LOVE CANAL EMERGENCY DECLARATION AREA

PROPOSED HABITABILITY CRITERIA

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WDR100/43

LOVE CANAL EMERGENCY DECLARATION AREA

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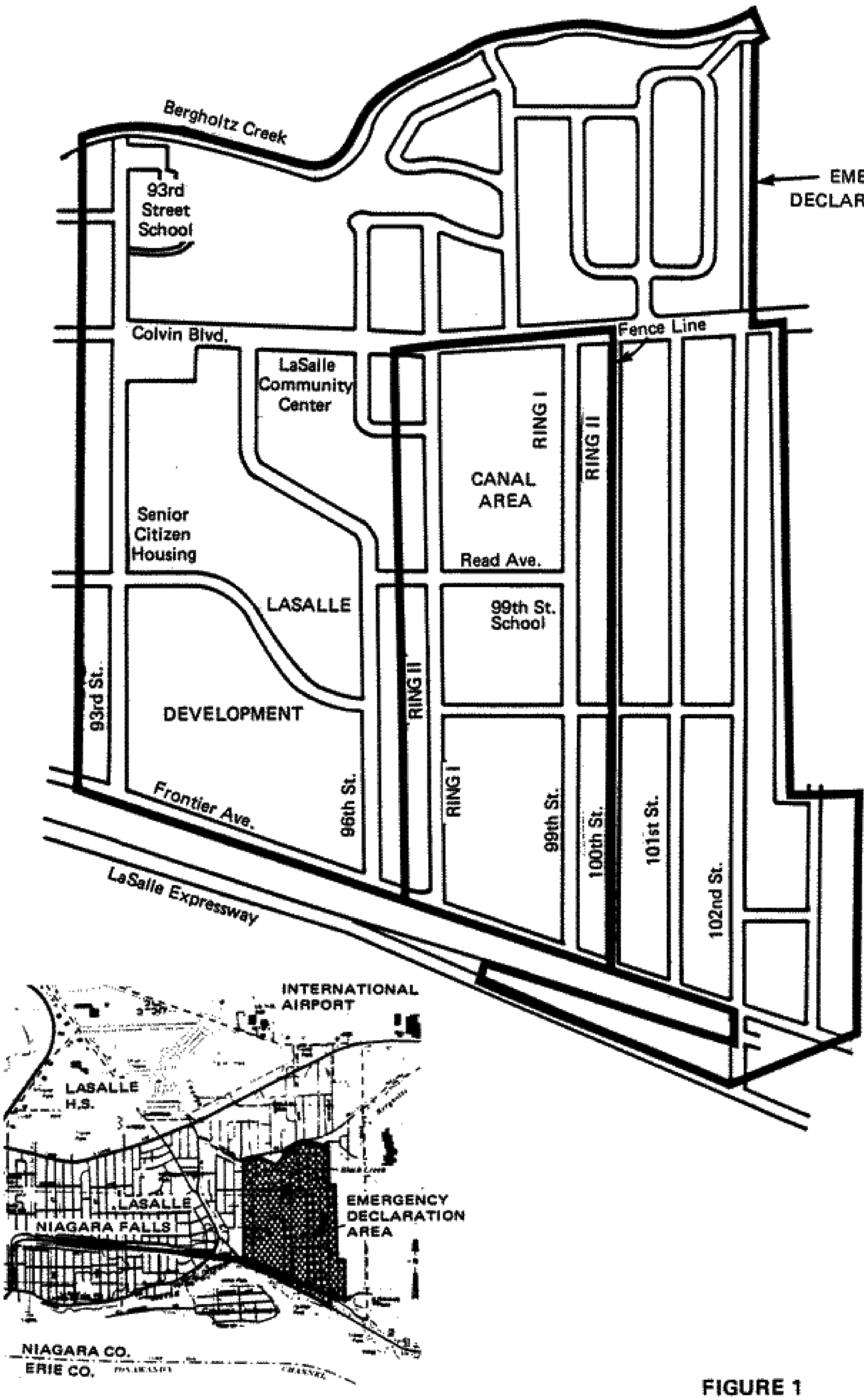
November 21, 1985

1. INTRODUCTION

As part of the Environmental Protection Agency (EPA) remedial program at the Love Canal hazardous waste disposal site, a Technical Review Committee (TRC) was formed to provide interagency coordination and oversight for all issues related to the program. The TRC is chaired by EPA and includes senior officials of EPA Region II, the New York State Department of Health (NYSDOH), the New York State Department of Environmental Conservation (NYSDEC), and the Department of Health and Human Services--Centers for Disease Control (DHHS-CDC). Among the most difficult issues is the question of habitability of the Emergency Declaration Area (EDA). The EDA consists of the neighborhoods adjacent to and surrounding the canal site. The EDA does not include the canal itself nor the area formerly occupied by two rows of demolished homes immediately east and west of the site (Figure 1). Residents of the area were offered relocation assistance; homes were appraised and purchased by the government at various times as the problem unfolded. The site itself has been contained and the two rows of



Adapted from: Environmental Monitoring at Love Canal, Volume III.

FIGURE 1
Love Canal Study Area

CH2M HILL

homes closest to the canal (Rings I and II) demolished. Most of the residences in the EDA are still unoccupied. Appendix 1 presents a chronology of events related to Love Canal and the EDA.

The NYSDOH and CDC were asked to develop criteria for habitability that could be applied to the EDA and that, if met, may be used by the Commissioner of Health of New York State to make a determination about the habitability of the EDA or of neighborhoods or residences within the EDA. To assist in developing habitability criteria, NYSDOH and CDC sought the opinions and recommendations of 10 distinguished scientists representing a variety of disciplines (Appendix 2). Many of the views and opinions of those scientists are reflected in this document. The development of this document also involved a thorough review of all known environmental monitoring results along with their quality control and quality assurance documentation, where available; and the published and unpublished health study data.

After carefully considering the limitations of available information (Appendix 3) and their scientific interpretations, the scientists concluded that habitability criteria could and should be established for the EDA (Appendix 4). The process of establishing habitability criteria was open to the public, and

community involvement was actively solicited throughout the process (Appendix 5). Use of the criteria and the final decision on habitability of the EDA will also involve the public and the citizens affected.

To assure community understanding and support for government actions regarding the EDA, no significant changes in procedures or operations related to Love Canal remediation and management activities (Appendix 6) should be made before community input is sought.

Decisions about operations at the Love Canal site must be reported to the public on a regular basis. A library of documents relating to Love Canal should be maintained as a resource for scientists and the community.

2. DEFINITION OF HABITABILITY

For purposes of the task at hand, "habitable" means suitable for human habitation. In most situations, including that of the Love Canal EDA, judgments about suitability for human habitation rarely involve a simple "yes/no" response. Important considerations include the degree of certainty about the presence or absence of risks and whether these risks are immediate or delayed, serious or negligible, voluntary or involuntary, and whether restricted habitability or alternative land use is intended. With regard to the Love Canal EDA, the judgment is also complicated by the fact that the residents of the EDA were offered temporary relocation pending an official judgment on the risks posed by the presence of the Love Canal disposal site. This, compounded with the publicly voiced critiques (whether justified or not) of the existing exposure and health assessment data of Love Canal have created questions in the community concerning the risks posed by rehabitation of the Love Canal EDA. To the degree that they exist, any risks would be imposed involuntarily, may cause delayed health effects, and may be related to serious health outcomes.

3. NATURE AND SCOPE OF HABITABILITY CRITERIA

The proposed habitability criteria are intended to apply only to the Love Canal EDA, are as objective and quantifiable as possible, and should yield reproducible results. Several approaches to the development of habitability criteria were discussed within this framework:

1. Identification of time trends in environmental data to evaluate the effectiveness of remediation

2. Risk assessment based on measured levels of chemicals present in the EDA and the extrapolation of animal toxicity data for those chemicals to human health risks

3. Application of environmental and health standards, criteria, and guidelines

4. Epidemiological assessment

5. Comparison of Love Canal after remediation with a state-of-the-art hazardous waste management facility meeting existing laws and regulations

6. Comparison of environmental data from the EDA to similar data from comparable, inhabited areas

7. Combinations of the above

The options were discussed in varying levels of detail. Some were discussed as the primary basis of a habitability decision, others as supplementary or supporting methodologies. The approach proposed as the most appropriate for the determination of habitability in the Love Canal EDA is a combination of using relevant federal and New York State standards, criteria, and guidelines which are generally derived from risk assessments; and comparing levels of Love

Canal Indicator Chemicals (LCICs) in the EDA with levels of these chemicals in similar inhabited urban areas not impacted by a chemical landfill. More detailed discussions of this choice are given in Appendix 7.

4. SUMMARY OF RECOMMENDED APPROACH

Relevant federal or New York State standards, criteria, or guidelines for chemicals identified in environmental media and to which residents and potential residents may have significant exposure will be used to assess the hazard of rehabitation of the EDA. For TCDD (2,3,7,8 tetrachlorodibenzo-p-dioxin), the currently accepted level of concern of 1 part per billion (ppb) in residential soils will be used as a criterion in the EDA.

Measurements of TCDD in the comparison areas will not be made because an absolute level of concern of 1 ppb now exists and therefore knowledge of concentrations of TCDD in the comparison area is not necessary. A sampling protocol will be followed to determine whether TCDD is present in the soils of the EDA. The protocol will be designed to determine if TCDD is present in concentrations over 1 ppb. If TCDD is found to be over 1 ppb in the EDA or a portion of the EDA, that area will be considered habitable only if remediation can be accomplished and other circumstances do not cause it to be declared not habitable.

Where applicable and relevant standards, criteria, or guidelines are not available, as they currently are not for residential air and soil for most of the chemicals identified thus far in Love Canal and the EDA, a comparison methodology will be used to assess the habitability of the EDA. This approach to determining the relative habitability of the EDA is based on a comparison of environmental sampling results for the LCICs from the neighborhoods (Appendix 8) and residences in the EDA with results from sampling for LCICs in similar inhabited communities not impacted by a chemical landfill. This method assumes that data collected from the comparison areas will correspond to "normal" or habitable conditions which, when compared to similar measurements in the EDA, provide an indication of whether EDA neighborhoods and homes are "as safe as" those in comparable western New York communities. The comparison approach to developing habitability criteria is based on the assumption that inhabited urban neighborhoods that meet public health and housing codes and are not impacted by a chemical landfill are habitable.

Habitability decisions will be based primarily on statistically valid comparisons of low level environmental contamination between EDA neighborhoods and comparison areas. This novel approach to the unique situation at Love Canal has been designed to identify the presence of a potentially toxic chemicals related to this hazardous waste disposal site. However, its implementation presents certain major problems:

1. Environmental sampling data collected from the EDA contain a high percentage of reported "non-detect" results for chemicals known to have been deposited in Love Canal. For the selected LCICs, 2 percent of soil LCICs had reported concentrations and 6 percent of the air LCICs had reported concentrations (Appendix 9).

2. Standard technology for detecting chemicals (particularly in soil) is limited at the ultra-low range (i.e., low parts per billion and below) and does not differentiate concentrations under the parts per trillion range.

3. The precision and accuracy of the standard available analytic chemistry technology decrease in the detection of ultra-low concentrations of chemicals in various environmental (and biologic) samples.

4. Statistical methods are limited for defining significant differences in data sets that include a vast majority of chemical concentrations below the limit of detection (Appendix 10).

5. Statistical capabilities to detect a preset difference with a given sample size are limited by data variability. Increasing variability makes the difference more difficult to detect.

6. There is very little direct observation data which defines the human health effects of exposures to chemicals at low concentrations in environmental media in residential settings.

7. There is little data on background levels of the chemicals of concern in the Love Canal EDA in comparable residential settings in the U.S.

The proposed habitability criteria and the ultimate decision on the habitability of the Love Canal EDA deal with these problems in the following manner:

1. For purposes of reproducibility, unique and heroic laboratory methods should be avoided. Accepted laboratory methods with stringent quality assurance and quality control should be followed even though the variability of analytic results

may increase at very low concentration levels. Measurements with large inaccuracies will be down-weighted in the statistical comparisons. Estimates of detection limits will be based on appropriate statistical techniques and defined such that the detection limit is the sample concentration which can be detected with 95 percent confidence and which requires 95 percent non-detects in procedural blanks. This determines the probability of false positives and false negatives.

2. The soil sampling plan should be designed to detect an order-of-magnitude difference between the EDA neighborhoods and comparison areas for each LCIC concentration. The design should employ criteria of 5 percent overall significance for all comparisons and 90 percent power for an order-of-magnitude difference for each single comparison.

3. The air sampling plan should be designed to characterize the distribution of air LCIC concentrations in the comparison areas.

4. For purposes of statistical comparisons, all nondetected concentrations from each laboratory for each LCIC will be considered equal in both the EDA neighborhoods and the comparison areas.

5. Several statistical procedures will be used to compare individual (univariate) and collective (multivariate) properties of LCICs between each EDA neighborhood and the comparison areas. A statistically significant difference should take into account the reliability of data across the observed range of concentrations. One approach is to use more stringent statistical criteria to detect significant differences for comparisons at very low LCIC concentrations, while less stringent criteria would be used to detect significant differences at higher concentrations.

6. The data sets should be evaluated for general trends and directions as well as for statistically significant differences.

7. The determination of habitability or non-habitability of any EDA neighborhood will require a prudent public health judgment based on a review of the data from the comparison studies as well as all other pertinent factors. The ultimate determination should be explained and justified.

All of the environmental testing data from the comparison studies including the information regarding sampling error, quality control/quality assurance of the laboratory work, and the values reported will be made available to the general public and the scientific community for analysis and interpretation. Data from the comparison areas should be limited sufficiently to protect the privacy of the home owners.

5. SPECIAL PROVISIONS

Before the proposed habitability criteria are used to evaluate the habitability of the EDA, the following provisions should be met:

1. The habitability criteria should be subjected to an independent scientific peer review.

2. A small-scale pilot study should be conducted to demonstrate the feasibility of implementing the habitability criteria as proposed.

3. The following recommendations, as stated in 1981 by DHHS, must be complied with: "Any judgment regarding the future habitability of the Love Canal area rests on two important requirements. The first reservation is that appropriate measures must be taken to clean up the obvious contamination of local storm sewers and their

drainage tracts. Second, the security of Area 11* must be re-evaluated to guarantee permanent containment of chemicals in the dump. To assure habitability into the indefinite future, it is essential that optimal containment methods are installed and maintained and that continuous safeguards are observed to prevent further leakage from the site either through erosion of the clay cover or through its displacement by movement of dump contents."

The contamination of the storm sewers and creeks by 2,3,7,8-TCDD has not been remedied. This has caused two major concerns:

1. If the criteria allow the area to be considered acceptable for habitation prior to completion of remediation, there may be no incentive to complete remediation.

2. If remediation, when implemented, includes the movement of TCDD-contaminated soil and water into the EDA for treatment or storage or both as well as for transport or temporary storage, it may

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*Refers to the actual Love Canal and Rings I and II of residences that surround it.

force a reassessment of the habitability criteria for the EDA or render them non-applicable.

Therefore, it is the consensus of the scientific advisors, HHS, and DOH that the collection of environmental samples may proceed and could occur immediately, that an analysis of results could take place, and that comparisons could be made. However, further application of the criteria and decisions on habitability must await full remediation of the contamination of the storm sewers and, where indicated, the sanitary sewers. There must also be an acceptable plan for remediation of the creeks and, if applicable, other areas of known or suspected TCDD contamination such as the 93rd Street School in the EDA. This is intended to protect against human exposure or danger of further contamination of the environment with TCDD. In no event should people be encouraged to move into the EDA until the contamination in the creeks, as it affects the EDA, is remediated.

Based on these concerns, additional technical and administrative safeguards that provide for effective, continuous, and clearly accountable management of the Love Canal site must be in place:

1. The administrative structure should ensure accountability. The agency which administers the

remedial program at Love Canal, including operation of the treatment plant, must ensure that the operation is open to independent outside monitoring and review. Under the November 1984 amendments to the Resource Conservation and Recovery Act (RCRA, 42 U.S.C. 3251 et seq.), EPA has the responsibility to review the operation of state-owned or operated facilities.

2. Protocols for all aspects of the remedial action, including the treatment plant operation and supervision, should be developed. The protocols should include a timely synthesis, scrutiny, and application of analytical results for routine control and day-to-day operation of the treatment plant. Analyses should include determinations of the volume of leachates processed, amount and character of sludge generated, leachate characteristics during treatment (influent, midpoint, and effluent), and carbon removal and replacement requirements.

3. Quarterly reports summarizing results of remedial action/treatment plant operations should be prepared, advertised, and made available for public scrutiny.

4. A plan for periodic monitoring of the shallow well water in the EDA by EPA and NYSDEC to determine the effectiveness of remediation should be prepared and implemented. The plan should describe immediate measures that will be taken if the monitoring program reveals vulnerabilities or failures in the remediation activities.

6. COMPARISON STRATEGY

A. Neighborhoods

Criteria for habitability are intended to affect general residential viability over and above the designation of any individual home as "safe." For this reason, sociological advice resulted in the delineation of 13 discrete areas within the EDA that contain obvious arrangements of housing with the potential to become socially logical residential groupings. The delineation of these neighborhoods was based in part on input solicited from some of the community members.

A sampling plan will be developed to collect samples to determine the LCIC concentrations in soil throughout each neighborhood in the EDA. The sampling plan will allow the assessment of the chosen aggregate values (e.g., mean, mode, median, percentiles, etc.) of each LCIC in each neighborhood in the EDA and in the comparison areas. In addition, the samples will be available for individual examination and comparison. A sampling location may be retested and appropriate remedial action taken if the individual LCIC concentrations from that location are greater than anticipated.

A neighborhood in the EDA is considered habitable if all three of the following conditions are met:

1. If soil sample measurements of TCDD are less than 1 ppb and if the levels of other Love Canal chemicals are below existing federal or New York State standards, criteria, or guidelines

2. If the chosen aggregate values (e.g., mean, median, percentiles, etc.) of each non-TCDD LCIC evaluated both individually (univariate) and collectively (multivariate) are not significantly different than the values from the comparison areas

3. If the integrity of the neighborhood with reference to the habitability of individual homes within it and to its location relative to other neighborhoods (habitable or uninhabitable) is maintained

B. Residences

The air in each residence in the EDA will be sampled for airborne LCICs. The NYSDOH made a commitment to sample air in individual houses within the EDA for two reasons:

1. Air in basements was sampled to seek evidence of migration from the landfill during the early period of the Love Canal crisis (1978). While the findings could not be interpreted conclusively, the results did show varying levels of chemicals; this was a source of great concern to the occupants, and this concern remains.

2. Existing chemicals in each residence need to be assayed prior to reoccupancy to document levels for both the new occupant and the government. It will not be possible to make direct comparisons between empty residences and occupied residences.

Occupied residences in the EDA will be compared to occupied residences in the comparison areas. Residences in the EDA with LCIC concentrations found to be significantly greater than the chosen aggregate concentration of those LCICs measured in the comparison areas will be selected for retesting and remediation if appropriate.

The LCIC concentrations measured in unoccupied residences in the EDA will be compared to EDA ambient air LCIC concentrations. Unoccupied residences in the EDA with air LCIC concentrations significantly greater than the chosen aggregate concentration of those LCICs measured in the EDA ambient air will be selected for retesting and remediation if appropriate.

A residence in the EDA is considered habitable if all three of the following conditions are met:

1. If it is located in a neighborhood judged to be habitable

2. If the results of the air comparisons show that retesting and/or remediation are not necessary

3. If remediation is performed and is shown to be successful

C. <u>Churches and Commercial Establishments in the EDA</u>

At the request of their respective owners, churches, commercially owned land, and other non-residential properties will be included in the soil sampling protocol, and air in churches and commercially owned establishments will be tested for LCICs. The same habitability criteria used for residences will be applied.

D. The EDA

The whole EDA will be judged uninhabitable if no habitable neighborhoods can be defined within it by the criteria.

7. COMPARISON AREAS AND SELECTION METHODOLOGY

The comparison areas will be chosen from two or more inhabited urban residential census tracts in western New York State selected on the basis of the following sequentially applied criteria (Appendix 11):

1. Contain soil types and hydrogeological conditions similar to those found in the EDA; and,

2. Have borders located as far from known chemical landfill sites as possible, but no less than one-half mile; and preferably no less than one mile; and,

3. Exhibit similarities to the EDA with respect to Niagara Falls urban industrial framework and industrial base, prevailing winds in relation to industrial point sources of potential

environmental contamination, and selected socioeconomic status indicators such as density, value, and age of housing units.

In essence, the comparison areas will be chosen from two or more census tracts matched as closely as possible with the census tracts comprising the EDA, with the exception of the limitation on proximity to a known chemical landfill.

The methodology for selecting the comparison areas will include the following sequence of steps:

1. Identify and characterize soil types and hydrogeology found in the EDA.

2. Identify and map census tracted areas in western New York with soil types and hydrogeology similar to those of the EDA.

3. Identify and map known chemical landfill sites in and adjacent to the census tracts identified in "2" above.

4. Rank census tracts with EDA-like soil types and hydrogeological conditions by distance from known chemical landfill sites, excluding those census

tracts with borders one-half mile or less from known sites.

5. Compare the remaining census tracts with the two census tracts comprising the EDA for similarity with respect to industrial base, prevailing winds in relation to industrial point sources of potential environmental contamination, and selected socioeconomic status indicators such as density, value, and age of housing.

6. Starting with census tracts closest to known landfill sites, reject tracts which represent the poorest match with the EDA, until the list is reduced to six tracts.

7. Review existing data on landfill sites proximate to the six tracts for any suggestion of potential impact on each of the six census tracts; reject any tracts for which there is evidence of offsite migration from a proximate landfill site which could potentially affect the tract.

8. Visit the remaining tracts and survey for visual comparability with the EDA; reject tracts or portions of tracts which, in the opinion of NYSDOH, are markedly different.

The two or more census tracts which are located farthest from or are the least impacted by known landfill sites and which have met all the other criteria will be selected for use as the comparison areas. The environmental data generated from the sampling of the two or more census tracts will be treated as one data set but data from all census tracts will be available for separate analysis if such analysis is deemed worthwhile.

8. ENVIRONMENTAL MEDIA AND LCICs TO BE CONSIDERED

A. Soil and Air

LCICs have been individually selected for soil and air on the basis of a review of existing environmental data which documented the following:

1. Their presence in Love Canal

2. Their presence in the EDA

3. Their possible migration or displacement from the Canal to the EDA (e.g., concentrations in Rings I and II higher than in the EDA)

4. Their potential for being Love Canal chemicals (those chemicals that are known or suspected to have been deposited in Love Canal)

This approach assumes that LCICs can serve as indicators of contamination of the EDA resulting from chemical migration or displacement from the Love Canal. The soil LCIC are beta BHC, gamma BHC, total BHC, chlorobenzene, 1,2-dichlorobenzene, 1,2,4,-trichlorobenzene, 1,2,3,4-tetrachlorobenzene, and 2-chloronaphthalene. As previously discussed, 2,3,7,8-tetrachlorodibenzo-p-dioxin will be compared to the 1-ppb level of concern. The air LCICs are chlorobenzene, 2-chlorotoluene, and 4-chlorotoluene.

B. Groundwater and Sump Pumps

Groundwater testing and sampling of the contents of sump pumps are not included in the comparisons of environmental media for the purpose of determining habitability of the EDA. This decision is based primarily on the assumption that there could not be significant human exposure due to either of these media. Groundwater is not used for drinking by any of the residents or potential residents of the EDA and ingestion is therefore not a principal direct route of exposure. If contaminated groundwater were leaking into the EDA and into basements, it might be expected to be concentrated in sump pumps. The most logical pathway for human exposure to the contents of sumps would be through volatilization, and the criteria do call for air sampling for comparison purposes.

Existing groundwater chemical data and hydrogeological data demonstrate little, if any, groundwater contamination beyond Rings I and II (Appendix 6). In addition, groundwater monitoring is included as one of the special provisions and is an integral part of the remedial program. Monitoring of the EDA groundwater in the summer of 1984 did not demonstrate contamination by Love Canal chemicals.

9. QA/QC OF ENVIRONMENTAL DATA

Any environmental data used in determining habitability should meet the requirements for QA/QC as discussed in Appendix 12. Future environmental sampling protocols should be reviewed by the community and the TRC before they are implemented. EPA standards for QA/QC should be adhered to in any future environmental analyses.

10. CONSENT FOR SAMPLING

All environmental sampling recommended in this document will require written consent of the landowners. It is recommended that a pilot study be conducted as soon as possible to determine the willingness of property owners to participate in this study.

11. OTHER IMPORTANT CONSIDERATIONS

The criteria for determining habitability, as specified above, were based on existing knowledge of toxicology and are expected to protect future residents of the area against detectable harm from any residual levels of Love Canal chemicals that may remain. Nonetheless, to address certain basic indicators of public health in Love Canal--with the understanding that the results of future studies may reflect exposures before relocation, unmeasured factors related to the response to a perceived crisis, or undetermined exposures after relocation--the scientific experts recommended that the NYSDOH determine the following:

1. Whether Love Canal residents have experienced an increased mortality rate relative to other comparable U.S. urban areas.

2. Whether the rate of cancer has increased among Love Canal residents relative to other comparable U.S. urban areas.

3. Whether the rate of congenital malformations or other adverse reproductive outcomes have increased

among Love Canal residents relative to other comparable U.S. urban areas. (The above indicators of general health status will be reviewed in the comparison areas).

4. Whether studies can be designed to determine if other chronic diseases or social problems that can be independently verified have occurred more frequently in Love Canal residents.

5. Whether small-animal surveillance is feasible and useful.

Although the above determinations are not directly related to the development of habitability criteria, the major importance of the Love Canal episode requires that New York State health officials assure the public and scientific community that these questions will be addressed and reported in a timely manner.

WDR102/036

Chronology of Love Canal

APPENDIX 1

Appendix 1

CHRONOLOGY OF LOVE CANAL

Segments of the history of the Love Canal have been documented in several publications during the last five years. These publications have been used as a source of information in compiling this summary of the events leading to the charge to the Centers for Disease Control (CDC) and the New York State Department of Health (NYSDOH) by the Environmental Protection Agency (EPA) to recommend criteria to determine habitability in the Love Canal Emergency Declaration Area.

The former Love Canal landfill is a rectangular, 16-acre tract of land located in the southeast end of the City of Niagara Falls in Niagara County on the western frontier of New York State.

The landfill takes its name from William T. Love, whose plan it was in the 1890's to dig a power canal between the upper and lower Niagara Rivers to provide cheap hydroelectric power for a proposed model industrial city. The model city project and the partially dug canal were abandoned before the turn of the century when alternating current was invented, obviating the need for industry to locate near the source of power.

Aerial photography from 1938 depicts the canal as being about 3,000 feet long and almost 100 feet wide, extending in a north-south axis, with the southern end approximately 1,500 feet from the Niagara River. Much of the canal bed contained impounded water and there was no visible evidence of waste disposal in 1938. The excavation was reportedly used as a swimming hole for local residents for several decades into the twentieth century.

Manufacturing of chemical and allied products was, and still is, a major industrial enterprise in Niagara County. In 1970 there were nine major chemical producing companies in the county employing a total of 5,267 people. Today, 115 inactive hazardous waste sites have been identified within the county. One of these is the Love Canal landfill, in which the Hooker Electric Chemical Company, now the Occidental Chemical Corporation, admitted to dumping at least 21,800 tons of chemical wastes between 1942 and 1953. These wastes, some drummed, some not, included chlorinated hydrocarbon residues, processed sludges, fly ash and other materials. The City of Niagara Falls also used the site for disposal of municipal wastes for a number of years, concluding in 1953.

In the spring of 1953, the site was sold by the Hooker Chemical Company to the Board of Education of the City of Niagara Falls. Beginning in 1950, home building accelerated along the streets adjacent to the canal and the existing residential neighborhood grew (several homes had been built in the 1930's and 40's). In 1954 a public elementary school was built on the middle third of the Love Canal property.

During the years that followed, chemical odors from the landfill were cited by residents in complaints to local officials. There were also persistent reports of chemicals breaking through the top soil of the canal, spontaneous fires on the canal, and children and pets injured by chemicals while playing at the canal site, etc.

As early as the mid-70's it became increasingly apparent that rain water and melting snow had seeped into the canal and forced waste chemicals to the surface of the site and led to the lateral spread of chemicals into yards and basements of adjoining homes. Other possible migration routes are being studied and have not been ruled out.

In the late winter of 1978, Department of Health (DOH) analyses of sump samples from eight homes abutting the Love Canal revealed significant levels of toluene, chlorobenzene, dichlorobenzene, and other compounds. The Environmental Protection Agency (EPA) released a report by Research Triangle Institute confirming the presence of significant contamination of air samples taken from six homes bordering the landfill. In April, based on these findings and a review of other information, the New York State Commissioner of Health declared the area a threat to human health and welfare and ordered local health officials to restrict access to the landfill site.

Throughout the spring and summer a remedial action plan was developed, environmental sampling and analyses continued, and epidemiological studies were initiated. At the end of July, the Commissioner of Health convened a meeting of nationally prominent experts in toxicology, epidemiology and industrial hygiene to present the State's findings, seek recommendations and review further actions to protect public health and correct environmental problems.

On August 2, 1978 the Commissioner of Health declared a state of emergency at the Love Canal and issued a second, more detailed order to the county, city and school board recommending relocation of pregnant women and children under two residing in those dwellings adjacent to the canal, as well as closure of the 99th Street School.

Recognizing the complexity of the Love Canal situation and the necessity for close coordination of all State activities and assistance, the Governor on August 3, 1978 directed the formation of an interagency Love Canal Task Force. The Task Force was charged with three responsibilities:

- the relocation of affected families;

- the construction of a drainage system to prevent further migration of toxic chemical waste from the landfill; and

- the continuation of environmental testing and toxicological and epidemiological health studies.

On August 7, 1978 the President of the United States declared an emergency under Public Law 93-288 and authorized actions necessary to save lives and property or to avert or lessen the threat of disaster at the Love Canal; and the Governor expanded the State's relocation effort, authorizing permanent evacuation of all persons in homes in the first two rings immediately adjacent to the canal regardless of family makeup. This directive called for the immediate relocation of 239 families to interim housing, a subsequent move to permanent housing of their choice, and a provision of all relocation benefits which normally accompany State acquisition of right of way.

To accomplish this unprecedented undertaking, personnel with experience in purchase of real property from around the State were called in to inventory available housing, interview residents to determine housing needs, survey and appraise homes, arrange for families to rent and move into temporary housing, provide security for the empty houses, purchase the 239 Love Canal homes in Rings I and II at fair market value, and help families make the move to permanent housing.

During the same period, plans were finalized to contain the migration of chemicals from the canal site, and environmental testing and epidemiological studies continued. These measures, however, failed to reassure residents remaining in areas surrounding the canal that their health and safety was secured. Residents outside of Rings I and II were concerned that chemical wastes might have migrated into their homes and also feared that planned remedial work would cause additional exposure to toxic chemicals. In an effort to address these fears, the Love Canal Homeowners Association organized activities to effect a further expansion of the boundaries of the officially designated "state of emergency" to enable more families to be eligible for permanent relocation.

By January 1979, virtually all families living in Rings I and II had been temporarily relocated, and 232 purchase agreements had been signed by the State with the owners of eligible Love Canal properties.

To further assist Love Canal homeowners and help stabilize the area, the State approved a $1.2 million support program, including $1 million in State aid for a five-year graduated property tax relief program and a $200,000 contract with United Way of Niagara Falls to provide psychological and family counseling for area residents.

Based on continuing evaluation of environmental and health data, the Department of Health, on February 8, 1979, issued a supplemental order recommending that all pregnant women and children under the age of two (residing between 97th Street and 103rd Street and from Frontier Avenue north to Colvin Boulevard) be temporarily relocated away from the area. The Governor modified the order to apply to entire families with pregnant women or young children and to include residents of the LaSalle Development, a low income housing project west of the Love Canal. Approximately 49 families became eligible for this temporary relocation and, of these, 45 were temporarily moved from the area at their request.

In June of 1979, a State Supreme Court Justice, in response to a Show Cause Order filed by the Homeowners Association, ordered temporary relocation at State expense for area residents who claimed to be suffering illness or having breathing difficulties associated with site excavation work to lay the peripheral drains around the landfill. Throughout the summer and fall, particularly on smoggy days, varying numbers of area residents requested and were given temporary relocation to hotels or to nearby Niagara University because of such illness or discomfort.

By mid-October 1979, three relocation programs were in progress at the Love Canal, with the following status:

1. Permanent Relocation Program for Rings I and II: of the 239 families eligible, 237 closings on property parcels had been completed.
2. Temporary Relocation Program for Families with Pregnant Women or Young Children: of the 49 eligible familes, 33 sought and had been placed in apartments or other, longer term housing.
3. Temporary Relocation Based on Illness Associated with Remedial Construction Work: 91 families were being maintained in temporary accommodations.

On November 5, 1979 the last of the deep excavations at the construction site was completed and the temporary relocation program ordered by the Supreme Court was terminated; residents in hotels were notified that temporary housing in hotels would no longer be provided at State expense.

In the two years that followed, an increasingly adversarial relationship developed between certain state and local officials, on one hand, and a core of remaining residents on the other. The conflict between the two was rooted in the fact that the boundaries of risk were and continue to be ambiguous.

While increased levels of chemicals related to the Canal were detected on the Canal site itself, in storm sewers and creeks draining the area, and in certain homes in the first two rings, no official report was issued documenting either the extent of leachate migration or the probability of health risk attendant upon it. The decision to relocate residents from Rings I and II has been characterized as a pragmatic one, based on limited data demonstrating beyond any reasonable doubt that toxic chemical waste products had been identified in and/or on the property of some specific homeowners living adjacent to the Canal. These findings and the reactions of homeowners to it suggested the relocation of all residents living on the streets immediately surrounding the Canal as the most prudent course of action.

A number of remaining residents felt that these boundaries drawn by the state for relocation may have been arbitrary, and less than fully reasonable, and groups of such residents and advocates began to organize around their convictions. Among these were the Love Canal Homeowners Association and the Ecumenical Task Force. Media focused intense public and political attention on the Love Canal situation and a barrage of criticism on the state's policies ensued.

On May 17, 1980, the EPA announced that a recent study showed evidence that some residents of the Love Canal may have suffered chromosome damage from exposure to toxic chemicals buried at the landfill. This announcement created widespread panic and fear among remaining residents. Three days later, Love Canal Homeowners held two representatives of the EPA hostage for five hours in an effort to gain a hearing with the White House to demand immediate evacuation of the area surrounding the Canal and Rings I and II.

Responding to the situation on May 21, 1980, the Governor Carey requested President Carter to declare an emergency in the Love Canal area, paving the way for federal aid to relocate families who lived near the former dumpsite. President Carter responded on May 22, 1980 by declaring a Federal Emergency in the area and offering federal funds for temporary relocation. In June of that same year, the Governor, stating that the federal declaration did not go far enough, requested federal assistance in the purchase of Love Canal homes.

On July 3, Congress approved emergency appropriations allowing the President to spend up to $20 million on the relocation of families in the Love Canal EDA. Following several weeks of negotiations, the federal government agreed to provide a $7.5 million grant and a $7.5 million advance to New York State for the acquisition of Love Canal properties. This $15 million total was to be administered by the previously created Love Canal Area Revitalization Agency, which would act as the agent for the purchase of eligible properties and for the revitalization of the area. This unprecedented agreement was signed by the Governor and the President in October 1980, rendering some 550 homes eligible for purchase at the owner's request. To date, 442 of the 550 eligible homes in the EDA have been purchased by LCARA.

In the last two years, increasing attention has been directed toward the stabilization and revitalization of the EDA. In the summer of 1982, the USEPA released a study begun in August of 1980, designed to assess the extent of contamination of air, water and soil in the EDA as a basis for forming recommendations regarding future use of the area. Later, the Department of Health and Human Services became responsible for deciding, on the basis of the EPA study and other data, whether the EDA was habitable. In July of 1982, after considering comments by the National Bureau of Standards on the procedures the EPA used, and after further consultation with the EPA, DHHS affirmed its earlier provisional decision that the EDA was as habitable as the control area to which it was compared. This decision was contingent on the provision that the storm sewers and their drainage tracts be cleaned and that special plans be made to perpetually safeguard future leakage from the Canal.

In December of 1982, the Congressional Office of Technology Assessment (OTA) was requested by Senators Daniel Moynihan and Alfonse D'Amato of New York to prepare a case study to examine the technical basis for, and validity of, the habitability decision for the Emergency Declaration Area. The OTA was also asked to examine the current monitoring and clean-up activities at the Love Canal and the plans for future remedial action.

In June of 1983, the OTA published its findings in a technical memorandum. The OTA's principle finding was that with the information available, it was not possible to conclude either that unsafe levels of toxic contamination exist or that they do not exist in the EDA; and that the analysis of available data does not support the DHHS decision that the EDA was as habitable as the control areas with which it was compared. In addition, the OTA report indicated that there remains a need to demonstrate more unequivocally that the EDA is safe immediately, and over the long term, for human habitation. If that cannot be done, the OTA report suggests that it may be necessary to accept the original presumption that the area is not habitable.

In August of 1983, in response to the OTA report, the EPA established a Technical Review Committee (TRC) composed of the EPA, DHHS, NYSDOH and DEC to provide coordination and oversight for all aspects of the remedial program at the Love Canal.

As members of the TRC, the CDC and the NYSDOH have been requested to recommend to the Director of the EPA and the New York State Commissioner of Health criteria to be used to determine habitability of houses in the EDA.

Sources

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2. New York State Department of Environmental Conservation: Inactive Hazardous Waste Disposal Sites in New York State: January 1, 1984.

3. Heath, Clark, W. Jr., MD: "Assessment of Health Risks at Love Canal": presentation at the Fourth Annual Symposium on Environmental Epidemiology: May 2-4, 1983, Pittsburgh, PA.

4. Fowlkes, Martha R. and Miller, Patricia Y.: Love Canal: The Social Construction of Disaster; The Federal Emergency Management Agency: October 1982.

5. U.S. Congress Office of Technology Assessment, Habitability of the Love Canal Area - An Analysis of the Technical Basis for the Decision on the Habitability of the Emergency Declaration Area - A Technical Memorandum; June 1983.

Expert Scientists:
Attendance at Meetings and Curriculum Vitae

APPENDIX 2

Appendix 2
EXPERT SCIENTISTS: ATTENDANCE AT
MEETINGS AND CURRICULUM VITAE

Name and Address	Meetings (X indicates meetings attended) 1984						1985
	3/14	5/2-5/3	6/29	7/26	9/26	11/14	3/27
Thomas Chalmers, M.D. Distinguished Service Professor Mt. Sinai School of Medicine Annenberg 24-64 1 Gustave L. Levey Place New York, New York 10029	X	X	X	X			X
Devra Lee Davis, Ph.D., M.P.H. Executive Director Board on Toxicology and Environmental Health Hazards National Research Council 2101 Constitution Avenue Washington, D.C. 20418	X	X		X		X	X
Martha R. Fowlkes, Ph.D. Associate Professor Department of Sociology and Anthropology Smith College Northampton, MA 01060	X	X	X		X	X	X
Patricia Miller, Ph.D. Associate Professor Department of Sociology and Anthropology Smith College Northampton, MA 01060	X	X	X	X	X	X	X
Frederick G. Pohland, Ph.D. Professor and Coordinator of Environmental Engineering School of Civil Engineering Georgia Institute of Technology Atlanta, Georgia 30332	X	X	X	X	X	X	X

Name and Address	Meetings (X indicates meetings attended) 1984 3/14	5/2-5/3	6/29	7/26	9/26	11/14	1985 3/27
Ellen K. Silbergeld, Ph.D. Senior Scientist Toxic Chemical Program Environmental Defense Fund 1525 18th Street, N.W. Washington, D.C. 20036							
I. Glenn Sipes, Ph.D. Professor of Pharmacology, Anesthesiology & Toxicology Arizona Health Sciences Center Tucson, Arizona 85724	X	X	X	X	X	X	X
Michael Stoline, Ph.D. Biostatistician Department of Mathematics Western Michigan University Kalamazoo, Michigan 49008		X	X	X	X	X	X
Jan A. Stolwijk, Ph.D. Yale University School of Medicine Chairman Department of Epidemiology and Public Health P.O. Box 3333 New Haven, Connecticut 06510	X	X	X	X			X
Arthur Upton, M.D. Professor and Chairman Institute of Environmental Medicine New York University Medical Center 550 First Avenue New York, New York 10016				X			
Warren Winklestein, Jr., M.D. Professor of Epidemiology School of Public Health 140 Warren Hall University of California Berkeley, California 94720	X		X		X	X	X

Note: At the request of the community Joseph Highland, Ph.D., School of Engineering, Princeton University, Princeton, NJ 08544 was invited to participate as a consultant but was unable to do so because of other commitments. Dr. Stoline was not asked to serve as a consultant until April 1984.

WDR102/039

Curriculum Vitae

Thomas C. Chalmers, M.D.

Born: Forest Hills, New York — S:S.# 041-18-1186
December 8, 1917

Business Address — Mount Sinai Medical Center
One Gustave L. Levy Place
New York, New York 10029
(212) 650-8254

Education & Training

Yale College	1936-39
Columbia College of Physicians and Surgeons	M.D.1943
Medical Intern, Presbyterian Hospital, New York City	1943-44
Research Fellow, Department of Medicine, New York University Malaria Research Unit, Goldwater Memorial Hospital, NYC	1944-45
Assistant Resident & Resident, 2nd and 4th Medical Services (Harvard), Boston City Hospital, Boston	1945-47
Research Fellow, Harvard Medical School and Thorndike Memorial Laboratory, Boston City Hospital, Boston	1946-47

Licensure

Licensed to practice medicine
New York State License No. 42374 — Date Issued: May 12, 1944

Academic Appointments

1947-1961	Harvard Medical School	Assistant in Medicine Instructor Clinical Associate Assistant Clinical Professor of Medicine
1961-1968	Tufts University School of Medicine	Professor of Medicine
1962-1975	Harvard Medical School	Lecturer in Medicine
1970-1973	George Washington University School of Medicine	Professor of Medicine
1973-1983	Mount Sinai School of Medicine of the City University of N.Y.	Dean and President Professor of Medicine
1983-	Mount Sinai School of Medicine of the City University of N.Y.	President Emeritus, Dean Emeritus and Distinguished Service Professor

HOSPITAL AND RELATED APPOINTMENTS

Boston City Hospital, 2nd and 4th Medical Services, (Harvard) and Thorndike Memorial Laboratory, Boston

1947-1948	Out-patient Physician
1949-1953	Assistant Visiting Physician
1955-1968	Associate Visiting Physician

Mount Auburn Hospital, Cambridge

1947-1953	Junior Physician
1955-1968	Associate Visiting Physician

New England Center Hospital, Boston

1961-1968	Associate Staff

Faulkner Hospital, Boston

1955-1968	Consultant in Medicine

Lemuel Shattuck Hospital, Boston

1955-1968	Chief of Medical Services

Director of Hepatitis Study, Commission in Liver Disease, Armed Forces

1951-1953	Epidemiological Board

Veteran's Administration Central Office, Washington, D.C.

1968-1970	Assistant Chief Medical Director for Research and Education

National Institute of Health

1970-1973	Associate Director for Clinical Care & Director of the Clinical Center

Mount Sinai Medical Center, New York City

1973-1983	President

MILITARY SERVICE - United States Army Reserve, Walter Reed Army Hospital Washington, D.C.

1953-1955	Captain

COMMITTEES AND BOARDS

Federal Advisory Committees

National Heart and Lung Institute

1961-1965	Training Committee
1964-1969	Heart Special Projects Committee (Chairman, 1968-69)
1968	Diet-Heart Review Panel

National Cancer Institute

1965-1966	Cancer Chemotherapy Collaborative Program Review Committee (Richardson Committee)

Health Resources Administration (HEW)

1974-	National Center for Health Statistics (Consultant)

Food and Drug Administration

1970-1974	Consultant to the Bureau of Drugs
1973-1975	Drug Experience Advisory Committee
1975-1976	Review Panel on New Drug Regulations (Chairman)

Veterans Administration

1971-1974	Cooperative Studies Evaluation Committee (Chairman, 1972-74)
1974-1975	Medical School Assistance Review Committee
1976-	Center for Ulcer Research and Education, Los Angeles Advisory Board Member

Department of Defense

1965-1973	Surgeon General's Advisory Committee on General Medicine, Subcommittee on the Liver
1970-1972	United States Army Medical Research and Development Command, Consultant to the Commander

Clinical Trial Policy Advisory Boards and Data Monitoring Committees

1966-1975	National Heart and Lung Institute, Coronary Drug Project
	1966-1968 Special Review Panel
	1966-1975 Data and safety Monitoring Committee
1971-	National Heart and Lung Institute, Safety Monitoring Committee, Type II Hyperlipidemia Coronary Intervention Study
1968-1972	National Heart and Lung Institute, Urokinase-Streptokinase Pulmonary Embolism Trials Policy Board
1971-1973	Boston Collaborative Drug Surveillance Program, Myocardial Infarction Study Advisory Board
1971-1978	National Institute of Arthritis, Metabolism and Digestive Diseases, National Cooperative Crohn's Disease Study Advisory Board (Chairman)
1972-1975	National Heart and Lung Institute, Hyper-immune Gamma Globulin Trials Policy Board
1972-1977	University Group Diabetes Program, Policy Advisory Board (Chairman)
1978-	National Institute of Arthritis, Metabolism and Digestive Diseases, Member of Policy Advisory Committee of the National Cooperative Gallstone Study
1974-	Persantine-Aspirin Re-Infarction Study Policy Board (Chairman)
1975-	Program on the Surgical Control of the Hyperlipidemias, Data Monitoring Committee (Chairman-1978)
1976-	VA-NHLBI Cooperative Study of Mild Hypertension, Advisory Committee on Trial Design

National Academy of Sciences - National Research Council Committees

1965-1969	Committee on Epidemiology and Veterans Follow-up Studies
1974-1977	" " " " " "
1970-1972	Ad Hoc Committee on Hepatitis-Associated Antigen Tests
1971	Ad Hoc Committee on Hepatitis-Associated Antigen Carrier Guidelines
1972-1973	Division of Medical Sciences, Member-at-Large
1974	Visiting Committee, Drug Review Board

MISCELLANEOUS COMMITTEES AND BOARDS

1963-1967	American Gastroenterological Association, Committee on Research
1964-1967	American Public Health Association, Committee on New Drugs
1966-1970	Pharmaceutical Manufacturers Association Foundation Advisory Committee to the Faculty Development Awards in Clinical Pharmacology Program (Chairman, 1968-1970)
1966-1968	Pharmaceutical Manufacturers Association Foundation Scientific Advisory Committee
1970-1976	American Board of Internal Medicine, Subspeciality Board on Gastroenterology
1974-1976	American Gastroenterological Association, Committee on Publications and Communications
1974-	National Disease and Therapeutic Index, Advisory Committee of Physicians and Educators
1975-	Board of Overseers of Harvard College, Visiting Committee on Statistics
1975-	The Public Health Research Institute of the City of New York, Inc., Board of Directors
1977-1979	National Commission on Digestive Diseases, Chairman of the Subcommittee on Clinical Trials
1978-	Institute of Medicine (Natl. Acad. of Sci.) Membership Committee
1978-1979	Advisory Panel on Coronary Disease (Council on Sci. Affairs of the AMA)
1981-	International Physicians for the Prevention of Nuclear War
1982-	Physicians for Social Responsibility
1982-	Technical Board of the Milbank Memorial Fund
1983-	Chairman, Board of Trustees, Dartmouth-Hitchcock Med. Center

PROFESSIONAL MEMBERSHIPS

American Association for the Study of Liver Disease (President, 1959)
American Board of Internal Medicine, 1950 and Recertification, 1974
American Clinical and Climatological Association
American College of Gastroenterology (Honorary Fellow, 1975)
American College of Physicians
American Federation for Clinical Research
American Gastroenterological Association (President, 1969)
American Public Health Association
American Society for Clinical Investigation
Associated Medical Schools of New York (Vice President, 1974-1975; President, 1976-1977)
Association of American Medical Colleges
Association of American Physicians
Biometric Society
International Association for the Study of the Liver (Councilor for North America, 1970-1974)
Medical Society of the County of New York

PROFESSIONAL MEMBERSHIPS (cont'd.)

Medical Society of the State of New York
National Academy of Science, Institute of Medicine
New York Academy of Medicine (Fellow)
New York Academy of Sciences
Practitioners Society of New York
Society for Epidemiological Research
Society for Experimental Biology and Medicine
National Library of Medicine, Board of Regents (1978-1979)
AOA (1979)
Ethics Advisory Board-Special Consultant, 1980 (NIH) Department of Health and Human Services

AWARDS

Julius Friedenwald Medal for Outstanding Achievement in Gastroenterology 1982
Paul Lazarfeld Award for Research 1982 given by the Evaluation Research Society

BIBLIOGRAPHY
Thomas C. Chalmers, M.D.

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231. Chalmers, T.C. Randomized Clinical Trials and the Consumers. In: The Randomized Clinical Trial and Therapeutic Decision. Chapter 18. Eds. Niels Tygstrup, John M. Lachin, and Erik Juhl. New York: Marcel Dekker, 1982.

232. Chalmers, T.C. Doctors Well-Trained in Basic Health Care. Letter to the Editor. New York Times. August 13, 1982.

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245. Chalmers T.C., van den Noort S., Lockshin M.D., Waksman B H. Summary of A Workshop On The Role of Third-Party Payers in Clinical Trials of New Agents. N Engl J Med 309: 1334-1336, 1983.

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248. Chalmers TC. Discussion of Presentations by Christian R. Klimt, Sandra A. Forman and Darwin R. LaBarthe. Israel J Med Sci 19: 479-480: 1983

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EDUCATION

B.S.	1967, University of Pittsburgh, Physiological Psychology, with honors
M.A.	1967, Sociology of Science, with honors
Ph.D.	1972, University of Chicago, Science Studies
M.P.H.	1982, The Johns Hopkins University, Epidemiology

PROFESSIONAL EXPERIENCE

1983 - Executive Director, Board on Toxicology and Environmental Health Hazards, National Academy of Sciences/National Research Council. The major duties and responsibilities of this position include: the development and management of studies on contemporary problems in toxicology, epidemiology, and environmental health; the conduct of studies on scientific issues that underlie regulatory decisions; the coordination of 12 study committees comprising 200 scientists in a variety of disciplines; the recruitment and supervision of 13 professionals; and the management of a yearly budget of approximately $2.5 million.

1979 - 1983 Science Policy Director (1982 - 1983), Director, Toxic Substances Program (1979-1982) and Member of the Board of Directors of ELI, a National nonprofit interdisciplinary research center. Directs federal and foundation research and fundraising on chronic disease epidemiology, cancer policy, regulatory innovation, occupational, environmental and health policies, risk and exposure assessment, Superfund, compensating victims of pollution, and regional approaches to managing hazardous wastes. Raised $1.4 million.

1977-79 Senior Health Policy Advisor, Environmental Protection Agency, Science Advisory Board, Office of the Administrator. Advised on establishing the Offices of Toxic Substances and Health and Environmental Assessment. Served as Executive Secretary of the Administrator's Toxic Substances Advisory Committee.

1974-77 Health Consultant, main clients included: New York State Board of Medicine; Thompson Medical Company; New York University Institute of Rehabilitation Medicine; New York Society of Physicians and Dentists for Acupuncture.

1970-76 Queens College, City University of New York, Assistant Professor, 1972-73; Director of Interdisciplinary Studies; Director of Population and Pathology Project; Co-Director, Institute of Sociology and Education.

FACULTY APPOINTMENTS

1983 Visiting Professor, Environmental Medicine, University of Madrid
1982- Associate, Department of Health Service Administration, The Johns Hopkins University, School of Hygiene and Public Health
1970-76 Assistant Professor, Department of Sociology, Queens College, City University of New York, Flushing, New York

ADVISORY POSITIONS

1982- Member, Technical Reports Review Subcommittee of the National Toxicology Program Board of Scientific Counselors
1982 Scientific Reviewer, Asbestos Criteria Document, Environmental Protection Agency
1982 Advisor, Cancer Policy, Brookhaven National Laboratory, Department of Energy
1983- Advisor on toxic substances and policy standards to the Director General, Pharmaceutical and Drug Administration, Ministry of Health, Madrid, Spain.
1984 Member, Childhood Lead Poisoning Prevention Advisory Committee, Centers for Disease Control
1984 Member, Advisory Group on the Habitability Criteria for Love Canal, New York State Department of Health

PROFESSIONAL AFFILIATIONS

Fellow, American College of Epidemiology
American College of Toxicology
Society for Occupational and Environmental Health, Governing Council, 1981
American Association for the Advancement of Science
American Public Health Association
Society for Epidemiological Research
New York Academy of Sciences
Health Task Force, Committee for Lead Elimination in the District of Columbia

HONORS AND AWARDS

Undergraduate and Graduate

	University of Pittsburgh:
1964-66	Special Fellowship Student: Service Awards
1966	National Science Foundation: Honors Undergraduate in Physiological Psychology
1967	National Science Foundation: Graduate Traineeship, Department of Sociology
1967-70	University of Chicago: Danforth Foundation Graduate Fellow
1968	Virginia Union University: Visiting Scholar, Title IV, Department of Sociology

Post-Doctoral Fellowships

1971	National Science Foundation Fellow in History, Philosophy and Sociology of Science, Catholic University of America
1976	Fellow in Health and Environmental Policy, World Man Fund,
1977	U.S. Public Health Association: Finalist in J. D. Lane Open Competition, 1977
1981-82	National Cancer Institute Senior Fellow in Cancer Epidemiology

BIOGRAPHICAL LISTINGS

The World Who's Who of Women; Who's Who in American Women; Who's Who in the East

PUBLICATIONS

Refereed Articles

Davis, D.L. "Acupuncture," Journal of the American Medical Association, 229 (September 1974), p. 1421.

Davis, D.L. "Universitatsverlage: Kampf um Uberleben," Boersenblatt des Deutschen Buchhandels, Frankfurt: Boersen Verein des Deutschen Buchhandels, NR 6, 21 (January 1975), 111-16.

Davis, D.L. "The History and Sociology of the Scientific Study of Acupuncture," American Journal of Chinese Medicine, 3:1 (1975), 5-26.

Davis, D.L. "Density, Crowding and Stress: A theoretical Model and an Unobtrusive Measure," Systems Thinking and the Quality of Life, (C.K. Blong, ed.), Washington D.C.: Society for General Systems Research, (1975), 105-16.

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Davis, D.L. "When the Neighbors get Noisy, We bang on the Walls: A Critique of Density and Crowding," American Journal of Social and Behavioral Sciences, (1976).

Davis, D.L., L.K.Y. Ng and R.W. Mandersheid. "The Health Promotion Organization: A Practical Intervention Designed to Promote Healthy Living," Public Health Reports, 93:5, (1978), 444-455.

Davis, D.L. "Multiple Risk Assessments As Preventive Public Health Strategy," FDA Symposium on Risk/Benefit Decisions in the Public Health, J. Staffa (ed.). Washington, D.C., 1979.

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Davis, D.L. "Science and Regulatory Policy," Science, (January 5, 1979), 203:7.

Davis, D.L. "Cancer and Chemical Production," with Brian Magee, Science, 206 (December 21, 1979), 1356-58.

Babich, H., D.L. Davis, and G. Stotzky. "Acid Precipitation," Environment, 22:4 (1980), 6-13.

Babich, H., D.L. Davis, and J. Trauberman. "Setting of Environmental Quality Criteria: Some Considerations," with Environmental Management, 1981.

Davis, D.L. "Cancer in the Workplace: The Case of Prevention," Environment, 23:6, 25-37, reprinted in Congressional Record, October 20, 1981.

Davis, D.L., H. Babich and G. Stotzky. "Dibromochloropropane," Science of the Total Environment, 17 (1981), 207-221.

Davis, D.L. and H. Babich. "Food Tolerances and Action Levels: Do They Adequately Protect Children?" Bioscience, (June 1981), pp. 429-438.

Davis, D.L. and H. Babich. "Phenol: A Review of Environmental and Health Risks," Regulatory Toxicology and Pharmacology, 1, (1981), 90-109.

Davis, D.L. and H. Babich. "Updating Federal Standards for Toxicants: n-Hexane as the Model," Environmental Monitoring and Assessment, 2, (1982), 287-299.

Davis, D.L., K. Bridbord, and M. Schneiderman. "Estimating Cancer Causes: Problems in Methodology, Production, and Trends," Banbury Report 9: Quantification of Occupational Cancer, (1981) 285-316.

Davis, D.L., K. Bridbord, and M. Schneiderman. "Cancer Prevention: Assessing Causes, Exposures and Recent Trends in Incidence and Mortality," Teratogenesis, Carcinogenesis, and Mutagenesis, 2, (1982), p. 105-135. Reprinted in the International Journal of Health, (1983), Vol. 13, No. 3, 337-372.

Davis, D.L. and S. Gusman. "Exposure Assessment: An Introduction," Co-editors, Two Special Issues, Toxic Substances Journal, (Summer and Autum, 1982), Vol. 4, Nos. 1 and 2.

Davis, D.L. "Workplace Cancer: The Case Against Complacency," Health and Safety at Work, Vol. 5, No. 8 (Surrey, England, 1983), 19-21.

Davis, D.L., L. Ritts & J. Trauberman. "Compensation for Victims of Toxic Pollution--Assessing the Scientific Knowledge Base" (March 1983) PRA Research Report 83-6. NSF 83-31. NTIS PB83202-978. 219 pp.; Addendum 2. "Compensation for Victims of Toxic Pollution--Assessing the Scientific Knowledge Base" (April 1983) PRA Research Report 83-8. NSF 83-46. NTIS PB 83212-308. 71 pp.

Davis, D.L. "The Shotgun Wedding of Science and Law: Case Law on Risk Assessment," Columbia Journal of Environmental Law, forthcoming.

Davis, D.L. and A. Pope. "Reproductive Risks of Benzene: Need for Additional Study." To be presented at the International Conference on Organic Solvent Toxicity, Stockholm, Sweden, October 15-17, 1984.

Pope, A., E. Paulson, and D. Davis. "The Need for Documentation Indicators for Health and Environmental Data Reference." Presented at the Chemical Manufacturers Association Workshop on Indicators of Data Documentation Quality, May 1984.

Davis, D. and Mandula, B. "Asbestos and Public Health." Annual Review in Public Health. Forthcoming.

Davis,D. and Mandula, B. "Assessing the Power and Quality of Epidemiologic Studies of Asbestos Exposed Populations." To be presented at an EPA Symposium on Advances in the Health Risk Assessment for Systemic Toxicants and Chemical Mixtures, October 23-25, 1984, Cincinnati, OH.

Books

Nett, R., D. Kubat, and D. L. Davis (eds). Social Research Cooperation in Latin America. Pittsburgh: International Dimensions Program (1966).

Davis, D.L., L.S. Ritts and V. Wolf. (eds). Toxic Substances and Hazardous Wastes. American Law Institute, American Bar Association (1980).

Ng, L.K.Y. and D.L. Davis (eds). Strategies for Public Health: Promoting Health and Preventing Disease. New York, N.Y.: Van Nostrand Reinhold (1981).

Davis, D.L. with J. Trauberman et al. Six Case Studies of Compensation for Toxic Substances Pollution: Alabama, California, Michigan, Missouri, New Jersey and Texas, prepared for the Congressional Research Service and published by the Government Printing Office for the Senate Committee on Environment and Public Works, Washington, D.C. (1980).

NonRefereed Articles

Kubat, D. and D.L. Davis. "An Essay on Malthus," Carnegie Magazine, (February 1966) 57-60.

Davis, D.L. "The Woman in the Moon: Prolegomenon for Women's Studies," Female Studies, V, (1972), (R. Siporin, ed.), Pittsburgh: Know Press, 120-42.

Davis, D.L. "Watergate: Government by Negation," Theory and Society, I, (January 1974), 111-16.

Davis, D.L. "Is Marxism Ignored?" American Sociologist, (August 1974), 157-58.

Davis, D.L. "Is Patriarchy Inevitable?" Review of The Inevitability of Patriarchy by Stephen Goldberg, Dissent, (Spring, 1975), 205-6.

Davis, D.L. "Reply to Goldberg," Dissent, (Summer 1975), 301-3.

Davis, D.L. Reviews of Towards the Sociology of Knowledge, edited by G. Remmling, and Pour Une Sociologie de la Connaissance Economique, by Jean Lohomme, Contemporary Sociology, (1975), 71-74.

Davis, D.L. Letter on the Sociology of Science, Science, (25 April 1975), 188:309-11.

Davis, D.L. Fiber, Diet and Health, pamphlet prepared for Thompson Medical Company, (1976).

Davis, D.L. Review of From Karl Mannheim, edited by K. Wolff, Sociological Review, 24:2 (May 1976), 373-75.

Davis, D.L. Review of Naturzustand und Naturgeschichte der Burgerlichen Gesellschaft by Hans Medick (with E. Gebhardt, American Political Science Review, (1976).

Davis, D.L. Incentives for Health (ed.), Washington D.C.: World Man Fund pamphlet, (1977).

Davis, D.L. "The Social Experience of Neighborhood Density and Apartment Density in Queens, New York City," Community and Privacy (Aristide H. Esser, ed.), New York: Planum Press, 1978).

Davis, D.L. "Summary of Conference," Proceedings of the Conference on Environmental Law, Marshall-Wythe School of Law, College of William and Mary, Williamsburg, Virginia, (1979).

Davis, D.L. Review of Health Effects of Environmental Pollutants, by George L. Waldbott, Environment Internationale, (1979).

Babich, H., R. Adler, and D.L. Davis. Basic Science-Forcing Laws and Regulatory Case Studies: Kepone, DBCP, Halothane, Hexane, and Carbaryl, with Harvey Babich, Reid Adler and Stuart Dunwoody. Presented at the American Association for the Advancement of Science Annual Meeting, San Francisco, California, (January 5, 1980), Published by the Environmental Law Institute, Washington, D.C.

Davis, D.L., A. Jamieson, S. Dunwoody, and L. Hedal. "Cost-Benefit Analysis and Environmental, Health and Safety Regulation: An Overview of the Agencies and Legislation," reprinted in The Analysis of Costs and Benefits in Environmental Regulation, prepared by the Conservation Foundation and the Illinois Institute of Natural Resources, Chicago, Illinois, (1980).

Davis, D.L. with L.K.Y. Ng. "National Policy Issues for Health Promotion and Disease Prevention," Introduction in Strategies for Public Health, (1981), 1-32.

Ng, L.K.Y., D.L. Davis, R. Manderscheid. and J. Elkes. "Toward A Conceptual Formulation of Health and Well-Being," in Strategies for Public Health, (1981), 44-58.

Davis, D.L. and D. Rall. "Risk Assessment for Disease Prevention," Strategies for Public Health, (1981), 129-157.

Davis, D.L. and H. Babich. "Chemical Control and Prevention," in Umweltschutz der Achtziger Jahre, H. Karpe (ed.), (forthcoming), Dortmund: INFU.

Davis, D.L. "Lead: Ancient Metal, New Concerns," The Environmental Forum, 1:1, (1982), 24-26.

Davis, D.L, and B. Mandula. "Is Silica the Next Asbestos? A Study in Contrasts," in Silica, Silicosis and Cancer Proceedings, (forthcoming).

Selected Seminars and Public Lectures

Davis, D.L. "Epidemiology and Regulatory Policy," University of Pennsylvania, Department of Biostatistics, School of Medicine, (January 1980).

Davis, D.L. "Cancer Policy and Epidemiological Studies," John F. Kennedy School Lecture, Harvard University, (March 1980).

Davis, D.L. "Environmental Epidemiology," Department of Pathology, Medical College of Virginia, Richmond, (December 1980).

Davis, D.L. "Ecogenetics: The Case of Food Policy," Paper Invited for the American Association for the Advancement of Science Symposium on Ecogenetics, Toronto, (January 1981).

Davis, D.L. "Lead: A Problem for all Children," Consumers' Union Conference, New York, (June 1981).

Davis, D.L. "Risk Assessment of Hazards," Conference on Limiting Liability for Hazardous Waste Disposal, Chicago, (November 1981).

Davis, D.L. "Science for Torts," Toxic Torts Conference, University of Virginia School of Law, Charlottesville, (November 1981).

Davis, D.L. "Estimating Cancer Causes," Faculty Seminar Series and Grand Rounds in Preventive Medicine, Department of Epidemiology, The Johns Hopkins University, School of Medicine, Baltimore, (November 1981 and March 1982).

Davis, D.L. "Recent Trends in Cancer Mortality and Incidence," Inter-departmental Seminar at University of Texas, Medical Branch, Galveston, (March 1982).

Davis, D.L. "Differential Mortality for Older and Younger White U.S. Males," Associates Seminar, Environmental Law Institute, Washington, D.C., (June 1982).

Davis, D.L. Workshop on Cancer Policy and Risk Assessment, Brookhaven National Laboratory, Department of Energy, (September 1982).

Davis, D.L. "Environmental Health Policy," Seminar, Johns Hopkins University, School of Hygiene and Public Health, (April 1983).

Davis, D.L. "Trends in Site-Specific, Age-Specific Cancer Mortality (1968-1978," Seminar, National Cancer Institute, (April 1983).

Davis, D.L. "Environmental Health Policy as Preventive Medicine," Graduate Seminar, Johns Hopkins University, School of Hygiene and Public Health, (April, 1983.

Davis, D.L. "Some Lessons on the Role of Science in Decision Making at EPA," presented to the Chemical Manufacturers Association, Cosmos Club, (May 1983).

Davis, D.L. "Race-Sex Trends in Age-Specific, Site-Specific Cancer Mortality 1968-1978" Seminar, National Institute of Environmental Healt Sciences, (June 1983).

Davis, D.L. "Trends in Cancer Mortality for Older Persons and Nonwhites from 1968-1978: A Critique of Doll and Peto," Harvard School of Public Health, (January 1984); and to the Columbia School of Public Health, (October 1984).

<u>Selected Supervised Research Projects at ELI</u>

Gardner, R. and D.L. Davis. "RCRA Manifest System Report to EPA," (1979).

Ritts, L.S. and D. L. Davis. "Workplace Hazards: Some Generic Prospects," Report to NIOSH, (1981).

Yang, E., P. Reed, and D.L. Davis. "Siting of Hazardous Wastes; Regional Issues," Report to EPA, (1981).

Ritts, L.S., D.L. Davis, and J. Trauberman. "A Case Study of Compensation for DES Related Injuries," A Report to the National Science Foundation, (1981).

Davis, D.L., H. Babich, and J. Trauberman. "Regulatory and Scientific History of DDT Regulation," Private Report, (1981).

Entwistle, E., J. Trauberman, and D.L. Davis. "On the Coverage of Radioactive Wastes Under CERCLA Subcontract to Rockwell for EPA Superfund Office, (1981).

Trauberman, J. et al. Toxic Tort Conference Manual for Virginia Environmental Endowment, 1981.

Yang, E., D.L. Davis, and J. Trauberman. "Pilot Innovations in Regional Hazardous Waste Control," Report to Appalachian Regional Commission, (1982).

Yang, E., J. Trauberman, A. Horne, and D.L. Davis. "Regional Approaches to Hazardous Waste Management," Report to the Appalachian Regional Commission, 1981-1982.

Davis, D.L., J. Trauberman, et al. A Model Statute for Compensating Victims, prepared for the Virginia Environmental Endowment and Appalachian Regional Commission, (1982).

Davis, D.L. and A. Gittelsohn. "Epidemiological Analyses of Polluted Counties vs. Non-Polluted Counties," Subcontract to AMS for EPA, Program Integration Project, (1982).

Davis, D.L. and A. Gittelsohn. "Epidemiological Mapping of the City of Philadelphia, Chronic Mortality, 1971-1980," Subcontract to AMS for EPA, Program Integration Project, (1983).

Davis, D.L. Benzene Health Effects in Humans and Risk Assessment. The Environmental Law Institute under Contract to Occupational Safety and Health Administration (OSHA), May, 1983.

Davis, D.L. (with E. Yang and J. Trauberman). Cooperative Agreement with ORD for Hazardous Waste Research at EPA 1981-1983. Projects include: Legislative Index of CERCLA; policy analyses of alternative generic regulations; review of case law on risk assessment; evaluation of clean-up technologies at 22 field sites, 1981-1983.

Congressional Testimony

Davis, D.L. Testimony Regarding the Toxic Substances Control Act before the House Committee on Interstate and Foreign Commerce, (April 22, 1980).

Davis, D.L. Testimony at Hearing Before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives. "Lead Poisoning and Children." Second Session. (December 2, 1982). Serial No. 97-184, (Washington D.C.: GPO, 1983), 93-101.

Davis, D.L. Testimony at Hearing on FDA's Regulation of Zomax, Subcommittee on Intergovernmental Relations and Human Resources of the Committee on Government Operations, (Washington D.C.: Office of the Clerk, Office of Official Reporters), (April 26, 1983), pp. 8-65.

Davis, D.L. Testimony at Hearing Before U.S. House of Representatives Subcommittee on Health and the Environment, (May 24, 1984).

Selected NRC Research Studies of BOTEHH

Non-Occupational Health Risks of Asbestiform Fibers

Identificationof Toxic and Potentially Toxic Chemicals for Consideration by the National Toxicology Program

Epidemiology of Air Pollutants

Passive Smoking

Health and Ecological Effects of Synfuel Industries

Methods for In Vivo Toxicity Testing of Complex Mixtures from the Environment

Toxicity Review of Synthetic Pyrethroids

Spring 1985

Curriculum Vitae

MARTHA R. FOWLKES
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Current Position

1980 - date. Research Director, Alumnae Biography Project -- Office of Institutional Research;
Associate Professor (Adjunct) Department of Sociology and Anthropology, Smith College. Northampton, MA 01063

This is a combined institutional research and teaching position. For the research component I have been responsible for the technical planning and survey design and administration necessary to build a computerized alumnae record data base to serve multiple information and planning needs of a number of college offices. I have also undertaken specialized research projects --each entailing its own research design, data gathering and analysis -- related to various areas of planning at the college. Concurrent with my research responsibilities I have taught regularly (usually a course each semester) in the Department of Sociology and Anthropology and have served students as a major adviser and supervisor of special studies projects.

Education

1977 Ph.D. in Sociology (with distinction), University of Massachusetts at Amherst.

Dissertation: "The Wives of Professional Men: The Interdependency of Family and Career." Professor Alice S. Rossi, supervisor.

1965 M.A. in Social Anthropology, The London School of Economics and Political Science, University of London.

Thesis: "A Comparative Analysis of Salem and African Witchcraft." Professors Isaac Schapera and Raymond Firth, supervisors.

1961 A.B. Smith College. (magna cum laude; Phi Beta Kappa; Samuel Bowles Prize in Sociology)

Fellowships

1977-78 National Research Service Award,(Post-doctoral) by the National Institute of Mental Health for a study of "The Community Life of Deinstitutionalized Mental Patients."

1975-76 Woodrow Wilson Doctoral Dissertation Fellowship in Women's Studies.

1961-63 Smith College Faculty Fellowship, Danforth Foundation.

Administrative and Research Positions

1978-80 Associate Dean for Student Affairs, Smith College.

1970-71 Social Service Research and Evaluation, Northampton State Hospital.

1970 Medical Sociologist, Memphis (TN) Regional Medical Program.

1963-64 Project on Urban Middle-Class Kinship Networks in London, Prof. Raymond Firth, director.

Teaching Positions

1982 Lecturer in Sociology (Five-College Exchange) Mt. Holyoke College.

1974-78 Summer Faculty, Social Policy Sequence, Smith College School for Social Work.

1974-75 Teaching Assistant/Associate, Department of Sociology University of Massachusetts at Amherst.

1971-75 Instructor, Department of Sociology and Anthropology, Smith College.

1967-69 Instructor in Anthropology, Onondaga Community College, Syracuse, N.Y.

Publications

"The Myth of Merit and Male Professional Careers: the Roles of Wives" in N. Gerstel and H. Gross, eds. Public/Private -- Work/ Family: Towards Reintegration. in review.

Review of Work and Family: Changing Roles of Men and Women. Patricia Voydanoff, ed. (Mayfield, Palo Alto, Calif., 1984) in Contemporary Sociology, to be published, late 1985.

Unnatural Disaster: Chemicals and Community at Love Canal (with Patrical Y. Miller) book in progress.

Review of The Private Lives and Professional Identity of Medical Students by Robert S. Broadhead (Transaction Books, New Brunswick, N.J., 1983) in Contemporary Sociology, 1984.

"Katie's Place: Women's Work, Professional Work and Social Reform" in The Interweave of Social Roles, Vol 3. of Men, Women and Work. H. Lopata and J. Pleck, eds. JAI Press. 1983.

Love Canal: The Social Construction of Disaster. (with Patricia Y. Miller) Federal Emergency Management Agency, Washington, D.C. 1982.

Behind Every Successful Man: Wives of Medicine and Academe. New York: Columbia University Press. 1980.

"Social and Behavioral Constructions of Female Sexuality." (with Patricia Y. Miller) Signs: Journal of Women in Culture and Society. Vol 5, Summer 1980.

"Social and Behavioral Constructions of Female Sexuality." reprinted in Women: Sex and Sexuality. C. R. Stimpson and E. S. Person, eds. Chicago: Univ. of Chicago Press. 1980.

"Business as Usual at the State Mental Hospital." Psychiatry, Vol. 38, No. 1. February, 1975.

Papers and Presentations

"Toward a Sociology of Unnatural Disaster: The Case of Love Canal," (with Patricia Y. Miller) Paper to be presented at the American Sociological Association, Annual Meetings. Washington. August, 1985.

"Psychosocial Effects of Invisible Environmental Contaminants: the Case of Love Canal," Three Mile Island Public Health Fund Workshop. Philadelphia. June 1984.

"Non-Traditional Resources for the Study of Women's Lives," Berkshire Conference on Women's History. Northampton. June 1984.

Discussant, Conference on "Toxics in the Community," Silver Bay, NY. October 1983.

Discussant, "Sociology of Affect," American Sociological Association annual meetings. Detroit. August 1983.

"Criteria for Evacuation in Man-made Disaster," Eighth Invitational Conference on Natural Disaster Research and Assessment. Boulder, Colo. July 1983.

Discussant, "Medical Sociology." Eastern Sociological Association annual meetings. Baltimore. March 1983.

"Behind Every Successful Man," Plenary Address to the Women's Auxiliary Scientific and Medical Session, annual meetings of the American Congress of Neurosurgeons. Toronto 1982.

"Women's Work as a Model of Care for the Deinstitutionalized Mentally Ill." paper presented at the annual meetings of the American Sociological Association. Toronto. August 1981.

"Women's Roles and Male Careers." paper presented at the annual meetings of the American Sociological Association. San Francisco. 1978.

<u>Institutional Research Reports</u>

"The Quality of Student Life at Smith." Alumnae Biography Project, Smith College. 1984.

"Smith Alumnae: Patterns of Affiliation and Disaffiliation." Alumnae Biography Project, Smith College. 1983.

"The Class of 1978: Five Years Later." Alumnae Biography Project, Smith College. 1983.

"Senior Survey: Class of 1983." Alumnae Biography Project, Smith College. 1983.

"Class of 1983: The First Year Out." Alumnae Biography Project, Smith College. 1984.

"The Community Care Drop-in Center: Patterns of Use." Community Care Mental Health Center, Springfield, MA. 1978.

"Evaluation -- Supervised Apartment Program." Community Care Mental Health Center, Springfield MA. 1977.

<u>Professional Service and Consulting</u>

Member of Woburn Review Panel to assess health studies and environmental investigations. (Massachusetts Department of Public Health and USCenters for Disease Control) 1985.

Member of Interagency Technical Review Committee to review and establish "criteria of habitability at Love Canal." (New York State Department of Health; USEnvironmental Protection Agency; USCenter for Disease Control) 1984, ongoing.

Editorial service: <u>Journal of Work and Occupations</u>; <u>Journal of the Sociology of Education</u>; <u>Social-Psycholgical Quarterly</u>; Cambridge University Press.

Co-chair, Supplementary Program Committee for the annual meetings of the American Sociological Association. 1983.

Organizer, session on "Medical Sociology," Eastern Sociological Meetings, 1983.

Board of Trustees, Northampton State Hospital. Northampton MA. (Gubernatorial appointment) 1975-78.

Board of Approval and Certification of Physician Assistant Program, Massachusetts Department of Public Health. (Gubernatorial appointment) 1974.

Teaching

1. Sociological Perspectives on Women and Work
2. Sociology of Everyday Life (social psychology; symbolic interaction)
3. Sex Roles; issues of contemporary feminism
4. Social Policy
5. Sociology of Health and Mental Health Care
6. Comparative Social Structures and Socialization
7. Introductory Sociology

References

Professor Alice S. Rossi, Department of Sociology, University of Massachusetts, Amherst, MA.

Professor Robert Faulkner, Department of Sociology, University of Massachusetts, Amherst, MA.

Professor Peter I Rose, Department of Sociology, Smith College, Northampton, MA.

Professor Helena Lopata. Department of Sociology, Loyola University, Chicago, IL.

Professor Sheila Allen, Department of Sociology, University of Bradford, England.

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Education:	1970 A.B.	University of Illinois at Chicago Circle
	1972 M.S.	University of Wisconsin, Madison
	1976 Ph.D.	Northwestern University
Fellowships:	1970-1971	U.S. Public Health Service Training Fellowship
	1972-1974	National Institute for Mental Health Training Fellowship
Positions Held:	1970-1971	Training Fellow, Center for Demography and Human Ecology, University of Wisconsin
	1971-1973	Research Assistant, Institute for Juvenile Research, Chicago
	1972-1973	Teaching Assistant, Department of Sociology, Northwestern University
	1973-1975	Staff Sociologist, Institute for Juvenile Research, Chicago
	1974	Teaching Associate, The Evening Division, Northwestern University
	1975-1976	Project Director, "Youth and Society in Illinois," Institute for Juvenile Research, Chicago
	1976-1978	Associate Director of Research, Institute for Urban Studies, University of Houston
	1976-1978	Assistant Professor, Department of Sociology, University of Houston
	1978-1984	Assistant Professor, Department of Sociology and Anthropology, Smith College
	1980-	Director, Jahnige Social Science Research Center, Smith College
	1984-	Associate Professor, Department of Sociology and Anthropology, Smith College

Master's Thesis:

"Metropolitan Dominance and the Urban Hierarchy," written at the University of Wisconsin under the supervision of Professor Halliman H. Winsborough.

Doctoral Thesis:

"Blaming the Victim of Child Molestation: An Empirical Analysis," written at Northwestern University under the supervision of Professor Howard S. Becker. Data analysis supervised by Professor Richard Berk.

Papers:

"Social and Social Psychological Correlates of Adolescent Sexual Experience," (with William Simon and Calvert Cottrell, Pacific Sociological Society, May 1973).

"Sexual Molestation and Adolescent Development," (with Aimee St. Pierre and Joseph Puntil, Society for the Scientific Study of Sexuality, November 1974).

"Delinquency, Gender and Social Control," (American Society for Adolescent Psychiatry Conference on Juvenile Delinquency, January 1976).

"Victimization, Norm Violation and Normative Integration," (with Mary Ellen Marsden, Second International Symposium on Victimology, September 1976).

"Infant and Childhood Sexual Experience as a Substitute for God," (with William Simon, Stanford Conference on Sex and Its Psychosocial Derivatives, January 1977).

"Do Youth Really Want To Work," (with William Simon, U. S. Department of Labor Conference on Youth Unemployment: Its Measurement and Meaning, February 1978).

"The Social Construction of Disaster," (with Martha Fowlkes, Federal Emergency Management Agency, Division of Hazardous Waste Management, October 1982).

"Unnatural Disaster," (Eighth Invitational Conference on Natural Disaster Research and Assessment, July 1983).

Books and Articles:

"Adolescent Sexual Behavior: Context and Change," (with William Simon, Social Problems 22(1), October 1974).

"Female Delinquency: Facts and Fictions," (in Max Sugar (ed.), Female Adolescent Development, Brunner/Mazel, 1979).

"Toward A Theory of Psychosexual Development in Adolescence," (with William Simon, in Joseph Adelson (ed.), Handbook of Adolescence, Wiley and Sons, 1980).

"Do Youth Really Want To Work?" (with William Simon, Youth and Society 10(4), June 1979).

"Social and Behavioral Constructions of Female Sexuality," (with Martha Fowlkes, Signs 5(4), Summer 1980).

Books and Articles (cont.):

"Social and Behavioral Constructions of Female Sexuality," (reprinted in Catharine R. Stimpson and Ethel Spector Person (eds.), Women, Sex and Sexuality, University of Chicago Press, 1980).

Unnatural Disaster: Chemicals and Community at Love Canal, (with Martha Fowlkes, work in progress).

Published Research Reports:

Adolescent Alcohol Use, (with Frances Silveira and William Simon, Chicago: Illinois Law Enforcement Commission, 1975).

Adolescent Theft, (with Frances Silveira and William Simon, Chicago: Illinois Law Enforcement Commission, 1975).

The American Man, (with William Simon, The Playboy Foundation, 1978).

Five College Cooperation: Student Perceptions and Experiences, (Amherst Mass.: Five Colleges, Inc., 1981).

Love Canal: The Social Construction of Disaster, (with Martha Fowlkes, Federal Emergency Management Agency, October 1982).

Book Reviews:

Sisters in Crime by Freda Adler (New York, McGraw-Hill, 1975) and Women and Crime by Rita James Simon (Lexington, Mass.: Lexington Books, 1975), Sex Roles: A Journal of Research 2(4) XXXXXX 197X.

Sex, Motivation and the Criminal Offender by Robert H. Morneau, Jr., and Robert R. Rockwell (Springfield, Ill.: Chas. C. Thomas, 1980), Contemporary Sociology 11(1), January 1982.

Professional and Institutional Consulting:

Rape Avoidance (P. Bart -- NIMH), 1977-1983.
Rape Incidence (D. Russel -- NIMH), 1977-78.
The Playboy Corporation (1977-1979).
Smith College Stables (1979)
Smith College News Office (1980)
Smith College Alumnae Association, Career Development Office and Development Office (1980)
Sophia Smith Collection (1982)
Smith College Health Service (1983)
Smith College Alumnae Biography Project (1982-date)
Smith College Financial Aid Office (1984)

Professional Memberships:

American Association for the Advancement of Science
American Sociological Association
Society for the Study of Social Problems

Professional Service:

Committee on Professional Ethics, American Sociological Association, 1979-81, Chair 1980-81.

Committee on the Profession, American Sociological Association, 1980.

Committee on the Status of Homosexuals in Society, American Sociological Association, 1980-Date, Chair 1984-85.

Service on Editorial Boards:

Social Problems, 1979-81.
Youth and Society, 1977-Date.

Other Professional Activities:

Discussant, "Human Sexuality," (American Sociological Association Annual Meetings, August 1975).

Discussant, "Rape," (American Sociological Association Annual Meetings, August 1976).

Panelist, "Pop Art," "Phallocracy," and "Busing in Boston," World Affairs Invitational Conference, April 1977.

Discussant, "Homosexuality," (American Sociological Association Annual Meetings, September 1977).

Presider, "Current Issues in Criminology," Eastern Sociological Society, March 1979.

Session Organizer, "Alternative Lifestyles," American Sociological Association Annual Meetings, August 1979.

Representative, American Sociological Association to the Workshop on Professional Ethics of the American Association for the Advancement of Science, November 1979.

Panelist, "Women and Achievement," "Men in America," and "Life As Art," World Affairs Invitational Conference, April 1980.

Discussant, "Theory and Research," (American Sociological Association Annual Meetings, September 1983).

Presider, "Sociology of Affect," American Sociological Association Annual Meetings, September 1983.

Other Professional Activities (cont.)

Session Organizer, "Human Sexuality," American Sociological Association Annual Meetings, August 1984.

College Service:

Committee on Financial Aid, 1979-82.
Committee on the Course Critique, 1981-82, 1983-Date.
Faculty Advisory Committee on Academic Computing, 1979-Date.

Teaching:

Individual and Society (Social Psychology), 1974.
Introductory Sociology, 1974-75, 1977-Date.
Sex and Social Arrangements, 1977-78.
Methods of Survey Research, 1977-Date.
Theories of Deviant Behavior, 1978-Date.
Criminology, 1978-Date.

References:

Professor Howard S. Becker, Department of Sociology, Northwestern University, Evanston, Illinois.

Professor Myron Glazer, Chair, Department of Sociology and Anthropology, Smith College, Northampton, Massachusetts.

Professor William Simon, Department of Sociology, University of Houston, Houston, Texas.

Dean Frances Volkmann, Dean of the Faculty, Smith College, Northampton, Massachusetts.

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Education:

B.S. in Civil Engineering, Valparaiso University	1953
M.S. in Civil Engineering (Environmental Engineering), Purdue University	1958
Ph.D. (Environmental Engineering), Purdue University	1961
Visiting Scholar, University of Michigan	1967-1968

Professional Employment:

Erie Railroad Company, Civil Engineer	1953
U.S. Army, Preventive Medicine Specialist	1953-1956
Purdue University, Graduate Research Assistant	1956-1961
Georgia Institute of Technology	
Assistant Professor	1961-1964
Associate Professor	1964-1971
Professor	1971-present
Delft University of Technology, Delft, Netherlands	
Guest Professor	1976-1977

Professional Registration:

Professional Engineer, Georgia
Diplomate, American Academy of Environmental Engineers

Honors, Honorary Society Memberships and Professional Recognition:

Engineer of the Year in Education Award, Georgia Society of Professional Engineers (1984)
Harrison Prescott Eddy Research Medal, Water Pollution Control Federation (1964)
Charles Alvin Emerson Service Medal, Water Pollution Control Federation (1983)
Society of Sigma Xi (Vice President, Georgia Tech Chapter, 1980-1981)
Tau Beta Pi
Chi Epsilon

Listed in American Men and Women of Science, Who's Who in Georgia, Who's Who in the South and Southwest, Who's Who in American Education, Personalities of the South, and Engineers of Distinction

Professional Society Membership and Activities:

- Water Pollution Control Federation (Director-at-Large, 1982-1985)
  - Program Committee (1969-1975, 1978-1983)
  - Research Committee (Vice-Chairman 1970-1975, Co-Chairman 1975, Chairman 1976-1980)
  - Industrial Waste Committee (1963-1976)
  - Publications Committee (1976-1982)
  - Eddy Medal Committee (Chairman, 1967-1968, 1979-1980)
  - Emerson Medal Committee (1983-1984)
  - Student Activities Committee (1973-1975)
  - Standard Methods Committee (Chairman, Joint Task Group, 1977-1982)
- American Water Works Association
- American Chemical Society
  - Division of Microbial and Biochemical Technology
  - Division of Environmental Chemistry
- Georgia Water and Pollution Control Association
- American Society of Civil Engineers
  - Georgia Section
  - Environmental Standards Committee (Chairman, Liners Task Group, 1978-1981)
  - Georgia Tech Student Chapter (Faculty Advisor; 1965-1966, 1969-1971)
- American Public Works Association
  - Research Committee
  - Institute of Solid Wastes
  - Institute for Water Resources
- Association of Environmental Engineering Professors
  - Board of Directors (Secretary-Treasurer; 1970, 1971)
- Society for Industrial Microbiology
- American Society for Microbiology
- American Academy of Environmental Engineers
  - Engineering Education Committee (Chairman, 1983-present)
  - Accreditation Visitor, Accreditation Board for Engineering and Technology (ABET), Environmental Engineering Programs
  - Alternate Representative, ABET Board of Directors
- International Association on Water Pollution Research and Control
  - United States of America National Committee (Delegate, 1974-present; Vice-Chairman, 1980; Chairman, 1981-1984)
  - Governing Board (1980-1984)
  - U.S. Editor, Water Research (1983-present)
  - Editorial Committee (1983-present)

Government Refuse Collection and Disposal Association
National Society of Professional Engineers
Georgia Society of Professional Engineers
Buckhead Chapter

Civic Organization Membership:

Rotary International, Buckhead (Atlanta) Club
Board of Directors; 1975-1976, 1977-1983
Secretary, 1979-1980; President Elect, 1980-1981; President, 1981-1982
Buckhead Fifty Club

Current Professional Emphasis:

Environmental Engineering Operations and Processes, Water and Wastewater Chemistry and Microbiology, Solid and Hazardous Waste Management, Industrial Waste Treatment and Disposal, Energy Recovery from Biomass, Environmental Impact Monitoring and Assessment

Major Consulting and Professional Services:

Technical Consultant to Government and Industry

Member, Love Canal Expert Advisory Panel (1984)

Member, Technical Advisory Committee, Georgia Hazardous Waste Management Authority (1982-present)

Member, Georgia State Board of Examiners for Certification of Water and Wastewater Treatment Plant Operators and Laboratory Analysts (1984-1987)

Member, Scientific Advisory Committee, Hazardous Waste Research Center, Louisiana State University (1982-present)

Member, Joint Committee on Flexible Membrane Liners, National Sanitation Foundation (1979-1983)

Regional Editor, Water Research (1983-present)

Associate Editor, Environmental Science and Engineering (1971-1984)

Manuscript Review; Journal Water Pollution Control Federation, Biotechnology and Bioengineering, Science, Water Research, Journal Environmental Engineering Division, ASCE, Water Science and Technology, Journal Environmental Science and Health, ACS Symposium Series, Environmental Science and Technology, Journal of Engineering Sciences (Saudi Arabia), Journal of Solar Energy Engineering, ASME

Program/Proposal Review; National Commission on Water Quality, U.S. Environmental Protection Agency, National Science Foundation, Natural Sciences and Engineering Research Council of Canada, National Sea Grant Program, U.S. Department of Interior, Accreditation Board for Engineering and Technology

Professional Publications:

Theses -

1. Pohland, F.G., "Dissolved Oxygen Utilization by Trickling Filter Organisms", M.S. Thesis, Purdue University, 1958.

2. Pohland, F.G., "Laboratory Investigations on the Thermological Aspects and Volatile Acids - Alkalinity Behavior During Anaerobic Sludge Digestion," Ph.D. Thesis, Purdue University, 1961.

Journals -

1. Bloodgood, D.E., Teletzke, G.H., and Pohland, F.G., "Fundamental Hydraulic Principles of Trickling Filters," Sewage and Industrial Wastes, 31, 3, 243 (1959).

2. Etzel, J.E. and Pohland, F.G., "Volatile Acid Formation During Sludge Digestion," Public Works, 91, 7, 105 (1960).

3. Pohland, F.G. and Bloodgood, D.E., "Laboratory Studies on Mesophilic andThermophilic Anaerobic Sludge Digestion," Jour. Water Poll. Control Fed., 35, 1, 11 (1963).

4. Pohland, F.G., "High-Rate Digestion," Water and Sewage Works, 111, 6, 262 (1964).

5. Pohland, F.G. and Dickson, B.H., Jr., "Organic Acids by Column Chromatograph," Water and Wastes Engineering, 1, 7, 54 (1964).

6. Pohland, F.G., "Thermal Energy Interchange During Anaerobic Methane Fermentation of Waste Organic Substrates," Applied Microbiology, 16, 10, 1518 (1968).

7. Pohland, F.G. and Mancy, J.H., "The Use of pH and pE Measurements During Methane Biosynthesis," Biotechnology and Bioengineering, XI, 4, 683 (1969).

8. Borchardt, J.A. and Pohland, F.G., "Anaerobic Treatment of Alewife Processing Wastes," Jour. Water Poll. Control Fed., 42, 12, 2060 (1970).

9. Pohland, F.G. and Ghosh, S., "Developments in Anaerobic Stabilization of Organic Wastes - The Two-Phase Concept," Environmental Letters, 1, 4, 255 (1971).

10. Ghosh, S. and Pohland, F.G., "Kinetics of Assimilation of Multiple Substrates in Dispersed Growth Systems," Water Res., 6, 99 (1972).

11. Ghosh, S., Pohland, F.G. and Gates, W.E., Phasic Utilization of Substrates by Aerobic Cultures," Jour. Water Poll. Control Fed., 44, 3, 376 (1972).

12. Ghosh, S. and Pohland, F.G., "Kinetics of Substrate Assimilation and Product Formation in Anaerobic Digestion," Jour. Water Poll. Control Fed., 46, 4, 748 (1974).

13. Pohland, F.G., "Accelerated Solid Waste Stabilization and Leachate Treatment by Leachate Recycle Through Sanitary Landfills," Progress in Water Technology, 7, 1, 173 (1975).

14. Pohland, F.G. and Massey, M.L., "An Application of Process Kinetics for Phase Separation of the Anaerobic Stabiliztion Process," Progress in Water Technology, 7, 3/4, 753 (1975).

15. Pohland, F.G. and Hudson, J.W., "Aerobic and Anaerobic Microbial Treatment Alternatives for Shellfish Processing Wastewaters in Continuous Culture," Biotechnology and Bioengineering, XVIII, 1219 (1976).

16. Massey, M.L. and Pohland, F.G., "Phase Separation of Anaerobic Stabilization by Kinetic Controls," Jour. Water Poll. Control Fed., 50, 9, 2204 (1978).

17. Pohland, F.G., "Leachate Recycle as Landfill Management Option," Jour. Environmental Engineering Division, ASCE, 106, EE6, 1057 (1980).

18. Chang, K.C., Chian, E.S.K., Pohland, F.G., Cross, W.H., Roland, L., and Khan, B., "Behavior of Radionuclides in Sanitary Landfills," Health Physics, 46, 1, 44 (1984).

Proceedings -

1. Pohland, F.G. and Engstrom, R.J., "High-Rate Digestion Control I. Fundamental Concepts of Acid-Base Equilibrium," Proc. 19th Industrial Waste Conference, Purdue University, 1, 80 (1965).

2. Pohland, F.G., "Water Resources Reseach Programs at Georgia Tech," Proc. 14th Southern Water Resources and Pollution Control Conference, University of North Carolina, 1, 245 (1965).

3. Pohland, F.G., "Concepts in Sludge Digestion," Proc. 19th Kentucky-Tennessee Water Pollution Control Association Meeting, Memphis, Tennessee, 1965.

4. Gates, W.E. and Pohland, F.G., "Sanitary Engineering Research at Georgia Tech," Proc. 15th Southern Water Resources and Pollution Control Conference, North Carolina State University, 1966.

5. Gates, W.E., Pohland, F.G., Mancy, K.H. and Shafie, F.R., "A Simplified Model for Studying Assimilative Capacity," Proc. 21st Industrial Waste Conference, Purdue University, 2, 665 (1966).

6. Pohland, F.G., "High-Rate Digestion Control II. Techniques for Evaluating Acid-Base Equilibrium," Proc. 22nd Industrial Waste Conference, Purdue University, 2, 353 (1968).

7. Pohland, F.G., "High-Rate Digestion Control III. Acid-Base Equilibrium and Buffer Capacity," Proc. 23rd Industrial Waste Conference, Purdue University, 1, 275 (1969).

8. Meredith, J.C. and Pohland, F.G., "Some Observations of Purple Sulfur Bacteria Associated with Waste Stabilization Ponds," Proc. 25th Industrial Waste Conference, Purdue University, 2, 699 (1970).

9. Ghosh, S., Pohland, F.G. and Gates, W.E., "Kinetics of Removal of Mixed Carbohydrates in Activated Sludge Processes," Proc. 25th Industrial Waste Conference, Purdue University, 1, 365 (1970).

10. Pohland, F.G., "Design Considerations and Operational Procedures for Anaerobic Wastewater Solids Reduction," Proc. Applied Filtration Technology in Municipal Industrial Water and Wastewater Treatment, Houston, TX, Civil Engr., Dept. Univ. of Houston, 19 (1970).

11. Jorden, W.L., Pohland, F.G. and Kornegay, B.H., "Evaluating Treatability of Selected Industrial Wastes," Proc. 26th Industrial Waste Conference, Purdue University, 1, 514 (1971).

12. Pohland, F.G. and Maye, P.R., "Landfill Stabilization with Leachate Recycle," Proc. 3rd Environmental Engineering and Science Conference, University of Louisville, 389 (1973).

13. Horn, C.R. and Pohland, F.G., "Characterization and Treatability of Selected Shellfish Processing Wastes," Proc. 28th Industrial Waste Conference, Purdue University, 2, 819 (1973).

14. Hudson, J.W. and Pohland, F.G., "Treatment Alternatives for Shellfish Processing Wastewaters," Proc. 30th Industrial Waste Conference, Ann Arbor Science, 981 (1975).

15. Hudson, J.W., Smith, J.P. and Pohland, F.G., "Rotating Biological Contactor Treatment of Shellfish Processing Wastewaters," Proc. 31st Industrial Waste Conference, Ann Arbor Science, 193 (1976).

16. Hudson, J.W., Pohland, F.G. and Pendergrass, R.P., "Anaerobic Packed Column Treatment of Shellfish Processing Wastewaters," Proc. 33rd Industrial Waste Conference, Ann Arbor Science, 560 (1978).

17. Pohland, F.G., Shank, D.E., Benson, R.E. and Timmerman, H.E., "Pilot-Scale Investigations of Accelerated Landfill Stabilization with Leachate Recycle," Proc. 5th Annual Research Symposium on Municipal Solid Wastes: Land Disposal, EPA-600/9-79-023a, 283 (1979).

18. Pohland, F.G. and Gould, J.P., "Stabilization at Municipal Landfills Containing Industrial Wastes," Proc. 6th Annual Research Symposium: Disposal of Hazardous Waste, EPA-600/9-80-010, 242 (1980).

19. Pohland, F.G., "Leachate Collection and Recycle as a Landfill Management Option," (In German), Proc. Waste Management Seminar, Technischen Universitate Berlin, 374, February 1980.

20. Pohland, F.G., "Anaerobic Processes for Treatment of Leachate from Landfills," (In German), Proc. Waste Management Seminar, Technischen Universitate Berlin, 445, February 1980.

21. McCarty, P.L., O'Melia, C.R., Dick R.I., Morgan, J.J., Pohland, F.G., Theis, T.L., and Tomlinson, H.D., "Excellance in Environmental Engineering Education," Proc. Fourth Conference on Environmental Engineering Education, University of Toronto, June 19-21, 1980.

22. Pohland, F.G., Gould, J.P., Ramsey, R.E., Spiller, B.V. and Esteves, W.R., "Containment of Heavy Metals in Landfills with Leachate Recycle," Proc. 7th Annual Research Symposium on Land Disposal: Municipal Solid Wastes, EPA-600/8-81-002a, 179 (1981).

23. Pohland, F.G., "Leachate Recycle as a Management Option," Proc. Leachate Management Seminar, Byer, P.H. [Ed.], University of Toronto, Environment Canada, WM-1, 37-62, July 1981.

24. Pohland, F.G., Gould, J.P., Ramsey, R.E. and Walter, D.C., "The Behavior of Heavy Metals During Landfill Disposal of Hazardous Wastes," Proc. 8th Annual Research Symposium: Land Disposal of Hazardous Waste, EPA-600/9-82-002, 360 (1982).

25. Chang, K.C., Chian, E.S.K., Pohland, F.G., Kahn, B., Cross, W.H. and Roland, L., "Co-disposal of Low-Level Radioactive Wastes Within Sanitary Landfills," Proc. 1982 National Conference on Environmental Engineering, ASCE, 325, July 1982.

26. Pohland, F.G., Dertien, J.T. and Ghosh, S.B., "Leachate and Gas Quality Changes During Landfill Stabilization of Municipal Refuse," Proc. 3rd International Symposium on Anaerobic Digestion, Boston, MA, 185, August 1983.

Books or Symposia in Print -

1. Howland, W.E., Pohland, F.G. and Bloodgood, D.E., "Kinetics in Trickling Filters," In Advances in Biological Waste Treatment, Eckenfelder, W.W. and McCabe, J. [Eds.], Pergamon Press, 233, 1963.

2. Pohland, F.G. and Ghosh, S., "Development in Anaerobic Treatment Processes," In "Biological Waste Treatment," R.P. Canale [Ed.], Biotechnology and Bioengineering Symposium No. 2, Interscience, New York, 85 (1971).

3. Ghosh, S. and Pohland, F.G., "Population Dynamics in Continuous Cultures of Heterogeneous Microbial Populations," In Developments in Industrial Technology, E.D. Murray [Ed.], 12, Soc. of Microbiol., Amer. Inst. of Biol. Sciences, Washington, D.C., 295 (1971).

4. Mancy, K.H., McClelland, N. and Pohland, F.G., Applied Chemistry of Wastewater Treatments, Units I-VIII, Ann Arbor Science Publishers, Inc., Ann Arbor, MI, 1973.

5. Pohland, F.G., "Sanitary Landfill Stabilization with Leachate Recycle and Residual Treatment," Water-1974; II. Municipal Wastewater Treatment, G.F. Bennett [Ed.], Amer. Inst. of Chemical Engineers, Symp. Ser. 145, 71, 308 (1975).

6. Pohland, F.G., "Landfill Management with Leachate Recycle and Treatment: An Overview," In Gas and Leachate from Landfills - Formation, Collection and Treatment, Genetelli, E.J., and Cirello, J. [Eds.], Symposium Proc., EPA-600/9-76-004, March 1976.

7. Pohland, F.G. and Suidan, M.T., "Prediction of pH Stability in Biological Treatment Systems," In Chemistry of Wastewater Technology, A.J. Rubin [Ed.], Ann Arbor Science Publishers, Ann Arbor, MI, 441, 1978.

8. Pohland, F.G., Verstraete, W., Cohen, A., and Goma, G., "Process Design," In Anaerobic Digestion 1981, Huges, et al. [Eds.], Elsevier Biomedial Press V. V., 363, 1982.

9. Gould, J.P., Ramsey, R.E., Giabbai, M. and Pohland, F.G., "Formation of Volatile Haloorganic Compounds in the Chlorination of Municipal Landfill Leachates," In Water Chlorination: Environmental Impacts and Health Effects, R.F. Jolley [Ed.], 4, Chap. 36, 525, Ann Arbor Science Publishers, Inc., Ann Arbor, MI, 1982.

10. Cross, W.H., Chian, E.S.K., Pohland, F.G., Harper, S., Kharkar, S., Cheng, S.S., and Lu, F., "Anaerobic Biological Treatment of Coal Gasifier Effluent," Proc. Fourth Symposium on Biotechnology in Energy Production and Conservation, Biotechnology and Bioengineering Symposium No. 12, John Wiley & Sons, New York, 349 (1982).

Discussions -

1. Pohland, F.G., "Billion-Dollar River Clean-Up," A Discussion, Jour. Sanitary Engineering Division, ASCE, 89, No. SA3, 92 (1963).

2. Pohland, F.G. and Martin, J.C., "Dynamic Model of the Anaerobic Digestion Process," A Discussion, Jour. Sanitary Engineering Division, ASCE, 95, SA6, 1191 (1969).

3. Pohland, F.G., "Treatment of High Nitrate Wastewaters by Plastic Media Anaerobic Filters with Particular Reference to Latex Processing," A Discussion, Progress in Water Technology, 10, 5/6, 981 (1978).

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Review and Reports -

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8. Pohland, F.G., "Measurements of Active Biomass Concentrations in Biological Waste Treatment Processes," Final Research Report, EPA-600/2-75-209, September 1975.

9. Pohland, F.G., "Sanitary Landfill Stabilization with Leachate Recycle and Residual Treatment," Final Research Report, EPA-600/2-75-043, October 1975.

10. Pohland, F.G., and Engelbrecht, R.S., "Impact of Sanitary Landfills - An Overview of Environmental Factors and Control Alternatives," Amer. Paper Inst. Report, February 1976.

11. Pohland, F.G. and Hudson, J.W., "Wastewater Management Alternatives for the Shellfish Processing Industry," Final Research Report, Number 7802 (SCEGIT-77-157), Georgia Sea Grant Program, Univ. of Georgia, Athens, Ga., 133 pp., April 1978.

12. Husted, J.E., Pohland, F.G., Wallace, J.W. and Dodson, G., "Optimum Water Management in Kaolin Mining for Aluminum Production," Final Report OWRT Grant No. 14-34-001-6229 (SCEGIT-78-178), Georgia Institute of Technology, Atlanta, Ga., 126 pp., November 1978.

13. Pohland, F.G., Salgaonkar, J.B., Reinhart, D.R. and O'Neil, J.P., "Anaerobic Biological Treatment of Chemical Processing Wastewaters Containing Soluble Organic Substrates," Final Report, HERCOFINA, Inc., Wilmington, NC, 124 pp., January 1981.

14. Pohland, F.G., "Controlled Landfill Stabilization by Leachate Recycle," Final Report, EPA Grant No. R-803953 (SCEGIT-82-109), Georgia Institute of Technology, Atlanta, GA, 149 pp., September 1982.

15. Pohland, F.G., Gould, J.P., Ramsey, R.E. and Chian, E.S.K., "Identification and Assessment of Effluent Residuals in Treated Leachate from Landfill Disposal Sites," Final Report, OWRT Grant No. A-088-GA (ERC-07-83; SCEGIT-83-109), Georgia Institute of Technology, Atlanta, GA, 107 pp., May 1983.

16. Pohland, F.G., Saunders, F.M., Gould, J.P. and Khudenko, B.M., "Technical Advisory Services for Solution of Water Conservation, Reuse and Treatment Problems," Completion Report, ERC Project No. B-10-303 (ERC-09-83; SCEGIT-83-110), 14 pp., May 1983.

17. Pohland, F.G., "The Use of Plastic Foam as a Cover Material During Landfilling of Solid Wastes," Final Report, SCEGIT-83-122, SaniFoam, Inc., Costa Mesa, CA, 112 pp., December 1983.

Program and Research Administration:

Program Administration -

Program Coordinator, Environmental Engineering Program, Georgia Institute of Technology, 1971 to present.

Administrative Secretary, Radiation Health Specialists Training Program, U.S. Public Health Service (1963-1966).

Project Director, Solid Waste Technology Training Program, U.S. Public Health Service/EPA (1966-1976).

Project Director, Graduate Training in Water Quality Management, U.S. Environmental Protection Agency (1976-1979).

Project Director, Training Program in Hazardous Waste Management, U.S. Environmental Protection Agency (1979-1982).

Research Administration -

Principal Investigator, "Measurement of Active Biomass Concentrations in Biological Waste Treatment Processes," U.S. Department of Interior, Federal Water Quality Administration (1970-1973).

Principal Investigator, "Buffer Capacity in Aquatic Ecosystems," U.S. Department of Interior, Office of Water Resources Research (1970-1973).

Principal Investigator, "Problems Involving Waste Treatment at Seafood Processing Plants," U.S. Department of Commerce, National Oceanic and Atmospheric Administration - Sea Grant Program (1973).

Principal Investigator, "Shellfish Processing Wastewater Characteristics and Treatment Alternatives," U.S. Department of Commerce, National Oceanic and Atmospheric Administration - Sea Grant Program (1973-1976).

Principal Investigator, "Sanitary Landfill Stabilization with Leachate Recycle," U.S. Environmental Protection Agency (1971-1973).

Faculty Advisor, "Whirlpool Research Fellowship in Sanitary Engineering," Whirlpool Corporation (1972-1975).

Principal Investigator, "Sanitary Landfill Stabilization with Leachate Recycle and Residual Treatment," U.S. Environmental Protection Agency (1973-1974).

Faculty Advisor, "Zimpro Research Fellowship in Sanitary Engineering," Zimpro, Inc. (1973-1975).

Principal Investigator, "Controlled Landfill Stabilization by Leachate Recycle," U.S. Environmental Protection Agency (1975-1978).

Co-Principal Investigator, "Optimum Water Management in Kaolin Mining for Aluminum Production," U.S. Department of Interior, Office of Water Resources Research (1976-1979).

Project Director, "Instructional Scientific Equipment Grant," National Science Foundation (1978-1981).

<u>Principal Investigator</u>, "Anaerobic Biological Treatment of Chemical Processing Wastewaters Containing Soluble Organic Substances," HERCOFINA, Inc. (1979-1981).

<u>Principal Investigator</u>, "Fate of Heavy Metals During Landfill Stabilization of Solid Waste Materials with Leachate Recycle," U.S. Environmental Protection Agency (1978-1983).

<u>Co-Principal Investigator</u>, "An Investigation of Containment of Low Level Radioactive Wastes in Landfills," Department of Energy/Gundle Lining Systems, Inc. (1981-1984).

<u>Faculty Advisor</u>, "Union Carbide Research Fellowship in Environmental Engineering," Union Carbide Corporation (1981-1983).

<u>Principal Investigator</u>, "The Use of Plastic Foam as a Cover Material During Landfilling of Solid Wastes," Sanifoam, Inc. (1982-1983).

<u>Principal Investigator</u>, "Critical Review and Summary of Leachate and Gas Production from Landfills," U.S. Environmental Protection Agency (1982-1983).

<u>Principal Investigator</u>, "Landfill Disposal of Hazardous Waste," Union Carbide Corporation (1982-1983).

<u>Co-Principal Investigator</u>, "Anaerobic Treatment of Gasifier Effluents," Department of Energy (1982-1984).

<u>Principal Investigator</u>, "Critical Review and Summary of Analytical Methods for the Determination of the Hydraulic Integrity of Synthetic Liners," U.S. Environmental Protection Agency (1983-1984).

CURRICULUM VITAE

Name: ELLEN KOVNER SILBERGELD

Date and Place of Birth: July 29, 1945, Washington, DC

Education:

1967 - A.B.	Vassar College
1972 - Ph.D.	Johns Hopkins University

Chronology of Employment:

1967	Instructor, California International Summer Program, Uppsala Sweden
1968-70	Secretary and Program Officer, National Academy of Sciences, National Research Council, Washington, DC
1969	Intern, Center for the Study of Responsive Law, Washington, DC
1972-75	Postdoctoral Fellow in Environmental Medicine and Neurosciences, Johns Hopkins University, Baltimore, Maryland
1975	Assistant Professor, Department of Environmental Medicine, School of Hygiene and Public Health, Johns Hopkins University
1975-79	Staff Fellow and Head, Unit on Behavioral Neuropharmacology, Experimental Therapeutics Branch, NINCDS,NIH
1979-81	Chief, Section on Neurotoxicology, NINCDS,NIH
1982-84	Guest Scientist, Reproductive Toxicology Section, Pregnancy Research Branch, NICHD,NIH
1982-	Chief Toxics Scientist, Environmental Defense Fund, Washington, DC
1985-	Adjunt Research, University of Maryland Medical School Departments of Neurology and Community Medicine

Other Professional Appointments:

Member,	Nutrition Foundation National Committee on Food Additives and Hyperkinesis, 1975-1980
Member,	USDHEW-FDA Committee to Coordinate Toxicology and Related Programs, 1977-1981
Member,	US Delegation of the Joint US-USSR Health Agreement on Environmental Health, 1977-78
Member,	Society for Neuroscience Committee on Social Issues, 1978 - 3

Member, OECD Chemicals Program Ad Hoc Expert Review Committees on Reproductive Toxicity and Neurotoxicity, 1982 - 3
Member, Maryland Panel on Lead Poisoning, 1984
Member, Council on Environmental Quality Panel on long-range research plannning in environmental health, 1984

Member, US Delegation to OECD Expert Meetings on Existing Chemicals, 1983 -
Member, Hazardous Waste Task Force and Hazardous Waste Facilities Siting Board, State of Maryland, 1983
Member, Govenor's Blue Ribbon Panel on Binghamton, NY, State Office Building, 1982 -
Member, Center for Disease Control-NY State Panel on Love Canal, 1984 -
Member, Executive Committee, Science Advisory Board, US EPA, 1983 -
Member, Board on Toxicology and Environmental Health Hazards, National Academy of Sciences, 1983 -
Member, Public Policy Committee, American Society for Neurochemistry, 1983 -

<u>Professional Society Memberships</u>:

American Public Health Association
Society for Occupational and Environmental Health
Society for Neuroscience
Association of Women in Science
American Association for the Advancement of Science
International Brain Research Organization
American Society for Neurochemistry
American Society for Pharmacology and Experimental Therapeutics
Engineering Society of Baltimore

<u>Other Activities</u>

Secretary-Treasurer, Society for Occupational & Environmental Health, 1983-
Editorial Board: Neurobehavioral Toxicology, 1979-
American Journal of Industrial Medicine, 1980-
Neurotoxicology, 1981-
Environmental Research, 1983-
Hazardous Waste, 1983 -
Participant, NIH Consensus conferences, 1979 and 1982
Expert consultant on lead poisoning, U.S. Secret Service, 1979-81
Chairperson, Society for Occupational and Environmental

Health Special Committee on El Paso Lead Poisoning, 1977-1979

Preceptor, NIGMS Pharmacology-Toxicology Research Associateship Program, 1977-1981

Graduate board examiner, University of Pittsburgh and University of Toronto

Lecturer, continuing medical education courses in occupational and environmental medicine and toxicology (Johns Hopkins) and occupational medicine (NIOSH)

Consultant, Astra Pharmaceuticals, 1974

Consultant, NSF Energy Program, 1974-1975

Elected councillor, NIMH-NINCDS Assembly of Scientists, 1979-1981

Elected representative, NINCDS EEO Committee, 1977-1980

Co-organizer, Women in Neuroscience

Member, Solowey Lectureship selection committee, NIH, 1980-1981

Environmental Health Consultant, Oil, Chemical and Atomic Workers Union, AFL-CIO, Washington, D.C., 1970

Reviewer, EPA documents on lead, manganese, PCBs, mercury, dioxin, risk assessment, and exposure, 1981-

Ad Hoc Member, Occupational Safety and Health Study Section, NIOSH, 1983-

Member, Council on Environmental Quality Committee on Futures in Environmental Research, 1984-1985

Member, NIMH Committee on Frontiers of Neuroscience, 1983-4

Member, NIEHS Task Force on Future Research, 1984

Participant, Dahlem conferences on changing Biogeochemical cycles of Metals (1983) and on Mechanisms of Cell Injury (1985)

Grants reviewer, National Foundation - March of Dimes; National Science Foundation; Nutrition Foundation; Thrasher Foundation; Hereditary Diseases Foundation, NIH

Manuscript reviewer, Life Sciences, Biochemical Pharmacology, Environmental Journal Pharmacology, Science, Neurotoxicology, Neurobehavioral Toxicology Teratology, Pharmacology Biochemical Behavior, Procs. Society Experimental Biological Medicine, Experimental Neurology, etc.

Honors and Awards:

Graduated summa cum laude, 1967

elected to Phi Beta Kappa, 1967

undergraduate academic scholarship, 1963-1965

Woodrow Wilson National Foundation Fellow, 1967-1968

Leverhulme and Fulbright Fellowships to University of London, 1967

National Science Foundation Graduate Traineeship, 1968-1972

Public Health Service Research Fellowship to Woods Hole, 1970
Rockefeller Foundation predoctoral research fellowship, 1971-1972
NIH postdoctoral fellowship in environmental health sciences, 1972-1972
Joseph P. Kennedy, Jr. Fellowship in neurosciences, 1974-1975
Pharmaceutical Manufacturers Association Foundation Research Starter Award, 1974-1975
National Academy of Sciences Exchange Fellow to Yugoslavia, 1976
George Miller lectureship in environmental studies, University of Illinois, 1984
Dean's lectureship, Loyola Medical School, 1984
National Science Foundation IBRO fellowship to India, 1984

Professional Interests:

Neuropharmacology & Toxicology
Environmental Risk Assessment

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ELLEN KOVNER SILBERGELD

A. SCIENTIFIC PUBLICATIONS

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2. Silbergeld, E. K.: and Goldberg, A.M.: A lead-induced behavior disorder. Life Sci. 13(9):1275-1283, 1973.

3. Silbergeld, E. K.: Blood glucose: A sensitive indicator of environmental stress in fish. Bull. Environ. Contam. Toxicol 11(1):20-25, 1974.

4. Silbergeld, E. K., Fales, J. T. and Goldberg, A.M.: Lead: Evidence for a prejunctional effect on neuromuscular function. Nature 247:49-50, 1974.

5. Silbergeld, E. K., Fales, J. T. and Goldberg, A.M.: Lead: The effects of inorganic lead on the neuromuscular junction. Neuropharmacology 13:146-157, 1974.

6. Silbergeld, E. K. and Goldberg, A.M.: Lead induced behavioral dysfunction: An animal model of hyperactivity. Exp. Neurol. 42:146-157, 1974.

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8. Silbergeld, E. K. and Goldberg, A.M.: Pharmacological and neurochemical investigations of lead induced hyperactivity. Neuropharmacology 14:431-444, 1975.

9. Morrison, J. H., Olton, D. S., Goldberg, A.M. and Silbergeld, E. K.: Alterations in consummatory behavior of mice produced by dietary exposure to inorganic lead. Dev. Psychobiol. 8(5):389-396, 1975.

10. Silbergeld, E.K.: Neurochemical and pharmacological studies of central nervous system lead toxicology. In Carnow, B.W. (ed.): Health Effects of Occupational Lead and Arsenic Exposure, USDHEW, PHS, CDC, NIOSH, Washington, D.C., pp. 74-85, 1976.

11. Silbergeld, E. K. and Chisolm, J. J., Jr.: Lead poisoning: Altered urinary catecholamine metabolites as indicators of intoxication in mice and children. Science 192:153-155, 1976.

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13. Silbergeld, E. K. and Goldberg, A. M.: Hyperactivity. In Goldberg, A.M. and Hanin, I. (eds): Biology of Cholinergic Function. Raven Press, New York, pp. 619-645, 1976.

14. Silbergeld, E. K.: Interactions of lead and calcium on the synaptosomal uptake of dopamine and choline. Life Sci. 20(2):309-318, 1977.

15. Carroll, P. T., Silbergeld, E. K. and Goldberg, A. M.: Alteration of central cholinergic function by chronic lead acetate exposure. Biochem. Pharmacol. 26:397-402, 1977.

16. Silbergeld, E. K. and Pfeiffer, R. F.: Differential effects of three dopamine agonists: Apomorphine, bromocriptine and lergotrile. J. Neurochem. 28:1323-1326, 1977.

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59. Hruska, R. E., Ludmer, L. M., Pitman, K. T., DeRyck, M., and Silbergeld, E. K.: Effects of estrogen on striatal dopamine receptor function in male and female rats. Pharmacol. Biochem. Behav. 16: 285-291, 1982.

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63. Silbergeld, E.K., Anderson, S.M., and Morris, S.J.: Interactions of erythrosin B (U.S. F, D & C Red 3) with rat cortical membranes. Life Sci. 31:957-969, 1982.

64. Silbergeld, E. K., Hruska, R. E., Bradley, D., Lamon, J. M., and Frykholm, B. C.: Neurotoxic aspects of porphyrinopathies: lead and succinylacetone. Environ. Res., 29:459-471, 1982.

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75. Silbergeld, E.K.: Behavioral teratology of lead. In Yanai, J. (ed) Neuro Behavioral Teratology, Amsterdam, Elsevier/North Holland, pp. 433-445, 1984.

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77. Silbergeld, E.K.: Mitochondrial mechanisms of lead neurotoxicity. In Narahashi, T. (ed) Cellular and Molecular Mechanisms of Environmental Neurotoxins, New York, Raven Press, pp 153-164, 1984.

78. Silbergeld, E.K.: Health Effects of PCBs: Review of occupational exposure. In Barros, M, et al, Konneman, H., and Visser, R. (eds) PCB Seminar Proceedings. Hague: OECD, pp 136-151, 1984.

79. Mattison, D.R., Nightingale, M.S., and Silbergeld, E.K.: Reproductive toxicity of TCDD. In Lowrance, W. (ed) Public Health Risks of the Dioxins, San Francisco, Kaufman, pp. 249-275, 1984.

IN PRESS:

Phillips, A., Silbergeld, EK, Golden, M: Health effects at hazardous waste dumpsites. Amer. J. Indust. Med.

Silbergeld, E.K.: Neurotoxicity of lead. In Manzo, L. and Blum, J. (eds) Neurotoxicology, Dekker.

Silbergeld, E.K.: The relevance of animal models for neurotoxic disease states. International Journal of Mental Health, special issue "Psychiatric Aspects of Pollutant Exposure".

Silbergeld, E.K.. and Mattison, D.R.: The effects of dioxin on reproduction: experimental and clinical studies. American J. Industrial Medicine.

IN PREPARATION:

Silbergeld, E.K., Mattison, D.R., White, N., Godlove, K.R., and Malley, J.: Effects of three polycyclic aromatic hydrocarbons on fertility in female mice: A lifetime study of the effects of single-dose treatment.

Silbergeld, E.K.: A Textbook in Neurotoxicology.

Mattison, D.R., Kay, H., Silbergeld, E.K., and Nightingale, M.S.: Effects of TCDD on gonadal hormones and function in mice.

Mattison, D.R., Silbergeld, E.K., and Bertin, J.E.: Scientific and legal implications of reproductive toxicology, In Evans, ME (ed), Current Topics in Obstetrics and Gynecology.

Silbergeld, E.K., Phillips, A., and Golden, M.: Health effects of hazardous waste.

Silbergeld, E.K.: Biochemical basis of solvent neurotoxicity.

Silbergeld, E.K., Schwartzman, D., and Percival, R.V. Environmental exposures to organometals. In Sparber, S. and Tilson, H. (eds) Neurotoxicology of Organometals. New York, Wiley Interscience.

O'Leary, T. and Silbergeld, E.K. (eds): Health Effects in Communities at Hazardous Waste Dumpsites, AAAS

B. ABSTRACTS

1. Silbergeld, E. K.: Effects of lead on neuromuscular functions: In vitro evidence for site of action at the presynaptic level. Fed. Proc. 32:275, 1973.

2. Silbergeld, E. K. and Goldberg, A. M.: Lead poisoning: an animal model of hyperactivity. Pharmacologist 15:143, 1973.

3. Silbergeld, E. K. and Goldberg, A. M.: cholinergic-aminergic interactions in lead induced hyperactivity. Pharmacologist 16:335, 1974.

4. Goldberg, A. M. and Silbergeld, E. K.: Neurochemical aspects of lead induced hyperactivity. Trans. Amer. Soc. Neurochem. p.185, 1974.

5. Silbergeld, E. K., Carroll, P. T. and Goldberg, A. M.: Monoamines in lead-induced hyperactivity. Pharmacologist 13:203, 1975.

6. Goldberg, A. M., Carroll, P. T. and Silbergeld, E. K.: Cholinergic aspects of hyperactivity. Fifth Internatl. Meeting for Soc. Neurochem., 1975.

7. Pfeiffer, R. . and Silbergeld, E. K.: Differential behavioral and neurochemical effects of three dopaminergic agonists. Neurosci. Abst. II:720, 1976.

8. Silbergeld, E. K. and Miller, L. P.: Lead intoxication: changes in seizure threshold and gamma-aminobutyric acid function. Neurology 4(27):405, 1977.

9. Adler, H. S. and Silbergeld, E. K.: Intrasynaptosomal interactions of lead and calcium in dopaminergic neurotransmission. Pharmacologist 19(2):40, 1977.

10. Silbergeld, E. K. and Walters, J. R.: Dopamine uptake and release in substantia nigra: Effects of gamma-aminobutyric acid and substance P. Pharmacologist 19(2):544, 1977.

11. Silbergeld, E. K., Miller, L. P., Kennedy, S. and Eng, N.: Lead and seizures: Role of gamma-aminobutyric acid. Neurosci. Abst. III:1039, 1977.

12. Adler, H. S. Costa, J. L. and Silbergeld, E. K.: X-ray microanalysis in neurochemistry: Localization of an elemental neurotoxin and manipulations of mitochondrial Ca++. Neurosci. Abst. III:1235, 1977.

13. Baring, M. D., Walters, J. R., Silbergeld, E. K., Eng, N., and Lakoski, J. M.: Effect of systemic apomorphine on firing rates of dopamine cells in rats with striatal kainic acid lesions. Neurosci. Abst. 4, 267, 1978.

14. Hruska, R. E. and Silbergeld, E. .: Ergot drugs inhibit spiroperidol and serotonin receptor binding. Soc. Neurosci. Abst. 4: 425, 1978.

15. Silbergeld, E. K., Hruska, R. E., Walters, J. R., Kennedy, S., Eng, N., and deSantis, S.: Effects of intrastriatal kainic acid on motor behavior in rats. Soc. Neurosci. Abst. 4: 49, 1978.

16. Kennedy, S., Hruska, R. E., and Silbergeld, E. K.: Serotonergic-dopaminergic effects of ergot drugs. Soc. Neurosci. Abst. 4: 426, 1978.

17. Silbergeld, E. . Hruska, R. E., Lamon, J. M., Frykholm, B. F., and Hess, R. A.: Neurotoxic mechanisms in porphyria and lead intoxication: Possible role of d-aminolevulinic acid. Clin. Res. 27:307A, 1979.

18. Lamon, J. M., Silbergeld, E. K., Frykholm, B. F., and Hruska, R. E.: Extra-erythropoietic heme metabolism in lead intoxication. Clin. Res. 27: 299A, 1979.

19. Silbergeld, E. K., Hruska, R. E., Lamon, J. M., Frykholm, B. F., and Hess, R.A.: The effects of lead (Pb) on hepatic heme synthesis and drug metabolism. Pharmacologist 21: 209, 1979.

20. Silbergeld, E. K., Hruska, R. E., and Lafferman, J. A.: Actions of lead (Pb) on GABAergic neurotransmission: Discrepancies between in vivo and in vitro effects. Soc. Neurosci. Abst. 5: 416, 1979.

21. Lafferman, J. and Silbergeld, E. K.: Erythrosin B (Food, Drug and Cosmetic Red No. 3) inhibits dopamine uptake in rat caudate synaptosomes: a kinetic study. Soc. Neurosci. Abst. 5, 562, 1979.

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23. Silbergeld, E. K., Hruska, R. E., Schwarcz, R.: GABA in the basal ganglia: effects of selective lesions. Brain Res. Bull., 4: 696, 1979.

24. Weir, R. L., Hruska, R. E. and Silbergeld, E. K.: Effects of dopamine agonists on ^{3}H-spiroperidol receptor binding. Soc. Neurosci. Abst. 5: 81, 1979.

25. Hruska, R. E., Ludmer, L. M., and Silbergeld, E. K.: Prolactin increases the number of striatal dopamine receptors. Pharmacologist 22:220 (1980), No. 338.

