EPA/ROD/R09-89/900
1989

EPA Superfund
Record of Decision:

NINETEENTH AVENUE LANDFILL
EPA ID: AZD980496780
OU 01
PHOENIX, AZ
09/29/1989

0272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. EPA/ROD/R09-89/042

2.

3. Recipient's Accession No.

4. Title and Subtitle

SUPERFUND RECORD OF DECISION
Nineteenth Avenue Landfill, AZ
First Remedial Action - Final

5. Report Date 09/29/89

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.

(C)

(G)

12. Sponsoring Organization Name and Address

U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered 800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 213-acre Nineteenth Avenue Landfill is in an industrial area of Maricopa County, Phoenix, Arizona. The landfill is divided by the Salt River channel into two sections or cells. A 200-acre section, Cell A, lies north of the channel and a 13-acre section, Cell A-1, lies south of the channel. State permitted landfill operations were conducted from 1957 to 1979 during which time approximately nine million cubic yards of municipal refuse, solid and liquid industrial wastes, and some medical wastes and materials containing low levels of radioactivity were deposited in the landfill. Sampling of the landfill contents has revealed no concentrated sources of contamination, however, the State ordered the landfill closed in 1979 due to the periodic inundation of the landfill by flood waters from the Salt River Channel. Subsequently, the city covered the site with fill, stockpiled soil for final capping, installed ground water monitoring wells, built berms around the landfill, and installed a methane gas collection system. This remedial action is designed to mitigate threats resulting from flooding of the landfill, which has occurred intermittently since 1965. The primary contaminants of concern in the soil/refuse include VOCs such as toluene and xylenes. There is little risk to public health from ground water pathways because ground water contaminants are of small magnitude, and only limited migration has occurred off the site. (Continued on next page)

17. Document Analysis a. Descriptors

Record of Decision - Nineteenth Avenue Landfill, AZ
First Remedial Action - Final
Contaminated Media: soil/refuse
Key Contaminants: VOCs (toluene, xylenes)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) None

20. Security Class (This Page) None

21. No. of Pages 600

22. Price

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

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

16. Abstract (Continued)

Nineteenth Avenue Landfill, AZ
First Remedial Action - Final

The selected remedial action for this site includes containing landfill wastes onsite by constructing an impermeable cap and surface drainage structures over the landfill, as well as soil-cement levees along the river at the landfill boundary; widening the river channel; collecting and flaring landfill generated gases; institutional controls and access restrictions; and air and ground water monitoring. A contingency ground water treatment plan will be implemented whenever ground water standards are exceeded at the landfill boundary. The estimated present worth cost for this remedial action is $42,990,000, which includes an annual O&M cost of $1,010,000 for 30 years.

RECORD OF DECISION
DECLARATION

Site Name and Location

Nineteenth Avenue Landfill
Phoenix, Arizona

Statement of Basis and Purpose:

This document serves as the EPA selection of remedy for the Nineteenth Avenue Landfill site in Phoenix, Arizona. The Arizona Department of Environmental Quality (ADEQ) has also approved this remedial action in conformance with: the Arizona Administrative Code (A.A.C.) R18-7-108, Remedial Action Plan (RAP); Arizona Revised Statute (A.R.S.) 49-282, Water Quality Assurance Revolving Fund (WQARF); the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1996 (SARA); the National Contingency Plan (NCP), to the extent practicable; and relevant state and federal requirements. This decision document explains the factual and legal basis for selecting the remedy for this site.

The EPA remedy selection is based upon ADEQ's Letter of Determination, the Remedial Action Plan, the Remedial Investigation, the Feasibility Study, the Responsiveness Summary, and the Administrative Record. The information supporting this decision is contained in the Administrative Record for this site. The attached index lists the items comprising the administrative record.

Assessment of the Site:

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

Description of the Selected Remedy:

This is a final remedy for the Nineteenth Avenue Landfill site. The final remedy provides for containment of the landfill wastes on-site with the collection and flaring of landfill generated gases. Landfill gases that are generated shall be managed by separate gas collection and flare systems which will operate independently in each cell of the landfill. Air and ground water monitoring shall be performed at the site, and a stand-by ground water treatment plan shall be implemented whenever groundwater quality standards are exceeded at the landfill boundary.

The containment of the landfill wastes and prevention of the infiltration of precipitation or any liquids shall be achieved by construction of a compacted clay-soil cap with surface drainage structures channeling precipitation off the cap. Construction of soil-cement levees along the landfill cells that border the Salt River shall prevent erosion and overtopping from the Salt River, while placement of a subsurface pipe with backfill will prevent erosional undercutting along the cast boundary of the landfill. ADEQ's Letter of Determination and the Remedial Action Plan describes the approved remedy in greater detail.

Declaration of Statutory Determinations:

The EPA final remedy selection for the Nineteenth Avenue Landfill site will be protective of human health and the environment, is cost effective, and attains federal and state requirements that are applicable or relevant and appropriate (ARARs). This alternative uses permanent solutions and alternate treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threat posed by the landfill was not found to be practicable, this remedy does not fully satisfy the Statutory preference for treatment as a principal element of the remedy. The collection and flaring of gas, and implementation of a ground water treatment plan are significant components of the remedy; however, the size of the landfill and volume of landfill waste preclude a remedy in which contaminants effectively could be excavated and treated.

As this remedy will result in hazardous substances remaining on-site above health based levels, a review will be conducted by EPA each five years after commencement of remedial action to ensure the remedy continues to provide adequate protection of human health and the environment. If this selected remedial action does not meet the goals and cleanup objectives identified in the remedy, or is not sufficiently protective of human health and the environment, then EPA may, under the authorities of CERCLA, require additional response action.

9.29.89
Date

John Wise
Daniel W. McGovern
for Regional Administrator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

September 25, 1989

MEMORANDUM

SUBJECT: **19th Ave. Remedial Action Plan**

FROM: **Mardi L. Black**

TO: **Gail B. Cooper**

The State of Arizona has approved a Remedial Action Plan (RAP) for the cleanup of the 19th Avenue landfill located in Phoenix, Arizona. The 19th Avenue landfill is a state-lead site which is on the NPL.

The RAP for the site provides for containment of the landfill wastes on-site with the collection and flaring of landfill generated gases. It also calls for air and ground water monitoring and a stand-by ground water treatment which will be implemented whenever ground water quality standards are exceeded at the landfill boundary. Containment of the landfill wastes will be achieved by construction of a compacted clay-soil cap with surface drainage structures channeling precipitation off the cap. The remedy is described in greater detail in the Letter of Determination and RAP prepared by the Arizona Department of Environmental Quality (ADEQ).

EPA has consulted with the State in the preparation of the RAP. I have reviewed and concurred on the EPA Record of Decision declaration which states that the RAP meets the requirments of a ROD under CERCLA.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

ROSE MOFFORD, GOVERNOR
RANDOLPH WOOD, DIRECTOR

Letter of Determination
for
City of Phoenix, l9th Avenue Landfill

September , 1989
RPU; 371

CERTIFIED MAIL
Return Receipt Requested

Mr. George Britton
Environmental Services Manager
City of Phoenix
251 W. Washington Street
Phoenix, Arizona 85003

Dear Mr. Britton:

RE: Approval of Remedial Action Plan for City of Phoenix l9th Avenue Landfill, dated June 12, 1989.

The Final Draft Remedial Action plan for the above referenced site has been reviewed for conformance with the Arizona Administrative Code (A.A.C.) R18–7–108 Remedial Action Plan (RAP), Arizona Revised Statute (A.R.S.) §49–282 Water Quality Assurance Revolving Fund (WQARF), the Comprehensive Environmental Response, Compensation, and Liability Act of l980 (CERCLA), the Superfund Amendments and Reauthorization Act of 1986 (SARA), and other pertinent state and federal requirements.

The Final Draft Remedial Action Plan for the l9th Avenue Landfill, dated June 12, 1989, has been approved along with the proposed Preferred Alternative A which includes a Groundwater Contingency Plan. This proposal was compared with alternatives B, C, D, and a No Action Alternative. Alternatives A, B, C, and D were evaluated using the same criteria (Attachment I). This decision is consistent with the recommendations made by the Office of Health Assessment Agency for Toxic Substances and Disease Registry (ATSDR) or the U.S. Public Health Service in their assessment of the 19th Avenue Landfill, dated April 18, 1989.

The following provides a brief historical summary of the site.

Location

The 19th Avenue Landfill is located in an industrial area of Maricopa County within the municipal boundaries of Phoenix, Arizona. The landfill is 213 acres in size. The major part of the landfill, which covers approximately 200 acres and is referred to as Cell A, is located on the north side of the Salt River channel. This cell is bounded on the north by Lower Buckeye Road, on the east by the 15th Avenue storm drain outfall channel, on the west by 19th Avenue, and on the south by the river channel. The remainder of the landfill, Cell A-1, covers approximately 13 acres and is located on the south side of the Salt River channel. Cell A-1 is bounded on the north by the Salt River channel, on the east by an active sand and gravel pit, on the south by industrial property, and on the west by an inactive sand and gravel pit.

History of Landfill

In 1955, the 19th Avenue Landfill site was relatively undisturbed except for a shallow 20-acre excavation in the northwestern portion of Cell A. In 1957, the City of Phoenix extended an existing lease with the landowner to operate a municipal landfill. The landowner brought in another party to start sand and gravel mining at the site to create the space needed for the landfill.

The mining and landfill operations began around 1957 Sand and gravel pits were excavated to a depth or approximately 30 to 35 feet, although some pits were excavated as deep as 50 feet below land surface. The pits were then backfilled with municipal refuse from the Phoenix area. Solid and liquid industrial wastes were also deposited. Liquid wastes, including industrial wastes, were poured into unlined pits dug into areas of Cell A previously filled with refuse. In addition to the municipal and industrial wastes, some medical wastes and materials containing low levels of radioactivity were also deposited. It has been estimated that the landfill contains approximately nine million cubic yards of refuse.

The refuse was generally covered on a daily basis. A final soil cap was placed over an area once it was full of waste.

Parts of the landfill were covered with water by at least one flood event during 1965 and intermittently during the 1970s. Liquid waste disposal pits had been breached at least once. Surface water runoff events in May, 1978, washed refuse from the southwest part of Cell A and the northern third of Cell A-1.

The landfill was closed by a ceased and desist order issued by the Arizona Department of Health Services (ADHS) in February, 1979. The City of Phoenix and ADHS entered into a consent agreement in June, 1979. The consent order was amended in December, 1979. To comply with the first amended consent order, the City covered the site with fill, stockpiled soil for final capping, installed groundwater monitor wells, built berms around the boundary of the landfill, and installed a methane gas collection system.

The landfill was placed on the Environmental Protection Agency's (EPA) National Priorities List in September, 1983. A Remedial Investigation/Feasibility Study (RI/FS) was voluntary conducted by the City. It was completed in l988. The RI/FS was prepared in accordance with the requirements of CERCLA and SARA. In addition to the RI/FS, other tasks and studies were completed for the site. These reports are listed in the index to the Administrative Record for 19th Avenue Landfill (Attachment 2).

In l988, the EPA delegated the lead oversite responsibility for the site to the Arizona Department of Environmental Quality (ADEQ) . Since ADEQ became the lead agency, the City of Phoenix was then required to prepared a remedial action plan (RAP) under the state WQARF rules. The draft RAP was completed in June, 1989, and was determined to be ready for public review and comment.

Community Relations

A public comment period was held on the 19th Avenue Landfill Draft RAP from June 29, 1989, through August 11, l989, by the ADEQ and EPA. In addition, a pubic meeting was held on July 20, l989, to present the RAP and to obtain additional public input. All comments received during this period have been documented in the Responsiveness Summary for the l9th Avenue Landfill. Both ADEQ and EPA responded to public comments and questions which pertained to the investigation and proposed RAP for the Landfill (Attachment III).

Purpose of the Remedial Action Plan

The 19th Avenue Landfill RAP is required under state WQARF rules since the lead oversight has been delegated to ADEQ. The RAP's purpose is to propose a remedy for the landfill which is subject to public review, agency review, and agency approval prior to implementation.

The RAP includes a summary of the results of the RI/FS. This includes a brief description of the impact that the l9th Avenue Landfill has had on the environment. The RAP also describes five different alternative remedies.

Alternative Selected

The Remedial Action Plan serves to document the selection of Alternative A as the preferred remedy for l9th Avenue Landfill. Alternative A consists of the following components:

- levees would be placed along both the north and south banks of the Salt River at the landfill site to provide for flood protection;
- the river channel would be widened;
- a soil cap would be placed over the landfill so that rain water does not seep into the landfill material;
- a secure fence would be erected around the landfill boundary;
- ambient air quality, methane gas, and groundwater would be monitored;
- a contingency plan would be implemented should groundwater quality standards be exceeded at the landfill boundary; and,
- methane gas would be collected and treated in a manner that eliminates any risk of explosion.

Evaluation Criteria

The Remedial Action Plan describes the selected alternative as the Preferred Alternative A. Alternative A is a remedy designed to provide:

- Overall protection of human health and the environment. The remedy will stabilize the landfill and monitor for contaminants. Groundwater will be remediated when standards are exceeded at the landfill boundary.

- N Compliance with applicable or relevant and appropriate requirements (ARARs) and substantive requirements of any future permits if required.

- N Long-term effectiveness and performance. The remedy will maintain reliable protection of human health and the environment over time and will mitigate any potential releases of contaminants to the groundwater.

- N Reduction of toxicity, mobility, or volume by stabilizing the landfill and remediating groundwater contamination at the landfill boundary.

- N Implementability. Alternative A is technically and administratively feasible.

- N Cost. The estimated cost for Alternative A is estimated to be 42,990,000 over the next 30 years.

- N Community comment. ADEQ has evaluated every public comment submitted concerning 19th Avenue Landfill (see Attachment III). Portions of the community did not feel that Alternative A went far enough in remediating the Landfill. Others commented that Alternative A is in excess of what is needed for remediation.

In summary, ADEQ believes that Alternative A will provide the best remedy among the proposed alternatives with respect to criteria used to evaluate remedies. Therefore based on the information available at the time, the State of Arizona believes that Alternative A would be protective of human health and the environment, would meet applicable State and local regulations, and would be cost effective. This alternative satisfies the preference for reduction of toxicity, mobility, or volume as a principal element. All substantive permit requirements will be met during the implementation of this remedial action. It is determined that the remedy for this landfill will use permanent solutions and alternative treatment technologies to the maximum extent practicable.

Outstanding issues pertaining to this remedy will be more clearly defined and addressed during the Consent Order negotiations. One item on the list of issues is recovery of past and future oversite costs.

Thank you for your cooperation. If you should have any questions regarding this decision letter, please contact Mr. Dan Marsin at (602) 256-2338.

Sincerely,

Norm Weiss
Assistant Director

Attachments

LGE : lge

cc: Gerald Clifford, Environmental Protection Agency
Doug Toy, Arizona Department of Environmental Quality

ATTACHMENT I*

THE NO ACTION ALTERNATIVE

General Response Action	Technology	Process	Screening Comments
No Action Response			
No action	None	None	Does not meet objective
Monitoring	Monitoring river erosion	Slope indicators, inspection	Not feasible alone. Consent order requires action.
	Monitor storm drain outfall erosion	Visual inspection	Not feasible alone. Consent order requires action.
Regulation	Regulate sand and gravel mining	Regulate sand and gravel mining	Potentially applicable

*Modified from the Final Draft remedial Action Plan for 19th Avenue Landfill, Dated June 12, 1989.

EVALUATION
OF
ALTERNATIVES

Criteria	Alternative A	Alternative B	Alternative C	Alternative D
Effectiveness				
Protectiveness				
Short-term	Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water, and groundwater	Significant public health and the environmental risks eliminated at Cell A an A-1 for refuse washout, surface water, and groundwater	Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water, and groundwater	Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water & groundwater
	Significant off-site accumulation of gas eliminated. On-site risk low	Significant off-site accumulation of gas eliminated. On-site risk low	Significant off-site accumulation of gas eliminated. On-site risk low	Significant off-site accumulation of gas eliminated. On-site risk low
	Satisfies objective	Satisfies objective	Satisfies objective	Satisfies objective
	Community protected during construction	Community at additional risk from transporting refuse across the river and on public roads	Community protected during construction	Community at additional risk from transporting refuse across the river and on public roads
	Workers protected during construction	Workers protected during construction	Workers protected during construction	Workers protected during construction
	Protection achieved after construction (1 year)	Protection achieved after construction (1 year)	Protection achieved after construction (1 year)	Protection achieved after construction (1 year)
Long Term	Expected 30-year protection	Expected 30-year protect on, permanent protection at Cell A-1 site	Expected 30-year protection	Expected 30-year protection. Permanent protection at Cell A-1 site
	Future exposures prevented	Future exposures prevented	Future exposures prevented	Future exposures prevented
	Periodic inspection required	Periodic inspection required	Periodic inspection required	Periodic inspection required
	Maintenance required for gas system	Maintenance required for gas system	Maintenance required for groundwater and gas systems	Maintenance required for groundwater and gas systems

Criteria	Alternative A	Alternative B	Alternative C	Alternative D
Costs				
Direct Capital Costs	$ 21,120,000	$ 23,840,000	$ 24,260,000	$ 26,980,000
Indirect Capital Costs	6,340,000	7,150,000	7,280,000	8,090,000
Total Capital Costs	$ 27,460,000	$ 30,990,000	$ 31,540,000	$ 35,070,000
Direct Annual Costs	$ 510,000	$ 470,000	$ 1,310,000	$ 1,270,000
Indirect Annual Costs	500,000	520,000	570,000	580,000
Total Annual Costs	$ 1,010,000	$ 990,000	$ 1,880,000	$ 1,850,000
Present Worth (5%, 30 years)	$ 42,990,000	$ 46,210,000	$ 60,440,000	$ 63,510,000
Compliance with ARAR's	ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria	ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria	ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria	ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria
Overall Protection of Human Health and the Environment	Adequate protection of human health and the environment is achieved through engineering and institutional controls	Adequate protection of human health and the environment is achieved through engineering and institutional controls	Adequate protection of human health and the environment is achieved through engineering and institutional controls	Adequate protection of human health and the environment is achieved through engineering and institutional controls

Criteria	Alternative A	Alternative B	Alternative C	Alternative D
Reduction of Toxic Exposure, Mobility, and Refuse Volume	Containment to reduce mobility of waste from wash-out and infiltration. Collection to reduce mobility of gas. Treatment to reduce gas hazard.	Containment to reduce mobility of waste from wash-out and surface water infiltration at Cell A. Removal to eliminate re use in Cell A-1. Collection to reduce mobility of gas. Treatment to reduce gas hazard.	Containment to reduce mobility of waste from wash-out and surface water infiltration. Collection to reduce mobility of gas and groundwater. Treatment to reduce gas hazard and ground-water risk.	Containment to reduce mobility of waste from wash out and surface water infiltration at Cell A. Removal to eliminate refuse in Cell A-1. Collection to reduce mobility of gas and ground water. Treatment to reduce gas hazard and ground water risk.
Implementability				
Technical Feasibility	Conventional technologies Good performance expected Can be monitored by periodic inspection	Conventional technologies Good performance expected Can be monitored by periodic inspection	Conventional technologies Good performance expected Can be monitored by periodic inspection	Conventional technologies Good performance expected Can be monitored by periodic inspection
Administrative Feasibility	Easily implemented with existing programs. Approval from other agencies likely.	Easily implemented with existing programs. Approval from other agencies likely.	Easily implemented with existing programs. Approval from other agencies likely.	Easily implemented with existing programs. Approval from other agencies likely.
Availability	Adequate work force and equipment available	Adequate work force and equipment available	Adequate work force and equipment available	Adequate work force and equipment available

Final Draft
June 12, 1989

Remedial Action Plan

for

19th Avenue Landfill
City of Phoenix

Prepared by

Dames & Moore

FINAL DRAFT
REMEDIAL ACTION PLAN
FOR THE
19TH AVENUE LANDFILL

June 1989

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1.0 INTRODUCTION

1.1 PURPOSE OF REMEDIAL ACTION PLAN

This remedial action plan (RAP) is submitted in accordance with the regulations and rules stated in Arizona Compilation of Administrative Rules and Regulations (ACRR), Title 18, Chapter 7, Article under Arizona Revised Statute 49-282.

The RAP provides required information on the set of corrective action that has been designed to control, contain, and mitigate the effects of hazardous substances contained in and generated by the 19th Avenue Landfill. The RAP is the culmination and summary of an extensive remedial investigation and feasibility study (RI/FS). The RI/FS report was submitted to the Arizona Department of Environmental Quality (DEQ) on June 9, 1988. The RI/FS report has been reviewed by DEQ, U.S. Environmental Protection Agency (EPA), and the Arizona Department of Water Resources (DWR). Comments by the agencies have been incorporated in the RAP.

The RI/FS reports are comprehensive and should be referred to for detailed information referred to but not presented in the RAP. Other key references are listed in Chapter 6.0 of this report. WQARF requirements are incorporated in this RAP by reference.

The State's requirements for completing the RAP specify the inclusion of legal, administrative, and technical information. These requirements (as identified in AAC R18-7-108) are cross-referenced in Table 1.1 with the section of the RAP that contains the required information.

In addition to complying with the requirements set forth under the Arizona Environmental Quality Act and its implementing regulations, the RAP presented in this document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act (“SARA”), codified at 42 U.S.C. §§ 9601 et seq. (“CERCLA”); in accordance with the National Contingency Plan, 40 C.F.R. Part 300; and in accordance with United States Environmental Protection Agency guidance and regulations.

The preferred alternative presented in this document consists of the following elements:

- N Emplacement of shallow seated compacted soil levees with soil cement bank protection along the Salt River banks adjacent to Cell A and Cell A-1.
- N Construction of a subsurface soil cement grade control structure across the river channel downstream of the landfill.
- N Installation of a concrete pipe with compacted soil backfill along the 15th Avenue storm drain outfall channel.
- N Widening of the Salt River Channel bottom by excavation and grading.
- N Construction of a single layer compacted soil cap over Cells A and A-1.
- N Provision of surface water drainage from Cells A and A-1.
- N Construction of a fence around Cells A and A-1 to prevent access to the site.
- N Relocation of A and B Silica Sand and All Chevy Auto Parts.
- N Monitoring of ground water quality using monitoring wells to detect possible changes in water quality conditions.
- N Ground-water quality will be protected and controlled through the use of a ground-water contingency plan.
- N Provision of local drinking water through the City of Phoenix water distribution system.
- N Collection of landfill gas at the perimeter of the site with an active collection system.
- N Treatment and collection of landfill gas by flaring and discharge to the atmosphere.

- Monitoring of methane at the perimeter of the site.

- Development and implementation of a methane and ambient air quality monitoring program at completion of remedial actions provided for in this Remedial Action Plan to ensure compliance with ARARs.

These remedial actions are preferred because they provide long-term protection of public health and the environment equal to other alternatives, do not include relocation of Cell A-1 thereby avoiding potential short-term health risks and higher costs which may result from relocation, and they are cost effective.

Community response will be enlisted during the public comment period and at a public hearing to be announced in the near future. A responsiveness summary will be developed following the public comment period to address concerns presented by interested parties. This public involvement program, described in more detail in Appendix A, satisfies the Public Participation requirements of CERCLA Section 113(k)(2)(i-iv) and 117.

1.2 LOCATION OF LANDFILL

The landfill occupies approximately 213 acres in an industrial area of Maricopa County within the municipal boundaries of Phoenix, Arizona (Figure 1.1). The major part of the landfill, Cell A, occupies approximately 200 acres north of the Salt River channel (Figure 1.2). Cell A is bounded on the north by Lower Buckeye Road, on the east by the 15th Avenue storm drain outfall channel, on the west by 19th Avenue, and on the south by the river channel. The remainder of the landfill, Cell A-1, occupies about 13 acres south of the river channel (Figure 1.2). Cell A-1 is bounded on the north by the Salt River channel, on the east by an active sand and gravel pit, on the south by industrial property, and on the west by an inactive sand and gravel pit. A legal description of the 19th Avenue Landfill is given in Table 1.2.

The Salt River bed adjacent to the landfill is normally dry. Parts of both Cell A and Cell A-1 are within the 100-year floodplain of the river. Flows in the Salt River at the landfill result from controlled releases from dams more than 30 miles upstream and local sources of discharge into the riverbed. Further information describing the physiography, geology, and climate of the site may be found in the RI/FS reports.

1.3 LANDFILL HISTORY

Until 1955, most of the 19th Avenue Landfill site was undisturbed except for a relatively shallow 20-acre excavation in the northwestern portion of Cell A. In 1957, the City of Phoenix extended an existing lease with the landowner to operate a municipal landfill on the site. This lease was subject to the landowner entering into an agreement with another party to start sand and gravel mining at the site. The open pits resulting from the mining excavations would create the space needed for landfilling. Excavation and landfill operations began in approximately 1957.

The sand and gravel pits were generally excavated 30 to 35 feet deep in Cell A and Cell A-1. Deeper pits were excavated in the southwestern portion of Cell A. The sand and gravel pits were backfilled with material that was predominantly municipal refuse collected tn the Phoenix area. Some solid and liquid industrial waste was also deposited. The refuse was generally covered on a daily basis and a final cover two to three feet thick was placed over an area once it was full of refuse. The liquids were mostly poured into pits dug in areas of Cell A previously filled with refuse. Most of the liquid disposal pits were in the north-central part of Cell A and along the eastern boundary.

Parts of the surface of the site were covered with water by at least one flood event during 1965 and intermittently during the 1970s. River flows in May 1978 washed refuse from the southwestern part of Cell A and the northern third of Cell A-L. The area in Cell A was refilled with refuse during the summer of 1978. The Cell A-1 area was refilled with construction debris in 1979. River flows in the winter and spring of 1979 covered the southwestern part of Cell A and washed refuse out again. The portion of the southwestern area of Cell A that was washed out by flooding was filled with rubble, asphalt, and dirt over the past few years.

The landfill was closed by a cease and desist order issued by the Arizona Department of Health Services (ADHS) in February 1979. The City and ADHS entered into a consent order agreement in June 1979. The consent order was amended in December 1979. The landfill was placed on the EPA's Superfund list in September 1983. To comply with the first amended consent order, the City covered the site with fill, stockpiled soil for final capping installed ground-water monitor wells, built berms around the boundary of the landfill, and installed a gas collection system. Since 1981, the City of Phoenix has undertaken several activities to address the potential public health and environmental issues posed by the landfill.

The City of Phoenix has taken the lead role in performing the remedial investigation and feasibility study of the landfill and will continue to work with ADEQ and EPA to pursue implementation of the Remedial Action Plan.

1.4 OVERVIEW OF LANDFILL IMPACTS

1.4.1 Remedial Investigation Methodology

The remedial investigation included four subjects of investigation: landfill contents, ground water, surface water and sediments, and air quality. The investigation of landfill contents provided information on types of refuse, chemical constituents in the refuse, and on the volume and distribution of refuse in the landfill. Subjects of the ground-water investigation were ground-water levels, direction of ground-water flow, horizontal and vertical gradients, chemical composition of ground water, and physical characteristics of the aquifer. Subjects of the surface water and sediment studies were the extent of potential flooding of the landfill by the Salt River, the potential for changes in the location or depth of the channel near the landfill caused by flooding, and the quality of surface water and sediments. The air quality investigation focused on the effectiveness of the existing gas collection system and the potential impacts of the landfill on ambient air quality.

The findings of the remedial investigation were used in a baseline risk assessment to evaluate the risk that the 19th Avenue Landfill might pose to public health and the environment. The findings of the remedial investigation and the baseline risk assessment were then used to select and design appropriate corrective actions for the site.

1.4.2 Landfill Contents

The 19th Avenue Landfill contains approximately nine million cubic yards of material. The average depth of the waste in the landfill is 30 to 35 feet. However, portions of the southern one-third of Cell A have wastes buried deeper than 50 feet; refuse in Cell A-1 is only 10 to 20 feet thick next to the Salt River. Interviews conducted with past operators of the landfill indicate that some solid and liquid wastes with hazardous characteristics and possibly materials with low levels of radioactivity were probably disposed of at the landfill,

Sampling of soil and refuse in the landfill showed that the contents of the landfill were generally similar to those expected in municipal landfills. Sampling detected several chemicals, including VOCs, PCBs, and pesticides. The most frequently detected VOCs were ethylbenzene, 1,4-dichlorobenzene, xylenes, and toluene. Analysis of EP Toxicity extracts for metals generally detected low concentrations, mostly beneath the defining criteria for hazardous wastes.

The principal conclusion drawn from the investigation of landfill contents is that the contents of the 19th Avenue Landfill are generally similar to those of other municipal landfills of its era and include some hazardous materials, pollutants, and contaminants.

1.4 Ground Water

The landfill is constructed on the alluvial sediments of the Upper Alluvial Unit, which extends to approximately 350 feet below the land surface. The Upper Alluvial Unit is underlain by the Middle Fine-Grained Unit, and the contact between the two units is gradational. The uppermost sediments of the Upper Alluvial Unit are extremely coarse-grained, ranging from cobbles to gravels and coarse sands. The bottom of the landfill is underlain by sediments of this type.

Ground water was found to flow to the northwest at a rate of 1 to 8 feet per day. Measured water levels varied between 20 and 80 feet below the land surface. The depth to water and the ground-water flow rates at the 19th Avenue Landfill are influenced by irrigation and industrial wells that pump ground-water and by recharge from surface water. Ground-water flow gradients, and therefore flow rates, increase during the summer because of seasonal ground-water withdrawals. The use of agricultural irrigation wells northwest of the 19th Avenue Landfill is limited almost exclusively to the six-month summer growing season. This use creates drawdown in the aquifer and induces steeper flow gradients. Downward vertical gradients were also observed in the Upper Alluvial Unit in response to summer agricultural irrigation pumping from nearby production wells.

From the remedial investigation, it was learned that flows in the Salt River recharge the ground water at an average rate of approximately one foot per day. The amount of recharge increases in relation to the amount of the Salt River channel that is covered with water. Therefore, the amount of water recharged is greatest when the river is in flood stage. Water level increases of 20 to 30 feet have been observed as a result of flood flows in the Salt River. The quality of water recharged by the Salt River flows is better than that of the ground water in the area.

Portions of the bottom of the 19th Avenue Landfill have probably been saturated by ground water at various times since the mid-1970s. The southwestern part of Cell A may have been saturated continuously since 1980. The saturation of the refuse in the landfill generates water that is relatively high in TDS (3,000 to 10,000 mg/l) and contains low levels of VOCs (less than 10 ppb) and metals. The water then flows out of the landfill, is diluted by ground water with lower TDS (400-700 mg/l) flowing past the site, and migrates to the northwest along the direction of ground-water flow.

Water quality in some wells on the boundary of the landfill reflects the interaction of landfill materials and ground water. Table 2.14 summarizes those compounds that were detected above MCLs during the remedial investigation. Water quality in downgradient wells shows little impact of the landfill and meets drinking water standards. Off-site monitor wells range from 300 feet (DM-2) to 1,600 feet (DM-6) downgradient from the boundary of the landfill. During the remedial investigation and feasibility study, there were no significant floods. Therefore, the data collected does not necessarily reflect the ground-water quality conditions that may occur during large floods.

1.4.4 Surface Water and Sediments

The Salt River adjacent to the 19th Avenue Landfill is normally dry. Flows have occurred in the normally dry river bed as a result of releases from upstream reservoirs. The 100-year floodplain covers approximately 50 percent-of Cell A-1 and 30 percent of Cell A at the present time.

The Salt River bed is downcutting in the vicinity of the landfill. Sand and gravel mining in the river bed may increase this erosion process. Erosion may undercut structures built along or within the river channel. In addition to general erosion of the channel on a regional scale, local scour of the channel during flooding may erode the channel to depths of 10 feet or greater.

Sampling of surface water and sediments during the remedial investigation indicated that there was negligible difference in the chemical quality of surface water or sediments in the Salt River channel upstream or downstream of the landfill.

It was concluded from the remedial investigation that without additional flood protection, approximately 30 percent of the surface area of Cell A and 50 percent of Cell A-1 will be subject to inundation during a 100-year flow in the Salt River. Washout of some landfill material is likely during a 100-year flow.

1.4.5 Air Quality

1.4.5.1 Ambient Air

The remedial investigation revealed methane concentrations of up to 50 percent by volume in the subsurface pores and voids of the landfill. The remedial investigation also found VOCs such as benzene, toluene, xylene, and trichloroethene in the landfill gas below the cover of the landfill. The concentrations of these compounds ranged from less than 0.001 ppm to 25 ppm.

Sampling of ambient air above the landfill indicated that concentrations of total hydrocarbons were generally below 10 ppm, which is considered typical of concentrations in an urban/suburban environment. Higher concentrations were sometimes observed near cracks in the landfill cover or the collection system exhaust, but their occurrence was sporadic and very short in duration.

Benzene was the most frequently detected component hydrocarbon. When detected the short-term concentrations ranged from 0.004 ppm to 0.3 ppm. These concentrations equate to long-term averages that are within the background concentrations measured in the Phoenix metropolitan area. Other VOCs were detected infrequently. The 19th Avenue Landfill does not appear to have an identifiable impact on the quality of ambient air in the vicinity of the landfill.

1.4.5.2 Subsurface Gas Migration

Methane is generated in the 19th Avenue Landfill by the decomposition of landfill refuse. The existing gas collection system is designed to control off-site migratron of methane along only the northern and western boundaries of Cell A. Prior to renovation of the collection system in December 1987 (during the RI investigation), concentrations of methane above the lower explosive limit (LEL) were measured in enclosed areas off site. After the system was renovated, concentrations of methane decreased at most off-site subsurface probes and off-site enclosed areas. However, concentrations in a pit at Tanner Inc. exceeded the LEL on occasion after the system was renovated.

When the existing gas collection system is maintained in good condition, it is an effective method for controlling off-site migration of landfill gas to levels below the LEL at most locations along the northern and western boundaries of the landfill. However, tests indicate that the system needs additional renovation to achieve this level of control along the entire extent of the existing system.

1.5 BASELINE RISK ASSESSMENT

The baseline risk assessment evaluated risk to public health and the environment resulting from both current and potential conditions at the landfill.

1.5.1 Current Risks

The assessment indicates that the landfill does not pose a current risk to public health, although releases from the 19th Avenue Landfill have affected, to some extent, the ground-water environment at the landfill boundary. Sampling of downgradient wells 300 to 1,600 feet show negligible impacts of the landfill on ground-water quality (see Table 2.14). No current risks to public health were identified for surface water, soil and refuse, and ambient air quality exposure pathways that were examined. The hazard associated with methane was limited to the off-site migration of methane if the gas collection system were not operating.

1.5.2 Potential Risks

Potential public health risks could occur if landfill materials were washed out of the landfill as a result of flows in the Salt River, although the risk cannot be quantified. Ingestion of landfill soil could be a possible exposure pathway if areas of the landfill beneath the existing cover were exposed in the future. For such exposure, however, someone would have to gain access to the site and ingest the soil or refuse. Another potential risk to public health and the environment may occur as a result of a rising water table which saturates a greater volume of refuse and releases additional leachate. The risk to the environment resulting from additional leachate generation by this mechanism is unknown and cannot be precisely quantified. Historical water quality data have not indicated any correlation between an increasing water table elevation and increasing ground-water VOC concentrations (see Figures 5.15 and 5.16 of the RI/FS report). Exposure to ground water from a shallow drinking water well, assuming such a well were drilled on or near the landfill boundary and used as a drinking water source, represents the only potential public health risk. However, the City of Phoenix currently supplies drinking water in the area and will continue to in the future. The area is becoming increasingly industrialized, lessening the chance of ingestion of ground water via a new domestic well.

1.6 FEASIBILITY STUDY AND RECOMMENDED REMEDIAL ACTION

This section presents the purpose of the feasibility study, the general approach to the study, and a summary of the results with special emphasis on the selected remedial action. A basic premise of the feasibility study is that the 19th Avenue Landfill will not be used for any purpose inconsistent with protection of public health and the environment and that public access to the landfill site will be prohibited by a site perimeter fence.

1.6.1 Purpose of Feasibility Study

The purpose of the feasibility study for the 19th Avenue Landfill was to develop a cost-effective corrective action or set of actions that will protect human health and the environment from releases or potential releases from the landfill. The feasibility study was completed concurrently with a remedial investigation in accordance with the Work Plan for the 19th Avenue Landfill (Dames & Moore, 1986b). The Work Plan was reviewed and approved by EPA, DEQ, and DWR.

The potential risks identified by the baseline risk assessment were considered as areas of concern to be addressed in the feasibility study. The feasibility study for the 19th Avenue Landfill identifies, develops, screens, and evaluates potential corrective actions (also-known as remedial actions) needed to protect human health and the environment.

1.6.2 Feasibility Study Methodology

1.6.2.1 Environmental Concerns

The remedial investigation identified some public and environmental risks associated with conditions at the landfill. These risks established areas of concern to be addressed by the feasibility study. The areas of concern were labeled as follows:

- Refuse washout
- Ground-water quality
- Surface-water quality
- Landfill-gas accumulation

The refuse washout concern is based on the potential for Salt River flows to wash material out of the landfill and impact the quality of surface water and sediments, thereby potentially increasing risk for the surface water and sediment pathway.

The surface-water quality concern is on the potential for surface-water runoff to contact refuse and transport material to the Salt River, thereby potentially increasing the risk for the surface-water and sediment pathway. The surface-water quality area of concern also addresses the potential for infiltration of surface-water runoff to infiltrate into the refuse and generate leachate. Leachate may impact the quality of ground water and increase the risk for the ground-water exposure pathway.

The ground-water quality concern is based on the potential that someone could drill a small domestic water supply well (less than 35 gpm capacity) near the boundary of the landfill and ingest the ground water. All aquifers in the State have been classified as drinking water by statute (ARS49-224.B). A total of 1,794 analyses were performed for compounds which have an MCL during the Remedial Investigation. Of this total 39 exceeded the MCL limit (Table 2.14). Ingestion of water exceeding standards may present a possible health risk. However, because of the continuing industrialization of the area and the presence of the City of Phoenix water distribution system it is not anticipated that drinking water supply wells will be drilled.

An additional ground-water quality concern includes the possibility that a rising water table would inundate a larger volume of refuse than is presently inundated. The amount of leachate originating from the landfill may be increased by this mechanism. Historical water quality data do not indicate a correlation between the degree of VOC ground-water contamination ind the ground-water table elevation (see Figures 5.15 and 5.16 of the RI/FS report). Therefore, the risk of additional ground-water quality degradation due to a rising water table cannot be quantified.

The landfill-gas accumulation concern is based on the observations of off-site migration of landfill gas. Methane in the landfill gas could accumulate in enclosed spaces in potentially explosive concentrations. Future development in the vicinity of the landfill may increase the risk of explosion along boundaries that are not presently protected by a gas collection system.

1.6.2.2 Identification of Remedial Action Alternatives

Remedial goals were developed for the landfill by identifying an overall objective for the entire site and then developing specific objectives for each of the four areas of concern. The overall goal for the feasibility study was to develop an action or set of actions that protects human health and the environment, meets federal and state public health and environmental requirements, is cost-effective, and uses permanent solutions and alternative treatments and resource recovery to the maximum extent practicable.

Broad categories of technologies and methods of meeting the specific objectives for each area of concern were identified and evaluated. The technologies and processes that appeared to be the most technically feasible were assembled into one or more actions that could potentially meet the specific objectives for each of the four areas of concern. These potential actions are referred to in this report as “options”. Four sets of options were independently developed for each area of concern. The options were further evaluated to select the option or options that best met the specific objective. For example, all options for the refuse washout concern were compared with each other, and the best options were retained.

The options that survived this evaluation were assembled into potential actions that applied to the entire site. These potential solutions are referred to in this report as “alternatives”. Each alternative consisted of four options, one for each of the four areas of concern. As a last step, the alternatives were screened and evaluated in detail to provide information for selecting a recommended remedial action.

1.6.3 <u>Recommended Remedial Action</u>

Using the progressive process described above, four alternative remedial action plans evolved. Each alternative addressed the four areas of concern defined in Section 1.6.2. Of these four alternative plans, one plan was selected as the preferred alternative; it has the following elements:

1. Refuse washout will be controlled to a 100-year flood by the construction of seated levees with bank protection for both Cell A and Cell A-1. A subsurface

grade control structure will be constructed across the river channel. The storm drain outfall channel will be piped and backfilled. The river channel between Cell A and Cell A-1 will be widened.

2. Surface water quality impacts will be controlled by

- N Installing a single-layer soil cap over both cells.
- N Providing positive drainage for both cells via surface grading and perimeter ditches.
- N Placement of fences around both cells.
- N Relocation of A & B Silica Sand and All Chevy Auto Parts (see Figure 1.2).

3. Potential ground-water impacts to human health and the environment will be controlled by:

- N Monitoring ground-water quality and implementing a contingency plan if ground-water quality conditions deteriorate due to future contaminant releases from the landfill. The objective of the contingency plan is to ensure that potential ground-water degradation does not to pose a risk to public health, welfare, or the environment in the future.
- N Continuing to provide drinking water from the existing City of Phoenix distribution system.

4. Subsurface-gas migration will be controlled by

- N Improving and expanding the gas collection and combustion system for both cells.
- N Single-layer soil caps over both cells (see 1a above).
- N Monitoring of subsurface-methane concentrations.

- Development and implementation of a methane and ambient air quality monitoring program at completion of remedial actions provided for in this Remedial Action Plan to ensure compliance with ARARs.

The elements of the recommended remedial action are compared to the elements of the other alternatives in Table 1.3. The recommended remedial action was selected because it

- Provides protection of public health and the environment equal to other alternatives.

- Does not include relocation of Cell A-1 and therefore avoids the potential short term health risks and higher costs that may result from relocation.

- Is cost-effective.

- Will assure that applicable or relevant and appropriate requirements (ARARs) are complied with at the facility boundary after completion of construction activities associated with the preferred alternative.

This alternative uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. Because treatment of the principal threat at the site was not found to be practicable, however, this remedy does not satisfy the statutory preference for treatment as a principle element of the remedy.

Sections 4.5.5 (Comparison of Alternatives) and 4.5.6 (Recommended Alternative) describe more fully the recommended alternative.

2.0 REMEDIAL INVESTIGATION

2.1 INTRODUCTION

The remedial investigation comprised five separate studies. First, in order to understand present environmental conditions and impacts associated with the landfill, to predict possible future impacts, and to design and implement remedial activities, it was necessary to characterize the amount, types, and location of refuse within the landfill.

Another task was to assess the effects of the landfill on surface water and sediments in the Salt River and to evaluate the infiltration of surface water into the refuse and the subsequent impact on ground-water quality.

Another important task was the characterization of ground-water flow system and the existing quality of ground water. Information gained from this task allowed inferences to be made regarding the current impact of the landfill on ground-water quality, provided an understanding of the interaction between ground water and refuse, and provided hydraulic and source data for predicting future changes in ground-water quality. The ground-water investigation included ground-water modeling studies for predicting contaminant transport and for evaluating ground-water remedial actions.

The air quality investigation had a two-fold objective. One objective as to evaluate the impact of the landfill on ambient air quality. Another objective was to evaluate the effectiveness of the existing gas collection system for controlling off-site migration of the subsurface gas.

The fifth and final task was to assess the risks to public health and environment resulting from releases of contamination from the landfill refuse. This task relied primarily on data collected from the other tasks and on exposure and toxicity data from the published literature on health effects.

In the following sections of Chapter 2.0, the results from the first four tasks of the remedial action will be presented. The risk assessment will be summarized in Chapter 3.0.

2.2 LANDFILL AND REFUSE CHARACTERIZATION

2.2.1 Objectives and Methodology

One purpose of the landfill characterization task was to gain an understanding of the landfill as a potential source by assessing the size of the landfill and characterizing its contents. Another purpose was to adequately estimate the dimensions of the landfill so that potential corrective actions could be properly designed and evaluated.

There were two principal objectives for this task:

- Identification of the lateral and vertical boundaries of the refuse.
- Characterization of the chemical composition of soil and refuse at selected locations in the landfill.

Both Cell A and Cell A-1 were studied in the landfill characterization task. The investigation comprised several subtasks: interviews with former operators and other city employees, a review of aerial photographs, a surface geophysical survey, drilling and sampling of boreholes and utilization of previous investigations of contents and size of landfill.

2.2.2 Landfill Geometry and Refuse Volume

2.2.2.1 Horizontal Extent

A review of historical aerial photographs indicated that the landfill is bounded by 19th Avenue on the west, the 15th Avenue storm drain on the east, Lower Buckeye Road on the north, and the Salt River on the south. However, interviews with city employees and former landfill operators indicated that there was some uncertainty about the actual boundaries of the refuse. Therefore, a geophysical investigation (soil conductivity) was conducted to provide additional information on the refuse boundaries. The results of the geophysical investigation were then confirmed by drilling shallow boreholes around the edges of Cell A and Cell A-1. The landfill boundaries, as inferred from geophysical and borehole data, are shown in Figure 2.1, along with the location of soil borings.

The two businesses, All Chevy Auto Parts and A & B Silica, have been included within the landfill boundary on the basis of evidence from aerial photographs. The tallow plant has been excluded from Cell A, primarily because aerial photographs indicate that no refuse was placed on the tallow plant site.

The extent of Cell A may be overestimated by the boundaries shown in Figure 2.1. The boundary includes a seven-acre area that is approximately 2,400 feet south of the intersection of Lower Buckeye Road and 19th Avenue in the west-central portion of Cell A. This seven acres corresponds to the area where geophysical measurements were unable to locate the limits of the landfill and where reportedly no refuse was deposited. Aerial photographs provide little additional information about this area. A review of aerial photographs showed that the seven-acre portion had not been excavated prior to January 1958, and the area was not disturbed after January 1963, the date of the next available photograph.

2.2.2.2 Vertical Extent

Eighteen boreholes provided information about the depth of refuse in Cell A and Cell A-1. The locations of the boreholes are shown in Figure 2.1. Drilling data from other sources were also used to evaluate the vertical extent of the landfill. Data from 27 borehole logs of work done prior to the RI were utilized for the estimate of the landfill thickness.

Elevation contours of the top of the refuse and contours of the estimated refuse thickness are shown in Figures 2.2 and 2.3, respectively. Figure 2.2 shows the location of all boreholes used in the analysis.

The refuse in Cell A varies in thickness from 12 feet to 58 feet. Cell A can be divided into two general areas based on the thickness of the refuse. The northern two-thirds of the site contains refuse that is generally between 20 and 30 feet thick. The southern third of Cell A, the portion of the 19th Avenue Landfill nearest the Salt River, is characterized by refuse thicknesses between 30 and 50 feet. The thickness of the soil cover varies widely in Cell A. Much of the site is covered by two to four feet of silty sands and gravels with some cobbles. This probably represents the final cover that was placed over Cell A prior to and immediately after closure. The cover is generally thinner over the parts of the southwestern portion of the site that were washed out during the 1978 flood and were not refilled with construction debris. The northwestern quarter of the site is covered by approximately 15 feet of stockpiled silty sand with an estimated volume of 1.7 million cubic yards. The City brought this material to the site for use as the final cover.

The soil cover at Cell A-1 is fairly uniform across the site, with a thickness of about 10 to 14 feet. The thinnest cover observed in remedial investigation borings was four feet. The thickness of refuse in Cell A-1 varies from 30 to 34 feet in much of the southern two-thirds of the site to 10 to 20 feet in the northern portion near the Salt River.

2.2.2.3 Volume

The total estimated volume of refuse in Cell A is 9 million cubic yards. The estimated volume of Call A-1 refuse is 436,000 cubic yards. The estimated total volume is consistent with the estimate by the City of Phoenix that approximately 3.4 million tons of material were disposed of at the landfill. A density of .37 tons per cubic yard of refuse obtained by dividing the tonnage estimate by the volume estimate is in the range expected for municipal refuse.

2.2.3 Landfill Contents

2.2.3.1 Visual Observations

A wide variety of materials was encountered during drilling. The materials recovered would generally be expected to be present in a typical municipal landfill. For example, some of the items that were observed were wood, tires, plastic, newspapers. and other paper products, glass, cardboard, wire, and metal scrap. Samples of soil and refuse were occasionally recovered that appeared to be coated with a black oily substance.

2.2.3.2 Soil and Refuse Analyses

Forty-two samples of soil and refuse were analyzed for metals, organic compounds, and chemical indicators identified in Table 2.1.

Organic Compounds

A complete listing of organic compounds with reported concentrations above the detection limits is given in the RI report. The concentrations of the four most frequently detected compounds are summarized in Table 2.2.

The highest total organic concentration (the sum of all detected organic compounds) was observed in boring DB-2 (Figure 2.1) near the top of the refuse, along the eastern boundary and approximately 1,000 feet south of Lower Buckeye Road. This area had the longest history of use for liquid disposal. The next highest total organic concentration was found in boring DB-4 from within the refuse layer. This area, in the north-central part of the landfill, was also a center for liquid disposal. The samples with the next highest total organic concentrations were collected from borings DB-6 and DB-11 in areas where liquid wastes were not known to have been disposed.

PCBs were detected in five samples of soil or refuse. The maximum observed PCB concentration was 30 mg/kg which is well below the DEQ guidance level for cleanup.

Samples were collected from the refuse layer and from the alluvial sediments below the refuse at several locations throughout the landfill. Samples from the refuse tested positively for various organic chemicals, such as chlorinated hydrocarbons, ethylbenzene, xylenes, and toluene. In samples from the soils beneath the refuse, these organic chemicals were not present above the analytical detection limits. The results from within the refuse and below the refuse indicate that organic chemical waste was not present below the bottom of the refuse at the locations sampled.

Metals

Forty-two samples of refuse and soils were analyzed for the EP-Toxicity metals. Only one sample, from DB-9, exceeded federal EP-Toxicity standards. Cadmium was detected at a concentration of 2.15 mg/L in the sample, compared to the federal standard of 1.0 mg/L. Likewise, none of the soil samples that were collected from Cell A (Brown and Caldwell, 1983) and Cell A-1 (Brown and Caldwell, 1986) prior to the RI exceeded federal EP-Toxicity standards.

Indicators

The moisture content of samples collected near or below the water table was about 60 percent. The moisture content for refuse samples above the water table ranged from 15 percent to 50 percent. Samples of alluvial material from beneath the northern two-thirds of Cell A had moisture contents of 5 percent or less. Most of the samples collected in the northern two-thirds of the landfill were collected beneath old liquid disposal pits. The moisture data therefore are indicative of the moisture contents below the pits at the time of sampling. These low moisture contents indicate that if leachate was being produced in the refuse, it was not migrating downward at the sampling points at the time of sampling.

The pH measurements generally ranged between 8.5 and 7.5 for the samples. The lowest recorded pH values were 6.5 and 6.6 from boring DB-6 within the refuse. Total organic halogen (TOX) and cyanide (CN) were detectable in less than one-fourth of the samples analyzed. The highest CN concentration was observed in the surface sample (2.98 mg/kg).

Phenols were detected in 10 of the 14 borings sampled and in 16 of the 42 samples collected. No phenols were detected in samples or alluvial material beneath the refuse. Total organic carbon (TOC was detected in all samples and ranged from greater than 16,000 mg/kg to 260 mg/kg. In almost all cases, the lowest TOC concentrations were reported for the samples of alluvial material. Cation exchange capacity (CEC) values ranged from between 61.9 to 1.6 milliequivalent per 100 grams (meq/100g). The average CEC value for refuse samples was 19.6 meq/100g, and the average for alluvial material was 6.3 meq/100g. No significance is given to the CEC data. Soils of Maricopa County are generally low in organic content. Therefore, low TOC is expected in alluvial soils at the site.

2.2.3.3 Liquid Analyses

One liquid sample was collected near the bottom of boring DB-10 and two liquid samples were collected in boring DB-11 (Figure 2.1). The first sample from boring DB-11 was collected at a depth of approximately 33 feet below land surface and the second sample was collected at a depth of 53 feet below land surface. The liquid samples were analyzed for major ions, metals, coliform bacteria, indicator parameters, gross alpha and beta, and VOC.

None of the liquid samples are believed to consist entirely of leachate generated in the refuse above the water table. Water levels measured in November 1986 in monitor wells on the boundary of the landfill indicate that each of the samples were collected below the depth of the water table. The sample at DB-10 and the shallower sample at DB-11 were collected in the refuse. The deeper water sample in boring DB-11 was collected from alluvium below refuse.

Organic Compounds

There were no detections of VOCs, pesticide or PCBs. The only compound detected was bis(2-ethylhexyl) phthalate in the DB-10 liquid sample at a concentration of 7.6 ppb.

Metals

No metal concentration exceeded established federal drinking water standards.

Major Ions and Indicators

The liquid samples can be classified as sodium-bicarbonate/chloride water by the relative percentages of their major ions. The TDS concentrations ranged from about 900 mg/l in liquid collected below the refuse to 6,600 mg/l in liquid from the refuse layer.

Liquid samples from the refuse also have higher concentrations of several other indicator parameters than found in liquid samples from below the refuse and in monitor wells. The parameters that appear to be most characteristic of ground water in contact with the refuse are ammonia (NH_3), Kjeldahl-nitrogen, biological oxygen demand (BOD), chemical oxygen demand (COD), and gross beta.

The relatively high concentrations of TDS and other indicators within the refuse layer are not observed in ground water below the refuse or off-site monitor wells. Therefore, significant water quality changes due to interaction of refuse with ground water does not persist over long distances.

2.3 SURFACE WATER AND SEDIMENTS INVESTIGATION

2.3.1 Objectives and Methodology

The Salt River channel lies between two individual portions (known as cells) of the 19th Avenue Landfill. The river drains a large area in north-central and northeastern Arizona. The Salt River channel is often dry in the vicinity of the landfill because river flows are controlled by a system of upstream water conservation dams. Water is released from the reservoirs when they become full. These controlled releases result in river flows past the 19th Avenue Landfill. These high volume flows are capable of eroding into the landfill and carrying away portions of the landfill material. Flows in the Salt River adjacent to the landfill also occur due to runoff from local rainfall or local discharges of ground water pumped to dewater sand and gravel pits or construction projects. These nuisance flows are low volume and do not erode the landfill.

There is a potential that the erosion of landfill material could affect the quality of surface water in the Salt River channel and downstream, ponds. In addition, the chemical quality of the sediments in the Salt River could also be affected. Water from high flows in the Salt River could inundate parts of the landfill and percolate through the refuse. Leachate could then migrate downward and have an impact on the quality of ground water.

Flows resulting from local drainage in the immediate vicinity of the landfill may also flow across, the landfill. Water from these local sources could percolate through the refuse and generate leachate that could affect ground-water quality. Also, local drainage flows could erode landfill materials and carry them into the river, possibly impacting the quality of downstream sediments and surface water.

Several subtasks were conducted to examine each potential impact. Information on the hydrology of the Salt River and physical structures and processes in the riverbed were obtained from previous investigations, maps, aerial photographs, and field observations. Local drainage patterns were also investigated by the use of maps and field observations.

Surface-water quality was evaluated by collecting samples from the river upstream and downstream of the landfill and from a pond immediately east of the landfill. The sampling locations are shown in Figure 2.4. The constituents analyzed in surface-water samples are given in Table 2.3A.

Sediments from the Salt River were collected upstream and downstream from the landfill to provide a comparison of the quality of the sediments on either side of the landfill. Sediment sample locations are shown in Figure 2.5. The chemical analyses performed on sediment samples are given in Table 2.3B.

2.3.2 Salt River Hydrology

2.3.2.1 Drainage System and Flows

The 19th Avenue Landfill is adjacent to the lower reach of the Salt River. The Granite Reef Diversion Dam (GRDD) is about 25 miles upstream from the site. The Salt River outfalls to the Gila River about 12 miles downstream from the site.

Six water conservation dams operated by the Salt River Project (SRP) are upstream from the GRDD. Four of these dams are on the Salt River, and two are on the Salt River’s major tributary, the Verde River. The GRDD provides controlled releases of water from the six upstream dams into irrigation canals. Because the six water conservation dams were not designed for flood control, large releases are not possible until reservoir levels reach the emergency spillway crest elevations. At these times, floods can occur along the lower Salt River. These flows can be relatively large with respect to volume and duration. The 100-year floodplain, in relation to the landfill and vicinity, is shown in Figure 2.6. Plans for increased flood control capability are currently under review, but no final decisions have been made.

Between 1941 and 1962, the Salt River below GRDD was essentially dry. Since 1962, several large discharges past GRDD have occurred. A summary of these flows is presented in Table 2.4. Flows during 1978 inundated the landfill and eroded landfill materials in both cells of the 19th Avenue Landfill.

2.3.2.2 Local Conditions

The presence of bridges, drainage ditches, and sand and gravel quarries places constraints on future construction in the landfill vicinity. The bridges are designed to withstand large river flows; as a result, these structures can significantly affect river dynamics.

The present channel in the vicinity of the landfill is fairly well defined, and there are some channel bank stabilization measures in place upstream and downstream from the landfill. The riverbed materials are alluvial and subject to rapid erosion during major flows. The upstream channel bank protection includes a blanket of rock-filled wire baskets (gabions) on the south bank just upstream from Cell A-1. Downstream channel bank protection includes the armoring of both abutments at the 19th Avenue bridge. The channel bottom width varies from about 400 to 600 feet and curves about 30 degrees to the right as it approaches the 19th Avenue bridge, as shown in Figure 2.6. The channel slope has been estimated at 0.0016 feet/foot for the reach from 7th Avenue to 19th Avenue.

The bridge across the Salt River at 19th Avenue is about 1,000 feet long. The present channel width at this point is about 600 feet. The bridge is elevated at the approaches to direct flows under the bridge. The channel could be widened several hundred feet to the north without affecting the bridge. The bridge at 7th Avenue includes elevated, armored approaches similar to those at the 19th Avenue bridge. These two bridges will tend to restrict lateral migration in the channel between points one-half mile an either side of the landfill.

The 15th Avenue storm drain is an unlined open channel that ties along the east side of Cell A. Landfill materials are exposed along the drain channel. Storm-water runoff from tributary storm drain systems and local flows are carried by the drain and are discharged to the Salt River near the southeastern corner of Cell A. Major flows in the Salt River can restrict the flow through the drain. Flows can infiltrate directly into the landfill material or possibly erode landfill materials and carry them to the Salt River.

According to a report by the U.S. Army Corps of Engineers (USACOE, 1987), a 100-year flow of 195,000 cfs would produce channel flows with velocities of 5 to 13 feet per second (fps) and water depths of 24 to 36 feet adjacent to the landfill. A cross section of the river channel and landfill showing the 100-year water surface is shown in Figure 2.7. Under present conditions, overbank flows would cover over 50 percent of Cell A-1 and about 30 percent of Cell A, as shown in Figure 2.6.

Large sand and gravel pits exist an the north side of the river just upstream from Cell A, on the south side of the river just upstream from Cell A-1, and downstream (west) from 19th Avenue on the north side of the river. Attempts have been made to isolate these pits from channel flows by leaving an alluvial dike between the channel and the pit. Although river banks can be armored to minimize bank erosion, the potential exists for major flows to overtop or erode these dikes and allow flows to pass through these pits. It is difficult to predict these types of failures or what effect they would have on the 19th Avenue Landfill.

2.3.2.3 Sediment Movement

Sediment movement is a major concern when designing foundations for facilities in and adjacent to alluvial channels. Foundation design for these facilities must take into account the combined effects of all river actions that can remove sediment adjacent to the foundation. The upper reach of the Salt River below the GRDD has been degrading in recent years. Active erosion of riverbed materials has deepened the channel. A previous study indicated that between 1952 and 1979, degradation of about 27 feet had occurred at the Interstate-10 crossing approximately seven miles upstream from the landfill (Dames & Moore, 1979). It is expected that riverbed degradation will continue in the vicinity of the landfill. Design of structures along this reach of the river should take this into consideration.

In the Phoenix area, the need is extensive for sand and gravel. For the design of structures in the floodplain, consideration should be given to the effects of future as well as existing sand and gravel mining operations. The creation of pits as a result of sand and gravel mining could result in serious damage to the channel and associated structures during flood events unless the mining is carefully controlled. Erosion processes, specifically downstream migration and long-term channel degradation, have the potential to substantially modify the channel bottom and undercut dikes, bridge piers, and other structures (Anderson-Nichols/West, 1981.

The effects of local scour can be expected in the vicinity of fixed objects such as bridge piers and abutments and channel bank protection materials. Local scour does not necessarily involve large portions of the channel bottom but can extend tens of feet vertically.

2.3.2.4 Future Plans

Modifications are planned for several of the upstream water conservation dams on the Salt and Verde rivers (see Figure 2.8). Additional water conservation storage, sediment storage, and an increased flood storage allocation are planned for the reservoir at Theodore Roosevelt Dam. Safety modifications are planned for Stewart Mountain, Horseshoe, and Bartlett dams. When these improvements are made, the 100-year peak flowrate past the landfill may be affected. Although the expected effect of the modification of Roosevelt Dam will be a reduction of peak flowrate, the dam controls less than half of the total drainage area of the Salt River at the landfill site. A major portion of the watershed drains to the Verde River downstream from Roosevelt Dam.

It is difficult to predict flood control improvements for the Verde River now that Cliff Dam has been removed from Plan 6. However, it is assumed that dam safety improvements will be made to the two Verde River water conservation dams. While these improvements may reduce peak flowrates in the Salt River adjacent to the landfill, their purpose is to protect the dams, not to reduce flood peak flowrates. Without a flood control structure on the Verde River, recurring flows may be expected at the landfill from the Verde River watershed.

2.3.3 Surface-Water Quality

2.3.3.1 Major Ions

Water samples were analyzed for major ions such as calcium and chloride, organic compounds, metals, and other general indicators of water quality. Sodium is the major cation found in all surface water samples. Pond water can be classified as a sodium-chloride water type, and river water can be classified as a sodium-chloride bicarbonate type.

Total dissolved solids in surface water samples varied very little. The average TDS was approximately 490 mg/L in river water and approximately 680 mg/l in the ponds. Pond samples also contained slightly higher levels of magnesium than river water samples.

The differences in general chemical composition and TDS concentrations indicate that the water in the Salt River and the pond are chemically different. The quality of the river water is affected by nuisance sources (e.g., ground-water pumping for dewatering) upstream of the landfill. The pond surface corresponds to the top of the water table and is representative of ground water just upgradient from the landfill. The quality of the pond water indicates that the composition of ground water near the river is strongly influenced by recharge from the river. This relationship is discussed in greater detail in Section 2.4.

2.3.3.2 Trace Constituents

The pH of pond and river water samples were 7.7 and 8.5 respectively. Concentrations of heavy metals were all below maximum contaminant levels (MCLs). In pond water, BOD and COD were 20 mg/l and 35 mg/l respectively. In river water, BOD and COD were 16 mg/l and 37 mg/l. Cyanide was less than 0.01 mg/l and phenols were less than detection limits in all samples. Total organic carbon was approximately 12 mg/l in pond water and was approximately 3 mg/l in river water. Total organic halogens were less than 0.04 mg/l in all samples. Neither pond nor river samples contained detectable concentrations of VOCs or pesticides.

The only drinking water standard exceeded in the four samples collected was for coliforms. Concentrations of coliforms ranged from 75 to 2400 coliform per 100 ml. These concentrations are not unusual in untreated surface water.

No water quality problems (other than coliform) were identified. There are no apparent impacts of the landfill on the quality of water in either the pond or river.

2.3.4 <u>Sediment Quality</u>

Sediment samples were analyzed for organic compounds, priority pollutant metals, and several indicator parameters. No organic compounds were detected in any of the samples. None of the samples had EP-Toxicity concentrations above levels established by the EPA.

A comparison between upstream and downstream sediment data revealed no evident impact of the landfill an sediment quality.

2.3.5 <u>Summary of Results</u>

- Flows have been observed in the normally dry Salt River as a result of releases from upstream reservoirs. Flows during 1978 overtopped the landfill and eroded and transported landfill material.

- A 100-year flow in the Salt River would cover 50 percent of Cell A and 30 percent of Cell A-1 under present conditions.

- There are several factors that should be considered when designing structures in the riverbed at the 19th Avenue landfill:

  - The riverbed has the potential to cut a deeper channel adjacent to the 19th Avenue Landfill.

  - Sand and gravel mining operations in the river might cause additional downcutting by the river.

  - Local scour can result in large amounts of local erosion.

- Surface-water sampling showed that there was no impact from the landfill on water quality.

- Sediment sampling showed that there was no impact from the landfill on the chemical quality of the sediments.

2.4 GROUND-WATER INVESTIGATION

2.4.1 Objectives

After the 19th Avenue Landfill was closed in 1979, monitor wells were installed around the boundary of the landfill for collecting data on ground-water levels and quality. The wells on the boundary of the landfill have been sampled since 1980.

Sampling of the monitor wells between 1980 and 1986 showed that drinking water standards for some metals, the radioactivity indicator gross Beta, and VOCs were exceeded in ground water at the boundaries of the landfill. Because there were no wells upgradient or downgradient of the site, the source and extent of the compounds in ground water could not be evaluated. Measurements of water levels showed the water levels fluctuated tens of feet over a period of a few months and that water levels could be as shallow as 20 feet below land surface. A study of ground-water occurrence and quality was conducted during the remedial investigation to obtain the data needed to evaluate the impacts of the landfill on ground-water quality and the extent of the impacts. Table 2.14 summarizes the exceedances of drinking water standards (MCL) for each well in the monitoring network. The ground-water investigation also provided data on the physical characteristics of the water-bearing materials beneath the site. The factors influencing ground-water quality were evaluated using information on ground-water occurrence and quality together with data on refuse and surface water.

The major objectives of the ground-water investigation were characterization of

- Geologic conditions beneath the landfill, including the sizes and types of materials and their distribution.
- Horizontal and vertical directions and rate of ground-water flow and the factors that influence ground-water flow.
- Ground-water quality upgradient, downgradient, and beneath the landfill.

2.4.2 Methods

Four subtasks were conducted to obtain data during the remedial investigation: (1) monitor well drilling, (2) ground-water quality sampling, (3) ground-water level monitoring, and (4) aquifer testing. Information collected by previous investigations of the landfill supplemented the RI data. Each of these subtasks and the data generated by them are fully discussed in the RI report. A brief description of the methodology is given in the following subsections.

2.4.2.1 Monitor Wells

Remedial investigation geologic data were primarily collected during the drilling of 12 new on-site and off-site monitor wells. These new wells were added to the existing monitor well network of seven on-site wells, called the I-series wells. The I-series wells are located primarily along the perimeters of Cell A and Cell A-1. In addition, three small diameter wells designated River North, River South, and Jackrabbit are located along the banks of the Salt River. The new wells, designated as the DM-series, are located both on and off site. Figure 2.9 shows the locations of the monitor wells.

DM-series monitor wells were sited both on and off site of the landfill in order to measure ground-water quality and water levels both upgradient and downgradient of the site. Wells were also completed at different depth intervals so that vertical variations in ground-water quality and water levels could be assessed. DM-3 is actually a cluster of six wells used for a long-term aquifer test.

2.4.2.2 Ground-Water Sampling

Ground-water samples were collected from most of the monitor wells on a quarterly basis during the remedial investigation. This was done to characterize ground-water quality at various times during the year upgradient and downgradient from the landfill and beneath the landfill. Ground-water samples were collected from intervals at various depths to characterize vertical ground-water quality differences near the landfill. All monitor wells, with the exception of DM-1 and DM-2, were sampled using dedicated submersible pumps and well head sampling systems. Wells DM-1 and DM-2 are multiport wells and were sampled using specialized pneumatic sampling equipment. Twenty-four ground-water sampling points were monitored for water quality during the course of the remedial investigation. Sampling levels at the multiport wells are identified by numbers corresponding to the sampling port depth in feet below ground surface (for example, DM-1 54). Single completion wells are identified by a letter to indicate the relative depth of the well within the aquifer (for example, S, I, and D for shallow, intermediate and deep, respectively). Of the 24 sampling locations, 12 are on site and 12 are off site. The general analytical groups for which the samples were analyzed are given in Table 2.5.

2.4.2.3 Aquifer Testing and Monitoring

Both short-term and long-term aquifer tests were conducted to evaluate the hydraulic properties of the aquifer below the landfill. The long-term test was performed at the DM-3 well cluster. Water level measurements were made at five observation wells, three of which were at the same depth as the production wells and two that were deeper. Irrigation wells within one-half mile of the DM-3 cluster were monitored to evaluate their effects on the long-term test.

Short-term tests were performed on Well DM-5D and Well DM-6. Well DM-5S was used as an observation well for the DM-5D test. The DM-6 test was a single well test.

Ground-water levels were monitored throughout the remedial investigation to provide information on the fluctuations in ground-water levels with time. Water levels were used to estimate ground-water flow directions and gradients. Water levels were generally measured on a monthly basis between January 1986 and January 1988. Water levels were measured more frequently during the time periods in which water was released into the Salt River from upstream dams so that the effects of recharge from surface water could be noted.

2.4.3 Geology

2.4.3.1 Regional Geology

The 19th Avenue Landfill is situated in the southeastern portion of the West Basin of the Salt River Valley in central Arizona. The site is within the Basin and Range physiographic province. The landfill is on alluvial fill material that commonly occupies the structurally depressed basins of the region. No active faults are known to be present near the site. The basement rock near the landfill has not been drilled. However, based on data from boreholes about five miles east of the site (Dames & Moore, 1987d), basement rocks probably consist of Precambrian igneous and metamorphic rocks that have been deformed by the nearby South Mountain metamorphic: core complex and by Basin and Range high angle normal faulting and Tertiary sedimentary and volcanic units.

2.4.3.2 Site Geology

One of the primary objectives of the remedial investigation monitor well installation program was to characterize the shallow subsurface geology in the area near the landfill. This was accomplished by drilling 12 boreholes during the summer of 1987, 4 of which were drilled to a depth of 300 feet or greater. Data collected from the boreholes indicate that at least five identifiable stratigraphic units exist within approximately 400 feet of the surface. They have been designated Units S, A, B, C and MFU for the purposes of this report. Unit A can be further subdivided in Subunits A1, and A2. Figure 2.10 gives a description of the geologic units and shows a generalized stratigraphic column indicating the relationships between these units. A cross section showing their relationship is given in Figure 2.11. No major structural displacements or flexures were identified during the drilling program. All units appear to be essentially horizontal.

2.4.4 <u>Ground-Water Flow System</u>

This section describes the ground-water flow system in the vicinity of the site as identified during the remedial investigation. Data from previous site-specific investigations were also included within this analysis. Components of the ground-water flow system investigated were trends in ground-water levels, ground-water recharge, ground-water flow directions, ground-water flow gradients, and aquifer characteristics. Knowledge of the variation of these flow system components is necessary to characterize ground-water movement and ground-water quality near the 19th Avenue site.

2.4.4.1 Ground-Water Levels

Water level measurements show that the upper surface of the saturated zone is relatively close to the land surface in the area near the site. In general, the water table is 20 to 40 feet below the land surface near the river and 60 to 80 feet below the land surface north of the site. Observed ground-water levels have fluctuated over 20 to 30 feet in the wells at the landfill, because of two principal external factors. These factors are seasonal water level fluctuations that result from the influence of agricultural ground-water pumping and variations in recharge to the ground-water system from the Salt River.

The seasonal fluctuations in water level seen in monitor wells at the landfill can be directly attributed to the seasonal use of large production wells in the area. Most of these wells are agricultural wells owned by the Roosevelt Irrigation District (RID). Essentially no pumping takes place at most wells from October through March, but all wells are pumped extensively from April through September. Most of the RID wells are completed in geologic Units A, B, C, and the top of the MFU.

The hydrographs of I-series wells from mid-1980 to the present show that water levels in monitor wells peak in late March and then begin to decline in April when the RID wells are turned on. Water levels reach their lowest water points in September and begin to recover in October when the RID wells are turned off. Water levels recover in the wells through the winter and decline in the following spring when the production wells are turned on. Figure 2.12 portrays this relationship for 1987 data.

