BOSTON OUTFIT BUYS LOCAL WASTE FIRM				BAY CITY
784 CORRESPONDENCE		HARTLEY & HARTLEY	ROBERT COURCHAINE	8/2/74	BAY CITY
785 CORRESPONDENCE		S. J. SIMMONS, WELLMAN-DYNAMICS	JAMES KEPPLER, NRC		BAY CITY
786 DATA	MDNR ENIVRONMENTAL LABORATORY			5/5/88	BAY CITY
787 DATA	DNR LABORATORY REPORT			5/5/88	BAY CITY
788 DATA	DNR LABORATORY REPORT			5/5/88	BAY CITY
789 CORRESPONDENCE	THORIUM - MAGNESIUM ALLOY LICENSE	ATOMIC ENERGY COMMISSION, AEC	O. T. WELLMAN, WELLMAN-DYNAMICS	10/8/57	BAY CITY
790 CORRESPONDENCE	PROCTOR AND GAMBLE RECORDS	GARY FINKBEINER	BRETT HEINRICH, WASTE MANAGEMENT	4/27/94	BAY CITY
791 CORRESPONDENCE	CORRECTED ANALYTICAL RESULTS FORMAT	LABORATORY USERS	BOB NORDLUND	8/24/87	BAY CITY

792 PERMIT	WASTEWATER DISCHARGE PERMIT			10/26/90	BAY CITY
793 CORRESPONDENCE	TREATMENT OF STATE OWNED HARTLEY & HARTLEY LANDFILL LEACHATE AT WEST BAY COUNTY WWTP, BAY CITY	KATHY BREWER, MDNR	LISA BOETTCHER, MDNR	9/13/90	BAY CITY
794 CORRESPONDENCE		LARRY, MDNR	LISA BOETTCHER, MDNR	10/9/90	BAY CITY
795 REPORT	RECT CONTACT				BAY CITY
796 CORRESPONDENCE	MEETING WITH MICHIGAN CHEMICAL REPRESENTATIVES	FILES, MDNR	JOHN BOHUNSKY, MDNR	5/7/75	BAY CITY
797 CORRESPONDENCE		ROBERT COURCHAINE, MDNR	PATRICK LINCOLN, MICHIGAN CHEMICAL CORP.	5/13/75	BAY CITY
798 REPORT	MICHIGAN CHEMICAL COMPANY. STATUS REPORT ON PBB CLEANUP				BAY CITY
799 CORRESPONDENCE		JOHN BOHUNSKY	MICHIGAN CHEMICAL CORP.	8/20/75	BAY CITY
800 CORRESPONDENCE		JOHN SHAUVER, MDNR	DONALD BRADY, HARTLEY & HARTLEY	12/17/75	BAY CITY
801 REPORT	1989 SEMI-ANNUAL GROUNDWATER MONITORING RESULTS FOR THE HARTLEY & HARTLEY FACILITY IN KAWKAWLIN, MICHIGAN	DAN SCHULTZ, MDNR	MICHAEL REARDON	1/3/90	BAY CITY
802 CORRESPONDENCE	SCA LANDFILL, KAWKAWLIN MICHIGAN	REGION III FILES	C. J. PAPERIRLLO	10/30/84	BAY CITY
803 CORRESPONDENCE		DEL RECTOR, MDNR	JOHN VOELPEL, ATTORNEY FOR HARTLEY & HARTLEY INC.	6/8/78	BAY CITY
804 CORRESPONDENCE	FIELD INSPECTION, HARTLEY & HARTLEY INC.	D. JENKINS, MDNR	MARVIN JOHNSON, MDNR	5/8/78	BAY CITY
805 CORRESPONDENCE		DAVID MILLER, WMI	SUE KAELBER MATLOCK, MDNR	2/11/87	BAY CITY
806 CORRESPONDENCE	HARTLEY & HARTLEY, KAWKAWLIN, MICHIGAN	DAN SCHULTZ, MDNR	DAVID MILLER, WMI	3/31/89	BAY CITY
807 CORRESPONDENCE		DONALD BRADY, HARTLEY & HARTLEY	DELBERT RECTOR, AIR QUALITY DIVISION, MDNR	7/30/75	BAY CITY
808 CORRESPONDENCE	DISCHARGE OF PURGED GROUNDWATER FROM HARTLEY & HARTLEY WASTE DISPOSAL SITE TO THE WEST BAY COUNTY REGIONAL WWTP	ALLAN BROUILLET, MDNR	MICHAEL MASTERSON, MDNR	12/9/87	BAY CITY
809 ARTICLE	1. OIL FIELD SPILL CLEANUP; 2. CHEM-TROL AD			1/1/77	BAY CITY
810 CORRESPONDENCE	INCINERATION OF METHYL ETHYL KETONE AT HARTLEY & HARTLEY	BEN WHITE, MDNR	JIM MILLER, MDNR	10/19/77	BAY CITY
811 CORRESPONDENCE		WASTE MANAGEMENT OF NORTH AMERICA, WMNA	M. SCHUMACHER	10/19/88	BAY CITY
812 CORRESPONDENCE	SCA/HARTLEY & HARTLEY	ROSS POWERS, EPA	GARY GETTEL, MDNR	5/17/83	BAY CITY
813 FIELD NOTE	FIELD REVIEW OF PROPOSED WELL SITE			4/10/80	BAY CITY
814 SITE INFORMATION	LOG OF OIL, GAS, DISPOSAL FOR STORAGE WELL			8/6/82	BAY CITY
815 CORRESPONDENCE	FAIR HARTLEY & HARTLEY ENERGIES, WEBER #1-25	C. TROY YODER, MDNR	SAMUEL ALGUIRE, MDNR	8/4/80	BAY CITY

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816 PERMIT	APPLICATION FOR PERMIT TO DRILL OR DEEPEN A WELL FOR OIL, GAS, BRINE DISPOSAL HYDROCARBON STORAGE AR SECONDARY RECOVERY			8/8/80	BAY CITY
817 CORRESPONDENCE	KAWKAWLIN DIGGINGS	SYUD, BEN, MDNR	SARGE, MDNR		BAY CITY
818 CORRESPONDENCE	HARTLEY & HARTLEY WASTE DISPOSAL AREA	CHARLES HARRIS, MDNR	JOHN BYERLAY, MDNR	10/2/69	BAY CITY
819 COURT	COMMENTS OF THE MICHIGAN UNITED CONSERVATION CLUBS TO THE MDNR REGARDING THE PROPOSED FINAL CONSENT ORDER WITH SCA SERVICES, INC.			6/8/78	BAY CITY
820 CORRESPONDENCE		JAMES MILLER, U.S. NRC	GEORGE BRUCHMANN	7/12/83	BAY CITY
821 DATA		SCA	CLOW	3/15/83	BAY CITY
822 CORRESPONDENCE		LORENZO CABRERA, ABB	DREW LONERGAN, ABB	5/15/97	BAY CITY
823 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID WASTE FACILITY INSPECTION	RONALD SHAVER	REBERT KETTNER	1/23/75	BAY CITY
824 REPORT	STAFF REPORT BIOLOGICAL AND CHEMICAL SURVEY OF TOBICO MARSH GAME AREA, INDIAN TOWN DRAIN, AND KAWKAWLIN RIVER IN ASSOCIATION WITH HARTLEY & HARTLEY INC			6/2/77	BAY CITY
825 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID AND SOLID WASTE OPERATIONS, BANGOR TOWNSHIP	JOHN BOHUNSKY	JOHN COSENS	1/25/74	BAY CITY
826 CORRESPONDENCE	HARTLEY & HARTLEY LIQUID AND SOLID WASTE LANDFILL OPERATION	JOHN BOHUNSKY	JOHN COSENS	10/1/73	BAY CITY
827 CORRESPONDENCE	BANGOR TOWNSHIP AND HARTLEY & HARTLEY REFUSE DISPOSAL FACILITIES.	JEROME MASLOWSKI	FRED B. KELLOW, ENVIRONMENTAL PROTECTION BRANCH/LARRY R. THORNTON, ENVIRONMENTAL SANITATION	7/14/69	BAY CITY
828 CORRESPONDENCE		B. SHAH, MDNR	ROBERT MUTCH	10/6/78	BAY CITY
829 CORRESPONDENCE	FIELD INSPECTION OF BANGOR TOWNSHIP LANDFILL ANDHARTLEY & HARTLEY	C. D. HARRIS, MDNR	ARLOW BOYCE, MDNR	7/23/70	BAY CITY
830 REPORT	SITE PROGRESS REPORTS		RANDALL MOORE	10/12/92	BAY CITY
831 DATA	DNR LABORATORY REPORT			5/5/88	BAY CITY
832 DATA	DNR LABORATORY REPORT			11/3/89	BAY CITY
833 CORRESPONDENCE		WASTE MANAGEMENT OF NORTH AMERICA, WMNA	M. SCHUMACHER		BAY CITY
834 CORRESPONDENCE	RADIOACTIVITY SURVEY OF MDNR LAND NEAR BAY CITY, MICHIGAN	JOSEPH HENNIGAN	ROBERT DEHAAN	5/2/83	BAY CITY
835 CORRESPONDENCE	PHASE II RECOMMENDATION FOR HARTLEY & HARTLEY, SECTION 25, T15N, R4E	FILES	JOHN JUROSZEK	10/12/81	BAY CITY
836 ACTIVITY REPORT			MICHAEL JURY	10/12/92	BAY CITY
837 ACTIVITY REPORT			MICHAEL JURY	9/28/92	BAY CITY
838 ACTIVITY REPORT			MICHAEL JURY	9/21/92	BAY CITY
839 ACTIVITY REPORT			MICHAEL JURY	9/14/92	BAY CITY