26. Silbergeld, E. K.: Erythrosin B: ouabain-like actions of an artificial food dye in rat brain tissue. Pharmacol. 22:198, 1980.

27. Hruska, R. E., Ludmer, L. M., and Silbergeld, E. K.: The striatal dopamine receptor supersensitivity produced by estrogen may be mediated through prolactin. Soc. Neurosci. Abst. 6: 441, 1980.

28. Chisolm, J. J., and Silbergeld, E. K.: Increased excretion of homovanillic acid (HVA) in urine by young children with increased lead absorption. Neurosci. Abst. vol. 6:508, 1980.

29. Silbergeld, E. K., and Anderson, S. M.: Erythrosin B: specific inhibitor of high affinity [^{3}H]-ouabain binding and ion transport in rat brain. Neurosci. Abst. vol. 6:56, 1980.

30. Silbergeld, E. K., Anderson, S. M., DeRyck, M., Chronwall, B., and Morris, S. J.: Neurotoxicity of an artificial food color (erythrosin B): methods for rapid testing. Abstr. 8th Meeting Internat. Soc. Neurochem., p. 238, 1981.

31. Pitman, K. T., Hruska, R. E., Ludmer, L. M., and Silbergeld, E. K.: Prolactin increases the density of striatal dopamine receptors in normal and hypophysectomized male rats. Soc. Neurosci. Abstr. 7: 217, 1981.

32. DeRyck, M., Hruska, R. E., and Silbergeld, E. K.: Estrogen potentiates haloperidol-induced catalepsy/akinesia in male rats. Soc. Neurosci. Abstr. 7: 217, 1981.

33. Silbergeld, E.K.: The biochemical basis of lead neurotoxicity. Abstr. Ann. Mtg. AAAS, Toronto, 1981.

34. Hruska, R. E., Pitman, K. T., Ludmer, L. M., DeRyck, M., and Silbergeld, E. K.: Comparison of the biochemical and behavioral effects of estrogen in male and female rats. Soc. Neurosci. Abstr. 7: 218, 1981.

35. Silbergeld, E. K., Morris, S. J., and Anderson, S. M.: Erythrosin B and Na,K-ATPase: receptor-like interactions with brain synaptic membranes. Soc. Neurosci. Abstr. 7: 105, 1981.

36. Silbergeld, E. K.: Basic and applied neurochemistry of hazards. Abstr. Annual Meet. AAAS, Washington, D.C., p. 63, 1982.

37. Silbergeld, E. K.: Neurotoxic implications of altered heme synthesis in lead poisoning. Neurotoxicol. 3:119-120, 1983.

38. Silbergeld, E. K., Nightingale, M. S., and Mattison, D. R.: Effect of oocyte destruction by polycyclic aromatic hydrocarbons (PAH) on fertility of DBA/2N (D2), C57BL/6N (B6), and (D2 x B6) F1 mice. Soc. Gynecol. Invest. Abstr., p. 51, 1983.

39. Silbergeld, E.K., Nightingale, M.S., Godlove, K., Malley, J., and Mattison, D.R.: Reproductive toxicity of polycyclic aromatic hydrocarbons (PAHs) in female mice. Pharmacol., 25:655, 1983.

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41. Mattison, D.R., and Silbergeld, E.K.: Occupational exposures and pregnancy, Abstr. 15th Ann. Cong. Col. Soc. Obstet. Gynecol., Bucaramanja, Colombia, 1983.

42. Mattison, D.R., Nightingale, M.S., Shiromizu, K., Takizarva K., Silbergeld, E.K., Kay, H.H., and Swartz, W.J.: Ovarian toxicity, Abstr. 15th Ann. Cong. Col. Soc., Obstet. Gynecol, Bucaramanga, Colombia, 1983.

43. Swartz, W., Silbergeld, E.K., Malley, K., and Mattison, D.R.: The effects of benzo(a)pyrene on murine ovarian function and fertility. Abstr. Amer. Assoc. Anat., 177A-178A, 1984.

44. Silbergeld, E.K.: PCB transformer fires. Abstracts, Amer. Pub. Health Assn. Annual Meeting, Anaheim, 1984.

OTHER PUBLICATIONS

REVIEWS

Silbergeld, E.K.: "Lead in Man and the Environment" for Trends in Pharmacological Sciences, 1981.

Silbergeld, E.K.: "Hazardous Waste in America" for Quarterly Review of Biology 59:88-89, 1983.

Silbergeld, E.K.: "Nutrition and Brain Function" for Trends in Neurosciences, 1984.

OTHER

Silbergeld, E.K.: "US Lead Program Vital" (editorial) Clin. Chem. News, February, 1983, page 4

Silbergeld, E.K.: "Health Effects" in Environmental Defense Fund, Dumpsite Cleanups: A Guide to the Superfund Program, Washington, DC, 1983

Silbergeld, E.K., and Highland, J.: "Ghost Dumps" (letter) Science, 216:462, 1982

Silbergeld, E.K.: "Cancer Policy: Has the Dust Settled?" Environmental Forum, 2:25-29, 1983

Hall, K.L., and Silbergeld, E.K.: "Reappraising Epidemiology" Harvard Environmental Law Review, 7:441-448, 1983

Silbergeld, E.K.: "New lead control plan unlawful and ineffective" (editorial) Clin. Chem. News. August 1984, page 5.

Silbergeld, E.K.: "Where do we go from here?", in Legator, M.S. (ed) Community Health Studies: A Guide for Citizens, Johns Hopkins Press, Baltimore, MD, in press

Silbergeld, E.K., and Percival, R.V. "The lessons of lead", EPA Journal, in press

Silbergeld, E.K.: "Have Environmentalists Snatched Defeat from the Jaws of Victory? - A Response to Ruckelshaus" Issues in Sci. Technol., in press.

PAPERS GIVEN

1972 "Effects of Chronic Sublethal Exposure to Dieldrin on Adaptation to Thermal Stress in a Freshwater Fish," American Fisheries Society, June, 1972.

1973 "Effects of Lead on Neuromuscular Function," FASEB Meetings, April, 1973.

"Lead Poisoning: An Animal Model of Hyperactivity?" ASPET, August, 1973.

"Hyperactivity: A Lead-Induced Behavioral Disorder," National Institute of Environmental Health Sciences Conference on Low Level Lead Poisoning, October, 1973 (invited speaker).

1974 "Lead Induced Hyperactivity," Society of Toxicology, March, 1974.

"Cholinergic-Aminergic Interactions in Lead-Induced Hyperactivity," ASPET, August, 1974.

1975 "Neurological and Behavioral Toxicology of Lead," Society for Occupational and Environmental Health, February, 1975 (invited speaker).

"Neurotoxicity of Inorganic Lead," Toronto Conference on Heavy Metals in the Environment, October, 1975 (invited speaker).

"Lead Poisoning," Society for Neuroscience, November, 1975 (invited speaker).

1976 "Neurochemical Approaches to Behavioral Toxicology," American Psychological Association, September, 1976 (invited speaker).

"Differential Aspects of Three Dopaminergic Agonists," Socieity for Neuroscience, November, 1976.

1977 "Animal Models of Hyperactivity," Workshop on Animal Models in Psychiatry and Neurology (NIMH), June, 1977 (invited speaker).

"Intrasynaptosomal Interactions of Lead and Calcium in Dopaminergic Neurotransmission," American Society for Pharmacology and Experimental Therapeutics, August, 1977.

"Dopamine Uptake and Release in Substantia Nigra," American Society for Pharmacology and Experimental Therapeutics, August, 1977.

"Lead and Seizures: Role of GABA," Society for Neuroscience, November, 1977.

"X-ray Microanalysis in Neurochemistry," Society for Neuroscience, November, 1977.

1978 "Serotonergic-dopaminergic interactions of ergot drugs," International Symposium on Dopaminergic Ergots and Motor Function (Stockholm), July, 1978 (invited speaker).

"Effects of intrastriatal kainic acid on motor behavior in rats," Society for Neuroscience, November, 1978.

"Dopaminergic-serontonergic interactions of ergot drugs," Society for Neuroscience, November, 1978.

"Altered cholinergic function and response to tremorine in kainic acid treated rats," Second International Huntington's Disease Symposium (San Diego), November, 1978 (invited speaker).

1979 "The effects of lead on hepatic heme synthesis and drug metabolism," American Society for Pharmacology and Experimental Therapeutics, August, 1979.

"In vitro testing for neurotoxicity," NATO Advanced Study Institute on In Vitro Toxicity Testing (Monte Carlo), July, 1979 (invited speaker).

"Neurochemical aspects of lead intoxication," Harvard Symposium on Health Effects of Lead at Low Dose, September, 1979 (invited speaker).

"Neurochemical approaches to toxicity testing," FDA Science Symposium on Foods, Drugs and the Developing Brain, November, 1979 (invited speaker).

"Actions of lead on GABAergic neurotransmission: discrepancies between in vivo and in vitro effects," Society for Neuroscience, November, 1979.

1980 "Electron microanalysis in neurobiology," Winter Conference on Brain Research, January, 1980.

"Neurotoxicology," NIOSH Training Seminar in Occupational Health, November, 1980 (invited speaker).

"Potential neurotoxicology of artificial food colors: erythrosin B," Nutrition Coordinating Committee, NIH, December, 1980 (invited speaker).

1981 "Biochemical bases of lead neurotoxicity," AAAS Symposium on Lead in the Environment, Annual Meetings of the AAAS, January, 1981 (invited speaker).

"Artificial food colors and childhood behavior disorders," New York Academy of Medicine Symposium on Therapeutic Claims of Diet, February, 1981 (invited speaker).

"Neurotoxicity of an artificial food color (erythrosin B). Methods for rapid toxicity testing," International Society for Neurochemistry Symposium on Neurotoxic Mechanisms, September, 1981 (invited speaker).

"Porphyrinopathic mechanisms of neurotoxicity: heavy metals," International Conference on Heavy metals in the Environment, Amsterdam, September, 1981.

1982 "Basic and applied neurochemistry of environmental hazards," Symposium on Environmental Assaults on the Nervous System, AAAS Annual meetings, January, 1982 (invited speaker).

"Biochemical bases for the action of artificial food colors," NIH Consensus Conference on Defined Diets and Childhood Hyperactivity, January, 1982 (invited speaker).

"Effects of estrogen on striatal dopamine function," Winter Conference on Brain Research, January, 1982.

"Behavioral and biochemical effects of artificial food colors," Washington Nutrition Group, April, 1982 (invited speaker).

"Porphyrinopathic mechanisms in neurotoxicity--lead and chemical porphyria." Symposium on Mechnaisms of Neurotoxicology (satellite to IBRO conference, Dusseldorf), March, 1982 (invited speaker).

"Experimental studies of lead neurotoxicity." CLEAR International Symposium on Low Level Lead Exposure, London, May, 1982 (invited speaker).

"Neurotoxic implications of altered heme synthesis in lead poisoning." International Symposium on Neurotoxicity of Lead, Chicago, September, 1982 (invited speaker).

1983

Ontario Toxicology Symposium, "Neurotoxicology," London, Ontario Canada, May, 1983 (invited speaker).

International Congress of Toxicology, Symposium on Neurotoxins Environmental, San Diego, CA, "Mitochrondrial mechanisms of lead neurotoxicity," July, 1983 (invited speaker).

Mid-Atlantic Association of OB/GYN Nurses, Atlantic City, NJ, "Reproductive hazards in the occupational and general environment," October, 1983 (invited speaker).

"Occupational exposures to PCBs," OECD Symposium on PCBs, Den Haag, Netherlands, September, 1983 (invited speaker).

University of Rochester Toxicology Program, "Science vs. Policy: the example of lead" (invited speaker).

International Association of Firefighters, Toronto, Canada, Seventh International Redmond Symposium, "Hazards of PCB fires," December, 1983 (invited speaker).

Rockefeller University Symposium on Dioxins, New York, NY, "Public policy of dioxin control," October, 1983 (invited speaker).

Society for Occupational and Environmental Health Symposium on Dioxin, Washington, DC, Arlington, VA, "Reproductive effects of TCDD," December, 1983 (invited speaker).

Harvard School of Public Health, Boston, MA, "Environmental Toxicology," November, 1983 (invited lecturer).

1984

Consumer Federation of America symposium on Product liability, Washington, DC, "Epidemiological Bases of Causation," January, 1984 (invited speaker).

IBRO International Congress on Neurotoxicology, Lucknow, India, February, 1984.

George C. Miller lectureship in environmental studies, University of Illinois, Urbana, IL, March, 1984 (invited speaker).

Dean's distinguished lecturer in pharmacology, Loyola Medical School, Chicago, IL, March, 1984 (invited speaker).

National Conference for Food Protection, "Regulating Risks," Washington, DC, May, 1984 (invited speaker).

NIH-FAES Toxicology Course, "Dioxin", May 1984 (invited lecturer)

"Health Effects at Hazardous Waste Dump Sites", coorganizer of AAAS Symposium, New York, May 1984.

Istituto Superiore di Sanita (Rome), "Dioxin: new perspectives in science and public policy in the United States", October 1984 (invited lecturer).

Association of Official Analytic Chemists Symposium on environmental toxicology and chemical analysis Washington, DC, October 1984 (invited lecturer).

"Neurotoxicology of Agent Orange", Training Course in Neurotoxicology, Johns Hopkins School of Hygiene and Public Health, November 1984 (invited lecturer).

American Public Health Association symposium of Hazards of PCB transformer fires, Los Angeles ,November 1984.

Canadian Institute of International Affairs, Conference on science, Values and Environmental Policy, "Health Effects of Environmental Contaminants" Toronto, November 1984 (invited speaker).

1985

Course lecturer, Clinical Toxicology, Johns Hopkins Medical School, January 1985.

Mt Sinai Environmental Sciences Laboratory "Neurochemical effects of organic solvents", (invited speaker) January 1985.

University of Maryland Medical School, "Epidemiological studies at hazardous waste dumpsites", February 1985 (invited speaker).

Agricultural Research Institute, "Environmental perspectives on risks of pesticides", Washington, DC (invited speaker).

Johns Hopkins University, "Health Effects of Hazardous Waste", March 1985.

University of North Carolina Institute of Environmental Studies, "Health Studies of Hazardous Waste Dumpsites", March 1985.

National Institute of Environmental Health Sciences, "Reproductive effects of polycyclic aromatic hydrocarbons", March 1985.

05 April 1983

CURRICULUM VITAE

I. Glenn Sipes, Ph.D.

BIRTHDATE AND PLACE

July 26, 1942

Natrona Heights, Allegheny County, Pennsylvania

EDUCATION

June 1965, University of Cincinnati, B.S. in Pharmacy

November 1969, University of Pittsburgh, Pittsburgh Pennsylvania, Ph.D. in Pharmacology

Dissertation: Studies on the Pharmacology and Peripheral Mechanism of Fenfluramine HCl. Dissertation Director: Joseph P. Buckley, Ph.D. (Presently Dean at the University of Houston, School of Pharmacy).

ACADEMIC AND PROFESSIONAL APPOINTMENT

1969-1971 Staff Fellow, National Heart, Lung and Blood Institute, National Institutes of Health

1971-1973 Senior Staff Fellow, National Heart, Lung and Blood Institute, National Institutes of Health

1971-1973 College of General Studies Special Lecturer, George Washington University, Washington, D.C. (Off-campus lecturer on drug abuse to military personnel, law enforcement officers, clergy, nurses)

1973-1975 Assistant Professor of Pharmacology, University of Arizona; Visiting Scientist, Hoffmann - La Roche (Fellow)

1975-1978 Assistant Professor of Toxicology, University of Arizona, Tucson; Assistant Professor of Pharmacology and Assistant Professor of Anesthesiology, University of Arizona, College of Medicine, Tucson, Arizona

1978-1982 Associate Professor of Pharmacology and Toxicology, College of Pharmacy and Associate Professor of Pharmacology and Anesthesiology, College of Medicine, University of Arizona, Tucson, Arizona

1982- Professor and Head, Department of Pharmacology and Toxicology, College of Pharmacy and Professor of Pharmacology and Anesthesiology, College of Medicine, University of Arizona, Tucson, Arizona

MAJOR FIELD

Major emphasis in teaching and research is in the areas of biochemical pharmacology and biotoxicology.

Biochemical Pharmacology (Biotransformation):

Identification of drug metabolites excreted by animals and man
Pharmacokinetics of drug disposition
Factors affecting drug metabolism
Mechanism(s) of induction of microsomal drug metabolizing enzymes

Biotoxicology:

This area is uniquely related to biotransformation in that many drugs and xenobiotics produce tissue injury after *in vivo* enzymatic biotransformation to chemically reactive metabolites.

Chemical Carcinogenesis:

Development of animal models for detection of initiating and promoting agents.

Research and teaching areas are:

Role of biotransformation in the hepatotoxicity and carcinogenicity of inhalation anesthetics and related compounds
Bioactivation and covalent binding of carcinogens to tissue macromolecules
Drug metabolism and pharmacokinetics

HONORS, AWARDS, FELLOWSHIPS, SOCIETY MEMBERSHIPS

Cum Laude, University of Cincinnati

NIH Predoctoral Fellowship (1965-1969)

NIH Staff Fellowship (1969-1973)

Rho Chi

Sigma Xi

Foundation for Advanced Education in the Sciences (sponsored by NIH Alumni)

American Society of Pharmacology and Experimental Therapeutics (ASPET)

Society of Toxicology

Western Pharmacology Society

Recipient: ASPET Travel Grant to Sixth, Seventh International Congresses of Pharmacology; Helsinki, 1975, Paris, 1978

Elected to membership: Association of University Anesthetists (1980)

HONORS, AWARDS, FELLOWSHIPS, SOCIETY MEMBERSHIPS (con't)

Associate Editor, Life Sciences, 1973 - present

Associate Editor - Toxicology and Applied Pharmacology, January 1984

Editorial Board, Toxicology and Applied Pharmacology, 1981 - present

Member, International Union of Pharmacology (IUPHAR) Section on Toxicology

Secretary-Treasurer-Society of Toxicology Subsection on Mechanisms of Toxicity

International Society for the Study of Xenobiotics - Charter Member

American Men and Women of Science

Elected to Membership Committee - Society of Toxicology

Research Fellowship, Japanese Society for the Promotion of Science (April 1, 1980 to March 31, 1981)

RESEARCH SUPPORT

$30,000 Hoffmann-LaRoche 1973-1975. Studies on the metabolism and pharmacokinetics of bumetanide. Status: Completed

$1,000 American Cancer Society 1974-1975. Effects of polychlorinated biphenyls on the metabolism and covalent binding of dimethylnitrosamine. Status: Completed

$35,000 Hoffmann-LaRoche 1975-1976. Studies on the metabolism and covalent binding of hepatotoxins and hepatocarcinogens to tissue macromolecules. Status: Completed

$5,500 Hoffmann-LaRoche 1975-1976. Studies on the metabolism and disposition of ^{14}C-bumetanide; a potent new diuretic. Status: Completed

$1,800 American Cancer Society 1976-1977. Role of lipoperoxidation in chemical carcinogenesis. Status: Completed

$124,853 National Institute of Arthritis and Metabolic Diseases, NIH. Studies of inhalation anesthetic hepatotoxicity. Principal Investigator: Burnell R. Brown, Jr., M.D., Ph.D., Co-Investigator: I. Glenn Sipes, Ph.D., June 1, 1976 to May 31, 1979. Status: Completed

$194,355 NIH-NIEHS. Extrapolation of PCB deposition. Principal Investigator: I. Glenn Sipes, Ph.D., April 20, 1977 to June 30, 1978. Status: Completed

$64,906 NIH-NIEHS. Continuation for extrapolation of PCB deposition. Principal Investigator: I. Glenn Sipes, Ph.D., October 20, 1978 to October 19, 1979. Status: Completed

$189,410 National Cancer Institute, NIH. Activation and binding of organohalogen carcinogens. Principal Investigator: I. Glenn Sipes, Ph.D., September 1, 1977 to August 31, 1980. Status: Completed

RESEARCH SUPPORT (con't)

$124,256 Department of the Navy. Oxygen toxicity and lung collagenous protein. Principal Investigators: I. Glenn Sipes, Ph.D. and Klaus Brendel, Ph.D. Status: September 1, 1977 to February 28, 1981. Status: Completed

$129,970 NIH-NIAMD. Studies of inhalation anesthetic hepatotoxicity. Co-Investigator: I. Glenn Sipes, Ph.D., Principal Investigator: B.R. Brown, Jr., M.D., Ph.D., July 1, 1979 to June 30, 1982. Status: Completed

$717,180 NIH-NIEHS. Pharmacokinetics of xenobiotics. Principal Investigator: I. Glenn Sipes, Ph.D., Co-Investigator: Dean E. Carter, Ph.D. 8/18/78 - 9/14/83. Status: Completed

$572,364. Studies of inhalation anesthetic hepatotoxicity. Co-Investigator: I. Glenn Sipes, Ph.D., Principal Investigator: B.R. Brown, Jr., M.D., Ph.D., June 1, 1982 to May 31, 1987. Status: Current

$1,363,244 NO1-ES-3-5031. Studies on chemical disposition in mammals. Principal Investigator: I. Glenn Sipes, Ph.D., Co-Investigator: Dean E. Carter, Ph.D. Awarded 9/14/83 - 9/14/88. Status: Current

$228,146. Animal models of alcohol-related cancers. Principal Investigator: I. Glenn Sipes, Co-Investigator: Siraj Mufti. Awarded 12/01/83 - 12/01-86. Status: Current

$100,697 T-32-ES07091-05. Graduate Training Program in Environmental Toxicology. Principal Investigator: I. Glenn Sipes, Ph.D. Awarded 7/1/83 - 6/30/84. Status: Current

$535,455 T-32-ES07091-01. Graduate Training Program in Environmental Toxicology. Principal Investigator: I. Glenn Sipes, Ph.D. 7/1/84 - 6/30/89. Status: Approved

$212,008 NIEHS. Animal models of alcohol-related cancers. Principal Investigator: I. Glenn Sipes, Co-Investigator: Siraj Mufti. Awarded 2/1/84 - 1/31/87. Status: Current

TEACHING RESPONSIBILITIES

Toxicology 602 - Class coordinator and major instructor for this graduate level one semester course on organ and cellular toxicity, from January 1975 to present. Average enrollment has been 18-25 graduate students. Course consists of 15 two-hour lectures, 14 three-hour laboratories or demonstration sessions, 1 three-hour midterm exam and 1 three-hour final exam. Lectures presented include:

Absorption, Tissue Distribution and Metabolism of Xenobiotics (4 hours)

Anatomy, Biochemistry and Physiology of the Liver (2 hours)

Mechanism of Liver Toxicity (2 hours)

Chemical Mutagenesis (2 hours)

Chemical Carcinogenesis (4 hours)

TEACHING RESPONSIBILITIES (con't)

Toxicology 602: Laboratories presented include:

Routes of Administration and Animal Handling

Absorption and Distribution of Xenobiotics

LD_{50} Determination

In Vitro Tests for Assessing Chemical Induced Liver Damage

In Vivo Tests for the Assessment of Chemical Induced Liver Damage

Effect of Liver Toxins on Hepatic Protein Synthesis

Mercury Chloride Renal Toxicity

Preparation of Tissue Subcellular Fractions

In Vitro Chemical Carcinogenesis (Ames Test)

Assessment of Xenobiotic Induced Lung Damage

Toxicology 598 c: A special topics course that discusses the pharmacology and toxicity of antibiotics and antineoplastic agents and is offered only to Toxicology graduate students when requested. It consists of 15 one-hour lectures and has an enrollment of 4 to 8 students. Lectures presented include:

The Sulfonamides
Mechanism of Protein Synthesis
Inhibitors of Protein Synthesis 1: Chloramphenicol
Inhibitors of Protein Synthesis 2: Tetracyclines
Inhibitors of Protein Synthesis 3: Streptomycins
Inhibitors of Cell Wall Synthesis - Penicillins
Antibiotics Affecting Membrane Permability

Toxicology 596a: Advanced Toxicology Seminar. Coordinated this one-hour seminar series presented in the Fall semesters of 1976-77, 1977-78, 1978-79, 1979-80, 1981-82 and 1982-83.

Pharmacology 501: The Pharmacological Basis of Therapeutics. This course is offered by the College of Medicine, Department of Pharmacology and is taught by the entire faculty. The enrollment in the class is approximately 100 and consists of about 110 hours of lecture and 10 hours of exam review. Lectures presented include:

Drug Metabolism (3 hours) 1975-81

Adrenergic Drugs (4 hours) 1975-76-77

Sedatives and Hypnotics (1 hour) 1975-76

Exam Review (2 hours) 1975-81

TEACHING RESPONSIBILITIES (con't)

Pharmacology 550: Drug Disposition and Metabolism. This is a three-unit graduate course offered yearly by the College of Medicine, Department of Pharmacology. Average enrollment is 16 graduate students. Share approximately one-third of the following lectures and laboratories:

Drug Metabolism—Basic Pathways (10 hours)

Drug Metabolism—Biochemical Aspects (10 hours)

Role of Drug Metabolism in Chemical Carcinogenesis, Teratogenesis, Mutagenesis and Drug Allergy (10 hours)

Drug Metabolism Laboratory and Demonstrations (24 hours)

Pharmacology 372: Pharmacology for Nurses, offered in Yuma, Arizona through the College of Nursing and Continuing Education (6 hours), Fall 1982.

Pharmacology 900: Research in Pharmacology. Coordinator for this elective course for the Department of Pharmacology and the Curriculum Phase III Committee.

Pharmacology 900: Research. Arranged and supervised an introductory research experience for Mr. Dennis Roscoe, a graduate student in Physiology.

Additional Lectures:

Medicine 596e - Occupational and Environmental Health Seminar: June 7, 1977

Pharmacology 352 - Histamine as a Neurotransmitter. Anesthesiology Resident Lectures: Usually 2-3 lectures per year in areas of anesthetic metabolism, drug metabolism and drug induced liver injury

Toxicology 600a - Introductory Lecture (2 hours) Fall, 1975, 1976

Pharmacology 474 - Clinical Toxicology Drug Metabolism - Influence on Toxicity and Management of Poisoning, 1978, 1979, 1980, 1981

Oncogenic Transformation: Department of Hematology/Oncology, Bioactivation and Interaction of Chemical Carcinogens with DNA and Other Tissue Constituents, 5/30/78

Pharmacology 372 a & b - (Applied Pharmacology): "General Principles; Antiinfective Drugs; and Antineoplastic Drugs", September 24-25, 1982, Yuma Regional Medical Center, Yuma, Arizona

NIOSH Course No. 549 - (Applied Industrial Hygiene): "Environmental and Occupational Carcinogenesis", September 27-October 1, 1982 at Alamos Resort Hotel, Scottsdale, Arizona

UNIVERSITY AND PROFESSIONAL COMMITTEES

1. Toxicology Curriculum Development Committee

2. Toxicology Admissions Committee

3. Phase III Subcommittee - Medical School 1975-78

4. Interviewer of Medical School Applicants: 1975-80 (38 applicants - 1975-76; 20 applicants - 1976, 1980)

5. Toxicology Program Committee

6. Participant Member, Cancer Center - Arizona Health Sciences Center

7. Safety Liaison Officer, Department of Anesthesiology 1976-82

8. Temporary Building Management Committee - College of Medicine, Chairman 1978-82

9. President's Advisory Committee on Aflatoxins

10. Faculty Search Committee, Department of Pharmacology, College of Medicine

11. Graduate Committee - Program in Pharmacology and Toxicology (Chairman, 1982-)

12. Self Study Committee - College of Pharmacy 1982-83

13. Executive Committee - College of Pharmacy

14. Ad Hoc Promotion and Tenure Committee - University of Arizona - 1983

NATIONAL COMMITTEES

Liaison Committee Society of Toxicology - ASPET 1980-81

Appointed to Toxicology Study Section 1980-84

Chairman, Toxicology Study Section - 1983-1984

External Peer Reviewer for NIEHS Intramural Collaborative Programs

External Peer Reviewer for EPA Intramural Research Program

ASPET - Committee on Environmental Toxicology 1981-83

ASPET - Organizing Committee for Section on Toxicology

ASPET - Committee for B.B. Brodie Award in Drug Metabolism

External Reviewer - National Health Research and Development Program, Health and Welfare Department, Canada

THESIS AND DISSERTATION COMMITTEES

M.S. in Toxicology:

Thomas Podolsky—director, graduated
Marguerite Slocumb—director, graduated
Steve Haag-director, graduated
Thomas L. Evans—director, graduated
Mark LaFranconi—co-director, graduated
Bruce Ryerson—co-director, graduated
Richard Jee-director, graduated
Barbara Larcom—co-director, graduated
John MacDonald—co-director, graduated
Janine Eisenphar—co-director, graduated
Gary Bignami—director, graduated
Kathleen Cater—director, graduated
Mary Jo Miller—co-director, graduated
Ronald MacFarland—director, graduated
Richard Lind—director, graduated
Frank Plescia—co-director, graduated
Sally Masters—co-director, current student
Robert Nenad—director, current student
Alaa Elsisi—co-director, graduated
Debra Randall—director, current student
Tamra Goodrow—director, current student
Deborah Jaffe—secondary reader
Ronald Bergeson—secondary reader
Lester Melnick—secondary reader
Charles Lapin—secondary reader
George Behnke—secondary reader
James Warren—secondary reader
Larry Isacson—secondary reader
Bernie Feldman—secondary reader
Jane Keller—secondary reader
Donald Sheer—secondary reader
Matthew Miller—secondary reader
Stan Morris—secondary reader
Mary Helen Flowers—secondary reader
Gary Rosenblum—secondary reader
Steve Waters—secondary reader
Cynthia Blackwell—secondary reader
Jane McCreary—secondary reader
Winnie Sim—secondary reader
Eric Stine—seconary reader

M.S. in Pharmacology:

Catherine Orendac—secondary reader

M.S. in Mathematics:

Golde I. Holtzmann—secondary reader

Ph.D. in Pharmacology: - Toxicology: - or Pharm. Sci.:

Steven Halladay—co-director with Dean E. Carter (present position: Pharmacologist, Syntex, Palo Alto, California)

Michael L. Cunningham—director (present position: postdoctoral fellow, Argonne National Laboratory

THESIS AND DISSERTATION COMMITTEES (con't)

Russell White--director (present position: postdoctoral fellow CIIT)
Carl Potter--co-director (present position: postdoctoral fellow, Univ. of Wisconsin)

Matthew Miller--co-director (present position: postdoctoral fellow, Albert Einstein Univ.)

John MacDonald--director, current student
Ricky G. Schnellmann--director, current student
Thomas Petry--director, current student
Alaa El Sisi, current student
Eric Stine, current student
Robert Hruska--secondary reader
Max Costa--secondary reader
Thomas Hielle--secondary reader
Dave Sundheimer--secondary reader
Jeff Reinking--secondary reader
Greg Wastek--secondary reader
Charles Lapin--secondary reader
Kevin Beaumont--secondary reader
Douglas Eisenstein--secondary reader
Manzoor M. Khan--secondary reader
John M. Trang (Ph.D. in Pharmaceutical Sciences)--secondary reader
Mari Haddox--secondary reader
Dennis Roscoe (Ph.D. in Physiology)--secondary reader
Donald Jung (Ph.D. in Pharmaceutical Sciences)--secondary reader
Henry Pieniaszek--secondary reader
James Woodworth--secondary reader
Donald Sheer--secondary reader
Allison Vickers--secondary reader
Chris Hassal--secondary reader
Douglas Bonhaus--secondary reader
Mark LaFranconi--secondary reader
James Gallo--Pharm. Sci.--secondary reader
Larry Schaaf--Pharm. Sci.--secondary reader
Joseph Rubino--Pharm. Sci.--secondary reader
Lane Hirning--secondary reader
Steve Peters--secondary reader
Robert Dorr--secondary reader

Research Associates and Post-Doctoral Fellows:

Ramadasan Kuttan, Ph.D.--Research Associate, 10/1/77 - 6/30/79
Richard Maiorino, Ph.D.--Postdoctoral fellow, 10/1/77 - to present
Louis J. Zimmer, M.D., Ph.D.--Postdoctoral fellow, 10/1/78 - 9/1/79
David Sundheimer, Ph.D.--Postdoctoral fellow, 7/1/80 - 5/15/81
Robert Volp, Ph.D.--Postdoctoral fellow, 3/1/81 to present
David Wiersma, Ph.D.--Postdoctoral fellow, 1/1/82 to present
Siraj Mufti, Ph.D.--current Senior Research Fellow
David Eigenberg, Ph.D.--Postdoctoral fellow, 10/15/82 to present

PUBLICATIONS (See attached)
ABSTRACTS (See attached)
REVIEWS OR BOOKS IN PREPARATION (See attached)

PROFESSIONAL ACTIVITIES AND RECOGNITION OTHER THAN ACADEMIC

Seminars and Lectures:

Laboratory of Chemical Pharmacology, National Heart, Lung and Blood Institute, National Institutes of Health. Studies on the Peripheral Mechanism of Action of Fenfluramine, March 3, 1969.

University of Pittsburgh, Department of Pharmacology. Mechanism of Drug Induced Liver Injury, April 1973.

University of California, Medical Center, San Francisco, Department of Pharmacology. Biotransformation of Xenobiotics: Correlation with Tissue Damage, January 1975.

University of California, Medical Center at Los Angeles, Department of Pharmacology. Metabolism and Binding of Xenobiotics and Their Relationship to Tissue Injury, June 1976.

12th Annual Southwest Safety Congress, Tucson, Arizona. Toxicity of Inhalation Anesthetics and Related Compounds, March 14-16, 1977.

University of Bonn, Medizinische Klinik and Department of Anaesthesiologie, Bonn, West Germany. Bioactivation and Covalent Binding of Halothane as Vectors in Halothane Hepatotoxicity, September 8, 1977.

Stanford University and Veterans Hospital, Department of Anesthesiology. Bioactivation of Halothane: Correlation with Hepatotoxicity, November 1977.

Karolinski Institute, Department of Clinical Pharmacology, Huddinge, Stockholm, Sweden. Bioactivation of Halothane: Correlation with Hepatotoxicity, September 28, 1977.

Annual Meeting, Association of University Anesthetists, Tucson, Arizona. Biotransformation and Covalent Binding of Anesthetics and Hepatotoxicity, April 13-15, 1978.

St. Mary's Hospital and the University of London, London, England. Animal Models of Halothane Hepatotoxicity, July 6, 1978.

Clinical Research Center: Division of Anaesthesia of the Medical Research Council, Northwick Park Hospital, Harrow, England. Bioactivation of Halothane: Its Role in Halothane Hepatotoxicity, July 7, 1978.

Drug Metabolism Section: Imperial Chemical Industries. Animal Models of Halothane Hepatotoxicity, July 11, 1978.

Chairman, Session on Biochemical Pharmacology and Toxicology II, Joint Meeting of ASPET and SOT, University of Houston, Houston, Texas, August 13-17, 1978, Session - August 17.

Southwest Desert Symposium in Anesthesiology, Tucson, Arizona. Lecture I - Structure and Function of the Cell; Lecture II - Search for Animal Models to Explain Inhalation Anesthetic Toxicity, February 2-4, 1979.

PROFESSIONAL ACTIVITIES AND RECOGNITION OTHER THAN ACADEMIC (con't)

Seminars and Lectures (con't):

University of Arizona, College of Pharmacy Seminar, Tucson, Arizona. Studies of Halothane Hepatotoxicity, November 15, 1978.

Chairman, Session on Environmental Toxicology, 1979 Annual Meeting, ASPET, Portland, Oregon, August 19-23, 1979.

Chairman, Session on Pharmacokinetics, 1980 Annual Meeting Society of Toxicology, Washington, D.C., March 9-13.

Arizona Center for Occupational Safety and Health, Tucson, Arizona. Nursing Update: Occupational Carcinogenesis, Mutagenesis. Feb. 11-14, 1980.

Duke University. Bioactivation of Halothane: Correlation with Hepatotoxicity, April 30, 1980.

Chemical Industries Institute for Toxicology. Bioactivation of Halothane: Correlation with Hepatotoxicity, May 1, 1980.

National Institute of Environmental Health Sciences Research, Triangle Park, NC. Studies on the In Vitro Biotransformation of PCBs, May 2, 1980.

Laboratory Chemical Pharmacology, NHLBI/NIH Bethesda, Maryland. Halothane: Biotransformation and Hepatotoxicity, April 25, 1980.

Chairman, Session on Halogenated Hydrocarbons, 1981 Annual Meeting, Society of Toxicology, San Diego, March 1-5, 1981.

University of California at Santa Barbara. Species Variation in the Distribution and Metabolism of PCBs, January 9, 1981.

Invited Participant - Conference on Drugs and Environmental Toxicants, Pinehurst, NC, March 18-21, 1981.

University of Minnesota. Halothane Associated Liver Injury: Role of Biotransformation, May 19, 1981.

Medical College of Wisconsin. Halothane Associated Liver Injury: Role of Biotransformation, May 20, 1981.

Invited Lecturer - Lecture on Factors Affecting the Disposition of PCBs and on Hepatotoxicity of Halogenated Agents: Halothane, Chloroform, Carbon Tetrachloride. University of Pittsburgh, Department of Pharmacology and Toxicology, Pittsburgh, PA, June 25 and 29, 1981.

Visiting Professor, Department of Anesthesiology, University of Hiroshima, Japan, July 12-20, 1981. Lectures on Halothane Hepatotoxicity and on Factors Affecting the Metabolism of Anesthetics.

Division of Laboratories, New York Department of Health, Albany. Disposition of PCBs; Studies in Dogs, Monkeys and Man, August 27, 1981.

PROFESSIONAL ACTIVITIES AND RECOGNITION OTHER THAN ACADEMIC (con't)

Seminars and Lectures (con't):

Invited Lecturer - Basic Pharmacology I, Pharmacodynamics, University of California, Santa Barbara, October 2,5,7 and 9, 1981.

Department of Biological Sciences, University of California, Santa Barbara. Seminar: Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane, October 5, 1981.

Food and Drug Administration, Washington, D.C. Seminar: Halothane Associated Liver Injury: Role of Biotransformation, October 21, 1981.

Department of Pharmacology and Toxicology, University of Mississippi. Seminar: Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane, December 17, 1981.

Cancer Biology Retreat - Development of Animal Models for Hepatocarcinogenesis, Tucson, Arizona, May 1981.

Trichloroethylene Toxicity Workshop on Water. League of Women Voters, Tucson, Arizona, January 16, 1982.

Invited Lecturer - Lecture on Chemical Toxicity on Biological Tissues. The Southern Arizona Section of the American Chemical Society, The University of Arizona, Pima Community College, February 6, 1982.

Department of Pharmacology, Southern Illinois College of Medicine. Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane, March 1, 1982.

Department of Pharmacology, University of Illinois College of Medicine. Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane, March 2, 1982.

College Graduate Studies, Jefferson Medical College. Development of Animal Models for Anesthetic Induced Liver Injury, March 29, 1982.

Smith, Kline and French, Pathology/Toxicology Division. Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane, April 29, 1982.

Environmental Toxicology Center, University of Wisconsin. Lecture 1: Hepatotoxicity of Drugs and Environmental Chemicals and Lecture 2: Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane and Pyrrolizidine Alkaloids, November 2,3, 1982.

University of Arizona, College of Medicine, The Dean's Clinical Rounds. Cimetidine - The King of Drugs (Should it be?), November 16, 1982.

Smith, Kline and French Distinguished Lecture in Toxicology, University of Kansas Medical School. Genotoxicity of Environmental Compounds: Studies with 1,2-Dibromoethane and Pyrrolizidine Alkaloids, January 10-12, 1983.

PROFESSIONAL ACTIVITIES AND RECOGNITION OTHER THAN ACADEMIC (con't)

Seminars and Lectures (con't):

Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico. Genotoxicity of Environmental Compounds (studies on DNA damage produced by 1,2-dibromoethane and pyrrolizidine alkaloids), May 17-18, 1984.

INTERNATIONAL MEETINGS ATTENDED

Fifth International Congress of Pharmacology, San Francisco, July 1972.

Sixth International Congress of Pharmacology, Helsinki, Finland, July 1975.

First International Congress of Toxicology, Toronto, Canada, March 1977.

Seventh International Congress of Pharmacology, Paris, July 1978.

Second International Congress of Toxicology, Brussels, Belgium, July 6-11, 1980.

Eighth International Congress of Pharmacology, Tokyo, Japan, July 1981.

Fifth International Symposium on Microsomes and Drug Oxidations, Tokyo, Japan, July 1981.

IUPHAR Ninth International Congress of Pharmacology, London, England, July 29-August 3, 1984.

Sixth International Symposium on Microsomes and Drug Oxidations, Brighton, Sussex, England, August 5-10, 1984.

Invited Symposia (National and International)

Science and Man in the Americas. American Association of the Advancement of Science Symposium, Mexico City. Biochemical Mechanism of Tissue Damage by Drugs and Other Organic Compounds, June 1973.

International Conference on In Vivo Aspects of Biotransformation and Toxicity of Industrial and Environmental Xenobiotics, Prague, Czech., September 15-17, 1977. Bioactivation of Halothane: Correlation with Hepatotoxicity.

NIEHS Conference on Comparative Metabolism and Toxicity of Vinyl Chloride Related Compounds. NIH, Bethesda, Maryland, May 2-4, 1977. Bioactivation and Covalent Binding of Halothane to Liver Macromolecules.

Workshop on Polyhalogenated Biphenyls. Michigan State University, Environmental Toxicology Program and Department of Agriculture. June 30 - July 1, 1980. Metabolism of Polyhalogenated Biphenyls.

International Symposium on: Drug Reactions and the Liver-Mechanisms and Measures for Control. The Royal Society and King's College, London, England, July 3-4, 1980. Halothane: A Direct Hepatotoxin.

Invited Symposia (National and International, con't):

Second International Symposium on Biological Reactive Intermediates, July 14-17, 1980, University of Surrey, Guildford, United Kingdom. Metabolism of Halogenated Anesthetics.

Gordon Research Conference on Drug Metabolism, July 21-25, 1980. Role of Bioactivation in Anesthetic Induced Hepatotoxicity.

Speaker, Symposium on "Metabolism and Toxicity of Halogenated Hydrocarbons", ASPET, 1980 Annual Meeting, August 17-21, Rochester, MN.

Invited Participant - Conference on Drugs and Environmental Toxicants, Pinehurst, NC, March 18-21, 1981.

FASEB Symposium - "Non-respiratory Functions of the Lung", Isolation and Metabolic Characteristics of Lung Cell Types, April 14, 1981.

Chairman, Session on Halogenated Hydrocarbons, ASPET/PSC Calgary, August 20, 1981 - Overview - Activation and Toxicities of 1,2-Dibromoethane.

Canadian Anesthesiology Society, Regional Workshop on Toxicity of Inhalation Anesthetics, November 21, 1981, Calgary, Alberta Canada. Metabolism and Bioactivation of Anesthetics.

Chairman: Biotransformation/Disposition I; Society of Toxicology Annual Meeting, February 23, 1982.

Workshop on Toxicity of Inhalation Anesthetics. Winnipeg, Canada, June 1982.

ISSX - First International Symposium on Foreign Compound Metabolism. West Palm Beach, Florida, October 30 - November 4, 1983.

Stowe School Symposium on Drug Metabolism, Stowe School, Buckingham, England, April 8-11, 1984.

EPA Peer Review Panel on Specific Toxicology of Chemicals Identified in Drinking Water. On-site review, Cincinnati, Ohio, April 5-8, 1983.

Academy of Pharmaceutical Sciences, Medicinal Chemistry and Pharmacognosy Section. Miami, Florida, November 14-16, 1983. The Role of Metabolism in the Toxicity of Alkyl Halides.

Monsanto Environmental Health Laboratory Symposium, St. Louis, Missouri, September 14-15, 1983. New Approaches in Toxicity Testing and Their Application to Human Risk Assessment.

International Workshop on Manpower Development and Training in Toxicology and Chemical Safety. Luxembourg, Germany, Nov. 28 - Dec. 2, 1983.

Symposium on the Toxicity of Fluorinated Volatile Anesthetics, 1984 Society of Toxicology Meeting, Atlanta, Georgia, March 11-16, 1984.

Invited Symposia (National and International, con't):

England - Second Stowe School Symposium. London, England, April 4-14, 1984.

Third International Conference on Molecular and Cellular Mechanisms of Anaesthesia. Calgary, Alberta Canana, June 13-15, 1984.

PUBLICATIONS

Dixit, B.N. and Sipes, I.G.: Potentiation of hypnotic action of barbiturates by chloramphenicol and its analogs. Ind. J. Physiol. and Pharmacol. 13:32, 1969.

Sipes, I.G., Ziance, R.J. and Buckley, J.P.: Some cardiovascular and autonomic effects of fenfluramine hydrochloride. J. Pharmacol. Exp. Ther. 176:220-228, 1971.

Brodie, B.B., Reid, W.D., Cho, A.K., Sipes, I.G., Krishna, G. and Gillette, J.R.: Possible mechanism of liver necrosis caused by aromatic organic compounds. Proc. Nat. Acad. Sci. 68:160-164, 1971.

Ziance, R.J., Sipes, I.G., Kinnard, W.J., Jr., Buckley, J.P.: Central nervous system effects of fenfluramine HCl. J. Pharmacol. Exp. Ther. 180:110-117, 1972.

Sipes, I.G., Stripp, B., Krishna, G., Maling, H.M. and Gillette, J.R.: Enhanced hepatic microsomal activity by pretreatment of rats with acetone or isopropanol. Proc. Soc. Biol. Med. 142:237-245, 1973.

Ilett, K.F., Reid, W.E., Sipes, I.G. and Krishna, G.: Chloroform toxicity in mice: Correlation of renal and hepatic necrosis with covalent binding of metabolites. Exp. and Mol. Path. 19:215-229, 1973.

Maling, H.M., Eichelbaum, F.M., Saul, W., Sipes, I.G., Brown, E.A. and Gillette, J.R.: The nature of the protection against CCl_4-induced hepatotoxicity produced by pretreatment with dibenamine, N-(2-chlorethyl) dibenzylamine. Biochem. Pharmacol. 23:1470-1491, 1973.

Sipes, I.G., Gigon, P. and Krishna, G.: Biliary excretion of metabolites of bromobenzene. Biochem. Pharmacol. 23:451-455, 1974.

Stripp, B., Sipes, I.G., Maling, H.M. and Gillette, J.R.: Dibenamine impairment of rat hepatic microsomal enzymes and its relation to hepatotoxicity induced by CCl_4 and dimethylnitrosamine. Drug Metabolism and Disposition 2(5):464-468, 1974.

Brown, B.R., Sipes, I.G. and Sagalyn, A.: Studies on mechanism of acute liver toxicity: Chloroform, halothane and glutathione. Anesthesiology 41:554-561, 1974.

Maling, H.M., Stripp, B., Sipes, I.G., Highman, B., Saul, W. and Williams, M.A.: Enhanced hepatotoxicity of carbon tetrachloride, thioacetamide and dimethylnitrosamine by pretreatment of rats with ethyl alcohol and some comparisons with potentiation by isopropyl alcohol. Toxicol. Applied Pharmacol. 33(2):291-308, 1975.

Chvapil, M., Sipes, I.G., Ludwig, J.C. and Halladay, S.C.: Inhibition of NADPH oxidation and oxidative metabolism of drugs in liver microsomes by zinc. Biochem. Pharmacol. 24:917-919, 1975.

PUBLICATIONS (con't)

Halladay, S.C., Carter, D., Sipes, I.G., Brodie, B.B. and Bressler, R.: Evidence for the metabolism of bumetanide in man. Life Sciences 17:1003-1010, 1975.

Chvapil, M., Ludwig, J.C., Sipes, I.G. and Misiorowski, R.: Inhibition of NADPH oxidation and related drug oxidation in liver microsomes by zinc. Biochem. Pharmacol. 25:1787-1791, 1976.

Byus, C.V., Costa, M., Sipes, I.G., Brodie, B.B. and Russell, D.H.: Activation of 3'-5'-cyclic AMP-dependent protein kinase and induction of ornithine decarboxylase as early events in induction of mixed-function oxygenases. Proc. Nat. Acad. Sciences 173:1241-1245, 1976.

Costa, M., Costa, E., Manen, C., Sipes, I.G. and Russell, D.H.: Adenosine cyclic 3'-5'-monophosphate-dependent protein kinase and ornithine decarboxylase involvement in the induction of cytochrome P-450 and hepatic hypertrophy. Mol. Pharmacol. 12(5):871-878, 1976.

Sipes, I.G. and Brown, B.R.: An animal model of halothane induced hepatotoxicity. Anesthesiology 45(6):622-628, 1976.

Halladay, S.C., Sipes, I.G. and Carter, D.E.: Biotransformation and diuretic effect of bumetanide in man. Clin. Pharmacol. and Ther. 22(2):179-187, 1977.

Brown, B.R. and Sipes, I.G.: The biotransformation and hepatotoxicity of halothane. Biochem. Pharm. 26:2091-2094, 1977.

Sipes, I.G., Krishna, G., Gillette, J.R.: Bioactivation of carbon tetrachloride, chloroform and bromotrichloromethane: role of cytochrome P-450. Life Sciences 20(9):1541-1548, 1977.

Manen, C.A., Costa, M., Sipes, I.G. and Russell, D.H.: Further evidence of cyclic AMP-mediated hypertrophy as a prerequisite of drug-specific enzyme induction. Biochem. Pharmacol. 27:219-224, 1977.

Sipes, I.G., Podolsky, T.L. and Brown, B.R.: Bioactivation and covalent binding of halothane to liver macromolecules. Environ. Health Perspectives 21:171-178, 1977.

Brown, B.R., Baker, R.K. and Sipes, I.G.: Metabolism of halothane and toxicity of 1,1,1-trifluoro-2-chloroethane. Environ. Health Perspectives 21:185-188, 1977.

Halladay, S.H., Carter, D.E. and Sipes, I.G.: A relationship between the metabolism of bumetanide and its diuretic activity in the rat. Drug Metabolism and Disposition 6(1):45-49, 1978.

Sipes, I.G., Slocumb, M. and Holtzman, G.: Stimulation and repression of dimethylnitrosamine N-demethylase in mice. Chemico-Biological Interactions 21:155-166, 1978.

Sipes, I.G., McLain, G.E. and Brown, B.R.: Bioactivation of halothane: correlation with hepatotoxicity. Excerpta Medica Int'l. Congress Series 440:238-240, 1977.

Eichelbaum, M. and Sipes, I.G.: The physiological disposition of fenfluramine and norfenfluramine in the rat. In revision for Drug Metabol. and Disposition.

PUBLICATIONS (con't)

Chang, S.Y., Evans, T.L., Alberts, D.S. and Sipes, I.G.: The stability of L-phenylalamine mustard in bile. Life Sciences 23:1697-1702, 1978.

Vaughan, R.W., Sipes, I.G. and Brown, B.R.: Role of biotransformation in the toxicity of inhalation anesthetics. Life Sciences 23:2447-2462, 1978.

Kuttan, R., LaFranconi, M., Sipes, I.G., Meezan, E. and Brendel, K.: Effect of paraquat treatment on prolyl hydroxylase activity and collagen synthesis of rat lung and kidney. Res. Comm. in Chem. Pathol. and Pharmacol. 25:257-268, 1979.

McLain, G.E., Sipes, I.G. and Brown, B.R.: An animal model for halothane induced hepatotoxicity: Role of microsomal enzyme induction and hypoxia. Anesthesiology 51:321-326, 1979.

Blitt, C.D., Brown, B.R., Wright, B.J., Gandolfi, A.J. and Sipes, I.G.: Pulmonary biotransformation of methoxyflurane: An in vitro study in the rabbit. Anesthesiology 51:528-531, 1979.

Maiorino, R.M., Sipes, I.G., Gandolfi, A.J. and Brown, B.R.: Quantitative determination of volatile halothane metabolites in biological tissues. J. of Chromatography 164:63-72, 1979.

Jee, R., Gandolfi, A.J., Sipes, I.G. and Brown, B.R.: Factors influencing halothane hepatotoxicity in the rat hypoxic model. Toxicology and Applied Pharmacol. 52:267-277, 1980.

Haag, S.M. and Sipes, I.G.: Differential effects of acetone or Aroclor-1254 pretreatment on the microsomal activation of dimethylnitrosamine to a mutagen. Mutation Research 74:431-438, 1980.

Chang, S.Y., Larcom, B.J., Alberts, D.S., Larsen, B., Walson, P.D. and Sipes, I.G.: Mass spectrometric analysis of chlorambucil, its degradation products and its metabolite in biological samples. J. Pharm. Sci. 69:80-84, 1980.

Sipes, I.G., Gandolfi, A.J., Pohl, L., Krishna, G. and Brown, B.R.: Comparison of the biotransformation and hepatotoxicity of halothane and deuterated halothane. J. Pharmacol. and Expt. Ther. 214:716-720, 1980.

Gandolfi, A.J., White, R., Sipes, I.G. and Pohl, L.: Bioactivation and covalent binding of halothane in vitro. Studies with ^{3}H- and ^{14}C-halothane. J. Pharmacol. and Expt. Ther. 214(3):721-725, 1980.

Sipes, I.G., Slocumb, M.L., Perry, D.F. and Carter, D.E.: 4,4'-dichlorobiphenyl: Distribution, metabolism and excretion in the dog and monkey. Toxicol. Appl. Pharmacol. 55:554-563, 1980.

Maiorino, R.M., Gandolfi, A.J. and Sipes, I.G.: Gas chromatographic method for the halothane metabolites, trifluoroacetic acid and bromide, in biological fluids. J. Analytical Toxicol. 4:250-254, 1980.

Sipes, I.G. and Gandolfi, A.J.: In vitro comparative bioactivation of aliphatic halogenated hydrocarbons. In: Mechanisms of Toxicity and Hazard Evaluation (Holmsted, et al., eds.). pp. 501-506, 1980.

PUBLICATIONS (con't)

Kuttan, R., Spall, R.D., Duhamel, R.C., Sipes, I.G., Meezan, E. and Brendel, K. Preparation and composition of alveolar extracellular matrix and incorporated basement membrane. Lung (in press).

DiRenzo, A.B., Gandolfi, A.J. and Sipes, I.G. Microsomal bioactivation and covalent binding of aliphatic halides to DNA. Toxicology Letters 11:243-252, 1982.

Maiorino, R.M., Gandolfi, A.J., Brendel, K., MacDonald, J.R. and Sipes, I.G.: Chromatographic resolution of amino acid adducts of aliphatic organohalogens. Chemico-Biological Interactions 38:175-188, 1982.

MacDonald, J.R., Gandolfi, A.J. and Sipes, I.G.: Acetone potentiation of 1,1,2-trichloroethane hepatotoxicity. Toxicology Letters 13:57-69, 1982.

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Cater, K.C., Gandolfi, A.J. and Sipes, I.G.: An evaluation of dimethylnitrosamine (DMN)-induced hepatocellular alterations in the newborn mouse model using histochemical and histoenzymatic markers. Toxicologist 2(1):99, 1982.

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Gandolfi, A.J., DiRenzo, A.B., McDougal, J.N. and Sipes, I.G.: Effect of senescence on the bioactivation of aliphatic halides. Toxicologist 2(1):21, 1982.

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Miller, M.S., Buck, S.H., Sipes, I.G. and Burks, T.F.: Altered axoplasmic transport of nerve growth factor by capsaicin. Proc. Western Pharmacol. Soc. 25:87-88, 1982.

MacDonald, J.R., Gandolfi, A.J. and Sipes, I.G.: Cystamine treatment of carbon tetrachloride induced heptic damage. Fed. Proc. 41:1582, 1982.

Potter, C.L., Sipes, I.G. and Russell, D.H.: Hypoglycemia and decreased serum thyroid hormone concentrations in response to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) administration. Toxicologist 2(2):190, 1982.

Schnellmann, R.G. and Sipes, I.G.: Metabolism of polychlorinated biphenyl (PCBs) by monkey liver microsomes. Toxicologist 2(2):143, 1982.

Volp, R.F., Schnellmann, R.G., and Sipes, I.G.: Glucuronidation of 4,4'-dichlorobiphenyl (4-DCB) metabolites by human and monkey liver microsomes. Toxicologist 2(2):142, 1982.

Carter, D.E., Miller, M.J., Perry, D.F. and Sipes, I.G.: Pharmacokinetics and metabolism of o-nitroanisole in Fisher 344 rats. Toxicologist 2(2):171, 1982.

MacFarland, R.T., Gandolfi, A.J. and Sipes, I.G.: Extrahepatic GSH-dependent metabolism of 1,2-dibromoethane (DBE) and 1,2-dibromo-3-chloropropane (DBCP) in the rat and mouse. Toxicologist 2(2):136, 1982.

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Masters, S.R., Cater, K.C. and Sipes, I.G.: Reversal of dimethylnitrosamine (DMN) induced preneoplastic hepatic lesions in mice by glutathione. Toxicologist 2(2):154, 1982.

Lee, H.R., Gandolfi, A.J., Sipes, I.G. and Bentley, J.: Effect of histamine H_2-antagonists on fentanyl metabolism. Toxicologist 2(2):145, 1982.

Lind, R.C., Gandolfi, A.J., Sipes, I.G. and Brown, B.R.: Role of endotoxin in the halothane hepatitis model in rats. Anesthesiology 57(3):A220, 1982.

Burks, T.F., Miller, M.S., Buck, S.H., Hameroff, S.R. and Sipes, I.G.: Capsaicin: A long acting pain fiber specific local anesthetic. Anesthesiology 57(3):A213, 1982.

Wiersma, D.A. and Sipes, I.G.: Effect of dibromoethane and dichloroethane on the nonprotein sulfhydryl content of rat organs. Toxicologist 3(1):97, 1983.

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Schnellmann, R.G., Randall, D.J., Smith, T.L. and Sipes, I.G.: Effect of chronic ethanol diet on hepatic mixed function oxygenase activity in mice. Toxicologist 3(1):158, 1983.

Miller, M.S., Buck, S.H., Burks, T.F. and Sipes, I.G.: Altered neurotrophic factor availability: A novel neurotoxic mechanism. Toxicologist 3(1):56, 1983.

Miller, M.J., Miller, M.S., Burks, T.F. and Sipes, I.G.: A sensitive measure of peripheral nerve function in the rat following acrylamide. Toxicologist 3(1):53, 1983.

Lind, R.C., Gandolfi, A.J., Sipes, I.G. and Brown, B.R.: Endotoxin mediated mechanisms of halothane hepatitis. Toxicologist 3(1):116, 1983.

Webb, D.R., Sipes, I.G. and Carter, D.E.: Clearance and toxicity of gallium arsenide particulates in Fisher 344 rats. Toxicologist 3(1):169, 1983.

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MacDonald, J.R., Gandolfi, A.J. and Sipes, I.G.: Hepatic Ca^{++} levels following cystamine treatment of chemically-induced hepatotoxicity. Fed. Proceed. 42(4):356, 1983.

Petry, T.W., Bowden, G.T., Buhler, D.R. and Sipes, I.G.: Hepatic DNA damage induced by the pyrrolizidine alkaloid jacobine. Fed. Proceed. 42(4):623, 1983.

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Eigenberg, D.A., Carter, D.E. and Sipes, I.G.: Comparative excretion profiles of diallylphthalate in Fischer 344 rats and B6C3F1 mice. Pharmacologist, 1983.

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Wiersma, D.A., Schnellmann, R.G. and Sipes, I.G.: Human liver microsomal and cytosolic metabolic activation of 1,2-dibromoethane. Pharmacologist, 1983.

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Sipes, I.G., DiRenzo, A.B., Gandolfi, A.J., Brendel, K. and Byard, J.L.: Effect of O_2 tension on the bioactivation and metabolism of aliphatic halides by primary rat hepatocyte cultures. ISSX Meetings, 1983.

Sim, W.W., Earnest, D.L., Sipes, I.G. and Chvapil, M.: Hypervitaminosis A potentiates liver toxicity of known hepatotoxins. American Association for the Study of Liver Diseases, 1983.

MacDonald, J.R., Gandolfi, A.J., and Sipes, I.G.: Structural requirements for cytoprotective agents in galactosamine-induced hepatic necrosis. Toxicologist, 1984.

Petry, T.W. and Sipes, I.G.: Monocrotaline-induced hepatic genotoxicity in rats: Effect of cytochrome P-450 modulation and the dietary antioxidant butylated hydroxyanisole. Toxicologist, 1984.

Eigenberg, D.A., Bozigian, H.P., Carter, D.E. and Sipes, I.G.: The metabolism and disposition of benzylbutyl phthalate in Fishcher-344 rats. Toxicologist, 1984.

Lind, R.C., Gandolfi, A.J., and Sipes, I.G.: Role of induction and normothermia in two models of volatile anesthetic hepatotoxicity. Toxicologist, 1984.

Vickers, A.E.M., Sipes, I.G., and Brendel, K.: Binding of PCB congeners and metabolites to rat liver cytosol proteins. Toxicologist, 1984.

Randall, D.J. and Sipes, I.G.: Trichloroethylene: Tumor promoting effects. Toxicologist, 1984.

Waters, S.J., Gandolfi, A.J., and Sipes, I.G.: Reductive metabolism and hepatotoxicity of halothane in Aroclor 1254 pretreated rats. Toxicologist, 1984.

Schnellmann, R.G. and Sipes, I.G.: Evidence for an additional pathway of polychlorinated biphenyl (PCB) metabolism in dog liver microsomes. Toxicologist, 1984.

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Petry, T.W. and Sipes, I.G.: Evaluation of DNA crosslinking as a possible mechanism of action of the antineoplastic agent indicine N-oxide. Fed. Proc., 1984.

Petry, T.W. and Sipes, I.G.: Structure-activity relationships in pyrrolizidine alkaloid-induced genotoxicity. IUPHAR 9th International Congress of Pharmacology, 1984.

VITA

1. Name: Michael R. Stoline Born (1940; Jefferson, Iowa)

2. Address: Office: Department of Mathematics Wife (Marie)
5510 Everett (616-383-6165)

Home: 2421 Glenwood Drive
Kalamazoo, MI 49008
(616-381-8016)

3. Rank: Professor of Mathematics, Western Michigan University, Kalamazoo, Michigan 49008. (Duties include Director of the Biostatistics Program at Western Michigan University.)

4. Fields of specialization:

Applied Statistics and Statistical Consulting including:

(i) Analysis of Variance
(ii) Regression Analysis
(iii) Selected areas of Sample Survey
(iv) Selected areas of Design of Experiments
(v) Selected areas of Time Series Analysis
(vi) Selected areas of Multivariate Statistics
(vii) Selected areas of Biostatistics

5. Educational background, degrees and fields:

(i)	B.A.	(1962)	University of Iowa - Mathematics
(ii)	M.S.	(1964)	University of Iowa - Mathematics
(iii)	Ph.D.	(1967)	University of Iowa - Statistics

6. Publications:

A: Western Michigan University Mathematics Reports

1. Simultaneous Estimation in an unbalanced ANOVA using the Studentized Range, Western Michigan University Mathematics Report #17 (April, 1970).

2. Examples of Hypothesis Tests Concerning Correlated Correlation Coefficients, Western Michigan University Mathematics Report #21 (January, 1972).

3. Analysis of One-way Repeated Measurement Designs, Western Michigan University Mathematics Report #41 (June, 1976).

4. Tables of the Bonferroni-F Distribution and an Application to the Two-Way Analysis of Variance, Western Michigan University Mathematics Report #45 (February, 1977).

5. Fortran Program: Generation of the Upper α-points for the Studentized Maximum Modulus Distribution, Western Michigan University Mathematical Report #47 (June, 1977) (with Tom Vidmar, Peter Sheh, and Hans Ury).

6. ITS1-An Intervention ARIMA (1,0,0,1,0,0;L,δ) Time-Series Computer Program, Western Michigan University Mathematical Report #53 (September, 1978), (with Brian Mitchell).

7. ITS2-An Intervention ARIMA (1,0,0,;L,δ_1,δ_2,δ_3) Time-Series Computer

   Program, Western Michigan University Mathematics Report #54 (September, 1979). (with B. T. Mitchell).

8. Fortran Program: Double Precision Generation of the Upper Alpha-Points for the Studentized Maximum Modulus Distribution, Western Michigan University Mathematics Report #57 (September, 1979). (with B. T. Mitchell and Dr. H. K. Ury).

B. Center for Statistical Services Reports

I. CSS Statistical Reports

1. Generation of the Hunter second-order Bonferroni approximation to the multivariate t and its applications, CSS Report #1 (March, 1981)(with Brian T. Mitchell).

2. Fortran Program: A two-stage parametric test of a specified ordered alternative of three or four means in a one-way AOV, CSS Report #2 (March, 1981).

3. A detailed statistical critique of the EPA Love Canal environmental monitoring study, CSS Report #3 (May, 1984) (with Richard Cook).

II. CSS Program Documentation Series

1. STRS - Stratified random sample package, CSS-DOC-1 (version 1), (January, 1981)(with Brian T. Mitchell).

C. Regular Publications

1. An Extension of the T-Method of Multiple Comparison to Include Cases with Unequal Sample Sizes. J. Amer. Statist. Assoc. (December, 1973), Vol. 68, 975-8 (with Emil Spjotvoll)

2. Tables of the Studentized Augmented Range and Applications to Problems of Multiple Comparisons, J. Amer. Statist. Assoc. (September, 1978), pg. 656-660.

3. Tables of the Studentized Maximum Modulus Distribution and an Application to Multiple Comparisons Among Means, Technometrics (February, 1979) (with Hans Ury), 87-93.

4. Further Tables of the Studentized Maximum Modulus Distribution, Communications in Statistics Series B, 89(2), 167-178 (1980), (with Dr. Hans Ury and Brian Mitchell).

5. Intervention Time-Series Model with Different Pre- and Post-Intervention First-order Autoregressive Parameters, Psychological Bulletin, 1980, 46-53 (with Bradley Huitema).

6. The Status of Multiple Comparisons & Simultaneous Estimation of All Pairwise Comparisons in One-Way ANOVA Designs, The American Statistician, August, 1981, 134-141.

7. The Hunter Method of Simultaneous Inference and its Recommended Use for Applications Having Large Known Correlation Structures, to appear in the Journal of the American Statistical Association (June, 1983). 78, 367-370.

D. Proceedings

1. Aspects of the intervention time series analyses of the Pilot Programs of Michigan Public Act 339: An Act decriminalizing drunkenness. American Statistical Association Proceedings of the Social Science Section, 1978, 397-402 (with Bradley Huitema).

E. Major Consulting Evaluation Publications

1. Statistical Analysis of the Drunkenness Arrest Data from Five Pilot P.A. 339 Programs in Michigan 1967-77: Consultant Report, Center for Sociological Research, Western ~~Michigan University (1977)~~, (with Bradley Huitema) - 80 pages.

2. Rainbow Health Advocacy Program - Risk Reduction Project - An In-depth Analysis of Pre- and - Post Assessment Scores., August, 1981. (with William Rieck)

3. Rainbow Health Advocacy Program-Risk Reduction Project - An In-depth Analysis of Pre- and - Post Assessment Scores, August, 1982. (with William Rieck)

7. Consulting Experience (Large-Scale)

1. Statistical Consultant to the University (1/2 time position with the Academic Computer Center, Western Michigan University from 1967-1979).

2. Upjohn Company - Half-time during Spring, 1968.
(Kalamazoo, MI) - Half-time during Spring, 1974.
- Sabbatical Leave (July-December, 1975).

8. Recent Consulting Experience

1. Statistical consulting with the Toxic Shock Syndrome Study directed by Don Batts, M.D. of Borgess Hospital in Kalamazoo - 1981.

2. Statistical consulting with the survey of human needs in Portage, Michigan - 1981.

3. Statistical evaluation of the immediate effect of a two-week program on alcohol and tobacco in selected seventh and eighth grade classrooms in the Toledo, Ohio public school systems - 1981 and 1982.

4. Statistical critique of the EPA Love Canal statistical work and conclusions (with Dr. Richard Cook of the Chemistry Dept. at Kalamazoo College). Dr. Cook presented this critique on February 17, 1983 as testimony to the New York Assembly Committee on Environmental Conservation and Subcommittee on Toxic and Hazardous Substances.

5. Statistical analysis of the effects of aluminum Ibuprofen tablets, Motrin tablets, and aspirin tablets on the gastric and duodenal mucosa of normal volunteers. This was completed for the Upjohn Company in April, 1984.

6. Prepared testimony for Court concerning a statistical analysis of age and salary dta pertaining to an age discrimination question raised as a result of the 1982 Battle Creek City government administration personnel reorganization. (April, 1984).

9. Administrative Experience

1. Director of the Biostatistics Masters Program at Western Michigan University. (1976-)

Our Masters program has a mandatory 450 hour internship program with the pharmaceutical industry. As Director it is my responsibility:

a) to locate the sponsors and the sources of funding ($3000-$4200 per student) and

b) to write the statistical contract between the industrial sponsor, the intern, and Western Michigan University.

In the eight year history of our program I have placed nearly 20 students in such internship experiences with The Upjohn Company (Kalamazoo, MI), Miles Laboratories (Elkhart, IN.), the G.D. Searle Company (Chicago), and the W. G. Kellogg Company (Battle Creek, MI).

10. Professional Talks

NO.	Title	Occasion	Location	Date
1.	Misuse of the t test	Quality Control Conf.	Kalamazoo	1968-
2.	Misuse of the t test	Michigan Math Assoc.	Ann Arbor	March-1969
3.	An Extension of the T-Method of Multiple Comparison to Include the Cases with Unequal Sample Sizes.	Eastern Regional IMS Meetings	Ithaca, N.Y.	May-June 1973

4.	An Extension of the T-Method of Multiple Comparison to Include the Cases with Unequal Sample Sizes.	WMU Math Colloq.	WMU	Fall 1973
5.	Topics in Multiple Comparisons	Upjohn Company	Kalamazoo	Summer-1973
6.	Analysis of One-Way Repeated Measurement Designs	Upjohn Company	Kalamazoo	Fall-1975
7.	Multiple Comparisons-1976	Upjohn Company	Kalamazoo	Fall-1975
8.	Multiple Comparisons-1976 (Handout)	Kaiser Permanente	Oakland, CA.	May-1976
9.	Multiple Comparisons-1977	WMU Math. Collq.	Kalamazoo	Nov-1976
10.	How to analyze two-way AOV data in the presence of the significant interaction	Southwest Michigan Chapter-ASA	Richland, MI	Dec-1976
11.	Recent Developments in Multiple Comparisons (Handout)	1977 Summer Research Conference in Statisics (Invited Speaker)	Arkadelphia, Arkansas	June-1977.
12.	Tables of Some Studentized Distributions: Applications to Multiple Comparisons and Analysis of Variance (Handout)	Invited Paper Session Multiple Comparisons at the 1977 American Statistical Association's Annual Meeting.	Chicago, Illinois	August-1977
13.	Aspects of the Intervention Time Series Analyses of the Pilot Programs of Michigan Public Act 339, an Act Decriminalizing Drunkenness (with B. Huitema) (Handout)	Contributed Paper Session at the 1978 American Statistical Association Meetings.	San Diego, California	August-1978
14.	Multiple Comparisons-1978 (Handout)	The 34th Annual Princeton Conference on Applied Statistics (Invited Speaker)	Princeton, N.J.	Dec-1978

15.	Recent Developments in Multiple Comparisons (Handout)	The 2nd Annual Midwest Biopharmaceutical Statistics Workshop (Invited Speaker).	Muncie, Indiana	May-1979
16.	Recent Developments in Multiple Comparisons of Means	Statistics Seminar given at McMaster University	Hamilton, Ontario	Nov-1979
17.	The Status of Multiple Comparisons of Means (Handout)	Invited Lecture-Univ. of Mass.	Amherst, Mass.	Sept-1980
18.	Aspects of Simultaneous Estimation for Certain Repeated Measurement Designs (Handout)	Invited talk for the First Statistical Conference of the G.D. Searle Company	Skokie, Illinois	Sept.-1981
19.	The Status of Multiple Comparisons of Means (Handout)	Colloquium at the Univ. of Illinois	Urbana Illinois	Nov. 10, 1981
20.	The Superiority of the Hunter Method of Simultaneous Inference for Cases with Large Correlation Structure (Handout)	Contributed paper - Eastern Regional Meeting of the Biometric Society-IMS-ASA	San Antonio, Texas	March 1982
21.	Imbalanced Repeated Measurement Designs, Univariate Cases- (Handout)	Invited Statistical Methods Talk for the Fifth Annual Midwest Biopharmaceutical Statistics Workshop	Muncie, Indiana	May 1982
22.	Aspects of Simultaneous Inference in One-Way Repeated Measurement Designs (Handout)	Invited talk at the Eastern Regional Meeting of the Biometric Society, IMS, and ASA	Nashville, Tenn.	March, 1983
23.	A Critique of the EPA Environmental Study of Love Canal	Invited talk for Southwest Michigan Chapter of Data Processing Managers with Dr. Richard Cook (Kalamazoo College)	Battle Creek, MI	April 13, 1983
24.	A Critique of the EPA Environmental Study of Love Canal	Colloquium at Western Michigan Univ. with Dr. Richard Cook (Kalamazoo College)	Kalamazoo, MI	May 11, 1983

25.	A Statistical Critique of the 1982 EPA Love Canal Environmental Monitoring Study	Presentation made as a Panel member to an Ethics and Science forum as part of the third annual All Center Conference of the WMU Science for Citizens Center	Kalamazoo, MI	November 14, 1983
26.	A Statistical Critique of the 1982 EPA Love Canal Monitoring Study (Handout)	Contributed Paper - Eastern Regional Meeting of the ASA and Biometric Society	Orlando, Florida	March 13, 1984

11. Related Professional Activity

1. Sabbatical leave (Winter, Spring - 1976) University of California at Berkeley (visited the Biostatistics Program).

2. Statistical Consultant to the University (1/2 time Position with the WMU Computer Center) - (1967-1978).

3. Co-hosted the Michigan visit of the Latin American statisticians in 1977.

12. Professional Affiliations

1. Institute of Mathematical Statistics

2. American Statistical Association

3. Biometric Society

CURRICULUM VITAE

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EDUCATION:

B.S.	Wageningen University, Holland	1948
	Candidate Post Graduate Status	1949
M.S.	Wageningen University, Holland	1951
Ph.D.	Wageningen University, Holland	1955
	Research Fellow, Harvard Univ.	1955-56

CAREER:

1950-52	Research Fellow, Netherlands Organization For Basic Research
1952-55	Staff Physicist, Laboratory For Plant Physiological Research, Wageningen, Netherlands
1955	Senior Scientific Officer at Large With Dutch ~~Government~~
1955-57	Maria Moors Cabot Research Fellow, Harvard University Biological Laboratories
1957-61	Biophysicist, John B. Pierce Foundation, New Haven, Conn.
1961-64	Associate Fellow, John B. Pierce Foundation, New Haven, Conn.
1962-63	Instructor, Department of Physiology, Yale University School of Medicine
1964-6[illegible]	Assistant Professor, Department of Physiology, Yale University School of Medicine
1964	Fellow, John B. Pierce Foundation
1965-69	Assistant Professor of Epidemiology (Environmental Physiology), Yale University School of Medicine
1969	Associate Professor of Epidemiology (Environmental Physiology), Yale University School of Medicine.
	Joint appointment at Institution For Social and Policy Studies
1974-	Associate Director, John B. Pierce Foundation
1975-82	Professor of Epidemiology (Environmental Health), Yale University School of Medicine
1976-82	Director of Graduate Studies, Department of Epidemiology and Public Health
1982-	Susan D. Bliss Professor of Epidemiology and Public Health, and Chairman, Department of Epidemiology and Public Health

Jan A.J. Stolwijk, Ph.D.

PROFESSIONAL HONORS OR RECOGNITION:

Maria Moors Cabot Research Fellow, Harvard University Biological Laboratories - 1955-1957
Elected Member - Connecticut Academy of Science and Engineering - 1980-
The First Craig D. Hollowell Memorial Lecturer, University of California, Berkeley - 1983

MEMBERSHIPS:

American Physiological Society
Biophysical Society
Aerospace Medical Society
American Public Health Association
American Association For The Advancement of Science
International Biometeorological Society
Society For Occupational and Environmental Health
American Conference On Government Industrial Hygienists
NAS/NRC Committee on Human Factors and Psychophysiology (1972-1976)
NAS/NRC Committee on Costs and Benefits of Automobile Emission Control - 1974
U.S. Department of Commerce, Technical Advisory Board - 1976-1977, 1979
NAS/NRC Committee on Indoor Pollutants - 1980-81
Ventilation Standards Committee, ASHRAE

UNIVERSITY COMMITTEES:

University Committee on World Hunger (Chairman), 1975-77
Radiation Safety Committee, 1975-
Committee on Chemical Carcinogens, Chairman, 1980-
Yale Industrial Associates Faculty, Advisory Committee, 1980-
Doctoral Committee, EPH, Chairman, 1976-82
Search Committee for a Dean, School of Forestry and Environmental Studies, 1981
Development Advisory Committee, 1982-
Search Committee for a Dean, School of Nursing, 1982-83

CONSULTANT:

Connecticut State Health Department, Disease Prevention Division
Department of Motor Vehicles, Vehicle Inspection Program

BIBLIOGRAPHY

Jan A. J. Stolwijk, Ph.D.

Wassink, E.C., Sluysmans, C.M.J. and Stolwijk, J.A.J.: On some photoperiodic and formative effects of colored light in Brassica Rapa F. Oleifera, Subf. Annua. Proc. Kon. Ned. Akad. v. Wetensch 53:1466-1475, 1950.

Wassink, E.C., Stolwijk, J.A.J. and Beemster, A.B.R.: Dependence of formative and photoperiodic reactions in Brassica Rapa Var., Cosmos and Lactuca on wavelength and time of irradiation. Proc. Kon. Ned. Akad. v. Wetensch. 54:421-432, 1951.

Stolwijk, J.A.J.: Photoperiodische en formatieve effecten van supplementaire belichting met verschillende spectrale gebieden. Hand. 32 Ned. Geneesk. Congr., p. 87, 1951.

Stolwijk, J.A.J.: Photoperiodic and formative effects of various wavelength regions in Cosmos bipinnatus, Spinacia oleracea, Sinapis alba and Pisum sativum. Proc. Kon. Ned. Akad. v. Wetensch. 55:489-502, 1952.

Wassink, E.C. and Stolwijk, J.A.J.: Effects of light of narrow spectral regions on growth and development of plants. Proc. Kon. Ned. Akad. v. Wetensch. 55:471-488, 1952.

Wassink, E.C. and Stolwijk, J.A.J.: Effect of photoperiod on vegetative development and tuber formation in two potatoe varieties. Meded. Landb. Wageningen 53:99-112, 1953.

Wassink, E.C. and Stolwijk, J.A.J.: Specification of radiant flux and radiant flux density in irradiation of plants with artificial light. J. Hortic. Sci. 28:117-124, 1953.

Stolwijk, J.A.J.: Some characteristics of internode elongation. Proc. 1st. Intern. Photobiol. Congr., 79-82, 1954.

Stolwijk, J.A.J.: Wave length dependence of photomorphogenesis in plants. Meded. Landb. Wageningen 54:181-244, 1954.

Stolwijk, J.A.J. and Zeevaart, J.A.D.: Wavelength dependence of different light reactions governing flowering in Hyoscyamus niger. Proc. Kon. Ned. Akad. v. Wetensch. 58:386-396, 1955.

Wassink, E.C. and Stolwijk, J.A.J.: Effects of light quality on plant growth. Ann. Rev. Plant Physiol. I:373-400, 1956.

Stolwijk, J.A.J. and Thimann, K.V.: On the uptake of carbon dioxide and bicarbonate by roots, and its influence on growth. Plant Physiol. 32: 513-520, 1957.

Burg, S.P. and Stolwijk, J.A.J.: A highly sensitive katharometer and its application to the measurement of ethylene and other gases of biological importance. J. Biochem. and Microbiol. Techn. & Eng. 1:245-259, 1959.

Glenn, W.W., Stolwijk, J.A.J., Annamunthodo, H., Rapp, G.M. and Himmel, M.: An integral fin-type blood heat exchanger. Surgical Forum 10:574-577, 1960.

Hammel, H.T., Jackson, D.C., Stolwijk, J.A.J., Hardy, J.D. and Stromme, S.B.: Temperature regulation by hypothalamic proportional control with an adjustable set point. J. Appl. Physiol. 18:1146-1154, 1963.

Rawson, R.O., Stolwijk, J.A.J., Graichen, H. and Abrams, R.: Continuous radio telemetry of hypothalamic temperatures from unrestrained animals. J. Appl. Physiol. 20:321-325, 1965.

Stolwijk, J.A.J. and Hardy, J.D.: Skin and subcutaneous temperature changes during exposure to intense thermal radiation. J. Appl. Physiol. 20: 1006-1013, 1965.

Gagge, A.P., Stolwijk, J.A.J. and Hardy, J.D.: A novel approach to measurement of man's heat exchange with a complex radiant environment. J. Aerospace Med. 36:431-435, 1965.

Hardy, J.D., Stolwijk, J.A.J., Hammel, H.T. and Murgatroyd, D.: Skin temperature and cutaneous pain during warm water immersion. J. Appl. Physiol. 20: 1014-1021, 1965.

Abrams, R.M., Stolwijk, J.A.J., Hammel, H.T. and Graichen, H.: Brain temperature and brain blood flow in unanesthetized rats. Life Sci. 4:2399-2410, 1965.

Stolwijk, J.A.J. and Hardy, J.D.: Partitional calorimetric studies of responses of man to thermal transients. J. Appl. Physiol. 21:967-977, 1966.

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Abrams, R.M. and Stolwijk, J.A.J.: Automatic weighing machine for small animals. J. Appl. Physiol. 21:1935-1937, 1966.

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PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR: ________

BIOGRAPHICAL SKETCH

Give the following information for key professional personnel listed on page 2, beginning with the Principal Investigator/Program Director. Photocopy this page for each person.

NAME	TITLE	BIRTHDATE (Mo., Day, Yr.)
Arthur Canfield Upton	Director and Professor	February 27, 1923

EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training)

INSTITUTION AND LOCATION	DEGREE (circle highest degree)	YEAR CONFERRED	FIELD OF STUDY
University of Michigan, Ann Arbor	B.A.	1944	Pre. Med.
University of Michigan, Ann Arbor	M.D.	1946	Medicine

RESEARCH AND/OR PROFESSIONAL EXPERIENCE: Concluding with present position, list in chronological order previous employment, experience, and honors. Include present membership on any Federal Government Public Advisory Committee. List, in chronological order, the titles and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

1947- - Intern, University Hospital, Ann Arbor, Michigan
1948-1950 - Resident in Pathology, University of Michigan
1950-1951 - Instructor in Pathology, University of Michigan
1951-1954 - Pathologist, Biology Division, Oak Ridge National Laboratory
1954-1969 - Chief, Pathology-Physiology Section, Biology Division, Oak Ridge National Laboratory
1969-1977 - Professor of Pathology, State University of New York at Stony Brook
1969-1970 - Chairman, Department of Pathology, State University of New York at Stony Brook
1970-1975 - Dean, School of Basic Health Sciences, State University of New York at Stony Brook
1969-1977 - Associate Pathologist, Medical Department, Brookhaven National Laboratory
1977-1979 - Director, National Cancer Institute
1980- - Director, Institute of Environmental Medicine, New York University
1980- - Professor and Chairman, Department of Environmental Medicine, New York University, School of Medicine

Honors:
Alpha Omega Alpha, 1946
Phi Beta Kappa, 1944
Ciba Foundation Lecturer, 1959
E. O. Lawrence Award, 1965
Peruvian Oncology Society, 1967
Failla Lecturer, Radiation Research Society, 1977
Comfort Crookshank Award for Cancer Research, 1978
Japanese Cancer Association, 1979
Claude M. Fuess Award, 1980
IBM-Princess Takamatsu Research Fund Lecturer, 1981
Sarah L. Poiley Award, 1984

Membership:
Institute of Medicine, National Academy of Sciences
Commission on Life Sciences, National Academy of Sciences
Scientific Council, U.S.-Japan Radiation Effects Research Foundation
National Research Council, Advisory Committee on Radiation Effects Research Foundation
International Commission on Radiological Protection, Committee 1
National Academy of Sciences, National Research Council, Steering Committee on Identification of Toxic and Potentially Toxic Chemicals for Consideration by the National Toxicology Program, 1981-1984
New York State Health Research Council, Member, 1980; Chairman, 1981-
Task Force for Research Planning in Environmental Health Science, Co-Chairman, 1983-

PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR OR AWARD CANDIDATE (Last, first, middle) | SOCIAL SECURITY NUMBER

Publications:

Upton, A. C.: Thoughts on the prevention of Cancer. In: Genetic and Environmental Factors in Experimental and Human Cancer, H. V. Gelboin, et al. (eds.), Japan Aci. Soc. Press, Tokyo, 1980, pp. 29-41

Upton, A. C.: Evolving Perspectives on the Epidemiology and Biology of Cancer: Needs and Opportunities. In: Cancer Research in the People's Republic of China and the United States of America, P. A. Marks (ed.), Grune & Stratton, New York, 1980, pp. 23-41.

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Upton, A. C.: Injury by Ionizing Radiation. In: Environmental Pathology, N. K. Motter (ed.), Oxford University Press, London, 1984 (in press).

CURRICULUM VITAE

Name: Arthur Canfield Upton

Date & Place of Birth: February 27, 1923, Ann Arbor, Michigan

Marital Status: Married, March 1, 1946, to Elizabeth Perry

Children: Rebecca, Melissa, Bradley

Military Record: Army U.S., 1943-1946
Capt. USAF Reserve, 1955-1970

Education: B.A., University of Michigan, 1944
M.D., University of Michigan, 1946

Positions Held:

1947- -- Intern, University Hospital, Ann Arbor, Michigan
1948-1950 -- Resident in Pathology, University of Michigan
1950-1951 -- Instructor in Pathology, University of Michigan
1951-1954 -- Pathologist, Biology Division, Oak Ridge National Laboratory
1954-1969 -- Chief, Pathology-Physiology Section, Biology Division, Oak Ridge National Laboratory
1969-1977 -- Professor of Pathology, State University of New York at Stony Brook
1969-1970 -- Chairman, Department of Pathology, State University of New York at Stony Brook
1970-1975 -- Dean, School of Basic Health Sciences, State University of New York at Stony Brook
1969-1977 -- Associate Pathologist, Medical Department, Brookhaven National Laboratory
1977-1979 -- Director, National Cancer Institute
1980- -- Director, Institute of Environmental Medicine, New York University
1980- -- Professor and Chairman, Department of Environmental Medicine, New York University, School of Medicine

Honors and Awards:

Alpha Omega Alpha
Phi Beta Kappa
Ciba Foundation Lecturer, 1959
E. O. Lawrence Award, 1965
Peruvian Oncology Society, 1967
Failla Lecturer, Radiation Research Society, 1977
Comfort Crookshank Award for Cancer Research, 1978
Japanese Cancer Association, 1979
Institute of Medicine, National Academy of Sciences, 1979
Claude M. Fuess Award, 1980
IBM-Princess Takamatsu Cancer Research Foundation, Lecturer, 1981
Sarah L. Poilley Award, 1983
Failla Memorial Lecturer, Health Physics Society, Greater NY Chapter, 1983

Membership in National Scientific Societies:

American Association for Advancement of Science
American Association for Cancer Research
American Association of Pathologists and Bacteriologists
American College of Toxicology
American Society for Experimental Pathology
Collegium Ramazzini
Gerontological Society
Harvey Society
International Academy of Pathology
New York Pathological Society
Permanent Commission and International Accociation on Occupational Health
Peruvian Society of Oncology, Honorary Member
Radiation Research Society
Scientific Research Society of America (RESA)
Society for Experimental Biology and Medicine
Society for Risk Analysis

Offices Held in National Scientific Societies:

American Association for Cancer Research:
- Board of Directors, 1961-1964
- Vice-President, 1962-1963
- President, 1963-1964

Representative to USA National Academy of Sciences-National Research Council: 1967-1969

Representative to USA National Committee on the International Union Against Cancer: 1972-1975

American Society for Experimental Pathology:
- Councilor, 1965
- Vice-President, 1966-1967
- President, 1967-1968

Radiation Research Society:
- Councilor, Medicine, 1963-1964
- Vice-President, 1964-1965
- President, 1965-1966

International Association for Radiation Research:
- Vice-President, 1979-1983
- President, 1983-

Society for Risk Analysis:
- Council, 1983-

Editorial Boards:

Cancer Research, 1960-1964
Radiation Research, 1961-1964
Laboratory Investigation, 1961-1975
Nuclear Medicine, Excerpta Medica, 1964-1977
International Journal of Cancer, International Union Against Cancer, 1965-1974
Proceedings of the Society for Experimental Biology and Medicine, 1965-1968
Cancer, 1977-
Forum on Medicine, 1978-1982
American Journal of Industrial Medicine, Associate Editor, 1980-
Gerontology and Geriatrics Education, 1980-1984
American Society of Preventive Oncology, Publications Committee, 1980-
Risk Analysis, 1980-
SciQuest, 1981-1982
Environmental Research, 1981-

Committees:

National Academy of Sciences-National Research Council, Subcommittee on Long-Term Effects of Ionizing Radiation from External Sources, 1957-1960
American Cancer Society, Advisory Committee on Research on Etiology of Cancer, 1958-1961
U.S. Air Force, Life Sciences Working Group, 1958-1960
National Committee on Radiological Protection, Subcommittee on Relative Biological Effectiveness (M-4), 1958-1962
International Commission on Radiological Protection, Committee on Radiation Biology, 1960-1962
International Commission on Radiological Protection, Subcommittee on Relative Biological Effectiveness, 1960-1962
U.S. Public Health Service, National Advisory Committee on Radiation, 1961-1965
National Academy of Sciences-National Research Council, Ad Hoc Advisory Committee on Radiation Pathology, Chairman, 1962-1964
National Academy of Sciences-National Research Council, Committee on Pathology, 1962-1972
International Cancer Research Commission on the International Union Against Cancer, Expert Panel on Carcinogenicity, 1963
International Commission on Radiological Protection, Committee I, The Committee on Radiation Effects, 1963-, Vice-Chairman, 1965-1973; Chairman, 1973-1978
International Commission on Radiological Protection, Committee I Task Group on the Biological Effects of High Energy Radiations, Chairman, 1963-1965
Executive Office of the President, Office of Science and Technology, NIH Study Committee Panel on Pathology, 1964
National Academy of Sciences-National Research Council, Advisory Committee to Federal Radiation Council, Chairman, 1964-1966; 1968-1971

General Motors Cancer Research Foundation, Awards Assembly, 1978-1981
Institute of Medicine, National Academy of Sciences, 1979-
March of Dimes, Advisory Committee on Reproductive Hazards in the Workplace, 1980-1982
National Academy of Sciences-National Research Council, Advisory Committee on the Radiation Effects Research Foundation, Chairman, 1980-
Oak Ridge National Laboratory, Biology Division Advisory Committee, 1980- ; Chairman, 1984-
Northwestern University Cancer Center, External Advisory Committee on Commonwealth Edison Study, 1980-
Brookhaven National Laboratory, Medical Department Visiting Committee, 1980- ; Chairman, 1984-
GTE Laboratories, Technical Advisory Council, Steering Committee, 1980-1982
Department of Energy, Ad Hoc Advisory Board on Melanoma, 1980-1981
Governor's Committee on Love Canal, State of New York, 1980
National Academy of Sciences-National Research Council, Assembly of Life Sciences, 1980-1983
National Academy of Sciences-National Research Council, Commission on Life Sciences, 1983-
National Academy of Sciences-National Research Council, Steering Committee on Identification of Toxic and Potentially Toxic Chemicals for Consideration by the National Toxicology Program, 1980-1983; Committee on Priority Mechanisms, Chairman, 1980-1983
Exxon Corporation, Medical Department, Science Advisory Board, Chairman, 1980-
National Academy of Sciences-National Research Council, Assembly of Life Sciences, Panel on Hiroshima/Nagasaki Occupation Forces, 1980-1981
Johns Hopkins University, Nuclear Shipyard Workers Study, Technical Advisory Panel, Chairman, 1980-
New York State Department of Health, Health Research Council, 1981- ; Chairman, 1982-
American Health Foundation, Scientific Advisory Board, 1981- ; Chairman, 1984-
American Association for Cancer Research, Public Issues Committee, Chairman, 1981-
The Permanent Commission and International Association on Occupational Health, Committee on Occupational Carcinogenesis, 1981-
Robert Wood Johnson Foundation, National Hospice Study, National Advisory Committee, 1981-
Three Mile Island Unit-2 Safety Advisory Board, 1981-1982
Harvard University, School of Public Health Overseers' Committee, 1981-
Labor Policy Insitute Advisory Board, 1982-
Associated Universities, Inc., Council for Research Planning in Biological Sciences, Board of Directors, 1982-
World Resources Institute, Board of Directors, 1982-
Third Task Force for Research Planning in Environmental Health Sciences, National Institute of Environmental Health Sciences, Co-Chairman, 1983-
Harvard University, JFK School of Government, Center for Health Policy and Management, Advisory Board, 1984-
Society for Risk Analysis, Councilor, 1982-

National Council on Radiation Protection and Measurements, 1965-1977; 1980- ; Board of Directors, 1984-
International Commission on Radiological Protection, Task Group on the Radiosensitivity of Different Tissues in Relation to Radiation Protection, 1966-1968
Federal Aviation Administration, Standing Committee for Radiation Biology Aspects of the SST, 1967-1970
National Cancer Institute, Ad Hoc Discussion Group on Recruitment and Training in Chemical Carcinogenesis, Chairman, 1967-1968
American Cancer Society, Tennessee Division, Board of Directors, 1967-1969
National Academy of Sciences-National Research Council, Division of Medical Sciences, 1967-1972; Executive Committee, 1968-1972
National Academy of Sciences-National Research Council, NASA Life Sciences Review Program Committee, 1970
National Cancer Institute, Cancer Research Training Committee, 1970-1971
Smithsonian Institution, Interdisciplinary Communications Program, Carcinogenesis Core Group, 1970-1973
Steering Committee of Los Alamos Meson Physics Facilities, Subcommittee on Whole Animal Radiation Biology and Pathology, 1971-1977
National Academy of Sciences-National Research Council, Advisory Committee on the Biological Effects of Ionizing Radiation, 1971-1977; Subcommittee on Somatic Effects, Chairman, 1971-1977
National Academy of Sciences-National Research Council, Committee on Pathology; Subcommittee on Environmental Pathology, Chairman, 1971-1972
Argonne Universities Association Review Committee, Biological and Medical Research Division, Argonne National Laboratory, 1971-1973
Argonne National Laboratory, Advisory Committee for the Center on Human Radiobiology, 1972-1977
Federation of American Societies for Experimental Biology, Life Sciences Research Office, Advisory Committee, 1972-1977; Chairman, 1974-1977
National Cancer Institute, Carcinogenesis Advisory Panel, 1972-1973
National Cancer Institute, Division of Cancer Biology and Diagnosis, Board of Scientific Counsellors, 1973-1977; Chairman, 1976-1977
International Commission on Radiological Protection, Main Commission, 1973-1978
Scientific Advisory Group, U.S.-Japan Cooperative Cancer Research Program, 1974-1977
National Center for Toxicological Research, Scientific Advisory Board 1974-1977
U.S.-Japan Radiation Effects Research Foundation, Scientific Council, 1975-1977; 1980- ; Co-Chairman, 1984-
World Health Organization, International Agency for Research on Cancer, Scientific Council, 1975-1977; Governing Council, 1977-1979
Environmental Protection Agency, Administrator's Pesticide Policy Advisory Committee, 1975-1977
International Commission for Protection Against Environmental Mutagens and Carcinogens, 1978-1979; 1980-1983

Rutgers Medical School, Joint Graduate Program, Toxicology Advisory Committee, 1983-
International Commission for Protection Against Environmental Mutagens and Carcinogens, Corresponding Member, 1984-
Cancer Hopefuls United for Mutual Support, Medical Advisory Board, 1984-

BIBLIOGRAPHY

Arthur C. Upton, M.D.

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228. Upton, A.C.: Health Effects of Ionizing Radiation. Carolina Biology Readers Series. Carolina Biological Supply Company, Burlington, North Carolina, 1983 (submitted for publication).

229. Upton, A.C. and Teebor, G.W. Chairmen's Overview on Carcinogen-Induced Modification in DNA. In: Application of Biological Markers to Carcinogen Testing. H.A. Milman and S. Sell (Eds.), Plenum Press, New York, 1983, pp. 387-388.

230. Upton, A.C.: Need for legality of required annual chest x-ray examination questioned. (Problems and Solutions). Postgraduate Medicine 74:44-45, 1983.

231. Upton, A.C.: Introduction of Seventh Lauriston S. Taylor Lecturer. In: The Lauriston S. Taylor Lecture Series in Radiation Protection and Measurements. Lecture No. 7. National Council on Radiation Protection and Measurements, Bethesda,

Maryland, 1983, pp. 1-4.

232. Upton, A.C.: A Tribute to Rene Dubos. In: Proceedings of the International Convocation on World Environmental Regeneration. Rene Dubos Center for Human Environments, Inc., New York, 1983 (submitted for publication).

233. Upton, A.C.: The Effects of Ionizing Radiation on Human Health. 1983 (submitted for publication).

234. Upton, A.C.: Analysis of Atomic-Bomb Survivor Data: Ongoing Research and Opportunities for the Future. In: Atomic Bomb Survivor Data: Utilization & Analysis. R.L. Prentice and D.J. Thompson (Eds.), SIAM, Philadelphia, 1984, pp. 280-289.

235. Upton, A.C.: The enviromental roots of modern illness. In: Journal '84. World Resources Institute, Washington, D.C., 1984, pp. 58-66.

236. Upton, A.C.: Biological Aspects of Radiation Carcinogenesis. In: Radiation Carcinogenesis: Epidemiology and Biological Significance. J.D. Boice and J.F. Fraumeni (Eds.), Raven Press, New York, 1984, pp. 9-19.

237. Upton, A.C. (Chairman), Clayson, D.G., Jansen, J.D., Rosenkranz, H., Williams, G.: Report of ICPEMC Task Group 5 on the Differentiation Between Genotoxic and Non-Genotoxic Carcinogens. ICPEMC Publ. 9. Mutation Research 133:1-49, 1984.

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242. Upton, A.C.: Radiation Effects on Humans. In: Proceedings from the AAAS Symposium, May, 1983.

CURRICULUM VITAE

Warren Winkelstein, Jr., M.D.

BIRTHPLACE & DATE: Syracuse, New York, 1 July 1922

CITIZENSHIP: United States

FAMILY STATUS: Married, three children (Wife: Veva Kerrigan Winkelstein)

RESIDENCE: 560 Washington Avenue
Point Richmond, CA 94801

EDUCATION:

B.A.:	University of North Carolina	1943
M.D.:	Syracuse University	1947
M.P.H.:	Columbia University	1950

POSTGRADUATE TRAINING:

Internship:	Charity Hospital of Louisiana (New Orleans)	1947-1948
Apprentice Epidemiologist:	N.Y.S. Dept. of Health	1948-1949
Research Fellow, Department of Epidemiology, Roswell Park Memorial Institute, Buffalo, N.Y.		1956-1957

PROFESSIONAL QUALIFICATIONS:

Medical Licensure: New York, Louisiana

Diplomat, American Board of Preventive Medicine

MILITARY SERVICE:

U.S. Army	1944-1946
U.S. Public Health Service	1951-1953
U.S. Public Health Service (Inactive Reserve; Permanent Grade: Medical Director)	1953-1982

POSITIONS:

County District Health Officer, Erie County Health Department, Buffalo, N.Y.	1950-1951
Regional Representative, Public Health Division, Special Technical and Economic Mission to Cambodia, Laos, and Viet Nam (Mutual Security Agency), Hanoi, Viet Nam	1950-1951
Director, Division of Communicable Disease Control, Erie county Health Department, Buffalo, N.Y.	1953-1956
Chief, Dept. of Epidemiology, Chronic Disease Research Institute of the University of Buffalo, N.Y.	1957-1963
First Deputy Commissioner, Erie County Health Dept., Buffalo, N.Y.	1959-1962
Associate Professor (Epidemiology), Dept. of Preventive Medicine, State University of New York at Buffalo, School of Medicine	1962-1964
Professor, (Epidemiology) Dept. of Preventive Medicine, State University of New York at Buffalo, School of Medicine	1964-July 1968
Assistant Managing Editor American Journal of Epidemiology	1965-1975
Professor of Epidemiology, Department of Biomedical and Environmental Health Sciences, School of Public Health, University of California, Berkeley	July 1968-present
Associate Dean for Student and Academic Affairs, School of Public Health, University of California, Berkeley	May 1970-June 1971
Acting Dean, School of Public Health, University of California, Berkeley	July 1971-July 1972
Dean, School of Public Health, University of California, Berkeley	Sept 1972-Dec 1981

TEACHING:

Assistant (Part-time) State University of N.Y. at Buffalo					1953-1954
Instructor (Part-time)	"	"	"	"	1954-1955
Associate (Part-time)	"	"	"	"	1955-1956
Assistant Professor (Part-time)	"		"	"	1956-1962
Associate Professor (Full-time)	"		"	"	1962-1964
Professor (Full-time)	"	"	"	"	1964-July 1968
Visiting Professor, Dept. of Clinical Epidemiology and Social Medicine, St. Thomas' Hospital Medical School, London					April 1967
Professor, (Full-time) School of Public Health, University of California, Berkeley					July 1968-present

HONORS AND AWARDS:

-M.D. (Cum Laude) Syracuse Univesity	1947
-Special Research Fellow, National Heart Institute (PHS)	1956-1957
-Buswell Research Fellow, University of Buffalo	1958-1959
-Research Career (Development) Program Award HE-K3-6566 National Heart Institute (PHS)	1962-1968
-Gold Medal, National University of Ascuncion, Ascuncion, Paraguay	May 1963
-Citation, New York State Air Pollution Control Board	1968
-Delta Omega	1968

MAJOR COMMITTEE APPOINTMENTS:

Air Pollution Training Committee; Division of Air Pollution, Bureau of State Services, Public Health Service	1962-1965
Heart Disease Control Program Advisory Committee; Division of Chronic Diseases; Bureau of State Services, Public Health Service	1963-1966
Committee on Cardiovascular Disease Epidemiology; Epidemiology Section, American Public Health Association	1963-1967
Scientific Advisory Committee for Mass Mannography Study; Health Insurance Plan of New York (HIP)	1962-1968
Committee for the 1970 Census (Chairman) Epidemiology Section, A.P.H.A.	1965
Subcommittee on Epidemiologic Use of Hospital Data, U.S. National Committee on Vital and health Statistics	1965-1968
Research Committee, American Heart Association	1966-1971
Preventive Medicine Research Study Committee (Chairman), American Heart Association	1968-1971
Consulting Committee on Epidemiology of the Inter-Society Commission for Heart Disease Resources	1969-1974
National Air Quality Criteria Advisory Committee	1969-1972
Executive Committee, Association of Teachers of Preventive Medicine	1969-1972
APHA Environmental Health Hazard Project: Panel on Arsenic Studies (Chairman)	1975-1976
California Air Resources Board - Research Screening Committee	1974-1976
National Research Council - Commission on Natural Resources: Panel on Effects of Ambient Environmental Quality	1975-1977
National Cancer Institute Ad Hoc Working Group (Epidemiology) on Mammograph Screening for Breast Cancer	1975-1977
American Board of Preventive Medicine, Inc. (member and Trustee of the Corporation)	1970-1978
Panel of Experts on the Archives of Public Health Service Documents Relating to Effects of Nuclear Weapons Testing on Health (Chairman)	1979

MAJOR CONSULTANT APPOINTMENTS:

International Cooperation Administration: (Surveyed public health problems and health resources in Ivory Coast, Upper Volta, Niger Dahomey, and Togo. Recommended programs for U.S. Aid)	Dec 1960–Mar 1961
University of Buffalo (Reviewed accomplishments of U.B.-U.S. Agency International Development Contract for assistance to Medical School, National University of Ascuncion, Paraguay. Renegotiated Project Agreement & Contract National University, U.S.A.I.D. and University of Buffalo)	Jan-Feb 1962
Epidemiology Branch, Communicable Disease Center (PHS) (Assisted in planning and announcing U.S. assistance for smallpox eradication and measles control in 18 countries of West Africa. Visited Upper Volta, Liberia, Fed. Rep. of Cameroon, and Guinea in this connection.)	Nov-Dec 1965
University of Southern California and National Cancer Institute (Advised on study design for epidemiological study of the etiology of cancer in man and household pets)	1968-1972
World Health Organization (Attended meeting on Research and Reporting Programme of the project, Epidemiology of Drug Dependence, Geneva, Switzerland and to assist with preparatory work in this connection. Served as chairman of the meeting	13-17 Sept 1976
State of New York, Department of Health (Development of criteria for rehabilitation of Love Canal Emergency Declaration Area)	1984

PROFESSIONAL ORGANIZATIONS: (current)

- American Public Health Association (Fellow)
- American Association for Advancement of Science
- Council on Epidemiology, American Heart Association
- American College of Preventive Medicine (Fellow)
- Pan American Medical Association (Hon.Diploma)
- American Epidemiologic Society
- Society For Epidemiological Research
- International Epidemiological Association

MAJOR OFFICES IN PROFESSIONAL ORGANIZATIONS:

-Secretary, Epidemiology Section, APHA	1967-1970
-Member Governing Council, APHA	1967-1970
-Executive Committee, Council on Epidemiology, AHA	1968-1971
-President, N.Y.S. Academy of Preventive Medicine	1966-1967
-Chairman, Executive Committee, Continuing Education Program, Western Branch, APHA	1971-1973
-President, American Epidemiological Society	1976-1977

PUBLICATIONS

Warren Winkelstein, Jr., M.D., M.P.H.

1. Winkelstein W, Jr.: Modified nasal diphtheria in immunized persons. NY State J Med 50:1117-1118, 1950.

2. Braff E, Winkelstein W, Jr.: Field treatment of trachoma in North Viet Nam, Public Health Rep 67:1233-1236, 1952.

3. Winkelstein W, Jr.: Report from Indochina. Pediatrics 2:217-220, 1955.

4. Karzon DT, Barron AL, Winkelstein W, Jr., Cohen S: Isolation of ECHO virus type 6 during an outbreak of seasonal aseptic meningitis. JAMA 162:1298-1303, 1956.

5. Kelly S, Winsser J, Winkelstein W, Jr.: Poliomyelitis and other enteric viruses in sewage. Amer J Public Health 47:72-77, 1957.

6. Winkelstein W, Jr., Karzon DT, Barron AL, Hayner NS: Epidemiologic observations of an outbreak of aseptic meningitis due to ECHO virus type 6. Amer J Public Health 47:741-749, 1957.

7. Winkelstein W, Jr., Stenchever MA, Lilienfeld AM: Occurrence of pregnancy, abortion, and artificial menopause among women with coronary artery disease: a preliminary study. J. Chronic Dis 7:273-286, 1958.

8. Winkelstein W, Jr., Graham S: Factors in participation in the 1954 poliomyelitis vaccine field trials, Erie County, New York. Amer J Public Health 49:1454-1466, 1959.

9. Winkelstein W, Jr., Lilienfeld R, Pickren JW, Lilienfeld AM: The relationship between aortic atherosclerosis and cancer. Brit J Cancer 13:606-613, 1959.

10. Winkelstein W, Jr., Rekate AC: Occurrence of pregnancy, stillbirth, and abortion among women with coronary artery disease. Circulation 20:786-787, 1959 (Abstract).

11. Winkelstein W, Jr.: Selected aspects of the epidemiology of coronary artery disease. Health News 38(3):4-13, 1961.

12. Karzon DT, Eckert GL, Barron AL, Hayner NS, Winkelstein W, Jr.: Aspectic meningitis epidemic due to ECHO 4 virus. Amer J Dis Child 101:610-622, 1961.

13. deGroot I, Winkelstein W, Jr.: Sociological variables in air pollution research. Presented at the 32nd Annual Meeting of the Eastern Sociological Society, Philadelphia, 1962.

14. Winkelstein W, Jr., Jenss R, Gresham GE, Karzon DT, Mosher WE: Inactivated measles virus vaccine. III. A field trial in young school children. JAMA 179:398-403, 1962.

15. Karzon DT, Winkelstein W, Jr., Jenss R, Gresham GE, Mosher WE: Field trial of inactivated measles vaccine. Amer J Dis Child 103:425-426, 1962.

16. Karzon DT, Hayner NS, Winkelstein W, Jr., Barron AL: II. A clinical study of ECHO 6 infection. An epidemic of aseptic meningitis syndrome due to ECHO virus type 6. Pediatrics 29(3):418-431, 1962.

17. Winkelstein W, Jr.: The Erie County air pollution—respiratory function study. J Air Pollution Control Assoc 12(5):221-222, 1962.

18. deGroot I, Winkelstein W, Jr.: Sociological aspects of air pollution. Progress Report 2(3):3, 1962.

19. deGroot I, Winkelstein W, Jr.: Sociological aspects of air pollution. Part II. Progress Report 2(4):3, 1962.

20. Winkelstein W, Jr., DeGroot I: The Erie County air pollution—pulmonary function study. Amer Rev Resp Dis 86(6):902-906, 1962.

21. Guinee VF, et al: A collaborative study of measles vaccines in five United States communities. Preliminary report. Amer J Public Health 53:645-651, 1963.

22. Winkelstein W, Jr.: Study of blood pressure in Buffalo, N.Y. The New York Academy of Sciences 107:570-575, 1963.

23. Chazen JA, Winkelstein W, Jr.: Household aggregation of hypertension. A report of a preliminary study. J Chronic Dis 17:9-18, 1964.

24. Winkelstein W, Jr., Rekate AC: Age trend of mortality from coronary artery disease in women and observations on the reproductive patterns of those affected. Amer Heart J 67:481-488, 1964.

25. Sackett DL, Winkelstein W, Jr.: Epidemiology of cardiovascular disease. Aortic and peripheral atherosclerosis. Nat Conf Cardiovascular Dis 2:220-221, 229-231, 1964 (Republished - see 38).

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29. Winkelstein W, Jr., Karzon DT, Rush D, Mosher WE: A field trial of inactivated measles virus vaccine in young school children; protection during 27 months of follow-up. JAMA 194:494-498, 1965.

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49. Winkelstein W, Jr., Sackett DL: Eugenics and genetic equilibrium. Clin Pediat 7:2-3, 1968.

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53. Winkelstein w, Jr., Kantor S: Prostatic cancer: relationship to suspended particulate air pollution. Amer J Public Health 59:1134-1138, 1969.

54. Winkelstein W, Jr., Kantor S, Ibrahim MA, Sackett DL: Remarks on the analysis of familial aggregation of blood pressure in the Alameda County Blood Pressure Study. Amer J Epidem 89:615-618, 1969.

55. Kohn RM, Ibrahim MA, Winkelstein W, Jr., Pinsky W, Borden H, Binette PJ: Identifying coronary prone families by screening of school populations. Israel J Med Sci 5:683-686, 1969.

56. Winkelstein W, Jr.: Validation: techniques required, accuracy precision, reliability and requisite populations. In Proceedings of the 2nd Annual Conference on Automated Indirect Blood Pressure, edited by Rochmis PG. New Jersey, Hoffmann-La Roche Inc., 1969, p. 26.

57. Winkelstein W, Jr., Kantor S: Respiratory symptoms and air pollution in an urban population of northeastern United States. Arch Environ Health 18:760-767, 1969.

58. Kuller LH, and 15 others, including Winkelstein W, Jr.: Nationwide cerebrovascular disease mortality study. I. Methods and analysis of death certificates. Amer J Epidem 90:536-544, 1969.

59. Kuller LH, and 15 others, including Winkelstein, W, Jr.: Nationwide cerebrovascular disease mortality study. II. Comparison of clinical records and death certificates. Amer J Epidem 90:545-555, 1969.

60. Kuller LH, and 15 others, including Winkelstein W, Jr.: Nationwide cerebrovascular disease mortality study. III. Accuracy of the clinical diagnosis of cerebrovascular disease. Amer J Epidem 90:556-566, 1969.

61. Kuller LH, and 15 others, including Winkelstein W, Jr.: Nationwide cerebrovascular disease mortality study. IV. Comparison of the different clinical types of cerebrovascular disease. Amer J Epidem 90:567-578, 1969.

62. Ibrahim MA, Sackett DL, Winkelstein W, Jr.: Acute myocardial infarction; magnitude of the problem. In Thrombosis, edited by Sherry S, Brinkhous KM, Genton E, STengle JM. Washington D.C., National Academy of Sciences, 1969, pp. 106-116.

63. Kantor s, Winkelstein W, Jr.: Further observations on the nature of the index of classification accuracy--its relatinship to Kendall's tau. Amer J Epidem 91:19-20, 1970.

64. Winkelstein W, Jr., Gay M: Arteriosclerotic heart disease and cerebrovascular disease: further observations on the relationship of suspended particulate air pollution and mortality in the Erie County Air Pollution Study. In Proceedings of the 16th Annual Meeting of the Institute of Environmental Science. Boston, 1970, pp. 441-447.

65. Inter-Society Commission for Heart Disease Resources, including Winkelstein W, Jr.: Primary prevention of the atherosclerotic diseases. Circulation 42:A-53-A-95, 1970.

66. Winkelstein W, Jr., French FE: The role of ecology in the design of a health care system. Calif Med 113:7-12, 1970.

67. Winkelstein W, Jr., Gay M: Suspended particulate air pollution: relationship to mortality from cirrhosis of the liver. Arch Environ Health 22: 174-177, 1971.

68. Ibrahim MA, Borden HH, Pinsky W, Kohn R, Feldman JG, Winkelstein W, Jr.: Screening of the coronary prone by study of offspring. Public Health Rep 86:577-582, 1971.

69. Winkelstein W, Jr., French FE: The role of ecology in the design of a health care system. Ecosphere 2:4-8, 1971.

70. Winkelstein W, Jr.: Utility or futility of ordinary mortality statistics in the study of air pollution effects. In Proceedings Sixth Berkeley Symposium on Mathematical Statistics and Probability. University of California Press, Berkeley, June and July, 1970, pp. 539-554.

71. Winkelstein W, Jr.: Epidemiological considerations underlying the allocation of health and disease care resources. Internat J Epid 1(1):69-74, 1972.

72. Kagan A, Harris BR, Winkelstein W, Jr, Johnson KG, Kato H, Syme SL, Rhoads GG, Gay ML, Nichaman MZ, Hamilton HB, Tillotson J: Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California: Demographic, physical, dietary, and biochemical characteristics. Technical Report 16-72.

73. Winkelstein, W, Jr.: Book review. Epidemiology: Man and Disease, Fox JP, Hall CE, Elveback. The MacMillan Company, 1972, 339 p. In Mayo Clin Proc 48:222 (March) 1973.

74. Winkelstein W, Jr.: A view of community medicine from UC School of Public Health, Berkeley. In Community Medicine in California—A Symposium. Calif Med 118:81-82, 1973.

75. Winkelstein W, Jr.: California's Shame—the flouridation issue (Editorial). Calif Med 118:61-62, 1973.

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77. Winkelstein W, Jr., French FE: The training of epidemiologists in schools of public health in the United States: a historical note. Int'l J Epid 2(4):415-416, 1973.

78. Winkelstein W, Jr., Gay M: Suspended particulate air pollution: relationship to mortality from cirrhosis of the liver. In Goldstein et al. (eds.) Air Pollution and the Politics of Control. New York, MSS Information Corporation, 1973.

79. Kagan A, Harris BR, Winkelstein W, Jr., Johnson K, Kato H, Syme SL, Rhoads GG, Gay ML, Nichaman MZ, Hamilton HB, Tillotson J: Epidemiologic stuies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California: Demographic, physical, dietary and biochemical characteristics. J Chron Dis, Vol. 27, pp. 345-364, Pergamon Press, 1974.

80. Winkelstein W, Jr.: Contemporary perspectives on prevention. Bulletin of the NY Academy of Medicine. Second Series, vol. 51, no. 1, pp. 27-38, Jan. 1975.

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83. Winkelstein W, Jr.: Cooperative studies of blood pressure in Japanese in Japan, Hawaii and the United States. In Epidemiology and Control of Hypertension. Symposia Specialists, Miami, Florida, pp. 101-115, 1975.

84. Marmot MG, Winkelstein W, Jr.: Epidemiologic observations on intervention trials for prevention of coronary heart disease. Amer J Epidem 101:177-181, 1975.

85. Winkelstein W, Jr., French FE: A survey of USA Schools of Public Health--faculty, research, personnel, and students in biostatistics and epidemiology programs, 1974-1975. Amer J Epidem 103:436-438, 1976.

86. Winkelstein W, Jr., Sacks ST, Ernster VL, Selvin S: Correlations of incidence rates for selected cancers in the nine areas of the Third National Survey. Amer J Epidem 105(5):407-419, 1977.

87. Ernster VL, Winkelstein W, Jr., Selvin s, Brown SM, Sacks ST, Austin DF, Mandel SA, Bertolli TA: Race, socioeconomic status, and prostatic cancer. Cancer Treatment Reports 61(2):187-191, Mar/Apr 1977.

88. Breslow L, Henderson B, Massey F, Jr., Pike M, Winkelstein W, Jr.: Report of NCI ad hoc working group (epidemiology) on the gross and net benefits of mammography in mass screening for the detection of breast cancer. J Nat'l Cancer Inst 59:475-478, 1977.

89. Winkelstein W, Jr.: Smoking and Cancer of the Uterine Cervix: Hypothesis. Amer J Epidem 106(4):257-259, Oct. 1977.

90. Winkelstein W, Jr.: Is there an alternative to the comprehensive approach to health care? In Conditions for Change in the Health Care System. DHEW Pub. No. (HRA) 78-642, US Government Printing Office, Washington, D.C, September 1977, pp. 59-64.

91. Winkelstein W, Jr., French FE: Biostatistics and epidemiology programs in schools of public health. In Tracing the Patterns of Disease: The Role of Epidemiology and Biometry, DHEW Pub. No. (NIH) 77-1285, U.S. Government Printing Office, Washington D.C., 1977, pp. 83-91.

92. Kolonel L, Winkelstein W, Jr.: Cadmium and prostatic carcinoma. Lancet, September 10, 1977 (letter).

93. Ernster VL, Selvin S, Sacks ST, Austin DF, Brown SM, Winkelstein W, Jr.: Prostatic cancer: mortality and incidence rates by race and social class. Amer J Epidem 107(4):311-319, Apr. 1978.

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99. Winkelstein W, Jr.: an epidemiological look at the methodology of the health hazard appraisal. Proceedings of the Fifteenth Annual Meeting on Prospective Medicine and Health Hazard Appraisal (1979), Health and Education Resources, Bethesda, MD pp. 11-13.

100. Hexter A, Winkelstein W, Jr.: Registering Baby: Politics or Professional Standards? Hastings Center Report, August 1980. (Letter).

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List of All Documents Reviewed by Expert Scientists in Preparation of Habitability Criteria

APPENDIX 3

Appendix 3

LIST OF ALL DOCUMENTS REVIEWED BY EXPERT SCIENTISTS IN PREPARATION OF THE HABITABILITY CRITERIA

Numerous articles, maps, and data compilations were reviewed by the experts in developing the habitability criteria. The information encompassed health studies, animal experiments, environmental data collection efforts, and the present status of properties within the Emergency Declaration Area. The general distribution of information was the responsibility of the New York State Department of Health (DOH) and EPA. DOH supplied experts with copies of pertinent health and animal studies as well as environmental reports prepared by DOH staff and summaries of data from sump and soil sampling efforts conducted by DOH. Qualitative and quantitative summaries of environmental data sets and listings of the over 800 documents in the project files were provided. In addition, the U.S. Department of Justice and the New York Department of Law made all litigation data documents available. A list of all major documents reviewed by the experts is provided in Table 3-1.

Specific health, environmental, and remedial information was conveyed to the experts through discussions or presentations during meetings and one-on-one discussions outside the meeting framework. The involved professionals and their contributions to the experts' knowledge of the Love Canal habitability issues are listed in Table 3-2.

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Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
1	Use of Small Mammals (Voles) to Assess A Hazardous Waste Site at Love Canal, Niagara Falls, New York	Archives of Environmental Contamination & Toxicology: 12:383-397 M.H. Rowley, et. al.	00/00/83
2	Pilot Cytogenetic Study of The Residents of Love Canal	Biogenics	05/14/80
3	Love Canal Emergency Declaration Area (EDA) Strategy for Determination Habitability	Centers for Disease Control	03/00/84
4	Data Collection and Evaluation Support, Love Canal Remedial Action Plan, Draft - Phase I Work Plan	CH2M HILL	03/17/84
5	Summary of Love Canal Well Data Base Compiled by NYSDEC	NYSDEC/CH2M HILL	
6	1st Complete Love Canal Non-Confidential Document Citations Listing	CH2M HILL	04/24/84
7	2nd Complete Love Canal Non-Confidential Document Citations Listing	CH2M HILL	06/22/84

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
8	List of Chemicals from Love Canal and Other Areas	CH2M HILL	06/27/84
9	Love Canal Marker Chemical Data Summary	CH2M HILL	07/25/84
10	Summary of Love Canal Environmental Data Collection Efforts by Medium	CH2M HILL	07/10/84
11	Love Canal Target Chemicals	CH2M HILL	09/06/84
12	Love Canal QA Review & Assessment Technical Memorandum No. 1 Phase A Results	CH2M HILL	10/29/84
13	Printouts of Data from EPA, NYSDEC, and Malcolm Pirnie Data Bases	CH2M HILL	10/31/84
14	Love Canal Sewer and Creek Remedial Alternatives Evaluation and Risk Assessment	CH2M HILL	03/01/85
15	Love Canal's Unhealthy Voles	*Natural History*: 10:8-16 J.J. Christian	00/00/83

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
16	Aerial Assessment of Leachate Contamination Associated with the Landfill Site	Cornell University	08/04/78
17	**Love Canal Contaminant Movement Study	Earth Dimensions, Inc.	00/00/79
18	**Love Canal Remedial Project-Task V - A Borehole Investigation, Vol. I, Text	E.C. Jordan	10/00/83
19	**Love Canal Remedial Project-Task V - A Borehole Investigation, Vol. II, Appendices	E.C. Jordan	10/00/83
20	Interim Status Report on Growth and Maturation Study	Environmental Defense Fund	08/06/81
21	Personal Exposure to Volatile Organics and Other Compounds Indoors and Outdoors--the Team Study	EPA Lance Wallace	06/19-24/83
22	Monitoring Individual Exposure Measurements of Volatile Organic Compounds in Breathing-Zone Air, Drinking Water and Exhaled Breath	EPA Lance Wallace	00/00/82

**Not a Complete Document--Pertinent Sections Only

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
23	**Environmental Monitoring at Love Canal Vol. I, Vol. II Parts I & II, and Vol. III	EPA	05/00/82
24	Carcinogen Assessment Group's Cancer Risk Estimation Procedure for Selected Carcinogens in Love Canal Area Housing	EPA	11/14/79
25	Surface Soil Sampling Protocol 2,3,7,8-TCDD at Love Canal EDA	EPA	10/26/84
26	**Permitting Requirements for Land Disposal Facilities	Federal Register	07/26/82
27	**Analysis of a Groundwater Contamination Incident in Niagara Falls, N.Y.	Fred C. Hart Associates	07/28/78
28	HHS Evaluation of Results of Environmental Chemical Testing Performed by EPA in the Vicinity of Love Canal--Implications for Human Health	Department of Health and Human Services	10/07/81
29	HHS Response to Office of Technology Assessment Report	Department of Health and Human Services	07/19/83

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
30	Occidental Chemical Company (HOOKER) (OCC) Critique of Malcolm Pirnie Report	Hooker Chemical & Plastics Corp.	
31	A Study of Cytogenetic Findings in Persons Living Near the Love Canal	JAMA:251:11:1437-1440 C.W. Heath, et. al.	03/16/84
32	**The Groundwater Monitoring Program at Love Canal, Vol. I: Final Report	JRB Associates	09/00/81
33	**The Groundwater Monitoring at Love Canal, Vol. II: Well Logs and Diagrams	JRB Associates	09/00/81
34	**DRAFT FINAL REPORT: Hydrogeology of the Love Canal Area	JRB Associates	11/07/80
35	Lewis Steel to Norman Nosenchuck RE: Malcolm Pirnie report, Site Investigations and Remedial Action Alternatives--Love Canal	Love Canal Renter's Assoc.	01/06/84
36	Fact Sheet and Map	Love Canal Area Revitalization Agency R.J. Morris	
37	**Site Investigations and Remedial Action Alternatives-Love Canal	Malcolm Pirnie, Inc.	10/00/83

**Not a Complete Document--Pertinent Sections Only

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
38	The Rebuttal to the OCC (Hooker) Critique of the Malcolm Pirnie report, Site Investigations and Remedial Action Alternative--Love Canal	Malcolm Pirnie, Inc.	03/29/84
39	**Evaluation of Site Investigations and Remedial Action Alternatives for Love Canal-Task Areas II, III, IV, VI, and VII	Malcolm Pirnie, Inc.	08/12/83
40	Analysis of Human Blood Samples for Selected Toxic Substances	Midwest Research Institute	08/15/80
41	Health Studies Face Review Before Release	Newspaper-Niagara Gazette	03/28/82
42	Data In Health Studies at Canal Called Fake	Newspaper-Buffalo News	03/27/82
43	**6NYCRR PART 360-Solid Waste Management Facilities (excerpts pertain to site characteristics and design)	New York State	03/00/82
44	Love Canal Public Health Time Bomb	NYSDOH	09/00/78
45	A Special Report to the Government and Legislature-Love Canal	NYSDOH	04/00/81

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
46	Epidemiologic Studies and Outcome of Pregnancies	NYSDOH	
47	Determination of 2,3,7,8 Tetrachlorodibenzo-p-Dioxin in Sediment Samples from the Love Canal Storm Sewers, Black and Bergholtz Creeks	NYSDOH	
48	OCC Chemicals in the EDA	NYSDOH Dr. Robert H. Huffaker	03/13/84
49	Liver Function Tests--Love Canal Families	NYSDOH	00/00/78
50	Medical Records Review--Love Canal Families	NYSDOH	
51	Health Implications of Materials Found in or Associated with the Love Canal	NYSDOH	11/20/78
52	Preliminary Report--Epidemiology	NYSDOH	07/27/78

**Not a Complete Document--Pertinent Sections Only

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
53	Analysis of Water Samples Collected at Love Canal	NYSDOH	06/03/78
54	Soils Report	NYSDOH	10/02/78
55	Air Samples of Basements at Love Canal	NYSDOH	01/23/84
56	Epidemiological Data (published and unpublished)	NYSDOH	
57	**Adverse Pregnancy Outcomes in the Love Canal Area	NYSDOH	
58	**Report on Chemicals Found in the Blood of Love Canal Residents	NYSDOH	01/18/80
59	**Love Canal Soil Analyses	NYSDOH	00/02/81
60	**Love Canal Litigation Soil Sampling	NYSDOH	02/02/81
61	**Analysis of Love Canal First Ring Air and Sumps	NYSDOH	06/03/82
62	Survey of Chemical Contamination in Love Canal Storm Sewers	O.H. Materials	06/03/80

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
63	Habitability of the Love Canal Area, An Analysis of the Technical Basis for the Decision on the Habitability of the Emergency Declaration Area	Office of Technology Assessment	06/00/83
64	Controversy at Love Canal	Hastings Center Report Dr. Beverly Paigen	06/00/82
65	**Low Birth Weight, Prematurity and Birth Defects in Children Living Near the Hazardous Waste Site, Love Canal and	Dr. Beverly Paigen	
	Prevalence of Health Problems in Children Living Near the Hazardous Waste Site, Love Canal	Dr. Beverly Paigen	
66	**Growth and Health of Children Living Near the Hazardous Waste Site, Love Canal	Dr. Beverly Paigen	04/29/83
67	Cancer Incidence in the Love Canal Area	<u>Science</u>: Vol. 212, pp. 1404-1407 D.T. Janerich, et. al.	06/19/81

**Not a Complete Document--Pertinent Sections Only

Table 3-1
INFORMATION REVIEWED BY LOVE CANAL HEALTH EXPERTS
(Listed Alphabetically by Source)

No.	Title	Source	Date
68	**Volatile Organic Chemicals in the Atmosphere-An Assessment of Available Data	SRI International	04/00/83
69	The Rationale and Methodology of Quantifying Sister Chromatid Exchange in Humans	Mutagenicity: New Horizons, In Genetic Toxicology. New York, Academic Press. A.H. Carrano, and D.H. Moore, II	00/00/82

Table 3-2
PROFESSIONAL RESOURCES OF HEALTH EXPERTS

Professional Name/Organization	Contribution
Richard Morris, Former Executive Director of Love Canal Area Revitalization Agency (LCARA)	Tour of Canal area with health experts and residents on 3/14/84 including discussion of the status of remaining properties and LCARA finances.
John Sevee, E.C. Jordan	Presentation at 5/2/84 experts' meeting concerning hydrogeology of Love Canal and plans for future groundwater monitoring program
Dr. Nicholas Vianna Epidemiologist	Presentation at 5/2/84 experts' meeting on health effects, especially adverse pregnancy outcomes, observed in Love Canal residents.
Dr. Nick Kolak, DEC	Discussion with experts at 6/29/84 meeting related to the onsite leachate treatment plant operations and sludge disposal alternatives. Additional discussion and tour of treatment plant with Dr. Pohland.
Bob Senior, Senior Sanitary Engineer, DEC	Discussion during 6/29/84 meeting regarding status of present remedial efforts and plans for future efforts.
Dr. Larry Kaminsky, Toxicologist, DOH	Presentation at 7/26/84 meeting on the results of exposing chick embryos and rats to dioxin-laden Love Canal leachate.
Dr. Beverly Paigen, formerly of the Roswell Park Memorial Institute in Buffalo, NY	Presentation at 7/26/84 meeting summarizing the results of her study of adverse pregnancies and child maturation problems in Love Canal residents.