2.4.4.2 Ground-Water Recharge

Surface-water flow in the Salt River and 15th Avenue storm drain adjacent to the 19th Avenue Landfill has been observed to influence the ground-water levels in monitor wells at the site. Water percolates down from the Salt River bed and **** of the storm drain and enters the ground-water system.

A conservative estimate of the average infiltration rate in ephemeral Arizona rivers has been set by various investigators at one foot per day (Babcock and Cushing, 1942; Briggs and Werho, 1966; Mann and Rohne, 1983). However, the investigations indicate that infiltration rates range from more than two feet per day to less than one-half foot per day depending on river flowrate, flow duration, and sediment load.

No flows occurred in the Salt River during the remedial investigation that were of large enough magnitude and duration to allow calculation of recharge rates for the Salt River in the vicinity of the landfill. The recharge rate probably falls within the range reported by others for the Salt River. However, qualitative estimates of the impact of recharge on water levels at the site can be made by comparing monthly and daily Salt River flow volumes past GRDD (Table 2.4) with observed ground-water level increases at the site for a particular year or month. The flows from GRDD are depicted graphically in Figure 2.13.

Increases in ground-water levels occurred during river flow events exceeding 10,000 cfs past GRDD. Flows at the landfill are not equal to the flow past GRDD. However, the best records exist at the GRDD site and the flowrates are used as a relative number for the purposes of this study. Therefore, it can be concluded that flows in excess of 10,000 cfs at GRDD are capable of raising the ground-water level beneath the site. Sustained flows of smaller volumes are probably also capable of raising water levels. If the monthly water level increase is divided by the days of river flow, a qualitative estimate of daily water level increase for a given river flow can be made. Calculations for various periods of flow result in a rate of ground-water level increases of approximately 0.7 to 1.3 feet per day of flow at the 19th Avenue Landfill. Ground-water levels decrease at the site at an approximate rate of four feet per year given the absence of flow in the Salt River past the site (Sverdrup & Parcel , 1980). Flows lasting longer than two to three weeks in duration in the Salt River at the landfill may negate several years of water level decline.

2.4.4.3 Ground-Water Flow Direction

Figures 2.14 and 2.15 show typical contours of summer and winter water levels measured during the remedial investigation for wells in geologic Unit A, the shallowest unit. These figures show that ground water flows to the west-northwest or northwest. The flow direction is controlled by ground-water pumping to the northwest of 19th Avenue Landfill. This includes the Luke pumping cone near Litchfield Park, local RID wells, and City of Phoenix water production well fields. Although most pumping at these centers takes place in the summer months, ground-water continues to flow to the northwest at the landfill throughout the year. Data collected prior to the remedial investigation from production wells and the I-series wells also indicated a west-northwest to northwest flow direction consistent with regional flow (James M. Montgomery, 1980; Brown and Caldwell, 1983 and 1985; Sverdrup and Parcel, 1980).

When flows occur in the Salt River, a ground-water mound develops beneath the river because of recharge, and ground water appears to flow to the south and southeast on the south side of the river based on data from shallow wells. The apparent local reversal of flow direction reflects changes in water levels in the shallow wells due to the temporary recharge mound and does not affect regional flow.

Wells in deeper geologic units were installed near the 19th Avenue site in mid-1987. These deeper wells, DM-5D, DM-1, DM-2, DM-3I and DM-3D, are sited along a southeast-northwest trending line (Figure 2.9). Based on the data for the wells completed in Unit B, ground-water flow in Unit B is also generally to the northwest in the deeper units.

2.4.4.4 Ground-Water Flow Gradients

The rate at which ground-water moves is directly proportional to the ground-water flow gradient. Variations in horizontal and vertical ground-water gradients in the vicinity of the landfill are controlled primarily by pumping from production wells near the landfill. As was discussed in Section 2.4.4.3, almost all of the pumping done by RID wells near the landfill occurs during the summer months. This seasonal pumping causes changes in vertical and horizontal ground-water flow gradients.

During the winter months, when ground-water pumping is at a minimum, only small vertical gradients were observed. There was virtually no difference in water levels between Wells DM-5S and DM-5D, Vertical gradients of 0.015 ft/ft or less were measured in the remainder of the wells.

When ground-water pumping increases in the summer, water levels begin to decline in the monitor wells closest to the RID wells. The pumping of the RID wells causes water levels to drop more rapidly in Well DM-3D which is completed in Unit C, than in Wells DM-3P and DM-3I which are completed in Units A and B, respectively. A downward vertical gradient between Units A and B and Unit C is therefore induced by the summer pumping. Water levels in monitor wells at greater distances from the RID wells (DM-1 and DM-5 cluster) respond less to the effects of the pumping.

Horizontal gradient data for the 19th Avenue site show increases in Unit A in the summer months when the production wells are pumping. The horizontal gradient decreases in the fall when the pumps are shut down. Since 1980, the horizontal gradient has fluctuated between a value of nearly 0.0 feet per foot to over 0.007 feet per foot. The yearly average horizontal gradient has increased since 1980 from a value of approximately 0.0028 feet per foot to approximately 0.0044 feet per foot.

2.4.4.5 Aquifer Characteristics

Aquifer hydraulic characteristics of geologic Unit A were evaluated at the landfill to obtain data that can be used to assess the rates and volume of ground-water flow and to assess the volumes and rates at which ground water may be extracted or injected. The hydraulic data were obtained from a long-term (62 hours) aquifer test conducted at the DM-3 well cluster.

Data were analyzed using the Theis Method, the Cooper-Jacob Approximation Method, and the distance-drawdown method. Table 2.6 summarizes transmissivity (T, gpd/ft), storativity (S), and hydraulic conductivity (K, ft/day) values that were derived from the different methods of analysis.

The values of S derived from the Theis analysis appear to indicate semi-confined aquifer conditions. The lack of confining sediments found in the boreholes suggests that the ground-water system should be unconfined to semi-confined. The average value of S (0.11) derived from the Jacobs analysis was used in modeling efforts. The average values of T and K derived from the various analysis methods varied by less than 16 percent. Overall, average values of 138,565 gpd/ft and 230 ft/day are obtained for T and K, respectively, using a saturated aquifer thickness of 110 feet. The value for T is in close agreement with 194,000 gpd/ft obtained by the U.S. Geological Survey (USGS) in 1984 from aquifer tests on wells completed in Salt River sediments near 24th Street and Lower Buckeye Road in Phoenix (approximately 2.5 miles east of the 19th Avenue Landfill). For modeling performed during the remedial investigation, a value of 190,000 gpd/ft was used as a value for T and 230 ft/day was used for the K value of Unit A.

Short-term (four-hour) tests were conducted for geologic Units A and B. The results are presented in the RI report. Aquifer tests were not performed for the Middle Fine-Grained Unit. This unit is apparently not affected by releases from the landfill, and hydraulic information was not required for remedial action design or modeling.

2.4.5 Water-Quality Results

2.4.5.1 Major Ions

The major chemical components of ground water that can be used to classify different general categories of waters are cations of calcium, sodium, potassium, magnesium, and anions of bicarbonate, sulfate, and chloride. The major chemical composition of ground water can be used as a tool to help evaluate the flow paths and mixing of ground waters with different compositions. The relative concentration of the individual major ions and their total concentration can be expressed both graphically and numerically to interpret the mixing and movement of different waters. This technique provides a convenient framework within which ground water at the 19th Avenue Landfill can be described.

A summary of the statistics of the major ions for existing wells (the I series) is presented in Table 2.7. Similar summaries for DM wells, installed during the remedial investigation, are listed in Table 2.8.

Water samples collected during the RI and in programs prior to the RI were classified separately by water type based on the relative concentrations of major ions. A trilinear plotting technique which converts concentrations of ions to percentages of total milli-equivalents per liter of cations and anions (Piper, 1944) was used to classify the samples. The mean concentrations of ground-water analyses listed in Tables 2.7 and 2.8 were plotted on the trilinear diagram and classified by selected hydrogeochemical boundaries. The resulting classifications are given in Table 2.9.

The prevailing water quality of the various wells was identified as calcium-sodium/bicarbonate-chloride water or sodium-bicarbonate/chloride. There is no difference in classifications between I-series wells (data prior to the remedial investigat ion) and new wells.

Stiff diagrams were also used to evaluate geochemical variations in water quality for data from both the remedial investigation and programs prior to the remedial investigation. Concentrations of cations were compared with anions by plotting them on four sets of opposing parallel horizontal axes. The resulting data points were connected to obtain polygonal shapes that indicate general chemical makeup of the water. In general, calcium, sodium, bicarbonate, and chloride are the dominant projections for each Stiff diagram. However, the overall size of the plots varies, indicating that the concentrations of TDS vary.

The consistent shape for varying sizes of each Stiff diagram implies that TDS may behave as a dependent variable with respect to each of the ions. To evaluate this hypothesis, the concentration of each major ion was plotted versus TDS. Data of the Salt River surface water and upgradient ground water were included. Plots of sodium, potassium, calcium, magnesium, and chloride each displayed a linear trend, showing a significant positive correlation between metal concentrations and TDS. Correlation coefficients were between 0.7 and 0.9.

The plots for sulfate and alkalinity also exhibit linear trends, but display a larger amount of data scatter than the other ion data. Sulfate and alkalinity data for samples collected at Wells I-3 and I-4 do not plot in areas consistent with the linear trends established by the remaining data. Data for both of these wells indicate that the water is enriched with bicarbonate (as alkalinity) and depleted of sulfate.

In general, the linear segments for each ion correspond to a TDS range approximately 500 to 1,900 mg/l. The lower end of the TDS range represents Salt River water and water in the upgradient off-site wells. The linear trends are interpreted as a mixing line beginning with Salt River recharge water and ground water located south of the river and upgradient from the landfill. The linear trends are very useful for explaining the inorganic chemical quality of water in most monitor wells at the 19th Avenue Landfill.

2.4.5.2 Trace Constituents

Metals

A summary is given in Table 2.10 of the metals that were detected in one or more samples in each quarter. The results presented in Table 2.10 indicate that of the eight metals for which MCLs for drinking water have been set, mercury and barium had concentrations in excess of the MCL. Barium concentrations were above the standard (1.0 mg/l) in Wells I-3, I-4, and I-8. These wells are located on the western boundary of the landfill, generally downgradient with respect to ground-water flow. Barium was not detected above the MCL in off-site wells downgradient of the landfill. Mercury exceeded the MCL (2.0 ug/l) in one sample from Well I-3 and equalled the MCL in one sample from Well I-4. Arsenic exceeded the MCL in one sample from Well I-8.

Throughout the sampling program, metals were detected at Wells I-3, I-4, I-5, and I-6. Concentrations of. the metals detected were close to detection limits. The distribution and concentration of metals observed in the remaining wells at the 19th Avenue Landfill have not produced regular patterns of detection. Off-site wells, upgradient and downgradient, have displayed a similar pattern of infrequent detections at concentrations near but above detection limits.

VOCS

Vinyl chloride was detected in Wells I-1, I-2, and I-8 at concentrations in excess of the current MCL of 2.0 ug/l. The maximum observed vinyl chloride concentration was 2.6 ug/l in Well I-1 in the third quarter of 1987. Carbon tetrachloride was detected only once, at a concentration of 35 ug/l in Well I-1 in the fourth quarter of 1986. The MCL for carbon tetrachloride is 5.0 ug/l.

Most detectable concentrations of VOCs were less than 5.0 ug/l. The VOC concentrations exceeding 5.0 ug/l are given in Table 2.11. VOC concentrations were several times larger at I-1 than at other on-site wells.

Pesticides and PCBs

Pesticides and PCBs were analyzed in August 1986, August 1987, and December 1987 sampling periods during the remedial investigation. During. these three sampling rounds, PCBs were consistently below detection limits. The only pesticide detected in off -site wells was Dieldrin in Well DM-2 at 54 feet in December 1987. Pesticides were detected in on-site wells in August 1986 and August 1987. Pesticides detected included 4-4DDE, 4-4DDT, A-BHC, Aldrin, D-BHC, Dieldrin, Endosulfan II and G-BHC. No pesticides were found above MCLs. Pesticide concentrations ranged from 0.005 to 0.2 ppb.

2.4.5.3 Indicators

A summary of TOC, BOD, and COD data is given in Table 2.12. The results show that concentrations of BOD and COD in off-site wells averaged 50 to tOO mg/l greater than on-site wells. TOC concentrations in off-site wells were generally below the detection limits of 0.01 mg/l. On-site wells showed TOC concentrations up to 0.139 mg/l, with the highest levels being detected at Wells I-3 and I-4. The distribution of the reported concentrations for BOD and COD does not indicate trends with respect to either proximity to landfill boundaries or concentrations in surface water. Phenols and cyanide, if present, were at concentrations either less than or only slightly above detection limits.

Coliforms

Coliform analyses conducted during the remedial investigation sampling program ranged from < 2 to 2,400 col/100ml. Most coliform counts were less than 10 col/100 ml. Samples collected from the uppermost portion of the Upper Alluvial Unit displayed concentrations that were above those measured in deeper completion intervals. Samples collected from the two uppermost ports at DM-2 and the sample collected at DM-5S ranged from 49 to 2,400 col/100ml. The uppermost port at DM-2 produced a single coliform count of 2,400 col/100ml, a value that is approximately 50 to 100 times greater than the other coliform count data.

Radioisotopes

Gross alpha and beta emissions measured on samples collected at each well showed that concentrations were generally near detection limits. A total of 63 analyses were performed for gross alpha and beta. Of these analyses, one exceeded the gross alpha MCL of 15 pCi/l and four exceeded the gross beta MCL of 50 pCi/l. The results of all radioisotopes analyses are presented in Table 2.13. Well I-5 exceeded the MCL for gross alpha emissions with a concentration of 17.9 +/- 4.2 pCi/l in the first quarter of 1987. Although most of the gross beta measurements were below the MCL at Well I-3, three measurements exceeded the standard. Sample concentrations from Well I-3 exceeding 50 pCi/l were measured in the third quarter of 1986 (57 +/- 10.7 pCi/l); the fourth quarter of

1986 (122.0 +/- 8.7 pCi/l); and in the fourth quarter on 1987 (53.8 +/- 9.2 p Ci/l). One measurement at Well I-6 also exceeded the MCL for gross beta in the fourth quarter of 1986 (92.3 +/- 12.6 pCi/l). The sampling results from wells at different depths indicate that the uppermost portion of the aquifer has greater alfa and gross beta activity than deeper water bearing zones. Off-site and on-site wells displayed similar concentration ranges.

2.4.5.4 Summary of Results

The 19th Avenue Landfill is underlain by alluvial materials deposited within the West Basin of the Salt River Valley. These materials can generally be divided into five different units above a depth of 350 feet below land surface. There is a 15-foot surface layer composed of silty sand. Beneath this layer is approximately 100 feet of cobbles and coarse gravels. The next three units below this layer are divisions within the Upper Alluvial Unit.

The depth to ground water is between 20 and 40 feet below land surface. Ground water generally flows to the northwest beneath the landfill. Water levels have been observed to fluctuate 20 to 30 feet over a period of a few months. Most of the fluctuation is due to recharge from the Salt River that results from intermittent upstream releases into the Salt River bed. The high water tables resulting from the recharge of surface water are gradually reduced at a rate of about four feet of head per year by regional agricultural pumping.

The agricultural pumping also results in a seasonal fluctuation of water levels. Water levels are generally highest during the winter months when agricultural pumping is at a minimum and they decline during the summer as pumping increases. The agricultural pumping also causes an increase in the ground-water flow gradient during the summer.

The alluvial materials beneath the site are generally coarse grained and can transmit a relatively large amount of ground water. The transmissivity of the materials between a depth of approximately 100 and 150 feet is estimated to be 190,000 gallons per day per foot. The transmissivity of the cobble and gravel deposits above 100 feet is probably even greater.

Ground-water quality sampling of wells during the remedial investigation shows that recharge from the Salt River improves the general ground-water quality along the river as characterized by differences in major ions and TDS concentration between upgradient wells which are not influenced and downgradient wells which are. Additional water quality indicators such as pH and metals show that there is evidence for water quality changes due to the landfill. However, water quality in wells approximately one-quarter to one-half mile downgradient of the site show little impact and meet all federal primary drinking water standards. Table 2.14 summarizes MCL exceedances for all monitoring wells. Of the 1,794 analyses performed for compounds with MCL's, 39 analyses were found to exceed the MCL limit.

2.4.6 Interpretation of Landfill Influence on Ground-Water Quality

The chemical and physical processes that shape the ground-water quality observed during the remedial investigation must be understood in order to evaluate which, if any, corrective actions should be considered for ground water at the landfill. In particular, the interactions between landfill materials and ground water and its affect on water quality must be identified in the context of the overall system. To this end, information is combined from the several studies conducted during the remedial investigation to identify the factors that influence ground-water quality.

2.4.6.1 Ground-Water Levels and Refuse Saturation

A conceptual diagram of the hydrogeologic system at the 19th Avenue Landfill is presented in Figure 2.16. This diagram was developed early in the remedial investigation from information developed by previous investigations and is confirmed by the remedial investigation data. The diagram shows that when the water table is relatively high, ground water rises into a portion of the refuse. The rising ground water can saturate the refuse and provide a method for transporting materials away from the landfill. The water in the refuse will enhance the production of methane as well as dissolve component of the refuse.

In general, ground water is recharged by the downward percolation of water flowing in the normally dry Salt River in times of flood. Recharge is capable of raising the water table near the landfill by 10 to 30 feet in the period of a few months. This mound of recharged water gradually dissipates at a rate of about four feet of head per year.

Ground-water levels fluctuate seasonally near the landfill because of the influence of agricultural pumping (Figure 2.16). Ground water is pumped from several large agricultural wells near the landfill between April and September. The greatest pumping occurs in the summer months. Pumping of the wells causes a decline in water levels that is greatest in August or September. When pumping stops in September, water levels recover to near the winter water levels of the year before.

One cross section of the landfill is shown in Figure 2.17. Refuse in the northern portion of Cell A is generally above an elevation of 1,020 feet msl. Parts of the refuse in this northern portion of the landfill may be above an elevation of 1,035 feet msl. The bottom elevation of the refuse drops rapidly into an east-west trending trough in the southern one-third of the site. The trough is higher at the east end of the landfill, with an elevation of approximately 1,005 feet msl, and deeper in the western end of the landfill, with the lowest point at an elevation of approximately 990 feet. In Cell A-1, refuse is generally above an elevation of 1,040 feet msl. The remainder of Cell A-1 has a bottom elevation of approximately 1,020 feet msl. The deepest portion of cell A-1 has a bottom elevation of approximately 1,010 feet msl.

The highest and lowest water levels observed during the remedial investigation are projected onto Figure 2.17. The top of the ground-water table has been above the bottom of refuse in the deepest portion of the landfill (elevation 980 feet msl) even at the lowest recorded level during the remedial investigation. The water table was highest and the most refuse was saturated in the winter months. The inundated refuse at the highest observed water level is limited to the southern third of Cell A and a small portion in the center of Cell A-1.

Evidence of ground water rising into excavations in Cell A can be seen in aerial photographs taken between 1972 and 1976. The data from water level measurements since 1980 indicate that the water table has probably not been below an elevation of 995 feet msl. At that elevation, as much as 15 feet of refuse would be continuously saturated in the deepest portions of refuse in the southwestern part of the landfill. The data further indicate that the water level was up to 1,027 feet msl in 1983. Since 1983, ground-water levels have slowly receded. However, in the winter months when the water levels are the highest because there is no irrigation pumpage, refuse below an elevation of approximately 1,015 feet msl is saturated.

2.4.6.2 Inorganic Water Quality

Figure 2.18 gives a comparison between TDS and water levels in the time period between 1981 and 1988. There appears to have been a general tendency for higher TDS concentrations during periods of high water levels.

Variations in the patterns for inorganic water quality in the monitor wells sampled during the remedial investigation can be distinguished by superimposing Stiff diagrams on the site map Figure 2.19. The overall size of the Stiff diagram is an indication of the TDS concentration. The TDS concentrations are given within the Stiff diagrams in Figure 2.19. Waters with similarly shaped diagrams have similar quality.

Ground water in upgradient Wells DM-5S and I-6 has higher TDS concentrations than wells on the boundary of the landfill or downgradient. Furthermore Wells DM-5S and I-6 have different water quality types than the other wells. The waters in Wells DM-5S and I-6 can be classified as sodium/chloride, while the water from other wells are classified as sodium/chloride-bicarbonate.

The Stiff diagrams for Wells I-1, I-2, I-5, DM-3P, and DM-6 are similar to the surface water Stiff diagram. The Stiff diagrams for Wells I-3 and I-4 are different from the stiff diagrams for other wells on the boundary of the landfill or downgradient in that there is almost no sulfate in the water of Wells I-3 and I-4, and there is a reversal in the relative concentrations of calcium and magnesium. Well I-8 also shows the reversal in the relative concentrations of calcium and magnesium and some reduction in the concentration of sulfate. The ground water in Wells I-3 and I-4 also contains a relatively greater proportion of bicarbonate ions than in ground water from some other wells, such as I-2, DM-6, and DM-3P. Other wells showing the relative increase in bicarbonate ions are DM-1, I-8, and DM-2.

The similarity between the general composition of ground water observed in some monitor wells and the composition of the surface water in the Salt River is consistent with the observation made in Section 2.4 that plots of the major ions for most shallow monitor wells form a mixing line with the end members being composition of the ground water in Well DM-5S and the composition of surface water.

The composition of the surface water sampled during the remedial investigation is probably not entirely representative of the quality of surface water in the Salt River during periods of high flow. Sampling by the SRP indicates that in high flow years, the TDS concentration of the water may be as low as 200 to 300 mg/l (Salt River Project, 1982). The composition of the water can vary from sodium/chloride-bicarbonate, similar to that seen in the remedial investigation, to calcium/bicarbonate. The effect of mixing the recharged surface water with upgradient ground water would be to reduce the TDS concentration and increase the proportion of bicarbonate relative to chloride. These effects are consistent with the ground-water quality observed in several of the monitor wells.

There have been several periods of flow in the Salt River in the last decade that could provide a source of recharge to the ground water. Water level trends observed at the landfill indicate that recharge is taking place. The quality of the ground water in several of the monitor wells can be explained by the simple mixing of ground water upgradient from the site with recharge from the Salt River.

The wells where the apparent impact of the landfill is least on inorganic water quality are Wells I-1 and I-2 in the northeastern comer of the landfill. This is not unexpected given the position of the wells and the geometry of the landfill. Well I-2 is upgradient or off-gradient from much of the landfill and Well I-1 is directly downgradient from only a relatively small portion of the landfill. In addition, the bottom of the northern part of the landfill was above the water table during the remedial investigation.

Wells for which TDS concentration is not a good indicator of overall water quality are plotted off the linear trend were I-3, I-4, DM-2 54, and DM-5D. Well DM-5D is deeper than shallow wells and the differences in water quality are not unexpected. Well DM-2 54 is the shallowest port of a multiport installation and only contained enough water to be sampled during one sampling episode. More data would be needed to develop a trend, but it appears that the landfill may be having some impact on water quality at DM-2 54. Waters from Wells I-3 and I-4 have already been identified as having water quality characteristics different than most other wells and their composition would not be expected to plot on the mixing line. Other factors are influencing the quality of ground water observed in these wells. Wells I-3 and I-4 are downgradient from the deepest portions of the landfill that have been below the water table since at least 1981. The obvious source of modifications to water quality in these wells is the interaction between landfill materials and ground water.

The principal impact of the landfill on water quality occurs when the refuse and ground water come in contact. Ground water in contact with refuse has high TDS concentration when compared to upgradient ground-water quality. The higher TDS concentration is a result of an increase in the major ions of bicarbonate, chloride, sodium, and magnesium. Concentrations of calcium and sulfate ions are only slightly higher. Ground water in contact with refuse in the landfill also has increased concentrations of ammonia and organic nitrogen and a higher chemical oxygen demand.

Figure 2.20 presents Stiff diagrams for water samples collected from saturated refuse and for Wells I-3 and I-4. Samples D8-11W and DB-10W were collected within the refuse. Stiff diagrams for Wells I-3 and I-4 show the same relative increase in bicarbonate composition and decrease in sulfate composition shown by DB-11W and DB-10W. The reduction in sulfate concentrations in DB-11W and DB-10W in combination with the fact that the landfill is producing methane gas suggest that the low oxygen condition found in the landfill may provide a favorable environment for sulfate-reducing microorganisms. Such bacteria are commonly found in ground-water systems that are low in oxygen with sulfate and iron available for metabolism. Simultaneously, the increase observed in Bicarbonate concentration in Wells I-4 and I-3, and samples DB-11W and DB-10W may be the result of other bacterial fermentation processes that release carbon dioxide and thereby increase bicarbonate (alkalinity) concentrations.

The data indicate that the greatest impact of the landfill on inorganic water quality occurs when the refuse becomes saturated by a rising water table. Recognizable impacts were observed in wells on the western boundary of the landfill. However, by the time ground water flows one-quarter to one-half mile downgradient to the off-site monitor wells, the impacts of the landfill on inorganic water quality are not discernable.

2.4.6.3 Modeling Study

A ground-water transport model was applied to evaluate the above conclusions about the effects of the landfill on inorganic water quality. A detailed discussion of modeling at the landfill is given in Appendix A of the RI report. Information on geology and the ground-water flow system discussed previously was used to create the flow portion of the model. Total dissolved solids concentrations were chosen as the parameter for transport modeling.

The modeling scenario that best matched the observed distribution of TDS concentrations in the monitor wells utilized a source term of 10,000 mg/l of TDS input from a cell in the area corresponding to the deepest part of the landfill. The cell represents three percent of the total volume of refuse simulated. It was assumed water levels have been in the refuse for the past nine years and leachate has been generated over that time. Background TDS concentrations were set equal to the concentrations in the pond to the east of the landfill and the TDS concentrations of the Salt River was assumed to be 400 mg/l. Recharge from the Salt River was simulated by supplying a flux of 0.17 feet per day 4 at a 100-foot-wide cell along the upper boundary of the model. The flux rate was derived by calculating the percent of time over the nine-year period that flows had occurred below Granite Reef and using a seepage rate of one foot per day of flow.

Predicted TDS concentrations for off-site monitor wells are plotted versus time for four well points in Figure 2.21. For comparison, concentrations measured in the second quarter of 1987 are plotted in Figure 2.21. Predictions of the model are similar to the actual measured field conditions.

Data collected since 1980 indicate that much more than three percent of the volume of the landfill has been below the water table over the last nine years. However, modeling indicates that the source term under one scenario must be restricted to the smaller area of three percent at a concentration of 10,000 mg/l. Sensitivity analysis indicated that either an increase in the area of the source or an increase in the strength of the source results in much higher TDS concentrations than those observed during the remedial investigation. The actual average concentration of liquids in the refuse may actually have been lower over the time period modeled and may have been distributed over a wider area. Total dissolved solids concentrations for liquids sampled in refuse have varied between 3,200 and 10,000 mg/l. Alternatively, the effective horizontal and vertical conductivity of landfill materials may be lower than estimated and the relative amount of flow out of the landfill may be smaller in relationship to the regional ground-water flow past the landfill. In this case, liquids may be flowing out of the landfill over a broader area and at a much lower rate than modeled.

In general, ground-water flow and transport modeling are capable of reproducing the general distribution of TDS concentrations seen in the monitor wells. The actual situation at the landfill may be slightly different from the model, but the general factors influencing inorganic ground-water quality at the landfill are:

- **N** Improvement of upgradient ground-water quality by recharge from the Salt River.

- **N** Degradation of ground-water quality when ground water comes in contact with refuse.

- **N** Dilution and mixing of high TDS ground water leaving the landfill with lower TDS ground water that flows past the landfill.

The effects of the impact of the landfill on water quality were observed during the remedial investigation in those wells on the boundary of the landfill that were directly downgradient from the southern portion of the landfill. This portion of the landfill has been continually below the water table in recent years. Dilution continues to improve the quality of ground water as it moves away from the landfill, and impacts of the landfill on inorganic are generally not discernible at downgradient monitor wells.

2.4.6.4 VOCs

The total concentrations of VOCs in downgradient wells are generally similar to or less than in upgradient wells, with the exception of Well I-1. Total concentrations in boundary wells are also similar to those in the upgradient wells.

Well I-1 had the highest cumulative total of VOCs detected in the six sampling rounds. Well I-2 had the next highest total, followed by Wells I-3 and I-4. A comparison between total VOC concentrations and water levels in Wells I-1 and I-4 revealed no evident, consistent relation. This pattern is directly opposite the pattern for inorganic water quality impacts from the landfill discussed in the previous section. The inorganic water quality parameters in Wells I-3 and I-4 were the most affected by the landfill. This indicates that factors different than those influencing inorganic water quality result in the detection of VOCs in Wells I-1 and I-2.

Based on the data, saturation of refuse in the southern portion of the landfill has not caused concentrations of VOCs above 5 ppb at the boundaries of the landfill. This conclusion is supported by the fact that no VOCs were detected in the two samples of liquids collected in the refuse during the remedial investigation.

Trichloroethylene and tetrachicroethylene are found at similar concentrations in all monitor wells regardless of their position relative to the landfill. Trans-1,2-DCE and 1,1-DCE are found in higher concentrations at the boundary of the landfill than in upgradient wells, but concentrations are similar in downgradient wells to those in the upgradient well.

There are six compounds (1,1-DCA, TCA, 1,2-dichlorobenzene, vinyl chloride, 1,4-dichlorobenzene, and chlorobenzene) that are found in wells on the boundary of the landfill and not in the upgradient well. Only two compounds, 1,1-DCA and vinyl chloride, are found in a downgradient well.

Along with several other compounds, 1,1-DCA occurs in the highest concentrations in Well I-1. The presence of the VOC concentrations in Well I-1 cannot be explained by the processes that result in low concentrations of compounds found in Wells I-3 and I-4. Well I-1 is nearest the northern part of the landfill, which is generally above the water table. Furthermore, Well I-1 is downgradient from several former liquid disposal areas that were located along the eastern boundary of the landfill and had the longest history of use for liquid disposal (see Figure 2.22).

Laboratory analytical data for samples collected in the liquid disposal area were compared to the water quality in Well I-1 to see if similar compounds were detected. Table 2.15 shows this comparison. Phenols, xylenes, ethylbenzene, chlorobenzene, toluene, and tetrachloroethene were all found in soil samples collected at DB-2. In addition, several other VOCs were detected.

The occurrence of phenols, xylenes, benzenes, and toluene is consistent with some of the more frequently detected compounds elsewhere in the landfill. However, as data in Table 2.15 show, several of the VOCs found in the DB-2 sample are also found in Well I-1. The source of some of the VOCs in Well I-1 may be vertical movement of compounds from the liquid disposal area. The downward movement may be encouraged by infiltration from the unlined 15th Avenue storm drain.

The concentrations and frequencies with which VOCs were detected in Well I-1 during the RI were greater than for any other well on the boundary of the landfill. The sources of all VOCs in Well I-1 are not evident. The liquid disposal pits along the eastern boundary are possible sources of VOCs. There is not a good correlation between compounds found in solid samples from the pits and compounds found in water samples from Well I-1. A drum-washing facility is located 700 feet east of Well I-1. With respect to ground water flow, this facility occurs upgradient and laterally to Well I-1. VOCs occurring in Well I-1 may have originated from the drum washing facility.

2.4.6.5 Summary of Results

There are several factors that have an influence on ground-water quality in the vicinity of the 19th Avenue Landfill. One of the factors is recharge from the Salt River during those periods when it is flowing past the landfill. Recharge from the Salt River improves the inorganic quality of ground water by introducing water into the aquifer that is much lower in TDS than ambient ground water (200-400 mg/l vs. 1500 mg/l).

Another factor is refuse below the water table. The inorganic quality of ground water within the refuse is inferior to the quality of ground water in the aquifer, as evidenced by higher TDS concentrations, increased levels of ammonia and organic nitrogen, and higher chemical oxygen demand. Water quality in Wells I-3 and I-4 that are closest to the southwestern portion of the landfill that is below the water table reflect some impact from the landfill. In particular, sulfate concentrations decrease, bicarbonate ions increase, and there is an increase in magnesium relative to calcium. However, the TDS concentrations in Wells I-3 and I-4 are lower than in the upgradient well.

Modeling studies show that the amount of ground water flowing from the landfill with high TDS is relatively small compared to the quantity of better quality ground water flowing beneath the landfill. The water quality impacts of the landfill are quickly diluted and are almost unnoticeable in downgradient monitor wells.

Examination of the data also shows that the levels of VOCs that are leaching into the ground water in the portion of the landfill that is below the water table are low. Concentrations of VOCs in the boundary wells are generally less than 10 ppb, except for Well I-1 on the northern boundary of the landfill. The source of VOCs in the Well I-1 may be former liquid disposal pits in the eastern portion of the landfill and/or off-site sources such as the rendering plant 900 feet to the east, or a drum-washing facility 700 feet east of the well.

2.5 AIR QUALITY INVESTIGATION

2.5.1 Objectives

Air quality impacts that may result from a municipaI landfill include the migration of methane to nearby structures, the associated potential for explosion, and the release of other compounds into the atmosphere.

Methane, which accounts for a large percentage of the gas produced in a landfill, is combustible in concentrations between 5 and 15 percent by volume in air (50,000 and 150,000 ppm). The principal hazard associated with methane is its explosivity and flammability when mixed with air. This hazard may extend to areas beyond a landfill if methane migrates and accumulates in buildings and enclosed areas.

In addition to methane, gases produced in landfills include vapors of VOCs and possibly some inorganic gases. Examples of possible VOCs that may be expected are benzene, toluene, chloroform, formaldehyde, and vinyt chloride. Other possible gases include carbon dioxide (CO_2) and carbon monoxide (CO). Impacts from airborne compounds may occur from landfills that receive industrial refuse and from landfills that receive ordinary garbage including household waste. The composition of landfill gas varies among landfills because the type and quantity of refuse and the subsurface conditions vary among landfills.

Several businesses are located immediately to the north and west of the 19th Avenue Landfill (see Figure 1.2). As a means of controlling subsurface migration of landfill gases to off-site locations, the City of Phoenix has installed a gas extraction and collection system (Figure 2.23). In addition, several probes were installed by the City of Phoenix in order to monitor methane along the boundary of the landfill. The system comprises two lines of gas extraction wells. One line of wells is located along the northern boundary of the landfill, and the other line is located along the western boundary. The wells are approximately 200 feet apart. Each line of wells is served by an exhaust blower, or air pump, located in the northwestern corner of the landfill. The blowers draw subsurface gas from within the influence of each well into a manifold connecting the wells. The gases are exhausted to the atmosphere through a flare at the northwestern corner of the landfill. The gas collection system was renovated in December 1987.

The air quality investigation at the 19th Avenue Landfill was conducted from July 1987 through February 1988. The overall air quality investigation involved three distinct but related areas of investigation: (1) characterization of subsurface gas produced by refuse in the landfill, (2) ambient air quality, and (3) the performance of the existing gas collection system. (The term ambient air is used in this report to refer to the open air, as distinguished from subsurface air and other gasses located beneath the surface of the landfill.) There were two main purposes for the air quality investigation: (1) evaluate if the landfill is having an impact on ambient air quality, and (2) evaluate the performance of the existing gas collection system in preventing off-site migration of landfill (subsurface) gas.

Several objectives for the investigation were developed to support the stated purposes:

- Characterization of the composition of subsurface gas and its distribution throughout the landfill and adjacent properties.

- Measurement of the concentrations of compounds in ambient air that are found in subsurface gas.

- Measurement of the concentrations of methane in various areas to evaluate possible hazards.

- Evaluation of the performance of the existing gas collection system under a variety of operational configurations.

2.5.2 Methodology

The air quality investigation consisted of a shallow soil-gas investigation at the landfill, a review of the existing subsurface gas data collected by the City of Phoenix at various gas probes along the landfill perimeter, the collection of additional data from these probes, the characterization of the subsurface gas, and the monitoring of ambient air concentrations of total and component hydrocarbons on the landfill and on adjacent properties. General procedures followed during the air quality investigation are described in the RI report. The sampling and analysis plan was reviewed and approved by the regulatory agencies prior to the start of the program.

2.5.2.1 Subsurface Gas Investigation

The term subsurface gas refers to gas, produced in or by buried refuse, that has not been emitted to the atmosphere. Subsurface gas refers to gas beneath the surface of the landfill and does not refer to the gases or vapors in the ambient atmosphere above the landfill. However, ambient air quality impacts from the landfill would be due to an escape of the subsurface gas to the atmosphere. A characterization of the composition and distribution of subsurface gas is important to understanding the ambient air quality impacts of the landfill.

The subsurface gas was investigated by three methods over the period of about two years. First, a shallow soil-gas investigation was conducted on site to obtain concentrations of methane and other gases at a few feet below the surface of the landfill. Second, existing data from probes associated with the gas collection system were evaluated. Third, additional samples were collected from the probes and other locations on the landfill and analyzed to further characterize the components of the subsurface gas and their migration to the surface of the landfill.

On the basis of the information existing prior to the RI investigation, three halogenated hydrocarbons (TCE, TCA, and PCE), benzene and toluene were selected to be studied in the soil-gas investigation. Methane was also studied, since it is a principal product from the decay of buried organic refuse.

Soil-gas sampling points were located on a grid of approximately 400 feet between points and over an area of approximately one square mile. This area included the portion of the landfill north of the Salt River (Cell A) and a 2,000-foot strip directly north and west of the landfill. Within this area, 126 locations were sampled. A soil-gas survey of Cell A-1 south of the Salt River was also conducted. A more closely spaced grid was established in areas that had been previously designated as liquid disposal areas or where a closer grid was believed to be needed as the investigation progressed.

Landfill-gas probes located along the north and west boundaries of the 19th Avenue Landfill are routinely monitored by the City of Phoenix for concentrations of TH, expressed as methane. Probe locations are shown in Figure 2.23. The data from these probes represent concentrations of methane, expressed as percent by volume (% v/v), obtained in 23 probes at various locations near the landfill boundary and on properties adjacent to the landfill. The data collected by the City of Phoenix during 1986 and 1987 were reviewed to evaluate the subsurface gas concentrations in the probes, to identify possible trends, and to identify the probes with the highest concentrations.

Based an the review of the existing subsurface gas data collected by the City of Phoenix, several probes were selected and monitored with an Organic Vapor Analyzer (OVA) for

TH content. Probes 2, 3, and 13 were selected for monitoring on the basis of their relatively high annual average concentrations of subsurface gas compared to concentrations in other probes.

Sampling and chemical analysis of gas from the gas probes around the landfill, the collection system manifold, and a ground crack near the center of the landfill was also performed to characterize specific compounds in landfill gas in addition to TH. These samples were collected and analyzed using two techniques: portable gas chromatograph for on-site analysis, and grab sample for laboratory analysis.

2.5.2.2 Ambient Air Monitoring

Possible air quality impacts of the landfill were evaluated by monitoring ambient levels both of TH and of specific component hydrocarbons. Ambient levels for methane and VOCs were measured on the landfill and at adjacent properties.

The monitoring plan was influenced by the expected variable nature of landfill emissions. Because the landfill covers a rather large area and atmospheric and subsurface conditions vary, gases were expected to emanate from the landfill in quantities or rates that change with location over the landfill and vary over time. Consequently, air quality impacts near the landfill were expected to be variable both in location and time (see Section 2.5.3.5). Preliminary and existing data indicated that the potential for emission of subsurface gas is greatest in late morning to afternoon hours and least at night and early morning hours. Therefore, the air quality investigation was designed to obtain information on ambient air concentrations of several gases at several locations within periods of a few (two to four) hours on each sampling day. The objective of this survey approach was to identify possible locations of highest air quality impact and the times of day of highest impact. The landfill and adjacent properties were surveyed in five sessions over a period of eight months (July 1987 - February 1988) with the portable OVA to provide an overview of ambient conditions and to identify possible areas of high ambient TH concentrations. The results of this sampling were then used to focus the investigation of component hydrocarbons in those areas of high TH concentrations. Component hydrocarbons were investigated with a portable gas chromatograph during an intensive one-week study during which 75 samples were collected and analyzed.

The flexibility of this approach allowed sampling under a variety of conditions. Sampling was conducted during periods of variable atmospheric pressure, calm to moderate winds, variable temperatures, and rainy and dry periods. With the exception of one air quality survey conducted in February 1988, ambient sampling was conducted prior to the December 1987 renovation of the gas collection system.

Ambient air was generally monitored by the OVA in a layer within about 6 inches to 36 inches above the surface. In some instances, the air immediately above a ground crack was monitored. If a concentration peak was observed as a result either of changing location or a change in time at a fixed location, an attempt was made to locate the source of the emission. Peaks generally were short-lived and could not be traced to a definite source. Consistent, or lasting, concentrations could be obtained from various ground cracks or vents.

Restricted areas, including structures on the landfill and at adjacent businesses, were also monitored. The term “restricted”, as used here, means either an indoor area where methane could collect or an accessible, outside area where ventilation is restricted by nearby structures. Employees of businesses adjacent to the landfill on the north and west sides and adjacent to Cell A-1 were interviewed. The Phoenix Fire Department was also interviewed about its involvement in methane-related problems in the area. The businesses that were contacted are listed below:

- Blue Circle
- California Arizona Tractor (CAT)
- Kaiser Cement & Gypsum
- Waste Management, Inc.
- All Chevy Auto Parts (ACAP)*
- A&B Silica*
- Lincoln Auto
- Chevron
- Beverage Industry Recycling Program (BIRP)*
- Tanner Inc.*
- Harter Manufacturing, Inc.

The properties or businesses that indicated possible problems with methane are identified above with an asterisk. Restricted and unrestricted areas of these businesses were monitored routinely. Some surveys were made on the property of businesses reporting no problems with methane.

The ambient levels of component hydrocarboris on and in the vicinity of the 19th Avenue Landfill were monitored on a real time basis during November 3 through 7, 1987. The hydrocarbons that were sampled were the same components monitored in the landfill gas probes: benzene (BNZ); toluene (TOL); tetrachloroethene (PCE); 1,1,1-trichloroethene (TCA); and trichloroethene (TCE).

During February 1988, ambient air samples were collected with air sampling bags and analyzed in a laboratory by GC/MS. These samples were collected at a height of 10 feet along the upwind and downwind boundaries of the landfill. As with the portable GC, these samples are collected over a brief time period of about 5 to 10 minutes.

Meteorological data for the dates of ambient monitoring were obtained for each survey period from the National Weather Service (NWS) at Sky Harbor Airport.

2.5.2.3 Gas Collection System

The performance of the gas collection system was evaluated by measuring the flows and pressures along each leg of the system and at the blower assemblies under several adjustments of the system. The configuration of the system in relation to the landfill and adjacent properties is shown in Figure 2.23 in conjunction with Figure 1.2.

Pressure observation wells were installed at various distances from selected extraction wells to examine the ability of the system to capture or draw gas from zones around the extraction wells. Two observation wells were installed along the north leg of the system, and four observation wells were installed along the west leg of the system. The observation wells are shown in Figure 2.23 and identified as “GP”.

2.5.3 Subsurface Gas Characterization

2.5.3.1 Introduction

The data presented in the following sections were collected on the landfill and adjacent properties prior to and after the gas collection system was renovated in December 1987. The results obtained after renovation will be specifically identified.

Subsurface gas concentrations ranging from trace amounts to 50 percent or more by volume were observed. Therefore, two units will be used to report these concentrations: parts per million (ppm), and percent by volume (% v/v). These units are related as follows:

1 % V/V = 10,000 ppm

2.5.3.2 Soil Gas In Cell A

Methane

Methane concentrations in soil gas on the landfill ranged from about 1 ppm up to 54 percent by volume (540,000 ppm). Methane concentrations decreased to approximately 1 ppm within 400 feet outside of the boundaries of the landfill. Methane concentration contours of 1.5 and 15 percent v/v are shown in Figure 2.24. Concentrations exceeded 15 percent v/v over approximately 30 percent of the area of the landfill. The largest concentrations were found in the southern two-thirds of Cell A.

Halogenated Hydrocarbon Vapors

The soil-gas concentrations of TCA ranged from less than 0.0001 ppm up to 25 ppm, the highest observed value for the halogenated hydrocarbons. The 25 ppm value was recorded about 400 feet west of the midpoint of the eastern boundary of the landfill. TCA concentrations at surrounding sample points were much lower.

Concentrations of PCE measured in soil gas varied from 0.0006 ppm to 3 ppm. The location of the 3 ppm PCE concentration was coincident with the location of the highest observed TCA concentration. PCE concentrations ranging between 0.015 ppm and 0.90 ppm were observed immediately to the north of the landfill. The 0.90 ppm concentration was measured near the intersection of 19th Avenue and Lower Buckeye Road. Several locations within the landfill itself also had PCE concentrations between 0.015 ppm and 0.135 ppm. PCE concentrations above the detection limit were not as widespread as were the TCA concentrations; but PCE was detected at more sampling points than TCA.

Observed TCE concentrations ranged from less than 0.0001 ppm to 1.5 ppm. TCE was detected more often than TCA within the landfill. TCE was also observed immediately north of the landfill. A relatively high TCE concentration (0.4 ppm) in soil gas was measured at the intersection of 15th Avenue and Lower Buckeye Road. This area also had a high TCA concentration of about 6 ppm.

Benzene and Toluene

Because of high methane concentrations within the landfill soil, detection limits of benzene and toluene were as large as 94 ppm and 53 ppm, respectively. Although benzene and toluene could not be detected in soil gas at most locations within the landfill, they could have been present at concentrations less than the above noted detection limits. At the sampling points where benzene could be detected, the largest quantifiable concentration in the soil gas was 2 ppm, occurring at an off-site location near 15th Avenue and Lower Buckeye Road. At the sampling points where toluene could be detected, the largest quantifiable concentration in the soil gas was 27 ppm, occurring in the southwest quadrant of the landfill.

2.5.3.3 Soil Gas in Cell A-1

Concentrations of gases measured in Cell A-1 were generally less than those measured in Cell A. The highest concentrations of TCA, TCE, and PCE were 0.07 ppm, 0.07 ppm, and 0.3 ppm, respectively. Benzene was not detected (the detection limit for benzene was 0.3 ppm).

2.5.3.4 Existing Subsurface Gas Data

As noted previously, the City of Phoenix has installed several probes to monitor off-site migration of methane. A review of the data obtained from the subsurface gas probes by the City of Phoenix indicated that TH concentrations (which are almost 100 percent methane) vary considerably among the probes. Total hydrocarbon concentrations ranged from near 0 to over 40% v/v. Probes 2, 3, 13, and 14 (Figure 2.23) typically had the highest readings, averaging respectively 12, 14, 14 and 12% v/v during 1986 and 14, 15, 16, and 23% v/v respectively during 1987. A summary of the TH concentrations obtained from the gas monitoring probes during 1986 and 1987 is presented in Table 2.15.

The probes with the high annual average concentrations (probes 2, 3, 13, and 14) are in areas along the landfill boundary where some of the highest soil-gas concentrations of methane were observed during the soil-gas investigation. Probes 2 and 3 are in an area where soil-gas concentrations of methane were 5% v/v to 20% v/v; probe 13 is in an area with soil gas concentrations of 40% v/v.

2.5.3.5 Subsurface Gas From Collection System Wells and Probes

Results obtained by additional mgnitoring of the City of Phoenix gas probes during the remedical investigation identified a diurnal pattern in the subsurface TH concentrations. The concentrations observed in the probes during the very early morning hours (0500-0700 Mountain Standard Time (MST)) were less than 10 ppm and remained less than 10 ppm until the late morning (1000-1200 MST). The concentrations then increased and remained at concentrations greater than 1,000 ppm into the afternoon, exceeding the upper limit of the OVA instrument. As a consequence of this diurnal pattern, ambient air monitoring was routinely conducted during the late morning and afternoon hours when the subsurface TH concentrations tended to be highest.

Concentrations of TH obtained in the gas probes after renovation of the gas collection system were generally less than 10 ppm in most of the probes. Exceptions were probe 14, located in the BIRP parking lot and probe 21, located on the landfill across from Tanner Inc., (Figure 1.2) where occasionally concentrations above 1,000 ppm were observed.

2.5.3.6 Specific Hydrocarbons From Probes

Subsurface gas from the gas migration monitoring probes was analyzed with a portable gas chromatograph during the period November 3 through 7. A listing of results obtained from the probes is presented in Table 2.17.

In many of the probes that were monitored, a distinctly different compound (or group of compounds) was found at apparently greater concentrations than the compounds that the GC was calibrated to identify, namely benzene, toluene, PCE, TCA, and TCE. The concentration of this different compound could not be quantified or identified with the portable chromatograph used. The presence of the unknown masked the possible presence of the compounds of interest in several cases. General characteristics of the GC column in use indicated that the unknown could possibly be 2,2-dimethyl butanone or acetone.

Bag samples were collected from the manifold of the gas collection system and analyzed by GC in the laboratory for major and trace constituents. Results are presented in Tables 2.18 and 2.19. Samples, labeled GCS-1 and GCS-2, were obtained from the same location on December 28, 1987 and January 13, 1988, respectively. The two samples from the collection system were quite similar in contents of methane, nitrogen, and carbon dioxide, but they differed somewhat in oxygen content. Samples GCS-1, GCS-2, were also analyzed for VOCs. A third sample, GRN-1, obtained from within a ground crack near the center of the landfill on January 13, 1988 was also analyzed for VOCs.

The reported concentrations, if not the actual presence, of compounds labeled with an asterisk in Table 2.19 should be qualified as uncertain. None of the compounds delineated by an asterisk in Table 2.19 were detected in samples GCS-2 and GRN-1, but were detected in a control sample of commercial test gas.

2.5.4 Ambient Air Quality

2.5.4.1 Total Hydrocarbon Survey

Ambient air concentrations of TH, expressed as methane, were less than 10 ppm at most locations on the landfill and off-site. Measurements above 10 ppm were occasionally obtained, but they either were transient, lasting a few seconds, or were obtained from near ground cracks where landfill gas apparently vents to the air. These ground cracks were found along the collection system, at some locations along the river, along bank faces on the landfill, and at a PVC pipe near the center of the landfill. Readings from these ground cracks decreased rapidly within five to ten feet from the ground crack. Readings above 10 ppm were also obtained in the vicinity of the collection system exhaust and, depending on the wind direction, could be detected at the northwestern corner of the landfill, at 19th Avenue and Lower Buckeye Road. Transient readings of 100 to 1,000 ppm were obtained in the immediate vicinity of the system exhaust. The flare at the exhaust system was not operating when these measurements were made.

An ambient air concentration of TH between 500 to 1,000 ppm lasting greater than 30 seconds was obtained from within 10 to 20 feet of a PVC pipe protruding from the ground near the center of the landfill. The concentration decreased to less than 10 ppm within 100 feet of the pipe. The readings obtained at other locations were either much less than 1,000 ppm or lasted less than 30 secords. Ambient concentrations varied little over the area before and after the gas collection system was renovated.

With a few exceptions, concentrations of TH in restricted areas off site were no higher than the concentrations observed in the unrestricted areas. Of the restricted areas that were monitored, two locations at the Tanner Plant had the highest observed concentrations. At the Tanner Plant, the first location was within an enclosed elevator shaft near the Tanner scale house. Within this area, concentrations of 200 to 500 ppm were observed. The second location was an enclosed underground shaft or pit connected to the elevator shaft. Levels of methane within this area exceeded the lower explosive limit (LEL) of 5% v/v before and after renovation of the gas collection system. Total hydrocarbon concentrations at the Tanner pit were observed to be higher than at other ambient locations both prior to and after renovation of the gas collection system.

Other restricted locations had TH concentrations above 1,000 ppm, but these areas were either small and inaccessible or were above ground cracks. At the BIRP facility, concentrations in a small ground pit and in a below-grade conveyer were observed at a maximum of 0.5 percent v/v. Lower concentrations were observed in the ground pit after the gas collection system was renovated.

The maximum TH concentration within a ground crack in an open-sided wooden shed adjacent to the office at All Chevy Auto Parts was 46 percent by volume prior to renovation of the gas collection system. Ambient concentrations in the shed above the ground crack ranged from less than 10 ppm to transient peaks of 500 ppm during this period. Concentrations in the shed above the ground crack were less than 10 ppm after the gas collection system was renovated.

2.5.4.2 Specific Component Hydrocarbons

Measurements for five VOCs in ambient air were made with a portable gas chromatograph at locations on and near the landfill. These locations are shown on Figure 2.25. The measurements were made in November 1987, prior to renovation of the gas collection system. Results are itemized in Tables 2.20 and 2.21 for each of the five compounds analyzed.

Benzene was detected most frequently in the samples on and near the landfill. Ambient benzene concentrations are shown on Figure 2.25. Measurements made at 19th Avenue and Adams indicate that background ambient benzene concentrations of 0.01 ppm can occur. Data from a recent investigation by the DEQ show that over a period of three weeks, background ambient benzene concentrations in west Phoenix and central Phoenix averaged from 0.003 to 0.006 ppm, respectively for 24-hour sampling intervals (DEQ, 1988). Short-term sampling concentrations, such as those measured at the landfill, are generally higher than 24-hour samples. Therefore, the short-term background ambient benzene concentrations could frequently be greater than 0.010 ppm. For purposes of this report, it is assumed that the short-term background ambient benzene concentration is 0.02 ppm, allowing for potential local sources of benzene that may raise concentrations in the area above measured background concentrations.

Benzene concentrations exceeded 0.02 ppm at 12 locations. Several of these 12 measurements may be of the same event. For example, wind direction data indicate that the measurement of 0.120 ppm near probe 13 may be associated with the measurement of 0.209 ppm within the landfill boundary east of gas extraction Well 7W. Concentrations in excess of 0.02 ppm occurred primarily in the northwest part of the landfill between east and west coordinates defined by gas extraction Wells 5N and 3N and between north and south coordinates defined by Wells 6W and 8W. Concentrations in excess of 0.02 ppm occurred also along the north boundary, near gas extraction Wells 2N and 7N, and along the west boundary near probes 8 and 13, and at business along 19th Avenue from the intersection with Lower Buckeye Road to the BIRP property.

The largest observed benzene concentration was 0.336 ppm, which was measured near probe 3 on the northern boundary of the landfill. Several minutes later benzene was not detectable at this location.

The second most frequently observed compound was TCE. The largest TCE concentration at 1.4 ppm was measured on November 4, occurring near a PVC pipe protruding from the surface in the north central part of the landfill. Benzene at 0.104 ppm was observed near this location two days later. A TCE concentration of 0.048 ppm was observed at the BIRP lot. TCE was detected at concentrations of 0.085 and 0.115 ppm in an event at the northwest corner of the tallow plant fence.

Ambient air was analyzed, using the portable gas chromatograph, for the five hydrocarbon components in restricted areas where relatively high levels of TH were detected. This included samples from the shed adjacent to the office at All Chevy Auto Parts, the underground pit shaft at Tanner, Inc., and one sample from a small ground pit at BIRP. Toluene, TCA, and PCE were not detected at these locations. Benzene was detected twice in the All Chevy Auto Parts shed at concentrations of .013 ppm. TCE was detected once in the All Chevy Auto Parts shed (.080 ppm) and once in the Tanner pit (1.3 ppm). None of these concentrations of TCE occurred at the same time that benzene was detected.

2.5.5 Interpretation of Air Quality Results

2.5.5.1 General Observations

Although methane concentrations in soil gas exceeded 15,000 ppm over 60 percent of the landfill, ambient concentrations of TH (including methane) were on the order of 10 ppm above the surface of the landfill, except for occasionally higher transient readings. The higher ambient concentrations of about 1,000 ppm occurred downwind from the exhaust of the gas collection system and near vents such as ground cracks and gas probes that may penetrate the refuse below the landfill cap. Field observations indicate that higher ambient concentrations are transient at a fixed point and that the concentrations fall to 10 ppm or less within several feet of the location.

Comparing the concentrations of methane between the shallow soil zone and the ambient atmosphere indicates that gases diffuse slowly through the landfill cap. Furthermore, from the transient behavior of the higher ambient concentrations that were detected, it is evident that atmospheric processes such as turbulence and variable wind direction act to quickly disperse gases that originate from localized sources such as ground cracks. These effects are illustrated in Figure 2.26.

2.5.5.2 Effects of Dispersion on Air Quality

According to general concepts of atmospheric mixing, an initial instantaneous release of air pollutant would decrease in average concentration with the inverse of the square root of the sampling time (Csanady, 1973). Accordingly, a 20-second short-term ambient concentration would be reduced by a factor of 0.015 over a 24-hour averaging time. The factor of 0.015 to convert a 20-second average to a 24-hour average is not applicable to an averaging time of more than a few hours. The annual average, however, is most important in the assessment of long-term chronic health effects. To estimate the annual average from the short-term values, an additional model is needed. Studies of the DEQ are useful in providing the needed information. The DEQ (ADEQ 1988) has estimated that the annual average concentration is .485 times the maximum 24-hour concentration. This factor was derived from a study of carbon monoxide levels in urban Phoenix. Using the two factors of 0.015 and 0.485, the annual average concentration may be estimated from the peak short-term 20-second concentration by applying a factor Of 0.007 to the short-term concentration. This factor may yield an overestimate of the annual average at the landfill because it is surrounded locally by large areas of undeveloped land in contrast with the urban area for which the factor was developed.

2.3.5.3 Specific Compounds

Benzene

From the shallow soil-gas measurements, it can be concluded that benzene may have been present below detection limits that varied between 0.06 ppm to 94 ppm, depending on location. The largest concentration of benzene detected and measured in subsurface gas was 0.1 ppm, detected in a sample collected from the manifold of the gas collection system. The sample from the manifold should be considered as an average sample from along the lines of extraction wells and their zone of influence. The concentration may also have been diluted by ambient air that is drawn into the collection system.

Within the landfill boundary, the highest ambient benzene concentration, 0.209 ppm, was found in an area where the benzene detection limit in soil gas was 31 ppm. It would appear that the results for benzene are consistent with the interpretation that benzene emanates from the surface at highly localized points rather than from a large surface area of the landfill. It is possible also that one or more sources of benzene, other than the landfill, are nearby. It is well known, for example, that benzene is a component of gasoline and would be emitted by vehicles moving along 19th Avenue.

Near probe 3 (Figure 2.23), along the northern boundary of the landfill, a short-term benzene concentration of 0.336 ppm was observed. The concentration decreased to 0.004 ppm within 7 minutes and to less than 0.001 ppm within 23 minutes. Over the 23-minute period, the average benzene concentration was approximately 0.003 ppm, about one percent of the initial value of 0.336 ppm. This observed decrease over the 23-minute observation period is slightly greater than predicted using the turbulent diffusion concepts described above. The greater decrease is likely due to changes in wind direction and wind speed.

The 24-hour average associated with the 0.336 ppm short-term concentration is estimated to be from 0.0004 ppm to 0.005 ppm. The annual average associated with the 0.336 ppm short-term observation would be less than approximately 0.002 ppm. The DEQ (DEQ 1989) has measured benzene at several locations in urban Phoenix. The maximum benzene 24-hour concentration found in urban Phoenix by this study was 0.010 ppm with an estimated annual average of 0.005 ppm. Therefore, the annual average benzene concentration on and bordering the landfill is estimated to be less than background annual averages at other locations in urban Phoenix.

It is not possible to precisely estimate the impact of benzene emissions from the landfill at locations other than near or on the landfill because traffic along 19th Avenue and at businesses to the west of the landfill contributed to benzene concentrations detected at several locations along 19th Avenue. These contributions cannot be quantitatively distinguished. Also, short-term benzene concentrations along 19th Avenue, regardless of source, are such that the 24-hour concentrations would be less than background at other urban locations.

Benzene emissions from the landfill cannot be modeled to quantitatively estimate the impact at locations away from the landfill. However, it is estimated that changes in wind direction and wind speed, combined with the dilution effect of turbulence as the puffs or piume of benzene travels with the wind, would dilute the initial concentration at the landfill by a factor of 10 or more at distances of one-half mile and greater. Therefore, at one-half mile from the landfill the contribution to the overall background annual average from landfill emissions would be estimated to be less than 0.0002 ppm. This concentration is less than five percent of the annual benzene average found by DEQ at several urban Phoenix locations (DEQ 1988).

<u>TCE</u>

The infrequent detection of TCE in ambient air at the landfill suggests that it does not have a significant impact on the air quality above the landfill. Comparison of shallow soil-gas detections and ambient air concentrations, as well as samples upgradient and downgradient of the landfill, support this conclusion. The largest TCE concentration in the shallow soil gas was 1.5 ppm, located at the northwest corner of the landfill. No TCE was detected in the ambient air in the vicinity of this location.

These observations are consistent with the conclusion that sources of TCE are highly localized and other TCE sources may be in the vicinity of the landfill.

Other VOCs

Toluene was found in grab samples collected over an interval of approximately 15 minutes on both the downwind (east) and upwind sides (west) of the landfill (see RI report). The concentrations along both boundaries were very nearly the same, averaging 0.176 and 0.180 ppm on the east and west sides, respectively. In other short-term samples, the largest toluene concentration was 0.02 ppm. These results indicate that toluene, while present in subsurface gas on the landfill, is emitted by other sources in the vicinity and that the contribution to ambient air from the landfill cannot be identified.

TCA was observed at only two locations. The most significant detection of TCA occurred near the tallow plant fence line. The concentration of this event was 1.1 ppm. The infrequent detection of TCA indicates that it does not impact air quality.

Other VOCs were either not detected or were detected in essentially equal concentrations, on the order of 0.01 ppm, on both upwind and downwind boundaries, indicating sources not associated with the landfill.

2.5.5.4 Conclusions

Emissions of subsurface gas from the landfill occur primarily at isolated locations such as ground cracks, a pipe that extends into the subsurface at the center of the landfill, and from uncapped gas probes on the boundary of the landfill. Emissions from the major portion of the landfill appear to occur at a slow rate. Ambient concentrations of gases emitted by the landfill are transient and are quickly diluted by atmospheric processes. Annual average concentrations, resulting from landfill emissions, would be within general background levels typically found in the urban Phoenix area.

2.5.6 Gas Collection System Evaluation

2.5.6.1 General Observations

Some pressure gauges at the blower assemblies are broken. These gauges were installed to monitor pressure on each side of the blowers and the pressure differentials created by the blowers. Some of the valves (gates) that control the air flow in the extraction wells also are in need of repair or replacement.

There are air leaks along the system at some couplings and at a cracked collection pipe between Wells 18W and 19W. The presence of these leaks reduces the flow within the extraction wells and ultimately reduces the ability of the extraction wells to withdraw subsurface gases from the landfill.

Water was found in the collection pipe and in several of the extraction wells. The presence of water in the system reduces the air flow and the ability of each extraction well to withdraw subsurface gases. Although engineering drawings of the subsurface gas collection system indicate that condensate should drain back toward the extraction well, differential settlement in the collection pipe may have reduced the effectiveness of the system in preventing the accumulation of water in the system.

Flow volumes among wells varied from near 0 cfm to near 240 cfm. The lowest flow volumes were obtained in the extraction wells along the west leg of the collection system. Maximum flow volumes in the extraction wells along the west leg generally were 50-100 cfm. The lower flow volumes were at the end of the system leg varying from 22 to 48 cfm from Wells 15W and 19W. Extraction Well 7W had a flow near zero and appeared to have a broken valve.

Flow volumes in wells along the north leg of the system were higher than along the west leg and generally ranged from 90 to near 200 cfm. A relatively low flow volume of approximately 2 cfm was recorded in Well 5N. This low flow could be a result of water in the well, or the well could be plugged. In Well 8N, another low flow volume of 5 cfm was measured. No water could be detected in Well 8N, so the low flow may result either from a collapsed or plugged well or very dense soil.

2.5.6.2 Test Data

All gas extraction wells were fully open when the blowers were tested. Flows through the blowers fluctuated over a period of about five seconds. Flows varied between 470 and 1200 cfm in the north leg blower and between 400 and 2000 cfm in the west leg blower. Pressures on the vacuum sides of the blowers varied between 3.7 and 6.5 inches of water for the north leg blower and between 2.1 and 4.3 inches of water for the west leg blower. Positive side pressures of about 1.0 psi were measured on both blowers.

Pressure and linear flow rates were measured in gas extraction Wells 15N, 3N, 5W, 6W, 9W, and 12W. Pressures were measured in observation wells installed for the tests (Figure 2.23) near the selected wells. In one series of tests, each test well was tested at four valve positions with all other gas collection wells closed. The data for this series of tests are given in Table 2.22. In a second series of tests, all wells were opened fully (a valve position of 90E). Pressures and flow rates were then measured in several wells. The test data are given in Table 2.23. Finally, volume flowrates are summarized in Table 2.24 for wells operating one at a time and for all wells open simultaneously.

2.5.6.3 Evaluation

The radius of influence of an extraction well is defincd as the average radial distance from the well at which the pressure gradient toward the well is effectively zero (Schumacher, 1983). For practical application, pressure differences less than 0.1 inch of water between the observation well and the extraction well are considered small enough to place a practical upper bound on the radius of influence (Schumacher, 1983).

Four observation wells were at or above atmospheric pressure in tests involving individual isolated wells. This indicates that these observations wells were outside the radius of influence of the extraction wells. These observation wells, the valve positions, the associated extraction wells, and the distance between each observation well and extraction well are as follows:

Observation Well	Extraction Well	Value Positions	Separation (ft.)
GP3N	3N	90E	30
GP5WB	5W	20E,40E,60E,90E	115
GP5WB	6W	20E,40E,60E,90E	118
GP9W	9W	20E,40E	16

From the test data presented above it may be concluded that the radii of influence of Wells 3N, 5W, and 6W are less than 30 feet, 115 feet, and 118 feet, respectively. For Well 9W, the radius of influence at valve positions 20E and 40E is less than 16 feet.

These conclusions are based on tests made with each well isolated from the effects of all other wells of the system. If several wells are placed in operation simultaneously, a mutual interference develops and the production capacities per well decrease for fixed pressure gradients. If the pressure gradients decrease, as would occur if several wells are operated by one blower, the production capacities per well would be less than the capacity of a single well operating alone. Therefore, when all of the wells are in operation, the radius of influence of a given well will be less than when the well is operating alone.

The following empirical relationship describes the data of Table 2.22:

$$Q = [a_1/\ln(r/r_w)]\ (p_w - p_r) + b \qquad \text{Equation (1)}$$

where

Q: volume flow rate (cfm)

$$Q = r_W^2 F$$

r_w: well radius (ft)
F: average linear flow rate (fpm)

P_w: average well pressure (inches of water) relative to atmospheric pressure

P_r: average observation well pressure (inches of water) relative to atmospheric pressure

r: distance to observation point

The values of a_1 and b are given in Table 2.25 for extraction wells for which the observation wells are within their radii of influence. For Well 5W and Well 6W, the observation wells are beyond the radius of influence and equation (1) cannot be applied. It is assumed that equation (1) is good for all values of r greater than r_w and less than the radius of influence.

The data of Table 2.24 suggests that when all wells are operating simultaneously and fully open, each well is withdrawing at a volume rate approximately equivalent to its capacity at a valve position of 20E when operating alone within the system. The relation is not exact, but is a reasonable approximation.

For evaluating the radius of influence using equation (1), Q is taken as the flow rate with the well operating alone in the system with the value set at 20E, to simulate system operation with all well valves fully open.

The following conclusions are drawn using equation (1):

- o Wells 15N and 12W are effective at distances of at least 100 feet.
- o Well 5W is marginally effective at 100 feet.
- o Well 9W is not effective at 100 feet.

To summarize the information an the influence of ail the wells tested:

- 15N: effective at 100 feet
- 3N: not effective at distances greater than 30 feet
- 5W: marginally effective at 100 feet
- 6W: not effective at 100 feet
- 9W: not effective at 100 feet
- 12W: effective at 100 feet

2.5.6.4 Conclusion

The existing gas collection system at the landfill appears to be partially effective in preventing off-site migration of methane and other landfill gases. In areas adjacent to the landfill, methane was observed in the subsurface and in enclosed structures at concentrations exceeding five percent by volume, the lower explosive limit (LEL) of methane in air, prior to renovation of the system in late 1987. After the system was renovated, subsurface concentrations of methane decreased at most off-site locations. Even so, concentrations in a pit at the Tanner Inc. plant continued to exceed to LEL after renovation. On going engineering indicates that the concentrations have dropped below the LEL (Bruce Henning, City of Phoenix, personal communication, 1988) at these locations also. Tests indicate that the zones of influence of some gas collection wells are not as large as one-half the well spacing, and gas may be migrating through the collection barrier at such locations. The gas flare was inoperable during the remedial investigation.

3.0 BASELINE RISK ASSESSMENT

3.1 OBJECTIVES

The purpose of the baseline risk assessment was to evaluate the impact to public health and the environment that may result from releases from the 19th Avenue Landfill. A human exposure pathway consists of four elements: (1) a source and mechanism of chemical release, (2) an environmental transport medium such as air or ground water, (3) a point of potential human contact with the medium, and (4) a human exposure route such as inhalation of air or ingestion of ground water at the contact point. All four elements must be present to complete a pathway.

The baseline evaluation for the 19th Avenue Landfill considers each of the four areas of study in the remedial investigation: ground-water quality, surface-water quality, soils and refuse quality, and air quality. The objective of the baseline risk assessment was to characterize the following for each area of study:

- Potential for a release from the landfill.
- Toxicity, quantity, transport, and fate of the substance in each affected media (ground water, surface water, soils, and air).
- Presence of an exposure pathway.
- Likelihood and magnitude of any impact on public health or the environment.

A complete description of the baseline risk assessment is given in the RI report.

3.2 METHODS

The baseline risk assessment follows principles outlined in the EPA Superfund Public Health Evaluation Manual (U.S. EPA, 1986a).

The National Contingency Plan (40 CFR 300, 1987) and EPA Draft Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (U.S. EPA 1988) requires the selection of corrective actions that are protective of public health and the environment. The baseline risk assessment is conducted to evaluate whether corrective action is required to reduce existing and future threats. The basic steps to complete the baseline risk assessment are:

- Identification of applicable or relevant and appropriate requirements (ARARs).
- Exposure assessment.
- Toxicity assessment.
- Risk characterization.

Each of these steps is described below.

3.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

3.3.1 Surface Water

Arizona’s environmental protection regulations (ACRR R9-21-206) designate three protected uses for the Salt River in the study area: incidental human body contact, agricultural irrigation and livestock watering, and aquatic wildlife use. The regulations apply to the Salt River from below Granite Reef Dam to 99th Avenue. The regulations provide protection for both actual and future uses. There is no actual use of surface water at the present time because the river is dry. The standards set by the state for protection of these uses are considered applicant or relevant and appropriate requirements (ARARs).

3.3.2 Ground Water

Safe Drinking Water Act Maximum Contaminant Levels (“MCLs”) are relevant and appropriate requirements at the 19th Avenue landfill facility, because of the statutory designation of the underlying aquifer for drinking water use (although at present no drinking water wells are affected). Attached as Table 3.1 to this Remedial Action Plan is a summary of the ground-water analysis performed at the 19th Avenue Landfill. The table summarizes the results of the ground-water monitoring program at the landfill, comparing the range of concentration levels of detected compounds with MCLs. In addition, the table specifies for each compound the Safe Drinking Water Act Maximum Contaminant Level Goal, the Arizona Department of Health Service State Action Level, and the 10^{-6} excess risk level. These criteria have not been selected as present ARARs, but will be considered in the event future remedy selection under CERCLA § 121 is triggered by the Contingency Plan. In the event the Contingency Plan is triggered, such criteria will be considered as potential ARARs during the process of additional remedy selection analysis under CERCLA Section 121 and the National Contingency Plan. The Contingency plan framework is attached as Appendix B.

3.3.3 Air

Methane and VOCs have been detected at the 19th Avenue Landfill. Different ARARs apply to each of these components of air quality. The Phoenix metropolitan area is a non-attainment area for the following air pollutants: ozone, carbon monoxide, and airborne particulates. There are several organic compounds found in the ambient air in the Phoenix metropolitan area.