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840 ACTIVITY REPORT			MICHAEL JURY	9/9/92	BAY CITY
841 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	W. D. SHAFER, MDNR		BAY CITY
842 DATA	DATA MANAGEMENT SUMMARY REPORT			5/29/85	BAY CITY
843 REPORT					BAY CITY
844 CORRESPONDENCE		TOM KERN	RUSS OGLE	8/7/92	BAY CITY
845 ACTIVITY REPORT			MICHAEL JURY	7/14/92	BAY CITY
846 DATA	HARTLEY & HARTLEY SAMPLING			5/7/92	BAY CITY
847 ACTIVITY REPORT			MICHAEL JURY	5/19/92	BAY CITY
848 REPORT	TRIP REPORT - PUBLIC MEETING AT KAWKAWLIN TOWNSHIP HALL	ROY CANIANO	D. G. WEIDEMAN, MDNR	3/16/92	BAY CITY
849 CORRESPONDENCE		DAVID MILLER, WMI	M.SCHUMACHER	10/6/87	BAY CITY
850 CORRESPONDENCE	HARTLEY & HARTLEY LANDFILL PHASE II BID PACKAGE	RICK DUNKIN, ABB	JASON BELL, ABB	4/9/92	BAY CITY
851 CORRESPONDENCE		LISA BOETTCHER, MDNR	TERRY SMART, WMNA	2/6/92	BAY CITY
852 CORRESPONDENCE		DAVID MILLER, WMI	W. D. SHAFER, MDNR	6/21/88	BAY CITY
853 ARTICLE	1. TESTS BEGIN AT OLD DUMP IN KAWKAWLIN. 2. NO RADIATION RISK. 3. NO RADIATION RISKS. 4. HOT SPOT NEAR SAGINAW RIVER. 5. WASTE IS ALSO BURIED AT HARTLEY SITE.			3/27/92	BAY CITY
854 REPORT	REMEDIAL ACTION	ALL BIDDERS	MDNR	4/24/92	BAY CITY
855 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	M SCHUMACHER	10/6/87	BAY CITY
856 CORRESPONDENCE		GEORGE BRUCHMAN, MDPH	M. SCHUMACHER	10/19/88	BAY CITY
857 INTERVIEW	TAPE TRANSCRIPT			8/3/83	BAY CITY
858 REGULATION	NRC APPROVES ACTION PLAN TO ASSURE TIMELY CLEANUP OF SITES CONTAMINATED WITH RADIOACTIVE MATERIALS.			4/8/92	BAY CITY
859 CORRESPONDENCE		RICK DUNKIN, ABB	LISA BOETTCHER, MDNR	4/14/92	BAY CITY
860 CORRESPONDENCE	RADIOLOGICAL SURVEY AT HARTLEY & HARTLEY LIQUID INCINERATOR AND TREATMENT PLANT, KAWKAWLIN, MICHIGAN	ROBERT BOWDEN	TECHNICAL ASSISTANCE TEAM	5/2/83	BAY CITY
861 CORRESPONDENCE	HARTLEY & HARTLEY SYSTEM	JERUM	LEEMON	2/25/92	BAY CITY
862 CORRESPONDENCE	SAMPLING AT HARTLEY & HARTLEY LANDFILL	PETER OLLILA, MDNR	N MICHAEL HARRIS, MDNR	2/27/92	BAY CITY
863 CORRESPONDENCE		JEROME MASLOWSKI	JOHN BYERLAY, MDNR	7/31/89	BAY CITY

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864 CORRESPONDENCE	BANGOR TOWNSHIP AND HARTLEY & HARTLEY LANDFILLS	RICHARD HADFIELD	JOHN BYERLAY, MDNR	7/30/70	BAY CITY
865 CORRESPONDENCE	HELP WITH WELL DEVELOPMENT	NOYCER	LISA BOETTCHER, MDNR		BAY CITY
866 ARTICLE	SOIL SURVEY. CLASSIFICATION OF SOILS				BAY CITY
867 ACTIVITY REPORT	ACTIVITY REPORT FOR HARTLEY & HARTLEY LANDFILL			5/5/92	BAY CITY
868 ACTIVITY REPORT	HARTLEY & HARTLEY STATES PORTION (MDNR)			1/15/92	BAY CITY
869 ARTICLE	NOTICE OF A PROPOSED PLAN FOR REMEDIAL ACTION.			1/24/92	BAY CITY
870 CORRESPONDENCE	12' ACCESS ROAD AT THE OLD HARTLEY & HARTLEY LANDFILL, APPORXIMATELY 1.3 MILES IN LENGTH.	MICHAEL JURY, MDNR	STEVEN O MARA	4/6/92	BAY CITY
871 PHOTOGRAPH	AERIAL PHOTOGRAPH		ABB	4/11/54	FARMINGTON HILLS
872 PHOTOGRAPH	AERIAL PHOTOGRAPH		ABB	3/13/66	FARMINGTON HILLS
873 PHOTOGRAPH	AERIAL PHOTOGRAPH		ABB	10/20/78	FARMINGTON HILLS
874 PHOTOGRAPH	AERIAL PHOTOGRAPH		ABB	6/17/87	FARMINGTON HILLS
875 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
876 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	7/1/69	LANSING
877 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	7/1/69	LANSING
878 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
879 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
880 CORRESPONDENCE	HARTLEY & HARTLEY/SCA	RICK JOHNS, MDNR	DAN SCHULTZ, MDNR	5/10/84	LANSING
881 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
882 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
883 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
884 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
885 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
886 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING
887 PHOTOGRAPH	AERIAL PHOTOGRAPH		MDNR	5/11/83	LANSING

888 PHOTOGRAPH	AERIAL PHOTOGRAPH	MDNR	7/1/69	LANSING
889 PHOTOGRAPH	HARTLEY & HARTLEY AND MDNR PHOTOGRAPHS	MDNR		LANSING
890 PHOTOGRAPH	HARTLEY & HARTLEY AND MDNR SITES	MDNR		LANSING
891 PHOTOGRAPH	AERIAL PHOTOGRAPH	MDNR	5/11/83	LANSING
892 PHOTOGRAPH	AERIAL PHOTOGRAPH	MDNR	5/11/83	LANSING
893 PHOTOGRAPH	AERIAL PHOTOGRAPH	MDNR	5/11/83	LANSING
894 PHOTOGRAPH	AERIAL PHOTOGRAPH	MDNR	7/1/69	LANSING
895 MAP	HYDROGEOLOGIC INVESTIGATION & CLOSURE CERTIFICATION		8/1/75	
896 MAP	TOBICO MARSH STATE GAME AREA - CONSTRUCTION PLANS FOR HARTLEY & HARTLEY LANDFILL DEWATERING & CAP REPAIR - PHASE II		1/28/93	
897 MAP	PROPERTY SURVEY FOR HARTLEY & HARTLEY		3/9/78	
898 MAP	SOIL BORING, MONITORING WELL, SURFACE WATER ANE SEDIMENT LOCATION MAP			
899 MAP	VERTICAL CONTROL FOR CLAY CAPPING OF DISPOSAL SITE A HARTLEY & HARTLEY LANDFILL SITE IN NE 1/4 OF SECTION 25, T15N, R4E, KAWKAWLIN TWP., BAY COUNTY, MICHIGAN		10/18/84	
900 REGULATION	MULTI-AGENCY RADIATION SURVEY AND SIT INVESTIGATION MANUAL (MARSSIM)		12/1/96	FARMINGTON HILLS
901 MAP	LOCATION OF MONITORING WELLS AT THE HARTLEY & HARTLEY LANDFILL		9/6/94	
902 MAP	PROPOSED SANITARY LANDFILL DEVELOPMENT		1/1/75	
903 MAP	HARTLEY & HARTLEY LANDFILL SITE BENCH MARK LOCATIONS		9/28/88	
904 MAP	EXISTING FLOW DIAGRAM		5/5/95	
905 MAP	TOBICO MARSH LOCATION MAP			
906 MAP	DEPARTMENT OF NATURAL RESOURCES - BAY COUNTY			
907 MAP	HARTLEY & HARTLEY SANITARY LANDFILL - BAY CITY, MIICHIGAN		8/30/97	
908 MAP	KAWKAWLIN AND FRASER TOWNSHIPS WATER DISTRIBUTION SYSTEM		2/19/82	
909 MAP	GEOLOGIC SECTION		5/22/80	
910 MAP	CHLORIDE INFILTRATION			
911 MAP	TOBICO MARSH STATE GAME AREA		5/3/78	