Table 3-2
PROFESSIONAL RESOURCES OF HEALTH EXPERTS
(Continued)

Professional Name/Organization	Contribution
Joe Slack, DEC	Discussions during several meetings related to DEC's involvement in sampling and remedial efforts at the Canal. One meeting was held with Dr. Pohland to focus on these subjects.
Dr. Nancy Kim, DOH	Provided background on toxicology of Love Canal chemicals in 10/31/84 and 11/13/84 meetings with Dr. Sipes, Dr. Stoline, CH2M HILL and EPA in effort to develop list of marker chemicals.
Sam Fogel, Chemist Cambridge Analytical Associates	Provided information in 11/13/84 meeting with Dr. Sipes, Dr. Stoline, CH2M HILL and EPA on detectability and analytical methods for proposed marker chemicals.
Diane Lambert, Statistician University of Chicago	Participated in 11/13/84 meeting with Dr. Sipes, Dr. Stoline, CH2M HILL and EPA and provided information on potential statistical methods to be used to determine appropriate sample size for future sampling efforts. Worked closely with Dr. Stoline on this topic after 11/13 meeting.
CH2M HILL Staff and Subcontractors	Throughout criteria development work, support was provided in the areas of data collection, document tracking and distribution, data base development, and quality assurance of existing data. In addition, individuals provided expertise in marker chemical identification, statistics, sampling program development, and risk assessment.

Definition of Habitability

APPENDIX 4

Appendix 4

DEFINITION OF HABITABILITY

"Habitable" means suitable for human habitation. The type of human habitation considered by the expert scientists was that of a continuously occupied residential area. The transcripts of discussions by the expert scientists indicate a common understanding of the term "habitability." Subsequent discussion on the definition of habitability served to clarify the meaning of the term. Possible high-risk groups, different types of land use, and health concerns were the main aspects considered when discussing the concept of habitability.

POSSIBLE HIGH-RISK GROUPS

At the first meeting, several of the expert scientists expressed their concept of habitability in terms of its applicability to the entire population, including any high-risk groups. Dr. Warren Winkelstein stated his feeling that a habitable place should be "for all ages and both sexes and under pregnant and non-pregnant conditions." Dr. Devra Davis added that a place for continuous habitation "should be a healthy environment for people throughout the age spectrum and for all the things people do in their homes."

TYPES OF LAND USE

At the second expert scientists meeting on May 3, 1984 the meaning of habitability in relation to non-residential land uses was discussed. Dr. Devra Davis brought up the fact that standards for 24-hour-a-day exposure to many of the organic pollutants at Love Canal do not exist. Dr. Frederick Pohland noted that, given the scientists' charge to develop habitability criteria, the evaluation of alternative land uses would follow after an initial consideration for residential uses. Later Dr. Pohland noted an additional reason for considering full-time residential use:

> "The most sensitive habitability criteria would, I think, be applied to individual residences and so, in a way we would cover just about any other option should the decision be for something other than residences."

HEALTH CONCERNS

Dr. Martha Fowlkes noted in the first expert scientists meeting of March 14, 1984:

> "We are raising two questions that the person who might live there would ask: What does it mean to me and my health? And how safe is my house?"

Dr. Thomas Chalmers remarked:

> "If I were to be given the opportunity to move in there and buy a house and live there, I would want some reassurance that it wasn't going to damage my health."

At the fourth meeting on July 26, 1984 the scientists discussed a draft statement on the meaning of habitability. Dr. Michael Stoline suggested that the habitability statement for the criteria paper should discuss the fact that habitability would mean living in "a healthful place to raise a family, to conduct your work, to go about your life, and ... that it would be safe for children to play in the yard, safe for people to plant gardens, safe for people to wade in the puddles, safe for kids to go to school." Dr. Jan Stolwijk said he was trying to convey in the statement that, "uninhabitability occurs when somebody in authority makes the pronouncement that something is uninhabitable... there is a continuum of desirability for habitation that goes all the way from clearly unacceptable to very clearly acceptable. Our charge is to give criteria that might lead to a decision of habitability or uninhabitability."

The main concern with regard to habitation of the Love Canal EDA is that the levels of chemicals from Love Canal present in the EDA may represent a threat to human health. After considering a number of methodologies to determine habitability, the comparative approach methodology was selected. This methodology assumes that inhabited urban neighborhoods are "habitable" if they meet the public health and housing codes and are not impacted by a chemical landfill. If levels of Love Canal Indicator Chemicals are not significantly higher in the EDA than in "habitable" areas, by inference the EDA is then "habitable." Thus, for purposes of these criteria, habitability is defined in relative terms rather than in absolute terms. With regard to chemical contamination, the criteria will determine whether the Love Canal EDA is as safe as other inhabited urban areas that are not adversely affected by a chemical landfill.

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Summary of Expert Scientists' Responses to Public Comments

APPENDIX 5

Appendix 5

SUMMARY OF EXPERT SCIENTISTS' RESPONSES TO PUBLIC COMMENTS

Meetings of the expert scientists (to discuss habitability criteria and related issues) were held on March 14, May 2 and 3, June 29, July 16, September 26, November 14, 1984, and March 27, 1985. The first of these seven meetings was held in Buffalo, New York. At the request of the public, other meetings were held in Niagara Falls, New York.

The purpose of the meetings was to provide a public forum for the expert scientists' discussion of the issues related to habitability. Each meeting included a period for public comment and questions. The concerns of the public were expressed in several ways; direct questions, anecdotes from personal experience, pleas for help, and statements of opinion. Factual and procedural items were often answered directly by the scientists or agency officials. Other issues were addressed in subsequent discussions or in drafts of the habitability criteria document.

The main issues raised by the public, based upon the meeting transcripts, are summarized below. Responses to the public comments are indicated after the summary of each issue.

ACCEPTABILITY OF CRITERIA TO THE COMMUNITY

ISSUE: PANEL SELECTION AND QUALIFICATIONS

Various members of the public asked how the expert scientists had been selected, requested the resumes of each scientist and questioned their ability to be impartial. The public was very concerned that the scientists be able to give an unbiased opinion on the issue of habitability.

RESPONSE:

Mr. Daniel VanderMeer of CDC indicated that scientists were the best qualified persons known to the TRC agencies. Those who had previously served as consultants on Love Canal EDA habitability were not selected. The community was given the opportunity to nominate two consultants. Based on the community's recommendation, Dr. Michael Stoline and Dr. Joseph Highland were invited to serve as expert scientists. Dr. Stoline has been an active participant, while Dr. Highland was not able to participate. The resumes of the scientists were supplied to DEC's Public Information Office in Niagara Falls and are included in Appendix 2.

ISSUE: MEANING OF HABITABILITY

The question of what "habitability" means was raised by the public in terms of the 1978 and 1979 Health Department orders for Love Canal and the EDA, and whether the scientists might choose to live there if the criteria were to indicate the area is habitable.

RESPONSE:

The meaning of habitability was the first item of common understanding among the various scientists. The public's concern about this issue was responded to at the first meeting as well as at subsequent meetings.

ISSUE: ALTERNATIVE LAND USES

Several members of the public expressed their concern that the EDA is being considered for habitation. They suggested alternative land uses as an alternative to habitation. The suggestions ranged from "a buffer zone" to a "cancer research center." Related to the issue of alternative land uses was the question, "How long will the land be habitable or uninhabitable?"

The public questioned whether non-residential structures would be tested, how vacant lots would be evaluated, and whether vacant lots could be built upon.

RESPONSE:

The scientists also raised and considered the question of whether various non-residential land uses might be more appropriate than residential use. However, they felt it is necessary to first explore whether or not habitability could be established for residential use before trying to evaluate what alternative land uses might be less sensitive to the levels of chemical contamination that may or may not exist in the EDA. No time periods for application of the criteria were specified by the scientists. Churches and commercially owned land are included in the habitability criteria.

ISSUE: BOUNDARY OF EMERGENCY DECLARATION AREA

Several members of the public brought up the question of whether the EDA boundary was in the "right place."

RESPONSE:

This question is beyond the scope of the scientists' work.

ISSUE: AGENCY COORDINATION AND ACTIVITIES

The public was concerned whether the coordination and distribution of responsibilities for remedial and monitoring activities of various governmental agencies was appropriate, effective, and trustworthy.

RESPONSE:

As indicated by the "special provisions" section of the habitability criteria paper, the scientists share the public's concerns on this issue.

ISSUE: FUTURE ROLE OF COMMUNITY INVOLVEMENT

After the initial draft of the criteria document was made available, the scientists heard public comments that the section on community involvement was "very weak," and that the community was still not involved because, "we really don't know what is going on." The revised draft elicited requests for "specific requirements" and for a public meeting of the scientists to present the criteria recommendations.

RESPONSE:

As a result of community concerns, the first draft section on community involvement was revised. The Proposed Habitability Criteria contains recommendations on community involvement.

ENVIRONMENTAL INFORMATION RELATED TO LOVE CANAL

ISSUE: AVAILABILITY OF DATA

The public was concerned that the scientists may not have access to all of the data that should be reviewed in determining habitability criteria. Several members of the public made note of specific books, maps, reports, and tests related to the Love Canal area. Serious concern was expressed about how much of the relevant data would be available to the scientists, and whether the existing data are adequate to establish or apply habitability criteria. Several people discussed their own difficulties in obtaining various types of information, and their mistrust of the government agencies involved at Love Canal. The public questioned at each public meeting whether the scientists had received requested information or data.

RESPONSE:

The scientists indicated that they shared the public's concern about obtaining all relevant data. The responsible agencies provided the information recommended by the public as well as other pertinent documents as listed in Appendix 3. These documents were also available to the public through the New York Department of Environmental Conservation Public Information Office in Niagara Falls.

ISSUE: QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OF DATA

The public raised questions about the QA/QC of both existing data and additional environmental data to be collected.

RESPONSE:

Dr. Thomas Welty of CDC responded that the QA/QC criteria are "beyond the scope of this particular group" and that "our group is focusing in on habitability and the QA/QC issue is a separate question." Appendix 12 summarizes the QA/QC issues.

ISSUE: STATUS OF ENVIRONMENTAL MONITORING

The public asked on several occasions about the status of environmental monitoring. Specific questions were asked about: (1) monitoring for possible contamination of the bedrock aquifer, (2) sampling done since 1978, (3) sampling of shallow groundwater wells, and (4) long-term evaluation of treatment plant performance.

RESPONSE:

A great deal of the scientists' time was spent on the issues related to environmental monitoring. Recent (July 1984) testing of the groundwater in the EDA did not indicate any contamination by Love Canal chemicals.

ISSUE: APPROPRIATE COMPARISON AREA(S) FOR LOVE CANAL

The public was concerned about the areas selected as comparison areas in past studies as well as the selection of the comparison areas for application of the habitability criteria. The need for careful selection of comparison areas away from possible contamination was stressed. Another question related to the comparison areas is, "if the chemicals are present in Love Canal, why do you really need a control?"

RESPONSE:

The scientists were also concerned about appropriate selection of comparison areas. Comparison areas are needed because of the lack of standards that are adequate to make a habitability determination and serve as a yardstick against which to measure the impact of the Love Canal on the EDA. The habitability criteria are designed to establish whether the level of chemicals found in the EDA is significantly greater than the level of chemicals found in the other inhabited urban areas in the western New York area that are not impacted by a chemical landfill.

ISSUE: POSSIBLE CONTAMINANTS FROM NON-LOVE CANAL SOURCES

The public repeatedly brought up the fact that Love Canal is only one instance of chemical contamination in the Niagara Falls area. The public is concerned about how contaminants from non-Love Canal sources such as the 102nd Street dump or underneath the LaSalle Arterial may affect the habitability of the EDA.

RESPONSE:

The recommended criteria are sensitive to the presence of TCDD and the other Love Canal Indicator Chemicals regardless of the actual source of the chemicals. The selection of Love Canal Indicator Chemicals is discussed at greater length in Appendix 9.

CONCERNS ABOUT HEALTH AND SAFETY

ISSUE: STUDIES OF HEALTH EFFECTS

Studies of health effects are a significant public concern. The community is aware that numerous tests and studies on health effects have been done. However, questions remain about what problems did or could result from exposure to Love Canal chemicals, and what kinds of health studies need to be done for various groups of people.

RESPONSE:

The Proposed Habitability Criteria suggests several possible approaches to the examination of health effects in the Love Canal EDA.

ISSUE: SAFETY OF EDA FOR THOSE STILL LIVING THERE

On several occasions members of the public asked about the safety of the Love Canal EDA for those people who are still living there. The issue was expressed in several ways: Why are people still living there when "you haven't determined that it's safe?." Will people be forced to move if the area is either found "not habitable" or "declared uninhabitable," and "apparently somebody had decided it is safe because someone moved in." Finally, "what are the risks to those who stayed?" The concern was expressed by a former resident:

> "We want to know exactly where our neighborhood is, and I will say, how safe we are in our neighborhood, and that is what it boils down to. Are we safe or aren't we safe? Do we have to worry about something in the future? If we have to worry about something in the future, we weren't safe. What do we do to remedy that effect that we are going to inherit from the canal? Do we take medicine or what? That is what the questions are. If you can, come up and say yes or no. But we want to know what we got to do one way or the other."

RESPONSE:

The purpose of the habitability criteria is to address the issue of whether the EDA is a "safe" place to live for those who stayed and for those who might move in. The scientists did not recommend what current residents should do in the event the EDA is found to be "not habitable." Specific health care prescriptions are beyond the scope of the scientists' responsibilities.

ISSUE: RISK ASSESSMENTS/RISK FACTORS

The public asked a number of questions about risk assessment and risk factors. The tenor of many public comments indicates that citizens are looking for the habitability criteria to establish an acceptable level of risk and evaluate the risk of chemical exposure that people have experienced at Love Canal.

RESPONSE:

The rationale for basing its habitability criteria recommendations on a comparative approach rather than risk assessment is described in Appendix 7.

ISSUE: CITY WATER SUPPLY

The public expressed concern about the past contamination and reliability of the City of Niagara Falls water supply system which serves the Love Canal area.

RESPONSE:

The scientists were also concerned about the drinking water system as a possible source of contaminants. Dr. Davis expressed her surprise at the tap water levels of chloroform and total organic carbon in the potable water tested at Love Canal in 1978.

Dr. Huffaker indicated that the Department of Health had looked at the problem and found that chemical concentrations in the Niagara Water Works system were high before changes were made at the plant. There is no indication that drinking water was contaminated by the Love Canal site.

ISSUE: EFFECTIVENESS OF REMEDIATION VS. REMOVAL

Whether the remediation efforts at Love Canal have been effective and what further remediation is needed are concerns of the public. The sewers and creeks around the EDA, the operations of the treatment plant at the canal, the 93rd Street School grounds, dioxin (TCDD) onsite storage and disposal alternatives, and possible remediation measures of houses and lots are all areas of concern. Related to the remediation is the question--why not remove the waste to "some area where it would be safer" as well as whether there is a problem with putting "a new so-called secure landfill under RCRA in the middle of a neighborhood?" Many members of the public consider "cleanup" to be synonymous with removal of wastes rather than containment or treatment of wastes.

RESPONSE:

The panel's recommendations about remediation are included in the Proposed Habitability Criteria. The issue is addressed in detail in Appendix 6.

WDR100/27

Remedial Action and Management of the Love Canal Site; June, 1985

APPENDIX 6

Appendix 6

REMEDIAL ACTION AND MANAGEMENT OF THE LOVE CANAL SITE

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PREFACE

This document was prepared by the New York State Department of Environmental Conservation (NYSDEC) and was included as an appendix to a report entitled "Love Canal Emergency Declaration Area Proposed Habitability Criteria," which was submitted to the U.S Environmental Protection Agency in August 1985. The NYSDEC decided that the material should also be published separately as a means of bringing New York State citizens up to date on progress at the Love Canal site.

Many of the decisions discussed herein have led to the adoption of remedial actions involving varied and innovative technologies for remediation management of the site. The official documents describing the technologies in detail are available for public inspection at the NYSDEC Love Canal Public Information Office, 9820 Colvin Boulevard, Niagara Falls, New York. Specifically, the available documentation consists of the following:

- Detailed plans and specifications for the major elements of the Phase I remedial construction, including the 7,000-foot vitrified clay tile leachate barrier drainage system, the clay cap that covers the canal, and the leachate treatment plant.
- Detailed plans and specifications for the major elements of the Phase II remedial work, including the plugging and abandonment of sewers immediately adjacent to the Love Canal site, repairs to the leachate collection system, construction of an improved and expanded cap, and installation of a groundwater cutoff wall.
- Operation and maintenance (O&M) manual for the leachate collection system and a two-volume O&M manual for the leachate treatment plant.
- Groundwater elevation and groundwater quality data collected as part of the NYSDEC's groundwater monitoring program, which began in 1980.

For additional information, the public is encouraged to contact either the NYSDEC Division of Solid and Hazardous Waste, Albany, NY or the NYSDEC Love Canal Public Information Office.

SUMMARY

Appendix No. 6 provides a brief summary of remedial activities at the Love Canal site.

What started as William T. Love's dream in the late 1800's for a community in the southeast end of Niagara Falls became a national symbol of improper hazardous waste disposal practices in 1978. The canal, which was to be a source of cheap direct-current hydroelectric power, became a depository from 1942-1953 of about 21,800 tons of solid and liquid chemical wastes which included acids, chlorides, mercaptans, phenols, toluenes, pesticides, chlorophenols, chlorobenzenes, and sulfides. Municipal refuse was also deposited in the canal. Over the years infiltrating precipitation mixed with the buried wastes. Grossly contaminated water and liquid wastes pooled at the surface, and runoff carried contaminants into sewers and yards of adjacent homes. Leachate migrated slowly through the ground, reaching the basements of adjacent homes. On August 2, 1978 Commissioner Robert D. Whalen, M.D., declared that a health emergency existed at Love Canal; and on August 7, 1978, President Carter issued a declaration of emergency making Federal disaster assistance funds available to begin remedial work. During the fall of 1978, the homes of over 230 families were purchased and the families living nearest the canal were relocated.

The objectives of the initial remedial work (October 1978-November 1979) were to prevent further discharge of chemical contaminants into the shallow groundwater system and to reduce the potential for discharge into the bedrock groundwater system. The work was also intended to prevent chemical contaminants from migrating offsite via atmospheric emissions of volatiles and dust, direct contact, and surface runoff. This initial work consisted of constructing a barrier drain system (8 to 21 feet deep) outside of and completely surrounding

the canal; covering 22 acres including the entire surface of the landfill with a compacted clay cap; and building an onsite treatment plant to treat the collected leachate.

The objectives of the more recent remedial work (December 1982-December 1984) were to enhance the effectiveness of the initial work and further reduce the amount of infiltration; reduce long-term operation and maintenance costs; and eliminate manmade pathways (utilities) that allowed the migration of chemicals offsite. During this period, a synthetic membrane composed of high-density polyethylene was installed over an expanded area of 40 acres, which included the landfill; storm and sanitary sewers adjacent to the dumpsite were taken out of service, plugged, and cleaned; and the barrier drain was cleaned, repaired as needed, and inspected.

The primary objectives of the remaining remedial work are to clean areas beyond the site which have been identified as being impacted by previous chemical migration and to develop a long-term monitoring program for the site.

The Division of Solid and Hazardous Waste of the New York State Department of Environmental Conservation (NYSDEC) is responsible for the development and implementation of the remedial program, ongoing operation of the leachate treatment facility, and site maintenance.

In 1984 the Love Canal Technical Review Committee (TRC) was established to act as a management group, coordinating the many interrelated governmental activities necessary to resolve complex site issues. The TRC is chaired by a representative from the United States Environmental Protection Agency and includes representatives from USEPA Region II, the Federal Center for Environmental Health of the Centers for Disease Control, the New York State Department of Health, and the NYSDEC. The TRC is working on the development of criteria to be used to determine if the Love Canal area is habitable.

Appendix 6

REMEDIAL ACTION AND MANAGEMENT OF THE LOVE CANAL SITE

OVERVIEW

In 1978, Love Canal, a community in the southeast end of Niagara Falls, New York, exploded into the news and entered the nation's daily vocabulary as a grim symbol of improper hazardous waste disposal practices. Reports of chemicals entering the basements of homes nearest to the original Love Canal channel, along with reports of high numbers of illnesses in those homes, led to an investigation by New York State and set off a chain of actions and reactions that forced many of the residents to move. Numerous State and Federal agencies, and even the President of the United States, became involved.

Probably more than any other single event, the environmental/health tragedy that unfolded at the Love Canal site focused national attention on the serious problems associated with abandoned hazardous waste disposal sites. The remedial program developed in response to the Love Canal incident is an ongoing effort to contain and control one such site. By reviewing the history, the objectives, the work that was actually performed, and the work planned for the Love Canal site, it may be possible to gain additional confidence in the habitability of areas separated by a safe distance from the site itself.

The Love Canal story began in the late 1800's, when entrepreneur William T. Love began digging a channel from the Upper Niagara River escarpment. He was trying to create a canal with a 280-foot drop that would be a secondary source of cheap direct-current hydroelectric power. His dream was to divert some of the Niagara River's potential water power to new areas in the hope that new industries and towns would spring up nearby. But before the project was completed, alternating electrical current was developed so industry no longer needed to be near the source of power. The canal project was abandoned, leaving behind, according to newspaper reports of the day, an excavation approximately one mile long and 80 feet wide.

From 1942 to 1953, the Hooker Electrochemical Company (hereinafter "Hooker") dumped about 21,800 tons of chemical wastes from its nearby plants, which produced pesticides and plasticizers, into the abandoned canal. In 1953, the Niagara Falls Board of Education purchased the property from Hooker and built the 99th Street School on the site. Partly because of the school, the number of young families moving into the surrounding area increased. During the next 25 years, chemical odors and black oily substances oozing into the nearby basements became more noticeable, and as the dirt fill settled, barrels and chemical wastes were exposed.

In August of 1978, after some investigation by the New York State Department of Environmental Conservation (NYSDEC), the New York State Commissioner of Health declared the area around the old dump site to be a health hazard. The 99th Street School was closed immediately, over 230 families were permanently relocated from the first two "rings" of houses around the Love Canal (see Figure 1). The area was fenced off, and a Presidential emergency declaration allowed the Federal Government to provide funds to assist the State in its relocation efforts. The State purchased homes located along 97th and 99th Streets at fair market value.

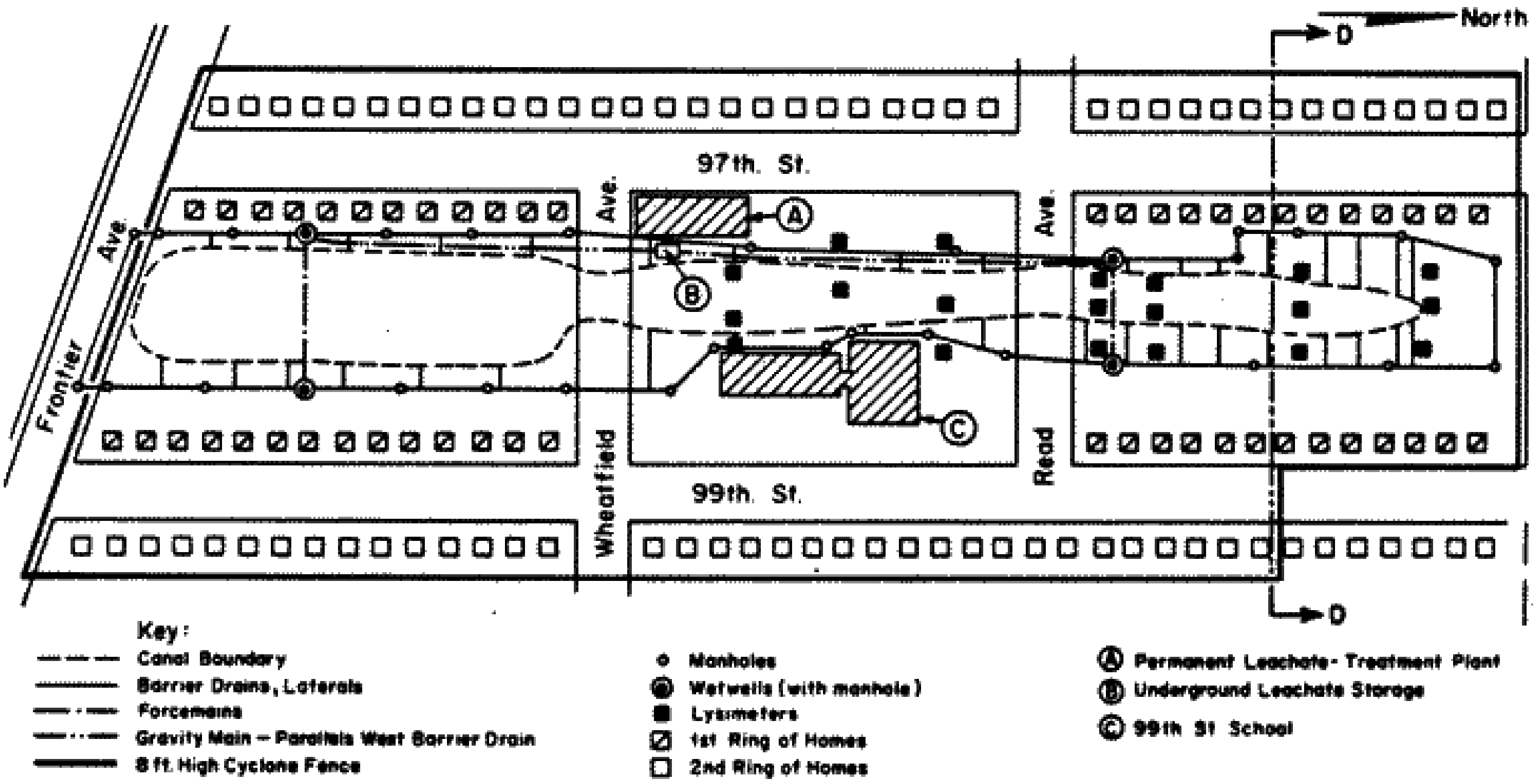
In May 1980, President Carter issued a second emergency declaration for Love Canal. New boundaries were drawn establishing the horseshoe-shaped Emergency Declaration Area (EDA) and affecting approximately 800 additional families. Again, extensive Federal funding supplemented the State's resources.

Remedial Actions Taken

Prior to the 1980 developments, the United States Environmental Protection

Figure 1

REMEDIAL PROJECT -- PLAN VIEW



Source: "Love Canal— — A Special Report to the Governor & Legislature," prepared by New York State Department of Health, April 1981.

Agency (EPA) and NYSDEC had signed a cooperative agreement to develop a program to contain the chemicals at Love Canal.

The first step by NYSDEC was the installation of a collection system around the dumpsite and construction of a facility to treat the collected contaminated groundwater (leachate). A 22-acre, three-foot thick clay cap was installed over the Love Canal dump.

Leachate moving through the ground is intercepted and conveyed to a drain pipe. This collection system lowers the level of the water inside the dumpsite and causes water in the ground outside the canal itself to flow inward toward the pipes. The system is a barrier, preventing leachate from moving into the groundwater adjacent to the canal. The leachate collection system and treatment plant began operating in December 1979.

The clay cap acts as an umbrella, preventing rainwater and melting snow from mixing with the toxic and hazardous chemicals underneath it. The cap decreased the amount of water entering the dumpsite; prevented the runoff of contaminated rainfall; prevented human contact with the waste in the dumpsite; and stopped atmospheric emissions from the buried chemicals.

The abandoned homes in the area immediately adjacent to Love Canal were bulldozed into their basements and covered with earth. The 99th Street School was demolished.

At this point, the way was clear for completing the expanded remedial program by extending the 16-acre cap to about 40 acres. These additional remedial measures further reduced the amount of water entering the leachate collection system.

Eighteen inches of soil materials were put on top of a plastic liner and seeded with a mix of grasses and fertilizer. Before the winter of 1984-1985's first snowfall, healthy grass covered the dumpsite. The eight-foot high chain link fence still limits access to the area.

In 1983, NYSDEC investigations in the EDA confirmed that Love Canal chemicals had moved from the dumpsite into the storm and sanitary sewers. Dioxin-contaminated sediments were found in Black and Bergholtz Creeks. As of August 1985, EPA and NYSDEC are developing plans to clean the sewers and creeks. It is hoped that this work will be completed by 1987. One concern, however, is where and how to dispose of the dioxin-contaminated sediments when they are removed. This issue is still unresolved.

Additional work will include an extended perimeter survey to be performed by drilling into the ground to determine the extent of chemical contamination from the Love Canal dumpsite. Any additional work needed will be done as soon as possible.

Reassessment of Love Canal Habitability

EPA conducted a study of the Love Canal EDA in 1980 to provide an environmental data base for decisions related to the sale of the homes there. The study results, released in May 1982, concluded that there was no clear evidence of environmental contamination in these residential areas which could be directly attributed to the movement of chemicals from Love Canal.

In June 1983, the Congressional Office of Technology Assessment (OTA) issued a report, "Habitability of the Love Canal Area--An Analysis of the Technical Basis for the Decision on the Habitability of the Emergency Declaration Area," which disputed the EPA's conclusions. The principal OTA finding was that, "with available information, it is not possible to conclude either that unsafe levels of toxic contamination exist or that they do not exist in the EDA." The report adds: "The OTA analysis does not not support an interpretation of the DHHS decision that would lead to the immediate and complete rehabitation of the EDA. There remains a need to demonstrate more unequivocally that the EDA is safe for human habitation immediately and over the long term. If that cannot be done, it may be necessary to accept the original presumption that the area is not habitable."

Since the OTA report was released, a new government committee has been formed to restudy the habitability question. This Love Canal Technical Review Committee (TRC) includes representatives of EPA, NYSDEC, the New York State Department of Health (NYSDOH), and the U.S. Department of Health and Human Services (DHHS). This group acts as a managerial body, coordinating the many interrelated governmental activities necessary to resolve the complex issues related to habitation of the Love Canal EDA and cleanup and protection of the site.

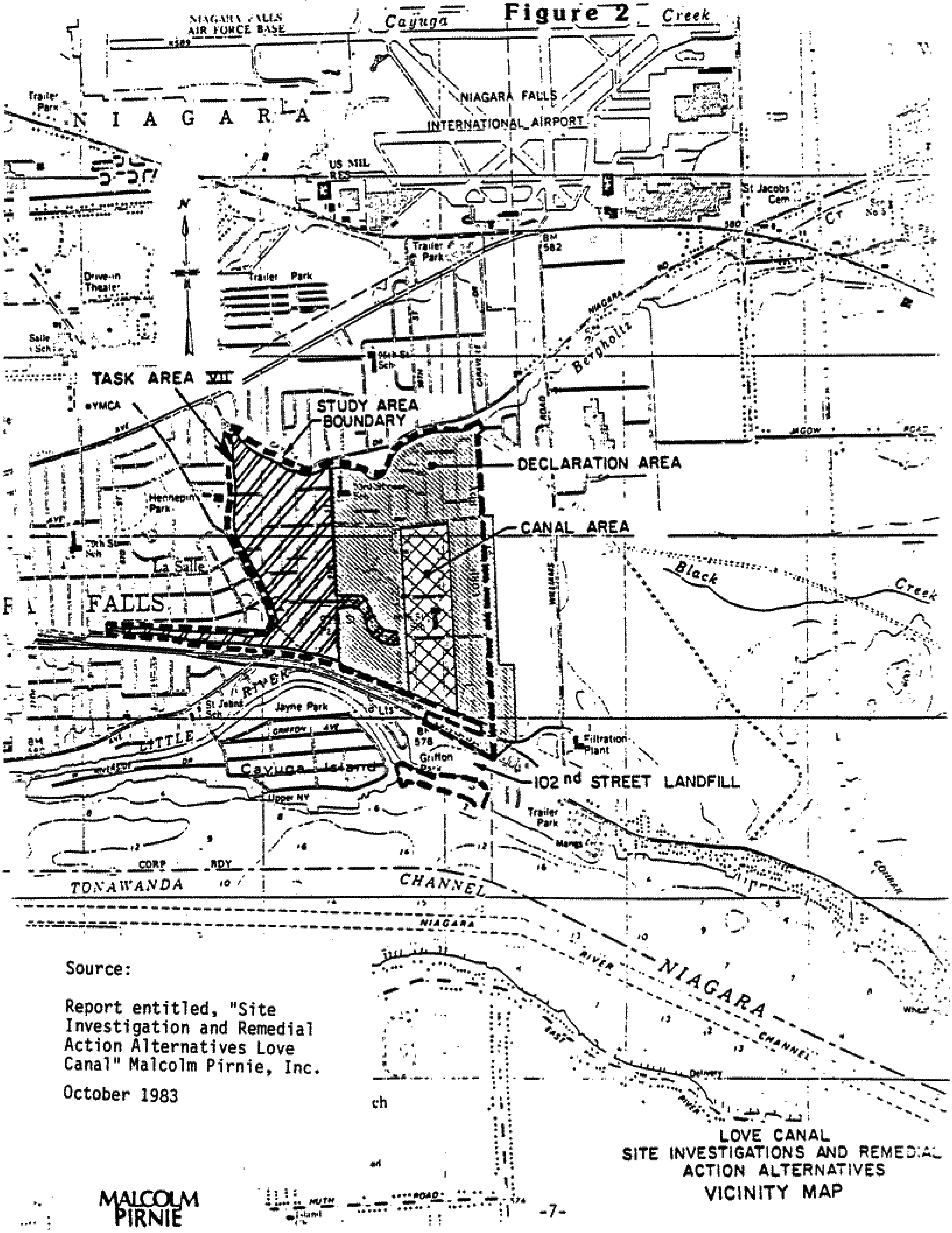
A second group, consisting of non-governmental expert scientists from a variety of disciplines, was formed by DHHS and the NYSDOH to develop the criteria upon which the habitability of the EDA could be judged. These scientists have met on several occasions in public forums in the City of Niagara Falls to discuss the development of these habitability criteria.

SETTING

The Love Canal site is located in the southeast corner of the City of Niagara Falls and is approximately one-quarter mile north of the Niagara River (see Figure 2). Aligned nearly north-south, the Love Canal extends through the center of three city blocks in what was once a residential area. It was one of two initial excavations in what was to be a power canal to provide cheap hydroelectric power for industrial development around the turn of the century. The abandoned excavation, partially filled with water, was used largely for recreational purposes.

The portion of the canal project that was abandoned was approximately 3,200 feet long and perhaps 80 feet wide. The exact depth of the canal excavation has not been documented and there are only anecdotal references that indicate an original depth of about 10 to 12 feet (3.05 to 3.66m), which was subsequently increased to a maximum depth of between 20 to 35 feet (6.10 to 10.68m) prior to placement of wastes in some areas (Hartman, 1981). If true, the latter depths would appear to place the base of the excavation, in some areas, near or at the top of the bedrock. Interpretation of data from geophysical explorations conucted in 1979 by NYSDEC suggests a range of waste deposits from 10 to 15 feet

Figure 2



Source:

Report entitled, "Site Investigation and Remedial Action Alternatives Love Canal" Malcolm Pirnie, Inc.

October 1983

LOVE CANAL
SITE INVESTIGATIONS AND REMEDIAL ACTION ALTERNATIVES
VICINITY MAP

MALCOLM PIRNIE

(3.05 to 4.57m) in portions of the central and northern sections of the canal.

USE OF SITE

Between the years 1942 and 1953, Hooker disposed of over 21,800 tons of various chemicals into Love Canal. The solid and liquid wastes deposited in the Love Canal include acids, chlorides, mercaptans, phenols, toluenes, pesticides, chlorophenols, chlorobenzenes, and sulfides.

Hooker obtained title to the Canal property in 1947 and continued to dispose of wastes there until about 1953. Portions of the Canal were also used by the City of Niagara Falls for the disposal of municipal refuse.

The early 1950's saw an increase in the rate of residential development in this area of the City. In 1953, the Board of Education of the City of Niagara Falls purchased the Love Canal from Hooker. In 1954 an elementary school was built immediately adjacent to the Canal, around which time waste disposal at the Love Canal ceased. Also, 97th and 99th Streets and public utilities were installed that ran parallel (north-south) and at some distance from the Canal. Read Avenue and Wheatfield Avenue were also constructed and ran directly across the Canal.

By the mid-1970's approximately 100 homes stood on lots that were immediately adjacent to the abandoned hazardous waste dump. Children from this area attended a public school (the 99th Street School) built at the very edge of the dump and often played on portions of the Canal.

Due to infiltration of precipitation, water accumulated in the landfill and carried chemically contaminated leachate to the surface where it migrated through the more permeable soils near the land surface into contact with basement foundations. In response to complaints from residents of homes abutting the Canal, NYSDEC and the New York State Department of Health (NYSDOH), with the assistance of the EPA, conducted studies on groundwater pollution and basement air and sump water contamination in late 1977.

In April 1978, on the basis of this initial study data, the Commissioner of the NYSDOH issued an order to the Niagara County Health Department to restrict access to the site and to remove surficial chemical contamination and cover exposed areas. Additional monitoring studies by NYSDEC, NYSDOH, and EPA in 1978 led the NYSDOH Commissioner to declare a state of emergency at Love Canal on August 2, 1978. President Carter also declared an environmental emergency at the Canal, enabling the Federal government to provide financial assistance to the State for the initiation of remedial measures.

THE PROBLEM

An understanding of the geology and the hydrogeology of the Love Canal area is very important in order to understand the mechanisms that allowed the buried wastes to become a serious threat to the health and the environment of the Love Canal neighborhood.

The Love Canal was excavated in unconsolidated lacustrine sediments. The upper 5 feet of these sediments vary in texture from a clayey silt to a sandy silt, with some zones near the base of this zone grading to a fine sand. This upper zone appears to be the most permeable sediment at the Canal.

Beneath the upper silt zone lies approximately 18-20 feet of varved silty clays. It is most likely that these clays were the bottom of the original canal. Permeabilities of these clays have been reported to be very low.

The presence of such a thickness of clay is often considered a desirable geologic setting for waste disposal. However, careful inspection of the clay revealed that the upper 5 to 6 feet of the clays had been exposed and dried at some time following their deposition. These layers of dried (dessicated) clays could allow the movement of leachate in otherwise non-permeable areas. However, beneath the desiccated clays lie another 10-15 feet of unaltered lacustrine clays. These clay beds are of very low permeability and are believed to retard migration of contaminants into the underlying bedrock.

Beneath the clays lie approximately 10-15 feet of glacial till, also having low permeability. Bedrock is encountered at depths of 35-40 feet and is composed of the Lockport Dolomite (Upper Silurian). Figure 3 presents a typical geologic section of the Love Canal area.

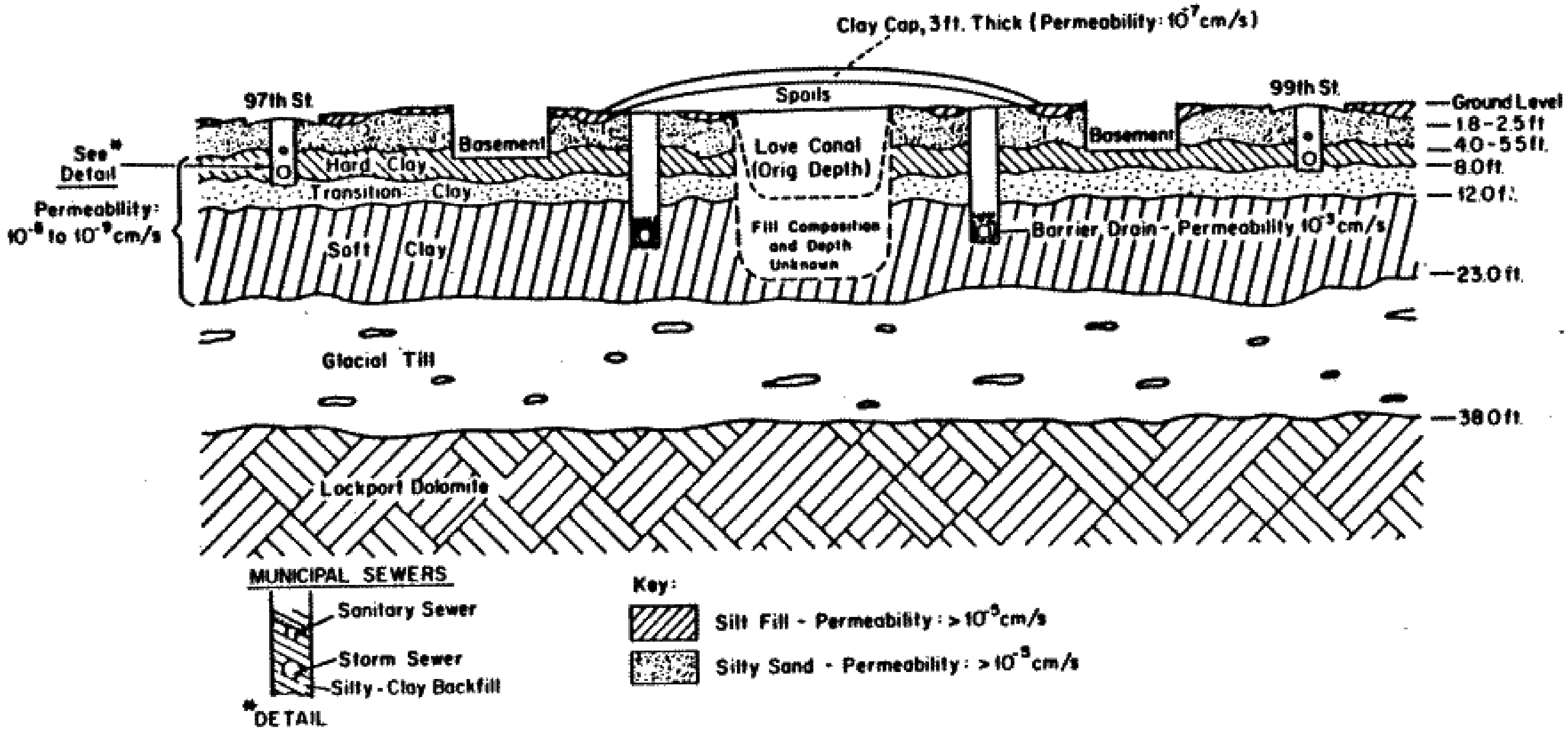
There are two separate groundwater regimes at the Love Canal. The upper groundwater regime occurs within the upper silts and clay. The water table within the upper silt fluctuates seasonally. The area near the Love Canal is relatively flat and is generally poorly drained, and at times the upper zone is completely saturated. In late summer, the upper groundwater system may be entirely depleted. The deeper regime, a confined system, occurs within the Lockport Dolomite. The piezometric surface lies roughly 10 feet below ground surface.

It is this hydrogeologic setting that allowed chemical wastes to escape from the Love Canal. Over the years infiltrating precipitation mixed with the buried wastes. The underlying clays retarded further downward migration of the contaminated groundwater (leachate), and in time the wastes became completely saturated.

Water grossly contaminated with toxic chemicals and liquid wastes pooled at the landfill's surface, and runoff from the site carried contaminants into area sewers and yards of adjacent homes. Differential settlement of the landfill exposed buried wastes at the surface, and volatile compounds and contaminated dust exposed at the surface escaped into the air. Leachate migrated slowly through the upper silts and the desiccated clays, eventually reaching the base-

Figure 3

TRANSVERSE VIEW (Looking North)



ments of the homes adjacent to the Canal. Figure 4 presents a schematic of the main routes by which chemicals migrated from the Canal.

Investigation Of The Problem

In the spring of 1978, following a series of complaints by local residents, a number of studies were begun to investigate the health and environmental problems at the Love Canal. A preliminary hydrogeologic investigation of the site was conducted by the City of Niagara Falls. The NYSDOH and NYSDEC collected and analyzed samples of soil, groundwater, water from basement sump pits, and air within the homes. An epidemiological study was begun by the NYSDOH.

As noted under "Use of Site," on August 2, 1978, based upon the results of these studies, then Commissioner Robert Whalen, M.D., NYSDOH, declared that a health emergency existed at the Love Canal. In addition, Commissioner Whalen ordered that a pollution abatement program be initiated.

The Response

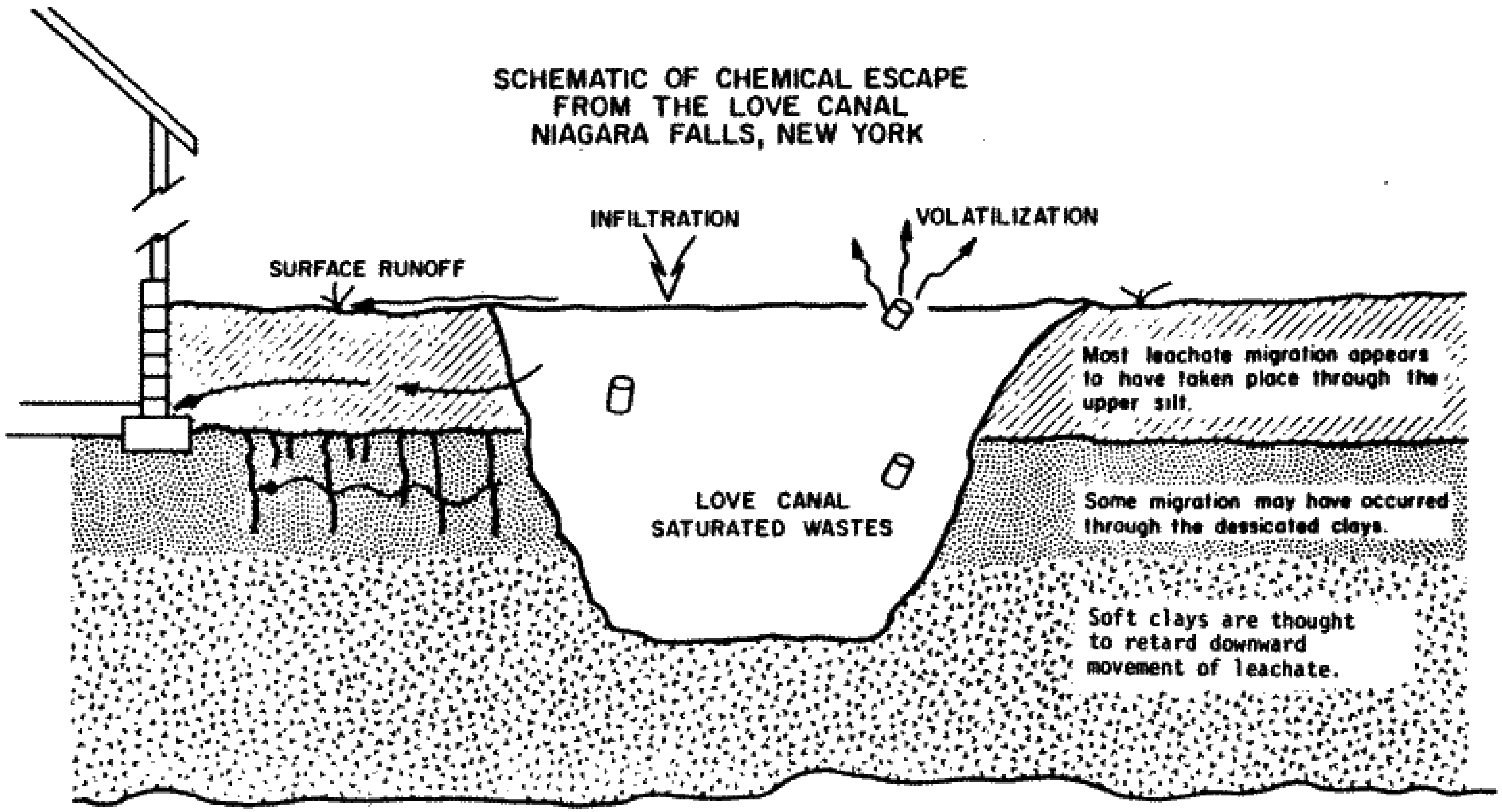
On August 7, 1978, President Carter issued a declaration of emergency making Federal disaster assistance funds available to the City of Niagara Falls to begin remedial construction. Governor Carey directed that people living closest to the Canal be evacuated. During the fall of 1978, the homes of over 230 families were purchased by the State of New York and the families living nearest the Canal were relocated in preparation for the remedial construction.

DESCRIPTION OF REMEDIAL PROGRAM

The Love Canal Remedial Program was initiated to reduce the environmental and health hazard that resulted from the escape of toxic chemicals from the dump. The overall objective of the Love Canal Remedial Program (Phase I) was to

Figure 4

SCHEMATIC OF CHEMICAL ESCAPE
FROM THE LOVE CANAL
NIAGARA FALLS, NEW YORK



contain the chemical waste at the site. More specifically, the initial objectives of the remedial program were to:

1. Prevent further discharge of chemical contaminants into the shallow groundwater system where the chemical contaminants could migrate offsite
2. Reduce the potential for discharge of chemical contaminants into the bedrock groundwater system
3. Prevent surface runoff from carrying chemical contaminants offsite
4. Prevent atmospheric emissions of volatile contaminants and fugitive dust
5. Prevent direct contact with wastes which had been exposed at the surface of the canal

More recently, additional remedial work (Phase II) has been performed to meet the following objectives:

1. Further reduce the amount of precipitation infiltrating the site
2. Reduce the long-term costs of operation and maintenance of the leachate collection and treatment system at the site
3. Eliminate manmade pathways which had in the past allowed chemical migration offsite

The objectives of the remaining remedial work at Love Canal (Phase III) are to clean up areas beyond the site which have been identified as being impacted by chemical waste migration from the Love Canal, and to develop a long-term monitoring program. The objectives of this work are to:

1. Identify the extent to which sewers and surface streams which drain the Love Canal area have been contaminated by the Love Canal
2. Design and carry out remedial programs to remove chemical contaminants found in the sewers and the streams which drained the Love Canal area

3. Design and install a permanent monitoring program to evaluate the effects and the effectiveness of the Love Canal remedial programs to determine the extent to which Love Canal chemicals have migrated with the groundwater, and to provide sufficient information to determine if any additional effort is needed to address groundwater contamination attributable to the Love Canal site

Remedial Work--Phase I

The first phase of remedial construction at the Love Canal site consisted primarily of the following elements:

1. A perimeter "Barrier Drain" system was constructed outside of and completely surrounding the Love Canal. The drain served as a hydraulic barrier to prevent the further migration of chemical contaminants in the upper groundwater system. The drain also provided a means of removing leachate from the canal in order to dewater it and, to a limited extent, recovered contaminants that had migrated beyond the location of the drain.
2. The entire landfill was covered with a minimum of 3 feet of well compacted clay. The clay prevented human contact with the waste and prevented further migration of volatiles and fugitive dust from the landfill's surface. The clay cap also greatly reduced infiltration of precipitation and therefore reduced the production of leachate.
3. A treatment plant was built onsite, and leachate collected by the barrier drain system is pumped to the plant for onsite treatment.

Conduct Of The Phase I Remedial Work

The first phase of remedial construction at the Love Canal site was carried out in two separate stages. The City of Niagara Falls was responsible for stage one and contracted with the engineering firm of Conestoga-Rovers and Associates, Inc., Waterloo, Ontario, to prepare detailed plans and specifications for the work. Following review of the plans and specifications by local, State, and Federal agencies, the City of Niagara Falls entered into a contract with Newco Chemical Waste Systems, Inc. (now CECOS International, Inc.) to conduct the remedial construction on the southern portion of the canal. This work started in October of 1978 and was substantially complete by October 1979. The work performed by the City included installation of a portion of the barrier drain system along the east and the west sides of the southern section of the Love Canal and the placement of a 3-foot-thick clay cap over the southern section (see Figure 3). The southern section of the canal posed the greatest environmental health hazard, and the remedial work focused on the "worst-first."

The second stage of the remedial construction was carried out by the NYSDEC. Again, plans and specifications for the remedial work were prepared by Conestoga-Rovers and Associates, Inc. Following the receipt of competitive bids, the NYSDEC entered into a contract with SCA Chemical Waste Services to complete the installation of the barrier drain system along the central and northern sectors of the canal and to complete the installation of the clay cap over the central and northern sectors. The Department also entered into a contract with the Albert Elia Building Company to provide detailed design and construct a permanent leachate treatment plant at the site.

Installation of the drains and clay cap along the central and northern sectors of the canal began in May of 1979 and was substantially complete by November of 1979. Construction of the treatment plant began in September of 1979 and was substantially complete in December of the same year. During the fall of 1980, the clay cap was regraded and recompacted, topsoil was placed over the clay, and grass was sown to protect the cap from erosion.

Major Elements Of The Remedial Work

The Barrier Drain - The barrier drain that now surrounds the Love Canal site consists of approximately 7,000 feet of extra strength perforated vitrified clay tile. The tile is of bell and spigot design with no seal at the joint. The tiles were installed using conventional construction techniques in a trench approximately 3 feet wide, ranging in depth from 12-20 feet below original grade. The tiles are bedded in and covered with a minimum of one foot of crushed stone. The remainder of the trench is filled with concrete sand. Manholes have been placed in the drain at each change of alignment and at 280 to 300-foot intervals on straight runs.

In comparison to the adjacent soils, the materials used to backfill the barrier drain trench are very permeable. Leachate migrating away from the canal enters the barrier drain and readily percolates down to the crushed stone bedding. During high flows encountered during construction, liquids entered the perforated tile and flowed rapidly to wet wells where the liquids were pumped out of the ground. Now that a cap is in place and infiltration into the site has been significantly reduced, it appears that the crushed stone bedding has a sufficient hydraulic capacity to transmit current leachate volumes to the pump chambers. Inspection of the manholes reveals little leachate migrating in the tile during normal operating conditions.

Although it was considered feasible to construct the barrier drain system without an underdrain pipe, it was decided that the pipe provided a needed margin of safety for long-term operation of the drain. The tile also provides greater flow capacity and would provide a path for leachate flow if a section of the sand and gravel filter materials were ever to become plugged due to migration of adjacent soil particles or if an unexpected chemical reaction occurred with the leachate. In addition, the manholes provide a means to inspect the drain system and offer access for cleaning operations if necessary.

Clay Cap And Grass Cover - Upon completion of the installation of the barrier drains along both sides of the canal, a 3-foot thickness of clay was placed over the canal. The cap was installed in 6-inch lifts and compacted to 90% of maximum dry density. The final permeability of the cap material was to be less than 1×10^{-7} centimeters per second.

During the installation of the clay cap on the southern sector, it became obvious that the canal was not being drained quickly enough. As the clay was placed on the canal, leachate was forced to the surface, contaminating parts of the clay cap and making proper compaction impossible. To overcome this limitation and to hasten the draining of the canal so that the clay cap could be properly installed, a series of lateral drains filled with gravel and sand were constructed, connecting the barrier drain with the canal itself. Daily flows of leachate increased substantially as the laterals were completed and the canal was drained to the point where the clay cap could be placed and compacted properly. These lateral drains provide good hydraulic communication between the barrier drain system and the landfill itself.

Leachate Treatment Plant - The leachate collected by the barrier drain contains a variety of hazardous organic chemicals. Studies performed by the EPA and the City of Niagara Falls in 1978 and 1979 indicated that granular activated carbon was highly effective in removing the pollutants dissolved in the groundwater. These initial findings were substantiated by the successful performance of two temporary leachate treatment facilities which were used to treat leachate collected during installation of the barrier drain. Both temporary facilities utilized granular activated carbon and both consistently produced an effluent which could be safely discharged to the sanitary sewers of the City of Niagara Falls.

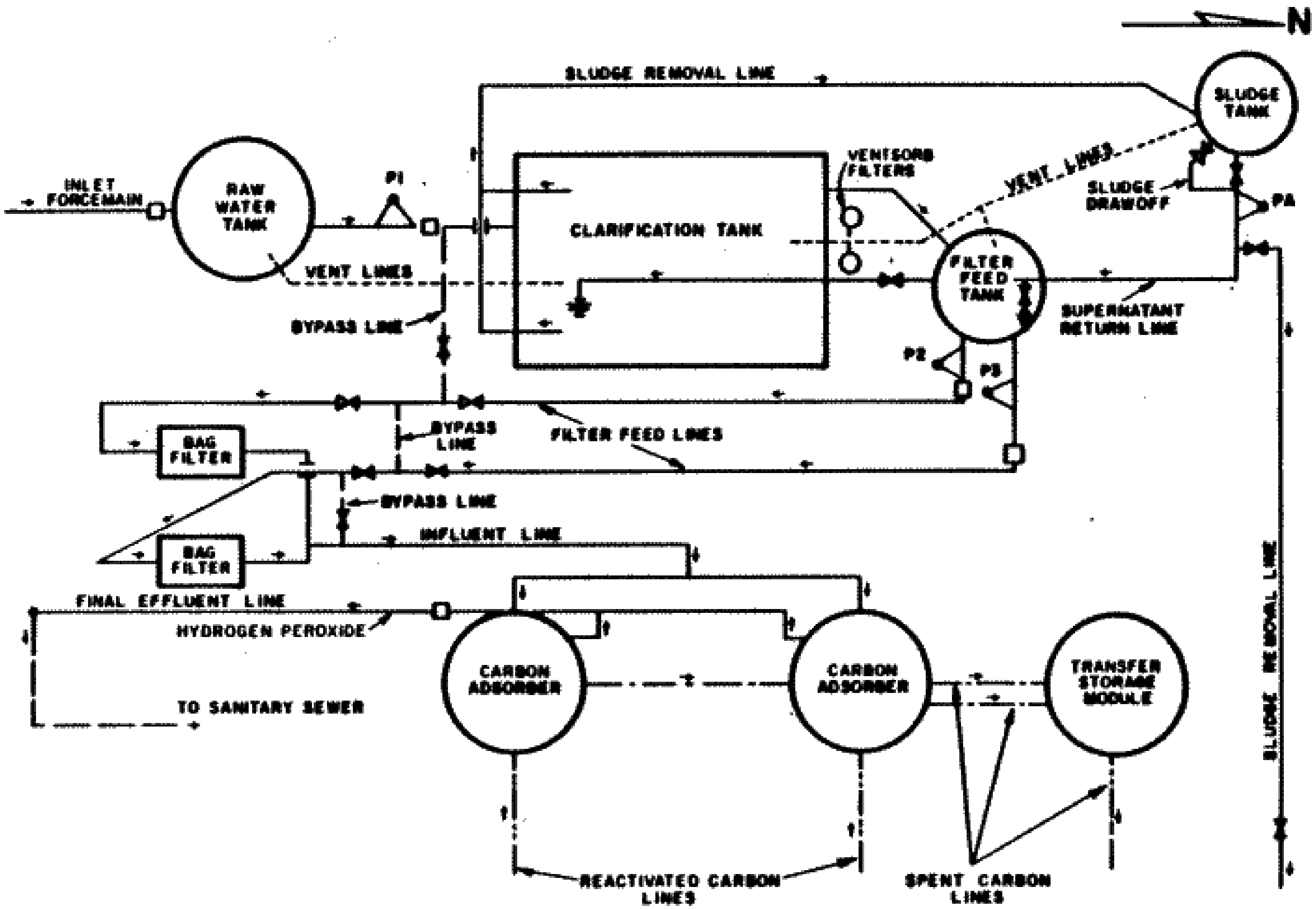
As noted previously, in the spring of 1979 the NYSDEC contracted with Conestoga-Rovers and Associates to prepare bidding documents and performance specifications for the construction of a permanent leachate treatment facility. On August 28, 1979 the NYSDEC entered into a contract with the Albert Elia Building Company (AEBC) for the detailed design and construction of the treatment facility.

The treatment system designed by AEBC was approved by the NYSDEC and consists of the following major process elements:

1. Raw leachate is pumped from the leachate collection system into a large tank within the plant which provides storage needed to accommodate the differences in rates of leachate entering the plant and the rate of treatment.
2. Raw leachate is transferred to a clarifier where settleable solids, if any, and immiscible organic liquids are separated from the contaminated groundwater.
3. The clarified leachate flows into a surge tank and is then passed through a bag filter which removes suspended solids.
4. The clarified and filtered leachate is passed through two beds of granular activated carbon. The two beds are linked in series and as the leachate passes through first one bed and then the second, organic pollutants dissolved in the groundwater are effectively removed.
5. Hydrogen peroxide is injected into the effluent to oxidize the hydrogen sulfide generated by anaerobic bacteria which grow in the carbon beds.

Figure 5 presents a flow diagram of the leachate treatment process at the facility, which was substantially completed in December of 1979.

Figure 5



TREATMENT PROCESS FLOW DIAGRAM

LOVE CANAL LEACHATE TREATMENT FACILITY

The treatment process at the Love Canal Leachate Treatment Facility starts with pumping the leachate through a clarifier. The purpose of this clarifier is to separate the heavier chemical sludge and any suspended solids from the leachate. The residence time in the clarifier is approximately 2 hours. After clarification, the water is pumped through a bag filtration unit to remove any remaining suspended material which might otherwise clog the activated carbon system. Two 8,000-gallon downflow, activated carbon adsorbers, which are operated in series, are utilized to remove organic pollutants from the waste stream. Following the activated carbon treatment, hydrogen peroxide is injected into the effluent to control sulfur odors arising as a result of bacterial activity on the carbon. The effluent is then discharged to the City of Niagara Falls sanitary sewer system for additional treatment.

For over 5 years the NYSDEC has been responsible for leachate treatment at the Love Canal site. During that time the quality of the effluent has been regularly monitored, and the leachate has consistently been treated to a level allowing for a safe discharge to the City of Niagara Falls sanitary sewers.

Remedial Work--Phase II

Monitoring of groundwater elevations and the chemical quality of the groundwater near the perimeter of the clay cap revealed that (a) a considerable amount of recharge was occurring at the toe of the cap, and (b) chemical contaminants were present in the groundwater beyond the zone of influence of the barrier drain system.

Precipitation running off the clay cap was, by design, allowed to run overland to the streets where it entered the storm sewers and was conveyed off-site. Monitoring of groundwater elevations indicated that a significant amount of runoff from the cap percolated into the ground just beyond the toe of the clay cap. An area of unusually high recharge was created at the toe of the cap due to the precipitation it received directly and also received as a result of the significant amount of runoff from the cap. The increased recharge at the toe of the cap resulted in large quantities of relatively clean groundwater entering the barrier drain due to increased infiltration occurring only a small distance from the drain. The increased infiltration also created a mound in the shallow groundwater system which tended, during times of high recharge, to move contaminated groundwater further away from the drain.

Conduct Of The Phase II Remedial Work

At the request of the NYSDEC, in October 1981, U.S. EPA entered into a contract with CH2M HILL, Inc., Reston, Virginia, to design an improved cap for the Love Canal site that would improve the efficiency of the leachate collection system. Also included in the design provided by CH2M HILL were elements of work which would further isolate the contaminants in and around the Love Canal from the surrounding area. The major elements of this work included:

1. Repairs to leachate collection system
2. Expansion of the capped area and upgrading of the cap to include a synthetic membrane
3. Improved surface drainage in the vicinity of the Love Canal
4. Cleaning, abandonment, and plugging of storm and sanitary sewers that drained in the Love Canal site
5. New stormwater drainage facilities for the Love Canal site
6. A below-grade concrete groundwater cutoff wall

In July of 1982, NYSDEC entered into an Assistance Agreement with EPA for construction of the Phase II remedial work designed by CH2M HILL for EPA. In August, detailed plans and specifications were completed for the supplemental remedies, and in September 1982, NYSDEC received bids for the remedial construction. NYSDEC also negotiated a contract with CH2M HILL to provide engineering services (construction management, contract management) during the remedial construction. In December 1982, NYSDEC awarded a contract to Sevenson Construction Corporation to perform the remedial construction.

Major Elements Of The Remedial Work--Phase II

The following are summary descriptions of each of the major elements of the work included in Phase II.

Abandonment Of Storm And Sanitary Sewers - The storm and sanitary sewers which served the Love Canal area of the City of Niagara Falls were known to be contaminated with chemicals that had migrated from the Love Canal. The sewers immediately adjacent to the Love Canal site were taken out of service, plugged, and cleaned. (The contaminated sediment and debris removed from the sewers is now being stored in drums on the site until an acceptable means of disposal is found.) The plugging of these sewers prevents the continuing direct migration of chemical wastes from Love Canal to Black and Bergholtz Creeks and the Niagara River.

The effluent from the Love Canal Leachate Treatment Plant was previously discharged into the 97th Street sanitary sewer. Since the 97th Street sanitary sewer was abandoned and plugged, a new effluent line from the plant was constructed and connected with the 95th Street sanitary sewer. Effluent from the Love Canal Leachate Treatment Plant is conveyed to the City of Niagara Falls wastewater treatment plant before it is discharged to the Niagara River.

Repairs To Leachate Collection System - Before a new cap was constucted over the landfill, the barrier drain was cleaned and inspected, and necessary repairs were made. In the fall of 1982, NYSDEC hired O.H. Materials to clean and inspect the barrier drain on the southern portion of the Love Canal. As a result of this work, a number of sections of the drain were found to need repairs. Subsequent cleaning and inspection of the barrier drain along the central and northern portion of the Love Canal also revealed a number of areas that required repair.

All areas of the drain requiring repair were removed and replaced with new pipe, and the entire drain was cleaned. The drain was again inspected, and found to be acceptable. Contaminated sand, gravel, and debris resulting from the repair of the barrier drain were buried onsite. As with any operating facility, the barrier drain, the pumps, the controls, etc., that comprise the leachate collection system will require periodic maintenance and repair. NYSDEC will continue to routinely inspect and repair, as necessary, the leachate collection system.

Improved Cap And Site Drainage - To reduce the amount of precipitation which infiltrated the ground near the barrier drain, an improved and expanded cap over the landfill was constructed. The clay cap, completed in 1980, was stripped of topsoil, regraded, and recompacted. Select soil was brought onsite, graded, and compacted to provide a suitable base for the new "cap."

The new cap was a synthetic membrane composed of high-density polyethylene, 0.040 inch thick. The cap was expanded to cover an area of approximately 40 acres and now extends 200+ feet beyond the barrier drain to the east and to the west. Additional select fill was placed over the liner to protect it from weather and sunlight.

The additional fill brought onsite and the spoiled materials from the repairs to the barrier drain created steeper slopes grading away from the landfill. The steeper slopes and the synthetic membrane result in significantly less infiltration of precipitation into the landfill. Precipitation now runs off the site and is collected by a new surface drainage system at the edge of the cap. Surface drainage which is uncontaminated is conveyed to area storm sewers by a system of new storms which was built for this purpose. The new cap should result in less leachate generation and an expansion of the zone of influence of the barrier drain. Expansion of the zone of influence of the barrier drain should place under hydraulic control polluted groundwater that, without the expanded cap, would be beyond the hydraulic influence of the barrier drain. Recent monitoring shows that the hydraulic influence of the drain extends nearly to the edge of the expanded cap (see Figure 6).

Groundwater Cutoff Wall

A below-grade concrete wall was included in the original design of the Phase II remedial work. The concrete wall was designed to prevent groundwater from migrating beneath the expanded cap toward the barrier drain. It was anticipated that cutting off the influx of relatively clean groundwater would reduce the amount of water treated at the Love Canal Leachate Treatment Plant and would be a cost-effective means of reducing the long-term costs for operation and maintenance of the leachate collection and treatment system.

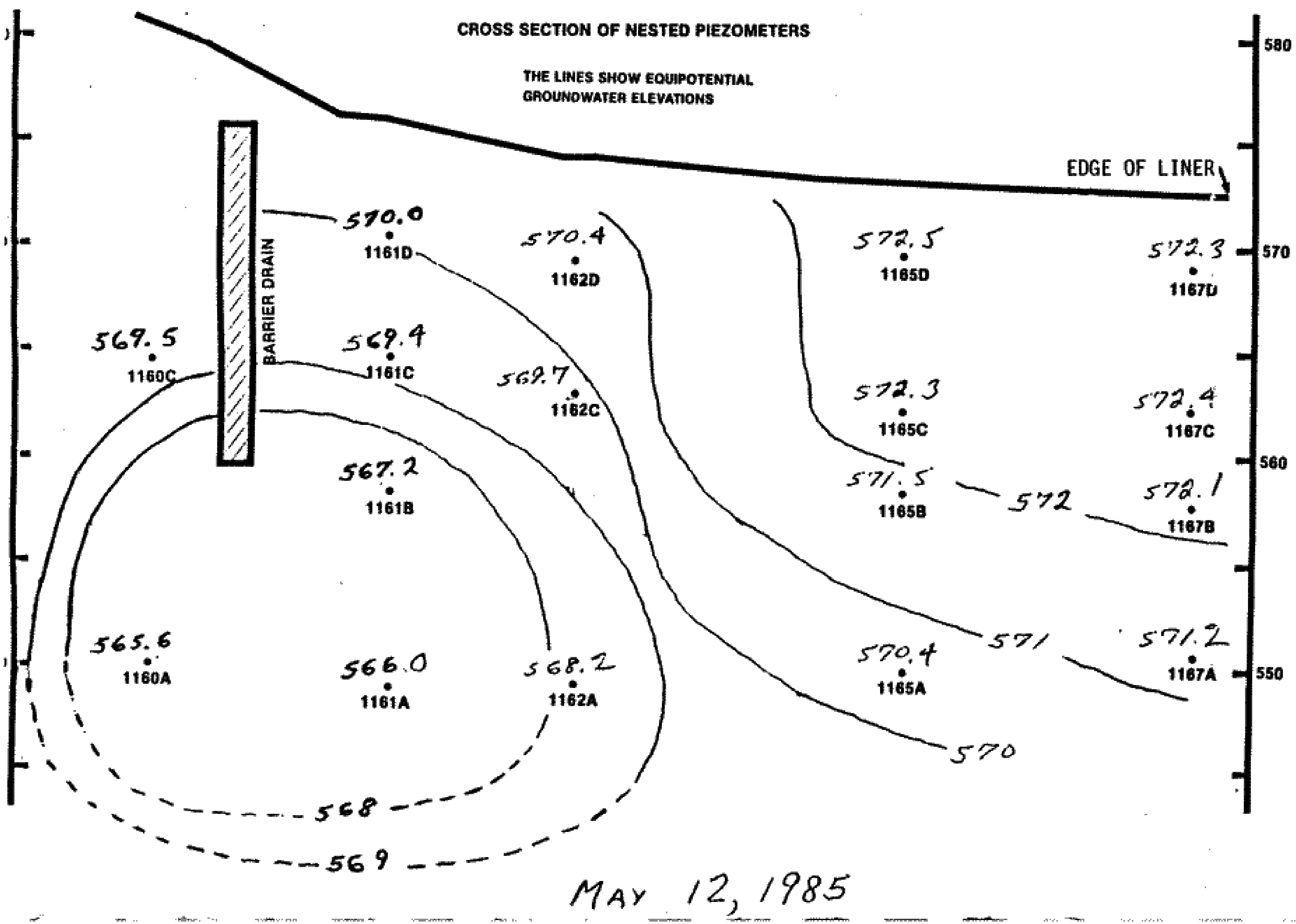
Subsequent analysis indicated that the cutoff wall would only slightly reduce the amount of leachate collected for treatment and therefore was not cost effective. Furthermore, the cutoff wall would prevent any groundwater contamination located outside the wall from ever being recovered by the barrier drain. For these reasons NYSDEC, with the approval of EPA, deleted the groundwater cutoff wall from the remedial work.

Figure 6

LOVE CANAL GROUNDWATER MONITORING PROGRAM

CROSS SECTION OF NESTED PIEZOMETERS

THE LINES SHOW EQUIPOTENTIAL GROUNDWATER ELEVATIONS



SITE MANAGEMENT--OVERVIEW

On August 2, 1978, then Commissioner of the NYSDOH, Robert Whalen, issued an order and directives to the Niagara County Board of Health and the Niagara County Health Commissioner; the City of Niagara Falls; and the City of Niagara Falls Board of Education. Included in this order were directives that appropriate and necessary corrective actions be taken to abate the public health nuisance existing at the Love Canal chemical waste site and that the City of Niagara Falls and the Niagara County Board of Health take all appropriate steps to implement a "Pollution Abatement Plan" subject to the approval of the Commissioner of NYSDEC. On the same date, then Governor Carey established the Love Canal Interagency Task Force chaired by the Commissioner of the New York State Department of Transportation. The Task Force became the management board responsible for carrying out Commissioner Whalen's order. By spring of 1979, the initial phase of remedial work at Love Canal was substantially complete and families living in the immediate area of the canal had been relocated. By this time, the NYSDEC had entered into a Cooperative Agreement with the EPA to complete the remedial program begun by the City of Niagara Falls and in the fall of 1979, the NYSDEC assumed all responsibility for the remedial activities at Love Canal.

In assuming responsibility for the remedial activities at the Love Canal site, the NYSDEC carried out its general functions, powers, and duties as described in Article 3, Title 3 of the New York State Environmental Conservation Law. The Law reads in part that the NYSDEC shall provide for prevention and abatement of all water, land, and air pollution (Article 3, Title 3, Section 3-0301.1(i)). Furthermore, guidance is provided to the NYSDEC in Article 27, Title 13 of the New York State Environmental Conservation Law, which states in part, "the Department may develop and implement an inactive hazardous waste disposal site remedial program for such site" (Section 27-1313(5)(a)). The purpose of both the State and Federal Superfund statutes is to facilitate remediation, by the appropriate State agencies, of abandoned or inactive hazardous waste sites, including appropriate operation and maintenance. The NYSDEC must carry out its statutory responsibilities and will continue to implement an inactive hazardous waste disposal site plan at the Love Canal. Execution of this plan has required and will continue to require the following activities:

1. Investigations of problems attributable to Love Canal
2. Design of appropriate remedial programs to abate pollution attributable to Love Canal
3. Execution of remedial construction to abate pollution attributable to Love Canal
4. Operation and maintenance of facilities built to abate pollution of Love Canal
5. Monitoring of the effects and the effectiveness of remedial programs implemented at the Love Canal site

Such responsibilities will be carried out by the NYSDEC in accordance with all State and Federal rules and regulations. Relief from such responsibility may result from the ongoing litigation (which the State joined in 1980) against Hooker.

Until such time as the NYSDEC has obtained appropriate relief, it will continue to carry out its statutory obligations and retain full responsibility for the remedial program at the Love Canal site.

Role Of The NYSDEC Division Of Solid And Hazardous Waste

Within the NYSDEC, responsibility for the development and implementation of the inactive hazardous waste disposal site remedial program for Love Canal has been assigned to the Division of Solid and Hazardous Waste. Since the time at which the NYSDEC accepted responsibility for the Love Canal site, the remedial programs at Love Canal have been under the direct administrative control of Mr. Norman H. Nosenchuck, P.E., Director, Division of Solid and Hazardous Waste. In February 1985 Mr. Nosenchuck established the Bureau of Western Remedial Action within the Division of Solid and Hazardous Waste. This Bureau is responsible for carrying out the inactive hazardous waste disposal site remedial program at the canal. Within the Bureau there are two sections that are responsible for remedial activities at Love Canal. The Bureau's Special Projects Section is responsible for the day-to-day operation and maintenance of the facilities at the canal and for research into new technologies which may have application at the canal. The Bureau's Remedial Section A is responsible for the investigation, design, and execution of remedial construction projects found to be necessary at Love Canal and for monitoring the effects and the effectiveness of these remedial programs (see Figure 7).

Love Canal Technical Review Committee (TRC): Purpose and Functions

The TRC, established in 1984, was formed by Federal and State agencies involved in addressing the issues surrounding habitation of the Love Canal EDA and remediation of the site. Its purpose is to act as a management group, coordinating the many interrelated governmental activities necessary to resolve these very complex issues.

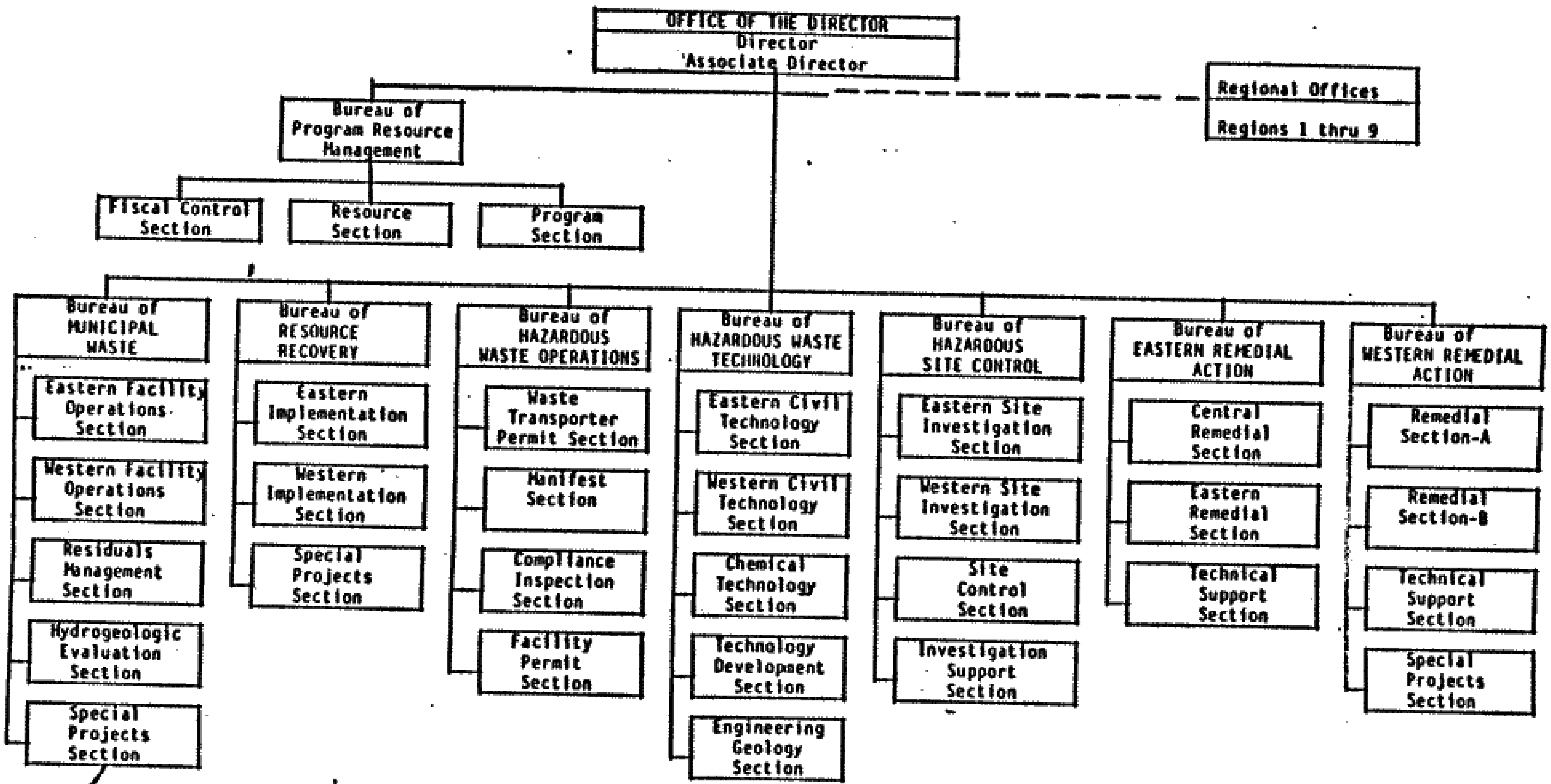
The TRC members are:

William Librizzi, Director, Office of Emergency and Remedial Response, EPA Region II, New York, NY (Chairman)

Robert Ogg, Chief, Hazardous Waste Branch, EPA Region II, New York, NY (Alternate Chairman)

Figure 7

DIVISION OF SOLID AND HAZARDOUS WASTE
ORGANIZATION CHART
1985-1986



APPROVED: DATE: Feb. 22, 1985

Norman H. Nosenchuck, P.E.
Director, Division of Solid & Hazardous Waste

APPROVED: DATE: February 22, 1985

R. Darryl Banks
Deputy Commissioner

APPROVED: DATE: 2/23/85

Henry G. Williams
Commissioner
N.Y.S. Department of Environmental Conservation

Vincent Pitruzzello, Environmental Engineer, Hazardous Waste Branch, EPA Region II, New York, NY

Daniel Van der Meer, Associate Director, Center for Environmental Health, Centers for Disease Control, U.S. Department of Health and Human Services (DHHS), Atlanta, GA

Thomas Welty M.D. (Member from beginning through spring 1985), Medical Epidemiologist, Cancer Branch, Chronic Diseases Division, Centers for Disease Control, U.S. Department of Health and Human Services (DHHS), Atlanta, GA

Robert Huffaker, Associate Director, Office of Public Health, New York State Department of Health (NYSDOH), Albany, NY

Norman Nosenchuck, Director, Division of Solid and Hazardous Waste, New York State Department of Environmental Conservation (NYSDEC), Albany, NY

Use of Consultants - To assist the TRC in performing many of its activities, EPA has contracted with the consulting firm of CH2M HIll. Tasks assigned to CH2M HILL include data collection, quality assurance review of previously collected environmental data, data computerization, statistical and chemical consulting, design and implementation of a pilot study, and other support as required by the TRC. In addition, CH2M HILL served as the mechanism for procurement of the expert scientists who advised DHHS and NYSDOH on development of the habitability criteria. The scientists do not report to nor work under the direction of CH2M HILL; rather, they work directly with DHHS and NYSDOH. CH2M HILL's rolè in the development of the habitability criteria is solely to procure the scientists' services and provide support to the scientists, DHHS, and NYSDOH as requested.

Life Systems, Inc. (Interdisciplinary Consulting and Information Research - [ICAIR]) was contracted to conduct an impartial, multidisciplinary peer review of the proposed habitability criteria and to document the conclusions and recommendations of the peer review panel. The peer review panel will consist of independent scientists selected by ICAIR and approved by the TRC and the public. The conclusions and recommendations of this panel will be considered by the TRC before the habitability criteria are finalized.

ONGOING WORK--OPERATION AND MAINTENANCE

The NYSDEC has been assigned responsibility for direct administrative control of the Love Canal site and the operation and maintenance of all remedial facilities at the site. The following presents an overview of the operation and maintenance of the facilities at the Love Canal site.

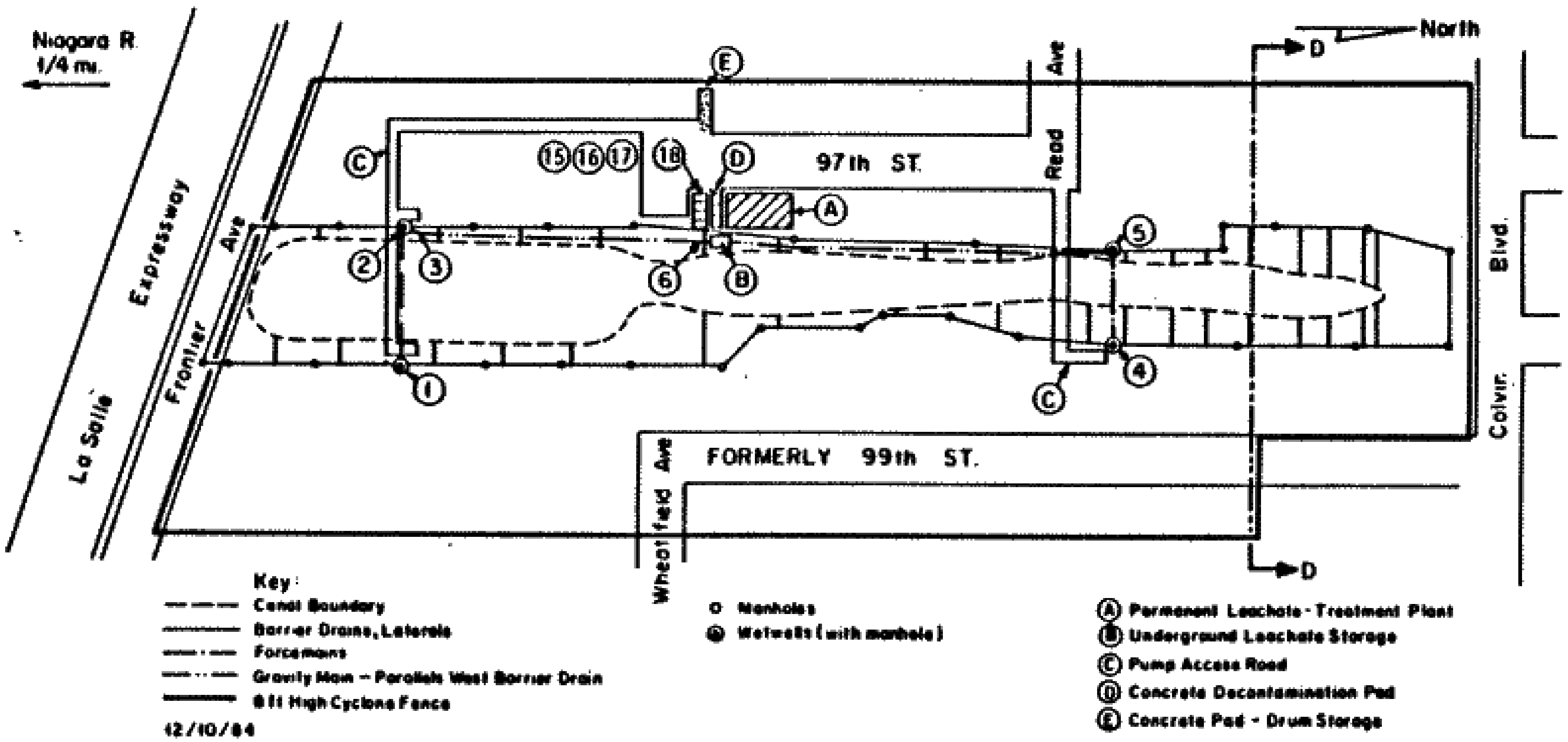
Barrier Drain/Leachate Collection System

As described previously, a drain which serves as a barrier to leachate migration in the near-surface groundwater system completely surrounds the landfill. Leachate which enters the drain system flows to one of four wet wells included in the drain system. From the wet wells, the leachate is pumped to underground storage tanks which are also located within the perimeter of the drain. From the underground storage tanks, leachate is pumped into the onsite leachate treatment plant for processing. Figure 8 presents a plan view of the leachate collection system.

Like any other buried utility, the leachate collection system (including the barrier drain, pumps, storage tanks, etc.) requires maintenance and periodic repair. Pumps, wet wells, and other appurtenances comprising the leachate collection system are regularly inspected. Routine maintenance of these

Figure 8

LOVE CANAL SITE PLAN



facilities includes such activities as lubrication of pumps and motors and replacement of worn or defective parts.

During the summer of 1984, the entire barrier drain was inspected, cleaned, and repaired. Periodic inspection, cleaning, and repair of the leachate collection system will be required as long as the Love Canal site produces leachate, i.e., for an indefinitely long period of time. The State of New York will continue to assure the proper functioning of the system unless and until another entity is assigned the responsibility.

Additional details describing the operation and maintenance of the leachate collection system are presented in the two-volume operation and maintenance manual which is available for public inspection at the Love Canal Public Information Office.

Leachate Treatment Plant

As described previously, the leachate treatment plant provides for gravity separation of the contaminated water from the settleable solids and immiscible fluids collected by the leachate collection system. Removal of chemical contaminants from the water is achieved by passing the contaminated groundwater through large tanks filled with granular activated carbon (see Figure 5).

Currently, the NYSDEC has a contract with CECA, Inc., of Tulsa, Oklahoma to provide fresh activated carbon. The activated carbon has a finite capacity for the adsorbtion of chemical contaminants from the leachate. Once that capacity is used (the carbon is "spent"), the carbon is removed from the adsorption vessel and in the past has been transferred to trucks for disposal at CECOS, International, Inc., a secure chemical landfill located in Niagara Falls, New York. Since July 15, 1985 under the Hazardous and Solid Waste Act Amendments of 1984, the spent carbon can no longer be transported to CECOS for disposal and instead will have to be stored at the Love Canal site.

The leachate treatment process also requires the collection of samples for chemical analysis and the operation of numerous pumps, valves, control devices, air compressors, etc. All these appurtenances require regular maintenance and periodic repair or replacement. In addition, the leachate treatment plant building has lighting, heating, and plumbing facilities which must be maintained in proper working order. Much of this work is performed by NYSDEC staff. Those tasks which cannot be performed by NYSDEC staff are performed by qualified electricians, plumbers, mechanics, etc., under contract with the Department. Additional details describing the operation and maintenance of the leachate treatment facility are presented in the operation and maintenance manual.

As experience has been gained in the operation and maintenance of both the leachate collection system and the leachate treatment plant, modifications have been made to improve the ease, efficiency, and safety of operations and maintenance. For example, recently an improved ventilation system was installed in the leachate treatment facility to improve working conditions within the plant, and plans have been prepared for an Administration Building to be constructed near the leachate treatment plant. The new building will provide space for storage of tools and equipment, office space, improved hygiene facilities for increased worker safety, and a safe area for equipment repair and maintenance.

Resources

Operation and maintenance of the leachate collection system and the leachate treatment plant is the direct responsibility of the Special Projects Section within the Bureau of Western Remedial Action. Nicholas Kolak, Ph.D., is the supervisor of the Special Projects Section. The Special Projects Section has a staff of seven, composed of scientists, engineers, and technicians. All members of the section are trained in and capable of operating the leachate collection and treatment systems.

The leachate collection and treatment systems are normally operated 5 days per week, 8 hours per day. The facilities are operated and maintained by two full-time NYSDEC employees hired for this specific purpose. Other staff in the Special Projects Section serve as back-up operators and provide support assistance as required. The onsite operators and all other staff in the Special Projects Section are also familiar with facility contingency plan and are on-call on a continuous basis to handle any problems which may arise.

The NYSDEC currently spends over $600,000 per year on routine operation and maintenance of the leachate collection and treatment systems. This sum is spent in the following major categories:

- o Personnel services
- o Operating costs
  - carbon
  - carbon disposal
  - heat/light/phone
- o Maintenance/Repairs
- o Improvements

Funding for these activities is approved each year by the New York State Legislature. Such approval is expected each year as long as there is a need to operate and maintain these facilities in order to protect the health and welfare of the people and environment at this site.

Description of Routine Operations

Operation of the facility commences each day when the leachate collection system pumps are turned on. Leachate is pumped from the barrier drain to the underground storage tanks. Once the liquid level in the storage tanks warrants processing, the treatment facility is activated and leachate is pumped from the storage tanks into the treatment plant. During operation, which typically occurs 2 to 3 days per week, the operators continuously monitor tank levels, pump outputs, and various pressure and flow readings, as well as taking samples of the process for laboratory analysis. Leachate processing varies depending upon the quantity of leachate available for treatment. It has been observed that leachate quantities vary according to precipitation throughout the year. When there is insufficient leachate to require operation of the plant, the operators perform maintenance activities on the system as prescribed in the operation and maintenance manual.

The treatment plant has two activated carbon tanks (lead tank and polishing tank), which are operated in series. This method of operation permits the lead tank to be removed from service when chemical analysis shows that the activated carbon in the lead tank is spent. When this occurs, a fresh load of activated carbon is received and the carbon in the lead tank is replaced. The flow is changed so that the lead tank, now with the fresh carbon, becomes the polishing carbon tank.

During plant operation, the quality of the effluent is monitored through periodic sampling. Samples are taken from the activated carbon influent, the midpoint (between the two carbon beds), and the effluent. Thus, the effectiveness of each carbon bed can be assessed continuously. The first set of samples is taken after 5,000 gallons of leachate have been processed. This procedure ensures the receipt of better data by allowing the system to be flushed of process water which has stood from the preceding day. The effluent is discharged directly to the sanitary sewers of the City of Niagara Falls under permit (see Attachment II).

The decision to exchange the carbon in the lead tank is based on the chemical characteristics of the leachate at the influent, midpoint, and effluent points of the system. These data are interpreted relative to the plant's discharge permit with the City of Niagara Falls, which calls for a limit of 50 pounds of soluble organic carbon (SOC) and 6.25 pounds of total suspended solids (TSS) per day as a quarterly average. The maximum daily load is 75 pounds per day SOC and 16 pounds per day TSS. At a flow rate of 30,000 gallons per day, the latter limits correspond to a concentration of 300 ppm SOC and 64 ppm TSS. When the SOC concentration in a sample taken between the carbon beds reaches the level specified in the discharge permit, the carbon in the lead tank is scheduled for replacement. The carbon in the polishing tank continues to remove contaminants during the time required to receive and transfer a fresh load of carbon to the spent tank.

A data summary for SOC and TSS for 1984 is presented in Table 1.

Table 1

CARBON EFFLUENT PERMIT PARAMETERS

		Concentrations (ppm)			
Constituent	No. Data Points	Low	High	2nd Highest	Average
TSS	41	< 2	120	20	6.8
SOC	40	22	320	290	145

Overall, the data show that TSS values are well within the permit limit. There was one value at 120 ppm which exceeded the permit, but this averages out over time. This single high value is unexplained.

The SOC data illustrate permit compliance as well. The values of 320 ppm and 290 ppm lie on either side of the maximum daily SOC concentration of 300 ppm. These data could be associated with disturbances in the field, such as construction or sampling activities, but the frequency of such events is sufficiently low not to warrant concern. In general, plant operations are readily able to meet the permit conditions to insure the highest performance in decontamination of the leachate.

Other types of work performed at the facility include the construction activities required to modify and upgrade the facility. As experience is gained through the operation of the facility, modifications are proposed with the objective of increasing safety and plant performance. Examples include the addition of walkways on the four sludge storage tanks; the addition of a hydrogen peroxide system for odor control; and the pending construction of the Administration Building. This work encompasses equipment and structural or safety modifications which cannot be performed by the treatment facility staff. Subsequent to design, such work is normally performed by private contractors. Another example of this type of work is the recent construction of modifications to the ventilation system at the plant. The end result was increased convenience and safety at the plant.

Currently under design is a project to replace the pumps in the south pump chambers. When completed, this project will result in increased operator safety and reduced maintenance and repairs.

Performance

Flow data represent the volume of leachate being pumped through the carbon beds when the plant is in operation. The need to operate the plant daily is determined by the onsite operators and is based upon the quantity of leachate which has accumulated in the underground storage tanks.

With plant capacity of 160 gallons per minute, operation eight hours per day is sufficient to process the leachate which is produced throughout the year, including the peak volume which occurs during the spring thaw. The average flow processed over each operating day in the past five years is 31,000 gallons; the total leachate volume treated as of August 15, 1985 is 22,580,240 gallons. NYSDEC has never had to operate a second or third shift at the plant to accommodate the volume of leachate produced by the landfill. If the need arose to process an unusually large amount of leachate, the treatment plant is designed to (and can) operate three shifts per day.

To fulfill the need to monitor the chemistry of the chlorinated hydrocarbons within the leachate, samples have been collected every operating day from November 1980 to date. Samples are obtained from the influent, midpoint, and effluent stations and submitted to the NYSDOH for analysis. All samples are analyzed using a gas chromatograph-mass spectrometer for positive identification of chemical components.

The priority pollutants which were initially monitored consisted of 113 components, which are categorized as follows:

Priority Pollutant Categories and Components

Base Neutrals	61	
Acid Extractables	12	
Volatiles	27	
Metals	13	
Total	113	Components

As a result of compiling this data over 4 years, it is evident that many of these priority pollutant components are not present in the influent samples collected at the treatment plant. In the case of base neutrals, only 9 of 61 components have been observed at levels above the detectable limits established by the laboratory. For acid extractables, only 4 of 12 chemicals have been detected and are consistently present. For the volatiles category, 12 of 27 chemicals are normally observable; in the case of trace metals, none of the 13 components was present consistently enough to warrant continued monitoring. Therefore, analysis for trace metals has been discontinued.

Most of these chemicals readily adsorb onto the activated carbon and are easily removed from the leachate. The surface of the carbon, its porous structure, and the process of adsorption (binding to a surface) are represented in Figure 9. For the base neutral category, the 9 components observable in the influent samples at concentrations of several thousand ppb are at or below detectable limits in the corresponding midpoint and effluent analyses. Materials such as chlorinated benzenes (including lindane) and a chlorinated napthalene are examples of this category in which binding to activated carbon is very strong. Similarly for the acid extractable category, the four observable components are represented by phenols and their chlorinated derivatives, e.g., 2,4,5-trichlorophenol (2,4,5-T). The average range in the influent for these materials reaches 2000 ppb, while the corresponding results in the effluent are at the detectable limit of 10 ppb. Such data demonstrate high removal efficiencies for the higher molecular weight components, examples of which are presented in Table 2.

As a result of such efficiencies evident over 3 years of monitoring, the base neutral and acid extractable categories are no longer analyzed routinely. Such sampling is now performed quarterly so that we can continue to monitor for any subtle changes in the composition of the leachate over time. The latter type of data also serves to meet the requirements of the discharge permit which has been authorized for the treatment plant by the City of Niagara Falls. In

Figure 9

CONCEPT OF MOLECULAR SCREENING IN MICROPORES

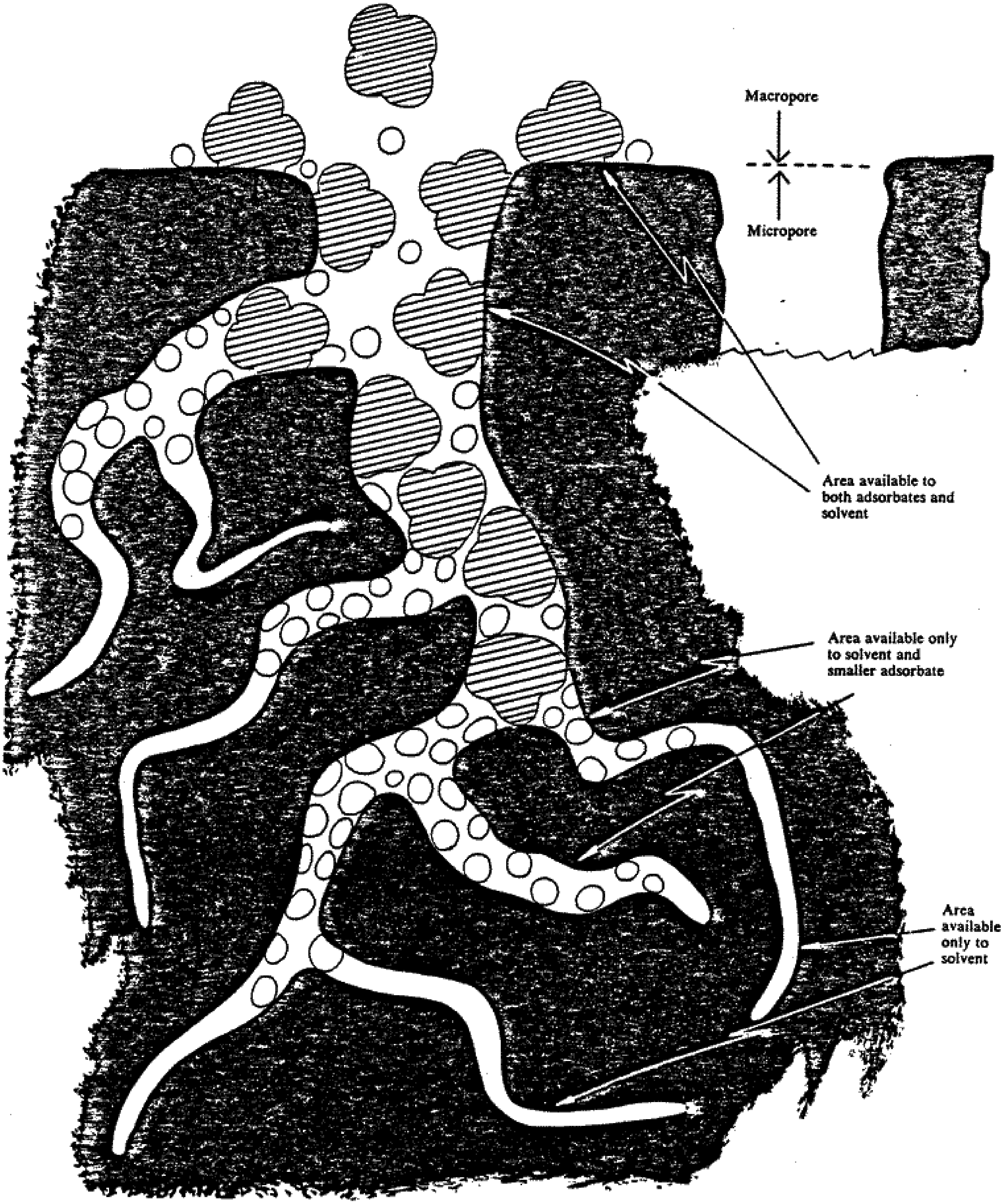


Table 2

TYPICAL REMOVAL RESULTS FOR BASE NEUTRAL AND ACID EXTRACTABLE COMPONENTS

	Influent		Effluent	
	Highest Values Observed (ppb) 1983	Average Value (ppb) 1983	Highest Values Observed (ppb) 1983	Average Value (ppb) 1983
1,4-Dichlorobenzene (Base neutral)	2100	427	10[a]	b
Avg. 1980-83	(113 data points)	347.2	(100 data points)	10
	1983	1983	1983	1983
2,4,6-Trichlorophenol (Acid extractable)	1700	440	38	22.5[c]
Avg. 1980-83	(127 data points)	842.3	(114 data points)	22.5[d]

[a] All 100 data points were below the detection limit of 10 ppb.
[b] There is no significance to averaging data below the detection limit.
[c] This number is the average of four points which exceeded the detection limit.
[d] Note: 110 of the 114 data points are below detection limits.

similar fashion, samples are also submitted quarterly for analysis of total organic phosphorus and total phenols. While 3 years of data for the latter parameters only revealed levels at the detectable limits in the laboratory, quarterly monitoring will be sufficient to provide notice of any changes in the quality of the leachate.

The volatile priority pollutant chemicals in the influent samples represent the highest concentrations of all monitored components. Data for the three components representing the highest concentrations in this class, i.e., benzene, toluene, and chlorobenzene, are presented in Table 3.

Table 3

VOLATILE INFLUENT DATA FOR 1984

Compound	Highest Values Observed (ppb)	Average Value (ppb)
Benzene	7,000	2,400
Toluene	70,000	17,600
Chlorobenzene	15,000	4,500

Upon treatment with activated carbon, volatiles are removed from the leachate with more difficulty than are the base neutral and acid extractable categories. Nevertheless, benzene, toluene, and chlorobenzene are reduced to laboratory detection limits in the effluent discharge stream (Table 4), well within the requirements of the discharge permit. The treatment plant is operated in a conservative manner to ensure removal of the greatest amount of contaminants, thereby producing the highest quality discharge.

Table 4

VOLATILE INFLUENT DATA FOR 1984

Compound	Highest Values Observed (ppb)	Average Value (ppb)
Benzene	4.2	4
Toluene	11	11
Chlorobenzene	8	8

The chemicals which comprise the volatile category are normally used in industry as solvents. It should not be surprising that these materials possess a lower binding capacity with the activated carbon. Chloroform and methylene chloride are examples of two components which are not readily retained by carbon and "break through" into the effluent easily. Therefore, the data for these two parameters are constantly monitored to maintain plant operations within the permit limits. The data to date reflect that these two components and the entire class of volatiles have been controlled effectively under the discharge permit for the protection of the residents and the environment.

As discussed previously, materials such as tetrachlorodibenzodioxins (TCDD) and base neutrals bind tightly to the activated carbon and do not readily "break through" to the effluent. While all of the priority pollutants have been monitored in the past, noting that base neutrals and acid extractables have since been discontinued, overall plant performance is governed by SOC and TSS in accordance with requirements of the City of Niagara Falls. The latter two parameters are analyzed by RECRA Environmental Laboratories (Amherst, New York), where results are communicated by telephone to the plant operator with a 5-day turn-around. This time frame is reasonable for the laboratory and is satisfactory for the maintenance of plant operations. "Break-through" of the higher molecular weight chemical components does not occur instantly relative to daily operations; monitoring of SOC and TSS assures that such chlorinated materials do not exceed the permit conditions. As the values for SOC and TSS rise, a decision by staff is made to change the primary bed of activated carbon. Upon replacement of the primary bed of carbon, the cycle starts anew.

GROUNDWATER MONITORING PROGRAM

The NYSDEC has a contract with the E.C. Jordan Co., Portland, Maine, to design a long-term groundwater monitoring program. The monitoring program will provide data to evaluate the effects and the effectiveness of the leachate collection system. Until the permanent long-term monitoring program is operational, the NYSDEC has used and will continue to use a system of approximately

94 wells to monitor the effects and the effectiveness of the leachate collection system. In fact, the Department's interim monitoring program has provided much useful data to assist in the design of the permanent system.

Monitoring wells are located around the Love Canal site at varying distances (6-400 feet) from the drain. Figure 10 shows a plan view of the location of the wells currently being monitored. The wells are also installed to differing depths so that data specific to a particular soil or bedrock interval can be obtained.

Generally, measurements of water elevations are made in every well once a month. The NYSDEC has also installed continuous water elevation recording devices on two wells. These devices are moved periodically to collect a continuous record of water elevation fluctuations at various locations. Approximately once every 3 months, water samples are collected from approximately 20 wells and are chemically analyzed for volatiles and base neutrals.

For the past 2 years, quarterly reports have been prepared compiling the data collected. One quarterly report is appended to this report as Attachment III. This document deals with a period of time before the cover over the Love Canal site was improved and extended.

Copies of all future quarterly reports will be available for public inspection within approximately 3 months after the close of the quarter. A summary of the results of the interim monitoring program is presented below.

EFFECTS AND EFFECTIVENESS OF THE REMEDIAL PROGRAM

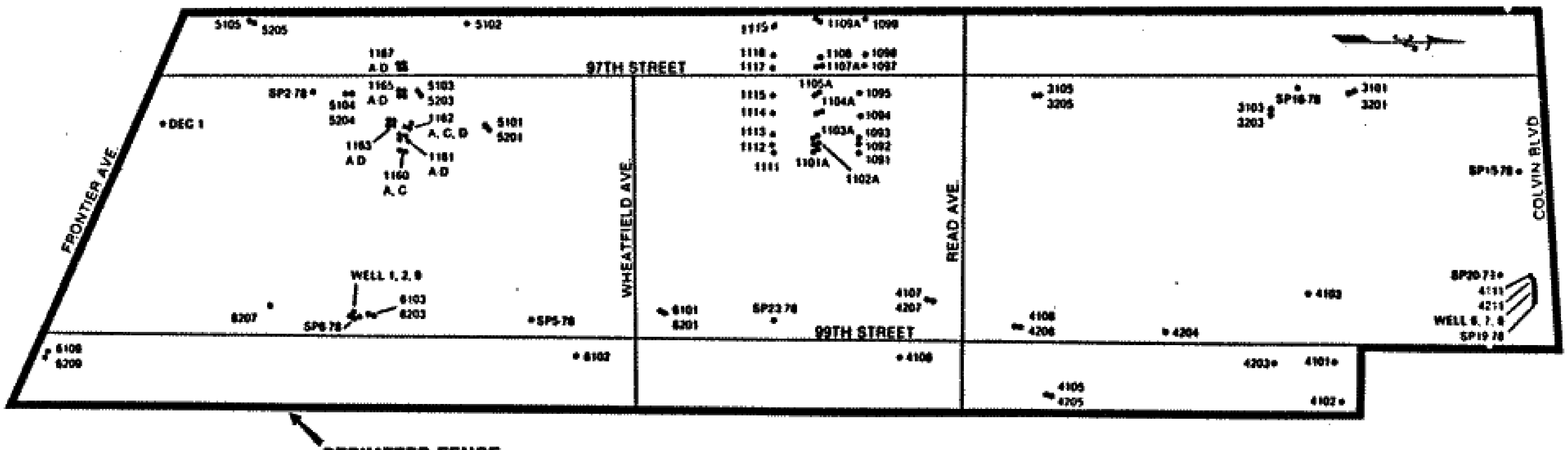
Groundwater Monitoring

The NYSDEC has been monitoring groundwater elevations and groundwater quality at the Love Canal site since 1980. All data collected by the Department have been and will in the future be provided to the Technical Review Committee.

Figure 10

PLAN VIEW-MONITORING WELLS

LOVE CANAL GROUNDWATER MONITORING PROGRAM



Groundwater elevations in the shallow groundwater system are lowered in the vicinity of the barrier drain. The amount of and the distance to which this lowering is observed varies (2 to 6 feet) seasonally and with precipitation. Prior to 1984 and the expansion of the cap over the Love Canal Site, the shallow groundwater system was affected by the drain to a distance of approximately 150 feet parallel to the barrier drain line. It is unlikely that the dewatering effect will extend any significant distance beyond the edge of the expanded cap (if at all) and it may take a number of years for water elevations in the shallow groundwater system beneath the expanded cap to reach equilibrium.

Groundwater elevations measured in the shallow groundwater system in the immediate vicinity of the drain indicate groundwater flow is converging on the drain from all directions (see Figure 6).

The barrier drain acts as a sink for the shallow groundwater system and therefore will capture any leachate migrating horizontally out of the Love Canal wastes in the shallow groundwater system.

Chemical contaminants dissolved in the groundwater may be recovered by the barrier drain from those areas immediately adjacent to the drain.

Chemical Concentrations

From October 1980 through September of 1984, approximately 150 groundwater samples were collected from the 94 wells located within the fence surrounding the Love Canal site. These samples were chemically analyzed and 13,040 concentration values were determined. Most of the values (93.6 percent) indicate that the concentrations of the contaminants, if present, were below the detection limits of the standard sampling and analytical procedures used.

Tables 5 and 6 present lists of all the Love Canal Indicator Compounds as determined by the NYSDEC. The lists are made up of all the organic compounds found in the influent to the leachate treatment plant plus pyrene, which showed a correlation with respect to distance from the canal.

For the compounds listed in Table 5, there is a statistically significant correlation between concentration and distance from the sampling location to the Love Canal (nonparametric, Spearman correlation coefficient of <-0.25) for one section of the west side of the canal between the Love Canal Leachate Treatment Plant and west Frontier Avenue. This correlation coefficient was chosen to prevent possible good indicators from being excluded. These chemicals may be good indicators of the extent of groundwater contamination attributable to Love Canal.

TABLE 5

COMPOUNDS SHOWING GOOD CORRELATION OF CONCENTRATION WITH RESPECT TO DISTANCE

Compound Name	N	Corr. Coefficient	Alpha
1,2,4 Trichlorobenzene	114	-0.53687	0.0001
Benzene	114	-0.50549	0.0001
Chlorobenzene	114	-0.53565	0.0001
Chloroform	111	-0.55891	0.0001
Toluene	111	-0.52531	0.0001
Trichloroethylene	114	-0.49761	0.0001
1,2-Tran-dichloroethylene	66	-0.49459	0.0001
Alpha BHC	32	-0.31558	0.0785
Delta BHC	31	-0.39184	0.0293
Gamma BHC	32	-0.45845	0.0083
Hexachlorobenzene	113	-0.31368	0.0007
Phenol	98	-0.32742	0.0010
Tetrachloroethylene	105	-0.37233	0.0001
1,1,2-Trichloroethyane	112	-0.25620	0.0064
1,1,2,2-Tetrachloroethane	113	-0.35120	0.0001
1,2-Dichlorobenzene	113	-0.38974	0.0001
1,3-Dichlorobenzene	113	-0.25945	0.0055
1,4-Dichlorobenzene	113	-0.35442	0.0001
2-Chloronaphthalene	110	-0.27430	0.0037
2,4-Dichlorophenol	102	-0.26691	0.0067
2,4,6-Trichlorophenol	98	-0.30008	0.0027
4-chloro-3-methyl phenol	98	-0.27680	0.0058
Hexachlorobutadiene	114	-0.25846	0.0055

TABLE 6

COMPOUNDS SHOWING POOR CORRELATION OF CONCENTRATION WITH RESPECT TO DISTANCE

Compound Name	N	Corr. Coefficient	Alpha
Carbon tetrachloride	112	-0.16163	0.0887
Ethyl benzene	110	-0.20219	0.0341
Naphthalene	110	-0.11291	0.2125
Pyrene	110	-0.11982	0.2125
2-Chlorophenol	98	-0.15444	0.1289

For the compounds listed in Table 6, there was no statistically significant correlation between concentration and distance from the sampling location to the Love Canal (nonparametric, Spearman correlation coefficient of >-0.25). The absence of a significant correlation may be due to two reasons: (a) the concentration of the compound was generally below the detection limit and therefore not quantified, and (b) the detection of the compound was sporadic and the concentration varied randomly with distance from the canal. The compounds presented in Table 6 would not be good indicators of the extent of groundwater contamination attributable to Love Canal.

At a distance of 100 feet from the barrier drain, 86 percent of all analyses were below the limit of detection of the standard sampling and analytical procedures used.

At a distance of 225 feet from the barrier drain, 95 percent of all analyses were below the limit of detection of the standard sampling and analytical procedures used. Figure 11 shows a plot of percent detects vs. distance from the barrier drain. Table 7 lists the substances with positive results beyond 225 feet.

Figure 11

Plot of Percent of Results above Detection Limit vs. Distance from the Barrier Drain at Love Canal

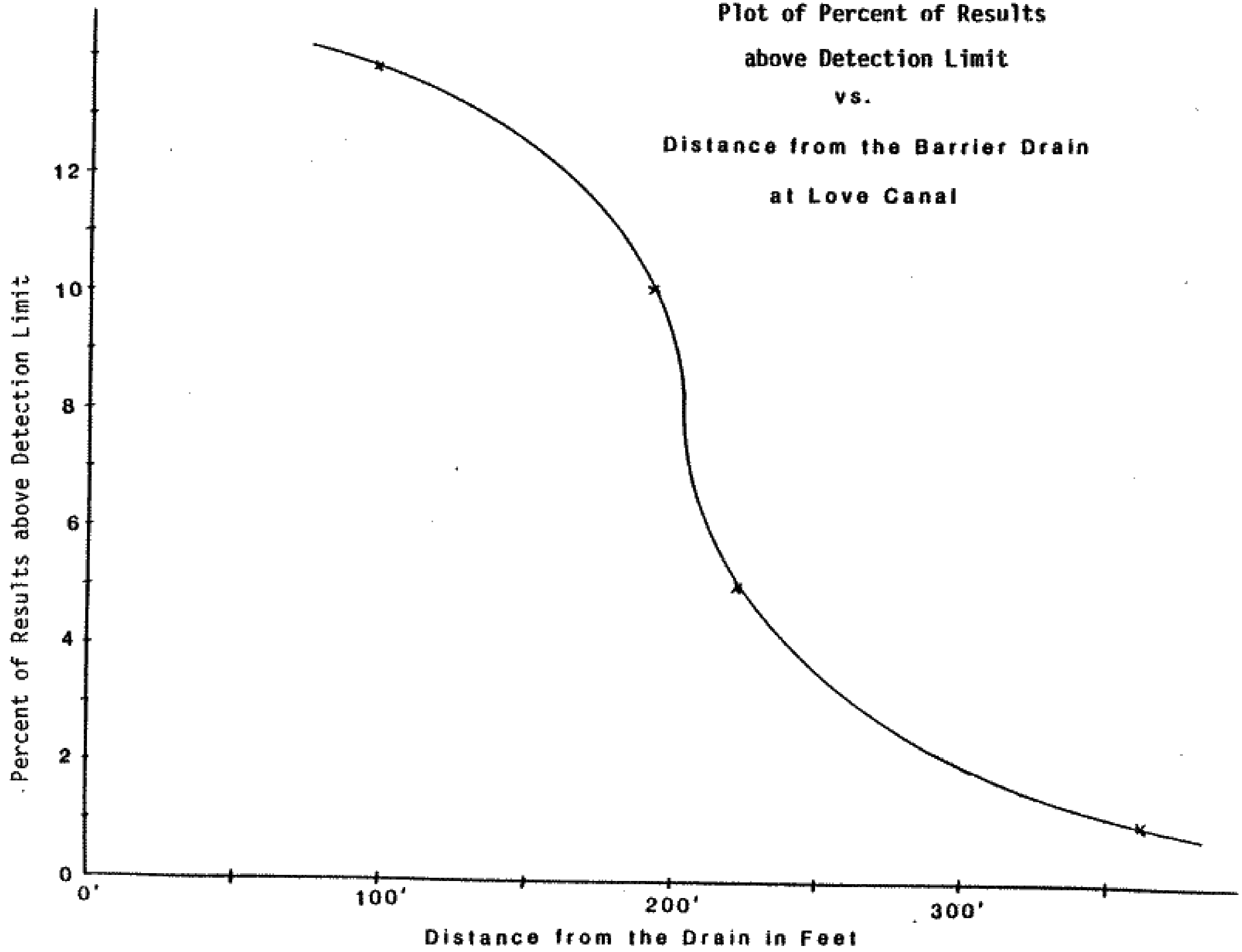


TABLE 7

SUBSTANCES IN RINGS I AND II WITH POSITIVE RESULTS BEYOND 225 FEET FROM THE BARRIER DRAIN

Substance	Number of Results Above Detection Limits
BHC alpha	2
Benzene	1
BHC beta	1
Bis (2 Et-Hexyl) Phthalate	4
Chloroform	2
Chromium	3
Copper	4
BHC Delta	2
Di-N-Butylphthalate	1
Endosulfan Sulfate	5
BHC Gamma (lindane)	2
Methylene Chloride	7
Phenol	1
Toluene	1
4,4-DDT	5

Variations in chemical concentration with distance from the barrier drain are best observed in closely spaced wells located close to the drain (see Figure B.1 in Attachment III).

The NYSDEC observed no statistically significant correlation between chemical concentrations in groundwater and time elapsed following installation of the barrier drain. Any correlation between chemical concentration observed in the groundwater and time elapsed following installation of the barrier drain can be best observed by analyses of samples collected very near the drain. Otherwise, most of the concentration values would be found to be below limits of detection or at concentrations too close to the limits of detection to allow for a measurement of any significant change.

CURRENT STATUS

The storm sewers continue to be a source of contamination, transporting contaminants to area waterways. Sanitary sewers also transport contaminated material through the sewer system, with overflows and surcharging creating a potentially hazardous situation. As a result of the environmental monitoring study published by EPA in 1980, "Environmental Monitoring at Love Canal," a determination was made by U.S. Department of Health and Human Services (DHHS) that the area surrounding the Canal (i.e., the EDA) would be no less habitable than other tested industrial areas in Niagara Falls if the Canal itself were constantly safeguarded against future leakage and local storm sewers and their drainage tracts were cleaned of existing contamination.

In March of 1983, the sewers were severed at the Canal to deter future contaminant flow via these pathways. While the contamination that currently exists in the sewers should not increase, these pollutants could eventually migrate from the sewers and end up in creek and river sediments.

During the first three weeks of January 1983, an intensive field investigation was performed and nearly 1,000 samples were collected by Malcolm Pirnie, Inc. Laboratory analysis and contamination assessments were performed and as a result, engineering alternatives for remediation of the sewers and creeks were developed and evaluated. More recent sampling by the NYSDOH was undertaken in April 1984 to confirm the presence of dioxin in Bergholtz Creek. This study revealed dioxin concentrations above 1 ppb in Bergholtz Creek sediments west of 93rd Street.

During any remediation at Love Canal, special consideration will be given to the remedial activities under way at the 102nd Street Landfill, which is a site adjacent to the canal. The State, EPA and the responsible companies are actively engaged in a remedial investigation of the 102nd Street Landfill under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980, (Federal Superfund Program), P.L. 96-510) which will provide the data necessary to design a permanent remedial plan. Remediation recommended for the

102nd Street outfall area will factor in the potential of contamination by the Love Canal landfill and will be coordinated with any cleanup activities to be undertaken at the 102nd Street site.

ALTERNATIVES EVALUATION

The Malcolm Pirnie investigation conducted for the NYSDEC was divided into five study areas:

- North storm and sanitary sewers
- Black and Bergholtz Creeks
- South storm and sanitary sewers
- 102nd Street outfall
- West storm and sanitary sewers

For each area, samples were taken of aqueous and sediment media to determine the levels of contamination. In addition, the bedding materials encircling the sewers were also sampled. The basis for selecting a remedial alternative was the development of a contamination assessment which established a ranking of remedial actions that incorporated both relative concentration and sampling location.

Subsequently, remedial alternatives were developed for each task area and were evaluated with emphasis placed on effectiveness, reliability, worker safety, ease of implementation, environmental impacts, and public acceptance. Feasible alternatives were then selected and re-evaluated; the cost to arrive at a recommended cost-effective alternative was included in this re-evaluation. However, following completion of the Malcolm Pirnie study, EPA determined that certain requirements of the National Contingency Plan were not fully addressed by the study. EPA retained CH2M HILL to expand upon the Malcolm Pirnie study and to evaluate additional remedial alternatives that were in compliance with applicable laws. The results of the CH2M HILL study were presented to the public, and EPA and NYSDEC selected a series of remedial alternatives based on this input.