Regulations have been proposed under the Resource Conservation and Recovery Act that, if promulgated, will establish an upper limit of 1.25 percent by volume for methane in landfill facility structures and an upper limit of 5 percent by volume (the LEL at landfill boundaries (U.S. EPA, 1988b). Therefore, these limits are taken to be ARARs for methane in structures both new and on the landfill and at the landfill boundary.

EPA’s ambient air quality standards are directly applicable to the 19th Avenue Landfill. However, standards have not been developed for the constituents under consideration at the landfill. At present, no ARARs can be identified which apply specifically to the VOCs which are detected in gas emissions from the landfill. Developments in setting additional standards will be considered when evaluating the design of the gas collection system.

3.3.4 Soil and Refuse

Table 3.2 presents a summary of soil and refuse ARARs for the landfill site. Health-based standards for soil are not well developed at the state or federal level. The ADHS has developed interim soil action levels that represent the 10-6 excess lifetime cancer risk level for carcinogens. In the absence of definable ARARs for soils, published toxicological data will be used to assess risk for soils, if necessary.

3.4 EXPOSURE ASSESSMENT

3.4.1 Potential Receptors

The populations and environment in the vicinity of the landfill were characterized within a study area (Figure 2.27) to identify potential receptors.

Figure 2.28 illustrates the current land use in the area. The landfill is located in an industrial portion of Phoenix. Existing industrial facilities occupy more than 50 percent of the land in the study area. Nearly 99 percent of the study area is zoned for heavy or light industrial use. The residential population of the area is relatively small and has declined over the past 10 to 15 years due to increasing industrialization of the area. Land in the study area will continue to be used primarily for heavy industrial applications with agricultural, vacant, and residential uses being converted to heavy industrial uses.

Ground water in the study area is used for agricultural and industrial applications. There are only three wells in the study area that are downgradient from the landfill: the RID well and the two Tanner wells. There is no known domestic use of the ground water in the area. The City of Phoenix operates the public water supply system that serves this area. The Arizona Corporation Commission prevents any other company from providing drinking water within the City's service area.

Surface water in the study area has either limited use or no use because of the intermittent nature of flows in the Salt River. Arizona's environmental protection regulations (A.A.C. R9-21-206) designate three protected uses for the Salt River in the study area: incidental human body contact, agricultural irrigation and livestock watering, and aquatic wildlife use. There are no recreational facilities along the Salt River within the study area. Salt River water from this area is not used for agricultural purposes.

Several native species of plants and animals have been displaced by urbanization in the vicinity of the landfill. Various species of birds occur in the study area. Jackrabbits and burrowing owls have been observed living on the surface of the landfill. Some fish species may be present in the Salt River during periods of flow. Permanent fish populations probably do not occur in the Salt River adjacent to the landfill because of the intermittent and varying flow in the river.

3.4.2 Human Exposure Pathways

Potential points of exposure must be identified for each media as a part of the risk assessment process. Risks are evaluated on the basis of the estimated concentrations of indicator constituents at these points of exposure. If no exposure point exits, there is no complete exposure pathway, and it is assumed for the purpose of the assessment that there is no associated risk.

Possible pathways of exposure for human receptors are as follows:

1a. Inhalation of particulate matter dispersed by wind action, and

1b. Ingestion of off-site soil containing deposited particulates.

Since the site is covered to a minimum depth of two feet, pathways 1a and lb can be eliminated.

2. Consumption of ground water. Ground water in the vicinity of the 19th Avenue Landfill is used for agricultural and industrial purposes. The mean concentrations of detected compounds in any given well do not exceed drinking water standards. Maximum concentrations exceed MCLs for four compounds. Drinking water use in this area is supplied by the City and there are no known domestic wells. Thus, consumption of contaminated ground water does not represent a complete exposure pathway at this time. However, the RI report contains a supplementary analysis of risks associated with using ground water for drinking water purposes. An additional exposure would be incidental use of industrial and agricultural well water for drinking water purposes. Samples collected from downgradient industrial and agricultural wells did not exceed MCLs for any compounds, therefore, exposure from this pathway is not evaluated further.

3. Emission of volatile organics into air. The exposure point for emissions from the landfill into the air would be nearby populations such as businesses on the landfill or in the surrounding area. People driving or walking along 19th Avenue also present another actual exposure point. Air sampling in the vicinity of the landfill has indicated that the concentrations of volatile organics in air in the vicinity of the landfill are within the range expected for the Phoenix urban area. In the absence of standards and guidelines for VOCs in ambient air, ARARs are taken as the levels in the Phoenix area. Consequently, evaluation of exposure to VOCs emitted by the landfill via this potential exposure pathway has been omitted.

4a. Emission of volatile organics from ground water used for either industrial or agricultural purposes. Ground water samples from wells near the landfill used for agricultural and industrial purposes do not contain volatile organics above detection limits; therefore, no exposure has occurred from this pathway and no further evaluation of risk is made.

4b. Incidental contact with ground water pumped from contaminated wells. Only the monitor wells at the boundary of the landfill exceed MCLs. No exposure point exists for this pathway and the pathway is not further evaluated.

5. Consumption of foodstuffs grown using ground water for irrigation purposes. Most compounds are below limits of detection in the agricultural well nearest the

landfill. This exposure pathway is evaluated, however, for both barium and zinc which are present in ground water above detection limits.

6. <u>Surface-water contact.</u> The surface-water exposure point would be incidental human contact by populations that may encounter intermittent low volume flows in the Salt River, such as those observed during the remedial investigation. Transient populations were observed residing part time near the landfill during the remedial investigation, and other persons were occasionally observed along the riverbed. The exposure point only exists intermittently when there is flow in the river and people in the area at the same time. These conditions were observed very infrequently during the investigation and, therefore, this pathway was not considered further.

   Flood flows in the Salt River may wash refuse out of the landfill and into the riverbed. The impacts due to the refuse washout cannot be quantified.

7. <u>Methane exposure.</u> The exposure point for the methane exposure pathway would be populations in enclosed spaces on or near the landfill. Enclosed spaces would be buildings or pits below ground. Examples of existing potential exposure points include the All Chevy Auto Parts and A&B Silica businesses on the landfill and those businesses to the north and west of the landfill.

   Methane concentrations observed in the subsurface adjacent to the landfill and in structures or pits on or near the landfill were used to evaluate the actual and potential risk for the methane exposure pathway. The variation in concentrations observed before and after the renovation of the gas collection system were considered in the assessment of risk.

8. <u>Consumption of on-site contaminated soil.</u> The landfill is covered although there are a few locations on the surface of the landfill where tar-like or oily materials are visible at the surface. Since access to the landfill is controlled, this exposure pathway is highly unlikely and has been omitted.

3.4.3 Environmental Exposure Pathways

On the basis of the remedial investigation, the surface water and sediments in the Salt River have not been adversely affected. Maximum observed surface-water concentrations do not exceed standards set for protection of aquatic wildlife and agricultural uses. Although waste washout could result in potential risks to aquatic wildlife and agriculture use, these risks are difficult to quantify. Protective measures such as bank protection along the river should further reduce the potential for future impacts.

A permanent fish population is not supported by the Salt River adjacent to the landfill because the flow is intermittent. Therefore, bioaccumulation of compounds in fish is not considered a potential impact.

The animal species that were identified in the vicinity of the landfill may drink from the Salt River when there is water present. This would provide an intermittent exposure route; however, ARARs for protection of aquatic and wildlife are not exceeded. Therefore, there is no risk to small animals or birds through exposure to surface water.

The small mammals and birds observed at the landfill would not be expected to ingest soils and refuse. Therefore, no complete exposure pathway exists.

The air above the landfill provides another potential exposure pathway for small mammals and birds. Air quality monitoring during the remedial investigation showed no apparent additional impact from landfill emissions on the quality of ambient air near the landfill. Small mammals and birds would not be exposed to any additional risk due to air quality impacts.

3.4.4 Exposure Pathways Evaluated

Based on the considerations presented above, the following pathways were included in the risk assessment:

- Consumption of vegetables grown using ground water for irrigation purposes.
- Methane accumulation.

3.5 RISK ASSESSMENT

3.5.1 Exposure By Consumption of Vegetables

This exposure pathway has been evaluated for barium and zinc, the two compounds present in wells used for irrigation purposes at levels above limits of detection. In addition, the pathway has been evaluated using the detection limit for arsenic since this is a potential carcinogen and has a high carcinogenic potency slope.

Calculations are described below. The following assumptions are made:

- Plants grown and consumed from this area are of the leafy vegetable type. The soil to metal uptake ratios used for this assessment are those developed by Baes et al. (1984) who developed values for leafy and reproductive parts of the plant.

- Uptake by plants is considered to be by root uptake only. Deposition on the plants is not considered a pathway.

- The concentration of constituent in ground water is equivalent to the concentration of soil. Concentrations in soil will actually be less than concentrations in water.

- Gastrointestinal (GI) absorption efficiency is assumed to be 100 percent.

- The average amount of leafy vegetables eaten daily in the United States is assumed to be 52.3 g (U.S. EPA 1980a).

- A lifetime average body weight is assumed to be 70 kg. A lifetime is assumed to be 70 years.

The portion of the locally grown fruit and garden vegetable ingestion due to root uptake of contaminants is described by the following equation (Baes et al., 1984):

Dose (ug/kg/day) = concentration in soil (g/g) x soil/plant uptake factor x amount of vegetables/fruit eaten (ug per day) x GI absorption efficiency/body weight

3.5.1.1 Barium Exposure

The barium concentration in nearby irrigation wells is 0.11 mg/kg, based on monitoring data. Using the assumptions noted above along with a plant uptake factor of 15 percent, the predicted chronic daily intake (CDI) is 1.2 x 10^{-5} mg/kg-day. The acceptable daily intake for barium is 0.051 mg/kg-day. For barium the ratio of predicted to acceptable chronic daily intakes is

$$(CDI)/(AIC) = 2.4 \times 10^{-4}$$

3.5.1.2 Zinc Exposure

The dose of zinc, even if this water was used as drinking Water, assuming consumption of 2 L/day and a concentration of zinc of 0.05 mg/L, would be 0.1 mg/day. Zinc is an essential element and the recommended daily intake of zinc is 15 mg/day (EPA, 1980b). The (CDI)/(AIC) ratio would, therefore, be no greater than 6.7 x 10-3.

<u>Cumulative Risks of Barium and Zinc</u>

The total ratio CDI/ADI for barium and zinc is 6.93 x 10-3. Since this value does not exceed 1, it is acceptable.

3.5.1.3 Arsenic Exposure

The calculation utilized for barium was also used to calculate risk for arsenic at a concentration of 0.014 mg/l, the detection limit reported for arsenic. With a plant uptake factor of 0.04 a daily intake is predicted of 4.2 x 10^{-7} mg/kg/day. If an arsenic ingestion cancer potency slope of 1.5 is utilized, an excess cancer risk of 6.3 x 10^{-7} is produced. This value is an upperbound estimate of excess cancer risk potentially arising from a lifetime hypothetical exposure to arsenic which was not actually detected. A number of other assumptions were made in the calculations, most of which are intentional overestimates of exposure or toxicity. The actual risk may even be zero.

3.5.2. Exposure to Methane

Accumulation of methane in enclosed areas was observed prior to the renovation of the gas collection system. Accumulation of methane may occur if the existing gas collection system does not operate properly. Furthermore, no collection system exists on the eastern and southern boundaries of Cell A or on the eastern, northern, and western boundaries of Cell A-1. Future development may place buildings along boundaries that are not presently protected from off-site migration. Therefore, explosion is a potential risk.

Monitoring of methane concentrations during the remedial investigation in subsurface probes and pits below ground revealed that methane migrates away from the landfill when the existing methane collection system is not operational.

Methane can be explosive if it accumulates in confined areas in concentrations between 5 and 14 percent by volume. The ARAR for methane is a concentration of 1.25 percent by volume within a building or less than 5 percent by volume in the subsurface outside the boundaries of the landfill. There are two businesses located on the landfill itself and several others located along the western and northern boundaries. Buildings and other structures at these businesses are in areas where methane may collect. Concentrations above the ARAR of 1.25 percent methane by volume have been observed in confined spaces adjacent to the landfill prior to the renovation of the gas collection system. Concentrations in excess of 5 percent by volume were also observed in probes outside the boundaries of the landfill.

Therefore, the risk of explosion in confined spaces on the landfill is present if the existing methane collection system is not operational. This demonstrates a potential risk of explosion in these areas.

3.6 RISK CHARACTERIZATION

The baseline risk assessment for the 19th Avenue Landfill indicates that there is no current risk to public health; however, releases from the landfill have affected the environment at the landfill boundary. Table 2.14 summarizes MCL exceedances at the landfill boundary. No risks to public health were identified due to (1) inhalation of VOCs and particulate matter originating from the landfill, (2) the use of ground water for industrial use and agricultural irrigation, (3) contact with surface water, and (4) ingestion of soil and refuse. Public health risks resulting from releases from the landfill are limited to the possible accumulation of methane in enclosed areas at explosive levels, if the exiting gas collection system is not operating properly. Although there is no current use of local ground water for drinking and other domestic purposes, this pathway could result in a risk to public health if domestic ground-water wells are developed in the future.

4.0 FEASIBILITY STUDY

4.1 INTRODUCTION

A phased approach was used for selecting a recommended remedial action. Phase I of the narrowing process begins with general concepts and objectives and ends with the identification of specific processes combined into options to meet the individual objectives. In Phase II, these options are evaluated, screened, and combined into alternatives for remedial action. The alternatives are evaluated further and compared in Phase III to select a preferred remedial action.

A basic premise for all options of the feasibility study is that the 19th Avenue Landfill will not be used for any purpose in the future. Public access to the present landfill site will be prohibited.

4.2 OBJECTIVES OF THE FEASIBILITY STUDY

The overall objective for the feasibility study was to arrive at a set of corrective actions that protects human health and the environment, meets federal and state requirements, is cost-effective, and uses permanent solutions and alternative treatments or resource recovery to the maximum extent practicable. The initial step in developing options for the 19th Avenue Landfill was to develop specific objectives that would meet the overall goal of the feasibility study. The specific objectives were developed for each of four areas of concern identified as a result of the remedial investigation. These areas of concern are:

- Refuse washout
- Surface-water quality
- Ground-water quality
- Landfill-gas accumulation

Site conditions, health risks, and ARARs were considered when developing specific objectives. Site conditions and the health risk assessment were described in Chapters 2.0 and 3.0 of this RAP. Some portions of the areas of concern may overlap and the specific objective developed for one area of concern may also provide a benefit for other areas of concern. The specific objectives for each area of concern are discussed in the following paragraphs.

4.2.1 Refuse Washout

The contents of the landfill are generally similar to other municipal landfills of the same era and include some hazardous wastes, pollutants, and contaminants. The Salt River may inundate portions of Cell A and Cell A-1 during a 100-year flow and it is likely that some landfill material would be washed out if additional flood protection is not provided. Inundation of the landfill and refuse washout might adversely impact the quality of ground water and sediments or water in the Salt River and support the generation of methane. The ARARs identified for the ground-water, surface-water, and landfill-gas accumulation could apply to the refuse-washout objective. Preventing refuse washout would potentially reduce risks for these various pathways and assist in complying with ARARs. Most recently constructed major structures located along the Salt River have been designed using the 100-year flood as a practical and effective criterion. Therefore, the specific objective for the refuse-washout objective is to prevent erosion or overtopping of the landfill during a 100-year flow in the

4.2.2 Surface-Water Quality

Surface-water runoff across the landfill may transport the exposed refuse to the Salt River resulting in adverse impacts on the quality of surface water or sediments. Surface water runoff may also pond in existing depressions in the landfill cover and seep into the underlying refuse, affecting the quality of ground water and increasing the generation of methane. As was the case with the refuse washout objective, ARARs for several different areas of concern are applicable to the surface-water quality objective. In particular, ARARs and health risks associated with surface-water quality, ground-water quality, and the landfill-gas accumulation would apply. The specific objective for the surface-water quality objective is to prevent the infiltration of surface-water into the landfill and the transport of landfill material in surface-water runoff.

4.2.3 Ground-Water Quality

The remedial investigation showed that the landfill has had little, if any, impact on downgradient ground-water quality, but has had an identifiable effect on ground-water quality at the boundary of the landfill. Water in some monitor wells occasionally exceeds maximum contaminant levels for drinking water. Although ground-water in the vicinity of the landfill is not currently used for drinking water, a risk could develop in the unlikely event that someone would install a domestic drinking water supply well near the boundary of the landfill in the future. The relevant and appropriate standards for the ground-water quality objective are the maximum contaminant levels that have been set for drinking water. Of the 1,794 analyses performed for compounds with MCLs, 39 analyses were found to exceed the MCL limit. Table 2.14 summarizes MCL exceedances for all monitoring wells at the landfill. If there continues to be no exposure to ground water near the boundary of the landfill, as is the present situation, there would continue to be no risk in this regard. Therefore, the specific objective for the ground-water quality area of concern is to ensure that in the future, potential ground-water degradation does not pose a risk to public health, welfare, or the environment.

4.2.4 Landfill-Gas Accumulation

Off-site migration of landfill gas was observed during the remedial investigation. Concentrations of methane above the lower explosive limit were measured off-size before renovation of the existing gas collection system. Concentrations of methane dropped below the lower explosive limit after renovation of the system. The ARAR for the landfill gas accumulation would be a limit of 5 percent on the concentration of methane (the lower explosive limit) in the subsurface at the boundary of the landfill and less than 1.25 percent methane in buildings. Prevention of landfill gas migration past the landfill boundaries would eliminate the risk of explosion due to the accumulation of methane in enclosed spaces off site. Therefore, the specific objective for the landfill gas accumulation objective is to prevent the off-site migration of landfill gas.

4.2.5 Methodology of the Feasibility Study

The phased approach for selecting a recommended remedial action was described in Section 1.6.2.

In the feasibility study, the technologies, options, and alternatives for the 19th Avenue Landfill were screened to varying degrees so that the most promising general response actions received the most detailed attention. The technologies, options, and alternatives were screened according to effectiveness in protecting human health and the environment, ease of implementation (constructed and maintained), and cost to construct and maintain. The approach described generally in Section 1.6.2 was conducted in three phases of increasing scrutiny as outlined below:

1. Phase I, the development of options, consisted of:

   N Identifying regulatory requirements for the landfill.

   N Developing specific objectives for the area of concern.

   N Identifying general response actions for each area of concern.

   N Identifying dimensions of the landfill to which general response actions might be applied.

   N Identifying and screening potential technologies and processes for each general response action.

   N Evaluating the processes and selecting representative processes.

   N Assembling the processes into options for each area of concern.

2. Phase II, screening of options, consisted of:

   N Refining each option by developing design concepts and identifying interactions with other options.

- N Evaluating each option based on its effectiveness, implementability, and cost.

- N Assembling the surviving options into alternatives for the entire site.

3. Phase III, analysis of alternatives, consisted of:

- N Evaluating each alternative for its long- and short-term effectiveness, implementability, and cost.

- N Evaluating the sensitivity of alternatives to varying assumptions on effectiveness, implementability, and cost.

- N Comparing the alternatives.

- N Summarizing the analysis of the alternatives.

4.3 DEVELOPMENT OF OPTIONS (PHASE I)

4.3.1 <u>General Response Actions</u>

4.3.1.1 Potential Genera.1 Response Actions

Fifteen potential general response actions (U.S. EPA, 1985b) were identified as being potentially applicable to the specific objectives developed for the l9th Avenue Landfill. Definitions of these general response actions were developed specifically for application to the conditions at the landfill as follows:

- N No action: either no action at all or minimal action such as monitoring and institutional actions.

- N Containment: complete or partial encapsulation to prevent off-site migration of liquids, gas, or refuse.

- N Pumping: either removing ground water and surface water after contact with refuse or preventing ground water or surface water from contacting the refuse.
- N Collection: the controlled accumulation of liquids and gases.
- N Diversion: intercepting and redirecting off-site surface water or ground water to prevent contact with refuse.
- N Complete removal: excavating the entire landfill.
- N Partial removal: excavating portions of the landfill.
- N On-site treatment: processing of refuse, ground water, and gas on the site.
- N Off-site treatment: processing of refuse, ground water, and gas off the site.
- N In-situ treatment: on-site processing of refuse, ground water, and gas.
- N Storage: holding collected refuse, ground water, and gas for future treatment or disposal.
- N On-site disposal: landfilling of refuse on the site.
- N Off-site disposal: landfilling of refuse off the site.
- N Alternative water supply: providing another water source to users whose supply is impacted.
- N Relocate receptors: relocating businesses and resident dwellers.

4.3.1.2 Selected General Response Actions

A general response was eliminated for further consideration for a specific objective if one or more of the following criteria applied:

- N The general response action is not effective in meeting the specific objective.

- N The general response action is not applicable for an area of concern. For example, collection refers to liquids and gases but not to refuse. Therefore, collection is not applicable to the refuse-washout objective.

- N The general response action would require a remedy that would be unreasonable to implement, create a greater risk to either environment or health or both, or not be cost effective.

The potential general response actions for each specific objective are identified and evaluated in Table 4.1. General response actions that were found to be applicable are listed in Table 4.2. Each general response action is described in detail in Appendix A of the Feasibility Study report.

4.3.1.3 Dimensions for General Response Actions

Volume, area, and length dimensions relevant to each specific objective were identified for each general response action. Preliminary dimensions, given in Table 4.3, are based on site characteristics as assessed in the remedial investigation. These quantities were used to develop appropriate technologies and processes that can be applied to conditions at the landfill.

4.3.2 Identification and Screening of Technologies and Processes

This section summarizes the identification and screening of potentially applicable technologies and processes for each applicable general response action at the 19th Avenue Landfill. In this feasibility study, the term “technology” refers to a broad group of technical actions that could be applied to the general response actions, such as chemical treatment for the general response action of on-site treatment. The term “process” refers to a more specific technical action, such as adsorption by activated carbon and reverse osmosis for ground-water treatment. In cases where no subdivision is necessary, the technology and process may be the same.

The technologies and processes for the general response actions were identified based on engineering experience, reference to EPA documents (U.S. EPA, 1985a; U.S. EPA, 1987b), and their potential application to the specific objectives. The technologies and processes identified for each specific objective and the selected general responses are presented in Tables 4.4 through 4.7.

Process options and entire technologies were eliminated from further consideration if they could not be implemented because of physical constraints at the site, refuse characteristics, or if their implementation could potentially result in a greater risk to human health and the environment than presently exists. Comments on the screening of technologies and processes are provided in Tables 4.4 through 4.7.

4.3.3 Selection of Representative Processes

The processes that survived screening with respect to technical implementability were evaluated in greater to detail to select one process to represent a particular technology. Such a process is termed a “representative process” in this feasibility study. Each representative process was carried forward to Phase II of the feasibility study. For some cases, more than one representative process was selected. For the cases where an entire technology was screened out based on technical implementability, no representative process, was carried forward to Phase II.

Processes were evaluated on the basis of their effectiveness, implementability, and cost. The evaluation of effectiveness considered:

- Potential effectiveness of the process in handling the estimated volumes, areas and lengths, in satisfying the general response actions.

- Effectiveness of the process in protecting human health and the environment during construction.

- N Reliability and past experience of the process with respect to site conditions and refuse characteristics.

The evaluation of implementability considered:

- N Approvals required from federal, state, arid local government agencies.

- N Compliance with ARARs.

- N Availability and capacity of treatment and disposal services.

- N Availability of equipment and workers to implement the process.

The evaluation of cost was based on approximate capital costs and the approximate costs of operations and maintenance rather than on detailed engineering cost estimates. The cost evaluations for each process were based on engineering judgment and on how the costs compared to costs of other processes of the same technology type. Of the three criteria, cost was the least influential in selecting final processes.

The results of the identification, screening, and evaluation of technologies and processes are summarized in Tables 4.8 through 4.11.

4.3.4 Assembly of Options

From the selected processes, nine options were assembled for the four specific objectives for the 19th Avenue Landfill: four for the refuse washout objective, two for the surface-water quality objective, two for the ground-water quality objective, and one for the landfill-gas accumulation objective.

Four options were developed for the refuse-washout objective.

4.3.4.1 Refuse-Washout Options

Each option for control of refuse washout consists of three or more of the following processes:

A_1: Relatively deep seated compacted soil levees with soil cement bank protection along the river banks of Cell A and Cell A-1.

A_2: Relatively deep seated compacted soil levees with soil cement bank protection along the river banks of Cell A only.

B_1: Relatively shallow seated compacted soil levees with soil cement bank protection along the river banks of Cell A and Cell A-1.

B_2: Relatively shallow seated compacted soil levees with soil cement bank protection along the river banks of Cell A only.

C: Subsurface soil cement grade control structure across the river channel down-stream of the landfill.

D: Concrete pipe with compacted soil backfill along the 15th Avenue storm drain outfall channel.

E: Widened river channel bottom by excavating and grading.

F: Relocation of Cell A-1 to Cell A by excavating, transporting, and landfilling.

The four individual options are defined in terms of these processes as follows:

RW-1: A_l, D, and E
RW-2: B_l, C, D, and E
RW-3: A_2, D, E, and F
RW-4: B_2, C, D, E, and F

The use of a grade control structure would affect the required depth of the bank protection for the levees. If a grade control structure were used, bank protection would be needed through a shallow depth to protect against local river scour. If a grade control structure were not used, bank protection would be required through a somewhat greater depth to protect against the combination of local scour and general riverbed degradation.

Relocating of Cell A-1 (Process F) would eliminate the need for any other remedial work at Cell A-1. Details of Process E could differ slightly between options with and without Process F. The relocation of Cell A-1 would affect other objectives. For instance, if Cell A-1 were relocated, a cap would not be required at Cell A-1 for the surface-water objective.

4.3.4.2 Surface-Water Options

Two options, SW-1 and SW-2, were defined for the surface-water objectives.

Option SW-1 consists of four processes:

- Single-layer compacted soil cap over Cell A and Cell A-1.
- Surface drainage from Cell A and Cell A-1.
- Fence around Cell A and Cell A-1 to prevent access to the site.
- Relocate A and B Silica Land and All Chevy Auto Parts.

Option SW-2 consists of the four processes:

- Double-layer soil and synthetic liner cap over Cell A and Cell A-1.
- Surface drainage from Cell A and Cell A-1.
- Fence around Cell A and Cell A-1.

- N Relocate A and B Silica Land and All Chevy Auto Parts.

The relocation of the two businesses from the landfill is recommended so that a properly graded cap can be installed. Furthermore, relocation of the businesses will reduce the potential for exposure to the landfill and is consistent with the design objective of no end use for the landfill.

4.3.4.3 Ground-Water Options

Two options were defined for addressing the ground-water quality concerns. Option GW-1 consists of three processes:

- N Ground-water quality monitoring using the existing monitoring network to detect possible changes in water quality conditions.
- N Provision of drinking water by the City of Phoenix water distribution system.

Option GW-2 consists of four processes:

- N Collection of ground water flowing past the landfill using production wells.
- N Treatment of the collected ground water.
- N Discharge of the treated ground water.
- N Verification of the effectiveness of the option using the existing monitoring network.

4.3.4.4 Landfill-Gas Accumulation Options

One option (LG-1) was assembled for the landfill gas accumulation objective:

- N Collection of landfill gas at the perimeter of the site with an active collection system.
- N Treatment of and collect landfill gas by flaring and discharge to the atmosphere.
- N Monitoring of landfill gas at the perimeter of the site and monitor air quality.

4.4 SCREENING OF OPTIONS (PHASE II)

4.4.1 Criteria for Screening

The procedural steps in Phase II were the refinement of each option by developing design concepts and identifying interactions with other specific objectives, and the evaluation of all options and elimination of some options based on effectiveness, implementability, and cost, with emphasis on the protection of human health and the environment. The surviving options were assembled into alternatives for addressing all objectives together. The alternatives that emerged from Phase II were carried into Phase III for evaluation of their abilities to meet all objectives of remediation.

4.4.1.1 Effectiveness

Effectiveness is defined as a combination of several measures of protection:

- N Extent to which ARARs are complied with.
- N Extent to which workers and the public are protected from exposure to toxic and hazardous substances during implementation of the remedial action.

- Ultimate risk to public health and the environment after remedial action has been implemented.

- Time to achieve protection.

- Need for maintenance of remedial system.

- Permanency of protection.

4.4.1.2 Implementability

The implementability of each option was evaluated on the basis of technical feasibiiity, administrative feasibility, and availability of processes. Evaluation of technical feasibility involves the consideration of reliability, operability, maintainability, and verifiability of process action over the long term.

Administrative feasibility involves consideration of obtaining approvals from federal, state, county, and local agencies, and compliance with pertinent regulations. Permits are not required at a Superfund site, the substantive requirements must be met. Options found not to be administratively feasible at present were not eliminated since administrative procedures might evolve in the future to make the options feasible.

Availability refers to the availability of technologies such as earthwork, construction, transportation, landfilling, treatment, and pumping.

4.4.1.3 Cost

Capital, operation, and maintenance cost estimates were developed for each option at the 19th Avenue Landfill on the basis of the design concept considerations and unit cost estimates. The unit cost estimates were based on unit costs from construction cost guide publications (R.S. Means Company, Inc., 1987a, 1987b, 1988; U.S. EPA, 1987c), discussions with suppliers and contractors, and engineering cost estimating and construction-related experience in Arizona. The cost estimates are considered to be within minus 30 percent and plus 50 percent of the actual cost. This cost precision is sufficiently accurate to make relative cost comparisons between options (U.S. EPA, 1988).

Capital costs were estimated for construction, site development, buildings, and services. Annual operation and maintenance costs were estimated for operating labor, maintenance material and labor, auxiliary material and energy, purchased services, and disposal. Operation and maintenance costs were projected for 30 years. Present worth analyses were conducted using a five percent discount factor to evaluate expenditures that would occur over different time periods (U.S. EPA, 1988).

4.4.2 Refuse-Washout Option

4.4.2.1 Design Considerations

General design concepts developed for the refuse-washout options were:

- Side slopes of excavations would be 1.5:1.
- Dewatering would be required to a depth of five feet below the bottom of excavations that extend below the ground-water table
- Refuse under structures would be replaced with compacted soil.
- Soil used for construction and for producing soil cement aggregates would be obtained from alluvium in the site area.
- Excavations for structures would be backfilled with compacted soil around the completed structures.

The compacted earth levee and soil cement bank protection system would be constructed such that:

- Levees would extend three feet above the 100-year flow level.

- Levees for Cell A would extend from 100 feet upstream from the storm drain outfall channel to the 19th Avenue bridge.

- Levees for Cell A-1 would extend from 100 feet upstream from the eastern boundary of Cell A-1 to the western boundary of Cell A-1.

- Refuse excavated for constructing the levees would be landfilled on the same side of the river as the excavation.

The soil cement grade control structure would be downstream of the 19th Avenue bridge. Design concepts developed for the grade control were:

- The structure would traverse the 600-foot channel width and would tie into the Cell A channel bank protection structure.

- The foundation of the structure would be deeper than foundations of the levees.

Design concepts developed for the storm drain were developed

- A three-foot bedding layer of compacted granular soil would be placed under the pipe.

- The pipe would be eight feet in diameter and would be equipped with a gas monitoring system and inspection shafts.

- The zone above the pipe will be backfilled with compacted soil to the final ground surface.

Design concepts developed for relocating Cell A-1 to Cell A were:

- The existing soil cover on Cell A-1 would be excavated to within one foot of the top of refuse and stockpiled for use as backfill.

- N All refuse and the remaining cover material would be transported across the river to Cell A by trucks or scrapers.

- N Relocated material would be placed near the center of Cell A, compacted, and covered daily with soil.

4.4.2.2 Interaction with Other Options

The compacted soil levee and soil cement bank protection structures for options RW-1 through RW-4 could interact with the surface water quality objective by obstructing surface-water runoff from the landfill. Outfalls would be required through the levees to convey on-site and diverted off-site surface water to the river. On the other hand, the compacted soil levees with soil cement facing would prevent high river flows from inundating and infiltrating landfill.

The concrete pipe could be constructed to convey on-site and off-site surface water directed to the east side of Cell A. The concrete pipe for the storm drain outfall channel would prevent infiltration from high flows in the outfall channel. Gas collection and monitoring systems will be required to prevent gases from accumulating in and around the pipe.

Relocation of Cell A-1 to Cell A in options RW-3 and RW-4 would eliminate the need for further remediation of the surface-water quality, ground-water quality, and landfill-gas accumulation objectives at Cell A-1.

4.4.2.3 Evaluation of Options

The screening comparison of the refuse-washout options is summarized in Table 4.12.

4.4.3 <u>Surface-Water Options</u>

4.4.3.1 Design Consideration

Design concepts for the surface-water options at the 19th Avenue Landfill were developed to better quantify the dimensions and configurations of the 213-acre cap and the sizes and capacities of the processes required. Design concepts developed for the cap were:

- **N** Earthwork for site preparation would leave at least one foot of existing soil cover in place over the refuse.
- **N** The cap would be constructed using only soil presently stockpiled at the site.
- **N** The single-layer cap section would consist of at least one foot of existing soil and three feet of compacted soil.
- **N** The double-layer cap section would consist of at least one foot of existing soil, a 60-mil synthetic liner, and three feet of compacted soil.
- **N** Compacted soil in the cap would have a permeability less than 10^{-4} centimeters per second.
- **N** The cap would be graded with a surface slope of two percent so that surface water is directed toward the perimeter of the site.
- **N** Refuse relocated from Cell A-1 would be spread near the center of Cell A where final grades would bit the highest.

Design concepts developed for the surface drainage and outfall structure were:

- **N** Surface-water flows onto Cell A from the northerly direction.
- **N** Off-site surface water would be directed around Cell A-1 by existing ridges.

- N The slopes of perimeter channels would be at least 0.2 percent and side slopes would be lined with gunite.

- N Perimeter channels empty into the river except for the northern channel of Cell A which empties into the storm drain.

- N River outfalls would have flap gates if they are below the 100-year water surface profile.

4.4.3.2 Interaction with Other Options

The levees from the refuse washout options would prevent inundation of the landfill from river flows. The pipe and backfill for the storm drain outfall channel would prevent inundation from storm drain flows as well as river inflow. Levees along the river banks of the landfill would affect surface-water drainage by creating barriers between the landfill and the river. Because the levees would extend upstream and downstream of Cell A and Cell A-1, they could impound off-site surface water diverted around the site. Outfalls would be needed through the levees to convey on-site and diverted off-site surface water. Outfalls below the 100-year water surface profile would include a flap gate to prevent inflow from the river.

The single-layer soil cap in option SW-1 would be more permeable to landfill gas than the double-layer cap in option SW-2. Either cap, however, would retard emissions of gases from cracks and holes observed in the present cap. Gases contained by the cap would migrate laterally and be intercepted by the gas collection system.

Drainage for the surface-water options would be aided by the storm drain outfall channel. A second pipe would be added to convey on-site and off-site surface water directed toward the eastern side of the site.

The cap would reduce infiltration of surface water into the refuse and the generation of leachate. This would reduce potential ground-water quality impacts that might be caused by the leachate by surface water. The refuse washout options of relocating Cell

A-1 to Cell A would eliminate the need for a cap on Cell A-1. Final cap grades at Cell A would reflect the added waste relocated from Cell A-1.

4.4.3.3 Evaluation of Option

The screening comparison of the surface-water options is summarized in Table 4.13.

4.4.4 Ground-Water Option

4.4.4.1 Design Considerations

Design concepts developed for ground-water monitoring were:

- Water levels would be monitored in all wells, at a minimum of once every three months.
- Ground water would be sampled every three months from the monitor wells.

Design concepts developed for the extraction wells, treatment system, and discharge system were:

- Six ground-water extraction wells and a treatment plant would be installed at Cell A.
- Each well would pump at least 700 gallons per minute to capture water flowing beneath the landfill in geologic Unit A.
- Each pump would be run 24 hours per day, 365 days per year. (In practice this may not be necessary.)
- Constituents to be treated would be: arsenic, vinyl chloride, 1,1-dichloroethene, barium, and nickel.

- N Treatment would use ten beds of granulated activated carbon with five parallel banks of two beds each in series.

4.4.4.2 Interaction with Other Options

The refuse washout option of relocating Cell A-1 to Cell A would eliminate the need to remediate or monitor ground water near Cell A-1. A levee at the south end of Cell A could reduce the potential for surface water from the river to infiltrate the refuse.

Installation of a cap over the landfill, diverting drainage around the landfill, and enclosing the storm drain outfall would all reduce surface-water infiltration into the landfill. This would aid in decreasing the amount of leachate generated in the landfill that might impact ground-water quality.

No direct impact on the ground-water options is expected from the landfill gas objective. However, ground-water extraction may be beneficial to the gas control objectives. Lowering the ground-water levels by pumping would tend to reduce moisture in the refuse, thereby reducing the amount of gas generated.

4.4.4.3 Evaluation of Options

The screening comparison of the ground-water options is summarized in Table 4.14.

4.4.5 Landfill Gas

4.4.5.1 Design Considerations

Evaluation of the existing gas collection system during the remedial investigation indicated that renovations to the system are needed to ensure proper operation. The extent of renovations to the existing system will be decided during the design phase. Renovation or replacement of the existing system would be a relatively small capital cost compared to other options considered in this report.

The existing active gas collection system to be renovated or replaced comprises two lines of extraction wells interconnected by header pipes in Cell A, and the header pipes are connected to a blower which discharges to a flare system. A similar but much smaller system exists at Cell A-1.

Improvements would be made to the existing gas collection system as follows:

- Additional extraction wells would extend to the bottom of the refuse.
- Valves would be placed at each well head for adjustments.
- Well and header pipe joints would be flexible to allow for settlement of the refuse.
- The header pipe can be either above ground for ease of maintenance or below ground for protection.
- The header pipe would be sloped to drains to allow condensate to trickle back into the refuse. Drains would consist of a small pipe extending 10 feet below the surface.
- The blower would discharge to a small flare for destruction of combustibles.

Gas monitor wells or probes would be installed to evaluate the efficiency of the collection system and to check if gases are bypassing the wells.

4.4.5.2 Interaction with Other Options

Options for the refuse washout and surface-water objectives would affect the location, layout and size of a gas control system. The ground-water objective would not directly interact with the landfill gas.

Addition of the storm drain outfall pipe for the waste washout and surface-water objective requires adding a new gas collection system along the eastern perimeter of Cell A similar in construction and layout to the existing systems at the site.

The refuse-washout options RW-3 and RW-4 involving removal of Cell A-1 would eliminate the need for gas controls in the Cell A-1 area. River bank protection at Cell A would restrict gas migration from the river bank. This would not affect the gas control requirements and would encourage gas to migrate either to other perimeters or to the surface of Cell A.

The installation of a compacted soil cap over the site for the surface-water option should restrict the vertical movement of landfill gas, enhancing horizontal migration of the gas toward the gas collection system. Processes such as capping and bank protection that restrict gas flow indirectly benefit the control of gas migration when used with conventional gas control methods. Options that restrict surface water or ground water from entering the refuse have an indirect benefit in possibly reducing gas generation.

4.4.5.3 Evaluation of Option

The screening comparison for the landfill gas accumulation option is summarized in Table 4.15.

4.4.6 Selected Alternatives

4.4.6.1 Elimination of Options

Options RW-1 and RW-3 for refuse washout were eliminated on the basis that Options RW-2 and RW-4, with relatively shallow seated levees and a grade control structure across the river, would be as effective as RW-1 and RW-3 and implementable at a lower cost. Because of the small differences in cost developed at the screening level, Options RW-1 and RW-3 should be re-examined during detailed design.

The surface-water quality option SW-2 uses a double-layer compacted soil and synthetic liner cap, whereas option SW-1 uses a single-layer compacted soil cap. SW-1 would be as effective as SW-2, would be more implementable, and cost less. Therefore, SW-2 was eliminated.

The ground-water quality options GW-1 and GW-2 were both retained for assembly into alternatives to preserve a range of remedies for detailed analysis in Phase III. Option GW-1 uses no action with monitoring of ground water and uses. Option GW-2 uses pumping and treatment of ground water.

The landfill gas accumulation objective LG-1 uses an active collection system with treatment. Phase II screening revealed that the option could be effective and implementable.

Following the Phase II screening, the surviving options for the four areas of concern were as follows:

Refuse Washout Options	Surface Water Quality Options	Ground Water Quality Options	Landfill Gas Accumulation Options
RW-2	SW-1	GW-1	LG-1
RW-4		GW-2	

4.4.6.2 Alternatives

The options surviving screening in Phase II of the feasibility study for the 19th Avenue Landfill were assembled into alternatives for addressing all objectives combined. This was accomplished by using all combinations of one option each from the four areas of concern. Five alternatives were selected and designated as Alternatives A, B, C, D, and No Action. The lettered alternatives are the options shown in the following table:

Alternative A	Alternative B	Alternative C	Alternative D
RW-2	RW-4	RW-2	RW-4
SW-1	SW-1	SW-1	SW-2
GW-1	GW-1	GW-2	GW-2
LG-1	LG-1	LG-1	LG-1

The no action alternative is defined as consisting of continued ground water monitoring, installation of a perimeter fence to prevent access, and monitoring of ground water use through ADWR permit applications for well construction. No other surface work would be performed. This alternative did not meet federal or state objectives for assuring permanent protection of human health and the environment.

4.5 RECOMMENDED ALTERNATIVE (PHASE III)

4.5.1 Introduction

The purpose of Phase III was the evaluation of Alternatives A, B, C, and D and the selection of a preferred alternative for remedial action that addresses all objectives together.

Alternatives A, B, C, and D were evaluated on the basis of their short-term and long-term effectiveness, implementability, and cost in more detail than applied in Phase II. Short-term refers to the period of construction plus any operation and maintenance required to complete the remediation. Long-term refers to the period of operation and maintenance after construction is complete. Long-term considerations include any required replacement and limitations in the effective life of an action.

4.5.2 Evaluation Criteria

4.5.2.1 Effectiveness

Effectiveness was evaluated in terms of short- and long-term protectiveness, extent of and permanence in the reduction of potential for toxic exposure, and mobility of contamination and refuse.

Components of short-term protectiveness included:

- Reduction of existing risks.

" Compliance with applicable laws and regulations.

" Protection of the community and workers during remedial actions.

" Time until protection is achieved.

Components of long-term protectiveness included:

" Magnitude of residual risk.

" Long-term reliability for continued protection, including assessing the potential for failure of the alternative.

" Compliance with ARARs.

" Prevention of future exposure to residuals.

" Potential need for replacement, when such replacement might be needed, and the risks associated with replacement.

4.5.2.2 Implementability

Implementability was judged in terms of short- and long-term technical feasibility, administrative feasibility, and the availability of required resources.

Components of short-term technical feasibility include:

" Ability to construct components of the remedy, considering difficulties and unknowns.

" Short-term reliability of meeting performance specifications, and at the potential for schedule delays.

Components of long-term technical feasibility include:

- Ease of undertaking additional remedial action, if necessary.

- Ability to monitor effectiveness of the remedy and perform operation and maintenance functions.

Components of administrative feasibility include:

- Ability to obtain approvals from federal, state, and local agencies.

- Likelihood of favorable community response and steps required to address community concerns.

- Activities requiring coordination with federal, state, and county agencies.

Components of availability considered for the analysis include:

- Availability of adequate off-site treatment, storage, and disposal services.

- Availability of necessary equipment and specialists to construct the remedy.

4.5.2.3 Cost

In Phase III, indirect costs were added to the direct costs, developed in Phase II, to obtain the estimated cost of each alternative. The cost estimates are considered to be within minus 30 percent and plus 50 percent of the actual cost.

Capital costs considerations include:

- Estimated direct capital cost for development and construction.

- Estimated indirect costs for engineering design and preparation of specifications and bid documents.

- Other capital and short-term costs, such as permitting and legal costs until the alternative is constructed.

Annual operating and maintenance costs include:

- Operating labor, materials and energy, maintenance materials and labor, and disposal of residues.

- Administration, insurance, taxes, and license.

- Costs of five-year reviews such as sampling and analyses.

- A contingency for potential future remedial action and replacement costs.

Present worth calculations were based on a 5 percent discount rate and a 30-year time period (U.S. EPA, 1988).

4.5.2.4 Sensitivity Analysis of Alternatives

Sensitivity analyses were conducted to assess the effect of varying the specific assumptions on effectiveness, implementability, and cost that were made in developing the alternative. The sensitivity analysis factors that were examined included the effective life of remedial actions, operation and maintenance costs, discount rates, duration of treatment systems, and uncertainty of site conditions.

Small factors that might bring about a significant change in the overall costs were of most concern in the sensitivity analyses. A small variance in large cost items such as the flood control structure may generate a large cost change. Costs generated in the sensitivity analyses are used to assess the best and worst case scenarios for each alternative.

4.5.3 Summary of Alternatives

Alternatives A, B, C, and D, resulting from the Phase II evaluation, are summarized in Table 1.3.

4.5.4 Evaluation of Alternatives

A thorough discussion of the evaluation of each alternative would be lengthy. Such a discussion is contained in the feasibility study report. The evaluation of alternatives is summarized in Table 4.16.

4.5.5 Comparison of Alternatives

This section presents a qualitative assessment of the strengths and weaknesses of Alternatives A, B, C, and D for the 19th Avenue Landfill so that a comparative analysis can be made between the alternatives. The relative performance of the alternatives with respect to effectiveness, implementability, and cost were used as the basis for comparison.

4.5.5.1 Effectiveness

Short-term protection for reducing existing risks is achieved for the refuse-washout and surface-water quality areas of concern of Alternatives A, B, C, and D by containing the refuse and eliminating contact between surface water and refuse. Short-term protection is also achieved by controlling the off-site migration of the gas. In addressing the ground-water quality objective, Alternatives A and B achieve short-term protection of public health by monitoring quality and use of ground water and continuing to supply drinking water from the City of Phoenix distribution system. Alternatives C and D also provide protection by utilizing pumping and treatment of ground water to prevent any off-site migration of ground water that has been impacted by the landfill.

The community and workers can be protected during construction of Alternatives A and C if proper safety procedures are followed by workers. Possible risks of exposure would be greater in Alternatives B and D because the option to relocate Cell A-1 to Cell A has the potential for spilling refuse along roads or the river channel while it is being transported. Larger amounts of landfill material will be moved in the construction of Alternatives B and D, increasing the potential for worker or community exposure to landfill materials.

Long-term protection would be achieved for the refuse washout and surface water quality objectives of each alternative if the flood control structure and cap are properly maintained. Changes in ground-water flow directions and other hydrogeologic conditions at the site may affect the effectiveness of the options designed to protect public health from the impacts of the landfill on ground-water quality. Long-term monitoring is required for all alternatives. A contingency plan will assure long-term protection of public health and the environment by ensuring compliance with ARARs. Proper design, operation, and maintenance of the gas collection, should provide long-term protection of public health and the environment.

Mobility of refuse is reduced in all alternatives by containment or by relocation and containment. Mobility and hazards of landfill gas accumulated are reduced for all alternatives by collection and treatment. Alternatives A and B do not reduce the mobility of compounds in ground water. However, wells downgradient of the property boundary do not presently exceed MCL’s. Alternatives C and D use pumping to reduce mobility of contamination and treatment to reduce toxicity of contaminated ground water.

4.5.5.2 Implementability

The implementability of Alternatives A, B, C, and D was analyzed in terms of technical feasibility, administrative feasibility, and availability of resources.

The technical feasibility of implementing Alternatives A, B, C, and D is sound. Remedial actions for the alternatives would employ conventional technologies that have been used in the arid desert regions of Arizona. Good performance is expected.

Administrative feasibility problems are not expected to be significant. Approval from the appropriate regulatory agencies is considered likely for all alternatives. The monitoring of ground-water use (which is a component of Alternatives A and B) will require coordination with DWR.

Resources to implement Alternatives A, B, C, and D are readily available in Arizona. Adequate equipment, services, labor, and technical expertise are available in the Phoenix area. The actions can be monitored and inspected for all alternatives.

4.5.5.3 Cost

The costs for Alternatives A, B, C, and D at the 19th Avenue Landfill were analyzed in terms of capital costs, operation and maintenance costs, and present worth.

Present worth comparisons show a small difference between Alternative A and B. This indicates that the difference between containing or relocating Cell A-1 is not a major cost factor given the assumptions and level of analysis in the feasibility study. The sensitivity analysis showed that costs of relocating Cell A-1 will increase greatly if hazardous waste is encountered. The addition of ground-water treatment in Alternatives C and D over no action in Alternatives A and B results in an increase in capital cost and significant increase in annual operation and maintenance costs:

4.5.5.4 Discussion

The analysis of Alternatives A, B, C, and D provides information that is used to select an action or set of actions for the Landfill that protect human health and the environment. Each alternative contains options that address the four areas of concern at the landfill: refuse washout, surface-water quality, ground-water quality, and landfill gas accumulation. The proposed actions fulfill the following goals:

- Human health and the environment would be protected.
- Specific objectives and the overall site objective would be met.
- Cost-effective remediation would be achieved.

Two major differences among Alternatives A, B, C, and D are the removal of Cell A-1 and the pumping and treatment of ground water.

The first major difference involves relocating Cell A-1 to Cell A. Alternatives A and C would leave Cell A-1 in place. This means that flood protection structures, caps, and gas collection system would have to be built at both Cell A and Cell A-1. If Cell A-1 is moved to Cell A, as called for in Alternatives B and D, no additional action would be required at Cell A-1. Impacts from Cell A-1 would be eliminated and the solution for Cell A-1 would be permanent.

The removal of Cell A-1 in Alternatives B and D, however, would require the excavation and exposure of much more refuse than in Alternatives A and D. The chances of short-term health impacts to workers and the community increases with the amount of refuse that is exposed and handled. If hazardous materials are encountered during the excavation of Cell A-1, costs can be expected to increase significantly. Increased time and expense will be required to detect, handle, and dispose of hazardous waste. Protection of workers and the community would become more time-consuming, expensive, and less reliable.

The second major difference between alternatives involves taking either a management approach or pumping and treating to meet the ground-water quality objective. The impacts on the alternatives and the tradeoffs between alternatives are based on the issues of protection, cost, and beneficial use of resources.

The no action option for ground water in Alternatives A and B will be protective of public health. The City of Phoenix presently provides water from their distribution system for the area. The City plans to eliminate the use of ground water for drinking water in the future except for periods of peak demand but has no plans to develop ground water in the area of the landfill. Continued industrialization of the area makes development of small domestic wells a remote possibility. A ground-water quality monitoring program coupled with the contingency plan will assure long-term protection of public health, welfare, and the environment.

Capturing all ground water that flows through the 19th Avenue Landfill by pumping and then treating it, as in Alternatives C and D, will cost approximately $3 million in capital expenses and $890,000 a year in operational expenses. The principal difference from the no action alternative would be that there are no off-site migration of compounds in ground water for any distance. However, approximately 4,200 gallons per minute or 6,800 acre-feet per year will have to be pumped to capture all the ground water. At the present time, this ground water will require minimal or no treatment (i.e., it would meet MCLs 98 percent of the time). This water will have to be put to beneficial use. It may be very difficult to find a beneficial use for that amount of water in the vicinity of the site. Additionally, the wisdom of pumping large volumes of ground water that meets MCLs is questionable given the State's objective of meeting safe yield and stabilizing ground water levels.

Components of Alternatives A, B, C, and D relating to the surface-water quality and landfill-gas accumulation areas of concern are basically constant for all four alternatives. Removing Cell A-1 to Cell A will reduce the surface area to be capped by 6.5 percent, but will not reduce the volume of refuse.

The comparison process presented in the feasibility study showed that, with the exception of the no action case, all alternatives are protective of human health and the environment and will comply with all federal, state, and local laws, regulations, and standards. The principal differences between Alternatives A, B, C, and D are the removal of Cell A-1 and the pumping and treatments of ground water. Removal of Cell A-1 poses serious short term health impacts to worker and the community and increases the expense and time required to achieve adequate protection of human health and the environment. Pumping and treating ground water will significantly add to the cost of remediation and produce large quantities of water which will require minimal or no treatment. Based on these considerations, a recommended alternative was identified and is described in the following section.

4.5.6 <u>Recommended Alternative</u>

Alternative A is the recommended remedial action for the 19th Avenue Landfill for the following reasons:

- Alternative A provides long-term protection of public health and the environment equal to other alternatives.

- Alternative A does not include relocation of Cell A-1 and therefore avoids the potential short-term health risks and higher costs that may result from relocation.

- Alternative A is cost-effective.

5.0 RECOMMENDED REMEDIAL ACTION

5.1 INTRODUCTION

The feasibility study for the 19th Avenue Landfill evaluated alternatives for correcting existing public health or environmental impacts and for preventing future impacts. In order to accomplish this purpose, several goals should be met by the selected remedial action. The goals are related to impacts and potential risks identified by the remedial investigation. The remedial action goals are:

" Prevention of erosion and overtopping of the landfill during a 100-year flood to eliminate the risk of refuse being washed out of the landfill and prevent impacts on surface water and sediment quality in the Salt River.

" Prevention of infiltration of surface water into the landfill and the transport of landfill material in surface-water runoff to eliminate the possible impact of the landfill on surface water and sediment quality, to reduce the generation of leachate in the landfill, and to reduce localized air emissions from cracks or holes in the existing landfill cover.

" Ensure that in the future potential ground-water degradation does not to pose a risk to public health, welfare, or the environment.

" Prevention of the off-site migration of landfill gas to eliminate the risk of explosions that could result from the accumulation of methane.

" Compliance with ARARs presented in Section 3.3 of this document.

The recommended remedial action would achieve these goals through the use of:

" Levees with bank protection designed to protect Cell A and Cell A-1 from the 100-year flood.

" A single-layer soil cap with surface drainage control for both cells.

- Continued ground-water monitoring at the site.

- Continued delivery of an adequate supply of drinking water from the City of Phoenix distribution system to residents and businesses in the vicinity of the landfill.

- Renovation or replacement and expansion of the existing gas collection system at both cells.

The following sections of this report describe the components of the recommended remedial action and discuss how the recommended remedial action (1) minimizes or mitigates danger to public health and the environment from release or threatened release from the landfill site, (2) reduces the mobility of contaminants and refuse, and (3) reduces the potential for exposure to toxic contaminants and hazardous materials generated by the landfill.

The Recommended Remedial Action presented below is preliminary and could change as a result of public comments or new information. The public is encouraged to review and comment on all alternatives presented in the RAP.

5.2 COMPONENTS OF RECOMMENDED REMEDIAL ACTION

5.2.1 <u>Refuse-Washout Control</u>

5.2.1.1 Summary

The proposed levee and bank protection system will provide containment of the refuse and will protect the landfill from inundation by the 100-year flood. A concrete pipe installed in the storm drain outfall channel will prevent refuse washout by isolating the refuse from flows in the drain. The effects of general riverbed degradation would be controlled by a subsurface grade control structure. The structure would limit the levee foundation depth to the depth of local scour (estimated to be about nine feet).

5.2.1.2 Levees and Bank Protection

Concepts for the shallow seated compacted earth levee and soil cement bank protection system are illustrated in Figures 5.1 through 5.5. The design concepts for the earth levees are as follows:

" Levees will extend three feet above the 100-year flow level.

" Levees for Cell A will extend from about 100 feet upstream from the storm drain outfall channel to the 19th Avenue bridge and will tie into the existing topography with a minimum of disturbance.

" Levees for Cell A-1 will extend from 100 feet upstream from the eastern boundary to the western boundary of the cell.

" Refuse excavated during the construction of the levees will be buried in the cell on the same side of the river as the levee excavation.

" All refuse and cover material will be transported by trucks or scrapers.

" The existing soil cover will be excavated to within one foot of the waste and stockpiled for use as an engineered fill prior to waste placement.

" Relocated refuse will be placed near the center of the cells, compacted, and provided with a daily soil cover.

" Excavation side slopes will not be allowed to exceed 1.5:1.

" Dewatering will be required to five feet below the bottom of excavations that extend below the ground-water table.

" Refuse beneath structures will be replaced with compacted soil to stabilize the levee foundation area.

- Soil used for construction and for producing soil cement aggregates will be obtained from alluvium in the site area.

- Excavations for structures will be backfilled with compacted soil around the completed structures.

5.2.1.3 Grade Control Structure

The grade control structure will be downstream of the 19th Avenue bridge and configured as shown in Figure 5.6. Design concepts for the structure are:

- The structure would be constructed of soil cement.

- The structure will traverse the 600-foot channel width and will tie into the Cell A channel bank protection structure.

- The foundation of the structure will be significantly deeper than foundations of the levees.

5.2.1.4 Storm Drain Pipe

A configuration of the concrete storm drain pipe and backfill is shown in Figure 5.7. Design concepts for the storm drain pipe are:

- A three-foot thick bedding layer of compacted granular soil will be placed under the pipe.

- The pipe will be eight feet in diameter and will be equipped with a gas monitoring system and inspection shafts.

- The trench around the pipe will be backfilled with compacted soil to the final ground surface.

5.2.2 Surface-Water and Sediment Quality Protection

5.2.2.1 Summary

With regular inspection and maintenance, a single-layer soil cap will provide long-term protection to human health and the environment by preventing contact between surface water and refuse.

Evapotranspiration at the landfill greatly exceeds rainfall. The average annual rainfall and evaporation are approximately 7.1 and 71 inches (National Oceanic and Atmospheric Administration, 1973, 1979), respectively. Given these parameters, a minimum surface slope of 2 percent, and a soil permeability of 10^{-4} centimeters per second, the 4-foot thick single-layer soil cap should prevent surface water from infiltrating the refuse during a 100-year rain event. This will reduce potential ground-water quality impacts that might be caused by leachate generation.

This cap together with the levees and wider river channel will effectively prevent surface water from contacting the refuse and minimize surface water infiltration into refuse and transport of leachate into the ground water. The cap will isolate the refuse from rain. Perimeter ditches will intercept off-site flows and convey and discharge them into the river.

5.2.2.2 Single Layer Soil Cap

Single layer compacted soil caps over Cell A and Cell A-1 are illustrated in Figures 5.8 and 5.9. Design concepts for the surface cap are as follows:

- Site preparation earthwork will leave at least one foot of existing soil cover in place over the refuse.

- The cap will be constructed using the soil presently stockpiled at the site without mixing in any other materials.

- The single-layer cap section will consist of at least one foot of existing soil and three feet of compacted soil.

- The compacted soil of the cap will have a permeability less than 10^{-4} centimeters per second.

- The cap will have a surface slope of two percent to direct surface water toward the perimeter of the site and away from the landfill.

- Refuse excavated during the construction of the levees will be placed at the center of each cell where final grades would be the highest.

5.2.2.3 Drainage and Outfall Structures

The surface drainage and outfall structures will be configured as shown in Figures 5.7, 5.9, and 5.10. Design concepts are as follows:

- Surface water flowing onto Cell A from off the site originates from north of the site.

- Surface water flowing onto Cell A-1 from off the site will be directed around the cell by existing ridges.

- The slopes of the perimeter drainage collection channel will be at least 0.2 percent. Side slopes will be lined with gunite.

- Perimeter channels will empty into the river with the exception of the northern channel of Cell A which will empty into the storm drain.

- River outfalls will have flap gates if they are below the 100-year water surface profile.

5.2.3 Ground-Water Quality Protection

5.2.3.1 Summary

Ground-water quality does not currently pose a risk to public health, welfare, or the environment. Ground water in the vicinity of the landfill is not currently used for drinking water. Drinking water will continue to be supplied by the City of Phoenix water distribution system. Long-term protection will be assessed by monitoring ground water at the landfill. Monitoring of ground-water use will prevent inadvertent use of ground water for drinking water at and downgradient of the boundary of the landfill. Protection of human health at the boundary of the landfill will be verified by ground-water monitoring. Monitoring will detect changes in ground-water quality and in the flow system. A contingency plan (Appendix B) will be implemented if contaminant levels exceed MCLs at the property boundary.

Maintenance of the existing monitoring network would be required. Ground-water monitoring has been ongoing at the landfill for several years. Long-term consistency in the monitoring program can be achieved by developing specifications for procedures and analytical requirements in advance.

5.2.3.2 Monitoring

A monitoring well network will be used for detecting changes in ground-water quality and flow systems. Key concepts for monitoring are:

" The monitoring well network will include the existing wells shown on Figure 2.9 and two existing production wells.

" Sampling will be on a quarterly basis.

" Supplementary sampling will be conducted if flows in the Salt River exceed flows that occurred during the RI.

- At the completion of the remedial action currently provided for in this Remedial Action Plan, a methane and ambient air quality monitoring program will be developed and implemented to ensure compliance with ARARs.

5.3 IMPLEMENTATION OF THE REMEDIAL ACTION

5.3.1 General

A remediation plan will be prepared to identify steps necessary for implementing the recommended remedial action and achieving the goals of remedial action. In order to accomplish the goals and objectives of the remedial action, the following tasks are necessary:

- Prepare design and construction documents.

- Acquire permits.

- Select a qualified contractor.

- Construct the required site features under strict quality control and assurance.

- Operate and maintain the site facilities properly to protect the public health and the environment.

The following sections discuss the steps associated with carrying out the remedial action and presents an estimated schedule over which the plan can be implemented.

The information presented in these sections utilize the assumptions and the 10 percent conceptual design level documents presented in the feasibility study report. Modifications to design and construction features are to be expected during the final design, permitting, and construction process in order to accomplish the goals and objectives of the remediation plan.

5.3.2 Design and Construction Documents

Construction drawings and specifications will be prepared for all components of the project. These documents will be submitted for review by appropriate federal, state, county, and city agencies for regulatory compliance and be used as a basis for bids and subsequent construction. It is anticipated that the appropriate regulatory agencies will review the design documents at the 30 and 90 percent levels of design as well as at the completion of the design. In addition, it is assumed that prior to starting the design phase that additional geotechnical and geophysical work, and aerial and ground survey work will be required to further define surface and subsurface site conditions. The estimated schedule for developing design and construction is given on Figure 5.14.

It is anticipated that construction documents will consist of drawings that will include:

- Site location drawings.

- General plan showing the location of existing and proposed facilities, runoff diversion system, levee and soil cement bank protection system, grade control structure, storm drain pipe and outfall system, and methane collection system.

- Plans showing the location of borings, test pits, monitor wells, recommended borrow areas, and recommended stockpile areas.

- Plans, profiles, sections, and details for the following:

  - levee and soil cement bank protection system
  - grade control structure
  - widening of the Salt River channel
  - storm drain pipe and outfall system
  - single layer compacted soil cap
  - runoff diversion system
  - methane collection system
  - site security fence system

- Pertinent boring logs, test pit logs, and geologic cross sections.

- Plans showing location of required demolition activities.

- Plans and details for the dewatering systems.

- Miscellaneous plan, section, details, for required mechanical, electrical, and structural work.

Construction specifications will be required for use as part of the bid documents, and are anticipated to consist of:

- Instruction to bidders
- Bid forms
- General conditions
- Supplementary conditions
- Technical specifications, and
- Appendices–geotechnical and materials data

Following the preparation of the construction plans and specifications an engineer’s estimate of the construction cost will be required for comparison against contractor bids. The engineer’s estimate will be based on the actual bidding schedule(s) developed in the contract document.

5.3.3 Permit Application

Applicable permits and/or approvals for construction and operation will be obtained from various federal, state, county, and city agencies. As discussed earlier in this report, the appropriate regulatory agencies would review the design and construction documents at key points in the design for regulatory compliance. The agencies anticipated to be involved in the permitting, review, and/or approval process and their area of responsibility are as follows:

- N United States Environmental Protection Agency (USEPA)
  - ! Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
  - ! Superfund Amendments and Reauthorization Act (SARA)
  - ! National Pollutant Discharge Elimination System (NPDES) Permit for disposal of water in the Salt River

- N United States Army Corps of Engineers (USCOE)
  - ! Section 404 of the Clean Water Act (404 Permit)

- N Maricopa County Flood Control District (MCFCD)
  - ! Floodplain ordinances

- N Arizona Department of Water Resources (ADWR)
  - ! Dewatering Permit

- N Arizona Department of Environmental Quality (ADEQ)
  - ! Surface-Water Quality Standards
  - ! Resource Conservation and Recovery Act (RCRA)

- N Maricopa County Health Department (MCHD)
  - ! Air Quality Discharge Permit
  - ! Air Quality Standards

- N City of Phoenix
  - ! Right-of-way/easements
  - ! Land ownership
  - ! City floodplain regulations
  - ! Surface water diversion and discharge regulations

It is presumed that the design documents will be formally reviewed at the 30 and 90 percent levels of design as well as at the completion of the design. It is assumed that the agencies will require at least a 30-day review period after the 30 and 90 percent design submittal and a 90-day review period after submittal of the final design and permit application. The estimated schedule for this process is illustrated in Figure 5.14.

5.3.4 Contractor Selection

After the completion of the design and construction documents and the issuing of the appropriate permits, the project will be advertised for bids. All bids, once received, will have to be evaluated based on contractors qualifications and pricing. A contractor will be selected following this review process.

Following the selection of the contractor, a pre-construction meeting should be held among the principal parties involved in the remediation. The organization of the parties to the project is delineated at this meeting, and the decision-making authority is clarified and acknowledged. The network of information and communication specified at this meeting will be utilized throughout the projects implementation. At this meeting, the parties will analyze the project requirements and examine the contractors schedule for meeting requirements.

Throughout the term of the project, the principal parties would confer periodically. Those meetings are used to clarify all outstanding issues and questions, and to permit regular review of the progress of the remediation. The estimated schedule for these processes is included in Figure 5.14.

5.3.5 Site Remediation

Once the project has been planned, the schedule has been laid out, and all issues have been addressed by the contract documents or consent order, the actual remediation of the site begins. From the beginning, it is essential that the contractor and the construction management team:

- Maintain communications with regard to all construction activities.
- Direct the progress of the work to ensure that it advances correctly.
- Coordinate the work.
- Document all aspects of the work.

The preliminary assessment of the construction effort required for the remedial action plan is based on a number broad and qualified assumptions. The construction schedule assumes that a sequential order of construction activities would be followed, using reasonable amounts of equipment and resources. The schedule further assumes a single contractor will be utilized. The duration of the construction period is based on the quantities and scope of work developed in the feasibility study. The schedule duration further reflects consideration for various other aspects of the work such as:

- Dewatering of the project site.
- Procurement of select equipment required for the landfill gas collection.
- Environmental monitoring of the individual construction activities and the overall site operations.
- Standard efficiencies in the work effort.

The preliminary assessment of the duration of the construction effort does not include the adverse impact of encountering the following considerations:

- Encountering hazardous waste within the landfill requiring significantly different handling than the bulk of the material handling and the associated inefficiencies in the construction activities.
- The impact of severe weather and large flows in the Salt River.
- Limitations or restrictions on the availability of construction resources or materials which could significantly impact the construction progress.

A preliminary estimate of the duration of the construction effort required is shown in Figure 5.15. This duration is estimated assuming the construction effort will proceed in a logical progression to initially provide the shallow seated levees with soil cement bank protection for Cell A and Cell A-1 respectively, followed by the construction of the subsurface grade control structure.

The sequencing is predicated on the potentially very costly site dewatering requirements and constraint in the production of soil cement. Dewatering, the widening of the existing channel, the relocation of cell refuse, and the partial completion of the single layer compacted soil cap for Cell A and Call A-1 respectively will be an integral aspect of these activities.

The landfill gas collection system, the surface water collection and control facilities, and the storm drain outfall channel will be constructed within the same time frame.

Construction of the single layer compacted soil cap for Cell A and Cell A-1 will be complete once the refuse is relocated and the final configuration of the landfill is determined.

This evaluation is based on the assumption that a single prime contractor has limited resources. Various other scenario's using combinations of contracts and prime contractors could potentially apply. For example, the construction of the subsurface grade control struction in advance of any other work on site may provide an option to reduce the overall project duration. These various options would need further assessment as the scope of work is better defined and the project economies can be more accurately addressed.

Basic practices of construction management throughout the construction period will be followed in implementing the work. These practices include schedule control, quality control, quality, assurance, health and safety, competitive pricing and purchasing, project cost monitoring, manpower allocation, and site documentation.

The estimated schedule for the site remediation construction is illustrated on Figure 5.15.

5.3.6 Postconstruction Work and Operations Monitoring

At the completion of the final inspection and close-out of the construction contract, a construction report will be prepared to document each aspect of the project. Records of construction activities and inspection and materials data gained during construction will be summarized and compiled. The report will additionally provide a summary of the construction history complete with dates, names of contractors, names of persons involved, volumes of materials, types of equipment, details on excavations and installations, and other pertinent details.

As-built drawings of all components of the project will be maintained throughout the construction phase. They will be completed, reviewed, and finalized concurrently with the preparation of the construction report.

Operation and maintenance manuals will be prepared to provide operations and maintenance staff with the correct procedures for operating and maintaining the various installed systems. The estimated schedule for postconstruction is illustrated in Figure 5.16.

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**TABLE 1.1
CROSS REFERENCES BETWEEN RAP SECTIONS
AND WQARF REQUIREMENTS**

WQARF Citation (R18-7)	RAP Section, Table or Figure Number
108.A.1. (Name, title, etc. of person submitting plan)	Cover letter dated February 17, 1989
108.A.2. (The location and legal description of the site)	Figures 1.1 and. 1.2 and Table 1.2
108.A.3. (Description of the release of a hazardous substance)	1.3, 1.4
108.A.4. (Exposure routes, environmental effect and population)	Section 3.4
108.A.5. (Purpose and schedule of the remedial action)	Sections 1.6, 4.2, 5.1, 5.3
108.A.6. (Notarized statement regarding cost recovery)	Transmittal Letter
108.A.7. (Meeting requirements and criteria of RAP)	1.1, Table 1.1
108.A.8 (Expeditious RAP)	Section 4.5, Chapter 5.0
108.A.9. (Matching funds)	Not Applicable [a]
108.B.1. Review of the potential for release of hazardous substance)	Sections 2.2, 2.3, 2.4, 2.5
108.B.2. (Remedial Investigation)	Chapter 2.0
108.B.3. (Risk Assessment)	Chapter 3.0
108.B.4. (Health effects study)	Not Applicable
108.B.5. (Feasibility study)	Chapter 4.0
108.B.6. (Description of cleanup methods)	Chapter 5.0

Table 1.1 (continued)
Cross References Between RAP Sections
and WQARF Requirements

WQARF Citation (R18-7)	RAP Section, Table or Figure Number
108.B.7. (O&M, and monitoring plan)	Section 5.3
109.A.1. (Protect public health, welfare and environment)	Sections 4.3, 4.4, 4.5
109.A.2. (Beneficial use of waters of the state)	Chapters 4.0, 5.0
109.A.3. (Cost effective)	Sections 4.4, 4.5
109.A.4. (Consistent with A.R.S. 45-401 through 45-655)	Chapters 4.0, 5.0
109.B.6 (Description of clean-up, methods)	Chapter 5.0
109.C.6 (Description of clean-up methods)	Chapter 5.0
109.D.6 (Description of clean-up methods)	Chapter 5.0

[a]No monies from the Fund are sought for remedial action at the 19th Avenue Landfill.