APPENDIX A
Documents Reviewed for the Development of HSA

912 PHOTOGRAPH	06-14-73 AERIAL PHOTO OF THE MDNR SITE			6/14/73	FARMINGTON HILLS
913 PHOTOGRAPH	05-14-69 AERIAL PHOTO OF MDNR SITE			5/14/69	FARMINGTON HILLS
914 DATA	RADIOLOGICAL SCREENING OF WELLS	MDNR	MDNR	10/10/91	BAY CITY
915 CORRESPONDENCE	LANDFILL LEACHATE AT WEST BAY COUNTY WASTEWATER TREATMENT PLANT	MDNR	MDNR	1/16/91	BAY CITY
916 REPORT	THE LEACHATE TREATMENT FACILITIES AT THE STATE-OWNED PORTION OF THE HARTLEY & HARTLEY SITE.	MDNR	WOODWARD-CLYDE	6/1/97	FARMINGTON HILLS

EXCERPTS FROM 1986 REMEDIAL INVESTIGATION, E.C. JORDAN CO, CHRONOLOGY AND BIBLIOGRAPHY, FIGURES 3, 5 AND 6

APPENDIX A
A.1 CHRONOLOGICAL SITE HISTORY
A.2 TERRAIN CONDUCTIVITY FIELD MEASUREMENTS

1957:

State of Michigan purchased 1,694 acres of land to start the Tobico State Game Area. (1)

1960:

Wayne T. Hartley and his son formed a corporation named Hartley and Hartley, Inc.

1962:

Hartley and Hartley, Inc. began disposing of solid and liquid wastes on the ground, in pits and surface water ponds. Typical wastes included: foundry core sand, various drummed liquid chemicals, cutting oils, oil-field tank bottoms, and oil-field brines (1) and non-radioactive waste from Wellman Dynamics Corporation in Bay City. (31)

MDNR discovered that private land owned by Hartley and Hartley, Inc. was being used as a landfill and some of the waste was also disposed of on adjacent State of Michigan property. (31)

1966:

In December, a MDNR field inspection indicated presence of rats, uncovered refuse, open burning, odors, and dumping of refuse in open water. (8)

1967:

March - Michigan Department of Public Health (MDPH) field inspection report indicates situation unchanged. (8)

September - MDPH issues Hartley and Hartley, Inc. first Act 87, P.A. 1965 sanitary landfill license with stipulation that groundwater must be protected. (8,28)

MDNR field inspection report noted that a perimeter dike on north side of the Hartley and Hartley landfill was seeping into a trench area and that materials were being stored in ponds and occasionally burned. (8)

1968:

August - Hartley and Hartley applied for renewal of sanitary landfill license. (8)

1969:

February - First trespass and pollution of state land was discovered by MDNR district biologist. (1)

March - MDPH approves relicensing of Hartley and Hartley, Inc. to operate 5.5 acres of sanitary landfill. (8,9)

At a meeting with MDNR district biologist and law supervisor, Hartley and Hartley, Inc. agreed to bury 100 tons of potato wastes openly disposed of on state land. (1)

July - Aerial photograph taken of Hartley and Hartley landfill showed many drums (barrels) on the surface of the landfill and state property. (29,31)

MDPH, MDNR, and Bay County Health Department (BCHD) conducted field inspection of the Hartley and Hartley site and found trespassing, pollution, and vegetation killed on state land. (1)

Surface water samples taken from state land immediately adjacent to landfill indicated elevated levels of organics, chlorides, and sulfates. (1)

Hartley and Hartley, Inc. was requested to remove barrels from state land. (9)

August - At a court hearing in Lansing, Michigan, the State Attorney General informed Hartley and Hartley, Inc. of four locations of trespass and gross pollution of state land. The Attorney General also presented Hartley and Hartley, Inc. with a list of six requested actions to repair trespass violations, pollution damage, and vegetation killed on 11.64 acres of state land. (1,28)

October - Hartley and Hartley, Inc. received a Permit-to-Install for a liquid waste incinerator from the MDNR-Air Quality Division. (24)

MDNR field inspection of state land surrounding Hartley and Hartley, Inc. reported chemicals have migrated into state land affecting approximately 30 acres. Ground disposal of brine wastes has resulted in surface and ground water of inferior quality. (8)

At a second court hearing in Lansing, Mr. Hartley promised to have a high temperature liquid incinerator in operation by January, 1970; ask customers to hold liquid wastes until incinerator is operating; eliminate dumping of liquid wastes on the ground; remove all oil drums and solid wastes from state land; and dispose of all water accumulating in his landfill via incinerator. (1)

MDNR memo to Charlie Harris, Deputy Director, MDNR, from John Byerlay of MDNR. Geological survey indicated the presence of shallow disposal wells being used for brine, and recommended MDPH revoke Hartley and Hartley, Inc. Act 87, P.A. 1965 license. (9)

Numerous reports of open burning (liquids) and smoke problems throughout the year. (8)

The Hartley and Hartley Sanitary Landfill operation was expanded to approximately 200 acres by 1970 and at that time was one of the largest land disposal operations of its kind in the Bay City - Saginaw area. (1)

1970:

March - MDNR field inspection of Hartley & Hartley found recent disposal of liquid wastes in open pits, and steel drums recently dumped on state land. The high temperature incinerator was being warmed up for operation March 12. Several photographs of trespass evidence were taken. (1)

April - MDNR field inspection found the incinerator not operating, one trespass area covered but no indication of metal or chemical waste removal, trucks dumping refuse outside licensed landfill, fresh waste oil overflowing on to state land, open fires burning outside landfill area without permit, previous day's refuse not covered, and water accumulating in landfill covered with floating garbage and refuse. (1)

MDNR memorandum to Fred Kellow MDPH from C.C. Harris MDNR Deputy Director requesting immediate revocation of Hartley and Hartley, Inc. sanitary landfill license. (9)

MDPH issues Hartley and Hartley a Notice of Intent-to-Deny license to operate citing several violations. (8)

June - Hearing held on Notice of Intent-to-Deny license to operate a sanitary landfill to Hartley and Hartley, Inc. Hearing examiner Victor Meier agreed to allow Hartley and Hartley, Inc. to continue operations with stipulations. (1,9)

MDNR inter-office memo to C. Harris, Deputy Director from A. Boyce, Game Division, indicated trespass area to north of Hartley and Hartley Landfill had been covered with sand and seeded. Also, Mr. Hartley mentioned to A. Boyce that not all of the barrels had been removed.(9)

MDPH issues Act 87 license to Hartley and Hartley, Inc. for operation of 5.5 acres as a sanitary landfill with the stipulations that future refuse collected be spread and composted daily and that no refuse be deposited in groundwater. (8,9)

August - Letter to D. Van Farowe, MDPH from S.J. Simmons, Director Industrial Relations and Procurement, Wellman-Dynamics Corporation states, "We have a contract with Hartley and Hartley, Bay City, Michigan, to provide the labor and land for burial (of their radioactive thorium melting pot sludge wastes). Wellman would retain possession of the material until burial and would supervise the actual burial." (31)

September - Attorney General filed law suit to force settlement of trespass litigation brought against Hartley and Hartley, Inc. (2)

Ether odors reported emanating from Hartley and Hartley, Inc. (8)

November - MDPH issues a second Act 87 license to Hartley and Hartley, Inc. to operate an additional two (2) acres as a sanitary landfill, giving Hartley and Hartley a total of 7.5 acres. (9)

1971:

October - MDPH issues a new Act 87 license to Hartley and Hartley, Inc. for operating 7.5 acres as a sanitary landfill. (9)

1972:

January - Letter to M. Reizen, MDPH from C. Harris, MDNR, points out that a land exchange is involved in settlement of trespass litigation suit regarding pollution damage done by Hartley and Hartley, Inc. (9)

November - MDPH reissues Act 87 license to Hartley and Hartley, Inc. for operating 7.5 acres as a sanitary landfill. (9)

December - MDNR memorandum to the Director, by Robert Wood, Lands Division and Merrill Petoskey, Wildlife Division, proposes exchange of land in settlement of trespass litigation against Hartley and Hartley, Inc. Hartley and Hartley, Inc. recommends land swap of 39 acres of Hartley and Hartley, Inc. property in exchange for 22 acres of state-owned land. (2)

Numerous soot complaints by area residents throughout the year. (8)

1973:

Hartley and Hartley advised they must conduct analyses of liquids before being burned in the high temperature liquid incinerator. (8)

March - SCA Chemical Services, Inc. (SCA) announced the purchase of the Hartley and Hartley facility. Hartley and Hartley, Inc. continued to manage the site until December, 1977. (28)