No-Action Alternative

The no-action alternative was considered for each study area, but was eliminated for the following reasons:

- Prior to the initiation of the Malcolm Pirnie investigation, studies by EPA (Survey of Chemical Contamination in Love Canal Storm Sewers) identified the sewers leaving the Canal as pathways of contamination. A previous recommendation by the federal Centers for Disease Control (CDC) supported rehabitation if various remedial actions were initiated, including the cleaning of the storm sewers and contaminated sediment in the receiving waters.
- As part of the initial cleanup under CERCLA, the storm and sanitary sewers were severed from the Canal area, thus deterring contamination from continuing to leave the site. It is the intention of the State and local authorities to continue to use the existing sewers if the area becomes reinhabited. With or without residential influence, contaminants in the sewers will continue to migrate due to area runoff as well as pipe infiltration. Storm sewers will discharge this hazardous material to area waterways, while sanitary sewers will transport the material to downstream points in its system that are subject to overflows to the storm sewer system.
- The detailed sampling effort performed by Malcolm Pirnie provided evidence that contamination does exist, some at high ppm levels, within the sewer system. Within the samples taken, benzene and its derivatives

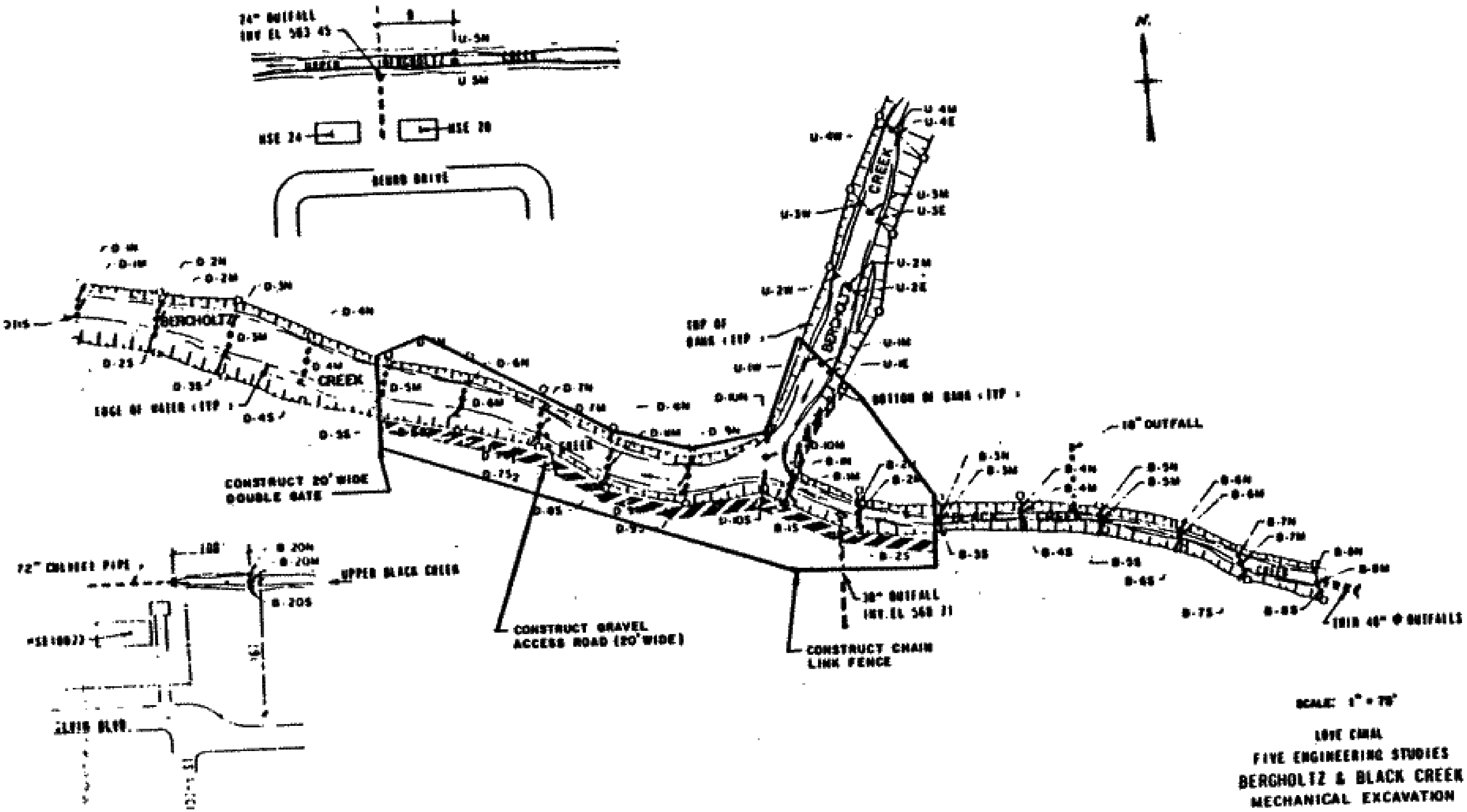
were identified at 2,600 ppm, toluene up to 280 ppm, and trichlorobenzene at up to 310 ppm. Many inorganics such as arsenic and zinc were also identified at levels over 100 ppm. Metals were found throughout the study area and beyond at high concentration levels (ppm's).

- Of major concern, however, is the presence of dioxin (2,3,7,8 TCDD) in the study area and, because of its toxicity, the potential harm to public health and the environment. The toxic effects of TCDD have been extensively studied in animals. These studies indicate that on a molecular basis TCDD is perhaps the most poisonous synthetic chemical. Human exposure to TCDD has induced chloracne, polyneuropathies, liver dysfunction, and enzyme induction. In animals, TCDD has been shown to be teratogenic, fetotoxic, and carcinogenic. Other chronic effects of TCDD in animals include hepatotoxicity (liver effects), renal toxicity, endocrine effects, immunologic effects (impairment of cellular immunity), and hematologic effects. TCDD has been also shown to accumulate and concentrate in aquatic and terrestrial organisms directly from water uptake as well as from food contaminated with dioxin. TCDD is suspected of being a human carcinogen because of multiple-positive animal carcinogenicity studies.

The EPA sampling effort (1980) detected dioxin in a number of storm sewer sediment samples at decreasing concentrations with distance from the Canal. Dioxin levels as high as 650 ppb were detected. The 1983 Malcolm Pirnie study also identified dioxin in various creek and sewer sediments but at significantly lower levels. Eleven of the more than 1000 samples proved positive, with six exceeding 1 ppb in the waterway sediments and five in the sewers. Figure 12 indicates where these quantifiable concentrations were identified.

Figure 12

Bergholtz & Black Creek Sample Location Points



Four sediment samples were taken by NYSDEC in the vicinity of the 93rd Street storm sewer outfall and analyzed by NYSDOH for dioxin during April 1984. Results revealed significant levels of dioxin (6.4-10.2 ppb). Sampling of Bergholtz Creek sediments by NYSDEC in the summer of 1984 indicated dioxin (11 ppb) as far downstream as 90th Street.

The dioxin in the EDA has been found in sediment deposits in creeks bordering residential areas. The potential for exposure has existed and will continue to be present. These are areas that are currently inhabited and are also considered for rehabitation; increases in populations will subsequently increase the population at risk.

There are several pathways of human exposure to contaminated waters and sediments, as summarized below:

- Ingestion of fish. The discharge of TCDD-laden sediment from these sewers and streams is contributing to levels of TCDD in fish in the Niagara River and Lake Ontario that exceed NYSDOH, Canadian, and Federal Food and Drug Administration health advisories (10 ppt[a], 20 ppt, and 25 ppt, respectively).

  Chemical analyses of various species of fish indicate levels of TCDD up to 417 ppt (near Love Canal) and an average level of approximately 34 ppt. EPA and New York State have identified a limited number of sources of TCDD along the Niagara River, and Love Canal is one of the most significant sources. TCDD concentrates at high levels in fish tissue from the water, sediment, and ingestion of other fish through what is known as bioconcentration, bioaccumulation, and biomagnification. EPA, states, and other researchers have also detected significant levels of

a - Parts per trillion

TCDD in fish near other TCDD sites, particularly sites in the States of Missouri and Michigan.

To minimize the bioaccumulation of TCDD in fish in the Niagara River, the discharge of TCDD-laden sediments should, to the extent practicable, be eliminated from the streams and sewers of Love Canal.

- Sewer maintenance. If maintenance is required on a typical sewer, standard practice is to ventilate the sewers before entry and not to use special equipment such as respirators or dermal protection. The no action alternative would necessitate the use of higher levels of protection for entry into the Love Canal EDA sewers in order to minimize worker exposure.
- Potential inhalation of volatile organics. Volatile organics were detected in some samples in the sewers. Although emissions through manholes or the outfalls will be dispersed to some degree by winds and atmospheric turbulence, the potential for the public to inhale volatile organics from the sewers will remain.
- Surcharging of sediments to surface. Surcharging to within a few feet of the surface was observed in the storm sewer manholes by Malcolm Pirnie. Surcharging of the sanitary sewers has been reported in the area of 91st, 92nd, 93rd Streets and Read Avenue during periods of high rainfall, and in the area of the storm sewers to the surface along 93rd Street. Chemical concentrations in material surcharged to the surface would become diluted as mixing with water and surface material occurs. The amount of sediment deposited would depend on local conditions. Human exposure would depend on the duration of the condition (e.g., surface washing by city service and rain and chemical degradation would decrease concentrations), contact time, and the rates of soil ingestion,

intestinal absorption, dermal absorption, and inhalation of entrained soil.

- Potential backflow of sanitary sewer sediments to basements. Backflow preventers were not installed in many of the Love Canal EDA homes. Therefore, the potential exists that the sanitary sewer sediments may be discharged to the homes. If such discharges remain undetected, exposure to contaminated material may result.
- Exfiltration to groundwater. The spread of contaminants that may have left sewer pipes was reduced in the Love Canal EDA by the absence of a drainage (bedding) system to channel the groundwater away from the pipes. The shallow groundwater increases the potential for release. Certain chemicals, such as benzene, are highly soluble and may migrate with the groundwater. However, no such exfiltration of contamination was detected during the Malcolm Pirnie study. TCDD would not be expected to be transported by this means.

Transport of creek sediment with stream flow will tend to decrease the concentrations over time, but this possibility is reduced by the continued loading from the storm sewer outfalls, although the amount of TCDD-contaminated sediment in the storm sewers is limited and would in time be totally dissipated into the creeks. Potential human exposure from creek contaminants may occur in two scenarios:

- Recreational activities. Exposure could occur during swimming, wading, or other recreational use of the creeks. Access is temporarily limited along Black and Bergholtz Creeks because of fencing along the banks down to the 93rd Street School grounds. While the general effect of fences is to reduce exposure, they can be breached, and therefore, are neither an effective nor a permanent remedy pursuant to CERCLA. Access to Cayuga Creek is open but the sediment here had the lowest concentrations. During recreational activities, water may be ingested or absorbed through the skin. The exposure factors and their uncertainty are much the same as discussed in the section on sewer surcharging. Ingestion of dried sediment along the creek banks is a potential additional exposure route.

- Potential migration to residential yards. A high rainfall rate or a high stage of the Niagara River could produce flooding of the creeks into local residential yards. The qualitative nature of the human exposure potential is much the same as discussed above for surcharged sewer sediments.

Correspondence (February 22, 1984) from the NYSDOH (Attachment I) states, "It is clear that the presence of Love Canal associated chemicals, especially dioxin, in the sewers and creeks does pose a direct threat to children playing in the creeks, persons using yards subject to flooding from the creeks, and persons exposed to biota downstream subject to exposure to chemicals being washed down to them."

A very low potential exists for contamination of the drinking water supply taken from the Niagara River through creek sediment transport and suspension of the 102nd Street outfall sediment.

The no-action alternative was thus eliminated based upon the existence of hazardous chemicals (especially dioxin) within the study area waterways and fish populations, and the potential that exists for continued exposure to the local community.

Since dioxin is persistent in the environment, has been shown to bioaccumulate in the tissues of animals, and has low solubility in water, the contamination will remain in the environment unless efforts are undertaken to contain it. This has been recognized in other cases such as U.S. v. Vertac, 489 F.SUPP. 870 (E.D. Arkansas, 1980), and in consent decrees, such as United States V. Hooker Chemicals and Plastics Corp., 450 F.SUPP. 1067 (W.D.N.Y., 1982), where Occidental Chemical Corporation agreed to clean up TCDD-laden sediment from a local creek and clean out contaminated sediment in a storm sewer system. This consent decree demonstrates that TCDD remedial actions are feasible and have been ordered by the courts or agreed to by responsible parties.

Sewer Remedial Evaluation

Based on the sampling results, contamination exists within the sewer sediments at levels that warrant cleanup. The remedial options that are available for storm and sanitary sewers are identical. The sampling effort indicated that the bedding material surrounding the sewers was quite clean and that no remediation would be necessary for these areas. A positive note was that the sewers, except for minor defects, were structurally sound. As a result, various alternatives were developed.

- No-action--While the no-action alternative for the sewer system has been rejected, portions of these lines were found to be relatively clean and would require minimal or no remediation.
- Monitoring--One option that exists is to periodically sample the sewers in lieu of a physical remediation measure. This may not be cost-effective in light of the high cost of analysis and the potential that a future cleanup may be required.
- Abandonment in Place--While this would be a detriment to future rehabitation efforts, cutting off or plugging the sewer lines and abandoning

the system is a viable alternative. However, contaminant migration via exfiltration would remain a future threat. The structural integrity of lines is a major factor in evaluating the usefulness of the current system.

- Sewer Cleaning--Numerous methods exist to remove accumulated sediment from existing sewer lines. Power rodding, hydraulic scouring and flushing, bucket dredging, suction cleaning with pumps or vacuums, chemical treatment, or combinations of these are available. Depending on the remedial option selected, sewer repair via grouting or pipe relining may be required to deter groundwater infiltration and/or sewer exfiltration. Physical inspection of the sewers as a diagnostic tool should be performed in conjunction with any remediation. Defects such as offset joints, root intrusion, broken or collapsed pipe, and leaky connnections can be identified during this inspection.
- Removal and Replacement--The actual excavation of portions of the sewers to remove contaminated pipe and bedding material followed by disposal is a possibility. This option is necessary when the degradation of the sewers is sufficiently severe to preclude current or future service via these facilities.

The above alternatives were evaluated to arrive at a selected alternative. Certain assumptions were applied, many of which were derived from information accumulated during the sampling effort:

- The potential for sewer use to continue is high.
- The physical, structural condition of the sewers is good.
- The bedding material is basically uncontaminated.
- The degree of contamination found in the sewers is significant.

- The levels of contaminants, though found in sediment (no standard exists), are high enough to present risk and, therefore, warrant concern.
- The creeks will continue to be the repository for this material if conditions remain unchecked.
- Options selected will be consistent with remedial efforts at the 102nd Street Landfill to the degree feasible at this time.

The following recommendations were drawn from the evaluation:

North - All of the storm sewers (see Figure 13) should be cleaned utilizing a hydraulic flushing technique, since this method would provide the most complete cleanup. Of most concern are areas downgradient of Love Canal connection points located at 97th and 99th Streets. Also cleaned will be storm sewer tributary lines that may have been subject to surcharging and the 1,400-foot portion of Black Creek which is enclosed in corrugated metal pipes. All sanitary sewers (see Figure 14) will be cleaned.

South - All of the storm sewers in this area (see Figure 15) will be hydraulically cleaned. Of greatest significance are those lying downgradient of Love Canal connection points, i.e., 97th and 99th Streets and Wheatfield Avenue as well as tributaries to these areas. All sanitary sewers (see Figure 16) will be cleaned. Television inspection is recommended in three distinct locations to verify the presence of unknown connections and/or the existence and nature of structural pipe damage.

Of special concern is the relationship of this system to the 102nd Street Landfill. The Malcolm Pirnie report recommends cleaning of the storm sewers up to the landfill property line. The CH2M HILL study recommended a complete

Figure 13

North Storm Sewers

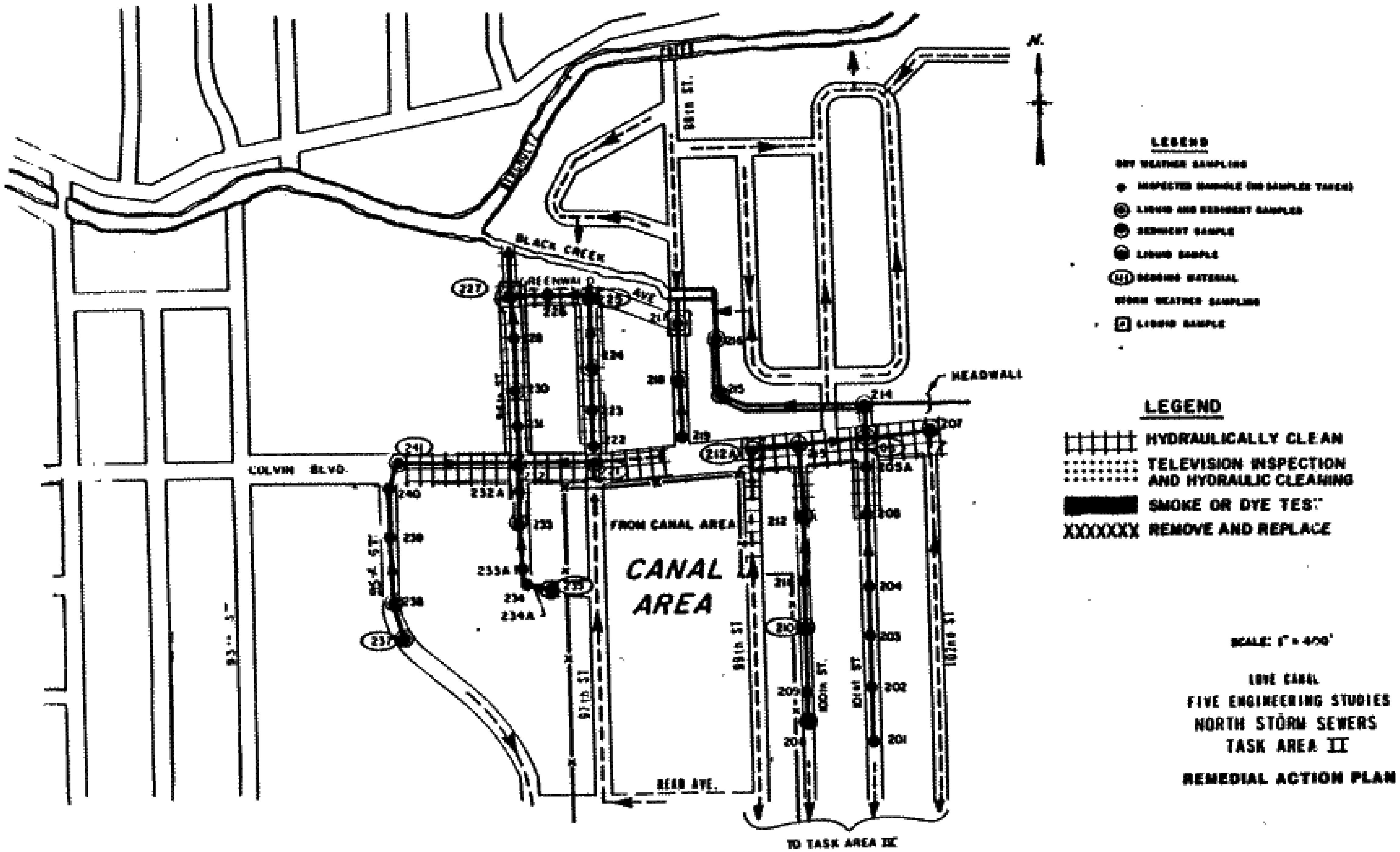


Figure 14

North Sanitary Sewers

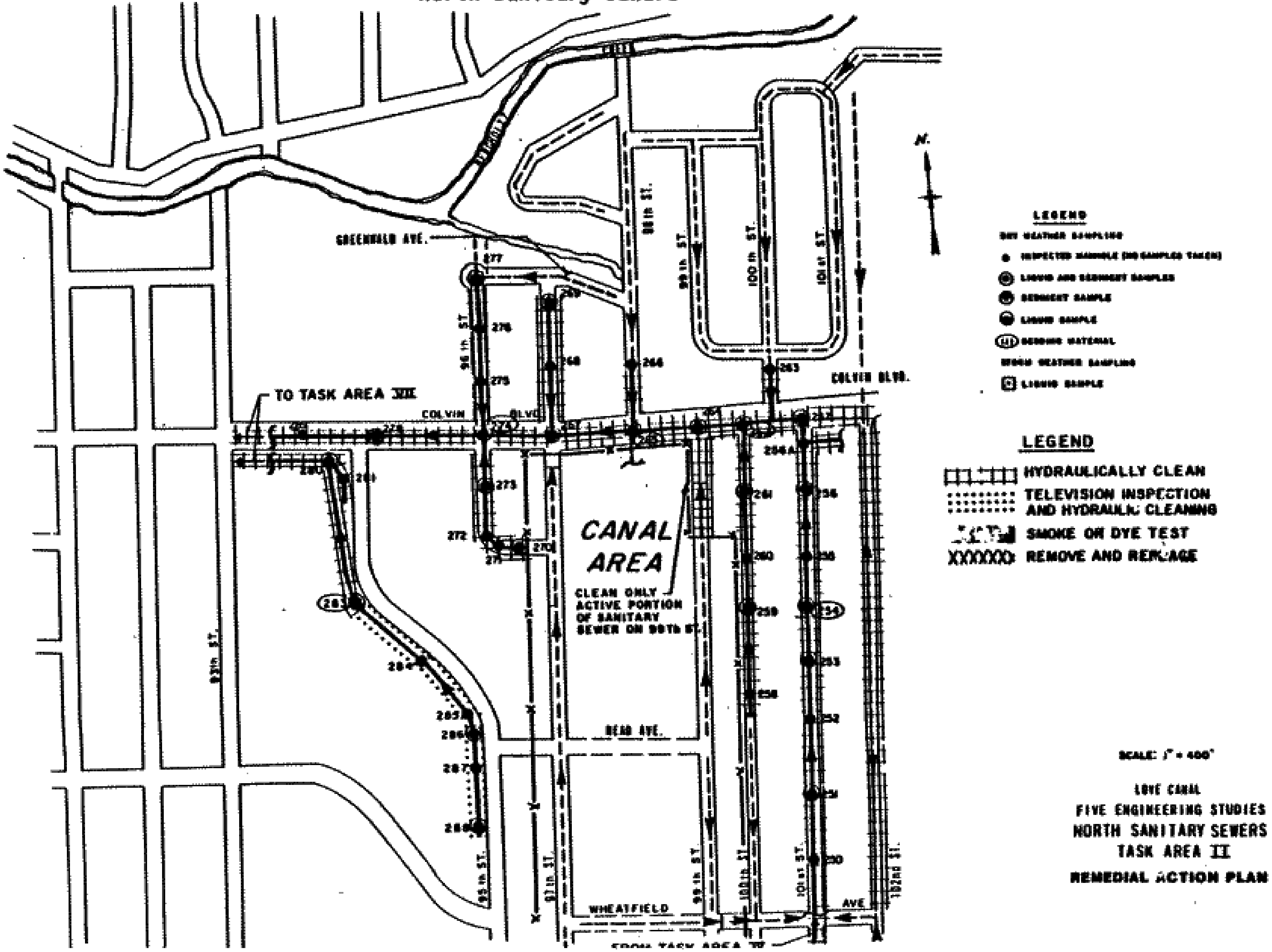


Figure 15

South Storm Sewers

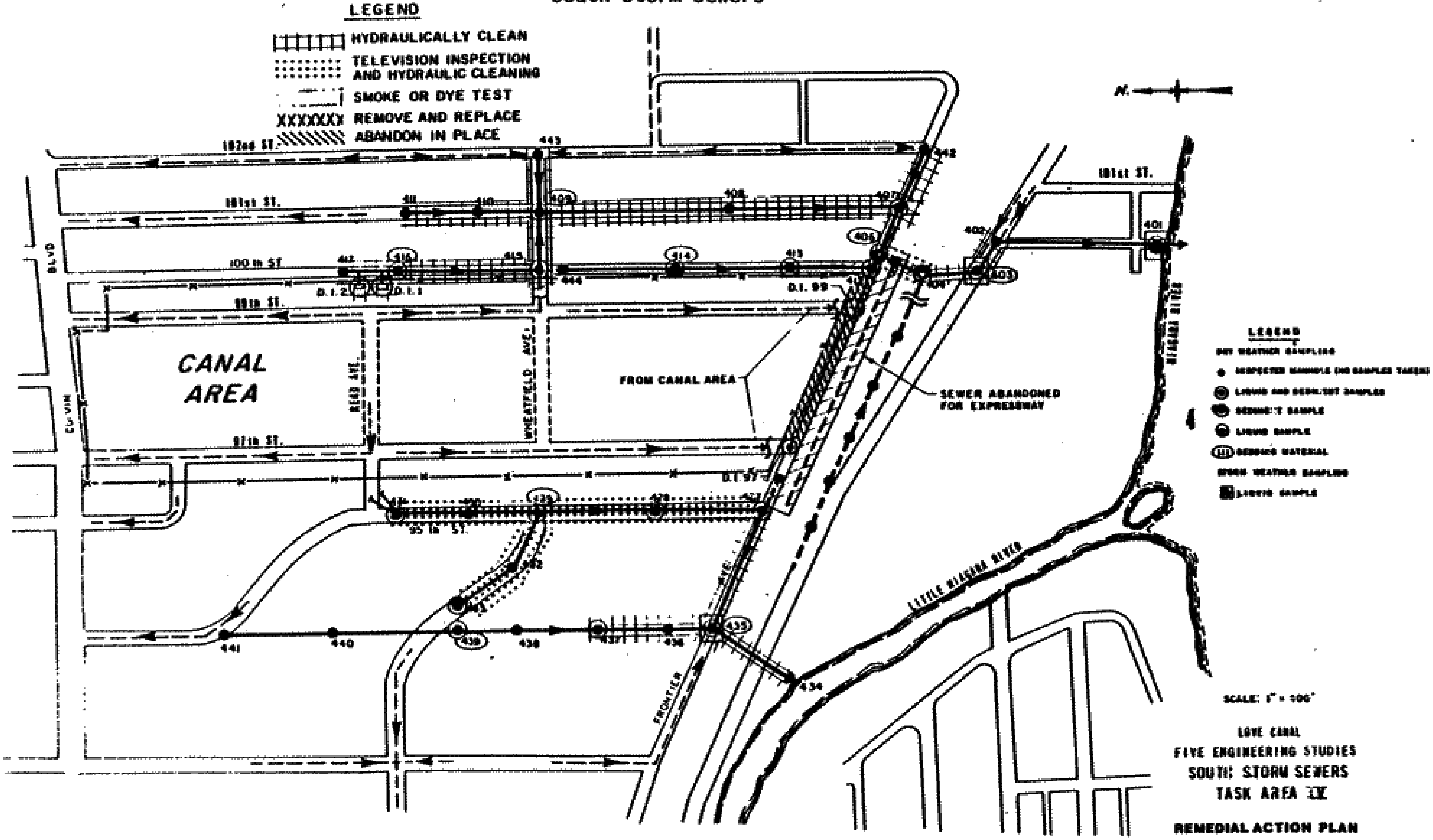
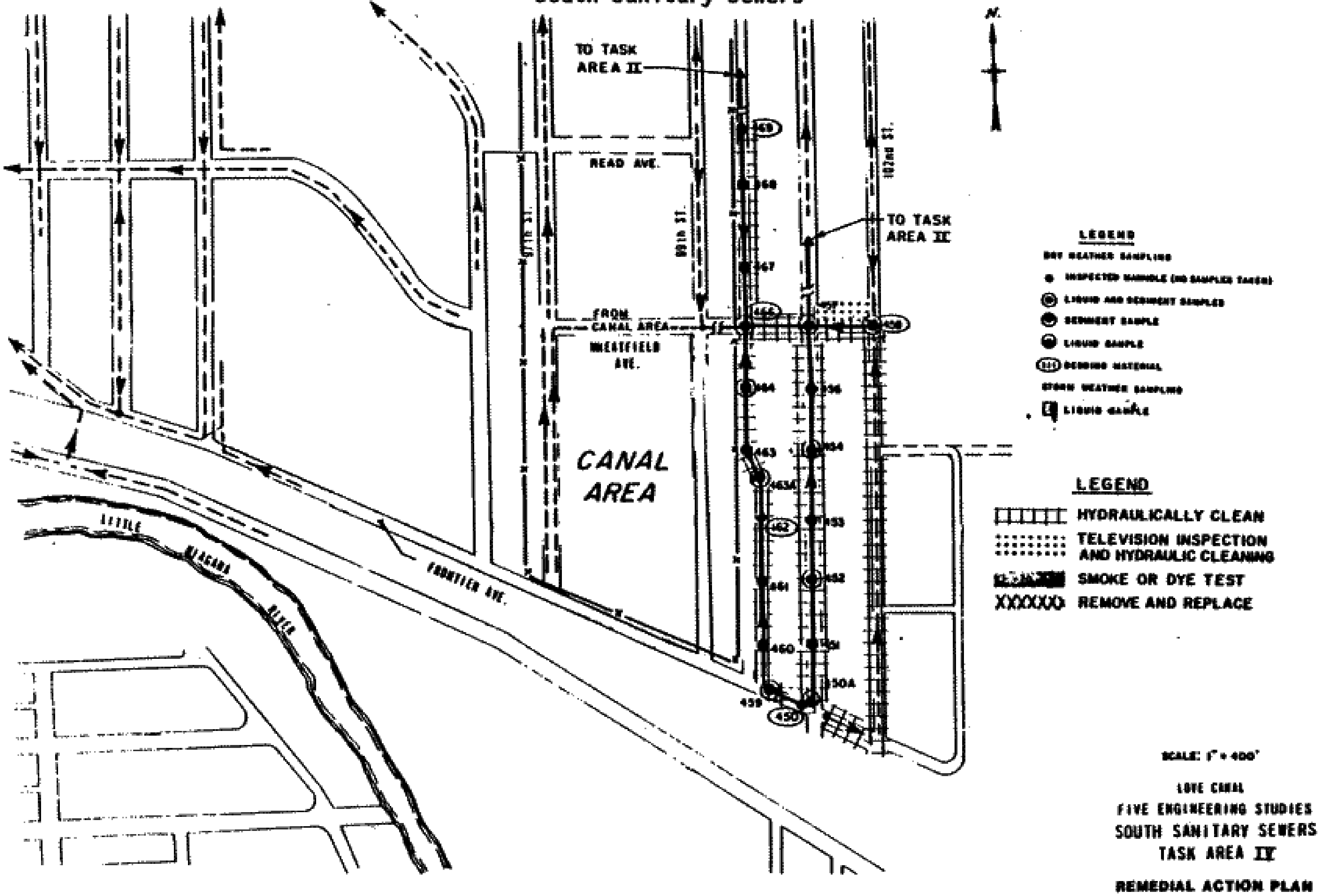


Figure 16

South Sanitary Sewers



cleaning of the sewer combined with containment of material from the 102nd Street sewer outfall and that portion of the Niagara River adjacent to it.

West - The storm sewers in this area (see Figure 17) recommended to be hydraulically cleaned are those that have been contaminated due to overflow bypassing from the main intercepting sewer, which collects all the wastewater flows from EDA. This bypassing occurs at Lift Stations No. 1, 4, and 5 and at 93rd Street and Colvin Boulevard. The majority of sanitary sewers (see Figure 18) will be cleaned and some television inspection will also be necessary. It should be noted that a portion of the sewers (several thousand linear feet) recommended for cleaning is located outside the boundaries of the EDA in the City of Niagara Falls.

Malcolm Pirnie had recommended that the segment of the main interceptor sanitary sewer from Lift Station No. 6 to the intersection of 66th Street and John Avenue be sampled for Love Canal related contaminants. CH2M HILL, in their 1985 report, stated that due to the high probability that contamination will be found and remediation will be necessary, it appears to be more cost-effective to forego the costs of additional sampling ($34,000) and proceed with the cleaning of this sewer segment (approximate cost $67,000). However, recent field investigations by the NYSDEC have shown that very little, if any, sediments are present in these downstream sections of sewer, because the flows in these sewers are high enough to prevent sediment from settling out. NYSDEC will further investigate these sewers, and if any sediments are found, the sediments will be sampled to determine if they are contaminated.

Black and Bergholtz Creeks Remediation Evaluation

The contamination assessment identified specific portions of Black and Bergholtz Creeks requiring remedial action. Cayuga Creek has been recommended

Figure 17

West Storm Sewers

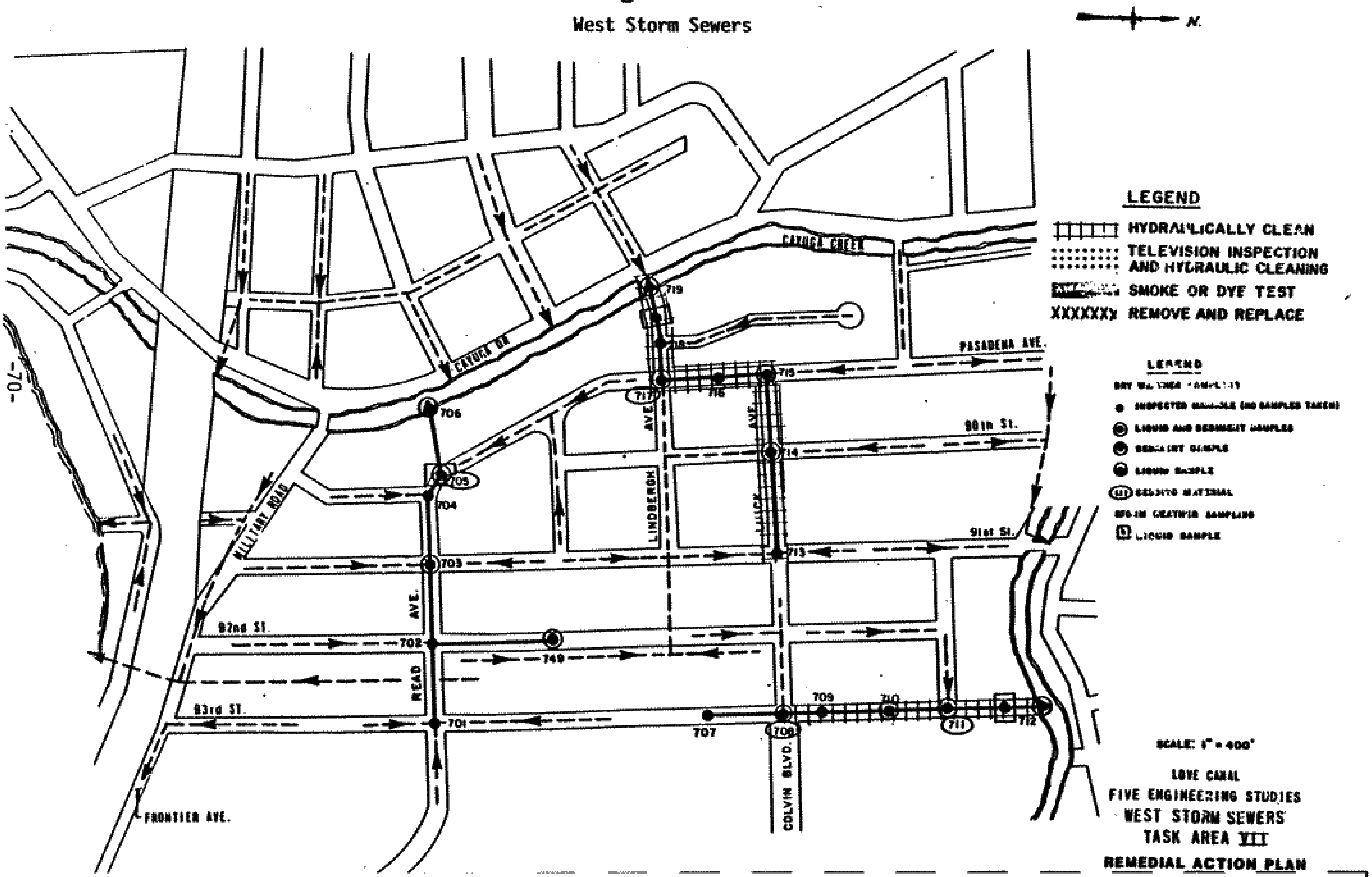
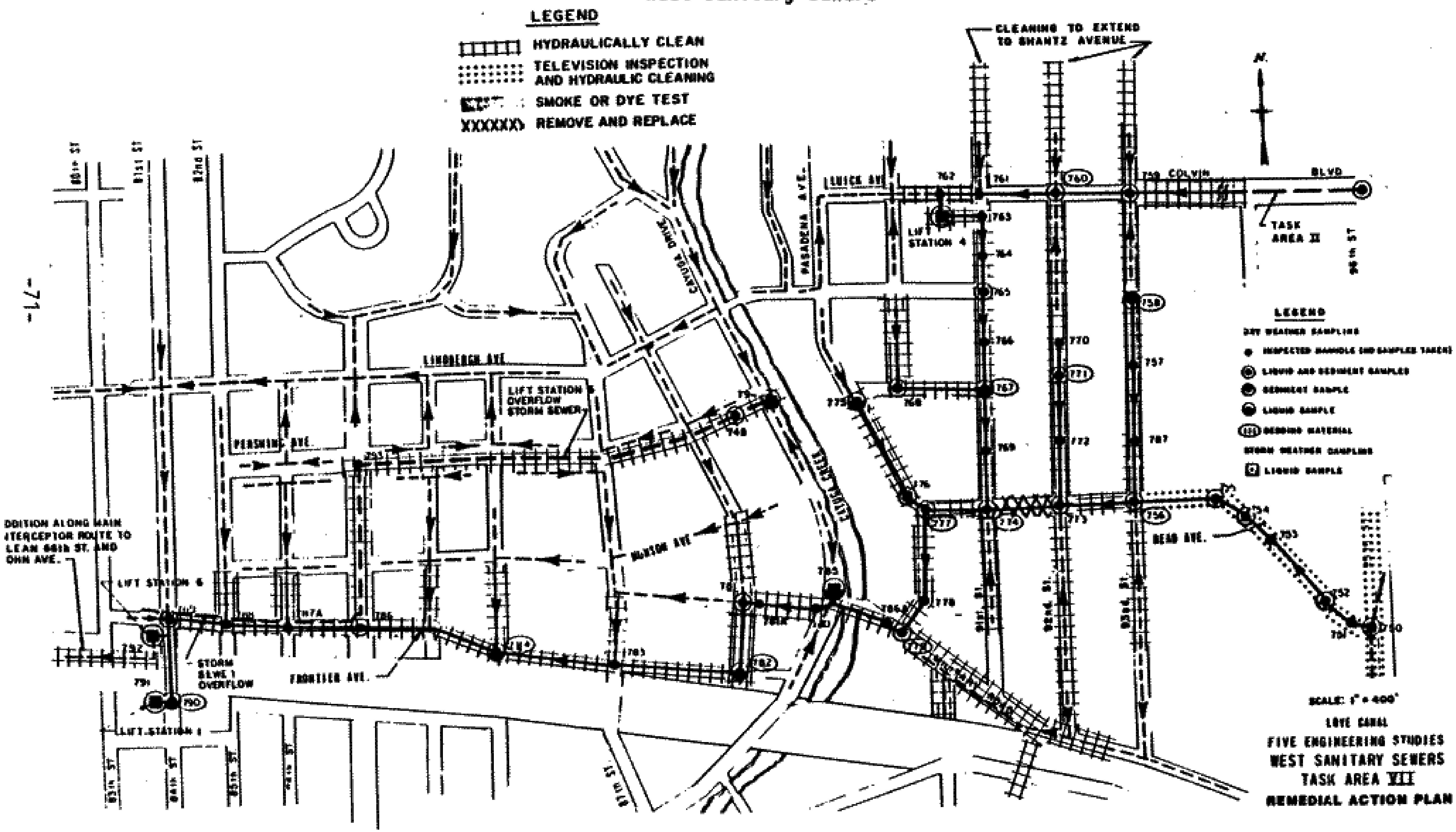


Figure 18

West Sanitary Sewers



for further sampling. The remedial alternatives assessed were included within the following major categories:

- o No Action
- o Restrict access
- o Stabilization in-situ
- o Removal and disposal
- o Combinations of the above

One major assumption applied in this assessment was that any contaminated storm sewer or sanitary sewer with overflows discharging to the creeks would be cleaned prior to implementing any creek remediation. Common to all alternatives would be the development of a detailed monitoring program to assess the effectiveness of any option selected.

No Action--Beyond periodic sampling no remedial action in the creeks would involve leaving the sediment intact. This option is unacceptable for reasons explained above.

Restrict Access--This activity can be accomplished in numerous ways such as increasing public awareness, posting signs and erecting fences, or a combination of these. The effectiveness of this option alone is considered very low. This is envisioned as a temporary measure.

In-Situ Stabilization - This involves the securing of contaminated sediments in place to minimize or prevent further contaminant migration. Options viable for this scenario would be the placement of small stones or filter fabric on the sediment, enclosing the creeks in pipes or culverts, or treatment in place.

Removal and Disposal--Two major methods for creek sediment removal are available: hydraulic dredging or mechanical excavation. Various onsite and offsite disposal options exist which involve new (unproven) technologies.

Transport to a secure landfill as well as interim storage at Love Canal are also viable options.

The detailed evaluation included consideration of the following factors:

- o Rehabitation of the area is being evaluated and cannot be ruled out.
- o There is presently an apparent stable population in the EDA.
- o Creeks form the border of the EDA; therefore, there is a population that will always exist adjacent to the creeks.
- o Dioxin has been found in some locations in the creeks at levels significantly higher than one ppb. No standards currently exist for chemicals within sediment and, therefore, the impacts on the human population are unknown. However, CDC has previously recommended the cleanup of residential areas to within an average of one ppb TCDD in soils. Fish sampled in the study areas contain significant levels of dioxin, levels that exceed by over three times the FDA advisory levels.

Sampling has indicated that the potential exists that Love Canal-related contaminants might have been discharged (or may be discharged in the future) to Cayuga Creek and ultimately the Niagara River. Based on the above, the conclusion has been reached that the length of Bergholtz Creek from about 150 feet upstream of the confluence of Black Creek to the confluence of Cayuga Creek and the stretch of Black Creek from the 98th Street culverts to the confluence of Bergholtz Creek should be cleaned. It is being recommended that Bergholtz Creek be cleaned to its confluence with Cayuga Creek, and that a sediment trap be placed there to deter the backflow of sediment. It has been determined that Bergholtz Creek is just one point source of contamination, specifically dioxin, that may be entering Cayuga Creek. Additional sampling of Cayuga Creek will determine a strategy for the remediation of this creek.

Black Creek must be mechanically excavated because of engineering constraints associated with hydraulic dredging. The decision to go with either hydraulic dredging or mechanical excavation for remediation of Bergholtz Creek will be finalized during the design phase. Both options have comparable capital costs. The selection will be dependent on technical considerations. If it is determined that the banks of Bergholtz Creek need to be cleaned, only mechanical excavation can be used since this is the only method that will adequately clean these sloped areas. Based upon settling tests that are planned during design to determine the filtering and dewatering characteristics of the clayey creek sediment, hydraulic dredging may be ruled out due to the high water content of the waste that will be generated. Hydraulic dredging would also necessitate the treatment of several million gallons of dredge water, either in the Love Canal leachate treatment facility or in another facility constructed for that purpose.

A significant issue associated with the removal of the contaminated sediment and debris from Black and Bergholtz Creeks is the disposition of these materials. At this time, no final decision has been reached regarding the disposition of these materials. The alternative that currently appears most promising is storage at the Love Canal site until a facility is available for treatment (destruction) of the chemical contaminants.

102nd Street Outfall Remedial Evaluation

Based on the contamination assessment performed by Malcolm Pirnie, an "action zone" map has been prepared that identifies the areas of relatively high and medium contamination levels. Alternatives considered for alleviating the problems associated with contaminated sediments in this zone include:

1. No action
2. Temporary in-situ stabilization followed by removal and disposal or

long-term stabilization

3. Long-term in-situ stabilization
4. Immediate removal and storage/disposal

A premise for the alternative evaluation was that the identified action zone lies adjacent to the 102nd Street Landfill site, which is currently being investigated in a separate CERCLA action. Since the contribution attributed to the 102nd Street Landfill site and the subsequent permanent, long-term remedial actions for that site have not been established, the alternative selected for the 102nd Street outfall must be flexible so that is can conform with the remedial alternative selected for the 102nd Street Landfill.

Currently the NYSDEC is considering the erection of a containment wall or berm around the "action zone". The containment wall or berm would be designed to contain the movement of much of the contaminated river sediments found near the 102nd Street storm sewer outfall. Such a containment program would be considered an interim solution until a complete remedial program is developed for the 102nd Street landfills.

If the rate of progress in the remedial progams under investigation by Occidental Chemical Corporation and Olin Corporation is satisfactory, and if the remedial program for the 102nd Street Landfill provides for remediation of the contaminated sediments in the Niagara River, this task will be deleted from the Love Canal Superfund program.

Storage/Disposal of Contaminated Materials

The sediment which is proposed to be removed from the creeks and sewers is known to contain dioxin and therefore is subject to stringent disposal procedures. Approximately 16,000 cubic yards of sediment would be removed from the proposed cleaning of Bergholtz and Black Creeks; the sewers contain an additional 280 cubic yards. The volume would increase to approximately 21,000 cubic yards if the creek banks are determined to require excavation. Removal to a secure landfill was considered, but no facilities were willing and able to take the wastes. Incineration was also considered but did not seem to be a viable alternative for the immediate future for the following reasons:

- o No incinerator is currently permitted to incinerate dioxin.
- o Those incinerators that are most likely to be permitted to incinerate dioxin in the near future are located 1500 miles from Love Canal, necessitating a lengthy transportation operation that is prohibitatively expensive.
- o Concerned citizens living near the incinerators or along the haul routes may object to the transportation and off-site incineration of this material.
- o All existing portable incinerators are of such small capacity that on-site incineration could take years.

However, these options may become more feasible and may prove to be the ultimate method of disposal.

Because the sediments can be removed more rapidly than they can be treated or disposed of, and because all treatment or disposal methods require preparation of the sediments (dewatering, sizing, etc.), all sediments must be stored. An interim secure storage facility meeting all technical requirements of RCRA appears to be the most promising alternative. The wastes would be stored until one of the above means of disposal/destruction becomes available or until another method becomes technically feasible.

Construction of the storage facility could take place during the 1986 construction season with creek cleaning to follow and be complete in 1987.

Since the sewer cleaning will take place in the fall of 1985, a dewatering facility similar to the one used for dewatering sediments during the first sewer cleaning operation at Love Canal is planned. The facility would have a double liner, leachate and leak detection systems, and would dewater from below. It would allow the sewer sediments to be removed during the fall of 1985, placed in a dewatering facility, and eventually relocated to the interim storage facility upon its completion in 1986.

The type of storage facility, either earthen berm or concrete vault, will be determined during the design phase. The location of the facility must also be determined. Several places inside the Love Canal fence line are suitable. The potential locations for a concrete storage facility are restricted. The facility cannot be located over the capped areas of former residences within the fenced portion of Love Canal because of uncertain settlement problems. Also, it is not desirable to place a concrete structure on the cap covering the canal proper because of uncertain settlement and potential slippage caused by the high-density polyethylene (HDPE) liner in the cap. The concrete storage facility could be located on the roadbed of 97th or 99th Street in the canal area. An earthen berm facility would most likely be located in the southern portion of the Love Canal fenced area.

It should be noted that space requirements for the two types of facilities (concrete vs. earthen) are very different. The concrete facility would measure approximatley 100 feet wide, 200 feet long, and 20-25 feet high, if placed on the roadbed within the fenced area of Love Canal proper. An earthern berm facility used for hydraulically dredged sediments would measure approximatley 260 feet wide by 1,250 feet long by 12 feet high. If used for mechanically excavated sediments, an earthern berm facility could measure 260 feet wide by 400 feet long by 12 feet high.

A major factor influencing selection of the type of facility will be the method which is finally chosen for removing the creek sediments. The two options have comparable capital costs; therefore, selection will be based on technical considerations.

The increased surface area provided by the earthen berm facility (vs. the concrete vault design) is compatible with the dewatering and storage of sediment should they be hydraulically dredged. The greater surface area of the earthen berm facility makes it suitable for dewatering. If the facility is used to dewater hydraulically dredged sediments, it may be a year or more before it could be closed.

Because of its smaller surface area, a concrete vault would probably not be able to adequately dewater hydraulically dredged sediments. In the case where creek sediments were mechanically excavated, both the earthen berm and concrete facilities would be suitable for interim storage of the sediment.

Construction of a Permanent Administration Building

The existing onsite leachate treatment plant was completed in December 1979. During the 5+ years of plant operation, experience indicates that additional space is needed at the plant. Of major concern is the need for more space for storage of clean and uncontaminated equipment, materials, and supplies, and the need for additional facilities for personnel decontamination procedures.

Various options were evaluated. Rejected immediately were options that located an administration building offsite utilizing existing uninhabited structures, since the chance for offsite contamination would increase and security procedures would be more complex. Onsite alternatives involving the construction of additions to the existing facilities, erection of a new permanent building, or the placement of temporary facilities (trailers) were evaluated.

It was assumed that these facilities would be required for an indeterminate period of time and that a well constructed facility would be more cost-effective than a lesser quality building that would require more frequent repair and/or replacement. Therefore, the option to use temporary structures was dropped from consideration. In addition, a permanent facility would be in keeping with the long-term commitments made by the State of New York to maintain, indefinitely, the integrity of the Love Canal remedial work.

The new building will be constructed apart from the existing leachate treatment facility. The possibility of adding space to the existing leachate treatment facility was considered but was found not to be an acceptable alternative for the following reasons:

- o There is no room adjacent to the existing facility.
- o By separating the two buildings, the chance of contamination of the proposed facilities would be reduced.
- o Soils to the east of 97th Street are generally found to be chemically contaminated. The excavation of soils adjacent to the existing facility required to construct a foundation for an addition would likely result in the generation of contaminated soil requiring special handling and disposal. It appears possible to avoid the problem of contaminated soils by building on the west side of 97th Street.

The NYSDEC has prepared plans and specifications for a permanent structure across from the existing leachate treatment facility (see Figures 19 and 20).

Consistency With Other Environmental Laws

This section compares the recommended action with the technical requirements established by other environmental laws (reference the proposed policy on CERCLA

Figure 19

Architectural Rendering - Administration Building

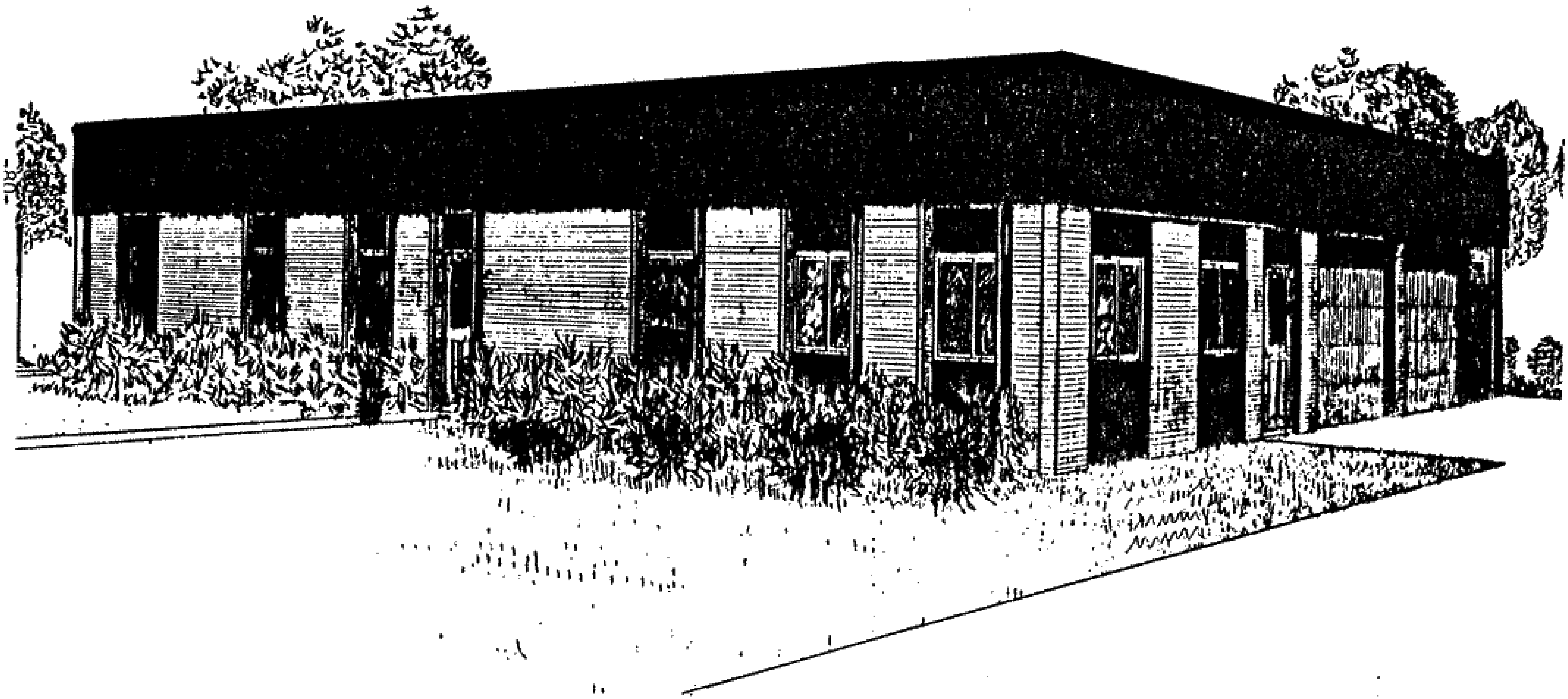
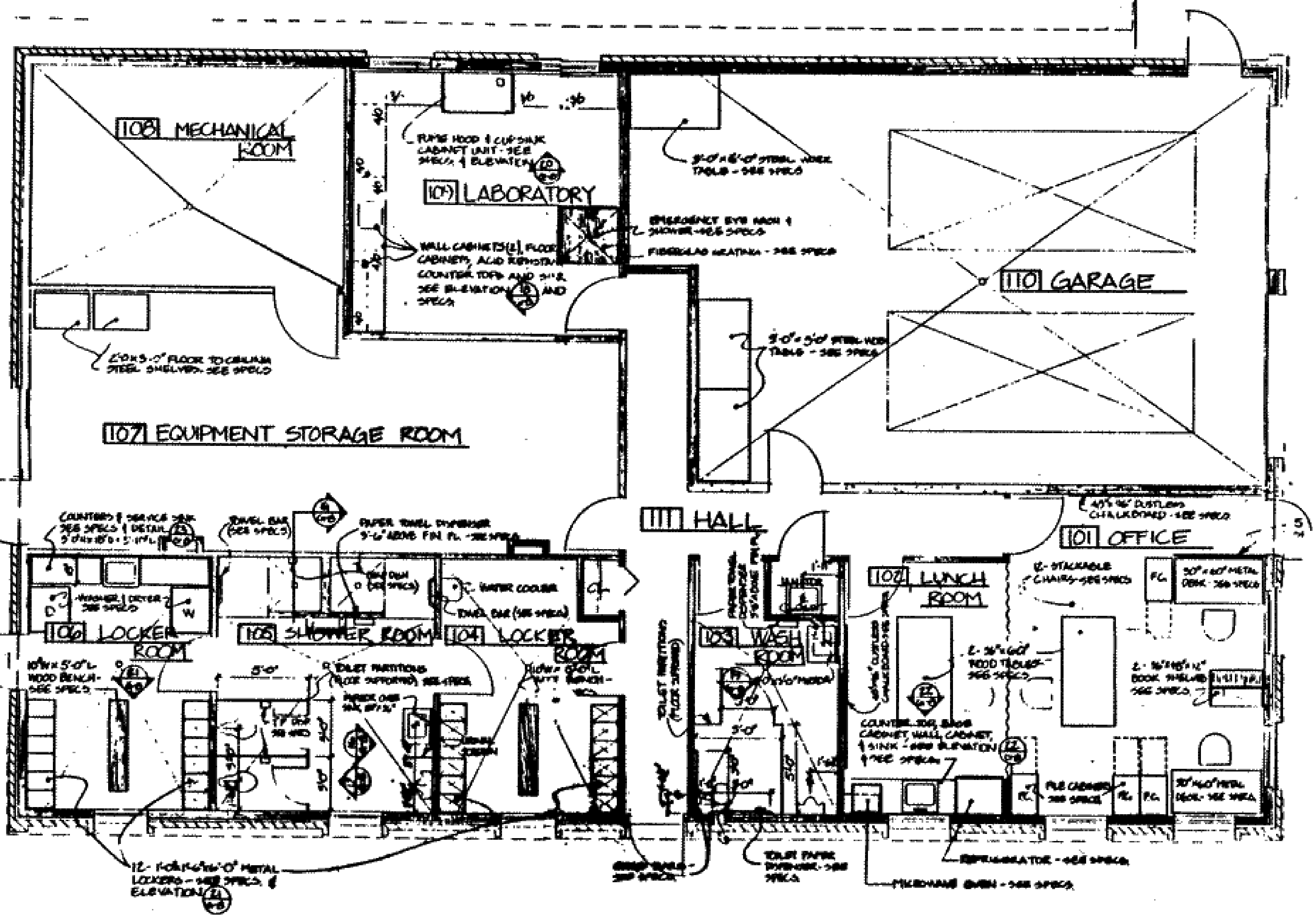


Figure 20



ROOM FINISH PLAN

SCALE 1/4" = 1'-0"

compliance with other environmental statues published in 50 FR 5928-32, February 12, 1985).

The recommended action, i.e., the cleaning of Love Canal sewers and creeks, has been reviewed for consistency with the technical requirements of the RCRA. The remediation of the sewers and creeks will result in the collection of large amounts of contaminated material, complicated by the fact that the material contains dioxin.

Currently, no RCRA permitted disposal facilities will accept the dioxin-contaminated wastes, and at this time, there are no commercial incineration facilities for dioxin-contaminated wastes. Therefore, this material will be placed in secure interim storage at the Love Canal site within the fenced-in area. The interim storage facility will be consistent with the technical requirements of RCRA for the storage of dioxin-contaminated wastes.

The facility will either be an earthen berm or a concrete vault. Design of the earthen berm facility would include the following:

- o Installation of a synthetic membrane liner, e.g. HDPE on the bottom of the facility to prevent migration of wastes out of the facility. A compatability test using actual creek and sewer sediment leachate would be performed during detailed design to determine if HDPE is suitable for use as a liner for the storage facility.
- o Installation of both leak detection and leachate collection systems separated by a synthetic membrane liner. Sand would be utilized as the initial layer of the leachate collection system to facilitate sediment dewatering. A particle size distribution analysis of the sediment would be performed as part of the detailed design in order to properly size the sand and prevent blinding of the filter fabric and the leachate collection system.

- o Placement of a synthetic membrane liner along the inside and outside faces of the berms.
- o Placement of drainage fabric along the inside face of the berm underneath the synthetic membrane liner to facilitate leak detection.
- o Cap construction identical to the recently installed synthetic membrane liner system.

It is also possible for the contaminated material to be stored in a concrete facility. The concrete facility would also be constructed in a manner which is consistent with RCRA guidelines for storage of dioxin-contaminated wastes. Appropriate materials would be placed below the contaminated material to drain moisture out of the containment and keep groundwater from it. An impervious synthetic liner protected by layers of geotextile fabric on each side would be placed above the prepared base. Above this liner there would be a leak detection system. While this system should collect very little liquid, any liquid it did collect would be drained by gravity to a leak detection sump and pumped to the leachate treatment system.

A drainage collection system would be installed above the leak detection system and the concrete floor and would be covered with a layer of geotextile fabric. Collected leachate would also be conveyed to the leachate treatment system.

The concrete interim containment facility, when closed, would be covered with an impermeable cover to minimize water percolation, promote drainage, minimize erosion, accommodate settling, and minimize maintenance.

The creek sediments would be placed directly into the facility, and the sewer sediments would be dewatered and placed in the facility upon the completion of its construction. The sewer sediment dewatering facility itself would also be consistent with technical requirements of RCRA. The dewatering facility for the sewer sediments would be similar to the one originally used at the first sewer cleaning operation at Love Canal.

The approximately 650 drums containing hazardous waste presently at Love Canal will also be temporarily stored in accordance with technical requirements set forth in RCRA. Drums from 93rd Street School and used carbon from the leachate treatment plant will also be stored at the Love Canal site in accordance with these requirements. The facility to store these drums will be within the fenced area at the Love Canal and will be roofed. The drums will be placed on wooden pallets and underlain by a concrete pad. There will be walkways (two feet minimum) between drums to allow easy inspection. The drums may be moved to the larger interim storage facility when it is constructed in 1986.

The wastes will be stored until onsite or offsite RCRA-permitted incineration facilities are available or until a RCRA-permitted landfill facility is willing to accept the waste. If the wastes are incinerated, the residue or ash will be disposed of at a RCRA-permitted facility or retained onsite until the ash is delisted by EPA.

The remediation of the sewers and creeks will produce some temporary adverse environmental impacts. Table 8 presents both short- and long-term impacts associated with the remedial alternatives. Work plans will address and incorporate measures to minimize possible effects of remedial activities.

<u>Recommended Alternatives</u>

The underlying goal of the remedial program at Love Canal has been to provide an environment as free of contamination as practically possible, within cost-effective guidelines. Actions that were selected for design and eventual

Table 8

IMPACTS ASSOCIATED WITH LOVE CANAL REMEDIAL ALTERNATIVES

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
1. Sewers			
a. No action	None	None	Continued sediment migration to creeks and sewage treatment facility. Continued potential public exposure to contaminants.
b. Hydraulically clean and repair.	1. Run blower and plug sewer section.	Public contact minimized.	Potential for small amount of material to remain; minimized by TV inspection
	2. Set up cleaning jet at downstream collection manhole.	Notice to residents of activity startup.	
	3. Perform cleaning operation (cleaning jet propels itself upstream and is then reeled back to collection manhole	Immediate cleanup if backup reported in house.	
		Backflow to cleaned sewer. Immediate cleanup if backup segments blocked.	
	4. Manually or mechanically remove large debris (using shovels and buckets).	Sewer demand decreased by performing action during dry season.	
	5. Use suction equipment (submersible pump and vacuum nozzle or vacuum truck) to remove sediments.	Volatiles inside house minimized by opening windows.	
	6. Transport sediment/water to treatment/disposal facility.	Dust emissions minimal because of sediment water content.	
	7. Remove plugs from cleaned sewer section.	Machinery noise during daylight work hours.	
	8. Decon blower, jet cleaning equipment and truck, and tank truck.	Truck Traffic to dewatering facility.	
	9. Collect and treat decon wash water.	Potential for discharge of cleaning water minimized by sewer plugs.	
	10. TV inspection of cleaned segment.		
2. 102nd Street Outfall *			
a. No action.	None.	None.	Continued sediment migration. Continued aquatic life exposure. Continued potential public exposure to sediments and contaminated fish.

*Source: Love Canal Sewers and Creeks, Remedial Alternatives, Evaluation and Risk Assessment, EPA 138.2L05.0, Volume I, March 1985

Table 8

IMPACTS ASSOCIATED WITH
LOVE CANAL REMEDIAL ALTERNATIVES
(Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
b. Mitigate backflow * to sewer by repair to tidal gate.	1. Remove rocks and debris from in front of headwall.	One day of activity.	Mitigates potential backflow from outfall to storm sewer.
	2. Mobilize backhoe and portable generator to top of headwall.	Small disturbance of outfall sediment because any actions are at outfall.	Continued sediment migration in river.
	3. Lower tidal gate into position on face of headwall.	Negligible public exposure.	Continued aquatic life exposure.
	4. Bolt tidal gate flange to headwall.	Machinery noise at outfall during daylight work hours.	Continued potential public exposure to sediments and contaminated fish.
c. Immediate Stabilization*			
1) Construct stone berm with timber sheeting.	1. Inspect intended berm location for large debris and remove debris as necessary (drill several borings along alignment).	Little or no worker or equipment contact with sediment, unless when driving wall, debris or rocks are hit. Then the wall will be pulled out, repositioned (or obstacle will be moved), and replaced. Some worker contact possible while repositioning sheeting.	Berm/sheeting will need to be maintained to insure continued effectiveness.
	2. Beginning at shore line, use front end loader and bulldozer to transport and place stone.		
	3. Use barge mounted pile driver to place timber sheeting (second barge may be necessary to guide sheeting).	Sediments disturbed and possibly entrained during construction.	
2) Construct steel pile wall.	1. Inspect wall location for debris, remove debris as necessary.	See 2(c)1, except sediment disturbance lessened.	See 2(c)1.
	2. Use barge-mounted drill rig to drill borings along wall alignment to determine depth of river bed and identify locations of any buried debris.		
	3. Use barge-mounted pile driver to construct wall starting at shoreline (2nd barge will need to be used to guide sheet piling).		

* Work may be deferred pending implementation of 102nd Street Site Remedial Program

Table 8

IMPACTS ASSOCIATED WITH LOVE CANAL REMEDIAL ALTERNATIVES (Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
d. Long-term remediation			
1) In-place containment (with 2(c)1 or 2.	1. Construct stone berm or wall (See 2(c) 1 or 2 above).	See 2(c)1.	See 2(c)1.
	2. Dewater, backfill contained area and cap it.	Haul trucks with fill.	None.
2) 2(c) 1 or 2 followed by removal using land based equipment	1. Construct stone berm or wall (See 2(c) 1 or 2 above).	Potential for splashing workers as sediments are transferred from clamshell to truck.	None.
	2. Remove rip-rap along shore line and build berms or mud mats as necessary.	Biota will be lost.	Biota community expected to reappear.
	3. Use shore-based drag line or clamshell on crawler crane to excavate sediments.	Truck traffic to dewatering facility.	
	4. Load excavated sediments into truck and transport sediments to dewatering/disposal facility.		
	5. Excavate stone berm placing stone in trucks--transport to disposal facility. Rebuild shore rip-rap to depth of excavation.		
	6. Decon dragline/clamshell, trucks, and/or other equipment.		
3. Black Creek			
a. No action.	None.	None.	Continued sediment migration. Continued potential public exposure.

Table 8

IMPACTS ASSOCIATED WITH LOVE CANAL REMEDIAL ALTERNATIVES (Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
b. Mechanically excavate	1. Construct access road along creek bank, clear, and grub.	Public contact minimized o Restricted access during activities. o Volatile emissions negligible because no volatiles detected in sediment. o Dust emissions minimal - Wet state of sediment - Cleanup of spills on banks o Sediment transport will be in leakproof trucks operating over short distance.	Potential for small fraction of contaminated sediment to remain.
	2. Construct berms up and downstream and dewater between using pumps.		Creek biota community expected to renew.
	3. Use backhoe to excavate sediments and place them in a watertight truck.		
	4. Transport sediments to dewatering/disposal facilities.		
	5. Remove earth berms and dispose of at hazardous waste facility.	Temporary haul roads.	
	6. Decon excavating equipment and truck, etc.	Machinery noise during daytime work hours.	
		Creek biota will be lost.	
c. Construct tidal gate or sediment trap at confluence conjunction with 3.b. above.	1. Excavate approximately 18 inches in Black Creek (at confluence with Bergholtz Creek).	Negligible addition to 3.b.	Prevents backflow of Bergholtz Creek sediments to Black Creek if two creeks not cleaned concurrently or are cleaned by different methods.
	2. Mix and pour concrete to form tidal gate/sediment trap.		
	3. Continue with steps 1 thru 6 above.		
4. Bergholtz Creek & Beyond			
a. No action.	None.	None.	Continued sediment migration. Continued aquatic life exposure. Continued potential public exposure to sediment and contaminated fish.
b. Mechanically excavate.	1. Construct temporary berm at mouth of Black Creek to use as stream crossing.	See 3.b. Numerous trips (more than 1,400) by haul truck to deposit sediments. Would block some streets at times. Noise and possible dust emissions.	Potential for small residual fraction of contaminated sediment to remain.
	2. Follow steps 1-6 under 3.b. above, except use frontend loader and clamshells.		

Table 8

IMPACTS ASSOCIATED WITH LOVE CANAL REMEDIAL ALTERNATIVES (Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
c. Hydraulically excavate.	1. Construct temporary berm at mouth of Black Creek to use as stream crossing.	Potential contact reduced because of closed transport in pipes.	Creek biota community expected to renew.
	2. Construct berms up and down-stream and dewater between.	Potential pipeline leaks minimized by double walls.	Potential residual contamination; banks cannot be remedied using hydraulic dredge.
	3. Construct access road, clear, and grub.	Volatile emissions minimal because no volatiles detected in sediments. (91st Street and Colvin Boulevard)	Dewatering facility may be open for year(s) to allow sediments to dewater and stabilize.
	4. Manually remove large debris; reflood.	Bridges required where pipe crosses road.	
	5. Use mud cat to dredge sediments.	Machinery noise during work hours.	
	6. Dewater and inspect; reflood and redredge if necessary.		
	7. Remove earth berms and dispose of at hazardous waste facility.	Creek biota will be lost.	
	8. Transport sediment to disposal facility.	Pipelines (two; each is one mile long) must be in place throughout; pumps will run continually. Haul trucks will carry debris through streets.	
	9. Dewater dredge spoils and treat filtrate.		
	10. Decon mud cat, truck, dewatering pump, piping, etc.		
6. <u>Sediment Dewatering</u>			
a. Mechanically dewater.	1. Transport sediment in water tight truck or pipe sediment to dewatering facility.	Sediment compression may emit volatiles. Minimal dust emission because sediment still wet and is dropped into covered container.	Action is an intermediate stage of remedial action. Sediments are removed to Interim Storage (See #7). No long term impacts from action.
	2. Feed sediment onto vacuum filter and air press.		
	3. Remove filter cake and transport to disposal facility.		

Table 8

IMPACTS ASSOCIATED WITH
LOVE CANAL REMEDIAL ALTERNATIVES
(Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
	4. Transport and treat filtrate, at LCTF, release to sewer system and NFWTP.		
b. Use interim storage	1. Construct temporary system for sewer sediment dewatering.	Splashing from hydraulically dredged sediments. Emissions possible.	Hydraulically dredged sediments may not solidify for over a year; cannot cap facility until then.
	2. Construct interim storage facility (48,000 cubic yards capacity for hydraulic dredge water recirculation) with major design modifications for hydraulic dredged sediments.		
	3. Pipe water/sediments by pipeline (3,000,000 gallons) or haul sediments to facility (1,400 truck trips).		Continual feed (3,000,000 gallons) to Love Canal leachate treatment facility from hydraulically dredged sediments.
	4. Collect liquid drained into underdrain/leachate collection system or taken off top. Recycle to creek in hydraulic dredging. Treat and dispose of water eventually.		Temporary feed (600,000 gallons) to Love Canal leachate treatment facility from mechanically excavated sediments; cap facility immediately.
	5. Choose disposal/treatment option from 8.		
7. <u>Interim Storage</u>			
a. Construct an earthen bermed facility.	1. Excavate soils and construct berms. If facility is to be within the cap, cut hole in existing HDPE liner.	Placement of material in the the facility could result in the release of contaminated materials that must be contained. Machinery would be involved, causing noise and dust. Haul trucks would bring material into area. Essentially same impacts as activities associated with capping Love Canal.	Aesthetics; if hydraulic dredging used, facility may not be capped for over a a year. Operation/maintenance needed for as long as 30 years. Can be capped immediately if mechanically excavated sediments disposed of.
	2. Fine grade base and install bottom liner. If facility is in cap, weld bottom liner to existing liner.		
	3. Compact clay layer and install leak detection system. Compact additional clay.		
	4. Fine grade and install second synthetic liner.		

Table 8

IMPACTS ASSOCIATED WITH LOVE CANAL REMEDIAL ALTERNATIVES (Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
	5. Place granular material and piping for leachate collection system.		
	6. Deposit sediments and decon all contacted equipment.		
	7. Construct cover including installation of a synthetic liner. (May be some delay in covering if facility is used for dewatering).		
	8. Topsoil and seed cover.		
b. Construct a concrete structure (Times Beach vault)	1. Excavate soils and install synthetic membrane.	See 7a.	See 7a. Aesthetic impact different than 7a. since vault would be taller, but Only one-fifth as long. Vault can be capped sooner than 7a.
	2. Place drainage gravel and geotextile layers.		
	3. Pour 8" reinforced concrete and coat with polymeric asphalt.		
	4. Place drainage gravel and geotextiles to act as leachate collection system.		
	5. Similarly construct concrete sidewalls.		
	6. Follow steps 6-8 in 7.a., except no delay in covering.		
8. <u>Offsite Disposal</u>			
	1. Open storage facility, remove sediment.	Opening of storage facility and removal of sediments could generate dust, release volatiles. Will take several openings to remove material. Many trucks required to make 1,500 mile trip; possible accidents/incidents. Treatment/disposal should have no more than "normal" impacts at disposal sites.	Facility must be maintained or demolished once empty.

Table 8

IMPACTS ASSOCIATED WITH LOVE CANAL REMEDIAL ALTERNATIVES (Continued)

Alternative	Steps in Operation	IMPACTS: Remedial Action Phase	IMPACTS: Long-Term
	2. Load sediment on truck. 3. Transport to site & unload. 4. Treat or dispose. 5. Decon all equipment.		
9. Incineration			
a. Construct facility onsite.	1. Construct incinerator. 2. Open storage facility. 3. Transport dewatered sediment to incinerator. 4. Incinerate sediment. 5. Transport ash to secure landfill for disposal. 6. Decon equipment.	If operated within the regulations, emissions and incinerator operations should not pose a risk thresy to workers or residents. Materials must be prepared (ground up, dried). Handling and transport of sediment will release dust, volatiles, and will generate noise. Incinerator will generate noise, ash, and steam. Must have building to house it. Transport of ashcould result in spills. May require additional area to accommodate all of equipment. Cooling water must be treated.	Several years to build; at least one year of operation necessary; storage facility would essentially remain open entire period. Landfilling of residual may necessitate construction of new facility at Love Canal, or transport to offsite facility (See 8).
b. Use mobile incinerator	Same as 9.a. except step 6 would involve demobilization of incinerator equipment.	See 9.a.	Same as 9.a., except incinerator would be onsite from 1 to 29 years and mobilization would be much shorter.

implementation reflect activities necessary to protect the public and the environment from the hazardous situation that exists. The sewers should be cleaned and the contaminated creek sediments removed as previously described.

There will be onsite interim storage of the contaminated sediment at the Love Canal site. To assure that this waste will remain secure onsite until ultimate disposal, the interim storage facilities will be constructed in accordance with the technical requirements of RCRA.

The construction of a permanent administration building will provide adequate and safe working conditions for site employees and will be consistent with the State's long-term commitment at the Canal.

Cost - Table 9 shows the costs associated with the feasible alternatives for remedial action as estimated by CH2M HILL. These costs are order of magnitude estimates, i.e., are expected to be accurate within a range of +50 and -30 percent.

The NYSDEC will continue as lead remedial agency on the project. Therefore, costs for NYSDEC's administration and management activities have also been estimated. Under CERCLA, the site has been classified as a 90 percent Federal and 10 percent State cost-sharing site.

Tentative Schedule

Major events on the planned schedule are listed below:

Commence construction of the sewer sediment dewatering facility	Fall 85
Commence sewer cleaning work	Fall 85
Commence sampling of Cayuga Creek and the banks of Bergholtz and Black Creeks	Fall 85
Commence construction of interim storage facility	Fall 86
Clean creeks	Summer 87

Table 9

SUMMARY OF ESTIMATED COSTS FOR FEASIBLE ALTERNATIVES

Alternative	Total Present Worth ($)[1]
Sewer Remediation and Repair	
1. No Action	--
2. Cleaning	1,348,000
3. Abandon in-place and replace with new line	7,080,000
102nd Street Outfall Remediation *	
1. Immediate Stabilization	
- No Action	--
- Filter Fabric and Stone	207,000
- Berm with Timber Sheeting	509,000
- Steel Pile Wall	636,000
2. Long Term Remediation	
- No Action Subsequent to Berm or Wall	--
- In-Place Containment	598,000
- Removal Using Shore Based Equipment	350,000
Creek Remediation	
1. No Action	--
2. Hydraulic Dredging of Bergholtz Creek	
- 1983 EID limits only	700,000
- 1983 EID limits plus 1st incremental reach	798,000
- Above Plus 2nd Incremental Reach (PROBABLE AREA)	1,026,000
3. Mechanical Excavation--Land-Based Clamshell	
- 1983 EID limits	165,000
- 1983 EID limits plus 1st incremental reach	225,000
4. Mechanical Excavation--Tracked Front End Loader (and Clamshell as needed)	
- 1983 EID limits	184,000
- 1983 EID limits plus 1st incremental reach	248,000
- Above, Plus 2nd Incremental Reach (PROBABLE AREA)	1,178,000
- Black Creek only (PROBABLE AREA)	120,000
5. Additional Sampling Bergholtz and Cayuga Creeks and Banks	169,000
6. Fence Downstream Section of Bergholtz and Cayuga Creeks	161,000

Source: Love Canal Sewer and Creek, Remedial Alternatives, Evaluation and Risk Assessment, EPA 138.2105.0, Volume I, March 1985.

*Work may be deferred pending implementation of 102nd Street site Remedial Program.

Table 9

Alternative	Total Present Worth ($)[1]
On-Site Storage	
1. Above-Cap, Earthern Berm	
- Mechanical Excavation/5,000 cy	803,000
- Hydraulic Dredging/5,000 cy	829,000
- Hydraulic Dredging; 21,000 cy (Probable Volume)	1,131,000
- Hydraulic Dredging/135,000 cy	4,924,000
2. Concrete Vault	
- Minimum Volume, 5,000 cy	509,000
- Probable Volume, 21,000 cy	1,135,350
- Maximum Volume, 135,000 cy	7,298,000
Transport of Sediment, Dewatering and Leachate Water Treatment	
1. Sewer Sediments Dewatering/Love Canal Leachate Treatment Plant	
- Mechanical Dewatering	391,000
- Clarification/Filtration/Mechanical Dewatering	683,000
- Temporary Steel Walls/Passive Dewatering	280,000
2. Transport and Dewatering of Mechanically Excavated or Hydraulically Dredged Creek Sediments Costs Are Contained in Creek Remediationand Interim Storage Costs.	12,900,000-18,060,000
Off-Site Incineration	
1. Rollins: 5,000 cy	7,900,000-9,400,000
2. Rollins: 21,000 cy	18,000,000-31,500,000
3. Rollins: 135,000 cy	206,900,000-247,400,000
On-Site Incineration	
1. EPA Mobile Incinerator: 5,000 cy	4,800,000-7,100,000
2. EPA Mobile Incinerator: 21,000 cy	15,600,000-42,000,000
3. EPA Mobile Incinerator: 135,000 cy	86,800,000-147,500,000
4. Huber AER: 5,000 cy	6,700,000-8,100,000
5. Huber AER: 21,000 cy	12,900,000-18,060,000
6. Huber AER: 135,000 cy	111,200,000-148,300,000
7. ENSCO Mobile Incinerator: 5,000 cy	5,400,000
8. ENSCO Mobile Incinerator: 21,000 cy	16,800,000
9. ENSCO Mobile Incinerator: 135,000 cy	91,300,000

[1] In 1984 dollars.

93rd Street School investigations	Spring 86
Commence construction of Administration Building	Spring 86
Commence construction of drum storage facility	Fall 85

Additional Phase III Remedial Activities Planned For The Love Canal Site

As previously discussed, additional remedial work (Phase III) is planned for the Love Canal area. This section provides a brief description of each of the planned activities, a rough estimate of the cost, and a brief discussion of the factors which may affect the timely initiation and completion of the work.

Plans and specifications for all future work will be publicly presented and available for public inspection. Consideration will be given to all comments received in the finalization of plans.

Phase III tasks are as follows:

1. Perimeter survey/implementation of the long-term monitoring program
2. Sewer cleaning
3. Construction of Administration Building
4. Removal of contaminated sediments from Black and Bergholtz Creeks
5. Use of plasma arc technology

Perimeter Survey/Implementation of The Long-Term Monitoring Program

It is planned that the NYSDEC will initiate a perimeter survey and begin implementation of the permanent long-term monitoring system for the Love Canal site in the fall of 1985. This program consists of the following elements of work.

1. A number of shallow groundwater monitoring wells will be installed at locations surrounding and near the perimeter of the Love Canal site (the green chain link fence). Water samples will be collected from these wells and analyzed to determine if the near-surface groundwater system has been significantly

contaminated by past migration from the Love Canal site. If significant contamination attributable to Love Canal is found in any wells, additional wells located at greater distance from the Love Canal will be installed until the areal extent of significant contamination in the shallow groundwater system is established by a series of monitoring wells completely encircling the site.

2. Once the extent of significant contaminant migration is determined in the shallow groundwater system, soil samples will be collected in the vicinity of these "perimeter" wells. These samples will be collected and analyzed to determine if soils which people might come into contact with are significantly contaminated with chemicals attributable to the Love Canal site. If soils are found to be significantly contaminated with chemicals attributable to Love Canal, additional soil samples will be taken at greater distances from the site until the areal extent of significant surficial and near-surface soil contamination is determined.

It is the intent of the NYSDEC to use the information collected pursuant to the perimeter survey to determine the extent of significant contaminant migration away from the Love Canal site via the shallow groundwater system and surface runoff. These wells would be periodically resampled to confirm that contaminants are not migrating further from the site via the shallow groundwater system. It is the NYSDEC's intent that this program provide information sufficient to define the limits of an area where certain uses of the land should be restricted. Such restrictions might include bans on or limitations on depths of excavations, bans or restrictions on use of the area for residential purposes, etc.

3. A number of wells will be installed directly into the Love Canal site in order to monitor liquid elevations within the waste. The purpose of these wells is to better monitor the effectiveness of the leachate collection system

to remove mobile liquids from the interior of the landfill. A number of wells will also be installed near the Love Canal site and completed at depths within the bedrock underlying the site to better evaluate if or what potential exists for contamination of the bedrock groundwater system. The information obtained from these monitoring wells will also provide insight into the need for and the feasibility of additional efforts to dewater the actual landfill.

4. At a number of locations, a series of closely spaced wells will be installed at several different depths within the overburden. These wells will be installed relatively close to the barrier drain. Water elevations taken in these wells will better define the control the leachate collection system exerts on the shallow groundwater system. Water samples will also be collected from these wells periodically to monitor the effect of the drain on the chemical quality of the shallow groundwater system over time.

The estimated cost of this work is approximately $2 million for the first year. Costs for subsequent years will be dependent on the number and types of chemical analyses which must be performed. The number and types of chemical analyses which must be performed will be better known after the first year's data are evaluated.

The factors which might affect the scheduling of this work are:

1. Procurement of a contract for the services required to carry out the perimeter survey and implement the long-term monitoring program. At this time, the NYSDEC intends to extend its existing contract with the E.C. Jordan Company to perform this work. E.C. Jordan Company collected and analyzed a series of soil samples from around the Love Canal site and finalized a report in April 1985 presenting the design of a long-term groundwater monitoring program for the Love Canal site.

2. Finalization of detailed protocols, plans, and specifications for the installation of wells, collection and analysis of samples, and health and safety plans.

<u>Sewer Cleaning</u>

It is planned that the NYSDEC will procure a contractor to clean the storm and sanitary sewers which drained from the Love Canal site or might have been contaminated by drainage from the Love Canal site. This work is scheduled to begin in the fall of 1985. This task consists of the following elements of work:

1. Contaminated sediments will be removed from the storm and sanitary sewers by hydraulically cleaning the sewers. If necessary, large accumulations of sediment and debris will be removed mechanically and then the sewers will be hydraulically cleaned.
2. The sewers will be inspected by remote television cameras to ensure that contaminated sediments are removed.
3. Sediment and debris removed from the sewers will be dewatered and temporarily stored at the Love Canal site until the final method of disposal is determined.

The estimated cost of this work is approximately $2.4 million. The factors which might affect the scheduling of this work are:

1. Approval by U.S. EPA of the NYSDEC's application for Federal funding pursuant to CERCLA
2. Development of final contract and bidding documents describing the sewer cleaning, including health and safety plans
3. Timely procurement of a contract with a responsive, responsible contractor to perform this work

Construction of Administration Building

It is planned that the NYSDEC will begin construction of a new building to supplement facilities provided in the Love Canal leachate treatment plant. The new building will be located immediately west of the leachate treatment plant and will be approximately 40 feet by 70 feet in size. The new building will provide the following necessary facilities:

1. Additional office and storage space
2. Improved personal hygiene facilities for added worker comfort and safety
3. A small laboratory to perform some chemical analyses needed to monitor plant operations

The estimated cost for construction of the new Administration Building is approximately $500,000.

The factors which might affect the scheduling of this work are:

1. Approval by U.S. EPA of the NYSDEC's application for Federal funding pursuant to CERCLA
2. Development of final plans and specifications for the building
3. Procurement of a contract with a responsive, responsible contractor for construction of the building

Removal of Contaminated Sediments From Black and Bergholtz Creeks

It is planned that contaminated sediments will be removed from Black and Bergholtz Creeks. This work is currently planned for commencement in fall 1986. Removal of the contaminated sediments from Black and Bergholtz Creeks involves the following major elements of work:

1. Collection and analysis of additional sediment samples to better define the areal extent of the contaminated sediments

2. Removal of the contaminated sediments from the creeks by hydraulic or mechanical dredging techniques
3. Dewatering of the contaminated sediments and proper preparation for disposal

The actual cost of this work is unknown at this time. The cost estimates contained in the RI/FS report are dependent upon the amount and extent of contamination in and adjacent to the creeks and the means of disposal selected. The factors which affect the scheduling of this work are:

1. Approval by U.S. EPA of the NYSDEC's application for Federal funding pursuant to CERCLA (the existing funding request should enable the extent of the problem to be better defined and a means of sediment disposal identified.)
2. Development of final plans and specifications for the work, including an acceptable health/safety contingency plan
3. Procurement of contractual services necessary to carry out the work
4. Approval of a site for the storage of spoils

Use of Plasma Arc Techology

The NYSDEC entered into a contract with Pyrolysis Systems, Inc. (PSI) of Welland, Ontario, requiring PSI to design, construct, test, and demonstrate the full-scale operation of plasma arc technology for the destruction of liquid hazardous waste sludges at the Love Canal site.

Plasma arc technology involves passing compressed air through an electric arc, thus creating a high-temperature plasma or ionized gas stream. This plasma reaches temperatures in excess of 10,000°C. The liquid hazardous waste sludge is injected into this high-temperature plasma and the chemical constituents of the waste are subsequently reduced to the atomic state. The particulate carbon and acid gas resulting from the destruction of the wastes are removed in a conventional scrubber. The principal component of the scrubbed gas is hydrogen, which is subsequently flared in a stack.

The plasma arc unit is expected to be used at Love Canal for the purpose of destroying the chemical sludge, which is separated from the leachate and currently stored onsite. The plasma arc unit is expected to have capacity to destroy the existing inventory of sludge.

A major portion of the effort in the plasma arc project involves obtaining the necessary permits. To ensure that the health and safety of the surrounding community is protected, permits must be obtained from both the EPA and the NYSDEC before operation can commence at the Love Canal site. These permits require an extensive health and safety plan and an integral fail-safe system as well as trial burns to demonstrate that the by-products of the waste destruction do not themselves pose a hazard. In addition, the project must also satisfy the requirements of the State Environmental Quality Review Act (SEQR), and an environmental impact statement must be prepared.

The estimated cost of developing this technology to the point where it is permitted and ready to be used at the Love Canal site is over $2 million. The factors which will affect the conduct of this work are:

1. Obtaining the necessary funding to complete the project
2. Development of acceptable contractual arrangements to complete the work
3. Satisfactory completion of all testing to demonstrate that the plasma arc technology works properly
4. Preparation and approvals of various permit applications including conduct of public hearings
5. Preparation and approval of an environmental impact statement

CITIZEN PARTICIPATION AT LOVE CANAL

In the interest of finding and carrying out the best social, political, economic, and environmental solution to the Love Canal situation, the NYSDEC is committed to a comprehensive citizen participation program. Citizen participation at Love Canal is a dynamic, evolving program. The technical situation as well as the social, political, and psychological situation have changed since the NYSDEC's first involvement and they will continue to change as the remedial program continues. The NYSDEC is constantly reviewing and evaluating all of the varying factors related to the Love Canal program and involving the public as appropriate.

The overall design of the Love Canal Citizen Participation program is intended to develop an informed public and provide opportunity for the public to be an active participant in the decision-making process. A situation as complex as Love Canal affects a wide range of people (homeowners, State, Federal, and local government representatives, environmental groups, previous residents, etc.), and the development of an implementable solution requires the input and the effective acceptance of all these parties.

The cornerstone of the NYSDEC's citizen participation program at Love Canal is an onsite public information office. The office, located within the Love Canal Emergency Declaration Area (EDA) at 9820 Colvin Boulevard, is open to the public 9:00 a.m. to 5:00 p.m., five days a week. In addition, it is frequently open additional hours and days to accommodate the schedules and special interests of people interested in taking advantage of the office's services.

The office's full-time staff includes a professional citizen participation specialist and a stenographer. Both are very knowledgeable about the Love Canal situation and provide assistance in finding specific information or interpreting difficult-to-understand documents or program aspects. One of the major goals of the citizen participation program is the promotion of effective communication between all of the involved and affected interests. The office and its staff work toward accomplishing this by facilitating the transfer of information not only from the public to the government but from the government to the public and between all the various groups and interests as well. The office serves as a document depository for Love Canal reports, information, and correspondence, and the numerous "publics" are encouraged to review, discuss, and comment on them.

While the public information office is the focal point of the citizen participation program, it does not constitute the NYSDEC's whole effort. NYSDEC uses a variety of methods and techniques to fit the need of the affected interests and accomplish the program's goal of developing an informed public that is an effective and valuable component of the Love Canal decision-making process. These methods include:

1. Publication of a newsletter
2. Meetings between individuals and government officials
3. Small group discussion sessions
4. Public information meetings
5. Telephone communication
6. Drop-in visits to the Public Information Office
7. "At-home" visits and discussions
8. Mailings of pertinent documents, meeting notifications, etc.
9. Briefings with local government officials, the press, and special interest groups
10. Development and distribution of responsiveness summaries, fact sheets, information documents, and executive summaries
11. Maintenance of a toll-free "800" telephone
12. Discussion opportunity sessions

13. News releases

14. Responses to letters.

Detailed descriptions of these techniques follow.

Newsletter

The newsletter (Love Canal Update) is published periodically to inform the interested "publics" of planned and ongoing remedial work activities and projects at the Love Canal. Program problems are presented and alternatives reviewed. Lists of available documents and meeting notices are included in each newsletter. Each issue also includes telephone numbers and addresses for information on Love Canal and other hazardous waste sites.

The purpose of the newsletter is to promote and develop public understanding of the issues involved, to present information on the progress and results of the remedial actions, and to encourage involvement in the decision-making process.

Meetings Between Individuals and Government Officials

Government officials meet with individuals on a one-on-one basis to provide an opportunity for individuals to discuss their specific concerns. This allows for a detailed discussion that leads to a more complete understanding. It also allows the discussion to focus on very personal or individual concerns that might never surface at larger meetings. Working on problems together in this format also improves the relationship between the various parties, thereby enhancing the effectiveness of future discussions and problem-solving efforts.

Small Group Discussions

NYSDEC officials meet with various special interest groups to provide more detailed information on various aspects of the Love Canal Superfund program and other hazardous waste activities. These small group discussions promote the interchange of detailed information. They also promote a better understanding among interest groups regarding for each other's concerns and viewpoints.

Public Information Meetings

Large public information meetings are held to provide updates and presentations on large amounts of information to a fairly large number of people at once.

Public information meetings provide the public with an opportunity to express their concerns to government officials. They also provide an educational opportunity for all interested parties to hear the various concerns of other groups and individuals.

Telephone Contacts

Telephone contact is used extensively for many purposes. For example, it provides a quick method for immediate notification of available documents, test results, program changes, upcoming meetings, comment period deadlines, etc. It also serves as a method of receiving and discussing concerns and questions from interested groups and individuals.

Drop-In Visits

The Public Information Office is open daily to interested individuals and groups. Visitors are welcome to "drop in" for information on the history and major events that developed as a result of the Love Canal. Local residents and concerned interest groups also visit the office regularly to stay informed on the most recent developments and to discuss issues of concern.

At-Home Visits

To communicate with those individuals unable or reluctant to "drop in" at the Public Information Office, at-home visits are often arranged. These visits allow for a personalized discussion of topics and activities that most directly influence or concern the specific individuals.

Mailings

Mailings are used for the release of information and for meeting notifications. A comprehensive mailing list has been developed to include a large number (600-700) and wide variety of people including Love Canal homeowners, special interest groups, media representatives, government officials, and concerned and interested citizens.

Briefings

Press briefings are often held to accommodate media deadlines and to provide the press with a specific question-and-answer period. Local elected officials and special interest groups are also briefed on major findings, proposed activities, and other significant program details.

Responsiveness Summaries, Fact Sheets, Information Documents, Executive Summaries

Responsiveness summaries are public documents that are prepared to record government responses to input and comment. They allow those who make comments or are interested to have some input into the decision-making process. Responsiveness summaries also serve as a review method for agency officials to verify for themselves that all pertinent comments have been addressed. Comments and input included in a responsiveness summary may come from internal sources, as well as external, and may be reviewed very informally or during more formalized means--such as formal public comment periods.

Fact sheets and information documents are developed for specific program purposes. They are used as handouts at meetings or included in mailings. Executive summaries are written for major documents. They highlight the major aspects of the total document and allow for a general understanding of the document's contents in concise, easily read format.

Toll-Free Telephone

A toll-free telephone number (800-342-9296) is maintained in the NYSDEC central office. This serves as a backup for the Love Canal Public Information Office and provides a direct link to the central office for interested parties in the Love Canal area.

Discussion Opportunity Sessions

These sessions are designated periods (usually both afternoon and evening) in which representatives of government agencies and/or their consultants make themselves available for individuals to stop by and discuss a specific aspect of the program. This technique allows for individuals' schedules to be accommodated and still provides sufficient opportunity to speak directly with experts in particular program areas.

News Releases

Periodically, noteworthy program information, documents, or meeting announcements are brought to public attention through the distribution of news releases to the media. Media representatives often respond to news releases with follow-up calls to acquire more detailed information.

Responses to Letters

The NYSDEC receives numerous letters from interested and concerned "publics." These letters raise concerns and question various aspects of the Love Canal program. Each letter receives a written response from the NYSDEC if appropriate, or is forwarded to the appropriate source most capable of responding. This exchange of correspondence provides an opportunity for on-going, detailed communication.

CITIZEN PARTICIPATION PROGRAM SUMMARY

The aforementioned methods constitute the majority of the techniques that the NYSDEC uses in its citizen participation program; however, there is a great deal of less formalized activity that occurs in concert with these techniques to accomplish the citizen participation program goals.

At the core of the citizen participation program is the encouragement and promotion of effective communication between various publics and the government agencies responsible for the Love Canal remedial program. The NYSDEC's citizen participation program at Love Canal can be summarized as a concerted effort to provide up-to-date, accurate information fostering the exchange of facts and feelings, and developing an atmosphere for useful input from all interested parties.

GLOSSARY

Adsorbates - Materials which adhere to the surfaces of other particles.

Backflow - Fluid flow which is opposite of normal; i.e., reverse flow.

Bedding Materials - Fill placed in a trench as foundation support of pipe.

Dessicated Clays - Dried clay, frequently exhibiting shrinkage cracks.

Dolomite - A rock type, similar to limestone, composed of calcium-magnesium carbonate.

Exfiltration - Fluid passing out from a source; e.g., water leaking out through the joints or cracks of a pipe, or seeping out of the ground.

Glacial Till - Nonsorted material deposited by a glacier, consisting of intermixed clay, sand, gravel, and boulders.

Granular Activiated Carbon - Highly absorbent form of charcoal made by carbonization (coking) and chemical activation, and used as a purifier.

Hydrogeology - The science which deals with the application of geological principles to the understanding of ground water occurrence and flow.

Immiscible Organic Liquid - A liquid, composed of carbon-based compounds, which is incapable of mixing or attaining homogeneity, especially with water.

Infiltration - Water which seeps into a medium such as a sewer pipe or into the ground.

Lacustrine Sediments - Lake sediments.

Leachate - Solution or product produced by action of a percolating liquid which dissolves some of the material that it percolates through.

Lift - In construction, the thickness (height) of a soil layer prior to compaction.

Maximum Dry Density - Measure of compaction used to express the weight of solids per unit of volume at optimum moisture content according to the standard Proctor test.

Permeability - Measure of the ability of a soil, rock or other material to transmit water or other fluids through its porous openings.

Piezometric Surface - Water level attained due to combined effect of pressure and elevation. (The water table is a piezometric surface.)

ppm - Parts per million. (A measurement of concentration in very weak solutions. More precisely, the ratio of the weight of solute to the weight of solvant times one million.)

ppb - Parts per billion (A measurement of concentration equivalent to thousandths of ppm.)

ppt - Parts per trillion (A measurement of concentration equivalent to millionths of ppm.)

Quarterly Average - An average determined from three consecutive months of data.

Recharge - The infiltration of water from the surface to the zone of saturation.

Spoils - Waste soil or rock material.

Surcharging - Filling a pipe to excess in order to force fluid into a system.

Varved Silty Clay - Deposit exhibiting layers believed to comprise the annual cycle of deposition in a body of still water.

Zone of Saturation - That portion of the earth below the water table.

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Versar INC.

sampled March 28, 1984

DATA SUMMARY

Section I

000004

Versar INC.

Versar Project 857.2-16 & 20
NYS Contract No. C000661

DATA SUMMARY

	Sample	Compounds Detected	Concentration ug/L
6109	R-999-1	PCB 1260	2.23
5209	R-999-2	acetone	250
5209	R-999-2 (VOA dup.) ONLY	acetone	270
5103	R-999-4	toluene	4
		bis(2-ethylhexyl)phthalate	27
5103	R-999-4 (BNA dup.) ONLY	bis(2-ethylhexyl)phthalate	66
5102	R-999-5	bis(2-ethylhexyl)phthalate	16
5101	R-999-6	bis(2-ethylhexyl)phthalate	34
5201	R-999-7	bis (2-ethylhexyl)phthalate	10
4108	R-999-8	bis(2-ethylhexyl)phthalate	15
[illegible]06	R-999-10	bis(2-ethylhexyl)phthalate	15
[illegible]4	R-999-12	δ-BHC	0.0[illegible]
	Reagent Blank	none detected	ND
5201	R-999-7 (Pest. dup.) ONLY	none detected	ND

000005

Versar INC.

QUALITY CONTROL SUMMARY

Section II

000006

Versar INC.

Project 857.2-16 & 20
NYS Contract No. C000661

Q.C. SUMMARY

Matrix Spike Recoveries

Compound	% Recovery	EPA Recommended Limits
1,1 dichloroethane	82	61-145
benzene	73	76-127
trichloroethene	71	71-120
toluene	80	76-125
chlorobenzene	79	75-130
1,2,4-trichlorobenzene	70	39-98
acenaphthene	91	46-118
2,4-dinitrotoluene	108	24-96
di-n-butylphthalate	141	11-117
pyrene	105	26-127
N-nitrosodi-N-propylamine	72	41-116
1,4-dichlorobenzene	75	36-97
pentachlorophenol	86	9-103
phenol	41	12-89
2-chlorophenol	88	27-123
P-chloro-M-cresol	79	23-97
4-nitrophenol	55	10-80
lindane	75	56-123
heptachlor	84	40-131
aldrin	95	40-120
dieldrin	114	52-126
endrin	109	56-121
p,p'-DDT	97	38-127

6850 VERSAR CENTER • P.O. BOX 1549 • SPRINGFIELD, VIRGINIA 22151 • TELEPHONE: (703) 750-3000 • TELEX: 901125

Case NO. 857.2 -16 & 20
LOW LEVEL X
WATER X
QC REPORT NO. 857.2-16,20

CONTRACTOR VERSAR INC.
MED. LEVEL

CONTRACT NO. C 000661
HIGH LEVEL
OTHER (Specify)

[-------Volatile --------][--------------------Semi-Volatile--------------------------][Pesticide]--

% Recovery

Sample No.	D_8 Toluene	BFB	D_4-1,2-Dichloroethane	D_5-Nitrobenzene	2-Fluorobiphenyl	D_{14}-p-Terphenyl	D_5-Phenol	2-Fluorophenol	2,4,6-Tribromophenol	Dibutyl-Chlorendate	
R-999-1	110	100	77	58	76	123	36	46	79	62	
R-999-2	103	97	97	68	76	132	32	54	81	87	
R-999-4	104	96	94	80	58	114	26	42	70	67	
R-999-5	102	95	96	82	88	127	30	43	65	66	
R-999-6	100	95	93	82	87	134	29	46	82	84	B00000
R-999-7	99	88	94	81	87	125	32	50	74	65	
R-999-8	98	89	95	88	91	123	31	48	77	65	
R-999-10	108	96	92	93	81	106	33	56	68	73	
R-999-12	101	92	93	91	85	148	32	56	63	88	
RB	114	109	95	33	46	81	41	37	36	87	
Duplicate	99	90	95	87	94	121	29	46	82	66	
Matrix Spk	99	89	95	71	82	122	32	35	82	97	

Comments:

Limits Rev: 12/83

3/21/84

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   512

****
*** SITE DATA ***
****

SAMPLING AREA 03 STATION 512   COORDS 401053 E 1121805 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20666   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1230   CONTRACTOR JRB
WELL ID 006B   DEPTH 37.80 FEET   COMPOSITE SAMPLE   WATER TEMP 0

5223

*** ANALYSIS RESULTS ***

METHOD ANION   SPECIFIC METHOD 34020   ANALYSIS LAB PJBL   QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1100.000 UG/L		SAMPLE VOL. 100

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20779   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1230   CONTRACTOR JRB
WELL ID 006B   DEPTH 37.80 FEET   COMPOSITE SAMPLE   WATER TEMP 0

5223

*** ANALYSIS RESULTS ***

METHOD 608W   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20802   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1230   CONTRACTOR JRB
WELL ID 006B   DEPTH 37.80 FEET   COMPOSITE SAMPLE   WATER TEMP 0

5223

*** ANALYSIS RESULTS ***

METHOD 624W   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
1,1-DICHLOROETHENE	75-35-4	V03	TRACE		
CHLOROFORM	67-66-3	V11	TRACE		
BENZENE	71-43-2	V22	TRACE		
TOLUENE	108-88-3	V34	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20804   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1215   CONTRACTOR JRB
WELL ID 006A   DEPTH 21.50 FEET   COMPOSITE SAMPLE   WATER TEMP 0

5123

*** ANALYSIS RESULTS ***

METHOD 624W   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
1,1-DICHLOROETHENE	75-35-4	V03	TRACE		
BENZENE	71-43-2	V22	TRACE		
1,1,2,2-TETRACHLOROETHANE	79-34-5	V28	TRACE		
TOLUENE	108-88-3	V34	TRACE		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   512

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20907   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1230   CONTRACTOR JRB
WELL ID 006B   DEPTH   37.80 FEET   COMPOSITE SAMPLE   WATER TEMP   0

5223

*** ANALYSIS RESULTS ***

METHOD 625CW   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE   999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
4-CHLOROPHENOL	106-48-9	A03	TRACE		
NAPHTHALENE	91-20-3	B14	TRACE		
ANTHRACENE	120-12-7	B33	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20811   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/23/80   START TIME 1215   CONTRACTOR JRB
WELL ID 006A   DEPTH   21.50 FEET   COMPOSITE SAMPLE   WATER TEMP   0

5123

*** ANALYSIS RESULTS ***

METHOD 606W   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE   999.9 ML

COMPOUND   CAS   PC   CONCENTRATION   REPORTED CONC   COMMENT

PESTICIDES   BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20812   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/23/80   START TIME 1215   CONTRACTOR JRB
WELL ID 006A   DEPTH   21.50 FEET   COMPOSITE SAMPLE   WATER TEMP   0

5123

*** ANALYSIS RESULTS ***

METHOD 625CW   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE   999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
NAPHTHALENE	91-20-3	B14	TRACE		
ANTHRACENE	120-12-7	B33	TRACE		

ACIDS   BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20835   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/23/80   START TIME 1215   CONTRACTOR JRB
WELL ID 006A   DEPTH   21.50 FEET   COMPOSITE SAMPLE   WATER TEMP   0

5123

*** ANALYSIS RESULTS ***

METHOD ANION   SPECIFIC METHOD 34020   ANALYSIS LAB ERCO   QUAN SIZE   0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	920.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 512

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21300 MEDIUM H2O . SOURCE GRH2O SAMPLE DATE 09/29/80 START TIME 1130 CONTRACTOR JRB
WELL ID 006B DEPTH 37.80 FEET COMPOSITE SAMPLE WATER TEMP 0

5223

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	11.000 UG/L		
ZINC	7440-66-6	I14	75.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21335 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 0905 CONTRACTOR JRB
WELL ID 006A DEPTH 21.50 FEET COMPOSITE SAMPLE WATER-TEMP 0

5123

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	3.000 UG/L		
COPPER	7440-50-8	I07	8.000 UG/L		
ZINC	7440-66-6	I14	14.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 06 018

*** SITE DATA ***

SAMPLING AREA 06 STATION 018 COORDS 402858 E 1123503 N

*** SAMPLE DATA ***

SAMPLE-ID W21803 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/14/80 START TIME 1210 CONTRACTOR JRB
WELL ID 051A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

4111

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W21804 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/14/80 START TIME 1210 CONTRACTOR JRB
WELL ID 051A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

4111

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 999.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS	BELOW DETECTION LIMIT					
BASE/NEUTRALS	BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W21805 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/14/80 START TIME 1210 CONTRACTOR JRB
WELL ID 051A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

4111

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 999.9 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W21807 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/14/80 START TIME 1210 CONTRACTOR JRB
WELL ID 051A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

4111

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1100.000 UG/L		
NITRATE	0- 0-0	I16	3010.000 UG/L		

R A W   D A T A   L I S T I N G

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   10   042

****
*** SITE DATA ***
****

SAMPLING AREA 10 STATION 042   COORDS 402178 E 1120885 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25717 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0915 CONTRACTOR JRB
WELL ID 056A DEPTH 9.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6141

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25718 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0915 CONTRACTOR JRB
WELL ID 056A DEPTH 9.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6141

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 999.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS	BELOW DETECTION LIMIT				
BASE/NEUTRALS	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25719 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0930 CONTRACTOR JRB
WELL ID 056A DEPTH 9.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6141

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 900.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25720 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0915 CONTRACTOR JRB
WELL ID 056A DEPTH 9.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6141

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	10.000 UG/L		
CADMIUM	7440-43-9	I05	10.000 UG/L		
LEAD	7439-92-1	I08	61.000 UG/L		
ZINC	7440-66-6	I14	48.000 UG/L		

****RAW DATA LISTING****

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 10 042

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25721 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0915 CONTRACTOR JRB
WELL ID 056A DEPTH 9.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6141

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1500.000 UG/L		
NITRATE	0- 0-0	I16	1900.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25722 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0930 CONTRACTOR JRB
WELL ID 056B DEPTH 9.80 FEET COMPOSITE SAMPLE WATER TEMP 0

6241

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25724 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0930 CONTRACTOR JRB
WELL ID 056B DEPTH 9.80 FEET COMPOSITE SAMPLE WATER TEMP 0

6241

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 600.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25725 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 0930 CONTRACTOR JRB
WELL ID 056B DEPTH 9.80 FEET COMPOSITE SAMPLE WATER TEMP 0

6241

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	16.000 UG/L		
CADMIUM	7440-43-9	I05	27.000 UG/L		
ZINC	7440-66-6	I14	18.000 UG/L		

R A W   D A T A   L I S T I N G

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   09   019

*** SITE DATA ***

SAMPLING AREA 09 STATION 019   COORDS 402996 E 1122098 N

*** SAMPLE DATA ***

SAMPLE-ID W25658 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1630 CONTRACTOR JRB
WELL ID 110A DEPTH 4.70 FEET COMPOSITE SAMPLE WATER TEMP 0

6113

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CNTL QUAN SIZE 960.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS	BELOW DETECTION LIMIT					
BASE/NEUTRALS	BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W25659 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1630 CONTRACTOR JRB
WELL ID 110A DEPTH 4.70 FEET COMPOSITE SAMPLE WATER TEMP 0

6113

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CNTL QUAN SIZE 999.9 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W25660 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1630 CONTRACTOR JRB
WELL ID 110A DEPTH 4.70 FEET COMPOSITE SAMPLE WATER TEMP 0

6113

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	30.000 UG/L		
CADMIUM	7440-43-9	I05	7.000 UG/L		
CHROMIUM	7440-47-3	I06	18.000 UG/L		
COPPER	7440-50-8	I07	12.000 UG/L		
LEAD	7439-92-1	I08	71.000 UG/L		
NICKEL	7440- 2-0	I09	74.000 UG/L		
MERCURY	7439-97-6	I10	0.200 UG/L		
ZINC	7440-66-6	I14	100.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W25661 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1630 CONTRACTOR JRB
WELL ID 110A DEPTH 4.70 FEET COMPOSITE SAMPLE WATER TEMP 0

6113

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	2000.000 UG/L		
NITRATE	0- 0-0	I16	1550.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   041

*** SITE DATA ***

SAMPLING AREA 02 STATION 041   COORDS 401082 E 1123052 N

*** SAMPLE DATA ***

SAMPLE-ID W25203 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0900 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	11.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W25205 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0912 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 740.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W25206 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0910 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	800.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W25207 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0934 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	7.000 UG/L		
COPPER	7440-50-8	I07	7.000 UG/L		
ZINC	7440-66-6	I14	75.000 UG/L		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   041

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25208 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0930 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25210 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0952 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25211 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0935 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	740.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25212 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0905 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	17.000 UG/L		
ZINC	7440-66-6	I14	32.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25213 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0942 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	13.330 UG/L		C

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 02 041

*** SAMPLE DATA ***

SAMPLE-ID W25214 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0940 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	0.050 UG/L		
GAMMA-BHC	58-89-9	P03	0.012 UG/L		
DELTA-BHC	319-86-8	P04	0.018 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W25215 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0946 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
2,4-DICHLOROTOLUENE	95-73-8	B27	TRACE		
PHENANTHRENE	85- 1-8	B32	TRACE		
CHRYSENE	218- 1-9	B40	TRACE		

ACIDS BELOW DETECTION LIMIT

*** SAMPLE DATA ***

SAMPLE-ID W25216 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0947 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 50.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	27.000 UG/L		
MERCURY	7439-97-6	I10	TRACE		
ZINC	7440-66-6	I14	100.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W25217 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 0950 CONTRACTOR JRB
WELL ID 031B DEPTH 6.30 FEET COMPOSITE SAMPLE WATER TEMP 0

3222

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB EMSC QUAN SIZE 125.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	870.000 UG/L		SAMPLEDISTILLED
NITRATE	0- 0-0	I16	TRACE		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   041

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25471 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/08/80 START TIME 0945 CONTRACTOR JRB
WELL ID 031A DEPTH 11.90 FEET COMPOSITE SAMPLE WATER TEMP 0

3/22

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25472 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/08/80 START TIME 0950 CONTRACTOR JRB
WELL ID 031A DEPTH 11.90 FEET COMPOSITE SAMPLE WATER TEMP 0

3/22

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	5.000 UG/L		
BASE/NEUTRALS BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25473 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/08/80 START TIME 0955 CONTRACTOR JRB
WELL ID 031A DEPTH 11.90 FEET COMPOSITE SAMPLE WATER TEMP 0

3/22

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		
DDE	72-55-9	P10	TRACE		
DDD	72-54-8	P15	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25474 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/08/80 START TIME 0952 CONTRACTOR JRB
WELL ID 031A DEPTH 11.90 FEET COMPOSITE SAMPLE WATER TEMP 0

3/22

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	130.000 UG/L		
BERYLLIUM	7440-41-7	I04	0.800 UG/L		
CADMIUM	7440-43-9	I05	16.000 UG/L		
CHROMIUM	7440-47-3	I06	47.000 UG/L		
COPPER	7440-50-8	I07	68.000 UG/L		
LEAD	7439-92-1	I08	350.000 UG/L		
NICKEL	7440- 2-0	I09	110.000 UG/L		
ZINC	7440-66-6	I14	580.000 UG/L		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   043

****
*** SITE DATA ***
****

SAMPLING AREA 02 STATION 043   COORDS 401285 E 1122801 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25270 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1330 CONTRACTOR JRB
WELL ID 034A DEPTH 23.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3/23

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25272 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1339 CONTRACTOR JRB
WELL ID 034A DEPTH 23.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3/23

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		
ALDRIN	309- 0-2	P06	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25273 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1335 CONTRACTOR JRB
WELL ID 034A DEPTH 23.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3/23

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	26.000 UG/L		
CHROMIUM	7440-47-3	I06	17.000 UG/L 9.9		
COPPER	7440-50-8	I07	34.000 UG/L 26		
LEAD	7439-92-1	I08	150.000 UG/L 259		
NICKEL	7440- 2-0	I09	52.000 UG/L 21		
ZINC	7440-66-6	I14	240.000 UG/L 127		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25276 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1332 CONTRACTOR JRB
WELL ID 034A DEPTH 23.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3/23

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	AC5	8.000 UG/L		
PHENANTHRENE	85- 1-8	B32	TRACE		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   518

****
*** SITE DATA ***
****

SAMPLING AREA 03 STATION 518

COORDS 401699 E 1121277 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20863 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1020 CONTRACTOR JRB
WELL ID 039A DEPTH 26.10 FEET COMPOSITE SAMPLE WATER TEMP 0

5114

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1000.000 UG/L		
NITRATE	0- 0-0	I16	300.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20865 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 039B DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	7.000 UG/L		

BASE/NEUTRALS BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20866 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 039B DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
GAMMA-BHC	58-89-9	P03	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20886 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 039B DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	610.000 UG/L		
NITRATE	0- 0-0	I16	240.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 518

*** SAMPLE DATA ***

SAMPLE-ID W20989 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 0398 DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB EMSC QUAN SIZE 125.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	750.000 UG/L		SAMPLE DISTILLED
NITRATE	0- 0-0	I16	TRACE		

*** SAMPLE DATA ***

SAMPLE-ID W20990 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 0398 DEPTH 22.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W20991 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 0398 DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS BELOW DETECTION LIMIT					
BASE/NEUTRALS BELOW DETECTION LIMIT					

*** SAMPLE DATA ***

SAMPLE-ID W20992 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 0398 DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB EMSC QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	12.350 UG/L		
BROMODICHLOROMETHANE	75-27-4	V17	TRACE		
DIBROMOCHLOROMETHANE	124-48-1	V25	TRACE		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   518

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20916 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1020 CONTRACTOR JRB
WELL ID 039A DEPTH 26.10 FEET COMPOSITE SAMPLE WATER TEMP 0

5114

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20917 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 0930 CONTRACTOR JRB
WELL ID 039B DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	4.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21341 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1120 CONTRACTOR JRB
WELL ID 039B DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	180.000 UG/L		
CHROMIUM	7440-47-3	I06	21.000 UG/L		
COPPER	7440-50-8	I07	59.000 UG/L		
ZINC	7440-66-6	I14	40.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21342 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1120 CONTRACTOR JRB
WELL ID 039B DEPTH 44.50 FEET COMPOSITE SAMPLE WATER TEMP 0

5214

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	160.000 UG/L		
CHROMIUM	7440-47-3	I06	15.000 UG/L		
COPPER	7440-50-8	I07	56.000 UG/L		
ZINC	7440-66-6	I14	15.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 518

*** SAMPLE DATA ***

SAMPLE-ID W21344 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1115 CONTRACTOR JRB
WELL ID 039A DEPTH 26.10 FEET COMPOSITE SAMPLE WATER TEMP 0

5114

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	7.000 UG/L		
CADMIUM	7440-43-9	I05	5.000 UG/L		
CHROMIUM	7440-47-3	I06	9.000 UG/L		
COPPER	7440-50-8	I07	6.000 UG/L		
LEAD	7439-92-1	I08	67.000 UG/L		
ZINC	7440-66-6	I14	52.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W21377 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 0920 CONTRACTOR JRB
WELL ID 039A DEPTH 26.10 FEET COMPOSITE SAMPLE WATER TEMP 0

5114

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND CAS PC CONCENTRATION REPORTED CONC COMMENT

PESTICIDES BELOW DETECTION LIMIT

*** SAMPLE DATA ***

SAMPLE-ID W21378 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 0920 CONTRACTOR JRB
WELL ID 039A DEPTH 26.10 FEET COMPOSITE SAMPLE WATER TEMP 0

5114

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND CAS PC CONCENTRATION REPORTED CONC COMMENT

ACIDS BELOW DETECTION LIMIT
BASE/NEUTRALS BELOW DETECTION LIMIT

* * R A W D A T A L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 524

****
*** SITE DATA ***
****

SAMPLING AREA 03 STATION 524 COORDS 401681 E 1121448 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20900 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1245 CONTRACTOR JRB
WELL ID 049A DEPTH 21.40 FEET COMPOSITE SAMPLE WATER TEMP 0

5112

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	8.000 UG/L		
BASE/NEUTRALS BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20901 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1300 CONTRACTOR JRB
WELL ID 049B DEPTH 39.70 FEET COMPOSITE SAMPLE WATER TEMP 0

5212

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	5.000 UG/L		
BASE/NEUTRALS BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20902 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1300 CONTRACTOR JRB
WELL ID 049B DEPTH 39.70 FEET COMPOSITE SAMPLE WATER TEMP 0

5212

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20920 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1300 CONTRACTOR JRB
WELL ID 049B DEPTH 39.70 FEET COMPOSITE SAMPLE WATER TEMP 0

5212

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	6.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   524

*** SAMPLE DATA ***

SAMPLE-ID W20973 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1300 CONTRACTOR JRB
WELL ID 049B DEPTH 39.70 FEET COMPOSITE SAMPLE WATER TEMP 0

5/12

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	670.000 UG/L		
NITRATE	0- 0-0	I16	580.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W21384 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 0940 CONTRACTOR JRB
WELL ID 049A DEPTH 21.40 FEET COMPOSITE SAMPLE WATER TEMP 0

5/12

*** ANALYSIS RESULTS ***

METHOD AASFW SPECIFIC METHOD 20410 ANALYSIS LAB PJBL QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	150.000 UG/L		
CADMIUM	7440-43-9	I05	6.000 UG/L		
CHROMIUM	7440-47-3	I06	9.000 UG/L		
COPPER	7440-50-8	I07	8.000 UG/L		
NICKEL	7440- 2-0	I09	25.000 UG/L		
SELENIUM	7782-49-2	I11	4.000 UG/L		
ZINC	7440-66-6	I14	24.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W21385 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 0940 CONTRACTOR JRB
WELL ID 049A DEPTH 21.40 FEET COMPOSITE SAMPLE WATER TEMP 0

5/12

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB. PJBL QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1600.000 UG/L		SAMPLE VOL.10ML
NITRATE	0- 0-0	I16	100.000 UG/L		SAMPLE VOL.10ML

*** SAMPLE DATA ***

SAMPLE-ID W21387 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 0945 CONTRACTOR JRB
WELL ID 049A DEPTH 21.40 FEET COMPOSITE SAMPLE WATER TEMP 0

5/12

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

*** * R A W   D A T A   L I S T I N G * ***

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   526

****
*** SITE DATA ***
****

SAMPLING AREA 03 STATION 526   COORDS 400520 E 1122860 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25290 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1440 CONTRACTOR JRB
WELL ID 032A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3133

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BENZENE	71-43-2	V22	8.000 UG/L		
O-XYLENE	95-47-6	V30	18.000 UG/L		
M-XYLENE	108-38-3	V31	18.000 UG/L		
TOLUENE	108-88-3	V34	37.000 UG/L		
ETHYL BENZENE	100-41-4	V39	7.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25291 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1448 CONTRACTOR JRB
WELL ID 032A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3133

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACENAPHTYLENE	208-96-8	B19	TRACE		
PHENANTHRENE	85- 1-8	B32	TRACE		

ACIDS   BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25292 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1450 CONTRACTOR JRB
WELL ID 032A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3133

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
BETA-BHC	319-85-7	P02	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		
ALDRIN	309- 0-2	P06	TRACE		
DDT	50-29-3	P17	TRACE		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   526

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25293   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/02/80   START TIME 1445   CONTRACTOR JRB
WELL ID 032A   DEPTH 14.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3133

*** ANALYSIS RESULTS ***

METHOD ICPW   SPECIFIC METHOD   ANALYSIS LAB ERCO   QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	25.000 UG/L		
CHROMIUM	7440-47-3	I06	24.000 UG/L		
COPPER	7440-50-8	I07	27.000 UG/L		
LEAD	7439-92-1	I08	220.000 UG/L		
NICKEL	7440- 2-0	I09	39.000 UG/L		
ZINC	7440-66-6	I14	200.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25294   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/02/80   START TIME 1447   CONTRACTOR JRB
WELL ID 032A   DEPTH 14.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3133

*** ANALYSIS RESULTS ***

METHOD ANION   SPECIFIC METHOD -34020   ANALYSIS LAB ERCO   QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	910.000 UG/L		
NITRATE	0- 0-0	I16	1900.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20015   MEDIUM H2O   SOURCE STORM   SAMPLE DATE 08/10/80   START TIME 0720   CONTRACTOR GEOME
WELL ID 000   DEPTH 10.00 FEET   GRAB SAMPLE   WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD   SPECIFIC METHOD GAMMA   ANALYSIS LAB EMSV   QUAN SIZE 0.3 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
RADIATION BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20016   MEDIUM H2O   SOURCE STORM   SAMPLE DATE 08/10/80   START TIME 0720   CONTRACTOR GEOME
WELL ID 000   DEPTH 10.00 FEET   GRAB SAMPLE   WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD   SPECIFIC METHOD GAMMA   ANALYSIS LAB EMSV   QUAN SIZE 0.3 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
RADIATION BELOW DETECTION LIMIT					

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   04   508

*** SITE DATA ***

SAMPLING AREA 04 STATION 508

COORDS 401840 E 1124260 N

*** SAMPLE DATA ***

SAMPLE-ID W25327 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1644 CONTRACTOR JRB
WELL ID 090A DEPTH 22.50 FEET COMPOSITE SAMPLE WATER TEMP 0

3151

*** ANALYSIS RESULTS ***

METHOD AASFW SPECIFIC METHOD 20410 ANALYSIS LAB PJBL QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ANTIMONY	7440-36-0	I01	240.000 UG/L		
BARIUM	7440-39-3	I03	420.000 UG/L		
CADMIUM	7440-43-9	I05	6.000 UG/L		
CHROMIUM	7440-47-3	I06	36.000 UG/L		
NICKEL	7440- 2-0	I09	86.000 UG/L		
THALLIUM	7440-28-0	I13	62.000 UG/L		

*** SAMPLE DATA ***

SAMPLE-ID W25328 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1645 CONTRACTOR JRB
WELL ID 090A DEPTH 22.50 FEET COMPOSITE SAMPLE WATER TEMP 0

3151

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB PJBL QUAN SIZE 100.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	930.000 UG/L		VOL=10ML

*** SAMPLE DATA ***

SAMPLE-ID W25330 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1642 CONTRACTOR JRB
WELL ID 090A DEPTH 22.50 FEET COMPOSITE SAMPLE WATER TEMP 0

3151

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB GSNO QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	TRACE		
2,4-DICHLOROPHENOL	120-83-2	A07	TRACE		
DIETHYLPHTHALATE	84-66-2	B28	TRACE		

*** SAMPLE DATA ***

SAMPLE-ID W25331 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1647 CONTRACTOR JRB
WELL ID 090A DEPTH 22.50 FEET COMPOSITE SAMPLE WATER TEMP 0

3151

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB GSLA QUAN SIZE 999.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	0.012 UG/L		
BETA-BHC	319-85-7	P02	0.010 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25334 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1640 CONTRACTOR JRB
WELL ID 090A DEPTH 22.50 FEET COMPOSITE SAMPLE WATER TEMP 0

3151

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB GSNO QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BENZENE	71-43-2	V22	TRACE		
P-XYLENE	106-42-3	V32	TRACE		
TETRACHLOROETHENE	127-18-4	V33	TRACE		
ETHYL BENZENE	100-41-4	V39	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20032 MEDIUM H2O SOURCE STORM SAMPLE DATE 08/10/80 START TIME 0730 CONTRACTOR GEOME
WELL ID 000 DEPTH 10.00 FEET GRAB SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD SPECIFIC METHOD GAMMA ANALYSIS LAB EMSV QUAN SIZE 0.3 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
RADIATION	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20033 MEDIUM H2O SOURCE STORM SAMPLE DATE 08/10/80 START TIME 0730 CONTRACTOR GEOME
WELL ID 000 DEPTH 10.00 FEET GRAB SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD SPECIFIC METHOD GAMMA ANALYSIS LAB EMSV QUAN SIZE 0.3 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
RADIATION	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20034 MEDIUM H2O SOURCE STORM SAMPLE DATE 08/10/80 START TIME 0740 CONTRACTOR GEOME
WELL ID 000 DEPTH 10.00 FEET GRAB SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD SPECIFIC METHOD GAMMA ANALYSIS LAB EMSV QUAN SIZE 0.3 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
RADIATION	BELOW DETECTION LIMIT				

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 08 020

****
*** SITE DATA ***
****

SAMPLING AREA 08 STATION 020 COORDS 402837 E 1120865 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25678 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103A DEPTH 10.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/22 *** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 930.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS	BELOW DETECTION LIMIT				
BASE/NEUTRALS	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25679 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103A DEPTH 10.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/22 *** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 830.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25680 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103A DEPTH 10.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/22 *** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	45.000 UG/L		
CADMIUM	7440-43-9	I05	44.000 UG/L		
CHROMIUM	7440-47-3	I06	23.000 UG/L		
COPPER	7440-50-8	I07	16.000 UG/L		
LEAD	7439-92-1	I08	91.000 UG/L		
NICKEL	7440- 2-0	I09	30.000 UG/L		
ZINC	7440-66-6	I14	44.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25681 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103A DEPTH 10.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/22 *** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1400.000 UG/L		
NITRATE	0- 0-0	I16	2215.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 .08 020

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25682 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103B DEPTH 9.40 FEET COMPOSITE SAMPLE WATER TEMP 0

6222

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25683 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103B DEPTH 9.40 FEET COMPOSITE SAMPLE WATER TEMP 0

6222

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 999.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
DI-N-OCTYLPHTHALATE	117-84-0	B41	16.000 UG/L		
ACIDS BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25684 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103B DEPTH 9.40 FEET COMPOSITE SAMPLE WATER TEMP 0

6222

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 930.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25685 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/15/80 START TIME 1730 CONTRACTOR JRB
WELL ID 103B DEPTH 9.40 FEET COMPOSITE SAMPLE WATER TEMP 0

6222

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	36.000 UG/L		
CADMIUM	7440-43-9	I05	7.000 UG/L		
COPPER	7440-50-8	I07	7.000 UG/L		
ZINC	7440-66-6	I14	37.000 UG/L		

*** * R A W   D A T A   L I S T I N G * ***

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   039

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20808   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1130   CONTRACTOR JRB
WELL ID 0293   DEPTH 36.50 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3211