TABLE 1.2
LEGAL DESCRIPTION OF 19TH AVENUE
LANDFILL PROPERTY, PHOENIX, ARIZONA

That part of the Southwest quarter of Section 19, Township 1 North, Range 3 East, G & SRB&M, described as follows:

COMMENCING at the South quarter corner of said Section 19; thence North 00 degrees 49 minutes 15 seconds West, along the North-South mid-section line of said Section 19, a distance of 1156-40 feet;

thence North 99 degrees 51 minutes 22 seconds West to the West line of the East 40 feet of said Southwest quarter and the POINT OF BEGINNING of this parcel description;

thence North 00 degrees 49 minutes 15 seconds West, along said West line, a distance of 1143.20 feet;

thence South 57 degrees 45 minutes 05 seconds West, a distance of 1094.11 feet;

thence South 81 degrees 35 minutes 36 seconds East, a distance of 380.58 feet;

thence South 00 degrees 51 minutes 22 seconds East, a distance of 492.55 feet;

thence South 88 degrees 51 minutes 22 seconds East, a distance of 558.00 feet to the POINT OF BEGINNING:

TOGETHER WITH that part of the West half of said Section 19 described as follows:

COMMENCING at the POINT OF BEGINNING of the parcel of land described herein-above;

thence North 00 degrees 49 minutes 15 seconds West, along the West line of the East 40 feet of said West half of Section 19, a distance of 1896.31 feet to the TRUE POINT OF BEGINNING of this parcel description;

thence North 00 degrees 49 minutes 15 seconds West, along the West line, a distance of 2094.65 feet;

thence North 86 degrees 35 minutes 45 seconds West, a distance of 510 feet;

thence North 00 degrees 49 minutes 15 seconds West, a distance of 460 feet;

thence North 88 degrees 50 minutes 45 seconds West, a distance of 2101.70 feet;

thence southerly, along said East line, a distance of 3943.49 feet;

thence North 88 degrees 12 minutes 27 seconds East, a distance of 562.00 feet;

thence North 68 degrees 26 minutes 16 seconds East, a distance of 588.80 feet;

thence North 58 degrees 06 minutes 18 seconds East, a distance of 1080.75 feet;

Table 1.2 (continued)
Legal Description of 19th Avenue Landfill Property, Phoenix, Arizona

thence North 55 degrees 19 minutes 20 seconds East, a distance of 436.20 feet;

thence North 40 degrees 06 minutes 21 seconds East, a distance of 357.39 feet to the TRUE POINT OF BEGINNING.

TABLE 1.3
SUMMARY OF ALTERNATIVES

Components of Alternatives	Preferred Alternative A	Alternative B	Alternative C	Alternative D
Refuse Washout Components				
Shallow-seated levee with bank protection for Cell A	Yes	Yes	Yes	Yes
Shallow-seated levee with bank protection for Cell A-1	Yes	No	Yes	No
Subsurface grade control structure across the river channel	Yes	Yes	Yes	Yes
Pipe and backfill for the storm drain outfall channel	Yes	Yes	Yes	Yes
Relocate Cell A-1 to Cell A	No	Yes	No	Yes
Wider river channel between Cell A and Cell A-1	Yes	Yes	Yes	Yes
Surface Water Quality Components				
Single-layer soil cap over Cell A	Yes	Yes	Yes	Yes
Single-layer soil cap over Cell A-1	Yes	No	Yes	No
Surface drainage at Cell A	Yes	Yes	Yes	Yes
Surface drainage at Cell A-1	Yes	No	Yes	No
Fence around Cell A	Yes	Yes	Yes	Yes
Fence around Cell A-1	Yes	No	Yes	No
Relocate A&B Silica Sand and All Chevy Auto Parts	Yes	Yes	Yes	Yes

Table 1.3 (continued)
Summary of Alternatives

Components of Alternatives	**Preferred Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Ground-Water Quality Components				
Ground-water quality monitoring	Yes	Yes	Yes	Yes
Ground-water well and pump system	No	Yes	Yes	
Ground-water treatement system	No	No	Yes	Yes
Ground-water treatment system	No	No	Yes	Yes
Landfill Gas Accumulation Components				
Landfill gas monitoring at Cell A	Yes	Yes	Yes	Yes
Landfill gas monitoring at Cell A-1	Yes	No	Yes	No
Landfill gas collection system at Cell A	Yes	Yes	Yes	Yes
Landfill gas collection system at Cell A-1	Yes	No	Yes	No
Landfill gas treatment system at Cell A	Yes	Yes	Yes	Yes
Landfill gas treatment system at Cell A-1	Yes	No	Yes	No

TABLE 2.1
ANALYTICAL PARAMETERS FOR SOIL AND REFUSE SAMPLES

Metals (EP - Toxicity)

As, Hg, Se, Cd, Pb, Cr, Ag, Ba

Metals (total)

As, Hg, Se, Cd, Pb, Cr, Be,

Cu, Ni, Zn, Sb, Ag, Ba, Tl

Organic Compounds

Volatiles, (EPA Method 8010), Aromatics

(EPA Method 8020), Pesticides/PCBs

(EPA Method 8080)

Indicators

TOX, TOC, pH, Cyanide, Phenols, Moisture,

Cation Exchange Capacity

TABLE 2.2
SUMMARY OF MOST FREQUENTLY OBSERVED ORGANIC CONSTITUENTS IN REFUSE MATERIAL

	Concentration (ppm)		No. of Detections		Physical Data [a]	
	Max.	Avg.	Borings	Samples	Solub (mg/l)	Vapor Press (atm)
ethylbenzene	32	5	10	20	152	0.01
1,4dichlorobenzene	6	1	10	20	79	1.0
Xylenes	30	6	6	12	180	0.008
toluene	13	4	6	10	530	0.04

[a] at 25E C

TABLE 2.3
CHEMICAL ANALYSIS FOR SURFACE-WATER INVESTIGATION

A. Surface-Water Samples

General Classification

Ions	Ammonia, Boron, Calcium, Chloride, Fluoride, Iron, Kjeldahl Nitrogen, Magnesium, Manganese, Nitrate, Phosphate, Potassium, Sodium, Sulfate
Metals (Dissolved)	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Zinc
Organics	EPA Method 601 (Volatiles) EPA Method 602 (Aromatics) EPA Method 608 (Pesticides/PCBs)
Indicators	Biological Oxygen Demand, Chemical Oxygen Demand, Coliform Bacteria, Cyanide, pH, Phenols, Total Dissolved Solids, Total Organic Halides, Total Organic Carbon

B. Sediment Samples

Total Metals	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Zinc
EP Toxicity Metals	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Thallium, Zinc
Organics	EPA Method 8010 (Volatiles) EPA Method 8020 (Aromatics) EPA Method 8080 (Pesticides/PCBs)
Indicators	Cation Exchange Capacity, Cyanide, Moisture, pH, Phenols, Total Organic Carbon, Total Organic Halides

TABLE 2.4
RELEASES FROM GRANITE REEF DIVERSION DAM[a]
1962 - 1987

Calendar Year	Duration of Flow (days)	Annual Volume of Flow (acre-ft)	Maximum Flow Rates cfs	Maximum Flow Rates Date
1962	0	0	0	-
1963	10	1,000	200	8-17
1964	7	7,000	2,600	8-01
1965	4	200,000	67,000	12-31
1966	33	38,000	53,000	1-01
1967	2	12,000	3,000	12-19
1968	26	106,000	3,700	2-15
1969	1	0	<100	3-10
1970	2	0	15,000	9-05
1971	1	0	<100	8-15
1972	9	75,000	10,000	12-27
1973	11	1,240,000	22,000	4-01
1974	6	1,000	300	8-03
1975	2	0	100	7-13
1976	7	2,000	500	2-09
1977	1	0	300	10-23
1978	41	1,389,000	95,800	3-03
	15	-	110,000	12-19
1978[b]	-	-	80,000	3-03
	-	-	129,000	12-19
1979	152	1,997,000	87,500	1-18
	-	-	51,800	3-29
1979[b]	-	-	85,400	1-19
	-	-	60,000	3-29
1980	91	2,061,000	137,700	2-16
1980[b]	-	-	185,000	2-16
1981	0	0	0	-
1982	40	178,000	9,000	3-14
1983	165	1,744,000	30,000	2-10
	41	-	45,000	10-03
	7	-	11,000	12-26
1984	29	270,000	25,600	12-28
1985	158	772,000	16,500	3-18
1986	29	6,000	900	4-05
1987[c]	37	N/A	2,500	3-22

a Source: Salt River Project, 1987
For years with multiple releases, only major releases (> 10,000 cfs) are shown. All volumes are rounded to the nearest 1,000 acre-ft. All flow rates are rounded to the nearest 100 cfs.

b Approximate; measured at the old Joint Head Dam about seven miles upstream from the landfill site.

c Data through April 15, 1987.

TABLE 2.5
CHEMICAL ANALYSIS FOR GROUND-WATER INVESTIGATION

General Classification	
Ions	Ammonia, Boron, Calcium, Chloride, Fluoride, Iron, Kjeldahl Nitrogen, Magnesium, Manganese, Nitrate, Phosphate, Potassium, Sodium, Sulfate
Metals (Dissolved)	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Zinc
Indicators	Biological Oxygen Demand, Chemical Oxygen Demand, Coliform Bacteria, Cyanide, pH, Phenols, Total Dissolved Solids, Total Organic Halides, Total Organic Carbon, Alkalinity, Radionuclides (alpha, beta)
Organics[a]	Volatile Organic Cpds. EPA (601, 602, 624) Semilolatile Organic Cpds. EPA (625) Pesticides and PCBS EPA (608) Acrolein and Acrylonitrile EPA (603) 2, 3, 7, 8 - TCDD EPA (613)

[a]EPA (601, etc.) denotes EPA Method for analysis of water samples.

TABLE 2.6
SUMMARY OF GROUND-WATER QUALITY PROGRAM FOR GEOLOGIC UNIT A

Well ID	Location	Metals	Inorganics	Indicators	Radioisotopes	Coliforms	Organics	Pesticides
(Wells Installed Prior to RI)								
I-1	On-site	I-VI	I-VI	I-VI	I-VI	I-VI	I-VI	I,VI
I-2	On-site	I-VI	I-VI	I-VI	I,III-VI	I-VI	I-VI	I,IV,VI
I-3	On-site	I-VI	I-VI	I-VI	I-VI	I-VI	I-VI	I,VI
I-4	On-site	I-VI	I-VI	I-VI	I,III-VI	I-V	I-VI	I,IV,VI
I-5	On-site	I-VI	I-VI	I-IV	I,III-VI	I-VI	I-VI	I,IV
I-6	On-site	I-VI	I-VI	I-VI	I-VI	I-VI	I-VI	I,VI
I-7	On-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	I,IV,VI
(Wells Installed During RI)								
DM-1@54'	On-site	IV,VI	IV,VI	IV,VI	IV,VI	-	VI	IV,VI
DM-1@86'	On-site	-	-	-	-	-	IV,VI	-
DM-1@122'	On-site	IV	IV	IV	IV	-	IV,VI	IV
DM-1@157'	On-site	-	-	-	-	-	IV,VI	-
DM-1@192'	On-site	IV,VI	IV,VI	IV,VI	IV	IV	IV,VI	IV,VI
DM-2@ 54'	Off-site	VI	VI	VI	VI	IV,VI	IV,VI	VI
DM-2@89'	Off-site	IV	IV	IV	IV	IV	IV,VI	IV
DM-2@124'	Off-site	-	-	-	-	-	IV,VI	-
DM-2@159'	Off-site	-	-	-	-	-	IV,VI	-
DM-2@194'	Off-site	IV,VI	IV,VI	IV,VI	IV,VI	IV,VI	IV,VI	IV,VI
DM-3P	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI
DM3I	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI
DM-3D	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI
DM-4	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI
DM-5S	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI
DM-5D	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI
DM-6	Off-site	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI	IV-VI

Note: Roman numerals refer to specific sampling rounds as listed below:

I - 3rd quarter 1986; II - 4th quarter 1986; III - 1st quarter 1987; IV - 2nd quarter 1987; V - 3rd quarter 1987, and VI - 4th quarter 1987.

TABLE 2.7
MAJOR ION CONCENTRATION IN GROUND WATER
MEAN ± STANDARD DEVIATION (mg/l)
EXISTING (I) WELLS

Parameter	Data Set[a]	I-1[b]	I-[b]	I-3[b]	I-4[b]	I-5[b]	I-6[c]	I-8[c]
Sodium	R	143 ± 6	135 ± 14	230 ± 14	253 ± 20	179 ± 13	277 ± 21	180 ± 9
	H	162 ± 60	134 ± 59	338 ± 128	298 ± 46	211 ± 76	254 ± 88	
Calcium	R	58 ± 1	58 ± 5	57 ± 9	61 ± 12	59 ± 12	88 ± 17	47 ± 6
	H	73 ± 23	62 ± 23	116 ± 65	80 ± 30	51 ± 24	80 ± 29	
Magnesium	R	28 ± 2	26 ± 2	39 ± 3	45 ± 5	27 ± 6	46 ± 4	32 ± 4
	H	37 ± 15	30 ± 11	69 ± 34	55 ± 19	27 ± 6	40 ± 14	
Bicarbonate	R	261 ± 15	235 ± 11	564 ± 59	520 ± 26	312 ± 48	323 ± 12	323 ± 54
	H	333 ± 72	299 ± 91	998 ± 30	644 ± 138		432 ± 98	
Sulfate	R	64 ± 10	66 ± 10	6 ± 4	8 ± 6	83 ± 30	150 ± 18	28 ± 9
	H	103 ± 56	81 ± 32	16 ± 14	22 ± 36	93 ± 30	115 ±41	
Chloride	R	187 ± 33	208 ± 34	302 ± 30	351 ± 19	225 ± 71	424 ± 39	230 ± 24
	H	199 ± 86	183 ± 111	474 ± 247	384 ± 159	256 ± 251	321 ± 167	
Total Dissolved Solids	R	672 ± 28	662 ± 35	1005 ± 76	1078 ± 77	841 ± 111	1263 ± 54	798 ± 69
	H	826 ± 246	600 ± 115	1625 ± 588	1301 ± 192		775 ± 173	1088 ± 262

a R - Remedial investigation and feasibility study data collected 8/86 - 12/87
H - Historical data collected 8/78 - 6/86

b Basedon six observations

c Based on three observations

TABLE 2.8
MAJOR ION CONCENTRATIONS IN GROUND WATER
MEAN ± STANDARD DEVIATION (mg/l)
NEW (DM) WELLS

Parameter	DM-1[b] @54'	DM-1[a] @122'	DM-1[b] @192'	DM-2[a] @54'	DM-2[a] @89'	DM-2[b] @194'	DM-3P[c]	DM-3I[c]	DM-3D[c]	DM-4[c]	DM- [c]
Sodium	272 ± 28	243	244 ± 14	387	210	271 ± 29	179 ± 10	253 ± 50	157 ± 8	164 ± 5	360 ± 4
Calcium	44 ± 9	41	60 ± 9	53	50	84 ± 8	51 ± 1	110 ± 42	39 ± 1	71 ± 7	101 ± 8
Magnesium	21 ± 5	18	27 ± 1	8	25	34 ± 4	24 ± 1	36 ± 10	20 ± 1	27 ± 0	40 ± 2
Bicarbonate	495 ± 124	231	277 ± 13	170	390	280 ± 20	288 ± 9	297 ± 30	83 ± 1	315 ± 9	325 ± 4
Sulfate	44 ± 52	84	146 ± 22	25	60	110 ± 54	90 ± 12	165 ± 38	34 ± 0	121 ± 8	174 ± 10
Chloride	265 ± 15	195	290 ± 18	742	227	291 ± 124	227 ± 36	360 ± 97	340 ± 11	186 ± 7	505 ± 34
Total Dissolved Solids	1005 ± 134	710	1040 ± 60	1300	900	1165 ± 135	773 ± 6	1143 ± 271	693 ± 21	790 ± 17	1487 ± 23

[a] One observation
[b] Two observations
[c] Three observations

TABLE 2.10
SUMMARY OF DETECTED METALS IN GROUND WATER
CONCENTRATIONS IN ug/l

CONSTITUENT	QTR/YR	I-1	I-2	I-3	I-4	I-5	I-6	I-8
ARSENIC	3RD/86	.	7	32	42	32	.	.
BARIUM	3RD/86	170	160	1940	2580	370	270	.
BERYLLIUM	3RD/86	.	13	12	13	16	14	.
CADMIUM	3RD/86	5	5	8	6	8	6	.
MERCURY	3RD/86	1.4	0.4	11	0.4	6	0.8	.
NICKEL	3RD/86	10	20	30	30	20	30	.
ZINC	3RD/86	30	10	.	10	60	10	.
ARSENIC	4TH/86	.	.	40	47	23	.	.
BARIUM	4TH/86	140	160	1200	2130	390	280	.
CHROMIUM (TOT)	4TH/86	.	.	10	20	.	.	.
MERCURY	4TH/86	.	.	.	.	0.8	.	.
NICKEL	4TH/86	20	.	50	70	20	30	.
ZINC	4TH/86	80	10	30	60	90	120	.
ARSENIC	1ST/87	.	.	28	46	19	.	.
BARIUM	1ST/87	90	110	1050	1680	350	310	.
BERYLLIUM	1ST/87	.	.	22	13	45	18	.
MERCURY	1ST/87	.	0.5	.	.	.	.	.
NICKEL	1ST/87	45	34	45	73	21	68	.
ZINC	1ST/87	76	73	64	68	101	158	.
ARSENIC	2ND/87	.	.	29	3	22	.	15
BARIUM	2ND/87	400	280	1660	160	600	420	1150
BERYLLIUM	2ND/87	.	.	.	.	.	11	.
CADMIUM	2ND/87	3	3	9	4	7	.	.
CHROMIUM (TOT)	2ND/87	.	.	10	.	.	.	.
COPPER	2ND/87	70	26	180	110	90	20	20
LEAD	2ND/87	2	.	2	.	2	.	.
MERCURY	2ND/87	.	.	.	.	.	0.6	.
NICKEL	2ND/87	.	40	40	50	.	60	45
SILVER	2ND/87	.	.	.	.	.	.	16
ZINC	2ND/87	25	20	20	30	100	110	30
ARSENIC	3RD/87	.	.	.	32	23	.	170
BARIUM	3RD/87	130	210	920	1620	510	190	.
CHROMIUM (TOT)	3RD/87	.	.	.	.	.	.	12
COPPER	3RD/87	.	.	.	72	.	12	.
NICKEL	3RD/87	50	50	50	90	30	70	30
ARSENIC	4TH/87	.	.	38	36	23	.	17
BARIUM	4TH/87	290	.	1280	1290	500	230	1180
BERYLLIUM	4TH/87	.	270	.	.	.	.	.
CADMIUM	4TH/87	.	.	.	.	.	4	.
COPPER	4TH/87	.	.	.	35	.	14	.
MERCURY	4TH/87	.	.	.	2	.	.	.
NICKEL	4TH/87	39	.	113	99	.	52	.
ZINC	4TH/87	53	30	69	77	99	139	25

Table 2.10 (continued)
Summary of Detected Metals in Ground Water
Concentration in ug/l

CONSTITUENT	QTR/YR	DM-1 54	DM-1 122	DM-1 192	DM-2 54	DM-2 89	DM-2 194
BARIUM	2ND/87	460	90	60	.	430	90
CADMIUM	2ND/87	3	3	.	.	.	.
COPPER	2ND/87	10	.	.	.	.	.
MERCURY	2ND/87	.	.	.	.	0.4	.
NICKEL	2ND/87	30	.	.	.	30	40
ZINC	2ND/87	34	20	30	.	17	94
ARSENIC	4TH/87	12	.	.	22	.	.
BARIUM	4TH/87	550	.	100	580	.	140
NICKEL	4TH/87	44	.	.	.	.	.
ZINC	4TH/87	12	.	16	33	.	36

CONSTITUENT	QTR/YR	DM-3D	DM-3I	DM-3P	DM-4	DM-5D	DM-5S	DM-6
BARIUM	2ND/87	60	.	130	.	.	.	60
CADMIUM	2ND/87	.	.	3	.	3	.	.
CHROMIUM (TOT)	2ND/87	37	22	.	30	16	17	12
COPPER	2ND/87	13	14	.	14	.	.	19
LEAD	2ND/87	.	.	.	.	2	2	.
ZINC	2ND/87	.	20	16	23	33	5	22
BARIUM	3RD/87	70	150	.	90	230	150	110
LEAD	3RD/87	.	2	.	.	.	.	.
NICKEL	3RD/87	.	30	30	30	40	40	30
ZINC	3RD/87	12	32	17	11	24	36	27
BARIUM	4TH/87	170	260	130	140	300	150	150
CADMIUM	4TH/87	.	.	.	.	4	4	.
ZINC	4TH/87	.	29	19	32	41	41	37

TABLE 2.11
VOC CONCENTRATIONS EXCEEDING 5 ug/l
OR THE MCL FOR VINYL CHLORIDE

Compound	Qtr/Yr	Concentration (ug/l)		
		Well I-1	Well I-2	DM-1
1,1,1-Trichloroethane	1/87	6.5		
	3/87	15.8		
	4/87	11		
Trans-1,2-dichloro-ethylene	3/86		5.1	
		4/86	11	
	3/87	7.5		
	4/87	10		
1,1-Dichloroethane	4/86	11		
	1/87	64		
	2/87	5.6		
	3/87	8.5		
	4/87	20		
Carbon tetrachloride	4/86	35		
1,1 Dichloroethylene	4/87			5.4
Chloroethane	1/87	6.0		
Vinyl chloride*	3/86	2.5	2.5	
	3/87	2.6		

*MCL for vinyl chloride = 2.0 ug/l

TABLE 2.12
SUMMARY OF CONCENTRATIONS FOR BOD, COD, AND TOC

	Well ID	BOD (mg/l)	COD (mg/l)	TOC (mg/l)
On-Site Wells	I-1	26	60	2.6
	I-2	32	38	3.5
	I-3	34	78	25
	I-4	29	88	21
	I-5	38	57	4.4
	I-6	36	39	15
	I-8	29	39	11
	Mean	32	57	12
Off-Site Wells*	DM-3P	36	77	4.1
	DM-4	62	154	1.8
	DM-5S	53	106	0.6
	DM-6	71	100	1.6
	Mean	56	109	2.0

*For wells penetrating upper portion of UAU only.

TABLE 2.13
CITY OF PHOENIX 19TH AVENUE LANDFILL
RADIOISOTOPE DATA CONCENTRATIONS IN pCi/L

WELL	LEVEL	DATE	GROSS ALPHA		GROSS BETA		RADIUM 226		RADIUM 228	
DM-1	54	870824	-2.7	1.8	10.7	5.6	0.5	0.1	0	1
DM-1	54	871217	-0.1	3.2	17.8	6.6	.	.	.	.
DM-1	122	870825	2.0	2.6	2.9	5.6	0.0	0.1	0	1
DM-1	192	870825	0.2	1.9	2.1	3.3	0.2	0.1	0	1
DM-1	192	871217	10.2	2.7	16.2	6.8	.	.	.	.
DM-2	54	871217	-8.0	6.1	11.8	10.6	.	.	.	.
DM-2	89	870825	-2.3	2.7	9.4	5.2	0.7	0.1	0	1
DM-2	194	870826	0.3	2.2	4.1	4.3	0.6	0.1	0	1
DM-2	194	871217	-2.1	8.4	14.9	11.6	.	.	.	.
DM-3D		870818	-0.8	2.6	5.6	4.9	0.2	0.1	0	1
DM-3D		871021	-2.6	1.6	3.9	4.9	.	.	.	.
DM-3D		871217	0.7	4.5	4.8	5.4	.	.	.	.
DM-3I		870818	-3.0	2.7	8.9	5.4	0.3	0.1	0	1
DM-3I		871021	1.8	4.4	4.0	8.0	.	.	.	.
DM-3I		871218	-2.8	4.34	9.4	10.0	.	.	.	.
DM-3P		870819	-3.4	4.5	9.5	3.4	0.0	0.1	0	1
DM-3P		871023	-1.7	1.2	9.0	5.5	.	.	.	.
DM-3P		871217	-2.8	1.3	0.4	6.3	.	.	.	.
DM-4		870818	1.3	3.5	12.4	5.9	0.6	0.1	0	1
DM-4		871021	0.4	1.6	4.1	5.2	.	.	.	.
DM-4		871216	-5.7	4.8	8.8	6.2	.	.	.	.
DM-5D		870820	-0.7	2.8	8.2	5.8	0.0	0.1	0	1
DM-5D		871021	-0.7	3.7	6.8	9.1	.	.	.	.
DM-5S		870820	-1.4	3.2	10.5	5.9	0.4	0.1	0	1
DM-5S		871020	1.8	6.1	8.7	12.2	.	.	.	.
DM-5S		871216	0.8	2.3	4.1	6.2	.	.	.	.
DM-6		870818	-0.5	2.4	11.5	4.3	0.3	0.1	0	1
dm-6		871022	-1.4	1.4	6.4	8.2	.	.	.	.
Dm-6		871216	-2.1	2.4	4.1	5.1	.	.	.	.
I-1		860821	-2.4	2.9	8.3	3.8	.	.	.	.
I-1		870331	4.6	2.1	7.9	6.0	.	.	.	.
I-1		870728	-2.1	2.8	8.8	5.8	0.7	0.1	0	2
I-1		871019	-2.0	3.8	3.5	5.2	.	.	.	.
I-1		871214	-2.4	1.4	6.6	5.5	.	.	.	.
I-2		860821	-2.5	2.8	3.3	3.9	.	.	.	.
I-2		870331	-0.9	4.0	7.5	5.4	.	.	.	.
I-2		870728	-0.4	0.7	2.2	1.5	0.0	0.1	0	2
I-2		871019	0.5	1.8	19.4	6.1	.	.	.	.
I-2		871214	0.9	9.4	4.6	5.4	.	.	.	.
I-3		860822	1.9	5.7	57.0	10.7	.	.	.	.
I-3		861016	-0.9	3.4	122.0	8.7	.	.	.	.
I-3		870331	-1.4	1.8	33.0	8.1	.	.	.	.
I-3		870724	0.8	5.9	3.5	5.3	1.0	0.1	0	2
I-3		871019	-1.5	3.6	37.8	8.2	.	.	.	.
I-3		871217	-3.7	2.6	53.8	9.2	.	.	.	.
I-4		860821	0.1	6.2	8.8	7.4	.	.	.	.
I-4		870331	-0.2	2.5	39.6	8.0	.	.	.	.
I-4		870727	0.2	1.9	31.5	7.8	1.0	0.1	0	2
I-4		871020	-0.3	3.4	21.9	10.1	.	.	.	.
I-4		871215	-2.9	3.8	32.8	8.1	.	.	.	.
I-5		860822	-1.7	3.7	13.8	7.5	.	.	.	.
I-5		870401	17.9	4.2	8.7	6.2	.	.	.	.
I-5		870727	-0.8	2.6	15.6	6.1	0.7	0.1	0	2
I-5		871020	-4.3	4.2	19.2	10.8	.	.	.	.
I-5		871215	-0.6	2.8	13.9	5.8	.	.	.	.
I-6		860821	-4.1	8.1	22.0	17.2	.	.	.	.
I-6		861016	0.1	2.4	92.8	12.6	.	.	.	.
I-6		870401	4.1	2.7	4.0	6.5	.	.	.	.
I-6		870724	2.9	3.2	11.9	6.5	0.0	0.1	0	1
I-6		871020	-2.0	3.7	8.7	11.4	.	.	.	.
I-8		870731	4.0	6.5	9.6	6.0	0.3	0.1	0	1
I-8		871023	-2.8	4.6	8.0	5.1	.	.	.	.
I-8		871218	-2.4	3.8	11.9	6.3	.	.	.	.

**TABLE 2.14
SUMMARY OF DETECTIONS AT OR ABOVE MAXIMUM CONTAMINANT LEVELS
19TH AVENUE LANDFILL**

Well	Location	Compound	MCL (ug/l)	No. of Detections Above MCL/ No. of Samples	Maximum Conc. Observed
DM-5S	Upgradient	Nitrate	10 mg/L-N	3/3	16.0
DM-5D	Upgradient	Nitrate	10 mg/L-N	3/3	14.9
I-6	Boundary Cell A-1	Gross Beta	50 pCi/L	1/6	92.8
I-5	Boundary Cell A-1	Gross Alpha	15 pCi/L	1/6	17.9
I-1	Boundary Cell A	CarbonTetra- chloride	5.0	1/6	35.1
		Vinyl Chloride	2.0	2/6	2.6
I-2	Boundary Cell A	Vinyl Chloride	2.0	1/6	2.5
I-3	Boundary Cell A	Gross Beta Barium	50 pCi/L 1.0	3/6 5/6	122 1.94
I-4	Boundary Cell A	Barium Mercury	1.0 mg/L 2.0	5/6 1.6	2.58 2.0
I-8	Boundary Cell A	Vinyl Chloride Barium	2.0 1.0 mg/L	1/3 2.3	2.0 1.18
		Arsenic	50.0	1/3	170
DM-1-54	Down- gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-1-86	Down- gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-1-22	Down- gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-1-157	Down- gradient Cell A	NO COMPOUNDS ABOVE MCL			

Table 2.14 (continued)
Summary of Detections Above Maximum Contaminant Levels

Well	Location	Compound	MCL (ug/l)	No. of Detections Above MCL/ No. of Samples	Maximum Conc. Observed
DM-1-192	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-2-54	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-2-89	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-2-124	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-2-159	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-2-194	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-3P	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-3I	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-3D	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-4	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			
DM-6	Down-gradient Cell A	NO COMPOUNDS ABOVE MCL			

TABLE 2.15
COMPARISON OF COMPOUNDS FOUND IN BORINGS DB-2 AND WELL I-1

Compound	Boring DB-2	Well I-1
Phenols	Yes	No
Xylenes	Yes	No
Ethylbenzene	Yes	No
Chlorobenzene	Yes	No
Toluene	Yes	No
Tetrachloroethene	Yes	Yes
Trans-1,2-DCE	Yes	Yes
1,2-dichlorobenzene	Yes	Yes
1,1-dichloroethane	Yes	Yes
1,1-dichloroethene	No	Yes
Trichloroethene	No	Yes
Trichloroethane	No	Yes
Vinyl Chloride	No	Yes

TABLE 2.16
SUMMARY OF TOTAL HYDROCARBON CONCENTRATIONS (% V/V)
IN CITY OF PHOENIX SUBSURFACE GAS PROBES

Probe No.	1986 Mean (max./min.)		1987 Mean (max./min.)	
1*	7	(23/0)	6	(16/0)
2	12	(28/0)	14	(28/1)
3	14	(37/0)	15	(32/1)
4		**		**
5	6	(20/0)	8	(23/0)
6	<1	(2/0)	0	(0/0)
7	4	(18/0)	10	(21/0)
8	3	(14/0)	8	(18/0)
9	<1	(3/0)	15	(35/0)
10	5	(19/0)	8	(24/0)
11*	<1	(trace/0)	2	(6/0)
12*	<1	(trace/0)	<1	(trace/0)
13	14	(42/0)	16	(34/0)
14*	12	(37/0)	23	(36/0)
15*	<1	(1/0)	6	(25/0)
16*	<1	(3/0)	2	(6/0)
16A*	0	(0/0)	<1	(trace/0)
17	<1	(2/0)	<1	(trace/0)
18	6	(27/0)	22	(40/0)
19*	<1	(1/0)	<1	(trace/0)
20*	<1	(1/0)	<1	(trace/0)
21	5	(14/0)	<1	(4/0)
22 (Cell A-1)	3	(12/0)	2	(16/0)
23 (Cell A-1)	1	(5/0)	5	(12/0)

* Off-site probe

** Probe not available

TABLE 2.17
SHORT-TERM CONCENTRATIONS OF COMPONENT HYDROCARBONS (ppb)
OBTAINED IN CITY OF PHOENIX SUBSURFACE GAS PROBES
USING PORTABLE GAS CHROMATOGRAPH

Probe No.	Date (Hour-MST)		BNZ	TOL	TCE	TCA	PCE
2	11/3/87	(1459)	ND	ND	ND	ND	ND
3	11/3/87	(1507)	T	T	ND	ND	ND
	11/4/87	(1456)	ND	ND	T	ND	ND
	11/5/87	(1434)	ND	ND	ND	ND	ND
	11/6/87	(1417)	ND	ND	1200	ND	ND
	11/7/87	(1150)	ND	ND	ND	ND	ND
5	11/3/87	(1556)	ND	ND	T	ND	ND
6	11/3/87	(1531)	ND	ND	ND	ND	ND
7	11/3/87	(1538)	ND	ND	T	ND	ND
8	11/3/87	(0945)	ND	ND	ND	ND	ND
	11/3/87	(1608)	ND	ND	T	ND	ND
	11/4/87	(1635)	ND	2500	7000	ND	ND
	11/7/87	(0913)	26	ND	ND	ND	ND
13	11/3/87	(1050)	ND	ND	ND	ND	ND
	11/5/87	(1327)	ND	ND	ND	ND	ND
	11/6/87	(1227)	ND	ND	ND	ND	ND
14 *	11/3/87	(1011)	ND	ND	ND	ND	ND
	11/4/87	(1557)	ND	ND	1100	T	ND
	11/6/87	(1555)	ND	ND	ND	ND	ND
15 *	11/3/87	(1034)	ND	ND	ND	ND	ND
	11/7/87	(0958)	12	ND	ND	ND	ND
18	11/3/87	(1042)	ND	ND	ND	ND	ND
21 *	11/3/87	(1119)	ND	ND	ND	ND	ND
	11/4/87	(1626)	ND	ND	ND	ND	ND
	11/5/87	(1352)	ND	ND	ND	ND	ND
	11/7/87	(1103)	ND	ND	ND	ND	ND

ND - not detect (<1 ppb)
T - trace amount (detected, but too low to quantify)
* - off-site probe

TABLE 2.18
CONCENTRATION OF THE MAJOR GAS COMPONENTS IN THE SUBSURFACE GAS COLLECTION SYSTEM (% VOLUME)

Compound	Sample GCS-1[a]	Sample GCS-2[b]
Oxygen and/or Argon	0.85	6.8
Nitrogen	60.7	60.7
Methane	18.6	15.7
Carbon Dioxide	19.9	15.1
Carbon Monoxide	ND	ND

ND - not detected

Detection Limits: 0.01% volume for sample GCS-1
0.5% volume for sample GCS-2

[a]Collected December 28, 1987

[b]Collected January 13, 1988

TABLE 2.19
CONCENTRATIONS OF ORGANIC COMPOUNDS IN SUBSURFACE GAS

	Concentration (ppb)		
Compound	GCS-1[a]	GCS-2[a]	GRN-1
Acetone	340	100	ND
Benzene	100	200	50
2-Butanone	50	ND	ND
Chlorobenzene*	15	ND	ND
1,1-dichloroethane	15	ND	ND
1,2-dichloroethene (trans)	40	ND	ND
Ethylbenzene*	55	ND	ND
2-Hexanone	12	ND	ND
Tetrachloroethene*	4	ND	ND
Toluene	4,500	200	1,600
1,1,1-Trichloroethane*	18	ND	ND
Trichloroethene*	18	ND	ND
Vinyl Chloride	46	ND	ND
Xylenes	115	100	50

[a] GCS -1 and GCS-2 were grab samples collected from the manifold of the gas collection system on December 28, 1987 and January 13, 1988 respectively.

[b] GRN-1 was a grab sample collected from a ground crack near the center of the landfill on January 13, 1988.

* Quantitation uncertain in sample GCS-1.

TABLE 2.20
SHORT-TERM AMBIENT CONCENTRATIONS OF COMPONENT HYDROCARBONS IN UNRESTRICTED AREAS. NOVEMBER 3-7, 1987
(Samples Analyzed Using Portable Gas Chromatograph)

Location	Date (Hour-MST)		Concentration (ppb) BNZ	TOL	TCE	TCA	PCE
ACAP	11/3/87	(0853)	ND	ND	ND	ND	ND
*Between 8W and 9W		(1128)	ND	ND	ND	ND	ND
Between 8W and 9W		(1134)	ND	ND	ND	ND	ND
SW corner of system fence		(1446)	ND	ND	ND	ND	ND
NW corner Tallow Fence	11/4/87	(1450)	ND	ND	ND	ND	ND
Near Probe #3		(1500)	ND	ND	ND	ND	ND
W of PVC Pipe		(1508)	ND	ND	ND	ND	ND
W of PVC Pipe		(1513)	ND	ND	ND	ND	ND
BIRP Lot		(1551)	58	ND	48	ND	ND
Tanner Lot		(1610)	10-20	10-20	ND	10-20	ND
Tanner Lot		(1618)	ND	ND	ND	ND	ND
19th/Lower Buckeye		(1641)	ND	ND	ND	ND	ND
Near Probe #13	11/5/87	(1321)	ND	ND	ND	ND	ND
*600' E 7W	11/6/87	(1150)	17	ND	ND	ND	ND
600' E 7W	11/6/87	(1150)	17	ND	ND	ND	ND
Near Probe #13		(1218)	120	ND	ND	ND	ND
500' E 17W		(1238)	16	ND	ND	ND	ND
1000' E 17W		(1248)	169	ND	ND	ND	ND
1500' E 17W		(1258)	11	ND	ND	ND	ND
1800' E 12W		(1308)	9	ND	ND	ND	ND
1900' E 12W		(1315)	5	ND	ND	ND	ND
900' E 7W	11/6/87	(1322)	104	ND	ND	ND	ND
800' E 11W	11/6/87	(1346)	101	ND	ND	ND	ND
Near Probe #6		(1356)	95	ND	ND	ND	ND
Near Probe #3		(1411)	ND	ND	ND	ND	ND
NW Corner Tallow Fence		(1426)	ND	ND	85	ND	ND
NW Corner Tallow Fence		(1434)	ND	ND	117	ND	ND
Near 15N		(1440)	ND	ND	ND	ND	ND
Near 13N		(1445)	ND	ND	ND	ND	ND
Between 11N and 12N		(1449)	ND	ND	ND	ND	ND
N-Tallow Fence		(1455)	ND	ND	ND	1100	ND
15th/Lower Buckeye		(1458)	ND	ND	ND	ND	ND
E of Tallow Plant		(1503)	ND	ND	ND	ND	ND

*Refers to collection system extraction well numbers.

**Table 2.20 (continued)
Short-Term Ambient Concentrations of Component Hydrocarbons
in Unrestricted Areas**

Location	Date (Hour-MST)		Concentration (ppb) BNZ	TOL	TCE	TCA	PCE
19th/Lower Buckeye		(1512)	ND	ND	ND	ND	ND
Waste Mgt. Lot		(1530)	ND	ND	ND	ND	ND
ACAP Lot		(1545)	ND	ND	ND	ND	ND
BIRP Lot		(1550)	ND	ND	ND	ND	ND
Chevron Lot		(1601)	ND	ND	ND	ND	ND
Tanner Lot		(1606)	ND	ND	ND	ND	ND
Near Probe #8	11/7/87	(0859)	71	ND	ND	ND	ND
S-Waste Mgt. Lot		(0923)	22	ND	ND	ND	ND
ACAP Lot		(0927)	18	ND	ND	ND	ND
Chevron Lot		(0942)	13	ND	ND	ND	ND
BIRP Lot		(0947)	13	ND	ND	ND	ND
BIRP Lot	11/7/87	(0952)	10	ND	ND	ND	ND
Near Probe #13		(1004)	10	ND	ND	ND	ND
19th Ave./Adams		(1011)	11	ND	ND	ND	ND
Tanner Lot		(1046)	ND	ND	ND	ND	ND
Near Probe #21		(1057)	ND	ND	ND	ND	ND
15th/Lower Buckeye		(1114)	ND	ND	ND	ND	ND
E of Tallow Plant		(1120)	20	ND	ND	ND	ND
Near Probe #3		(1136)	336	4	ND	ND	ND
Near Probe #3		(1143)	4	ND	ND	ND	ND
Near Proble #3		(1159)	ND	ND	ND	ND	ND
E Probe #6		(1204)	ND	ND	ND	ND	ND
600' E 7W		(1209)	ND	ND	ND	ND	ND
500' E 12W		(1215)	ND	ND	ND	ND	ND
1600' E 12W		(1224)	ND	ND	ND	ND	ND
400' SE 13N		(1229)	36	ND	ND	ND	ND
NW Corner Tallow Fence		(1236)	ND	ND	ND	ND	ND
N-Tallow Fence		(1241)	ND	ND	ND	ND	ND
Near Probe #8		(1250)	ND	ND	ND	ND	ND
S-Waste Mtg. Lot		(1255)	ND	ND	ND	ND	ND
Near Probe #13		(1258)	ND	ND	ND	ND	ND
Near Probe #8		(1302)	ND	ND	ND	ND	ND
19th Ave./Adams		(1308)	ND	ND	ND	ND	ND

TABLE 2.21
SHORT-TERM AMBIENT CONCENTRATIONS OF COMPONENT HYDROCARBONS IN RESTRICTED AREAS. NOVEMBER 3-7, 1987
(Samples Analyzed Using Portable Gas Chromatograph)

			Concentration (ppb)				
Location	**Date (Hour-MST)**		**BNZ**	**TOL**	**TCE**	**TCA**	**PCE**
*BIRP Pit	11/3/87	(1027)	ND	ND	ND	ND	ND
Tanner Pit		(1112)	ND	ND	ND	ND	ND
ACAP Shed	11/4/87	(1536)	ND	ND	80	ND	ND
Tanner Pit		(1616)	ND	ND	1300	ND	ND
ACAP Shed	11/6/87	(1536)	ND	ND	ND	ND	ND
Tanner Pit		(1612)	ND	ND	ND	ND	ND
ACAP Shed	11/7/87	(0931)	13	ND	ND	ND	ND
ACAP Shed		(0937)	13	ND	ND	ND	ND
Tanner Pit		(1052)	ND	ND	ND	ND	ND

* - Not accessible
ND - Not Detected (<1 ppb)

TABLE 2.22
TEST DATA FOR GAS EXTRACTION WELLS WITH ALL OTHER WELLS CLOSED

Extraction Well[a]	Valve Position (degrees)	Range of Well Pressures[b] (inches of H_2) Low	Range of Well Pressures[b] (inches of H_2) High	Range of Flow Rates (feet/min) Low	Range of Flow Rates (feet/min) High	Obs. Well	Pressure[b] (inches of H_2)	Distance[c] (feet)
15N	90	2.3	4.5	1100	1800	GP15N	0.29	39
15N	60	2.0	4.2	1000	1600	GP15N	0.27	39
15N	40	1.5	2.5	900	1400	GP15N	0.24	39
15N	20	0.5	0.7	250	500	GP15N	0.07	39
3N	90	3.4	8.1	350	600	GP3N	0.00	30
5W	90	0.7	3.2	250	700	GP5WA	0.01	38
5W	60	2.4	3.6	550	700	GP5WA	0.07	38
5W	40	2.0	2.8	500	600	GP5WA	0.03	38
5W	20	0.4	0.4	200	240	GP5WA	0.01	38
5W	90	0.7	3.2	250	700	GP5WB	0.00	115
5W	60	2.4	3.6	550	700	GP5WB	0.00	115
5W	40	2.0	2.8	500	600	GP5WB	0.00	115
5W	20	0.4	0.4	200	240	GP5WB	0.00	115
6W	90	2.4	3.4	850	1020	GP5WB	0.00	118
6W	60	2.6	3.4	900	1020	GP5WB	0.00	118
6W	40	2.1	2.5	780	900	GP5WB	0.00	118
6W	20	0.4	0.4	240	280	GP5WB	-0.07	118
9W	90	0.2	1.6	500	2400	GP9W	0.03	16
9W	60	0.2	1.6	500	2300	GP9W	0.03	16
9W	40	0.2	1.0	400	1700	GP9W	-0.01	16
9W	20	0.0	0.0	200	450	GP9W	-0.06	16
12W	90	0.4	3.0	60	1100	GP12W	0.37	19
12W	60	0.4	2.8	60	1050	GP12W	0.35	19
12W	40	0.4	2.1	60	850	GP12W	0.28	19
12W	20	0.2	0.2	60	300	GP12W	0.06	19

a Gas extraction wells are 4 inches in diameter. Valve position of 90E is fully open.

b Pressure in observation well. Positively signed pressures are increments below atmospheric pressure.

c Distance between extraction well and observation well.

TABLE 2.23
TEST DATA FOR GAS EXTRACTION WELLS
WITH ALL WELLS FULLY OPEN (90E)

	Range of Well Pressures[a] (inches of H_2O)		Range of Flow Rates (feet.min)	
Well	**Low**	**High**	**Low**	**High**
15N	0.48	0.55	380	380
3N	–	–	230	350
5W	-0.04	0.92	60	350
9W	0.20	0.42	250	920
12W	0.28	0.42	120	180

a Positively signed pressures are increments below atmospheric pressure.

TABLE 2.24
VOLUME FLOW RATES FOR GAS EXTRACTION WELLS AT
A VARIETY OF VALVE POSITIONS

	Average Volume Flow Rate (cfm)				
	Valve Positions All Other Wells Closed				
Well	**90E**	**60E**	**40E**	**20E**	**All Wells Fully Open (90E)**
15N	127	113	100	33	33
3N	41	-	-	-	25
5W	41	54	48	19	18
6W	82	84	73	23	-
9W	127	122	92	28	51
12W	51	48	40	16	13

TABLE 2.25
LINEAR BEST FIT OF VOLUME FLOW RATE VERSUS PRESSURE DROP[1]

Well[2]	**b**	**a_1**	**R**
15N	23	185	0.96
5W(A)	14	N/A	0.99
5W(B)	14	N/A	0.99
6W	12	N/A	0.99
9W	21	543	0.99
12W	12	137	0.99

[1] Linear best fit for equation (1): $Q = \{a_1/\ln(r/r_w)](p_w - p_r) + b$

[2] 5W(a) and 5W(B) refer to data associated with observation well GP5WA and GP5WB, respectively. Other wells are associated with only one observation well, as indicated in Table 5-9.

R in column4 is correlation coefficient.

TABLE 3.1
SUMMARY OF GROUNDWATER ANALYSES
(AT 19TH AVENUE LANDFILL (ug/l or ppb)

	Presently Relevant and Appropriate	Not Presently Relevant and Appropriate	Not Presently Relevant and Appropriate but Potentially Relevant and Appropriate in the Future		
Compound	**SDWA Primary MCL[(a)]**	**SDWA MCLG[(b)]**	**Excell 10^{-6} Risk[(c)]**	**ADEQ Action Level Water[(d)]**	**Range of Detected Concentration**
Bromodichloromethane	100[(e)]	–	–	–	ND-0.3
Bromomethane	–	–	–	2.5	ND-0.7
Carbon Tetrachloride	5	0	0.42	5	ND-35.1
Chlorobenzene	–	–	–	–	ND-2.9
Chloroethane	–	–	–	–	ND-6.0
Chloroform	100[(e)]	–	0.19	3.0	ND-1.0
Chloromethane	–	–	–	0.5	ND-1.37
1,2 Dichlorobenzene	–	–	–	–	ND-4.0
1,4 Dichlorobenzene	75	75	–	–	ND-3.6
1,1 Dichloroethane	–	–	–	–	ND-64.3
Dichloodifluoromethane	–	–	–	1.0	ND-1.9
1,1 Dichloroethene	7	77	0.033	7	ND-5.4
Trans 1,2 DCE	–	–	–	–	ND-10.7
Freon	–	–	–	–	ND-1.2
Methylene Chloride	–	–	–	4.7	ND-7.6
Toluene	–	–	–	2,000	ND-0.9
Tetrachloroethene	–	–	0.88	1.0	ND-2.5
1,1,1 Trichloroethane	200	200	–	200	ND-15.8
Trichloroethene	5	0	2.8	5	ND-2.4
Trichlorofluoromethane	–	–	–	1.0	ND-1.1
Vinyl Chloride	2	0	–	2.0	ND-2.6

Table 3.1 (continued)
Summary of Ground Water Analyses
at 19th Avenue Landfill (ug/l or ppb)

	Presently Relevant and Appropriate	Not Presently Relevant and Appropriate	Not Presently Relevant and Appropriate but Potentially Relevant and Appropriate in the Future		
Compound	SDWA Primary MCL[(a)]	SDWA MCLG[(b)]	Excell 10^{-6} Risk[(c)]	ADEQ Action Level Water[(d)]	Range of Detected Concentration
Antimony	–	–	–	–	ND-3
Arsenic	50	–	–	–	ND-17
Barium	1,000	–	–	–	ND-2,580
Beryllium	–	–	0.0039	–	ND-270
Cadmium	10	–	–	–	ND-9
Chromium (Total)	50	–	–	–	ND-37
Copper	–	–	–	–	ND-180
Lead	50	–	–	–	ND-13
Mercury	2	–	–	–	ND-11
Nickel	–	–	–	–	ND-226
Selenium	10	–	–	–	ND-2
Silver	50	–	–	–	ND-16
Zinc	–	–	–	–	ND-158

ND = Not Deleted
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
Note - Compounds ending in ‘ethene’ may also be referenced as ‘ethylene’ in other literature.

References:
[a]40 CFR 141 and 143
[b]40 CFR 141.50
[C]45 FR 79318-79379; November 28, 1980 (Level at which one additional case of cancer would be expected to result, assuming one million persons drank two liters of water with this contaminant level every day for 70 years) as currently calculated
[d]Arizona Dept. of Environmental Quality (ADEQ) Draft policy for establishing drinking water action levels, revised march 13, 1987.
[e]Based on the standard for total trihalomethanes of 100 ug/l

TABLE 3.2
ADHS SUGGEST HEALTH-BASED CLEANUP LEVELS
FOR CONTAMINANTS IN SOILS (ug/kg)

TCE	320
1,1-DCE	700
1,2-DCE	700
4,4'-DDE	1,000
4,4'-DDT	1,000
Chromium	1,500,000
Arsenic	100,000
Barium	5,000,000
Cadmium	1,000
Lead	700,000
Mercury	5,000
Zinc	2,000,000
PCE	67
PCBs	0.79
Trichlorofluoromethane	19.0
Toluene	200,000
Ethylbenzene	68,000
Xylene	44,000
o-dichlorobenzene	62,000
p-dichlorobenzene	7,500

Sources: 1) ADHS draft policy for establishing drinking water action levels, March 13, 1987

2) CH2M Hill Draft RI/FS - Phoenix - Goodyear Superfund Site, 1989

TABLE 4.1
APPLICABILITY OF GENERAL RESPONSE ACTIONS TO SPECIFIC OBJECTIVES[a]

Potential General Reponse Actions	Refuse-Washout Objective	Surface-Water Quality Objective	Ground-Water Quality Objective	Landfill-Gas Accumulation Objective
No Action	X	X	X	X
Containment	X	X	X	X
Pumping	1	2	X	1
Collection	1	2	X	X
Diversion	4	X	X	1
Complete Removal	3	3	3	3
Partial Removal	X	2	3	2
On-Site Treatment	2	1	X	X
Off-Site Treatment	2	1	X	1
In Situ Treatmenet	X	1	X	X
Storage	2	1	2	2
On-Site Disposal	X	3	3	1
Off-Site Disposal	3	3	3	1
Alternative Water Supply	1	1	2	1
Relocate Receptors	2	2	2	2

a. X: The general response action is applicable.
1. The general response action was not applicable to area of concern.
2. The general response action would not be effective in satisfying the specific objective.
3. The general response action would require a remedy that would be unreasonable to implement or prohibitive to cost.
4. “Diversion” for the refuse washout objective is considered under “Containment”.

TABLE 4.2
SUMMARY OF APPLICABLE GENERAL RESPONSE ACTION

Refuse-Washout Objective	**Surface-Water Quality Objective**	**Ground-Water Quality Objective**	**Landfill-Gas Accumulation Objective**
No Action	No Action	No Action	No Action
Containment	Containment	Containment	Collection
Partial Removal	Diversion	Pumping	On-Site Treatment
In Situ Treatment		Collection	In Situ Treatment
On-Site Disposal		Diversion	
		On-Site Treatment	
		Off-Site Treatment	
		In-Situ Treatment	

Table 4.3
LANDFILL DIMENSION ESTIMATES

Dimension	Cell A	Cell A-1	Total
Material Volume (cubic yards)			
Refuse	8,977,000	436,000	9,433,000
Surface Cover	1,881,000	173,000	2,054,000
Stockpiled Soil	1,674,000	0	1,674,000
Total Material	12,532,000	609,000	13,141,000
Surface Area (acres)	200	13	213
Boundary Length (feet)			
Northern Boundary	2,500	1,000	3,500
Southern Boundary	3,000	500	3,500
Eastern Boundary	2,500	1,300	3,800
Western Boundary	4,000	900	4,900
Total Boundary	12,000	3,700	15,700
Maximum Thickness (feet)			
Refuse	58	38	
Surface Cover	10	10	
Stockpiled Soil	20	0	
Maximum Depth (feet)			
Refuse	67	14	
Surface Cover	30	10	
Stockpiled Soil	15	0	
Ground-Water Depth (feet)			
Maximum	80	50	
Minimum	20	20	
River Channel Dimensions (feet)			
River Length Adjacent to Site	3,000	500	3,000
River Channel Average Width	500	500	500
15th Avenue Storm Drain Dimensions (feet)			
Storm Drain Pipe Diameter	8		
Storm Drain Pipe Length	800		
Outfall Channel Length	1,700		

(1) Volumes are rounded to the nearest 1,000 cubic yards. (2) Areas are estimated to the nearest acre. (3) Horizontal linear dimensions are rounded to the nearest 100 feet. (4) Thicknesses and depths are estimated to the nearest one foot. (5) Dimensions do not include construction debris dumped into Cell A in 1987.

TABLE 4.4
SCREENING OF TECHNOLOGIES AND PROCESSES FOR THE REFUSE-WASHOUT OBJECTIVE

General Response Action	Technology	Process	Screening Comments
No Action Response			
No action	None	None	Does not meet objective
Monitoring	Monitoring river bank erosion	Slope indicators, visual inspection	Not feasible alone. Consent order requires action.
	Monitor storm drain outfall erosion	Visual inspection	Not feasible alone. Consent order requires action.
Regulation	Regulate sand and gravel mining	Regulate sand and gravel mining	Potentially applicable
Containment Response Action			
Containment of river and storm drain outfall channel	Capping	Soil cap, soil cap with synthetic membrane, asphalt cap, RCC cap, concrete cap	Not feasible because high flows would inundate site
	Physical barrier	Slurry wall	Not feasible due to potential for scour-induced erosion and instability
		Steel sheet piles	Not feasible due to inability to drive piles
		Concrete retaining wall, reinforced earth wall, compacted earth levee, soil grouting	Potentially applicable

Table 4.4
Screening of Technologies and Processes for the Refuse-Washout Objective

General Response Action	Technology	Process	Screening Comments
	River channel	Excavation, grading	Potentially applicable
	River grade control structure	Concrete structure, RCC structure, soil-cement structure	Potentially applicable
	River bank protection	Riprap, grouted riprap, RCC, soil-cement, gabions, shotcrete	Potentially applicable
		Grout mat	Not compatible with cobble river bottom
	Storm drain outfall lining	Riprap, grouted riprap, RCC, soil-cement, grout mat, gabions, shotcrete	Potentially applicable
	Storm drain outfall closed conveyance	Concrete pipe, steel pipe, polymer pipe	Potentially applicable
Partial Removal and On-Site Disposal Response Action			
Partial Removal and on-site disposal of Cell A-1	Excavation	Excavation equipment	Potentially applicable
	Transportation	Trucks, scrapers	Potentially applicable
	On-site landfilling	Landfilling	Potentially applicable

Table 4.4 (continued)
Screening of Technologies and Processes for the Refuse-Washout Objective

General Response Action	Technology	Process	Screening Comments
In Situ Treatment Response Action			
In situ treatment	In situ treatment	Grouting of waste	Not applicable due to potential for scour-induced erosion

TABLE 4.5
SCREENING OF TECHNOLOGIES AND PROCESSES FOR THE SURFACE-WATER QUALITY OBJECTIVE

General Response Action	Technology	Process	Screening Comments
No Action Response			
No action	None	None	Does not meet objective
Monitoring	Monitoring surface water quality	Water sampling	Not feasible alone. Consent order requires action.
Access restrictions	Fencing	Fencing	Potentially applicable
Land use restrictions	Land use restrictions	Land use restrictions	Potentially applicable
Containment and Diversion Response Action			
Containment and diversion	Capping	Soil cap, soil cap with synthetic membrane	Potentially applicable
		Asphalt cap	Not applicable due to potential for significant cracking
		RCC cap	Not applicable due to potential for significant cracking
		Concrete cap	Not applicable due to potential for significant cracking
	Drainage improvements	Diversion, grading, conveyance, detention, outfall	Potentially applicable

TABLE 4.6
SCREENING OF TECHNOLOGIES AND PROCESSES FOR THE GROUND-WATER QUALITY OBJECTIVE

General Response Action	Technology	Process	Screening Comments
No Action Response			
No action	None	None	Does not meet objective
Monitoring	Ground-water quality monitoring	Existing monitoring system	Potentially applicable
Water supply	Drinking water distribution system	Expand existing COP water distribution system	Potentially applicable
Containment and Diversion Response Action			
Containment and diversion	Vertical barrier	Slurry wall	Not feasible for cell containment due to downward ground-water flow gradients
		Steel sheet pile wall	Not feasible due to inability to drive piles and assure an adequate barrier
		Grout wall	Not feasible due to inability to drive piles and assure an adequate barrier
		Soil cement, concrete liner, shotcrete, RCC, asphalt	Potentially applicable to reduce recharge from river flow

Table 4.6 (continued)
Screening of Technologies and Processes for the Ground-Water Quality Objective

General Response Action	Technology	Process	Screening Comments
		Synthetic membrane wall	Not feasible for landfill cells due to inability to keep deep trench walls open for membrane placement
			Potentially applicable to reduce recharge from river flow
	Horizontal barrier	Synthetic membrane	Not feasible for landfill cells due to volume of waste that would be required to be moved
			Potentially applicable to reduce recharge from river flow
		Grout mat	No feasible for landfill cells due to volume of waste that would be required to be moved. Not feasible due to inability to assure effectiveness for reduction of river recharge
		Soil cement, concrete liner, shotcrete, RCC, asphalt	Not feasible for landfill cells due to volume of waste that would be required to be moved
			Potentially applicable to reduce recharge from river flow
	Ground-water extraction	Deep production wells	Potentially applicable

Table 4.6 (continued)
Screening of Technologies and Processes for the Ground-Water Quality Objective

General Response Action	Technology	Process	Screening Comments
	Subsurface drains	Trench drains, drain fields	Not feasible due to high permeability of aquifer material and volumes of water and waste requiring removal
Collection or Pumping and On-site or Off-site Treatment Response Action			
Collection, pumping, on-site treatment, and discharge	Ground-water pumping	Deep production wells	Potentially applicable
	Subsurface drains	Trench drains, drain fields	Not feasible due to high permeability of aquifer material and volume of water requiring removal
	Physical-chemical treatment	Activated carbon, reverse osmosis, ion exchange, precipitation, pH adjustment, neutralization	Potentially applicable
		Filtration, sedimentation, coagulation, flocculation	
		Stripping	
		Chemical oxidation, chemical reduction	Not applicable for type of constituents and volume of water requiring treatment

Table 4.6 (continued)
Screening of Technologies and Processes for the Ground-Water Quality Objective

General Response Action	Technology	Process	Screening Comments
	Biological treatment	Bioactivated sludge	Not applicable, low organic content of ground water is not suitable for biodegradation
	Discharge to aquifer	Injection wells	Potentially applicable
		Spreading basins	Potentially applicable
	Discharge to Salt River	Transmission system	Potentially applicable
	Discharge to irrigation canal system	Transmission system	Potentially applicable
Collection or pumping, and off-site treatment			
	Subsurface drains	Trench drains, drain fields	Not feasible due to high permeability of aquifer material and volume of water requiring removal
	Discharge to POTW	Transmission system	Potentially applicable
In Situ Treatment Response Action			
In situ stabilization	Physical stabilization	Grouting	Not feasible due to waste degradation, inability to confirm stabilization, and limited sphere of stabilizing influence

Table 4.6 (continued)
Screening of Technologies and Processes for the Ground-Water Quality Objective

General Response Action	Technology	Process	Screening Comments
In situ treatment	Physical treatment	Clean water flushing and circulation with subsequent surface treatment	Not feasible for wide scale application
		Soil gas venting	Not feasible for wide scale application
	Chemical treatment	Chemical treatment water flushing and circulation	Not feasible for wide scale application
	Biological treatment	Enhanced subsurface biodegration	Not feasible, not demonstrated for wide scale application

TABLE 4.7
SCREENING OF TECHNOLOGIES AND PROCESSES FOR THE LANDFILL-GAS ACCUMULATION OBJECTIVE

General Response Action	Technology	Process	Screening Comments
No Action Response			
No action	None	None	Does not meet objective
Monitoring	Monitor subsurface methane	Gas monitor wells	Potentially applicable
Collection and On-Site Treatment Response Action			
Collection and discharge	Capping	Soil cap, soil cap with synthetic membrane	Not applicable, vertical migration does not pose hazard
	Gas barriers	Synthetic membrane, slurry wall	Potentially applicable at perimeter for lateral migration control
	Gas collection	Passive vents, action system	Potentially applicable at perimeter
	Discharge raw gas to atmosphere	Venting	Potentially applicable
	Discharge raw gas to user	Transport system	Not applicable, gas collected at perimeter has insufficient methane content to be used as a viable fuel source
Collection, on-site treatment and discharge	Capping	Soil cap, soil cap with synthetic membrane	Not applicable, vertical migration does not pose hazard

Table 4.7 (continued)
Screening of Technologies and Processes for the Landfill-Gas Accumulation Objective

General Response Action	Technology	Process	Screening Comments
	Gas barriers	Synthetic membrane, slurry wall	Generally not required where active perimeter system is employed
	Gas collection	Passive vents	Not applicable for collecting gas for treatment
		Action system	Potentially applicable, perimeter system for migration control
	Thermal treatment	Flaring	Potentially applicable for destruction of methane and trace organics
	Recovery	Solvent adsorption, adsorbents, and membrane separator	Not applicable, gas collected at perimeter has insufficient methane content to be recovered as a viable fuel source
	Discharge flared gas to atmosphere	Venting	Potentially applicable
	Discharge treated gas to user	Transport system	Not applicable, gas collected at perimeter has insufficient methane content to be used as a viable fuel source
In Situ Treatment Response Action			
In situ treatment	In-situ treatment	Grouting	Unproven technology for reducing gas generation

TABLE 4.8
PROCESS SCREENING AND SELECTION SUMMARY FOR
THE REFUSE-WASHOUT OBJECTIVE

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
No Action Response				
No action	None	No action	--	--
Monitoring	Monitor storm drain outfall for erosion	Slope indicators, visual inspection	--	--
Regulation	Regulate sand and gravel mining	--	Regulate sand and gravel mining	Regulate sand and gravel mining
Containment Response Action				
Containment	Capping	Soil cap, soil cap with synthetic membrane. asphalt cap, RCC cap, concrete cap	--	--
	Physical barriers	Slurry wall, steel sheet piles, soil grouting	Concrete retaining wall, reinforced earth wall, compacted earth levee	Excavation, grading
	River channel	--	Excavation, grading	Compacted earth levee
	River grade control structure	--	Concrete structure, RCC structure, soil cement structure	Soil cement structure

Table 4.8 (continued)
Process Screening and Selection Summary for the Refuse-Washout Objective

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
	River bank protection	Grout mat	Riprap, grouted riprap, RCC, soil cement, gabions, shotcrete	Soil cement
	Storm drain outfall lining	--	Riprap, grouted riprap, RCC, soil cement, grout mat, gabions, shotcrete	No lining selected because concrete pipe selected for closed conveyance
	Storm drain outfall closed conveyance	--	Concrete pipe, steel pipe, polymer pipe	Concrete pipe
Partial Removal and On-site Disposal Response Action				
Removal and on-site disposal of Cell A-1	Excavation	--	Excavation equipment	Excavation
	Transportation	--	Trucks, scrapers	Trucks, scrapers
	On-site landfilling	--	Landfilling	On-site landfilling
In Situ Treatment Response Action				
In situ treatment	In-situ treatment	Grouting of waste	--	--

Table 4.9
PROCESS SCREENING AND SELECTION SUMMARY FOR THE SURFACE WATER QUALITY OBJECTIVE

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
No Action Response				
No action	None	No action	--	--
Monitoring	Monitor surface water quality	Water sampling	--	--
Access restrictions	Fencing	--	Fencing	Fencing
Land use restrictions	Land use restrictions	--	Land use restrictions	Land use restrictions
Containment and Diversion Response Action				
Containment and diversion	Capping	Asphalt cap, RCC, cap, concrete cap	Soil cap, soil cap with synthetic membrane	Soil cap, soil cap with synthetic membrane
	Drainage improvements	--	Diversion, grading, conveyance, detention, outfall	Diversion, grading, conveyance, detention outfall

TABLE 4.10
PROCESS SCREENING AND SELECTION SUMMARY FOR THE GROUND-WATER QUALITY OBJECTIVE

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
No Action Response				
No action	None	No action	--	--
Monitoring	Ground-water quality monitoring	--	Existing monitoring system	Existing monitoring system
Water supply	Drinking water distribution system	--	Expand existing COP system	Expand existing COP system
Containment and Diversion Response Action				
Containment and diversion	Vertical barrier	Steel sheet, pile wall, grouted wall, soil cement dike, synthetic membrane wall, slurry wall	--	--
	Horizontal barrier	Synthetic membrane, grout mat, soil cement	--	--
	Ground water extraction	--	Deep production wells	--
	Subsurface drains	Trench drains, drain fields	--	--

Table 4.10 (continued)
Process Screening and Selection Summary for the Ground-Water Quality Objective

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
Collection, Pumping and Treatment Response Action				
Collection, pumping, on-site treatment, and discharge	Ground-water pumping	--	Deep production wells	Deep production wells
	Subsurface drains	Trench drains, drain fields	--	--
	Physical-chemical treatment	Chemical oxidation, chemical reduction	Activated carbon, reverse osmosis, filtration, sedimentation, coagulation, flocculation, stripping, ion exchange, precipitation, pH adjustment	Activated carbon
	Biological treatment	Bioactivated sludge	--	--
	Discharge to aquifer	Injection wells	Spreading basins	--
	Discharge to Salt River	--	Transmission systems	--
	Discharge to irrigation canal system	--	Transmission systems	Transmission system

Table 4.10 (continued)
Process Screening and Selection Summary for the Ground-Water Quality Objective

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representa-tive Process
Collection, pumping, and off-site treatment	Ground-water pumping	--	Deep production wells	Deep production wells
	Subsurface drains	Trench drains, drain fields	--	--
	Discharge to POTW	---	Discharge to POTW	--
In Situ Treatment Response Action				
	Physical treatment	Clean water flushing and circulation with surface treatment, soil gas venting	--	--
In Situ Treatment	Chemical treatment	Chemical treatment water flushing and circulation	--	--
	Biological treatment	Enhanced subsurface biodegradation	--	--

TABLE 4.11
PROCESS SCREENING AND SELECTION SUMMARY FOR THE LANDFILL-GAS ACCUMULATION OBJECTIVE

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
No Action Response				
No action	None	No action	- -	- -
Monitoring	Monitor subsurface methane	- -	Gas monitor wells	Gas monitor wells
Collection and On-Site Treatment Response Action				
Collection and discharge	Capping	Soil cap, soil cap with synthetic membrane	- -	- -
	Gas barriers	Synthetic membrane, slurry wall	- -	- -
	Gas collection	Passive vents	Active system	- -
	Discharge raw gas to atmosphere	Venting	- -	- -
	Discharge raw gas user	Transport system	- -	- -

Table 4.11 (continued)
Process Screening and Selection Summary for the Landfill-Gas Accumulation Objective

General Response Action	Technology	Process Screened Out	Process Retained	Selected Representative Process
Collection, on-site, treatment, and discharge	Capping	Soil cap, soil cap with synthetic membrane	- -	- -
	Gas barriers	Synthetic membrane, slurry wall	- -	- -
	Gas collection	Passive vents	Active system	Active system
	Thermal treatment	- -	Flaring	Flaring
	Recovery	Solvent absorption, adsorbents, membrane separation	- -	- -
	Discharge treated gas to user	Transport system	- -	- -
	Discharge flared gas to atmosphere	- -	Venting	Venting
In Situ Treatment Response Action				
In situ treatment	In situ treatment	Grouting	- -	- -

TABLE 4.12
SCREENING OF REFUSE-WASHOUT OPTIONS

	Option RW-1	Option RW-2	Option RW-3	Option RW-4
Option Details*	N Deep-seated levee with bank protection Cell A and A-1 N Pipe and backfill for the storm drain outfall channel N Wider river channel between Cell A and A-1	N Shallow-seated levee with bank protection for Cell A and A-1 N Subsurface grade control structure across the river channel N Pipe and backfill for the storm drain outfall channel N Wider river channel between Cell A and Cell A-1	N Deep-seated levee with bank protection for Cell A N Pipe and backfill for the storm drain outfall channel N Wider river channel alongside Cell A N Relocate Cell A-1 to Cell A	N Shallow-seated levee with bank protection for Cell A N Subsurface grade control structure across the river channel N Pipe and backfill for the storm drain outfall channel N Wider river channel alongside Cell A N Relocate Cell A-1 to Cell A
Effectiveness				
Protectiveness	N Existing risks at Cell A and Cell A-1 eliminated for 100-year flow by physical barrier along river and pipe for the storm drain outfall	N Existing risks at Cell A and Cell A-1 eliminated for 100-year flow by physical barrier along river and pipe for the storm drain outfall	N Existing risks at Cell A eliminated for 100-year flow by physical barrier along river and pipe for the storm drain outfall	N Existing risks at Cell A and Cell A-1 eliminated for 100-year flow by physical barrier along river and pipe for the storm drain outfall

* Expanded option details presented in Appendix B.

Table 4.12 (continued)
Screening of Refuse-Washout Options

	Option RW-1	Option RW-2	Option RW-3	Option RW-4
			N Existing risks at Cell A-1 eliminated by removal	N Existing risks at Cell A-1 eliminated by removal
	N Satisfies ARARs	N Satisfies ARARs	N Satisfies ARARs	N Satisfies ARARs
	N Community protected during construction	N Community protected during construction	N Some additional risk to community from transporting waste across river	N Some additional risk to community from transporting waste across river
	N Workers protected during construction	N Workers protected during construction	N Workers protected during construction	N Workers protected during construction
	N Protection achieved after construction	N Protection achieved after construction	N Protection achieved after construction	N Protection achieved after construction
	N Expected to be protective for at least 30 years	N Expected to be protective for at least 30 years	N Expected to be protective for at least 30 years at Cell A. Permanent protectiveness at Cell A-1	N Expected to be protective for at least 30 years at Cell A. Permanent protectiveness at Cell A-1
	N Future exposures prevented	N Future exposures prevented	N Future exposures prevented	N Future exposures prevented
	N Periodic inspection required	N Periodic inspection required	N Periodic inspection required	N Periodic inspection required

Table 4.12 (continued)
Screening of Refuse-Washout Options

	Option RW-1	Option RW-2	Option RW-3	Option RW-4
Reduction of Toxicity, Mobility, of Volume	N Option uses containment to reduce mobility of refuse	N Option uses containment to reduce mobility of refuse	N Option uses containment to reduce mobility of refuse at Cell A and removal to reduce mobility and volume at Cell A-1	N Option uses containment to reduce mobility of refuse at Cell A and removal to reduce mobility and volume at Cell A-1
Implementability				
Technical Feasibility	N Conventional technologies	N Conventional technologies	N Conventional technologies	N Conventional technologies
	N Good performance expected	N Good performance expected	N Good performance expected	N Good performance expected
	N Can be monitored by periodic inspection	N Can be monitored by periodic inspection	N Can be monitored by periodic inspection	N Can be monitored by periodic inspection
Administrative Feasibility	N Approval from other agencies likely	N Approval from other agencies likely	N Approval from other agencies likely	N Approval from other agencies likely
Availability	N Adequate work force and equipment available	N Adequate work force and equipment available	N Adequate work force and equipment available	N Adequate work force and equipment available
Cost				
Capital Costs	$ 12,270,000	$ 10,500,000	$ 14,790,000	$ 13,730,000
Annual Costs	210,000	190,000	170,000	160,000
Present-worth Costs	15,500,000	13,420,000	17,400,000	16,190,000

TABLE 4.13
SCREENING OF SURFACE-WATER OPTIONS

	Option SW-1	Option SW-2
Option Details*	N Single-layer soil cap over Cell A and Cell A-1	N Double-layer soil and synthetic liner cap over Cell A and Cell A-1
	N Surface drainage at Cell A and Cell A-1	N Surface drainage at Cell A and Cell A-1
	N Fence around Cell A and Cell A-1	N Fence around Cell A and Cell A-1
	N Relocate A& B Silica Sand and All Chevy Auto Parts	N Relocate A& B Silica Sand and All Chevy Auto Parts
Effectiveness		
Protectiveness	N Existing Risks at Cell A and Cell A-1 eliminated by capping	N Existing Risks at Cell A and Cell A-1 eliminated by capping
	N Satisfies ARARs	N Satisfies ARARs
	N Community protected during construction	N Community protected during construction
	N Workers protected during construction	N Workers protected during construction
	N Protection achieved after construction	N Protection achieved after construction
	N Expected to have long-term protectiveness	N Expected to have long-term protectiveness
	N Future exposures prevented	N Future exposures prevented
	N Periodic inspection required	N Periodic inspection required

* Expanded option details presented in Appendix B.