September - John Bohunsky, MDNR advised Hartley and Hartley, Inc. to discontinue using two ponds containing oil and chemicals in order to protect state game area land. (8)

October - John Cosens, MDNR, advises Office of Toxic Materials Control that a sludge pond on Hartley and Hartley Landfill is filled with asbestos fibers. (8)

December - MDNR reissues Act 87 license to SCA for 7.5 acres of Hartley and Hartley Landfill. NOTE: This is first year MDNR issued Act 87 sanitary landfill licenses. (9)

1974:

February - Settlement signed by MDNR for Hartley and Hartley, Inc. Damage case at Tobico State Game Area, Land exchange #33131. (3)

April - Survey of SCA property completed, map revised, and copies submitted to Wildlife Division, T. Prawdzik, W. Hartley, and Region II Bureau of Field Operations file. (3)

SCA receives a Permit-to-Operate from MDNR, Air Quality Division, to regularly operate the high temperature liquid waste incinerator at the Hartley and

Hartley Landfill. Numerous complaints of smoke and violations recorded by MDNR Air Quality Division. SCA is advised that emission controls are needed. (8,31)

November - MDNR District Biologist reports breakage of several dikes surrounding Hartley and Hartley Landfill during the summer allowing water and garbage to flush into about five (5) acres of state land. (8)

1975:

January - Fred Kellow, MDPH denies that garbage presence on state land is due to dike breakage at Hartley and Hartley landfill; says this area was used for tire disposal. (8)

February - MDNR reissues Act 87 sanitary landfill license to Hartley and Hartley landfill delayed due to problems with bonding of the SCA facility. (9)

April - MDNR issued another Act 87 sanitary landfill license to SCA for the Hartley and Hartley landfill. (9)

October - Bay County Health Department approves further expansion of Hartley and Hartley, Inc. sanitary landfill operations. (8)

December - MDNR issues additional Act 87 sanitary landfill license for expansion of Hartley and Hartley, Inc. landfill. (9)

1976:

Throughout the year numerous ash, smoke, odor, and eye irritation complaints received by MDNR - Air Quality Division. (8)

July - Letter to Hartley and Hartley, Inc. from Larry Thorton, MDNR stating thorough disgust with lack of landfill operation controls and its deterioration, and presents seven complaints. (8)

September - MDNR reissues Act 87 sanitary landfill license to Hartley and Hartley.

SCA claims incinerator capacity of 1,000 gallons of liquid waste per hour (gph) despite prior Permit-to-Operate understanding with MDNR of 500 gph. A Hartley and Hartley report shows 793,000 gallons burned. Numerous complaints to MDNR - Air Quality Division of skunk odor from burning of Thimet (a synonym for phorate, an organo-insecticide with the molecular formula $C_7H_{17}O_2PS_3$). Incinerator is operating at 1,400 rather than 1,800 degrees Fahrenheit. Hauling trucks are operating uncovered and losing most of their loads before reaching the landfill. (8)

October - Numerous skunk odor complaints recorded by MDNR. MDNR advises Hartley and Hartley to control emissions and replace incinerator. (8)

November - Skunk odors continue, but Hartley and Hartley advises MDNR that they will discontinue Thimet burning. (8)

December - Hartley and Hartley applied for National Pollutant Discharge Elimination System (NPDES) permit with MDNR.

1977:

May - MDNR advised that four lagoons are being used for storage of liquid industrial wastes including chromic and other acids. The resulting sludge is being pumped on top of the landfill. (8)

June - MDNR conducted a biological and chemical survey of Tobico Marsh Game Area, Indian Town Drain, and Kawkawlin River in association with Hartley and Hartley, Inc. (4)

SCA presented MDNR with various stipulations to be granted prior to entering into a Final Consent Order to bring the waste incinerator operation at their facility into compliance with all MDNR regulations. (8)

July - SCA will enter into Consent Order and Final Order if company is given NPDES permit. (8)

A sizeable loss of 600 barrels of oil leaked from the Dow Chemical Wyanat line on to state land. The Wyanat oil line runs from the Buckeye Station in Gladwin County to the Dow Refinery in Bay City. The oil line was temporarily abandoned while it was being cleaned out and repaired. The oil leak was being cleaned up by Oil Pollution Control, Inc. contracted by Dow. (6)

August - By the end of the month, about 700 barrels of waste liquid were recovered from a 100' x 150' area located in SW quarter of NE quarter of NW quarter of Section 25 on MDNR property by Oil Pollution Control, Inc. (6)

October - Bob Courchaine, MDNR, advises Hartley and Hartley that NPDES permit could not be issued without details of location of incinerator scrubber; proposed water treatment methodology; plan showing method of liquid storage; analysis of groundwater in the area; and water discharge points of displaced groundwater and contaminated surface water. (8)

Bob Miller, MDNR, advises Hartley and Hartley that a consent order for their incinerator would require compliance with air pollution regulations; approval of interim program restricting waste liquids burned; securing an NPDES permit for scrubber water storage and discharge; no further expansion allowed without compliance and an environmental assessment; and no hauling or resource recovery license would be issued until compliance. (8)

November - The area in which Wyanat Oil line leaked was burned six times this month as a remedial action by Oil Pollution Control, Inc. (6)

December - Letter to MDNR from Paul Chenard, President, Hartley and Hartley, Inc. stated both Wayne Hartley and his son Ty have officially left the company, but both will be working with the landfill operations as consultants. (9)

Liquid waste incinerator operations were to have ceased due to lack of an MDNR Permit-to-Operate, but sporadic operations continued. (8)

1978:

March - Edwards Engineering, Inc. conducted land surveys of SCA Chemical Services property. (17)

Continued smoke complaints were received by MDNR Air Quality Division. (8)

March/April - State of Massachusetts advises MDNR that hazardous wastes are being sent to the SCA Chemical Services, Kawkawlin site. (8,9)

April - The area where the underground Wyanat oil line leaked was burned several more times. (6)

Bob Miller, MDNR informs State of Massachusetts that the Hartley and Hartley site is not licensed for disposal of hazardous wastes. (8)

MDNR inter-office memo to EPA Division Chief from Jack Bails, stated that Hartley and Hartley has agreed to shut down waste incinerator operations within six months and referral of this matter should be directed to the Attorney General's office for further action and other problems to be addressed. (8,9)

May - Michigan Air Pollution Control Commission recommended against the consent order to allow the SCA incinerator to operate at all until related air and solid waste concerns were addressed. (8)

MDNR field inspection of Hartley and Hartley, Inc. conducted by Charles Nelson and Marvin Johnson. (5)

MDNR field inspection of Hartley and Hartley, Inc. conducted by Thomas Prawdzik, D. Schultz, and Conservation Officer Dunckle discovered a Wyanat underground pipeline oil loss on the southwest corner state land picked up through the 1974 land exchange with Hartley and Hartley, Inc. (6,8,9)

Consent order signed by Paul Chenard for Hartley and Hartley which sets dates for removal of liquid wastes, limits of various operations, and discontinuation of waste incinerator operation. (8,9)

Director of the MDNR issued Emergency Order to Cease and Desist to Hartley and Hartley, Inc. (8,9,28)

August - Letter sent to Hartley and Hartley attorney from Jack Bails, MDNR, outlining requirements for the necessary hydrogeological study. (9)

September - MDNR field inspection was conducted to document progress of work at Hartley and Hartley relative to the Emergency Cease and Desist Order. (8)

October - Letter sent to B.P. Shah, MDNR, from Robert Mutch, Wehran Engineering Corp., outlining proposed scope of hydrological investigation at Hartley and Hartley site. (7)

November - Another MDNR field inspection was conducted to document progress of work at Hartley and Hartley relative to the Emergency Cease and Desist Order. (8)

MDNR inter-office memo to Bill Turney from Jack Bails indicates SCA Chemical Services plans to permanently close the Hartley and Hartley site in 90 days. (9)

December - The SCA Services, Inc. facility was permanently closed and no waste of any type was received at the site after December 31. (9,21,27)

1979:

April - MDNR field inspection was conducted to document progress of work at Hartley and Hartley relative to the Emergency Cease and Desist Order. During this investigation, continuing presence of debris on site and in the marsh, breaks in the dike, visible refuse, lack of cover, erosion, and leachate staining of ground was discovered. (8)

May - Wehran Engineering updates MDNR as to progress at Hartley and Hartley site indicating eleven test pits and nine permeability tests remain in the field work, and the closure report would be submitted by Fall 1979. (8)

October - Letter to Larry Thorton, MDNR, from SCA stating hydrogeological investigation report for the Hartley and Hartley site is completed and they would like to enter into an agreement with the MDNR whereby site would utilize a two-year monitoring program. (9)

1980:

May - An aerial radiological survey was conducted over Hartley and Hartley landfill area in response to State of Michigan concern about locations that radioactive material formerly used at a St. Louis, Missouri facility may have been deposited. The survey indicated an excess of thallium-208, the stable daughter nuclide in the thorium-232 radioactive decay series, over the SCA landfill. (31)

November - SCA and MDNR entered into a Stipulation and Consent Order for closure of the Hartley and Hartley site. Consent order involves encapsulation of about half of the landfill site, installation of numerous groundwater monitoring wells, and long-term monitoring of these wells around the perimeter of the site on a quarterly basis until December 1981, then semi-annually until December 1984. (28)

1981:

May - First quarter monitoring well sampling by Hydro Research Services was done at the SCA Hartley and Hartley site. (10)

June - Second quarter monitoring well sampling by Hydro Research Services was done at the SCA Hartley and Hartley site. (11)

June - Keck Consulting Services, Inc. replaced nine existing monitoring wells and provided survey data for each of the wells and local surface water at the closed SCA Hartley and Hartley site. (12)

August - Edmands Engineering, Inc. conducts resurvey of SCA Hartley and Hartley site, and set conduit landmarkers along the fence line. (17)

Third and fourth quarter monitoring well sampling by Hydro Research Services was done at the SCA Hartley and Hartley site.