*** ANALYSIS RESULTS ***

METHOD 625CW   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
2-CHLOROPHENOL	95-57-8	A01	42.000 UG/L		SEE J41-0516
3-CHLOROPHENOL	108-43-0	A02	33.000 UG/L		
PHENOL	108-95-2	A05	33.000 UG/L		SEE J41-0516
2,4-DIMETHYLPHENOL	105-67-9	A06	53.000 UG/L		
2,4-DICHLOROPHENOL	120-83-2	A07	30.000 UG/L		SEE J41-0516
1,4-DICHLOROBENZENE	106-46-7	B02	TRACE		
1,3-DICHLOROBENZENE	541-73-1	B03	15.000 UG/L		
1,2-DICHLOROBENZENE	95-50-1	B04	15.000 UG/L		
NAPHTHALENE	91-20-3	B14	TRACE		
BIS(2-CHLOROETHOXY)METHANE	111-91-1	B15	14.000 UG/L		
ACENAPHTHENE	83-32-9	B20	22.000 UG/L		
N-NITROSODIPHENYLAMINE	86-30-6	B29	14.000 UG/L		
ANTHRACENE	120-12-7	B33	9.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20809   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/18/80   START TIME 1130   CONTRACTOR JRB
WELL ID 0293   DEPTH 36.50 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3211

*** ANALYSIS RESULTS ***

METHOD 608W   SPECIFIC METHOD   ANALYSIS LAB PJBL   QUAN SIZE 999.9 ML

COMPOUND   CAS   PC   CONCENTRATION   REPORTED CONC   COMMENT

PESTICIDES   BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21235   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/24/80   START TIME 1630   CONTRACTOR JRB
WELL ID 029A   DEPTH 22.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3111

*** ANALYSIS RESULTS ***

METHOD 624W   SPECIFIC METHOD   ANALYSIS LAB ACEE   QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	2.000 UG/L		
BROMODICHLOROMETHANE	75-27-4	V17	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21236   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 09/24/80   START TIME 1630   CONTRACTOR JRB
WELL ID 029A   DEPTH 22.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3111

*** ANALYSIS RESULTS ***

METHOD 625CW   SPECIFIC METHOD   ANALYSIS LAB ACEE   QUAN SIZE 999.9 ML

COMPOUND   CAS   PC   CONCENTRATION   REPORTED CONC   COMMENT

ACIDS   BELOW DETECTION LIMIT

BASE/NEUTRALS   BELOW DETECTION LIMIT

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   039

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*** SAMPLE DATA ***

****

SAMPLE-ID W21285 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/29/80 START TIME 1220 CONTRACTOR JRB
WELL ID 029B DEPTH 36.50 FEET COMPOSITE SAMPLE WATER TEMP 0

3211

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	46.000 UG/L		
CADMIUM	7440-43-9	I05	5.000 UG/L		
ZINC	7440-66-6	I14	27.000 UG/L		

1

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*** SAMPLE DATA ***

****

SAMPLE-ID W21303 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/24/80 START TIME 1630 CONTRACTOR JRB
WELL ID 029A DEPTH 22.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3111

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	42.000 UG/L		
CHROMIUM	7440-47-3	I06	87.000 UG/L	94	
COPPER	7440-50-8	I07	40.000 UG/L	190	
LEAD	7439-92-1	I08	80.000 UG/L	212	
NICKEL	7440- 2-0	I09	130.000 UG/L	198	
ZINC	7440-66-6	I14	66.000 UG/L	224	

2

****

*** SAMPLE DATA ***

****

SAMPLE-ID W21304 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/24/80 START TIME 1630 CONTRACTOR JRB
WELL ID 029A DEPTH 22.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3111

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1500.000 UG/L		
NITRATE	0- 0-0	I16	2600.000 UG/L		

3

****

*** SAMPLE DATA ***

****

SAMPLE-ID W21364 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1540 CONTRACTOR JRB
WELL ID 029A DEPTH 22.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3111

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
BETA-BHC	319-85-7	P02	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 02 040

****
*** SITE DATA ***
****

SAMPLING AREA 02 STATION 040 COORDS 401594 E 1123205 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21338 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1145 CONTRACTOR JRB
WELL ID 030A DEPTH 25.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3112

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
BETA-BHC	319-85-7	P02	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
DELTA-BHC	319-86-8	P04	2.000 UG/L		
DIELDRIN	60-57-1	P13	TRACE		
DDT	50-29-3	P17	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25083 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1140 CONTRACTOR JRB
WELL ID 030A DEPTH 19.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3112

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
1,1,1-TRICHLOROETHANE	71-55-6	V14	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25084 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1142 CONTRACTOR JRB
WELL ID 030A DEPTH 19.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3112

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS BELOW DETECTION LIMIT					
BASE/NEUTRALS BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W25085 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1144 CONTRACTOR JRB
WELL ID 030A DEPTH 19.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3112

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB PJBL QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1200.000 UG/L		SAMPLE VOL.100ML
NITRATE	0- 0-0	I16	200.000 UG/L		SAMPLE VOL.10ML

R A W   D A T A   L I S T I N G

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   040

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*** SAMPLE DATA ***

****

SAMPLE-ID W25065   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/01/80   START TIME 1143   CONTRACTOR JRB

WELL ID 030A   DEPTH 19.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3112

*** ANALYSIS RESULTS ***

METHOD AASFW   SPECIFIC METHOD 20410   ANALYSIS LAB PJBL   QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ANTIMONY	7440-36-0	I01	190.000 UG/L	<10	
ARSENIC	7440-38-2	I02	2.000 UG/L	12	
BARIUM	7440-39-3	I03	43.000 UG/L		
CADMIUM	7440-43-9	I05	2.000 UG/L	<10	
CHROMIUM	7440-47-3	I06	28.000 UG/L	78	
COPPER	7440-50-8	I07	10.000 UG/L	82	
LEAD	7439-92-1	I08	48.000 UG/L	329	
NICKEL	7440- 2-0	I09	64.000 UG/L	124	
SELENIUM	7782-49-2	I11	10.000 UG/L	<10	
THALLIUM	7440-28-0	I13	52.000 UG/L	<10	
ZINC	7440-66-6	I14	84.000 UG/L	279	

*** * R A W   D A T A   L I S T I N G * ***

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   044

****
*** SITE DATA ***
****

SAMPLING AREA 02 STATION 044   COORDS 401648 E 1122585 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21372 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1027 CONTRACTOR JRB
WELL ID 035A DEPTH 22.00 FEET GRAB SAMPLE WATER TEMP 0

3113

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
BETA-BHC	319-85-7	P02	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21373 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1022 CONTRACTOR JRB
WELL ID 035A DEPTH 22.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3113

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS	BELOW DETECTION LIMIT					
BASE/NEUTRALS	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21374 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1020 CONTRACTOR JRB
WELL ID 035A DEPTH 22.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3113

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21375 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/01/80 START TIME 1025 CONTRACTOR JRB
WELL ID 035A DEPTH 22.00 FEET COMPOSITE SAMPLE WATER TEMP 0

3113

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB PJBL QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	810.000 UG/L		SAMPLE VOL.10CML
NITRATE	0- 0-0	I16	200.000 UG/L		SAMPLE VOL.10ML

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   02   044

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21376   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/01/80   START TIME 1024   CONTRACTOR JRB
WELL ID 035A   DEPTH 22.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

3113

*** ANALYSIS RESULTS ***

METHOD AASFW   SPECIFIC METHOD 20410   ANALYSIS LAB PJBL   QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ANTIMONY	7440-36-0	I01	280.000 UG/L	<10	
ARSENIC	7440-38-2	I02	5.000 UG/L	11	
BARIUM	7440-39-3	I03	570.000 UG/L		
CADMIUM	7440-43-9	I05	8.000 UG/L	11	
CHROMIUM	7440-47-3	I06	30.000 UG/L	52	
COPPER	7440-50-8	I07	12.000 UG/L	85	
LEAD	7439-92-1	I08	24.000 UG/L	200	
NICKEL	7440- 2-0	I09	160.000 UG/L	126	
SILVER	7440-22-4	I12	6.000 UG/L	<5	
THALLIUM	7440-28-0	I13	76.000 UG/L	<10	
ZINC	7440-66-6	I14	220.000 UG/L	310	

****RAW DATA LISTING****

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   515

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*** SITE DATA ***

****

SAMPLING AREA 03 STATION 515   COORDS 401390 E 1122128 N

****

*** SAMPLE DATA ***

****

SAMPLE-ID W25280 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/02/80 START TIME 1520 CONTRACTOR JRB
WELL ID 036A DEPTH 20.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5122

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT				

****

*** SAMPLE DATA ***

****

SAMPLE-ID W25281 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/02/80 START TIME 1527 CONTRACTOR JRB
WELL ID 036A DEPTH 20.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5122

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		
DDE	72-55-9	P10	TRACE		

****

*** SAMPLE DATA ***

****

SAMPLE-ID W25282 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/02/80 START TIME 1522 CONTRACTOR JRB
WELL ID 036A DEPTH 20.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5122

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENANTHRENE	85- 1-8	B32	TRACE		
ACIDS	BELOW DETECTION LIMIT				

****

*** SAMPLE DATA ***

****

SAMPLE-ID W25283 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/02/80 START TIME 1528 CONTRACTOR JRB
WELL ID 036A DEPTH 20.00 FEET COMPOSITE SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1100.000 UG/L		
NITRATE	0- 0-0	I16	2200.000 UG/L		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   515

****
*** SAMPLE DATA ***
****

SAMPLE-ID WC5284 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/02/80 START TIME 1525 CONTRACTOR JRB
WELL ID 036A DEPTH 20.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5122

*** ANALYSIS RESULTS ***

METHOD ICPW   SPECIFIC METHOD   ANALYSIS LAB ERCO   QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	17.000 UG/L		
CADMIUM	7440-43-9	I05	8.000 UG/L		
CHROMIUM	7440-47-3	I06	22.000 UG/L		
COPPER	7440-50-8	I07	23.000 UG/L		
LEAD	7439-92-1	I08	110.000 UG/L		
NICKEL	7440- 2-0	I09	46.000 UG/L		
ZINC	7440-66-6	I14	75.000 UG/L		

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   06   011

****
*** SITE DATA ***
****

SAMPLING AREA 06 STATION 011

COORDS 402739 E 1122217 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21579 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1020 CONTRACTOR JRB
WELL ID 066A DEPTH 15.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6111

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21580 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1028 CONTRACTOR JRB
WELL ID 066A DEPTH 15.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6111

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 160.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
DI-N-OCTYLPHTHALATE		117-84-0	B41	48.000 UG/L		
ACIDS	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21581 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1028 CONTRACTOR JRB
WELL ID 066A DEPTH 15.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6111

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 940.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21582 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1027 CONTRACTOR JRB
WELL ID 066A DEPTH 15.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6111

*** ANALYSIS RESULTS ***

METHOD AASFW SPECIFIC METHOD 20410 ANALYSIS LAB PJBL QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ARSENIC	7440-38-2	I02	19.000 UG/L		
BARIUM	7440-39-3	I03	150.000 UG/L		
CADMIUM	7440-43-9	I05	2.000 UG/L		
CHROMIUM	7440-47-3	I06	180.000 UG/L		
COPPER	7440-50-8	I07	95.000 UG/L		
LEAD	7439-92-1	I08	290.000 UG/L		
NICKEL	7440- 2-0	I09	190.000 UG/L		
ZINC	7440-66-6	I14	260.000 UG/L		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 06 011

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21583 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1028 CONTRACTOR JRB
WELL ID 066A DEPTH 15.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6211

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB PJBL QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1300.000 UG/L		VOL 200
NITRATE	0- 0-0	I16	200.000 UG/L		VOL 25

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21584 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1035 CONTRACTOR JRB
WELL ID 066B DEPTH 13.50 FEET COMPOSITE SAMPLE WATER TEMP 0

6211

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND CAS PC CONCENTRATION REPORTED CONC COMMENT

VOLATILES BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21585 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1038 CONTRACTOR JRB
WELL ID 066B DEPTH 13.50 FEET COMPOSITE SAMPLE WATER TEMP 0

6211

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 940.0 ML

COMPOUND CAS PC CONCENTRATION REPORTED CONC COMMENT

ACIDS BELOW DETECTION LIMIT

BASE/NEUTRALS BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21586 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1045 CONTRACTOR JRB
WELL ID 066B DEPTH 13.50 FEET COMPOSITE SAMPLE WATER TEMP 0

6211

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 999.9 ML

COMPOUND CAS PC CONCENTRATION REPORTED CONC COMMENT

PESTICIDES BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21587 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/09/80 START TIME 1039 CONTRACTOR JRB
WELL ID 066B DEPTH 13.50 FEET COMPOSITE SAMPLE WATER TEMP 0

6211

*** ANALYSIS RESULTS ***

METHOD AASFW SPECIFIC METHOD 20410 ANALYSIS LAB PJBL QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ANTIMONY	7440-36-0	I01	60.000 UG/L		

6211

****R A W   D A T A   L I S T I N G****

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   06   01

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	44.000 UG/L		
CHROMIUM	7440-47-3	I06	16.000 UG/L		
COPPER	7440-50-8	I07	12.000 UG/L		
LEAD	7439-92-1	I08	60.000 UG/L		
NICKEL	7440- 2-0	I09	37.000 UG/L		
SILVER	7440-22-4	I12	8.000 UG/L		
ZINC	7440-66-6	I14	41.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21588 MEDIUM H2O SOURCE GRH20 SAMPLE DATE 10/09/80 START TIME 1041 CONTRACTOR JRB
WELL ID 066B DEPTH 13.50 FEET COMPOSITE SAMPLE WATER TEMP 0

6211

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB PJBL QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1200.000 UG/L		VOL.200
NITRATE	0- 0-0	I16	100.000 UG/L		VOL 25

****
*** SAMPLE DATA ***
****

SAMPLE-ID S40754 MEDIUM SOIL SOURCE HOME SAMPLE DATE 10/03/80 START TIME 0830 CONTRACTOR GEOME
WELL ID 000 DEPTH 6.00 FEET COMPOSITE SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD SPECIFIC METHOD GAMMA ANALYSIS LAB EMSV QUAN SIZE 334.0 GRAM

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
K-STABLE POTASSIUM	0- 0-0	R01	0.011 GM/GM		
RADIUM-226	0- 0-0	R04	0.563 PC/GM		

****
*** SAMPLE DATA ***
****

SAMPLE-ID S40755 MEDIUM SOIL SOURCE HOME SAMPLE DATE 10/03/80 START TIME 0830 CONTRACTOR GEOME
WELL ID 000 DEPTH 6.00 FEET COMPOSITE SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD RAD SPECIFIC METHOD GAMMA ANALYSIS LAB EMSV QUAN SIZE 325.0 GRAM

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
K-STABLE POTASSIUM	0- 0-0	R01	0.010 GM/GM		
RADIUM-226	0- 0-0	R04	0.412 PC/GM		

****
*** SAMPLE DATA ***
****

SAMPLE-ID S45073 MEDIUM SOIL SOURCE HOME SAMPLE DATE 10/03/80 START TIME 0830 CONTRACTOR GEOME
WELL ID 000 DEPTH 6.00 FEET GRAB SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD 624PS SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 10.0 GRAM

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES BELOW DETECTION LIMIT					

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   07   020

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*** SITE DATA ***

****

SAMPLING AREA 07 STATION 020

COORDS 402935 E 1122487 N

****

*** SAMPLE DATA ***

****

SAMPLE-ID W21354   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/03/80   START TIME 1426   CONTRACTOR JRB

WELL ID 020A   DEPTH 21.50 FEET   COMPOSITE SAMPLE   WATER TEMP 0

4134

*** ANALYSIS RESULTS ***

METHOD 624W   SPECIFIC METHOD   ANALYSIS LAB ACEE   QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT				

****

*** SAMPLE DATA ***

****

SAMPLE-ID W21358   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/03/80   START TIME 1428   CONTRACTOR JRB

WELL ID 020A   DEPTH 21.50 FEET   COMPOSITE SAMPLE   WATER TEMP 0

4134

*** ANALYSIS RESULTS ***

METHOD AASFW   SPECIFIC METHOD 20410   ANALYSIS LAB PJBL   QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ANTIMONY	7440-36-0	I01	210.000 UG/L		
ARSENIC	7440-38-2	I02	3.000 UG/L		
BARIUM	7440-39-3	I03	320.000 UG/L		
CADMIUM	7440-43-9	I05	2.000 UG/L		
CHROMIUM	7440-47-3	I06	74.000 UG/L		
COPPER	7440-50-8	I07	32.000 UG/L		
LEAD	7439-92-1	I08	120.000 UG/L		
NICKEL	7440- 2-0	I09	150.000 UG/L		
SELENIUM	7782-49-2	I11	6.000 UG/L		
THALLIUM	7440-28-0	I13	32.000 UG/L		
ZINC	7440-66-6	I14	100.000 UG/L		

****

*** SAMPLE DATA ***

****

SAMPLE-ID W21359   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/03/80   START TIME 1430   CONTRACTOR JRB

WELL ID 020A   DEPTH 21.50 FEET   COMPOSITE SAMPLE   WATER TEMP 0

4/34

*** ANALYSIS RESULTS ***

METHOD ANION   SPECIFIC METHOD 34020   ANALYSIS LAB PJBL   QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1300.000 UG/L		SAMPLE VOL.100ML
NITRATE	0- 0-0	I16	200.000 UG/L		SAMPLE VOL.10ML

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 07 020

*** SAMPLE DATA ***

SAMPLE-ID W21360 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1433 CONTRACTOR JRB
WELL ID 020A DEPTH 21.50 FEET COMPOSITE SAMPLE WATER TEMP 0

4134

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ALPHA-BHC	319-84-6	P01	TRACE		
BETA-BHC	319-85-7	P02	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
HEPTACHLOR	76-44-8	P05	TRACE		
ALDRIN	309- 0-2	P06	TRACE		

*** SAMPLE DATA ***

SAMPLE-ID W21361 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 10/03/80 START TIME 1428 CONTRACTOR JRB
WELL ID 020A DEPTH 21.50 FEET COMPOSITE SAMPLE WATER TEMP 0

4134

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACENAPHTYLENE	208-96-8	B19	TRACE		
FLUORENE	86-73-7	B23	TRACE		
PHENANTHRENE	85- 1-8	B32	2.000 UG/L		

ACIDS BELOW DETECTION LIMIT

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   516

****
*** SITE DATA ***
****

SAMPLING AREA 03 STATION 516   COORDS 401652 E 1121825 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20873 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1400 CONTRACTOR JRB
WELL ID 0378 DEPTH 24.20 FEET COMPOSITE SAMPLE WATER TEMP 0

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	820.000 UG/L		
NITRATE	0- 0-0	I16	670.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20877 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1356 CONTRACTOR JRB
WELL ID 0378 DEPTH 24.20 FEET COMPOSITE SAMPLE WATER TEMP 0

5211

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
CHLOROFORM	67-66-3	V11	7.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20904 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1400 CONTRACTOR JRB
WELL ID 0378 DEPTH 24.20 FEET COMPOSITE SAMPLE WATER TEMP 0

5211

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
GAMMA-BHC	58-89-9	P03	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20905 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1400 CONTRACTOR JRB
WELL ID 0378 DEPTH 24.20 FEET COMPOSITE SAMPLE WATER TEMP 0

5211

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	14.000 UG/L		

BASE/NEUTRALS BELOW DETECTION LIMIT

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 516

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20906 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1420 CONTRACTOR JRB
WELL ID 037A DEPTH 24.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5111

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BETA-BHC	319-85-7	P02	TRACE		
GAMMA-BHC	58-89-9	P03	TRACE		
ALDRIN	309- 0-2	P06	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20907 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1414 CONTRACTOR JRB
WELL ID 037A DEPTH 24.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5111

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	4.000 UG/L		

BASE/NEUTRALS BELOW DETECTION LIMIT

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20971 MEDIUM H2O SOURCE GRH20 SAMPLE DATE 09/22/80 START TIME 1416 CONTRACTOR JRB
WELL ID 037A DEPTH 24.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5111

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	760.000 UG/L		
NITRATE	0- 0-0	I16	270.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21230 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/26/80 START TIME 0900 CONTRACTOR JRB
WELL ID 037A DEPTH 24.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5111

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND CAS PC CONCENTRATION REPORTED CONC COMMENT

VOLATILES BELOW DETECTION LIMIT

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 516

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21340 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1050 CONTRACTOR JRB
WELL ID 037A DEPTH 24.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5111

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	3.000 UG/L		
ZINC	7440-66-6	I14	7.000 UG/L 207		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21346 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1055 CONTRACTOR JRB
WELL ID 037B DEPTH 24.20 FEET COMPOSITE SAMPLE WATER TEMP 0

5211

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	14.000 UG/L		
COPPER	7440-50-8	I07	9.000 UG/L 52		
ZINC	7440-66-6	I14	27.000 UG/L 495		

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 525

****
*** SITE DATA ***
****

SAMPLING AREA 03 STATION 525

COORDS 401669 E 1121261 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20868 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1200 CONTRACTOR JRB
WELL ID 050B DEPTH 38.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5213

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 1.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	9.000 UG/L		
PHENANTHRENE	85- 1-8	B32	TRACE		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20870 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1200 CONTRACTOR JRB
WELL ID 050B DEPTH 38.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5213

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	1370.000 UG/L		
NITRATE	0- 0-0	I16	220.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20871 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1230 CONTRACTOR JRB
WELL ID 050A DEPTH 28.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5113

*** ANALYSIS RESULTS ***

METHOD ANION SPECIFIC METHOD 34020 ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
FLUORIDE	0- 0-0	I15	3100.000 UG/L		
NITRATE	0- 0-0	I16	970.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20872 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1230 CONTRACTOR JRB
WELL ID 050A DEPTH 28.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5113

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PHENOL	108-95-2	A05	12.000 UG/L		

BASE/NEUTRALS BELOW DETECTION LIMIT

****RAW DATA LISTING****

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 03 525

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20921 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1200 CONTRACTOR JRB
WELL ID 050B DEPTH 38.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5213

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT				

****
*** SAMPLE DATA ***
****

SAMPLE-ID W20922 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/22/80 START TIME 1230 CONTRACTOR JRB
WELL ID 050A DEPTH 28.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5113

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB ACEE QUAN SIZE 5.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
1,2-DICHLOROETHANE	107- 6-2	V12	17.000 UG/L		

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21337 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1105 CONTRACTOR JRB
WELL ID 050A DEPTH 28.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5113

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	12.000 UG/L		
CADMIUM	7440-43-9	I05	13.000 UG/L	<10	
CHROMIUM	7440-47-3	I06	26.000 UG/L	21	
COPPER	7440-50-8	I07	15.000 UG/L	45	
LEAD	7439-92-1	I08	53.000 UG/L	178	
NICKEL	7440- 2-0	I09	36.000 UG/L	63	
ZINC	7440-66-6	I14	70.000 UG/L	198	

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21339 MEDIUM H2O SOURCE GRH2O SAMPLE DATE 09/27/80 START TIME 1110 CONTRACTOR JRB
WELL ID 050B DEPTH 38.00 FEET COMPOSITE SAMPLE WATER TEMP 0

5213

*** ANALYSIS RESULTS ***

METHOD ICPW SPECIFIC METHOD ANALYSIS LAB ERCO QUAN SIZE 0.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	5.000 UG/L		
ZINC	7440-66-6	I14	45.000 UG/L	171	

* * R A W   D A T A   L I S T I N G * *

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82   03   525

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21366   MEDIUM H2O   SOURCE GRH2O   SAMPLE DATE 10/01/80   START TIME 0930   CONTRACTOR JRB
WELL ID 050A   DEPTH 28.00 FEET   COMPOSITE SAMPLE   WATER TEMP 0

5113

*** ANALYSIS RESULTS ***

METHOD 608W   SPECIFIC METHOD   ANALYSIS LAB ACEE   QUAN SIZE 999.9 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT				

RAW DATA LISTING

THIS REPORT IS BASED ON VALIDATED DATA ENTERED INTO THE SYSTEM THROUGH 02/17/82 08 011

****
*** SITE DATA ***
****

SAMPLING AREA 08 STATION 011

COORDS 402726 E 1121650 N

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21619 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/09/80 START TIME 1115 CONTRACTOR JRB
WELL ID 068A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/12

*** ANALYSIS RESULTS ***

METHOD 624W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 5.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
VOLATILES	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21620 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/09/80 START TIME 1125 CONTRACTOR JRB
WELL ID 068A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/12

*** ANALYSIS RESULTS ***

METHOD 625CW SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 0.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
ACIDS	BELOW DETECTION LIMIT					
BASE/NEUTRALS	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21621 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/09/80 START TIME 1119 CONTRACTOR JRB
WELL ID 068A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/12

*** ANALYSIS RESULTS ***

METHOD 608W SPECIFIC METHOD ANALYSIS LAB CMTL QUAN SIZE 930.0 ML

COMPOUND		CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
PESTICIDES	BELOW DETECTION LIMIT					

****
*** SAMPLE DATA ***
****

SAMPLE-ID W21622 MEDIUM H20 SOURCE GRH20 SAMPLE DATE 10/09/80 START TIME 1119 CONTRACTOR JRB
WELL ID 068A DEPTH 14.00 FEET COMPOSITE SAMPLE WATER TEMP 0

6/12

*** ANALYSIS RESULTS ***

METHOD AASFW SPECIFIC METHOD 20410 ANALYSIS LAB PJBL QUAN SIZE 200.0 ML

COMPOUND	CAS	PC	CONCENTRATION	REPORTED CONC	COMMENT
BARIUM	7440-39-3	I03	65.000 UG/L		
CADMIUM	7440-43-9	I05	6.000 UG/L		
CHROMIUM	7440-47-3	I06	14.000 UG/L		
COPPER	7440-50-8	I07	14.000 UG/L		
LEAD	7439-92-1	I08	85.000 UG/L		
NICKEL	7440- 2-0	I09	33.000 UG/L		
ZINC	7440-66-6	I14	160.000 UG/L		

TABLE 3

Table and Map of Positive Analytical Results Before and After the Drainage System Installation

EXPLANATION FOR THE THREE CHARTS

1. The charts are a comparison of the United States Environmental Protection Agency (USEPA) results taken two to four years ago and recent New York State Department of Environmental Conservation (NYSDEC) results.

2. The only wells listed are ones outside the fence where there are old USEPA results and recent NYSDEC results.

3. The only compounds listed are ones that showed up positive either in previous or current testing.

4. The numbers on top represent recent NYSDEC results and the numbers on the bottom are the old USEPA results.

5. All units of concentration are ug/l.

Love Canal Groundwater Monitoring Program

Well I.D. Number

	3222	3122	3123	3133	5114	5214	5112	5212	3151	6113	6141	6241	3111	3112	3113	6112	5111	5211	5113	5213	6122	6222	6111	6211	4134	5122
A-BHC	<10 0.05	<10 trace	<10 trace	<10 trace					<10 0.012				0.15 trace	<.005 trace	<.005 trace	0.69 < DL						0.56 < DL	3.9 < DL		0.64 trace	<.005 trace
Lindane	<10 0.012		<10 trace	<10 trace		<10 trace							0.74 trace	<.005 trace		2.0 < DL	<.005 trace	<.005 trace				0.36 < DL	2.4 < DL		0.49 trace	0.56 trace
B-BHC				<10 trace					<10 0.010				<.005 trace	2.0 trace	<.005 trace	13 < DL	<.005 trace					2.1 < DL	9.3 < DL		11 trace	
Heptachlor		<10 trace	<10 trace	<10 trace	13 < DL										<.005 trace	0.58 < DL							17 < DL		32 trace	<.005 trace
D-BHC	<10 .018				11 < DL									<.005 ?								2.8 < DL				
Aldrin			<10 trace	<10 trace	49 < DL											2.1 < DL	<.005 trace								0.89 trace	
Hept. Epox.					30 < DL								1.1 < DL													
Dieldrin					14 < DL									<.005 trace												
pp DDE		<10 trace																								<.005 trace
Endosulfan					13 < DL																					
DDT				<10 trace										<.01 trace												
DDD		<10 trace																								

(1) All concentrations in ug/l (ppb.)

(2) <10 - DEC results
0.05 - USEPA results

(3) Trace means present in low levels, but not quantified

(4) <DL means below the detection limit of that compound

Love Canal Groundwater Monitoring Program

Well I.D. Number

Compound	3222	3122	3123	3133	5114	5214	5112	5212	3151	6113	6141	6241	3111
Ag													
Be		<20 0.8											1.5 < DL
Cd		<20 16			<20 5		<20 6		<20 6	<40 7	10 10	11 27	
Cr		<100 47	<100 17	<100 24	<100 9	<100 21	<100 9		<100 36	<100 18	8.5 < DL	5.3 < DL	84 87
Cu	<50 7	<50 68	<50 34	<50 27	<50 6	<50 59	<50 8			<50 12	23 < DL		190 40
Ni		<50 110	<50 52	<50 39			<50 25		<50 86	110 74	29 < DL		198 130
Pb		<100 350	<100 150	<100 220	<100 27					<100 71	302 61	184 < DL	212 80
Zn	90 75	730 580	140 240	180 200	260 52	90 40	180 24	130 <DL	2500 <DL	200 100	135 48	79 18	224 66
As													16 < DL
Hg	<0.2 trace									<0.2 0.2			
Se							<5 4						
Sb									<100 240				
Tl									<100 62				

Compound	3112	3113	6112	5111	5211	5113	5213	6122	6222	6111	6211	4134	5122
Ag		<3 6									<3 8		
Be	1.7 < DL	1.4 < DL			2.6 < DL					2.2 < DL			
Cd	<10 2	11 8	<10 6			<10 13		<10 44	<10 7	< DL 2		<10 2	21 8
Cr	78 28	52 30	28 14	6.4 < DL	72 < DL	21 26	9.5 < DL	14 23	6.9 < DL	236 180	< 4 16	21 74	5.4 22
Cu	82 10	85 12	58 14	26 < DL	52 9	45 15	32 < DL	< 2 16	21 7	304 95	< 2 12	< 2 32	25 23
Ni	124 64	126 160	58 33	35 < DL	162 < DL	68 36	20 < DL	23 30		304 190	<15 37	49 150	35 46
Pb	329 48	260 24	122 85	107 < DL	472 < DL	198 53	568 < DL	206 91	78 < DL	696 290	91 60	142 120	82 110
Zn	279 84	310 220	120 160	209 7	495 27	178 70	171 45	109 44	56 37	348 260	80 41	122 100	33 75
As	12 2	11 5			21 < DL					56 19		<10 3	
Hg		.21 < DL								0.21 < DL			
Se	<10 10											<10 6	
Sb	<10 190	<10 280									<10 60	<10 210	
Tl	<10 52	<10 76										<10 32	

(1) All concentrations in ug/l (ppb.)

(2) 14 - DEC results
<10 - USEPA results

(3) Trace means present in low levels, but not quanitfied

(4) <DL means below the detection limit of that compound

Love Canal Groundwater Monitoring Program

Well I.D. Number

	3222	3122	3123	3133	5114	5214	5112	5212	3151	6113	6141	6241	3111	3112	3113	6112	5111	5211	5113	5213	6122	6222	6111	6211	4134	5122
Benzene				< 1 8					< 1 trace																	
1,1,2,2-tetra-chloroethane																										
Toluene				< 1 37																						
Dibromo-chloro-methane						< 1 trace																				
O-Xylene				< 1 18																						
M-Xylene				< 1 18																						
Ethyl Benzene				< 1 7					< 1 trace																	
Diethyl-phthalate									<10 trace																	
P-Xylene									< 1 trace																	
Tetrachloroethane									< 1 trace																	
Methylene-chloride																		42 < DL								
Fluoroanthene									23 <DL																	
Pyrene									31 <DL																	
Endosulfan Sulfate									15 <DL																	

(1) All concentrations in ugl/l (ppb.)

(2) <1 - DEC results; 8 - USEPA results

(3) Trace means present in low levels, but not quantified

(4) <DL means below the detection limit of that compound

ATTACHMENT A

INTERIM GROUNDWATER MONITORING PROGRAM
LOVE CANAL SITE

INTERIM GROUNDWATER MONITORING PROGRAM
LOVE CANAL SITE
NIAGARA FALLS, NEW YORK

The following maps show the concentrations of the major pollutants that have shown up in the wells inside the fence at Love Canal. Other pollutants have shown up but not in high enough concentrations or frequently enough to be a reliable indicator of Love Canal contamination. The results reflect data collected from June 17, 1981 through March 25, 1983. The individual compounds have been put on two maps each. One showing only overburden wells and the other showing only bedrock wells. The compounds included are:

Methylene Chloride
Bis (2-Et-Hexyl) phthlate
Chloroform
Trichloroethylene
1,2-Dichlorobenzene (O)
1,4-Dichlorobenzene (P)
Toluene
Chlorobenzene
1,2,4-Trichlorobenzene
2,4-Dichlorophenol
Tetrachloroethylene
Benzene
1,1,2,2-Tetrachloroethane

All but one of these compounds falls into two classes (volatiles and base neutrals). The remaining compound (2,4-Dichlorophenol) shows up in only one well (5101). The sandy loam and the desiccated silty clay layers of soil shows the largest amount of contamination. Wells located at this depth would probably show the first signs of a spread in the contamination. Well numbers 1160 (A and C), 1161C, 1163 (A and C), 4103 and 5101 have shown the largest concentration of contaminants. They would supply the most information for long term temperal trend analyses.

The bedrock wels have shown up clean except 4204, 4207, 5201, and 6207. Of these four, only 5201 has shown more than one different kind of contaminant. Well number 5201 is close to six of the seven most contaminated wells and near the leachate drainage system. This would probably be the best bedrock well to monitor to check on the downward migration of contaminants.

A monitoring program to meet the needs of early detection of a spread of contaminants along with long term analyses should consist of testing for volatiles and base/neutrals on the following schedule:

1st and 3rd Quarter	2nd and 4th Quarter
1160 (A and C), 1161C 4103, 4 bedrock wells (other than 5201) and 16 random overburden wells	1163 (A and C), 5101 5201, 3 bedrock wells other than 5201) and 17 random overburden wells

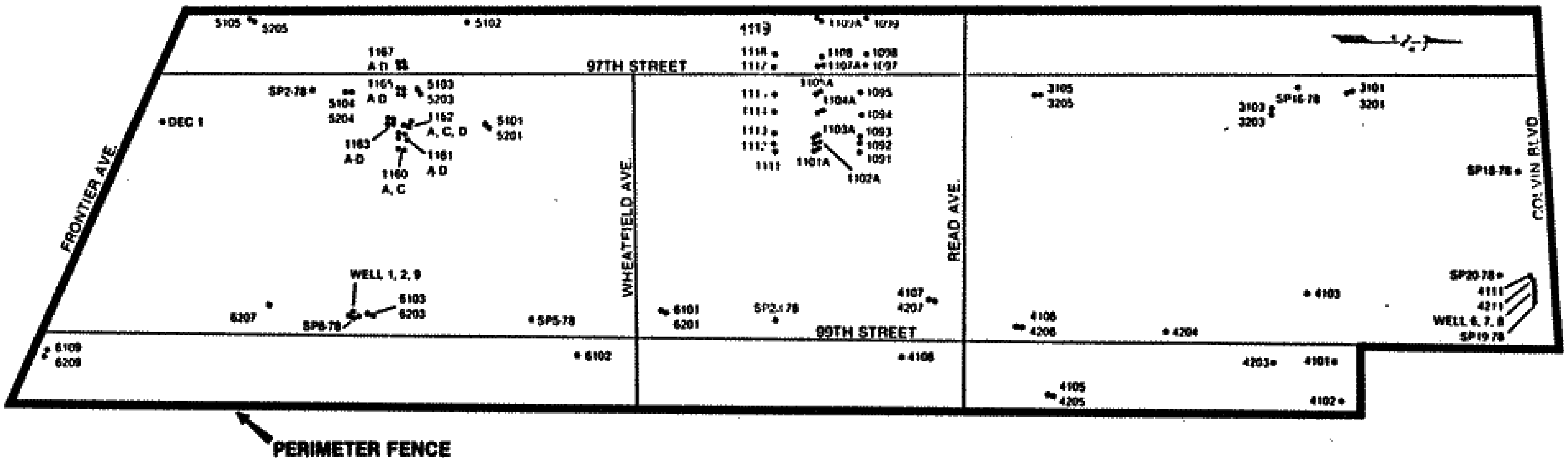
This schedule will result in water quality samples being taken at all the wells on-site (within the perimeter fence), during an 18 month period.

Twenty-four (24) off-site wells were sampled July 11 and 12, 1984. There are 16 wells, other than these 24, with risers that will also be sampled. When the results come back, any wells showing contamination will be resampled along with nearby wells. This will verify the results and check for the further spread of contamination.

Groundwater elevations of all the on-site wells and the 40 off-site wells (with risers) will be taken monthly.

FIGURE B.1

LOVE CANAL GROUNDWATER MONITORING PROGRAM



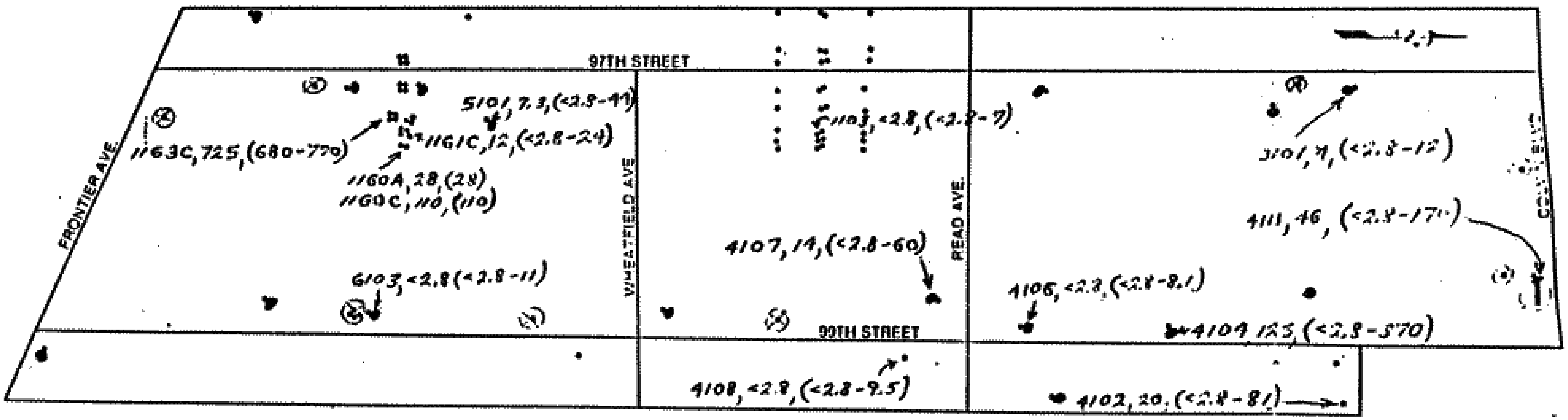
Methyl Chloride (ppb)
Overburden Wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

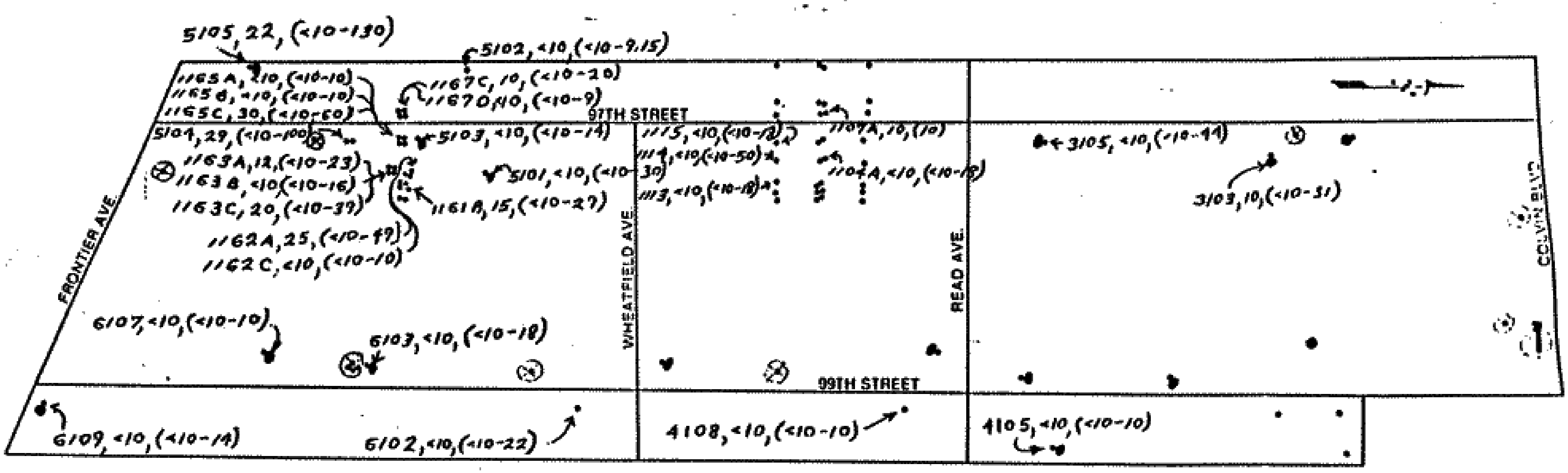
Bis (2-Ethylhexyl) phthalate (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

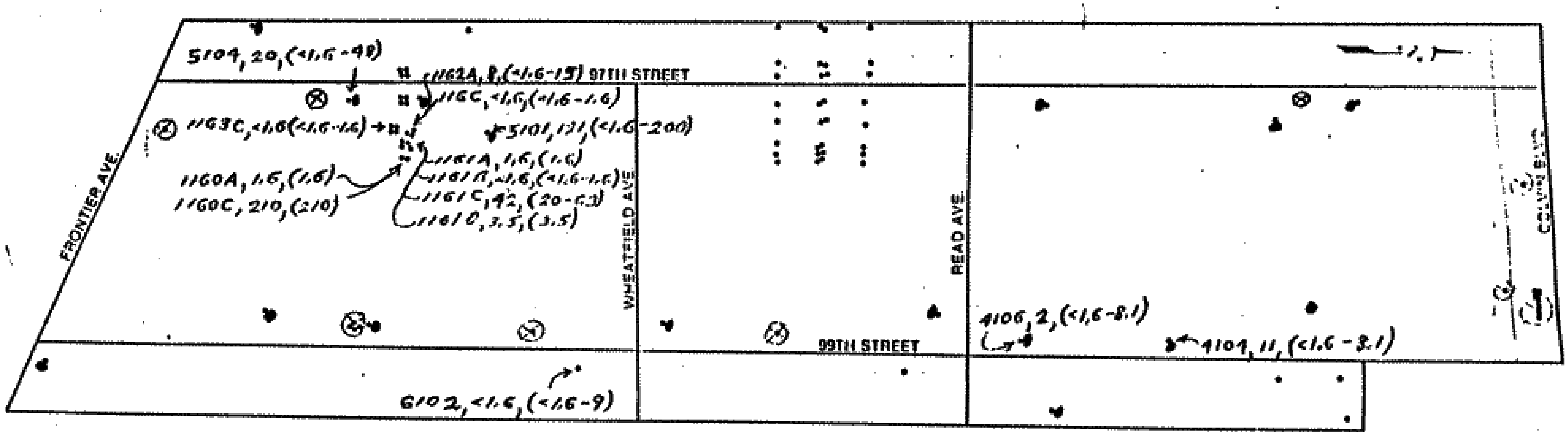
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

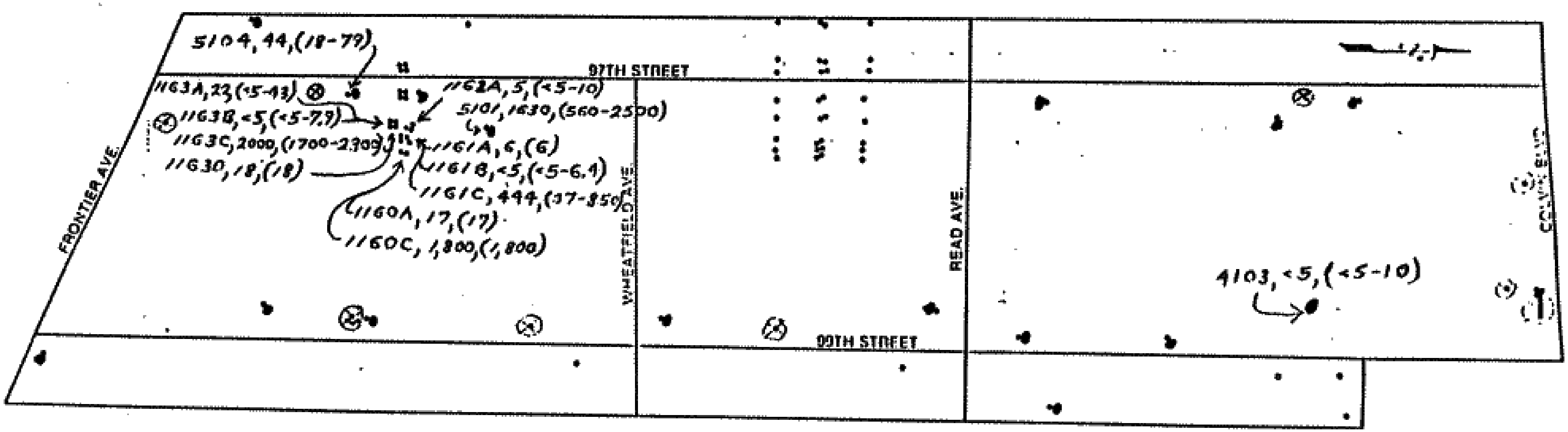
Trichloroethylene (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

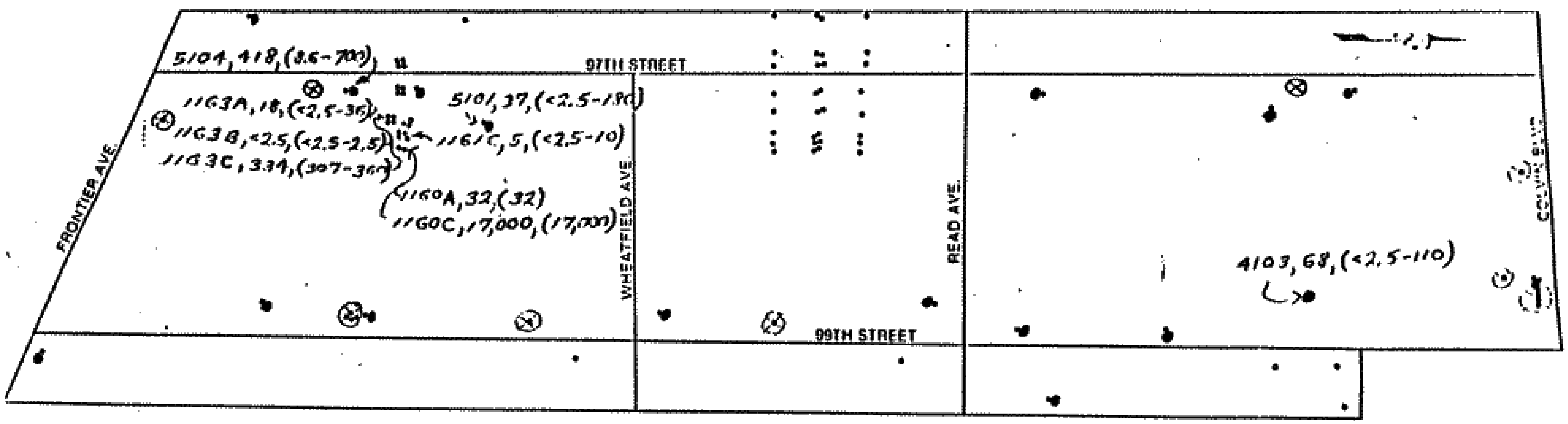
1,2 - Dichlorobenzene (o) (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

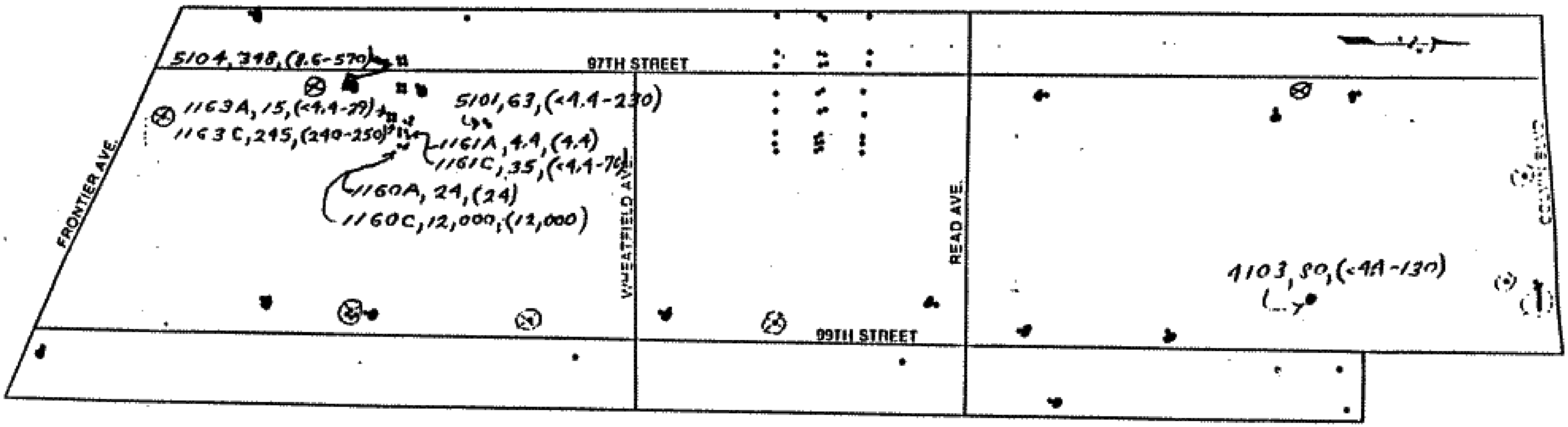
1,4-Dichlorobenzene (r) (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

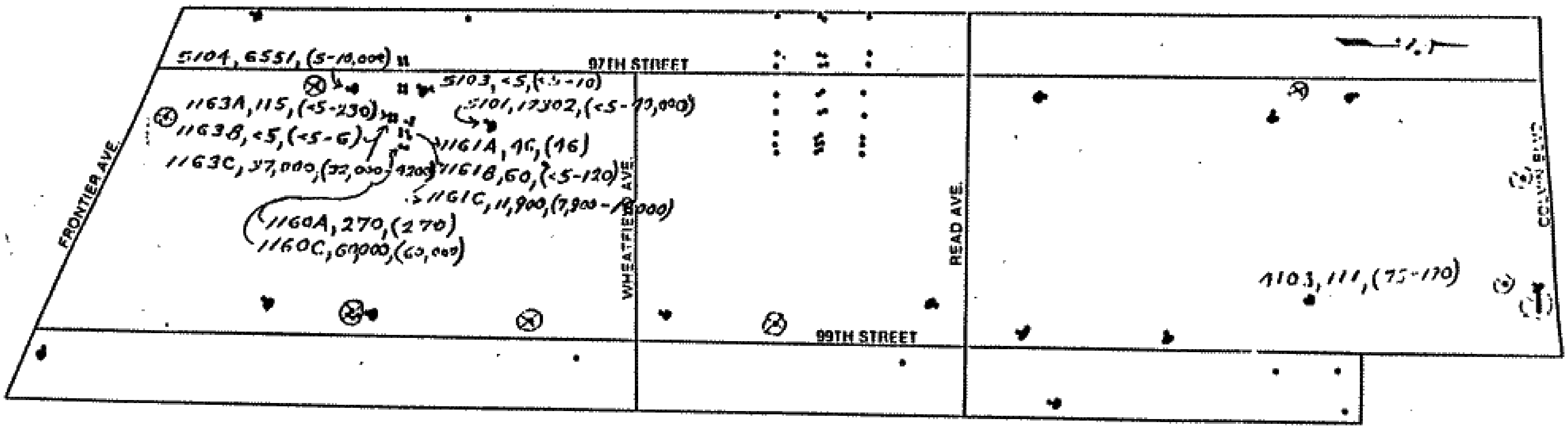
Tolue - (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

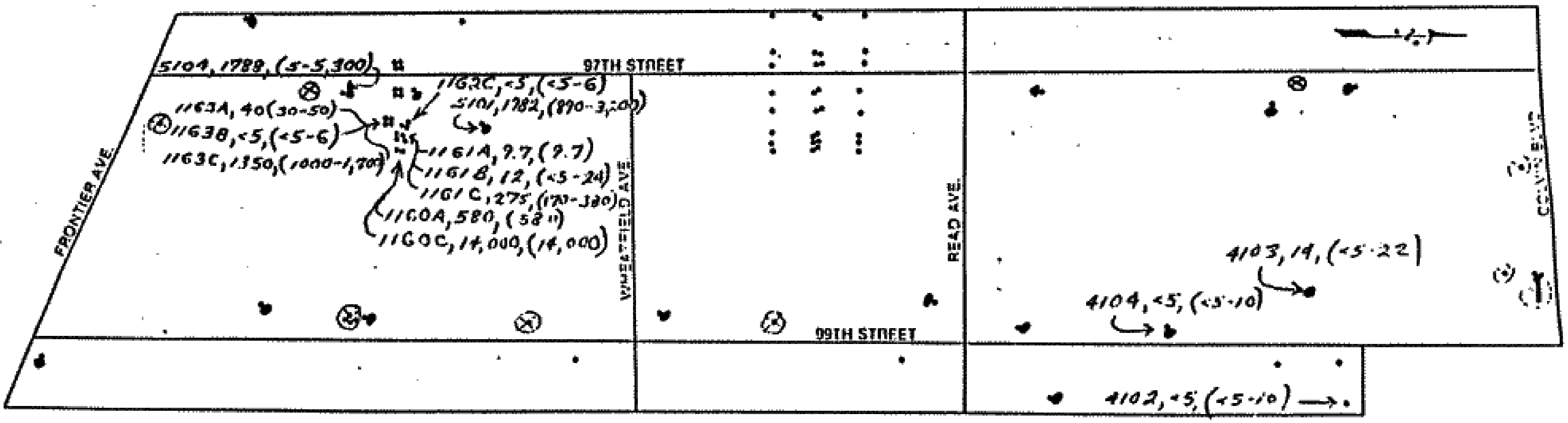
Chlorobenzene (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

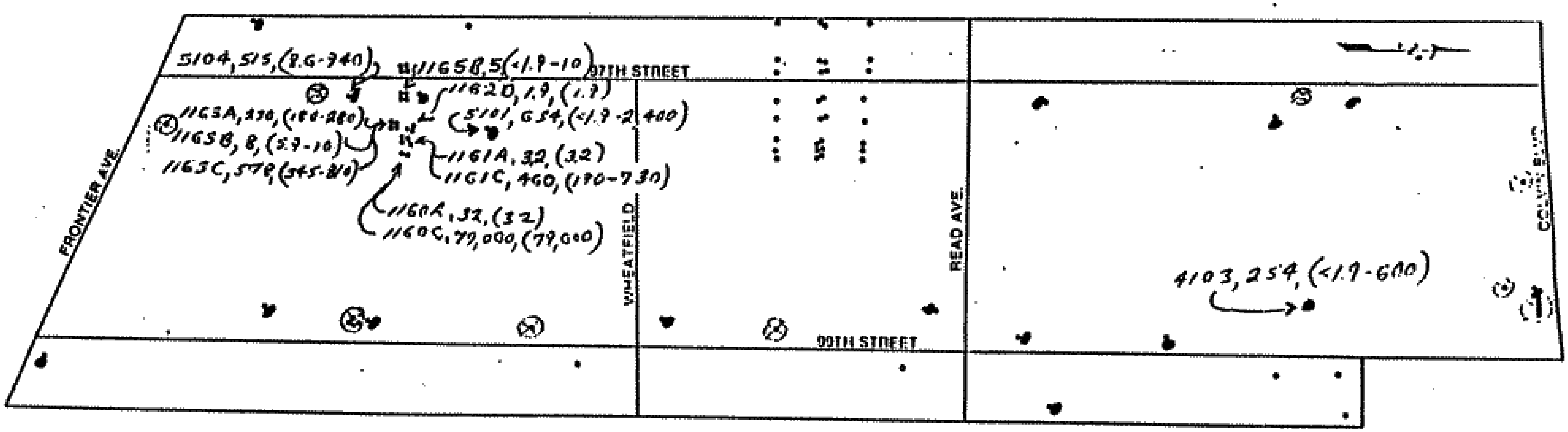
1,2,4-Trichlorobenzene (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

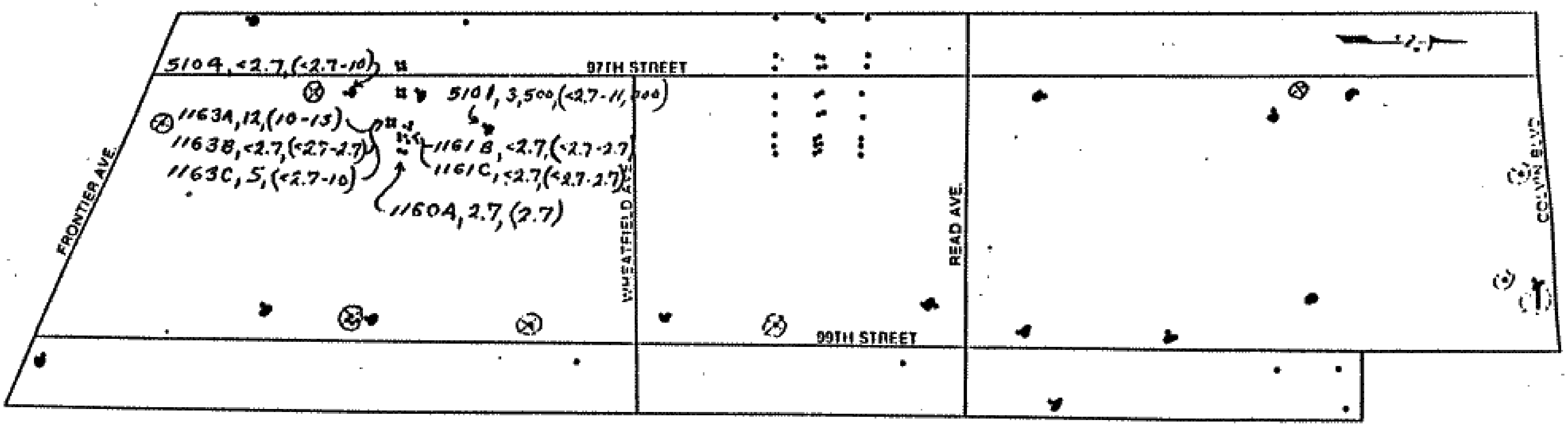
2,4 - Dichlorophenol (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

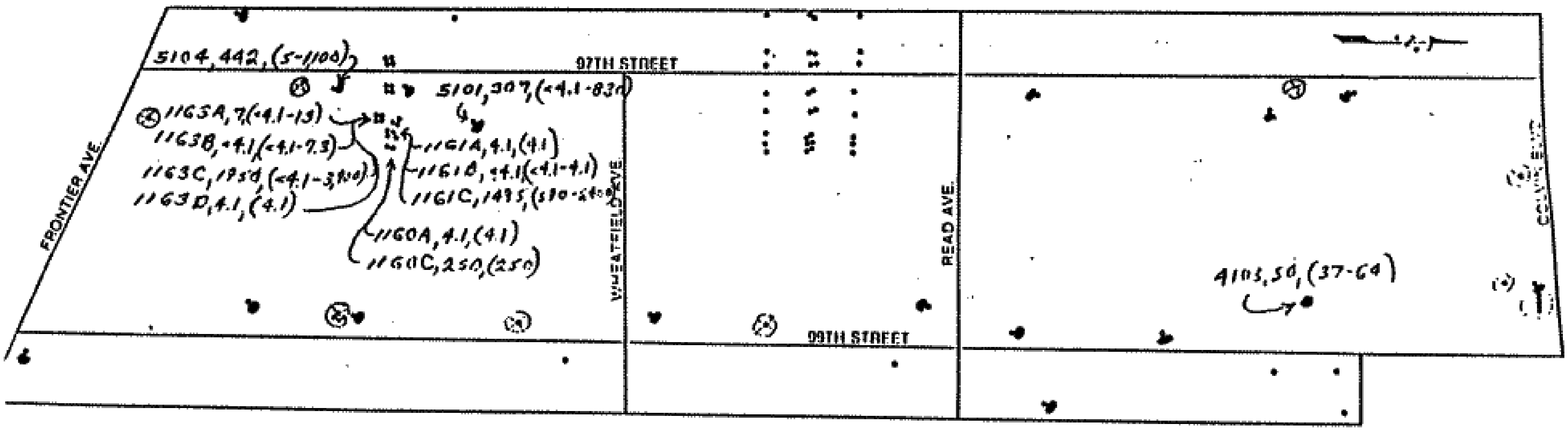
Tetrachloroethylene (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

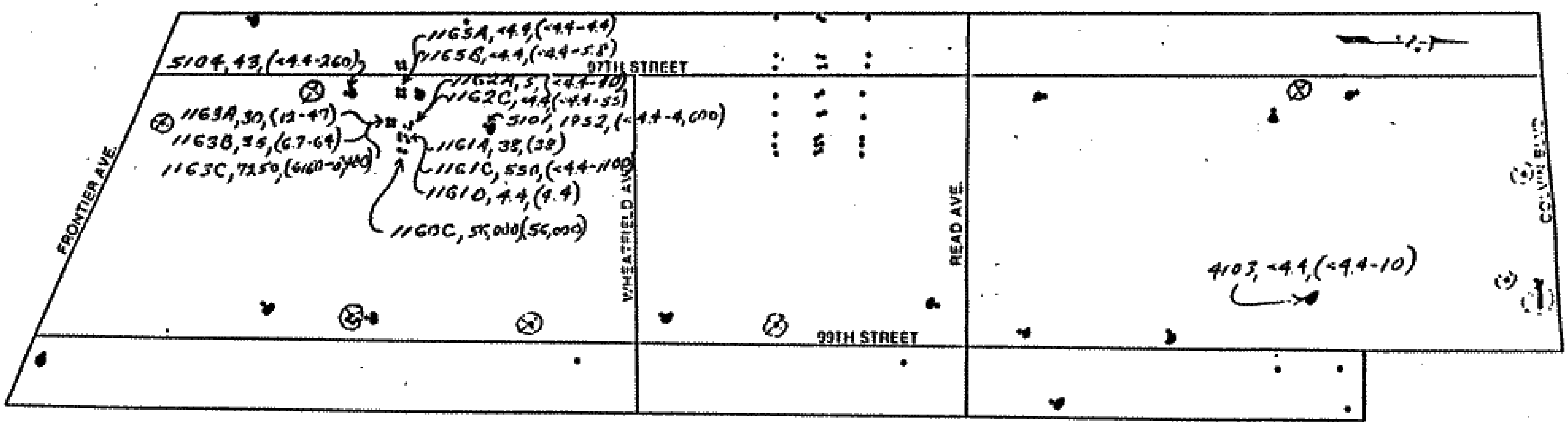
Benzene (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

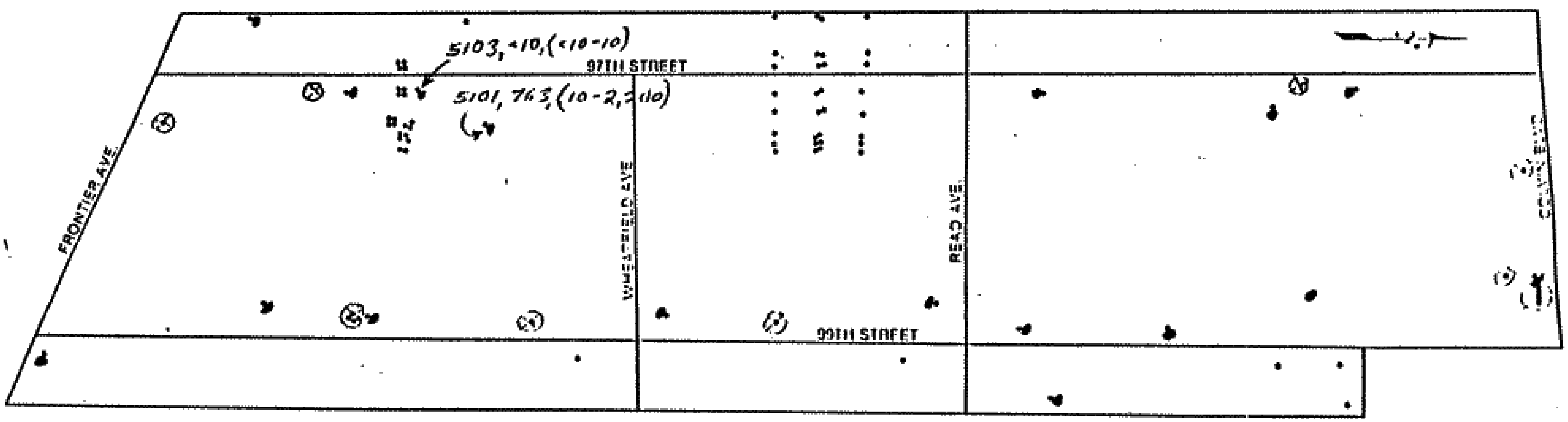
1,1,2,2 - tetrachloroethylene (ppb)
overburden wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

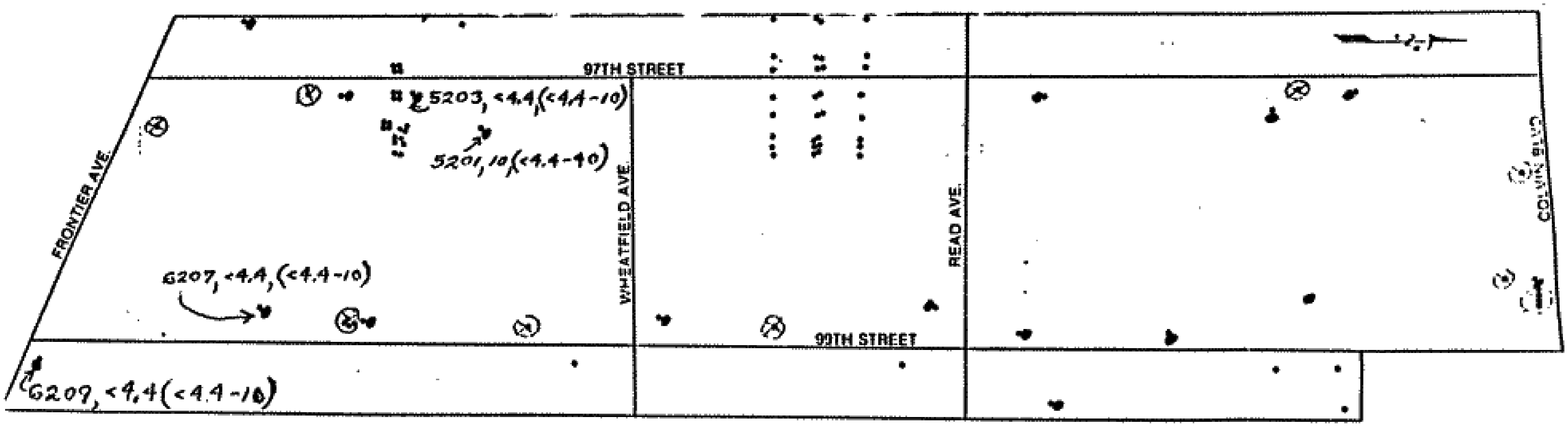
~ nzene (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

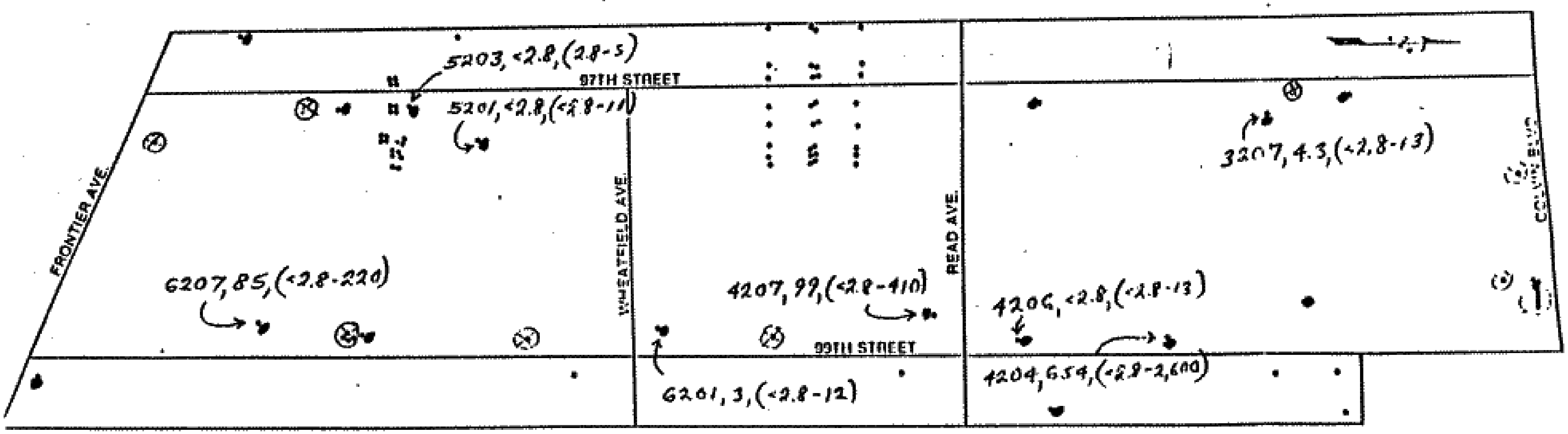
Methylene Chloride (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

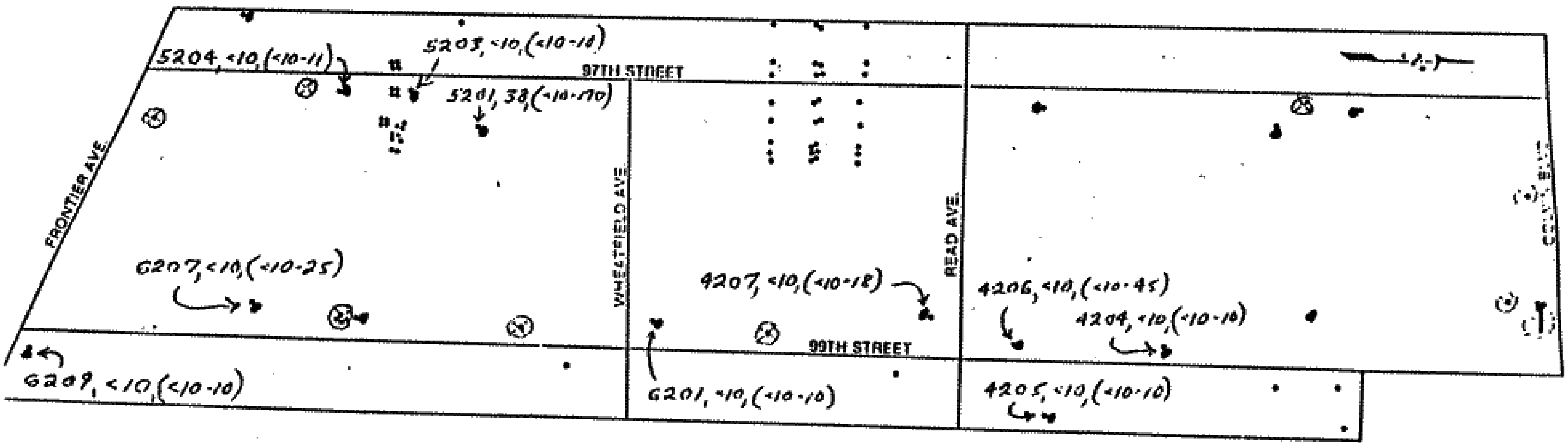
Bis (2-Ethylhexyl) phthalate (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

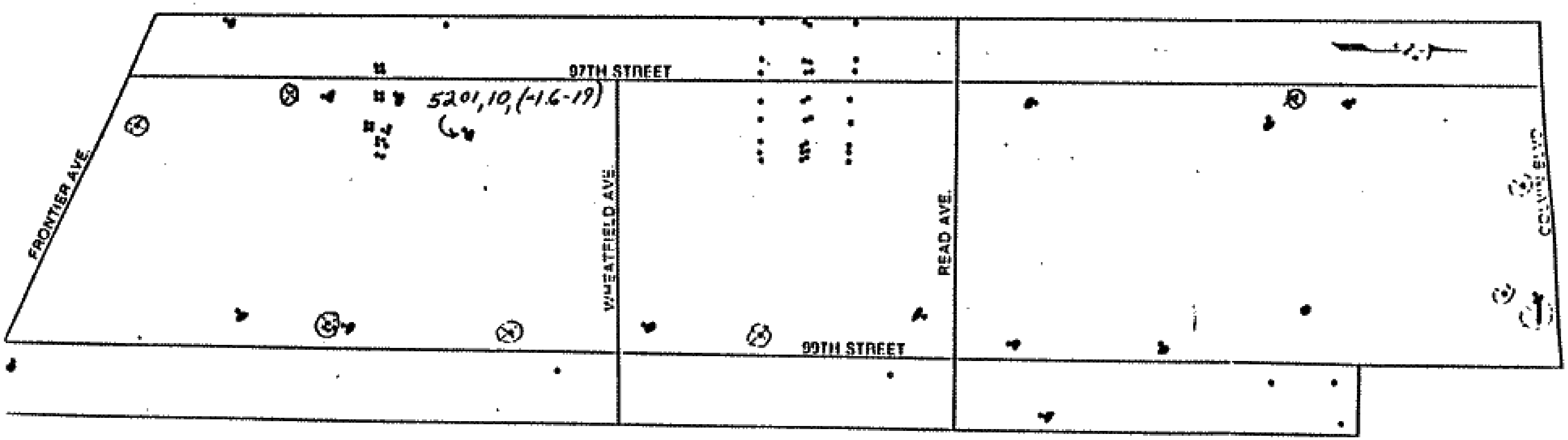
Chloroform (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



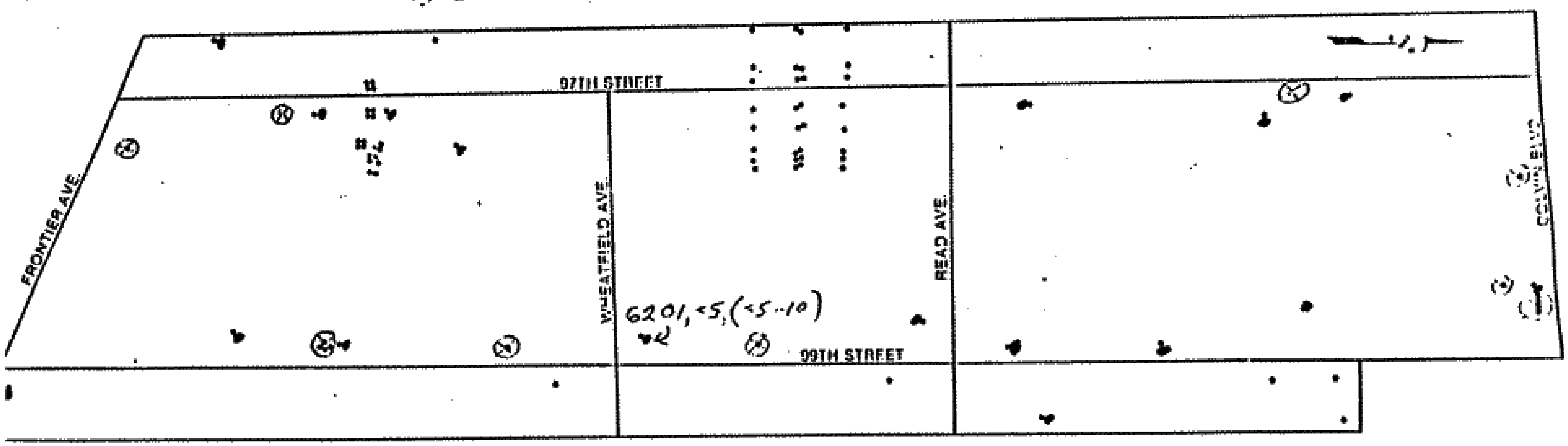
NOT TO SCALE

Trichloroethylene (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil
⊗ - Indicates wells that were never sampled



NOT TO SCALE

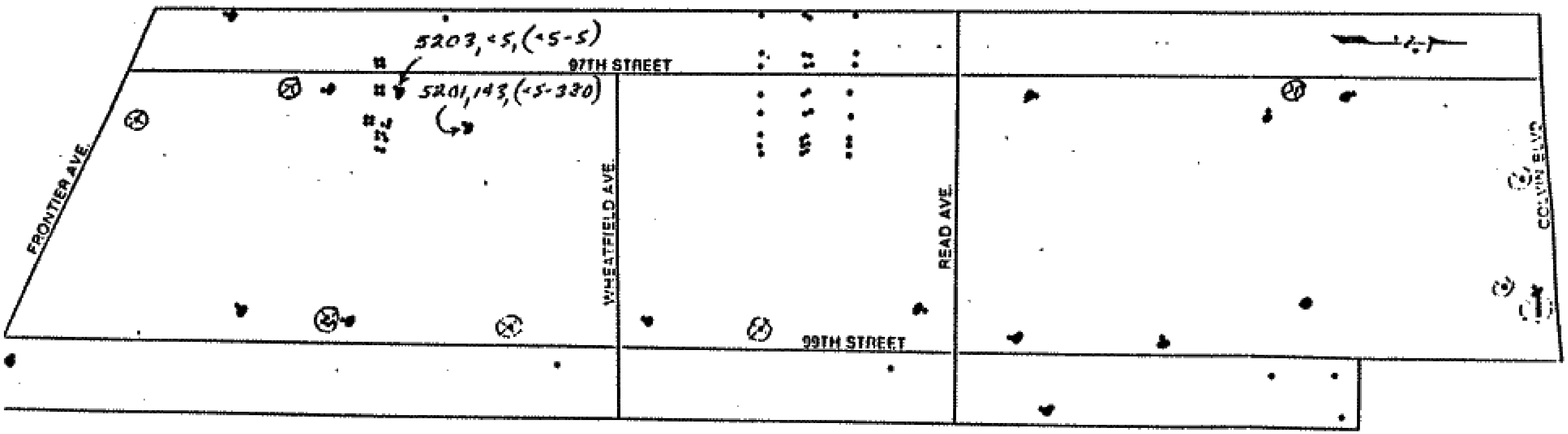
Toluene (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



NOT TO SCALE

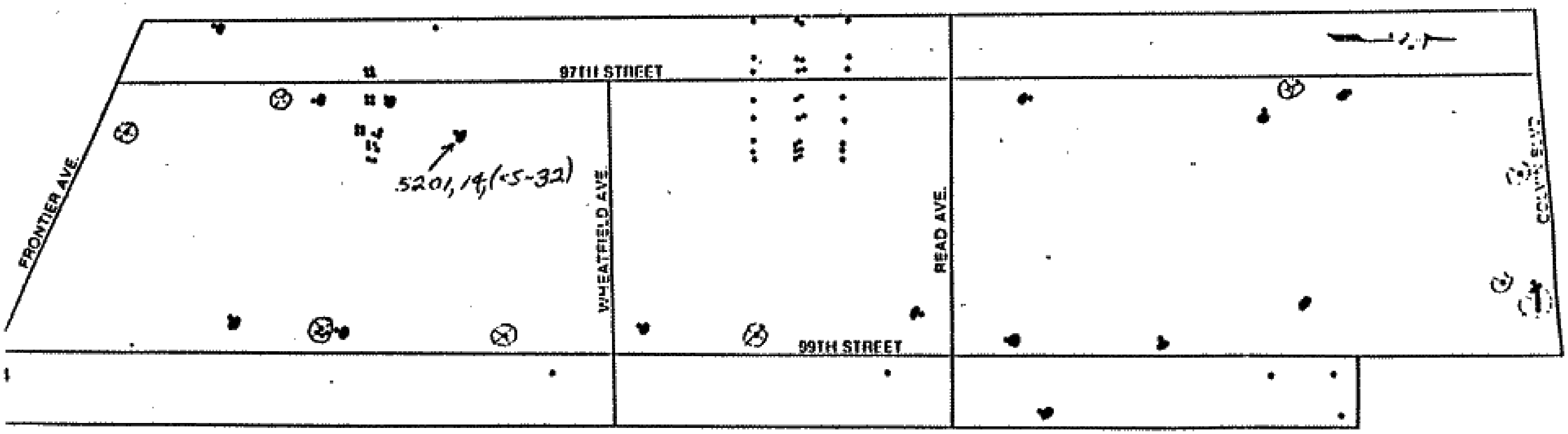
Chlorobenzene (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



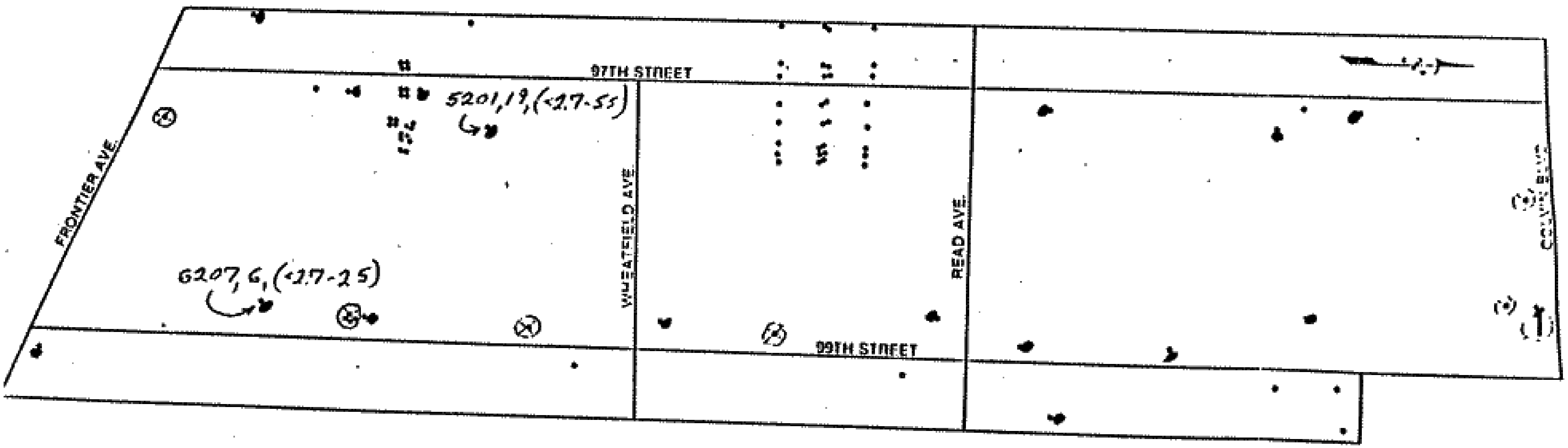
NOT TO SCALE

2,4-Dichlorophenol (ppb)
Bedrock wells

KEY - well #, average concentration, (range of concentration)

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil
⊗ - Indicates wells that were never sampled



NOT TO SCALE

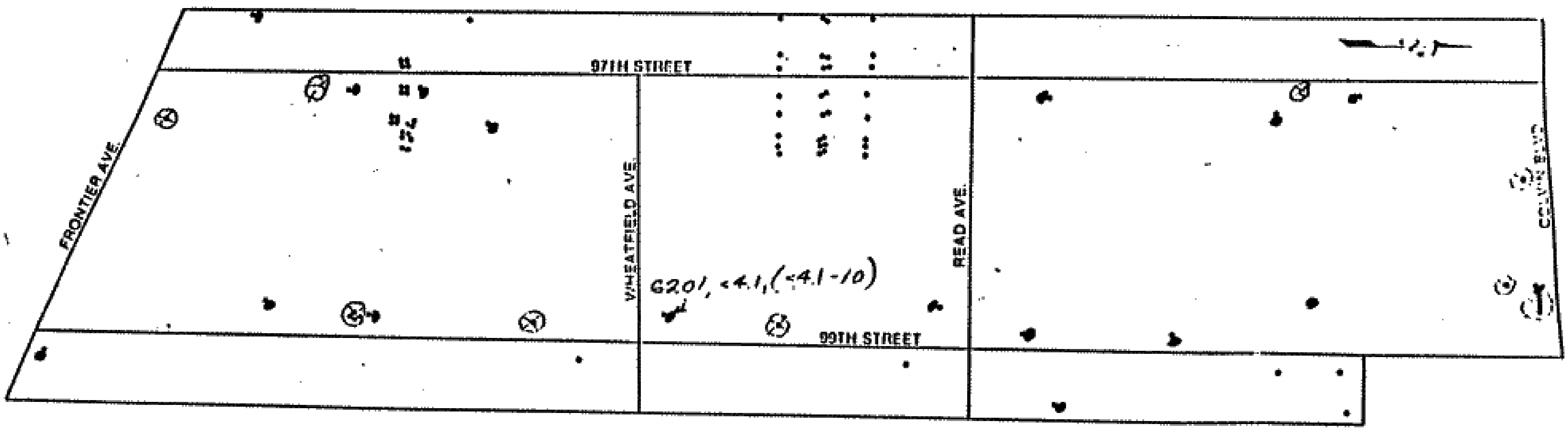
Tetrachloroethylene (ppb)
Bedrock Wells

KEY - [well #, average concentration, (range of concentration)]

Soil Layer for A, B, C and D Wells

A - gravelly loam, gravelly clay, loam till
B - nondesiccated silty clay
C - sandy loam, desiccated silty clay
D - silty clay loam (original topsoil), silty clay loam subsoil

⊗ - Indicates wells that were never sampled



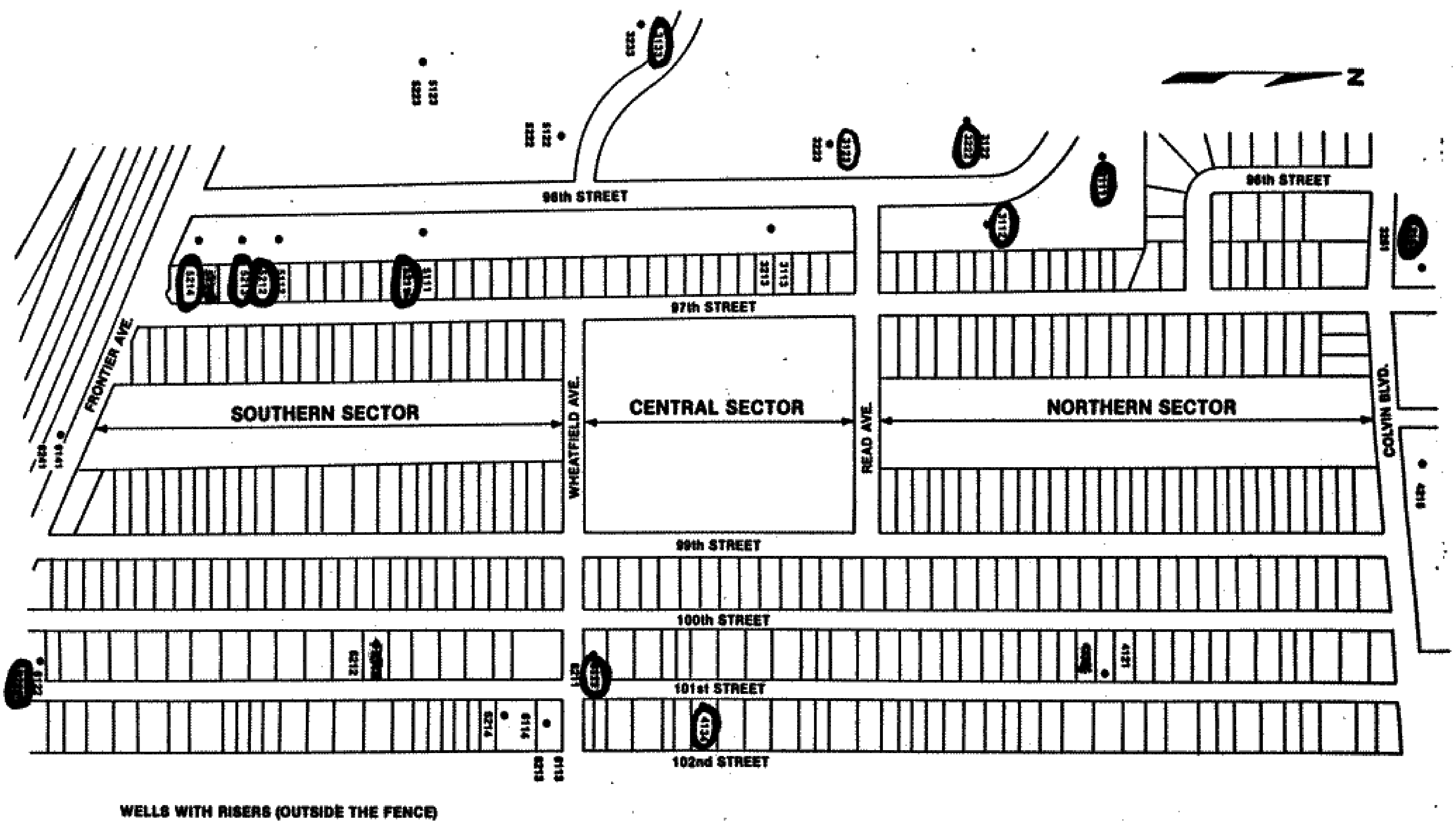
NOT TO SCALE

ATTACHMENT B

CROSS-SECTIONAL ELEVATION PLOTS
NESTED PIEZOMETERS

(Under Revision)

LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS OUTSIDE THE FENCE SAMPLED

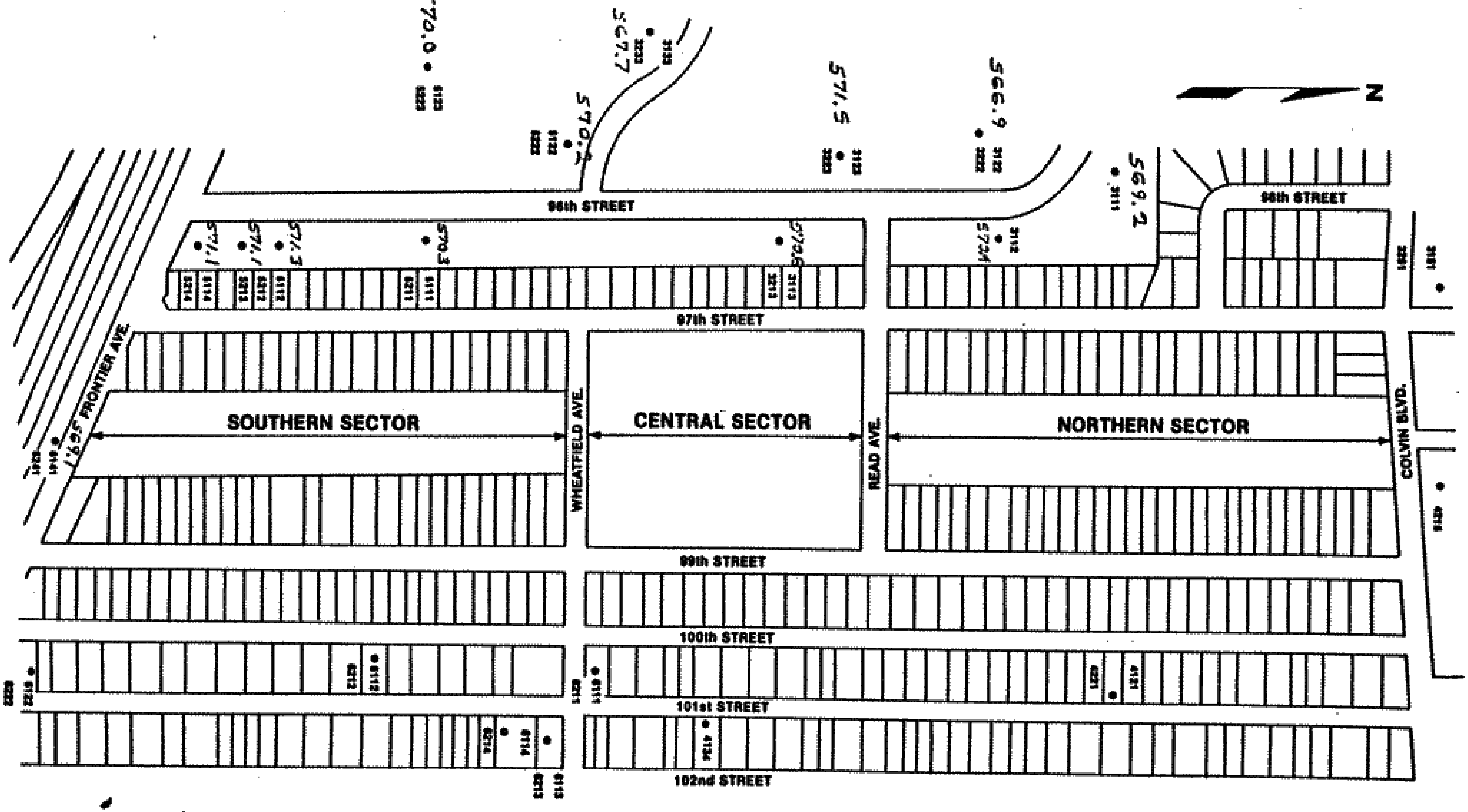
Red circles show positive results for the United States Environmental Protection Agency sampling

Blue indicates positive results for the New York State Department of Environmental Conservation sampling

ATTACHMENT C

ELEVATIONS AND FLOW PATTERNS OF EPA OVERBURDEN WELLS

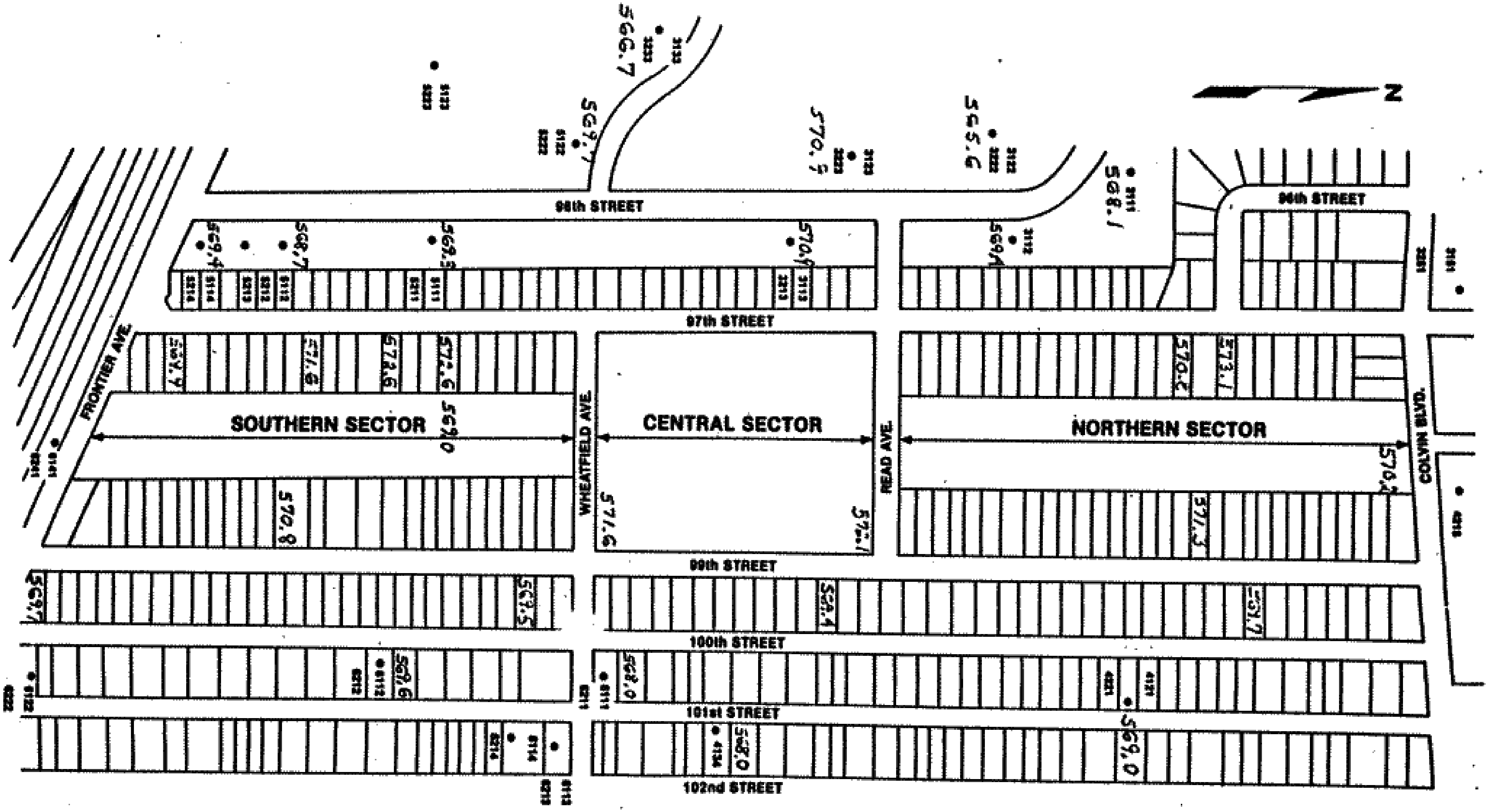
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

OVERBURDEN AQUIFER
JUNE 13, 1984

LOVE CANAL GROUNDWATER MONITORING PROGRAM

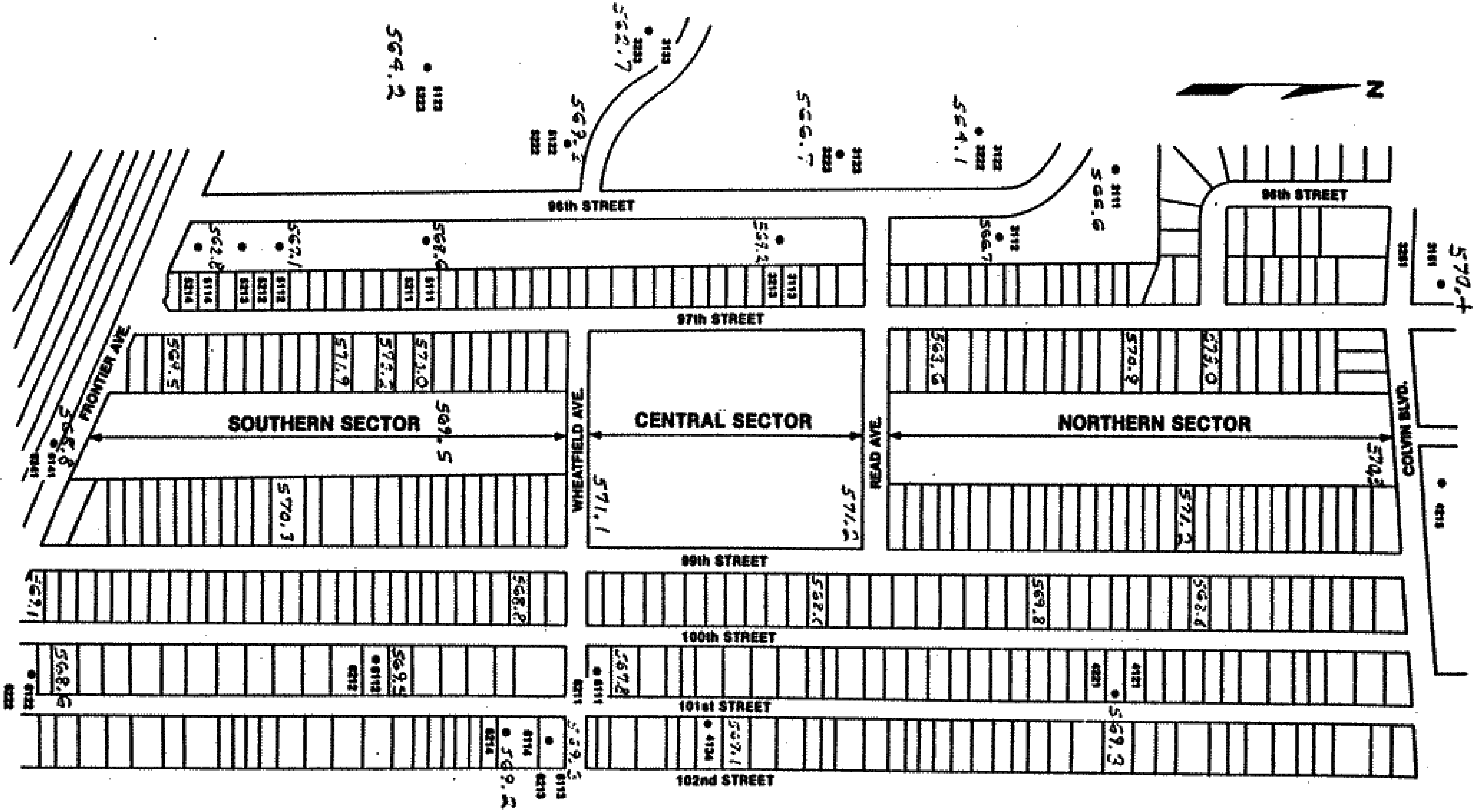


WELLS WITH RISERS (OUTSIDE THE FENCE)

OVERBURDEN AQUIFER

AUGUST 1, 1984

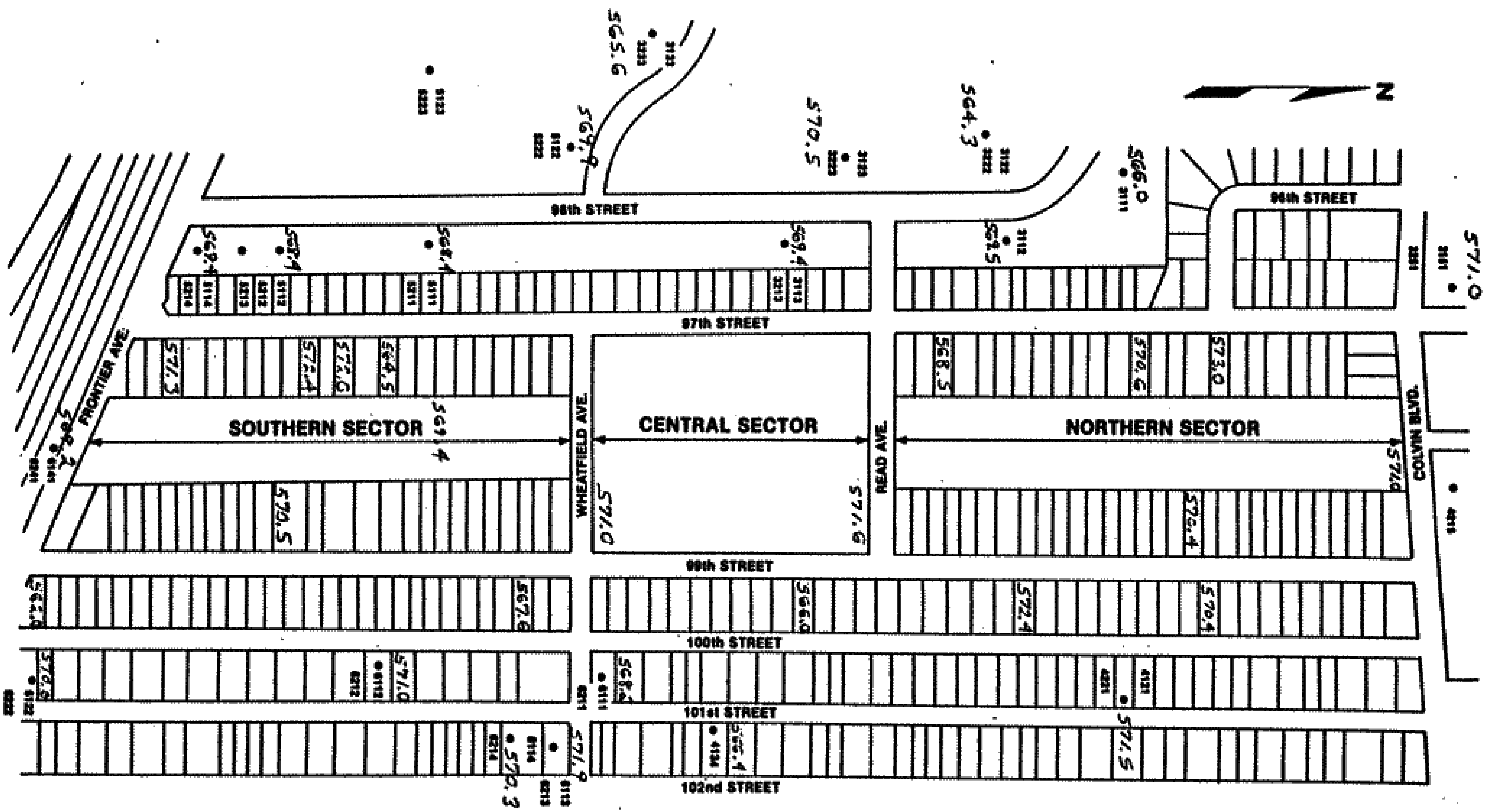
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

OVERBURDEN AQUIFER
AUGUST 30, 1984

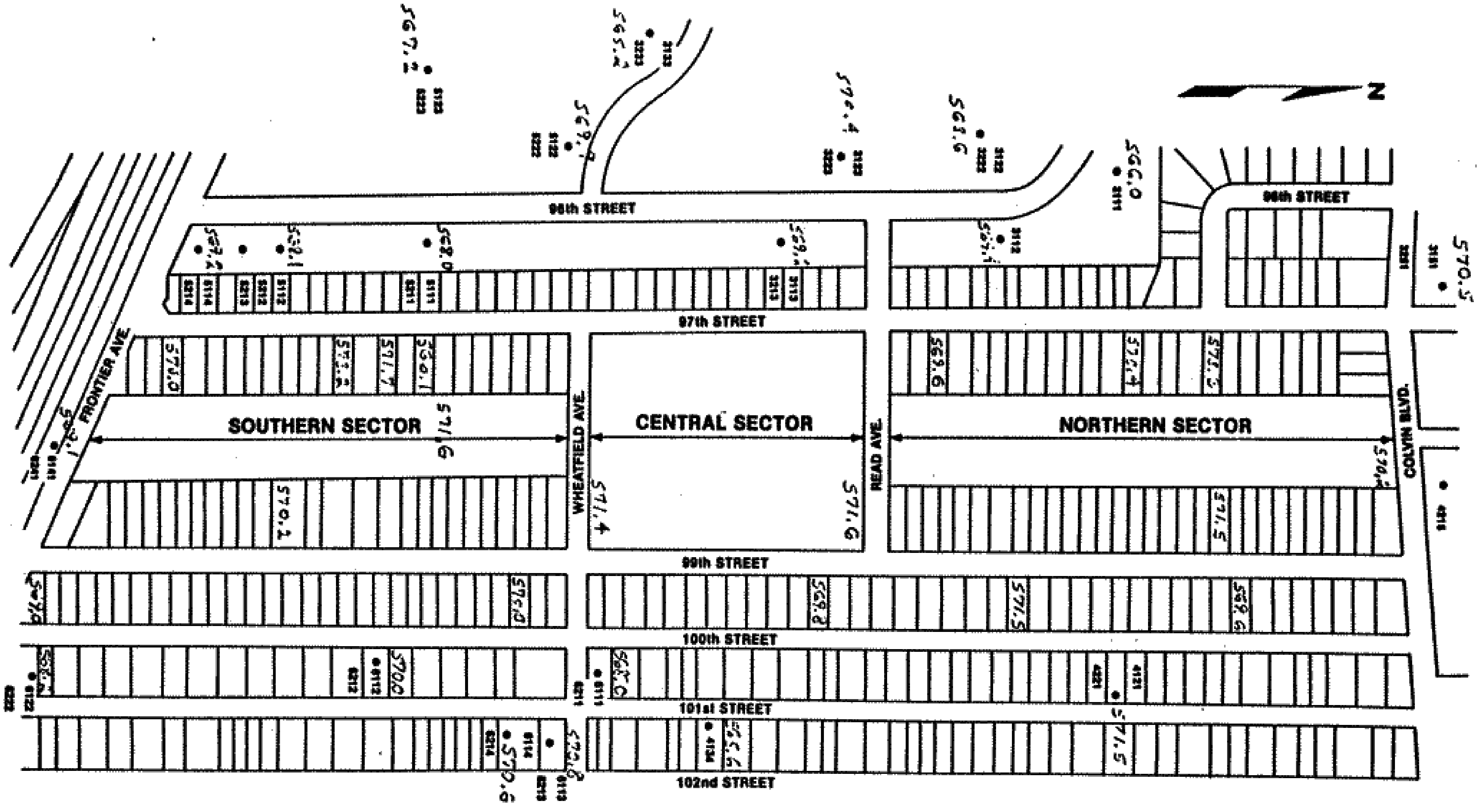
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

OVERBURDEN AQUIFER
SEPTEMBER 19, 1984

LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

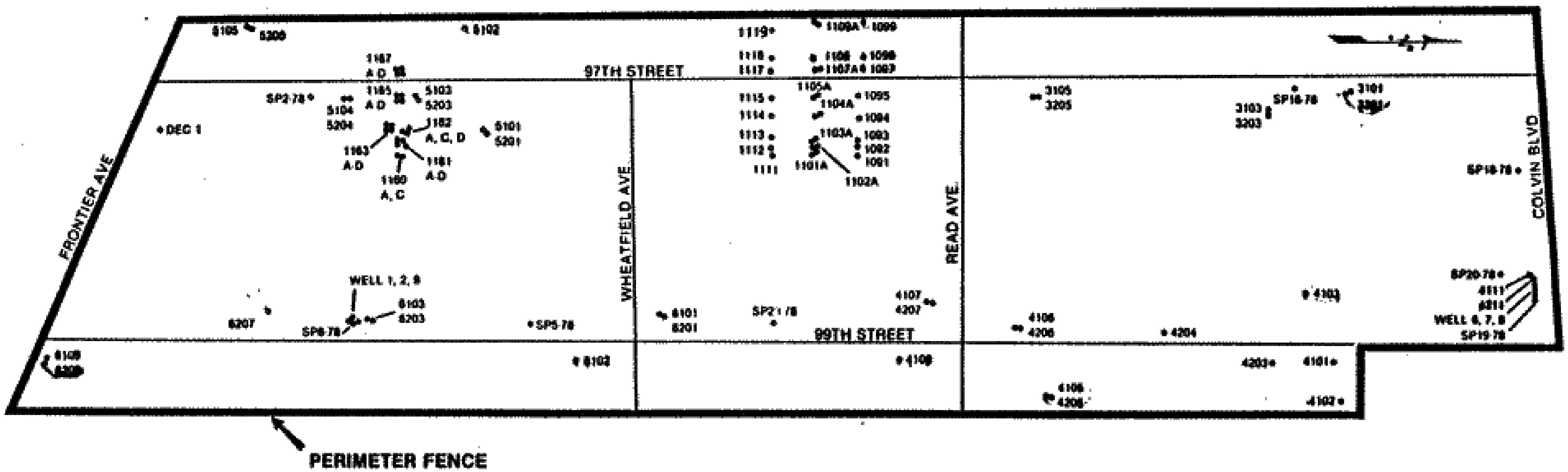
OVERBURDEN AQUIFER
OCTOBER 12, 1984

ATTACHMENT D

ELEVATIONS AND FLOW PATTERNS
OF EPA BEDROCK WELLS

Figure 1.