Table 4.13 (continued)
Screening of Surface-Water Options

	Option SW-1	Option SW-2
Reduction of Toxicity, Mobility, or Volume	N Option uses containment to reduce mobility of contaminants	N Option uses containment to reduce mobility of contaminants
Implementability		
Technical Feasibility	N Conventional technologies	N Conventional technologies but liner installation covers larger area than any previous similar application
	N Good performance expected	N Good performance expected but not verifiable
	N Can be monitored by periodic inspection	N Could only be monitored by extensive leak detection leak system
Cost		
Administrative Feasibility	N Approval from other agencies likely	N Approval from other agencies likely
Availability	N Adequate work force and equipment available	N Adequate work force and equipment available
Capital Costs	$ 9,770,000	$ 13,050,000
Annual Costs	190,000	260,000
Present-worth Costs	12,690,000	17,050,000

TABLE 4.14
SCREENING OF GROUND-WATER OPTIONS

	Option GW-1	Option GW-2
Option Details*	N Ground-water quality monitoring N Ground-water use monitoring N Expand existing COP water	N Ground-water quality monitoring N Ground-water well and pump system N Ground-water treatment system N Ground-water discharge system
Effectiveness		
Protectiveness	N Future potential exposures to ground water at the boundary of the landfill is prevented N Expected to be protective to human health for at least 30 years N Satisfies ARARs	N Future exposures to degrade ground water are prevented N Protective of the off-site environment N Satisfies ARARs N Workers protected during construction N Community protected during and after construction N Periodic insepction and maintenance required N Expected to be protective for at least 30 years

*Expanded option details presented in Appendix B.

Table 4.14 (continued)
Screening of Ground-Water Options

	Option GW-1	Option GW-2
Reduction of Toxicity, Mobility, or Volume	N No remediation measures taken	N Prevents ground water from moving off-site N Reduces constituents in collected ground water through treatment N Reduces the volume of leachate produced if ground-water levels are lowered
Implementability		
Technical Feasibility	N Conventional monitoring and water supply technologies	N Conventional technologies for collection, treatment, and disposal N Good performance expected
Administrative Feasibility	N DWR cooperation required to monitor use. All processes needed in place and easily implemented	N Administrative implementation easily accomplished N Irrigation district approval is uncertain
Availability	N Adequate work force and equipment are available	N Adequate work force and equipment are available
Cost		
Capital Costs	$ 0	$ 3,140,000
Annual Costs	60,000	860,000
Present-worth Costs	920,000	16,360,000

TABLE 4.15
SCREENING OF LANDFILL-GAS OPTIONS

	Option LG-1
Option Details*	N Landfill-gas monitoring N Landfill-gas collection system N Landfill-gas treatment by flaring
Effectiveness	
Protectiveness	N Existing risks reduced by collecting gas; remaining risks low, remedy is protective N Objective met N Community protected during remedial actions N Works protected during construction N Protection achieved after construction (1 year) N Collection and treatment system expected to be protective long term (30 years) N Future exposure can be prevented N Periodic maintenance and replacement of materials expected
Reduction of Toxicity, Mobility, or Volume	N Option uses collection to reduce mobility of gas, and flaring to reduce hazard
Implementability	
Technical Feasibility	N Conventional technologies N Good performance expected N Can be monitored by periodic inspection

*Expanded option details presented in Appendix B.

Table 4.15 (continued)
Screening of Landfill-Gas Options

	Option LG-1	
Administrative Feasibility	N	Approval from other agencies likely
Availability	N	Adequate work force and equipment available
Cost		
Capital Costs	$	850,000
Annual Costs		70,000
Present-worth Costs		1,930,000

TABLE 4.16
EVALUATION OF ALTERNATIVES

	Alternative A	Alternative B	Alternative C	Alternative D
Effectiveness				
Protectiveness				
Short Term	N Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water, and ground water	N Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water, and ground water	N Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water, and ground water	N Significant public health and the environmental risks eliminated at Cell A and A-1 for refuse washout, surface water, and ground water
	N Significant off-site accumulation of gas eliminated. On-site risk low	N Significant off-site accumulation of gas eliminated. On-site risk low	N Significant off-site accumulation of gas eliminated. On-site risk low	N Significant off-site accumulation of gas eliminated. On-site risk low
	N Satisfies objective	N Satisfies objective	N Satisfies objective	N Satisfies objective
	N Community protected during construction	N Community at additional risk from transporting refuse across the river and on public roads	N Community protected during construction	N Community at additional risk from transporting refuse across the river and on public roads
	N Workers protected during construction	N Workers protected during construction	N Workers protected during construction	N Workers protected during construction

Table 4.16 (continued)
Evaluation of Alternatives

	Alternative A	Alternative B	Alternative C	Alternative D
	N Protection achieved after construction (1 year)	N Protection achieved after construction (1 year)	N Protection achieved after construction (1 year)	N Protection achieved after construction (1 year)
Long Term	N Expected 30-year protection	N Expected 30-year protection. Permanent protection at Cell A-1 site	N Expected 30-year protection	N Expected 30-year protection. Permanent protection at Cell A-1 site
	N Future exposures prevented	N Future exposures prevented	N Future exposures prevented	N Future exposures prevented
	N Periodic inspection required	N Periodic inspection required	N Periodic inspection required	N Periodic inspection required
	N Maintenance required for gas system	N Maintenance required for gas system	N Maintenance required for ground-water and gas systems	N Maintenance required for ground-water and gas systems
Reduction of Toxic Exposure, Mobility, and Refuse Volume	N Containment to reduce mobility of waste from washout and infiltration. Collection to reduce mobility of gas. Treatment to reduce gas hazard.	N Containment to reduce mobility of waste from washout and surface water infil-tration at Cell A. Removal to eliminate refuse in Cell A-1. Collection to reduce mobility of gas. Treatment to reduce gas hazard.	N Containment to reduce mobility of waste from washout and surface-water infil-tration. Collection to reduce mobility of gas and ground water. Treatment to reduce gas hazard and ground water risk.	N Containment to reduce mobility of waste from washout and surface water infil-tration at Cell A. Removal to eliminate refuse in Cell A-1. Collection to reduce mobility of gas and ground water. Treatment to reduce gas hazard and ground water risk.

Table 4.16 (continued)
Evaluation of Alternatives

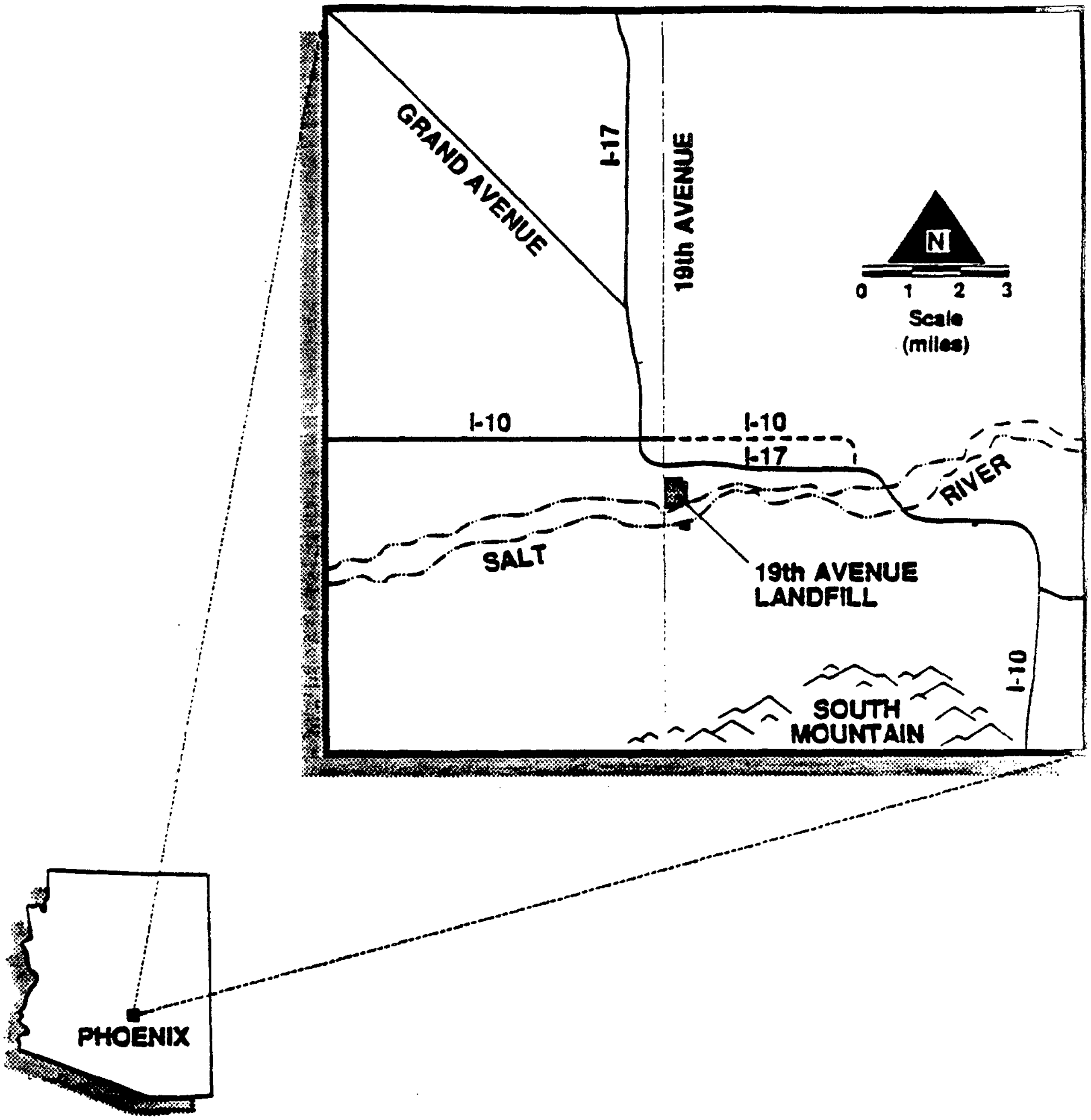
	Alternative A	Alternative B	Alternative C	Alternative D
Implementability				
Technical Feasibility	N Conventional technologies	N Conventional technologies	N Conventional technologies	N Conventional technologies
	N Good performance expected	N Good performance expected	N Good performance expected	N Good performance expected
	N Can be monitored by periodic inspection	N Can be monitored by periodic inspection	N Can be monitored by periodic inspection	N Can be monitored by periodic inspection
Administrative Feasibility	N Easily implemented with existing programs. Approval from other agencies likely.	N Easily implemented with existing programs. Approval from other agencies likely.	N Easily implemented with existing programs. Approval from other agencies likely.	N Easily implemented with existing programs. Approval from other agencies likely.
Availability	N Adequate work force and equipment available	N Adequate work force and equipment available	N Adequate work force and equipment available	N Adequate work force and equipment available

Table 4.16 (continued)
Evaluation of Alternatives

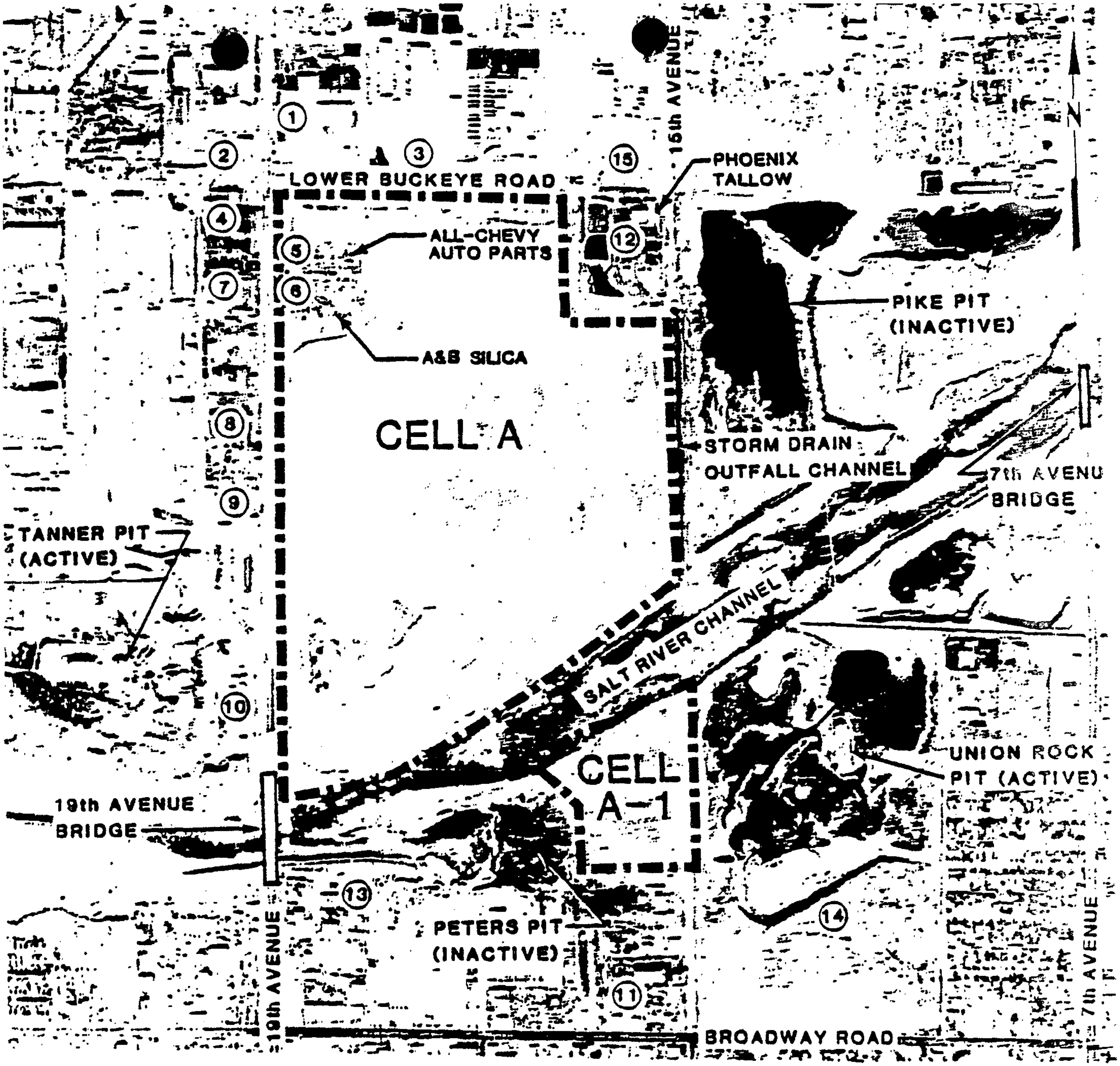
	Alternative A	Alternative B	Alternative C	Alternative D
Costs				
Direct Capital Costs	$ 21,120,000	$ 23,840,000	$ 24,260,000	$ 26,980,000
Indirect Capital Costs	6,340,000	7,150,000	7,280,000	8,090,000
Total Capital Costs	$ 27,460,000	$ 30,990,000	$ 31,540,000	$ 35,070,000
Direct Annual Costs	510,000	470,000	1,310,000	1,270,000
Indirect Annual Costs	500,000	$ 520,000	$ 570,000	$ 580,000
Total Annual Costs	$ 1,010,000	$ 990,000	$ 1,880,000	$ 1,850,000
Present Worth (5%, 30 years)	$ 42,990,000	$ 16,210,000	$ 60,440,000	$ 63,510,000

Table 4.16 (continued)
Evaluation of Alternatives

	Alternative A	Alternative B	Alternative C	Alternative D
Compliance with ARARs	N ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria	N ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria	N ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria	N ARARs for ground water, surface water, soil, and air will be complied with for chemical, location, and action criteria
Overall Protection of Human Health and the Environment	N Adequate protection of human health and the environment is achieved through engineering and institutional controls	N Adequate protection of human health and the environment is achieved through engineering and institutional controls	N Adequate protection of human health and the environment is achieved through engineering and institutional controls	N Adequate protection of human health and the environment is achieved through engineering and institutional controls



SITE LOCATION MAP
19th AVENUE LANDFILL
Figure 1.1



LEGEND:

APPROXIMATE BOUNDARY OF 19th AVENUE LANDFILL

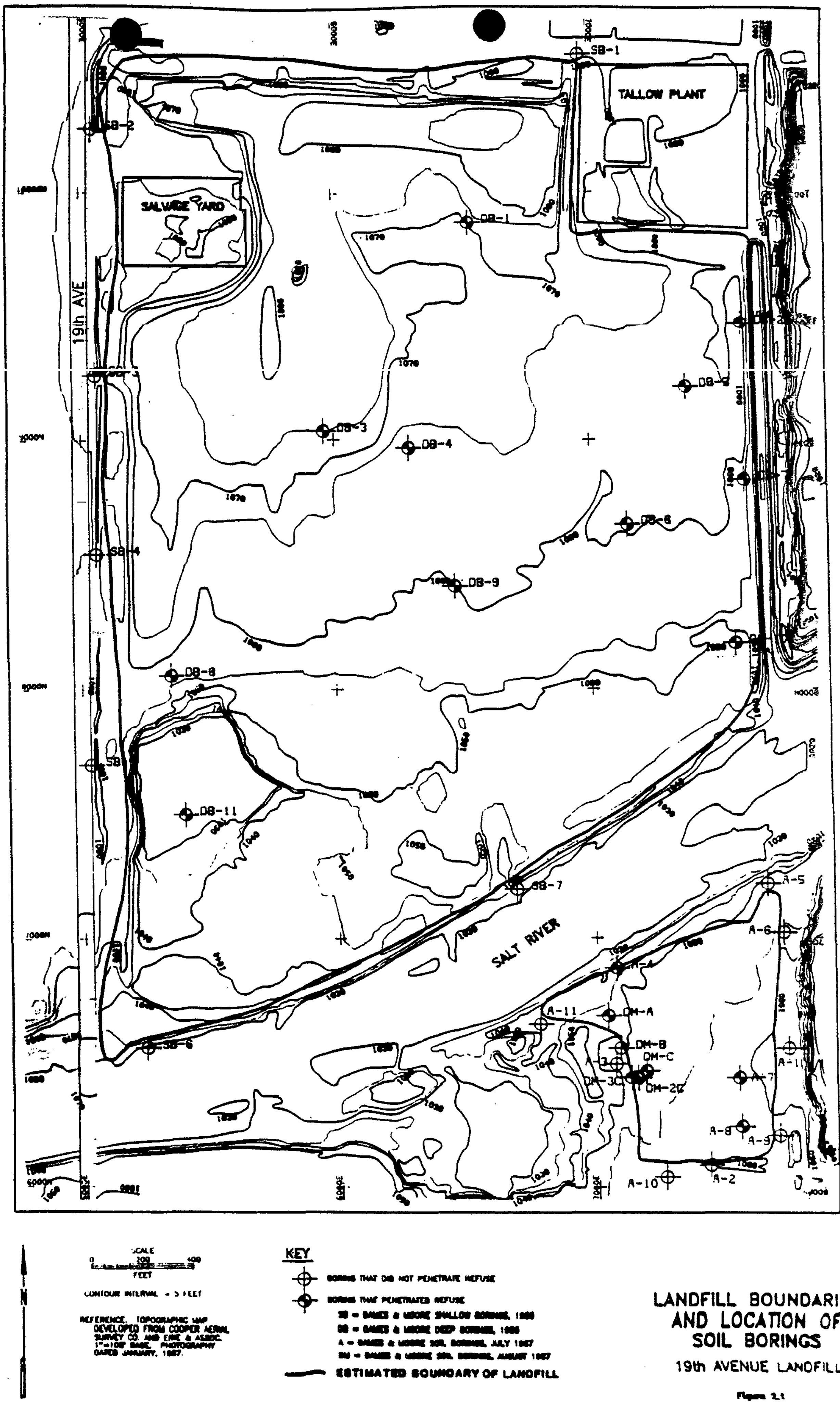
SCALE
0 1000 2000
FEET

ADJACENT BUSINESSES:

1. BLUE CIRCLE
2. CALIFORNIA ARIZONA TRACTOR (CAT)
3. KAISER CEMENT CORP.
4. WASTE MANAGEMENT INC.
5. ALL CHEVY AUTO PARTS (ACAP)
6. A&B SILICA SAND
7. LINCOLN AUTO OF PHOENIX
8. CHEVRON-ASPHALT DIVISION
9. BEVERAGE INDUSTRY RECYCLING PROGRAM (BIRP)
10. THE TANNER COMPANIES-UNITED METRO MATERIALS DIVISION
11. HARTER WM MANUFACTURING INC.
12. PHOENIX TALLOW
13. WESTERN BLOCK CO.
14. UNION ROCK AND MATERIALS CORP.
15. RINCHEM

19th AVENUE LANDFILL AND VICINITY

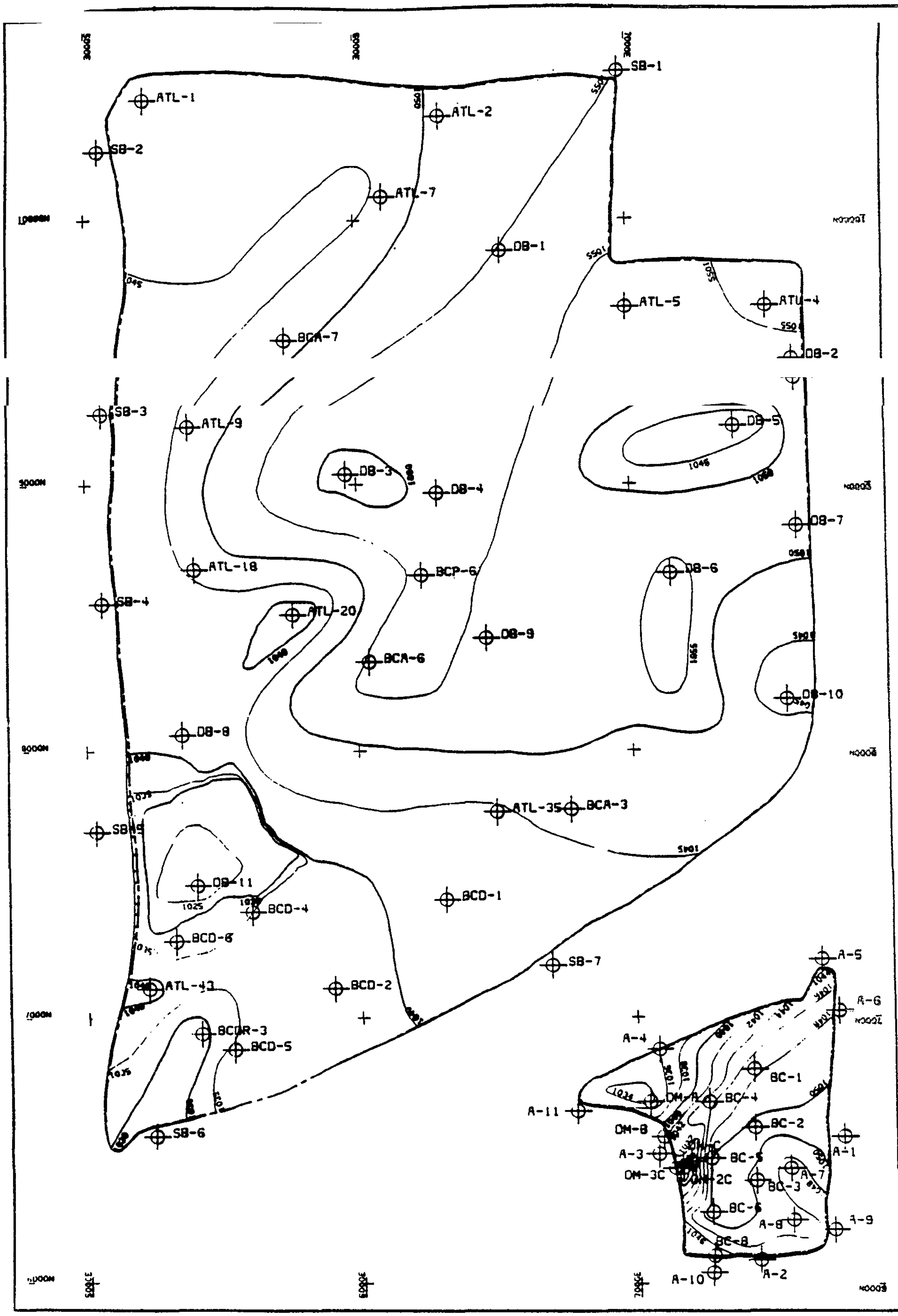
Figure 1.2



LANDFILL BOUNDARIES AND LOCATION OF SOIL BORINGS

19th AVENUE LANDFILL

Figure 2.1



SCALE
0 200 400
FEET

CONTOUR INTERVAL = 5 FEET

N

KEY

⊕ - BORING

SB = DAMES & MOORE SHALLOW BORINGS, 1986
DB = DAMES & MOORE DEEP BORINGS, 1986
A = DAMES & MOORE SOIL BORINGS, JULY 1987
DM = DAMES & MOORE SOIL BORINGS, AUGUST 1987
ATL = ARIZONA TESTING LABS BORINGS, 1980
BCA, BCD, BCP = BROWN AND CALDWELL BORINGS, 1985, 1986

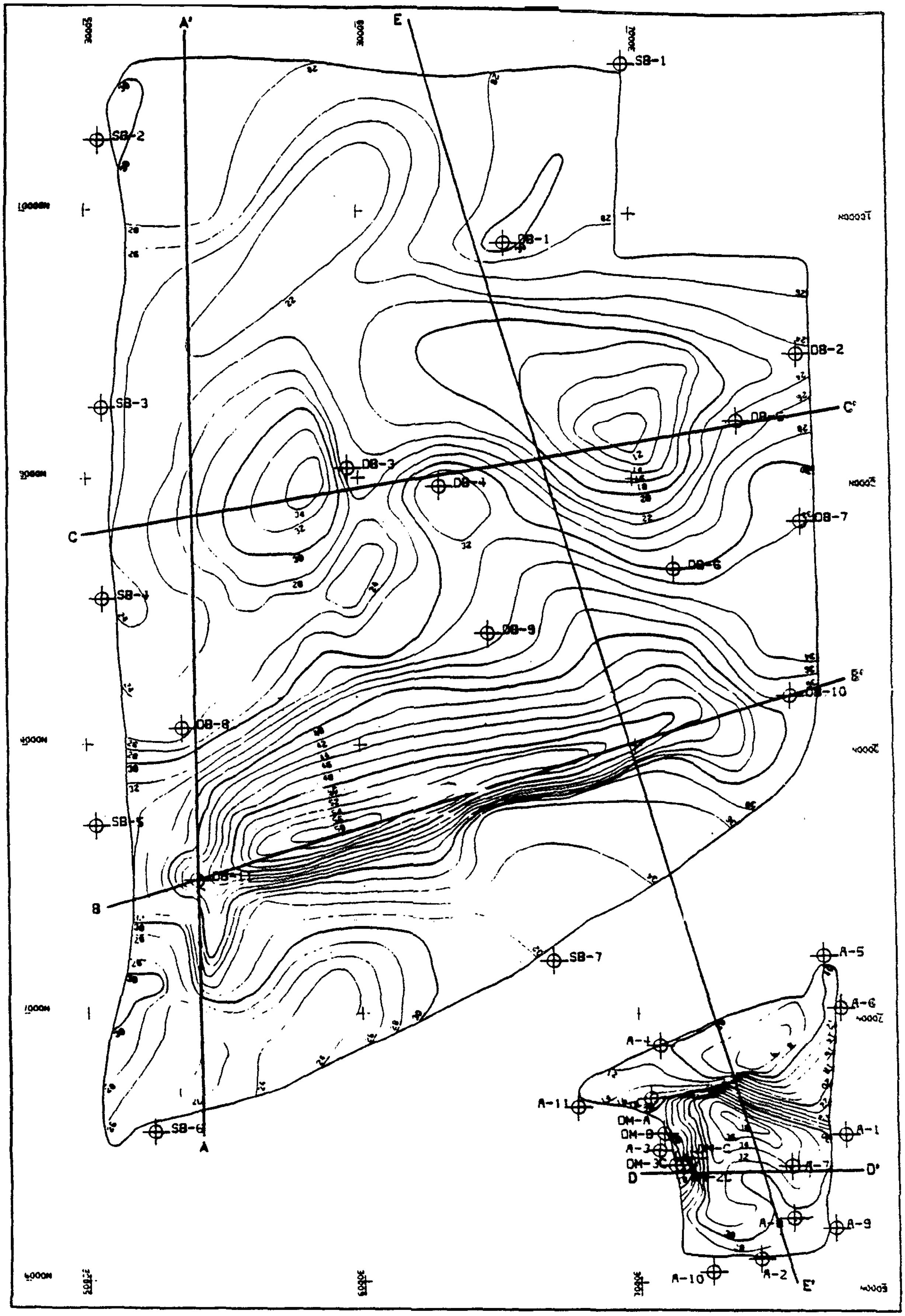
PROJECTED SURFACE BOUNDARY

ESTIMATED TOP OF REFUSE AT BOUNDARY

ESTIMATED TOP OF REFUSE

19th Avenue Landfill

Figure 2.2



SCALE
0 200 400
FEET

CONTOUR INTERVAL 2 FEET

N

KEY

BORING

SB = DAMES & MOORE SHALLOW BORINGS, 1986

DB = DAMES & MOORE DEEP BORINGS, 1986

A = DAMES & MOORE SOIL BORINGS, JULY 1987

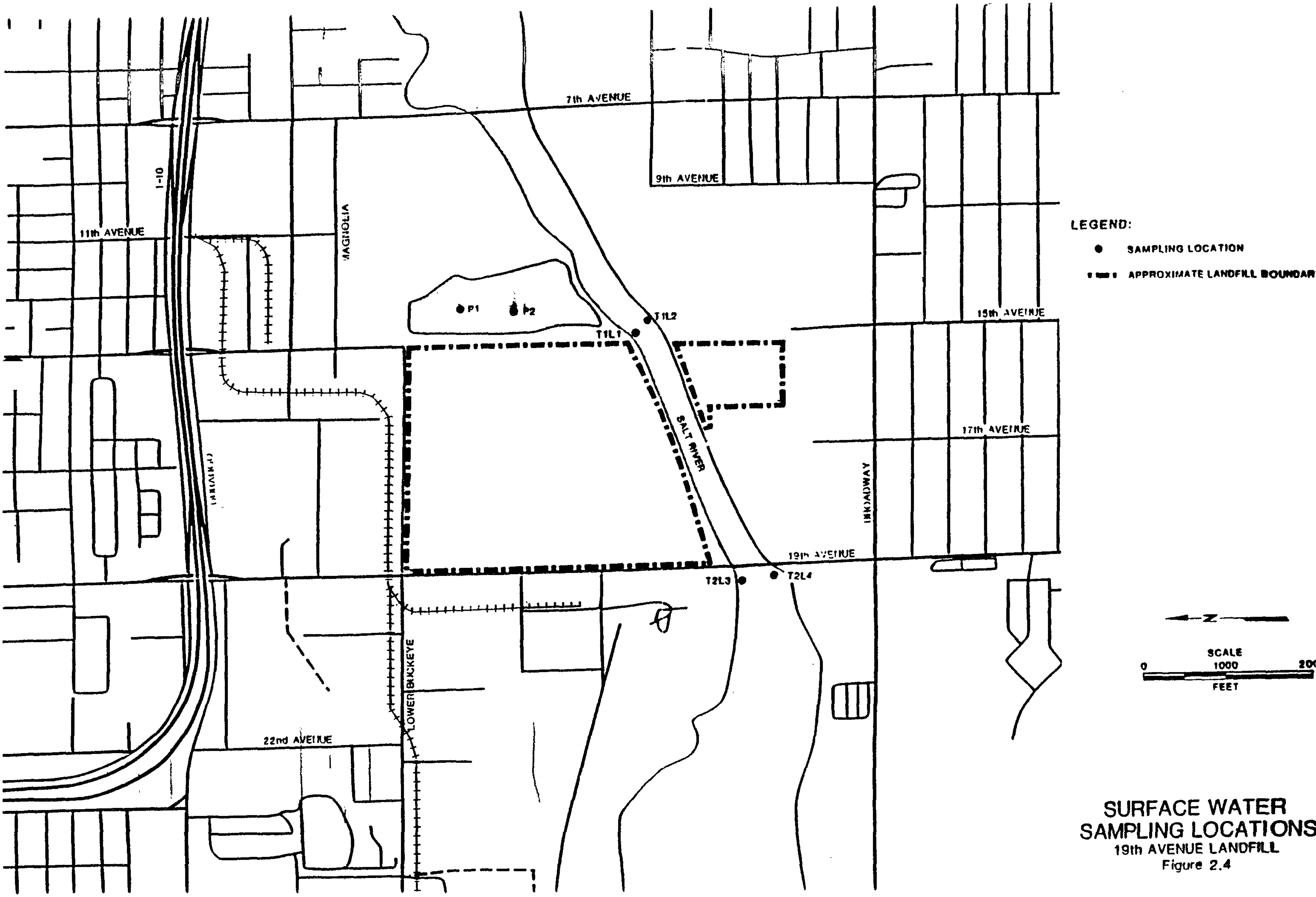
DM = DAMES & MOORE SOIL BORINGS, AUGUST 1987

E-E' CROSS SECTIONS

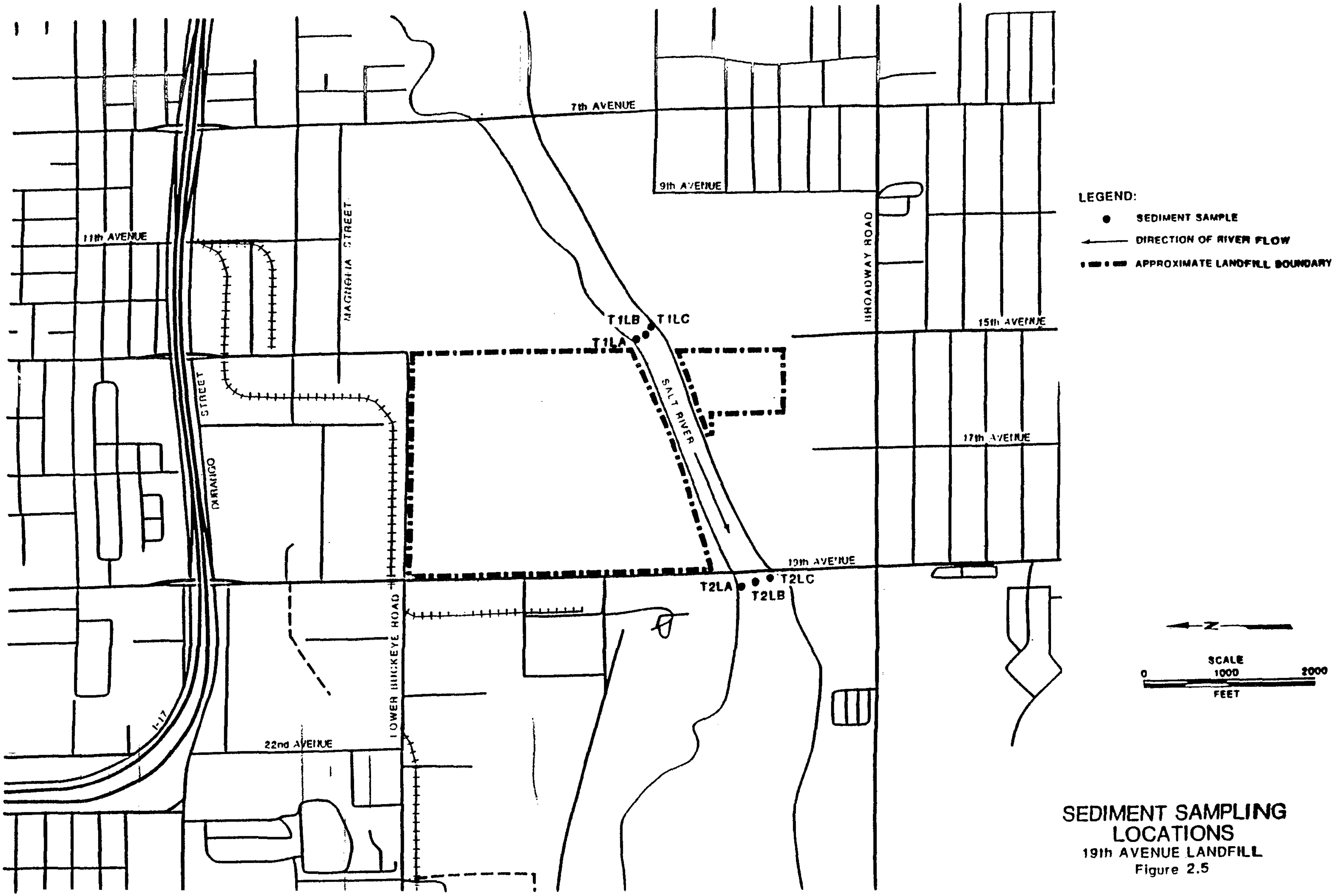
ESTIMATED AREAL EXTENT OF LANDFILL

ESTIMATED THICKNESS OF REFUSE

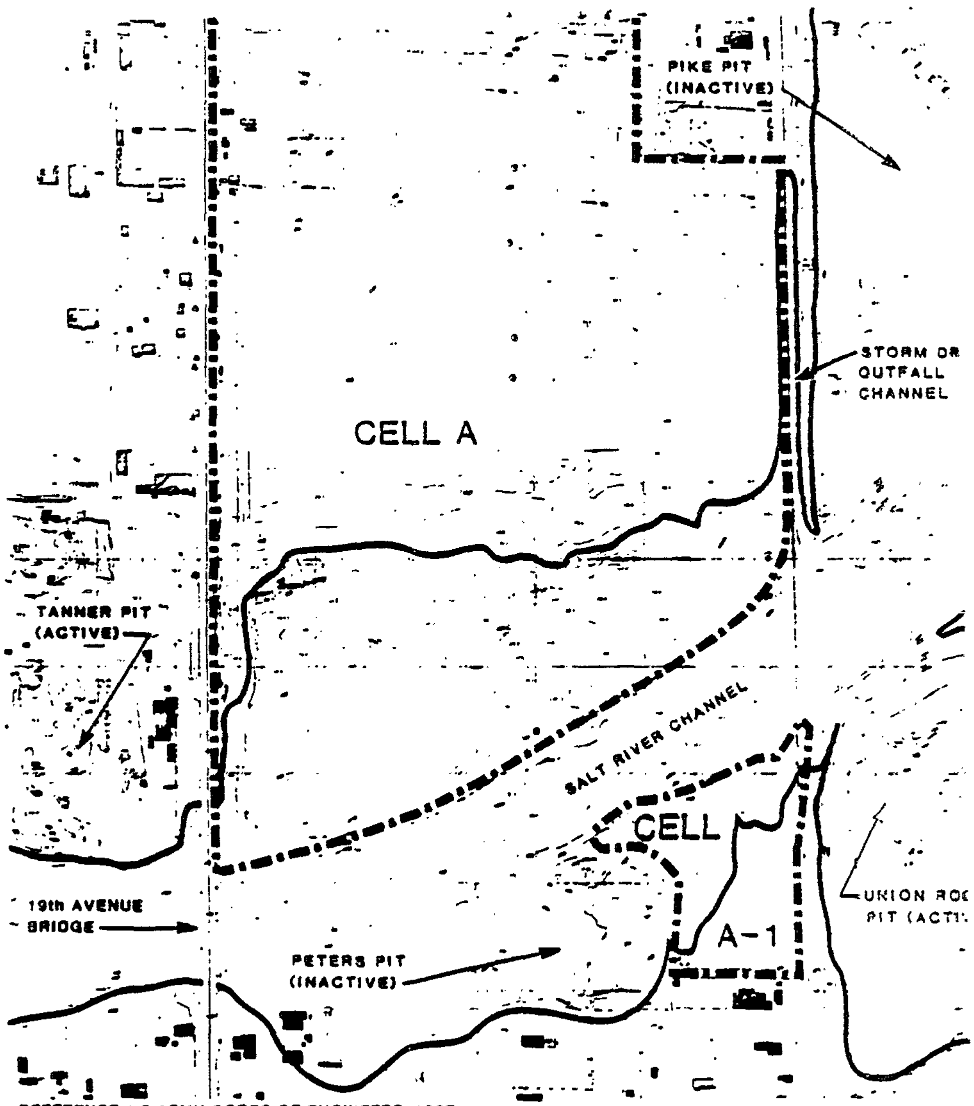
19th Avenue Landfill



SURFACE WATER SAMPLING LOCATIONS
19th AVENUE LANDFILL
Figure 2.4



SEDIMENT SAMPLING LOCATIONS
19th AVENUE LANDFILL
Figure 2.5



REFERENCE: US ARMY CORPS OF ENGINEERS ,1987

SCALE
0 600 1200
FEET

N

LEGEND:

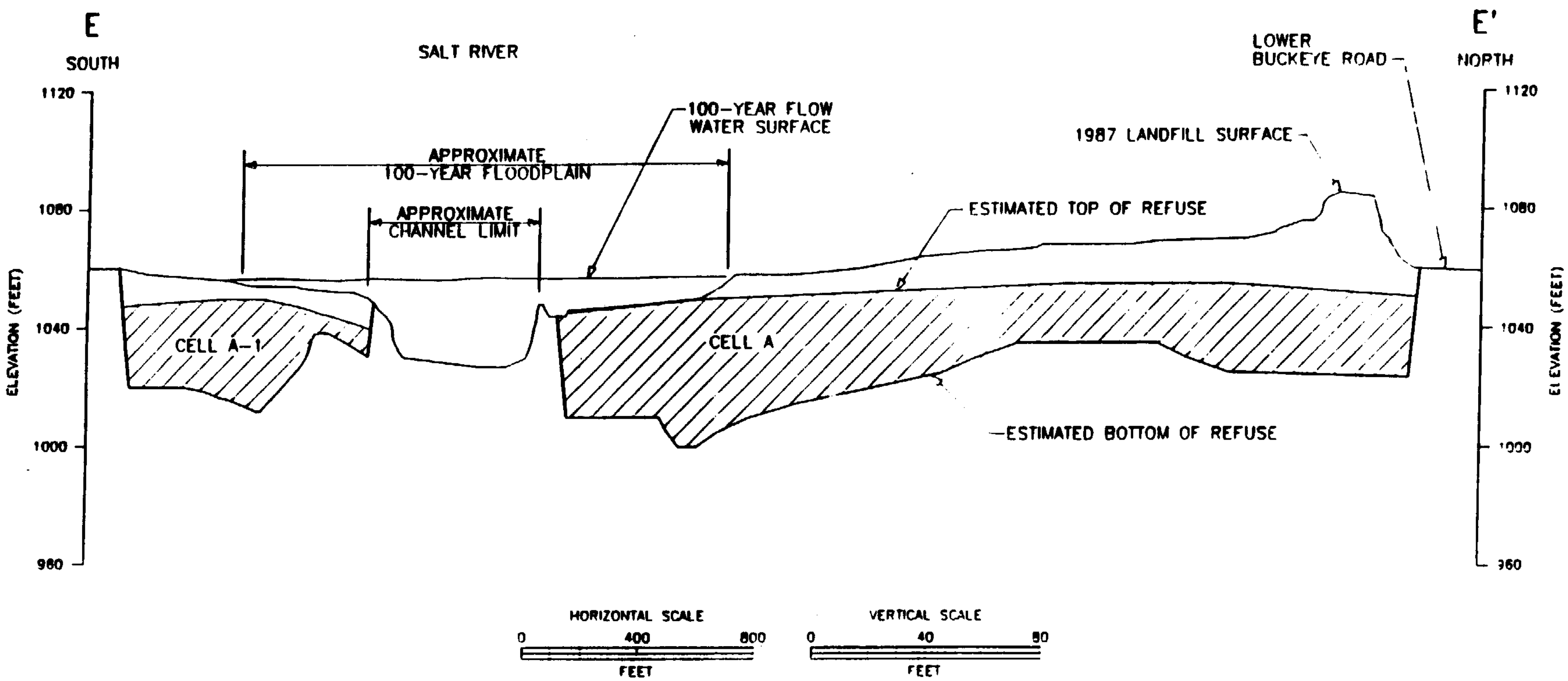
APPROXIMATE BOUNDARY OF 19th AVENUE LANDFILL

APPROXIMATE LIMITS OF 100-YEAR FLOODPLAIN

100-YEAR FLOODPLAIN LIMITS

19th AVENUE LANDFILL

Figure 2.6



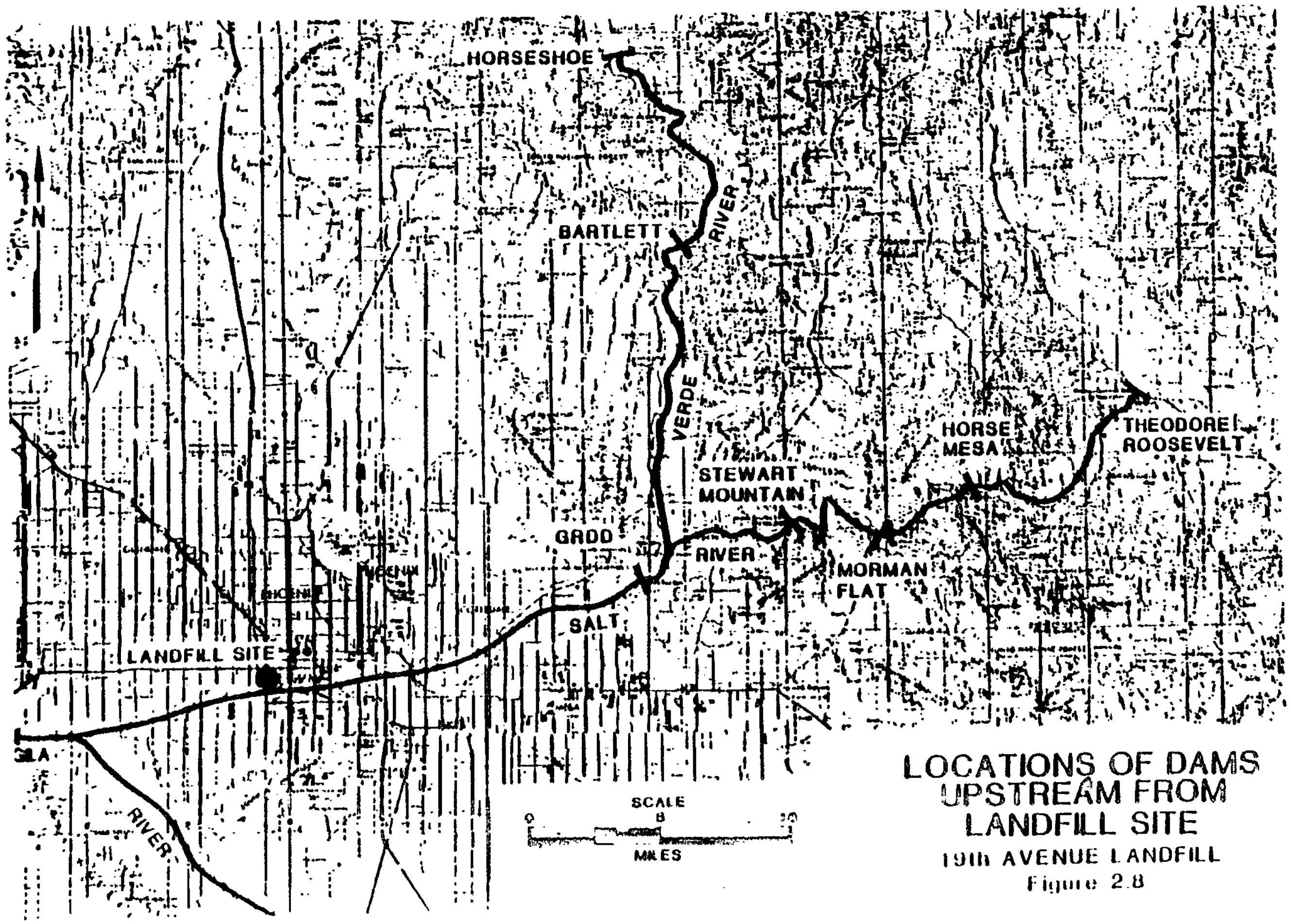
REFUSE

NOTE: THE CROSS SECTION ALIGNMENT IS SHOWN ON FIGURE 2.3

SUBSURFACE CROSS SECTION E-E'

19th AVENUE LANDFILL

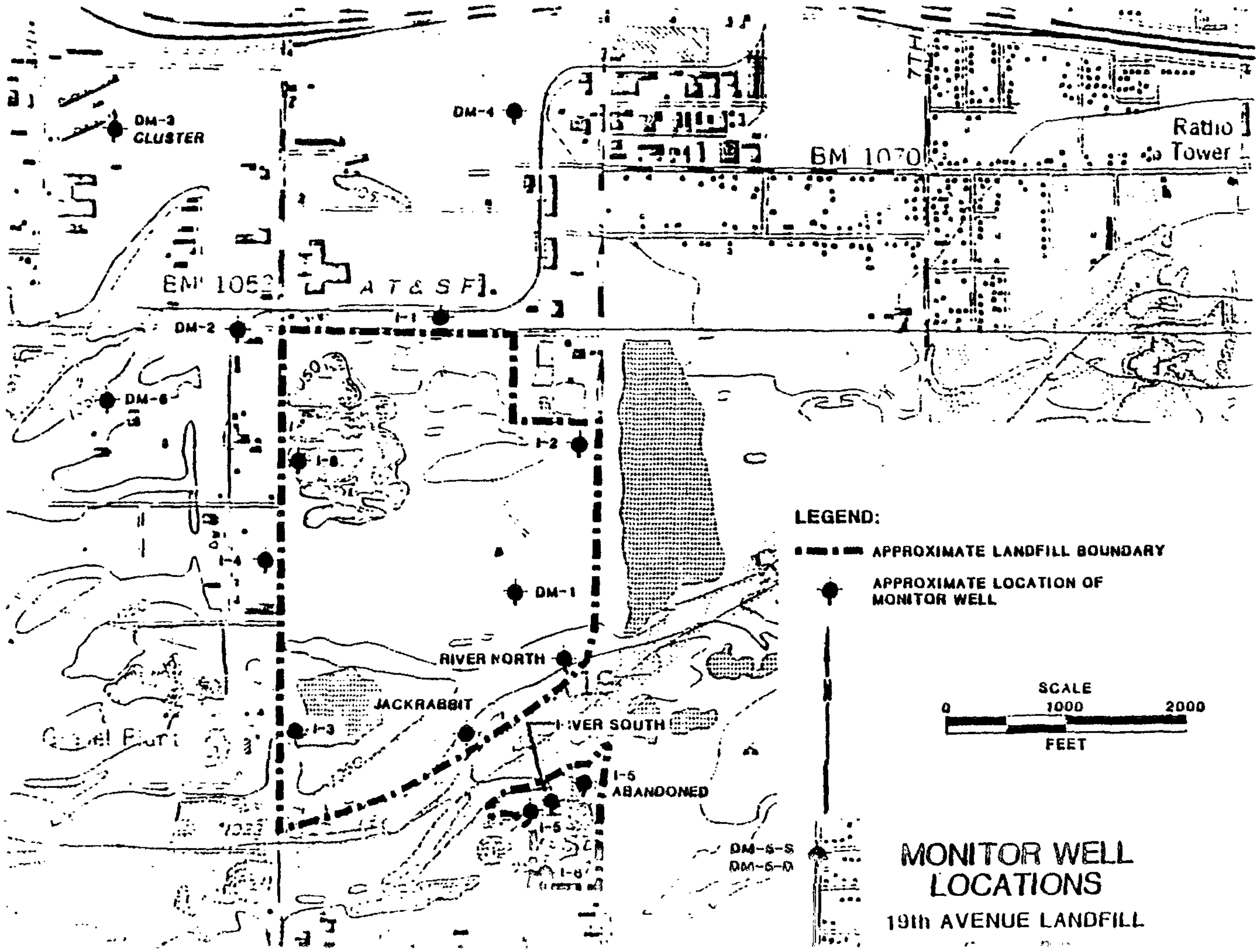
Figure 2.7



LOCATIONS OF DAMS UPSTREAM FROM LANDFILL SITE

19th AVENUE LANDFILL

Figure 2.8



MONITOR WELL LOCATIONS
19th AVENUE LANDFILL

DEPTH (FEET)	USCS *	GEOLOGIC SUB-UNIT	APPROXIMATE THICKNESS (FEET)	DESCRIPTION
0	SM	S	15	SILTY SAND, BROWN TO LIGHT BROWN, 50-60% FINE TO MEDIUM SAND, 30-40% SILT WITH CLAY, <10% GRAVEL, TRACE CALICHE.
50	GP	A_1	85	GRAVEL, 80-90% FINE TO COARSE GRAVEL AND COBBLES, 20-10% MEDIUM TO COARSE SAND, LITTLE TO NO FINES.
100–150	GP-SP	A_2	90	SANDY GRAVEL, 60-70% FINE TO COARSE GRAVEL, 30-40% FINE TO COARSE SAND, MINOR SILT, INCREASING FINES (SAND & SILT) WITH DEPTH. INTERBEDDED SAND (SP) LENSES.
200	SM-GM	B	50-30	SILTY SAND WITH GRAVEL, REDDISH BROWN, 40-50% FINE TO MEDIUM SAND, 40-50% SILT WITH CLAY, 10-15% FINE GRAVEL.
250–300	GM	C	120	SANDY GRAVEL WITH SILT AND CLAY, BROWN, 40-50% FINE TO MEDIUM GRAVELS, 40-50% FINE TO COARSE SAND, 0-20% SILT WITH CLAY. INTERBEDDED SAND (SP) AND GRAVEL (GP) LENSES. DECREASING FINES (SILT & CLAY) WITH DEPTH.
350–400	SM-GM	MFU	~200	SILTY SAND WITH GRAVEL, CLAYEY SILTS, BROWN INTERBEDDED SANDY SILT, CLAYEY SILT AND SILTY SAND WITH MINOR FINE TO MEDIUM GRAVEL.

——— CONTACT

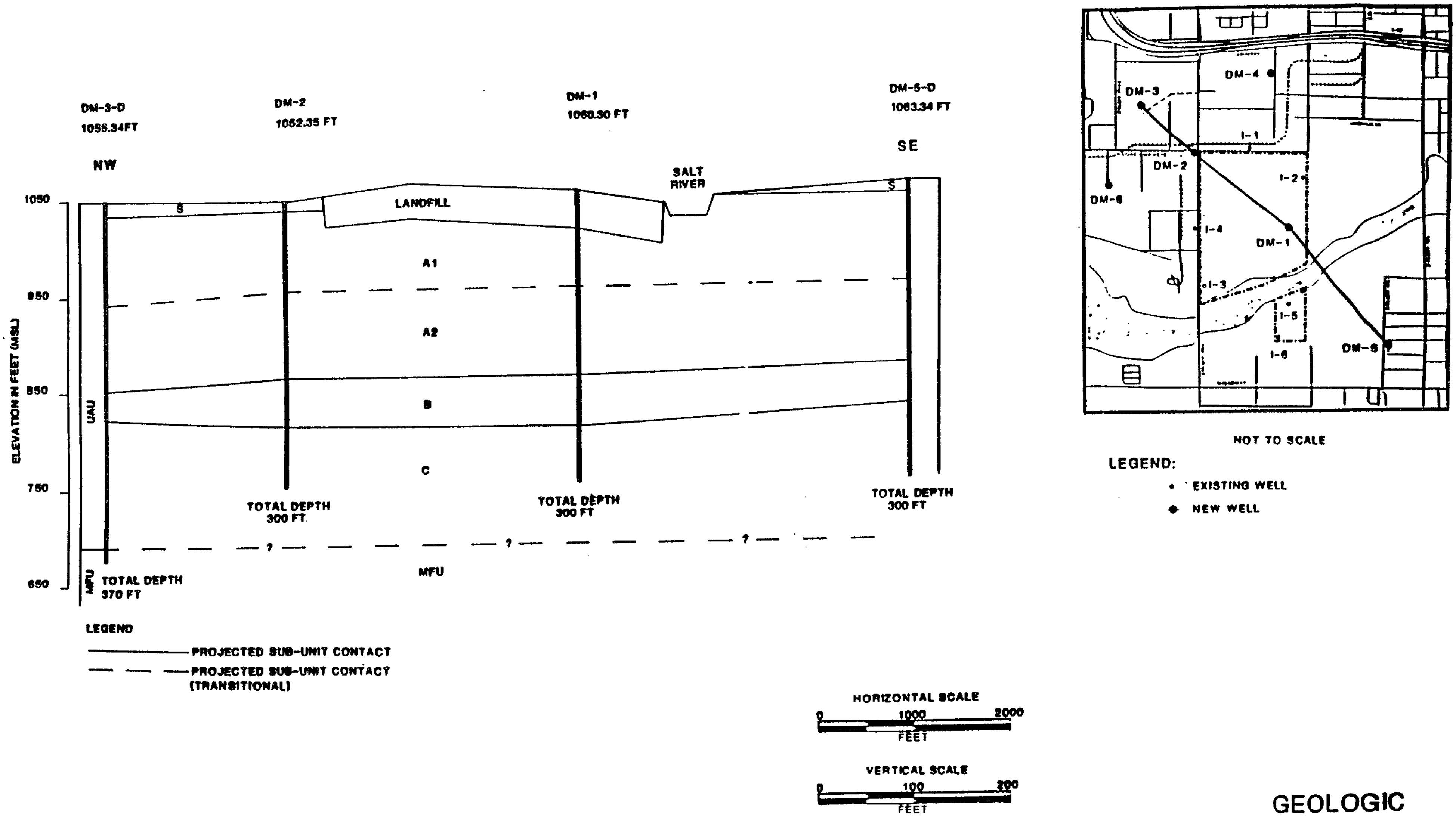
— — TRANSITIONAL CONTACT

* UNIFIED SOIL CLASSIFICATION SYSTEM

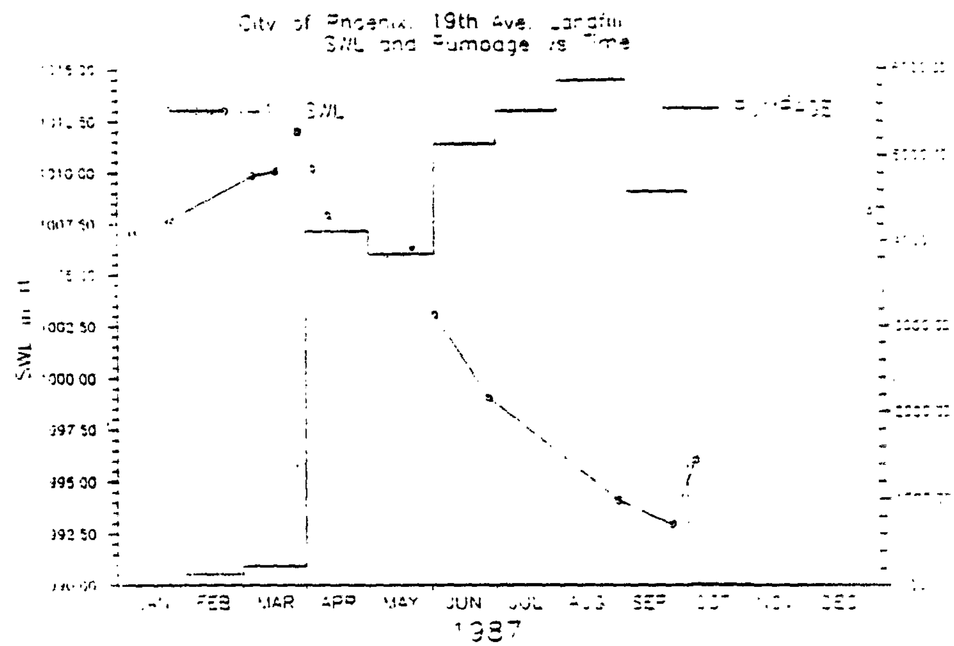
GENERALIZED STRATIGRAPHIC COLUMN

19th AVENUE LANDFILL

Figure 2.10



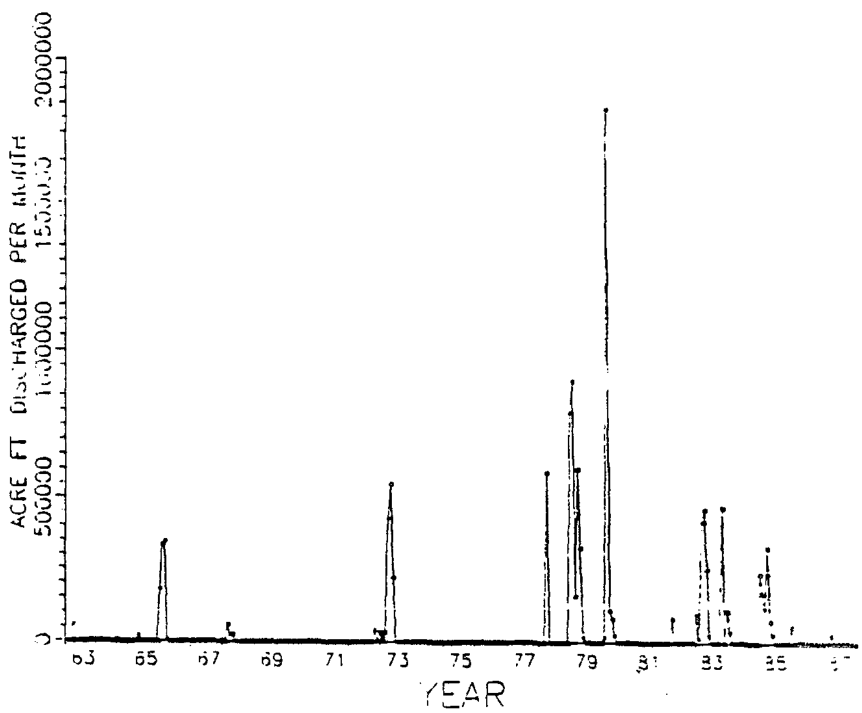
GEOLOGIC
CROSS SECTION
19th Avenue Landfill
Figure 2.11



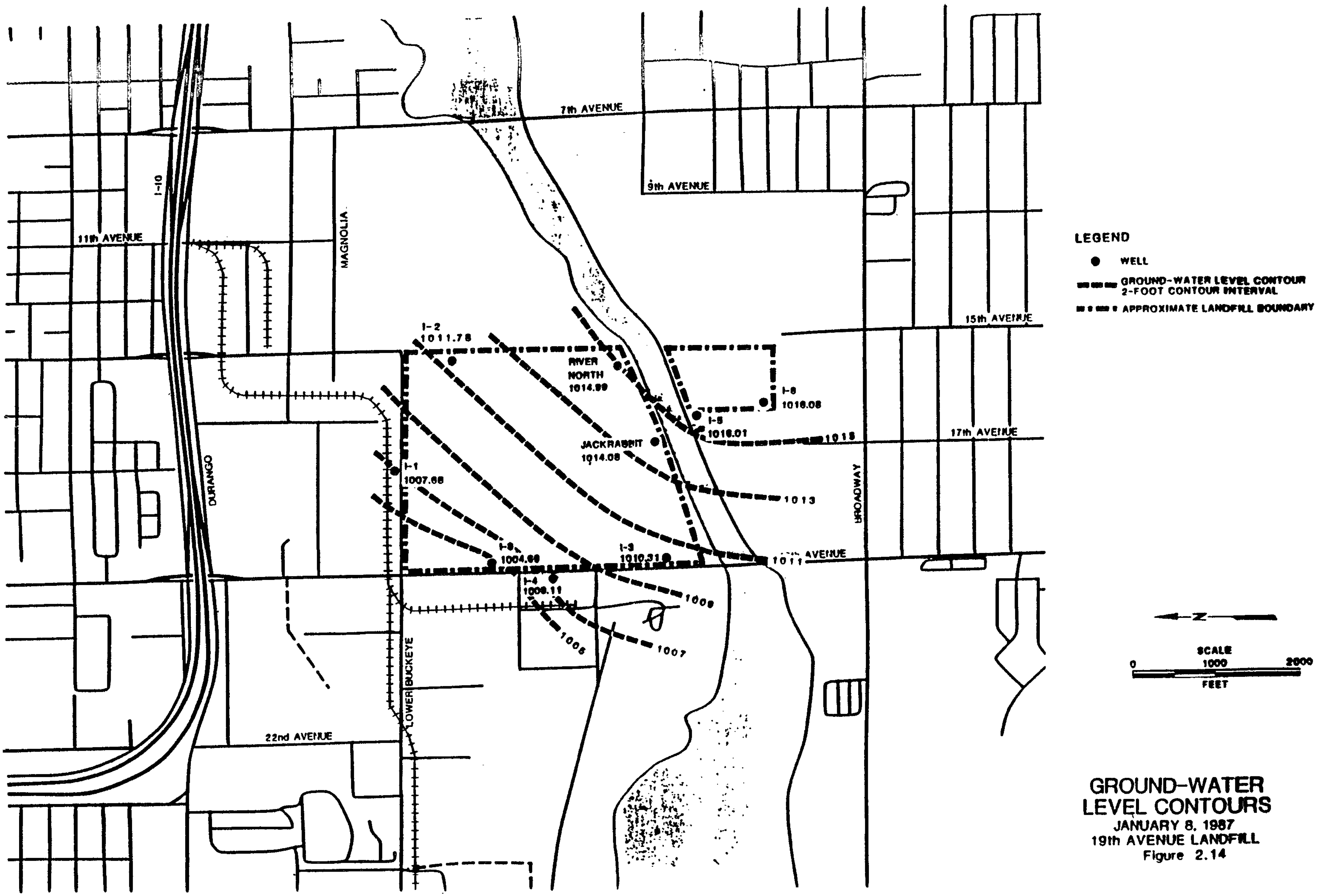
STATIC WATER LEVEL IN I-1 AND RID WELL PUMPAGE FOR 1987

19th AVENUE LANDFILL

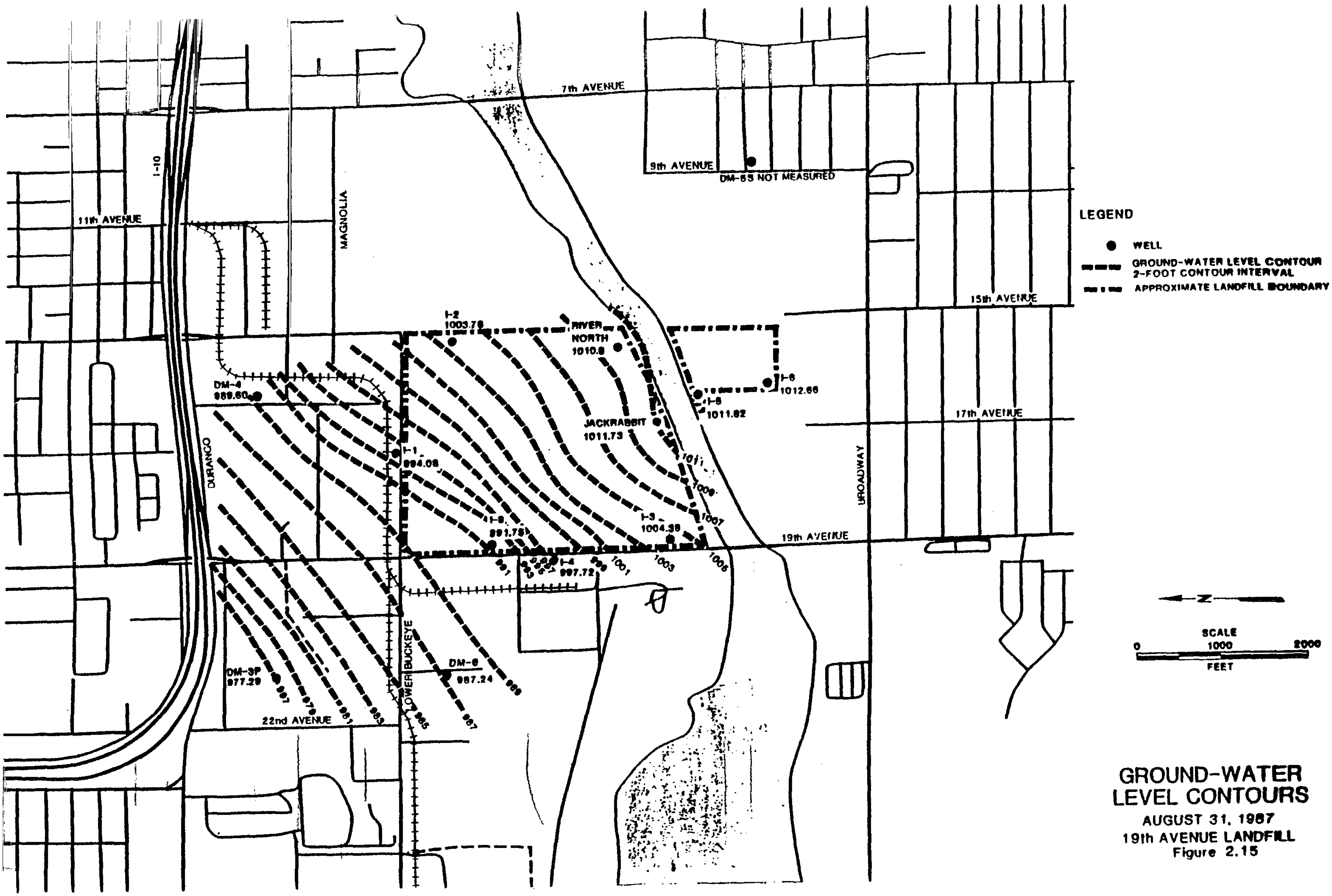
Figure 2.12



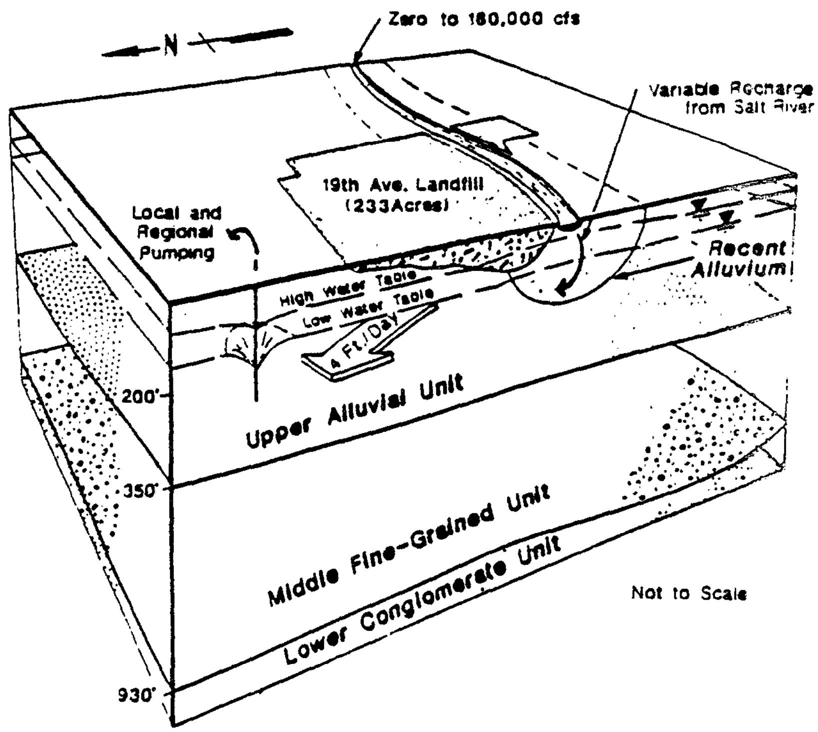
DISCHARGE FROM
GRANITE REEF DAM
(TOTAL ACRE FEET PER YEAR)
19th AVENUE LANDFILL
Figure 2.13