1982:

March - MDNR requested SCA to increase frequency of monitoring well sampling program from semi-annually to a quarterly basis at the northwest corner of the Hartley and Hartley site due to elevated levels of volatile organic compounds reported in some of the monitoring wells. (19)

First quarter monitoring well sampling by Hydro Research Services was done on the northwest corner of SCA Hartley and Hartley site. (19)

May - Second quarter monitoring well sampling by Hydro Research Services was done on the northwest corner of SCA Hartley and Hartley site. (19)

Biological survey of Hartley and Hartley site by U.S. EPA Technical Assistance Team for Region V discovered that one portion of State Game Area appears to have been used for disposal of materials and may have received a spill of oily material. (13)

July - Third quarter monitoring well sampling by Hydro Research Services was done on the northwest corner of SCA Hartley and Hartley site. (19)

September - Fourth quarter monitoring well sampling by Hydro Research Services was done on the northwest corner of SCA Hartley and Hartley site. (19).

November - MDNR acknowledged radioactive waste material on state land obtained in the 1974 land exchange with Wayne Hartley just as it is on the SCA Hartley and Hartley site. (28,31)

1983:

February - GeoEngineering, Inc. conducted a magnetic survey of northwest corner of SCA Hartley and Hartley site and also began the remedial investigation of the SCA site. (15,24)

First quarter monitoring well sampling by Hydro Research Services was done at SCA Hartley and Hartley site. (20)

March - MDNR staff collects three sets of surface water composite samples from locations: to the east and west of what was described as "the state's peninsula," and one off the southwest corner of SCA property. Elevated concentrations of toxic organic chemicals were discovered in surface water samples from both marsh areas either side of the state's peninsula. (23)

April - Ross Powers, U.S. EPA and Dan Schultz, MDNR, conduct a radiological survey of the SCA site and what was described as "the state's peninsula." The survey indicated radioactive material present at various locations around both properties. The hot spots were marked and segregated as contaminated areas with caution tape. (24)

U.S. EPA Technical Assistance Team (TAT) conducted a radiological survey of the SCA site and the state's peninsula where radioactivity was discovered. Nine locations were marked with wooden stakes where radioactivity measurements were measured and recorded. The readings ranged from 4,000 to 125,000 counts per minute and 0.4 to 1.4 milli-Roentgens per hour (mR/hr.). Two soil samples were collected and analyzed by the EPA Eastern Environmental Radiation Laboratory. (24,31)

May - MDNR evaluated the Hartley and Hartley Landfill for remedial action under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) to request emergency funding. (25,28)

MDNR initially surveys their Hartley and Hartley site and establishes a 20-foot grid pattern for magnetometer survey. (29)

June - MDNR conducts magnetometer survey at their Hartley and Hartley site.

July - Seven residential water supplies around the landfill area were analyzed by MDPH Environmental Laboratory for 40 different hazardous materials. None of the samples indicated anything above detectable limits. (27,31)

August - U.S. Nuclear Regulatory Commission (NRC) began special safety inspection to determine the responsible party for the radioactive thoruim disposed of on MDNR and SCA properties. (31)

NRC and MDNR conducted direct radiation level measurements on MDNR and SCA property. Samples of soil and rock (or slag) were collected for analysis by U.S. NRC Region III. (31)

September - SCA Chemical Services submits proposal for encapsulation and leachate treatment as a clean-up method for the SCA site. (30)

December - Groundwater monitoring well sampling by Hydro Research Services was done at the SCA site. (32)

1984:

March - Monitoring well and surface water sampling was done by Hydro Research Services at the SCA site. (35)

April - SCA submitted final design plans and specifications for the slurry wall to be installed at SCA Hartley and Hartley site and proposed to include MDNR property in exchange for elimination of monitoring requirements. (34)

May - Construction of the contaminant slurry wall system began at SCA. (33,34,37)

June - SCA draft agreement regarding contaminant system proposed for MDNR property. Slurry wall construction installation started on SCA site.

July - A limited radiological survey conducted by the NRC on the SCA site using detectors and ratemeters, and collected soil samples from trenches for analyses. (41)

August - Wetland protection permit application for encapsulation of the MDNR Hartley and Hartley site was submitted. (39)

NRC collected additional soil samples for radiological analysis to confirm previous data showing direct radiation levels considerably above background area levels on the SCA site. (41)

Groundwater monitoring well and surface water sampling was done by Hydro Research Services at the SCA site. (42)

September - MDNR and SCA entered into an agreement in which SCA would pay for labor and materials for construction of a contaminant slurry wall and clay cap enclosure around that portion of state land where wastes were known to be buried. (43)

October - Eight of proposed eleven investigative borings drilled along slurry wall trench perimeter on MDNR-owned property. (44)

November - Slurry wall trench excavation began and completed along with installation of clay cap on MDNR property. The MDNR encapsulated area is approximately 300' x 400'. (44)

December - Four monitoring wells were installed on MDNR property after slurry wall and clay cap were completed: one through cap and three placed outside the slurry wall on the west, north, and east sides of the cap. Also, three Shelby tube samples of the slurry wall material were taken and permeabilities estimated to be less than 1×10^{-7} cm/sec. (44)

1985:

March - MDNR received Closure Certifications for the slurry wall, cap, and monitoring systems at SCA and MDNR sites from Waste Management, Inc., parent of SCA Chemical Services. (44)

May - MDNR conducted monitoring well sampling at Hartley and Hartley landfill site and found significant levels of contamination. The analyses indicated residual organic pollutants still remained in the upper aquifer around the site. (45)

Groundwater monitoring well and surface water sampling was done by the Hydro Research Services at SCA site.

July - MDNR and Jordan conducted a site reconnaissance to observe current site conditions.

October - Jordan submits Work Plan for a Remedial Investigation and Feasibility Study.

1986:

January - The Hartley and Hartley Remedial Investigation study begins.

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13. U.S. EPA Project Memorandum, Region II, dated June 2, 1982 to Ross Powers, EDO, from Technical Assistance Team provided by Ecology and Environment, Inc. via Scott McCone. Subject: Biological Survey of Hartley and Hartley Landfill conducted May 17-18, 1982.

14. MDNR inter-office communication dated August 16, 1982 to Gary Hurlburt, Environmental Services Division, from Fred Gottschalk, Water Quality Specialist, Resource Recovery Division. Subject: Hartley and Hartley monitoring well water and pond water sample analyses data.

15. Letter dated November 22, 1982 to Richard Mahoney, SCA Chemical Services from William McTigue, Geo Engineering, Inc. Subject: Proposal for Magnetic Survey and Preliminary Remedial Study at the Hartley and Hartley Landfill property.

16. Technical Proposal for SCA Chemical Services by Polybac Corporation dated December 6, 1982, to undertake investigations to ascertain the feasibility of using microorganisms to degrade on-site organic compounds.

17. Letter dated December 17, 1982 to Larry Thorton, MDNR Region II Headquarters, from Richard Mahoney, Assistant Manager, Environmental Affairs, SCA Chemical Services, Inc. Subject: Hartley and Hartley Landfill Preliminary Assessments in northwest corner (proposed metal detector survey and field applications of microbiological methods for detoxifying contaminated soils).

18. Letter dated January 19, 1983 to Richard Mahoney, SCA Chemical Services, Inc. from Layne Johnson Sr., Research Microbiologist, Polybac Corporation. Subject: Results of first phase of research on SCA Chemical Services, Inc. 11 soil samples.

19. Proposal dated March 1983 by Polybac Corporation to develop a program to control the discharge to surface and groundwater contaminants emanating from the SCA Hartley and Hartley landfill site.

20. Analytical report dated March 15, 1983 by Hydro Research Services, Water Management Division, Clow Corporation to Richard Mahoney, SCA Chemical Waste Services, Inc., regarding quarterly groundwater sampling conducted February 7-8, 1983 at the SCA Hartley and Hartley Landfill.

21. Analytical report dated March, 1983 by MDNR Environmental Lab on split samples taken by Hydro Research Services during February 7-8, 1983 quarterly groundwater sampling survey at the SCA Hartley and Hartley Landfill.