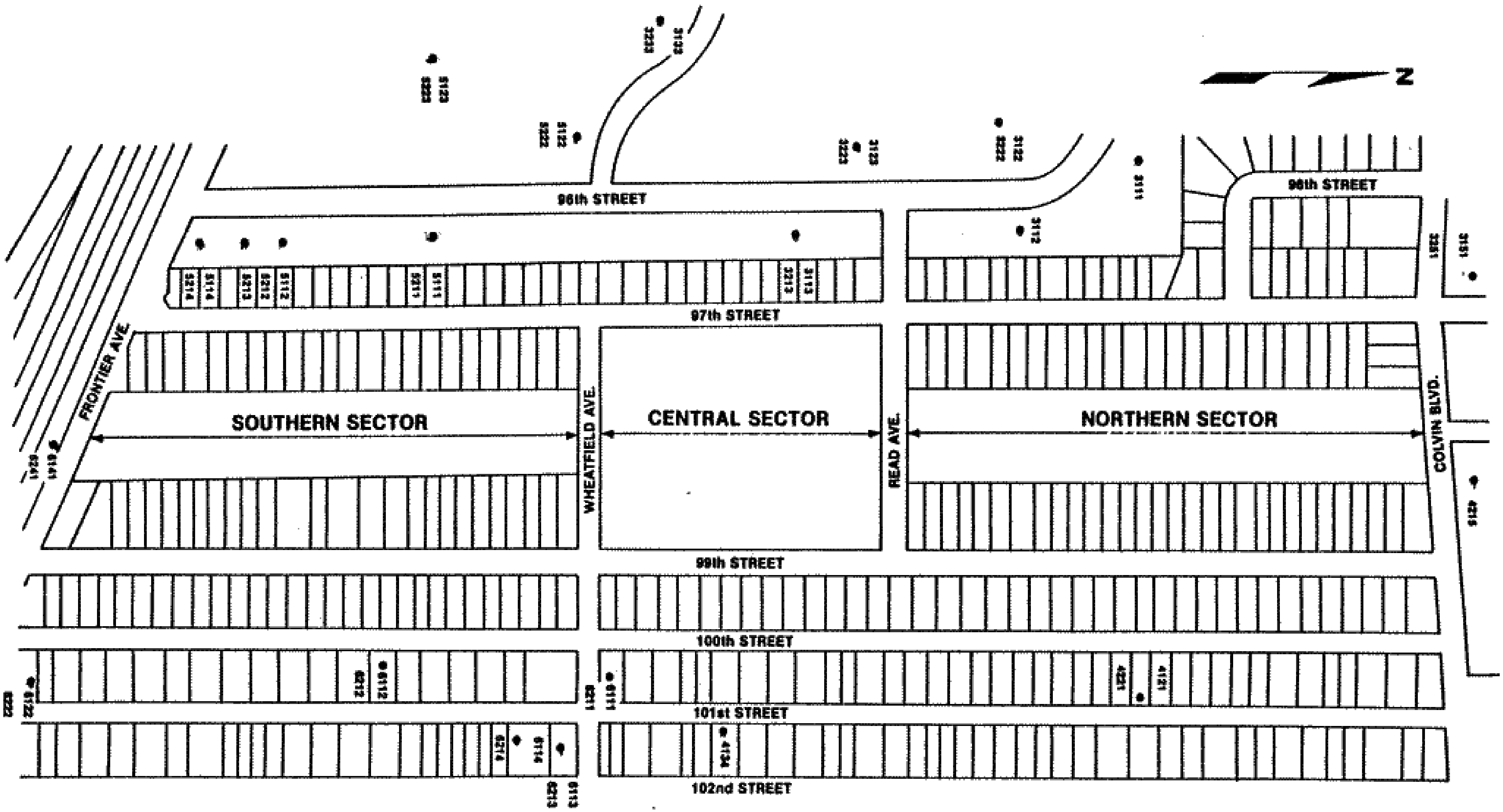
LOVE CANAL GROUNDWATER MONITORING PROGRAM



ATTACHMENT E

WATER QUALITY SAMPLING LOCATIONS
WELLS WHICH WERE SAMPLED ARE LABELLED IN RED

LOVE CANAL GROUNDWATER MONITORING PROGRAM

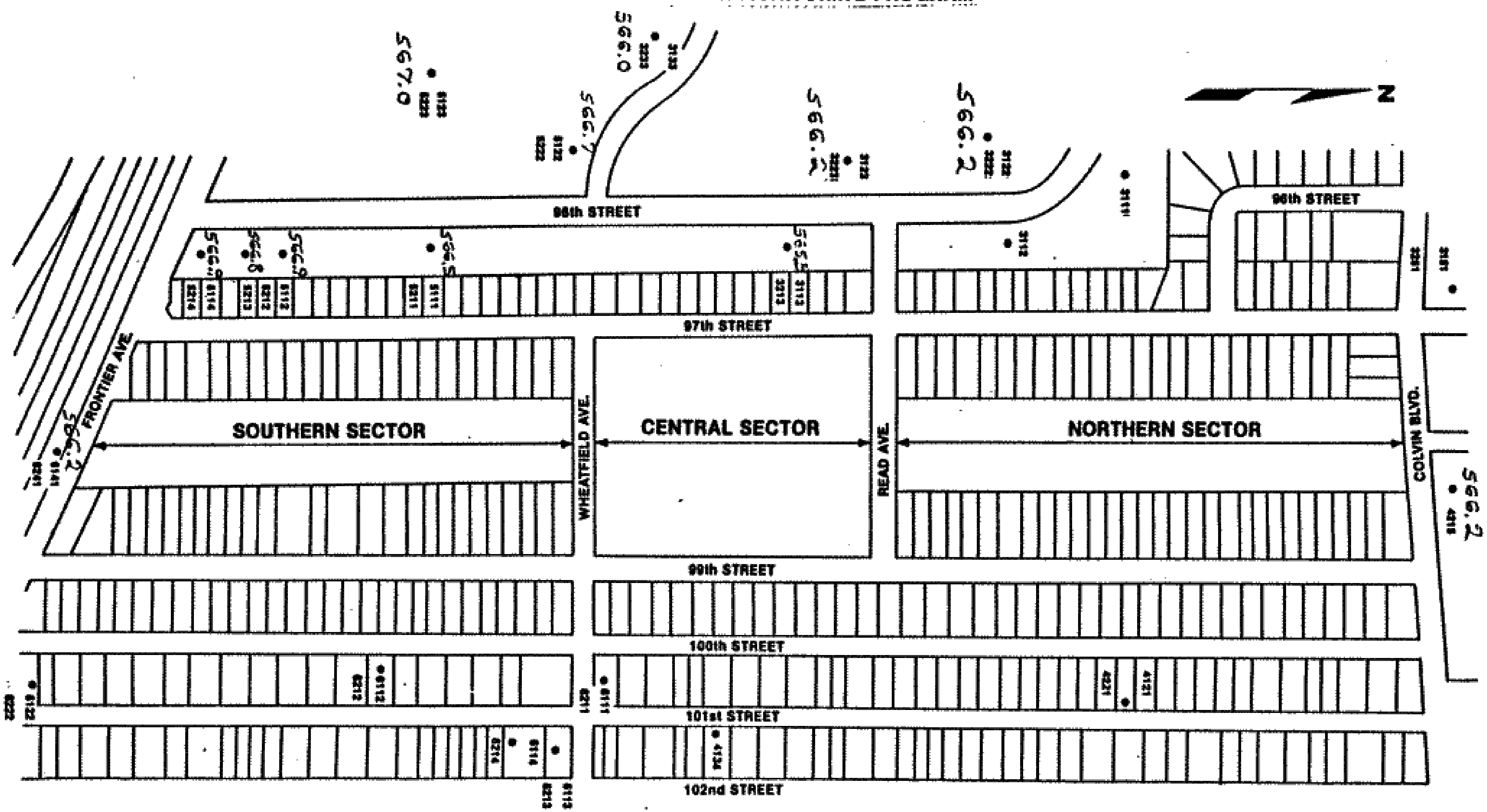


WELLS WITH RISERS (OUTSIDE THE FENCE)

ATTACHMENT F

CROSS-SECTIONAL ELEVATION PLOTS
DEC WELLS

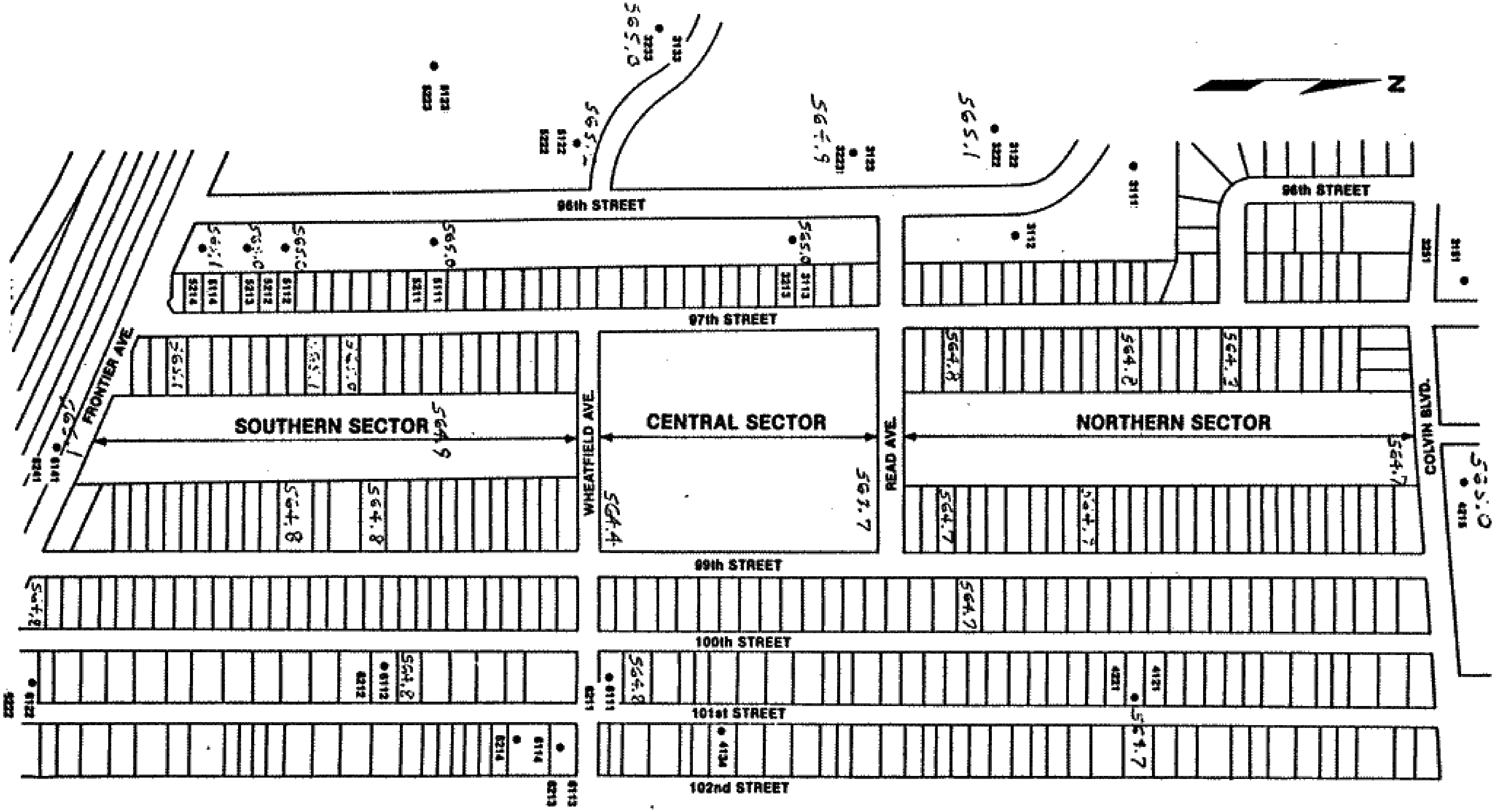
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

BEDROCK AQUIFER
JUNE 13, 1984

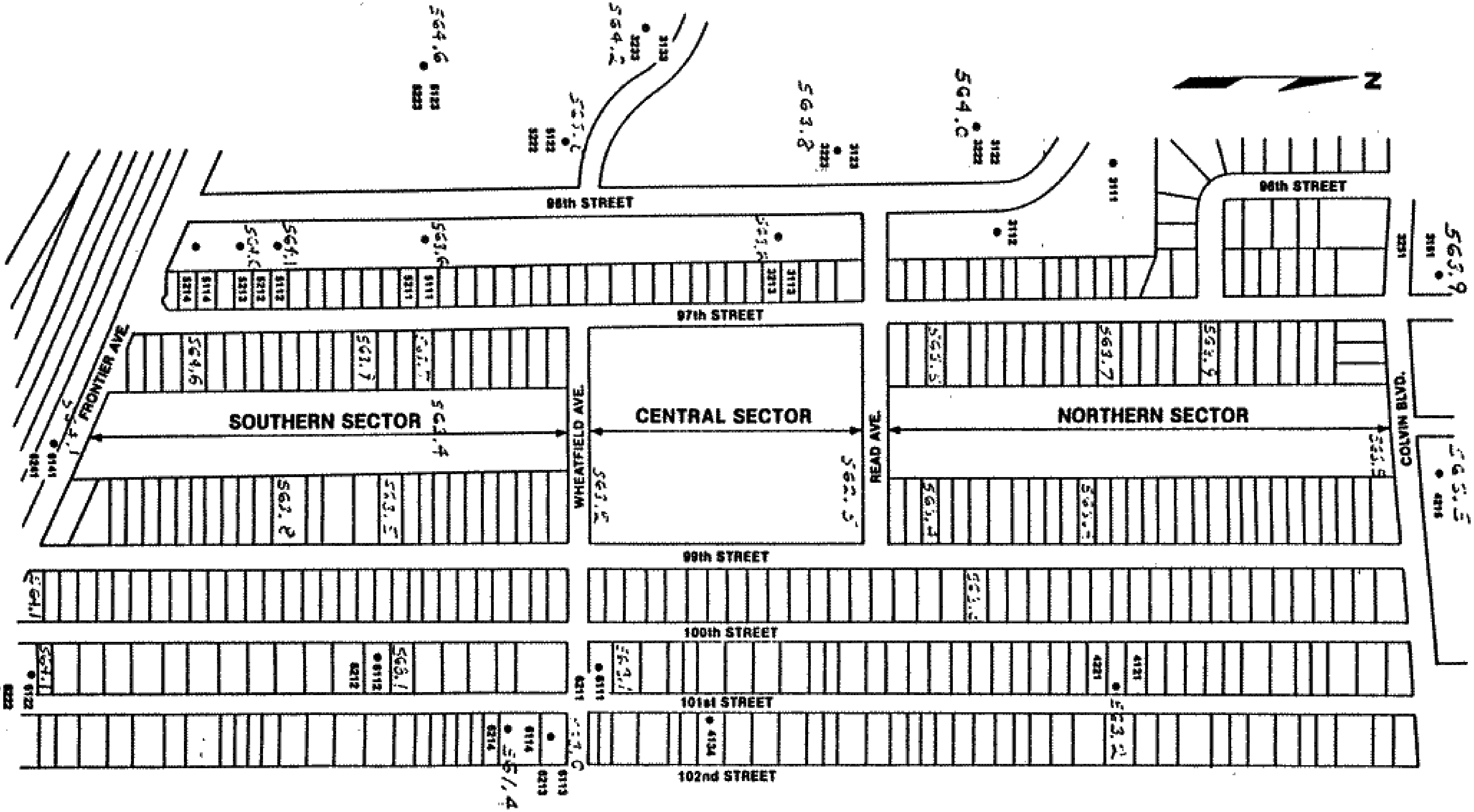
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

BEDROCK AQUIFER
AUGUST 1, 1984

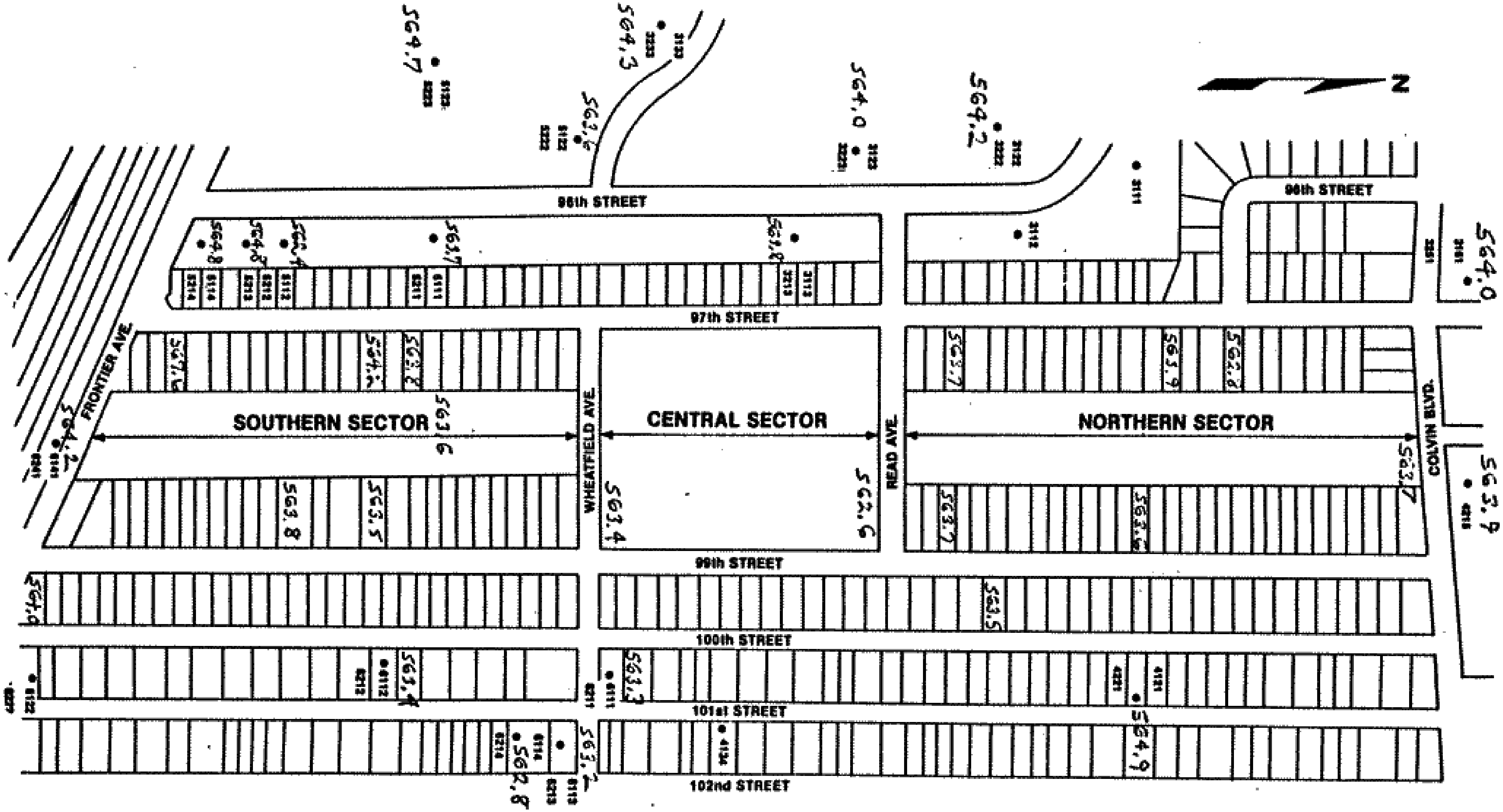
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

BEDROCK AQUIFER
AUGUST 30, 1984

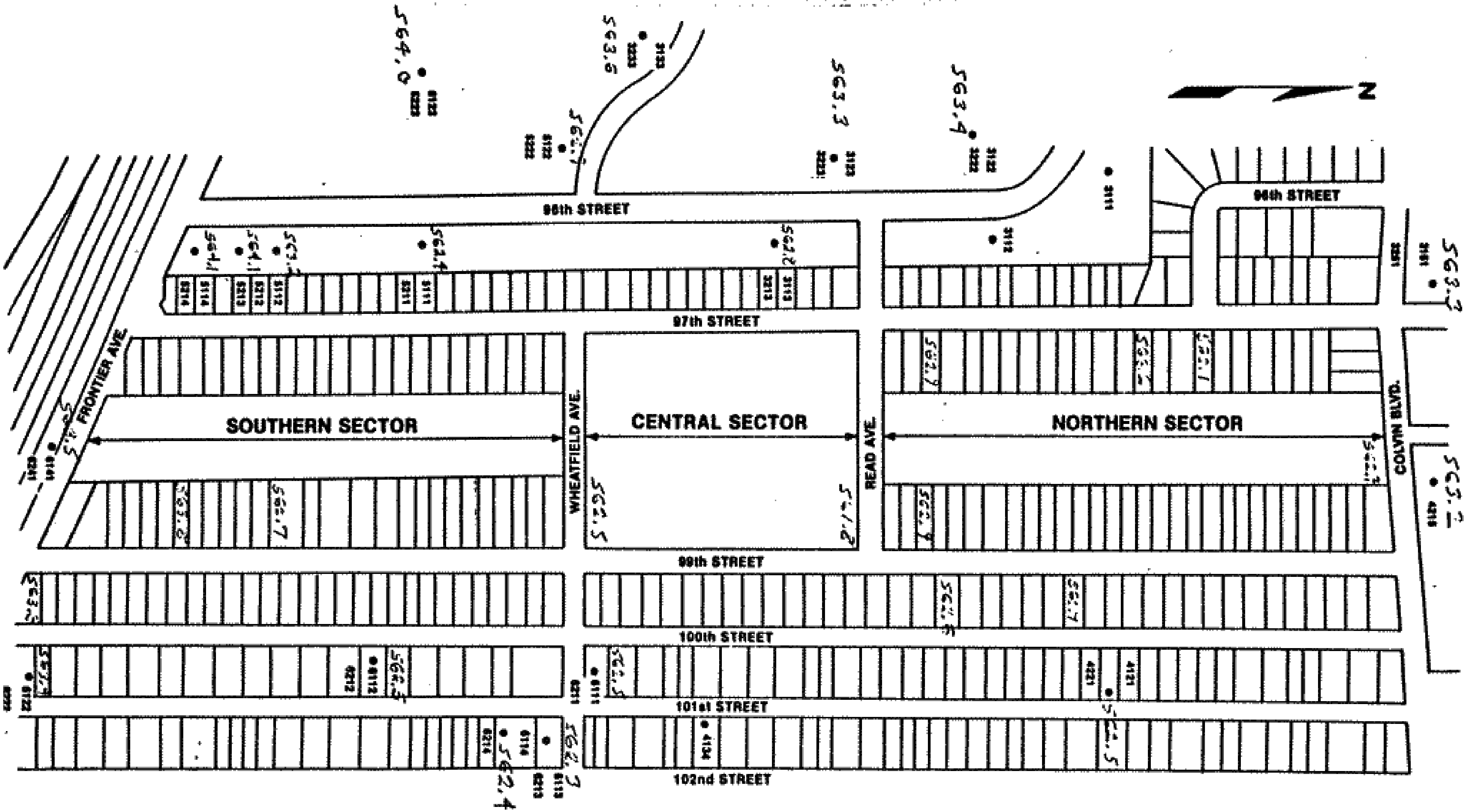
LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

BEDROCK AQUIFER
SEPTEMBER 19, 1984

LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

BEDROCK AQUIFER

OCTOBER 12, 1984

EXPLANATION FOR

CROSSECTIONAL WATER ELEVATION PLOTS

IN DEC WELLS

1(a) Row #10 corresponds to wells labeled 1101 through 1109 in Figure 1

(b) Row #9 corresponds to wells labeled 1091 through 1099 in Figure 1

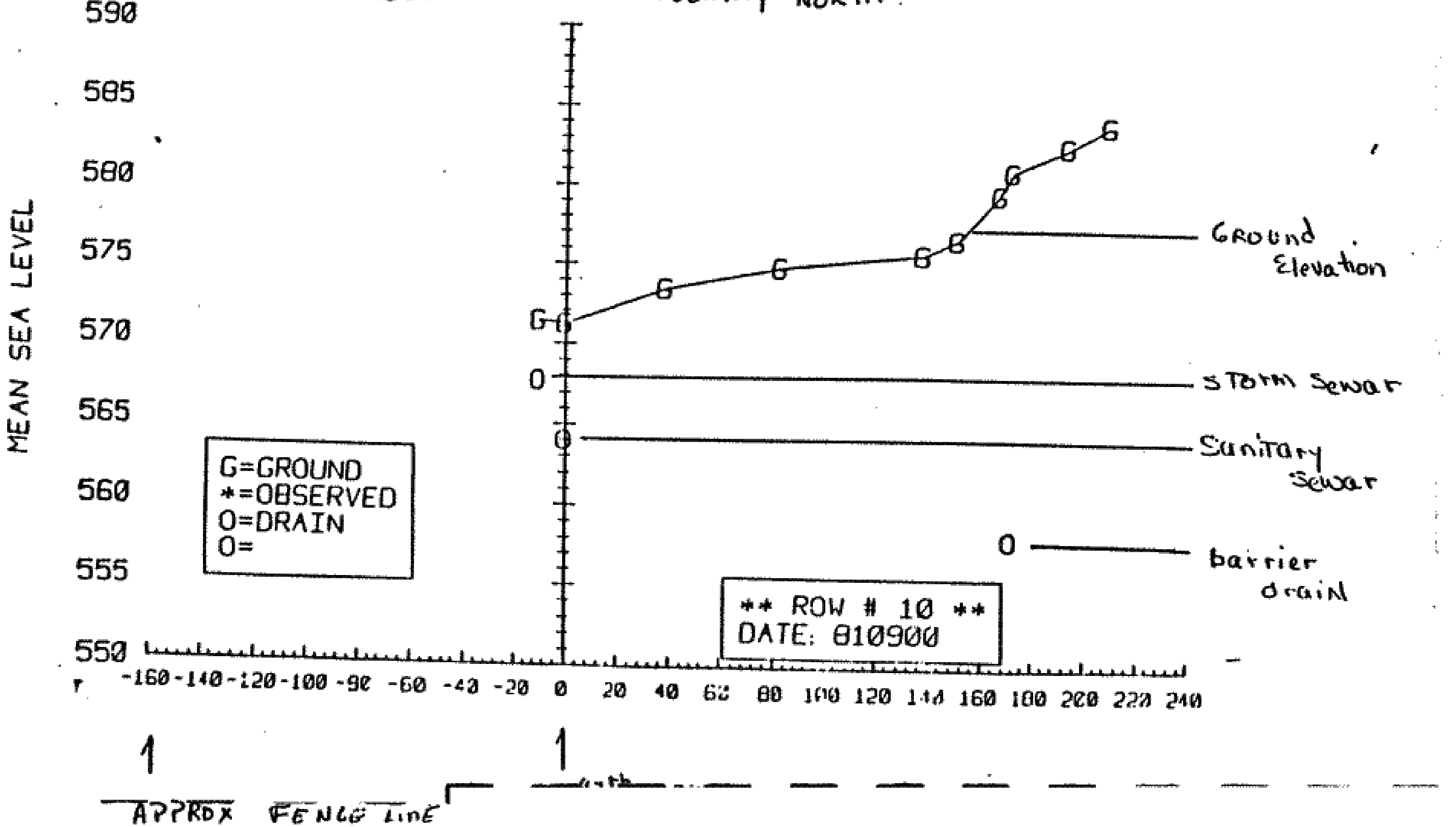
(c) Row #11 corresponds to wells labeled 1111 through 1119 in Figure 1

(d) On the cross-sectional plots, Well Nos. 1091 or 1101 or 1111 is on the right of the plots, and 1099 or 1109 or 1119 is on the left side of the plot.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

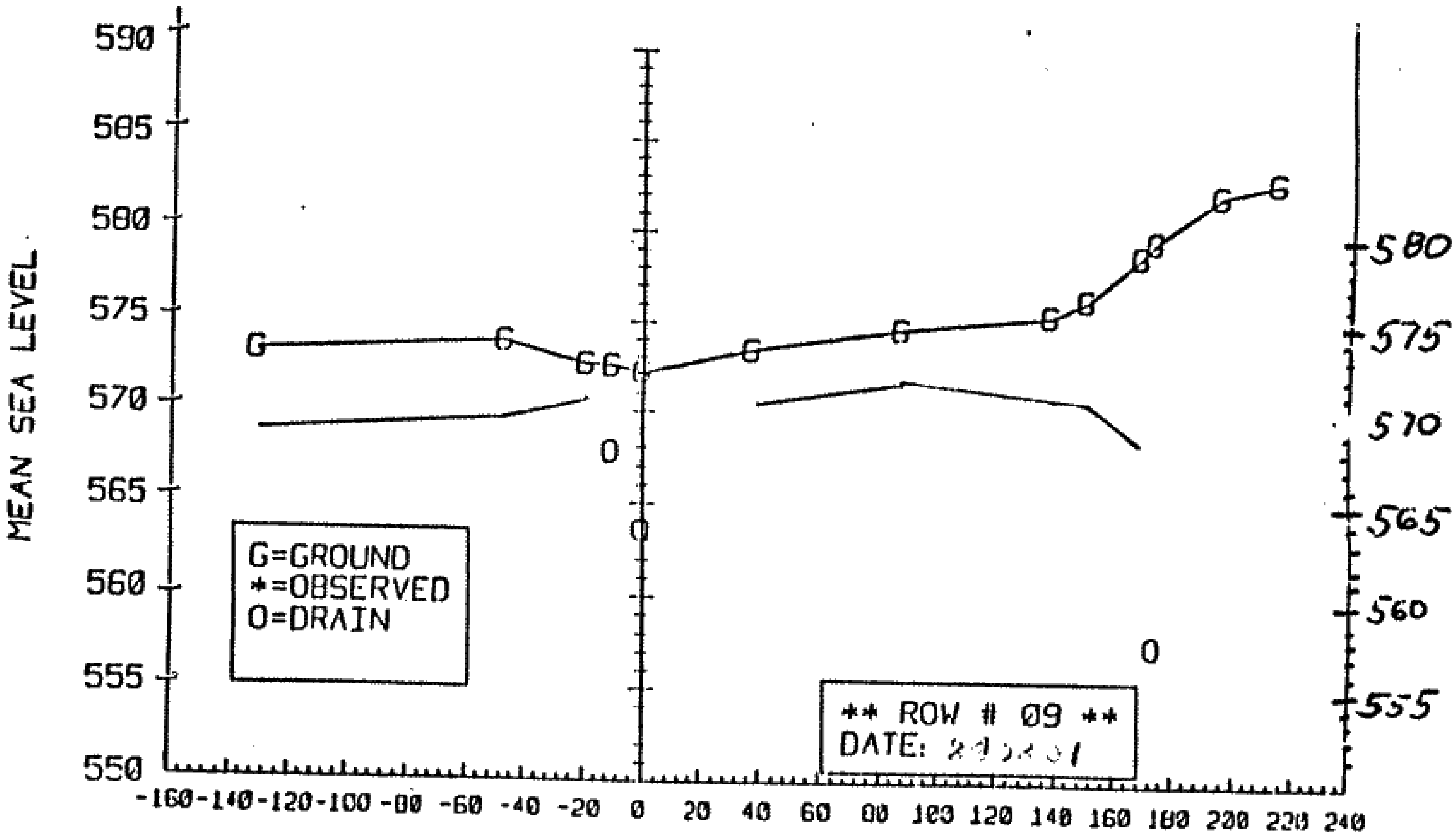
SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS

CROSS SECTION LOOKING NORTH



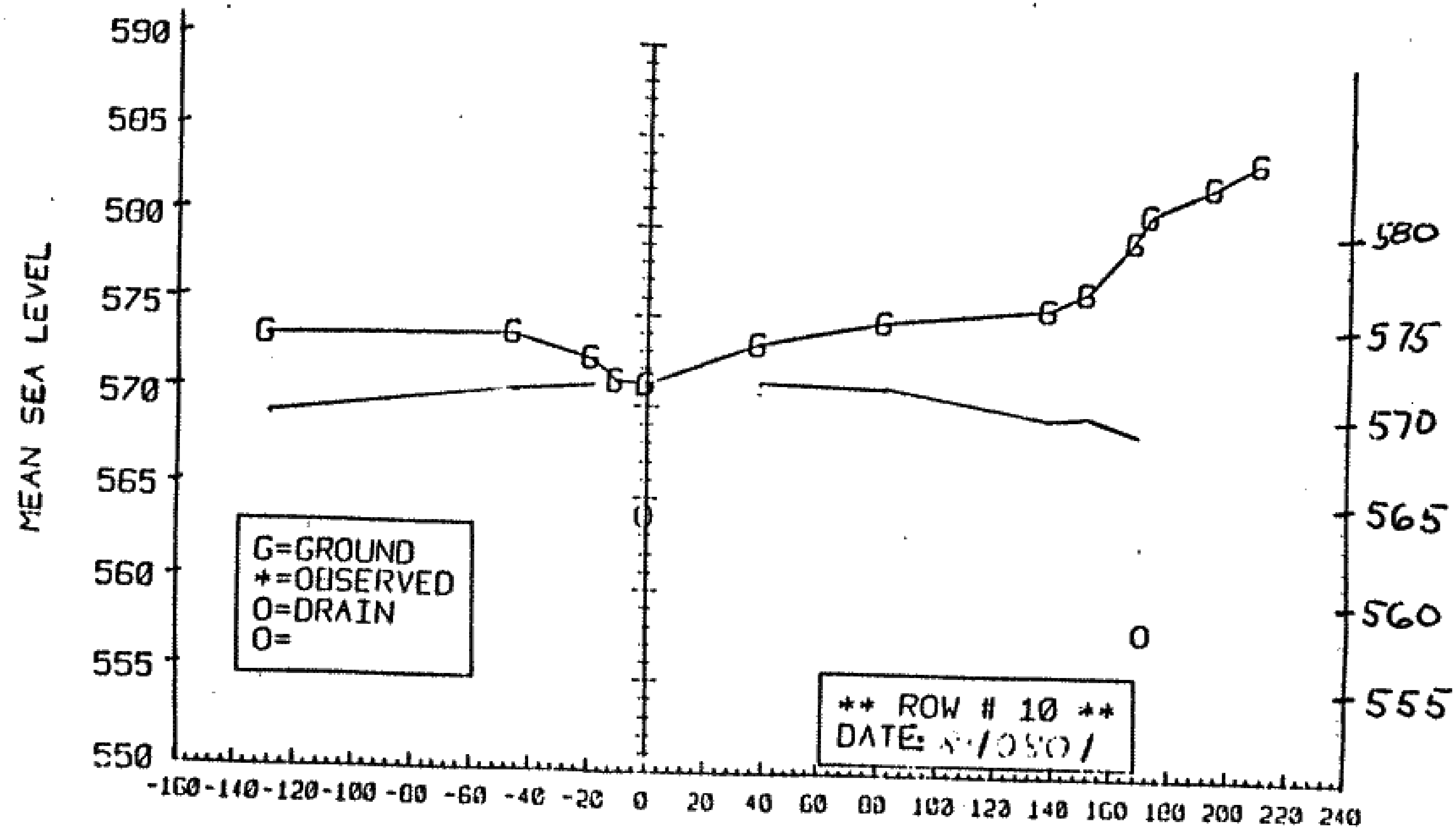
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



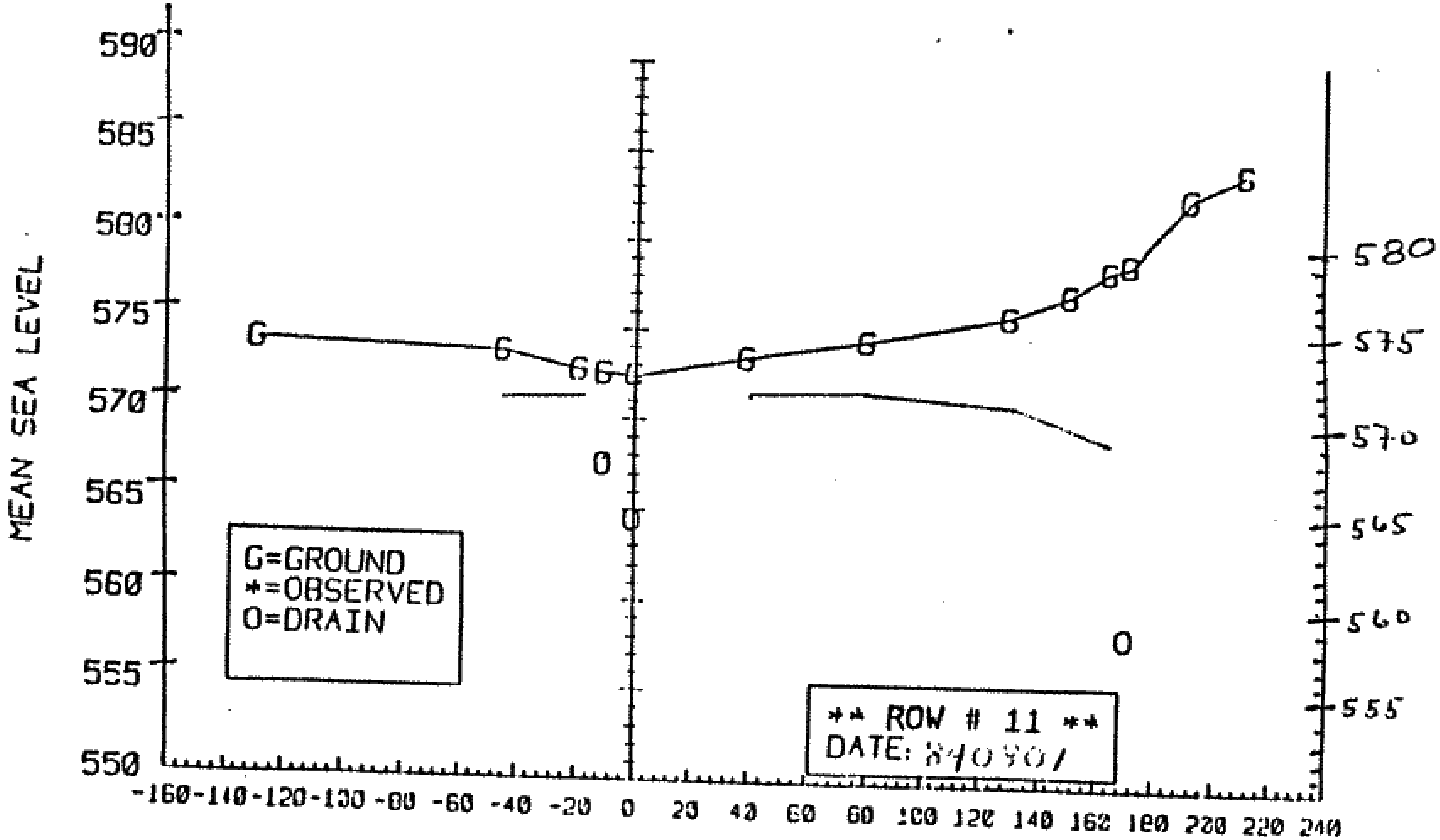
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



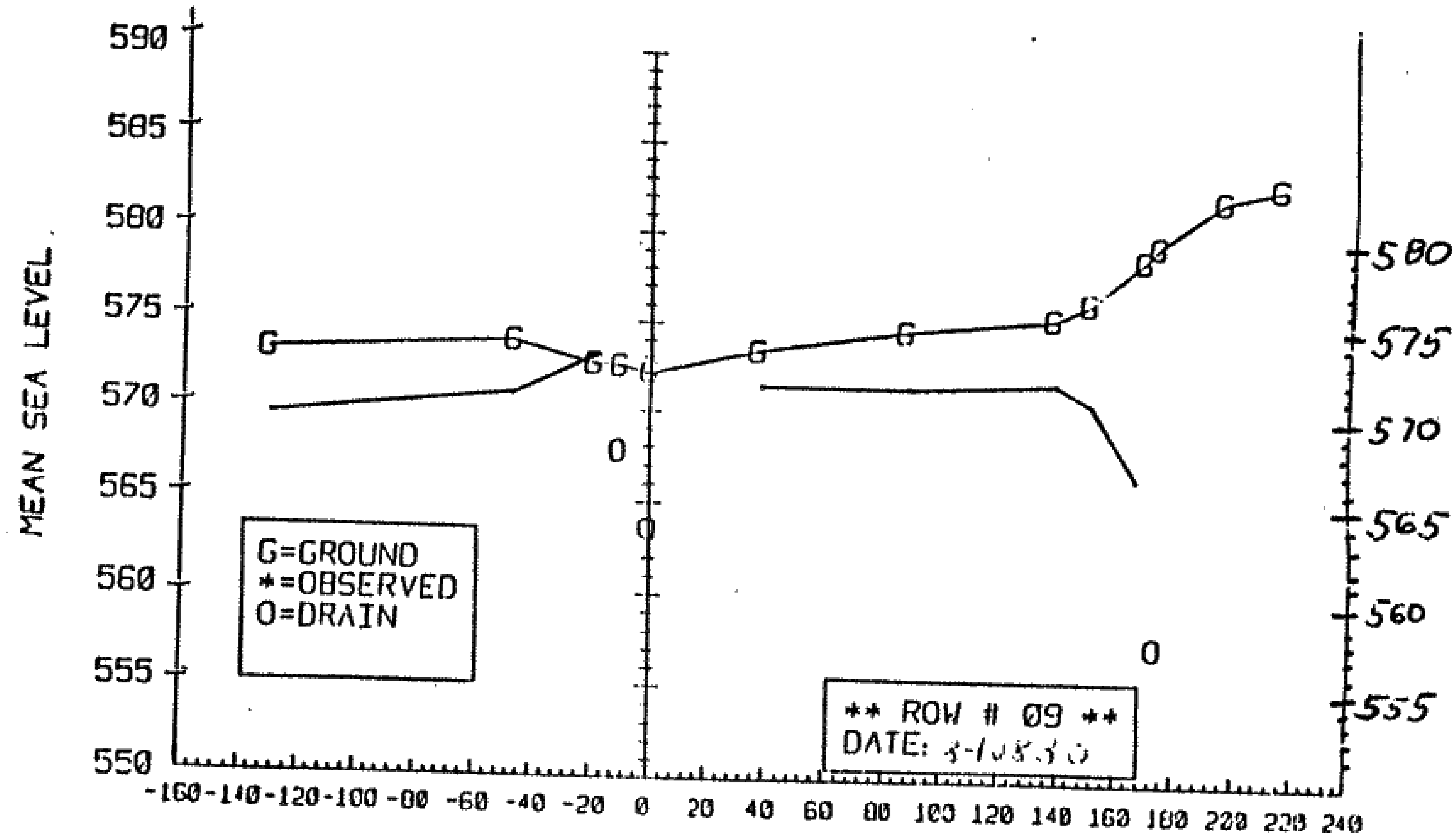
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



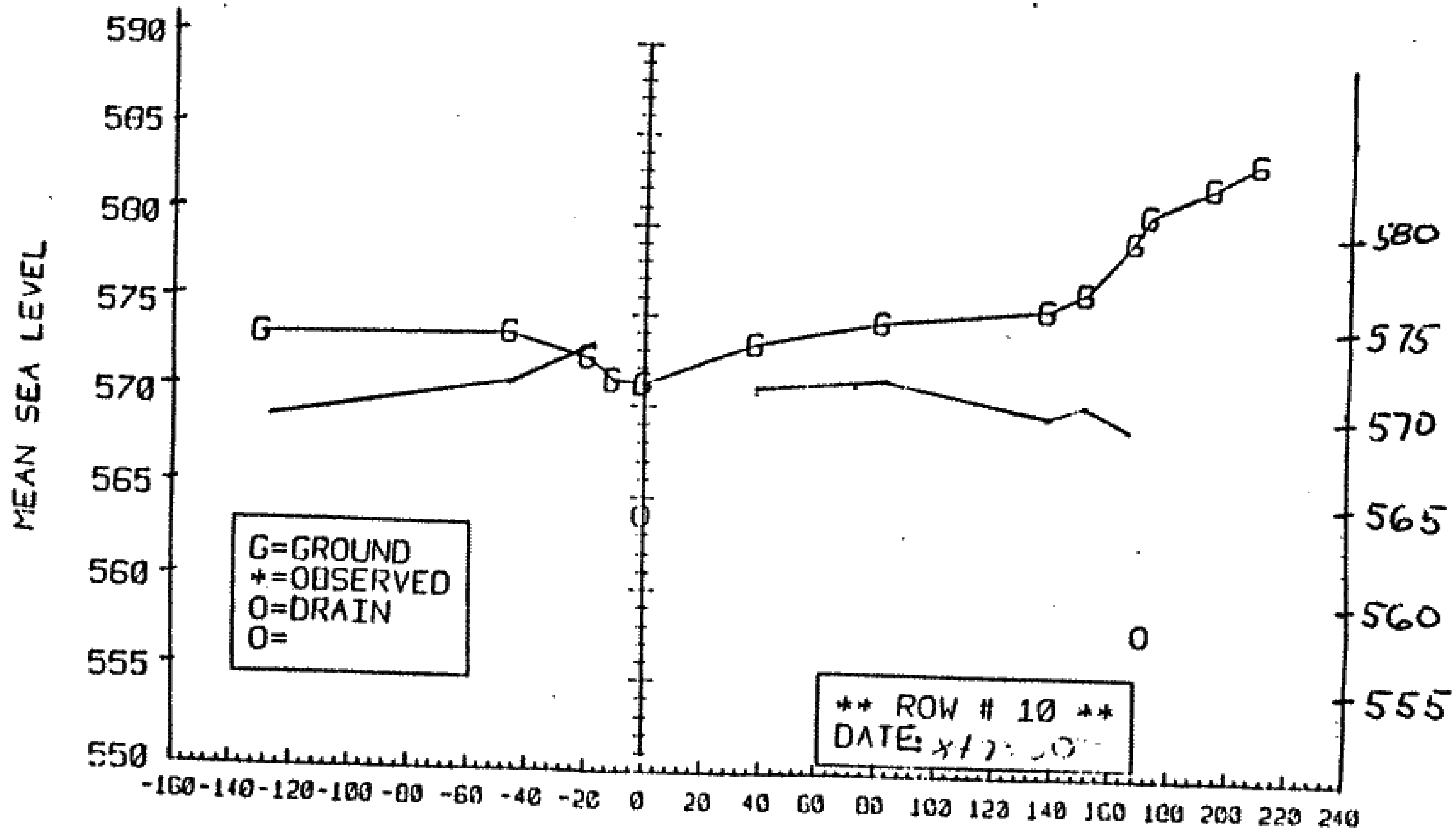
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



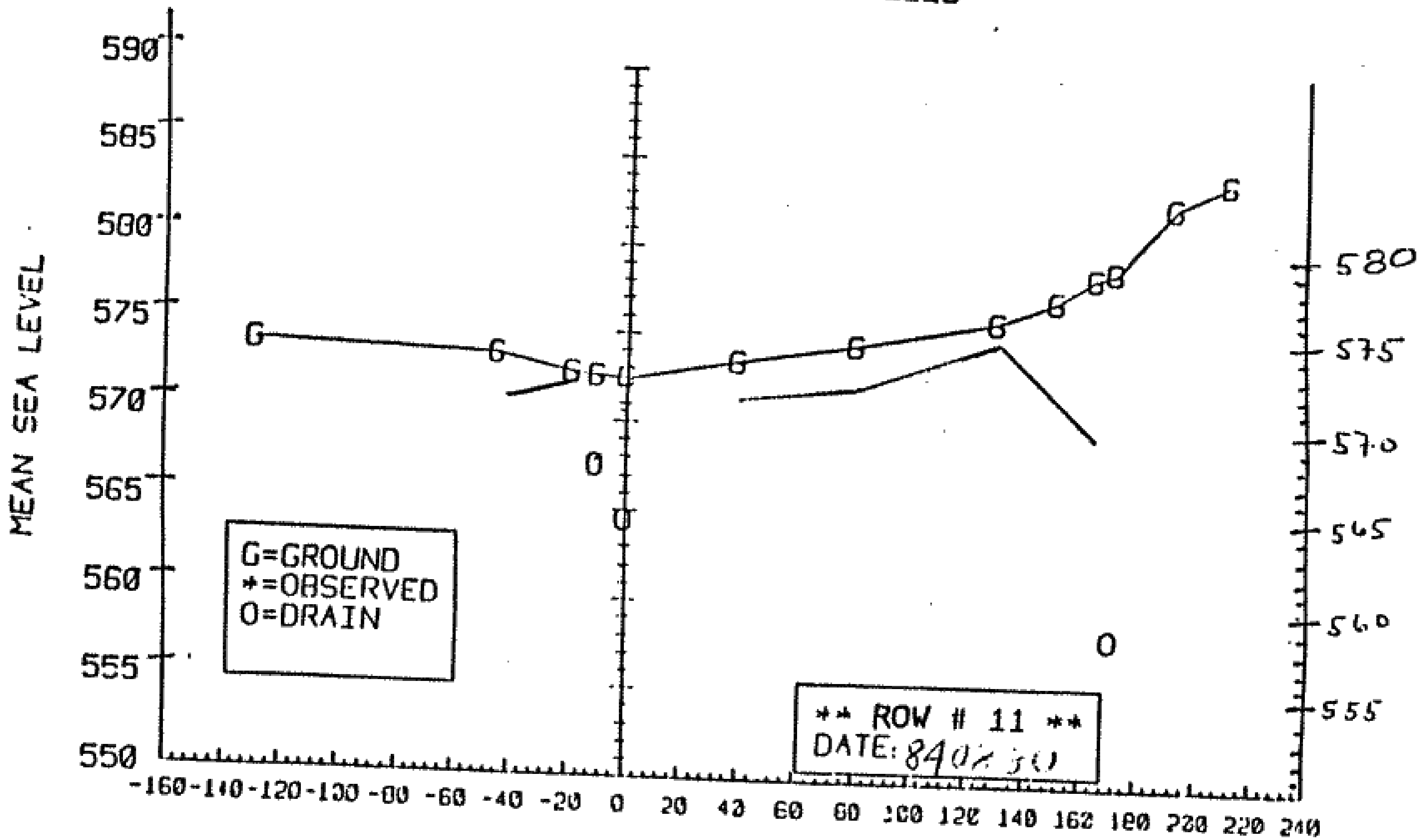
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



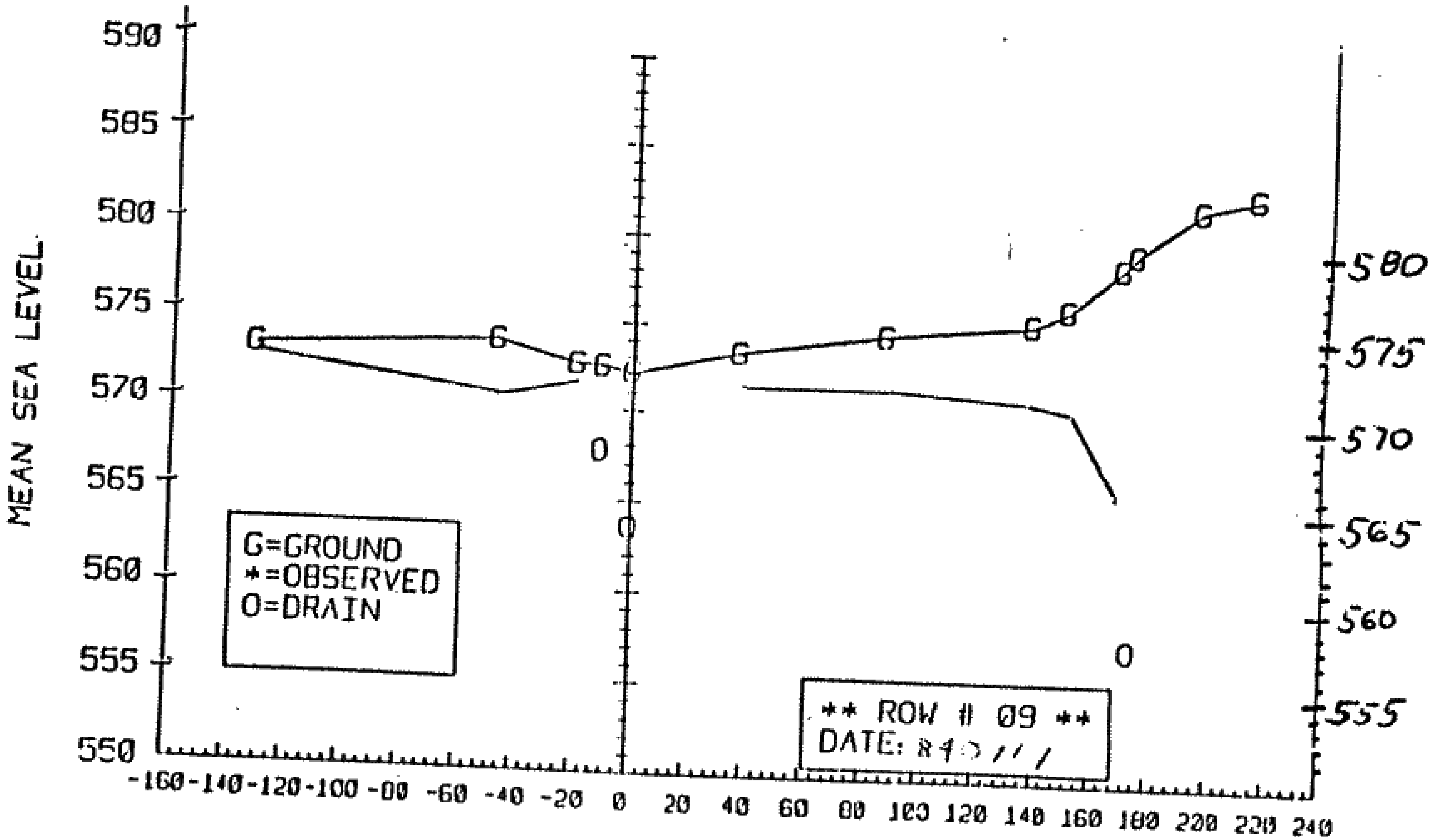
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE.CANAL MONITORING WELLS



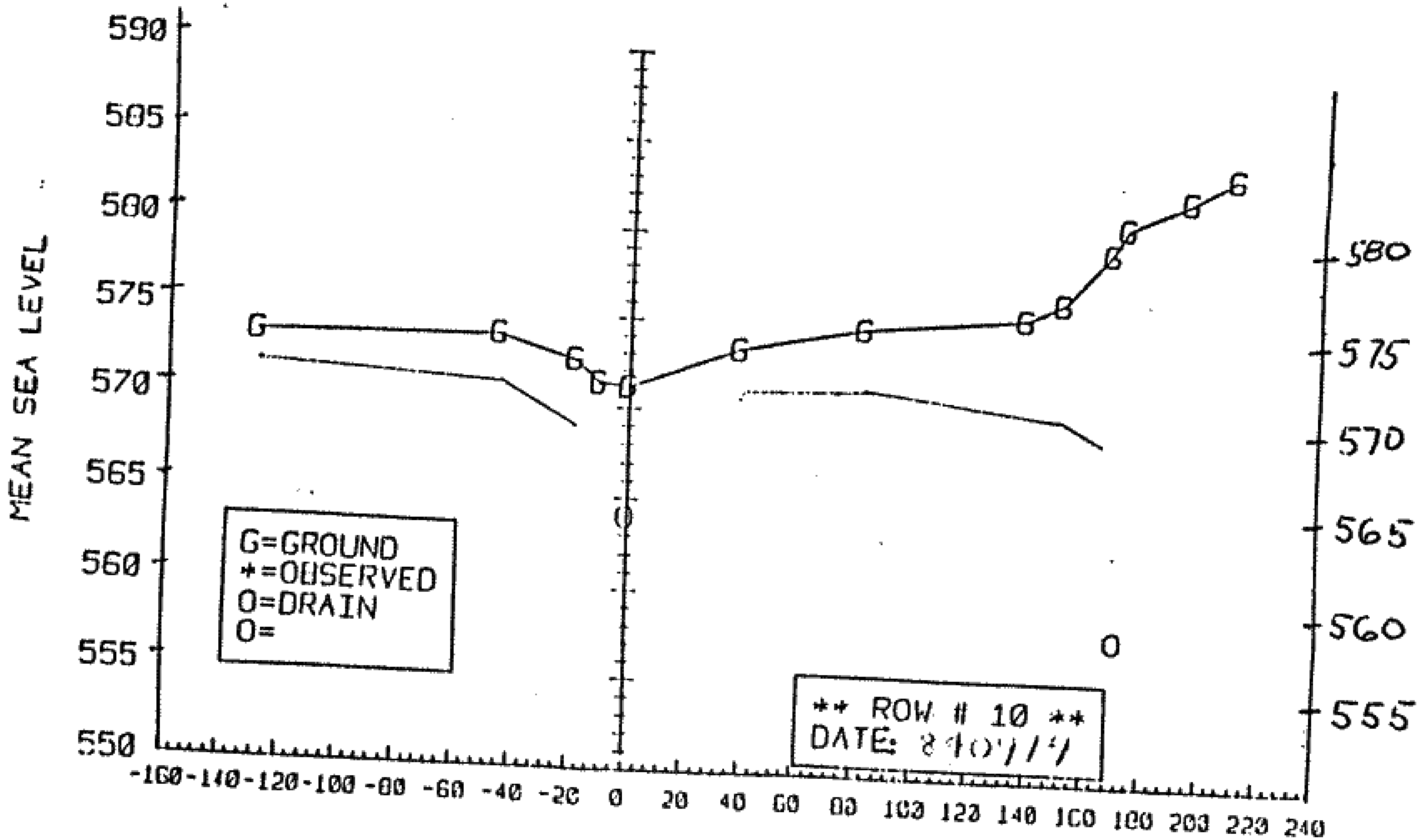
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



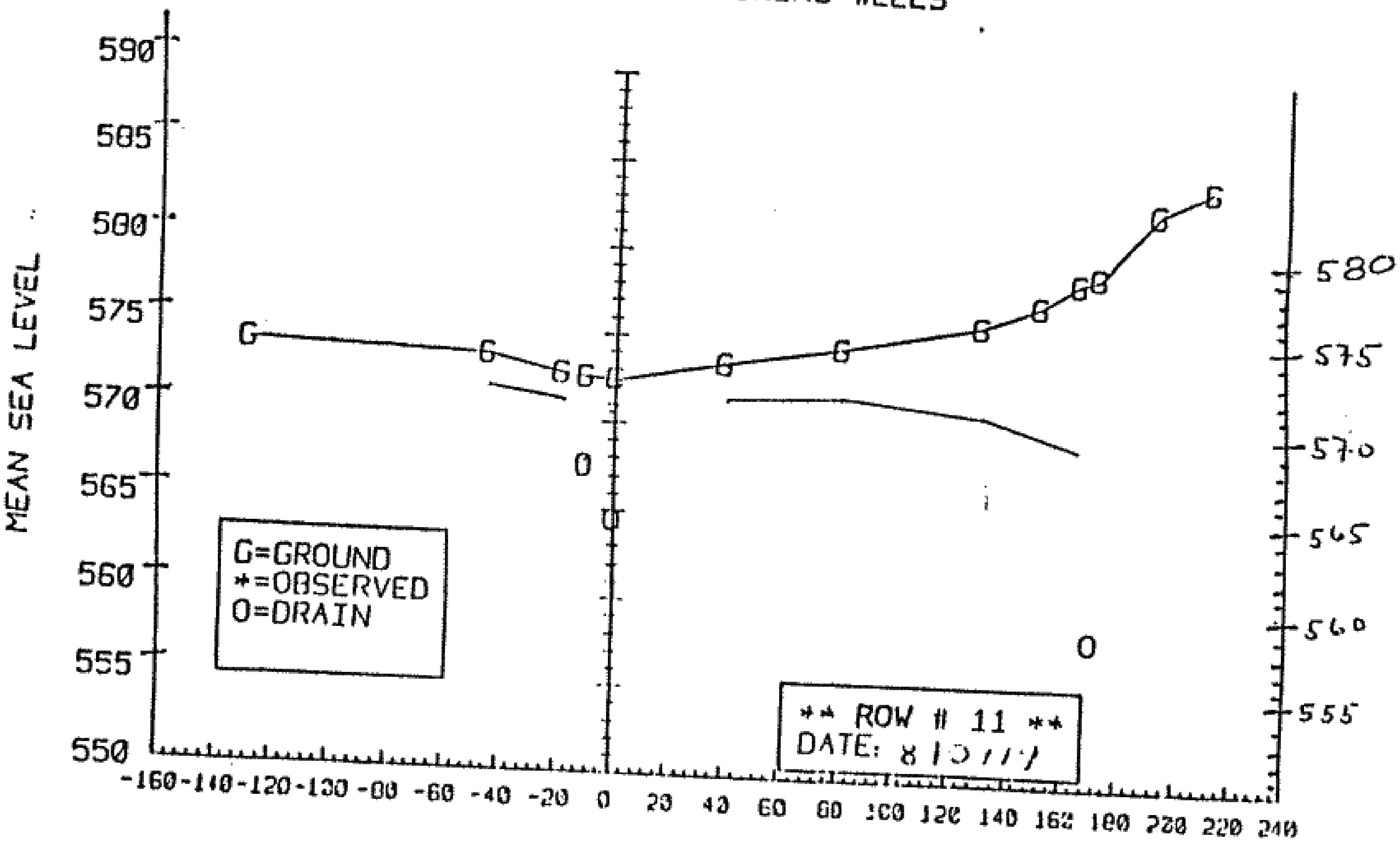
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



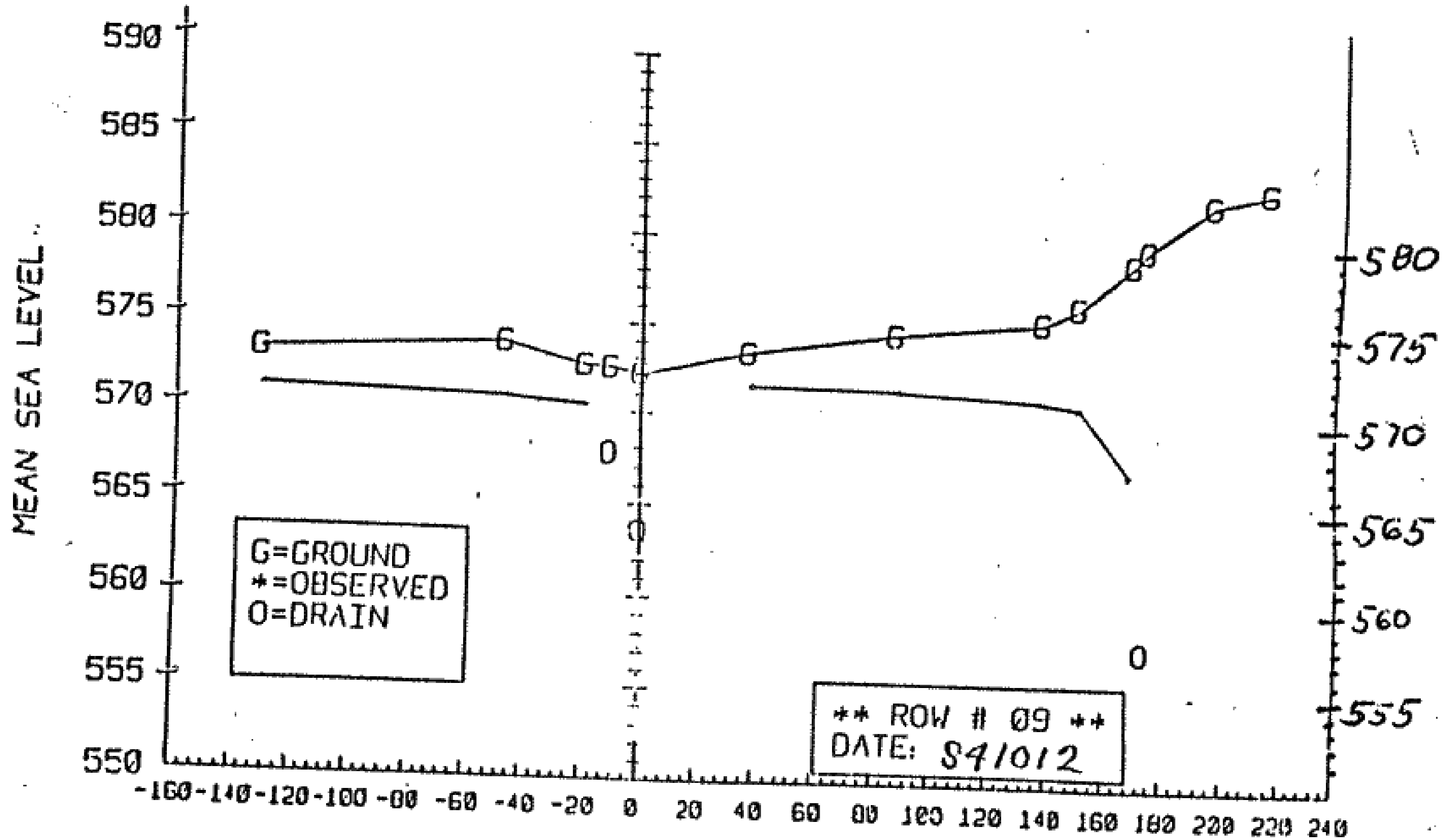
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



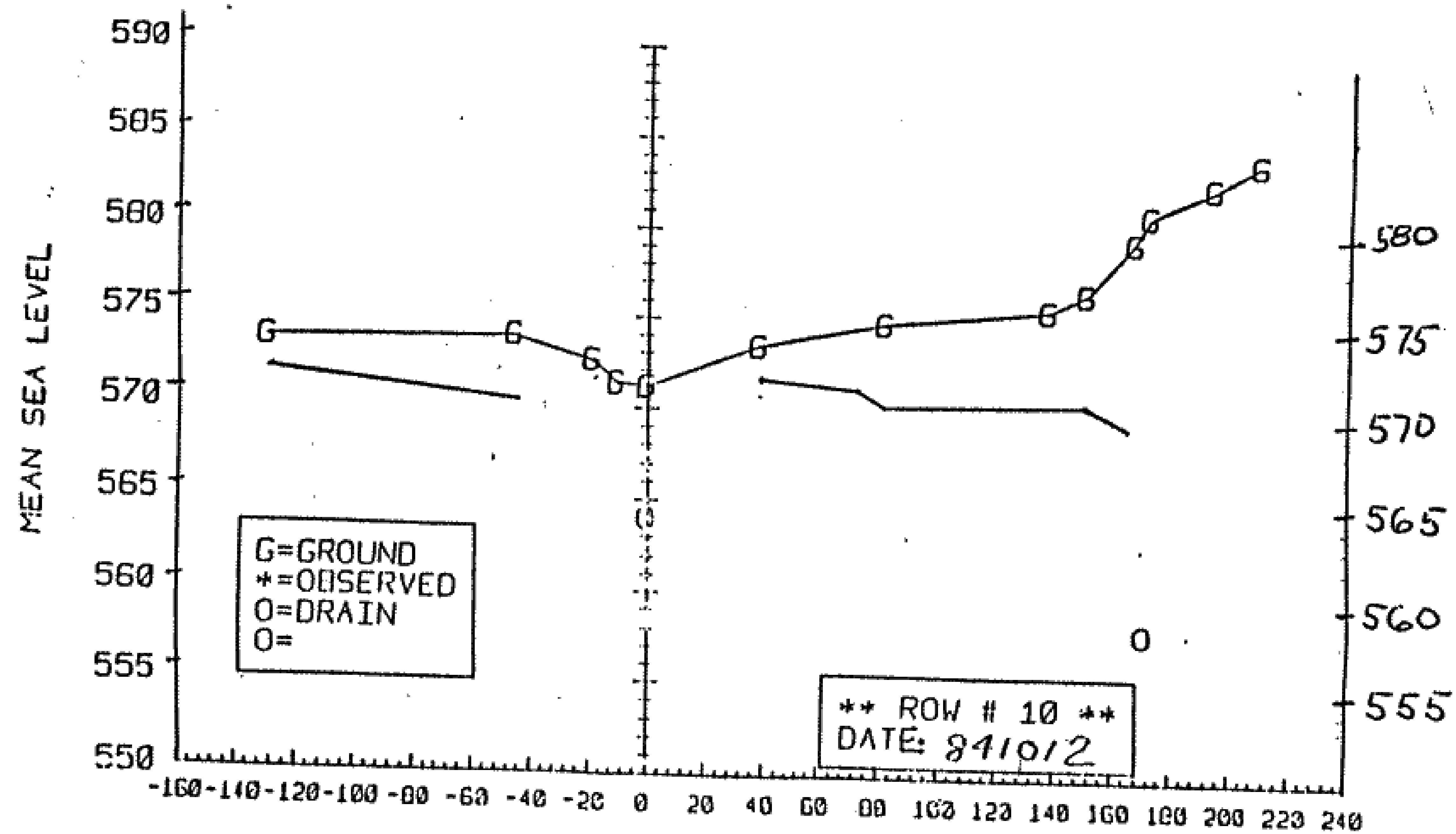
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



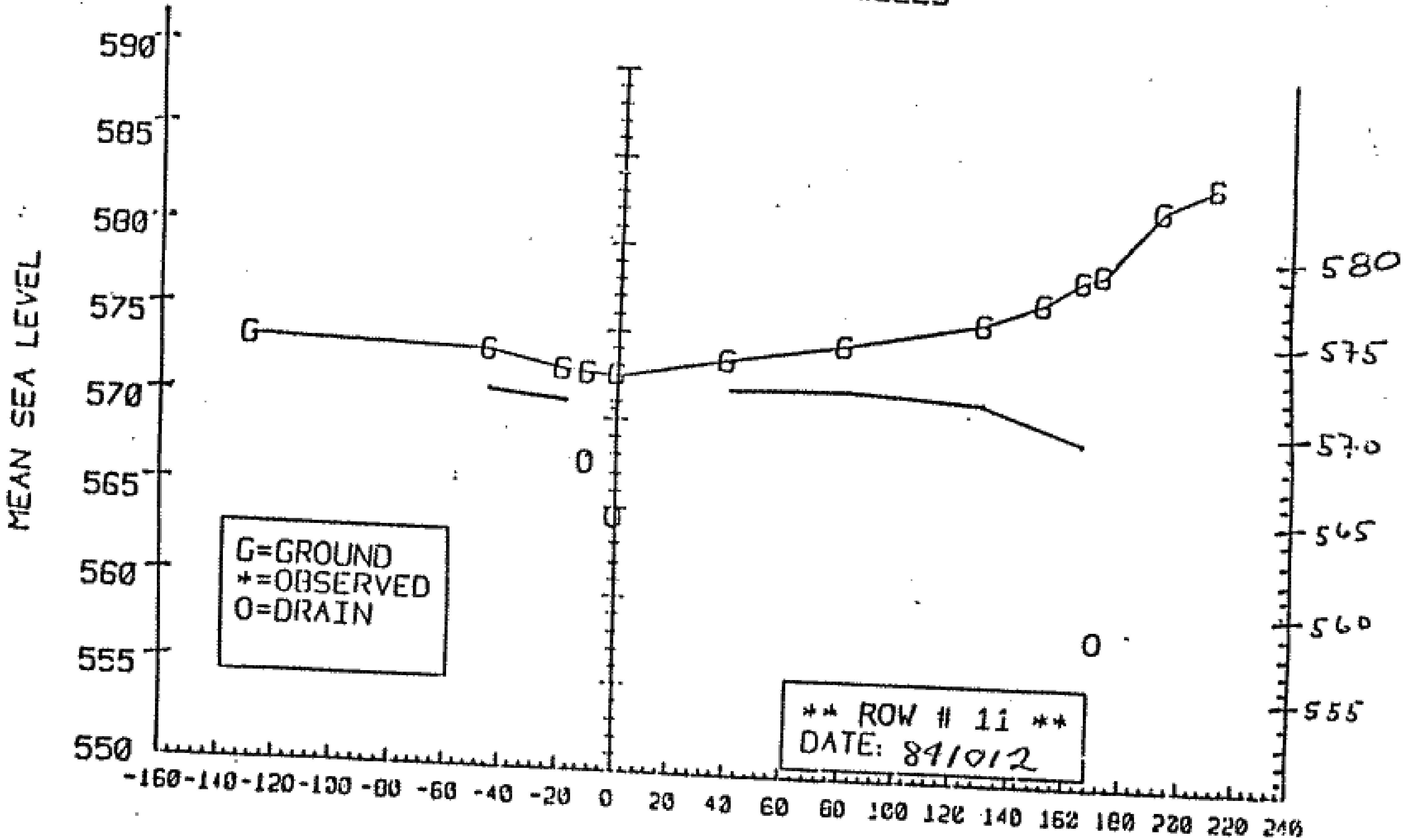
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID WASTE

SPECIAL PROJECTS UNIT
LOVE CANAL MONITORING WELLS



ATTACHMENT I

STATE OF NEW YORK
DEPARTMENT OF HEALTH OFFICE OF PUBLIC HEALTH

CORNING TOWER • THE GOVERNOR NELSON A. ROCKEFELLER EMPIRE STATE PLAZA • ALBANY, N.Y. 12237

DAVID AXELROD, M.D.
Commissioner

LINDA A. RANDOLPH, M.D., M.P.H.
Director

WILLIAM F. LEAVY
Executive Deputy Director

February 22, 1984

Norman H. Nosenchuck, P.E.
Director
Division of Solid and Hazardous Waste
Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Dear Mr. Nosenchuck:

Re: Malcolm Pirnie Report: "Site Investigation and Remedial Action Alternatives - Love Canal

You asked if the subject report provides sufficient information for us to make an assessment of public health risk; whether we will make such an assessment that may be useful in determining the appropriateness of the remedial programs proposed for streams and sewers in the area; and how much time we would need to do the job.

The assessment of potential public health risk was made by the US Department of Health and Human Services when they declared the EDA to be habitable subject to clean up of contaminated sewers and their drainage tracts (see attached). The Malcolm Pirnie investigation was directed at locating the contaminated areas of the sewers and their drainage tracts - the areas where cleaning was needed and these areas are identified in their report.

The Health and Human Services report did not make a "numerical risk-assessment" to estimate the increased morbidity and mortality that would result if the sewers and creeks were not cleaned. However, the report is direct and unambiguous in making the clean-up of the sewers and creeks a condition of habitation. It is clear that the presence of Love Canal associated chemicals, especially dioxin, in the sewers and creeks does pose a direct threat to children playing in the creeks, persons using yards subject to flooding from the creeks, and persons exposed to biota downstream subject to exposure to chemicals being washed down to them.

Sincerely,

Robert H. Huffaker

Robert H. Huffaker, DVM, MPH
Associate Director
Office of Public Health

Attachment

Attachment II

City of Niagara Falls
Department of Utilities

WASTEWATER DISCHARGE PERMIT

Permit No. 16

In accordance with all terms and conditions of Chapter 250 of the City of Niagara Falls Municipal Code; Sewer Use Ordinanc as adopted by City Council on July 25, 1983; et seq. and also with all applicable provisions of Federal and State law or regulation;

Permission is Hereby Granted To: LOVE CANAL TREATMENT SYST NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVAT

located at: 97th Street

classified by SIC No(s): ______

for the contribution of wastewater into the City of Niagara Fal Publicly-Owned Treatment Works (POTW).

Effective this 1ST day of MARCH, 19
To expire this 28TH day of FEBRUARY, 19

Robert E. [signature]

Director of Utilities

WASTEWATER DISCHARGE PERMIT REQUIREMENTS FOR:	ACTION REQUIRED	REQUIRED DATE OF SUBMISSION
A. Discharges to the City Sewer System		
1. Identification of all discharges to the City Sewer System on a current plant sewer map certified by a New York State licensed professional engineer.	None	Previously Submitted
2. Identification of each contributing waste stream to each discharge to the City Sewer System clearly marked on, or referenced to, a current plant sewer map certified by a New York State licensed professional engineer.	None	Previously Submitted
3. Elimination of all uncontaminated discharges to the City Sewer System.	NA	
All uncontaminated flows should be clearly identified on a current sewer map certified by a New York State licensed professional engineer.	None	Previously Submitted
4. Identification of control manhole or monitoring location for each uncontaminated discharge diverted to storm or Diversion sewer.	NA	
5. Consolidation of all contaminated discharges through no more than two monitoring stations. Each additional monitoring station requires approval by the Director and will be surcharged accordingly.	Not Required	
6. Establishment of a control manhole that is continuously and immediately accessible for each discharge to the City Sewer System.	Now available	
7. Identification of, and reduction or elimination of, on-site excessive infiltration/inflow, certified by a New York State licensed professional engineer.		

B. Wastewater Discharge Management Practices	ACTION REQUIRED	REQUIRED D OF SUBMISS
1. ~~Detailed compliance schedule for attainment of wastewater discharge permit limits.~~		
2. Schedule for optimization of existing pretreatment facilities.	Not Required	
3. Submission of plan for equalization, scheduling or improved process control of semi-continuous, batch or slug discharges.	Not Required	
4. Identification of responsible person(s) (day-to-day and in emergencies).	List up-date	3-31-85
5. Submission of inspection, maintenance and testing schedules and outline of attendant recordkeeping requirements for all pretreatment and monitoring facilities. Identification of a contact person responsible for maintaining in-plant inspection, maintenance and testing records for all process and pretreatment facilities.	None	Previous Submitte
6. Submission of an outline of housekeeping, construction and demolition procedures including truck, and equipment washing and washwater collection, pretreatment, and discharge to City sewer(s).	None	Previousl Submitte

	ACTION REQUIRED	REQUIRED [illegible]AT OF SUBMIS[illegible]IC
C. <u>Spill Prevention Control And Countermeasures**</u>		
1. A facility which has experienced one or more spill events within twelve months prior to the effective date of this Permit should submit a written description of each spill, corrective action taken and plans for preventing recurrences.	Report Submittal	3-31-85
2. Where a reasonable potential for equipment failure exists (such as tank overflow, rupture, or leakage), a statement identifying the equipment and contents, including a prediction of the direction and rate of flow, and total quantity which could be discharged from the facility as a result of each major type of failure will be submitted.		
3. Installation of appropriate containment and/or diversionary structures or equipment to prevent a spill from reaching the City sewer system.		
4. When it is determined that the installation of the aforementioned structures or equipment to prevent spills from reaching the City sewer system is not practicable then the SIU should clearly demonstrate such impracticability.	None (items 2–5)	Satisf[illegible] Subm[illegible] Receive[illegible] (items 2–5)
5. Each SIU shall provide a spill contingency plan including a definition of the authorities, responsibilities and duties of all persons which could be involved in an accidental discharge; establishment of notification procedures for the purposes of early detection and timely notification of City Wastewater Treatment Plant personnel; a current list of names, telephone numbers and addresses of the responsible persons and alternates on call; an estimate of the equipment, materials and supplies which would be required to remove the discharge; and provisions for well-defined and specific actions to be taken after discovery of an accidental discharge.		

	ACTION REQUIRED	REQUIRED OF SUBMI
6. A written committment for a responsible party of manpower, equipment and materials required to expeditiously control and remove any harmful quantity discharged.	Statement Submitted	3-31-8

** This section applies to all compounds limited by the City's SPD Permit and all prohibited wastewater discharges (See Section 250.5.1-A of Sewer Use Ordinance).

D. Supplementary Agreements:

1. Discharges shall not exceed 100,000 ge per day.
2. See attachment

2. Supplemental Agreement

RIGHTS OF ENTRY AND AUTHORITY OF INDUSTRIAL MONITORING INSPECTORS

The City's Right of Entry is established by the Sewer Use Ordinance. However, the City agrees that its employees will:

1. Present valid identification cards on request.
2. Sign in as required.
3. Abide by SIU's general safety rules including wearing hard hats, safety shoes and safety glasses with side shields.
4. Be accompanied by escort provided by SIU.
5. Abide by SIU's rules regarding photography on the premises.
6. Notify in advance.

Billing Agreements

For billing purposes Flow will be determined by dividing the total of integrator readings each month by the number of days in the month. Suspended Solids and Soluble Organic Carbon will be exempt from charge.

Revised May 7, 1985 RGA

Permit No. 16 for Love Canal Treatment System/NYSDEC

Discharge Point: Treatment System Effluent

Located at: 97th St

MONITORING REQUIREMENTS

Parameter	Monitoring Requirements
Flow	1
Total Suspended Solids	1
Soluble Organic Carbon	1
Volatile Priority Pollutants	2
Acid Priority Pollutants	2
Base/Neutral Priority Pollutants	2
Total Phenols	2
Monochlorotoluenes	2
Monochlorobenzotrifluoride	2

General Monitoring Requirements:

1. Determination of quantities shall be based upon analyses of the effluent during each discharge. Volume of each discharge must be reported.
2. Grab samples of effluent for each sample type, all from a single discharge, once per quarter.

Permit No. 16 for LOVE CANAL TREATMENT SYSTEM / NYS

Permit Limits for sum of discharges from: Treatment System Effluent

Wastewater Discharge Limits:

Parameter	Quarterly Average Load (lbs/day)	Maximum Daily Load (lbs/day)	Maximum Conc. (
Flow (MGD)		0.075	
Total Suspended Solids	6.25	16	170
Soluble Organic Carbon	50	75	820

General Wastewater Discharge Permit Conditions

1. Flow monitoring should be performed concurrently with any Wastewater Discharge Permit sampling and should be reported at the same time as analytical results. If it is not feasible to perform flow monitoring, an estimate of flow (and the means by which it was established) should be submitted with the analytical results.

2. All sampling for billing and pretreatment compliance purposes shall be coordinated through the Chief of Monitoring and Enforcement.

3. All analyses must be performed by a laboratory using analytical methods and quality control provisions approved by the City Chief Chemist prior to the sampling. The laboratory must obtain those detection limits specified on the User's Initial Wastewater Discharge Permit unless otherwise authorized by the City Chief Chemist prior to the sampling.

4. An estimate of relative production levels for wastewater contributing processes at the time of any pretreatment compliance sampling shall be submitted upon request of the Director of Utilities.

5. All samples shall be handled in accordance with EPA-approved methods. Chain of custody records shall be submitted with all sampling results.

6. Any discharge in excess of the loads or concentrations specified in this permit, may be considered a non-compliance event and subject to penalty or fines as outlined in Section 250.9 of the City's Sewer Use Ordinance.

7. Sampling frequency for any permitted compounds may be increased; but a minimum of five per quarter for flow, total suspended solids (TSS) and soluble organic carbon (SOC), and once per quarter for substances of concern is required. If the permitee monitors more frequently than required under this permit, all results of this monitoring must be reported.

Attachment III

Division of Solid and Hazardous Waste
New York State Department of Environmental Conservation
Albany, New York 12233

LOVE CANAL MONITORING REPORT

APRIL 1, 1984 - OCTOBER 31, 1984

During this period, risers were put on 40 wells, outside the fence, to facilitate sampling and obtaining groundwater elevations in the winter. A map showing the location of these wells is in Figure 2. All of these wells were sampled to determine the extent of contamination from Love Canal. A summary of the results is enclosed in Table 2 along with the United States Environmental Protection Agency's (USEPA) results from the same wells, four (4) years ago.

Nine (9) wells were sampled on March 28, 1984 and four wells were sampled on April 6, 1984. A summary of these results are enclosed in Table 2.

An Interim Groundwater Monitoring Program was established in August as a guideline for sampling and groundwater (elevation) monitoring until E.C. Jordan submits its recommendations for a long-term groundwater monitoring program. A copy of the interim program is in Attachment A.

The groundwater elevations on the 40 wells (with risers) outside the fence and all the wells inside the fence have been monitored on a monthly basis since August. This ongoing monitoring is to determine the effect of the barrier drain on the local water table.

As a part of the Interim Groundwater Monitoring Program, 24 wells inside the fence were sampled on September 17 and 18, 1984. These samples were sent to the New York State Department of Health (NYSDOH).

On August 8, 1984, some of the wells inside the fence were resurveyed by Mr. Robert Senior and Mr. Stephen Barlow. Several of the wells showed elevations differing from the previous survey by approximately one (1) foot. This would explain the anomalies that show up in in cross-sectional views for elevation of both the New York State Department of Environmental Conservation (NYSDEC) wells and the piezometers. The Attorney General's Office was surveying the wells outside the fence at this time and finished surveying the wells inside the fence. At this time, the Attorney General's survey data is not available.

Groundwater Monitoring USEPA Monitoring Wells

Overburden Wells - The monitoring data is presented in Table 1. Plots of this data are presented in Attachment C. Figures 1 and 2 are maps depicting the locations of the monitoring wells, on-site and off-site (with risers). When appraising the data from the wells, it should be kept in mind that they were screened over a large interval. Had they been screened at specific intervals, covering individual soil layers, they would give a truer picture of the flow patterns in the area.

The plots from this data, when they do show a distinctive flow pattern, show a flow away from the cap. Looking at the cross-section map of the NYSDEC piezometers, it looks like ths trend starts from 97th out on the west side of the cap and probably does the same from the 99th out on the east side of cap.

Bedrock Wells - The monitoring data is presented in Table 1. The plots are in Attachment D. The bedrock aquifer system shows only a small gradient over the area. The flow pattern is from west to east.

NYSDEC Monitoring Wells - The values obtained from the groundwater monitoring are in Table I. Plots of the data are in Attachment F. Figure 1 shows the locations of these wells. The plots show a consistent drawing down of the water surface in the vicinity of the barrier drain. The effect west of 97th Street fluctuaties from a flow towards the cap to a flow away from the cap.

Piezometers - The nested piezometers were constructed to monitor different substrata for water quality and water elevations. The data taken during this time period and plots of the data presented in Table 1 are displayed in Attachment B. From the plots, three observations can be made. First, the plots show that there is a lower head potential (water elevation) for those wells which are screened for lower horizons. Secondy, the amount of water elevation depression is greatest near the barrier drain. Third, the nested wells furtherest from the canal exhibit heads at approximately the same elevation except for the B Level wells. These wells, constructed in the nondesiccated silty clay soil layer, show a draw down west on 97th Street. This could be from a local sewer line. The drawing down of the water table near the barrier drain is in agreement with the data gathered from the NYSDEC wells.

Because the barrier drain is working and dewatering the aquifer, the effects upon the groundwater regimes are greatest in the vicinity of the drain, and least further away.

Water Quality Sampling - At the time of this writing, analytical results from the 40 wells outside the fence, the nine (9) wells sampled March 28 and four (4) wells sampled April 6 have been received.

Included in Table 2 are copies of results from the same 40 wells outside the fence, the 13 wells inside the fence, and from analyses performed for the USEPA. A table of comparison of these results is included with Table 3.

This table lists only compounds that have shown up at or above detection limit and list only the wells that have results from both NYSDEC and USEPA.

This table of comparison is broken into three (3) groups of chemicals.

I. Pesticides

II. Metals

III. Volatiles, Base/Neutrals and Acid Extractables.

Group I show fluctuations of decreasing in some wells and increasing in others. It is difficult to say if they are attributed to the Love Canal Site since pesticides are so widely used.

Group II shows an increase in most cases. Again with the metals, it is hard to attribute to Love Canal some of the metals may be attributed to degredation of the well casing.

The third group which is most directly attributable to Love Canal shows concentrations either decreasing or remaining the same in all cases except one. That was the presence of Methylene Chloride at 42 ug/l in Well Number 5211.

The map included in Table 3 shows wells with any organic pollutants detected from USEPA with red circles around them. The wells in blue are those that show any organic pollutants now. The only wells shown on this map are the 40 with risers outside the fence.

TABLE 1

LOVE CANAL MONITORING DATA
GROUNDWATER ELEVATIONS
APRIL 1, 1984 - OCTOBER 31, 1984

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

	SAMPLING DATE									
	840612	840613	840614	840801	840829	840830	840831	840919	841011	841012
WELLNUMBER	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)
1091	.0	.0	.0	568.28	.0	566.65	.0	565.92	.0	566.64
1092	.0	.0	.0	570.47	.0	570.63	.0	570.48	.0	570.58
1093	.0	.0	.0	.0	.0	571.84	.0	570.80	.0	571.02
1094	.0	.0	.0	570.61	.0	571.24	.0	571.16	.0	571.36
1095	.0	.0	.0	571.43	.0	571.25	.0	571.21	.0	571.54
1097	.0	.0	.0	570.41	.0	572.84	.0	571.13	.0	570.05
1098	.0	.0	.0	570.61	.0	570.67	.0	570.54	.0	570.54
1099	.0	.0	.0	569.62	.0	569.66	.0	572.09	.0	570.76
1101	.0	.0	.0	568.93	.0	569.00	.0	568.92	.0	568.95
1101A	.0	.0	.0	567.67	.0	568.33	.0	568.14	.0	568.71
1102	.0	.0	.0	569.88	.0	570.26	.0	570.10	.0	570.32
1102A	.0	.0	.0	568.56	.0	573.43	.0	569.20	.0	569.51
1103	.0	.0	.0	569.30	.0	569.72	.0	569.36	.0	569.95
1103A	.0	.0	.0	574.33	.0	570.86	.0	570.70	.0	570.99
1104	.0	.0	.0	571.19	.0	571.25	.0	571.43	.0	571.85
1104A	.0	.0	.0	572.03	.0	572.14	.0	572.10	.0	572.70
1105	.0	.0	.0	570.89	.0	570.70	.0	571.20	.0	571.54
1105A	.0	.0	.0	573.09	.0	571.53	.0	572.02	.0	572.64
1107	.0	.0	.0	571.09	.0	572.96	.0	568.12	.0	569.89
1107A	.0	.0	.0	570.45	.0	571.05	.0	571.24	.0	570.75
1108	.0	.0	.0	570.16	.0	570.66	.0	571.00	.0	571.52
1108A	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1109	.0	.0	.0	568.70	.0	568.25	.0	571.44	.0	568.91
1109A	.0	.0	.0	570.53	.0	570.13	.0	570.93	.0	570.78
1111	.0	.0	.0	569.02	.0	569.39	.0	569.23	.0	569.29
1112	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1113	.0	.0	.0	570.73	.0	574.67	.0	570.94	.0	571.28
1114	.0	.0	.0	571.41	.0	571.61	.0	571.62	.0	572.12
1115	.0	.0	.0	571.23	.0	570.81	.0	571.47	.0	572.08
1117	.0	.0	.0	571.08	.0	571.75	.0	570.71	.0	570.45
1118	.0	.0	.0	570.62	.0	570.46	.0	571.72	.0	571.09
1119	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1160A	.0	.0	.0	565.53	.0	565.52	.0	565.53	.0	570.55
1160C	.0	.0	.0	572.36	.0	565.76	.0	570.83	.0	567.85
1161A	.0	.0	.0	566.44	.0	566.46	.0	565.45	.0	567.17
1161B	.0	.0	.0	568.59	.0	568.82	.0	563.89	.0	570.50
1161C	.0	.0	.0	570.63	.0	570.90	.0	573.38	.0	571.45
1161D	.0	.0	.0	573.66	.0	572.71	.0	571.08	.0	571.23
1162A	.0	.0	.0	569.13	.0	568.65	.0	563.52	.0	570.59

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

SAMPLING DATE

	840612	840613	840614	840801	840829	840830	840831	840919	841011	841012
WELLNUMBER	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)
1091	.0	.0	.0	568.28	.0	566.65	.0	565.92	.0	568.64
1092	.0	.0	.0	570.47	.0	570.63	.0	570.48	.0	570.55
1093	.0	.0	.0	.0	.0	571.84	.0	570.80	.0	571.02
1094	.0	.0	.0	570.61	.0	571.24	.0	571.16	.0	571.39
1095	.0	.0	.0	571.43	.0	571.25	.0	571.21	.0	571.54
1097	.0	.0	.0	570.41	.0	572.84	.0	571.13	.0	570.05
1098	.0	.0	.0	570.61	.0	570.67	.0	570.54	.0	570.54
1099	.0	.0	.0	569.62	.0	569.66	.0	572.09	.0	570.76
1101	.0	.0	.0	568.93	.0	569.00	.0	568.92	.0	568.95
1101A	.0	.0	.0	567.67	.0	568.33	.0	568.14	.0	568.71
1102	.0	.0	.0	569.88	.0	570.26	.0	570.10	.0	570.32
1102A	.0	.0	.0	568.56	.0	569.43	.0	569.20	.0	569.51
1103	.0	.0	.0	569.30	.0	569.72	.0	569.35	.0	569.95
1103A	.0	.0	.0	574.33	.0	570.86	.0	570.70	.0	570.99
1104	.0	.0	.0	571.19	.0	571.25	.0	571.43	.0	571.85
1104A	.0	.0	.0	572.03	.0	572.14	.0	572.10	.0	572.70
1105	.0	.0	.0	570.89	.0	570.70	.0	571.20	.0	571.54
1105A	.0	.0	.0	573.09	.0	571.53	.0	572.02	.0	572.64
1107	.0	.0	.0	571.09	.0	572.96	.0	568.12	.0	569.89
1107A	.0	.0	.0	570.45	.0	571.05	.0	571.24	.0	570.75
1108	.0	.0	.0	570.16	.0	570.66	.0	571.00	.0	571.52
1108A	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1109	.0	.0	.0	568.70	.0	568.25	.0	571.44	.0	568.91
1109A	.0	.0	.0	570.53	.0	570.18	.0	570.93	.0	570.78
1111	.0	.0	.0	569.02	.0	569.39	.0	569.23	.0	569.29
1112	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1113	.0	.0	.0	570.73	.0	574.67	.0	570.94	.0	571.28
1114	.0	.0	.0	571.41	.0	571.61	.0	571.62	.0	572.12
1115	.0	.0	.0	571.23	.0	570.81	.0	571.47	.0	572.08
1117	.0	.0	.0	571.03	.0	571.75	.0	570.71	.0	570.45
1118	.0	.0	.0	570.62	.0	570.46	.0	571.72	.0	571.09
1119	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1160A	.0	.0	.0	565.53	.0	565.52	.0	565.53	.0	570.55
1160C	.0	.0	.0	572.36	.0	569.76	.0	570.83	.0	567.85
1161A	.0	.0	.0	566.44	.0	566.46	.0	565.45	.0	567.17
1161B	.0	.0	.0	568.59	.0	568.82	.0	563.89	.0	570.50
1161C	.0	.0	.0	570.63	.0	570.90	.0	575.38	.0	571.45
1161D	.0	.0	.0	573.66	.0	572.71	.0	571.08	.0	571.23
1162A	.0	.0	.0	559.13	.0	563.65	.0	563.52	.0	570.59

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

	SAMPLING DATE									
	840612	840613	840614	840801	840829	840830	840831	840919	841011	841012
WELLNUMBER	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)
1162C	.0	.0	.0	571.96	.0	571.71	.0	571.77	.0	568.28
1162D	.0	.0	.0	572.15	.0	571.96	.0	572.20	.0	572.01
1163A	.0	.0	.0	573.66	.0	573.60	.0	573.15	.0	572.46 572.98
1163B	.0	.0	.0	571.18	.0	571.39	.0	571.64	.0	572.95 573.02
1163C	.0	.0	.0	571.95	.0	572.11	.0	572.22	.0	573.47 572.74
1163D	.0	.0	.0	572.26	.0	572.27	.0	572.21	.0	572.94 572.46
1165A	.0	.0	.0	572.11	.0	571.10	.0	572.25	.0	573.51
1165B	.0	.0	.0	572.71	.0	572.44	.0	572.65	.0	573.23
1165C	.0	.0	.0	572.49	.0	572.11	.0	572.08	.0	572.11
1165D	.0	.0	.0	572.57	.0	571.93	.0	572.38	.0	571.55
1167A	.0	.0	.0	570.32	.0	571.76	.0	571.77	.0	571.63
1167B	.0	.0	.0	569.57	.0	569.13	.0	569.21	.0	569.35
1167C	.0	.0	.0	572.82	.0	571.50	.0	571.94	.0	570.96
1167D	.0	.0	.0	571.23	.0	571.54	.0	572.03	.0	570.74
3101	.0	.0	.0	573.09	.0	573.01	.0	572.99	573.50	.0
3103	.0	.0	.0	570.76	.0	570.79	.0	570.56	570.38	.0
3105	.0	.0	.0	.0	.0	563.60	.0	568.47	569.55	.0
3111	.0	569.16	.0	568.05	566.58	.0	.0	566.61	555.99	.0
3112	.0	570.37	.0	569.43	569.60	.0	.0	569.49	569.44	.0
3113	.0	570.63	.0	567.90	569.19	.0	.0	569.36	569.24	.0
3121	.0	567.23	.0	.0	.0	.0	.0	.0	.0	.0
3122	.0	566.94	.0	565.64	.0	.0	564.05	564.27	563.61	.0
3123	.0	571.49	.0	570.94	.0	.0	566.68	570.50	570.41	.0
3131	.0	566.23	.0	.0	.0	.0	.0	.0	.0	.0
3132	.0	567.69	.0	.0	.0	.0	.0	.0	.0	.0
3133	.0	567.68	.0	566.66	.0	.0	562.21	565.59	565.19	.0
3142	.0	.0	566.41	.0	.0	.0	.0	.0	.0	.0
3143	.0	.0	568.05	.0	.0	.0	.0	.0	.0	.0
3145	.0	.0	571.40	.0	.0	.0	.0	.0	.0	.0
3151	.0	.0	567.59	.0	.0	.0	570.40	570.96	570.47	.0
3153	.0	.0	569.47	.0	.0	.0	.0	.0	.0	.0
3161	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3162	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3163	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3166	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3201	.0	.0	.0	564.26	.0	563.93	.0	562.83	562.08	.0
3203	.0	.0	.0	564.75	.0	563.74	.0	563.89	563.18	.0
3205	.0	.0	.0	564.79	.0	563.50	.0	563.73	562.93	.0
3211	.0	566.21	.0	.0	.0	.0	.0	.0	.0	.0

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

SAMPLING DATE

WELLNUMBER	840612 ELEV (FEET)	840613 ELEV (FEET)	840614 ELEV (FEET)	840801 ELEV (FEET)	840829 ELEV (FEET)	840830 ELEV (FEET)	840831 ELEV (FEET)	840919 ELEV (FEET)	841011 ELEV (FEET)	841012 ELEV (FEET)
3212	.0	567.13	.0	.0	.0	.0	.0	.0	.0	.0
3213	.0	565.49	.0	554.96	563.59	.0	.0	563.81	562.81	.0
3222	.0	566.13	.0	’565.09	.0	.0	563.99	564.20	563.39	.0
3229	.0	566.16	.0	564.90	.0	.0	563.75	564.01	563.28	.0
3231	.0	565.75	.0	.0	.0	.0	.0	.0	.0	.0
3232	.0	566.15	.0	.0	.0	.0	.0	.0	.0	.0
3235	.0	566.00	.0	564.96	.0	.0	564.17	564.30	563.57	.0
3241	.0	.0	567.46	.0	.0	.0	.0	.0	.0	.0
3245	.0	.0	566.09	.0	.0	.0	.0	.0	.0	.0
3251	.0	.0	563.01	.0	.0	.0	563.85	564.06	563.33	.0
3252	.0	.0	6.40	.0	.0	.0	.0	.0	.0	.0
3253	.0	.0	566.60	.0	.0	.0	.0	.0	.0	.0
3261	.0	.0	566.54	.0	.0	.0	.0	.0	.0	.0
3262	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3263	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3264	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3265	.0	.0	566.19	.0	.0	.0	.0	.0	.0	.0
4102	.0	.0	.0	569.68	.0	568.79	.0	570.40	569.59	.0
4103	.0	.0	.0	571.30	.0	571.23	.0	570.84	571.15	.0
410[illegible]	.0	.0	.0	570.54	.0	569.82	.0	572.42	571.46	.0
4105	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4107	.0	.0	.0	572.10	.0	571.18	.0	571.63	571.64	.0
4108	.0	.0	.0	569.28	.0	568.80	.0	566.03	569.76	.0
4111	.0	.0	.0	570.17	.0	570.25	.0	571.00	570.17	.0
4115	.0	.0	569.28	.0	.0	.0	.0	.0	.0	.0
4121	.0	.0	.0	569.04	.0	.0	569.34	571.43	571.45	.0
4132	571.14	.0	.0	.0	.0	.0	.0	.0	.0	.0
4133	571.20	.0	.0	.0	.0	.0	.0	.0	.0	.0
4134	.0	.0	.0	567.98	.0	.0	567.08	566.35	565.62	.0
4135	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4141	.0		.0	.0	.0	.0	.0	.0	.0	.0
4151	569.36	.0	.0	.0	.0	.0	.0	.0	.0	.0
4152	566.04	.0	.0	.0	.0	.0	.0	.0	.0	.0
4155	568.16	.0	.0	.0	.0	.0	.0	.0	.0	.0
4161	.0	.0	570.50	.0	.0	.0	.0	.0	.0	.0
4162	570.60	.0	.0	.0	.0	.0	.0	.0	.0	.0
4163	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4204	.0	.0	.0	564.85	.0	563.42	.0	563.60	562.85	.0
4205	.0	.0	.0	564.65	.0	563.33	.0	563.46	[illegible]	.0

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

SAMPLING DATE

	840612	840613	840614	840801	840829	840830	840831	840919	841011	841012
WELLNUMBER	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)
4205	.0	.0	.0	564.65	.0	563.36	.0	563.63	562.56	.0
4207	.0	.0	.0	563.68	.0	562.45	.0	562.62	561.81	.0
4211	.0	.0	.0	564.67	.0	563.50	.0	563.74	562.93	.0
4215	.0	.0	566.17	564.98	.0	.0	563.60	563.88	563.18	.0
4221	.0	.0	.0	564.71	.0	.0	563.20	564.85	562.53	.0
4231	568.15	.0	.0	.0	.0	.0	.0	.0	.0	.0
4232	566.53	.0	.0	.0	.0	.0	.0	.0	.0	.0
4233	566.59	.0	.0	.0	.0	.0	.0	.0	.0	.0
4235	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4241	568.75	564.28	.0	.0	.0	.0	.0	.0	.0	.0
4252	566.11	.0	.0	.0	.0	.0	.0	.0	.0	.0
4253	566.40	.0	.0	.0	.0	.0	.0	.0	.0	.0
4254	566.55	.0	.0	.0	.0	.0	.0	.0	.0	.0
4255	567.76	.0	.0	.0	.0	.0	.0	.0	.0	.0
4261	.0	.0	566.54	.0	.0	.0	.0	.0	.0	.0
4262	572.09	.0	.0	.0	.0	.0	.0	.0	.0	.0
4263	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5101	.0	.0	.0	568.99	.0	569.46	.0	569.41	.0	571.59
5102	.0	.0	.0	575.55	.0	569.96	.0	564.52	.0	566.10
5103	.0	.0	.0	572.59	.0	572.17	.0	572.03	.0	571.69
5104	.0	.0	.0	571.61	.0	571.94	.0	572.44	.0	573.20
5105	.0	.0	.0	569.85	.0	569.50	.0	571.33	.0	570.04
5111	.0	570.32	.0	569.28	568.56	.0	.0	568.39	567.97	.0
5112	.0	571.31	.0	568.79	.0	.0	567.12	568.37	568.11	.0
5113	.0	571.08	.0	.0	.0	.0	.0	.0	.0	.0
5114	.0	571.13	.0	569.43	.0	.0	562.82	569.41	569.19	.0
5121	.0	563.54	.0	564.30	.0	.0	.0	.0	.0	.0
5122	.0	570.17	.0	569.71	569.32	.0	.0	563.87	569.92	.0
5123	.0	569.95	.0	.0	564.24	.0	.0	567.70	567.17	.0
5124	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5201	.0	.0	.0	564.88	.0	563.35	.0	563.58	.0	562.75
5202	.0	.0	.0	565.00	.0	563.65	.0	563.77	.0	563.04
5204	.0	.0	.0	565.12	.0	563.95	.0	564.17	.0	563.30
5205	.0	.0	.0	565.13	.0	564.60	.0	567.58	.0	564.16
5211	.0	566.52	.0	564.99	563.64	.0	.0	563.70	562.44	.0
5212	.0	555.90	.0	565.74	.0	.0	554.11	562.40	563.22	.0
5213	.0	565.80	.0	565.03	564.60	.0	.0	564.78	564.08	.0
5214	.0	563.94	.0	565.12	.0	.0	564.62	564.75	564.12	.0
5221	.0	555.72	.0	561.34	.0	.0	.0	.0	.0	.0

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

	SAMPLING DATE									
	840612	840613	840614	840801	840829	840830	840831	840919	841011	841012
WELLNUMBER	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)
5222	.0	566.66	.0	565.20	563.83	.0	.0	563.59	562.86	.0
5223	.0	566.97	.0	.0	564.56	.0	.0	564.67	564.02	.0
5224	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5231	.0	.0	566.14	.0	.0	.0	.0	.0	.0	.0
5241	.0	.0	565.96	.0	.0	.0	.0	.0	.0	.0
6101	.0	.0	.0	571.63	.0	571.12	.0	570.96	571.42	.0
6102	.0	.0	.0	569.49	.0	563.80	.0	567.58	570.02	.0
6103	.0	.0	.0	570.78	.0	570.29	.0	570.53	570.19	.0
6109	.0	.0	.0	569.73	.0	569.13	.0	562.35	563.37	.0
6111	.0	.0	.0	567.97	.0	.0	567.63	568.24	557.98	.0
6112	.0	.0	.0	569.57	.0	.0	569.43	571.02	569.96	.0
6113	.0	.0	.0	.0	.0	.0	569.28	571.89	570.75	.0
6114	.0	.0	.0	.0	.0	.0	569.15	570.26	570.60	.0
6121	.0	.0	.0	564.34	.0	.0	.0	.0	.0	.0
6122	.0	.0	.0	.0	.0	.0	568.60	569.96	568.19	.0
6133	569.54	.0	.0	.0	.0	.0	.0	.0	.0	.0
6134		.0	.0	.0	.0	.0	.0	.0	.0	.0
6141	.0	569.12	.0	568.90	568.82	.0	.0	569.24	569.05	.0
6142	.0	.0	.0	564.85	.0	.0	.0	.0	.0	.0
6143	.0	564.88	.0	.0	.0	.0	.0	.0	.0	.0
6144	.0	571.59	.0	.0	.0	.0	.0	.0	.0	.0
6146	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6201	.0	.0	.0	564.41	.0	563.19	.0	563.42	562.52	.0
6203	.0	.0	.0	564.83	.0	563.45	.0	563.51	562.73	.0
6207	.0	.0	.0	564.83	.0	563.80	.0	563.83	563.77	.0
6209	.0	.0	.0	564.77	.0	564.05	.0	563.98	566.29	.0
6211	.0	.0	.0	564.79	.0	.0	563.11	563.31	562.47	.0
6212	.0	.0	.0	564.83	.0	.0	563.13	563.43	562.52	.0
6213	.0	.0	.0	.0	.0	.0	566.49	566.69	562.31	.0
6214	.0	.0	.0	.0	.0	.0	561.44	562.81	562.44	.0
6221	.0	.0	.0	561.47	.0	.0	.0	.0	.0	.0
6222	.0	.0	.0	.0	.0	.0	564.09	564.10	563.42	.0
6233	567.81	.0	.0	.0	.0	.0	.0	.0	.0	.0
6234	568.44	.0	.0	.0	.0	.0	.0	.0	.0	.0
6241	.0	566.19	.0	565.05	564.13	.0	.0	564.24	563.46	.0
6242	.0	.0	.0	560.88	.0	.0	.0	.0	.0	.0
6243	.0	565.90	.0	.0	.0	.0	.0	.0	.0	.0
6244	.0	565.93	.0	.0	.0	.0	.0	.0	.0	.0
6245	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

LOVE CANAL WATER LEVEL MONITORING DATA

SAMPLING DATE

	840612	840613	840614	840801	840829	840830	840831	840919	841011	841012
WELLNUMBER	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)	ELEV (FEET)
6246	567.10	.0	.0	.0	.0	.0	.0	.0	.0	.0

FIGURE 1

MONITORING WELLS (ON-SITE)
AT LOVE CANAL

FIGURE B.1

LOVE CANAL GROUNDWATER MONITORING PROGRAM

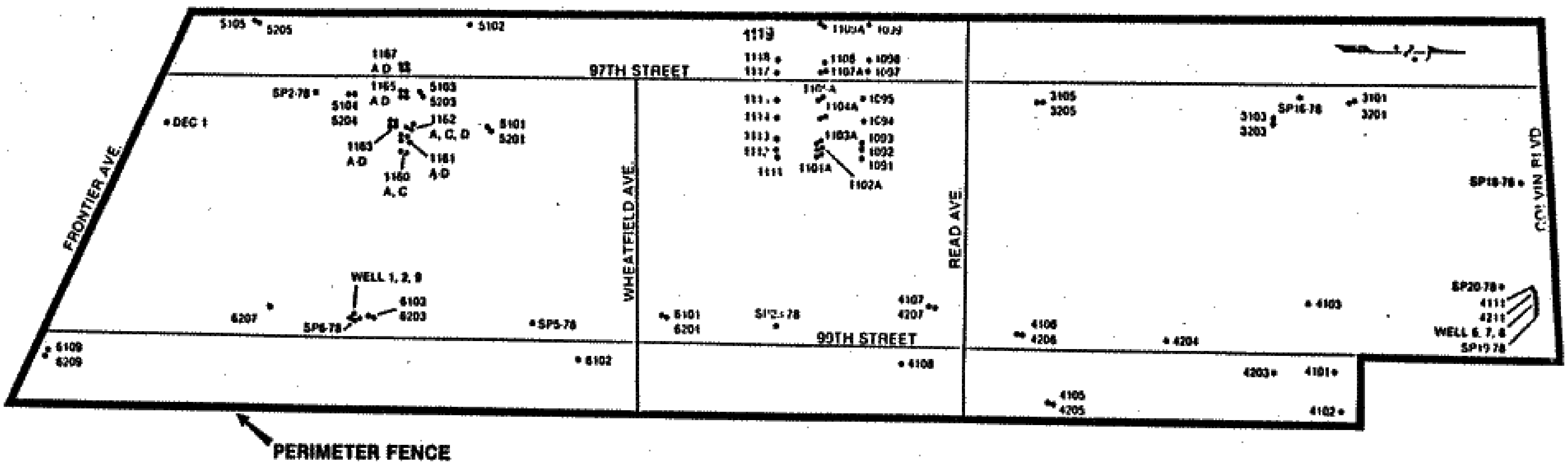
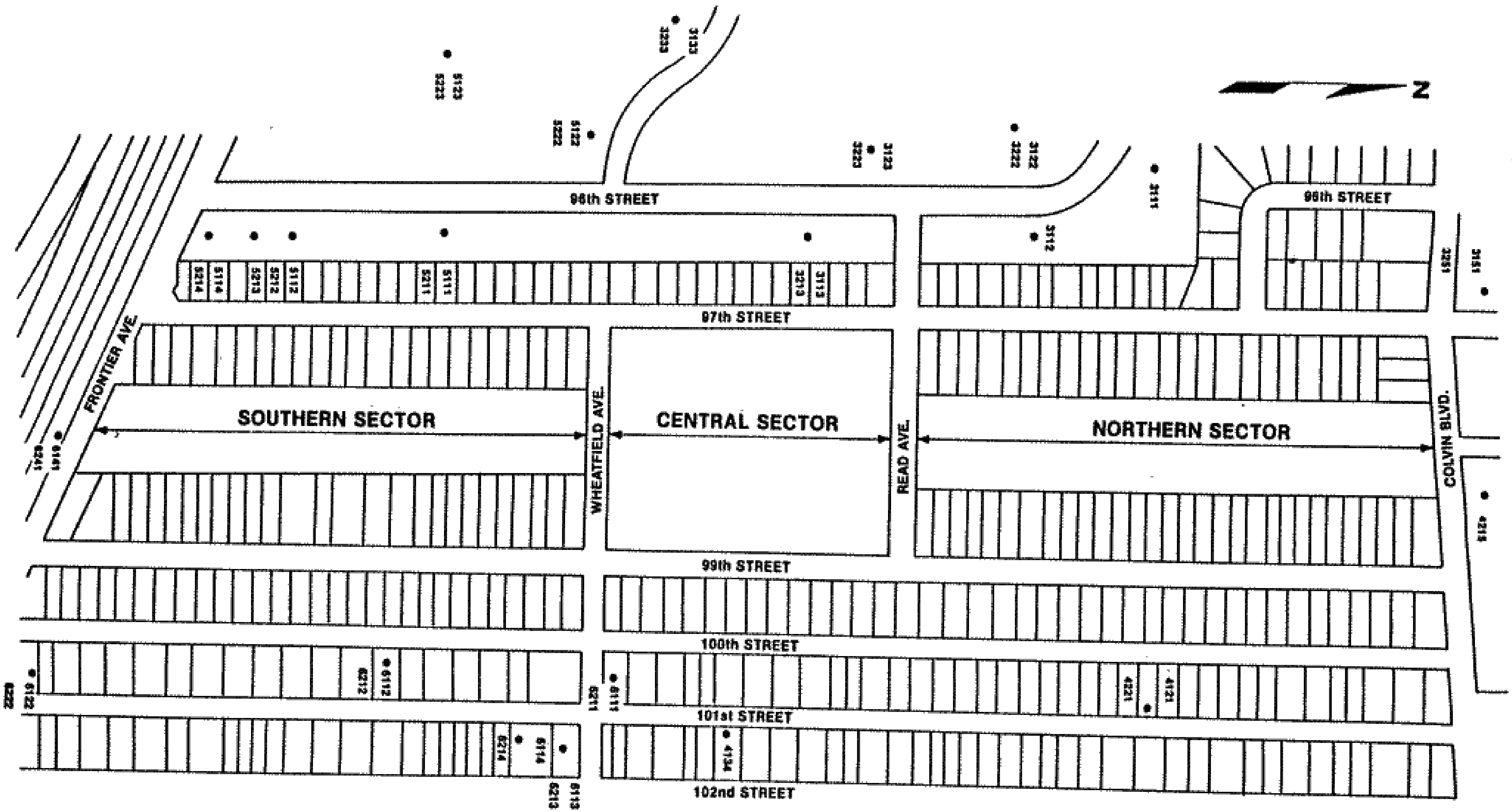


FIGURE 2

MONITORING WELLS OFF-SITE
(WITH RISERS) AT LOVE CANAL

LOVE CANAL GROUNDWATER MONITORING PROGRAM



WELLS WITH RISERS (OUTSIDE THE FENCE)

Table 2

Analytical Results of
Monitoring Wells at
Love Canal

sampled
July 11th, 1984

DATA SUMMARY

Versar INC.

Sample #: 3111
RR84 002 001

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4920

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	< 3.	As	10.	16.
Be	1.	1.5	Hg *	0.2	<0.2
Cd	10.	< 10.	Se	10.	<10.
Cr	4.	84.	Sb	10.	<10.
Cu	2.	190.	Tl	10.	<10.
Ni	15.	198.			
Pb	50.	212.			
Zn	3.	224.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC

Sample #: 3112
RR784 002 002

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4921

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	< 3.	As	10.	12.
Be	1.	1.7	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	78.	Sb	10.	<10.
Cu	2.	82.	Tl	10.	<10.
Ni	15.	124.			
Pb	50.	329.			
Zn	3.	279.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 3113
RR84 002 003

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4922

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	< 3.	As	10.	11.
Be	1.	1.4	Hg *	0.2	0.21
Cd	10.	11.	Se	10.	<10.
Cr	4.	52.	Sb	10.	<10.
Cu	2.	85.	Tl	10.	<10.
Ni	15.	126.			
Pb	50.	260.			
Zn	3.	310.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5613
RR84 002 004

METALS RESULTS

DATE: 8-21-84

PROJECT #: 857-42

LAB #: 4923

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	< 3.	As	10.	12.
Be	1.	1.8	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	9.9	Sb	10.	<10.
Cu	2.	26.	Tl	10.	<10.
Ni	15.	21.			
Pb	50.	239.			
Zn	3.	127.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5111
RR84 002 005

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4924

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	<3.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	6.4	Sb	10.	<10.
Cu	2.	26.	Tl	10.	<10.
Ni	15.	35.			
Pb	50.	107.			
Zn	3.	209.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5211
RR84 002 006

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4925

PARAMETER	ICP DETECTION LIMIT # (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	6.	<6.	As	10.	21.
Be	2.	2.6	Hg *	0.2	<0.2
Cd	20.	<20.	Se	10.	<10.
Cr	8.	22.	Sb	10	<10.
Cu	4.	52.	Tl	10.	<10.
Ni	30.	162.			
Pb	100.	472.			
Zn	6.	495.			

COMMENTS:

*Hg by CVAA

#Detection limit changed due to sample dilution.

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC

Sample #: 5113
RR84 002 007

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4926

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	<3.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	21.	Sb	10	<10.
Cu	2.	45.	Tl	10.	<10.
Ni	15.	68.			
Pb	50.	198.			
Zn	3.	198.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5213
RR 84 002 008

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4927

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	<3.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	9.5	Sb	10.	<10.
Cu	2.	32.	Tl	10.	<10.
Ni	15.	20.			
Pb	50.	568.			
Zn	3.	171.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5/5-1
RR84 002 009

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4928

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	< 3.	As	10.	<10.
Be	1.	< 1.	Hg *	0.2	<0.2
Cd	10.	< 10.	Se	10.	<10.
Cr	4.	22.	Sb	10.	<10.
Cu	2.	20.	Tl	10.	<10.
Ni	15.	66.			
Pb	50.	242.			
Zn	3.	121.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5221
RR84 002 010

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-12
LAB #: 4929

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	<3.	As	10.	<10.
Be	1.	1.4	Hg *	.02	0.21
Cd	10.	26.	Se	10.	<10.
Cr	4.	9.8	Sb	10.	<10.
Cu	2.	24.	Tl	10.	<10.
Ni	15.	17.			
Pb	50.	170.			
Zn	3.	112.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5122
RR84 002 011

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4930

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	<3.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	21.	Se	10.	<10.
Cr	4.	5.4	Sb	10.	<10.
Cu	2.	25.	[illegible]	10.	<10.
Ni	15.	35.			
Pb	50.	82.			
Zn	3.	33.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 5222
RR84 002 012

METALS RESULTS

DATE: 8-21-84
PROJECT #: 857-42
LAB #: 4931

PARAMETER	ICP DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)	PARAMETER	FURNACE DETECTION LIMIT (µg/l)	SAMPLE CONCENTRATION (µg/l)
Ag	3.	< 3.	As	10.	13.
Be	1.	1.3	Hg *	0.2	<0.2
Cd	10.	27.	Se	10.	<10.
Cr	4.	6.2	Sb	10.	<10.
Cu	2.	18.	Tl	10.	<10.
Ni	15.	32.			
Pb	50.	338.			
Zn	3.	136.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

857.002-42

BNA DATA SUMMARY

FIELD#		BNA COMPOUNDS DETECTED
RR-84-002-001	3111	ND
RR-84-002-002	3112	ND
RR-84-002-003	3113	ND
RR-84-002-004	3213	ND
RR-84-002-005	5111	ND
RR-84-002-006	5211	ND
RR-84-002-007	5113	ND
RR-84-002-008	5213	ND
RR-84-002-009	5121	ND
RR-84-002-010	5221	ND
RR-84-002-011	5122	ND
RR-84-002-012	5222	ND

ND= NONE DETECTED

857.002-42

VOA SUMMARY

FIELD#		VOA COMPOUNDS DETECTED
RR-84-002-001	3111	ND
RR-84-002-002	3112	ND
RR-84-002-003	3113	ND
RR-84-002-004	3213	ND
RR-84-002-005	5111	ND
RR-84-002-006	5211	Methylene Chloride 42 ppb
RR-84-002-007	5113	ND
RR-84-002-008	5213	ND
RR-84-002-009	5121	ND
RR-84-002-010	5221	ND
RR-84-002-011	5122	ND
RR-84-002-012	5222	ND

ND=NONE DETECTED

Versar INC.

Pesticide Data Summary *

857.2-42

Matrix: WATER
Units: ug/L

	RR84002001 3111	RR84002002 3112	RR84002003 3113	RR84002004 3213	RR84002005 5111	RR84002006 5211	RR84002007 5113	RR84002008 5213	RR84002009 5121	RR84002010 5221	RR84002011 5122	RR84002012 5222				
A-BHC	0.15	0.28														
LINDANE	0.74										0.56	0.53				
B-BHC																
HEPTACHLOR																
D-BHC		2.0														
ALDRIN																
HEPT.EPOX	1.1			0.09												
AENDOSULFAN																
DIELDRIN																
pp'DDE																
ENDRIN																
ENDOSULFAN																
pp'DDD																
DDT																
ENDRIN ALD.																
ENDOSULFATE																

FOOTNOTE: * A major unidentified (Non priority-pollutant) peak was found in the 6% fraction for samples in 857.42.

QC SUMMARY

Case No. 851.2-42
LOW LEVEL X
WATER X
QC REPORT NO. 851.2-42

CONTRACTOR VERSAR INC.
MED. LEVEL

CONTRACT NO. C00066
HIGH LEVEL
OTHER (Specify)

|--------Volatile --------||---------------------Semi-Volatile---------------------------||Pesticide|--|Dioxin|

	No.	D_8 Toluene (86-119)	BFB (85-121)	D_4-1,2-Dichloro-ethane (77-120)	D_5-Nitro-benzene (41-120)	2-Fluoro-biphenyl (44-119)	3-p-Terphenyl (33-128)	D_5-Phenol (15-96)	2-Fluoro-phenol (23-107)	2,4,6-Tribromo-phenol (20-105)	Dibutyl-Chloren-date (67-114)**	1,2,3,4-TCDD (23-148)
	CB	102/88	120/94	103/94	80	71	87	90	89	93		
	KKBY-002-001	111	00	96	78	65	74	74	67	85		
	KKBY-002-002	100	00	99	74	80	96	85	78	87		
	KKBY-002-003	103	00	102	59	70	80	71	70	62		
DUPLICATE	KKBY-002-003				74	94	108	86	82	92		
MATRIX SPIKE	KKBY-002-003				56	90	*131	86	88	101		
	KKBY-002-004	100	110	102	90	80	71	75	67	69		
	KKBY-002-005	101	110	99	91	82	121	82	76	95		
	KKBY-002-006	101	*128	*122	92	84	67	93	83	67		
	KKBY-002-007	109	*136	*121	75	80	81	57	77	77		
	KKBY-002-008	98	94	20	69	65	55	81	81	123*		
	KKBY-002-009	106	*131	*125	82	93	38	82	13	112*		
	KKBY-002-010	104	*133	*123	87	88	58	86	87	116*		
	KKBY-002-011	109	*137	*135	80	84	72	86	84	115*		
	KKBY-002-012	92	91	93	93	84	31*	76	86	40		
MS Dup	KKBY-002-012	*76	96	*74								
MS Spike	KKBY-002-012	*64	*76	*62								

* Asterisked values are outside of QC limits.
** Advisory Limit

Comments: Surrogate Spike Concentration Changed from 100ppb to 50ppb during analysis of Batch 42 for VOA's.

Volatiles: ___ out of ___; outside of QC limits
Semi-Volatiles: 5 out of 84; outside of QC limits
Pesticides: ___ out of ___; outside of QC limits
Dioxin: ___ out of ___; outside of QC limits

Limits Revised 12/83
1/84

MATRIX SPIKE DUPLICATE/RECOVERY

CASE NO. 851.2-42
LOW LEVEL X
WATER X
QC REPORT NO. 851.2-42

CONTRACTOR VERSAR
MED. LEVEL
SOIL/SED.

CONTRACT NO. C000661
HIGH LEVEL
OTHER (Specify)
UNITS (Circle) ug/kg (ug/L)

FRACTION	COMPOUND	CONC. SPIKE ADDED	CONC. MS	% REC.	CONC. MSD	% REC	RPD	QC RECOVERY LIMITS* RPD	WATER	SOIL	COMMENTS
VOA	1,1-Dichloroethylene	25	26	104				<15%	61-145	59-172	
#	Trichloroethylene	25	27	108				<15%	71-120	62-137	
RR84-002-012	Chlorobenzene	25	26	[illegible]				<15%	75-130	60-133	
	Toluene	25	19	[illegible]				<15%	76-125	59-139	
	Benzene	25	20	80				<15%	76-127	66-142	
B/N	1,2,4-Trichlorobenzene	100	56	56				<50%	39-98	38-107	
#	Acenaphthene	100	74	74				<50%	46-118	31-137	
RR84-002-003	2,4-Dinitrotoluene	100	38	38				<50%	24-96	28-89	
	Di-N-Butylphthalate	100	26	26				<50%	11-117	29-135	
	Pyrene	100	54	54				<50%	26-127	35-142	
	N-Nitrosodi-N-Propylamine	100	74	74				<50%	41-116	41-126	
	1,4-Dichlorobenzene	100	60	60				<50%	36-97	28-104	
ACID	Pentachlorophenol	200	116	58				<40%	9-103	17-109	
#	Phenol	100	67	67				<40%	12-89	26-90	
RR84-002-003	2-Chlorophenol	100	67	67				<40%	27-123	25-102	
	P-Chlor-M-Cresol	100	69	69				<40%	23-97	26-103	
	4-Nitrophenol	200	65	33				<40%	10-80	11-114	
PEST	Lindane	5	5.5	110	5.5	110	<1	<40%	56-123	46-127	
#	Heptachlor	5	3.8	76	3.3	66	14	<40%	40-131	35-130	
RR84-002-004	Aldrin	5	3.6	72	2.8	56	25	<40%	40-120	34-132	
	Dieldrin	5	4.5	90	4.2	84	6	<40%	52-126	31-134	
	Endrin	5	4.1	82	4.2	84	2	<40%	56-121	42-139	
	P,P-DDT	5	4.8	96	2.6	52	57*	<40%	38-127	23-134	

*Asterisked values are outside QC limits.

RPD: VOAs ___ out of ___; outside QC limits
B/N ___ out of ___; outside QC limits
ACID ___ out of ___; outside QC limits
PEST 1 out of 6; outside QC limits

RECOVERY: VOAs 0 out of 5; outside of QC limits
B/N 0 out of 7; outside of QC limits
ACID 0 out of 5; outside of QC limits
PEST 0 out of 6; outside of QC limits

*Advisory Limits
Rev: 12/83

/21/84

Versar INC.

Jack Ryan
Room 317
Bureau of Water Research
NYS Dept. Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

RECEIVED
OCT 24 1984
BUREAU OF WATER RESEARCH
DIVISION OF WATER

Reference: Versar Report Number 857-45

Jack:

Please find enclosed our report for sample numbers:

RR84-002-13, -14, -15, -16, -17, -18, -19, -20, -21, -22, -23, -24

Received from S. Barlow on 7/13/84.

Should you have any questions concerning these data please contact me at your earliest convenience and refer to the above report number.

Sincerely,

Robert Maxfield
Program Manager
Applied Chemistry Division

Versar INC.

METALS DATA

Versar INC.

Sample #: 6141
RR84 002 13

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5117

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	10.	Se	10.	<10.
Cr	4.	8.5	Sb	10.	<10.
Cu	20.	23.	Tl	10.	<10.
Ni	20.	29.			
Pb	50.	302.			
Zn	10.	135.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 6241
RR84 002 14

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5118

units = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	11.	Se	10.	<10.
Cr	4.	5.3	Sb	10.	<10.
Cu	20.	<20.	Tl	10.	<10.
Ni	20.	<20.			
Pb	50.	184.			
Zn	10.	79.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manage

Versar INC.

Sample #: 6112
RR84 002 15

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5119

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	28.	Sb	10.	<10.
Cu	20.	58.	Tl	10.	<10.
Ni	20.	53.			
Pb	50.	122.			
Zn	10.	120.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar Inc.

Sample #: 6212
RR84 002 16

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5120

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	6.7	Sb	10.	<10.
Cu	20.	22.	Tl	10.	<10.
Ni	20.	<20.			
Pb	50.	52.			
Zn	10.	65.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar Inc.

Sample #: 6111
RR84 002 17

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5121

UNITS= ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	20.	<20.	As	10.	56.
Be	2.	2.2	Hg *	0.2	0.21
Cd	20.	<20.	Se	10.	<10.
Cr	8.	236.	Sb	10.	<10.
Cu	40.	304.	Tl	10.	<10.
Ni	40.	304.			
Pb	100.	696.			
Zn	20.	348.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 6211
RR84 002 18

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5122

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10	<10.
Cr	4.	<4.	Sb	10.	<10.
Cu	20.	<20	Tl	10.	<10.
Ni	20.	<20			
Pb	50.	91.			
Zn	10.	80.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 6122
RR84 002 19

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5123

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	14.	Sb	10.	<10.
Cu	20.	<20.	Tl	10.	<10
Ni	20.	23.			
Pb	50.	206.			
Zn	10.	109.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 6222
RR84 002 20

METALS RESULTS

DATE: 8-31-84
PROJECT #: 857-45
LAB #: 5124

UNITS: ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	6.9	Sb	10.	<10.
Cu	20.	21.	Tl	10.	<10.
Ni	20.	<20.			
Pb	50.	78.			
Zn	10.	56.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar INC.

Sample #: 4134
RR84 002 21

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5125

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	21.	Sb	10.	<10.
Cu	20.	<20.	Tl	10.	<10.
Ni	20.	49.			
Pb	50.	142.			
Zn	10.	122.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar Inc.

Sample #: 4121
RR84 002 22

METALS RESULTS

DATE: 8-30-89

UNITS= ug/L

PROJECT #: 857-45

LAB #: 5126

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1	<1.	Hg *	0.2	0.46
Cd	10.	13.	Se	10.	<10.
Cr	4.	182.	Sb	10.	<10.
Cu	20.	130.	Tl	10.	<10.
Ni	20.	207.			
Pb	50.	265.			
Zn	10.	145.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Mayfield, Lab Manager

Versar INC.

Sample #: 4921
RR84 002 23

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5127

UNITS = ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	<4.	Sb	10.	<10.
Cu	20.	28.	Tl	10.	<10.
Ni	20.	<20.			
Pb	50.	67.			
Zn	10.	64.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

Robert Maxfield, Lab Manager

Versar Inc.

Sample #: 4215
RR 84 002 24

METALS RESULTS

DATE: 8-30-84
PROJECT #: 857-45
LAB #: 5128

UNITS=ug/L

PARAMETER	ICP DETECTION LIMIT	SAMPLE CONCENTRATION	PARAMETER	FURNACE DETECTION LIMIT	SAMPLE CONCENTRATION
Ag	10.	<10.	As	10.	<10.
Be	1.	<1.	Hg *	0.2	<0.2
Cd	10.	<10.	Se	10.	<10.
Cr	4.	4.2	Sb	10.	<10.
Cu	20.	<20.	Tl	10.	<10
Ni	20.	<20.			
Pb	50.	<50.			
Zn	10.	144.			

COMMENTS:

*Hg by CVAA

Procedures in accordance with:
Test Methods for Evaluating
Solid Wastes, SW-846, 2nd Edition,
USEPA, Washington, D.C. 1982

[signature]
Robert Maxfield, Lab Manager

METALS QUALITY ASSURANCE

FURNACE

EPISODE: –

DATE: 8-30-84

LAB: VERSAR, INC.

BATCH: 857-45

(ug/L)

			As	Hg	Se	Sb	Tl		
	REFERENCE STANDARD SOURCE: EPA	FOUND	27.	4.8	19.	90.	45.		
		TRUE	27.	4.35	18.	97.5	50.4		
		REL. % ERR.	0.	10.	5.	-8.	-11.		
	CALB. BLANK	RESULTS	<10.	<0.2	<10.	<10.	<10.		
	REG. BLANK 1	RESULTS	<10.	<0.2	<10.	<10.	<10.		
	REG. BLANK 2	RESULTS							
	INST. CALB. VERIFICATION SOURCE: VERSAR	FOUND	104.	5.2	90.	70.	90.		
		TRUE	100.	5.0	100.	70.	100.		
		REL. % ERR.	4.	4.	-10.	0.	-10.		
	DUPLICATE SAMPLE NO. RR84 002 21	SAMPLE RESULT	<10.	<0.2	<10.		<10.		
6112		DUPLICATE RESULT	<10.	<0.2	<10.		<10.		
	RR84 002 15 for Hg	RPD %	–	–	–		–		
	DUPLICATE SAMPLE NO. RR84 002 16	SAMPLE RESULT				<10.			
6212		DUPLICATE RESULT				<10.			
		RPD %				–			
	SPIKE SAMPLE NO. RR84 002 21	SAMPLE RESULT	<10.	<0.2	<10.		<10.		
4121		SPIKE RESULT	105.	1.7	90.		97.		
		SPIKE ADDED	100.	2.0	100.		100.		
	RR84 002 18	% RECOVERY	105.	85.	90.		97.		
	SPIKE SAMPLE NO. RR84 002 16	SAMPLE RESULT				<10.			
6212		SPIKE RESULT				176.			
		SPIKE ADDED				200.			
		% RECOVERY				88.			

METALS QUALITY ASSURANCE

ICP

EPISODE: —

LAB: VERSAR, INC.

DATE: 8-30-84

BATCH: 857-45

(ug/L)

		Ag	Be	Cd	Cr	Cu	Ni	Pb
REFERENCE STANDARD SOURCE: EPA	FOUND	32.	243.	37.	306.	345.	203.	436.
	TRUE	34.	235.	43.	311.	339.	207.	400.
	REL. % ERR.	-6.	3.	-14.	-2.	2.	-2.	-9.
CALB. BLANK	RESULTS	<3.	<1.	<10.	<4.	<20.	<20.	<50.
REG. BLANK 1	RESULTS	<3.	<1.	<10.	<4.	<20.	<20.	<50.
REG. BLANK 2	RESULTS							
INST. CALB. VERIFICATION SOURCE: EPA	FOUND	35.	239.	41.	305.	390.	211.	449.
	TRUE	34.	235.	43.	311.	339.	207.	480.
	REL. % ERR.	3.	2.	-5.	-2.	<1.	2.	-6.
6212 DUPLICATE 1 SAMPLE NO. RR84 002 16	SAMPLE RESULT	<10.	<1.	<10.	6.7	22.	<20.	52.
	DUPLICATE RESULT	<10.	<1.	<10.	8.6	24.	<20.	97.
	RPD %	—	—	—	25.	9.	—	59.
DUPLICATE 2 SAMPLE NO.	SAMPLE RESULT							
	DUPLICATE RESULT							
	RPD %							
6212 SPIKE 1 RR84 002 16 SAMPLE NO.	SAMPLE RESULT	<10.	<1.	<10	6.7	22.	<20	52.
	SPIKE RESULT	167.	186.	174.	184.	204.	182.	415
	SPIKE ADDED	200.	200.	200.	200.	200.	200.	400.
	% RECOVERY	84.	93.	87.	89.	91.	91.	91.
SPIKE 2 SAMPLE NO.	SAMPLE RESULT							
	SPIKE RESULT							
	SPIKE ADDED							
	% RECOVERY							

METALS QUALITY ASSURANCE

ICP

EPISODE: -

LAB: VERSAR, INC.

DATE: 8-30-81

BATCH: 857-45

		Zn						
REFERENCE STANDARD SOURCE: EPA	FOUND	410.						
	TRUE	418.						
	REL. % ERR.	-2.						
CALB. BLANK	RESULTS	<10.						
REG. BLANK 1	RESULTS	<10.						
REG. BLANK 2	RESULTS							
INST. CALB. VERIFICATION SOURCE: EPA	FOUND	416.						
	TRUE	418.						
	REL. % ERR.	<1.						
6212 DUPLICATE 1 SAMPLE NO. RR81002 16	SAMPLE RESULT	65.						
	DUPLICATE RESULT	61.						
	RPD %	6.						
DUPLICATE 2 SAMPLE NO.	SAMPLE RESULT							
	DUPLICATE RESULT							
	RPD %							
6212 SPIKE 1 SAMPLE NO. RR84002 16	SAMPLE RESULT	65.						
	SPIKE RESULT	236.						
	SPIKE ADDED	200.						
	% RECOVERY	86.						
SPIKE 2 SAMPLE NO.	SAMPLE RESULT							
	SPIKE RESULT							
	SPIKE ADDED							
	% RECOVERY							

Versar INC.

GC/MS DATA

Versar inc.

COMMENTS ON 857-45
GC/MS DATA

A number of the pesticide chromatograms contained large peaks which ~~did~~ not correspond well to any of the priority pollutant pesticides. The large peaks had a very characteristic pattern which was similar to another group of samples we analyzed recently for you (Batch 857-42). Along with the large peaks, some of the chromatograms contained some peaks which had retention times similar to the retention times of certain priority pollutant pesticides, usually lindane, alpha and beta NBC, and heptachlor. The retention time for lindane was usually shifted earlier than the corresponding peak in the standards, while the retention times for all of the other compounds were usually shifted later than the standards. Because of the shifting retention times, we are not convinced that these pesticides are truly in the samples. Thus, we have listed their concentrations as tentative identifications in the report.

We can deduce some information about the large peaks with the characteristic pattern which were in these samples and the earlier samples from Batch 42. In the pesticide cleanup process, the sample is divided into three fractions based on the polarity of the compounds. The large peaks always appeared in the least polar fraction. The other compounds eluting in this fraction include PCB's, DDT, the BHC isomers, chlordane, heptachlor, toxaphene, and others. These are all quite nonpolar compounds. The compounds appeared to be less volatile than DDE. The compounds are also capable of responding on an electron capture detector, so they must contain some electron capturing group, such as halogens, sulfur, nitrogen, or double bonded oxygen. The compounds had very assymetrical peak shapes, which is usually characteristic of compounds which are either thermally unstable, highly reactive, or polar. Thus, we suspect that the compounds are rather nonpolar compounds containing electron capturing groups, less volatile (lower vapor pressure) than DDE, and that they may be either thermally unstable or reactive.

Versar INC.

The following GC/MS information is provided in this report:

I. DATA SUMMARY

II. QUALITY CONTROL SUMMARY

III. SAMPLE DATA
1. Results
2. Chromatogram
3. Spectra

IV. STANDARDS DATA
1. Standards Chromatograms
2. Initial Calibration Curve Form
3. Calibration Curve Check Form

V. QUALITY CONTROL DATA
1. Calibration/System Performance Check
2. Reagent Blanks
3. Duplicate Samples
4. Matrix Spike Samples

VI. SAMPLE PREPARATION DATA
1. GC/MS Injection Logsheets
2. Extraction Forms/Notebook Pages

Versar INC.

DATA SUMMARY

Versar INC.

BNA DATA SUMMARY

FIELD NUMBER	PRIORITY POLLUTANT BNA Compounds Detected
RR84-002-13 6141	None detected
RR84-002-14 6241	None detected
RR84-002-15 6112	None detected
RR84-002-16 6212	None detected
RR84-002-17 6111	None detected
RR84-002-18 6211	None detected
RR84-002-19 6122	None detected
RR84-002-20 6222	None detected
RR84-002-21 4134	None detected
RR84-002-22 4181	None detected
RR84-002-23 4221	None detected
RR84-002-24 4215	None detected

Versar inc.

HSL VOA DATA SUMMARY

FIELD NUMBER	PRIORITY POLLUTANT VOA's Detected
RR84-002-13 6141	None detected
RR84-002-14 6241	None detected
RR84-002-15 6112	None detected
RR84-002-16 6212	None detected
RR84-002-17 6111	None detected
RR84-002-18 6211	None detected
RR84-002-19 6122	None detected
RR84-002-20 6222	None detected
RR84-002-21 4134	None detected
RR84-002-22 4121	None detected
RR84-002-23 4221	70 ppb methylene chloride
RR84-002-24 4215	None detected
RR84-002-23 Duplicate 4221	70 ppb methylene chloride

Versar INC.

Pesticide Data Summary

857.2-45

Matrix: Water

Units: ug/L

	RR84-002-13 6141	RR84-002-14 6241	RR84-002-15 ★6112	RR84-002-16 6212	RR84-002-17 ★6111	RR84-002-18 6211	RR84-002-19 6122	RR84-002-20 ★6222	RR84-002-21 ★7134	RR84-002-22 ★7121	RR84-002-23 4221	RR84-002-24 4215
A-BHC	ND	ND	0.65	ND	35	ND	ND	0.56	0.64	19	ND	ND
LINDANE			2.0		2.4			0.36	0.49	6.5		
B-BHC			13		7.3			2.1	11	18		
HEPTACHLOR			0.58		17			ND	32	50		
D-BHC			ND		ND			2.8	ND	ND		
ALDRIN			2.1					ND	0.85			
HEPT.EPOX			ND						ND			
AENDOSULFAN												
DIELDRIN												
pp'DDE												
ENDRIN												
ENDOSULFAN												
pp'DDD												
DDT												
ENDRIN ALD.												
ENDOSULFATE												

★ these concentrations and identification are only tentative, see text for more detail information

Versar INC.

QA SUMMARY

MATRIX SPIKE DUPLICATE/RECOVERY

CASE NO. 851.2-45
LOW LEVEL X
WATER X
QC REPORT NO. 851.2-45

CONTRACTOR VERSAR
MED. LEVEL
SOIL/SED.