GROUND-WATER
LEVEL CONTOURS
JANUARY 8, 1987
19th AVENUE LANDFILL
Figure 2.14



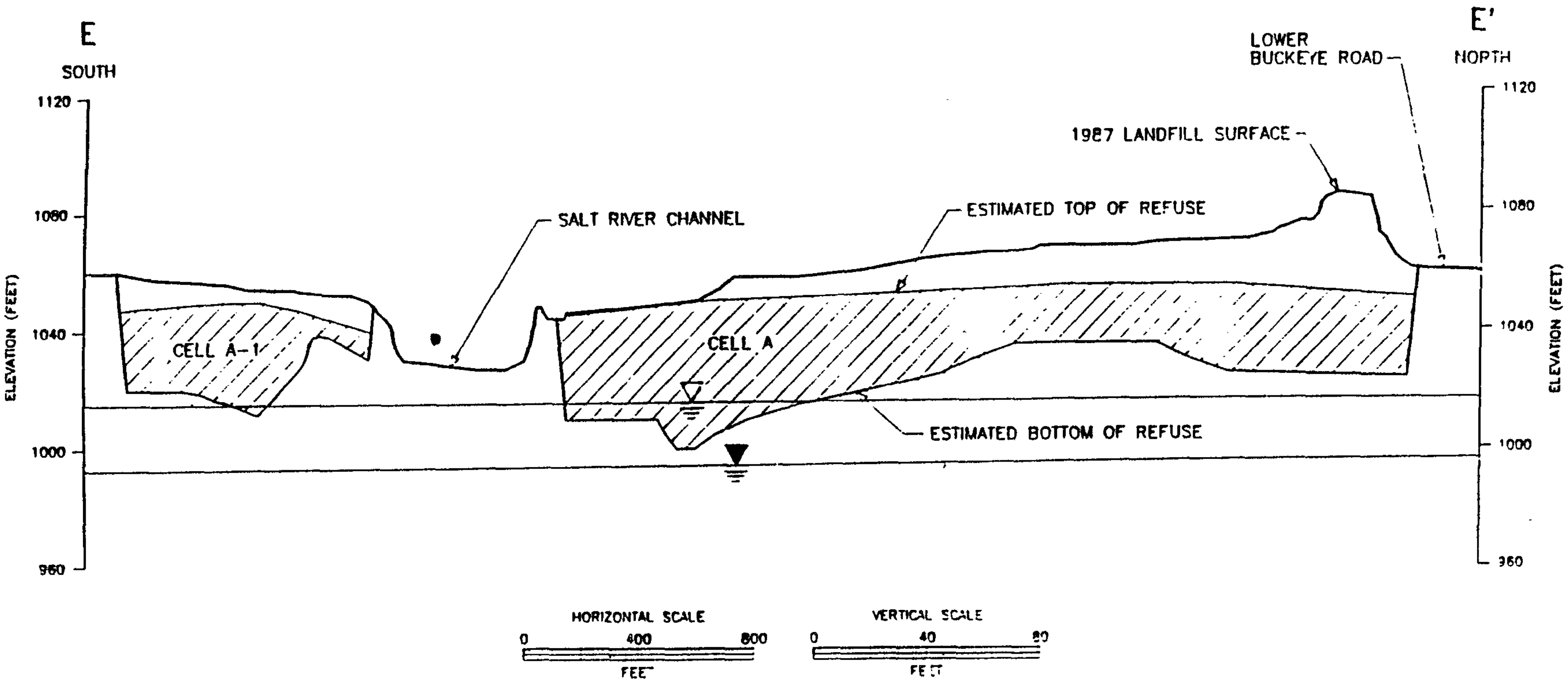
GROUND-WATER LEVEL CONTOURS
AUGUST 31, 1987
19th AVENUE LANDFILL
Figure 2.15



HYDROGEOLOGIC
CONCEPTUAL
DIAGRAM

19th AVENUE LANDFILL

Figure 2.16



NOTE: THE CROSS SECTION ALIGNMENT IS SHOWN ON FIGURE 2.3

▽ MAXIMUM WATER TABLE ELEVATION (1/10/86)

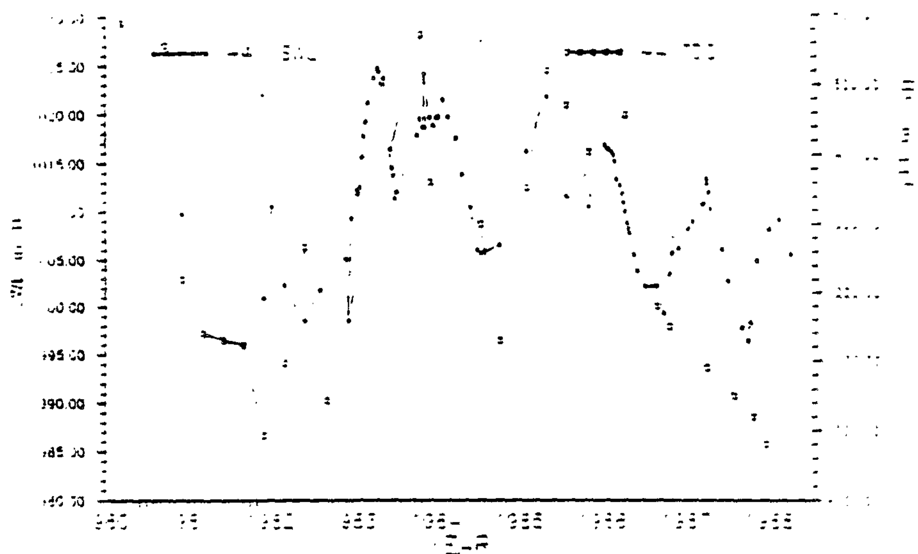
▼ MINIMUM WATER TABLE ELEVATION (9/25/87)

▨ REFUSE

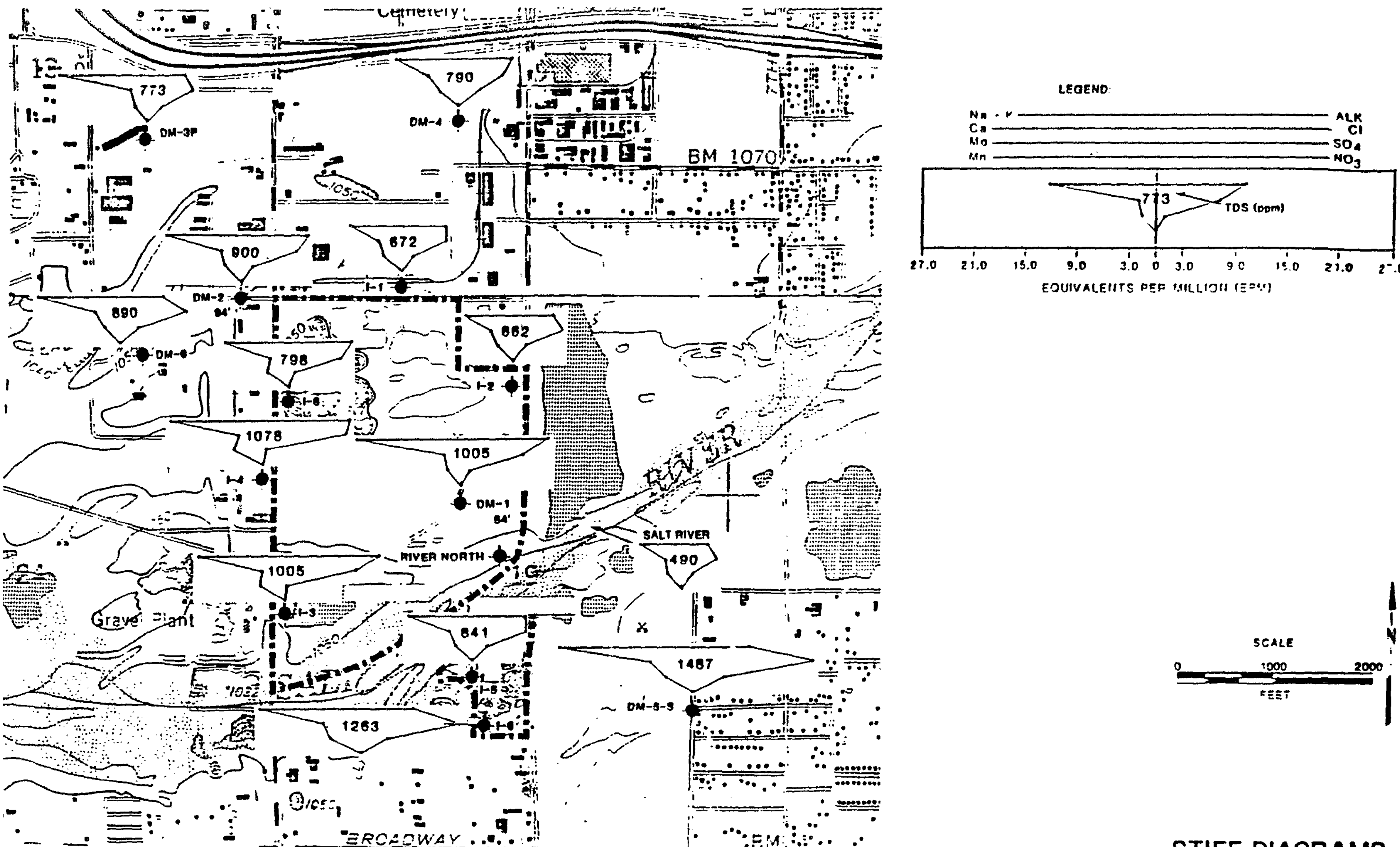
SUBSURFACE CROSS SECTION E–E'

19th AVENUE LANDFILL

Figure 2.17



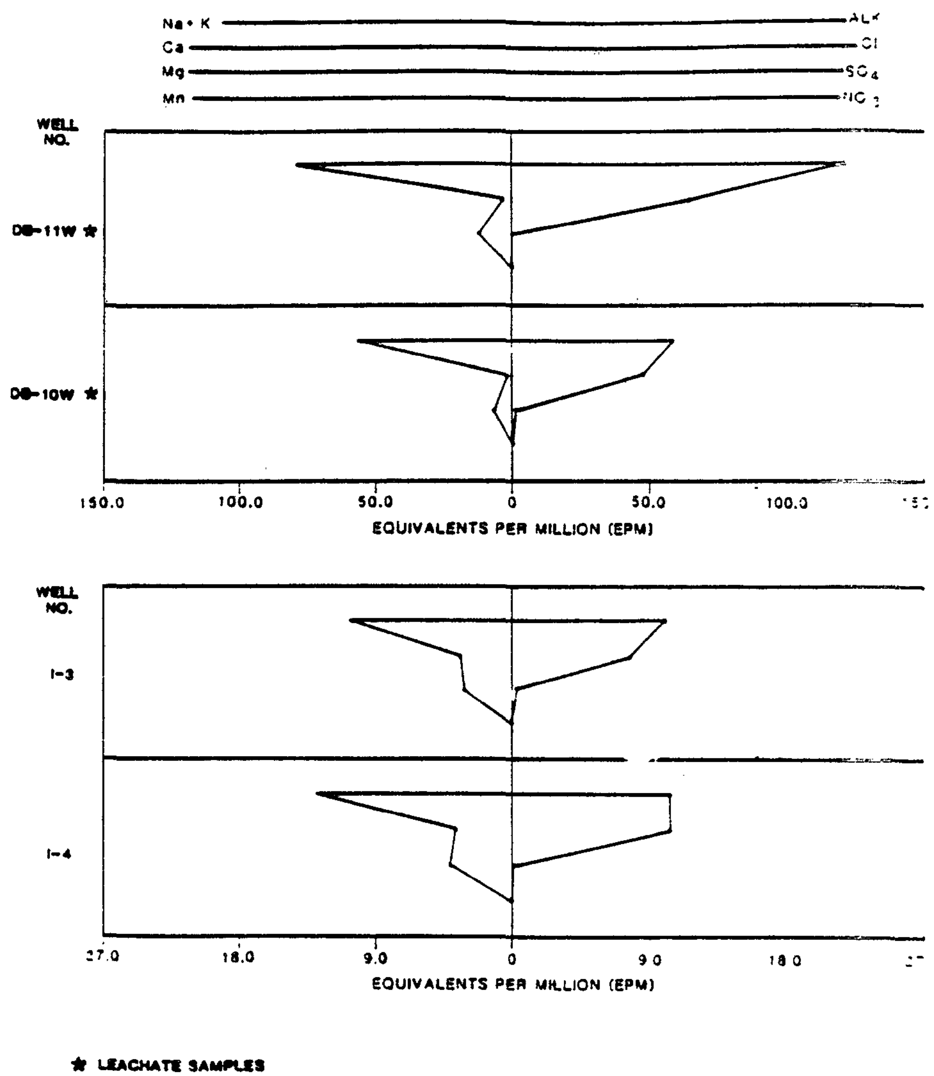
STATIC WATER LEVEL
AND TOTAL DISSOLVED
SOLIDS VS. TIME
WELL I-4
19th AVENUE LANDFILL
Figure 2.18



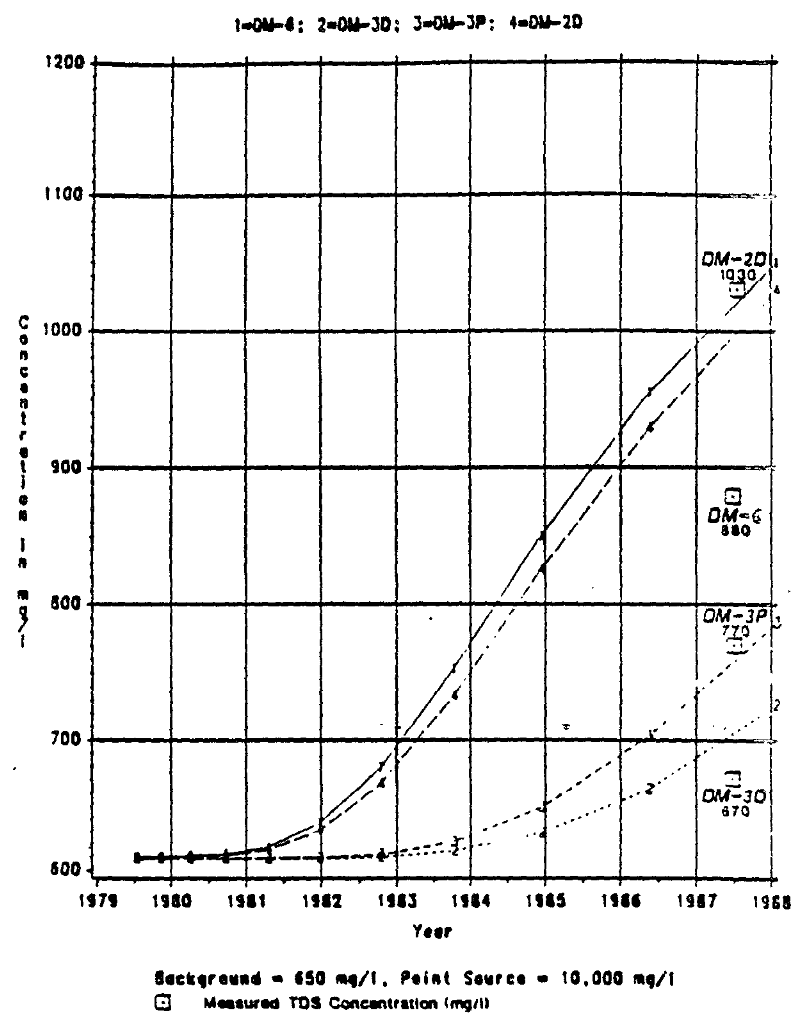
STIFF DIAGRAMS FOR MONITOR WELLS

19th AVENUE LANDFILL

Figure 2.19



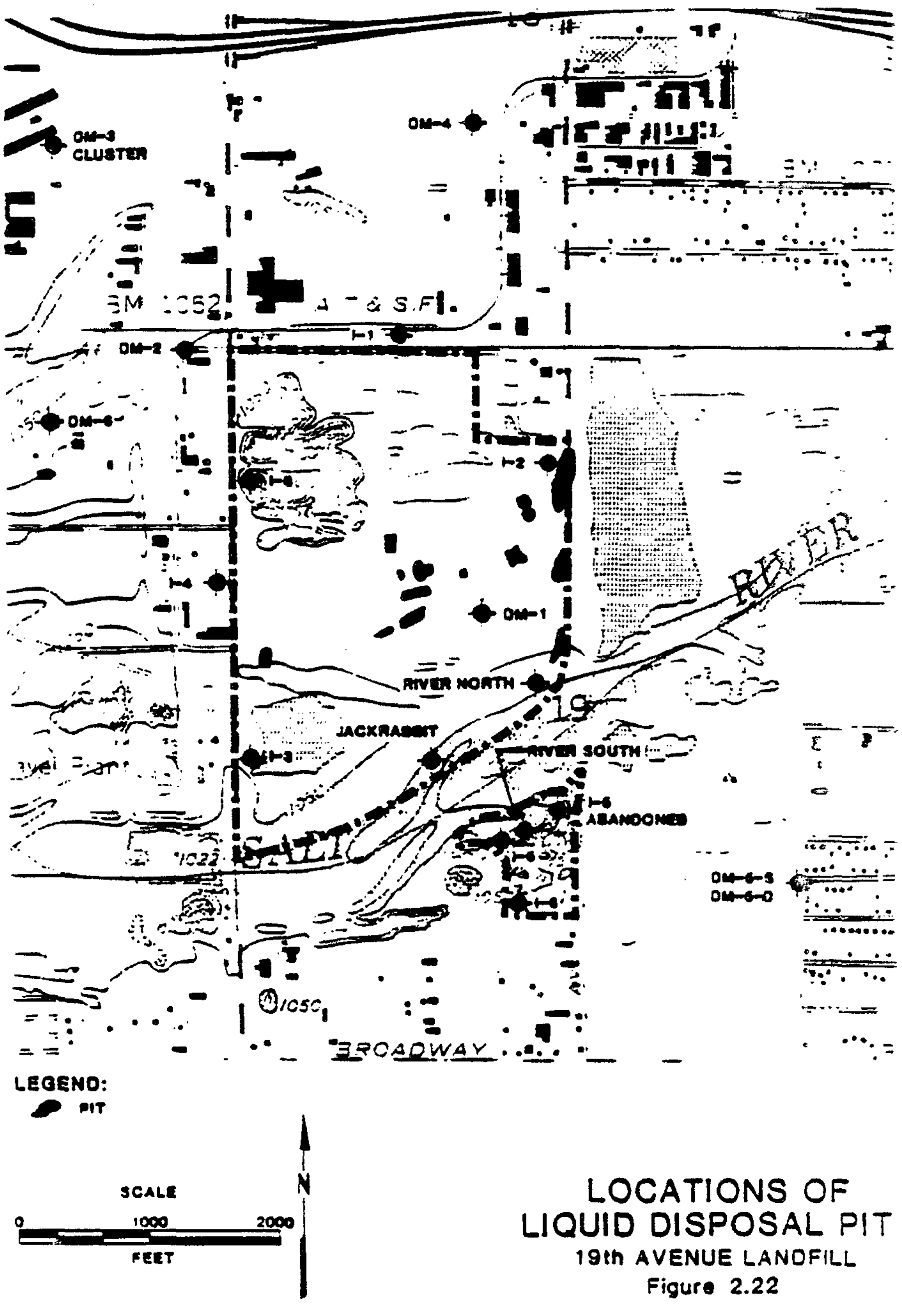
STIFF DIAGRAMS
FOR
LEACHATE AND WELLS
I-3 AND I-4
19th AVENUE LANDFILL
Figure 2.20



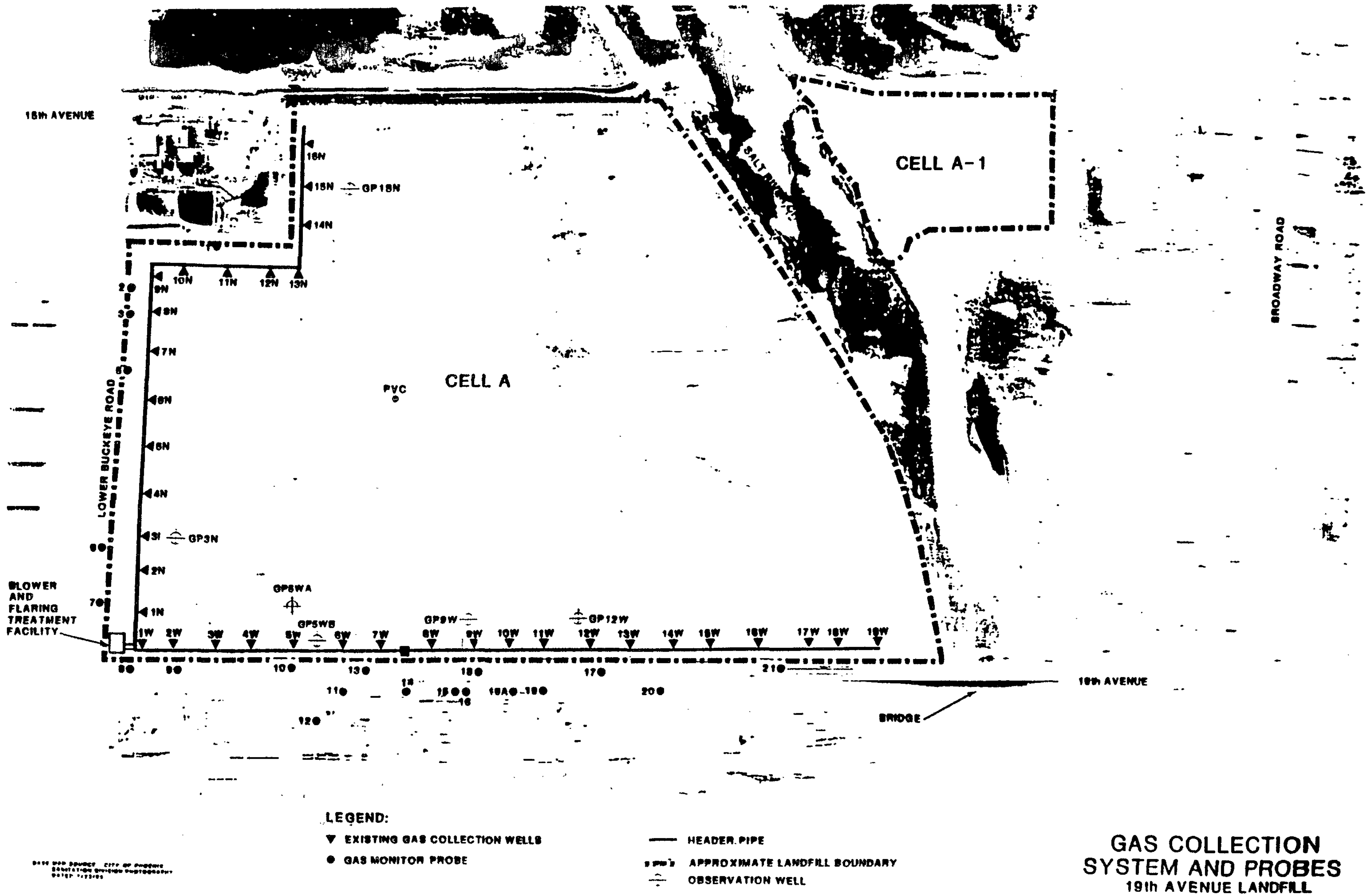
BASE CASE PREDICTED TDS CONCENTRATIONS COMPARED TO SECOND QUARTER 1987 MEASUREMENTS

19th AVENUE LANDFILL

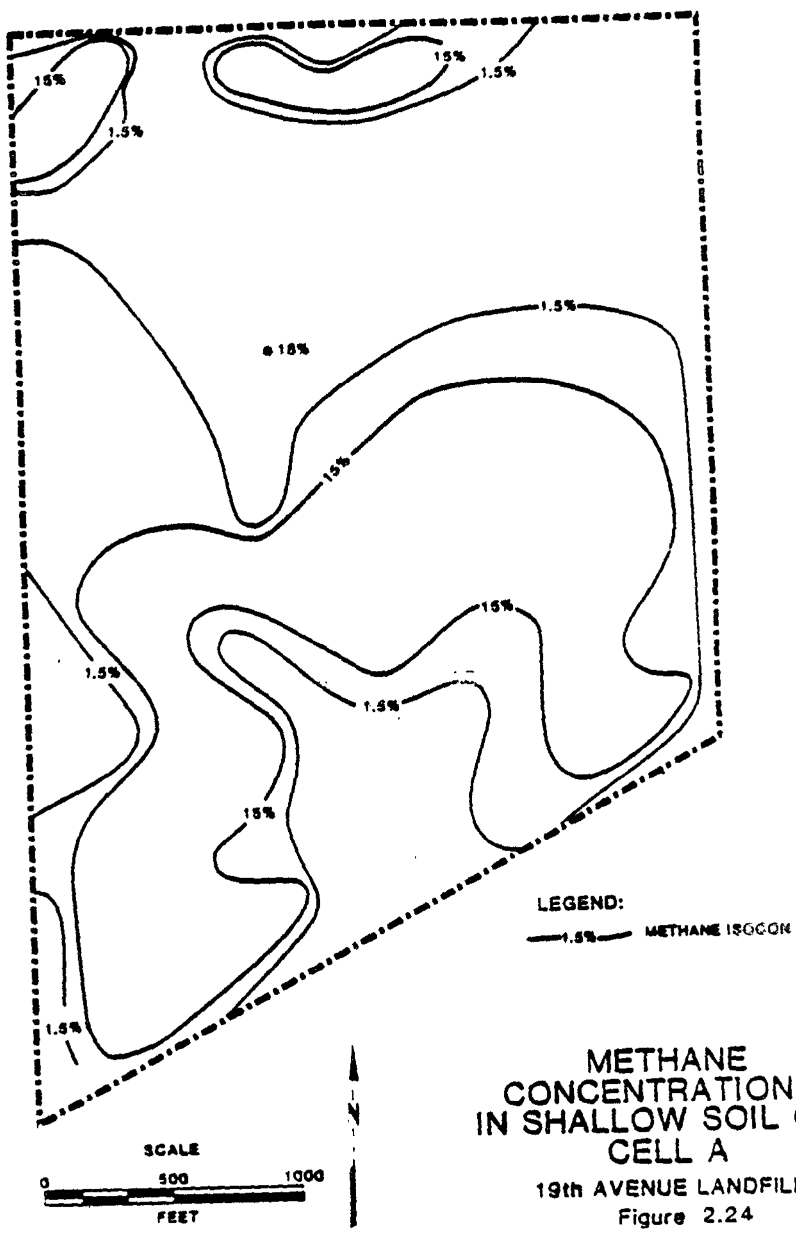
Figure 2.21



LOCATIONS OF
LIQUID DISPOSAL PIT
19th AVENUE LANDFILL
Figure 2.22



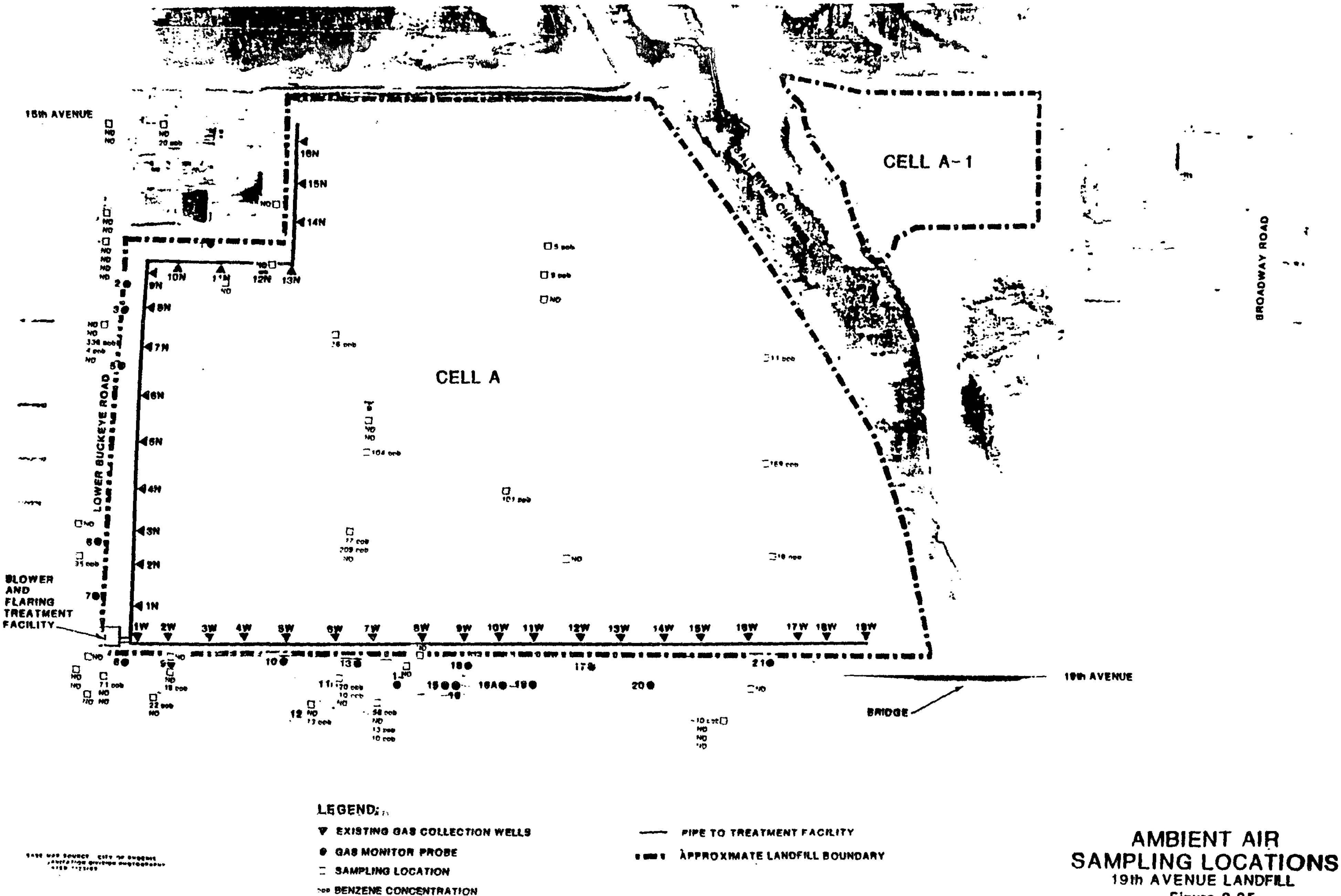
GAS COLLECTION SYSTEM AND PROBES
19th AVENUE LANDFILL
Figure 2.23



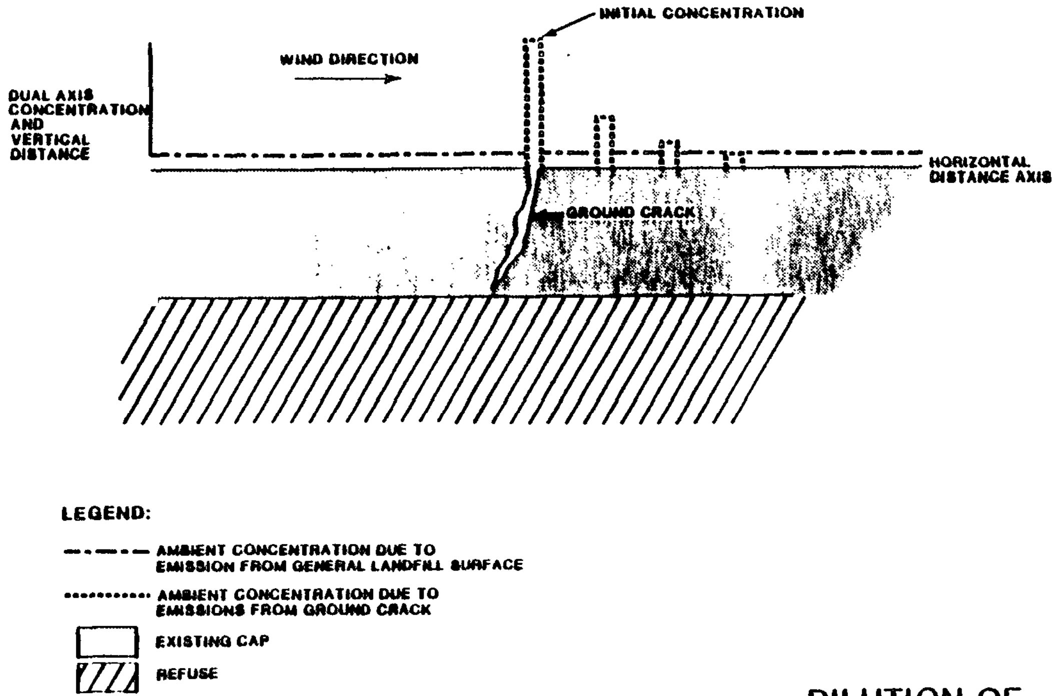
METHANE CONCENTRATIONS IN SHALLOW SOIL GAS CELL A

19th AVENUE LANDFILL

Figure 2.24



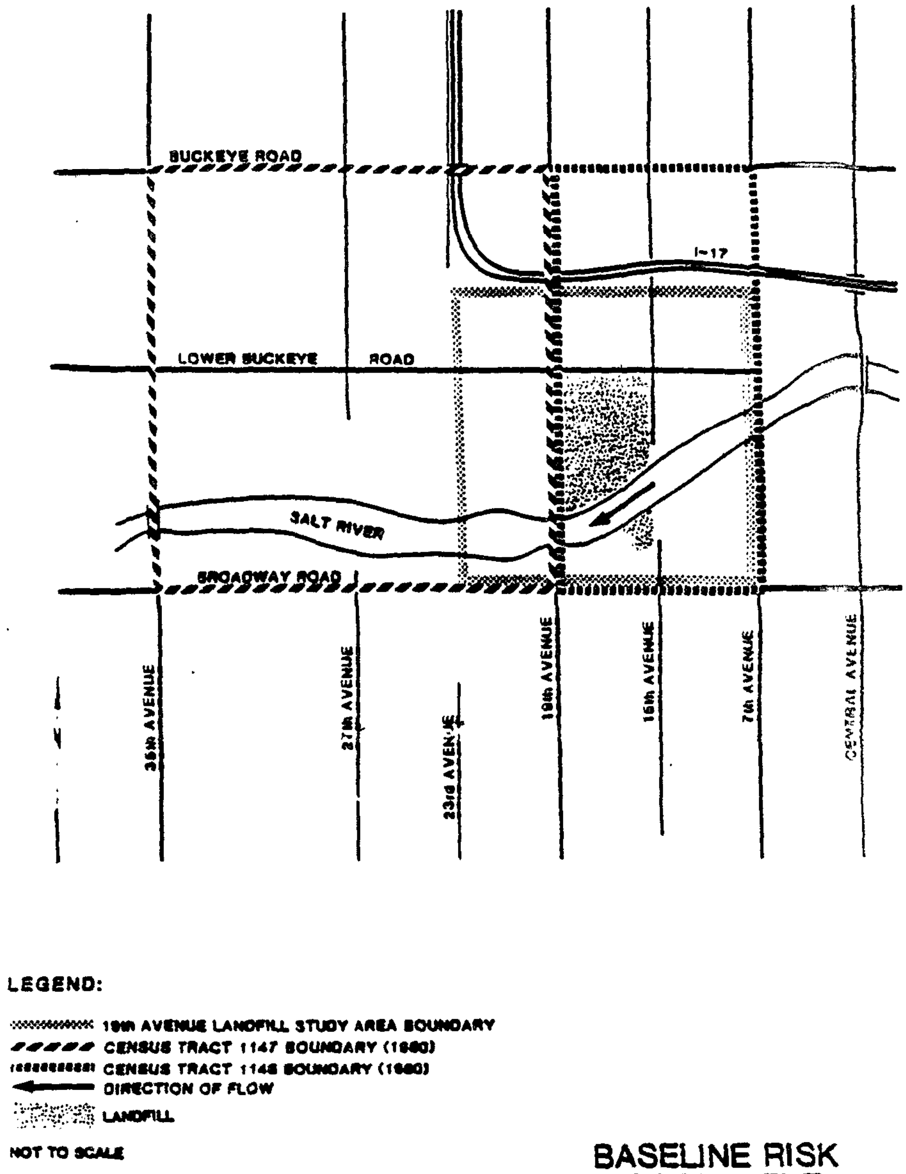
AMBIENT AIR SAMPLING LOCATIONS
19th AVENUE LANDFILL
Figure 2.25



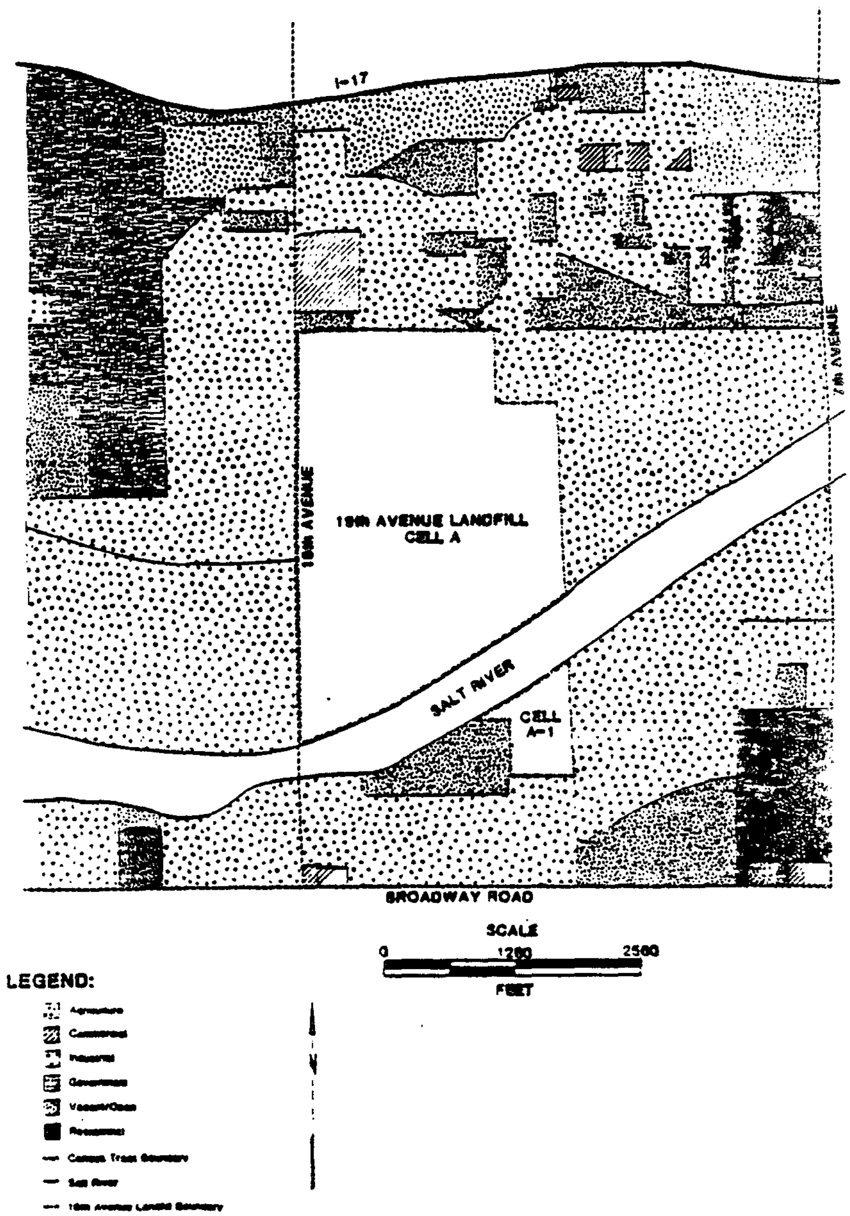
DILUTION OF EMISSIONS FROM GROUND CRACK BY ATMOSPHERIC PROCESS

19th AVENUE LANDFILL

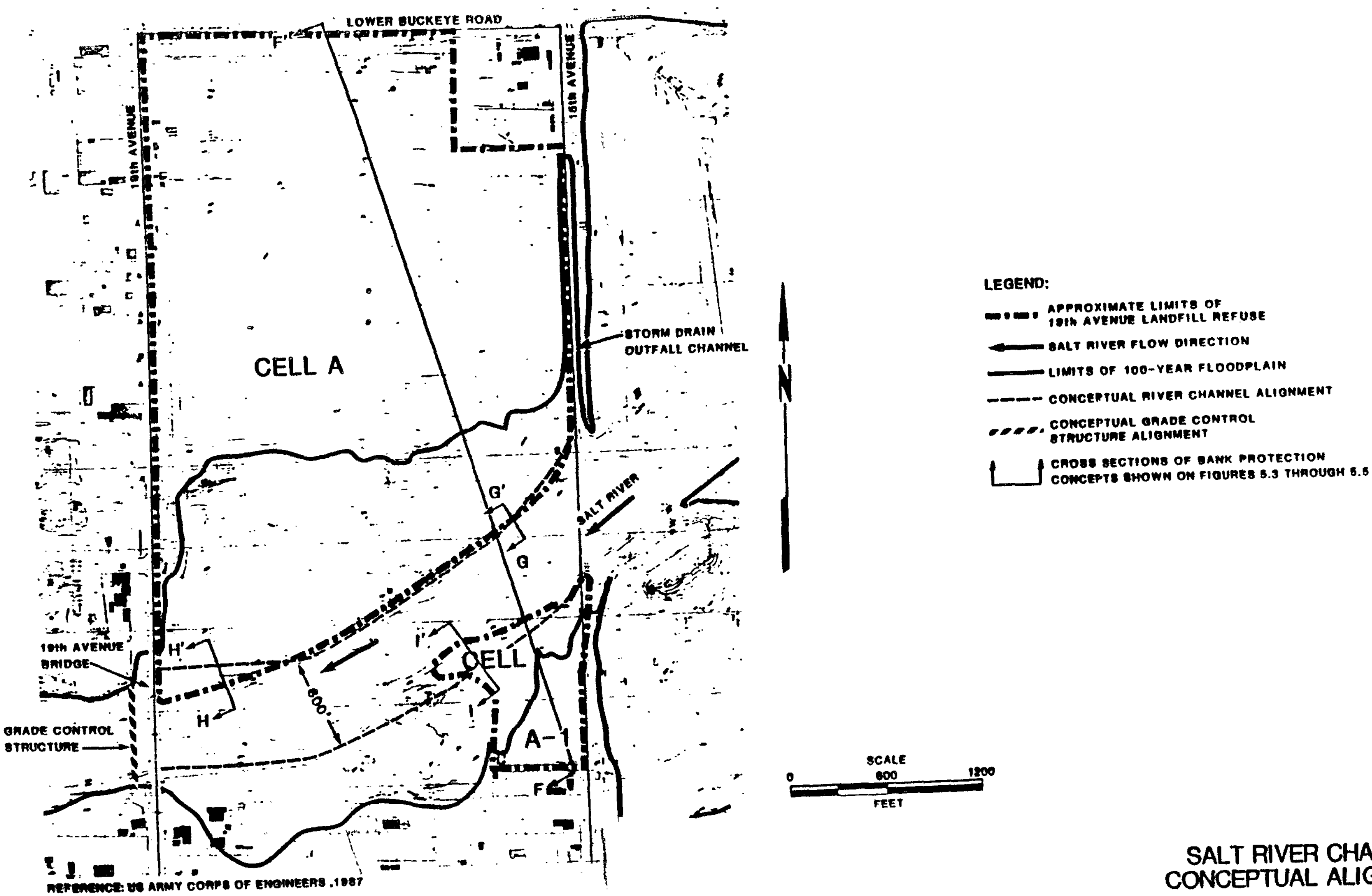
Figure 2.26



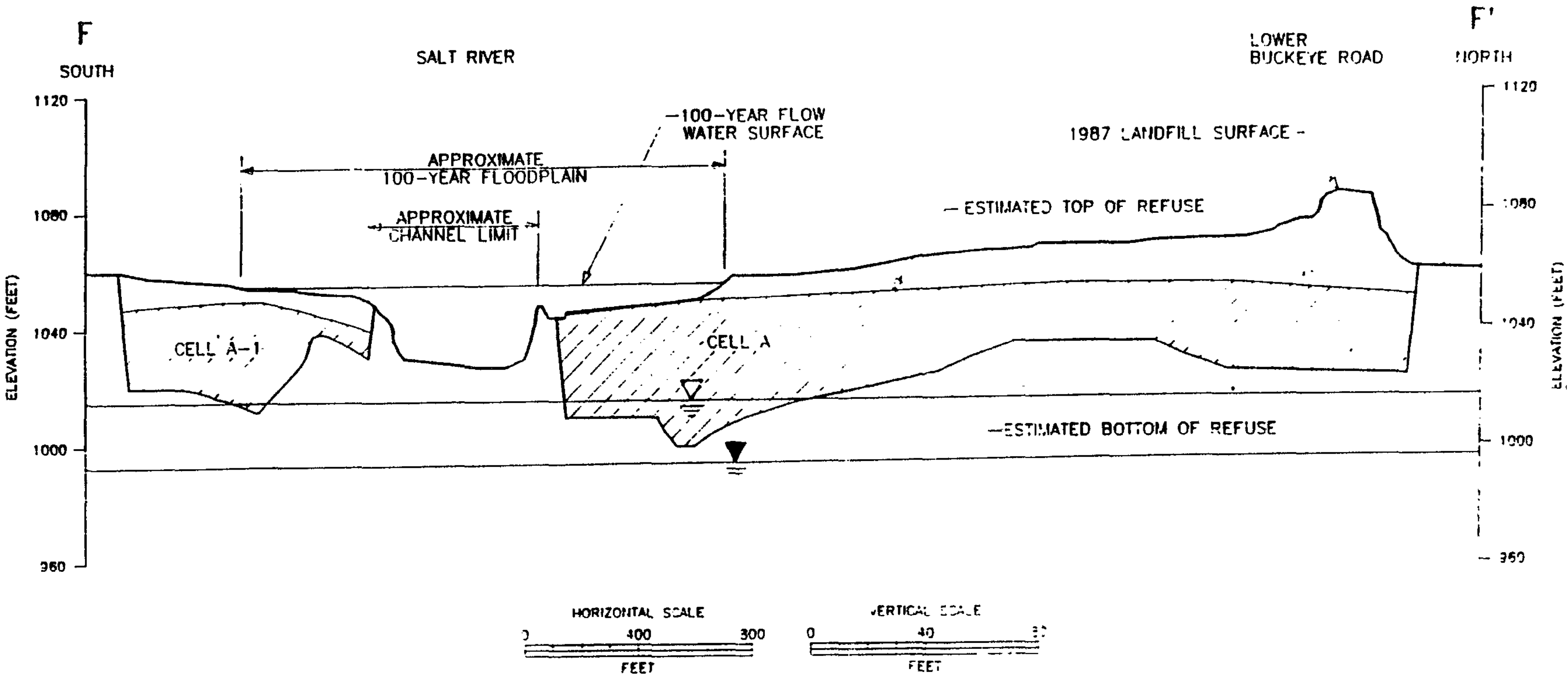
BASELINE RISK ASSESSMENT STUDY AREA
19th AVENUE LANDFILL
Figure 2.27



CURRENT
LAND USE
19th AVENUE LANDFILL
Figure 2.28



SALT RIVER CHANNEL
CONCEPTUAL ALIGNMENT
19th AVENUE LANDFILL
Figure 5.1



NOTE: THE CROSS SECTION ALIGNMENT IS SHOWN ON FIGURE 5.1

MAXIMUM WATER TABLE ELEVATION (1/10/86)

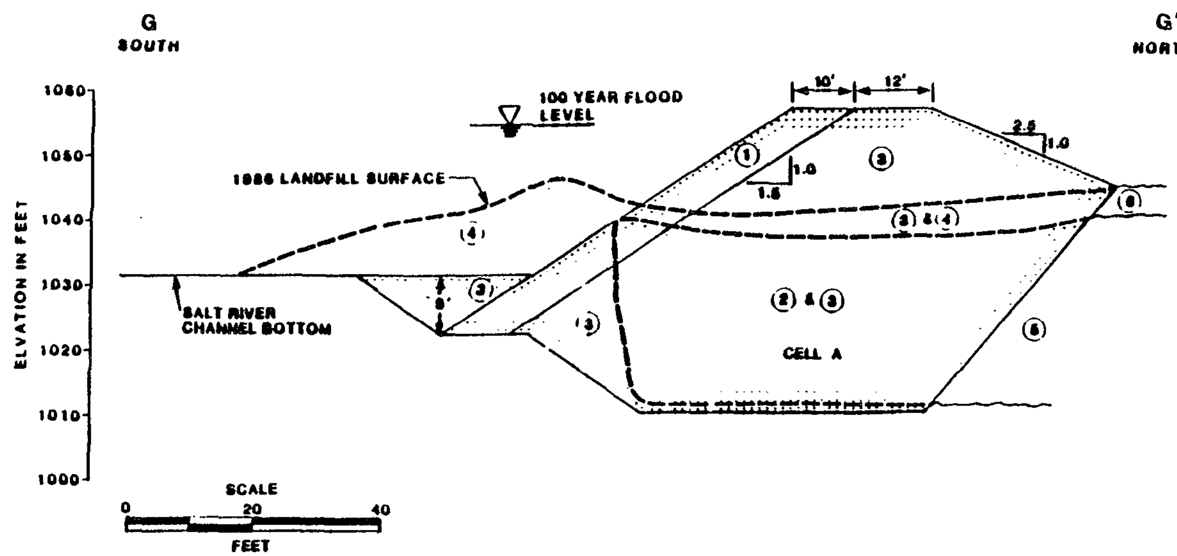
MINIMUM WATER TABLE ELEVATION (9/25/87)

REFUSE

SALT RIVER CHANNEL
CONCEPTUAL SECTION F–F'

19th AVENUE LANDFILL

Figure 5.2



LEGEND:

① SOIL CEMENT BANK PROTECTION

② REFUSE EXCAVATED DURING CONSTRUCTION

③ COMPACTED SOIL

④ EXISTING SOIL COVER EXCAVATED DURING CONSTRUCTION

⑤ REFUSE NOT EXCAVATED

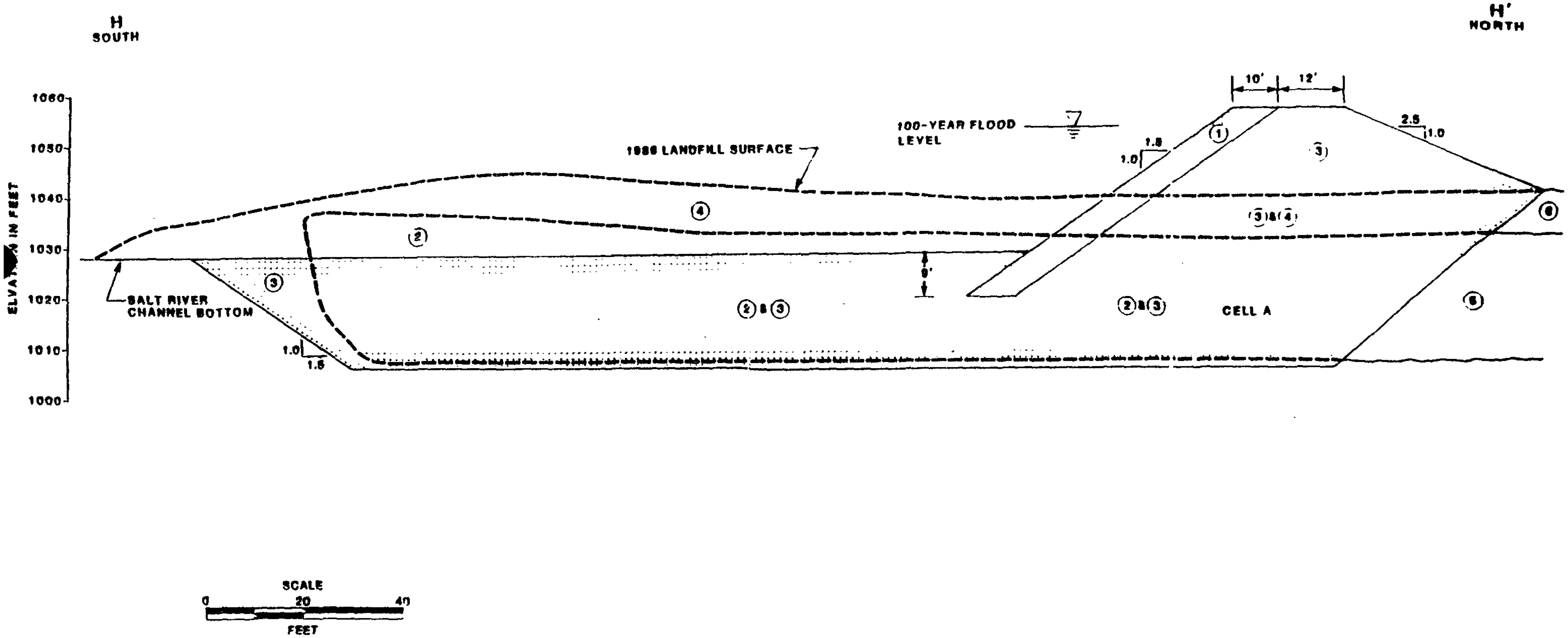
⑥ EXISTING SOIL COVER NOT EXCAVATED

NOTE: CROSS SECTION ALIGNMENT SHOWN ON FIGURE 5.1

SHALLOW SEATED BANK PROTECTION CONCEPT SECTION G-G'

19th AVENUE LANDFILL

Figure 5.3



LEGEND:

(1) SOIL CEMENT BANK PROTECTION

(2) REFUSE EXCAVATED DURING CONSTRUCTION

(3) COMPACTED SOIL

(4) EXISTING SOIL COVER EXCAVATED DURING CONSTRUCTION

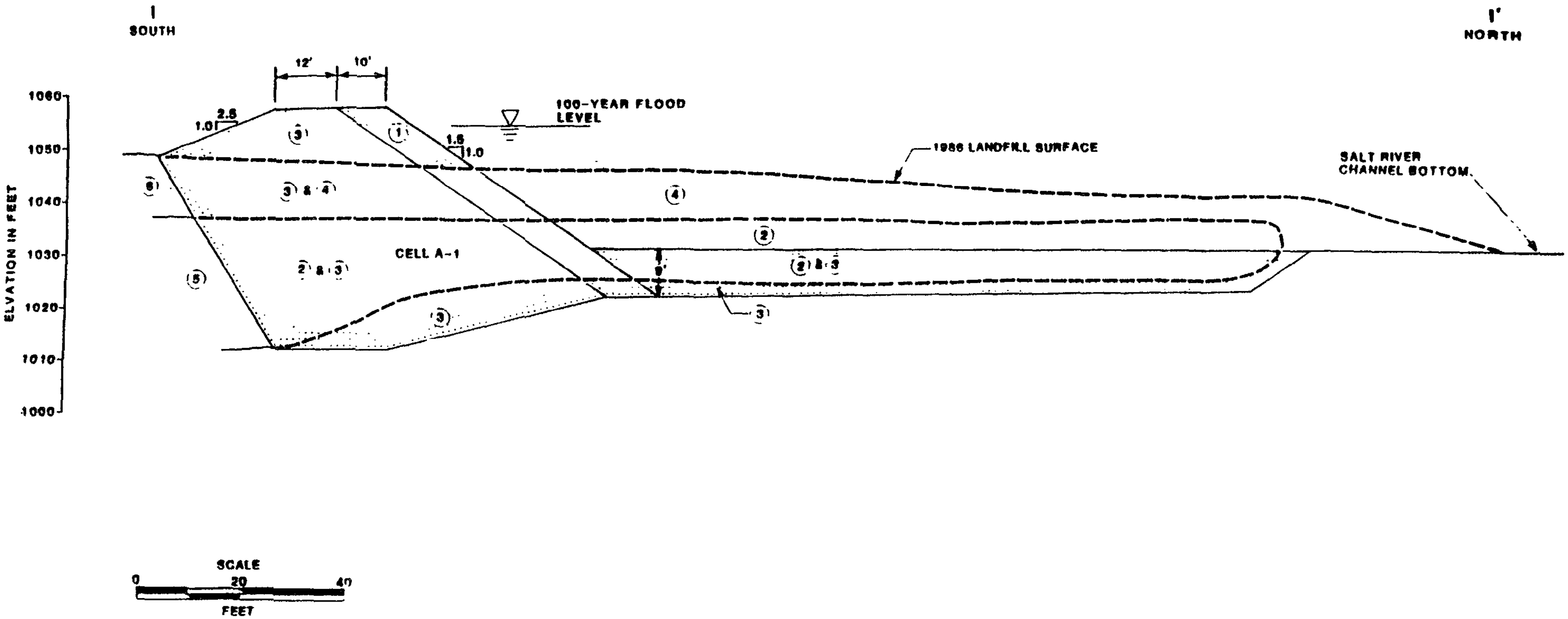
(5) REFUSE NOT EXCAVATED

(6) EXISTING SOIL COVER NOT EXCAVATED

SHALLOW SEATED BANK PROTECTION CONCEPT SECTION H-H'

19th AVENUE LANDFILL

Figure 5.4



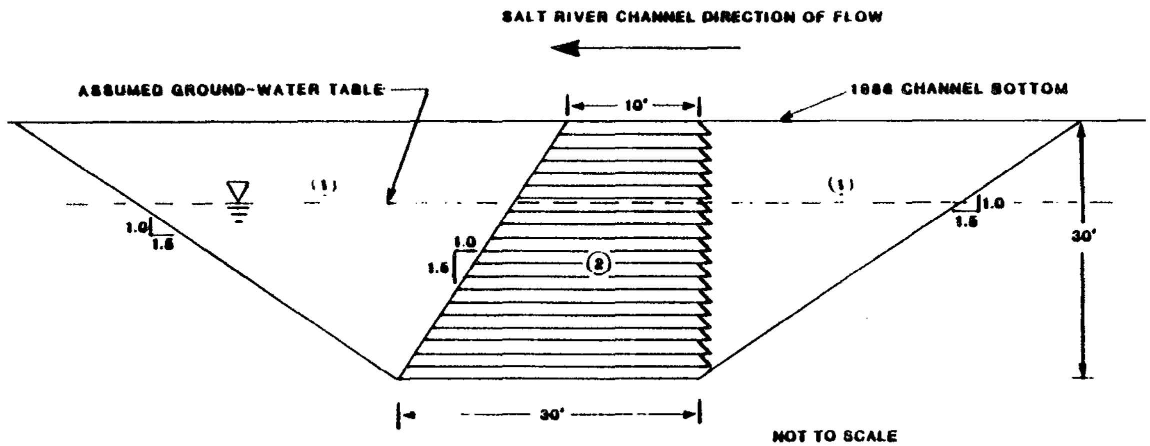
LEGEND:

1. SOIL CEMENT BANK PROTECTION
2. REFUSE EXCAVATED DURING CONSTRUCTION
3. COMPACTED SOIL
4. EXISTING SOIL COVER EXCAVATED DURING CONSTRUCTION
5. REFUSE NOT EXCAVATED
6. EXISTING SOIL COVER NOT EXCAVATED

SHALLOW SEATED BANK PROTECTION CONCEPT SECTION I-I'

19th AVENUE LANDFILL

Figure 5.5



LEGEND:

(1) SALT RIVER CHANNEL ALLUVIUM EXCAVATED TO CONSTRUCT THE GRADE CONTROL STRUCTURE AND BACKFILLED AS CONSTRUCTION PROCEEDS. DEWATERING OF THE EXCAVATION WILL BE REQUIRED

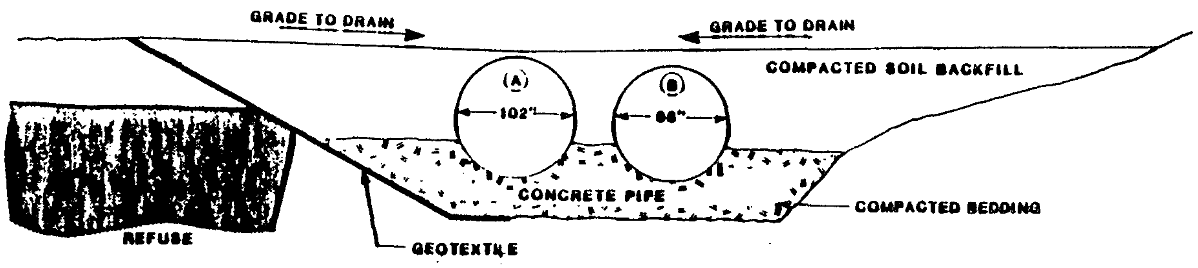
(2) SOIL CEMENT GRADE CONTROL STRUCTURE WITH INTERNAL DRAINAGE FOR GROUND WATER FLOW

[illegible]

CROSS SECTION OF GRADE CONTROL STRUCTURE CONCEPT

19th AVENUE LANDFILL

Figure 5.6



CELL A AND 15th AVENUE

SCALE
0 10 20
FEET

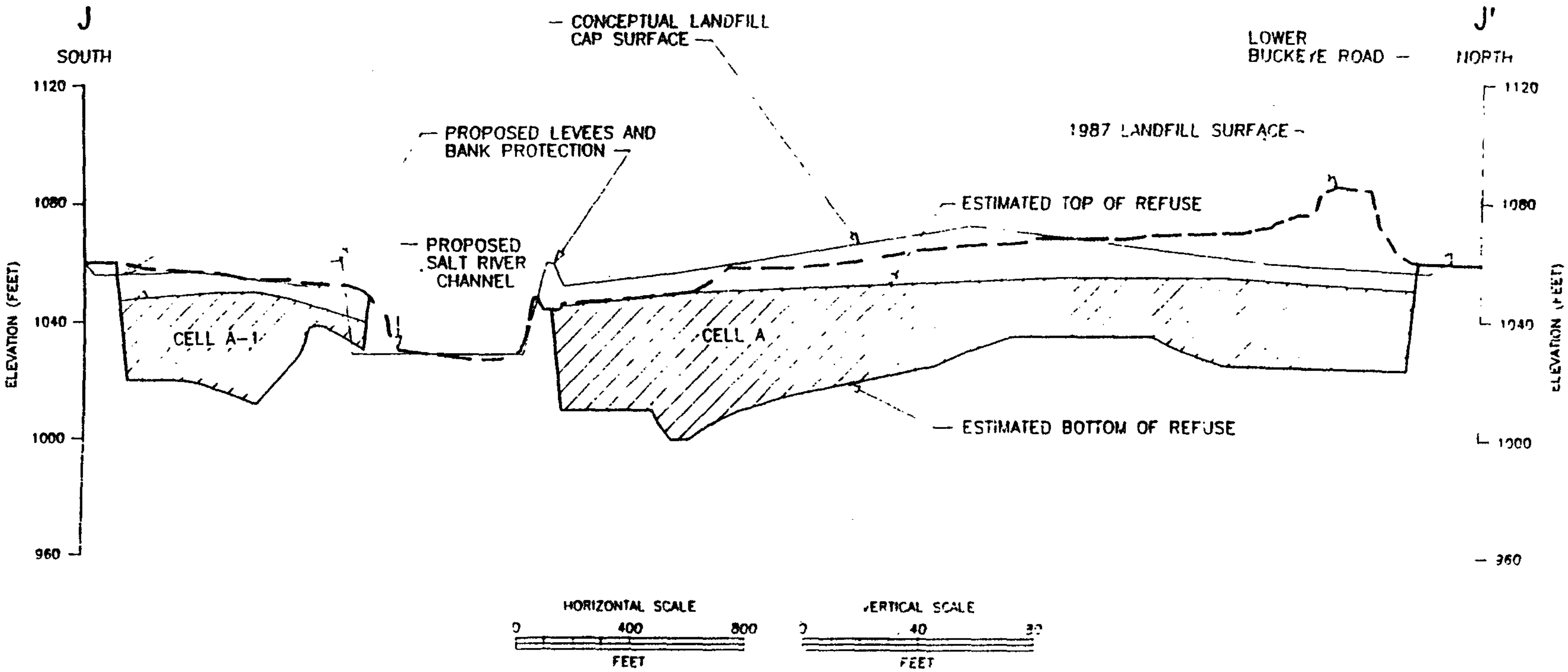
(A) 102" PIPE WOULD DRAIN SURFACE RUNOFF FROM THE NORTH AND EAST PORTIONS OF CELL A

(B) 96" PIPE WOULD BE A CONTINUATION OF THE 15th AVENUE STORM DRAIN

STORM DRAIN OUTFALL CHANNEL CONCEPT

19th AVENUE LANDFILL

Figure 5.7



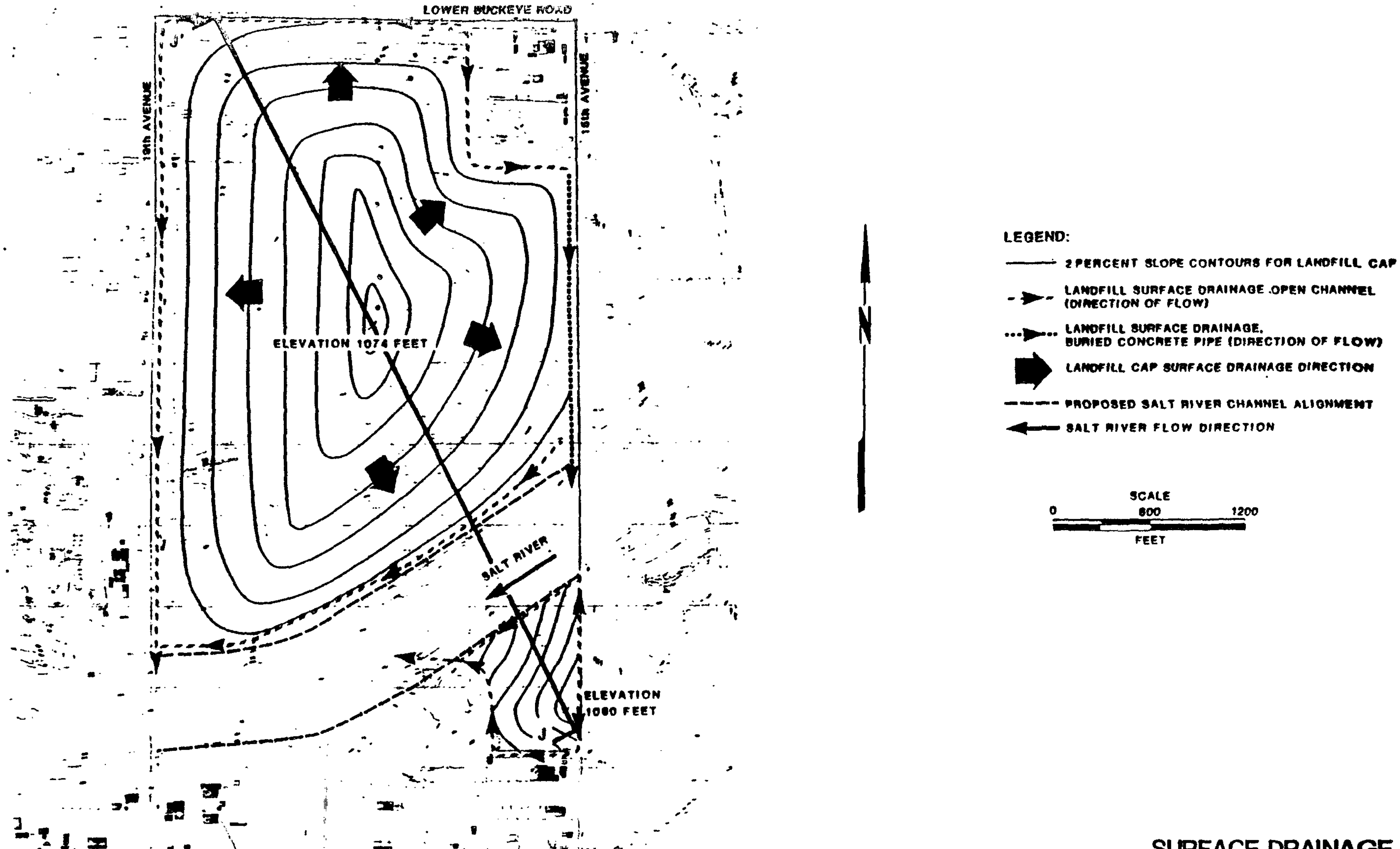
REFUSE

NOTE: THE CROSS SECTION ALIGNMENT IS SHOWN ON FIGURE 5.9

LANDFILL CAP CONCEPTUAL SECTION J–J'

19th AVENUE LANDFILL

Figure 5.8

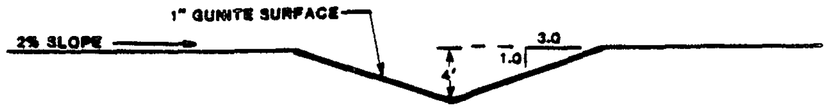


REFERENCE: US ARMY CORPS OF ENGINEERS, 1987

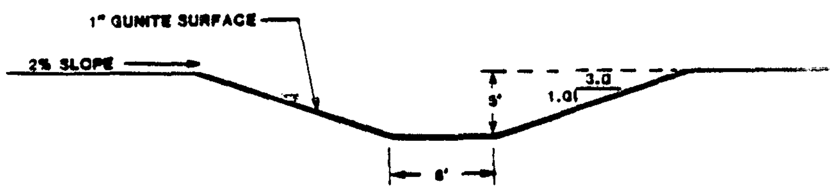
SURFACE DRAINAGE CONCEPT

19th AVENUE LANDFILL

Figure 5.9



V-CHANNEL DRAINAGE

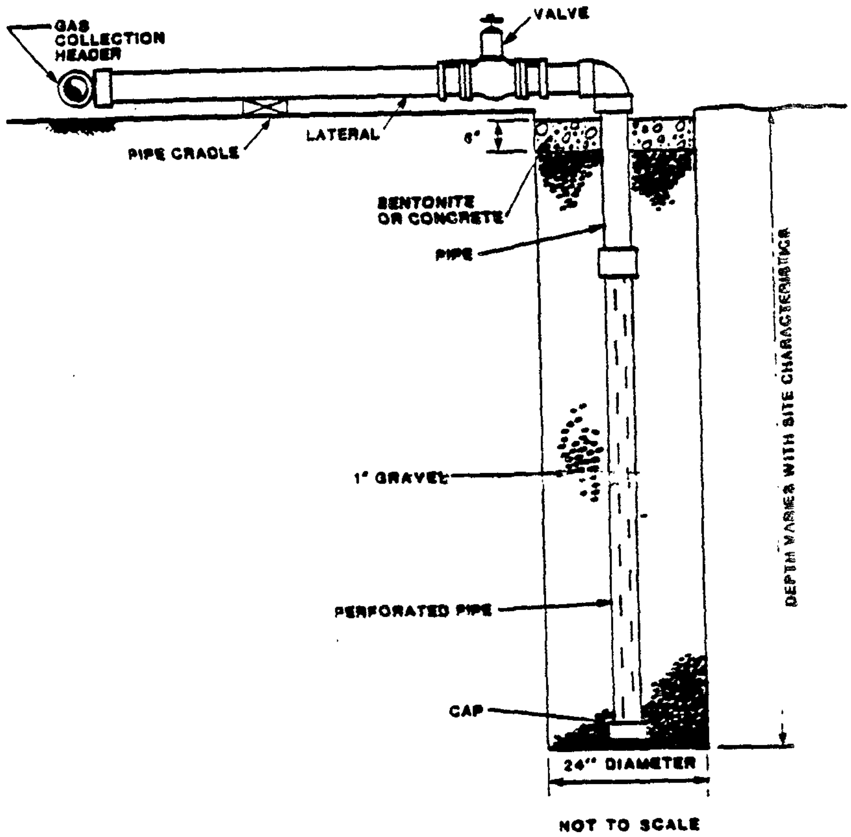


TRAPEZOIDAL CHANNEL DRAINAGE

SURFACE DRAINAGE CHANNEL CONCEPT

19th AVENUE LANDFILL

Figure 5.10

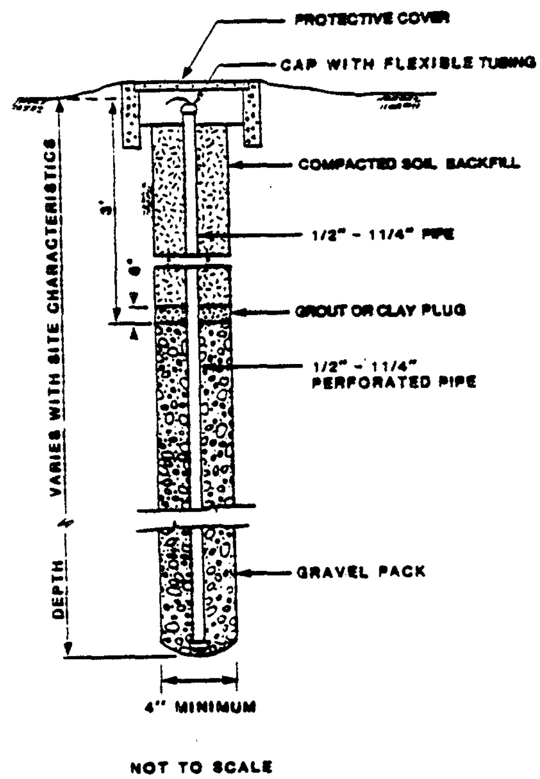


REFERENCE: EPA HANDBOOK, "REMEDIAL ACTION AT WASTE DISPOSAL SITES", 1985.