22. MDNR inter-office communication dated April 14, 1983 to Dan Schultz, GQD, from Janet Fekete, Toxic Chemical Evaluation Section, EDS. Subject: Hartley and Hartley (cursory chemical hazard assessments for terrestrial wildlife).

23. MDNR interoffice communication dated April 28, 1983 to Bill Bradford, Acting Chief, GQD, and Dave Dennis, Compliance Section #2 Supervisor, GQD from Dan Schultz Compliance #2, GQD. Subject: Hartley and Hartley Tobico Marsh, Bay County (analytical results from these sets of surface water samples collected and analyzed by MDNR).

24. Letter report dated May 2, 1983 to Robert Bowden from John Dourjalia, U.S. EPA, Technical Assistance Team via Jack Thorsen. Subject: Radiological Survey at Hartley and Hartley Liquid Incineration and Treatment Plant, Kawkawlin, Michigan.

25. Site Assessment Scoring Questionaire (partial) prepared by Rene Hix, MDNR, date unknown, for Act 307, P.A. 1982 and Superfund Priority Listing.

26. Bay County Department of Community Service memorandum dated June 22, 1983 to Elroy Klaviter, Chemicals and Health Center, Michigan Department of Public Health (MDPH) and Gary Gettel, MDNR, from Edward Golson, Director, Division of Environmental Health. Subject: Proposed sampling locations (of residential wells) around SCA site.

27. Chemical analyses of seven residential well water samples taken by Lahti and Golson MDPH on July 15, 1983 around SCA site.

28. MDNR inter-office communication dated June 23, 1983 to Lois Jacob, Toxic Substance Control Commission from William Bradford, Acting Chief, GQD. Subject: Hartley and Hartley Landfill - Bay County.

29. Magnetometer Survey Report of Hartley and Hartley Landfill dated July, 1983 conducted by Beth Mursch, MDNR-GQD Geotechnical Unit.

30. Letter dated October 24, 1983 to John DiNapoli, Project Manager, Hartley and Hartley site for SCA Chemical Services from Jack Bails, Chief Environmental Enforcement Division, MDNR. Subject: Technical questions by MDNR staff regarding SCA proposal to clean up the SCA Hartley and Hartley property.

31. Letter dated December 8, 1983 to S.J. Simmons, Director, Industrial Relations and Procurement, Wellman-Dynamics Corporation from James Keppler, Region III Administration, U.S. Nuclear Regulatory Commission. Subject: Special radiological safety inspection conducted by S.R. Lasuk from August 9 to October 20, 1983.

32. Analytical report dated January 9, 1984 by Hydro Research Services, Water Management Division, Clow Corporation, to John DiNapoli, SCA Chemical Services, Inc. regarding quarterly groundwater sampling conducted December 5-6, 1983 at SCA Hartley and Hartley Landfill.

33. Letter dated February 2, 1984 to Daniel Schultz, MDNR-GQD from John DiNapoli, Manager, Special Site Programs, SCA Chemical Services. Subject: Response to MDNR consolidated technical questions submitted October 24, 1983 concerning SCA proposal to clean up SCA Hartley and Hartley property.

34. Letter dated April 19, 1984 to Dan Schultz, MDNR, from John DiNapoli, SCA Chemical Services. Subject: Final design plans and specifications for the SCA slurry wall, and proposal to include state property in slurry wall plans at no charge in exchange for eliminating three MDNR requirements on SCA encapsulation project.

35. Analytical report (partial) dated April 6, 1984 by Hydro Research Services, Water Management Division, Clow Corporation, to John DiNapoli, SCA Chemical Services, Inc., regarding quarterly groundwater sampling conducted March 9, 1984 at the SCA Hartley and Hartley Landfill.

36. MDNR inter-office communication dated May 24, 1984 to Rick Johns, Chief GQD from Daniel Schultz, Compliance #2 Saginaw. Subject: Hartley and Hartley/SCA (discussion of MDNR options to SCA's proposal to encapsulate State's peninsula).

37. Letter dated June 12, 1984 to Dan Schultz, MDNR from John DiNapoli, SCA Chemical Services, Inc. Subject: Draft agreement between MDNR and SCA Chemical Services, Inc., regarding the contaminant system proposed for the state property.

38. Report addendum dated June 29, 1984 to Construction Specifications Slurry Wall, Cap and Monitoring System, Hartley and Hartley Landfill, Kawkawlin, Michigan owned by SCA Chemical Services, Inc. from Jeffrey Duncan, Ground/Water Technology, Inc.

39. MDNR inter-office communication dated August 3, 1984 to Dennis Hall, Special Lands Programs Section, Land Resource Programs Division from Daniel Schultz, GQD Saginaw District Office. Subject: Tobico Marsh (cover letter as introduction to Wetland Protection permit application to encapsulate state owned property).

40. MDPH memorandum dated August 16, 1984 to Thomas Schimpf, Assistant Attorney, General Environmental Protection & Natural Resources from George Bruchman, Chief, Division of Radiological Health. Subject: SCA Landfill, Kawkawlin Radioactive Material Monitoring Criteria.

41. Letter dated September 4, 1984 to Daniel Schultz, MDNR, from Martin Schumacher, Chief, Independent Measurements and Environmental Protection Section of U.S. Nuclear Regulatory Commission. Subject: Radiological survey report compiled on Mr. Hartley's property.

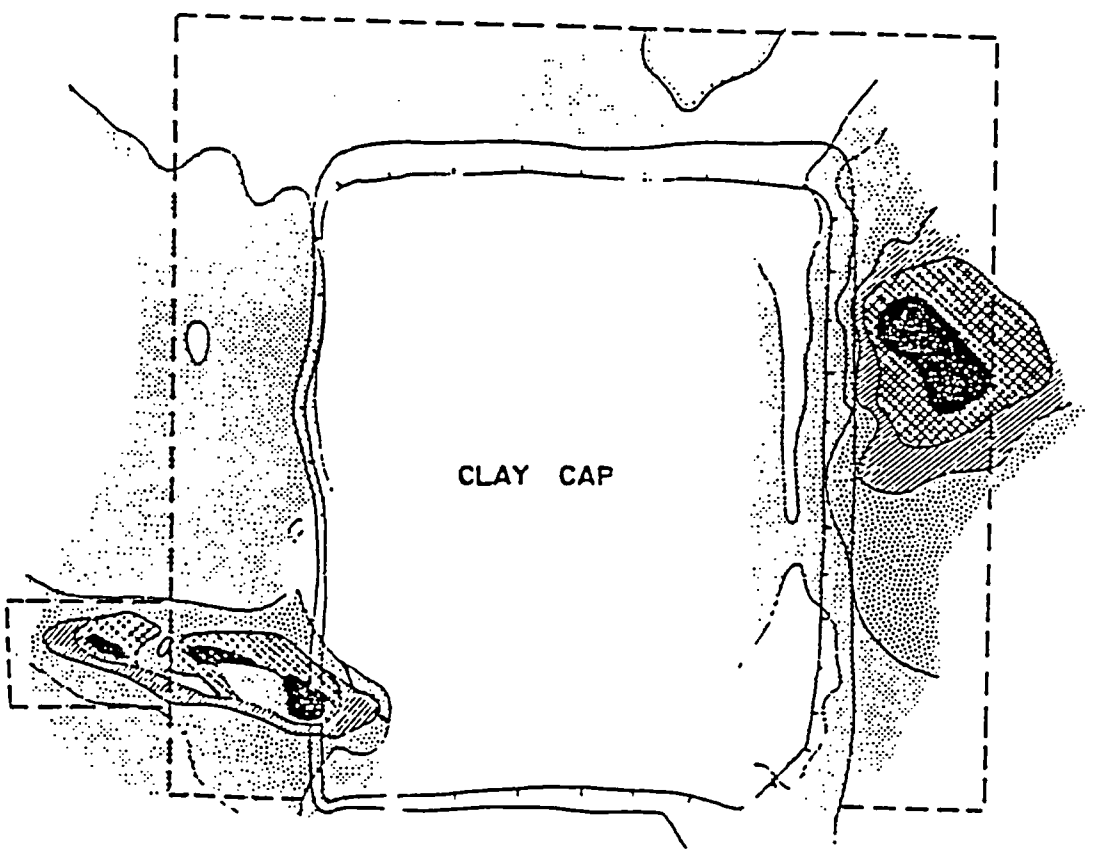
42. Analytical report dated September 9, 1984 by Hydro Research Services, Water Management Division, Clow Corporation to John DiNapoli, SCA Chemical Services, Inc. regarding groundwater sampling conducted June 6 and 27, 1984 at the SCA Hartley and Hartley Landfill.

43. Amendment to November 7, 1980 consent order for closure for SCA to provide at their cost encapsulation of the state property in the Tobico Marsh State Game Area consigned on September 25 and 28, 1984 by MDNR and SCA representatives, respectively.