CONTRACT NO. C000661
HIGH LEVEL
OTHER (Specify)
UNITS (Circle) ug/kg (ug/L)

FRACTION	COMPOUND	CONC. SPIKE ADDED	CONC. MS	% REC.	CONC. MSD	% REC	RPD	QC %RECOVERY LIMITS* RPD	WATER	SOIL	COMMENTS
4221 VOA # RR84-002-23	1,1-Dichloroethylene	25	22	88	24	96	9	<15%	61-145	59-177	
	Trichloroethylene	25	22	88	24	96	9	<15%	71-120	62-137	
	Chlorobenzene	25	23	92	25	100	8	<15%	75-130	60-133	
	Toluene	25	24	96	25	100	4	<15%	76-125	59-139	
	Benzene	25	21	84	24	96	13	<15%	76-127	66-142	
4221 B/N # RR84-002-23	1,2,4-Trichlorobenzene	100	61	61	57	57	7	<50%	39-98	38-107	
	Acenaphthene	100	87	87	83	83	5	<50%	46-118	31-137	
	2,4-Dinitrotoluene	100	96	96	93	93	3	<50%	24-96	28-89	
	Di-N-Butylphthalate	100	17	17	18	18	6	<50%	11-117	29-135	
	Pyrene	100	103	103	97	97	6	<50%	26-127	35-142	
	N-Nitrosodi-N-Propylamine	100	77	77	67	67	14	<50%	41-116	41-126	
	1,4-Dichlorobenzene	100	65	65	53	53	20	<50%	36-97	28-104	
4221 ACID # RR84-002-23	Pentachlorophenol	200	172	86	181	91	6	<40%	9-103	17-109	
	Phenol	100	62	62	62	62	0	<40%	12-89	26-90	
	2-Chlorophenol	100	55	55	58	58	5	<40%	27-123	25-102	
	P-Chlor-M-Cresol	100	74	74	74	74	0	<40%	23-97	26-103	
	4-Nitrophenol	200	192	96	204	102	6	<40%	10-80	11-114	
6171 PEST # RR84-002-13	Lindane	5	4.9	98	NA	NA	NA	<40%	56-123	46-127	
	Heptachlor	5	3.7	74				<40%	40-131	35-130	
	Aldrin	5	8.3	166				<40%	40-120	34-132	
	Dieldrin	5	4.3	86				<40%	52-126	31-134	
	Endrin	5	4.3	86				<40%	56-121	42-139	
	P,P-DDT	5	2.0	40				<40%	38-127	23-134	

WATER SURROGATE PERCENT RECOVERY SUMMARY

Case NO. 857.2-45
LOW LEVEL X
WATER X
QC REPORT NO. 857.2-45

CONTRACTOR VERSAR INC.
MED. LEVEL

CONTRACT NO. C000661
HIGH LEVEL
OTHER (Specify)

|--------Volatile --------||--------------------Semi-Volatile----------------------------||Pesticide|--

	No.	D_8 Toluene	BFB	D_4-1,2-Dichloro-ethane	D_5-Nitro-benzene	2-Fluoro-biphenyl	D_{14}-p-Ter-phenyl	D_5-Phenol	2-Fluoro-phenol	2,4,6-Tribromo-phenol	Dibutyl-Chloren-date
6141	RRBY-002-13	86	94	86	57	55	76	67	73	81	45
6241	RRBY-002-14	100	96	90	84	72	59	78	77	96	67
6112	RRBY-002-15	80	100	84	66	69	105	65	63	92	88
6212	RRBY-002-16	78	102	80	69	64	52	76	74	99	64
6111	RRBY-002-17	96	102	86	65	65	65	77	76	89	24
2211	RRBY-002-18	94	104	90	81	78	68	80	80	99	76
6122	RRBY-002-19	90	94	76	63	64	114	76	83	94	72
6222	RRBY-002-20	90	92	72	94	88	96	83	85	100	68
4134	RRBY-002-21	90	108	86	72	79	41	68	78	99	72
4121	RRBY-002-22	98	106	134	58	67	79	65	66	88	52
4221	RRBY-002-23	88	112	83	71	60	94	67	63	84	40
MATRIX SPIKE	RRBY-002-23	96	94	80	72	69	65	49	45	79	NA
MATRIX SPIKE DUPLICATE	RRBY-002-23	90	96	82	70	69	68	53	48	85	NA
4215	RRBY-002-24	84	106	83	67	60	70	73	68	103	40
	RB	98	106	90	90	66	85	76	72	90	77
Duplicate	RRBY-002-13										55
Matrix Spk	RRBY-002-13										66

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43585 SAMPLE RECEIVED:84/06/29/09
PROGRAM: 650:DFC SOLID WASTES
SOURCE ID:NFLBR113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #3272
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPFP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/09/28 11:30 DATE PRINTED:84/10/16

PARAMETER		RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61609	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
50 WOLF RD.,ROOM 417
ALBANY,N.Y. 12233

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (3222) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43585 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/16

	PARAMETER	RESULT
T70409	PARA-XYLENE	< 1. MCG/L
T70309	META-XYLENE	< 1. MCG/L
T51409	ORTHO-XYLENE	< 1. MCG/L
T85309	CUMENE	< 1. MCG/L
T85409	STYRENE	< 1. MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L
T51109	N-PROPYLBENZENE	< 1. MCG/L
T85609	TERT-BUTYLBENZENE	< 1. MCG/L
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L
T51209	BROMOBENZENE	< 1. MCG/L
T50509	META-CHLOROTOLUENE	< 1. MCG/L
T65809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L
T65909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L
T86009	P-CYMENE	< 1. MCG/L
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L
T86209	SEC-BUTYLBENZENE	< 1. MCG/L
T86309	N-BUTYLBENZENE	< 1. MCG/L
T86409	2,3-BENZOFURAN	< 1. MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L
T65609	NAPHTHALENE	< 5. MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L
T67109	PHENOL	< 10. MCG/L
T66409	2-CHLOROPHENOL	< 10. MCG/L
T66809	2-NITROPHENOL	< 10. MCG/L
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L
T66709	2,4-DINITROPHENOL	< 10. MCG/L
T66909	4-NITROPHENOL	< 10. MCG/L
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L
T67009	PENTACHLOROPHENOL	< 10. MCG/L
T85009	BENZOIC ACID	NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	< 10. MCG/L
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L
T65309	HEXACHLOROETHANE	< 10. MCG/L
T65709	NITROBENZENE	< 10. MCG/L
T65509	ISOPHORONE	< 10. MCG/L
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L
T64909	2,6-DINITROTOLUENE	< 10. MCG/L
T63109	ACENAPHTHYLENE	< 10. MCG/L
T64709	DIMETHYLPHTHALATE	< 10. MCG/L
T63009	ACENAPHTHENE	< 10. MCG/L

**** CONTINUED ON NEXT PAGE ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3222) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 11585 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/16

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	BCH,ALPHA	< 10. MCG/L	
T15809	BCH,BETA	< 10. MCG/L	
T35609	BCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	BCH,DELTA	< 10. MCG/L	
T09009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43586 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DFC SOLID WASTES
SOURCE ID:NFL8R113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #3251
REPORTING LAB: LOA:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/10/16

PARAMETER	RESULT
T62009 CHLOROMETHANE	< 1. MCG/L
T61809 BROMOMETHANE	< 1. MCG/L
T41009 VINYL CHLORIDE	< 1. MCG/L
T70209 DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909 CHLOROETHANE	< 1. MCG/L
T61709 TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809 DICHLOROMETHANE	< 1. MCG/L
T50909 1,1-DICHLOROETHENE	< 1. MCG/L
T51909 1,1-DICHLOROETHANE	< 1. MCG/L
T61209 TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009 CHLOROFORM	< 1. MCG/L
T50609 1,2-DICHLOROETHANE	< 1. MCG/L
T23609 1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609 CARBON TETRACHLORIDE	< 1. MCG/L
T38909 BROMODICHLOROMETHANE	< 1. MCG/L
T61309 1,2-DICHLOROPROPANE	< 1. MCG/L
T61509 TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109 TRICHLOROETHYLENE	< 1. MCG/L
T44909 DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409 CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709 1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109 2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109 BROMOFORM	< 1. MCG/L
T51809 1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209 TETRACHLOROETHENE	< 1. MCG/L
T40909 CHLOROBENZENE	< 1. MCG/L
T49709 1,3-DICHLOROBENZENE	< 1. MCG/L
T44109 1,2-DICHLOROBENZENE	< 1. MCG/L
T44209 1,4-DICHLOROBENZENE	< 1. MCG/L
T34409 BENZENE	< 1. MCG/L
T39209 TOLUENE	< 1. MCG/L
T51009 ETHYLBENZENE	< 1. MCG/L
T85209 1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

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MR. S. BRASWELL
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0829 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (3251) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43580 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/10/16

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	< 10. MCG/L	
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

0830 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3251) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43586 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/10/16

PARAMETER		RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T69309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	BCH,ALPHA	< 10. MCG/L	
T15809	BCH,BETA	< 10. MCG/L	
T35609	BCH,GAMMA (LINDANE)	< 10. MCG/L	
T15009	BCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T09309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43586 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLBR113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL (#3233)
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/10/16

PARAMETER		RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T35609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T65209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
50 WOLF RD.,ROOM 417
ALBANY,N.Y. 12233

0835 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (3233) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43588 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/10/16

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	< 10. MCG/L	
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3233) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43586 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/10/16

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	BHC,ALPHA	< 10. MCG/L	
T15809	BHC,BETA	< 10. MCG/L	
T35609	BHC,GAMMA (LINDANE)	< 10. MCG/L	
T16009	BHC,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43573 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #6114
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15:00 DATE PRINTED:84/10/22

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
50 WOLF RD., ROOM 417
ALBANY,N.Y.-12233

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 (6114) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43573 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:00 DATE PRINTED:84/10/22

	PARAMETER	RESULT
T70409	PARA-XYLENE	< 1.0 MCG/L
T70309	META-XYLENE	< 1.0 MCG/L
T51409	ORTHO-XYLENE	< 1.0 MCG/L
T85309	CUMENE	< 1.0 MCG/L
T85409	STYRENE	< 1.0 MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1.0 MCG/L
T51109	N-PROPYLBENZENE	< 1.0 MCG/L
T85609	TERT-BUTYLBENZENE	< 1.0 MCG/L
T85709	O/P-CHLOROTOLUENE	< 1.0 MCG/L
T51209	BROMOBENZENE	< 1.0 MCG/L
T50509	META-CHLOROTOLUENE	< 1.0 MCG/L
T85809	1,3,5-TRIMETHYLBENZENE	< 1.0 MCG/L
T85909	1,2,4-TRIMETHYLBENZENE	< 1.0 MCG/L
T86009	P-CYMENE	< 1.0 MCG/L
T86109	CYCLOPROPYLBENZENE	< 1.0 MCG/L
T86209	SEC-BUTYLBENZENE	< 1.0 MCG/L
T86309	N-BUTYLBENZENE	< 1.0 MCG/L
T86409	2,3-BENZOFURAN	< 1.0 MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5.0 MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5.0 MCG/L
T65609	NAPHTHALENE	< 5.0 MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5.0 MCG/L
T67109	PHENOL	< 10.0 MCG/L
T66409	2-CHLOROPHENOL	< 10.0 MCG/L
T66809	2-NITROPHENOL	< 10.0 MCG/L
T66609	2,4-DIMETHYLPHENOL	< 10.0 MCG/L
T66509	2,4-DICHLOROPHENOL	< 10.0 MCG/L
T66309	4-CHLORO-3-METHYLPHENOL	< 10.0 MCG/L
T67209	2,4,6-TRICHLOROPHENOL	< 10.0 MCG/L
T49609	2,4,5-TRICHLOROPHENOL	< 10.0 MCG/L
T66709	2,4-DINITROPHENOL	< 10.0 MCG/L
T66909	4-NITROPHENOL	< 10.0 MCG/L
T68509	2-METHYL-4,6-DINITROPHENOL	< 10.0 MCG/L
T67009	PENTACHLOROPHENOL	< 10.0 MCG/L
T85009	BENZOIC ACID	NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10.0 MCG/L
T65909	N-NITROSODI-N-PROPYLAMINE	< 10.0 MCG/L
T65309	HEXACHLOROETHANE	< 10.0 MCG/L
T65709	NITROBENZENE	< 10.0 MCG/L
T65509	ISOPHORONE	< 10.0 MCG/L
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10.0 MCG/L
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10.0 MCG/L
T64109	2-CHLORONAPHTHALENE	< 10.0 MCG/L
T64909	2,6-DINITROTOLUENE	< 10.0 MCG/L
T63109	ACENAPHTHYLENE	< 10.0 MCG/L
T64709	DIMETHYLPHTHALATE	< 10.0 MCG/L
T63009	ACENAPHTHENE	< 10.0 MCG/L

**** CONTINUED ON NEXT PAGE ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 6114 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43573 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:00 DATE PRINTED:84/10/22

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER	-	NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUOROANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	43. MCG/L	NC
T08309	HEPTACHLOR EPOXIDE	23. MCG/L	NC
T43309	ENDOSULFAN I	15. MCG/L	NC
T14809	DDE -PARA, PARA	11. MCG/L	NC
T08509	DIELDRIN	23. MCG/L	NC
T08409	ENDRIN	11. MCG/L	NC
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

0444 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43574 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #5114
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/ : DATE PRINTED:84/10/22

PARAMETER		RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
50 WOLF RD., ROOM 417
ALBANY,N.Y. 12233

0445

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (5114) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43574 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/ : DATE PRINTED:84/10/22

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T65309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (5114) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43574 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/ : DATE PRINTED:84/10/22

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER	-	NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	52. MCG/L	NC
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	11. MCG/L	NC
T08009	HEPTACHLOR	13. MCG/L	NC
T07709	ALDRIN	49. MCG/L	NC
T08309	HEPTACHLOR EPOXIDE	30. MCG/L	NC
T43309	ENDOSULFAN I	13. MCG/L	NC
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	14. MCG/L	NC
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43575 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC7803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #3123
REPORTING LAB: LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPFP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 17:00 DATE PRINTED:84/10/18

PARAMETER	RESULT
T62009 CHLOROMETHANE	< 1. MCG/L
T61809 BROMOMETHANE	< 1. MCG/L
T41009 VINYL CHLORIDE	< 1. MCG/L
T70209 DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909 CHLOROETHANE	< 1. MCG/L
T61709 TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809 DICHLOROMETHANE	< 1. MCG/L
T50909 1,1-DICHLOROETHENE	< 1. MCG/L
T51909 1,1-DICHLOROETHANE	< 1. MCG/L
T61209 TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009 CHLOROFORM	< 1. MCG/L
T50809 1,2-DICHLOROETHANE	< 1. MCG/L
T23609 1,1,1-TRICHLOROETHANE	< 1. MCG/L
T35609 CARBON TETRACHLORIDE	< 1. MCG/L
T38909 BROMODICHLOROMETHANE	< 1. MCG/L
T61309 1,2-DICHLOROPROPANE	< 1. MCG/L
T61509 TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109 TRICHLOROETHYLENE	< 1. MCG/L
T44909 DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409 CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709 1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109 2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109 BROMOFORM	< 1. MCG/L
T51809 1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209 TETRACHLOROETHENE	< 1. MCG/L
T40909 CHLOROBENZENE	< 1. MCG/L
T49709 1,3-DICHLOROBENZENE	< 1. MCG/L
T44109 1,2-DICHLOROBENZENE	< 1. MCG/L
T44209 1,4-DICHLOROBENZENE	< 1. MCG/L
T34409 BENZENE	< 1. MCG/L
T39209 TOLUENE	< 1. MCG/L
T51009 ETHYLBENZENE	< 1. MCG/L
T85209 1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

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MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
50 WOLF RD., ROOM 417
ALBANY,N.Y. 12233

SAMPLE ID: 43575 SAMPLE RECEIVED: 84/08/29/09
POLITICAL SUBDIVISION: NIAGARA FALLS C. COUNTY: NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/29 17:00 DATE PRINTED: 84/10/18

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T85109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T65509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
~~T49509~~	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T65909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T69609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3123) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43575 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:00 DATE PRINTED:84/10/18

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T69409	4-CHLOROPHENYL PHENYL ETHER		NA
T65009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T49809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 200. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	BCH,ALPHA	< 10. MCG/L	
T15809	BCH,BETA	< 10. MCG/L	
T35609	BCH,GAMMA (LINDANE)	< 10. MCG/L	
T15909	BCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	19. MCG/L	NC
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

0465 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43576 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NF68R113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #6213
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PREP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/18

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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0466 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (6213) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43576 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/18

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T65809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T85109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T65609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T65509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T69109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

0467 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 6213 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43576 SAMPLE RECEIVED:84/06/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/09/26 14:30 DATE PRINTED:84/10/18

	PARAMETER	RESULT
T64809	2,4-DINITROTOLUENE	< 10. MCG/L
T64609	DIETHYLPHTHALATE	< 10. MCG/L
T65209	FLUORENE	< 10. MCG/L
T68409	4-CHLOROPHENYL PHENYL ETHER	NA
T65009	N-NITROSODIPHENYLAMINE	< 10. MCG/L
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L
T69309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L
T48809	HEXACHLOROBENZENE	< 10. MCG/L
T66109	PHENANTHRENE	< 10. MCG/L
T63209	ANTHRACENE	< 10. MCG/L
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L
T68009	FLUORANTHENE	< 10. MCG/L
T66209	PYRENE	< 10. MCG/L
T63809	BENZIDINE	< 200. MCG/L
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L
T64209	CHRYSENE	< 30. MCG/L
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L
T65009	DIOCTYLPHTHALATE	< 30. MCG/L
T63409	BENZO(B)FLUORANTHENE	NA
T63509	BENZO(K)FLUORANTHENE	NA
T63609	BENZO(A)PYRENE	< 30. MCG/L
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L
T15709	BCH,ALPHA	< 10. MCG/L
T15809	BCH,BETA	< 10. MCG/L
T35609	BCH,GAMMA (LINDANE)	< 10. MCG/L
T16009	BCH,DELTA	< 10. MCG/L
T08009	HEPTACHLOR	< 10. MCG/L
T07709	ALDRIN	< 10. MCG/L
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L
T43309	ENDOSULFAN I	< 10. MCG/L
T14809	DDE -PARA, PARA	< 10. MCG/L
T08509	DIELDRIN	< 10. MCG/L
T08409	ENDRIN	< 10. MCG/L
T14909	DDD -PARA, PARA	< 10. MCG/L
T43409	ENDOSULFAN II	< 10. MCG/L
T67409	ENDRIN ALDEHYDE	< 10. MCG/L
T67309	ENDOSULFAN SULFATE	< 10. MCG/L
T14709	DDT -PARA, PARA	< 10. MCG/L

**** END OF REPORT ****

0415 NEW YORK STATE DEPARTMENT OF HEALTH
CENTER FOR LABORATORIES AND RESEARCH

 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43589 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID: DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: FIELD BLANK-LOVE CANAL MONITORING WELL SAMPLES
DESCRIPTION:WITH SAMPLE #43573 TO 43588
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: VOL2:EPA METHOD 503.1 & F.R.METHOD 601
SAMPLE TYPE: 297:FIELD BLANK
TIME OF SAMPLING: 84/08/21 : DATE PRINTED:84/09/17

PARAMETER		RESULT
T67009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

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SUBMITTED BY:BARLOW

0416 NEW YORK STATE DEPARTMENT OF HEALTH
CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 *field blank* RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43589 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: FIELD BLANK-LOVE CANAL MONITORING WELL SAMPLES
TIME OF SAMPLING: 84/08/21 : DATE PRINTED:84/09/17

	PARAMETER	RESULT
T70409	PARA-XYLENE	< 1. MCG/L
T70309	META-XYLENE	< 1. MCG/L
T51409	ORTHO-XYLENE	< 1. MCG/L
T85309	CUMENE	< 1. MCG/L
T85409	STYRENE	< 1. MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L
T51109	N-PROPYLBENZENE	< 1. MCG/L
T85609	TERT-BUTYLBENZENE	< 1. MCG/L
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L
T51209	BROMOBENZENE	< 1. MCG/L
T50509	META-CHLOROTOLUENE	< 1. MCG/L
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L
T86009	P-CYMENE	< 1. MCG/L
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L
T86209	SEC-BUTYLBENZENE	< 1. MCG/L
T86309	N-BUTYLBENZENE	< 1. MCG/L
T86409	2,3-BENZOFURAN	< 1. MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L
T65609	NAPHTHALENE	< 5. MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L

**** END OF REPORT ****

0347 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43580 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLBR113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #5212
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/10/26

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

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**** CONTINUED ON NEXT PAGE ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

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SUBMITTED BY:BARLOW

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 5212 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43580 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/10/26

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 5212 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43580 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/10/26

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUOROANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 RESULTS OF EXAMINATION - FINAL REPORT

SAMPLE ID: 43577 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #6113
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 14:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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MR. S. BRASWELL
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50 WOLF RD., ROOM 417
ALBANY, N.Y. 12233

SUBMITTED BY:BARLOW

0376 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 6113 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 83577 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 14:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T70409	PARA-XYLENE	< 1. MCG/L
T70309	META-XYLENE	< 1. MCG/L
T51409	ORTHO-XYLENE	< 1. MCG/L
T85309	CUMENE	< 1. MCG/L
T85409	STYRENE	< 1. MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L
T51109	N-PROPYLBENZENE	< 1. MCG/L
T85609	TERT-BUTYLBENZENE	< 1. MCG/L
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L
T51209	BROMOBENZENE	< 1. MCG/L
T50509	META-CHLOROTOLUENE	< 1. MCG/L
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L
T86009	P-CYMENE	< 1. MCG/L
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L
T86209	SEC-BUTYLBENZENE	< 1. MCG/L
T86309	N-BUTYLBENZENE	< 1. MCG/L
T86409	2,3-BENZOFURAN	< 1. MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L
T65609	NAPHTHALENE	< 5. MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L
T67109	PHENOL	< 10. MCG/L
T66409	2-CHLOROPHENOL	< 10. MCG/L
T66809	2-NITROPHENOL	< 10. MCG/L
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L
T66709	2,4-DINITROPHENOL	< 10. MCG/L
T66909	4-NITROPHENOL	< 10. MCG/L
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L
T67009	PENTACHLOROPHENOL	< 10. MCG/L
T85009	BENZOIC ACID	NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L
T65309	HEXACHLOROETHANE	< 10. MCG/L
T65709	NITROBENZENE	< 10. MCG/L
T65509	ISOPHORONE	< 10. MCG/L
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L
T64909	2,6-DINITROTOLUENE	< 10. MCG/L
T63109	ACENAPHTHYLENE	< 10. MCG/L
T64709	DIMETHYLPHTHALATE	< 10. MCG/L
T63009	ACENAPHTHENE	< 10. MCG/L

**** CONTINUED ON NEXT PAGE ****

0377 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (6113) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43577 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 14:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T15009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

0381 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43578 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLBR113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #3223
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12:08 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

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MR. S. BRASWELL
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0382 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (3223) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43578 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:08 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T70409	PARA-XYLENE	< 1. MCG/L
T70309	META-XYLENE	< 1. MCG/L
T51409	ORTHO-XYLENE	< 1. MCG/L
T85309	CUMENE	< 1. MCG/L
T85409	STYRENE	< 1. MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L
T51109	N-PROPYLBENZENE	< 1. MCG/L
T85609	TERT-BUTYLBENZENE	< 1. MCG/L
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L
T51209	BROMOBENZENE	< 1. MCG/L
T50509	META-CHLOROTOLUENE	< 1. MCG/L
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L
T86009	P-CYMENE	< 1. MCG/L
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L
T86209	SEC-BUTYLBENZENE	< 1. MCG/L
T86309	N-BUTYLBENZENE	< 1. MCG/L
T86409	2,3-BENZOFURAN	< 1. MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L
T65609	NAPHTHALENE	< 5. MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L
T67109	PHENOL	< 10. MCG/L
T66409	2-CHLOROPHENOL	< 10. MCG/L
T66809	2-NITROPHENOL	< 10. MCG/L
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L
T66709	2,4-DINITROPHENOL	< 10. MCG/L
T66909	4-NITROPHENOL	< 10. MCG/L
T69509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L
T67009	PENTACHLOROPHENOL	< 10. MCG/L
T85009	BENZOIC ACID	NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L
T65309	HEXACHLOROETHANE	< 10. MCG/L
T65709	NITROBENZENE	< 10. MCG/L
T65509	ISOPHORONE	< 10. MCG/L
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L
T64909	2,6-DINITROTOLUENE	< 10. MCG/L
T63109	ACENAPHTHYLENE	< 10. MCG/L
T64709	DIMETHYLPHTHALATE	< 10. MCG/L
T63009	ACENAPHTHENE	< 10. MCG/L

**** CONTINUED ON NEXT PAGE ****

0383 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3223) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43578 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:08 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUOROANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 3223 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43578 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:08 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

0386 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3223) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43578 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:08 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

0390 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43579 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #3133
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
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ALBANY, N.Y. 12233

0391 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (3133) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43579 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

0392 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3133) RESULTS OF EXAMINATION - FINAL REPORT

SAMPLE ID: 43579 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43591 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLBR113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #6214
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15:00 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	4. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	8. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

MR. S. BRASWELL
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ALBANY,N.Y. 12233

0397 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (6214) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43581 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:00 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T65809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T65309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 (6214) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43581 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:00
DATE PRINTED:84/10/2

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUOROANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 10. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 200. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE	< 30. MCG/L	
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE		NA
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 30. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T15009	HCH,DELTA	< 10. MCG/L	
T09009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

RESULTS OF EXAMINATION — FINAL REPORT

SAMPLE ID: 43582 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #3122
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO
50 WOLF RD.,ROOM 417
ALBANY,N.Y. 12233

SUBMITTED BY:BARLOW

SAMPLE ID: 43582 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T85009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	34. MCG/L	NC
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T85009	BENZOIC ACID		NA
T69109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

0401 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (3122) RESULTS OF EXAMINATION - FINAL REPORT

SAMPLE ID: 43582 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUOROANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T15009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

0405 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION - FINAL REPORT

SAMPLE ID: 43583 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #5112
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

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COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

MR. S. BRASWELL
BUREAU OF SOLID WASTES
N.Y.S.DEPT. OF ENVIRONMENTAL CONSERVATIO SUBMITTED BY:BARLOW
50 WOLF RD.,ROOM 417
ALBANY,N.Y. 12233

0406 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 2 (5112) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43583 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T70409	PARA-XYLENE	< 1. MCG/L
T70309	META-XYLENE	< 1. MCG/L
T51409	ORTHO-XYLENE	< 1. MCG/L
T85309	CUMENE	< 1. MCG/L
T85409	STYRENE	< 1. MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L
T51109	N-PROPYLBENZENE	< 1. MCG/L
T85609	TERT-BUTYLBENZENE	< 1. MCG/L
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L
T51209	BROMOBENZENE	< 1. MCG/L
T50509	META-CHLOROTOLUENE	< 1. MCG/L
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L
T86009	P-CYMENE	< 1. MCG/L
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L
T86209	SEC-BUTYLBENZENE	< 1. MCG/L
T86309	N-BUTYLBENZENE	< 1. MCG/L
T86409	2,3-BENZOFURAN	< 1. MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L
T65609	NAPHTHALENE	< 5. MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L
T67109	PHENOL	< 10. MCG/L
T66409	2-CHLOROPHENOL	< 10. MCG/L
T66809	2-NITROPHENOL	< 10. MCG/L
T65609	2,4-DIMETHYLPHENOL	< 10. MCG/L
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L
T66709	2,4-DINITROPHENOL	< 10. MCG/L
T66909	4-NITROPHENOL	< 10. MCG/L
T68509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L
T67009	PENTACHLOROPHENOL	< 10. MCG/L
T85009	BENZOIC ACID	NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER	NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L
T65309	HEXACHLOROETHANE	< 10. MCG/L
T65709	NITROBENZENE	< 10. MCG/L
T65509	ISOPHORONE	< 10. MCG/L
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L
T64909	2,6-DINITROTOLUENE	< 10. MCG/L
T63109	ACENAPHTHYLENE	< 10. MCG/L
T64709	DIMETHYLPHTHALATE	< 10. MCG/L
T63009	ACENAPHTHENE	< 10. MCG/L

**** CONTINUED ON NEXT PAGE ****

0407 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 (5/12) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43583 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T49809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUOROANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	17. MCG/L	NC
T14709	DDT -PARA, PARA	17. MCG/L	NC

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43584 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLBR113 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
DESCRIPTION:WELL #5214
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 16:00 DATE PRINTED:84/10/25

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23609	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 (5214) RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43584 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 16:00 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1. MCG/L	
T70309	META-XYLENE	< 1. MCG/L	
T51409	ORTHO-XYLENE	< 1. MCG/L	
T85309	CUMENE	< 1. MCG/L	
T85409	STYRENE	< 1. MCG/L	
T85509	P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109	N-PROPYLBENZENE	< 1. MCG/L	
T85609	TERT-BUTYLBENZENE	< 1. MCG/L	
T85709	O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209	BROMOBENZENE	< 1. MCG/L	
T50509	META-CHLOROTOLUENE	< 1. MCG/L	
T85809	1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909	1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009	P-CYMENE	< 1. MCG/L	
T86109	CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209	SEC-BUTYLBENZENE	< 1. MCG/L	
T86309	N-BUTYLBENZENE	< 1. MCG/L	
T86409	2,3-BENZOFURAN	< 1. MCG/L	
T52509	HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009	1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609	NAPHTHALENE	< 5. MCG/L	
T43909	1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109	PHENOL	< 10. MCG/L	
T66409	2-CHLOROPHENOL	< 10. MCG/L	
T66809	2-NITROPHENOL	< 10. MCG/L	
T66609	2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509	2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309	4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209	2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609	2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709	2,4-DINITROPHENOL	< 10. MCG/L	
T66909	4-NITROPHENOL	< 10. MCG/L	
T69509	2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009	PENTACHLOROPHENOL	< 10. MCG/L	
T65009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909	N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309	HEXACHLOROETHANE	< 10. MCG/L	
T65709	NITROBENZENE	< 10. MCG/L	
T65509	ISOPHORONE	< 10. MCG/L	
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109	2-CHLORONAPHTHALENE	< 10. MCG/L	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

 5214 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43584 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, BEDROCK MONITORING WELLS
TIME OF SAMPLING: 84/08/28 16:00 DATE PRINTED:84/10/25

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	< 10. MCG/L	
T66209	PYRENE	< 10. MCG/L	
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T64509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T16009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	< 10. MCG/L	
T07709	ALDRIN	< 10. MCG/L	
T08309	HEPTACHLOR EPOXIDE	< 10. MCG/L	
T43309	ENDOSULFAN I	< 10. MCG/L	
T14809	DDE -PARA, PARA	< 10. MCG/L	
T08509	DIELDRIN	< 10. MCG/L	
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	< 10. MCG/L	
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	< 10. MCG/L	
T14709	DDT -PARA, PARA	< 10. MCG/L	

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPOR

SAMPLE ID: 841006156 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLLP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3233
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALB
TEST PATTERN: 10-010:NDS - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/11/07

PARAMETER		RESULT
01ZINC	ZINC	0.11 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10.0 MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5.0 MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	1. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

**** END OF REPORT ****

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006157 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3223
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBANY
TEST PATTERN: 10-010:ADSY - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12: DATE PRINTED:84/11/08

PARAMETER		RESULT
01ZINC	ZINC	0.36 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.02 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10.0 MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5.0 MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L
01PHENOL	PHENOLS	4. MCG/L

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SUBMITTED BY:BARLOW

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 84100615M SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLLP11J DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3222
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBA
TEST PATTERN: TU-0101:WDSW - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/11/08

	PARAMETER	RESULT
01ZINC	ZINC	0.09 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10.0 MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5.0 MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROLIZABLE	< 0.002 MG/L
01PHENOL	PHENOLS	1. MCG/L

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SUBMITTED BY:BARLOW

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006159 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3251
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBANY
TEST PATTERN: 10-010:AASN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11: DATE PRINTED:84/11/08

PARAMETER		RESULT
01ZINC	ZINC	0.17 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10.0 MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5.0 MCG/L
05DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROCYZAMER	< 0.002 MG/L
01PHENOL	PHENOLS	2. MCG/L

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006160 SAMPLE RECEIVED:84/06/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLIP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #5112
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBA
TEST PATTERN: 10-010:NDSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/06/28 15:30 DATE PRINTED:84/11/08

	PARAMETER	RESULT
01ZINC	ZINC	0.19 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10.0 MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5.0 MCG/L
05DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L
01PHENOL	PHENOLS	< 1. MCG/L

**** END OF REPORT ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(1)

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ALBANY,N.Y. 12233

0203 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

RESULTS OF EXAMINATION — FINAL REPORT

SAMPLE ID: 43587 SAMPLE RECEIVED:84/08/29/09
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLC0803 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
DESCRIPTION:WELL #3151
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/11/06

SAMPLE EXTRACT EXAMINED FOR HYDROCARBONS. LUBRICATING OIL PRESENT WHICH ELUTES IN THE SAME REGION AS PRIORITY POLLUTANT PESTICIDES. DR.A.RICHARDS 1NOV84.

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41099	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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ALBANY,N.Y. 12233

SUBMITTED BY:BARLOW

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43587 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/11/06

PARAMETER	RESULT	
T34409 BENZENE	< 1. MCG/L	
T39209 TOLUENE	< 1. MCG/L	
T51009 ETHYLBENZENE	< 1. MCG/L	
T85209 1-CHLOROCYCLOHEXENE-1	< 1. MCG/L	
T70409 PARA-XYLENE	< 1. MCG/L	
T70309 META-XYLENE	< 1. MCG/L	
T51409 ORTHO-XYLENE	< 1. MCG/L	
T85309 CUMENE	< 1. MCG/L	
T85409 STYRENE	< 1. MCG/L	
T85509 P-BROMOFLUOROBENZENE	< 1. MCG/L	
T51109 N-PROPYLBENZENE	< 1. MCG/L	
T85609 TERT-BUTYLBENZENE	< 1. MCG/L	
T85709 O/P-CHLOROTOLUENE	< 1. MCG/L	
T51209 BROMOBENZENE	< 1. MCG/L	
T50509 META-CHLOROTOLUENE	< 1. MCG/L	
T85809 1,3,5-TRIMETHYLBENZENE	< 1. MCG/L	
T85909 1,2,4-TRIMETHYLBENZENE	< 1. MCG/L	
T86009 P-CYMENE	< 1. MCG/L	
T86109 CYCLOPROPYLBENZENE	< 1. MCG/L	
T86209 SEC-BUTYLBENZENE	< 1. MCG/L	
T86309 N-BUTYLBENZENE	< 1. MCG/L	
T85409 2,3-BENZOFURAN	< 1. MCG/L	
T52509 HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L	
T44009 1,2,4-TRICHLOROBENZENE	< 5. MCG/L	
T65609 NAPHTHALENE	< 5. MCG/L	
T43909 1,2,3-TRICHLOROBENZENE	< 5. MCG/L	
T67109 PHENOL	< 10. MCG/L	
T65409 2-CHLOROPHENOL	< 10. MCG/L	
T56809 2-NITROPHENOL	< 10. MCG/L	
T65809 2,4-DIMETHYLPHENOL	< 10. MCG/L	
T66509 2,4-DICHLOROPHENOL	< 10. MCG/L	
T66309 4-CHLORO-3-METHYLPHENOL	< 10. MCG/L	
T67209 2,4,6-TRICHLOROPHENOL	< 10. MCG/L	
T49609 2,4,5-TRICHLOROPHENOL	< 10. MCG/L	
T66709 2,4-DINITROPHENOL	< 10. MCG/L	
T66909 4-NITROPHENOL	< 10. MCG/L	
T68509 2-METHYL-4,6-DINITROPHENOL	< 10. MCG/L	
T67009 PENTACHLOROPHENOL	< 10. MCG/L	
T85009 BENZOIC ACID		NA
T68109 BIS(2-CHLOROISOPROPYL)ETHER	< 10. MCG/L	
T63909 BIS(2-CHLOROETHYL)ETHER	< 10. MCG/L	
T65909 N-NITROSODI-N-PROPYLAMINE	< 10. MCG/L	
T65309 HEXACHLOROETHANE	< 10. MCG/L	
T65709 NITROBENZENE	< 10. MCG/L	
T65509 ISOPHORONE	< 10. MCG/L	
T68609 BIS(2-CHLOROETHOXY)METHANE	< 10. MCG/L	
T49209 HEXACHLOROCYCLOPENTADIENE (C-56)	< 10. MCG/L	
T64109 2-CHLORONAPHTHALENE	< 10. MCG/L	

**** CONTINUED ON NEXT PAGE ****

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

RESULTS OF EXAMINATION — FINAL REPORT

SAMPLE ID: 43587 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/11/06

	PARAMETER	RESULT	
T64909	2,6-DINITROTOLUENE	< 10. MCG/L	
T63109	ACENAPHTHYLENE	< 10. MCG/L	
T64709	DIMETHYLPHTHALATE	< 10. MCG/L	
T63009	ACENAPHTHENE	< 10. MCG/L	
T64809	2,4-DINITROTOLUENE	< 10. MCG/L	
T64609	DIETHYLPHTHALATE	< 10. MCG/L	
T65209	FLUORENE	< 10. MCG/L	
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10. MCG/L	
T65109	1,2-DIPHENYLHYDRAZINE	< 10. MCG/L	
T68309	4-BROMOPHENYL PHENYL ETHER	< 10. MCG/L	
T48809	HEXACHLOROBENZENE	< 10. MCG/L	
T66109	PHENANTHRENE	< 10. MCG/L	
T63209	ANTHRACENE	< 10. MCG/L	
T64409	DI-N-BUTYLPHTHALATE	< 10. MCG/L	
T68009	FLUORANTHENE	23. MCG/L	NC
T66209	PYRENE	31. MCG/L	NC
T63809	BENZIDINE	< 200. MCG/L	
T64009	BUTYL BENZYL PHTHALATE	< 30. MCG/L	
T63309	BENZO(A)ANTHRACENE	< 30. MCG/L	
T61509	3,3'-DICHLOROBENZIDINE	< 30. MCG/L	
T64209	CHRYSENE	< 30. MCG/L	
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30. MCG/L	
T65009	DIOCTYLPHTHALATE	< 30. MCG/L	
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30. MCG/L	
T65409	INDENO(1,2,3-CD)PYRENE	< 30. MCG/L	
T64309	DIBENZO(A,H)ANTHRACENE	< 30. MCG/L	
T63709	BENZO(GHI)PERYLENE	< 30. MCG/L	
T15709	HCH,ALPHA	< 10. MCG/L	
T15809	HCH,BETA	< 10. MCG/L	
T35609	HCH,GAMMA (LINDANE)	< 10. MCG/L	
T15009	HCH,DELTA	< 10. MCG/L	
T08009	HEPTACHLOR	13. MCG/L	NC
T07709	ALDRIN	84. MCG/L	NC
T08309	HEPTACHLOR EPOXIDE	54. MCG/L	NC
T43309	ENDOSULFAN I	48. MCG/L	NC
T14809	DDE -PARA, PARA	29. MCG/L	NC
T08509	DIELDRIN	63. MCG/L	NC
T08409	ENDRIN	< 10. MCG/L	
T14909	DDD -PARA, PARA	10. MCG/L	NC
T43409	ENDOSULFAN II	< 10. MCG/L	
T67409	ENDRIN ALDEHYDE	< 10. MCG/L	
T67309	ENDOSULFAN SULFATE	15. MCG/L	NC
T14709	DDT -PARA, PARA	15. MCG/L	NC
MS-CONFIRM	MASS SPEC CONFIRMATION		NA
T65809	N-NITROSODIMETHYLAMINE		NA

**** CONTINUED ON NEXT PAGE ****

0206 NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 43587 SAMPLE RECEIVED:84/08/29/09
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LOCATION: NIAGARA FALLS, LOVE CANAL, OVERBURDEN MONITORING WELLS
TIME OF SAMPLING: 84/08/28 11:00 DATE PRINTED:84/11/06

PARAMETER	RESULT	
I07310 GASOLINE		ND
I07410 KEROSENE	< 0.1 MCL/L	
I07610 FUEL OIL	< 0.1 MCL/L	
I07510 OIL, LUBRICATING	PRESENT	

**** END OF REPORT ****

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006162 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #5114
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBANY
TEST PATTERN: 10-010:WOSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/12/07

PARAMETER		RESULT
01ZINC	ZINC	0.25 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L
01PHENOL	PHENOLS	4. MCG/L

**** END OF REPORT ****

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SUBMITTED BY:BARLOW

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006163 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #5212
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBA
TEST PATTERN: 10-010:WOSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15:30 DATE PRINTED:84/12/07

	PARAMETER	RESULT
01ZINC	ZINC	0.13 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	16. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006164 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3122
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBA
TEST PATTERN: 10-010:.OSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11:30 DATE PRINTED:84/12/07

PARAMETER		RESULT
01ZINC	ZINC	0.73 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	100. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

**** END OF REPORT ****

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006165 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3123
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBA
TEST PATTERN: 10-010:WOSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12: DATE PRINTED:84/12/07

	PARAMETER	RESULT
01ZINC	ZINC	0.14 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
00DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	< 1. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

**** END OF REPORT ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006166 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #5214
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBANY
TEST PATTERN: 10-010:A0SN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 16: DATE PRINTED:84/12/07

PARAMETER		RESULT
01ZINC	ZINC	0.09 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	< 1. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

**** END OF REPORT ****

COPIES SENT TO: CO(2), RO(0), LPHE(0), FED(0), INFO-P(0), INFO-L(0)

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WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 841006167 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3151
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBANY
TEST PATTERN: 10-010:WOSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 11: DATE PRINTED:84/12/07

	PARAMETER	RESULT
01ZINC	ZINC	2.5 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	< 1. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

**** END OF REPORT ****

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SAMPLE ID: 841006168 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #3133
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBAN
TEST PATTERN: 10-010:A3SN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 12:30 DATE PRINTED:84/12/07

PARAMETER		RESULT
01ZINC	ZINC	0.18 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	2. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

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SAMPLE ID: 841006169 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #6113
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALB
TEST PATTERN: 10-010:WDSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 14:30 DATE PRINTED:84/12/0

PARAMETER		RESULT
01ZINC	ZINC	0.20 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	0.11 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	0.04 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	2. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

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SAMPLE ID: 841006170 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3192
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #6213
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBAN
TEST PATTERN: 10-010:AOSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 14:30 DATE PRINTED:84/12/07

PARAMETER		RESULT
01ZINC	ZINC	0.09 MG/L
02LEAD	LEAD, TOTAL	< 0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01PHENOL	PHENOLS	3. MCG/L
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L

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SAMPLE ID: 841006172 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLTP111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #6214
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALB
TEST PATTERN: 10-010:WOSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15: DATE PRINTED:84/12/0

PARAMETER		RESULT
01ZINC	ZINC	0.09 MG/L
02LEAD	LEAD, TOTAL	0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	0.09 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L
01PHENOL	PHENOLS	2. MCG/L

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SAMPLE ID: 841006173 SAMPLE RECEIVED:84/08/29/11
PROGRAM: 650:DEC SOLID WASTES
SOURCE ID:NFLT9111 DRAINAGE BASIN:01 GAZETTEER CODE:3102
POLITICAL SUBDIVISION:NIAGARA FALLS C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: NIAGARA FALLS,LOVE CANAL,LEACHATE-TREATMENT PLANT
DESCRIPTION:WELL #6114
REPORTING LAB: 10:LABORATORY OF INORGANIC ANALYTICAL CHEMISTRY - ALBANY
TEST PATTERN: 10-010:WQSN - NPDES PRIORITY POLLUTANT METALS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 84/08/28 15: DATE PRINTED:84/12/07

PARAMETER		RESULT
01ZINC	ZINC	0.14 MG/L
02LEAD	LEAD, TOTAL	0.1 MG/L
02BERYL	BERYLLIUM, TOTAL	< 0.02 MG/L
02COPPER	COPPER, TOTAL	< 0.05 MG/L
02NICKEL	NICKEL, TOTAL	< 0.05 MG/L
02SILVER	SILVER, TOTAL	< 0.02 MG/L
01MERCURY	MERCURY	< 0.2 MCG/L
02CADMIUM	CADMIUM, TOTAL	< 0.02 MG/L
02ANTIMONY	ANTIMONY, TOTAL	< 1. MG/L
02CHROMIUM	CHROMIUM, TOTAL	< 0.1 MG/L
02THALLIUM	THALLIUM, TOTAL	< 1. MG/L
22ARSENIC	ARSENIC, TOTAL	< 10. MCG/L
22SELENIUM	SELENIUM, TOTAL	< 5. MCG/L
06DIGEST	DIGESTION OF WATER FOR TOTAL METALS	DONE
01CYANIDE	CYANIDES, HYDROLYZABLE	< 0.002 MG/L
01PHENOL	PHENOLS	< 1. MCG/L

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ALBANY,N.Y. 12233

Versar INC.

sampled
April 6, 1984

ORGANICS

I. DATA SUMMARY

Versar INC.

GC/MS ORGANICS DATA SUMMARY

	Sample Number	Volatile Organics Detected	Concentration	Semivolatile Organics Base Neutrals/AUDS	Concentration
4204	R-999-20	none detected		none detected	
4105	R-999-21	none detected		none detected	
4205	R-999-22	acetone	10 ppb	Phenol	7 ppb
41[illegible]2	R-999-23	none detected		none detected	

Versar INC

PESTICIDES DATA SUMMARY

R-999-20 None detected

QUANTITATION

4115	R-999-21:	α-BHC (0.03μg/ℓ) γ-BHC (0.05μg/ℓ) ∂-BHC (0.13μg/ℓ)
4205	R-999-22:	None detected
4102	R-999-23:	α-BHC (0.03μg/ℓ) γ-BHC (0.04μg/ℓ) ∂-BHC (0.16μg/ℓ)

Versar INC.

ORGANICS DATA REPORT NARRATIVE

Organic analysis was performed on four water samples received on April 6, 1984 (R-999-21, R-999-22, R-999-22, and R-999-23), from Newton Perrins for priority pollutants. EPA methods 8240, 8270, and 8080 from SW 846 were used for the volatiles, the semivolatiles (acid/base neutral), and the pesticide PCB analysis

Samples R-999-21 and R-999-22 were found to contain some low level pesticides which were confirmed by dual column GC/ECI) techniques. Sample R-999-22 was found to have low levels of acetone and phenol.

From Jack Ryan

II. QUALITY CONTROL SUMMARY

Versar INC.

VOA QUALITY CONTROL SUMMARY

Sample No.	1,1-dichloro-ethene	benzene	trichloro-ethene	toluene	chloro-benzene
R-999-23 Matrix Spike	91	85	83	95	100
R-999-23 Duplicate Matrix Spike	88	85	83	89	90
% Spike Recovery Limits (EPA Superfund)	61-145	76-127	71-120	76-125	75-130
Relative % Difference of Duplicate Spike Recoveries	3%	0%	0%	7%	11%

Versar INC.

QC SUMMARY

SEMIVOLATILES DUPLICATE MATRIX SPIKE PERCENT RECOVERY

	MATRIX SPIKE	DUPLICATE MATRIX SPIKE	RPD
1,2,4-trichlorobenzene	54	57	5
Acenaphthene	70	74	6
2,4-dinitrotoluene	74	78	5
Di-n-butylphthalate	10	12	18
Pyrene	77	82	6
N-nitrosodi-n-propylamine	60	59	2
1,4-dichlorobenzene	63	64	2
Pentachlorophenol	70	[illegible]	21
2-chlorophenol	64	78	20
Phenol	69	69	0
P-chloro-m-cresol	61	72	16
4-nitrophenol	66	81	20

Versar INC.

QC SUMMARY

VOLATILE SURROGATES
PERCENT RECOVERY

	Sample Number	1,2-dichloroethane d_4	Benzene d_6	Toluene d_8	4-bromofluorobenzene
4204	R-999-20	96	106	101	96
4105	R-999-21	93	101	101	97
4205	R-999-22	95	100	98	96
[illegible]	R-999-23	75	99	98	96
4102	R-999-23 MS	92	99	100	96
4102	R-999-23 DMS	96	98	93	88

Versar INC.

QC SUMMARY

VOLATILE SURROGATES PERCENT RECOVERY

Sample Number	2 fluoro-phenol	Phenole D6	Nitro-benzene D8	2 Fluoro biphenyl	2,4,6 tri-bromophenol	Terphenyl D14
Reagant Blank	60	94	74	79	25	128
R-999-20	97	105	63	79	71	122
R-999-20 MS	64	73	70	71	72	91
R-999-20 DUP	69	71	72	75	86	103
R-999-21	35	37	35	53	53	27
R-999-22	55	65	67	71	79	87
R-999-23	43	53	44	55	69	71

Versar INC.

857.2 - NEW YORK

QC SUMMARY
PESTICIDE ANALYSIS BATCH 21

SURROGATE RECOVERY

	Sample Number	Percent Recovery
	RB (Reagent Blank)	85%
4204	R-999-20	89%
4105	R-999-21	17%
4205	R-999-22	40%
4102	R-999-23	50%
4205	R-999-22 (DUP)	55%
[illegible]05	R-999-22 (MS)	37%

MATRIX SPIKE RECOVERY (Sample No. R-999-22 MS)

Compound	Percent Recovery
a-BHC (Lindane)	57%
Heptachlor	68%
Aldrin	66%
Dieldrin	83%
Endrin	84%
pp-DDT	53%

Choice of the Comparative Approach Methodology for Habitability Decision-Making

APPENDIX 7

Appendix 7

CHOICE OF THE COMPARATIVE APPROACH METHODOLOGY FOR HABITABILITY DECISION-MAKING

In opening discussions with the experts on March 14, 1984, Dr. Paul Wiesner of CDC outlined the general requirements for habitability criteria. According to CDC, in order for criteria to be established, they:

1. Will have to apply to Love Canal: the criteria may be unique to the Canal or generic and applicable to other sites; and

2. Must be objective, quantifiable, reproducible; and

3. Must give a yes or no answer using the defined process.

At the first meetings on March 14 and May 3, 1984, several approaches to the development of habitability criteria were discussed:

1. Identification of time trends in environmental data to evaluate the effectiveness of remediation;

2. Risk assessment based on measured levels of chemicals in the EDA and extrapolation of animal toxicity data;

3. Application of environmental and health standards, criteria, or guidelines;

4. Epidemiological assessment;

5. Comparison of Love Canal after remediation with a state-of-the-art hazardous waste facility meeting existing regulations;

6. Comparison of environmental data from the EDA to similar data from a matched, inhabited control area;

7. Combinations of the above.

The options were discussed in varying levels of detail. Some were discussed as the primary basis of a habitability decision, others as supplementary or supporting methodologies. The approach selected as the most appropriate for the determination of habitability of the EDA is a combination of the use of relevant federal and New York State standards, criteria, or guidelines, which are generally derived from risk assessment methodologies, and the comparison of levels of LCICs in the EDA with levels in inhabited urban areas not impacted by a landfill. The following sections summarize discussions by the expert consultants regarding the options that led to the choice of this approach.

TIME TRENDS

The major assumption inherent in this approach is that levels of chemicals present in the environmental media of the EDA in 1977 should now be reduced due to the construction of the clay cap and the leachate collection system and the installation of a synthetic membrane liner. Application of this methodology would require evaluation of monitoring data between 1977 and 1984 and identification of time trends where they exist. By itself, however, this methodology is not sufficient. In order to meet the yes/no decision requirement, its application would involve the establishment of standards based upon a quantitative risk assessment and a determination of an acceptable level of risk from various kinds of exposures to the different environmental media in the EDA.

The major fault of the time trend approach centers on the lack of sufficient quantified chemical data for the EDA, and the fact that none of the environmental test data collected thus far demonstrates a migration of chemicals through environmental pathways into the EDA from the Canal and the area just adjacent to it. This problem was best summarized by Dr. Stolwijk:

"In effect all the measurement and monitoring carried out at Love Canal does not produce a clear picture of the exposures in 1977 or 1978, or in 1983, which would allow for a clear comparison of the time trends in either concentration or species of chemicals at any particular site or at a number of sites" (paper presented June 29, 1984 to scientific experts).

RISK ASSESSMENT

Chemical risk assessment is the use of available toxicological and/or epidemiologic data to estimate the health effects such as carcinogenicity, mutagenicity, and teratogenicity from the exposures of man to hazardous materials. This approach to a habitability decision in the EDA would require four steps:

- HAZARD IDENTIFICATION - The qualitative evaluation of the adverse health effects of a substance(s) in animals or in humans

- EXPOSURE ASSESSMENT - The evaluation of the types (routes and media), magnitudes, time and duration of actual or anticipated exposures and of doses when known; and when appropriate, the number of persons who are likely to be exposed

- DOSE-RESPONSE ASSESSMENT - The process of estimating the relation between the dose of a substance(s) and the incidence of an adverse health effect

- RISK CHARACTERIZATION - The process of estimating the probable incidence of an adverse health effect to humans under various conditions of exposure, including a description of the uncertainties involved

In order to determine the risks of reinhabiting the EDA, each of these steps would have to be carried out for each chemical of toxicologic significance identified in each medium in the EDA or a group of chemicals that was demonstrated to be reasonably representative of the total.

Toxicological data are often obtained as the result of tests performed by exposing laboratory animals to the chemical in question. The percentage of animals exhibiting a response allows for a risk to be quantified and extrapolated into human terms based on the physiological and metabolic relationships between humans and the test animal.

The advantage of using risk assessment is that there are a variety of established methods of determining qualitative and quantitative risks for exposure to some chemicals in different environmental media. In addition, there is experience within the scientific community in applying risk assessment techniques to a variety of situations. The advantage of this experience is the potential for incorporating traditional scientific peer review procedures into the habitability decisionmaking process, thus lending credibility and strength to the ultimate decisions.

Risk assessment and risk management are the bases for many federal regulatory decisions. Generally in addressing a particular regulatory issue, a risk assessment is performed. The risk assessment information is reviewed by the government agency which makes a risk management decision. After balancing the health assessment, costs, and other factors, a decision is made concerning what should be the appropriate level for the standard.

Among the obstacles involved is the lack of a complete or adequate toxicologic or epidemiologic data base in the literature related to carcinogenesis, mutagenesis, and teratogenesis for many of the chemicals that might be detected in the EDA as well as limited knowledge regarding the chemicals' interactive effects. Furthermore, there are few, if any, direct measures of exposure among the many past, present, or future residents of the EDA. To counter these problems, it was suggested that the toxic effects of a select group of Love Canal chemicals could be reviewed. However, this suggestion appeared to be inadequate to the overall charge to develop habitability criteria for the EDA, and was rejected by the panel.

There is no firm consensus among scientists or among Federal/State agencies as to the specific process or assumptions that would be used in a risk assessment for the Love Canal EDA. EPA has published proposed guidelines for risk assessment and has solicited comment from the scientific community. As of this writing, the comments have not been reviewed nor have responses been prepared. At present, there is only one federal or New York State established standard, criterion, or guideline for chemicals identified in the EDA ambient air, indoor air, and soil (i.e., 1 ppb level of concern for 2,3,7,8 TCDD in residential soil). Limits remain on the knowledge of the relationship between laboratory animal and human responses to chemical exposures.

There was concern by some experts that the risk calculated at Love Canal would be perceived by the public as a guarantee of a specific risk level. As in all regulatory decisions, however, when new scientific information is available the scientific assessment may change. For example, well-designed and implemented animal carcinogen tests have not been performed on all chemicals. Theoretically, the decision on risk could significantly change, based on new data.

Experts are concerned that residents will incorrectly perceive that any risk greater than zero could be translatable into a specific individual, measurable danger to that person or their families. Such translation of quantitative risk assessments to individuals is impossible.

Discussion of risk assessment concluded with an agreement of most of the experts that the chosen habitability criteria methodology would need to be reproducible, not only by a contemporary peer group, but by future peer groups, particularly to avoid a recurrence of the trauma and frustration experienced by EDA residents concerning prior changes in habitability decisions. The experts felt that a comparability approach best satisfied these needs.

STANDARDS, CRITERIA, AND GUIDELINES

The use of standards to establish safe concentrations of chemicals in environmental media was discussed extensively as a step in implementing other methodologies such as time trend analysis and risk assessment. The setting or observance of standards was also advocated by some as a separate approach in itself. With this approach, the EDA environmental concentration would be compared against the standards to determine whether the EDA was habitable.

The case in favor of the use of standards was stated by Dr. Silbergeld:

> "It has been the position of EDF (Environmental Defense Fund), at Love Canal and other Superfund sites, to recommend adherence to criteria and standards, which were established without the pressures and considerations of hazardous waste site remediation, in order to guide decisions such as rehabitation. We recognize that such standards and criteria do not cover all the chemicals found at Love Canal, and, moreover, that these standards and criteria were developed for situations of human/environmental interface which differ from residences in Love Canal... However, our analyses of Superfund remedial actions convince us that these problems are not real impediments to the acceptance of our recommended approach. First, although site contamination may involve hundreds of chemicals (as at Love Canal), among those chemicals are at least several for which standards and criteria have been developed. Remedial actions and habitation decisions based only on those chemicals with standards and criteria will serve to cover those for which standards and criteria do not exist. For example, in meeting a standard for dioxin, it is assumed that clean-up measures will also provide adequate removal of concomitant PCBs, lindane, chlorobenzenes, etc. Second, standards and criteria developed for specific

environmental media--such as air or drinking water--can be adapted to soils or other media using well established methods for estimating exposure. The documentation for each standard or criterion contains extensive discussion of exposure pathways and assumptions of human exposure; these can be used to reevaluate exposure and dose through alternate routes..." (Letter from Dr. Silbergeld to Dr. Huffaker, DOH, November 2, 1984).

The problems associated with the use of standards are related to those described for risk assessment. Standards are usually based on quantitative and qualitative risk assessments that are based on toxicological data and, as a result, are subject to change when research progress is made. Also, as stated by Dr. Silbergeld, most existing standards have been set for media or exposure situations that do not directly correspond to those important in deciding habitability of the EDA in which the concern is related to residential soil and indoor air exposures. Also, it may or may not be appropriate to apply comprehensive drinking water standards to EDA groundwater and surface water for which there are no direct routes of exposure to potential residents of the EDA. Many health protection standards have been set at occupational settings, i.e., healthy adults exposed 8 hours per day, 5 days per week. There is no established, peer reviewed, commonly accepted procedure for extrapolating occupational standards to apply them to people of all ages, including the unborn, and all health conditions, for 24-hour, continuous exposures in residential settings.

In one instance, direct application of a level of concern to a residential setting was known to be possible and the experts recommended that guideline be adopted as part of the habitability methodology. Specifically, the experts advocated the use of the 1 ppb level of concern for TCDD dioxin, in residential soil which was previously established through risk assessment; peer reviewed and applied at Missouri sites. The habitability criteria recognizes the importance of standards, guidelines, and criteria and will use any established standards, guidelines, or criteria which exist in peer-reviewed and "final" form which are appropriate to residential settings. The responsibility for identification and choice of additional standards was given to CDC and DOH. Assistance in identifying such standards for chemicals present in measurable concentrations in the EDA will be sought from EPA.

EPIDEMIOLOGICAL ASSESSMENT

Some discussion focused on the use of epidemiological data as a supplementary methodology. Health information and other data such as records of school and employment absenteeism would be collected and reviewed for irregularities possibly related to chemical exposure. The need for such a study grew from the concern that if exposure at Love Canal has resulted in health disorders that compromise the quality of life, any methodology related to habitability should address the potential for the existence of these disorders. In a manner similar to risk assessment, epidemiological assessment provides some measure of real meaning to residents regarding the safety of their homes. However, there is also the same potential for misinterpretation by the public. The use of epidemiological data as the basis of habitability decisions may give an inaccurate impression that human harm is required before action should be initiated.

On a pragmatic level, it is difficult to ascribe a cause-effect relationship between subjective health end points and environmental exposures. Also, there is only a small amount of data in existence. Any broad habitability decisions based on these data could be inappropriate and misleading.

COMPARISON OF LOVE CANAL TO STATE-OF-THE-ART FACILITY

This methodology would involve the review of environmental monitoring data and design features for Love Canal and its remedial measures with those of a hazardous waste facility that meets all existing regulations. Comparability was the main difficulty cited for this approach. Other facilities would contain wastes with chemical characteristics different from those deposited at Love Canal. Also, no other site would have exact the same geologic setting. Finally, regulations governing modern sites require design standards and corrective action to clean up any leaks which are discovered. EPA's regulations do provide for the development of site-specific groundwater standards (called Alternative Concentration Limits). EPA requires that such limits be based on a site-specific risk assessment. Each facility's operating and closure requirements are determined on an individual basis allowing little or no common ground for comparison to the Love Canal site.

Although requirements for operation and closure are often determined on an individual basis, similar strategies are imposed and state-of-the-art comparisons could be approached within that perspective. Within the Love Canal circumstances, disposal in the canal in the past would be evaluated separately from leachate containment and treatment now.

COMPARISON OF EDA TO INHABITED URBAN AREA

The basis of this approach is to match environmental sampling results from the EDA to those from similar, inhabited communities which are not affected by a hazardous waste site. The method relies on the comparison areas to provide a relative measure of the contamination in the EDA. Habitability decisions are made, objectively based on the differences in observed chemical concentrations. The experts felt statistical significance criteria would generally be most appropriate for determining how much higher the EDA concentrations would need to be to prevent rehabitation. Exceptions were made to this plan for contamination in media governed by existing federal or New York State standards, criteria, or guidelines.

This methodology was deemed adequate as the core of habitability decision-making. In addition, the comparison approach provides reassurance, to those EDA residents in habitable neighborhoods, that their homes are as safe as those of others in the comparison areas.

Disadvantages of the comparison approach include difficulty in identifying appropriate comparison areas, choosing an appropriate method of statistical comparison between the EDA and the control areas, and taking new environmental samples in both the EDA and the comparison areas. In addition to the problem of ensuring comparability, the costs and time associated with conducting duplicate sampling efforts would be greater than for applying standards or other approaches which require sampling the EDA alone. Further, there is no guarantee that the comparison areas are actually "safe," only that they are inhabited and not known to be impacted by a hazardous waste site.

RECOMMENDED APPROACH

To address the special concerns of the Love Canal community, the Proposed Habitability Criteria recommend a unique multi-step methodology to assess the habitability of the EDA. This approach relies on criteria, standards and guidelines where they exist for chemicals identified in the Love Canal EDA. In addition, to further alleviate the concerns of the community, this document recommends that applicable federal and New York State criteria, standards and guidelines be augmented with a comparison of the EDA to comparable inhabitated areas. It is not suggested that the recommended approach for Love Canal is either necessary or appropriate for other sites. Rather, the proposed criteria are specifically suggested for Love Canal because of the unique history of events at this site.

WDR100/28

Criteria for Residential Viability as Criteria for Habitability in the Love Canal EDA

APPENDIX 8

Appendix 8

CRITERIA FOR RESIDENTIAL VIABILITY AS CRITERIA FOR HABITABILITY IN THE LOVE CANAL EDA

by

Martha Fowlkes, Ph.D. and Patricia Miller, Ph.D.

We have designated 13 areas that we propose be treated as discrete sections or "neighborhoods" with respect to the assessment of their potential for habitability within the EDA (see attached map). The designation of the sub-areas is based on our own familiarity with the area in consequence of the research we conducted in 1981-2, a tour of the EDA in September 1984, conversations with various present and former homeowners and renters in the EDA in September, and reference to the strata that organized the earlier data collection efforts of the EPA. Nonetheless, responsibility for the boundaries described below is appropriately ours.

In drawing the boundaries, we considered the patterns of roadways and waterways that traverse the EDA, as well as the distribution and location of housing units, and the patterns of social interaction among remaining and former residents to the extent that those are/were geographically based. The areas are not intended to imply the past or present existence of definitive, separate, or even socially cohesive neighborhoods. (Undoubtedly every current and former Love

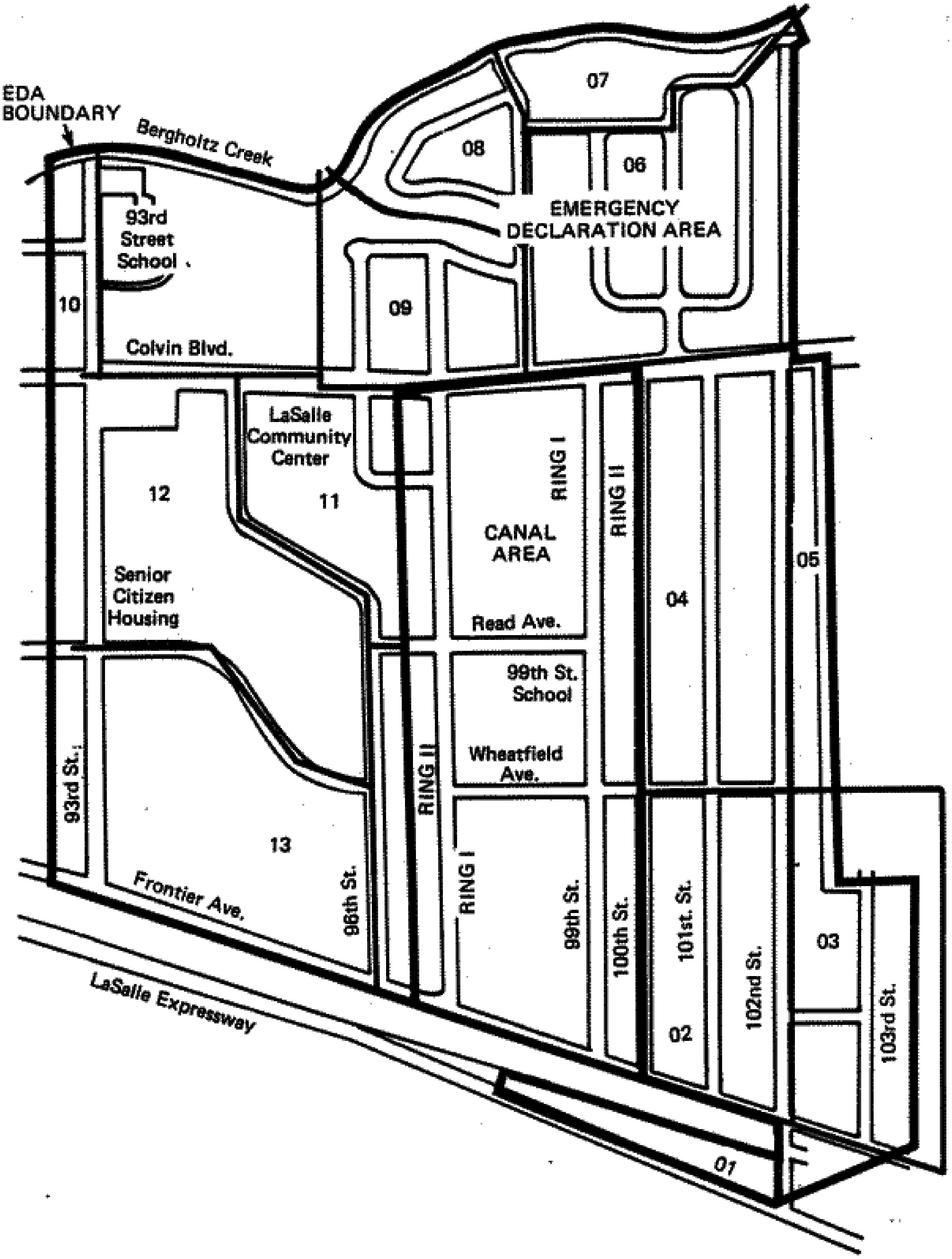

FIGURE 8–1
Emergency Declaration Area Neighborhoods

CH2M HILL

Canal resident has a somewhat unique sense of the meaning and outlines of "neighborhood" as that was shaped by individual experience.) Rather, the areas have been defined (in the manner of subdivisions) in an effort both to recognize and to maximize geographic and residential coherence within a system of clear boundaries. Thus, the areas contain obvious arrangements of housing, in most cases with a potential to become definitive, socially logical residential groupings.

In our view, the designation of an individual home as "safe" in terms of chemical risk is a necessary but not sufficient basis for a declaration of habitability; it is essential that the criteria established for assessing habitability encompass as well criteria for assessing residential viability. Our reasoning in insisting on the need for the establishment of residential viability as a component of habitability overall is as follows: (1) the EDA is unevenly contaminated; (2) some homes within the EDA may be sufficiently contaminated or deteriorated to preclude habitability on the grounds of safety alone; (3) if such homes exist they are more likely to be clustered than randomly distributed; (4) ascertainment of habitability by sub-areas will ensure that the maximum number of habitable homes become available for occupancy in a setting that is both environmentally and socially "normal;" (5) habitability decisions that treat the homes within a given sub-area as habitable or not on an essentially all or nothing bases will

enhance the quality of life for families that live there; (6) homes, then, are not habitable (residentially viable) in and of themselves without reference to the habitability of other homes in the immediate vicinity. To repeat our earlier assertion, a house-by-house declaration of habitability based solely on chemical risk would create an area pock-marked by environmentally contaminated "no man's lands." Such a residential pattern is incompatible, indeed utterly inconsistent, with any normatively based--lay or scientific--definition of community. On the other hand, an assessment of each area in terms of its overall habitability (as measured by comparative levels of chemicals found in soil, water, and indoor and outdoor air), while conforming to accepted scientific conventions rooted in probability theory would not be adequate in this instance. Such a strategy could obviously not suffice to dispel the distrust of science that has accumulated in the minds of many in the matter of Love Canal. Neither could it speak to the understandable concerns of existing or potential individual residents regarding the environmental quality of their own domiciles. Failure or inability to address these concerns effectively at the house level will impact negatively on the scientific credibility attending any assertion of habitability and, therefore, upon any subsequent community that is established in the EDA.

WDR102/009

Selection of Love Canal Indicator Chemicals

APPENDIX 9

Appendix 9

SELECTION OF LOVE CANAL INDICATOR CHEMICALS

This appendix discusses the selection of the Love Canal Indicator Chemicals (LCIC) by medium and the rationale behind their selection. The concept of using a select number of chemicals to represent the larger number of total chemicals found at a hazardous waste landfill has been used at other hazardous waste sites in Niagara Falls. The indicator chemical concept is based in part on determining what chemicals were deposited in Love Canal and viewing this composite as the "primordial ooze" which could have left the canal to contaminate the EDA. Rather than analyze for all the chemicals that could have been deposited in Love Canal, a select few of the more mobile and stable chemicals could be considered to represent the potential migration and extent of migration of the mixture of Love Canal chemicals. The intent is to select several LCIC whose types and properties are representative of a group of Love Canal chemicals that can be used to determine the habitability of the EDA.

Fundamental to the selection of LCIC is an understanding of their intended use in the comparison aspect of determining the habitability of the EDA. The key question to be answered is whether the concentrations of chemicals in the EDA originating from Love Canal are significantly higher than those of the same chemicals found in other urban areas in the vicinity of Niagara Falls. The comparison aspect of the habitability criteria produces a determination of habitability, relative to a similar urban area that is not affected by a hazardous waste landfill, rather than a determination of absolute habitability or an evaluation of health risks (risk assessment). Inherent in this approach is the assumption that the EDA may have been affected by migration of chemicals from Love Canal. Thus, the comparison should be based on chemicals that were disposed of in the canal and show a possibility of having migrated from the canal.

LCIC MEDIA

The selection of LCIC media is based on several factors, including (1) possibilities of exposure to humans via the media; (2) identification of a transport path for Love Canal pollutants by the media; (3) detection of Love Canal pollutants is likely in the media; (4) knowledge (or lack of knowledge) of the possibilities of contamination in the EDA based on existing data and current remedial measures. The LCIC media currently proposed are air and soil. Based on the above factors, these two media are strong candidates for selection. However, a review of other LCIC media is necessary to ensure that the habitability criteria are fully responsive to exposure risks in the EDA.

The following sections review alternative LCIC media using the three factors mentioned above as the primary criteria. The media considered in this review are soil, air, groundwater, surface water, sediments, sumps and flora and fauna. Recent and continuing remediation efforts have significantly altered the circumstances governing the possible presence of LCIC in each medium of exposure or transport. A prerequisite of the habitability criteria requires completion of remediation before application of the comparative approach.

AIR

Indoor Air

The air inside individual houses presents the greatest likelihood of exposure to LCIC in the EDA over an extended period of time. The inhalation of indoor air could be on a 24-hour-a-day basis for infants, the elderly, or for all members of a family during periods of extreme weather.

The indoor air could become contaminated through seepage of LCIC into basements and perhaps through the ambient air. Other sources of indoor air pollution are aspects of everyday life for many people and can include smoking, cooking, painting, and use of various household chemicals. These other sources may confound the ability to detect and interpret the presence of LCIC and are a reason for testing both occupied and unoccupied houses in the EDA and comparison areas.

Ambient Air

Ambient air would be tested as necessary primarily to interpret the results of indoor air sampling, although ambient air was an obvious source of past chemical exposure at Love Canal. Residents reported an odor of chemicals near Love Canal at times in the late 1970's. There was also a noticeable odor during the digging of trenches for the containment of leachate at Love Canal. However, there may be a greater long-term exposure to LCIC in the ambient air of the EDA due to emissions from chemical plants in Niagara Falls. Therefore, it would be difficult to discern whether a difference in ambient air quality between the EDA and a comparsion area outside of Niagara Falls is due to Love Canal or not.

SOIL

The shallow soil on individual lots in the EDA could result in human exposure to LCIC through dermal contact or ingestion. Deeper soil could contain LCIC that could move upward or seep into basements when the ground is saturated with water. Thus, deeper levels of contamination could result in surface soil contamination or indoor air contamination over time. The transport of soil as fill could be a source of LCIC "hot spots" in the EDA.

GROUNDWATER

Groundwater is clearly a major potential pathway for transport of Love Canal contaminants into the EDA. Although exposure potential is relatively low from groundwater contamination directly, groundwater could serve as an exposure medium via basement sumps or soil. A key factor in considering groundwater as an LCIC medium is the degree to which Love Canal contamination has been transported into the EDA via groundwater.

Shallow Groundwater

Shallow groundwater was a significant medium for the transport of LCIC to air and soil in the past. The monitoring of shallow groundwater (both its physical elevation and chemical quality) is an indicator of the efficacy of remediation efforts at Love Canal. Direct exposure to shallow groundwater in the EDA would be rare, especially now that remediation efforts have extensively altered the storm drainage network around Love Canal.

A detailed study of DEC well data has been conducted to investigate Love Canal contamination in groundwater as a function of (1) distance from the tile drains and (2) time. The analysis tools included linear regression, analysis of variance, non-parametric correlation, and graphics.

The results of the study indicate: (1) there are not enough data at this time to detect temporal changes in groundwater contamination; (2) there is a definite "cut-off" of contamination within 250 feet of the tile drains (this is within the Ring II boundary), and, (3) there is no apparent relationship between detection of a potential Love Canal contaminant and distance from the Canal within the EDA. The above results and the discussion in Appendix 6 indicate that groundwater has not been a major transport of contaminants into the EDA. Also, DEC is continuing a well monitoring program to prevent groundwater from becoming a transport medium into the EDA.

Deep Groundwater

Groundwater is not a source of domestic water supply in the Love Canal area which is served by the Niagara Falls water system. Evidence on the hydrogeology of Love Canal and the surrounding area presented to the panel indicates the presence at the site of a layer of soft clay at depths of 12 to 25 feet that is, in turn, underlain by clayey glacial till. Both layers contain relatively non-permeable clay that rests on weathered dolomite bedrock, which holds the deep aquifer in the region.

SURFACE WATER

There are indications that surface water runoff may have been a medium to transport LCIC prior to remediation efforts at Love Canal, such as the leachate treatment plant. Surface water can also receive chemicals from soil or the sediments in creeks and sewers. With remediation and the passage of time no further LCIC contamination of surface water is expected in the EDA.

SEDIMENTS

Remedial measures for cleanup of creek and sewer sediments are planned or are being undertaken. Disposal of the sediment is still at issue. Since habitation is predicated on these measures being successful, sediments should not be incorporated into the habitability study until these remedial measures are complete. Otherwise, indeterminate delays would result. Remediation of contaminated TCDD sediments is already included in the habitability criteria; thus there is no need to include sediment as an LCIC medium.

SUMPS

Sumps as a sampling medium could include sediments in the sump, water from the sump, or both. Transport of Love Canal contamination to sumps could have occurred by migration through either the soil or shallow groundwater. Because soil is already an LCIC medium and groundwater has been addressed above, sumps were eliminated as an LCIC medium.

Flora and Fauna

Flora and fauna are not considered to be likely for monitoring LCIC, especially after remediation. Analysis of plants or animals (such as voles) could possibly indicate past contamination. They do not serve as media of exposure similar to air, soil, or water.

SELECTION PROCESS

The process of selecting the LCIC was an iterative one that involved the scientific experts, toxicologists, chemists, statisticians, engineers, and physicians. Varied and divergent viewpoints were considered in developing the criteria that led to selection of the LCIC. As a result of the diversity of viewpoints, three lists of possible LCIC were developed in response to different assumptions on the use of the LCIC.

Among the factors considered in the development of selection criteria were the toxicological effects of the chemicals identified at very low levels in the EDA media and whether New York State or federal standards exist for any of these. The basic physical, chemical, and biological properties of Love Canal chemicals were also important concerns. Other considerations involved types of transport from the canal, including migration by groundwater flow and surface flow, and transport by other means such as hauling of Love Canal soils for use as fill dirt. The requirement that the LCIC be chemicals known to have been disposed of in Love Canal was discussed extensively, with general agreement that the requirement should be maintained.

These concerns led to the development of three sets of selection criteria that were used to compile the lists of LCIC. The criteria were applied to the environmental data that had been collected at Love Canal. Only data collected after the Love Canal treatment plant began operation in December 1979 were considered. The data include the following monitoring studies: (Table 3-1, Appendix 3)

- 1980 EPA Environmental Monitoring Study
- Malcolm Pirnie Study
- New York State Department of Environmental Conservation (NYSDEC) groundwater monitoring
- New York State Department of Health (NYSDOH) Litigation Studies
- E.C. Jordan Soil Study
- NYSDEC Air Sampling
- Hooker Chemicals Air Sampling

- EPA Storm Sewer Sampling
- Dioxin Sampling (NYSDOH, NYSDEC)
- NYSDEC Love Canal Treatment Plant Influent Data

SELECTION CRITERIA

Selection criteria were developed for three different sets of considerations or assumptions. The gradient transport criteria are based on using LCIC to represent chemicals known to have been disposed of at Love Canal and assuming a migration of chemicals from the canal to the EDA that would result in a decreasing gradient of concentrations away from the canal. The nongradient transport criteria are largely the same as the gradient transport criteria except that the transport of chemicals from the canal to the EDA is assumed to have occurred such that a decreasing gradient of concentrations from the canal is not required. The toxicological criteria are concerned with those chemicals found in the Love Canal environmental monitoring studies that have applicable New York State or federal standards, criteria or guidelines.

The gradient transport criteria are as follows:

1. Chemicals known to have been disposed of at Love Canal.

2. Chemicals with physical, chemical, and biological properties that make them appropriate for use as an indicator chemical.

3. Chemicals unlikely to be confounded by other sources of contamination (nonubiquitous).

4. Chemicals that indicate decreasing concentrations with distance from the canal representative of migration via natural processes.

5. Chemicals found in the influent to the Love Canal treatment plant.

6. Chemicals that lend themselves to reliable analytical chemistry measurement.

7. Chemicals whose concentrations in the EDA show a statistical correlation with other Love Canal chemicals.

8. Chemicals that have detectable measurements from previous environmental monitoring studies.

The nongradient transport criteria are the same as for the gradient transport criteria except that criteria 4 and 7 are not included. Instead, the nongradient transport criteria include:

9. Those chemicals that indicate higher concentrations in the EDA than in Rings I and II.

The toxicological criteria (Toxicological LCIC) are based solely on the following criteria:

1. Chemicals detected in the EDA or in Rings I and II.

2. Chemicals for which relevant New York State or federal standards, criteria, or guidelines exist.

APPLICATION OF CRITERIA

Table 9-1 lists those chemicals known or likely to have been deposited in Love Canal. The list is a product of research into the Hooker Chemical manufacturing processes and information provided by Hooker Chemical of chemicals they know were deposited in the canal. Table 9-1 is also referred to as the Hooker-specific chemicals list or the list of Love Canal chemicals.

Table 9-1
LIST OF CHEMICALS LIKELY TO HAVE BEEN
DEPOSITED AT LOVE CANAL

acetyl chloride
arsenic
benzene
benzyl chloride
beta BHC
gamma BHC
carbon tetrachloride
chloroform
chromium
hexachlorobenzene
monochlorobenzene
1,2,3,4 tetrachlorobenzene
trichloroethylene
2,4,5 trichlorophenol
actic anhydride
benzotrichloride
chloronaphthalene
hexachlorobutadiene
hexachloroethane
toluene
1,2 dichlorobenzene
1,3 dichlorobenzene
hexachlorobenzene
2,4,6 trichlorophenol
trichloronaphthalenes

antimony trichloride
arsenic trichloride
benzoyl trichloride
alpha BHC
delta BHC
carbon disulfide
chlorobenzene
2- and 4-chlorotoluene
copper
1,2,4,5 tetrachlorobenzene
pentachlorobenzene
1,2,4 trichlorobenzene
TCDD
acetic acid
benzoic acid
1,1 dichloroethene
dichlorophenol
hexachlorocyclopentadiene
naphthalene
pentachlorophenol
1,4 dichlorobenzene
tetrachloroethylene
2,4 dichlorophenol
dichloronaphthalenes

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PHYSICAL, CHEMICAL, AND BIOLOGICAL PROPERTIES

Many hazardous chemicals (as defined by the Comprehensive Environmental Response Compensation and Liability Act, CERCLA) produced by Hooker Chemical were deposited in Love Canal. These chemicals have various physical and chemical attributes that make some more appropriate than others as chemical indicators of the release and extent of contamination in the EDA. Six factors have been used to evaluate and select indicator chemicals for air and soil from those chemicals listed in Table 9-1. These factors are:

- Water solubility
- Soil binding properties
- Biodegradability
- Chemical stability and reactivity
- Analytical measurement at low levels
- Ubiquity

Water solubility is the measure of the maximum amount of a chemical which will dissolve in water for a given set of conditions (e.g., temperature and pressure). Although other factors affect the concentration of a chemical in water, the chemical's water solubility provides an indication of the maximum amount that may migrate. Therefore, chemicals with high solubilities will dissolve readily in groundwater and move at high concentrations with the groundwater; chemicals with low solubilities will move at low concentrations with the groundwater. As the groundwater moves away from a chemical source, a dissolved chemical will disperse and its concentration will decrease. It is, therefore, desirable to look for chemicals with high solubilities that will maintain measurable concentrations as the groundwater moves away from the chemical source. Generally, low molecular weight compounds are more soluble and, therefore, better indicator chemicals than high molecular weight compounds.

The process of a chemical binding to (or adsorbing onto) soil retards and may even prevent migration from a contaminant source. Inorganic chemicals will chemically bind to clay substances within soil. Organic compounds will adsorb to soil with high natural organic material content. The extent to which a chemical will sorb to soil is defined as the chemical's adsorbtivity. Chemicals with low adsorbtivities will travel further and faster in the groundwater and will be more suitable as indicators than chemicals with high adsorbtivities.

Biodegradation and chemical instability are factors influencing the longevity of chemical contaminants in the environment. Chemicals that are persistent in the environment are better indicators of contaminant migration than chemicals that break down or are transformed into other species. Biodegradation is the process by which a chemical is broken down to simpler molecules by bacteria and other microorganisms. A chemical which is readily biodegraded will not be a reliable indicator of contaminant movement. Chemical instability (or reactivity) refers to the tendency of chemicals to react when they are in contact with water, soil, air, heat, light, or other chemicals which may be in the environment. In general, the more reactive a chemical, the less reliable it is as an indicator chemical. The stability of a chemical relative to the analytical process is also a factor in choosing indicator chemicals.

The ability to measure low levels of a chemical is another factor in the choice of indicators. Chemicals that are difficult to measure using accepted, standard techniques are undesirable as indicators.

"Ubiquity" of a chemical refers to the frequency of its occurrence in the environment from sources other than the suspected source (i.e., the Love Canal). The more assurance that a chemical is unique to the source, the more reliable that chemical is as an indicator. It is necessary that indicator chemicals be Hooker and Love Canal specific. Chemicals that cannot be directly attributed to Hooker processes are not suitable indicators.

Since the migration pathways from Love Canal to the EDA are not well understood or characterized, it is difficult to discuss the soil-chemical interactions governing migration. However, the cations from the metal chlorides deposited (arsenic trichloride, aluminum trichloride, and antimony tricholoride) typically have low migration potentials due to soil cation exchange. Soil cation exchange would also inhibit migration of other metals such as copper and chromium. Organic chemicals with extremely low water solubilities also have low migration potential. These chemicals include compounds such as hexachlorobenzene, 2,3,7,8-TCDD, hexachlorobutadiene, hexachlorocyclopentadiene, and trichloronaphthalenes.

Many of the chemicals deposited by Hooker will hydrolize or oxidize in groundwater or react with soil and therefore are termed "unstable." Acid chlorides and acid anhydrides and other reactive compounds such as acetyl chloride, benzyl chloride, benzal chloride, benzotrichloride, benzochlorobenzyl disulfide, acetic anhydride, and benzoyl chloride are very unstable and, therefore, are not suitable indicators.

Chemicals such as dichlorophenols, acetic acid, toluene, benzene, and benzoic acid are readily biodegradable by soil microorganisms and are not suitable indicator chemicals.

Niagara Falls is a highly industrialized area with a great number of potential sources of environmental contamination.

There are a large number of landfills and chemical disposal sites that have been used by a large number of different chemical industries. Chemicals such as benzene, chloroform, trichloroethylene, toluene, naphthalene, carbon disulfide, tetrachloroethylene, dichloroethene, hexachloroethane, and 1,4-dichlorobenzene (present in mothballs) may exist at many locations at Niagara Falls. Locations chosen as comparison areas for any future study in this region could be exposed to numerous sources of these chemicals. Thus, these chemicals are unsuitable as indicator chemicals.

The following chemicals are highly Hooker-specific, persistent in the environment, and have sufficiently high migration potential in groundwater, air, and soil to be considered as Love Canal indicator chemicals:

- BHCs (lindane, the gamma isomer, may have been widely used in the area as a pesticide)
- Monochlorobenzene
- Dichlorobenzenes (except the para isomer)
- Trichlorobenzenes
- Tetrachlorobenzenes
- Pentachlorobenzene

- Chloronaphthalenes
- Dichloronaphthalenes
- Chlorotoluenes
- Trichlorophenols

COMPARATIVE CRITERIA

Those Hooker chemicals with unsatisfactory physical, chemical, or biological properties as well as ubiquitous chemicals are listed in Table 9-2, while Table 9-3 provides a list of chemicals (reported by NYSDEC) that have been found in the influent to the Love Canal treatment plant. Table 9-4, attached at the end of this appendix, provides some basic statistics on the environmental data collected at Love Canal since December 1979, including the mean, maximum, and minimum concentrations, number of observations, and number of quantifiable results.

A variety of statistical tests were applied to the data collected at Love Canal after December 1979 to evaluate migration from the canal to the EDA. The tests were designed to indicate which chemicals showed decreasing concentrations from Rings I and II to the EDA. The tests used to show this trend were as follows:

Table 9-2
PHYSICAL, CHEMICAL, BIOLOGICAL, AND UBIQUITOUS PROPERTIES

The Hooker-specific chemicals listed below are inappropriate for use as marker chemicals for the following reasons:

Reactivity--Compounds listed will hydrolyze or oxidize in groundwater or react with soil:

- acetyl chloride
- benzyl chloride
- benzal chloride
- benzotrichloride
- acetic anhydride
- benzoyl chloride

Biodegradability--Chemicals listed will be rapidly biodegraded by microorganisms in the soil:

- dichlorophenol
- acetic acid
- benzoic acid

Ubiquity--Chemicals listed could come from many sources in the Niagara Falls area:

- benzene
- chloroform
- trichloroethylene
- toluene
- naphthalene
- carbon disulfide
- tetrachloroethylene
- dichloroethene
- hexachloroethane

Low Migration Potential--The following chemicals will show low migration potential in groundwater and soil due to cation exchange capacity, adsorptivity, and low water solubility:

- arsenic
- antimony
- copper
- chromium
- TCDD
- hexachlorobenzene
- trichloronaphthalenes

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Table 9-3
CHEMICALS FOUND IN LOVE CANAL TREATMENT PLANT INFLUENT

benzene
chlorobenzene
chloroform
1,1,2,2 tetrachloroethane
1,2 dichlorobenzene (O)
1,2 tran-dichloroethylene
1,2,4 trichlorobenzene
1,3 dichlorobenzene (M)
1,4 dichlorobenzene (P)
2 chloronaphthalene
2 chlorophenol
2,4,6 trichlorophenol
4 chloro-3 methylphenol
ethylbenzene
hexachlorobutadiene (C46)
methylene chloride
naphthalene
phenol
tetrachloroethylene
toluene
trichloroethylene
carbon tetrachloride
4,4 DDT
bis (2-et hexyl) phthalate
di-n-butly phthalate
di-n-octyl phthalate
endosulfan sulfate
hexachlorobenzene
alpha BHC
delta BHC
gamma BHC
pyrene
flouranthene
1,2 dichloropropane
1,1,2 trichloroethane
2,4 dichlorophenol
2,4 dimethylphenol

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1. The ratio of the EDA mean concentration to the mean concentration of Rings I and II is less than 0.5 for quantifiable observations.

2. The ratio of the EDA median concentration to the median concentration of Rings I and II is less than 0.5 for quantifiable observations.

3. The Wilcoxin rank sum test indicated a 90 percent confidence that there was a difference between the concentrations in the EDA and Rings I and II.

A chemical was considered to show a decreasing trend from Rings I and II to the EDA if tests 1 and 2 were met or if 3 was met. The results of the migration testing for air are given below. Table 9-5 summarizes the results of the migration analysis and also gives the results for the other comparative habitability criteria. The correlation results are based on a factor analysis of the environmental data for the Hooker chemicals and show that for air benzene, toluene, and chlorobenzene correlated well with each other, as did 2-chlorotoluene, and 1,4-dichlorobenzene. For soil 1,2,3-trichorobenzene, 1,2 dichlorobenzene, 1,2,3,4-tetrachloro-benzene, hexachlorobenzene, and 1,2,4-trichlorobenzene were highly correlated. Also, 2-chlorotoluene, toluene, and chlorobenzene were highly correlated, as were hexachloro-cyclopentadiene and 1,2-dichlorobenzene.

For air, the results are:

Chemical	Mean and Median ratio < 0.5	Wilcoxin Indicates EDA < Rings I and II	More Than 10% Detects
benzene		x	x
chlorobenzene	x	x	1
2 chlorotoluene	x	x	x
4 chlorotoluene	x	x	x
tetrachloroethene		x	x
toluene		x	x
1,4-dichlorobenzene	x		

x--Meets criteria
1--More than 10 percent detects in Rings I and II only.

The results of a similar analysis for soil are:

Chemical	Mean and Median ratio < 0.5	Wilcoxin Indicates EDA < Rings I and II	More Than 10% detects
benzene	x	x	x
BHC alpha	x	x	1
beta	x	x	x
delta	x	x	x
gamma	x	x	1
carbon tetrachloride		x	
chlorobenzene	x	x	1
chromium		x	x
toluene	x		x
trichloroethylene	x	x	
1,2-dichlorobenzene	x	x	1
1,2,3,4-tetrachloro-benzene	x	x	
1,2,4-trichlorobezene	x		1
1,4-dichlorobenzene	x	x	1
2-chloronaphthalene	x		1

x--Meets criteria
1--More than 10 percent detects in Rings I and II only.

Table 9-5
RESULTS OF COMPARATIVE HABITABILITY CRITERIA

Medium	Chemical	Migration	Influent to Treatment Plant	Reliable Measurement	Correlation Analysis	Percent Detected In EDA	Possible LCIC
Air	chlorobenzene	X	X	X	X	2	yes
	2-chlorotoluene	X		X	X	25	yes
	4-chlorotoluene	X		X		14	yes
	1,2-dichlorobenzene		X	X		36	no
	1,3-dichlorobenzene		X			--	no
	carbon tetrachloride		X	X		6	no
	1,2,3,4-tetrachloro-benzene			X		3	no
Soil	alpha BHC	X	X	X		7	yes
	beta BHC	X		X		12	yes
	delta BHC	X	X	X		10	yes
	gamma BHC	X	X	X		5	yes
	total BHC	X	X	X		8	yes
	carbon tetrachloride	X	X			10	no
	chlorobenzene	X	X	X	X	1	yes
	pentachlorobenzene			X		--	no
	1,2,3,4-tetrachloro-benzene	X		X	X	1	yes
	1,2,4-trichlorobenzene	X		X	X	1	yes
	2-chloronaphthalene	X	X	X		1	yes
	dichloronapthalene			X		--	no
	2,4,5-trichlorophenol		X	X		--	maybe
	1,2-dichlorobenzene	X	X	X	X	2	yes
	1,4-dichlorobenzene		X	X		--	no
	pentachlorophenol			X		--	no
	2,4-dichlorophenol		X	X		--	no
	hexachlorocyclo-pentadiene				X	--	no

x--Meets criteria

WDR102/029

Based on Table 9-5, the physical, chemical, and biological properties and the other comparative habitability criteria, the following chemicals are recommended as LCIC for the comparative habitability criteria:

- o Air
    - chlorobenzene
    - 2-chlorotoluene
    - 4-chlorotoluene

- o Soil
    - total BHC
    - beta BHC
    - gamma BHC (has been used as a pesticide and found in prescription medicine)
    - chlorobenzene
    - 1,2,4-trichlorobenzene
    - 1,2,3,4-tetrachlorobenzene
    - 2-chloronaphthalene
    - 1,2 dichlorobenzene

NON-GRADIENT TRANSPORT CRITERIA

To identify chemicals that could be considered for the non-gradient transport criteria, the same data were analyzed as were used in the migration analysis for the Comparative

Habitability criteria. The decision procedure was to consider those Hooker chemicals for which:

1. The ratio of the EDA mean concentration to the mean concentration of Rings I and II is greater than or equal to 2.0 for those observations with quantifiable results.

2. The same as 1 except using the median concentrations to calculate the ratio.

3. The Wilcoxin rank sum test indicated a 90 percent confidence that the EDA had higher concentrations than Rings I and II.

For air, carbon tetrachloride and 1,2,3,4 tetrachlorobenzene were the only chemicals that indicated higher concentrations in the EDA than in Rings I and II. The soil analysis resulted in arsenic and chloroform showing higher concentrations in the EDA than in Rings I and II. Arsenic was not chosen as an LCIC because of its natural occurrence in soil, which makes it possible that arsenic as an LCIC would indicate soil type differences rather than possible influences of Love Canal on the EDA.

TOXICOLOGICAL CRITERIA

TCDD is the only chemical known to have an established standard, criterion, or guideline in soil for purposes of habitation. New York State has published guidelines for ambient air but not for indoor air. If applicable standards, criteria, or guidelines should be developed in the future for the chemicals, they would be added to the list of Toxicological LCIC.

RECOMMENDATION

It is recommended that those chemicals that meet the comparative habitability criteria and those that have existing relevant New York State or federal standards, criteria, or guidelines (such as TCDD) be considered for LCIC. Based on this recommendation, the LCIC would be:

- Air
  - chlorobenzene
  - 2-chlorotoluene
  - 4-chlorotoluene
- Soil
  - total BHC
  - beta BHC

- gamma BHC (has been used as a pesticide and found in prescription medicine)
- chlorobenzene
- 1,2,4-trichlorobenzene
- 1,2,3,4-tetrachlorobenzene
- 2-chloronaphthalene
- 1,2-dichlorobenzene

The Toxicological LCIC is:

- TCDD

This list of recommended LCIC is suggested as a minimum number of chemicals that should be considered. Additional chemicals may be added.

WDR102/023

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=AIR (UG/M3)

LOC INSIDE EDA

	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
CHEMICAL								
A-A(PRIME)-DICHLOROXYLENE(O,M,P)	627	626	1.00	0.05	0.93	0.14	0.27	0.20
A,A,2,6-TETRACHLOROTOLUENE	394	0	0.00	NA	NA	NA	NA	NA
ALPHA-BHC	632	0	0.00	NA	NA	NA	NA	NA
ALPHA-CHLOROTOLUENE	899	0	0.00	NA	NA	NA	NA	NA
ANTIMONY	122	0	0.00	NA	NA	NA	NA	NA
ARSENIC	122	0	0.00	NA	NA	NA	NA	NA
BENZENE	1019	521	0.51	0.11	40.07	4.89	5.90	3.74
BERYLLIUM	122	4	0.03	0.00	0.00	0.00	0.00	0.00
C-56	633	0	0.00	NA	NA	NA	NA	NA
CADMIUM	122	57	0.47	0.00	0.00	0.00	0.00	0.00
CARBON TETRACHLORIDE	902	41	0.05	2.41	76.77	3.75	8.68	14.82
CHLOROBENZENE	900	4	0.00	3.24	3.48	3.27	3.31	0.11
CHLOROFORM	980	6	0.01	1.50	3.00	2.50	2.33	0.52
CHROMIUM	122	36	0.30	0.00	0.00	0.00	0.00	0.00
COPPER	122	121	0.99	0.00	0.06	0.01	0.01	0.01
DICHLOROMETHANE	898	0	0.00	NA	NA	NA	NA	NA
GAMMA-BHC	634	1	0.00	0.10	0.10	0.10	0.10	NA
HEPTACHLOR	630	0	0.00	NA	NA	NA	NA	NA
HEXACHLORO-1,3-BUTADIENE	634	0	0.00	NA	NA	NA	NA	NA
HEXACHLOROBENZENE	633	0	0.00	NA	NA	NA	NA	NA
LEAD	122	107	0.88	0.00	0.02	0.00	0.00	0.00
M-XYLENE	899	0	0.00	NA	NA	NA	NA	NA
NICKEL	122	90	0.74	0.00	0.00	0.00	0.00	0.00

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=AIR (UG/M3)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
O-CHLOROBENZALDEHYDE	900	0	0.00	NA	NA	NA	NA	NA
O-XYLENE	899	0	0.00	NA	NA	NA	NA	NA
OCTAFLUOROTOLUENE (PERFLUOROTOLUENE)	124	121	0.98	10.20	37.41	17.13	17.74	3.27
P-CHLOROBENZALDEHYDE	900	0	0.00	NA	NA	NA	NA	NA
P-XYLENE	609	0	0.00	NA	NA	NA	NA	NA
PENTACHLOROBENZENE	631	1	0.00	0.08	0.08	0.08	0.08	NA
PENTACHLORONITROBENZENE	633	0	0.00	NA	NA	NA	NA	NA
PHENOL	894	0	0.00	NA	NA	NA	NA	NA
TETRACHLOROETHENE	1018	589	0.58	2.27	158.32	5.54	9.88	12.70
TOLUENE	1017	430	0.42	2.27	484.48	12.12	18.00	34.84
TOTAL SUSPENDED PARTICULATES (TSP)	107	107	1.00	0.01	14.90	1.20	1.46	1.53
ZINC	122	23	0.19	0.01	0.02	0.01	0.01	0.00
1,1-DICHLOROETHANE	896	0	0.00	NA	NA	NA	NA	NA
1,1-DICHLOROETHENE	896	0	0.00	NA	NA	NA	NA	NA
1,2 DICHLOROETHENE	895	0	0.00	NA	NA	NA	NA	NA
1,2-DIBROMOETHANE	902	1	0.00	4.82	4.82	4.82	4.82	NA
1,2-DICHLOROBENZENE	901	135	0.15	1.17	68.42	5.44	9.78	12.80
1,2-DICHLOROETHANE	901	0	0.00	NA	NA	NA	NA	NA
1,2,3-TRICHLOROBENZENE	704	2	0.00	0.11	0.21	0.16	0.16	0.07
1,2,3,4-TETRACHLOROBENZENE	634	10	0.02	0.05	0.41	0.16	0.20	0.12
1,2,3,5-TETRACHLOROBENZENE	632	0	0.00	NA	NA	NA	NA	NA
1,2,4-TRICHLOROBENZENE	703	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=AIR (UG/M3)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
1,2,4,5-TETRACHLOROBENZENE	634	0	0.00	NA	NA	NA	NA	NA
1,3-BUTADIENE, PENTACHLORO(ISOMERS)	341	0	0.00	NA	NA	NA	NA	NA
1,3,5-TRICHLOROBENZENE	703	1	0.00	0.09	0.09	0.09	0.09	NA
1,4-DICHLOROBENZENE	899	55	0.06	2.21	25.27	4.83	7.34	6.18
2-CHLOROTOLUENE	901	105	0.12	2.15	7.59	2.69	3.14	1.01
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	3	0	0.00	NA	NA	NA	NA	NA
2,4-DICHLOROTOLUENE	900	0	0.00	NA	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	632	0	0.00	NA	NA	NA	NA	NA
4-CHLOROTOLUENE	901	65	0.07	2.26	5.43	2.70	3.04	0.74

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=AIR (UG/M3)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
A-A(PRIME)-DICHLOROXYLENE(O,M,P)	73	73	1.00	0.06	0.71	0.36	0.32	0.20
A,A,2,6-TETRACHLOROTOLUENE	41	0	0.00	NA	NA	NA	NA	NA
ALPHA-BHC	72	0	0.00	NA	NA	NA	NA	NA
ALPHA-CHLOROTOLUENE	120	0	0.00	NA	NA	NA	NA	NA
ANTIMONY	10	0	0.00	NA	NA	NA	NA	NA
ARSENIC	10	0	0.00	NA	NA	NA	NA	NA
BENZENE	160	85	0.53	2.41	1780.00	6.19	63.88	270.08
BERYLLIUM	10	0	0.00	NA	NA	NA	NA	NA
C-56	73	0	0.00	NA	NA	NA	NA	NA
CADMIUM	10	4	0.40	0.00	0.00	0.00	0.00	0.00
CARBON TETRACHLORIDE	160	7	0.04	2.00	3.82	3.00	2.90	0.89
CHLOROBENZENE	160	25	0.16	3.15	940.00	38.00	135.76	250.89
CHLOROFORM	120	0	0.00	NA	NA	NA	NA	NA
CHROMIUM	10	4	0.40	0.00	0.00	0.00	0.00	0.00
COPPER	9	9	1.00	0.00	0.01	0.00	0.00	0.00
DICHLOROMETHANE	120	0	0.00	NA	NA	NA	NA	NA
GAMMA-BHC	73	0	0.00	NA	NA	NA	NA	NA
HEPTACHLOR	72	0	0.00	NA	NA	NA	NA	NA
HEXACHLORO-1,3-BUTADIENE	72	0	0.00	NA	NA	NA	NA	NA
HEXACHLOROBENZENE	73	0	0.00	NA	NA	NA	NA	NA
LEAD	10	8	0.80	0.00	0.00	0.00	0.00	0.00
M-XYLENE	120	0	0.00	NA	NA	NA	NA	NA
M,P CHLOROTOLUENE	39	22	0.56	17.00	2130.00	265.00	415.14	484.02

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=AIR (UG/M3)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
NICKEL	10	6	0.60	0.00	0.00	0.00	0.00	0.00
O-CHLOROBENZALDEHYDE	120	0	0.00	NA	NA	NA	NA	NA
O-XYLENE	120	0	0.00	NA	NA	NA	NA	NA
OCTAFLUOROTOLUENE (PERFLUOROTOLUENE)	26	26	1.00	10.87	19.19	16.77	16.37	1.78
P-CHLOROBENZALDEHYDE	120	0	0.00	NA	NA	NA	NA	NA
P-XYLENE	81	0	0.00	NA	NA	NA	NA	NA
PENTACHLOROBENZENE	73	0	0.00	NA	NA	NA	NA	NA
PENTACHLORONITROBENZENE	72	0	0.00	NA	NA	NA	NA	NA
PHENOL	120	0	0.00	NA	NA	NA	NA	NA
TETRACHLOROETHENE	160	91	0.57	1.00	220.00	8.01	22.89	37.16
TOLUENE	159	80	0.50	2.43	14110.00	18.99	524.52	1985.58
TOTAL SUSPENDED PARTICULATES (TSP)	9	9	1.00	0.65	2.58	1.87	1.70	0.63
ZINC	10	1	0.10	0.01	0.01	0.01	0.01	NA
1,1-DICHLOROETHANE	120	0	0.00	NA	NA	NA	NA	NA
1,1-DICHLOROETHENE	120	0	0.00	NA	NA	NA	NA	NA
1,1,2,2-TETRACHLOROETHANE	40	5	0.13	1.00	5.00	2.00	2.60	1.82
1,2 DICHLOROETHENE	120	0	0.00	NA	NA	NA	NA	NA
1,2-DIBROMOETHANE	120	0	0.00	NA	NA	NA	NA	NA
1,2-DICHLOROBENZENE	120	6	0.05	4.78	81.44	5.48	20.35	30.48
1,2-DICHLOROETHANE	120	0	0.00	NA	NA	NA	NA	NA
1,2,3-TRICHLOROBENZENE	79	0	0.00	NA	NA	NA	NA	NA
1,2,3,4-TETRACHLOROBENZENE	73	3	0.04	0.03	0.10	0.03	0.05	0.04

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=AIR (UG/M3)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
1,2,3,5-TETRACHLOROBENZENE	72	0	0.00	NA	NA	NA	NA	NA
1,2,4-TRICHLOROBENZENE	79	0	0.00	NA	NA	NA	NA	NA
1,2,4,5-TETRACHLOROBENZENE	72	0	0.00	NA	NA	NA	NA	NA
1,3-BUTADIENE, PENTACHLORO(ISOMERS)	30	0	0.00	NA	NA	NA	NA	NA
1,3,5-TRICHLOROBENZENE	79	0	0.00	NA	NA	NA	NA	NA
1,4-DICHLOROBENZENE	120	3	0.02	4.63	21.38	7.54	11.19	8.95
2-CHLOROTOLUENE	160	39	0.24	2.32	2720.00	186.52	435.44	616.08
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	1	0	0.00	NA	NA	NA	NA	NA
2,4-DICHLOROTOLUENE	120	0	0.00	NA	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	73	0	0.00	NA	NA	NA	NA	NA
4-CHLOROTOLUENE	120	15	0.13	2.42	319.69	15.09	59.57	95.83

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
ACENAPHTHENE	134	1	0.01	26.00	26.00	26.00	26.00	NA
ACENAPHTYLENE	134	1	0.01	18.00	18.00	18.00	18.00	NA
ACROLEIN	275	0	0.00	NA	NA	NA	NA	NA
ACRYLONITRILE	275	0	0.00	NA	NA	NA	NA	NA
ALDRIN	130	5	0.04	2.00	8.00	4.00	4.40	2.30
ALPHA-BHC	130	7	0.05	2.70	150.00	10.00	44.39	57.36
ALPHA-CHLOROTOLUENE	275	0	0.00	NA	NA	NA	NA	NA
AMERICIUM-241	128	0	0.00	NA	NA	NA	NA	NA
ANTHRACENE	134	6	0.04	2.00	57.00	21.00	26.83	22.20
ANTIMONY	131	20	0.15	1300.00	26000.00	11000.00	12290.00	7191.51
ARSENIC	163	163	1.00	1900.00	74000.00	13000.00	16522.70	10570.31
BARIUM	138	136	0.99	11000.00	580000.00	77000.00	81562.50	66544.51
BENZENE	256	9	0.04	8.00	147.00	25.00	45.89	45.11
BENZIDINE	137	0	0.00	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	134	14	0.10	14.00	1200.00	90.00	205.64	313.15
BENZO(A)PYRENE	134	7	0.05	2.00	320.00	66.00	104.71	112.12
BENZO(B)FLUORANTHENE	133	0	0.00	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	134	3	0.02	7.00	62.00	20.00	29.67	28.75
BENZO(K)FLUORANTHENE	132	7	0.05	13.00	1400.00	260.00	357.00	484.24
BERYLLIUM	139	131	0.94	220.00	6600.00	550.00	604.50	553.12
BETA-BHC	130	13	0.10	5.00	950.00	14.00	117.00	261.16
BIS(2-CHLOROETHOXY)METHANE	134	0	0.00	NA	NA	NA	NA	NA
BIS(2-CHLOROETHYL)ETHER	133	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
BIS(2-CHLOROISOPROPYL)ETHER	133	0	0.00	NA	NA	NA	NA	NA
BROMOCHLOROMETHANE	275	0	0.00	NA	NA	NA	NA	NA
BROMODICHLOROMETHANE	275	1	0.00	12.00	12.00	12.00	12.00	NA
BROMOFORM	275	1	0.00	15.00	15.00	15.00	15.00	NA
BROMOMETHANE	275	0	0.00	NA	NA	NA	NA	NA
C-56	134	0	0.00	NA	NA	NA	NA	NA
CADMIUM	154	20	0.13	690.00	2300.00	1200.00	1354.50	474.77
CARBON TETRACHLORIDE	275	5	0.02	4.00	7.00	6.00	6.00	1.22
CESIUM-137	128	2	0.02	0.08	0.15	0.11	0.11	0.05
CHLORDANE	130	5	0.04	21.00	169.00	91.00	83.20	62.04
CHLOROBENZENE	274	2	0.01	3.00	3.00	3.00	3.00	0.00
CHLOROETHANE	275	0	0.00	NA	NA	NA	NA	NA
CHLOROFORM	275	36	0.13	2.00	45.00	8.00	10.89	10.80
CHLOROMETHANE	275	0	0.00	NA	NA	NA	NA	NA
CHROMIUM	165	165	1.00	3500.00	181000.00	16000.00	20163.64	18618.73
CHRYSENE	134	15	0.11	10.00	3300.00	210.00	797.00	1164.25
CIS-1,2-DICHLOROETHENE	275	0	0.00	NA	NA	NA	NA	NA
COPPER	165	165	1.00	6900.00	280000.00	18000.00	21486.06	27482.25
DDD	130	8	0.06	10.00	164.00	94.00	93.00	42.16
DDE	130	21	0.16	1.00	170.00	14.00	42.59	47.45
DDT	130	6	0.05	1.00	1020.00	75.00	221.17	394.22
DELTA-BHC	130	12	0.09	2.00	270.00	4.50	26.50	76.70
DI(2-ETHYLHEXYL)PHTHALATE	12	12	1.00	220.00	8000.00	1900.00	3117.50	2683.60

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
DIBENZO(A,H)ANTHRACENE	134	0	0.00	NA	NA	NA	NA	NA
DIBROMOCHLOROMETHANE	274	1	0.00	19.00	19.00	19.00	19.00	NA
DICHLOROMETHANE	4	4	1.00	2300.00	5900.00	5400.00	4750.00	1700.00
DIELDRIN	130	3	0.02	5.00	150.00	38.00	64.33	76.00
DIOCTYL ESTER PHTHALIC ACID	10	10	1.00	220.00	600.00	340.00	370.00	133.75
ENDOSULFAN I	130	0	0.00	NA	NA	NA	NA	NA
ENDOSULFAN II	130	4	0.03	6.00	47.00	24.00	25.25	17.50
ENDOSULFAN SULFATE	130	0	0.00	NA	NA	NA	NA	NA
ENDRIN	130	11	0.08	1.00	216.00	96.00	93.24	67.65
ETHYL BENZENE	275	0	0.00	NA	NA	NA	NA	NA
FLUORANTHENE	134	21	0.16	2.20	3700.00	40.00	339.17	812.04
FLUORENE	134	3	0.02	14.00	52.00	16.00	27.33	21.39
GAMMA-BHC	130	5	0.04	1.00	9.00	4.00	4.40	2.97
HEPTACHLOR	130	4	0.03	1.60	3.00	2.50	2.40	0.61
HEPTACHLOR EPOXIDE	130	1	0.01	5.00	5.00	5.00	5.00	NA
HEXACHLORO-1,3-BUTADIENE	133	0	0.00	NA	NA	NA	NA	NA
HEXACHLOROBENZENE	133	0	0.00	NA	NA	NA	NA	NA
HEXACHLOROETHANE	133	0	0.00	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	134	3	0.02	6.00	75.00	30.00	37.00	35.03
K-STABLE POTASSIUM	128	127	0.99	0.00	0.02	0.01	0.01	0.00
LEAD	165	159	0.96	9000.00	430000.00	20000.00	30199.37	39249.80
M-XYLENE	275	0	0.00	NA	NA	NA	NA	NA
MERCURY	139	126	0.91	9.00	2600.00	38.00	84.97	283.99

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
MIREX	130	1	0.01	66.00	66.00	66.00	66.00	NA
N-NITROSO-DI-N-PROPYLAMINE	133	0	0.00	NA	NA	NA	NA	NA
N-NITROSODIMETHYLAMINE	133	0	0.00	NA	NA	NA	NA	NA
N-NITROSODIPHENYLAMINE	133	0	0.00	NA	NA	NA	NA	NA
NAPHTHALENE	134	3	0.02	100.00	198.00	160.00	152.67	49.41
NICKEL	165	165	1.00	4700.00	54000.00	20000.00	20346.06	6740.63
NITROBENZENE	133	0	0.00	NA	NA	NA	NA	NA
O-XYLENE	275	0	0.00	NA	NA	NA	NA	NA
P-XYLENE	276	0	0.00	NA	NA	NA	NA	NA
PENTACHLORONITROBENZENE	134	0	0.00	NA	NA	NA	NA	NA
PENTACHLOROPHENOL	133	1	0.01	37.00	37.00	37.00	37.00	NA
PHENANTHRENE	134	12	0.09	10.00	708.00	64.50	201.25	261.10
PHENOL	133	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL (AROCLOR 1016)	130	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1221)	130	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1232)	130	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1242)	130	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1248)	130	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1254)	130	10	0.08	10.00	35.00	17.50	19.00	6.83
POLYCHLORINATED BIPHENYL(AROCLOR 1260)	130	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
PYRENE	134	16	0.12	14.00	8500.00	117.50	713.06	2089.10
RADIUM-226	128	127	0.99	0.26	5.78	0.51	0.58	0.50
RADIUM-228	128	79	0.62	0.32	1.16	0.66	0.69	0.19
SELENIUM	133	0	0.00	NA	NA	NA	NA	NA
SILVER	135	83	0.61	500.00	3700.00	990.00	1166.87	534.68
TETRACHLOROETHENE	276	2	0.01	4.00	6.00	5.00	5.00	1.41
TETRACHLOROTOLUENE	91	1	0.01	8.00	8.00	8.00	8.00	NA
THALLIUM	165	28	0.17	610.00	22000.00	8550.00	8978.93	4737.79
TOLUENE	274	1	0.00	1.50	1.50	1.50	1.50	NA
TOXAPHENE	130	0	0.00	NA	NA	NA	NA	NA
TRANS-1,2-DICHLOROETHENE	275	9	0.03	8.00	17.00	13.00	12.44	2.92
TRANS-1,3-DICHLOROPROPENE	275	1	0.00	4.20	4.20	4.20	4.20	NA
TRICHLOROETHYLENE	275	2	0.01	1.00	17.00	9.00	9.00	11.31
TRICHLOROFLUOROMETHANE	274	23	0.08	10.00	66.00	16.00	23.35	16.08
VINYL CHLORIDE	275	0	0.00	NA	NA	NA	NA	NA
ZINC	166	166	1.00	2800.00	490000.00	62000.00	70406.63	46981.18
1-CHLORO-4-(TRIFLUOROMETHYL)BENZENE	134	0	0.00	NA	NA	NA	NA	NA
1,1-DICHLOROETHANE	275	0	0.00	NA	NA	NA	NA	NA
1,1-DICHLOROETHENE	275	12	0.04	5.00	34.00	10.50	16.08	11.08
1,1,1-TRICHLOROETHANE	275	0	0.00	NA	NA	NA	NA	NA
1,1,2-TRICHLOROETHANE	275	0	0.00	NA	NA	NA	NA	NA
1,1,2,2-TETRACHLOROETHANE	275	0	0.00	NA	NA	NA	NA	NA
1,2 DICHLOROETHENE	103	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
1,2-DIBROMOETHANE	275	0	0.00	NA	NA	NA	NA	NA
1,2-DICHLOROBENZENE	133	2	0.02	2.00	138.00	70.00	70.00	96.17
1,2-DICHLOROETHANE	275	0	0.00	NA	NA	NA	NA	NA
1,2-DICHLOROPROPANE	275	0	0.00	NA	NA	NA	NA	NA
1,2-DIPHENYLHYDRAZINE	134	0	0.00	NA	NA	NA	NA	NA
1,2,3-TRICHLOROBENZENE	133	0	0.00	NA	NA	NA	NA	NA
1,2,3,4-TETRACHLOROBENZENE	134	2	0.01	16.00	440.00	228.00	228.00	299.81
1,2,4-TRICHLOROBENZENE	133	1	0.01	33.00	33.00	33.00	33.00	NA
1,2,4,5-TETRACHLOROBENZENE	134	0	0.00	NA	NA	NA	NA	NA
1,3-DICHLOROBENZENE	133	0	0.00	NA	NA	NA	NA	NA
1,3,5-TRICHLOROBENZENE	133	0	0.00	NA	NA	NA	NA	NA
1,4-DICHLOROBENZENE	133	2	0.02	20.00	178.00	99.00	99.00	111.72
2-CHLORONAPHTHALENE	135	1	0.01	340.00	340.00	340.00	340.00	NA
2-CHLOROPHENOL	133	0	0.00	NA	NA	NA	NA	NA
2-CHLOROTOLUENE	275	0	0.00	NA	NA	NA	NA	NA
2-METHYL-4,6-DINITROPHENOL	133	0	0.00	NA	NA	NA	NA	NA
2-NITROPHENOL	133	0	0.00	NA	NA	NA	NA	NA
2,3-DICHLOROPROPENE-1	275	0	0.00	NA	NA	NA	NA	NA
2,3,6-TRICHLOROPHENOL	91	0	0.00	NA	NA	NA	NA	NA
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	5	0	0.00	NA	NA	NA	NA	NA
2,4-DICHLOROPHENOL	133	0	0.00	NA	NA	NA	NA	NA
2,4-DICHLOROTOLUENE	133	0	0.00	NA	NA	NA	NA	NA
2,4-DIMETHYLPHENOL	133	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC INSIDE EDA

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
2,4-DINITROPHENOL	133	0	0.00	NA	NA	NA	NA	NA
2,4-DINITROTOLUENE	133	0	0.00	NA	NA	NA	NA	NA
2,4,6-TRICHLOROANILINE	134	0	0.00	NA	NA	NA	NA	NA
2,4,6-TRICHLOROPHENOL	133	0	0.00	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	134	0	0.00	NA	NA	NA	NA	NA
3-CHLOROPHENOL	91	0	0.00	NA	NA	NA	NA	NA
3-CHLOROTOLUENE	275	0	0.00	NA	NA	NA	NA	NA
3,3-DICHLOROBENZIDINE	134	0	0.00	NA	NA	NA	NA	NA
4-BROMOPHENYLPHENYLETHER	133	0	0.00	NA	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	133	0	0.00	NA	NA	NA	NA	NA
4-CHLOROPHENOL	91	0	0.00	NA	NA	NA	NA	NA
4-CHLOROPHENYLPHENYL ETHER	133	0	0.00	NA	NA	NA	NA	NA
4-CHLOROTOLUENE	275	0	0.00	NA	NA	NA	NA	NA
4-NITROPHENOL	133	0	0.00	NA	NA	NA	NA	NA

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
ACENAPHTHENE	27	0	0.00	NA	NA	NA	NA	NA
ACENAPHTYLENE	27	0	0.00	NA	NA	NA	NA	NA
ACROLEIN	55	0	0.00	NA	NA	NA	NA	NA
ACRYLONITRILE	55	0	0.00	NA	NA	NA	NA	NA
ALDRIN	26	1	0.04	7.00	7.00	7.00	7.00	NA
ALPHA-BHC	149	32	0.21	20.00	36000.00	510.00	3245.56	7037.88
ALPHA-CHLOROTOLUENE	55	0	0.00	NA	NA	NA	NA	NA
AMERICIUM-241	34	0	0.00	NA	NA	NA	NA	NA
ANTHRACENE	88	1	0.01	840.00	840.00	840.00	840.00	NA
ANTIMONY	114	7	0.06	1000.00	16000.00	1000.00	4571.43	6267.83
ARSENIC	119	119	1.00	2200.00	42000.00	11000.00	12439.50	7461.46
BARIUM	25	25	1.00	15000.00	750000.00	110000.00	220340.00	194116.63
BENZENE	159	24	0.15	13.00	12300.00	325.00	1175.04	2529.05
BENZIDINE	27	0	0.00	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	27	3	0.11	18.00	127.00	120.00	88.33	61.01
BENZO(A)PYRENE	27	1	0.04	101.00	101.00	101.00	101.00	NA
BENZO(B)FLUORANTHENE	27	0	0.00	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	26	0	0.00	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	27	1	0.04	181.00	181.00	181.00	181.00	NA
BERYLLIUM	25	14	0.56	380.00	670.00	550.00	538.57	90.63
BETA-BHC	149	14	0.09	3.90	4300.00	121.50	519.78	1160.18
BIS(2-CHLOROETHOXY)METHANE	27	0	0.00	NA	NA	NA	NA	NA
BIS(2-CHLOROETHYL)ETHER	27	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
BIS(2-CHLOROISOPROPYL)ETHER	27	0	0.00	NA	NA	NA	NA	NA
BROMOCHLOROMETHANE	56	0	0.00	NA	NA	NA	NA	NA
BROMODICHLOROMETHANE	56	0	0.00	NA	NA	NA	NA	NA
BROMOFORM	55	0	0.00	NA	NA	NA	NA	NA
BROMOMETHANE	56	0	0.00	NA	NA	NA	NA	NA
BUTYLBENZYLPHTHALATE	61	11	0.18	380.00	7000.00	3300.00	3530.00	2138.15
C-56	88	1	0.01	3100.00	3100.00	3100.00	3100.00	NA
CADMIUM	25	10	0.40	630.00	1600.00	1050.00	1080.00	264.87
CARBON TETRACHLORIDE	117	1	0.01	8.00	8.00	8.00	8.00	NA
CESIUM-137	34	0	0.00	NA	NA	NA	NA	NA
CHLORDANE	27	4	0.15	210.00	1800.00	960.00	982.50	887.18
CHLOROBENZENE	159	26	0.16	9.00	20000.00	1025.00	2660.35	4743.51
CHLOROETHANE	56	0	0.00	NA	NA	NA	NA	NA
CHLOROFORM	117	27	0.23	0.80	150.00	5.00	19.71	36.22
CHLOROMETHANE	56	0	0.00	NA	NA	NA	NA	NA
CHROMIUM	124	124	1.00	4500.00	80000.00	23500.00	22887.90	12343.39
CHRYSENE	88	0	0.00	NA	NA	NA	NA	NA
CIS-1,2-DICHLOROETHENE	56	0	0.00	NA	NA	NA	NA	NA
COPPER	25	25	1.00	12000.00	39000.00	18000.00	19220.00	5638.56
DDD	27	5	0.19	66.00	263.00	248.00	185.80	98.09
DDE	27	2	0.07	174.00	324.00	249.00	249.00	106.07
DDT	27	7	0.26	6.40	223.00	40.00	75.13	88.88
DELTA-BHC	88	17	0.19	2.00	500.00	60.00	81.13	116.82

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
DI(2-ETHYLHEXYL)PHTHALATE	61	26	0.43	270.00	4400.00	700.00	1117.31	1011.86
DIBENZO(A,H)ANTHRACENE	28	0	0.00	NA	NA	NA	NA	NA
DIBROMOCHLOROMETHANE	55	0	0.00	NA	NA	NA	NA	NA
DIBUTYL ESTER PHTHALIC ACID	61	5	0.08	550.00	3200.00	1050.00	1360.00	1053.80
DICHLOROMETHANE	61	14	0.23	20.00	320.00	90.00	119.86	105.89
DIELDRIN	27	1	0.04	2.00	2.00	2.00	2.00	NA
DIETHYLPHTHALATE	61	8	0.13	240.00	510.00	350.00	356.25	78.36
DIOCTYL ESTER PHTHALIC ACID	61	8	0.13	290.00	1800.00	460.00	723.13	568.04
ENDOSULFAN I	27	0	0.00	NA	NA	NA	NA	NA
ENDOSULFAN II	27	3	0.11	101.00	122.00	109.00	110.67	10.60
ENDOSULFAN SULFATE	27	0	0.00	NA	NA	NA	NA	NA
ENDRIN	27	7	0.26	25.00	349.00	236.00	215.29	96.37
ETHYL BENZENE	55	0	0.00	NA	NA	NA	NA	NA
FLUORANTHENE	88	3	0.03	19.61	269.00	47.00	111.87	136.77
FLUORENE	27	0	0.00	NA	NA	NA	NA	NA
GAMMA-BHC	149	16	0.11	9.00	3600.00	200.00	687.75	1183.55
HEPTACHLOR	27	3	0.11	4.90	17.00	12.00	11.30	6.08
HEPTACHLOR EPOXIDE	27	3	0.11	9.30	110.00	38.00	52.43	51.88
HEXACHLORO-1,3-BUTADIENE	27	0	0.00	NA	NA	NA	NA	NA
HEXACHLOROBENZENE	149	13	0.09	60.00	4500.00	400.00	1402.31	1529.49
HEXACHLOROETHANE	27	0	0.00	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	27	1	0.04	7.00	7.00	7.00	7.00	NA
K-STABLE POTASSIUM	34	33	0.97	0.01	0.02	0.01	0.01	0.00

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
LEAD	25	23	0.92	7100.00	130000.00	13500.00	20278.26	24938.52
M-XYLENE	55	0	0.00	NA	NA	NA	NA	NA
M,P CHLOROTOLUENE	43	26	0.60	300.00	175000.00	5700.00	22786.15	44247.20
MERCURY	25	17	0.68	10.00	9100.00	41.00	1152.94	2662.51
MIREX	27	2	0.07	11.00	116.00	63.50	63.50	74.25
N-NITROSO-DI-N-PROPYLAMINE	28	0	0.00	NA	NA	NA	NA	NA
N-NITROSODIMETHYLAMINE	27	0	0.00	NA	NA	NA	NA	NA
N-NITROSODIPHENYLAMINE	27	0	0.00	NA	NA	NA	NA	NA
NAPHTHALENE	27	0	0.00	NA	NA	NA	NA	NA
NICKEL	25	25	1.00	16000.00	33000.00	20500.00	21616.00	4032.03
NITROBENZENE	27	0	0.00	NA	NA	NA	NA	NA
O-XYLENE	55	0	0.00	NA	NA	NA	NA	NA
P-XYLENE	55	0	0.00	NA	NA	NA	NA	NA
PENTACHLORONITROBENZENE	27	0	0.00	NA	NA	NA	NA	NA
PENTACHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
PHENANTHRENE	27	3	0.11	13.00	202.00	18.59	77.86	107.54
PHENOL	27	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL (AROCLOR 1016)	27	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1221)	27	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1232)	27	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1242)	27	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
POLYCHLORINATED BIPHENYL(AROCLOR 1248)	27	0	0.00	NA	NA	NA	NA	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1254)	27	1	0.04	17.00	17.00	17.00	17.00	NA
POLYCHLORINATED BIPHENYL(AROCLOR 1260)	27	0	0.00	NA	NA	NA	NA	NA
PYRENE	88	3	0.03	17.27	195.00	60.00	90.76	92.77
RADIUM-226	34	32	0.94	0.21	0.81	0.46	0.48	0.15
RADIUM-228	34	15	0.44	0.31	1.25	0.65	0.67	0.25
SELENIUM	18	0	0.00	NA	NA	NA	NA	NA
SILVER	25	13	0.52	560.00	1800.00	834.00	916.46	318.59
TETRACHLOROETHENE	116	1	0.01	6.00	6.00	6.00	6.00	NA
TETRACHLOROTOLUENE	27	0	0.00	NA	NA	NA	NA	NA
THALLIUM	24	1	0.04	400.00	400.00	400.00	400.00	NA
TOLUENE	159	39	0.25	53.00	85500.00	3600.00	12367.51	22767.23
TOXAPHENE	27	0	0.00	NA	NA	NA	NA	NA
TRANS-1,2-DICHLOROETHENE	117	1	0.01	58.00	58.00	58.00	58.00	NA
TRANS-1,3-DICHLOROPROPENE	55	0	0.00	NA	NA	NA	NA	NA
TRICHLOROETHYLENE	116	1	0.01	40.00	40.00	40.00	40.00	NA
TRICHLOROFLUOROMETHANE	56	0	0.00	NA	NA	NA	NA	NA
VINYL CHLORIDE	56	0	0.00	NA	NA	NA	NA	NA
ZINC	25	25	1.00	42000.00	180000.00	59000.00	65816.00	26634.81
1-CHLORO-4-(TRIFLUOROMETHYL)BENZENE	27	0	0.00	NA	NA	NA	NA	NA
1,1-DICHLOROETHANE	56	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
1,1-DICHLOROETHENE	56	9	0.16	23.00	277.00	75.00	82.11	77.79
1,1,1-TRICHLOROETHANE	56	0	0.00	NA	NA	NA	NA	NA
1,1,2-TRICHLOROETHANE	55	0	0.00	NA	NA	NA	NA	NA
1,1,2,2-TETRACHLOROETHANE	56	1	0.02	900.00	900.00	900.00	900.00	NA
1,2 DICHLOROETHENE	36	0	0.00	NA	NA	NA	NA	NA
1,2-DIBROMOETHANE	55	0	0.00	NA	NA	NA	NA	NA
1,2-DICHLOROBENZENE	149	26	0.17	50.00	11700.00	1000.00	1847.31	2924.52
1,2-DICHLOROETHANE	56	0	0.00	NA	NA	NA	NA	NA
1,2-DICHLOROPROPANE	56	0	0.00	NA	NA	NA	NA	NA
1,2-DIPHENYLHYDRAZINE	27	0	0.00	NA	NA	NA	NA	NA
1,2,3-TRICHLOROBENZENE	88	29	0.33	50.00	10000.00	1200.00	2825.41	3182.19
1,2,3,4-TETRACHLOROBENZENE	26	1	0.04	10485.00	10485.00	10485.00	10485.00	NA
1,2,4-TRICHLOROBENZENE	149	40	0.27	50.00	49000.00	1300.00	8119.00	12041.18
1,2,4,5-TETRACHLOROBENZENE	87	33	0.38	60.00	36000.00	1300.00	5172.12	8979.53
1,3-DICHLOROBENZENE	149	3	0.02	100.00	550.00	280.00	310.00	226.50
1,3,5-TRICHLOROBENZENE	88	2	0.02	500.00	1200.00	850.00	850.00	494.97
1,4-DICHLOROBENZENE	149	23	0.15	70.00	18000.00	900.00	2427.22	3910.67
2-CHLORONAPHTHALENE	88	2	0.02	190.00	1400.00	795.00	795.00	855.60
2-CHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2-CHLOROTOLUENE	98	27	0.28	400.00	309000.00	10300.00	36085.19	72894.58
2-METHYL-4,6-DINITROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2-NITROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2,3-DICHLOROPROPENE-1	56	0	0.00	NA	NA	NA	NA	NA

(CONTINUED)

TABLE 9-4: LOVE CANAL DATA SUMMARY
ALL STUDIES
MEDIUM=SOIL (UG/KG)

LOC RINGS 1 AND 2

CHEMICAL	# OBS	# QUAN	#QUAN-/#OBS	MIN	MAX	MEDIAN	MEAN	STD OF CONC
2,3,6-TRICHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	33	7	0.21	0.04	30.00	16.60	14.72	13.16
2,4-DICHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2,4-DICHLOROTOLUENE	27	1	0.04	377.00	377.00	377.00	377.00	NA
2,4-DIMETHYLPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2,4-DINITROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2,4-DINITROTOLUENE	27	0	0.00	NA	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	61	7	0.11	1000.00	98000.00	25000.00	31528.57	33001.35
2,4,6-TRICHLOROANILINE	27	0	0.00	NA	NA	NA	NA	NA
2,4,6-TRICHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	27	0	0.00	NA	NA	NA	NA	NA
3-CHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
3-CHLOROTOLUENE	55	0	0.00	NA	NA	NA	NA	NA
3,3-DICHLOROBENZIDINE	27	0	0.00	NA	NA	NA	NA	NA
4-BROMOPHENYLPHENYLETHER	27	0	0.00	NA	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	27	0	0.00	NA	NA	NA	NA	NA
4-CHLOROPHENOL	27	0	0.00	NA	NA	NA	NA	NA
4-CHLOROPHENYLPHENYL ETHER	27	0	0.00	NA	NA	NA	NA	NA
4-CHLOROTOLUENE	55	0	0.00	NA	NA	NA	NA	NA
4-NITROPHENOL	27	0	0.00	NA	NA	NA	NA	NA

Statistical Approaches

APPENDIX 10

STATISTICAL ISSUES OF THE COMPARISON APPROACH

BACKGROUND

The purpose of any study that implements the Proposed Habitation Criteria is to provide objective data to assist in the decision to recommend for or against rehabilitation of the Love Canal EDA. According to the Proposed Habitability Criteria, this process will compare measured concentrations of the Love Canal Indicator Chemicals (LCICs), from the neighborhoods within the EDA to measured concentrations of the same chemicals in comparison areas. This process raises several statistical issues:

- How will the comparisons be made? What are the parameters of concern?
- What level of significance is desired in making the comparisons?
- What are the levels of statistical errors to be accepted in the sampling plan?
- Are equal numbers of samples desired for each neighborhood or equal numbers per unit area, or is an intermediate compromise desired?
- How many samples need to be taken from each EDA neighborhood and the comparison areas?
- What are the background concentrations and variabilities of the LCICs?