GAS EXTRACTION WELL CONCEPT

19th AVENUE LANDFILL

Figure 5.11

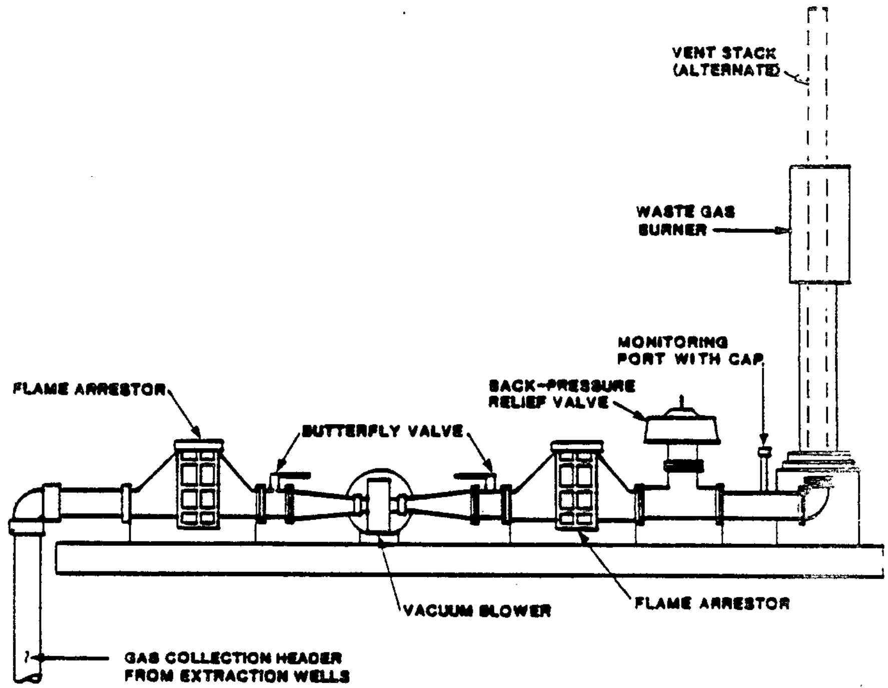


REFERENCE: EPA HANDBOOK,
"REMEDIAL ACTION AT WASTE
DISPOSAL SITES", 1985.

GAS MONITOR PROBE CONCEPT

19th AVENUE LANDFILL

Figure 5.12



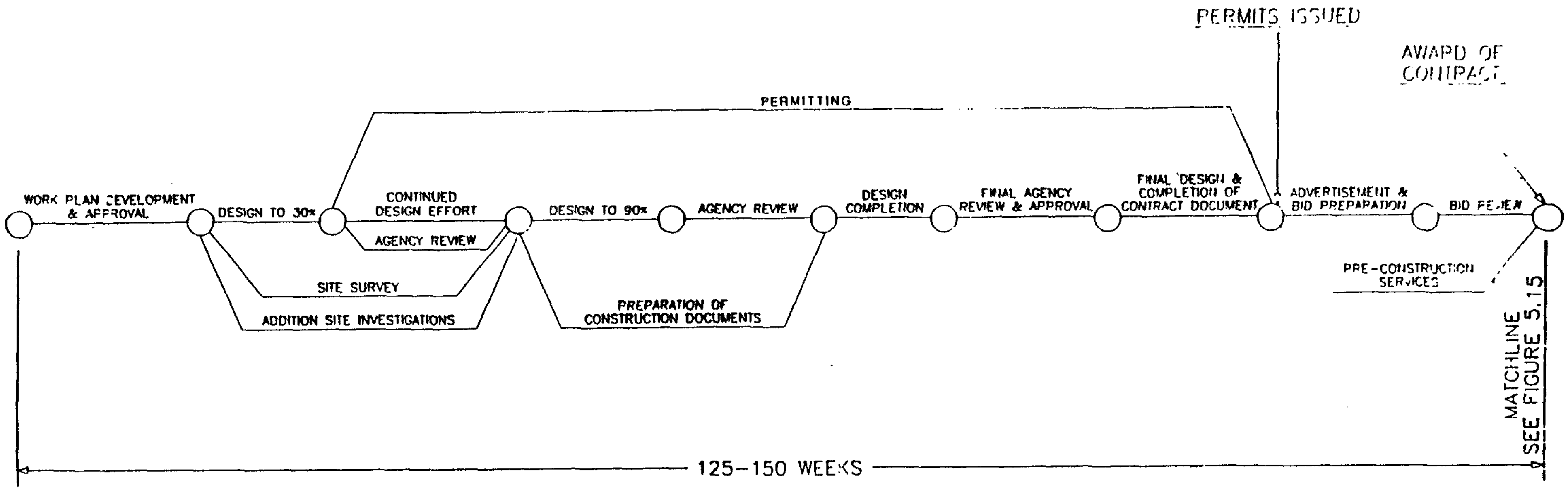
NOT TO SCALE

REFERENCE: EPA HANDBOOK: "REMEDIAL ACTION AT WASTE DISPOSAL SITES", 1985.

FLARING TREATMENT FACILITY CONCEPT

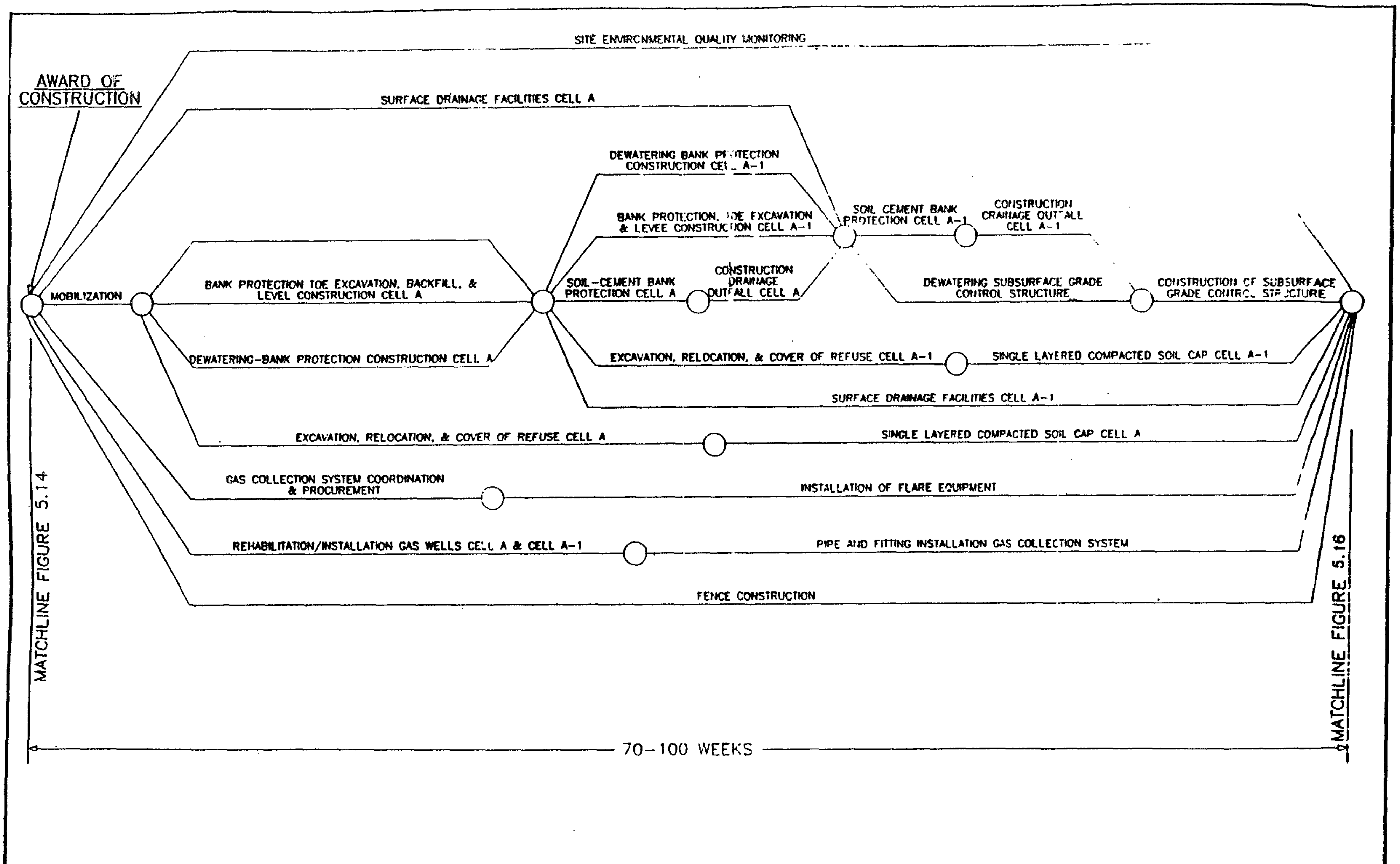
19th AVENUE LANDFILL

Figure 5.13



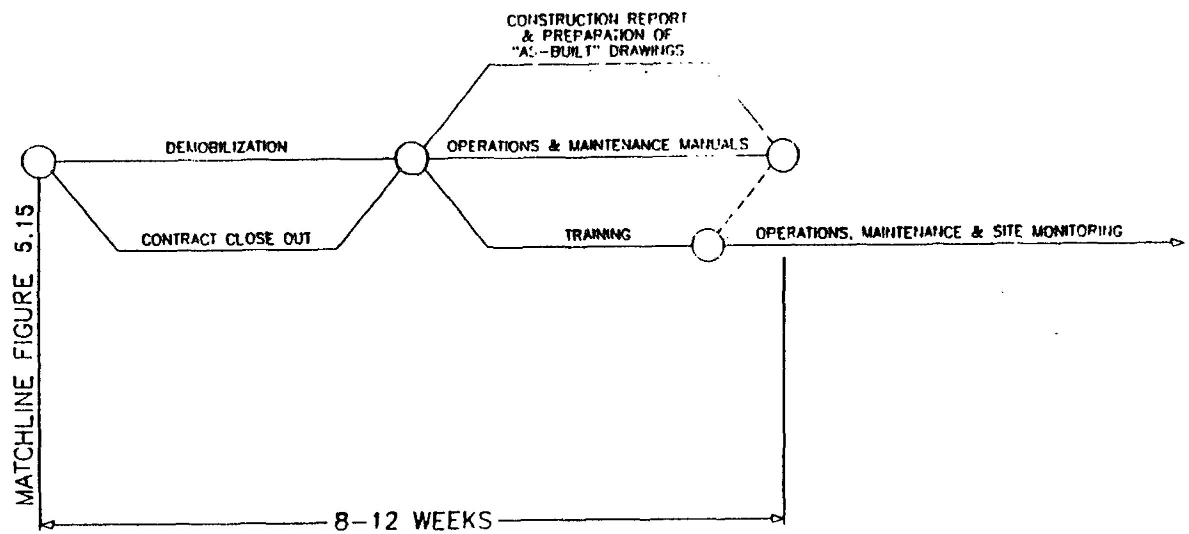
DESIGN & PERMITTING PHASE

FIGURE 5.14



CONSTRUCTION PHASE

FIGURE 5.15



POST CONSTRUCTION, OPERATIONS, & SITE MONITORING PHASE

FIGURE 5.16

APPENDIX A
COMMUNITY INVOLVEMENT HISTORY

APPENDIX A
COMMUNITY INVOLVEMENT HISTORY

In accordance with Section 113(K)(2)(i-iv) and 117 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), a Community Relations Plan (CRP) was developed and implemented for the duration of the Superfund process. The CRP is included in the RI/FS Work Plan (Dames & Moore, 1986, Appendix B-4).

The City of Phoenix (city), with oversight from the Arizona Department of Environmental Quality (ADEQ), initially undertook an analysis of community concerns regarding the 19th Avenue Landfill prior to preparing the plan. The analysis included informal interviews with nearby residents and agency representatives. The purpose of the analysis was to evaluate current and potential areas of public concern regarding the site, and to identify objectives and techniques for addressing those concerns.

Community Relations Activities

A number of community relations activities described in the CRP have occurred over the past three years and several are planned in the near future. These activities included:

Establishment of Information Repositories

Information regarding the site and the remediation process was provided to repositories at the city’s Ocotillo Branch Library at 102 W. Southern and the ADEQ office at 2005 N. Central Avenue. These repository locations have been announced to the media in the fact sheets distributed in the study area, and to the Citizen Participation Committee. The repositories will include the following documents: the CRP, fact sheets, RI/FS work plan, draft RI/FS report, the Remedial Action Plan, and miscellaneous other documents.

Designation of Information Contacts

To ensure dissemination of accurate information on the project and timely responses to inquiries, key contact persons were designated. Ron Jensen, public works director for the City of Phoenix, and Martha Rozelle of Dames & Moore were the information contacts for the project. Councilwoman Mary Rose Wilcox has played an active role in communicating with the community. Sam Ziegler, Community Relations Coordinator for the Environmental Protection Agency Region IX, was also listed as a contact person.

Each of these individuals responded to inquiries from citizens, interested groups, elected officials, and the media. Their names, addresses, and telephone numbers were provided in news releases, fact sheets, community meetings, and local information repositories.

Development of a Mailing List

The mailing list includes elected officials, media contacts, agency and local representatives, and those individuals who returned mail-in reply cards enclosed in the first fact sheet, among others. The list contains over 150 names. In addition, more than 8,000 residents or businesses have received the fact sheets at their door.

Preparation of Fact Sheets

To date, the city has distributed two bilingual fact sheets, in English and Spanish, to more than 8,000 community members. The history of the landfill operations was explained, the plan for Remedial Investigation was presented, and contact people and information repositories were announced in the first fact sheet. A response card asking for concerns and questions was enclosed, and approximately 50 replies were received. The second fact sheet, released during the fall of 1987, summarized the preliminary results of the Remedial Investigation.

The third fact sheet will be distributed in conjunction with the start of the public comment period for the remedial action plan. The third fact sheet will discuss the results of the RI/FS, the final draft Remedial Action Plan, the extent of landfill impacts on public health, and the environment, various cleanup alternatives described in the draft Remedial Action Plan (RAP), and the recommended alternative.

Media Relations Program

The city has maintained contacts with appropriate media representatives to promote accurate and timely coverage of the RI/FS process. Press releases have been and will continue to be distributed before Community Participation Group meetings. A briefing for the press was held midway through the project and included a field trip to the landfill to look at the drilling activities and the methane collection system. A supplemental briefing will be conducted during the public comment period.

Community Participation Group

The city established a community participation group consisting of 12 individuals representing various interests. This group

- reviews available information about the project and provides comments to the city
- serves as a point for information exchange
- educates their neighbors about the project

The Community Participation Group has met seven times to date, usually at the Southwest Service Center. The group meetings are chaired by City Councilwoman Mary Rose Wilcox and are open to the public.

Comment Period an the Draft RAP

A 30-day public comment period will be held on the draft RAP. Public notices in area newspapers and the fact sheet will specify the dates of the comment period, date of a public meeting during the public comment period, and the name and address of contact person for questions and written comments. The fact sheet will be placed in the information repository and distributed throughout the information area as before.

Community Meeting

A community meeting will be held during the comment period to receive comments on the draft RAP. It will be publicized through the media and the fact sheet mailings.

Preparation of the Responsiveness Summary

A Responsiveness Summary, required as part of the Record of Decision, will document public concerns and issues raised during the public comment period. ADEQ will respond to these concerns, and the Responsiveness Summary will be placed in the information repositories.

APPENDIX A

Arizona Department of Environmental Quality
and
United States Environmental Protection Agency

RESPONSIVENESS SUMMARY
19th Avenue Landfill, Phoenix, Arizona

INTRODUCTION

During the public comment period for the 19th Avenue Landfill from June 29, 1989 through August 11, 1989, the Arizona Department of Environmental Quality (ADEQ) and the United States Environmental Protection Agency (EPA) received comments on the proposed remedy for the site from persons residing or doing business in the area of the landfill, and from interested parties. In this responsiveness summary, the agencies will respond to comments and questions which pertain to the investigation and proposed remedy for the 19th Avenue Landfill.

In order to fully inform the public of the concerns and questions, this responsiveness summary will also address and document informal inquiries made to the agency during the public meeting held on July 20, 1989, in addition to the formal public comments submitted. Attached to this responsiveness summary are full copies of all written comments received, a transcript of the public comment meeting, and the written script of a video presentation made during the meeting.

The purpose of this responsiveness summary is to address and document comments on the Remedial Action Plan for the 19th Avenue Landfill. This responsiveness summary will be used by ADEQ and the EPA to gain an understanding of the views expressed by the public and interested parties regarding the proposed remedy and other actions considered. The comments will be taken into consideration during the selection of the final remedy. The ADEQ and EPA will prepare records of decision, which will include the responsiveness summary, and which will explain the final remedy selected for the 19th Avenue Landfill.

SUMMARY OF PUBLIC QUESTIONS AND COMMENTS AND AGENCY RESPONSES

Written Questions Presented During the July 20, 1989 Public Comment Meeting

1. Question/Comment: Have you identified any potentially responsible parties (parties who are legally obligated under Superfund to help pay for remedial action at the landfill)? Who are they? [See Reporter's Transcript of Proceedings of Public Comment Meeting, Attachment 1, pp. 32.]

Response: Yes. In 1987, the United States Environmental Protection Agency provided formal notice of potentially responsible party status to the site's owners, Superior Companies, Amos and Edna Pasqualetti, Pasqualetti Properties, and Pasqualetti Properties, Inc. Subsequently, the United States Environmental Protection Agency, the Office of the Arizona Attorney General, the Arizona Department of Environmental Quality, and the City of Phoenix have been conducting an investigation to identify parties with an interest at the 19th Avenue Landfill site. The investigation is continuing, and the agencies and the City anticipate that more parties will be contacted. No final list of such parties has been compiled.

Many companies have received requests for information regarding potential waste disposal at 19th Avenue from the ADEQ or EPA. EPA sent formal requests for information regarding use of the 19th Avenue Landfill to 97 companies in April, 1987. On June 16, 1989, ADEQ formally requested information from an additional 58 companies. Companies who received the information requests are listed in Attachment 3. The City, ADEQ, the Office of the Arizona Attorney General, and EPA are currently analyzing this information and other evidence to identify all potentially responsible parties. The City and State intend to seek cost recovery, through legal action if necessary, from responsible parties.

2. Question/Comment: How would the levy system in the proposed remedy prevent groundwater from rising into the landfill during flooding conditions? [See Reporter's Transcript, Attachment 1, p. 32.]

Response: The levy system is not intended to prevent groundwater from rising into the landfill refuse during flooding. The primary purpose of the levy is to prevent flood waters from washing out landfill contents into the Salt River. The studies conducted during the Remedial Investigation and Feasibility Study show that although the deepest portion of the landfill has been below the groundwater table, no primary drinking water standards have been exceeded in the downgradient wells, except for nitrate, which is a relatively common contaminant and which cannot be positively identified as originating from the 19th Avenue Landfill. The groundwater Contingency Plan would be implemented in the event flooding caused groundwater to rise into the landfill and resulted in groundwater contamination. The Contingency Plan is discussed further in response to Question 10 below.

3. Question/Comment: How many consulting firms have worked on the 19th Avenue Landfill project for the City? Who are they? [See Reporter's Transcript, Attachment 1, p. 33.]

Response: Dames & Moore has performed the formal Remedial Investigation and Feasibility Study for the City of Phoenix. The Remedial Investigation and Feasibility Study (RI/FS) relied in part on previous technical work done for EPA or for the City. The Woodward-Clyde consulting firm prepared an RI/FS work plan outline for EPA in 1986. Previously, the following consulting firms performed work pertaining to the 19th Avenue Landfill on behalf of the City:

1. Emcon Associates (preliminary design for methane gas control system, 1979);
2. Sverdrup and Parcel (flood protection engineering work, 1979);
3. James M. Montgomery, Consulting Engineers (preparation of report pertaining to environmental impact of 19th Avenue Landfill, 1980);
4. ATL Testing Laboratories (subsurface investigation, 1980);
5. Brown and Caldwell (groundwater monitoring and assessment and flood protection engineering work, 1981-86);
6. EAL Corporation (water sample analysis, 1982).
7. Western Technologies, Inc. (study of volume of waste in Cell A-1, 1985); and
8. Water Resources Associates, Inc. (hydrologic analysis, 1985).

4. Question/Comment: Did the City and the agencies consider the use of a leachate collection system and slurry walls to eliminate the potential risk of off-site migration of groundwater contamination? [See Reporter's Transcript, Attachment 1, p. 34.]

Response: Yes. Both systems were considered but rejected. Use of slurry walls was evaluated as part of the Feasibility Study. Their effectiveness was determined to be doubtful because of the high permeability of the sand and gravel deposits that comprise the sediments underlying the landfill. During a flood condition, some of the water flowing in the Salt River would move rapidly through the underlying sand and gravel deposits. A slurry wall, even if constructed to the maximum cost-effective depth of 50 feet, would not prevent ground water from moving under it. Installation of a leachate collection ,doom. system would require removal of the landfill contents, an option that was determined to pose a risk to public health and the environment, to be infeasible, and also not to be cost-effective.

Further information regarding the removal option is contained in response to Question No. 19 below.

5. Question/Comment: Is Alternative A a permanent solution? [See Reporter's Transcript, Attachment 1, p. 35.]

Response: Yes, to the extent practicable. While EPA and ADEQ give Preference to permanent remedies, such remedies were not considered feasible at 19th Avenue. Alternative A accordingly will require future monitoring to ensure continued protection. Alternative A also includes a Contingency Plan that will be activated if groundwater standards are exceeded beyond the landfill's property boundary.

6. Question/Comment: How much will Alternative A cost? [See Reporter's Transcript, Attachment 1, p. 35.]

Response: Alternative A has an estimated present worth of $42,990,000 over the next thirty years, as follows:

Direct Capital Costs	$21,120,000
Indirect Capital Costs	6,340,000
Total Capital Costs	$27,460,000
Direct Annual Costs	510,000
Indirect Annual Costs	500,000
Total Annual Costs	$ 1,010,000
Present Worth (5%, 30 years)	$42,990,000

7. Question/Comment: How much has been spent on the landfill so far? [See Reporter's Transcript, Attachment 1, p. 37.]

Response: To date, the City has incurred Superfund response cost totaling approximately $11 million at the 19th Avenue Landfill. EPA and the State of Arizona have also incurred response and oversight costs, in an undetermined amount.

8. Question/Comment: How does Alternative A differ from the remedy proposed by Brown & Caldwell in 1984? [See Reporter's Transcript, Attachment 1, p. 38.]

Response: The Brown and Caldwell study, which was incorporated into the formal Remedial Investigation and Feasibility Study, did not address air quality issues at all. Alternative A was selected after a formal Remedial Investigation and Feasibility Study (RI/FS), conducted in accordance with the Superfund process and the National Contingency Plan. The RI/FS both incorporated old data and collected new data.

9. Question/Comment: How much has the City paid to its technical consultant, Dames & Moore? [See Reporter's Transcript, Attachment 1, p. 38.]

Response: To date, the City has paid Dames & Moore approximately $1.3 million for work in connection with the 19th Avenue Landfill.

10. Question/Comment: The Contingency Plan must be described in detail and the cost of it identified. [See Reporter's Transcript, Attachment 1, p. 40.]

Response: The Contingency Plan is described in detail in Appendix B at the Remedial Action Plan. The trigger for the Contingency Plan is exceedance in groundwater monitor wells of Safe Drinking water Act Maximum Contaminant Levels (MCLs), Proposed MCLs, or state Action Levels (ALs). The Contingency Plan will be triggered in the event of either three consecutive quarterly exceedances of any one of such criteria, or one exceedance at three times such criteria. Costs for monitoring of groundwater quality under the plan are estimated to be less than $100,000,per year. If triggered, the Contingency Plan would require evaluation and selection of an additional remedial alternative, if necessary. The cost for the remedial alternative will depend upon the selected remedy. If the plan is never triggered, the cost of the Contingency Plan would be limited to the groundwater monitoring expense. Conversely, if severe groundwater contamination occurred in the future, one potential remedy selected could be pumping and treating of groundwater, which could cost in the range of $20 to $40 million.

11. Question/Comment: What are the post-closure plans for the landfill?

Response: Use of the landfill site in the future will be limited to uses consistent with protection of public health and the environment and with the final remedy selected. If the proposed Alternative A is selected, the post-closure activities will include at a minimum: maintenance of the flood protection structures, soil cap, fences, perimeter ditches, monitor wells, and the methane gas and combustion system; the monitoring of methane gas and ambient air quality; continued monitoring of groundwater quality and water levels; and, if standards are exceeded, an appropriate supplemental remedy to insure that public health is not placed at risk.

The end use of the site could range from landscaping to industrial development. However, land use decisions must comply with local zoning, be approved by the landowner, and not interfere with the implementation of the approved remedy. For example, a proposed structure must be properly designed and engineered so that the integrity of the cap is maintained and monitoring can continue.

Oral Questions Presented During the July 20, 1989 Public Comment Meeting

12. Question/Comment: What will happen in the future if buried drums begin to leak chemicals? [See Reporter's Transcript, Attachment 1, p. 45.]

Response: The Contingency Plan of Alternative A is designed to address this concern. As described in detail in response to Question No. 10 above, under the Contingency Plan the site would be continually monitored in the future for groundwater contamination (including any resulting from leaking drums). If chemicals did leak into the groundwater and were detected, and an appropriate supplemental remedy implemented in order to protect public health and the environment.

13. Question/Comment: I am concerned that water will seep into the landfill and cause migration of further groundwater contamination. [See Reporter's Transcript, Attachment 1, p. 47.]

Response: Seepage of rainwater would be prevented under the preferred remedy by implacement of the soil cap. In addition, the groundwater Contingency Plan is designed to respond to potential future migration of contaminated groundwater. The plan is described in further detail in response to Questions 10 and 12 above.

14. Question/Comment: Are responsible parties being located? Will they be held accountable? [See Reporter's Transcript, Attachment 1, p. 48.]

Response: The EPA, Arizona Department of Environmental Quality, Office of the Arizona Attorney General, and the City of Phoenix have been conducting an investigation to gather additional information about waste handling practices. If during the course of the project a responsible party is identified, the City and State intend to hold these parties accountable, through legal action if necessary. Further detail regarding the investigation is contained in response to Question No. 1 above.

15. Question/Comment: What is being done differently at other landfills to prevent them from having similar problems? [See Reporter's Transcript, Attachment 1, p. 51.]

Response: Subsequent to closure of the 19th Avenue Landfill in 1979, the two major federal laws pertaining to hazardous waste disposal, the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), became effective. Since 1980, RCRA regulations have prohibited disposal of hazardous waste and substances in municipal landfills, such as the 19th Avenue Landfill. The State of Arizona has since adopted the federal regulations, and also developed a hazardous waste program to control these wastes. Now, all hazardous wastes must be tracked and sent to a permitted hazardous waste facility. The Superfund law requires parties responsible for past disposal of hazardous substances to pay for the cost of clean-up of those substances. Both RCRA and Superfund contain civil and criminal penalties for non-compliance. In addition, the State has developed other environmental programs and regulations, such as the Groundwater Quality Protection Permit Program and the Aquifer Protection Permit Program. These programs regulate new and existing non-hazardous waste landfills. The Water Quality Assurance Revolving Fund, also known as the State Superfund Program, can also be used to clean-up closed or abandoned landfills if groundwater quality is threatened. The laws have been incorporated into the comprehensive Arizona Environmental Quality Act, which became effective July 1, 1987.

16. Question/Comment: I am concerned about reports of the landfill burning in the past. [See Reporter's Transcript, Attachment 1, p. 53.]

Response: An underground fire at the landfill did occur in February, 1986. EPA's emergency response section determined that the fire did not pose a threat to public health. Alternative A would prevent future such fires, which potentially could allow chemicals to escape into the air, by expanding the landfill's methane gas collection system. Further information regarding the 1986 fire is contained in response to Question 32 below.

17. Question/Comment: Did the Remedial Action Plan analyze the economic impact of the landfill on the surrounding area? [See Reporter’s Transcript, Attachment 1, p. 57.]

Response: No. Whether the site or its remediation may have any economic impact on the surrounding area is beyond the scope of the Superfund process, and no economic evaluation was performed. However, if Alternative A is implemented, there may be a positive effect on the overall impact to property values. If Alternative A is implemented, then off-site migration of contaminants should be controlled. If additional work is performed that increases the aesthetic appearance, such as berms and landscaping, this should also have a positive effect on the overall impact to property values.

18. Question/Comment: What use will be made of the site in the future? [See Reporter's Transcript, Attachment 1, p. 58.]

Response: Use of the landfill site in the future will be limited to uses consistent with protection of public health and the environment and with the final remedy selected. This may require restricted use of the property.

Public Comment Presented
During The Public Comment Meeting

19. Question/Comment: The landfill should be excavated and removed.

Response: This option was considered but rejected, based on an evaluation of relative risk to public health and the environment using Superfund guidelines. The relative risks were based upon a comparison of the potential amount of exposure to hazardous materials from moving the landfill with that from leaving the landfill in place. At present, in place the landfill has no significant impact on public health or the off-site environment. Potential future impacts can be prevented by leaving the landfill in place and implementing the preferred alternative, in accordance with CERCLA (Superfund) Section 121(d)(2)(A).

Moving the landfill would increase the potential for exposure to the hazardous materials. Removing the landfill closure cap and the existing flood berm in order to move the landfill would increase the exposure of workers and nearby businesses and residents to gases, odors, and hazardous materials and substances. The landfill would also be susceptible to flooding during a move, and transport of the material would have the potential for accidents that might release hazardous materials or cause injury to workers or other people.

The potential short-term risks from moving the landfill are much greater than those from leaving it in place. The long-term impact on public health and environment also would not be greatly reduced by moving the landfill, whose contents would have to be incinerated or reburied. Therefore, using EPA screening criteria, the decision was made not to move the landfill. In addition, moving the landfill would not be feasible or cost effective. The estimated cost to remove the landfill is over one billion dollars. This high cost estimate is the result of dealing with the nine million cubic yards of waste in the landfill which includes residential, agricultural and industrial waste.

Written Comments Received During Public Comment Period June 29, 1989 to August 11, 1989

Letter From Pamela E. Swift, Chairwoman Toxic Waste Investigative Group, Inc. (full text of letter at Attachment 4)

20. Question/Comment: The 19th Avenue Landfill site should not have been administered under the Arizona water Quality Assurance Revolving Fund program (the State's Superfund law), but should have remained under the United States Environmental Protection Agency federal Superfund program. The Arizona Department of Environmental Quality (ADEQ) should not have been granted lead authority over the site.

Response: The landfill was administered under both programs. EPA designated ADEQ the "lead" agency for remedial activities for the 19th Avenue Landfill Superfund site but maintained oversight to ensure Superfund compliance. ADEQ has coordinated all regulatory and remedial activities very closely with EPA, which will issue a record of decision certifying that the final remedy selected for the 19th Avenue Landfill complies with federal as well as state law. A consent order will be developed. ADEQ has been empowered by the Arizona legislature to deal with this type of problem. A strong lead presence at the State level is more timely and more effective for ensuring correction of any environmental problems if they develop.

21. Question/Comment: Why didn't the ADEQ act upon the injunction pertaining to closure of the Landfill obtained in 1981 against the City of Phoenix?

Response. ADEQ did act upon the injunction, and subsequently developed in conjunction with the City a program for responding to the environmental issues presented by the 19th Avenue Landfill. This program resulted in the data used to develop the work plan for the Remedial Investigation. Because the City voluntarily undertook the Remedial Investigation and Feasibility Study, there was no need for additional legal action.

22. Question/Comment: Why was the landfill evaluated under the Arizona Water Quality Assurance Revolving Fund program instead of the U.S. EPA's Superfund program?

Response: The landfill was evaluated under both programs. The Remedial Investigation/Feasibility Study and Remedial Action Plan followed Superfund guidance. ADEQ was delegated lead enforcement authority over the site in July,1988, and required compliance with the Arizona Water Quality Assurance Revolving Fund program as well as with the federal Superfund program. EPA also evaluated the City's activities for Superfund compliance.

23. Question/Comment: Why didn't the public comment meeting discuss EPA's Superfund remedy selection process?

Response: It did. The purpose of the public meeting was to discuss the remedial alternatives, including the agencies, preferred alternative, and to present the results of the site investigation. A general overview of the federal Remedial Investigation/Feasibility Study process under the Superfund law, the Comprehensive Environmental Response and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), was presented during this overview.

24. Question/Comment: Why was the public comment meeting held on one of the hottest days of the year?

Response: ADEQ notified the City of Phoenix by letter that the City's Remedial Action Plan was ready for public comment on June 12, 1989. According to the WQARF rules, the State then had 90 days to determine the remedial alternative. The Rules require a public comment period during this time, as does EPA's Superfund-program. The public meeting was held during the public comment period. ADEQ scheduled the public comment meeting during the cooler evening hours and arranged an air-conditioned building to assure the comfort of the participants.

25. Question/Comment: Why weren't residents and industries located downgradient of the landfill notified of the public comment meeting?

Response: They were, through both media and personally delivered information. The public meeting was announced in 19th Avenue Landfill Fact Sheet Number 3, 8,000 copies of which were distributed door-to-door on July 2 and July 3, 1989 to residences and businesses in an area bounded by Buckeye Road to the north, Southern Avenue to the south, Central Avenue to the east, and 35th Avenue (between Buckeye Road and Lower Buckeye Road) or 27th Avenue (from Lower Buckeye Road to Southern Avenue) to the west. ADEQ also provided notice of the July 20, 1989 public meeting in the Arizona Republic on June 25, 1989. In addition, the City purchased advertising space to publicize the meeting in the Arizona Republic on July 15, 1989, and in the suburban west Phoenix newspaper Westsider on July 19. Broadcast and print media were notified of the meeting, and public service announcements were distributed. KJZZ radio discussed the public meeting on its "Morning Edition" program and included interviews with Norm Weiss of ADEQ on July 19, 1989 and Pamela Swift of Toxic Waste Investigative Group, Inc., on July 20, 1989.

26. Question/Comment: Since drinking water standards have been violated at the 19th Avenue Landfill site, why have the agencies chosen to require monitoring rather than cleanup?

Response: Groundwater treatment is not necessary for protection to public health and the environment at present. The infrequent and minor exceedances of drinking water standards were determined not to require groundwater pumping and treating at present. As discussed in the Remedial Investigation/Feasibility Study and Remedial Action Plan, drinking water standards were occasionally exceeded in monitor wells at the boundary of the landfill. Downgradient wells do not exceed drinking water standards except for nitrate, which is a relatively common contaminant and which cannot be positively identified as having originated from the 19th Avenue Landfill. The exceedances on the boundary wells have generally been sporadic and at levels near the standard of nearly 1,800 analyses performed for compounds having drinking water standards, two percent exceeded the standards during the RI/FS investigation.

If groundwater quality is impacted, cleanup may be required in the future under the Contingency Plan. If there is a consistent exceedance of drinking water standards in the future, the Contingency Plan will require evaluation and implementation of any necessary supplemental remedial action. The Contingency Plan is discussed in detail in response to Question No. 10 above.

27. Question/Comment: There have been several studies performed on the 19th Avenue Landfill site over the past 10 years. Why have the agencies disregarded this past information?

Response: This past information was not disregarded. Data generated during studies conducted prior to the Remedial Investigation/Feasibility Study (RI/FS) report were used to examine and illustrate long-term trends (for example, water levels or water quality) or for comparison with data collected during the remedial investigation. Numerous figures in the RI/FS report are based on water level and water quality data dating back to 1980, as are several of the technical discussions in the text.

28. Question/Comment: Why has the ADEQ disregarded its own tests from the 19th Avenue Landfill site?

Response: ADEQ has not disregarded any test data. As explained in response to the previous question, the early data were reviewed during the course of the studies to help establish historic (long-term) trends.

29. Question/Comment: Methane gas has spread from the landfill across 19th Avenue, off the north bank of the Salt River. Why wasn't this fact pointed out to the public at the hearing?

Response: The transcript of the public meeting (pp. 24-25 of Attachment 1) does show that the concern for potential migration of methane past the boundaries of the landfill was discussed. Air quality monitoring indicates that, in general, methane and other gases are quickly dissipated in the air above the landfill by natural processes. As reported in the Remedial Investigation/Feasibility Study and Remedial Action Plan, prior to renovation of the gas collection system methane had been measured at concentrations exceeding the explosive limits for methane in enclosed areas adjacent to the landfill. Since renovation, the concentrations of methane have decreased below the explosive limit.

30. Question/Comment: 19th Avenue itself used to be a part of the 19th Avenue Landfill. Why wasn't this portion tested?

Response: Groundwater monitoring wells were drilled at various locations along 19th Avenue, near the street, but studies indicated no refuse was contained under 19th Avenue. Three separate means of identifying the western boundary of the landfill along 19th Avenue were used. Aerial photographs of the site were used in conjunction with geophysical surveys and subsurface borings to locate the boundaries of the landfill. Based on the review of aerial photographs, which date back to 1953, subsurface boring data, and geophysical results, no landfill materials are present beneath 19th Avenue.

31. Question/Comment: In the past, there has been extensive off-site groundwater contamination from the landfill. Why wasn't this brought out at the public comment meeting?

Response: The data do not suggest that the landfill has ever produced extensive off-site contamination. Occasional exceedances of drinking water standards have been observed in boundary wells, but groundwater quality data collected from off-site monitor wells do not show that "extensive off-site groundwater contamination" has occurred. Wells downgradient or the landfill do not exceed drinking water standards except for nitrate, which is a relatively common contaminant and which cannot be positively identified as having originated from the 19th Avenue Landfill.

32. Question/Comment: From time to time, fires have started at the landfill. Why wasn't this fact mentioned and properly addressed at the public comment meeting?

Response: There were reports of landfill fires during the operation story of the landfill. The only known fire at the landfill since it was closed occurred on February 26, 1986. The fire was caused when high subsurface temperatures ignited a plastic pipe that was part of the methane gas collection system. The burning pipe was extinguished and no further evidence of fire was observed. EPA's emergency response section was called to the scene and determined that the fire did not pose a risk to public health. The elevated temperatures in the landfill material were monitored and dissipated in less than two weeks. The public meeting concentrated on conveying as much information as possible within a short time span. All the major aspects of the investigation and cleanup were addressed, including prevention of future fires under the preferred remedy through expansion of the landfills methane gas collection system.

33. Question/Comment: Three years ago the City of Phoenix dumped hundreds of loads "clean dirt" at the landfill site. Where was this "clean dirt" dumped and spread? Was this area tested? Why or why not?

Response: This area was tested. The clean fill was placed on the northern one-third of the landfill. The landfill materials beneath the area of stockpiled soil were tested by borings placed into the landfill underneath. Soil gas surveys were also conducted in this area.

34. Question/Comment: Why weren't the residents to the south of the landfill notified of all meetings held regarding the landfill and the July 20th public comment meeting?

Response: They were. Facts sheets were distributed in November 1986, October 1987, and July 1989. Each fact sheet was delivered door-to-door in an area bounded by Southern Avenue to the South, Buckeye Road to the north, Central Avenue to the east, 35th Avenue (between Buckeye Road and Lower Buckeye Road) or 27th Avenue (from Lower Buckeye Road to Southern Avenue) to the west. The most recent fact sheet, distributed July 2 and 3, 1989, announced the public meeting of July 20. Each of the fact sheets provided names and local telephone numbers of persons who could provide more information about the landfill studies and scheduled meetings. The public comment meeting was also announced twice in the Arizona Republic and in the Westsider suburban West Phoenix newspaper. Further information regarding the public notification program is contained in response to Question No. 25 above and in response to Question No. 37 below.

35. Question/Comment: Who was on the list of 8,000 people that were notified of the public comment meeting? May I have a copy of this list?

Response: Because the fact sheets were distributed door-to-door, there is no list of the individuals (approximately 7,000) and businesses (approximately 1,000) which received notification of the public comment meeting in Fact Sheet Number 3. A list of the individuals on the fact sheet mailing list is Attachment 20.

36. Question/Comment: Why wasn't a clean-up plan submitted regarding the landfill?

Response: If this question pertains to non-selection of the option of excavation and removal of the landfill, this option was considered but rejected as posing a greater risk to public health and the environment than the preferred remedy, and also not feasible or cost-effective, as outlined in detail in response to Question No. 19 above.

37. Question/Comment: Why didn't the ADEQ keep residents and industries in the landfill area informed of the progress of the landfill studies?

Response: ADEQ did. Facts sheets regarding the landfill were distributed in November 1986, October 1987, and July 1989. Each fact sheet was delivered door-to-door in an area bounded by Southern Avenue to the south, Buckeye Road to the north, Central Avenue to the east, and to 35th Avenue or 27th Avenue to the west. The most recent fact sheet, distributed July 2 and 3, 1989, announced the public meeting of July 20 and discussed the preferred remedy. Each of the fact sheets provided names and local telephone numbers of persons who could provide more information about the landfill studies and scheduled meetings. As discussed further in response to Questions 25 and 34 above, the public comment meeting was also announced in local media. In addition, West Phoenix Councilwoman Mary Rose Wilcox formed a citizens' group in 1986 to keep local residents informed about the Remedial investigation and Feasibility Study process and results. This Citizens Participation Committee met six times between July 1986 and July 1989 to discuss the progress of the studies.

38. Question/Comment: Why didn't the ADEQ or the City get a written statement from Conrad Gamez, who worked at the landfill for over 20 years, and witnessed the dumping of hazardous waste by various industries?

Response: Mr. Gamez has been interviewed twice. The City, EPA, and ADEQ personally interviewed twenty-four former City employees with knowledge of the landfill operations, including Mr. Gamez. Mr. Gamez was interviewed on January 12, 1988 by representatives of the City and EPA, and again by the City and ADEQ on August 31, 1989.

39. Question/Comment: What two businesses would have to be relocated if Alternative A was selected as the remedy for the site? Why would these two businesses have to be relocated? What is the time frame for relocation?

Response: A&B Silica Sand and All Chevy Auto Parts would need to be relocated to properly cap the landfill. The schedule for relocating the two businesses will be dependent upon the overall construction schedule for the chosen remedy, which will be incorporated into the consent decree.

40. Question/Comment: Dames & Moore's draft Remedial Investigation/Feasibility Study was issued in June, 1988. Why did it take so long to hold the public comment meeting?

Response: Once the RI/FS was completed, EPA and ADEQ had to review it to make sure it complied with federal and state law. Some modifications were required, including development of the groundwater Contingency Plan. In addition, the City was required to develop a Remedial Action Plan (RAP) under the state WQARF Program. The draft RAP was determined to be ready for public review and comment on June 12, 1989. The public meeting was hold during the public review comment period for the RAP.

41. Question/Comment: How many meetings were held with various agencies regarding the 19th Avenue Landfill after the Remedial Investigation/Feasibility Study came out? Was the public notified about these various meetings?

Response: The ADEQ and the City of Phoenix met 15 times between June 1988 and July 1989 to discuss the draft Remedial Action Plan and to develop the groundwater Contingency Plan. After completion of the Remedial Action Plan and Contingency Plan, the public was invited to comment on the plans and attend the public meeting held at the C.J. Jorgenson Elementary School on July 20, 1989. Various issues were also discussed among the City, the ADEQ, and the EPA in additional informal meetings.

42. Question/Comment: If the landfill is too hazardous to move, as was stated at the public comment meeting, isn't it too hazardous to leave it in our neighborhood?

Response: No. As discussed in response to Question No. 19 above, moving the landfill would pose a greater risk to public health and the environment than leaving the landfill in place and implementing the preferred remedy. In addition, removing the landfill would result in worker exposure at the site.

43. Question/Comment: There are schools in the area of the landfill. What effect will the on- and off-site pollution of this land have on these children?

Response: None. The Arthur Hamilton School at 2020 West Durango Street is the nearest school to the 19th Avenue Landfill. It is located approximately three-quarters of a mile from the closest landfill boundary. The 19th Avenue Landfill presently does not have any effect on the children attending the school. The City of Phoenix provides the school's water supply from sources other than area groundwater. The landfill will not have any identifiable impact on air quality in the area. School children are prevented from wandering onto the landfill by the security fencing and guard. The preferred alternative will continue to ensure that the landfill poses no health risk to the neighboring area, including the school.

44. Question/Comment: What emergency steps are the agencies prepared to take to protect public health and the environment in the event of a fire, explosion, flood or other rapid migration off-site of hazardous waste from the landfill? What such plans were in place in the past?

Response: The ADEQ Emergency Response Unit is on call 24 hours a day along with the City of Phoenix Fire Department in case of a sudden emergency such as a fire, explosion, or surface release of any hazardous material, although an event such as this is unlikely at the 19th Avenue Landfill. In the event of a flood, groundwater monitor wells are already in place and will detect any increase in contaminant levels if they occur.

45. Question/Comment: Will capping the landfill and monitoring the groundwater allow the agencies to discover a problem while it is happening, or only after it already has happened?

Response: The monitoring provisions of the preferred remedy would provide timely notice of potential adverse changes in ground water quality, methane migration rates, or air quality.

46. Question/Comment: Why did the ADEQ and the EPA allow the City to take so long to propose a final solution to the landfill? Was this in the best interest of public health and the environment?

Response: The 19th Avenue Landfill is actually one of the first large municipal landfills listed as a Superfund site to be processed for remedy selection. Remedy selection under Superfund and WQAPF is complex and time consuming, and making sure the final solution is the proper one is in the best interest of public health and the environment.

47. Question/Comment: Are you aware that the City's technical consultant, Dames & Moore, has also been an environmental consultant for Motorola, one of the polluters of the landfill?

Response: Dames & Moore is an independent engineering consulting firm that has worked with over 16,000 clients, including -- on projects unrelated to the 19th Avenue landfill -- Motorola. No conflict of interest is presented by this unrelated consulting work, which has been managed by different personnel. Historical data are available with regard to Motorola's disposal practices at the 19th Avenue Landfill.

48. Question/Comment: How does the Remedial Action Plan prepared by Dames & Moore differ from the eight previous studies performed by the City?

Response: Data generated during studies conducted prior to the Remedial Investigation/Feasibility Study (RI/FS) report were used to examine and illustrate long-term trends (for example, water levels or water quality) or for comparison with data collected-during the remedial investigation. Numerous figures in the RI/FS report are based on water level and water quality data dating back to 1980, as are several of the technical discussions in the text. Only the more recent data collected during the official remedial investigation were used in the baseline risk assessment for the site, because these data contain consistent and verifiable QA/QC procedures. The response to Question No. 3 has additional information.

49. Question/Comment: Why has it taken the ADEQ so long to locate the potential industrial polluters of the landfill? The EPA compiled a list of the potential industrial polluters several years ago. Why didn't you obtain a copy of this list from the EPA and locate the polluters of the landfill? Why wasn't the list of the potential industrial polluters presented at the public meeting?

Response: The City of Phoenix has been the operator of the landfill and has taken initial responsibility for the remediation. Parties that may have an interest in the landfill have been notified. Others will be notified in the future. If during the course of the project a responsible party is identified, the City and State intends to hold those parties accountable.

50. Question/Comment: Why did the ADEQ allow Dames & Moore to show a film regarding “general” trash problems, since the main problem with the landfill is hazardous waste.

Response: The video program was presented at the July 10, 1989 public meeting in an effort to convey the major findings of the investigation and to describe the preferred alternative in an effective, concise medium, thereby increasing the ability of the public to judge the preferred alternative. As noted in the video presentation, the video was developed by Dames & Moore for the City of Phoenix. A copy of the script of the video may be found at Attachment 2.

51. Question/Comment: What role did the cost factor play in the final solution?

Response: A role subordinate to protection of public health and the environment. In accordance with EPA regulations, the cost factor was only considered when comparing alternatives that provided equal protection of public health and the environment. Only where two or more options provide the same degree of short- and long-term protection of public health can the less costly alternative can be selected. This is the case with the preferred alternative for the 19th Avenue Landfill.

52. Question/Comment: What role did protection of public health and the environment play in the selection of the landfill remedy?

Response: Protection of public health and the environment was the primary remedy selection criteria.

53. Question/Comment: Do you believe that the landfill site is safer today than it was when it was put on the EPA Superfund (National Priorities) List? Why or why not?

Response: Yes. A number of actions have been taken to make the landfill safer since the site was placed on the EPA Superfund list. These include the following:

1. A soil cover was placed over the landfill to close the landfill;
2. A gas collection system was installed to prevent the migration of methane and other gases;
3. Ground-water monitoring wells were installed on and off-site of the landfill; and
4. Berms were constructed around the boundary of the landfill to provide flood protection.

54. Question/Comment: What steps will the agencies take to bring the City into compliance if the City does not fulfill its commitment to the site?

Response: The State and City will enter into a Consent Decree, which is enforceable in Superior Court. Violations would subject the City to fines of $5,000 per day and treble damages.

55. Question/Comment: What effect will this 213-acre contaminated site have on the property values in the neighborhood?

Response: The site has as been operated as a landfill since about 1957, and has been on the NPL since 1983. If remedial activities are implemented to prevent off-site migration of contamination, property values should not be effected.

56. Question/Comment: Are you aware that information is harder to obtain from ADEQ in recent months regarding the 19th Avenue Landfill and other polluted sites in Arizona?

Response: ADEQ records remain open to public inspection. Compilation of the Administrative Record for the 19th Avenue Landfill has resulted in an organized, complete set of important documents; however, these documents by law must remain on the ADEQ premises so that any interested party may inspect them.

57. Question/Comment: Do you think that two polluted landfills [19th Avenue and 27th Avenue] in the same area have an adverse effect on the environment? Are these two landfills a risk to public health?

Response: The results of studies conducted at the 19th Avenue Landfill indicate that it is not currently a risk to the public health. Both landfills have been and are being studied and evaluated independently. At this time the data indicate that the two landfills are separate and distinct in terms of groundwater quality.

58. Question/Comment: Is there a risk to public health because of the methane gas problems along the north bank of the Salt River?

Response: If this question refers to the north bank of the Salt River at 19th Avenue, results presented in the Remedial Action Plan and the Remedial Investigation/Feasibility Study indicate that methane does not pose a risk to public health along the north bank of the Salt River. No structures are present to trap the gas and allow it to reach explosive levels.

59. Question/Comment: Will monitoring the 19th Avenue Landfill stop the pollution?

Response: Monitoring alone will not stop groundwater pollution, but is one part of a program to prevent pollution from becoming a risk to public health and the environment. Groundwater monitoring provides the data on groundwater conditions so that an appropriate remedial response can be implemented if or when standards are exceeded. Monitoring is a key part of the groundwater Contingency Plan, which is further discussed in response to Question No. 10 above.

60. Question/Comment: When will we get some landfill laws that will prevent air, water, and soil pollution?

Response: There are currently existing laws and regulations that control the release of contamination from landfills and are designed to prevent air, water, and soil pollution from these sources. The laws are discussed further in response to Question No. 15 above.

61. Question/Comment: Whatever happened to BADCAT?

Response: BADCT or, Best Available Demonstrated Control Technology, applies to new or currently operating facilities regulated under the Arizona Aquifer Protection Permit Program. Since 19th Avenue Landfill closed prior to the implementation of this program, BADCT would not apply.

Letter from Anthony Abril
1190 E. Hilton
Phoenix, Arizona 85034
(full text of letter at Attachment 5)

62. Question/Comment: I believe the preferred remedy does not clean up the site, and I prefer excavation and removal.

Response: Excavation and removal of the landfill was considered but rejected, because it would pose a greater risk to public health and the environment, and also would not be feasible or cost-effective, as discussed in detail in response to Question No. 19 above.

Letter from J. Lacey
2228 West Tonopah
Phoenix, Arizona
(full text of letter at Attachment 6)

63. Question/Comment: I am concerned that Alternative A would not prevent hot spots from erupting in the future and contaminating groundwater.

Response: Alternative A (the preferred remedy) contains a groundwater Contingency Plan to address this concern. Groundwater quality will be closely monitored, and if groundwater quality degrades in the future, then any contamination will be detected, evaluated, and appropriately addressed. The Contingency Plan is discussed further in response to Question No. 10 above.

Letter from Jim and Nancy Giordano
6909 East Kathleen Road
Scottsdale, Arizona 85254
(full text of letter at Attachment 7)

64. Question/Comment: Excavation and removal of the landfill is the only acceptable remedy.

Response: Excavation and removal of the landfill was considered but rejected, because it would pose a greater risk to public health and the environment, and also would not be feasible or cost-effective. Both public health and the environment will be protected with Alternative A. Existing contaminants will be contained at the landfill resulting in minimal public exposure. Please see response to Question No. 19 for additional discussion.

Letter from Debbie McQueen
1408 Rosemont Drive
Phoenix, Arizona 85024
(full text of letter at Attachment 8)

65. Question/Comment: Alternative A does not do enough to protect public health and the environment because it allows toxic waste to remain in the landfill. The landfill and the area surrounding it should be cleaned up and returned to a pristine condition.

Response: Excavation and removal of the landfill was considered but rejected, because it would pose a greater risk to public health and the environment, and also would not be feasible or cost-effective, as discussed in detail in response to Question No. 19 above.

Letter from Teri Johnson
6742 West Palm Lane
Phoenix, Arizona 85035
(full text of letter at Attachment 9)

66. Question/Comment: ADEQ should take the City to court and force the City to clean-up the landfill.

Response: The State of Arizona did obtain an injunction regarding the landfill in 1980. Later, the landfill was placed on the National Priorities (Superfund) List. Since then, the EPA, State, and City have cooperated on responding to the environmental issues presented by the 19th Avenue Landfill. No court action has been required.

Letter from Melody Baker
Mothers of Maryvale (C.A.R.E.S.)
P.O. Box 23495
Phoenix, Arizona 85063
(full text of letter at Attachment 10)

67. Question/Comment: Implementation of the recommended alternative and leaving the landfill in place would not be in the best interest of public health and the environment. We prefer excavation and removal.

Response: Excavation and removal of the landfill was considered but rejected, because it would pose a greater risk to public health and the environment, and also would not be feasible or cost-effective, as discussed in detail in response to Question No. 19 above.

Letter from Filomena B. Durazo
1531 West Corona Avenue
Phoenix, Arizona 85041
(full text of letter at Attachment 11)

68. Question/Comment: The landfill should be cleaned up and removed.

Response: Excavation and removal of the landfill was considered but rejected, because it would pose a greater risk to public health and the environment, and also would not be feasible or cost-effective, as discussed in detail in response to Question No. 19 above.

69. Question/Comment: I am concerned that past fires from the landfill caused toxic fumes to spread to residential areas nearby.

Response: There is no evidence that harmful migration of toxic fumes into residential areas occurred. An underground fire at the landfill did occur in February, 1986. EPA's emergency response section determined that the fire did not pose a threat to public health. Alternative A would prevent future such fires, which potentially could allow chemicals to escape into the air, by expanding the landfill's methane gas collection system. The 1986 fire is discussed in greater detail in response to Question No. 32 above. In addition, any toxic gases that may be present will be monitored and controlled as necessary.

Letter from Joyce Ward
716 West Broadway
Phoenix, Arizona 85041
(full text of letter at Attachment 12)

70. Question/Comment: Why wasn't I notified about the public meeting?

Response: The public meeting was announced in the 19th Avenue Landfill Fact Sheet Number 3, 8,000 copies of which were distributed door-to-door on July 2 and July 3, 1989 to residences and businesses in an area bounded by Buckeye Road to the north, Southern Avenue to the south, Central Avenue to the east, and 35th Avenue (between Buckeye Road and Lower Buckeye Road) or 27th Avenue (from Lower Buckeye Road to Southern Avenue) to the west. ADEQ also provided notice of the July 20, 1989 public meeting in the Arizona Republic on June 25, 1989. In addition, the City purchased advertising space to publicize the meeting in the Arizona Republic on July 15, 1989, and in the suburban west Phoenix newspaper Westsider on July 19. Broadcast and print media were notified of the meeting, and public service announcements were distributed. KJZZ radio discussed the public meeting on its "Morning Edition" program and included interviews with Norm Weiss of ADEQ on July 19, 1989 and Pamela Swift of Toxic Waste Investigative Group, Inc., on July 20, 1989.

Letter from James J. Lemmon, R.G.
Hazardous Waste Specialist
Urban Research Associates
454 East Susan Lane
Tempe, Arizona 85281
(full text of letter at Attachment 13)

71. Question/Comment: I was the Arizona Department of Health Services Hydrologist who testified on behalf of the agency in legal proceedings regarding the landfill against the City in 1979. Although some of the data collected by the ADHS from 1979 to 1983 did not have full quality assurance/quality control, it was scientifically invalid to disregard this data during the remedial action process. This data has tremendous hydrologic significance and should have been considered when evaluating impacts of the landfill on human health, the environment and the selection of the proposed remedial alternative. The missing data demonstrated high levels of groundwater contamination at the boundary of the landfill.

Response: No data was disregarded. Data collected from previous studies were reviewed and incorporated into the Remedial Investigation and Feasibility Study (RI/FS). In particular, water level and water quality trends were noted in data collected from previous studies. Data collected from the earlier studies were used in the ground water modeling task to calibrate the flow and transport calculations. Data from earlier studies were also used to score the site for placement an the National Priorities (Superfund) List. Earlier data were also used to examine water quality trends for development of the groundwater Contingency Plan.

Letter from Thomas W. Kalinowski, Sc.D.
Project Manager
Erler & Kalinowski, Inc.
Consulting Engineers and Scientists
1930 South Amplett Blvd., Suits 320
San Mateo, California 94402
(on behalf of Phoenix Tallow, holder
of leasehold interest to the property
on which the landfill sits)
(full text of letter at Attachment 14)

72. Question/Comment: Can more time be made available for review of the Draft RAP and supporting documents?

Response: The public comment period, which began on June 29, 1989, was extended from July 28 to August 11, 1989.

73. Question/Comment: Did the risk assessment identify any significant current or future public health risks associated with the landfill?

Response: The landfill does not pose a current risk to public health, although releases from the 19th Avenue Landfill have degraded, to some extent, the groundwater at the landfill boundary. No current risks to public health were identified for the surface water, soil and refuse, and ambient air quality exposure pathways that were examined. The hazard associated with methane was limited to the off-site migration of methane if the gas collection system were not operating.

Without remedial action, there would be potential future public health risks associated with the landfill. Potential public health risks could occur if landfill materials were washed out of the landfill as a result of flows in the Salt River. Ingestion of landfill soil could be a possible exposure pathway if areas of the landfill beneath the existing cover were exposed in the future. Another potential risk to public health and the environment could occur as a result of a rising water table saturating a greater volume of refuse and releasing additional leachate. The preferred remedy is designed to minimize these risks and the potential for release of hazardous substances.

74. Question/Comment: What is the linkage between the risk assessment and the "Areas of Environmental Concern" stated in the Draft RAP? What is the linkage between the baseline risk assessment, ARAR's, and the proposed remedy?

Response: The areas of concern evaluated during the Remedial Investigation and Feasibility Study were refuse washout, surface-water quality, groundwater quality, and landfill-gas accumulation. The risk assessment examined the current and potential risks to public health and the environment through these pathways. The proposed remedy was selected in accordance with CERCLA Section 121, 42 U.S.C. § 9621, with the National Contingency Plan (NCP), and with EPA guidance concerning ARARs, or applicable or relevant and appropriate requirements. Under EPA guidance, one factor in the ARARs analysis is risk. The preferred remedy would ensure compliance with ARARs.

75. Question/Comment: Why is the Appendix B Contingency Plan for potential future groundwater degradation at the 19th Avenue Landfill needed?

Response: To protect against the possibility of future groundwater quality degradation and a resulting public health risk, as discussed in further detail in response to Questions 10 and 12 above.

Letter from Gary G. Small, Manager
Environmental Management Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025
(full text of letter at Attachment 15)

76. Question/Comment: SRP questions the need for addressing the landfill under Superfund, as it appears that public health and the environment have not been impacted or threatened by the landfill. The proposed remedy appears to be a closure plan for a normal landfill, and not a response action to a release of hazardous materials into the environment. Therefore, the City, as the landfill operator, has a responsibility for all of these costs.

Response: The 19th Avenue Landfill was scored, proposed and went final on the NPL in the early 1980s. The public was given an opportunity to comment on the proposal at that time. Currently, it is listed as a site on the NPL and is being handled as such.

77. Question/Comment: In order to remain consistent with common usage, the geologic units in the site subsurface, which have been referred to as Units S, A, B, C, and MFU, would be better described as subunits of the Upper Alluvium Unit (UAU) and the Middle Fine Grained Unit (MFU), described as the Middle Alluvium Unit.

Response: The Remedial Action Plan presents a brief overview of the local geology; a more through description of the local geology is included in the Remedial Investigation Report (pages 4-9 to 4-13). The designations S, A, B, and C and MFU were utilized for study of the 19th Avenue Landfill and not intended as formal stratigraphic designations.

78. Question/Comment: The Remedial Action Plan should contain further detail regarding the analysis to be performed and the constituents to be monitored in the quarterly groundwater monitoring proposed in the RAP.

Response: Groundwater analyses have included the following parameters:

1. EPA Method 601/602 volatile organic compounds (total '36)
2. Inorganic metals (total'21)
3. Radioisotope indicators (gross alpha and gross beta)
4. Indicators: pH, alkalinity, Total Dissolved Solids (TDS), Total Organic Carbon (TOC), Total Organic

Halogen (TOX), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Cyanide (CN), and phenol

5. Major Ions: Ammonia (NH_3), Boron (B), Calcium (Ca), Iron (Fe), Magnesium (Mg), Manganese (Mn), Potassium (K), Sodium (Na), Chloride (Cl), Fluoride (F), Kjeldahl nitrogen (KN), Nitrate (NO_3), Phosphate (PO_4), and Sulfate (SO_4).

79. Question/Comment: The contingency plan should be clarified to avoid triggering of an unnecessary evaluation when there are exceedances of drinking water standards that are already present in background groundwater (nitrate and possibly barium).

Response: The Contingency Plan sets forth specific trigger criteria and does not provide for waiver of them, but background contamination potentially may be considered in the remedy selection phase. Upgradient wells and upgradient water quality conditions will be evaluated prior to selection of any remedial activity.

Letter from Kenneth G. Ford, P.E.
Corporate Manager
Environmental Affairs
Honeywell, Inc.
(full text of letter at Attachment 16)

80. Question/Comment: Honeywell agrees that the proposed remedy best meets the Superfund objectives. However, the landfill should not be treated as a Superfund site in view of the City's responsibility for its operation as a municipal sanitary landfill and the lack of a current risk to public health or the environment. Review of the chemical data in the RAP shows the site groundwater test results to be consistent with those from sanitary landfills of its age which received only municipal waste. The components of the remedy are consistent with closure of a municipal landfill and not of a Superfund site containing significant quantities of hazardous substances. The refuse washout controls, cap, and groundwater monitoring would be necessary for closure of a normal municipal landfill. Methane gas production is the result of the municipal component of the waste at the site. Therefore this site should not be a WQARF or SARA site, but a normal landfill closure.

Response: The landfill was addressed under the Superfund and WQARF programs because of the presence of a release or threat of release of hazardous substances. The landfill accepted both municipal and industrial wastes. The preferred remedy has been selected because it would be protective of public health and the environment and best meets the Superfund remedy selection criteria. Although some of the actions under the preferred remedy also may have "landfill closure" aspects, to the extent these actions are not inconsistent with the National Contingency Plan they constitute eligible costs of response under CERCLA Section 107, 42 U.S.C. § 9607.

81. Question/Comment: The $11 million cost of the Remedial Investigation/Feasibility Study is three to five times higher than the average cost of such studies. This cost should be borne by the City.

Response: The formal Remedial Investigation and Feasibility Study by Dames & Moore has cost approximately $1.3 million to date. The balance of the City's $11 million have been incurred for other activities and studies. The cost breakdown is provided in the response to Question No. 6.

Letter from Terrence T. Holleran
Director of Safety, Medical, and Environmental Affairs
Motorola Semi-Conductor Products Sector
3102 North 56th Street
Phoenix, Arizona 85018-6606
(full text of letter at Attachment 17)

82. Question/Comment: Conditions at the landfill, which do not pose a current risk to public health, are insufficient to trigger application of state or federal environmental laws.

Response: Application of the federal Superfund and state WQARF laws is authorized whenever there is a release or threat of release of hazardous substances into the environment, as was the case at the 19th Avenue Landfill.

83. Question/Comment: There is inadequate substantiation in the Remedial Action Plan for the statement that the proposed remedy is cost effective.

Response: Table 4.16 of the Remedial Action Plan (RAP) examines the cost of the alternative remedies evaluated, including the preferred remedy. Tables 4.12 through 4.15 examine the projected cost of the underlying remedial options for refuse washout, surface water, groundwater, and landfill gases. Further cost analysis is contained in volume 3, Chapter 5 of the Feasibility Study.

84. Question/Comment: It does not appear necessary to prohibit virtually all future use of the landfill site, similar sites have been developed into golf courses, parking lots, etc.

Response: Future use of the site must be limited to uses consistent with protection of public health and the environment, and with the selected remedy. If consistent with these criteria, such uses could be acceptable.

Letter from Charles J. Muchmore
O'Connor, Cavanaugh, Anderson, Westover,
Killingsworth & Beshears
Suits 1100
One East Camelback Road
Phoenix, Arizona 85012-1656
(on behalf of waste management of Arizona, Inc.,
Waste Management of Phoenix - South,
Waste Management of Phoenix - North,
Chemical Waste Management, Inc., and their affiliates)
(full text of letter at Attachment 18)

85. Question/Comment: The manner in which the Remedial Action Plan has been handled has violated my clients' due process rights. The period of time which my clients were given to review the RAP was too short.

Response: The public comment period, which began on June 29, 1989, was extended from July 28 to August 11, 1989. Your client has the same rights as any other member of the public and has been provided an opportunity to comment during this period.

86. Question/Comment: The proposed remedy is not the most efficient and cost-effective remedy.

Response: The primary remedy selection criteria was protection of public health and the environment. Of the remedies providing equal levels of protectiveness, Alternative A was determined by EPA and ADEQ to be the most cost-effective.

87. Question/Comment: The RAP is inconsistent with the NCP, in part because the costs of implementing it should be born by the City.

Response: The preferred remedy, the Remedial Action Plan, the Remedial Investigation and Feasibility Study, and the City's underlying response activities were determined by EPA and ADEQ to be consistent with the National Contingency Plan. In addition, the RAP is a requirement under the State WQARF Program.

88. Question/Comment: Simple pilings could be used in the Salt River bank rather than an expensive levy and bank protection system, as proposed in the RAP.

Response: A simple piling constructed of soil or local gravel could not be relied upon to prevent a 100-year flood from washing out refuse for any reasonable length of time. In the event of such a flood, erosion would quickly destroy the integrity of the embankment by reducing the height and width of the piles. The preferred remedy's levy and bank protection system would provide a reliable, permanent protection for refuse washout.

Letter from Robert H. Allen
Allen, Kimerer & LaVelle
2715 North 3rd Street
Phoenix, Arizona 85004
(on behalf of Pasqualetti Properties, Inc.,
owner of the northern 150 acres of the landfill)
(full text of letter at Attachment 19)

89. Question/Comment: Total closing of the landfill to any future public use may not be necessary, and the Remedial Action Plan does not specify how control of the property owned by the Pasqualettis would be acquired. The Pasqualettis did not have sufficient time to analyze the issue independently.

Response: Future use of the site must be limited to uses consistent with protection of public health and the environment, and with the selected remedy. If consistent with these criteria, various land use options could be considered. The Pasqualettis were previously given notice by EPA that, as owners of the site, they were considered potentially responsible for some or all of the cost of response at the landfill.

90. Question/Comment: The RAP does not conform to the National Contingency Plan.

Response: The preferred remedy, the Remedial Action Plan, the Remedial Investigation and Feasibility Study, and the City's underlying response activities were determined by EPA and ADEQ to be consistent with the National Contingency Plan. In addition, the RAP is a requirement under the State WQARF Program.

Attachments

1. Transcript of Public Comment Meeting

2. Script of Informational Video

3. Receipients of EPA and ADEQ Information Request Letters

4. Letter from Pamela E. Swift, Chairwoman Toxic Waste Investigative Group, Inc.

5. Letter from Anthony Abril
   190 E. Hilton
   Phoenix, Arizona 85034

6. Letter from J. Lacey
   2228 West Tonopah
   Phoenix, Arizona

7. Letter from Jim and Nancy Giordano
   6909 East Kathleen Road
   Scottsdale, Arizona 85254

8. Letter from Debbie McQueen
   1408 Rosemont Drive
   Phoenix, Arizona 85024

9. Letter from Teri Johnson
   6742 West Palm Lane
   Phoenix, Arizona 85035

10. Letter from Melody Baker
    Mothers of Maryville (C.A.R.E.S.)
    P.O. Box 23495
    Phoenix, Arizona 85063

11. Letter from Filomena B. Durazo
    1531 West Corona Avenue
    Phoenix, Arizona 85041

12. Letter from Joyce Ward
    716 West Broadway
    Phoenix, Arizona 85041

13. Letter from James J. Lemmon, R.G.
    Hazardous Waste Specialist
    Urban Research Associates
    454 East Susan Lane
    Tempe, Arizona 85281

14. Letter from Thomas W. Kalinowski, Sc.D.
Project Manager
Erler & Kalinowski, Inc.
Consulting Engineers and Scientists
1930 South Amphlett Blvd., Suite 320
San Mateo, California 94402

15. Letter from Gary G. Small, Manager
Environmental Management Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

16. Letter from Kenneth G. Ford, P.E.
Corporate Manager Environmental Affairs
Honeywell, Inc.

17. Letter from Torrence T. Holleran
Director of Safety, Medical, and Environmental Affairs
Motorola Semi-Conductor Products Sector
3102 North 56th Street
Phoenix, Arizona 85018-6606

18. Letter from Charles J. Muchmore
O'Connor, Cavanaugh, Anderson, Westover, Killingsworth & Beshears
Suite 1100
One East Camelback Road
Phoenix, Arizona 85012-1656

19. Letter from Robert H. Allen
Allen, Kimerer & LaVelle
2715 North 3rd Street
Phoenix, Arizona 85004

20. Mailing List for Fact Sheet Number 3

21. Letter from Nicholas Tereby, Jr.
P.O. Box 82712
Phoenix, Arizona 85071

APPENDIX B
CONTINGENCY PLAN

APPENDIX B
CONTINGENCY PLAN FOR POTENTIAL FUTURE GROUND-WATER DEGRADATION AT THE 19TH AVENUE LANDFILL

A Remedial Investigation/Feasibility Study (RI/FS) was conducted at the 19th Avenue Landfill between January 1986 and June 1988 by the City of Phoenix. Sampling of the landfill contents revealed no concentrated sources of contamination. Landfill impacts on ground-water quality pose no health risk at present and are observable only within and at the boundary of the landfill. Sporadic exceedences of Safe Drinking Water Act Maximum Contaminant Levels (MCLs) in different monitor wells at different times have been noted, with approximately two percent of samples exceeding MCLs. The small magnitude and infrequency of the exceedences, the limited migration off the site of the detected contaminants, and the lack of risk to public health have resulted in present recommendation of a No Action alternative for ground water (except for monitoring, which will continue on a quarterly basis).