44. Report dated February 16, 1985 by Jeffrey Duncan, Ground/Water Technology, Inc. for SCA Chemical Services, Inc. entitled, "Closure Certifications Slurry Wall, Cap and Monitoring Systems, Hartley and Hartley Landfill and State of Michigan DNR Site, Kawkawlin, Michigan."

45. Analytical report dated May 28, 1985 by MDNR Environmental Laboratory to Dan Schultz, MDNR-GQD regarding groundwater sampling conducted by Mike Czuprenski on MDNR on May 2, 1985 at state owned Hartley and Hartley landfill site.

46. Letter dated July 2, 1985 to Rich Johns, Chief GQD, MDNR, from Dan Sweeney, Director, Environmental Management, Waste Management, Inc. Subject: Groundwater and surface water sampling results conducted May 1-2, 1985 at SCA Hartley and Hartley Landfill.



LEGEND

(ALL VALUES IN MILLIMHOS/METER)

- GREATER THAN 70
- 60 - 70
- 50 - 60
- 40 - 50
- 30 - 40
- 20 - 30
- 10 - 20
- METAL DETECTOR SCREENING BOUNDARY LINE

0 100 200 FEET

FIGURE 3
TERRAIN CONDUCTIVITY CONTOUR MAP
HARTLEY AND HARTLEY LANDFILL SITE
BAY COUNTY, MICHIGAN

E.C. JORDAN CO.

A

A'

WEST

EAST

ELEVATION IN FEET

595

590

585

580

575

MW-1

MW-2

MW-4

MW-5

MW-7

SLURRY WALL

SLURRY WALL

CLAY CAP

MATERIAL

PEAT

SAND

PEAT

CLAY TILL

BOB

BOB

BOB

BOB

BOB

LEGEND

WELL SCREEN

WATER LEVEL

0 200 400 FEET

PROFILE A-A'

FIGURE 5
INTERPRETIVE GEOLOGIC PROFILE
HARTLEY AND HARTLEY LANDFILL SITE
BAY COUNTY, MICHIGAN

ECJORDANCO

128504

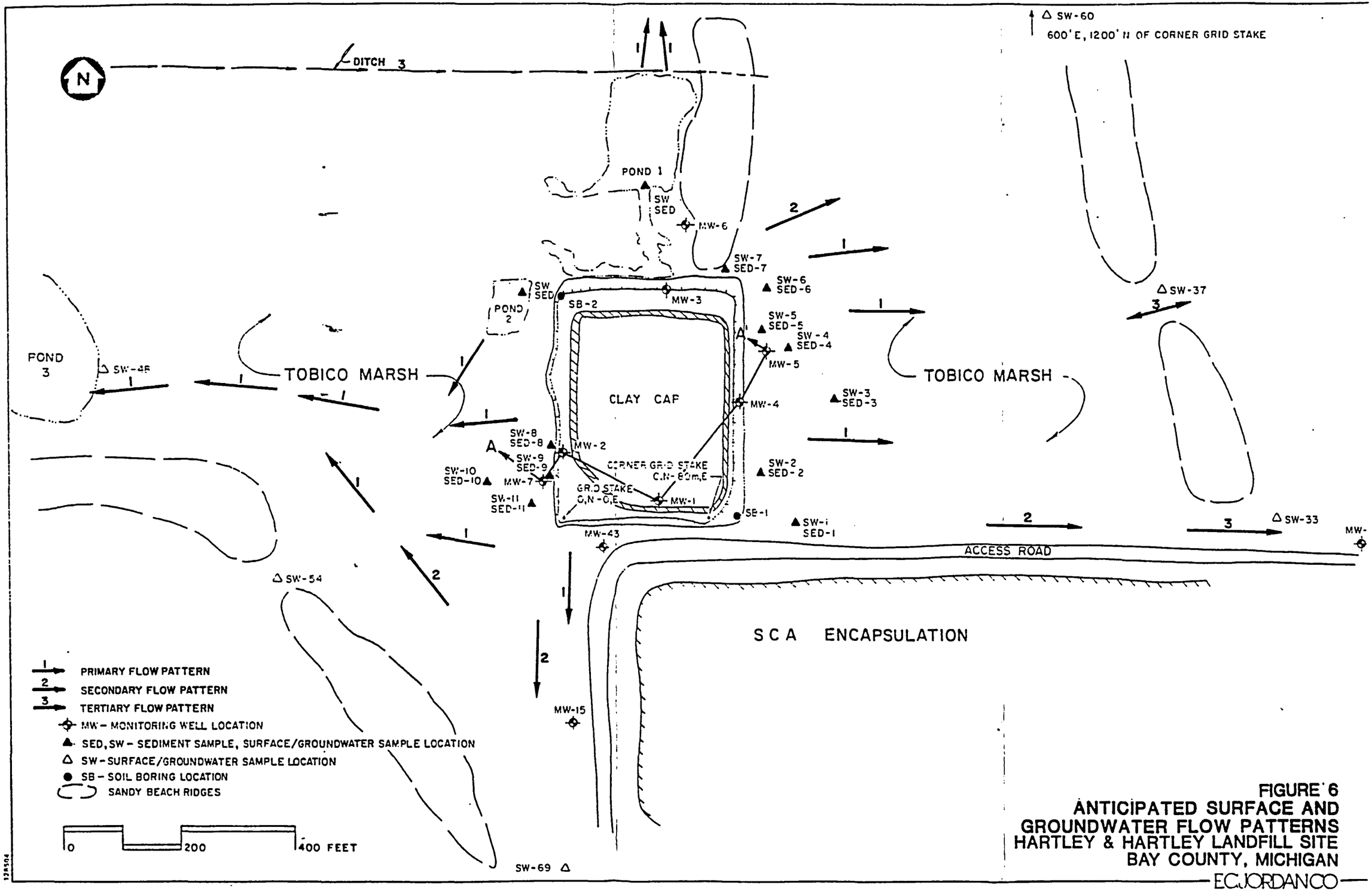


FIGURE 6
ANTICIPATED SURFACE AND GROUNDWATER FLOW PATTERNS
HARTLEY & HARTLEY LANDFILL SITE
BAY COUNTY, MICHIGAN

E.C. JORDAN CO.

EXCERPTS FROM 1983 RADIOACTIVITY SURVEY, MDPH

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

G. Smith, Ph.D.
B. Walker, Ph.D.
Director

MEMORANDUM

TO: Jose A. Hennigan, P.E., Chief
Nuclear Facilities and Environmental Monitoring Section

DATE: 5/2/83

FROM: Robert L. DeHaan, Chief
Environmental Monitoring Unit

Lansing

SUBJECT: Radioactivity Survey of DNR Land Near Bay City, Michigan

On April 20, 1983, Harold Johnson and I accompanied Michigan Department of Natural Resources (DNR) and U. S. Environmental Protection Agency (EPA) representatives on a radioactivity survey of a small portion of the DNR land near Bay City, Michigan. Personnel present for this survey in addition to us were:

Representing the EPA:
1. Pete Tedeschi, Regional Director
Radiation Branch

2. Tom DeFouw and John Dourjalian
Roy F. Weston, Inc.
Spill Prevention & Emergency Response
Division (EPA contracted consulting firm)

Representing the DNR:
1. Gary Gettel, Resource Specialist
Environmental Enforcement Division

2. Gordy Hahn, Criminal Investigator,
Environmental Enforcement Division

3. Dan Schultz, Water Quality Specialist
Ground Water Quality Division

The property was formally owned by Hartley and Hartley and was used as a landfill. DNR reportedly acquired the land from Hartley and Hartley as part of a court settlement. Also, as part of the settlement, Hartley and Hartley was to remove all the barrels of waste from the property. Hartley and Hartley has since sold the remainder of the landfill to SCA Corporation.

Recently, DNR found some corroded barrels at or just below the ground surface on a small portion (about the size of a football field) of their property. Also a DNR Wildlife Biologist recalled seeing barrels labeled "Radioactive" stored on the property when Hartley and Hartley was using it as a landfill. Hence, DNR requested EPA and our assistance to survey the area and determine what kind and how much radioactivity is present there.