It is not possible at this time to describe in detail the statistical methods to be used in the comparison approach. The very high frequency of nondetects (chemical concentrations less than the detection limit) in previous sampling programs and changes in laboratory analytical protocols in recent years have led to a high degree of uncertainty about the type of results that might be obtained. There are no data on the LCIC concentrations in the comparison areas.

This appendix outlines the major statistical considerations of the comparison approach. Resolution of the concerns raised here is expected following completion of a pilot study in which soil and air concentration data will be obtained from both the EDA and the comparison areas.

COMPARISONS

At Love Canal, a major goal is to decide whether chemical concentrations in the EDA are different from those of a comparison area. The information that will be available for this decision is a set of concentration measurements for each LCIC from the EDA and from the comparison areas.

There are two types of comparisons that will be made: neighborhood soil LCICs versus comparison area soil LCICs, and house air LCICs versus comparison air LCICs. Each comparison has its own unique statistical issues.

ELEMENTS OF THE STATISTICAL COMPARISONS

INTRODUCTION AND DEFINITION

What do we mean by "different" and how do we measure this? Comparing two single numbers is easy--10 is different (and larger) than 6. Comparisons between an EDA neighborhood and the comparison areas are harder. Are the 50 or more LCIC sample concentrations (from 50 or more soil samples for example) different than the 50 or so LCIC sample concentrations from the comparison area? While some values may be larger and some smaller, all the values have associated with them uncertainty due to imprecise measurement procedures.

Statistical hypotheses testing is a formal, mathematical procedure for taking sets of imprecise (or uncertain) data and making comparisons as to whether the data sets are different.

The sets of data can be represented by probability density functions (also referred to as frequency distributions). The area under the probability density function between two values is the probability that a value will occur in that interval (Figure 10-1).

Figure 10-2 illustrates the essential elements of a statistical comparison. Usually some measure of the data, a test statistic, is used for comparison. For the illustrations here, assume that the mean or average concentration can be used to represent the data. If an infinite amount of data were available the true mean could be calculated exactly. Since a finite set of data is available from which to calculate the mean, the calculated mean has some uncertainty associated with its value. That is, different sets of samples would give different values for the mean. Figure 10-2 (b) depicts the probability distribution of the mean. In many cases, probability theory will permit an estimate of this probability density from the probability density function of the underlying process, i.e., the concentrations.

To make a comparison, a working hypothesis is needed. The usual hypothesis in statistical testing of the type described here is that concentrations from the EDA and comparison areas are the same. Equivalently, the means are equal or the

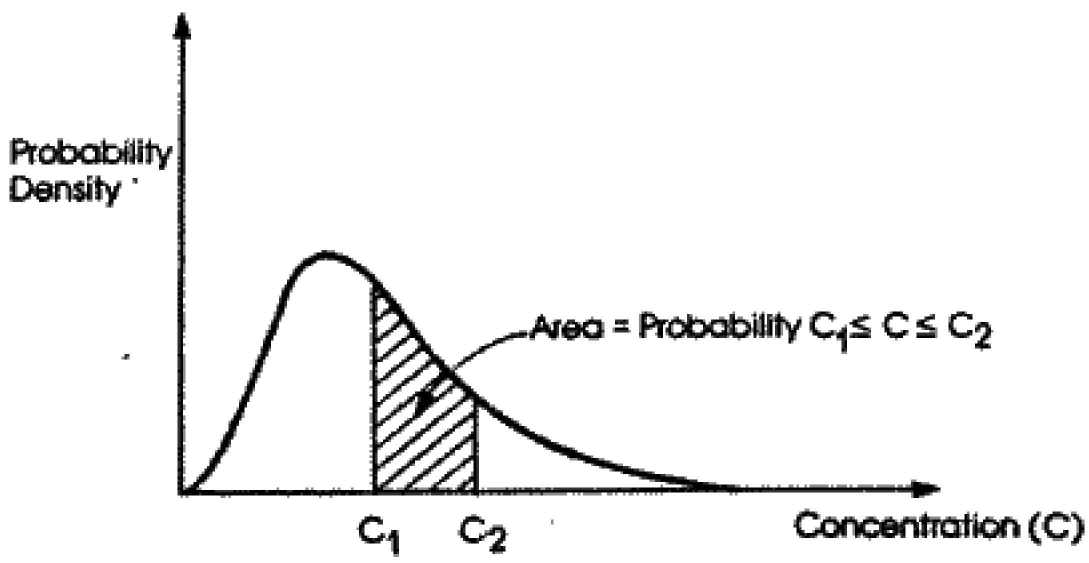


FIGURE 10-1
PROBABILITY DENSITY FUNCTION

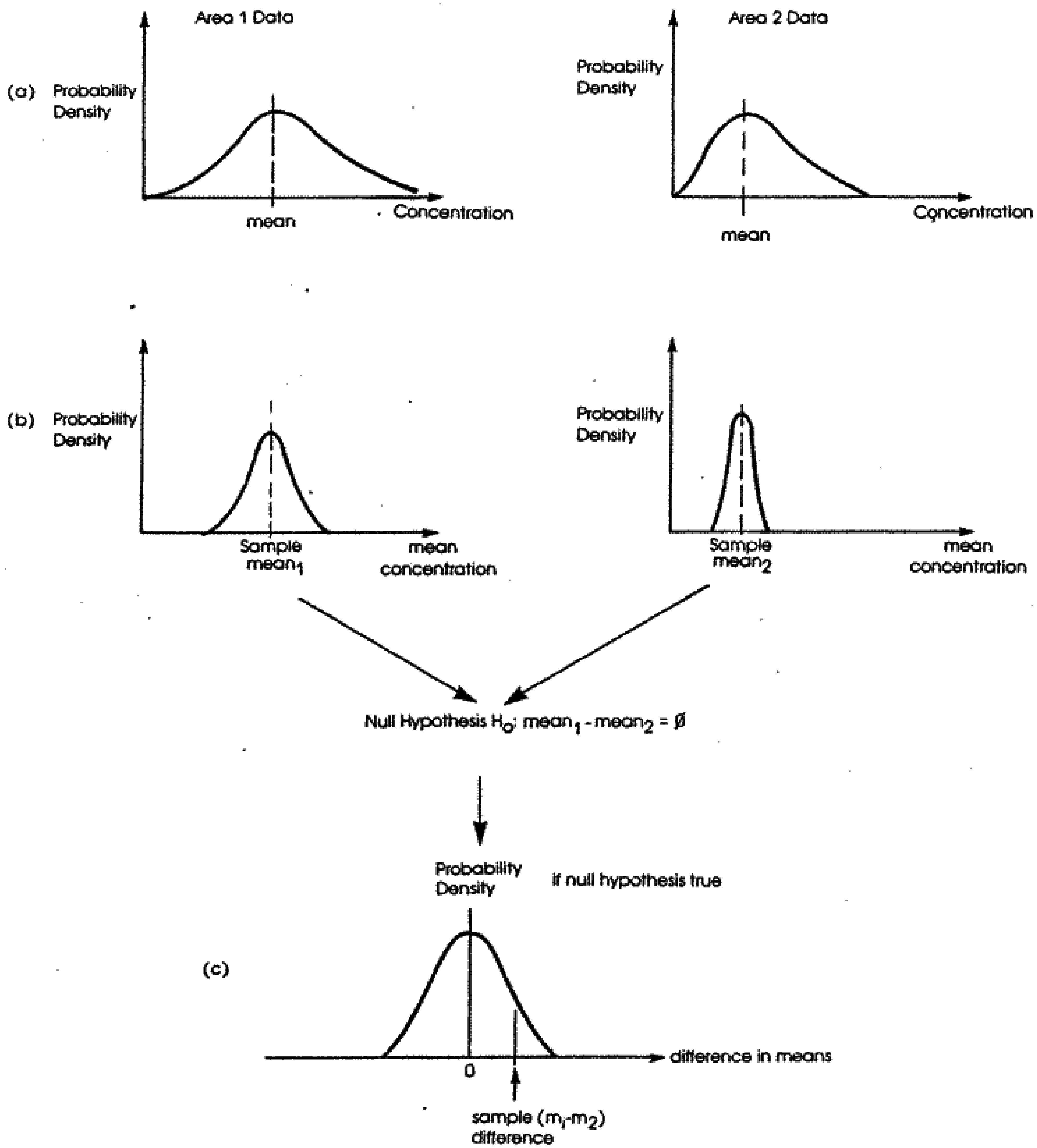


FIGURE 10-2
STATISTICAL COMPARISON STEPS

difference in means is zero. This primary hypothesis is defined as the null hypothesis. It is the hypothesis that is addressed by statistical comparison tests.

The next step, shown in Figure 10-2 (c), is to determine the probability distribution (the density function) under the null hypothesis. The null hypothesis assumes that the difference in the means is zero, but since the means are uncertain their difference is also uncertain. This uncertainty can be represented by a probability density function.

The final step is to test the sample value of delta, the difference of the sample means, as to whether it is consistent statistically with the probability distribution under the null hypothesis. Under the null hypothesis, the expected value of delta is zero. So delta is tested to see if it is significantly different from zero.

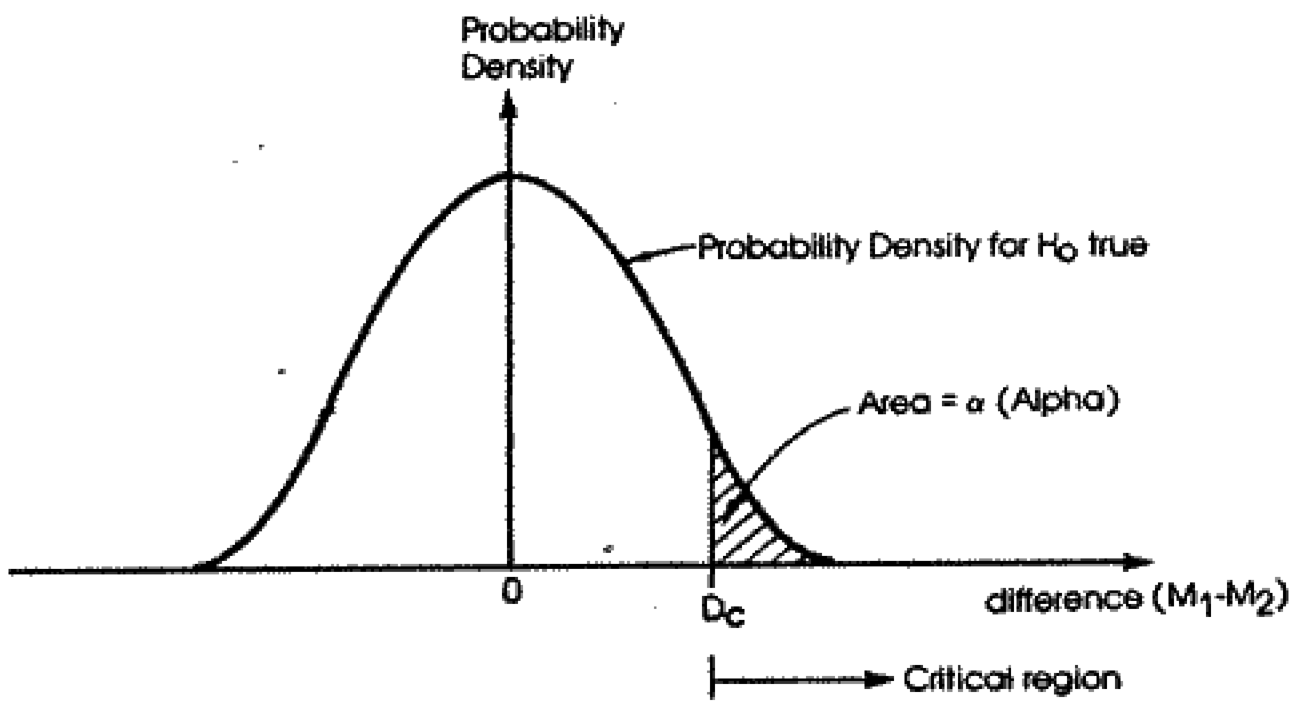
A significance level is established which is the probability of rejecting the null hypothesis (H_o) when it is true. This probability, often described by the symbol alpha, represents the probability of making the error of rejecting H_o when it should be accepted; this error is referred to as a Type I error.

If the only concern is positive deltas (i.e., whether the EDA has a higher mean than the comparison area), then specifying alpha allows one to calculate a critical value D_c, as shown in Figure 10-3. Any sample value of delta equal to or greater than D_c results in rejecting the null hypothesis that there is no difference in the test statistics of the two data sets.

There are several points to keep in mind:

- The statistical test is carried out on a test statistic (in this example the mean), where the probability density is derived from the probability distribution of the concentrations and the number of samples. Therefore, taking more samples reduces the variability in the test statistics. A larger variability in the underlying process (the concentration data) increases the variability in the test statistics. Figure 10-4 illustrates this.

- In the comparison example above, the null hypothesis H_o is accepted or rejected. No reference is made to what is accepted if H_o is rejected, beyond the statement that the two comparison parameters are statistically different. It is not explicitly determined "how different" one area is. It cannot be explicitly determined "how different" they are. What can be analyzed is the probability of detecting



If the samples give $M_1 - M_2 \geq D_c$, reject H_0

FIGURE 10-3
LOCATION OF THE CRITICAL REGION

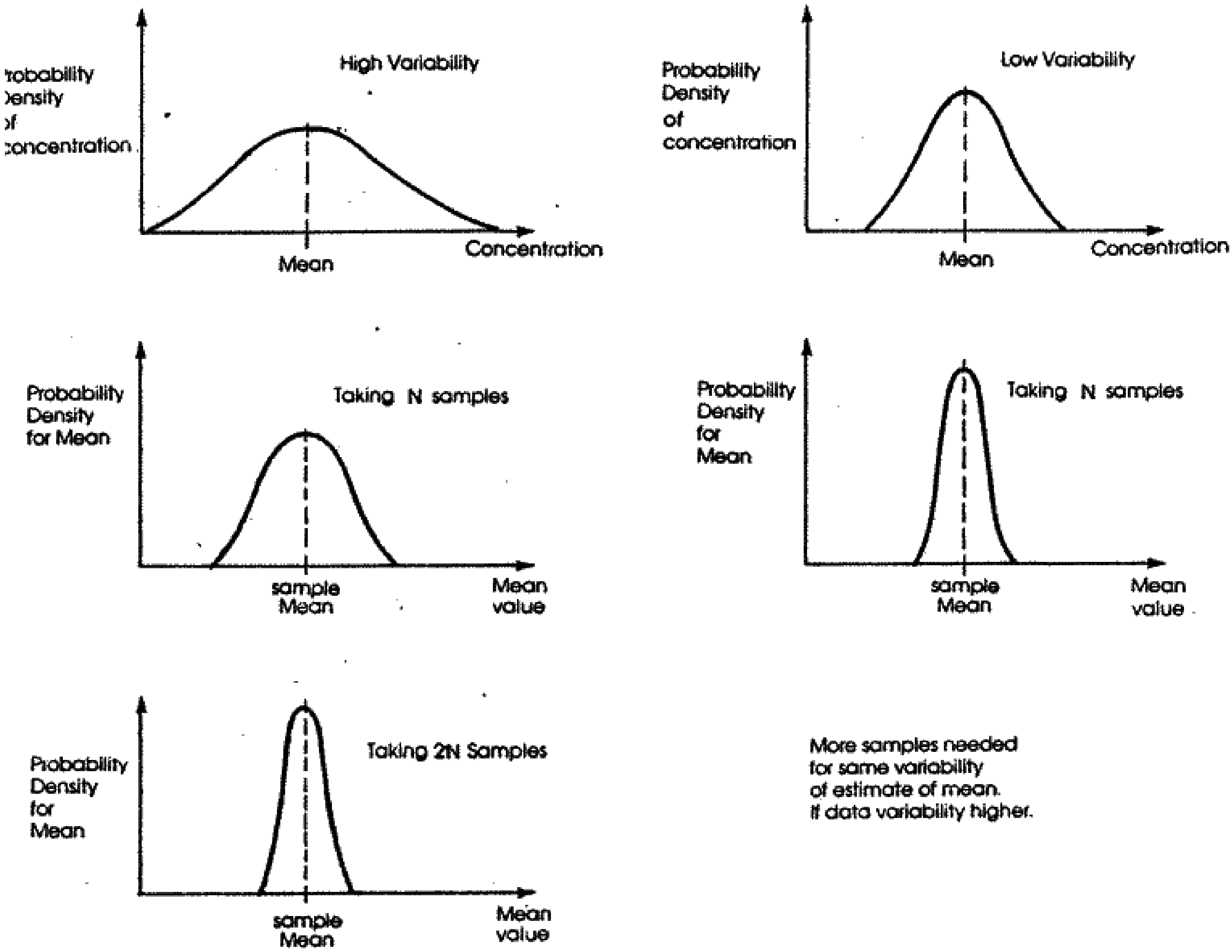


FIGURE 10-4
INFLUENCE OF SAMPLE SIZE ON
VARIABILITY

a given difference, the minimum unacceptable difference. The minimum unacceptable difference is the smallest difference that will imply that the EDA is not habitable. This is usually called the alternative hypothesis, H_a. The probability of detection at this given difference is referred to as the power of the statistical test. Figure 10-5 illustrates the relationship between the probability determination for H_o and H_a and the power curve.

Computationally, power is the area under the H_a probability density curve to the right of D_c (see Figure 10-5) the critical value defined earlier. The area under the H_a probability density curve to the left of D_c (i.e. for values of the sample difference where H_o would not be rejected) is known as beta (equals one minus power) and is referred to as the Type II error. The Type II error is the probability of accepting H_o when H_o is not true.

- Central to carrying out a statistical comparison test is the ability to quantify the underlying frequency distribution for the concentration. Usually, this is estimated from the sample concentration values.

TRADEOFFS BETWEEN STATISTICAL DESIGN PARAMETERS

There are five factors that play a role in the design and performance of a statistical hypothesis test:

- Sigma, the standard deviation of the probability distribution for the concentration values. Often it is assumed that sigma is equal under the H_o and H_a probability distributions.
- Significance level (alpha), which is set to control the Type I errors.
- Minimum unacceptable difference (delta-min) which is the minimum difference in the test statistics to be detected with a specified detection probability.
- Power (detection probability), for the specified minimum unacceptable difference.
- Sample size, which is the necessary number of samples collected for the test.

When a hypothesis test is designed, all parameters cannot be specified. Usually alpha, power, and the minimum unacceptable difference are specified. Sigma is assumed fixed and known

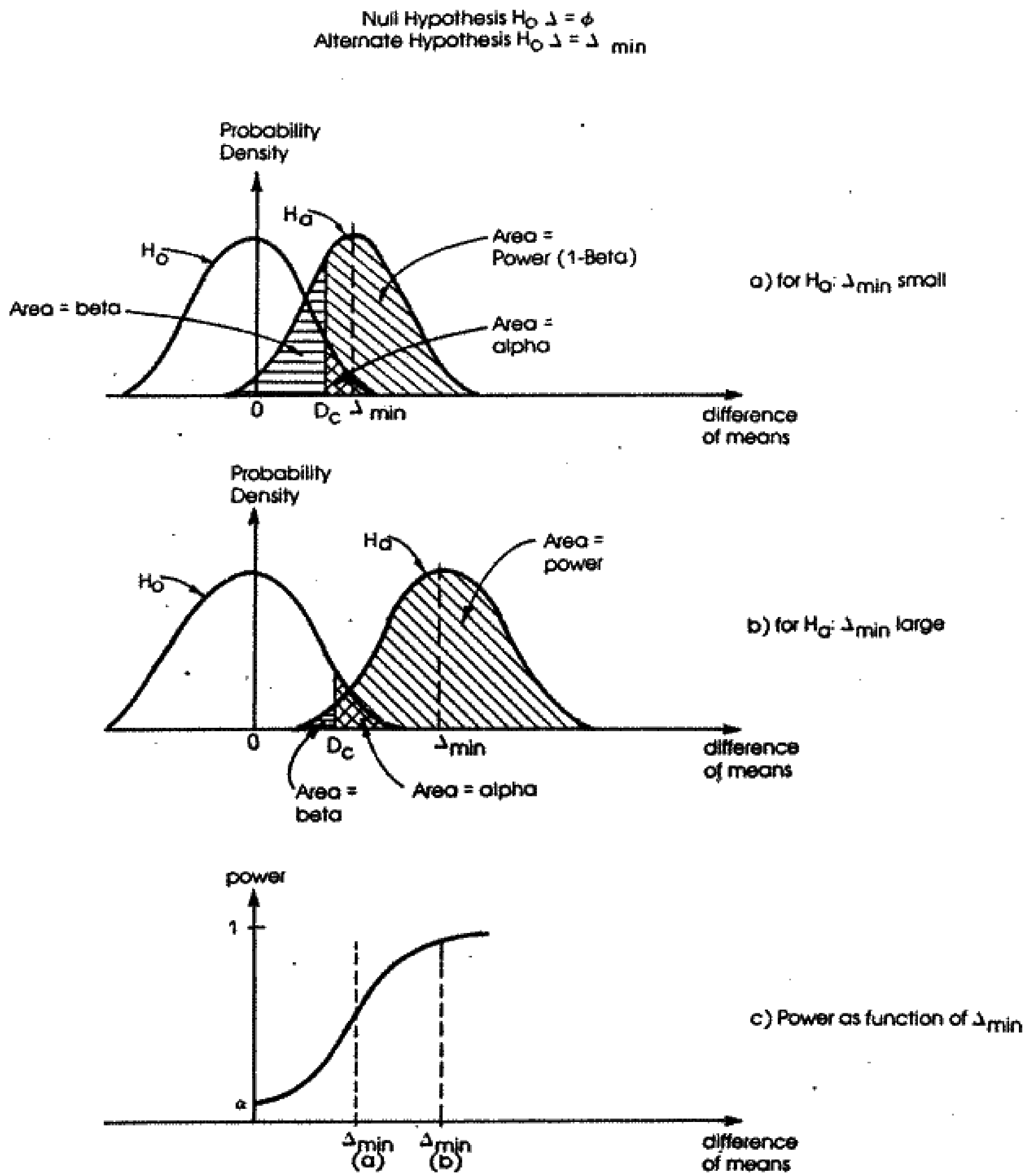


FIGURE 10-5
INFLUENCE OF Δ_{min} (MINIMUM ACCEPTABLE DIFFERENCE) ON THE PROBABILITY OF DETECTION (POWER)

(from the data) and the sample size required to yield the specified alpha, power and delta-min is calculated.

The relationships among these parameters is illustrated in Figures 10-6 through 10-9. For example, if sigma (the variability is increased by a factor of two (that is there is more variability than before) then the minimum unacceptable difference must increase for a constant significance level, power, and sample size.

Figure 10-6 illustrates the power curves (probability of detection) for different sample sizes. Figure 10-7 shows the tradeoff between different levels of variability in the test statistics; Figure 10-8 shows the effect of different alpha values and Figure 10-9 shows the effect of different power levels.

ADMINISTRATIVE DECISIONS

A number of important and critical administrative decisions must be made prior to finalizing the sample plan design for collecting the data needed for the comparison.

The first decision relates to defining the comparison test statistic which forms the basis of the hypothesis test. A test statistic must be specified reflects concerns about differences between the EDA and the comparison areas. Several alternatives could be considered:

- Measures of location: indicators of "average" condition like the mean or median value (the median is the value where 50 percent the samples have values lower than the median and 50 percent have higher values). These would be most appropriate if the concern is for people exposed to a variety of areas within a given neighborhood.

- Measures of variability: indicators such as variance or extreme values such as the 95th percentile could be most appropriate if the concern was principally with exposure to "hot spots". The 95th percentile (or quantile) is that concentration were 95 percent of all concentration values would be lower and 5 percent higher.

A second decision concerns the significance level (alpha) which sets the Type I error level. For instance, this error is deciding that an EDA neighborhood is more contaminated than the comparison area when it is actually not contaminated.

A third decision concerns the detection probability (power) for a specified minimum unacceptable difference. As previously discussed, power is the probability of detecting a

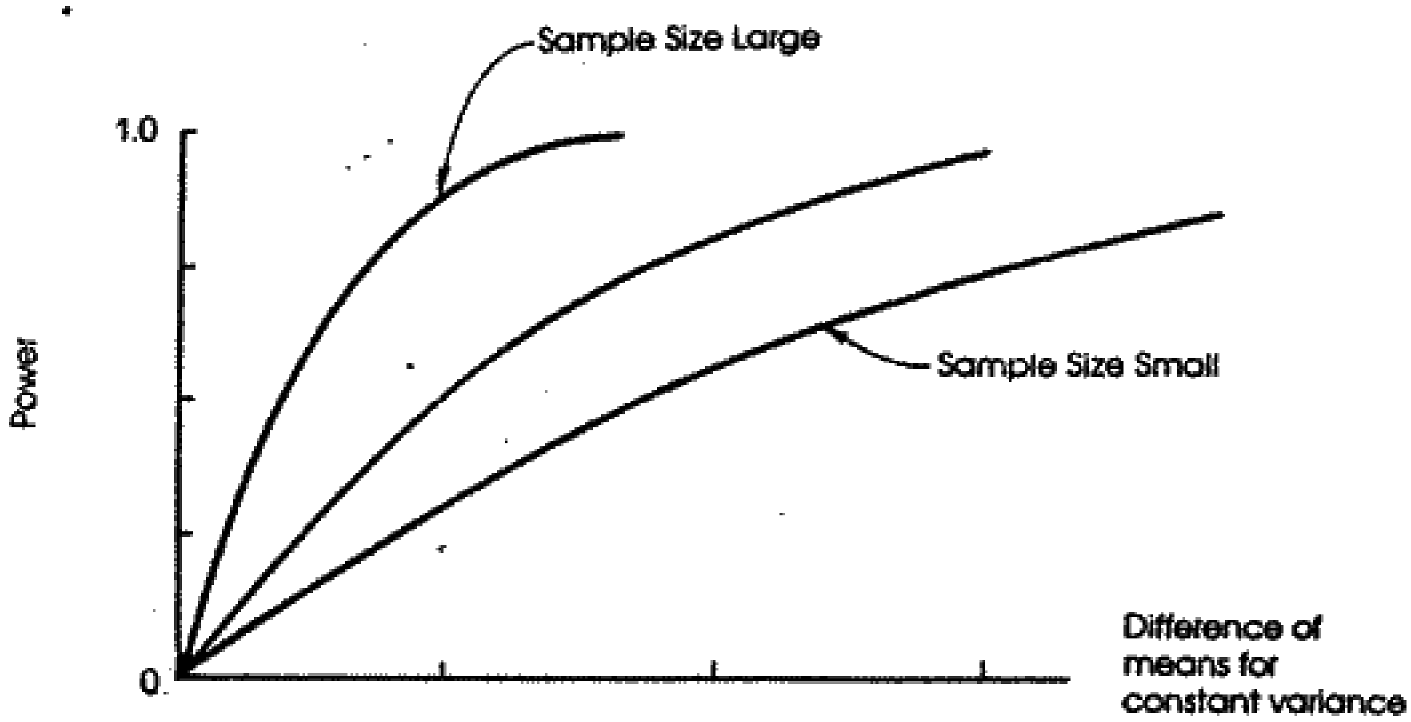


FIGURE 10-6
POWER OF TEST FOR
DIFFERENT SAMPLE SIZES

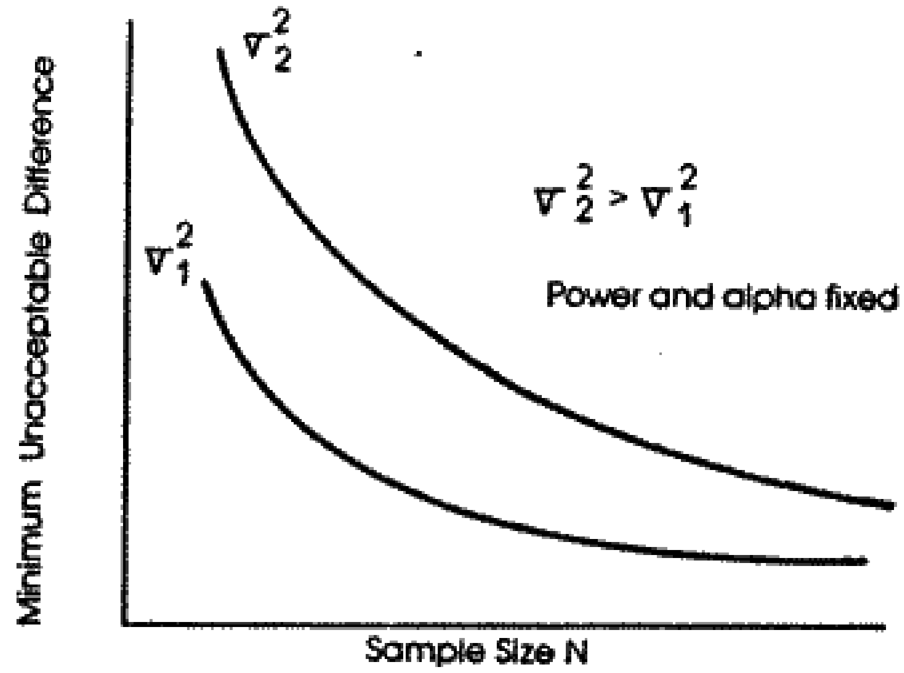


FIGURE 10-7
EFFECT OF ∇^2 (VARIANCE) MINIMUM DETECTABLE CHANGE VS SAMPLE SIZE

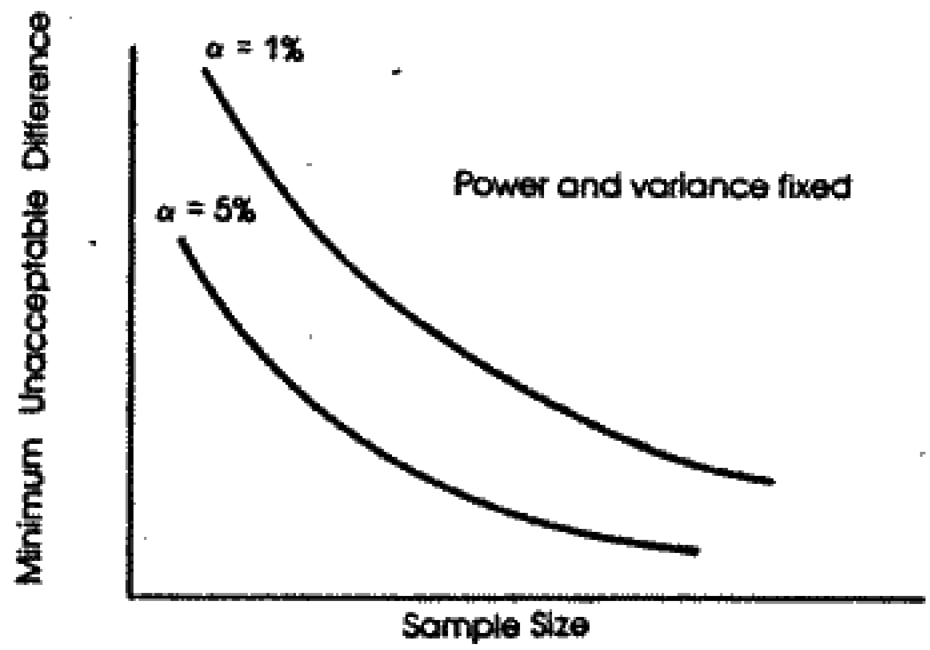


FIGURE 10-8
EFFECT OF α (ALPHA) ON MINIMUM DETECTABLE CHANGE VS SAMPLE SIZE

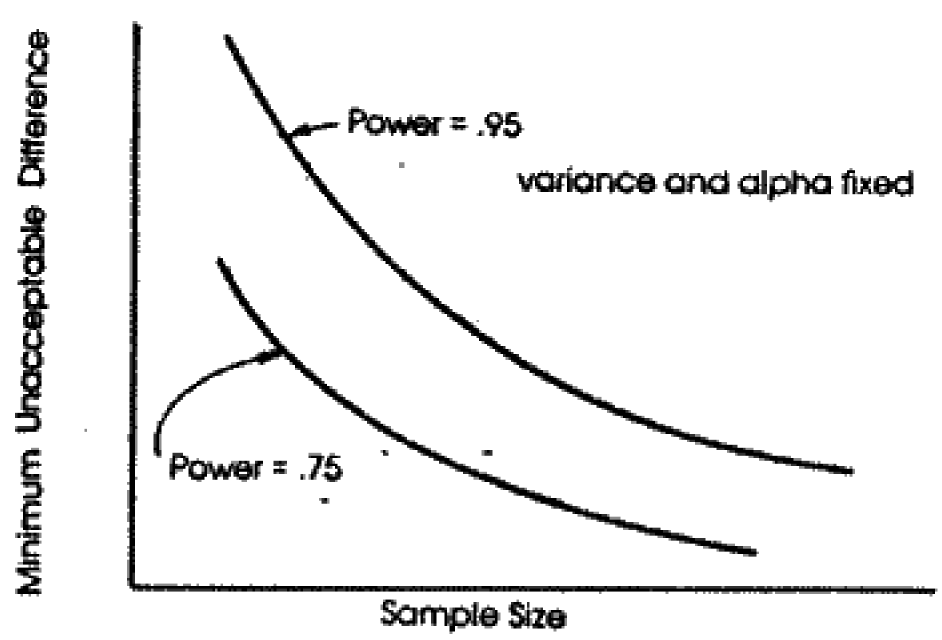


FIGURE 10-9
EFFECT OF POWER ON MINIMUM VS. SAMPLE SIZE

specific difference (the alternative hypothesis) when it exists.

To make this decision, administrators may begin by deciding what magnitude of difference is important to detect. For example, would a difference of 100 ppb be important to detect, or would a difference of five times the comparison areas' median concentration be important to detect. Once the minimum unacceptable difference is established, the probability of detection should be specified. That is, administrators should decide upon the power corresponding to this minimum unacceptable difference.

STATISTICAL DESIGN DECISIONS

A number of statistical decisions must also be addressed and resolved prior to carrying out the statistical comparison after concentration data are available from the Pilot Study.

The first decision concerns estimating the form of the frequency distribution for the sample data. For example, if the data follows a lognormal distribution, the natural logarithms of the data will follow a normal distribution. Extensive statistical results are available for comparing data from normal distributions; the most important being that the frequency distributions for the test statistics (i.e, the mean) are readily available.

A second decision addresses how to handle data variability between the EDA neighborhoods and the comparison areas. If the test statistic is a measure of location, it is assumed that the variances are the same in the EDA and the comparison areas and the pooled variance is estimated. As an additional complication, the variability may depend upon the concentration level.

The data variability has an effect upon the ability of the statistical comparison test to detect differences between the EDA and the comparison areas. Correct analysis of this variability is an essential aspect of the sample plan design.

A third decision is which statistical test is most appropriate given the administrative decisions on the test statistic and the statistical parameters discussed previously. With these decisions, a sample plan can be designed and the number of samples estimated.

SOURCES OF VARIABILITY

A set of concentration data is the end result of collecting and analyzing samples. A data value can be thought of being composed of a "true" value and a random value that corresponds to changes in the true value due to collection and analytical procedures.

The variability in true values is due to the spatial variability in concentrations within the EDA neighborhoods and the comparison areas. Ideally, this is the variability that is used in the statistical comparison tests and the design of the tests.

In addition to this spatial variability, there are a variety of additional "measurement" fluctuations that are added to the spatial variability. Some of these sources are:

- o Sample collection variability. It is possible that sample collection procedures may introduce variability in the measured concentrated values.
- o Sample handling variability. Some of the contaminants of interest are volatile organics. If they are not properly handled and carefully stored, their concentrations may not correctly reflect field concentrations.
- o Laboratory variability. The laboratory analysis procedures can yield concentration values different from the true values. For this reason, new laboratory protocols have been developed for the habitability study that will reduce and quantify this variability. The inclusion of quality control samples (blanks and spikes of known concentration mixed in with field samples) will help in estimating laboratory variability.
- o Inter-laboratory variability. It is possible that a laboratory could analyze samples and be relatively consistent within itself but inconsistent when compared to samples from other laboratories. Since data from a number of laboratories will be pooled, it is crucial to estimate any inter-laboratory variability.

Understanding and estimating this variability is necessary for the sampling plan design. For this reason, a pilot study has been authorized, which will permit the estimation of these sources of variability.

POTENTIAL METHODS OF STATISTICAL COMPARISON

At this time it is not clear which statistical procedures are appropriate for the sample plan design for the habitability study. Most of the factors influencing this choice have already been discussed. An additional factor is the problem of non-detected values. Non-detected values are concentrations too low to be accurately quantified by the laboratory protocol.

The potential extent of this problem is evident in data collected in 1980 by EPA, which were examined to find expected levels of LCICs, sources of variability and concentration distributions. As shown in Table 10-1, most of the concentrations in these studies were reported as nondetects (i.e. low concentrations were censored). These data provided some information on what the upper limits of the concentrations may be, but little information on frequency distributions or expected concentrations.

If a large proportion of nondetects is found in the proposed habitability study, similar to that found in the 1980 study, the number of applicable statistical approaches would be severely limited. The nondetect problem has been well recognized, and new protocols have been developed to obtain greater sensitivity for the LCICs.

Table 10-1
INDICATOR CHEMICALS--
ALL PREVIOUS STUDIES IN THE EDA

Chemical	Medium	No. of Detects	No. of Observations	Percent Detected
Chlorobenzene	Air	14	900	2
Chlorotoluene*	Air	345	1802	19
BHC*	Soil	44	520	8
Chlorobenzene	Soil	4	274	1
Dichlorobenzene*	Soil	4	266	2
1,2,4-Trichloro-benzene	Soil	1	133	1
1,2,3,4-Tetrachloro-benzene	Soil	2	134	1
2 Chloronaphthalene	Soil	1	135	1

*Results varied with different isomers.

The choice of a statistical method depends on the type of data that result from the habitability sampling, and the decisions to be made. The largest variety of techniques is available for data consisting of defined (i.e., detected) concentrations. For this case, the statistical tests can be grouped into two broad categories: parametric methods and non-parametric.

Parametric methods are based upon specifying or assuming the frequency distribution of the data. Comparison tests can then be made about the values of the parameters of the data frequency distribution. More importantly, the frequency distribution for the test statistics can often be derived from the frequency distribution for the data. The frequency distribution for the test statistics is required to carry out a statistical comparison.

Parametric methods can pose problems, however, if the actual distribution of the data differs greatly from the assumed or specified frequency distribution.

Nonparametric methods do not make assumptions about the form of the data's frequency distribution. Instead, the frequency distribution for the test statistic is derived using other statistical arguments.

POTENTIAL PROBLEMS

A variety of problems can arise if standard statistical methods are applied to the comparison of the EDA and comparison areas without first understanding the data. Two of these have already been discussed, understanding and quantifying sources of variability, and the potential problem of obtaining almost all non-detectable concentration values.

Additional potential problems have been identified and their resolution will be analyzed as part of the pilot study. The most significant of these are presented below.

Multiple Comparisons

In the statistical comparisons discussed up to now, two test statistics are contrasted, one representing the EDA neighborhood data and one for the comparison areas. If the habitability analyses are made neighborhood by neighborhood for each LCIC and if an EDA neighborhood would be statistically classified as not habitable on the basis of one statistical comparison, then the probability of incorrectly classifying a neighborhood as in need of remediation or unsuitable for habitation increases substantially with the number of LCICs compared.

An alpha of 0.05 implies a 5 percent probability of rejecting the null hypothesis that there is no difference between the EDA neighborhood and the comparison area. This Type I error probability refers to a single LCIC comparison. Now if eight LCIC comparisons are made separately for each EDA neighborhood, the probability of misclassifying the EDA neighborhood as being different when it is not increases to almost 34 percent. For 13 neighborhoods, it would be expected that four may be incorrectly classified as not habitable when in fact they are all statistically equivalent to the comparison area.

There are a number of alternatives that can address this important problem. Some of these are discussed below:

- Use a multivariate comparison approach. With a multivariate approach, all the LCIC data for an EDA neighborhood are analyzed together so that the number of comparisons are reduced. However, with a multivariate approach, it may be possible to have a statistically significant difference for the eight LCICs as a group even though there are no significant differences among individual LCIC.

- Adjust the significance level. The significance level (alpha) for the single comparisons could be adjusted by dividing alpha by the number of comparisons to be made. This is referred to as the Bonferroni correction. Unfortunately in this approach, the number of required samples can increase dramatically if power and the minimum unacceptable difference are to be the same as before.

- Adjust the decision rule on habitability. The statistical classification of a neighborhood as not habitable due to a single LCIC comparison can be changed. For example, one may require three of the eight LCIC comparisons to indicate a contaminated neighborhood, or one may require that a validation resampling also indicate contamination.

<u>Varying Error Statistics With Concentration</u>

Chemists believe that the relative error of measurements increases at extremely low concentrations. The standard way to accommodate decreasing precision is to estimate the variance of measurements for each level or range of concentrations and to weigh the measurements in the statistical analysis according to the reciprocal of the variances or standard deviations. With this approach, measurements believed to be unreliable, are weighted less relative to the measurements with higher reliability.

It is possible that there will be insufficient information to estimate the variability of measurements of low concentrations. However, there may be strong evidence that low concentration measurements are much less reliable than high concentration measurements. In this case, the qualitative information about reliability should not be ignored, but incorporated into the statistical analysis in a manner that does not require knowledge of the exact relationship between reliability and concentration but only approximate knowledge of the relationship.

For example, a standard statistical procedure for comparing the EDA and comparison area concentrations could use the ratio of the mean concentrations. The null hypotheses of no difference will be rejected whenever the ratio exceeds a critical value. The critical level depends on alpha, but not on the EDA mean concentration. In particular, if the critical ratio is 10 then the null hypothesis must be rejected if the observed EDA mean is 11 ppt and the observed comparison area mean is 1 ppt, even though measurements in the ppt range are very likely to be unreliable. This suggests that it is inappropriate to reject the null hypothesis on the basis of the observed ratio alone. Rather the critical level to which the observed ratio is compared should depend on the mean EDA concentration. The critical level should be large for measurements near the detection limit.

Increasing the critical limit for mean EDA concentrations near the detection limit decreases the chance of falsely rejecting the null hypothesis at the low. Increasing the critical limit is equivalent to decreasing alpha. Consequently, this modification of the critical limit is equivalent to using a small value of alpha, when the observed mean EDA concentration is near the detection limit and using the conventional value of alpha when the observed mean EDA concentration is sufficiently large so that the relative error of measurements is nearly constant.

This adjustment of alpha is meant to compensate for the uncertainties of extremely low measurements due to limitations in state-of-the-art analytical chemistry when there is not enough information for a more formal compensation of measurement reliability. The exact critical levels on alpha values that would be used if this adjustment were made cannot be specified until information on protocol reliability is obtained from the pilot study.

PILOT STUDY

AIMS AND GOALS

The pilot study goal is to resolve many of the statistical issues. Among the pilot study statistical goals are the following:

- To test protocols concerning sample collection, handling, storage, and to quantify, if possible, the variability and bias introduced by it.

- To evaluate the new analysis procedures and to quantify the sensitivity, bias, and variability introduced by the new protocols. Two laboratories will be used in the pilot to estimate the inter-laboratory variability. Analysis of previous data has shown intra- and inter-laboratory variability to be a major source of bimodality observed in 1980 data.

- To estimate the validity of the assumption of spatial homogeneity in the EDA and comparison areas. Existing data do not indicate "hot spots" or gradients in the 1980 data. The assumption that the LCICs are distributed homogeneously throughout the EDA and comparison areas is a critical aspect of any sampling design. The number and locations of samples will differ if the data are inhomogeneous.

- To estimate variability from the spatial dispersion even if no "hot spots" exist, of the LCICs in the EDA and comparison areas. Total variability in the LCIC concentration distributions will influence sample sizes required.

- To estimate the distributions of LCIC concentrations. Concomitant with this is the estimation of the fraction of non-detects. Knowledge of the likely distributions will narrow the potential statistical tests of comparison, thereby affecting the sampling plan design.

- To provide data to determine appropriate statistical tests for habitability study design.

Although the pilot study will undoubtedly provide more information than is available now, it is possible that additional questions and uncertainties will be raised by the study. There are several potential outcomes which could leave significant uncertainties. For example, the data may still have a large number of non-detects in spite of the more sensitive analytical chemistry techniques used. Even if the data are not extensively censored, the distribution of concentrations may still be a mixture of distributions, e.g., possibly bimodal. This would make the design of a sampling plan very difficult.

Other complications may occur as a result of high inter-laboratory variability. Since only two laboratories are being used in the pilot, it may be difficult to estimate the variability expected in the analyses if a larger number of laboratories are used in the future. This would contribute to uncertainty in sample sizes for the main study.

Finally, the data from the pilot may show the influence of some unanticipated nonrandom factor which would complicate the sample design problem. One such factor may be the pattern of comparison area property owners who give permission to sample on their property.

As explained above, the pilot study, although carefully planned with the requirements for the sampling plan design in mind, may not provide all the answers needed to design an optional sampling plan. It will, however, provide enough information to allow an informed sampling plan to be formulated.

This Sampling Plan will include the detailed discussion of the Statistical Procedures used in determining the number of samples that need to be collected for the habitability study.

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Selection of Comparison

APPENDIX 11

Appendix 11

SELECTION OF COMPARISON AREAS

The comparison approach to determining the relative habitability of the Love Canal Emergency Declaration Area (EDA) is based on a comparison of environmental sampling results from the neighborhoods and homes of the EDA with those from similar inhabited communities not impacted by a chemical landfill. This method relies on the comparison area to provide data that corresponds to "normal" or habitable conditions and which, when compared to similar measurements in the EDA, can provide an indication of whether EDA neighborhoods and homes are "as safe as" those in other western New York communities. Critical to this approach are the criteria and methodology for selection of the comparison areas.

The criteria and methodology for selecting the comparison areas as presented in this document represent a distillation of the collective deliberations of the scientific advisors on November 14, 1984, and March 27, 1985.

Consensus was reached on the following issues:

1. The comparison areas should consist of inhabited, urban, residential neighborhoods in western New York.

2. The comparison area should be as far from known chemical landfill sites as possible and no closer than one-half mile.

3. The comparison area should be similar to the Love Canal EDA with respect to soil type, hydrogeology, industry base, prevailing wind with regard to industrial point sources of potential environmental contamination, and selected socioeconomic status indicators such as density, value, and age of housing.

4. The similarity of soil types and hydrogeological conditions and distance from known chemical landfills are more critical as selection factors for the comparison area than matching for selected socioeconomic status indicators.

In addition, the scientific advisors agreed on the need for specific, definitive, objective selection criteria to guide the process by which comparison areas would be selected.

Discussions of the expert advisors that led to the criteria for comparison area selection are summarized in the following sections.

GEOGRAPHIC SETTING

Recognizing that the ideal comparison area would be one which duplicates as closely as possible those environmental conditions found in the EDA (with the exception of proximity to the Love Canal or some other known source of environmental contamination), the scientists agreed that the comparison areas should consist of urban residential neighborhoods similar to those in the EDA. It was recognized that uninhabited, rural, or nonresidential neighborhoods would not provide a suitable match.

Western New York was identified as the geographical area from which to select the comparison neighborhoods because it presents a frame of reference for people living in the EDA and surrounding areas, and because it meets the criteria noted above. Compared to other areas in the Northeast, western New York (and Niagara Falls in particular) is unique in its concentration of chemical manufacturers. From a sociological perspective, this industrial base forms a common framework for employment and lifestyle. From an environmental perspective, air studies show that chemical emissions of chlorinated organic compounds and other compounds resulting from manufacturing processes are indigenous to Niagara Falls and western New York.

Coupled with these factors, the scientists recommended the selection of the comparison neighborhoods in western New

York to ensure a geographically based frame of reference with meaning for people still living in the EDA and others interested in its relative habitability. Comparison neighborhoods selected in the western New York area would enable those interested to examine them and make a meaningful comparison with respect to the habitability of neighborhoods in the EDA.

DISTANCE FROM KNOWN CHEMICAL LANDFILLS

While the scientists agreed that the one factor in which the comparison areas should differ from the EDA was proximity to a known landfill, questions arose concerning how far was "far enough away." Initially, it was agreed that the borders of comparison area census tracts should be located at least one mile from a known chemical landfill. However, it was determined that none of the residential census tracts in the Buffalo-Niagara Falls Standard Metropolitan Statistical Areas with socioeconomic status indicators comparable to the EDA were greater than one mile from at least one of the 252 landfills in the two-county area. The scientists then considered reducing the one-mile distance to one-half mile. This led to a discussion on the significance of an absolute minimum distance.

Since distance from a known chemical landfill is meant to relate to the potential for exposure, the scientists concluded that an absolute measure of distance would be arbitrary and meaningless unless it was determined on the basis of site-specific circumstances. Recognizing the limitation of detailed information on the nature and quantity of chemical wastes, the potential for offsite migration (type of soils, hydraulic heads, etc.), and the possibilities for human exposure at each site, the scientists agreed that limiting the criteria to a single absolute distance factor was not practical.

One purpose of the comparison approach is to provide reassurances to those still living in the Love Canal EDA, or who may later wish to move there, that if areas are found to be potentially habitable, those areas are "as safe" now as a comparable area not known to be impacted by a chemical landfill. The scientists therefore agreed that the selected comparison areas should be as far away from a known chemical landfill as possible.

There was some debate that the comparison areas should be selected outside of the Erie-Niagara County area to ensure a sufficient distance from known landfills. Other scientists indicated that in order to avoid the sacrifice of EDA-like conditions with respect to soil type, hydrogeology, industrial framework, and selected socioeconomic status indicators coupled with the meaninglessness of an absolute distance factor, however great or small, that Erie and Niagara Counties should be the area of focus.

Finally, it was generally accepted that the comparison area would be closely matched with the EDA with respect to soil types, hydrogeological conditions, industry, prevailing winds in relation to industrial point sources of potential environmental contamination, and property value (proxy for the type and quality of the structures, and perhaps an indicator of comparable lifestyles). With this matching, a relative distance factor could be implemented, as long as the area was greater than one-half mile from a known site.

SOIL TYPE, HYDROGEOLOGY, INDUSTRY BASE, AND SOCIOECONOMIC STATUS INDICATORS

Given that certain topographical, hydrogeological, and meteorological conditions are likely to promote or curtail the movement and persistence of chemicals, and influence the opportunity for transport and potential for human exposure, the scientists agreed that the comparison areas should match as closely as possible the soil types and hydrogeological and meteorological conditions of the Love Canal EDA. It was also recognized that, in analyzing chemicals at low levels, some interferences may be related to soil types. Both these factors persuaded the scientists to recommend particular attention to soil type and further supported the argument to select the comparison areas in western New York with geological and meteorological conditions the same as those of the EDA.

The census tracts comprising the EDA have soil types characterized as lake silt, sand, and clay. According to the State Geological Survey of the New York State Education Department, Quaternary Geology of New York, Niagara Sheet (1977) the overburden is composed of silt, fine to medium sand, and clay. It is thin bedded to massive, and in part, very regularly bedded with cyclic alternation of clay and silt laminae. It is moderately permeable along bedding surfaces. The circumstances leading to this geological formation were the offshore deposits from lakes in basins which did not require an impounding ice margin for closure and hence persisted after deglaciation.

The scientists also agreed that the comparison areas should match the historically unique industry base which has existed in Niagara Falls for nearly 100 years and which forms a common psychosocial milieu for employment and life in general. From this perspective, selecting an area with a comparable industry base and prevailing winds to some degree controls for the factors relating to industrial processes.

The exodus of population from the EDA since 1980 makes it difficult to use population-based characteristics such as age, sex, race, percent female head of household, income, etc., for matching in the selection of a comparison area. Certain housing characteristics, however, as recorded in the 1980 Census, such as value of owner occupied housing, contract rent for renter occupied housing, percent of owner occupancy, median number of rooms per occupied housing unit, percent of housing built before 1950, percent of houses with utility gas as fuel, and percent of houses with public water were considered for this purpose. The scientists agreed that the three most useful socioeconomic status indicators of those considered were density, age, and value of housing. These factors are used to represent the nature of a residential neighborhood. Value of housing, in particular, serves as a proxy for the type of house and perhaps as an indicator of living styles.

The following table presents data on the selected socioeconomic status indicators for the two census tracts comprising the Love Canal EDA.

Selected Housing Characteristics	EDA CENSUS TRACTS 224.01	224.02
Total Housing Units	784	741
Value of Owner Occupied Housing	$36,900	$33,900
Contract Rent for Renter Occupied Housing ($/mo)	185	185
Percent Owner Occupancy	93.7	37.6
Median Number of Rooms per Occupied Unit	5.6	5.2
Percent Housing Units with more than one person per unit	2.9	6.3
Percent Housing Units Built Before 1960	89	40
Percent Housing Units Built Before 1950	43	19
Percent Housing Units with Gas as Fuel	69	80
Percent Housing Units with Public Water	100	100

Source: Census of Population and Housing--U.S. Department of Commerce--Bureau of the Census, 1980

RELATIVE IMPORTANCE OF SELECTION FACTORS

With regard to the relative importance of the selection factors, the scientists agreed that socioeconomic status indicators were the least important in matching for environmental comparability with the EDA. Of all socioeconomic status indicators considered, value of housing was considered most important because of its proxy value for life-style and subsequent accompaning indoor air environment.

Soil type and distance from a known chemical landfill were deemed the most important control factors and critical elements in any experimental design applying the comparison approach to determine relative habitability of the EDA.

NUMBER OF CONTROLS

Consideration was given to selecting two comparison areas, one in Erie and Niagara Counties and one outside Erie and Niagara Counties (yet still within western New York). The purpose of selecting a second comparison area outside of Erie and Niagara Counties was to provide assurance that at least one comparison area was not impacted by a landfill. The major criticisms of this approach centered around two major questions: how to interpret data from the EDA in relation to two comparison areas and how to control for the environmental effects of differences between the industrial bases.

Some scientists argued that using the two comparison areas, would provide additional information about the relative habitability of the EDA. Specifically, they contended that it would indicate whether the EDA is "as safe as" other neighborhoods in the Erie-Niagara Frontier, as well as whether it is "as safe as" other neighborhoods outside of Erie and Niagara Counties in western New York.

The question of interpreting the possible outcomes of environmental sampling with respect to a habitability decision caused other scientists some concern. For example, if the EDA were judged to be "as safe as" the comparison area in Erie and Niagara Counties, but not as safe as the second comparison area, what decision would be made regarding habitability? Some scientists agreed that the use of two comparison areas would be acceptable as long as (1) environmental sampling results showing more contamination in the EDA than in either of the two comparison areas are interpreted as an indication of non-habitability for the EDA or (2) the EDA is compared only with the less contaminated comparison area. Others argued that this limitation of interpretation would increase the chances for a negative habitability decision and essentially render the findings of one of the comparison areas superfluous.

Others argued that moving too far away from the Erie-Niagara Frontier would result in a significantly different industrial base, which could have a major impact on the ambient environment.

To accommodate the common interest of all the advisors to ensure that one or more comparison areas are not impacted by a landfill, the Department of Health reviewed existing data and visited landfill sites proximate to census tracts which were under consideration for final selection as a comparison area. The data review and onsite inspection served to identify any evidence of offsite migration which could have potentially impacted the census tracts under consideration. Census tracts which may be impacted by a landfill, as determined by this preliminary investigation, were rejected.

This final selection step, following rank ordering by distance from known landfill sites and matching for similarity to the EDA with respect to soil, hydrogeology, industry base, prevailing winds in relation to industrial point sources of potential environmental contamination, and selected socioeconomic indicators should ensure the selection of a comparison area which duplicates as closely as possible those environmental conditions found in the Love Canal EDA with the exception of impact by a landfill.

WDR102/022

Areas Love Canal Environmental Data
Quality Assurance Review and Assessment Report

APPENDIX 12

Appendix 12

LOVE CANAL ENVIRONMENTAL DATA QUALITY ASSURANCE REVIEW AND ASSESSMENT

INTRODUCTION

Originally the habitability decision regarding Love Canal was to be based on the environmental data resulting from environmental studies previously performed at Love Canal and in the EDA. Questions pertaining to the quality of some of the previously collected environmental data arose from concerns expressed by the National Bureau of Standards (NBS) and the Office of Technology Assessment (OTA) when they reviewed the EPA's 1980 Love Canal Environmental Monitoring Program. The majority of the questions raised by NBS were satisfactorily answered by EPA; however, issues pertaining to the limits of detection and the significance of non-detect values have never been resolved. Because most of the remaining environmental monitoring studies have not undergone a QA review, very little is known about the quality of the data. The QA Review and Assessment Task was developed primarily to provide this QA review and to explore the detection limits issues.

The scientific experts then began development of a comparative approach to the habitability decision which ruled out using the "old" environmental data. Some of the experts felt that the "old" data, which are approximately five years old, could not be used for comparison to any future data collected at the comparative areas.

It was decided that instead of abandoning the QA/QC review and assessment, it should be continued so that vital information derived from performing the task could be incorporated in any future sampling programs in the Love Canal and in the EDA. The goal of the QA/QC review and assessment task became one of learning as much as possible from the "old" environmental studies so that future studies could benefit from the past experience.

This appendix summarizes the results of the Love Canal Environmental Data Quality Assurance (QA) Review and Assessment Task.

The QA/QC Review and Assessment methodology consists of a phased sequential approach which is described in detail in "Love Canal Environmental Data Quality Assurance Review and Assessment Methodology--September 20, 1984." The tasks associated with this method for sample collection and analysis are:

- o Phase A: Existence/Verification of Data

- o Phase B: Review by Experts

- o Phase C: Documentation Audit
- o Phase D: Personnel Interviews
- o Detection Limit Assessment
- o Automated Data Processing (ADP) Audit

The first step in the two-step procedure chosen consisted of completing Phases A and B for all the environmental monitoring studies done at Love Canal and the EDA from December 1979 to present. The first step also included development and testing of procedures to conduct the pilot studies. Step two, which began after the completion of step one, consisted of the Phases C and D pilot, the detection limit assessment pilot, and the ADP audit pilot.

SUMMARY

Primary conclusions, recommendations, and summary comments of the QA/QC Review and Assessment are stated below:

Phase A

- o A total of 55 environmental studies were carried out at Love Canal and the EDA for air, drinking water, groundwater, sediment, soils, surface water, and sumps.

- A Document Tracking System was developed in which documents related to Love Canal are filed.

Phase B

- Documentation of sample collection procedures for the five air studies under review was insufficient to complete a Phase B review.

- Only one of the three groundwater studies under review did not have sufficient sample collection procedures documented to complete the Phase B review.

- Three of the five soil studies under review did not have sufficient sample collection procedures documented to complete the Phase B review.

- The analytical procedures for all of the studies met the defined minimum QA criteria.

Phase C and D Pilot--Sample Collection

Four data sets with samples collected in air, groundwater, and soil and having sufficient documentation to enable the Phase C and D reviews and the detection limit assessment to be performed were chosen for the pilot studies. They are as follows:

1. EPA Environmental Monitoring Study--Air data set. Samples collected in the EDA by GEOMET Technologies, Inc., and analyzed by PEDCO Environmental Laboratory. (1980)

2. EPA Environmental Monitoring Study--Soil data set. Samples collected by GEOMET Technologies, Inc., analyzed by Mead Compuchem Laboratory. (1980)

3. NYSDOL Soil Sampling--Samples collected by NYSDOH and analyzed by NYSDOH. (1980)

4. NYSDEC Groundwater Sampling--Samples collected by NYSDEC and analyzed by VERSAR Laboratories, Inc. (1984)

The overall sample collection procedures used in the field for the pilot study data sets were adequate; however, there were several discrepancies:

- Three of the four data sets did not have QC samples taken.

- Decontamination procedures were insufficient to maintain the integrity of the air and groundwater samples.

- o Field log books were severely inadequate in terms of thoroughness and attention to detail for the NYSDOH Soil Sampling Data Set and the NYSDEC Groundwater Sampling Data Set.

- o Holding times for the volatile organic samples (before laboratory delivery) were too long for the EPA Soil Data Set.

Phase C and D Pilot--Sample Analysis

The overall reliability of positive chemical identification is high, but the reported concentrations were found to be biased toward lower values than were actually present and there was excessive reporting of non-detect values. This was due to:

- o Poor extraction procedures for the soil samples

- o Long holding times for the volatiles

- o Stringent compound identification

- o Arbitrary detection limits set by the contract laboratories

Detection Limit Assessment Pilot

Since no method of quantifying an Instrument Detection Limit (IDL) or a Minimum Detectable Concentration (MDC) was specified for the EPA Soil and Air data sets, the Currie (Currie, L.A. 1968. Analytical Chemistry, Vol. 40, p. 586), U.S. Army/THAMA, and EPA/CLP (Glasser et al, 1981. Science and Technology, Vol. 15, p. 1426) methods were evaluated for estimation of the IDL and MDC. A modified Currie method was developed for estimating the IDL, and the EPA/CLP was modified for estimating the MDC. The modified Currie method requires measurement of instrument noise to calculate a standard deviation of background levels, and since the EPA data sets had no measureable background signals recorded, the method could not be applied. The EPA/CLP method requires multiple low level calibrations and since this was not done in the EPA data sets, this method also could not be applied to the data sets.

It is recommended that these methods for estimating the IDL and MDC be incorporated into future QA/QC protocols for analysis of samples from sites containing trace levels of contamination.

ADP Audit Pilot

The transfer of data from the laboratory sheets to the computer data base was executed with a low percentage of error. For the air data set, the percentage of error is less than 1 percent and for the soil data set the percentage of error is 3 percent.

Values of methylene chloride, Bis(2-ethylhexyl)phathalate, trichlorofluoromethane, and benzene were not reported because their presence was considered to have resulted from laboratory contamination.

QA REVIEW AND ASSESSMENT METHODOLOGY

The assessment and final selection of the alternatives for the QA review and assessment methodologies reviewed are discussed in detail in the "Love Canal Environmental Data Quality Assurance Review and Assessment Methodology" (September 20, 1984).

The following is a description of the tasks associated with the selected QA Review and Assessment Methodology. The Phase A and B tasks were performed for all of the environmental studies performed after December 1979 for three media: air, groundwater, and soil. Phase C and D, determinations of detection limits and ADP audits, were performed on selected pilot study data sets.

The Phase A task was designed to identify all of the environmental sampling studies conducted at Love Canal. Once identified, the studies were divided into data sets. A data set represents a single medium, collected by a single collection agency or contractor, analyzed by a single laboratory, and commissioned for a given study. Preliminary investigations for all the data sets were made to determine the status of readily available documentation of sample collection, information on the existence of quality control (QC) samples, sample handling protocols, laboratory analytical procedures, and whether or not the analytical results exist on a computer data base.

The scope of the Phase B task included reviews of a selected group of the data sets identified by Phase A task. The scientific experts decided that only air, groundwater, and soil were the media of interest. In addition, the experts decided that only those data sets collected after the treatment plant began operation in December 1979 should be considered. These studies were reviewed to determine if the procedures for sample collection and analysis were documented and if they were adequate to meet minimum quality assurance criteria set by experts in the fields of sample collection and analytical laboratory procedures. The goal of the QA review is to place each environmental study performed at Love Canal in one of the following categories:

1. Meets minimum QA criteria

2. Uncertain if minimum QA criteria are met

3. Does not meet minimum QA criteria

Documents which were identified by Phase A as being associated with a data set and which were not on hand were subsequently collected for review.

Phases C and D were conducted for four selected pilot data sets and consist of indepth reviews of the studies. For the Phase C task, studies were reviewed to determine if protocols established as representing minimum QA criteria in Phase B were followed for sample collection and analysis. When field notes, laboratory notes, and other available documentation were insufficient to determine the above, then Phase D task was attempted. This task consisted of interviews with personnel responsible for the collection and analysis of the samples.

The detection limits and possible assignment of values of non-detects for the four pilot data sets were investigated because these are important factors in the habitability decision-making process. The analytical "detection limit" (defined precisely in the "Detection Limit Assessment Pilot Study" section) is a critial determinant of the quality and usefulness of the laboratory analytical results. Knowledge of upper bounds for the many non-detects reported for the EDA is very desirable in determining the usefulness of each data set. This "limit" for non-detects, and the analytical "detection limit" are frequently different values that are specific to a given data set. An extensive literature search was conducted to find appropriate methods for estimating these limits. The methods reviewed and others subsequently developed are discussed in the pilot study results. Data sets for which "detection" limits have been reported were reviewed to evaluate these limits. This review requires analysis of the sources of error inherent in the laboratory analytical process. Sources of variability and bias were investigated in order to estimate these limits. To perform this review, raw analytical instrument data such as GC/MS output for field samples, blanks, standards, and other quality control data were evaluated. Data sets which have no such reported limits were reviewed to determine if sufficient raw data exist to estimate these limits.

ADP audits were executed on only two of the four pilot data sets since they were the only two data sets whose analytic results were available on computer tapes. Original laboratory forms were checked against the computer tapes to determine to what degree of reliability the data on the computer tape represented the original data on the laboratory forms.

RESULTS OF PHASE A AND PHASE B

The Phase A task identified a total of 55 environmental studies done at Love Canal and the EDA for air, drinking water, groundwater, sediment, soils, surface water, and sump water. A document tracking system was created to locate and file every available document relating to Love Canal issues. Each study was separated into data sets, resulting in 176 data sets. Table 12-1 provides a summary of the approximate number of environmental samples collected in each medium before and after December 1979. Tables 12-2 through 12-8 summarize the studies, the dates collected, and the locations where the samples were taken for each of the above mentioned media.

Table 12-1

SUMMARY OF ENVIRONMENTAL SAMPLING STUDIES

Medium	No. of Studies	No. of Data Sets	Approx. No. of Samples Collected Before Dec. 1979	Approx. No. of Samples Collected After Dec. 1979
Air	13	27	747	3,673
Drinking Water	3	12	20	271
Groundwater	9	28	21	958
Sediment	16	28	44	614
Soil	20	35	4,813	1,329
Water[a]	31	44	92	1,111

[a]Includes surface and sump water.

The results of the Phase B review for the sample collection and analysis of air, groundwater, and soil samples taken in the Love Canal and EDA area after December 1979 are shown in Table 12-9.

TABLE 12-2

SUMMARY OF PHASE A RESULTS FOR MEDIUM: AIR

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC.	NO OF SAMPLES	NO OF QC SAMPLES
RTI INDOOR AIR SAMPLING	002	070	1978, FEB 7-9	B,C	RTI	1	RTI	1	13	0
RTI OUTDOOR AIR SAMPLING	002	067	1978, JULY 6-7	B	RTI	1	RTI	1	18	1
DOH INDOOR AIR SAMPLING	009	080	1978, JUN 25 - DEC 14	B,C	NYSDOH	2	NYDOH	1	651	10
DOH OUTDOOR AIR SAMPLING	010	082	1978, MAY 18 - JUN 8	A,B	NYDOH	1	NYDOH	1	41	0
DOH OUTDOOR AIR SAMPLING	016	091	1978, OCT 26 - 27	B	NYSDOH	2		1	3	0
DOH OUTDOOR AIR SAMPLING	053	164	1979		NYSDOH	2	NYDOH	2	0	0
DOH INDOOR AIR SAMPLING	019	159	1979, MAY - JUNE	B-476 99TH STREET	NYSDOH	1	NYDOH	1	15	0
EPA INDOOR AIR SAMPLING	041	142	1979, NOVEMBER 15, 28	C	EPA	2	EPA	2	6	0
EPA INDOOR AIR SAMPLING	041	143	1979, NOVEMBER 15, 28	C	EPA	2	RTI	2	0	6
EPA STORM SEWER SAMPLING	052	162	1980, APR. 24-25, MAY 1-2	B,E	O.H. MATERIALS CO.	1	AES	1	33	4
HOOKER OUTDOOR	051	160	1980, AUG 7, 9, 22	A,B,C	HOOKER CHEMICAL	1	HOOKRC	1	77	0
1980 EPA ENVIRONMENTAL	001	001	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	WSU	1	5	3
1980 EPA ENVIRONMENTAL	001	002	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSLA	1	347	178
1980 EPA ENVIRONMENTAL	001	003	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	PEDC	1	387	317
1980 EPA ENVIRONMENTAL	001	004	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	SWRI	1	390	179
1980 EPA ENVIRONMENTAL	001	005	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	BCL	1	365	234
1980 EPA ENVIRONMENTAL	001	006	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	BCL2	1	328	166
1980 EPA ENVIRONMENTAL	001	007	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	BCL3	1	27	16
1980 EPA ENVIRONMENTAL	001	008	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSR	1	118	121
1980 EPA ENVIRONMENTAL	001	009	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	HERL	1	0	48
1980 EPA ENVIRONMENTAL	001	010	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	IIT	1	0	12
EPA AIR SAMPLING	039	139	1980, JUNE 12	E - LEACHATE SEWERS	EPA	2	EMSR	2	2	0
EPA INDOOR AIR SAMPLING	039	140	1980, JUNE 18-19	B - 476 99TH STREET	EPA	2		2	1	0
DOL LITIGATION	036	131	1981, SEPT. 15-16	B	NYSDOH	1	NYDOH	1	37	4
DEC OUTDOOR AIR SAMPLING	032	118	1982, DEC 15-1983, MAR 18	C	NYSDEC	1	NYDEC	1	349	0
DEC OUTDOOR AIR SAMPLING	032	119	1983, JUN 8 - NOV 22	C	NYSDEC	1	NYDEC	1	1093	0
DEC OUTDOOR AIR SAMPLING	032	120	1983, JUN 8 - NOV 22	C	NYSDEC	1	NYDOH	1	114	4

LOCATION KEY
A - CANAL D - CREEKS
B - RINGS 1&2 E - SEWERS
C - EDA F - ALL

PROCEDURE KEY
1 = DOCUMENTED
2 = NOT DOCUMENTED

ABBREVIATIONS
COLL. = COLLECTION
PROC. = PROCEDURE
ANAL. = ANALYTICAL

TABLE 12-3

SUMMARY OF PHASE A RESULTS FOR MEDIUM: DRINKING WATER

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC	NO OF SAMPLES	NO OF QC SAMPLES
RTI DRINKING WATER	002	068	1978, JULY 6-7	B	RTI	2	RTI	1	18	
DOH SUMP SAMPLING	017	092	1979, JAN 10	C		2	NYDOH	2	2	
1980 EPA ENVIRONMENTAL	001	055	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES INC	1	ACEE	1	23	
1980 EPA ENVIRONMENTAL	001	056	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	CMTL	1	9	
1980 EPA ENVIRONMENTAL	001	057	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	EMSC	1	8	
1980 EPA ENVIRONMENTAL	001	058	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	EMSV	1	20	
1980 EPA ENVIRONMENTAL	001	059	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	ERCO	1	28	
1980 EPA ENVIRONMENTAL	001	060	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	GSLA	1	17	
1980 EPA ENVIRONMENTAL	001	061	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	GSNO	1	38	
1980 EPA ENVIRONMENTAL	001	062	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	PJBL	1	83	
1980 EPA ENVIRONMENTAL	001	063	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	SWRI	1	17	
1980 EPA ENVIRONMENTAL	001	064	1980, AUG. 8 - OCT. 31	B,C	GEOMET TECHNOLOGIES, INC.	1	TRW	1	18	

LOCATION KEY
A - CANAL D - CREEKS
B - RINGS 1&2 E - SEWERS
C - EDA F - ALL

PROCEDURE KEY
1 = DOCUMENTED
2 = NOT DOCUMENTED

ABBREVIATIONS
COLL. = COLLECTION
PROC. = PROCEDURE
ANAL. = ANALYTICAL

TABLE 12-4

SUMMARY OF PHASE A RESULTS FOR MEDIUM: SEDIMENT

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC.	NO OF SAMPLES	NO OF QC SAMPLES
DEC SAMPLING	027	109	1976, NOV 10	E	NYSDEC	1	NYDOH	2	2	0
CALSPAN GROUNDWATER STUDY	047	150	1977, APRIL 12	B	CALSPAN CORPORATION	2		2	3	0
DEC WATER SAMPLING	028	114	1977, DEC 1	B	NYSDEC	2	NYDOH	2	3	0
DOH	012	086	1978, AUG 20 - 21	D	NYSDOH	1	NYDOH	2	7	0
EPA LOVE CANAL SAMPLING	037	136	1978, SEPT. 26	D,E		1		2	14	0
STORM SEWER & CREEK	013	088	1979, NOV 15	D,E	NYSDOH	1	NYDOH	1	15	0
EPA STORM SEWER SAMPLING	052	161	1980, APR. 24-25, MAY 1-2	B,D,E	O.H. MATERIALS CO.	1	AES	1	28	0
1980 EPA ENVIRONMENTAL	001	021	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	ACEE	1	24	34
1980 EPA ENVIRONMENTAL	001	022	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	CNTL	1	53	89
1980 EPA ENVIRONMENTAL	001	023	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSC	1	5	13
1980 EPA ENVIRONMENTAL	001	024	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSV	1	39	6
1980 EPA ENVIRONMENTAL	001	025	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	ERCO	1	22	33
1980 EPA ENVIRONMENTAL	001	026	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSLA	1	14	8
1980 EPA ENVIRONMENTAL	001	027	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSNO	1	29	38
1980 EPA ENVIRONMENTAL	001	028	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	PJBL	1	14	24
1980 EPA ENVIRONMENTAL	001	029	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	SWRI	1	23	80
1980 EPA ENVIRONMENTAL	001	030	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	WSU	1	32	12
1980 EPA ENVIRONMENTAL	001	066	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSC	1	0	3
DEC SEDIMENT SAMPLING	025	105	1980, MARCH 12-14	D	NYSDEC	1	NYDOH	1	2	1
DEC SEDIMENT SAMPLING	025	106	1980, MARCH 12-14	D	NYSDEC	1	NYDOH	2	12	0
DEC SEDIMENT SAMPLING	033	121	1980, MAY 27	B,E		2	NYDOH	1	3	0
INDIANA STATE UNIVERSITY	054	168	1981, SEPT.	B, C	INDIANA STATE UNIVERSITY	1	SCHINU	1	0	0
MALCOLM PIRNIE STUDY	003	072	1983, JAN 3-21, MAR 10,11	D,E,C	MALCOLM PIRNIE	1	CNTL	1	162	0
MALCOLM PIRNIE STUDY	003	165	1983, JAN3-21,MAR 10,11	1	MALCOLM PIRNIE	1	CNTL	1	127	0
DEC - CAYUGA CREEK	023	103	1984	D	NYSDEC	2		2	11	0
DEC SEDIMENT SAMPLING -	024	104	1984, APRIL 12	D	NYSDEC	1	NYDOH	1	8	0
DEC DIOXIN SAMPLING	056	171	1984, AUG. 29	D	NYSDEC	1	NYDOH	2	5	0
DEC DIOXIN SAMPLING	055	175	1984, JUL 26	C	RECRA RESEARCH	1	ENVIRO	1	1	1

LOCATION KEY

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PROCEDURE KEY

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2 = NOT DOCUMENTED

ABBREVIATIONS

COLL. = COLLECTION
PROC. = PROCEDURE
ANAL. = ANALYTICAL

TABLE 12-5

SUMMARY OF PHASE A RESULTS FOR MEDIUM: GROUNDWATER

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC	NO OF SAMPLES	NO OF QC SAMPLES
CALSPAN GROUNDWATER STUDY	047	148	1977, JUN 20, JULY 16	A	CALSPAN CORPORATION	2		2	8	0
DEC SOIL SAMPLING	034	123	1978, AUG. 9	C	NYSDEC	1	NYDOH	2	1	0
FRED C. HART GROUNDWATER	049	155	1978, JUNE 9	A,B	F.C. HART ASSOCIATES	1	YORK	1	7	0
DOH SOIL SAMPLING	011	084	1978, NOV. 17	B	NYSDOH	2	WSU	1	2	3
NYSDEC BEDROCK WELL	030	116	1978, SEPT. 11-12	A,B	NYSDEC	2	NYDOH	2	3	0
1980 EPA ENVIRONMENTAL	001	043	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	ACEE	1	164	0
1980 EPA ENVIRONMENTAL	001	044	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	AES	1	0	36
1980 EPA ENVIRONMENTAL	001	045	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	CMTL	1	117	0
1980 EPA ENVIROMENTAL	001	046	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	EMSC	1	29	[illegible]
1980 EPA ENVIRONMENTAL	001	047	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	ERCO	1	181	[illegible]
1980 EPA ENVIRONMENTAL	001	048	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	GSLA	1	8	0
1980 EPA ENVIRONMENTAL	001	049	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	GSNO	1	18	0
1980 EPA ENVIRONMENTAL	001	050	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	KERR	1	8	2
1980 EPA ENVIRONMENTAL	001	051	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	PJBL	1	128	[illegible]
1980 EPA ENVIRONMENTAL	001	052	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	SWRI	1	19	0
1980 EPA ENVIRONMENTAL	001	053	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	TRW	1	33	0
1980 EPA ENVIRONMENTAL	001	054	1980, AUG. 8 - OCT. 31	A,B,C	JRB ASSOCIATES	1	WSU	1	4	[illegible]
DEC WELL SAMPLING	020	097	1981, JUNE - 1983, MARCH	A,B	NYSDEC	1	RECRA	1	150	0
TOL MONITORING WELL	036	133	1982, JUN 28 - JULY 1	B,C	C.A. RICH CONSULTANTS	1	RECRA	1	11	4
TOL MONITORING WELL	036	134	1982, JUN 28 - JULY 1	B,C	C.A. RICH CONSULTANTS	1	WSU	1	2	3
DEC WELL SAMPLING	020	098	1982, MAR 17	A,B	NYSDEC	1	NYDOH	2	0	9
DEC WELL SAMPLING	020	096	1982, MAR 18	A,B	NYSDEC	1	ERCO	1	0	8
DEC WELL SAMPLING	020	095	1982, MAY - 1983, MAR	A,B	NYSDEC	1	ERCO	1	44	0
DEC WELL SAMPLING	020	099	1983, JUNE 9	A,B	NYSDEC	1	NYDOH	2	14	[illegible]
DEC WELL SAMPLING	020	100	1984, APRIL 30	A,B	NYSDEC	1	VERSAR	2	16	0
DEC DIOXIN SAMPLING	055	174	1984, JUL 26	C	RECRA RESEARCH	1	ENVIRO	1	4	1
DEC WELL SAMPLING	020	172	1984, JULY 11, 12	C	NYSDEC	1	VERSAR	2	24	0
DEC WELL SAMPLING	020	173	1985, 8/28/84-1/16	B,C	NYSDEC	1	NYDOH	2	64	2

LOCATION KEY
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PROCEDURE KEY
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ABBREVIATIONS
COLL. = COLLECTION
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TABLE 12-6

SUMMARY OF PHASE A RESULTS FOR MEDIUM: SOIL

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC	NO OF SAMPLES	NO OF QC SAMPLES
DOH BASEMENT AIR SAMPLING	009	081		B	NYSDOH	2	NYDOH	2	0	0
EPA LOVE CANAL SAMPLING	037	137				0		0	0	0
DEC SAMPLING	027	111	1976, NOV 10	B	NYSDEC	1	NYDOH	2	3	0
DEC WATER SAMPLING	028	113	1977, DEC 1	C	NYSDEC	2	NYDOH	2	4	0
DEC SOIL SAMPLING	034	122	1978, AUG 8	C	NYSDEC	1	NYDOH	2	14	0
CONST. OF CARBON FILTER	008	079	1978, DEC 12	A	EARTH DIMENSIONS, INC.	1		2	2	0
DOH SOIL SAMPLING	018	093	1978, DEC 19 - 20	B	EARTH DIMENSIONS, INC.	2	NYDOH	2	3	0
DOH SOIL SAMPLING	018	094	1978, DEC 19-20	B		2	WSU	1	0	3
RTI SOIL SAMPLING	002	069	1978, JULY 6-7	B,C	RTI	2		1	18	0
DEC SOIL, SAND SAMPLING	031	117	1978, OCT. 13-27	C	NYSDEC	2	NYDOH	2	164	0
DEC SAMPLING	026	107	1978, SEPT. 11-23	B	NYSDEC	1	NYDOH	2	0	0
DOH 93RD STREET STUDY	007	078	1979, DEC.	C	EARTH DIMENSIONS INC.	2	NYDOH	2	281	0
DOH TRANSECT STUDY	005	074	1979, FEB 2 - MAR 13	F	EARTH DIMENSIONS, INC.	1	NYDOH	2	425	0
DOH TRANSECT STUDY	005	075	1979, FEB 2 - MAR 13	F	EARTH DIMENSIONS, INC.	1	RECRA	1	0	225
DOH-HOUSEHOLD DUST IN	014	089	1979, JUN 11-12	B	NYSDOH	1	NYDOH	2	20	0
DOH INDIVIDUAL LOT SOIL	006	076	1979, MAR 14 - AUG 23	F	EARTH DIMENSIONS, INC.	1	NYDOH	2	3632	0
DOH 93RD STREET SCHOOL	007	077	1979, MAY 15 - MAY 22	C	EARTH DIMENSIONS, INC.	1	NYDOH	2	247	0
DOL LITIGATION	036	130	1980, AUG, SEPT	B	NYSDOH	1	NYDOH	1	75	10
1980 EPA ENVIRONMENTAL	001	011	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	ACEE	1	177	205
1980 EPA ENVIRONMENTAL	001	012	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	CMTL	1	209	266
1980 EPA ENVIRONMENTAL	001	013	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSC	1	26	31
1980 EPA ENVIRONMENTAL	001	014	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSV	1	189	30
1980 EPA ENVIRONMENTAL	001	015	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	ERCO	1	118	57
1980 EPA ENVIRONMENTAL	001	016	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSLA	1	37	30
1980 EPA ENVIRONMENTAL	001	017	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSNO	1	112	169
1980 EPA ENVIRONMENTAL	001	018	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	PJBL	1	51	45
1980 EPA ENVIRONMENTAL	001	019	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	SWRI	1	204	313
1980 EPA ENVIRONMENTAL	001	020	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	WSU	1	9	19
1980 EPA ENVIRONMENTAL	001	065	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES INC.	1	EMSC	1	0	1
MALCOLM PIRNIE STUDY	003	071	1983, JAN 3-21, MAR 10-11	C	MALCOLM PIRNIE	1	CMTL	1	9	0
MALCOLM PIRNIE STUDY	003	167	1983, JAN. MAR.	D, E, C	MALCOLM PIRNIE	1	CMTL	1	9	0
E.C. JORDAN BOREHOLE STDY	048	152	1983, MAR 23 - APRIL 11	B	E.C. JORDAN	1	ECJORD	1	64	0
E.C. JORDAN BOREHOLE STDY	048	153	1983, MAR 23 - APRIL 11	B	E.C. JORDAN	1	GSRI	1	19	0
E.C. JORDAN BOREHOLE STDY	048	154	1983, MAR 23 - APRIL 11	B	E.C. JORDAN	1	WSU	1	17	2
DEC DIOXIN SAMPLING	055	170	1984, JUL. 26	C	RECRA RESEARCH	1	ENVIRO	1	4	0

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TABLE 12-7

SUMMARY OF PHASE A RESULTS FOR MEDIUM: WATER

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC.	NO OF SAMPLES	NO OF QC SAMP
EPA WATER SAMPLING	040	141		C		2	EPA	1	9	[illegible]
EPA WATER SAMPLING	045	146			OHMSB	2	OHMSB	1	1	[illegible]
DEC SAMPLING	027	110	1976, NOV 10	B,C,D,E	NYSDEC	2	NYDOH	2	4	0
CALSPAN GROUNDWATER STUDY	047	149	1977, APRIL 12	B	CALSPAN CORPORAION	2		2	3	0
CALSPAN GROUNDWATER STUDY	047	151	1977, APRIL 12	D,B	CALSPAN CORPORATION	2		1	5	0
DEC WATER SAMPLING	028	112	1977, DEC 1	E,D	NYSDEC	1	NYDOH	2	2	0
DEC - WATER SAMPLING	028	163	1977, DEC 1	B	NYSDEC	2	NYDOH	2	2	0
DOH SUMP SAMPLING	015	090	1978, AUG - DEC	B,C		2	NYDOH	2	180	[illegible]
EPA MANHOLE SAMPLING	043	144	1978, AUG 14, 18	C	EPA - RFO	2	EPA	1	6	[illegible]
DOH	012	085	1978, AUG. 20 - 21	D	NYSDOH	1	NYDOH	2	7	0
FRED C. HART GROUNDWATER	049	156	1978, AUGUST 8-12	C	F.C. HART ASSOCIATES	1	YORK	2	8	0
DEC SUMP SAMPLING	029	115	1978, FEB 2	B	NYSDEC	2	NYDOH	2	8	0
FRED C. HART GROUNDWATER	049	157	1978, JUNE 9	D	F.C. HART ASSOCIATES	1	YORK	1	2	0
DEC SUMP SAMPLING	026	108	1978, SEPT. 11-23	B	NYSDEC	1		2	0	0
EPA LOVE CANAL SAMPLING	037	135	1978, SEPT. 26	D,E		1		2	15	0
DEC STORM SEWER STUDY	022	102	1979, APRIL	E	NYSDEC	2	NYDOH	1	52	0
DEC SUMP SAMPLING	021	101	1979, JAN 27-28	B,C	NYSDEC	2	NYDOH	2	30	0
EPA MISC. WATER SAMPLING	044	145	1979, JUNE 13-14	B	EPA	2	EPA	1	5	0
STORM SEWER & CREEK	013	087	1979, NOV 15	D,E	NYSDOH	1	NYDOH	1	15	0
1980 EPA ENVIRONMENTAL	001	031	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	ACEE	1	138	[illegible]
1980 EPA ENVIRONMENTAL	001	032	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	CMTL	1	93	0
1980 EPA ENVIRONMENTAL	001	033	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSC	1	61	0
1980 EPA ENVIRONMENTAL	001	034	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	EMSV	1	105	[illegible]
1980 EPA ENVIRONMENTAL	001	035	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	ERCO	1	252	0
1980 EPA ENVIRONMENTAL	001	036	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GCA	1	0	10
1980 EPA ENVIRONMENTAL	001	037	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSLA	1	53	0
1980 EPA ENVIRONMENTAL	001	038	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	GSNO	1	103	0
1980 EPA ENVIRONMENTAL	001	039	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	PJBL	1	163	0
1980 EPA ENVIRONMENTAL	001	040	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	SWRI	1	50	0
1980 EPA ENVIRONMENTAL	001	041	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	TRW	1	57	0
1980 EPA ENVIRONMENTAL	001	042	1980, AUG. 8 - OCT. 31	F	GEOMET TECHNOLOGIES, INC.	1	WSU	1	16	[illegible]
DOL LITIGATION	036	132	1981, SEPT. 14-16	B	NYSDOH	1	NYDOH	1	2	[illegible]
MALCOLM PIRNIE STUDY	003	073	1983, JAN 3-21, MAR 10-11	D,E	MALCOLM PIRNIE	1	CMTL	1	8	0
MALCOLM PIRNIE STUDY	003	166	1983, JAN., MAR.	D, E, C	MALCOLM PIRNIE	1	CMTL	1	7	0
DEC DIOXIN SAMPLING	055	169	1984, JUL 26	C	RECRA RESEARCH	1	ENVIRO	1	1	[illegible]

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TABLE 12-8

SUMMARY OF PHASE A RESULTS FOR MEDIUM: WATER SUMP

STUDY NAME	STUDY NO	DATA SET NO	DATE COLLECTED	LOCATION	COLLECTED BY	COLL. PROC.	ANAL. BY	ANAL. PROC.	NO OF SAMPLES	NO OF QC SAMPLES
DEC SAMPLING	027	110	1976, NOV 10	B,C,D,E	NYSDEC	2	NYDOH	2	4	0
CALSPAN GROUNDWATER STUDY	047	149	1977, APRIL 12	B	CALSPAN CORPORAION	2		2	3	0
DOH SUMP SAMPLING	015	090	1978, AUG - DEC	B,C		2	NYDOH	2	180	0
FRED C. HART GROUNDWATER	049	156	1978, AUGUST 8-12	C	F.C. HART ASSOCIATES	1	YORK	2	8	0
DEC SUMP SAMPLING	029	115	1978, FEB 2	B	NYSDEC	2	NYDOH	2	8	0
DEC SUMP SAMPLING	026	108	1978, SEPT. 11-23	B	NYSDEC	1		2	0	0
DEC SUMP SAMPLING	021	101	1979, JAN 27-28	B,C	NYSDEC	2	NYDOH	2	30	0
EPA MISC. WATER SAMPLING	044	145	1979, JUNE 13-14	B	EPA	2	EPA	1	5	0
DOL LITIGATION	036	132	1981, SEPT. 14-16	B	NYSDOH	1	NYDOH	1	2	1

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TABLE 12-9 _PHASE B QA REVIEW RESULTS

STUDY NO.	DATA SET	STUDY NAME	MEDIUM LOCATION	COLLECTED BY DATE COLLECTED	COLLECTION QA STATUS	ANALYSED BY	QA STATUS VOLATILES	ANALYSIS A/B/N	PESTICIDES	METALS	DIOXIN	COMMENTS
001	001	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	WRIGHT STATE UNIV.					1	NO SAMPLE DECON PROTOCOL
001	002	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	GULF SOUTH LAFAYETTE			1			NO SAMPLE DECON PROTOCOL
001	003	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	PEDCO ENVIRONMENTAL	1					NO SAMPLE DECON PROTOCOL
001	004	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	SOUTHWEST RESEARCH			1			NO SAMPLE DECON PROTOCOL
001	005	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	BATELLE COLUMBUS 1	1					NO SAMPLE DECON PROTOCOL
001	006	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	BATELLE COLUMBUS 2	1					NO SAMPLE DECON PROTOCOL
001	007	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	BATELLE COLUMBUS 3	1					NO SAMPLE DECON PROTOCOL
001	008	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	EPA-EMSL - RTP				1		NO SAMPLE DECON PROTOCOL
001	009	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	EPA-HERL - RTP		1	1			NO SAMPLE DECON PROTOCOL
001	010	1980 EPA ENVIRONMENTAL MONITORING STUDY	AIR F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	IIT RESEARCH INST.	1					NO SAMPLE DECON PROTOCOL
032	118	DEC OUTDOOR AIR SAMPLING	AIR C	NYSDEC 1982, DEC 15-1983, MAR 18	2	NYSDEC						TOTAL SUSPENDED PARTICLES ONLY. MET QA CRITERIA
032	119	DEC OUTDOOR AIR SAMPLING	AIR C	NYSDEC 1983, JUN 8 - NOV 22	2	NYSDEC						TOTAL SUSPENDED PARTICLES ONLY. MET QA CRITERIA
032	120	DEC OUTDOOR AIR SAMPLING	AIR C	NYSDEC 1983, JUN 8 - NOV 22	2	NYSDOH	1					NO COLLECTION PROTOCOL
036	131	DOL LITIGATION INDOOR AIR	AIR B	NYSDOH 1981, SEPT. 15-16	2	NYSDOH	1					NO COLLECTION PROTOCOL
039	140	EPA INDOOR AIR SAMPLING	AIR B - 476	EPA 1980, JUNE 18-19	2	EPA-HERL - RTP		1	1			NO COLLECTION PROTOCOL
051	160	HOOKER OUTDOOR AIR SAMPLING	AIR A,B,C	HOOKER CHEMICAL 1980, AUG 7, 9, 22	2	HOOKER RESEARCH	1					NO COLLECTION PROTOCOL

LOCATION KEY
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[redacted]

QA STATUS KEY
1 = MEETS MINIMUM QA CRITERIA
2 = UNCERTAIN IF MINIMUM QA CRITERIA IS MET
[redacted] DOES [redacted] MINIMUM [redacted] CRITERIA [redacted]

TABLE 12-9 (continued) PHASE B QA REVIEW RESULTS

STUDY NO.	DATA SET	STUDY NAME	MEDIUM LOCATION	COLLECTED BY DATE COLLECTED	COLLECTION QA STATUS	ANALYSED BY	VOLATILES	ANALYSIS A/B/N	QA STATUS PESTICIDES	METALS	DIOXIN	COMMENTS
001	043	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	ACUREX CORP.	1	1	1			
001	044	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	ADVANCED ENVIRON. S.						TOX. ONLY. MET MINIMUM QA REQUIREMENTS
001	045	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	NEAD COMPUCHEM	1	1	1			
001	046	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	EPA-EMSL - CINCINNAT	1	1	1	1		RADIATION
001	047	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	ENERGY RESOURCES CO.				1		
001	048	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	GULF SOUTH-LAFAYETTE	1	1	1	1		
001	049	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	GULF SOUTH N.ORLEANS	1	1	1			
001	050	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	EPA-KERR - ADA	1	1	1			
001	051	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	PJB LABORATORIES	1	1	1	1		
001	052	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	SOUTHWEST RESEARCH	1	1	1			
001	053	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	TRW INC.	1	1	1			
001	054	1980 EPA ENVIRONMENTAL MONITORING STUDY	GRNDWATER A,B,C	JRB ASSOCIATES 1980, AUG. 8 - OCT. 31	1	WRIGHT STATE UNIV.					1	
020	095	DEC WELL SAMPLING	GRNDWATER A,B	NYSDEC 1982, MAY 13 - MAR 25	1	ENERGY RESOURCES CO.	1	1	1			
020	096	DEC WELL SAMPLING	GRNDWATER A,B	NYSDEC 1982, MAR 18	1	ENERGY RESOURCES CO.	1	1	1			
020	097	DEC WELL SAMPLING	GRNDWATER A,B	NYSDEC 1981, JUNE - 1983, MARCH	1	RECRA RESEARCH	1	1	1	1		
020	098	DEC WELL SAMPLING	GRNDWATER A,B	NYSDEC 1982, MAR 17	1	NYSDOH	2	2	2	2		NO LAB PROTOCOLS

LOCATION KEY
A - CANAL D - CREEKS
B - RINGS 1&2 E - SEWERS
C - EDA F - ALL

QA STATUS KEY
1 = MEETS MINIMUM QA CRITERIA
2 = UNCERTAIN IF MINIMUM QA CRITERIA IS MET
3 = DOES NOT MEET MINIMUM QA CRITERIA

TABLE 12-9 (continued) PHASE B QA REVIEW RESULTS

STUDY NO.	DATA SET	STUDY NAME	MEDIUM LOCATION	COLLECTED BY DATE COLLECTED	COLLECTION QA STATUS	ANALYSED BY	VOLATILES	ANALYSIS QA STATUS A/B/N	PESTICIDES	METALS	DIOXIN	COMMENTS
020	099	DEC WELL SAMPLING	GRNDWATER A,B	NYSDEC 1983, JUNE 9	1	NYSDOH		1	1			
020	100	DEC WELL SAMPLING	GRNDWATER A,B	NYSDEC 1983, AUG 16-1984, MAR 31	1	VERSAR LAB.	1	1	1	1		
020	172	DEC WELL SAMPLING	GRNDWATER C	NYSDEC 1984, JULY 11, 12	1	VERSAR LAB.	1	1	1	1		
036	133	DOL MONITORING WELL SAMPLING	GRNDWATER B,C	C.A. RICH CONSULTANTS 1982, JUN 28 - JULY 1	2	RECRA RESEARCH	1	1	1			NO COLLECTION PROTOCOLS
036	134	DOL MONITORING WELL SAMPLING	GRNDWATER B,C	C.A. RICH CONSULTANTS 1982, JUN 28 - JULY 1	2	WRIGHT STATE UNIV.					1	NO COLLECTION PROTOCOLS

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TABLE 12-9 (continued) PHASE B QA REVIEW RESULTS

STUDY NO.	DATA SET	STUDY NAME	MEDIUM LOCATION	COLLECTED BY DATE COLLECTED	COLLECTION QA STATUS	ANALYSED BY	VOLATILES	ANALYSIS A/B/N	QA STATUS PESTICIDES	METALS	DIOXIN	COMMENTS
001	011	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	ACUREX CORP.	1	1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOL
001	012	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	HEAD COMPUCHEM	1	1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	013	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	EPA-EMSL - CINCINAT	1	1	1	1		LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	014	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	EPA-EMSL - LAS VEGAS						RADIATION SAMPLES
001	015	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	ENERGY RESOURCES CO.				1		LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	016	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	GULF SOUTH LAFEYETTE	1	1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	017	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	GULF SOUTH N.ORLEANS	1	1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	018	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	PJB LAB.	1	1	1	1		LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	019	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	SOUTHWEST RESEARCH		1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	020	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES, INC. 1980, AUG. 8 - OCT. 31	2	WRIGHT STATE UNIV.					1	LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
001	065	1980 EPA ENVIRONMENTAL MONITORING STUDY	SOIL F	GEOMET TECHNOLOGIES INC. 1980, AUG. 8 - OCT. 31	2	EPA-EMSL - CINCINAT	1					LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
003	071	MALCOLM PIRNIE STUDY	SOIL C	MALCOLM PIRNIE 1983, JAN 3-21, MAR 10-11	2	HEAD COMPUCHEM	1	1	1	1		LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
003	167	MALCOLM PIRNIE STUDY	SOIL D, E, C	MALCOLM PIRNIE 1983, JAN. MAR.	2	HEAD COMPUCHEM						LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
036	130	SOL LITIGATION	SOIL B	NYSDOH 1980, AUG, SEPT	1	NYSDOH	1	1	1	1	1	
048	152	E.C.JORDAN BOREHOLE STDY	SOIL B	E.C. JORDAN 1983, MAR 23 - APRIL 11	2	E.C. JORDAN LAB.	1	1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS
048	153	E.C. JORDAN BOREHOLE STDY	SOIL B	E.C. JORDAN 1983, MAR 23 - APRIL 11	2	GULF SOUTH RESEARCH	1	1	1			LACK OF DOCUMENTATION FOR COLLECTION PROTOCOLS

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It was uncertain if the collection procedures met minimum QA criteria for the five air studies under review, mainly because of a lack of documentation. However, the analytical procedures employed in the five data sets met the minimum QA criteria.

The collection procedures for the data sets of two of the three groundwater studies under review met the minimum QA criteria. The NYSDOL Groundwater Study did not have collection protocols documented. Hence it was uncertain if minimum QA criteria were met. The analytic procedures for all the groundwater data sets met minimum QA criteria.

The collection procedures for the data sets of two of the five soil studies under review met the minimum QA criteria. It was uncertain if the collection procedures of the other three studies met the minimum QA criteria. This was mainly due to lack of available documentation for collection protocols. The analytic procedures for all of the soil data sets met minimum QA criteria.

RESULTS OF THE PILOT STUDIES

The four data sets chosen for the pilot studies are:

1. EPA Environmental Monitoring Study--Air data set. Samples collected in the EDA by GEOMET

Technologies, Inc., and analyzed by PEDCO Environmental Laboratory. (1980)

2. EPA Environmental Monitoring Study--Soil data set. Samples collected by GEOMET Technologies, Inc., analyzed by Mead Compuchem Laboratory. (1980)

3. NYSDOL Soil Sampling--Samples collected by NYSDOH and analyzed by NYSDOH. (1980)

4. NYSDEC Groundwater Sampling--Samples collected by NYSDEC and analyzed by VERSAR Laboratories, Inc. (1984)

Phase C and D Sample Collection Review

The Phase C review consists of investigating whether sample collection protocols followed in the field were consistent with those developed by the experts for meeting minimum QA criteria.

The Phase C review was done on the samples associated with the pilot data sets using all available documentation. In cases where the documentation was insufficient, Phase D was executed--telephone calls were made to personnel who were involved with the actual sample collection. The following are the results of the Phase C and D sample collection reviews.

1. <u>EPA Air Data Set</u>. There are a total of 639 samples in this data set consisting of 391 samples, 197 field duplicates, triplicates, and background samples, 49 field blanks, and 3 void samples. The overall collection protocols for meeting minimum QA criteria were followed in the field; however, there were several inconsistencies:

- o No parallel or backup samples were taken to ensure adequate collection efficiency of the Tenax cartridges.

- o In some cases cartridge tubes were handled without gloves.

- o Charcoal, normally used for added protection against contamination, was not used in the stainless steel containers in which the Tenax tubes were shipped.

2. <u>EPA Soil Data Set</u>. There are a total of 475 samples in this data set consisting of 209 samples and 266 quality control samples. The overall collection protocols for meeting minimum

QA criteria were executed in the field; however, there were several inconsistencies:

- The final rinse of the decontamination process was done with methylene chloride, which could cause sample contamination by reacting with other organic compounds.

- The field log books did not adequately report which protocols were or were not followed in the field.

- The sample log book indicated that holding times before laboratory delivery for several of the volatile organic samples were exceeded.

- The samples were composited over a 6-foot depth. This composite was not representative of the shallower soil layers, i.e.,the ones most likely to pose a threat for direct human contact. This compositing could result in a dilution of the contaminants.

3. <u>NYSDOL Soil Sampling</u>. A total of 92 samples were collected, including eight field blanks and two spoon blanks which were taken to check for contamination of the sample collection equipment.

It is uncertain if the collection protocols followed in the field met minimum QA criteria. Available documentation for review was limited and Phase D could not be executed since field personnel could not be contacted. The following are items of concern which need a Phase D review:

- No collection of background, duplicate, or triplicate samples was mentioned in the documents reviewed.

- There were no protocols describing decontamination of sample collection equipment.

- No techniques for inserting the split-spoon were described in the documents reviewed.

- Geologic core logs were maintained in the field but it is uncertain if sample collection and decontamination logs were kept.

4. <u>NYSDEC Groundwater Sampling</u>. Thirty-six (36) wells were sampled during July and August of 1984 by NYSDEC. Sample collection protocols followed in the field generally met the minimum QA

criteria; however, there were several inconsistencies:

- No background, duplicates, or blanks were collected.

- Metals data include dissolved and particulate metals in the samples since there was no filtering.

- The use of cork and nylon on the sampler bailer is questionable.

- Field notes are essentially nonexistent.

- Well drilling techniques were adequate but water was used as the drilling fluid and no tracer was used to check the removal of the drilling fluid.

- The gravel pack is too long on several wells, which raises concerns about the exact zone of sampling.

- Well development was marginal; this could also result in the zone of sampling not being representative.

PHASE C AND D SAMPLE ANALYSIS REVIEW

The following is a summary of the Phase C task of evaluating the analytical data from four pilot Love Canal data sets. The data sets were reviewed to identify the sources of systematic bias, random variability, and gross error in each set of analytical procedures. Information for this summary has been extracted from the "Review and Critical Evaluation of Select Love Canal Laboratory Data" prepared by CAA.

A subset of each data set was used to determine data quality and the results were then extrapolated over the remainder of the data set.

Each of the four data sets was reviewed to:

- o Determine the reliability (i.e., the accuracy of identification and accuracy of quantification) of individual data reported for each data set.
- o Determine the overall consistency with which each laboratory performed its analyses and conformed to its stated protocols.
- o Assess the adequacy of the QA program and QC measures for each data set.

- o Determine the feasibility of examining the quality of a much larger portion of the data base.

- o Identify further QC procedures necessary to ensure the usefulness of any future studies of the EDA.

Each of the data set reviews was based on the QA/QC methods employed. The reviews consisted of detailed examination of the following:

- o Extraction or sample preparation technique

- o Instrumental analysis method, including instrument calibration and instrument tuning

- o Compound identification criteria

- o Other QC measures, such as monitoring internal standard consistency, surrogate standard recoveries, matrix spike recoveries, and blank contamination

The level of confidence in the reported concentrations of compounds detected in an analysis is dependent upon the specific procedures employed; differences in QC measures among laboratories result in different levels of confidence in the concentrations reported. Omission of a particular QC procedure does not necessarily invalidate an analysis but may decrease the level of confidence in reported values.

1. EPA Air Data Set. Detailed evaluations were made of 40 of the 450 samples analyzed by PEDCO. The analytical method employed by PEDCO was appropriate for the analysis of volatile compounds trapped on Tenax cartridges. Initial calibration response factors were used for the quantitation of all analyses. The instrument response was not recalibrated daily, but control standards were analyzed every 8 hours to verify that the instrument response for most compounds was still within ±20 percent of the initial calibration. Failure to recalibrate daily may have introduced variability into the reported concentrations, as they may be in error of at least this 20 percent factor. Similarly, the standards were prepared offsite and may have been subject to contamination or degradation during transport or storage, which cannot be quantitatively determined.

The internal standard method of quantitation was employed for these analyses. PEDCO used only one internal standard, which was a relatively poor selection because it had a short retention time and it eluted before all of the target analytes, reducing the level of confidence that the internal standard was properly compensating for instrument variations during an analysis.

A single surrogate compound was added to some of the samples; only 50 percent (20 of 40) of the samples subjected to a detailed review contained detectable levels of the surrogate. As with the internal standard, the choice of surrogate was poor, because it also eluted well before most of the analytes. Failure to monitor the surrogate recoveries reduces the confidence in the reported values. However, the analysis of standards as unknowns indicated that the variability was only in the ±20 percent range.

The major disagreement with reported values stems from the stringent compound detection criteria which were used. These criteria require that there be an unambiguous, unequivocal identification of a compound. The criteria state that a compound is a non-detect if any of the characteristic ions are not found. For example, in 13 of 40 samples dichlorobenzene (DCB) isomers were detected but minor chlorine isotope peaks were missing . The presence of four or more major characteristic ions indicates that the DCBs were indeed present. An additional nine samples contained levels of DCB isomers for which all spectral matching criteria were met, but they were still reported as non-detects due to their low concentrations. Thus a standard error calculation indicates that 37-68 percent of the DCB results may have been censored detects.

2. EPA Soil Data Set. Detailed evaluations were performed on 40 of the 209 samples analyzed by Mead Compuchem Laboratory (CMTL) (20 volatile and 20 semivolatile analyses). As with the NYSDOL and PEDCO data sets, the identification of reported analytes is highly reliable, but the results appear to be biased toward lower concentrations than were most likely present. In addition, censoring of the data may have resulted in more non-detects reported than actually occurred. These two observations are described in detail below.

Two major sources of uncertainty were determined in the semivolatile analysis. First, the surrogate compound recoveries were extremely low. In 13 of the 20 samples reviewed in detail at least two of the surrogates were not detected, and the third surrogate was present at less than a 50 percent recovery. Only three of the samples had detectable levels of all three surrogates, with recoveries ranging from 12 to 190%. Low recoveries indicate an extremely poor extraction procedure or an abnormally high number of complex matrices which prevented recovery of the surrogates. A third possibility is that a serious systematic error occurred in the addition, detection, or reporting of these compounds. The consistently low surrogate standard recoveries and low matrix spike recoveries result in a bias towards lower values than were likely to exist in the samples.

The second major source of uncertainty was due to the detection reporting criteria employed for these analyses. The detection limit for base neutral compounds specified by CMTL was 200 ppb for all compounds. Six of the 20 samples had detectable levels of phenanthrene at concentrations of 10 to 50 ppb but were not reported. The mass spectra for the six detected phenanthrenes met all spectral matching criteria. A single sample had trace (10 and 40 ppb) levels of two tetrachlorobenzene isomers which were also reported as non-detects. This censoring of the data suggests that low levels (<200 ppb) may have been detected in a significant number of Love Canal area samples but were not reported.

These analyses were performed according to the specified protocols and the data appears to be highly reliable. Holding times were often exceeded, and may have biased the results toward lower concentrations. Compound identification was a problem due to the detection limit specified by the laboratory. This limit was determined by CMTL to be 20 ug/kg (ppb) for all compounds. However, both internal standards and surrogate compounds were spiked into the samples at this level and produced a large instrument response. This indicates that the actual detection limit for most compounds was much lower than 20 ppb. With the exception of QC check samples, no values of analytes were reported at concentrations lower than 20 ppb. For example, benzene and toluene were detected in over 90% of the samples, but less than 5% of the samples in the EPA data base had reported concentrations.

Many other compounds, such as chloroform, carbon tetrachloride, and trichloroethylene, suspected of being laboratory contaminants were detected in samples and not reported despite meeting all spectral matching criteria.

3. NYSDOL Soil Sampling. An indepth evaluation of 25 of 82 semivolatile and 22 of 77 GC/MS analyses was

performed. An overall assessment indicates that the compound identification of the detected analytes was very reliable, but that a large portion of the reported concentrations have substantial uncertainty and are generally biased toward lower concentrations (see "EPA Soil Data Set") than were actually present.

Surrogate standard recoveries for semivolatile analyses, which averaged 48 percent, coupled with the very poor matrix spike recoveries indicated that compounds in the soil may not have been detected due to matrix effects or poor extraction technique. One potential cause for low recoveries may have been failure to dewater moist soils or to perform the extraction with a polar solvent. Poor recoveries also indicated that reported results are biased toward lower values than may have actually existed in the soil. There was a tendency to report non-detect even when all of a chemical's characteristic ions were present in the proper ratios. This omission was due to the laboratory's strict criteria for compound identification. This was particularly a problem when there was an interferring or coeluting compound.

Finally, compounds may not have been detected when the mass spectrometer was not tuned properly. Reported results for the volatile analysis have substantial uncertainty in chemical quantitation. The ratio of the sample internal standard response to that of the internal standard response in the standard exceeded a factor of two in three of the 22 analyses. The variability in internal standard response increases the uncertainty in compound quantitation. Replicate volatile analyses were often run two to three months apart and showed less reproducibility than the semivolatiles. The mass spectrometer was tuned to Perfluorotributylamine (PFTBA) but not bromofluorobenzene (BFB). This may have resulted in poor spectral resolution, which could have led to incorrect automated compound quantitation. However, for these cases a trained operator may have been able to manually confirm compound identification. Long sample eluate holding times (exceeding 100 days) may have resulted in the loss of target compounds, biasing reported concentrations toward lower values. Reported surrogate standard recoveries for these analyses were a factor of two higher than those for the semivolatile analyses, indicating that these results may be less biased than the semivolatile results.

4. NYSDEC Groundwater Sampling. These groundwater analyses were performed according to the EPA Contract Laboratory Program (CLP) protocols which incorporate more QA/QC procedures than any of the other pilot data sets. Therefore, a greater degree of confidence is associated with each reported concentration, including non-detects, than with the other data set results reviewed. The deviations from the protocols were minor, with two exceptions. First, manual compound identification and quantification procedures were used instead of automated computer library searching for volatile organics analysis. This may have led to the nondetection of trace amounts of compounds coeluting with the internal or surrogate standards, although this is unlikely. Secondly, the volatile organics analyses were usually performed 14 to 30 days after receipt and sometimes more than 60 days after receipt, far exceeding the 7-day holding time. This holding time problem may have contributed to low reported volatile organic chemical results due to volatilization of analytes from the samples.

To conclude, there are numerous sources of error in the analytical process. Recent data sets, as in the NYSDEC groundwater data set, have higher confidence levels than earlier ones since better QC procedures are continuing to be developed and implemented. A general characteristic found for all four pilot study data sets is that reliability of positive chemical identification is high due to the stringent compound identification criteria used; hence, gross error is small. However, these stringent compound identification criteria also led to frequent reporting of "non-detect" for compounds which are likely to be present. Excessive reporting of non-detect values was due to a variety of reasons other than simple lack of presence in the sample. If these observations are applicable to other data sets in the Love Canal data base, a substantial number of chemicals may be erroneously reported as non-detect.

Quantifications of the positive identifications were found to be unreliable, especially in the soil analytical results. Reported concentrations of semivolatile chemicals identified in soil have a noticeable bias toward lower values due to low surrogate standard recoveries, and low matrix spike recoveries, both of which were either the result of ineffective extraction procedures or matrix effects during the analytical process. Reported concentrations of volatile organic chemicals identified have a similar bias toward lower reported concentrations due to long sample holding times of sample and sample eluates prior to analysis. Some volatile organic compounds, which are also laboratory solvents, may have been biased toward higher than true values because of laboratory contamination which could have occurred during the long holding times of samples in the laboratory. It was not possible to draw any overall conclusions about these chemicals since recognition of the problem resulted in these values not being reported. The volatile organic air data reviewed had sources of variability similar to those of the soil, but to a lesser degree. Also, less confidence is placed in this data than in data generated using current QA/QC procedures.

DETECTION LIMIT ASSESSMENT PILOT STUDY

The following is a summary of statistical methods developed for evaluation of limits of detection in the measurement of low levels of chemical contamination in environmental samples. These methods were applied to unreduced data obtained from the EPA Air Data Set (PEDCO) and the EPA Soil Data Set (CMTL) for development of estimates of the limits of detection, variability, and bias in the analytical results of those data sets. Information for this summary was obtained from "Limits of Detection and Sources of Variability and Bias in the Evaluation of Low Levels of Environmental Contamination" prepared by Dr. Diane Lambert and Cambridge Analytical Associates.

The detection limit is an indication of the smallest signal which is measurably different from a signal produced by random fluctuations in instrument output (noise). Nondetects (ND) may arise because the signal produced by a low level of contaminant is indistinguishable from the signal produced by instrument noise. In the EPA data sets, a minimum detectable quantity of 10 nanograms (ng) of analyte was set as a data quality objective (DQO). Many sample results were subsequently reported as non-detect because the level of analyte measured was below 10 ng. In this case, the DQO became the level of nondetection; however, the detection limit was often significantly lower than this level. This use of an arbitrary level of concentration as a detection limit clearly indicates a need to define the detection limit in an unambiguous manner to confirm that measurements of environmental samples below the detection limit are indeed "nondetects."

The following are definitions of terms which will be used in the evaluation and estimation of detection limits.

- The Instrument Detection Limit (IDL) is the smallest signal which can be distinguished from random fluctuations in detector output with a 5 percent probability of false detection (Type 1 error) and 5 percent probability of false nondetection (Type 2 error). This signal is expressed in voltage or area counts and is not a concentration. There is no quantification of this signal. It is compared to a statistical model of noise and requires a realistic probability model for signals. Only the variability and bias introduced by instrument noise is associated with the IDL.

o The Minimum Detectable Concentration (MDC) is the smallest concentration of analyte in a sample that can be reliably distinguished from a blank in the sense that 95 percent of the measurements from samples with a concentration equal to the MDC exceed 95 percent of the measurements from blanks. The MDC considers the entire analytical process, including sample preparation, instrument calibration, and instrument noise. The MDC is a reliable detection, not quantification, of an analyte from a single sample and it requires a realistic probability model for the measurement process.

Neither the IDL nor the MDC provides an upper bound on the value of a non-detect. Modern gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS) instrumentation use sophisticated peak detection algorithms that may reject a signal that either does not change rapidly enough (slope sensitivity test) or whose integrated area is too small (area reject test). The fact that area, slope, and other signal properties may lead to non-detects makes determination of an upper bound on the value of non-detects difficult.

Neither the IDL nor the MDC represents a bound below which signals must be reported as non-detect. Using either detection limit as a criterion for reporting a non-detect results in a loss of information that may be critical to the determination of low levels of contamination at a site from which multiple samples were taken.

- The Threshold Concentration (TC) is the smallest concentration of analyte for which 95 percent of the samples produce a measurable signal. The TC is determined by operator-controlled factors, such as slope sensitivities, signal thresholds, and minimum area rejects, which ensures that no signal is observed when analyzing blanks. Consequently, "cluttered" chromatograms, storage of excessive data in limited computer memory, and long calculation times during data reduction are avoided. However, this results in reporting of non-detects at levels higher than the IDL or MDC. If instrument parameters are set such that exactly 95 percent of blanks are non-detects, then the TC is equal to the MDC. Operator-controlled parameters should be set such that TC is less than or equal to MDC.

- The Censoring Bound (CB) is the smallest measured signal which produces a non-detect with error probability 0.05 or less. The CB applies to measurements of the signal and not the actual concentration. While the TC describes which concentrations are unlikely to produce no detects, it is not the same as an upper bound for a non-detect. A realistic upper bound is defined by the CB.

Both the IDL and MDC require a probability model for signals and since the parameters for this model for the measurement process are typically unknown, the IDC and MDC must be estimated. Three estimation procedures are reviewed below.

- Currie's Method--This estimate of the IDL assumes a normal distribution of unfiltered signal levels and uses estimates of the standard deviation of blanks. The signal level of an independent blank is subtracted from the signal level of the sample to control for background noise. Standard deviation, however, can only be calculated from uncensored data and blank data are usually highly censored.

- U.S. Army/THAMA's Method--This estimate relies on assumptions of normally distributed data and is defined for estimates of concentrations rather than observed signals.

- EPA/CLP Method--This estimate relies on assumptions of normally distributed data with 99 percent of the measurement of blanks being zero. It is defined implicitly since the MDC depends on the standard deviation of measurements from samples with concentrations at the unknown MDC. Hence, the MDC is calculated iteratively.

Practical estimates of IDL and MDC which do not require strong distributional assumptions, which accommodate non-detects, and which may be estimated from routinely collected data were developed to evaluate and estimate detection limits for the two EPA data sets.

A modified version of the Currie method was recommended to estimate the IDL:

IDL = 3.29 * Standard Deviation of Blank

The U.S. Army/THAMA method for estimating MDC was found to be too sophisticated and involved multiple levels of calculations which were too complex for the detection limits pilot study. Hence the EPA/CLP method for calculating the MDC is proposed. The TC is significant only if the instrument operator is censoring data by setting the threshold limit at an inappropriate value. It is found to be more productive to have the threshold limit set such that the MDC is achieved rather than setting up a statistical method to calculate the TC.

The above methods for estimating the IDL and MDC were then applied to certain blanks of the 1980 EPA data sets. Single ion chromatograms for ions of interest were generated to allow an evaluation of instrument noise. The results indicated that no measurable signal was recorded during analysis of any of the six blanks. The only conclusion possible from this finding is that the instrument operators used large thresholds, large A/D converter offsets, or large electrometer offsets to avoid collection of low level signals. The consequence of such thresholds is that the determination of IDLs and MDCs for the PEDCO and CMTL data sets was impossible using the methods developed in this report.

It is recommended that the methods described above for estimating the IDL and MDC be incorporated into the QA/QC plans of future studies to provide a higher degree of reliability with regard to the results and contribute to their acceptance.

ADP AUDIT

The ADP audit was executed on the EPA air data set and the EPA soil data set since these were the only two of the four pilot data sets whose analytical results were reported on computer tapes. The data on the original laboratory sheets were compared to the data reported on the computerized data base.

1. EPA AIR DATA SET--Twenty-nine quality control (QC) laboratory forms were checked. No omissions or incorrect data were found. Six-hundred and nine regular sample laboratory forms were checked. Sixteen samples which had completed laboratory forms were not in the data base and 11 of these had valid reasons for not having been reported. Hence only 5 or <1 percent of the laboratory forms examined were not reported on the data base and only two had wrong data reported in the data base.

2. EPA SOIL DATA SET--Thirty-seven QA Laboratory forms were checked. No omissions or incorrect data were found however methylene chloride and bis (2-ethyl hexyl) phithalate were not reported on the computer data base. Two-hundred and thirty-nine regular sample laboratory forms were checked, of which 17 were laboratory forms of duplicate samples. Eight or 3 percent of the samples with completed laboratory

forms were not reported in the computer data base and only four had inconsistencies between the data on the forms and what is in the data base. A large number of samples had quantitative values for methylene chloride (109), bis (2-ethyl hexyl) phthalate (59), trichlorofluoromethane (5), and benzene (19), reported on the laboratory forms but these values were not reported in the data base. The general reason given for this was laboratory contamination of the samples.

WDR101/018