Other corrective actions to be implemented as part of the complete remedial action at this site, such as flood protection and capping, are anticipated to further reduce the frequency and concentration level of contaminants detected in ground water. However, because the landfill will remain onsite, the parties have prepared this contingency plan to address the possibility of potential ground-water quality degradation in the future.

In accordance with Section 121(d) of the Comprehensive Environmental Responses, Compensation, and Liability Act, as amended (CERCLA), the contingency plan will be implemented upon completion of the remedial action selected in this Remedial Action Plan. The framework of the contingency plan is as follows:

1. Applicable or relevant and appropriate requirements (ARARs) will be properly utilized in the development of any future ground-water remedial action, if such action becomes necessary. Consistent with the National Contingency Plan, Safe Drinking Water Act MCLs are considered ARARs for the determination of ground-water standards.

2. The landfill facility boundary will be the compliance point for purposes of monitoring and triggering any remedial response. In the event a remedial response

is triggered, the landfill facility boundary will be considered the compliance point for additional remedial action if selection of it is consistent with the National Contingency Plan and appropriate remedy selection under CERCLA. For such purposes, ARARs may be complied with within the capture zone of hypothetical recovery wells located at the landfill boundary. Establishment of the landfill facility boundary as the point of remedial action compliance does not preclude future selection of a remedial action of no action, if consistent with CERCLA, the National Contingency Plan, and the Arizona Environmental Quality Act.

3. Confirmed exceedence of MCLs, Proposed MCLs, or, for constituents which have no MCL or Proposed MCL, State Action Levels (ALs) will trigger a remedial response. The remedial response will be triggered when the following conditions are met:

   A. The average of three consecutive quarterly samples from a single well exceeds a constituent’s MCL, Proposed MCL (or an AL where an MCL has not been established or an MCL Proposed), <u>or</u> a single sample exceeds three times the MCL, Proposed MCL, or AL; and

   B. A follow-up sample confirms that either of the exceedence conditions described above has occurred. The follow-up sample will be collected within 15 calendar days of receipt of the results which indicated the apparent exceedence condition. The initiation of confirmatory sampling will start a monthly schedule of sampling at the affected well(s) for the exceeding constituent(s). If a follow-up sample does not confirm the exceedence, quarterly sampling may resume after three months of monthly sampling.

4. Once triggered, the remedial response will begin a process of evaluation and selection of a supplemental remedial action, not necessarily excluding no action, consistent with the requirements of CERCLA, the National Contingency Plan, and the Arizona Environmental Quality Act.

5. Because much of the information regarding the hydrogeology and evaluation of remedial alternatives has already been developed during the RI/FS, it is anticipated that the process of evaluating and selecting a remedial action under

this contingency plan can be expedited. Based on these considerations, the City of Phoenix will provide to the Arizona Department of Environmental Quality a report on remedial alternatives within 150 days after the initiation of the remedial response, excluding time for agency review and public participation.

6. The remedial action will be implemented upon selection and continue as necessary to ensure continued compliance with ARARs.

7. If continued operation of the selected ground-water remedial action is no longer required to ensure compliance with ARARs, the selected action may be concluded. Monthly ground-water monitoring of the affected wells(s) will continue for a period of six months after conclusion of the selected remedial action, before resumption of the schedule of routine ground-water monitoring.

APPENDIX C
WATER QUALITY DATA

INORGANIC DATA

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1986 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	I-1	I-2	I-3	I-4	I-5	I-6
DATE	860821	860821	860822	860821	860822	860821
AMMONIA	0.48	0.23	36.2	10.8	3.92	<0.1
BORON	<0.5	<0.5	1.05	0.99	<0.5	<0.5
CALCIUM	56.3	50.6	61.8	76.2	43.7	98.7
IRON	< 0.05	<0.05	1.23	1.26	0.57	<0.05
MAGNESIUM	27.3	23.3	43.7	52.1	21.3	49.6
MANGANESE	2.33	3.27	3.56	3.65	1.99	2.86
POTASSIUM	5.56	4.96	40.8	25.6	10.5	8.56
SODIUM	136	116	230	275	163	256
CHLORIDE	200	170	310	370	180	400
FLOURIDE	<0.5	<0.5	0.34	<0.5	<0.5	<0.5
KJELDAHL NITROGEN	1.2	0.8	61.3	11.4	6.9	0.8
NITRATE	<0.1	<0.1	<0.1	<0.1	<0.1	10
PHOSPHATE	<0.05	0.059	0.118	<0.05	0.153	<0.05
SULFATE	61	59	2.4	2.1	60	130
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.006	0.007	0.032	0.042	0.032	<0.006
BARIUM	0.17	0.16	1.94	2.58	0.37	0.27
BERYLLIUM	<0.01	0.013	0.012	0.013	0.016	0.014
CADMIUM	0.005J	0.005J	0.008J	0.006J	0.008J	0.006J
CHROMIUM (HEX)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
LEAD	<0.002	<0.002	<0.003	<0.002	<0.002	<0.002
MERCURY	0.0014J	0.0004J	0.011J	0.0004J	0.006J	0.0008J
NICKEL	0.01J	0.02J	0.03J	0.03J	0.02J	0.03J
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.03	0.01	<0.01	0.01	0.06	0.01
ALKALINITY	270	220	630	590	280	320
TOTAL DISSOLVED SOLIDS	670	630	1092	1180	1010	1220
TOTAL ORGANIC CARBON	2.6	2.8	24.4	22.3	1	1.5
TOTAL ORGANIC HALOGENS	0.024	0.035	0.125	0.139	0.017	0.013
BOD	4	4	4	5	7	4
COD	<10	<10	36	68	<10	<10
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1986 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	I-1	I-2	I-3	I-4	I-5	I-6
DATE	861017	861017	861016	861016	861016	861016
AMMONIA	0.63	0.26	34.3	17.4	4.23	<0.1
BORON	<0.5	<0.5	0.9	0.8	<0.5	<0.5
CALCIUM	58.4	61.6	68.8	75.2	50.7	108
IRON	<0.05	<0.05	1.23	0.83	0.82	<0.05
MAGNESIUM	24.4	24.3	38.9	49.4	20.7	48.2
MANGANESE	1.9	3.3	3.58	3.66	2.03	3.1
POTASSIUM	6.3	5.9	34	38	11.1	9.2
SODIUM	139	133	226	272	178	295
CHLORIDE	182	271	280	369	182	426
FLOURIDE	0.3	0.32	0.35	0.33	0.43	0.42
KJELDAHL NITROGEN	0.62	0.4	38	15.8	4.1	0.2
NITRATE	0.3	0.3	0.2	0.2	0.3	4.3
PHOSPHATE	<0.05	<0.05	0.1	<0.05	0.38	0.06
SULFATE	60	61	12.2	4.62	68.3	142
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	0.04	0.047	0.023	<0.01
BARIUM	0.14	0.16	1.2	2.13	0.39	0.28
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	0.01	0.02	<0.01	<0.01
COPPER	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
LEAD	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.001	<0.001	<0.001	<0.001	0.0008	<0.0005
NICKEL	0.02	<0.01	0.05	0.07	0.02	0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.08	0.01	0.03	0.06	0.09	0.12
ALKALINITY	234	241	498	519	267	316
TOTAL DISSOLVED SOLIDS	620	608	994	1150	710	1310
TOTAL ORGANIC CARBON	2.3	3.7	24.7	24.7	4.4	2.3
TOTAL ORGANIC HALOGENS	0.034	0.015	0.088	0.1	0.009	0.012
BOD	40	53	59	52	36	49
COD	<10	<10	<13	<13	<13	<13
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
COLIFORMS*						

RADIOISOTOPE DATA

CITY OF PHOENIX 19TH AVENUE LANDFILL
RADIOISOTOPE DATA
CONCENTRATIONS IN pCi/L

WELL	LEVEL	DATE	GROSS	ALPHA	GROSS	BETA	RADIUM	226	RADIUM	228
DM-1	54	870824	-2.7	1.8	10.7	5.6	0.5	0.1	0	1
DM-1	54	871217	-0.1	3.2	17.8	6.6	.	.	.	.
DM-1	122	870825	2.0	2.6	2.9	5.6	0.0	0.1	0	1
DM-1	192	870825	0.2	1.9	2.1	3.3	0.2	0.1	0	1
DM-1	192	871217	10.2	2.7	16.2	6.8	.	.	.	.
DM-2	54	871217	-8.0	6.1	11.8	10.6	.	.	.	.
DM-2	89	870825	-2.3	2.7	9.4	5.2	0.7	0.1	0	1
DM-2	194	870826	0.3	2.2	4.1	4.3	0.6	0.1	0	1
DM-2	194	871217	-2.1	8.4	14.9	11.6	.	.	.	.
DM-3 D		870818	-0.8	2.6	5.6	4.9	0.2	0.1	0	1
DM-3 D		871021	-2.6	1.6	3.9	4.9	.	.	.	.
DM-3 D		871217	0.7	4.5	4.8	5.4	.	.	.	.
DM-3 I		870818	-3.0	2.7	8.9	5.4	0.3	0.1	0	1
DM-3 I		871021	1.8	4.4	4.0	8.0	.	.	.	.
DM-3 I		871218	-2.8	4.3	9.4	10.0	.	.	.	.
DM-3 P		870819	-3.4	4.5	9.5	3.4	0.0	0.1	0	1
DM-3 P		871023	-1.7	1.2	9.0	5.5	.	.	.	.
DM-3 P		871217	-2.8	1.3	0.4	6.3	.	.	.	.
DM-4		870818	1.3	3.5	12.4	5.9	0.6	0.1	0	1
DM-4		871021	0.4	1.6	4.1	5.2	.	.	.	.
DM-4		871216	-5.7	4.8	8.8	6.2	.	.	.	.
DM-5 D		870820	-0.7	2.8	8.2	5.8	0.0	0.1	0	1
DM-5 D		871021	-0.7	3.7	6.8	9.1	.	.	.	.
DM-5 S		870820	-1.4	3.2	10.5	5.9	0.4	0.1	0	1
DM-5 S		871020	1.8	6.1	8.7	12.2	.	.	.	.
DM-5 S		871216	0.8	2.3	4.1	6.2	.	.	.	.
DM-6		870818	-0.5	2.4	11.5	4.3	0.3	0.1	0	1
DM-6		871022	-1.4	1.4	6.4	8.2	.	.	.	.
DM-6		871216	-2.1	2.4	4.1	5.1	.	.	.	.
I - 1		860821	-2.4	2.9	8.3	3.8	.	.	.	.
I - 1		870331	4.6	2.1	7.9	6.0	.	.	.	.
I - 1		870728	-2.1	2.8	8.8	5.8	0.7	0.1	0	2
I - 1		871019	-2.0	3.8	3.5	5.2	.	.	.	.
I - 1		871214	-2.7	1.4	6.6	5.5	.	.	.	.
I - 2		860821	-2.5	2.8	3.3	3.9	.	.	.	.
I - 2		870331	-0.9	4.0	7.5	5.4	.	.	.	.
I - 2		870728	-0.4	0.7	2.2	1.5	0.0	0.1	0	2
I - 2		871019	0.5	1.8	19.4	6.1	.	.	.	.

. no measurement

CITY OF PHOENIX 19TH AVENUE LANDFILL
RADIOISOTOPE DATA
CONCENTRATIONS IN pCi/L

WELL	LEVEL	DATE	GROSS	ALPHA	GROSS	BETA	RADIUM	226	RADIUM	228
I - 2		871214	0.9	9.4	4.6	5.4	.	.	.	.
I - 3		860822	1.9	5.7	57.0	10.7	.	.	.	.
I - 3		861016	-0.9	3.4	122.0	8.7	.	.	.	.
I - 3		870331	-1.4	1.8	33.0	8.1	.	.	.	.
I - 3		870724	0.8	5.9	3.5	5.3	1.0	0.1	0	2
I - 3		871019	-1.5	3.6	37.8	8.2	.	.	.	.
I - 3		871217	-3.7	2.6	53.8	9.2	.	.	.	.
I - 4		860821	0.1	6.2	8.8	7.4	.	.	.	.
I - 4		870331	-0.2	2.5	39.6	8.0	.	.	.	.
I - 4		870727	0.2	1.9	31.5	7.8	1.0	0.1	0	2
I - 4		871020	-0.3	3.4	21.9	10.1	.	.	.	.
I - 4		871215	-2.9	3.8	32.8	8.1	.	.	.	.
I - 5		860822	-1.7	3.7	13.8	7.5	.	.	.	.
I - 5		870401	17.9	4.2	8.7	6.2	.	.	.	.
I - 5		870727	-0.8	2.6	15.6	6.1	0.7	0.1	0	2
I - 5		871020	-4.3	4.2	19.2	10.8	.	.	.	.
I - 5		871215	-0.6	2.8	13.9	5.8	.	.	.	.
I - 6		860821	-4.1	8.1	22.0	17.2	.	.	.	.
I - 6		861016	0.1	2.4	92.8	12.6	.	.	.	.
I - 6		870401	4.1	2.7	4.0	6.5	.	.	.	.
I - 6		870724	2.9	3.2	11.9	6.5	0.0	0.1	0	1
I - 6		871020	-2.0	3.7	8.7	11.4	.	.	.	.
I - 8		870731	4.0	6.5	9.6	6.0	0.3	0.1	0	1
I - 8		871023	-2.8	4.6	8.0	5.1	.	.	.	.
I - 8		871218	-2.4	3.8	11.9	6.3	.	.	.	.

. no measurement

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	I-4	I-5	I-6	I-8
DATE	871215	871215	871215	871218
AMMONIA	12.5	3.81	<0.1	<0.1
BORON	0.96	0.63	0.81	0.74J
CALCIUM	50	56.6	88.4	53.5
IRON	0.377	0.81	<0.05	0.645
MAGNESIUM	40.2	27.3	48	35.4
MANGANESE	3.68	3	2.9	3.8
POTASSIUM	36.1	12.6	9.99	16.3
SODIUM	224	183	302	189
CHLORIDE	324	226	443	252
FLOURIDE	0.2	0.29	0.36	0.22J
KJELDAHL NITROGEN	0.22J	4.9	0.31J	3.67
NITRATE	7.68	0.17	9.9	0.23
PHOSPHATE	0.07	0.13	<0.05	<0.05
SULFATE	16.2	107	161	20.6
ANTIMONY	<0.02	<0.02	<0.02	<0.02
ARSENIC	0.036	0.023	<0.01	0.017
BARIUM	1.29	0.5	0.23	1.18
BERYLLIUM	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	0.004	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01
COPPER	0.035	<0.01	0.014	<0.01
LEAD	<0.002	<0.002	<0.002	<0.002
MERCURY	0.002	<0.0002	<0.0002	<0.0002
NICKEL	0.099	<0.03	0.052	<0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02
ZINC	0.077J	0.099J	0.139	0.025J
ALKALINITY	500	310	330	440
TOTAL DISSOLVED SOLIDS	980	810	1300	850
TOTAL ORGANIC CARBON	16	4.2	0.9J	8.2
TOTAL ORGANIC HALOGENS	0.064J	0.014J	0.046J	0.028J
BOD	12J	11J	10J	<1
COD	171J	222J	177J	<7
CYANIDE	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02
COLIFORMS*	.	.	<2	<2

* COLIFORMS MEASURED AS COLIFORMS/100ML

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	DM-4	DM-5D	DM-5S	DM-6	I-1	I-2	I-3
DATE	871216	871216	871216	871216	871214	871214	871217
AMMONIA	<0.1	<0.1	<0.1	<0.1	0.67	0.3	41.9
BORON	0.6	0.77	1.09	0.75	0.5	0.53	1.4
CALCIUM	64	161	96	59	59.1	56.2	62
IRON	0.038	0.048	<0.03	0.032	0.061	0.08	1.19
MAGNESIUM	27.6	56	39.9	25.2	28.3	25.3	41.2
MANGANESE	0.019	<0.01	<0.01	0.431	2.51	3.93	3.89
POTASSIUM	6.23	7.82	8.72	6.63	7.8	7.6	55.1
SODIUM	162	344	346	222	151	143	242
CHLORIDE	186	806	541	312	225	196	352
FLOURIDE	0.21	0.31	0.26	0.28	0.27	0.46	0.23
KJELDAHL NITROGEN	0.1	0.06	<0.05	<0.05	0.87	0.59	42
NITRATE	0.55	14.9	16	2.55	0.2	<0.1	0.51
PHOSPHATE	<0.05	0.28	0.06	0.06	<0.05	<0.05	2.1
SULFATE	130	146	185	123	80.1	80.1	8.78
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.038
BARIUM	0.14	0.3	0.15	0.15	0.29	<0.06	1.28
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	0.27	<0.01
CADMIUM	<0.003	0.004	0.004	<0.003	<0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LEAD	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
NICKEL	<0.03	<0.03	<0.03	<0.03	0.039	<0.03	0.113
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.032J	0.041J	0.041J	0.037J	0.053J	0.03J	0.069J
ALKALINITY	310	190	330	260	280	250	620
TOTAL DISSOLVED SOLIDS	770	1700	1500	890	690	670	1100
TOTAL ORGANIC CARBON	1.5J	<0.05	<0.5	1.3J	2.7	3.6	32.7
TOTAL ORGANIC HALOGENS	<0.01	<0.01	<0.01	<0.01	0.037J	0.013J	0.152J
BOD	7J	4J	1J	2J	10	8	12J
COD	261	<10	143	<7	148	163	<10
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	DM-1	DM-1	DM-2	DM-2	DM-3D	DM-3I	DM-3P
LEVEL	54	192	54	194			
DATE	871217	871217	871218	871218	871217	871216	871217
AMMONIA	4.73	<0.1	0.44	<0.1	<0.1	<0.1	<0.1
BORON	0.54	0.65	0.58J	1.05J	0.3	0.76	0.67
CALCIUM	38	69	53	93	38	145	52
IRON	<0.03	<0.03	0.03	<0.03	<0.03	0.048	0.143
MAGNESIUM	24	27.8	7.6	38.8	20.6	43.2	24.7
MANGANESE	2.79	0.031	0.649	0.17	<0.01	<1	0.367
POTASSIUM	16.1	6.99	19.5	8.23	6.72	8.55	6.67
SODIUM	292	258	387	300	162	284	168
CHLORIDE	267	308	742	415	331	421	210
FLOURIDE	0.45	0.25	0.44	0.25J	0.4	0.24	0.2
KJELDAHL NITROGEN	5.9	0.24	0.87	0.13J	0.07	0.07	0.09
NITRATE	0.28	5.54	0.28	7.06	0.52	8.49	0.23
PHOSPHATE	<0.05	0.38	<0.05	0.22J	<0.05	<0.05	<0.05
SULFATE	7.09	167	25.4	164	33.3	203	100
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	0.012	<0.01	0.022	<0.01	<0.01	<0.01	<0.01
BARIUM	0.55	0.1	0.58	0.14	0.17	0.26	0.13
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LEAD	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
NICKEL	0.044	<0.03	<0.03	<0.03	<0.03	<0.03	<0.01
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.012J	0.016J	0.033J	0.036J	<0.01	0.029J	0.019J
ALKALINITY	583	290	170	300	84	320	280
TOTAL DISSOLVED SOLIDS	1100	1100	1300	1300	710	1300	770
TOTAL ORGANIC CARBON	21.6	0.9J	29	1J	<0.5	0.7J	1.6J
TOTAL ORGANIC HALOGENS	0.057J	0.016J	0.024J	0.012J	0.014J	<0.01	0.023J
BOD	20J	8J	13	1	8J	<1	<1
COD	33	<10	85	<10	<7	<10	<10
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
COLIFORMS*	46	<2	<2	<2	<2	<2	<2

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	I-1	I-2	I-3	I-4	I-5	I-6	I-8
DATE	871019	871019	871019	871020	871020	871020	871023
AMMONIA	1.88	1.44	32.7	12.2	6.54	0.12	2.42
BORON	0.68	0.83	0.59	0.59	0.67	0.86	0.65
CALCIUM	58	55	47	52	72	66	41.8
IRON	<0.05	0.05	0.86	0.347	0.959	<0.03	0.042
MAGNESIUM	29.8	25.8	35.5	39.4	32.7	44.6	28.2
MANGANESE	2.31	4.04	2.83	3.75	3.53	2.86	2.89
POTASSIUM	6.6	6.4	36.3	35	15.8	9.4	10.9
SODIUM	140	134	209	240	200	290	180
CHLORIDE	128	206	274	348	294	466	205
FLOURIDE	0.23	0.28	0.26	0.2	0.24	0.28	0.18
KJELDAHL NITROGEN	0.48J	0.34J	29.7J	12.8J	5.5J	0.2J	2.3J
NITRATE	<0.1	<0.1	<0.1	1.31	<0.1	8.96	<0.1
PHOSPHATE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
SULFATE	51.2	65.6	7.86	12.4	84.4	180	38.7
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	<0.01	0.032	0.023	<0.01	0.17
BARIUM	0.13	0.21	0.92	1.62	0.51	0.19	<0.06
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.012
COPPER	<0.02	<0.02	<0.02	0.072	<0.01	0.012	<0.01
LEAD	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
NICKEL	0.05	0.05	0.05	0.09	0.03	0.07	0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.05	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.025	0.012	0.025	0.054	0.096	0.072	0.024
ALKALINITY	257	241	523	490	370	340	340
TOTAL DISSOLVED SOLIDS	700	680	920	1020	900	1320	720
TOTAL ORGANIC CARBON	2.3	4.2	19.4	17.8	11.1	81.3	6.8
TOTAL ORGANIC HALOGENS	0.025	0.018	0.084	0.073	0.031	0.009	0.023
BOD	88	104	88	84	78	82	50
COD	121	<3	121	76	15	<10	44
CYANIDE	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	DM-3D	DM-3I	DM-3P	DM-4	DM-5D	DM-5S	DM-6
DATE	871021	871021	871023	871021	871020	871020	871022
AMMONIA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BORON	0.22	0.95	0.45	0.65	0.65	0.95	0.64
CALCIUM	40.5	123	50.1	77.7	170	111	65.1
IRON	0.03	0.056	0.119	0.033	0.037	<0.03	0.041
MAGNESIUM	18.6	40.6	23.2	26.9	48.8	37.1	23.8
MANGANESE	<0.01	0.01	0.441	0.023	0.01	0.012	0.444
POTASSIUM	5.77	7.62	5.84	5.49	8.35	8.07	5.77
SODIUM	160	280	180	170	340	360	230
CHLORIDE	353	410	203	193	797	503	273
FLOURIDE	0.34	0.18	0.17	0.19	0.22	0.21	0.21
KJELDAHL NITROGEN	0.17J	0.19J	0.38J	0.17J	0.21J	0.13J	0.29J
NITRATE	0.54	7.49	0.37	0.58	12.5	14.6	2.38
PHOSPHATE	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05
SULFATE	33.9	165	76.1	117	123	165	96.1
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
BARIUM	0.07	0.15	<0.06	0.09	0.23	0.15	0.11
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LEAD	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
NICKEL	<0.03	0.03	0.03	0.03	0.04	0.04	0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.012	0.012	0.017	0.011	0.024	0.036	0.027
ALKALINITY	82	307	286	309	170	322	270
TOTAL DISSOLVED SOLIDS	700	1300	780	800	1860	1460	900
TOTAL ORGANIC CARBON	0.7	1.2	1.9	1.7	<0.5	0.8	1.2
TOTAL ORGANIC HALOGENS	<0.008	<0.008	0.009	<0.008	<0.008	0.008	0.02
BOD	73	72	42	87	89	92	83
COD	174	101	58	43	70	24	150
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
COLIFORMS*	<3	<3	<2	<3	<2	<2	<2

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	I-6	I-8
DATE	870724	870731
AMMONIA	<0.1	3.73
BORON	0.5	0.2
CALCIUM	68	46
IRON	0.03	0.05
MAGNESIUM	37.4	32.4
MANGANESE	3.29	2.92
POTASSIUM	9.45	11
SODIUM	254	171
CHLORIDE	429	232
FLOURIDE	0.35	0.26
KJELDAHL NITROGEN	0.59	2.9
NITRATE	7.09	0.24
PHOSPHATE	0.07	<0.05
SULFATE	149	25.3
ANTIMONY	<0.02	<0.02
ARSENIC	<0.01	<0.015
BARIUM	0.42	1.15
BERYLLIUM	0.011	<0.01
CADMIUM	<0.003	<0.003
CHROMIUM (HEX)	.	<0.03
CHROMIUM (TOT)	<0.01	<0.01
COPPER	0.02	0.02
LEAD	<0.002	<0.002
MERCURY	0.0006	<0.0005
NICKEL	0.06	0.045
SELENIUM	<0.01	<0.01
SILVER	<0.01	0.016
THALLIUM	<0.02	<0.02
ZINC	0.11	0.03
ALKALINITY	326	356
TOTAL DISSOLVED SOLIDS	1238	824
TOTAL ORGANIC CARBON	2	17.6
TOTAL ORGANIC HALOGENS	0.01	0.037
BOD	14	38
COD	59	74
CYANIDE	<0.01	<0.01
PHENOLS		

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	DM-5S	DM-6	I-1	I-2	I-3	I-4	I-5
DATE	870820	870818	870728	870728	870724	870727	870727
AMMONIA	<0.1	<0.1	0.76	0.36	44.7	13	4.52
BORON	0.8	0.5	<0.1	<0.1	1	0.8	<0.1
CALCIUM	97	63.1	59	64	50	62	74
IRON	0.03	<0.03	<0.03	<0.03	0.99	1.01	1.21
MAGNESIUM	42	24.5	28.6	28.9	37.4	43.4	35.8
MANGANESE	<0.01	0.368	2.47	5.46	3.17	3.22	3.06
POTASSIUM	8.3	5.4	5.77	5.97	42.2	23	11.8
SODIUM	375	238	141	130	250	244	183
CHLORIDE	472	296	204	210	315	362	323
FLOURIDE	0.25	0.28	0.31	0.32	0.33	0.26	0.3
KJELDAHL NITROGEN	<0.05	<0.05	0.84	0.29	24.1	11.1	3.5
NITRATE	14	1.97	<0.1	<0.1	<0.1	<0.1	<0.1
PHOSPHATE	<0.05	0.2	<0.05	<0.05	0.28	0.05	0.05
SULFATE	172	118	66	55.7	1.95	8.6	130
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	<0.01	<0.01	0.029	0.033	0.022
BARIUM	<0.06	0.06	0.4	0.28	1.66	0.16	0.6
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	0.003	0.003	0.009	0.004	0.007
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	.	.	.
CHROMIUM (TOT)	0.017	0.012	<0.01	<0.01	0.01	<0.01	<0.01
COPPER	<0.01	0.019	0.07	0.025	0.18	0.11	0.09
LEAD	0.002	<0.002	0.002	<0.002	0.002	<0.002	0.002
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
NICKEL	<0.03	<0.03	<0.03	0.04	0.04	0.05	<0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.055	0.022	0.025	0.02	0.02	0.03	0.1
ALKALINITY	324	265	262	235	598	513	275
TOTAL DISSOLVED SOLIDS	1500	880	678	694	984	1050	877
TOTAL ORGANIC CARBON	1	2.3	.	.	26.4	20.4	5.8
TOTAL ORGANIC HALOGENS	0.013	0.009	.	.	0.11	0.077	0.019
BOD	65	128	10	13	31	12	30
COD	151	151	89	66	119	75	104
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
COLIFORMS*	49	<2	<2	<2	.	<2	<2

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	DM-2	DM-3D	DM-3I	DM-3P	DM-4	DM-5D
LEVEL	194					
DATE	870826	870818	870818	870819	870818	870820
AMMONIA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BORON	0.5	<0.1	0.4	0.4	0.5	0.6
CALCIUM	78.5	39.2	63.3	50.7	71.6	127
IRON	0.054	<0.03	0.033	0.196	<0.03	<0.03
MAGNESIUM	29.7	21.4	24.1	25.6	27.5	48.6
MANGANESE	0.118	0.011	0.01	0.92	0.038	<0.01
POTASSIUM	5.5	5.4	5.6	9.6	6.4	7.2
SODIUM	242	148	195	188	161	359
CHLORIDE	167	337	248	268	179	534
FLOURIDE	0.23	0.5	0.27	0.26	0.27	0.26
KJELDAHL NITROGEN	0.31	0.08	0.13	<0.05	0.25	0.17
NITRATE	1.96	0.5	2.77	0.34	1.05	11.5
PHOSPHATE	<2.5	0.09	0.34	0.14	0.37	<0.05
SULFATE	56.5	33.3	128	93.3	115	137
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
BARIUM	0.09	0.06	<0.06	0.13	<0.06	<0.06
BERYLLIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CADMIUM	<0.003	<0.003	<0.003	0.003	<0.003	0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	0.037	0.022	<0.01	0.03	0.016
COPPER	<0.01	0.013	0.014	<0.01	0.014	<0.01
LEAD	<0.002	<0.002	<0.002	<0.002	<0.002	0.002
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
NICKEL	0.04	<0.03	<0.03	<0.03	<0.03	<0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.094	<0.01	0.02	0.016	0.023	0.033
ALKALINITY	261	84	263	298	325	248
TOTAL DISSOLVED SOLIDS	1030	670	830	770	800	1550
TOTAL ORGANIC CARBON	25.4	1.4	1.3	8.8	2.1	2
TOTAL ORGANIC HALOGENS	0.014	0.009	0.008	0.043	0.0009	0.008
BOD	20	97	125	65	93	78
COD	29	121	115	172	157	175
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	DM-1	DM-1	DM-1	DM-2
LEVEL	54	122	192	89
DATE	870824	870825	870825	870825
AMMONIA	3.21	0.14	<0.1	<0.1
BORON	0.5	1.2	0.5	<0.5
CALCIUM	50.6	40.9	51.1	50.3
IRON	<0.03	<0.03	<0.03	0.049
MAGNESIUM	17.4	18.4	25.5	25.1
MANGANESE	4.51	0.183	0.041	5.54
POTASSIUM	10.2	4.4	5	7.9
SODIUM	252	243	231	210
CHLORIDE	246	195	272	227
FLOURIDE	0.43	0.3	0.24	0.32
KJELDAHL NITROGEN	3.48	0.13	0.3	0.12
NITRATE	<0.1	2.1	4.21	<0.1
PHOSPHATE	0.12	0.17	0.16	<0.05
SULFATE	80	14	124	60.3
ANTIMONY	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	<0.01	<0.01
BARIUM	0.46	0.09	0.06	0.43
BERYLLIUM	<0.01	<0.01	<0.01	<0.01
CADMIUM	0.003	0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01
COPPER	0.01	<0.01	<0.01	<0.01
LEAD	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.0002	<0.0002	<0.0002	0.0004
NICKEL	0.03	<0.03	<0.03	0.03
SELENIUM	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02
ZINC	0.034	0.02	0.03	0.017
ALKALINITY	407	231	264	390
TOTAL DISSOLVED SOLIDS	910	710	980	900
TOTAL ORGANIC CARBON	17.3	3.7	2.6	18.9
TOTAL ORGANIC HALOGENS	0.056	<0.01	0.016	0.03
BOD	18	15	21	53
COD	244J	44J	74J	118
CYANIDE	<0.01	<0.01	<0.01	0.01
PHENOLS	<0.02	<0.02	<0.02	0.02
COLIFORMS*				

CITY OF PHOENIX 19TH AVENUE LANDFILL
1ST QTR 1987 INORGANIC WATER QUALITY DATA
CONCENTRATIONS IN PPM UNLESS OTHERWISE NOTED

WELL	I-1	I-2	I-3	I-4	I-5	I-6
DATE	870331	870331	870331	870331	870331	870331
AMMONIA	1.12	0.32	34.2	16.2	5.23	<0.1
BORON	<0.5	<0.5	0.9	0.08	<0.5	<0.5
CALCIUM	59.4	61.1	51.3	52.1	58.6	99
IRON	<0.05	<0.05	1.1	1.34	<0.05	<0.05
MAGNESIUM	28.6	26.4	35.2	44.8	24.8	45.4
MANGANESE	2.28	2.83	3.52	3.64	2.01	2.92
POTASSIUM	7.8	7.03	39.8	46.4	13.2	10.4
SODIUM	149	154	224	263	168	263
CHLORIDE	184	198	282	335	143	381
FLOURIDE	0.24	0.27	0.25	0.21	0.31	0.33
KJELDAHL NITROGEN	1.1	0.27	30.9	14	4.09	0.41
NITRATE	2.96	<0.1	<0.1	<0.1	<0.1	5.19
PHOSPHATE	<0.05	<0.05	0.4	0.21	0.18	<0.05
SULFATE	64.1	74.5	4.68	1.96	50.7	136
ANTIMONY	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ARSENIC	<0.01	<0.01	0.028	0.046	0.019	<0.01
BARIUM	0.09	0.11	1.05	1.68	0.35	0.21
BERYLLIUM	<0.01	<0.01	0.022J	0.013J	0.045J	0.018J
CADMIUM	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CHROMIUM (HEX)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CHROMIUM (TOT)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
LEAD	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MERCURY	<0.0002	0.0005	<0.0005	<0.0005	<0.0005	<0.0005
NICKEL	0.045	0.034	0.045	0.073	0.021	0.068
SELENIUM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SILVER	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THALLIUM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ZINC	0.076J	0.073J	0.064J	0.068J	0.101J	0.158J
ALKALINITY	262	224	512	508	372	306
TOTAL DISSOLVED SOLIDS	677	692	939	1090	741	1190
TOTAL ORGANIC CARBON	3.3	3.1	24	24	<0.5	2.3
TOTAL ORGANIC HALOGENS	0.073	0.018	0.09	0.085	<0.01	0.016
BOD	7	9	9	11	68	57
COD	<10	<10	189	140	<10	<10
CYANIDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHENOLS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1986 ORGANIC WATER QUALITY DATA
625 ANALYSES CONCENTRATIONS IN PPB

HEPTACHLOR EPOXIDE	<0.05	<0.05
FLUORANTHENE	<10	<10
PYRENE	<10	<10
ENDOSULFAN I	<0.05	<0.05
4,4-DDE	<0.05	<0.05
DIELDRIN	<0.1	<0.1
ENDRIN	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1
4,4-DDD	<0.1	<0.1
BUTYL BENZYL PHTHALATE	<10	<10
3,3-DICHLOROBENZIDINE	<20	<20
ENDOSULFAN SULFATE	<0.1	<0.1
CHRYSENE	<10	<10
4,4-DDT	<0.1	<0.1
BENZO(A)ANTHRACENE	<10	<10
BIS(2-ETHYLHEXYL)PHTHALATE	3.25	<10
DI-N-OCTYL PHTHALATE	<10	<10
BENZO(B)FLUORANTHENE	<10	<10
BENZO(K)FLUORANTHENE	<10	<10
BENZO(A)PYRENE	<10	<10
IDENO(1,2,3-C,D)PYRENE	<10	<10
DIBENZO(A,H)ANTHRACENE	<10	<10
BENZO(G,H,I)PERYLENE	<10	<10
ENDRIN ALDEHYDE	<0.1	<0.1
CHLORDANE	<0.5	<0.5
TOXAPHENE	<1	<1
PCB-1016	.	.
PCB-1221	.	.
PCB-1232	<30	<30
PCB-1242	.	.
PCB-1248	.	.
PCB-1254	<36	<36
PCB-1260	<10	<10
PHENOL	<10	<10
2-CHLOROPHENOL	<10	<10
2-NITROPHENOL	<10	<10
2,4-DIMETHYLPHENOL	<10	<10
2,4-DICHLOROPHENOL	<10	<10
4-CHLORO-3-METHYLPHENOL	<10	<10
2,4,6-TRICHLOROPHENOL	<10	<10
2,4-DINITROPHENOL	<50	<50
4-NITROPHENOL	<50	<50
2-METHYL-4,4-DINITROPHENOL	<50	<50

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1986 ORGANIC WATER QUALITY DATA
625 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-3
DATE	860822	860822
N-NITROSODIMETHYL AMINE	<10	<10
BIS(2-CHLOROETHYL)ETHER	<10	<10
1,3-DICHLOROBENZENE	<10	<10
1,4-DICHLOROBENZENE	<10	<10
1,2-DICHLOROBENZENE	<10	<10
BIS(2-CHLOROISOPROPYL)ETHER	<10	<10
HEXACHLOROETHANE	<10	<10
N-NITROSODI-N-PROPYL AMINE	<10	<10
NITROBENZENE	<10	<10
ISOPHORONE	<10	<10
BIS(2-CHLOROETHOXY)METHANE	<10	<10
1,2,4-TRICHLOROBENZENE	<10	<10
NAPHTHALENE	<10	<10
HEXACHLOROBUTADIENE	<10	<10
HEXACHLOROCYCLOPENTADIENE	<10	<10
2-CHLORONAPHTHALENE	<10	<10
ACENAPHTHYLENE	<10	<10
DIMETHYL PHTHALATE	<10	<10
2,4-DINITROTOLUENE	<50	<50
ACENAPHTHENE	<10	<10
2,6-DINITROTOLUENE	<10	<10
FLUORENE	<10	<10
4-CHLOROPHENOL PHENYL ETHER	<10	<10
DIETHYLPHTHALATE	<10	<10
N-NITROSODIPHENYLAMINE	<10	<10
4-BROMOPHENYL PHENYL ETHER	<10	<10
HEXACHLOROBENZENE	<10	<10
A-BHC	<0.05	<0.05
B-BHC	<0.05	<0.05
C-BHC	<0.05	<0.05
PHENANTHRENE	<10	<10
ANTHRACENE	<10	<10
D-BHC	<0.05	<0.05
HEPTACHLOR	<0.05	<0.05
BENZIDINE	<50	<50
DIBUTYL PHTHALATE	<10	<10

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1986 ORGANIC WATER QUALITY DATA
625 ANALYSES CONCENTRATIONS IN PPB

HEPTACHLOR EPOXIDE	<10	<10	<10	<10	<10
FLUORANTHENE	<10	<10	<10	<10	<10
PYRENE	<10	<10	<10	<10	<10
ENDOSULFAN I	<10	<10	<10	<10	<10
4,4-DDE	<10	<10	<10	<10	<10
DIELDRIN	<10	<10	<10	<10	<10
ENDRIN	<10	<10	<10	<10	<10
ENDOSULFAN II	<10	<10	<10	<10	<10
4,4-DDD	<10	<10	<10	<10	<10
BUTYL BENZYL PHTHALATE	<10	<10	<10	<10	<10
3,3-DICHLOROBENZIDINE	<20	<20	<20	<20	<20
ENDOSULFAN SULFATE	<10	<10	<10	<10	<10
CHRYSENE	<10	<10	<10	<10	<10
4,4-DDT	<10	<10	<10	<10	<10
BENZO(A)ANTHRACENE	<10	<10	<10	<10	<10
BIS(2-ETHYLHEXYL)PHTHALATE	3	<10	<10	3.6	<10
DI-N-OCTYL PHTHALATE	<10	<10	<10	<10	<10
BENZO(B)FLUORANTHENE	<10	<10	<10	<10	<10
BENZO(K)FLUORANTHENE	<10	<10	<10	<10	<10
BENZO(A)PYRENE	<10	<10	<10	<10	<10
INDENO(1,2,3-C,D)PYRENE	<10	<10	<10	<10	<10
DIBENZO(A,H)ANTHRACENE	<10	<10	<10	<10	<10
BENZO(G,H,I)PERYLENE	<10	<10	<10	<10	<10
ENDRIN ALDEHYDE	<10	<10	<10	<10	<10
CHLORDANE	<100	<100	<100	<100	<100
TOXAPHENE	<100	<100	<100	<100	<100
PCB-1016	<100	<100	<100	<100	<100
PCB-1221	<100	<100	<100	<100	<100
PCB-1232	<30	<30	<30	<30	<30
PCB-1242	<100	<100	<100	<100	<100
PCB-1248	<100	<100	<100	<100	<100
PCB-1254	<36	<36	<36	<36	<36
PCB-1260	<10	<10	<10	<10	<10
PHENOL	<10	<10	<10	<10	<10
2-CHLOROPHENOL	<10	<10	<10	<10	<10
2-NITROPHENOL	<10	<10	<10	<10	<10
2,4-DIMETHYLPHENOL	<10	<10	<10	<10	<10
2,4-DICHLOROPHENOL	<10	<10	<10	<10	<10
4-CHLORO-3-METHYLPHENOL	<10	<10	<10	<10	<10
2,4,6-TRICHLOROPHENOL	<10	<10	<10	<10	<10
2,4-DINITROPHENOL	<50	<50	<50	<50	<50
4-NITROPHENOL	<50	<50	<50	<50	<50
2-METHYL-4,4-DINITROPHENOL	<50	<50	<50	<50	<50
PENTACHLOROPHENOL	<50	<50	<50	<50	<50

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1986 ORGANIC WATER QUALITY DATA
625 ANALYSIS CONCENTRATIONS IN PPB

WELL	DM-2	DM-2	DM-2	I-1	I-3
LEVEL	89	89	194		
DATE	870904	870909	870826	870728	870724
N-NITROSODIMETHYL AMINE	<10	<10	<10	<10	<10
BIS(2-CHLOROETHYL)ETHER	<10	<10	<10	<10	<10
1,3-DICHLOROBENZENE	<10	<10	<10	<10	<10
1,4-DICHLOROBENZENE	<10	<10	<10	<10	<10
1,2-DICHLOROBENZENE	<10	<10	<10	<10	<10
BIS(2-CHLOROISOPROPYL)ETHER	<10	<10	<10	<10	<10
HEXACHLOROETHANE	<10	<10	<10	<10	<10
N-NITROSODI-N-PROPYL AMINE	<10	<10	<10	<10	<10
NITROBENZENE	<10	<10	<10	<10	<10
ISOPHORONE	<10	<10	<10	<10	<10
BIS(2-CHLOROETHOXY)METHANE	<10	<10	<10	<10	<10
1,2,4-TRICHLOROBENZENE	<10	<10	<10	<10	<10
NAPHTHALENE	<10	<10	<10	<10	<10
HEXACHLOROBUTADIENE	<10	<10	<10	<10	<10
HEXACHLOROCYCLOPENTADIENE	<10	<10	<10	<10	<10
2-CHLORONAPHTHALENE	<10	<10	<10	<10	<10
ACENAPHTHYLENE	<10	<10	<10	<10	<10
DIMETHYL PHTHALATE	<10	<10	<10	<10	<10
2,4-DINITROTOLUENE	<50	<50	<50	<50	<50
ACENAPHTHENE	<10	<10	<10	<10	<10
2,6-DINITROTOLUENE	<10	<10	<10	<10	<10
FLUORENE	<10	<10	<10	<10	<10
4-CHLOROPHENOL PHENYL ETHER	<10	<10	<10	<10	<10
DIETHYLPHTHALATE	<10	<10	<10	<10	<10
N-NITROSODIPHENYLAMINE	<10	<10	<10	<10	<10
4-BROMOPHENYL PHENYL ETHER	<10	<10	<10	<10	<10
HEXACHLOROBENZENE	<10	<10	<10	<10	<10
A-BHC	<10	<10	<10	<10	<10
B-BHC	<10	<10	<10	<10	<10
C-BHC	<10	<10	<10	<10	<10
PHENANTHRENE	<10	<10	<10	<10	<10
ANTHRACENE	<10	<10	<10	<10	<10
D-BHC	<10	<10	<10	<10	<10
HEPTACHLOR	<10	<10	<10	<10	<10
BENZIDINE	<50	<50	<50	<50	<50
DIBUTYL PHTHALATE	2.6	<10	<10	<10	<10
ALDRIN	<10	<10	<10	<10	<10

EPA METHOD 625 DATA

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1986 ORGANIC WATER QUALITY DATA
624 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-3
DATE	860822	860822
CHLOROMETHANE	<10	<10
BROMOMETHANE	<10	<10
VINYL CHLORIDE	<10	<10
CHLOROETHANE	<10	<10
METHYLENE CHLORIDE	10.3	10.1
TRICHLOROFLUOROMETHANE	<10	<10
1,1-DICHLOROETHENE	5.6	<5
1,1-DICHLOROETHANE	3.1	<5
TRANS-1,2-DICHLOROETHENE	<5	<5
CHLOROFORM	<5	<5
1,2-DICHLOROETHANE	<5	<5
1,1,1-TRICHLOROETHANE	<5	<5
CARBON TETRACHLORIDE	<5	<5
BROMODICHLOROMETHANE	<5	<5
1,2-DICHLOROPROPANE	<5	<5
TRANS-1,3-DICHLOROPROPENE	<5	<5
TRICHLOROETHENE	<5	<5
BENZENE	<5	<5
DIBROMOCHLOROMETHANE	<5	<5
1,1,2-TRICHLOROETHANE	<5	<5
CIS-1,3-DICHLOROPROPENE	<5	<5
2-CHLOROETHYLVINYL ETHER	<10	<10
BROMOFORM	<5	<5
1,1,2,2-TETRACHLOROETHANE	<5	<5
TETRACHLOROETHENE	<5	<5
TOLUENE	<5	<5
CHLOROBENZENE	<5	<5
ETHYLBENZENE	<5	<5

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
624 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-2	DM-2	I-1	I-3
LEVEL	89	194		
DATE	870904	870908	870728	870724
CHLOROMETHANE	<10	<10	<10	<10
BROMOMETHANE	<10	<10	<10	<10
VINYL CHLORIDE	<1	<1	4	<1
CHLOROETHANE	<1	<1	<1	<1
METHYLENE CHLORIDE	<2.7UJ	<2.4UJ	<2UJ	<2UJ
TRICHLOROFLUOROMETHANE	<10	<10	<10	<1
1,1-DICHLOROETHENE	<1	<1	3	<1
1,1-DICHLOROETHANE	<1	<1	6	<1
TRANS-1,2-DICHLOROETHENE	<1	<1	2	<1
CHLOROFORM	<1	<1	<1	<1
1,2-DICHLOROETHANE	<1	<1	<1	<1
1,1,1-TRICHLOROETHANE	<1	<1	3	<1
CARBON TETRACHLORIDE	<1	<1	<1	<1
BROMODICHLOROMETHANE	<1	<1	<1	<1
1,2-DICHLOROPROPANE	<1	<1	<1	<1
TRANS-1,3-DICHLOROPROPENE	<1	<1	<1	<1
TRICHLOROETHENE	<1	<1	1	<1
BENZENE	<1.6UJ	<1	<1	<1
DIBROMOCHLOROMETHANE	<1	<1	<1	<1
1,1,2-TRICHLOROETHANE	<1	<1	<1	<1
CIS-1,3-DICHLOROPROPENE	<1	<1	<1	<1
2-CHLOROETHYLVINYL ETHER	<10	<10	<10	<10
BROMOFORM	<1	<1	<1	<5
1,1,2,2-TETRACHLOROETHANE	<1	<1	<1	<1
TETRACHLOROETHENE	<1	<1	<1	<1
TOLUENE	<1	<1	<1	<1
CHLOROBENZENE	<1	<1	<1	3
ETHYLBENZENE	<1	<1	<1	<1
1,3-DICHLOROBENZENE	<10	<10	.	.
1,2-DICHLOROBENZENE	<10	<10	.	.
1,4-DICHLOROBENZENE	<10	<10	.	.
ACETONE	.	.	4UJ	.

EPA METHOD 624 DATA

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	I-4	I-5	I-6	I-8
DATE	871215	871215	871215	871218
A-BHC	<0.05	<0.05	<0.05	<0.05
B-BHC	<0.05	<0.05	<0.05	<0.05
C-BHC	<0.05	<0.05	<0.05	<0.05
D-BHC	<0.05	<0.05	<0.05	<0.05
HEPTACHLOR	<0.05	<0.05	<0.05	<0.05
ALDRIN	<0.05	<0.05	<0.05	<0.05
HEPTACHLOR EPOXIDE	<0.05	<0.05	<0.05	<0.05
ENDOSULFAN I	<0.05	<0.05	<0.05	<0.05
4-4 DDE	<0.5	<0.5	<0.5	<0.1
DIELDRIN	<0.1	<0.1	<0.1	<0.1
ENDRIN	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1	<0.1	<0.1
4-4 DDD	<0.1	<0.1	<0.1	<0.1
ENDRIN ALDHYDE	<0.1	<0.1	<0.1	<0.1
4-4 DDT	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN SULFATE	<0.1	<0.1	<0.1	<0.1
CHLORDANE	<1	<1	<1	<1
TOXAPHENE	<5	<5	<5	<5
PCB 1016	<2	<2	<2	<2
PCB 1221	<2	<2	<2	<2
PCB 1232	<2	<2	<2	<2
PCB 1242	<2	<2	<2	<2
PCB 1248	<2	<2	<2	<2
PCB 1254	<1	<1	<1	<1
PCB 1260	<2	<2	<2	<2

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-1	DM-1	DM-2	DM-2	DM-3D	DM-3I	DM-3P
LEVEL	54	192	54	194			
DATE	871217	871217	871218	871218	871217	871216	871217
A-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
D-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HEPTACHLOR	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ALDRIN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HEPTACHLOR EPOXIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ENDOSULFAN I	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-4 DDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
DIELDRIN	<0.1	<0.1	0.14	<0.1	<0.1	<0.1	<0.1
ENDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN ALDHYDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDT	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN SULFATE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CHLORDANE	<1	<1	<1	<1	<1	<1	<1
TOXAPHENE	<5	<5	<5	<5	<5	<5	<5
PCB 1016	<2	<2	<2	<2	<2	<2	<2
PCB 1221	<2	<2	<2	<2	<2	<2	<2
PCB 1232	<2	<2	<2	<2	<2	<2	<2
PCB 1242	<2	<2	<2	<2	<2	<2	<2
PCB 1248	<2	<2	<2	<2	<2	<2	<2
PCB 1254	<1	<1	<1	<1	<1	<1	<1
PCB 1260	<2	<2	<2	<2	<2	<2	<2

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-4	DM-5D	DM-5S	DM-6	I-1	I-2	I-3
DATE	871216	871216	871216	871216	871214	871214	871217
A-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
D-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HEPTACHLOR	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ALDRIN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HEPTACHLOR EPOXIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ENDOSULFAN I	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-4 DDE	<0.5	<0.1	<0.1	<0.1	<0.5	<0.5	<0.1
DIELDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN ALDHYDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDT	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN SULFATE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CHLORDANE	<1	<1	<1	<1	<1	<1	<1
TOXAPHENE	<5	<5	<5	<5	<5	<5	<5
PCB 1016	<2	<2	<2	<2	<2	<2	<2
PCB 1221	<2	<2	<2	<2	<2	<2	<2
PCB 1232	<2	<2	<2	<2	<2	<2	<2
PCB 1242	<2	<2	<2	<2	<2	<2	<2
PCB 1248	<2	<2	<2	<2	<2	<2	<2
PCB 1254	<1	<1	<1	<1	<1	<1	<1
PCB 1260	<2	<2	<2	<2	<2	<2	<2

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-4	DM-5D	DM-5S	DM-6	I-2	I-4	I-5
DATE	870818	870820	870820	870818	870728	870727	870727
A-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
B-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	0.2
HEPTACHLOR	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ALDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HEPTACHLOR EPOXIDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN I	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDE	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1
DIELDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12
4-4 DDD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN ALDHYDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDT	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	0.19
ENDOSULFAN SULFATE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CHLORDANE	<20	<50	<50	<20	<50	<50	<50
TOXAPHENE	<50	<50	<50	<50	<50	<50	<50
PCB 1016	<50	<50	<50	<50	<50	<50	<50
PCB 1221	<50	<50	<50	<50	<50	<50	<50
PCB 1232	<50	<50	<50	<50	<50	<50	<50
PCB 1242	<50	<50	<50	<50	<50	<50	<50
PCB 1248	<50	<50	<50	<50	<50	<50	<50
PCB 1254	<50	<50	<50	<50	<50	<50	<50
PCB 1260	<50	<50	<50	<50	<50	<50	<50

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	I-6	I-8
DATE	870724	870731
A-BHC	<0.1	<0.1
B-BHC	<0.1	<0.1
C-BHC	<0.1	<0.1
D-BHC	0.17	0.11
HEPTACHLOR	<0.1	<0.1
ALDRIN	<0.1	<0.1
HEPTACHLOR EPOXIDE	<0.1	<0.1
ENDOSULFAN I	<0.1	<0.1
4-4 DDE	0.1	<0.1
DIELDRIN	<0.1	<0.1
ENDRIN	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1
4-4 DDD	<0.1	<0.1
ENDRIN ALDHYDE	<0.1	<0.1
4-4 DDT	<0.1	<0.1
ENDOSULFAN SULFATE	<0.1	<0.1
CHLORDANE	<50	<50
TOXAPHENE	<50	<50
PCB 1016	<50	<50
PCB 1221	<50	<50
PCB 1232	<50	<50
PCB 1242	<50	<50
PCB 1248	<50	<50
PCB 1254	<50	<50
PCB 1260	<50	<50

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1986 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-2	I-3	I-4	I-5	I-6
DATE	860821	860821	860822	860821	860822	860821
A-BHC	<0.003	<0.003	0.077J	<0.003	0.053J	<0.003
B-BHC	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
C-BHC	<0.009	<0.009	0.03	<0.009	0.041	<0.009
D-BHC	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
HEPTACHLOR	<0.083	<0.083	<0.083	<0.083	<0.083	<0.083
ALDRIN	<0.004	<0.004	<0.004	<0.004	0.004J	<0.004
HEPTACHLOR EPOXIDE	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24
ENDOSULFAN I	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
4-4 DDE	<0.004	<0.004	0.005	<0.004	<0.004	<0.004
DIELDRIN	0.006J	0.005J	0.015J	<0.002	0.025J	0.006J
ENDRIN	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023
ENDOSULFAN II	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066
4-4 DDD	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
ENDRIN ALDHYDE	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
4-4 DDT	<0.012	<0.012	<0.012	<0.012	<0.033	<0.012
ENDOSULFAN SULFATE	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
CHLORDANE	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
TOXAPHENE	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1016	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1221	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1232	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1242	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1248	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1254	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
PCB 1260	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
608 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-1	DM-1	DM-1	DM-2	DM-3D	DM-3I	DM-3P
LEVEL	54	122	194	89			
DATE	870824	870825	870825	870825	870818	870818	870819
A-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
B-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D-BHC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HEPTACHLOR	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ALDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HEPTACHLOR EPOXIDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN I	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DIELDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN II	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDRIN ALDHYDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-4 DDT	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ENDOSULFAN SULFATE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CHLORDANE	<20	<50	<50	<50	<20	<20	<20
TOXAPHENE	<50	<50	<50	<50	<50	<50	<50
PCB 1016	<50	<50	<50	<50	<50	<50	<50
PCB 1221	<50	<50	<50	<50	<50	<50	<50
PCB 1232	<50	<50	<50	<50	<50	<50	<50
PCB 1242	<50	<50	<50	<50	<50	<50	<50
PCB 1248	<50	<50	<50	<50	<50	<50	<50
PCB 1254	<50	<50	<50	<50	<50	<50	<50
PCB 1260	<50	<50	<50	<50	<50	<50	<50

EPA METHOD 608 DATA

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	I-2	I-3	I-4	I-5	I-6	I-8
DATE	871214	871217	871215	871215	871215	871218
CHLOROMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BROMOMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
DICHLORODIFLUOROMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
VINYL CHLORIDE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
CHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
METHYLENE CHLORIDE	<2	<2	<2	<2	<2	<2
TRICHLOROFLUOROMETHANE	<2	<2	<2	<2	<2	<2
1,1-DICHLOROETHENE	<0.2	<0.2	0.5	<0.2	<0.2	<0.2
1,1-DICHLOROETHANE	0.5	<0.2	<0.2	<0.2	<0.2	<0.2
TRANS-1,2-DICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	<0.2	0.3
CHLOROFORM	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-DICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,1-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
CARBON TETRACHLORIDE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BROMODICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TRANS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TRICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	1.4	<0.2
DIBROMOCHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
CIS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-CHLOROETHYLVINYL ETHER	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BROMOFORM	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TETRACHLOROETHENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TOLUENE	<0.5	<0.5	<0.5	<0.5	<0.5	0.9
CHLOROBENZENE	<0.5	1.3	0.6	<0.5	<0.5	<0.5
ETHYLBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-DICHLOROBENZENE	<0.5	1.1	0.9	<0.5	<0.5	<0.5
TRICHLOROTRIFLUOROETHANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ACETONE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
O,P-XYLENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
M XYLENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-2	DM-2	DM-2	DM-3D	DM-3I	DM-3P	DM-4
LEVEL	124	159	194				
DATE	871215	871215	871215	871217	871216	871217	871216
CHLOROMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BROMOMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
DICHLORODIFLUOROMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
VINYL CHLORIDE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
CHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
METHYLENE CHLORIDE	<2	<2	<2	<2	<2	<2	<2
TRICHLOROFLUOROMETHANE	<2	<2	<2	<2	<2	<2	<2
1,1-DICHLOROETHENE	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-DICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	1.9	<0.2
TRANS-1,2-DICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	<0.2	0.9	<0.2
CHLOROFORM	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2
1,2-DICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,1-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
CARBON TETRACHLORIDE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BROMODICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TRANS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TRICHLOROETHENE	0.3	0.3	0.5	<0.2	0.5	<0.2	<0.2
DIBROMOCHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
CIS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-CHLOROETHYLVINYL ETHER	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BROMOFORM	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TETRACHLOROETHENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3
BENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TOLUENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
CHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ETHYLBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TRICHLOROTRIFLUOROETHANE	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5
ACETONE	.	.	.	<0.5	<0.5	<0.5	<0.5
O,P-XYLENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
M-XYLENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-5D	DM-5S	DM-6	I-1
DATE	871216	871216	871216	871214
CHLOROMETHANE	<0.2	<0.2	<0.2	<0.2
BROMOMETHANE	<0.2	<0.2	<0.2	<0.2
DICHLORODIFLUOROMETHANE	<0.2	<0.2	<0.2	<0.2
VINYL CHLORIDE	<0.2	<0.2	<0.2	0.5
CHLOROETHANE	<0.2	<0.2	<0.2	<0.2
METHYLENE CHLORIDE	<4.6UJ	<2	<2	<2
TRICHLOROFLUOROMETHANE	<2	<2	<2	<2
1,1-DICHLOROETHENE	<0.2	0.2	<0.2	0.5
1,1-DICHLOROETHANE	<0.2	<0.2	<0.2	19.7
TRANS-1,2-DICHLOROETHENE	<0.2	0.4	<0.2	10.5
CHLOROFORM	<0.2	0.7	<0.2	<0.2
1,2-DICHLOROETHANE	<0.2	<0.2	<0.2	<0.2
1,1,1-TRICHLOROETHANE	<0.2	<0.2	<0.2	11
CARBON TETRACHLORIDE	<0.2	<0.2	<0.2	<0.2
BROMODICHLOROETHANE	<0.2	<0.2	<0.2	<0.2
1,2-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2
TRANS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2
TRICHLOROETHENE	<0.2	0.9	<0.2	<0.2
DIBROMOCHLOROETHANE	<0.2	<0.2	<0.2	<0.2
1,1,2-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2
CIS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2
2-CHLOROETHYLVINYL ETHER	<0.5	<0.5	<0.5	<0.5
BROMOFORM	<0.5	<0.5	<0.5	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.2	<0.2	<0.2	<0.2
TETRACHLOROETHENE	<0.2	<0.2	<0.2	<0.2
BENZENE	<0.5	<0.5	<0.5	<0.5
TOLUENE	<0.5	<0.5	<0.5	<0.5
CHLOROBENZENE	<0.5	<0.5	<0.5	<0.5
ETHYLBENZENE	<0.5	<0.5	<0.5	<0.5
1,3-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5
1,2-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5
1,4-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5
TRICHLOROTRIFLUOROETHANE	<0.5	<0.5	<0.5	<0.5
ACETONE	<0.5	<0.5	<0.5	<0.5
O,P-XYLENE	<0.5	<0.5	<0.5	<0.5
M-XYLENE	<0.5	<0.5	<0.5	<0.5

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-2	I-3	I-4	I-5	I-6	I-8
DATE	871019	871019	871019	871020	871020	871020	871023
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
VINYL CHLORIDE	2.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHENE	0.5	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHANE	8.5	0.6	<0.05	<0.05	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	7.5	0.4	<0.09	<0.09	0.3	<0.09	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	15.8	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	0.3	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	0.2	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.16	1.2	0.7	0.5	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	0.9	1.3	<0.6	<0.6	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONE	<50	<50	<50	<50	<50	<50	<50
O,P-XYLENE	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18
M-XYLENE	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-1	DM-1	DM-1	DM-1	DM-1	DM-2	DM-2
LEVEL	54	86	122	157	192	54	89
DATE	871214	871214	871214	871214	871214	871215	871215
CHLOROMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
BROMOMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
DICHLORODIFLUOROMETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
VINYL CHLORIDE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
CHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
METHYLENE CHLORIDE	<2	<2	<2	<2	<2	<20	<2
TRICHLOROFLUOROMETHANE	<2	<2	<2	<2	<2	<20	<2
1,1-DICHLOROETHENE	<0.2	<0.2	1.1	<0.2	5.4	<2	<0.2
1,1-DICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
TRANS-1,2-DICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
CHLOROFORM	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
1,2-DICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
1,1,1-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
CARBON TETRACHLORIDE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
BROMODICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
1,2-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
TRANS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
TRICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	1.5	<2	<0.2
DIBROMOCHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
1,1,2-TRICHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
CIS-1,3-DICHLOROPROPENE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
2-CHLOROETHYLVINYL ETHER	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
BROMOFORM	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
TETRACHLOROETHENE	<0.2	<0.2	0.4	<0.2	0.3	<2	<0.2
BENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
TOLUENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
CHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
ETHYLBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
1,3-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
1,2-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
1,4-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
TRICHLOROTRIFLUOROETHANE	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2
O,P-XYLENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
M-XYLENE	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	I-8
DATE	870731
CHLOROMETHANE	1.37
BROMOMETHANE	0.7
DICHLORODIFLUOROMETHANE	<0.04
VINYL CHLORIDE	2
CHLOROETHANE	1.3
METHYLENE CHLORIDE	<0.02
TRICHLOROFLUOROMETHANE	<0.07
1,1-DICHLOROETHENE	<0.07
1,1-DICHLOROETHANE	<0.05
TRANS-1,2-DICHLOROETHENE	2
CHLOROFORM	<0.05
1,2-DICHLOROETHANE	<0.07
1,1,1-TRICHLOROETHANE	2.5
CARBON TETRACHLORIDE	<0.08
BROMODICHLOROETHANE	0.3
1,2-DICHLOROPROPENE	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11
TRICHLOROETHENE	0.4
DIBROMOCHLOROETHANE	<0.07
1,1,2-TRICHLOROETHANE	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03
BROMOFORM	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03
TETRACHLOROETHENE	<0.03
BENZENE	<0.2
TOLUENE	<0.4
CHLOROBENZENE	0.5
ETHYLBENZENE	<0.1
1,3-DICHLOROBENZENE	<0.4
1,2-DICHLOROBENZENE	<0.4
1,4-DICHLOROBENZENE	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05
ACETONE	<2.7
O, P-XYLENE	<0.15
M-XYLENE	<0.18

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-3D	DM-3I	DM-3P	DM-4	DM-5D	DM-5S	DM-6
DATE	871021	871021	871023	871021	871020	871020	871022
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
VINYL CHLORIDE	<0.05	<0.05	0.9	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHENE	<0.07	<0.07	<0.07	<0.07	<0.07	0.2	<0.07
1,1-DICHLOROETHANE	<0.05	<0.05	2.6	<0.05	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	<0.09	<0.09	1	<0.09	<0.09	0.7	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	1	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	<0.06	0.7	<0.06	<0.06	<0.06	1.5	<0.06
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	<0.03	0.2	<0.03	0.6	<0.03	0.2	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.02
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONE	<50	<50	<50	<50	<50	<50	<50
O,P-XYLENE	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18
M-XYLENE	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-2	DM-3D	DM-3I	DM-3P	DM-4	DM-5D	DM-5S
LEVEL	194						
DATE	870908	870818	870818	870819	870818	870820	870820
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	1.9	<0.04	<0.04	<0.04
VINYL CHLORIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.3
1,1-DICHLOROETHANE	<0.05	<0.05	<0.05	4.6	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	<0.09	<0.09	<0.09	1.1	<0.09	<0.09	0.7
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1UJ
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	<0.03	<0.03	0.3	0.3	0.4	<0.03	<0.03
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	0.8	<0.06	<0.7UJ	<0.06	<0.2UJ	<0.06	1.9
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	0.2	<0.03	0.2	<0.03	2	<0.03	0.4
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONE	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7
O,P-XYLENE	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
M-XYLENE	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-6	I-1	I-2	I-3	I-4	I-5	I-6
DATE	870818	870728	870728	870724	870727	870727	870724
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
VINYL CHLORIDE	<0.05	1.2	0.8	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHENE	<0.07	0.3	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHANE	<0.05	5.6	<0.05	<0.05	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	<0.09	2.3	3.8	<0.09	<0.09	<0.09	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	<0.03	3.5	<0.03	<0.03	<0.03	<0.03	<0.03
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	<0.3UJ	<0.06	<0.06	<0.06	<0.06	<0.06	1
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.16	<0.16	2.3	1	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	0.3	1.1	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	<0.6	1.2	2.1	<0.6	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONE	<2.7	<2.7	<2.7	<2.7	<50	<2.7	<2.7
O,P-XYLENE	<0.15	<0.1	<0.15	<0.15	<0.18	<0.15	<0.15
M-XYLENE	<0.18	<0.1	<0.18	<0.18	<0.15	<0.18	<0.18

CITY OF PHOENIX 19TH AVENUE LANDFILL
1ST QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-2	I-3	I-4	I-5	I-6
DATE	870331	870331	870331	870331	870331	870331
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
VINYL CHLORIDE	1.2	0.6	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	6	<0.1	<0.1	<0.1	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	7.6	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHENE	0.7	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHANE	64.3	2.3	<0.05	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	4.1	1.5	<0.09	<0.09	<0.09	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	6.5	<0.03	<0.03	<0.03	<0.03	<0.03
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	0.3	<0.06	<0.06	<0.06	<0.06	1.5
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	<0.2UJ	<0.03	<0.03	<0.03	<0.03	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.6UJ	<1.4UJ	<1.2UJ	<1.2UJ	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	4	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	1.3	1.6	0.9	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONE	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7
O,P-XYLENE	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18
M-XYLENE	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15

CITY OF PHOENIX 19TH AVENUE LANDFILL
2ND QTR 1987 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	DM-1	DM-1	DM-1	DM-1	DM-2	DM-2	DM-2
LEVEL	86	122	157	192	89	124	159
DATE	870903	870903	870903	870903	870904	870904	870904
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
VINYL CHLORIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	1.1	0.9	<0.07	0.4	<0.07
1,1-DICHLOROETHENE	<0.07	0.5	2.7	3.7	<0.07	<0.07	0.3
1,1-DICHLOROETHANE	<0.05	<0.05	<0.05	1.1	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	<0.09	<0.09	<0.09	0.4	<0.09	<0.09	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	<0.06	0.4	1.1	1.9	<0.06	0.3	0.6
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	<0.03	<0.03	<0.03	0.5	<0.03	<0.03	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
TRICHLOROTRIFLUOROETHANE	<0.05	0.3	<0.05	1.2	0.7	<0.05	1
ACETONE	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7
O,P-XYLENE	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
M-XYLENE	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18

CITY OF PHOENIX 19TH AVENUE LANDFILL
3RD QTR 1986 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-1	I-2	I-3	I-4	I-5	I-6
DATE	860821	860822	860821	860822	860821	860822	860821
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
VINYL CHLORIDE	2.5	1.9	2.5	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHENE	0.2	3.4	<0.07	<0.07	<0.07	<0.07	1.4
1,1-DICHLOROETHANE	3.9	1.7	1.5	<0.05	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	1.9	<0.09	5.1	<0.09	0.3	<0.09	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	4.8	4.7	<0.03	<0.03	<0.03	<0.03	0.3
CARBON TETRACHLORIDE	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	0.3	<0.06	0.6	<0.06	<0.06	<0.06	2.36
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	0.3	<0.03	2.5	<0.03	<0.03	<0.03	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	0.4	<0.16	<0.16	<0.16	2.9	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	<0.6	<0.6	3.6	<0.6	<0.6

CITY OF PHOENIX 19TH AVENUE LANDFILL
4TH QTR 1986 ORGANIC WATER QUALITY DATA
601/602 ANALYSES CONCENTRATIONS IN PPB

WELL	I-1	I-2	I-3	I-4	I-5	I-6
DATE	861017	861017	861016	861016	861016	861016
CHLOROMETHANE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
BROMOMETHANE	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
DICHLORODIFLUOROMETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
VINYL CHLORIDE	1.7	0.6	<0.05	<0.05	<0.05	<0.05
CHLOROETHANE	<0.1	<0.1	<0.1	0.5	<0.1	<0.1
METHYLENE CHLORIDE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRICHLOROFLUOROMETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHENE	0.9	<0.07	<0.07	<0.07	<0.07	<0.07
1,1-DICHLOROETHANE	10.7	1.3	<0.05	<0.05	<0.05	<0.05
TRANS-1,2-DICHLOROETHENE	10.7	3	<0.09	0.2	<0.09	<0.09
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,1-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CARBON TETRACHLORIDE	35.1	<0.08	<0.08	<0.08	<0.08	<0.08
BROMODICHLOROETHANE	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-DICHLOROPROPENE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TRANS-1,3-DICHLOROPROPENE	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
TRICHLOROETHENE	0.5	0.4	<0.06	<0.06	<0.06	2.4
DIBROMOCHLOROETHANE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-TRICHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
2-CHLOROETHYLVINYL ETHER	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
BROMOFORM	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1,2,2-TETRACHLOROETHANE	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
TETRACHLOROETHENE	0.5	<0.03	<0.03	<0.03	<0.03	<0.03
BENZENE	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TOLUENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
CHLOROBENZENE	<0.16	<0.16	1.4	1.2	<0.16	<0.16
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-DICHLOROBENZENE	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-DICHLOROBENZENE	<0.4	1.6	<0.4	<0.4	<0.4	<0.4
1,4-DICHLOROBENZENE	<0.6	<0.6	1.7	2.1	<0.6	<0.6
TRICHLOROTRIFLUOROETHANE	.	0.4	.	.	.	.

EPA METHOD 601/602 DATA