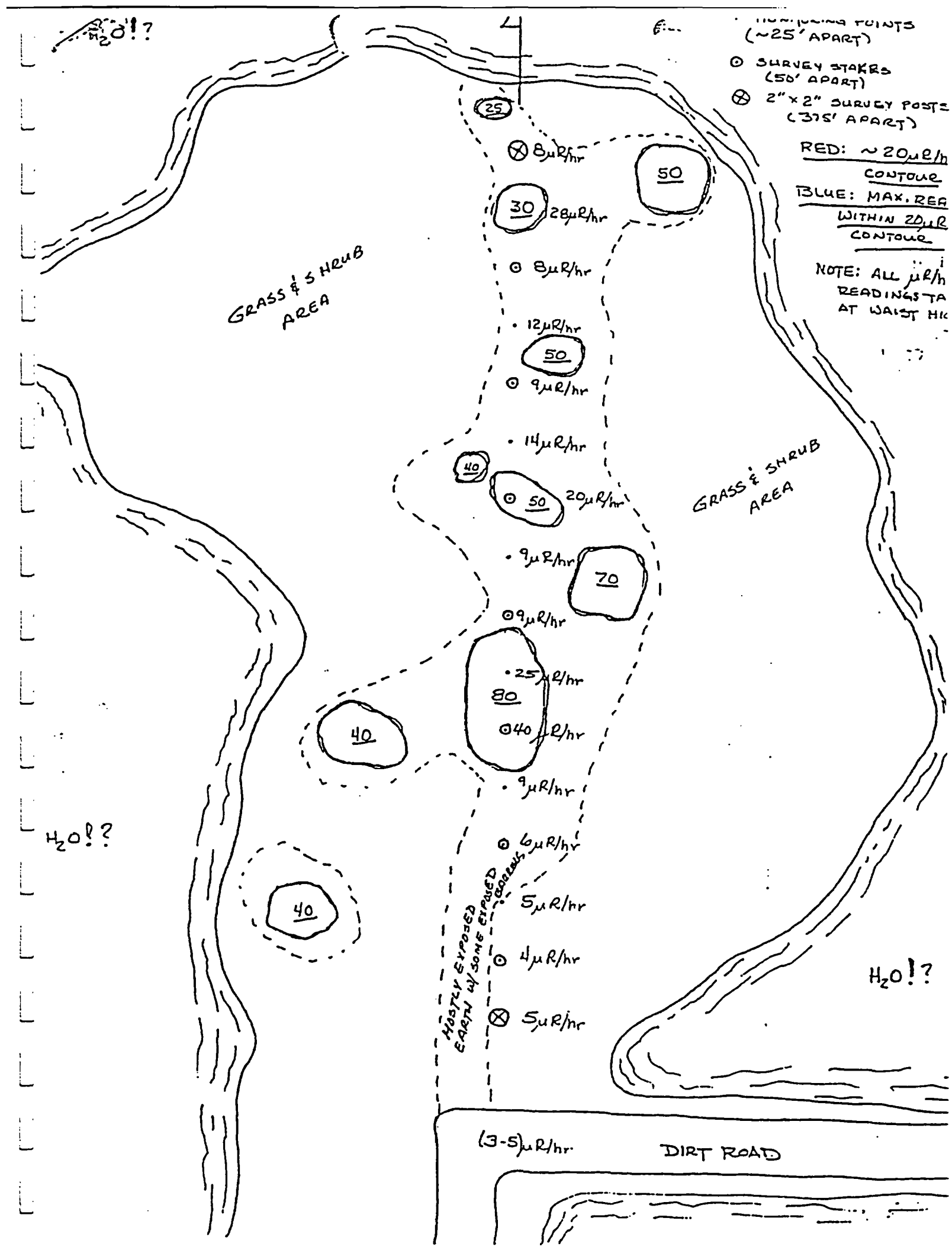
Attached is a crude sketch of the surveyed area. All distance measurements are referenced to a land survey line marked out by 2" x 2" wood and metal nail-type stakes. Using our Micro R meter, we found several areas with elevated readings (Background was determined to be 3-5 μR/hr.). The readings were taken at waist level (~1 meter above the ground surface) and ranged from background to 80 μR/hr. We have approximately drawn in the areas for 20 μR/hr. contours and included the highest reading within each contour. All elevated readings were found in areas where

the ground was exposed (no grass or shrub cover). In some of these areas, the ground was greyish-white in color and had a clumpy to powdery texture.

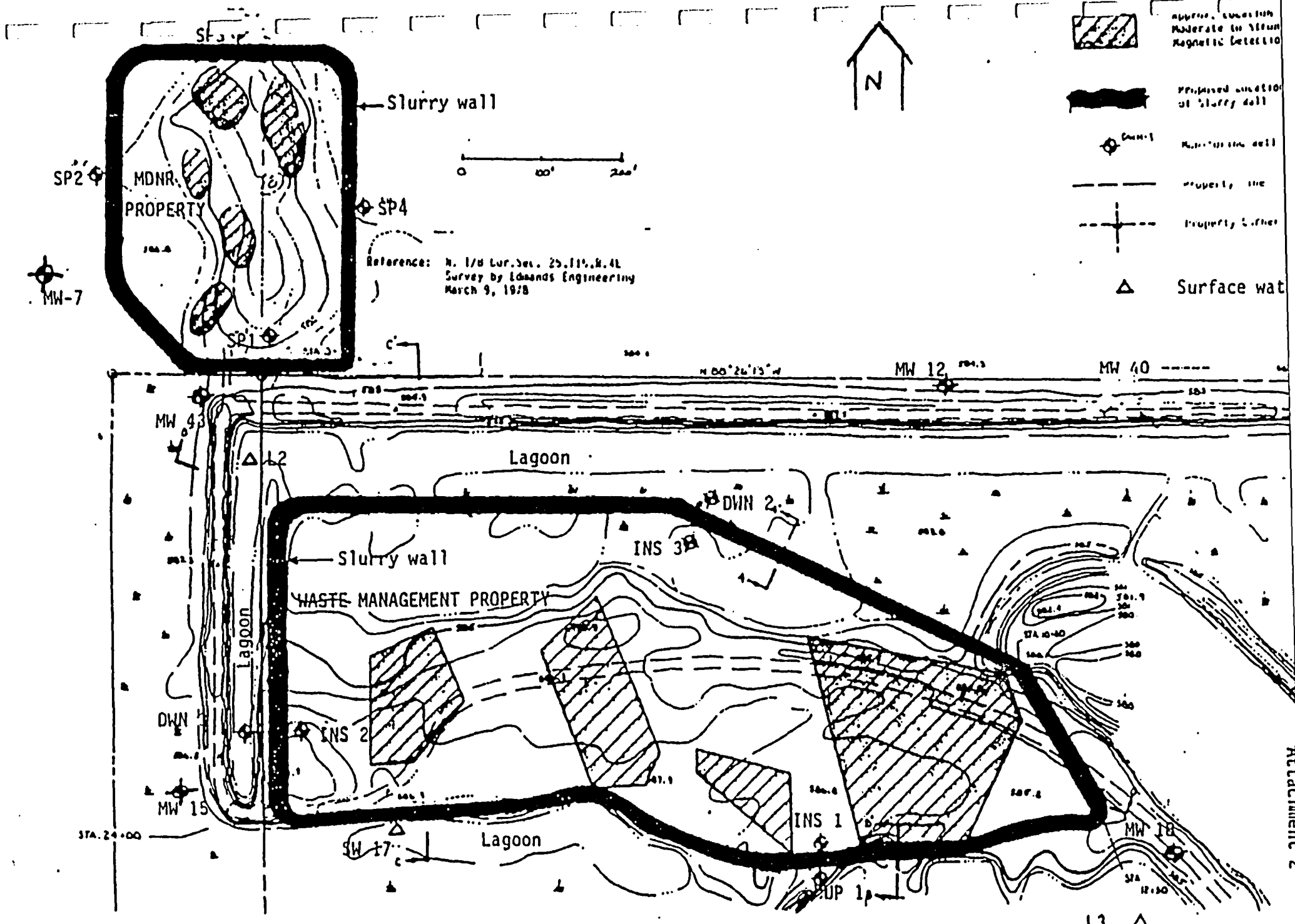
In one of the elevated reading areas, we removed some of the ground (6-8 inches) and found the remains of a corroded barrel with the greyish-white substance in it. A sample of this material was brought back to the lab and was analyzed. The analysis revealed 670±40 pCi/g dry of ^{232}Th. All daughters of ^{232}Th were confirmed to be present.

DNR is planning a ground penetrating radar study of the area which should assist in estimating the number of barrels buried there. Also aerial photographs will be taken of the area, and copies will be sent to us.

RLD/bls
Attachment
cc: George


H2O!?
MONITORING POINTS (~25' APART)
SURVEY STAKES (50' APART)
2"x2" SURVEY POSTS (375' APART)
RED: ~20μR/h CONTOUR
BLUE: MAX. REA WITHIN 20μR CONTOUR
NOTE: ALL μR/h READINGS TA AT WAIST HI
GRASS & SHRUB AREA
GRASS & SHRUB AREA
25
8μR/hr
50
30
28μR/hr
8μR/hr
12μR/hr
50
9μR/hr
14μR/hr
40
50
20μR/hr
9μR/hr
70
9μR/hr
25μR/hr
80
40
40μR/hr
9μR/hr
6μR/hr
40
5μR/hr
4μR/hr
5μR/hr
MOSTLY EXPOSED EARTH W/ SOME EXPOSED BOULDERS
H2O!?
H2O!?
(3-5)μR/hr
DIRT ROAD

EXCERPTS FROM 1991 RADIOCHEMICAL ANALYSES, NRC



ATTACHMENT 2. SELECTED MONITORING LOCATIONS

WASTE MANAGEMENT-MDNR SITES KAWKAWLIN MI